Proposal to Improve F-22 Operational Efficiency

at Joint Base Elmendorf-Richardson, Alaska

Final Environmental Impact Statement

673D AIR BASE WING

11 ELEVENTH AIR FORCE

NON SOLUM ARMIS

PACIFIC AIR FORCES

February 2018

Appendices

APPENDIX A
PUBLIC AND AGENCY OUTREACH

TABLE OF CONTENTS

SECTION **PAGE**

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A.1 Federal Register Notice of Intent

Federal Register / Vol. 80, No. 183 / Tuesday, September 22, 2015 / Notices 57155

the English and Spanish versions of the Booklet, entitled *Your home loan toolkit: A step-by-step guide* or *Su conjunto de herramientas para préstamos hipotecarios: Guía paso a paso,* respectively, should be used only after that date.

The Bureau also announces that it has fixed a typographical error in the ''small'' English-language version of the Booklet. This error was nonsubstantive: A duplicate sentence located on page 44. The corrected version is now available on the Bureau's Web site as well as in the Catalog of U.S. Government Publications.

Dated: September 14, 2015.

Richard Cordray,

Director, Bureau of Consumer Financial Protection.

[FR Doc. 2015–24031 Filed 9–21–15; 8:45 am]

BILLING CODE 4810–AM–P

DEPARTMENT OF DEFENSE

Department of the Air Force

US Air Force Partially Patent License

AGENCY: Air Force Research Laboratory Information Directorate, Rome, New York, Department of the Air Force.

ACTION: Notice of intent to issue a partially exclusive patent license.

SUMMARY: Pursuant to the provisions of part 404 of Title 37, Code of Federal Regulations, which implements Public Law 96–517, as amended, the Department of the Air Force announces its intention to grant Exelis Inc., a wholly owned subsidiary of Harris Corporation, Mission Sustainment Division, a corporation of Indiana, having a place of business at 474 Phoenix Drive, Rome, New York 13441, a partially exclusive license in any right, title and interest the United States Air Force has in: U.S. Patent No. 8,732,100, issued on May 20th, 2014 entitled ''Method and Apparatus for Event Detection Permitting Per Event Adjustment of False Alarm Rate.''

FOR FURTHER INFORMATION CONTACT: An exclusive license for this patent will be granted unless a written objection is received within fifteen (15) days from the date of publication of this Notice. Written objections should be sent to: Air Force Research Laboratory, Office of the Staff Judge Advocate, AFRL/RIJ, 26 Electronic Parkway, Rome, New York 13441–4514. Telephone: (315) 330–2087; Facsimile (315) 330–7583.

Henry Williams,

Acting, Air Force Federal Register Liaison Officer.

[FR Doc. 2015–23989 Filed 9–21–15; 8:45 am]

BILLING CODE 5001–10–P

DEPARTMENT OF DEFENSE

Department of the Air Force

Notice of Intent To Prepare an Environmental Impact Statement on the Proposal To Improve F–22 Operational Efficiency at Joint Base Elmendorf-Richardson, Alaska

AGENCY: United States Air Force, Pacific Air Forces.

ACTION: Notice of intent.

SUMMARY: Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321, *et seq.*), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR parts 1500–1508), and Air Force policy and procedures (32 CFR part 989), the Air Force is issuing this notice to advise the public of the intent to prepare an Environmental Impact Statement (EIS) for proposed F–22 operational efficiency improvements at Joint Base Elmendorf-Richardson (JBER).

The proposed action is to improve F–22 operational efficiency; there is no proposed change in the number of aircraft at JBER nor in the ongoing military training in existing Alaska training airspace. Six alternatives that have been initially identified include changes in runway use and/or airfield infrastructure and maintenance. The EIS will address potential impacts resulting from implementation of the alternatives. The No Action Alternative is the runway use conditions from the F–22 Plus-Up Environmental Assessment (EA) and Finding of No Significant Impacts (FONSI) published, June 2011.

Scoping: In order to define the full range of issues to be evaluated in the EIS, the Air Force will determine the scope of the analysis by soliciting comments from interested local, state and federal elected officials and agencies, as well as interested members of the public. This NOI also serves to provide early notice of compliance with Executive Order (EO) 11990, ''Protection of Wetlands'' and EO 11988, ''Floodplain Management.'' State and federal regulatory agencies with special expertise in wetlands and floodplains have been contacted to request comment. The Air Force plans to use the NEPA scoping process to also fulfill the requirements of the NHPA Section 106 implementing regulations by seeking public input on historic preservation issues and concerns.

The scoping meeting will be held Wednesday, October 14, 2015, from 6:00 p.m. to 8:30 p.m. ADT, at Tyson Elementary School, 2801 Richmond Avenue, Anchorage, Alaska.

Public scoping comments will be accepted in writing at the scoping meetings. Additional scoping comments will be accepted at any time during the EIS process. However, in order to ensure the Air Force has sufficient time to consider public input, scoping comments should arrive at the address below by October 27, 2015.

FOR FURTHER INFORMATION CONTACT: JBER Public Affairs, Bldg. 10480 Sijan Ave., Suite 123, JBER, AK 99506 telephone: 907–552–8151 or email: *jber.pa.3@us.af.mil.*

Henry Williams,

Acting Air Force Federal Register Liaison Officer.

[FR Doc. 2015–23988 Filed 9–21–15; 8:45 am]

BILLING CODE 5001–10–P

DEPARTMENT OF DEFENSE

Department of the Army

Army Science Board Partially Closed Meeting Notice

AGENCY: Department of the Army, DoD.

ACTION: Notice of a partially closed meeting.

SUMMARY: Pursuant to the Federal Advisory Committee Act of 1972, the Government in the Sunshine Act of 1976 and title 41 of the Code of Federal Regulations, the Department of the Army announces a meeting of the Army Science Board.

FOR FURTHER INFORMATION CONTACT: Army Science Board, Designated Federal Officer, 2530 Crystal Drive, Suite 7098, Arlington, VA 22202; LTC Stephen K. Barker, the committee's Designated Federal Officer (DFO), at (703) 545–8652 or email: *stephen.k.barker.mil@mail.mil,* or Mr. Paul Woodward at (703) 695–8344 or email: *paul.j.woodward2.civ@mail.mil.*

SUPPLEMENTARY INFORMATION: Pursuant to the Federal Advisory Committee Act of 1972 (5 U.S.C., Appendix, as amended), the Government in the Sunshine Act of 1976 (U.S.C. 552b, as amended) and 41 Code of Federal Regulations (CFR) § 102–3.140 through 160, the Department of the Army

A.2 Example Interagency/Intergovernmental Coordination for Environmental Planning (IICEP) Letters

A.2.1 General Agency Letter

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
JOINT BASE SAN ANTONIO LACKLAND TEXAS

September 22, 2015

MEMORANDUM FOR DISTRIBUTION (SEE LIST)

FROM: AFCEC/CZN
2261 Hughes Ave., Ste. 155
JBSA Lackland, TX 78236-9853

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA.

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. As required by NEPA, a No-Action Alternative will also be addressed. The attached brochure provides additional information on the proposed action and alternatives, as well as the EIS process.

The USAF published a Notice of Intent (NOI) in the *Federal Register* on September 22, 2015 to prepare an EIS, initiating the public involvement process. A public scoping meeting will be held October 14, 2015, from 6:00 pm to 8:30 pm, at Tyson Elementary School, 2801 Richmond Avenue, Anchorage, Alaska. The purpose of the meeting is to solicit comments on the scope of environmental issues to be addressed in the EIS.

Three of the F-22 runway use alternatives have the potential to affect flood plains and/or wetlands on JBER. Consistent with the requirements and objectives of Executive Order (EO) 11988 and EO 11990, this letter initiates early public review of the alternatives that have the potential to affect wetlands and/or floodplains.

We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process.

Sincerely,

J. DALE CLARK, PE, GS-14, DAF
Chief, Air Force NEPA Division
Environmental Management Directorate

Attachments:
1 – Project Brochure
2 – Distribution List

A.2.2 U.S. Fish and Wildlife Service (USFWS) Letter

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
JOINT BASE SAN ANTONIO LACKLAND TEXAS

September 22, 2015

Mr. J. Dale Clark
Air Force NEPA Division (AFCEC/CZN)
2261 Hughes Ave, Suite 155
JBSA Lackland TX 78236-9853

United States Fish & Wildlife Service (USFWS)
Anchorage Fish & Wildlife Field Office
ATTENTION: Kimberly Klein, Endangered Species Biologist
605 W. 4th Avenue Room G-61
Anchorage, AK 99501

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA

Dear Ms. Klein:

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. As required by NEPA, a No-Action Alternative will also be addressed. The attached brochure provides additional information on the proposed action and alternatives, as well as the EIS process.

The USAF published a Notice of Intent (NOI) in the *Federal Register* on September 22, 2015 to prepare an EIS, initiating the public involvement process. A public scoping meeting will be held October 14, 2015, from 6:00 pm to 8:30 pm, at Tyson Elementary School, 2801 Richmond Avenue, Anchorage, Alaska. The purpose of the meeting is to solicit comments on the scope of environmental issues to be addressed in the EIS.

In July 2014, for a different JBER proposed action, Ms. Klein, USFWS Endangered Species Biologist, communicated to Mr. Zack Walker, 673 CES/CENPP, that "there are no listed species requiring consultation under Section 7 of the Endangered Species Act in the vicinity of JBER." Ms. Klein recommended reviewing the USFWS website for any further information. As part of the effort to analyze the potential impacts of this proposed action, the USAF or its contractor, Leidos, will review your website and may contact the USFWS directly in their data collection efforts.

Three of the F-22 runway use alternatives have the potential to affect flood plains and/or wetlands on JBER. Consistent with the requirements and objectives of Executive Order (EO) 11988 and EO 11990, this letter initiates early public review of the alternatives that have the potential to affect wetlands and/or floodplains.

We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process.

Sincerely,

J. DALE CLARK, PE, GS-14, DAF
Chief, Air Force NEPA Division
Environmental Management Directorate

Attachment: Project Brochure

A.2.3 National Marine Fisheries Service (NMFS) Letter

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
JOINT BASE SAN ANTONIO LACKLAND TEXAS

September 22, 2015

Mr. J. Dale Clark
Air Force NEPA Division (AFCEC/CZN)
2261 Hughes Ave, Suite 155
JBSA Lackland TX 78236-9853

Mr. Greg Balogh
National Marine Fisheries Service (NMFS)
Protected Resources Division and Habitat
222 W. 7th Ave., Box 43
Anchorage, AK 99513

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA

Dear Mr Balogh:

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. As required by NEPA, a No-Action Alternative will also be addressed. The attached brochure provides additional information on the proposed action and alternatives, as well as the EIS process.

The USAF published a Notice of Intent (NOI) in the *Federal Register* on September 22, 2015 to prepare an EIS, initiating the public involvement process. A public scoping meeting will be held October 14, 2015, from 6:00 pm to 8:30 pm, at Tyson Elementary School, 2801 Richmond Avenue, Anchorage, Alaska. The purpose of the meeting is to solicit comments on the scope of environmental issues to be addressed in the EIS.

Three of the F-22 runway use alternatives have the potential to affect flood plains and/or wetlands on JBER. Consistent with the requirements and objectives of Executive Order (EO) 11988 and EO 11990, this letter initiates early public review of the alternatives that have the potential to affect wetlands and/or floodplains.

In accordance with the Endangered Species Act of 1973, as amended, we would like to request information regarding any federally-listed *threatened and/or endangered* species in addition to candidate or proposed-to-be-listed species that occur or may occur in the potentially affected area of the Knik Arm, west and north of the JBER-Elmendorf airfield. Please send information to Mr. Brent Koenen at 724 Postal Service Loop #4500, JBER, Alaska 99505.

Additionally, we request your office provide a point of contact and a possible alternate for any follow-up questions we may have.

If you have questions or concerns, please contact our NEPA Project Manager, Ms. Toni Ristau. Her email address and phone number is toni.ristau.1@us.af.mil, and she can be reached by telephone during business hours at 210-925-2738.

We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process.

Sincerely,

J. Dale Clark

J. DALE CLARK, PE, GS-14, DAF
Chief, Air Force NEPA Division
Environmental Management Directorate

Attachment: Project Brochure

A.2.4 State Historic Preservation Office (SHPO) Letter

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
JOINT BASE SAN ANTONIO LACKLAND TEXAS

September 22, 2015

Mr. J. Dale Clark
Air Force NEPA Division (AFCEC/CZN)
2261 Hughes Ave, Suite 155
JBSA Lackland TX 78236-9853

Ms. Judith Bittner
Alaska Department of Natural Resources
Office of History and Archaeology
550 W. 7th Ave., Suite 1310
Anchorage, AK 99501

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA

Dear Ms Bittner:

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. As required by NEPA, a No-Action Alternative will also be addressed. The attached brochure provides additional information on the proposed action and alternatives, as well as the EIS process.

The USAF published a Notice of Intent (NOI) in the *Federal Register* on September 22, 2015 to prepare an EIS, initiating the public involvement process. A public scoping meeting will be held October 14, 2015, from 6:00 pm to 8:30 pm, at Tyson Elementary School, 2801 Richmond Avenue, Anchorage, Alaska. The purpose of the meeting is to solicit comments on the scope of environmental issues to be addressed in the EIS.

Three of the F-22 runway use alternatives have the potential to affect flood plains and/or wetlands on JBER. Consistent with the requirements and objectives of Executive Order (EO) 11988 and EO 11990, this letter initiates early public review of the alternatives that have the potential to affect wetlands and/or floodplains.

In compliance with the National Historic Preservation Act (NHPA) (54 U.S.C. 300101), specifically Section 106 (54 U.S.C. 306108) and its implementing regulations (36 CFR 800), which encourages the consideration of alternatives and early notice and involvement, JBER is providing this information to the Office of History and Archeology regarding the undertaking to Improve F-22 Operational Efficiency at JBER, Alaska. In accordance with 36 CFR Part 800.2, the Air Force plans to use the public involvement process to also fulfill the mandate to seek public input and comments regarding historic preservation issues and concerns.

We are early in the process of identifying and evaluating potential effects and would appreciate any information your office may have regarding the historic properties or your concerns regarding effects as we move forward from scoping into the analytical stage. In an effort to analyze the potential impacts of the proposed action, the USAF or its contractor, Leidos, may contact you in their data collection efforts.

If you have questions or concerns, please contact our NEPA Project Manager, Ms. Toni Ristau. Her email address and phone number is toni.ristau.1@us.af.mil, and she can be reached by telephone during business hours at 210-925-2738.

We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process, and if you have a point of contact (POC) to whom we could directly address any future correspondence, the POC information would be appreciated.

Sincerely,

J. DALE CLARK, PE, GS-14, DAF
Chief, Air Force NEPA Division
Environmental Management Directorate

Attachment: Project Brochure

A.2.5 Tribal Letters

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

30 SEP 2015

Ms. Debra Call
Knik Village
PO Box 871565
Wasilla, Alaska 99687

SUBJECT: Environtmental Impact Statement (EIS) for the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER), Alaska.

Dear Ms. Call,

1. Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. The attached brochure provides details of the action for your review.

2. The USAF has published a Notice of Intent (NOI) to prepare an EIS on this proposal. Publication of the NOI in the *Federal Register* initiates the public involvement process. A public scoping meeting will be in Anchorage (currently projected for the mid-October timeframe), and meeting notices will be published in local newspapers two weeks prior to the meeting.

3. Consistent with the requirements and objectives of Executive Order (EO) 11988 "Floodplain Management" and EO 11990, "Protection of Wetlands", state and federal regulatory agencies with special expertise in wetlands and flood plains have been contacted to request comment. Consistent with EO 11988 and EO 11990, this letter initiates early review of the alternatives, including the three alternatives which extend Runway 16 on JBER and thus have the potential to affect wetlands and/or floodplains.

4. If you wish to meet to discuss this proposal or its potential effects, please contact our Native Liaison, Mr. Jon Scudder, at 907-384-6648, who will aid you in scheduling a meeting at your convenience. We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

30 SEP 2015

Mr. Lee Stephan, President and First Chief
Eklutna Native Village
26339 Eklutna Village Road
Chugiak, Alaska 99567

SUBJECT: Environtmental Impact Statement (EIS) for the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER), Alaska.

Dear Mr. Stephan,

1. Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. The attached brochure provides details of the action for your review.

2. The USAF has published a Notice of Intent (NOI) to prepare an EIS on this proposal. Publication of the NOI in the *Federal Register* initiates the public involvement process. A public scoping meeting will be in Anchorage (currently projected for the mid-October timeframe), and meeting notices will be published in local newspapers two weeks prior to the meeting.

3. Consistent with the requirements and objectives of Executive Order (EO) 11988 "Floodplain Management" and EO 11990, "Protection of Wetlands", state and federal regulatory agencies with special expertise in wetlands and flood plains have been contacted to request comment. Consistent with EO 11988 and EO 11990, this letter initiates early review of the alternatives, including the three alternatives which extend Runway 16 on JBER and thus have the potential to affect wetlands and/or floodplains.

4. If you wish to meet to discuss this proposal or its potential effects, please contact our Native Liaison, Mr. Jon Scudder, at 907-384-6648, who will aid you in scheduling a meeting at your convenience. We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

30 SEP 2015

Mr. Frank Standifer
Native Village of Tyonek
P.O. Box 82009
Tyonek, Alaska 99682-0009

SUBJECT: Environtmental Impact Statement (EIS) for the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER), Alaska.

Dear Mr. Standifer,

1. Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. The attached brochure provides details of the action for your review.

2. The USAF has published a Notice of Intent (NOI) to prepare an EIS on this proposal. Publication of the NOI in the *Federal Register* initiates the public involvement process. A public scoping meeting will be in Anchorage (currently projected for the mid-October timeframe), and meeting notices will be published in local newspapers two weeks prior to the meeting.

3. Consistent with the requirements and objectives of Executive Order (EO) 11988 "Floodplain Management" and EO 11990, "Protection of Wetlands", state and federal regulatory agencies with special expertise in wetlands and flood plains have been contacted to request comment. Consistent with EO 11988 and EO 11990, this letter initiates early review of the alternatives, including the three alternatives which extend Runway 16 on JBER and thus have the potential to affect wetlands and/or floodplains.

4. If you wish to meet to discuss this proposal or its potential effects, please contact our Native Liaison, Mr. Jon Scudder, at 907-384-6648, who will aid you in scheduling a meeting at your convenience. We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

30 SEP 2015

Mr. Gary Harrison, Chairman
Chickaloon Village Traditional Council
P.O. Box 1105
Chickaloon, Alaska 99674

SUBJECT: Environtmental Impact Statement (EIS) for the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER), Alaska.

Dear Mr. Harrison,

1. Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. The attached brochure provides details of the action for your review.

2. The USAF has published a Notice of Intent (NOI) to prepare an EIS on this proposal. Publication of the NOI in the *Federal Register* initiates the public involvement process. A public scoping meeting will be in Anchorage (currently projected for the mid-October timeframe), and meeting notices will be published in local newspapers two weeks prior to the meeting.

3. Consistent with the requirements and objectives of Executive Order (EO) 11988 "Floodplain Management" and EO 11990, "Protection of Wetlands", state and federal regulatory agencies with special expertise in wetlands and flood plains have been contacted to request comment. Consistent with EO 11988 and EO 11990, this letter initiates early review of the alternatives, including the three alternatives which extend Runway 16 on JBER and thus have the potential to affect wetlands and/or floodplains.

4. If you wish to meet to discuss this proposal or its potential effects, please contact our Native Liaison, Mr. Jon Scudder, at 907-384-6648, who will aid you in scheduling a meeting at your convenience. We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

30 SEP 2015

Ms. Sophie Minich
Cook Inlet Region, Inc (CIRI)
2525 C Street, Suite 500
Anchorage, Alaska 99503

SUBJECT: Environtmental Impact Statement (EIS) for the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER), Alaska.

Dear Ms. Minich,

1. Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. The attached brochure provides details of the action for your review.

2. The USAF has published a Notice of Intent (NOI) to prepare an EIS on this proposal. Publication of the NOI in the *Federal Register* initiates the public involvement process. A public scoping meeting will be in Anchorage (currently projected for the mid-October timeframe), and meeting notices will be published in local newspapers two weeks prior to the meeting.

3. Consistent with the requirements and objectives of Executive Order (EO) 11988 "Floodplain Management" and EO 11990, "Protection of Wetlands", state and federal regulatory agencies with special expertise in wetlands and flood plains have been contacted to request comment. Consistent with EO 11988 and EO 11990, this letter initiates early review of the alternatives, including the three alternatives which extend Runway 16 on JBER and thus have the potential to affect wetlands and/or floodplains.

4. If you wish to meet to discuss this proposal or its potential effects, please contact our Native Liaison, Mr. Jon Scudder, at 907-384-6648, who will aid you in scheduling a meeting at your convenience. We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

30 SEP 2015

Mr. Michael Curry
Eklutna, Inc.
16515 Centerfield Drive, Ste 201
Eagle River, Alaska 99577

SUBJECT: Environtmental Impact Statement (EIS) for the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER), Alaska.

Dear Mr. Curry,

1. Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and its implementing regulations, the United States Air Force (USAF) intends to prepare an EIS to analyze the potential impacts on the human environment from proposed F-22 operational efficiency improvements at JBER, Alaska. Alternatives currently identified for evaluation in the EIS include various options for changes to JBER runway usage patterns for F-22 flight operations, modifications to infrastructure at JBER, and changes in airfield maintenance. There is no proposed change in the number of aircraft at JBER, or in the ongoing military training in existing airspace. The attached brochure provides details of the action for your review.

2. The USAF has published a Notice of Intent (NOI) to prepare an EIS on this proposal. Publication of the NOI in the *Federal Register* initiates the public involvement process. A public scoping meeting will be in Anchorage (currently projected for the mid-October timeframe), and meeting notices will be published in local newspapers two weeks prior to the meeting.

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4. If you wish to meet to discuss this proposal or its potential effects, please contact our Native Liaison, Mr. Jon Scudder, at 907-384-6648, who will aid you in scheduling a meeting at your convenience. We also invite your participation at the scoping meeting in Anchorage, but if you cannot attend, you may submit written comments to: 673 ABW/PA, 10480 Sijan Avenue, Suite 123, JBER, AK 99506; or via email to jber.pa.3@us.af.mil. In advance, we thank you for your participation in the EIS scoping process.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

A.2.6 IICEP Letter Attachment, Project Brochure

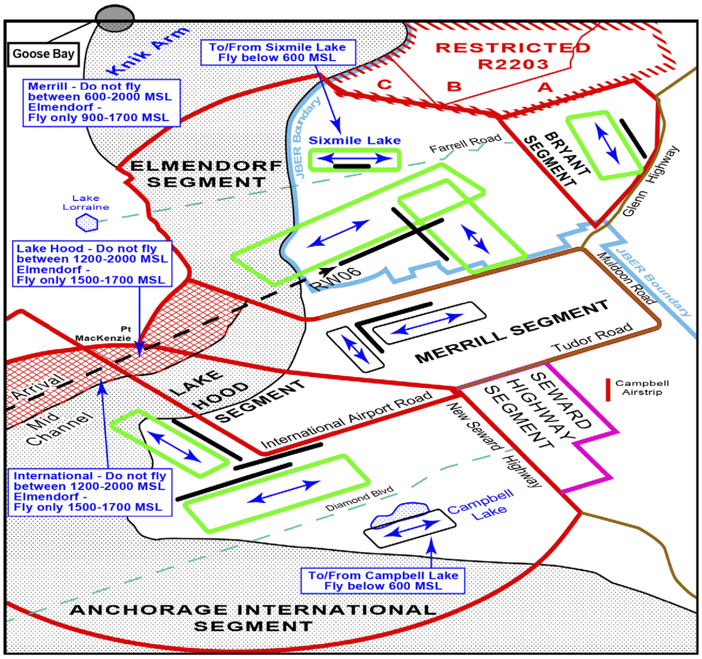
Purpose and Need

The Air Force needs to evaluate the distribution of F-22 departures and arrivals on JBER's runways to:

There is no proposed change in aircraft numbers or to training in existing Alaskan airspace.

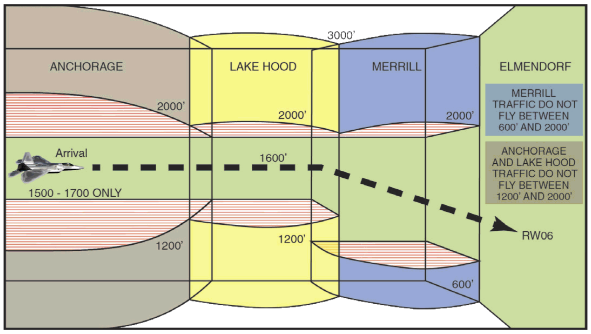
- Improve efficiencies in F-22 flight operations
- Respond to Federal Aviation Administration (FAA) 2014 guidance on the use of one runway for opposite direction flight operations (ODO)
- Address public/agency concerns regarding safety in the airspace around Anchorage
- Address constraints on operations resulting from the 2011 F-22 Plus-Up environmental analysis
- Address acoustic effects to sensitive areas

The Air Force is preparing the EIS in accordance with the National Environmental Policy Act (NEPA) to analyze potential environmental consequences associated with the proposal to improve F-22 operations efficiency at JBER.



The Anchorage airspace, known as the Anchorage bowl is subdivided into the six segments pictured at right. The Anchorage International Segment primarily supports commercial air carriers at Ted Stevens Anchorage International Airport. The Merrill, Lake Hood, and Seward Highway Segments, as well as Sixmile Lake primarily support general aviation. The Elmendorf and Bryant Segments support military aviation.

The primary arrival runway for all JBER-based aircraft is RW 06. This approach, depicted on the right, passes through the complex Anchorage Airspace, which is used by multiple commercial, general aviation, and military aircraft.



EIS Alternatives to Date

Alternative A - Runway (RW) 34 Focus: RW 34 would be used for nearly all F 22 departures and RW 06 would be used for nearly all arrivals (see opposite page for illustration of JBER's runways). Alternative A improves flexibility and efficiency for F-22 operations by relaxing the constraint on using RW 34 for departures; addresses the 2014 FAA ODO guidance; continues safety issues with RW 06 arrivals in congested airspace; and has the potential to increase off-base noise over residential areas.

Alternative B - RW 34 Focus with RW 16 Extension: RW 34 would be used for nearly all F 22 departures and RW 06 would be used for nearly all arrivals. A 2,000-foot extension of RW 16/34 would be constructed to the north with associated taxiways and lighting. Alternative B improves flexibility; has construction and additional maintenance costs; addresses the FAA ODO guidance; continues safety issues with RW 06 arrivals; and has the potential to decrease off-base noise over residential areas.

Alternative C - RW 34 Focus with RW 16 Extension/ Arrivals: RW 34 would be used for nearly all F 22 departures and an extended RW 16 would be used for nearly all arrivals. The RW 16/34 2,000 foot extension would be as described for Alternative B. Alternative C improves flexibility; has construction and additional maintenance costs; requires substantial runway management to address FAA ODO guidance; improves safety with RW 34 departures; improves safety with RW 16 arrivals; increases overflight of Sixmile Lake; and has the potential to decrease off-base noise over residential areas.

Alternative D - RW 06 Focus: RW 06 would be used for nearly all F-22 departures and arrivals. Alternative D does not improve efficiency and substantially increases F-22 taxi and hold time. Alternative D addresses the FAA ODO guidance; improves safety for departures; continues safety issues with RW 06 arrivals; and has the potential to decrease off-base noise over residential areas.

Alternative E - RW 24 Focus: RW 24 would be used for nearly all F-22 departures and RW 06 would be used for nearly all arrivals. Alternative E improves flexibility and efficiency; requires substantial runway management to address FAA ODO guidance; would not change safety for departures; continues safety issues with RW 06 arrivals; and has the potential to decrease off-base noise over residential areas.

Alternative F - RW 24 Focus with RW 16 Extension/Arrivals: RW 24 would be used for nearly all F 22 departures and an extended RW 16 would be used for nearly all arrivals. The RW 16/34 2,000 foot extension would be as described for Alternative B. Alternative F improves flexibility; has construction and additional maintenance costs; addresses the FAA ODO guidance; would not change safety for departures; improves safety with RW 16 arrivals; increases overflight of Sixmile Lake; and has the potential to decrease off-base noise over residential areas.

No Action - The No Action Alternative (required by NEPA) identifies the baseline conditions for environmental analysis. No Action does not improve flexibility or efficiency; requires substantial runway management to address FAA ODO guidance; does not change safety for departures; continues safety issues with RW 06 arrivals; and does not change off-base noise conditions.

F-22 Flight Operations for the Proposed Action and Alternatives

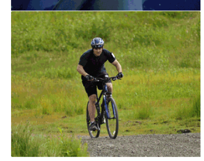
Unit	Sorties/Year*	Departure Operations				Arrival Operations			
		RW 34	RW 06	RW 24	RW 16	RW 34	RW 06	RW 24	RW 16
Alternative A (RW 34 Focus)									
3 WG F-22	5,710	4,335	900	470	5	444	5,231	7	28
Alternative B (RW 34 Focus with RW 16 Extension)									
3 WG F-22	5,710	4,235	900	570	5	444	5,231	7	28
Alternative C (RW 34 Focus with RW 16 Extension/Arrivals)									
3 WG F-22	5,710	4,235	900	570	5	144	800	7	4,759
Alternative D (RW 06 Focus)									
3 WG F-22	5,710	470	4,765	470	5	444	5,231	7	28
Alternative E (RW 24 Focus)									
3 WG F-22	5,710	470	900	4,335	5	444	5,231	7	28
Alternative F (RW 24 Focus with RW 16 Extension/Arrivals)									
3 WG F-22	5,710	470	900	4,335	5	144	800	7	4,759
No Action Alternative									
3 WG F-22	5,710	1,422	970	3,313	5	444	5,231	7	28

* Each sortie includes one departure and one arrival

Environmental Analysis

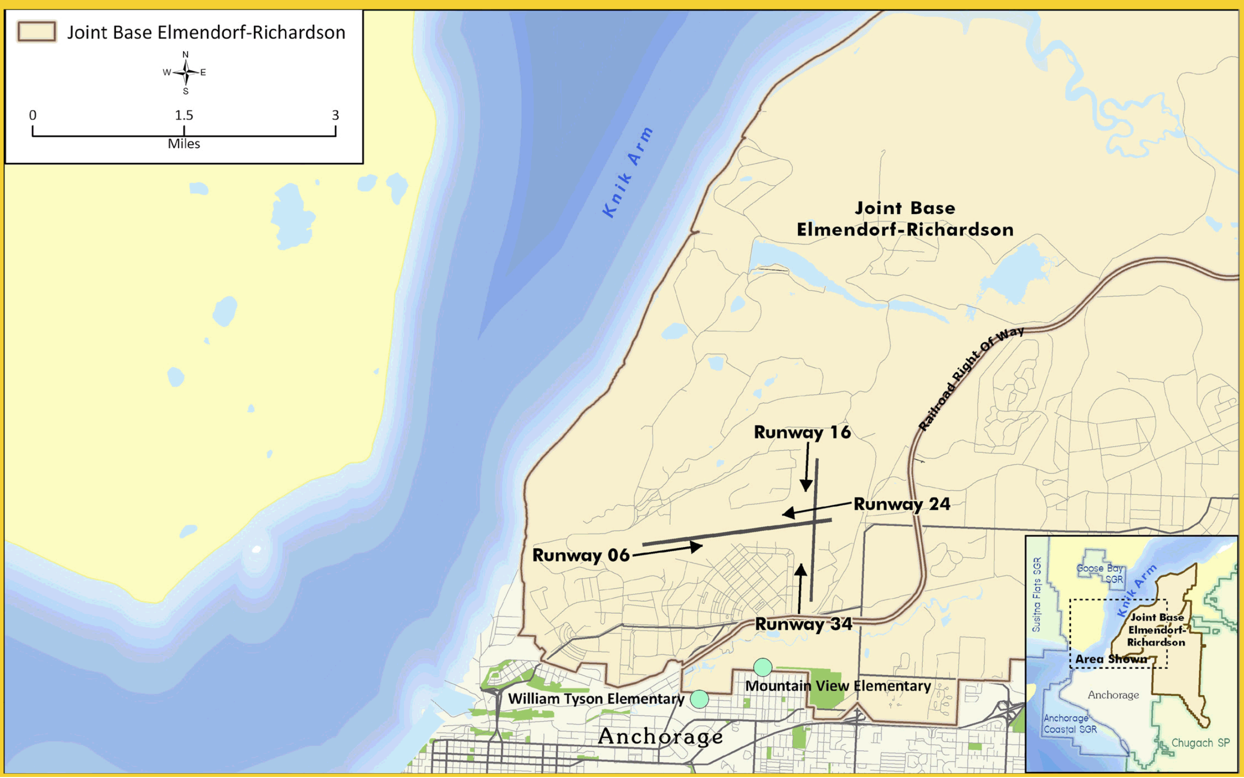
The Environmental Resources Analyzed for Each Alternative:

- Airspace Management and Air Traffic Control
- Acoustic Environment
- Air Quality
- Water Resources/Wetlands
- Geology/Soils
- Biological Resources
- Cultural Resources (Including Alaska Native Concerns)
- Land Use/Zoning
- Health and Safety
- Hazardous Materials and Waste Management
- Infrastructure
- Traffic
- Socioeconomics (Including Environmental Justice)



Changes to F-22 runway operations could potentially affect on-base infrastructure, airfield snow removal, on-base terrain, altitudes overflown of on-base areas, and off-base noise.

JBER Airfield and Vicinity



Your Involvement and Participation are Essential to the NEPA Process.

The National Environmental Policy Act (NEPA) is our national mandate for making informed decisions while considering environmental impacts. When Federal agencies propose projects having the potential to significantly impact the environment, NEPA requires the following process be undertaken as part of the planning process before final decisions are made:

- Evaluation and consideration of potential environmental consequences
- Consideration of public and agency comments on the proposal

This evaluation is presented in an Environmental Impact Statement, which:

- Identifies and describes the affected environment
- Evaluates the potential environmental consequences from a range of reasonable alternatives
- Identifies environmental permits and specific mitigation measures to avoid, minimize, or reduce environmental impacts, if required

Please take this opportunity to:

- Learn about the proposal
- Identify community-specific issues
- Make sure you are included on the mailing list

Environmental Impact Statement (EIS) Timeline

Opportunities for Public Involvement

Where We Are Now

Federal Register Publication of Notice of Intent to Prepare an EIS for F-22 Operations Changes at JBER
Fall 2015

EIS Scoping Period
Fall 2015

Preparation of Draft EIS
Fall 2015 - Winter 2016

Federal Register Publication of Notice of Availability of Draft EIS
Spring 2016

Draft EIS
Public Comment Period
Spring 2016

Preparation of Final EIS
Spring - Summer 2016

Federal Register Publication of Notice of Availability of Final EIS
Summer 2016

30-day Final EIS Waiting Period
Summer - Fall 2016

Record of Decision
Fall 2016

Notice of Intent and Scoping

The EIS process begins with publication of a Notice of Intent (NOI) in the Federal Register to prepare an EIS. The NOI provides basic information on the Proposed Action in preparation for scoping, which is an early and open process for:

- Actively bringing the public and agencies into the decision-making process
- Determining the scope of issues to be addressed
- Identifying the major issues related to a Proposed Action and alternatives

Scoping begins before any significant analysis is completed and public participation is an integral part of scoping. The purpose of soliciting public and agency comments is to identify interested parties and relevant issues so they can be considered in the EIS.

Public Scoping Comment Period

Submit comments at the public scoping meetings, or by mail before **October 27, 2015** to:
JBER Public Affairs, Bldg. 10480 Sijan Ave., Suite 123, JBER, AK 99506 • 907-552-8151 • jber.pa.3@us.af.mil
or through our website: **www.jberf22eis.com**

A.3 IICEP Mailing Lists

A.3.1 Government Agencies

Representatives/Members/Senators

Senator Lisa Murkowski
Attn: Kevin Sweeney
510 L Street, Ste 550
Anchorage, AK 99501

Federal Agencies

Bureau of Indian Affairs (BIA)

Bureau of Indian Affairs
Alaska Regional Office
709 West 9th Street
PO Box 21647
Juneau, AK 99802

Bureau of Indian Affairs
Anchorage Agency
3601 C Street, Ste 1100
Anchorage, AK 99503-5947

Bureau of Land Management (BLM)

Bureau of Land Management
Anchorage Field Office
Attn: Alan Bittner
4700 BLM Road
Anchorage, AK 99507-2599

Federal Aviation Administration (FAA)

Federal Aviation Administration
Alaska Region
Attn: Kerry Long
222 West 7th Avenue, # 14
Anchorage, AK 99513

National Park Service (NPS)

National Park Service
Alaska Regional Office
240 West 5th Avenue, Ste 114
Anchorage, AK 99501

U.S. Department of Agriculture (USDA)

U.S. Department of Agriculture
Natural Resources Conservation Service
Attn: Robert N. Jones
800 West Evergreen Avenue, Ste 100
Palmer, AK 99645-6546

U.S. Department of Interior (USDOI)

U.S. Department of Interior
Office of Environmental Policy & Compliance
Anchorage Regional Office
Attn: Philip Johnson
1689 C Street, Room 119
Anchorage, AK 99501-5126

U.S. Department of Transportation (USDOT)

U.S. Department of Transportation
Federal Highway Administration
Alaska Division
Attn: Sandra Garcia-Aline
709 West 9th Street, Room 851
PO Box 21648
Juneau, AK 99802-1648

U.S. Environmental Protection Agency (USEPA)

U.S. Environmental Protection Agency
Region 10
EPA Alaska Operations Office
Attn: Dianne Soderlund
222 West 7th Avenue #19
Anchorage, AK 99513-7588

State Agencies

State of Alaska
Office of the Governor
Attn: Bill Walker
PO Box 110001
Juneau, AK 99811-0001

Alaska Resources Library and Information Services
3211 Providence Drive, Ste 111
Anchorage, AK 99508

Alaska State Court Law Library
303 K Street
Anchorage, AK 99501

Alaska Department of Environmental Conservation (ADEC)

Alaska Department of Environmental Conservation
Division of Air Quality
Attn: Alice Edwards
410 Willoughby Avenue, Ste 303
PO Box 111800
Juneau, AK 99801

Alaska Department of Environmental Conservation
Division of Environmental Health
Attn: Elaine Floyd
555 Cordova Street
Anchorage, AK 99501

Alaska Department of Environmental Conservation
Division of Spill Prevention and Response
Attn: Kristin Ryan
410 Willoughby Avenue, Ste 302
PO Box 111800
Juneau, AK 99811-1800

Alaska Department of Environmental Conservation
Division of Water
Attn: Bill Griffith
555 Cordova Street
Anchorage, AK 99501-2617

Alaska Department of Fish and Game (ADFG)

Alaska Department of Fish and Game
Division of Wildlife Conservation
Attn: Bruce Dale
333 Raspberry Road
Anchorage, AK 99518-1599

Alaska Department of Military and Veterans Affairs (DMVA)

Alaska Department of Military and Veterans Affairs
Attn: Brig. Gen. Laurel J. Hummel
PO Box 5800
Camp Denali
JBER, AK 99505

Alaska Department of Natural Resources (ADNR)

Alaska Department of Natural Resources
Commissioner
Attn: Mark Myers
550 West 7th Avenue, Ste 1400
Anchorage, AK 99501

Local Agencies/Councils

Municipality of Anchorage
Attn: Ethan Berkowitz
632 West Sixth Avenue, Ste 840
Anchorage, AK 99501

Municipality of Anchorage
Anchorage Community Development Authority
Attn: Ron Pollock
245 West 5th Avenue, Ste 122
Anchorage, AK 99501

Municipality of Anchorage
Community Planning & Development
Attn: Jerry Weaver
4700 Elmore Road
Anchorage, AK 99507

Ted Stevens Anchorage International Airport
Attn: John Parrot
PO Box 196960
Anchorage, AK 99519

Anchorage Assembly
Attn: Barbara Jones
PO Box 196650
Anchorage, AK 99519

Port MacKenzie
Matanuska-Susitna Borough
Attn: Marc Van Dongen
350 East Dahlia Avenue
Palmer, AK 99645

Port of Anchorage
Attn: Stephen Ribuffo
2000 Anchorage Port Road
Anchorage, AK 99501

Anchorage Historic Preservation Commission
Community Development
PO Box 196650
Anchorage, AK 99519-6650

Eagle River Community Council
Attn: Michael Foster
13135 Old Glenn Hwy, Ste 200
Eagle River, AK 99577

Fairview Community Council
Attn: Christopher Constant
1121 East 10th Avenue
Anchorage, AK 99501

Government Hill Community Council
Attn: Stephanie Kesler
1057 West Fireweed Lane Ste 100
Anchorage, AK 99503

Mountain View Community Council
Attn: Daniel George
PO Box 142824
Anchorage, AK 99514

Northeast Community Council
Attn: Lorne Bretz
1057 West Fireweed Lane, Ste 100
Anchorage, AK 99503

Other Alaska

Alaska Railroad Corporation
327 West Ship Creek Avenue
PO Box 107500
Anchorage, AK 99510

A.3.2 Tribal

Alaska Native Villages

Eklutna Native Village
Attn: Mr. Lee Stephan, President and First Chief
26339 Eklutna Village Road
Chugiak, AK 99567

Knik Village
Attn: Debra Call
PO Box 871565
Wasilla, AK 99687

Native Village of Tyonek
Attn: Frank Standifer
PO Box 82009
Tyonek, AK 99682-0009

Chickaloon Village Traditional Council
Attn: Gary Harrison, Chairman
PO Box 1105
Chickaloon, AK 99674

Alaska Native Corporations

Cook Inlet Region, Inc (CIRI)
Attn: Sophie Minich
2525 C Street, Ste 500
Anchorage, AK 99503

Eklutna, Inc.
Attn: Michael Curry
16515 Centerfield Drive, Ste 201
Eagle River, AK 99577

A.4 IICEP Letter Responses

Room 537, Federal Building
222 West 7th Avenue, #19
Anchorage, Alaska 99513-7588

October 27, 2015

JBER ~~Public Affairs~~ 673 CES/CE/EC
Bldg. ~~10480 Sijan Ave., Suite 123~~
JBER, Alaska 99506

Dear Sir or Madam:

We have reviewed the Department of the Air Force March 5, 2015 Notice of Intent to prepare an Environmental Impact Statement on the proposal to improve F-22 operational efficiency at Joint Base Elmendorf-Richardson in Anchorage, Alaska (EPA Project #15-0054-DOD). Our comments (Enclosure 1) are provided pursuant to our authorities under the National Environmental Policy Act, as well as Section 309 of the Clean Air Act. Section 309, independent of NEPA, specifically directs the EPA to review and comment in writing on the environmental impacts associated with all major federal actions. Under our policies and procedures we also evaluate the document's adequacy in meeting NEPA requirements. A copy of EPA's Section 309 Review: The Clean Air Act and NEPA, May 2002 is also attached (Enclosure 2).

According to the NOI, the Air Force is proposing to improve the operational efficiency of the F-22 at JBER in Anchorage, Alaska. The NOI states that there is no proposed change in the number of aircraft at JBER or in the ongoing military training in existing Alaska training airspace. Six preliminary alternatives have been identified and include changes in runway use and/or airfield infrastructure and maintenance. The Air Force intends for the EIS to address potential impacts resulting from implementation of the alternatives.

In addition to general information regarding the adequacy of the EIS as required by NEPA and the Council on Environmental Quality regulations, our detailed comments focus on our environmental concerns related primarily to air quality; water quality, including wetlands; hazardous materials and wastes; and management of existing Comprehensive Environmental Response, Compensation and Liability Act Operable Units and potential CERCLA sites. We request that you consider our comments in the development of the Draft EIS.

Thank you for this opportunity to provide comments. If you have any questions, please contact me at (907) 271-6324 or curtis.jennifer@epa.gov.

Sincerely,

Jennifer Curtis, NEPA Reviewer
Environmental Review and Sediment Management Unit

ENCLOSURE 1
DETAILED SCOPING COMMENTS

Purpose and Need
The EIS should include a clear and concise statement of the underlying purpose and need for the proposed project, consistent with the implementing regulations for NEPA.[1] We recommend that this statement be framed broadly to ensure a robust analysis of alternatives.

Alternatives
The EIS should include a range of reasonable alternatives that meet the stated purpose and need for the projects and are responsive to the issues identified during the scoping process. This will ensure that the EIS provides the public and the decision-maker with information that sharply defines the issues and identifies a clear basis for choice among alternatives as required by NEPA. The CEQ recommends that all reasonable alternatives be considered, even if some of them could be outside the capability or the jurisdiction of the agency preparing the EIS for the proposed action[2]. We encourage the development of alternative(s) that will minimize environmental and resource degradation. Also, although the NOI identifies six initial alternatives, it does not describe those alternatives. We recommend in the future that preliminary alternatives be described in the NOI for public review and comment.

Comprehensive Environmental Response, Compensation and Liability Act
JBER has several identified OUs containing numerous sites, as well as sites not yet assigned to an OU. It is unclear from the NOI if these sites will be affected in any way from the proposed activities. Due to the number of sites, however, as well as the likelihood of undiscovered contaminated soils and/or groundwater in the general project area, we strongly encourage the Air Force to work closely with the Installation Restoration Manager for JBER (Gary Fink, Chief, Air Force Civil Engineering Center, (907) 384-1824 or gary.fink@us.af.mil) to ensure that all required steps are taken to comply with the institutional and land use controls prior to any ground disturbance and our Federal Facilities program (Sandra Halstead, EPA Region 10 Remedial Project Manager, (907) 271-1218 or halstead.sandra@epa.gov). If results of any sampling become available, and if any changes to institutional controls or the CERCLA Records of Decision, are contemplated these should also be included.

Aquatic Resources, Wetlands and Riparian Areas
If the proposed activities will require a Clean Water Act Section 404 permit from the US Army Corps of Engineers, the Clean Water Act Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material require that impacts to aquatic resources be avoided, minimized, and mitigated, in that sequence.[3] In order to effectively coordinate the NEPA process and the Clean Water Act Section 404 permitting process, we recommend that the EIS include information demonstrating compliance with the Guidelines, or how compliance will be achieved, and discussion of least environmentally damaging practicable alternative to aquatic resources.

For unavoidable impacts, compensatory mitigation should be consistent with the Compensatory Mitigation for Losses of Aquatic Resources; Final Rule.[4] The EIS should include a discussion of all

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[1] 40 CFR 1502.13
[2] 40 CFR 1502.14
[3] 40 CFR 230
[4] 33 CFR 325 and 332, and 40 CFR 230

2

compensatory mitigation should be implemented in advance of the impacts to avoid temporal habitat losses.

To the extent possible, the following information from a draft compensatory mitigation plan should be included in the EIS:

- A description of the resource type and amount that will be provided, the method of compensation, and the manner in which the resource functions of the compensatory mitigation project will address the needs of the ecoregion, physiographic province, or other geographic area of interest.[5]
- A description of the factors considered during the compensatory mitigation project site selection process.[6]
- A description of ecological performance standards that will be used to assess whether the project is achieving its objectives.[7]
- A description of parameters to be monitored in order to determine if the compensatory mitigation project is on track to meet performance standards and if adaptive management is needed.[8]
- Descriptions of the long-term management plan, adaptive management plan, and financial assurances.[9]

To help characterize the affected environment and environmental consequences for aquatic resources, please include the results of any historic or on-going aquatic resource-related survey(s).

Air Quality
To address potential air quality impacts, consider whether project construction, operation, and implementation would result in:

emission of air pollutants that:
- cause any adverse impact on air-quality-related values in a federal Class I area or state wilderness area, or
- create annual emissions greater than the basic Prevention of Significant Deterioration emission thresholds
- any new violation of any state or federal ambient air quality standards;
- interference with the maintenance or attainment of any state or federal ambient air quality standard in the analysis area;
- increases in the frequency or severity of any existing violations of any state or federal ambient air quality standard in the analysis area;
- exposure of nearby populations to increased levels of diesel particulate matter and other air toxics;
- delays in the timely attainment of any standard, interim emission reduction, or other air quality milestone promulgated by the EPA or state air quality agency; or

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[5] 40 CFR 230.94 (c)(2)
[6] 40 CFR 230.94 (c)(3)
[7] 40 CFR 230.95

- exposure of sensitive receptors to substantial pollutant concentrations.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires each Federal agency to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations, low-income populations, and Native American tribes.[10] The areas surrounding JBER contain numerous communities that qualify as environmental justice populations and may be impacted by proposed alternatives.

To address potential environmental justice concerns, we recommend reviewing CEQ's 1997 "Environmental Justice Guidance under the National Environmental Policy Act."[11] We emphasize addressing the following:

- Develop a Demographic Analysis. Gather geographic and demographic data about the area affected by the proposed action to determine whether minority populations, low-income populations, or Alaska Native tribes[12] are present, and if so whether there may be disproportionately high and adverse human health or environmental effects on these populations.
- Establish baseline conditions. Consult relevant public health data and industry data to establish the potential for multiple or cumulative exposure to human health or environmental hazards in the affected population and historical patterns of exposure to environmental hazards, to the extent such information is reasonably available.[13]
- Characterize/describe the direct, indirect, and cumulative effects of the proposed action within this context. Recognize the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed agency action. These factors should include the physical sensitivity of the community or population to particular impacts; the effect of any disruption on the community structure associated with the proposed action; and the nature and degree of impact on the physical and social structure of the community.
- Develop effective public participation strategies. As appropriate, acknowledge and seek to overcome linguistic, cultural, institutional, geographic, and other barriers to meaningful participation, and incorporate active outreach to affected groups. Strategies include: using notices, mailings, fact sheets, briefings, presentations, exhibits, tours, news releases, translations, newsletters, reports, community interviews, surveys, canvassing, telephone hotlines, question and answer sessions, stakeholder meetings, and on-scene information.[14]

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[10] Executive Order 12898, 3 CFR 859 (1994)

[11] CEQ, *Environmental Justice Guidance Under the National Environmental Policy Act,* December 10, 1997, http://ceq.hss.doe.gov/nepa/regs/ej/justice.pdf.

[12] Includes tribal subsistence and cultural resources/resource usage

[13] Ensure that the resolution of the data used is appropriate for the action. For example, some health disparities may not be visualized at the county level, whereas health planning area, census tract, and/or block group level data may be necessary. Analysis should include data at the highest resolution that still provides statistically significant and valid intercomparisons.

[14] Media and outreach should be conducted in a culturally-appropriate manner. Multiple media will likely be needed if diverse and/or multi-generational communities are affected

community as a whole.[15] Recognize that community participation should occur as early as possible if it is to be meaningful. The EIS should describe what was done to inform the communities about the project and the potential impacts it will have on their communities, what input was received from the communities, and how that input was used in the decisions that were made regarding the project.

- Seek tribal representation in the process in a manner that is consistent with the government-to-government relationship between the United States and tribal governments, the federal government's trust responsibility to federally-recognized tribes, and any treaty rights.

We also emphasize CEQ's framework for determining whether environmental effects are disproportionately high and adverse. Consider:

- whether environmental effects are or may be having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group; and
- whether the disproportionate impacts occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.[16]

With regard to mitigation, measures for avoidance or minimization of impacts should be considered first. Where avoidance or minimization is not possible, other measures to mitigate impacts should be proposed. Mitigation measures should be developed with input from the affected population.

We recommend including a summary conclusion for the environmental justice analysis, sometimes referred to as an "environmental justice determination." This summary can summarize identified environmental justice concerns and express whether and how impacts have been appropriately avoided, minimized or mitigated. For more information please visit EPA's Environmental Justice Considerations in the NEPA Process webpage, which includes agency guidance, best practices, methodologies, and online tools such as EJ View and NEPAssist.[17]

Children's Health and Safety

Executive Order 13045 directs that each Federal agency shall make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, and shall ensure that its policies, programs, activities, and standards address these risks.[18] Analysis and disclosure of these potential effects is appropriate because some physiological and behavioral traits of children render them more susceptible and vulnerable than adults to health and safety risks. Children may be more highly exposed to contaminants because they generally eat more food, drink more water, and have higher inhalation rates relative to their size. Also, children's normal activities, such as putting their hands in their mouths or playing on the ground, can result in higher exposures to contaminants as

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[15] For example, diversity of those who participate in meetings should reflect the diversity of the community.

[16] CEQ, *Environmental Justice Guidance Under the National Environmental Policy Act,* December 10, 1997, http://ceq.hss.doe.gov/nepa/regs/ej/justice.pdf.

[17] EPA, *Environmental Justice Considerations in the NEPA Process,* www.epa.gov/Compliance/nepa/nepaej/index.html

compared with adults. Children may be more vulnerable to the toxic effects of contaminants because their bodies and systems are not fully developed and their growing organs are more easily harmed.

Hazardous Materials and Waste

The EIS should identify projected hazardous waste types and volumes, and expected storage, disposal, and management plans. It should also identify any hazardous materials sites within the project's study area and evaluate whether those sites would impact the project in any way.

Cumulative Impacts

Cumulative impacts result when the effects of an action are added to other effects on a resource in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis. While impacts can be differentiated by direct, indirect, and cumulative, the concept of cumulative impacts takes into account all relevant disturbances since cumulative impacts result from compounding the effects of all actions over time. The cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting the resource.

Characterize resources, ecosystems and communities in terms of their response to change and capacity to withstand stresses. Focus on resources that are "at risk" or have the potential to be significantly impacted by the proposed project. Delineate and explain the reasoning behind geographic boundary decisions, using natural ecological boundaries to the extent possible. For example, for cumulative aquatic resource impacts, a natural boundary such as a watershed or sub-watershed could be identified for the spatial scope, although an analysis at multiple geographic scales may also be appropriate. Include a determination and explanation for the temporal scope of the analyses.

Trend data, where available, can be used to establish a baseline for the affected resources, project a reasonably foreseeable cumulative baseline for the affected resources, and to predict the environmental effects of the project when added to this baseline.

Mitigation and Monitoring

CEQ's January 14, 2011 guidance on the Appropriate Use of Mitigation and Monitoring addresses establishing, implementing, and monitoring mitigation commitments made during the NEPA process.[19]

Key concepts include:

- Ensuring that mitigation commitments are implemented;
- Monitoring the effectiveness of mitigation commitments;
- Remedying failed mitigation; and
- Involving the public in mitigation planning.

Consider giving special attention to Section II's information on "Monitoring Mitigation Implementation" and "Monitoring the Effectiveness of Mitigation." Inclusion of implementation monitoring information in the EIS, such as identification of responsible parties, mitigation requirements,

[19] CEQ, *Memorandum for Heads of Federal Departments and Agencies,* Subject: Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact, January 14, 2011, http://ceq.hss.doe.gov/current_developments/docs/Mitigation_and_Monitoring_Guidance_14Jan2011.pdf

agreements.

Coordination with Tribal Governments

Executive Order 13175 Consultation and Coordination with Indian Tribal Governments was issued in order to establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, and to strengthen the United States government-to-government relationships with Indian tribes.[20] The EIS should describe the process and outcome of government-to-government consultation between the Air Force and tribal governments, issues that were raised, and how those issues were addressed in the selection of the proposed alternative.

A.5 Endangered Species Act (ESA) Section 7 Consultation

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

22 Apr 2016

FROM: 673 CES/CEIEC
724 Postal Service Loop #4500
JBER, AK 99505

Dear Ms. Socheata Lor,

The United States Air Force (USAF) is preparing an Environmental Impact Statement (EIS) for the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER). JBER based F-22 fighter aircraft have restrictions that affect the pilot's ability to select a runway for departures based upon the airfield and traffic conditions at the time. The proposed action is to permit F-22 squadrons the flexibility to use JBER runways in as efficient a manner as possible within operational, airspace, and environmental constraints. Increased flexibility means that the F-22 squadrons would have the ability to choose any JBER runway based on the airfield and air traffic conditions. Three alternatives "action alternatives" involve changes in the number of departure(s) and arrival(s) on JBER's existing runways. Three additional alternatives "programmatic alternatives" are identified that extend the North / South (RW 16/34) runway (Attachment 1) to become a 10,000 foot north-south runway, as well as change the number of departure(s) and arrival(s) on JBER runways. Estimated acreage affected by vegetation removal, alteration, grading, and soil deposits is 424.7 acres. The analysis in the EIS for the programmatic alternatives provides early information so that decision makers can determine whether there are unacceptable environmental constraints associated with extending RW 16/34. No new airspace or additional aircraft are proposed under any of the alternatives.

In addition, the "no action" alternative is being analyzed, as required by the National Environmental Policy Act (NEPA). Implementation of the No Action Alternative would result in continuing the current constrained F-22 flight operations. Currently, F-22 departures on RW 34 (the north-south runway) are not to exceed 25 percent of total F-22 departures. The remaining 75 percent of F-22 departures are on RW 06/24 (the east-west runway), with the majority of departures on RW 24.

A synopsis of the effects specifically related to the Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 USC §668), and the Migratory Bird Treaty Act (MBTA) of 1918 (16USC §§703-712 are presented below for your consideration and concurrence.

Federally Listed Threatened/Endangered Species and Critical Habitat

The USAF accessed the U.S. Fish and Wildlife Service (FWS) Information, Planning and Conservation Online system (http://ecos.fws.gov/ipac/) on 20 January 2016 to determine if any federally-listed species potentially occur in the vicinity of the proposed action and associated alternatives. Our review of the FWS data base indicated no federal endangered or threatened species or associated critical habitats occur within the proposed action area (Attachment 2).

Other Species of Special Concern

Several migratory birds of conservation concern potentially occur within the area identified in Attachment 2. Per the FWS Planning and Conservation website (https://ecos.fws.gov/ipac/) access on 20 January 2015, the species include the Aleutian tern (*Sterna aleutica*) Arctic tern (*Sterna paradisaea*), Bald eagle (*Haliaeetus leucocephalus*), Fox sparrow (*Passerella iliaca*), Horned grebe (*Podiceps auritus*), Lesser yellowlegs (*Tringa flavipes*), Olive-sided flycatcher (*Contopus cooperi*), Pink-footed shearwater (*Puffinus creatopus*), Rufous hummingbird (*Selasphorus rufus*), Short-eared owl (*Asio flammeus*), and Solitary sandpiper (*Tringa solitaria*). The presence of Rusty blackbird (*Euphagus carolinus*) is not indicated within the FWS Information, Planning and Conservation Online data base but JBER in collaboration with FWS, University of Alaska-Anchorage and Alaska Department of Fish and Game has detected their presence between Runway 16 and Six Mile Lake.

Bird dispersal and data collection for the JBER Bird-Aircraft Strike Hazard (BASH) Program is contracted with the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), Wildlife Services. The Migratory Bird Treaty Act Depredation Permit is obtained by JBER and implemented by the APHIS personnel for the 3 WG (Federal Permit MB748033-0 and State Permit 16-040). JBER aircraft experience approximately five bird-strikes per year with almost all these bird strikes occurring off the installation. A juvenile Bald Eagle was struck in November 2012 east of runway 06. No migratory bird species of conservation concern were involved in any of these BASH incidents.

Analysis of the Action Alternative (A, D, E and No Action) Effects:

Air flight operational changes due to runway use patterns have the potential to affect migratory birds within the JBER-Elmendorf action area. Changes in runway use patterns will have a slight increase or decrease of localized noise effect depending on runway usage. An increase in runway usage may disturb the daily activities of nesting and foraging avian species.

Changes in runway use patterns have the potential to slightly increase BASH risk. This could potentially increase the number of MBTA species struck during flight operations. However, JBER has developed aggressive procedures designed to minimize the occurrence of bird-aircraft strikes by conditioning avian behavior so the overall risks associated with bird-aircraft strikes is expected to remain low.

Noise effects are expected to increase slightly or decrease from alteration of runway use patterns. Overall the noise environment at JBER would not increase because the number of aircraft launches and recoveries will not change.

Determination of Effects of Action Alternative (A, D, and E)

The potential noise effects on nesting Bald eagles and Species of Special Concern (SOSC) could include reproduction, energetics, and predation. However, avian species that occur under the airspace have been exposed to effects from past and ongoing military overflights. These overflights can be unpredictable in duration and exact location. Some avian species are known to tolerant and acclimate to noise over time (Ellis et al. 1991, Stalmaster and Kaiser 1997, Conomy et al. 1998, Schueck et al. 2001, Barron et al. 2012, Wilson et al. 2015).

BASH is a major operational concern as well as affecting migratory bird species. Under alternatives where no construction is involved, a slight BASH risk increase is expected. This assumed fractional increase in BASH risk is based on additional runway 16 departures anticipated because the avian habitat north of runway 16 and Sixmile Lake is less fragmented. There would be no change in the total number or minimal distribution of flights changes leaving the airfield at JBER, and therefore impacts to migratory bird species might change slightly.

The increase of localized noise effects from alternating runway usage is not likely to impact avian populations.

Analysis of the Effects of the Programmatic Alternatives (B, C, and F):

Activities occurring within the terrain analysis boundary have the potential to affect migratory birds using the forested and wetland areas under construction. Increased noise and vibrations from construction activities may disturb the daily activities of nesting avian species and foraging activities of Bald and Golden eagles. Approximately 288.4 acres of natural habitat, mostly forested upland and wetlands, will be disturbed if a programmatic alternative is selected in the future.

The proposed runway extension and changes in runway use patterns has the potential to slightly increase BASH risk. This could potentially increase the number of MBTA species struck during flight operations. However, JBER has developed aggressive procedures designed to condition bird behavior and minimize the occurrence of bird-aircraft strikes so the overall risks associated with bird-aircraft strikes is expected to remain low.

Noise effects are expected to increase within the terrain analysis boundary due to construction activities. The noise generated from construction will be temporary. The alteration of runway use patterns will have a slight increase or decrease in localized noise level; however the overall noise environment at JBER would not increase.

Determination of Effects of Programmatic Alternatives (B, C, and F):

Under alternatives where RW 16/34 would increase to a 10,000 foot runway, vegetation and wetland habitats would be removed. The permanent removal of vegetation and wetlands would directly impact habitat for foraging and possibly breeding migratory birds; however there are no documented observations of Bald eagles or SOSC nesting within the identified vegetation removal area.

To accommodate mission requirements JBER conducts annual Bald and Golden eagle nest success and productivity surveys and coordinates with the FWS to establish population trends and habitat use models for several SOSC species (Lesser yellowlegs (*Tringa flavipes*), Olive-sided flycatcher (*Contopus cooperi*), Solitary sandpiper (*Tringa solitaria*), Rusty blackbird (*Euphagus carolinus*), Tree Swallow (*Tachycineta bicolor*) and Violet Green Swallow (*Tachycineta thalassina*)).

The overall BASH risks associated with the extension of RW 16/34 and alteration of runway use patterns is expected to remain low under the current BASH procedures.

The increase of localized noise effects from construction activities and alternating runway usage is not likely to impact avian populations.

For these reasons, we conclude that implementation of the proposed action will have little effect on Bald and Golden eagles and other migratory birds with ranges that could extend under JBER-Elmendorf airspace. The programmatic alternative analysis also does not indicate there are unacceptable environmental constraints.

Please provide written comments regarding this action at your convenience within 30 days, if possible of this letter. Direct any questions you have to Kristy Craig, 552-0190, Zach Walker, 384-2460 or Brent Koenen, 384-6224. Written comments should be sent in care of Mr. Brent Koenen, Chief, Natural Resources, 673 CES/CEIEC, brent.koenen@us.af.mil.

Sincerely,

Brent Koenen

BRENT KOENEN GS-13
Chief, Natural Resources

Enclosures:
Attachment 1: EIS Alternatives
Attachment 2: IPAC Report

References:

Barron, D.G., J.D. Brawn, L.K. Butler, L.M. Romero, and P.J. Weatherhead. 2012. Effects of military activity on breeding birds. Journal of Wildlife Management. 76(5): 911-918.

Conomy, J.T., J.A. Dubovsky, J.A. Collazo, and W.J. Fleming. 1998. Do black ducks and wood ducks habituate to aircraft disturbance? Journal of wildlife management. 62(3): 1135-1142.

DeRose-Wilson, A., J.D. Fraser, S.M. Karpanty, and M.D. Hillman. 2015. Effects of overflights on incubating wilson's plover behavior and heart rate. Journal of Wildlife Management. 79(8): 1246-1254.

Ellis, D.H., C.H. Ellis, and D.P. Mindell. 1991. Raptor responses to low level jet aircraft and sonic booms. Environmental Pollution. 74(1): 53-83.

Schueck, L.S., J.M. Marzluff, and K. Steenhof. 2001. Influence of military activities on raptor abundance and behavior. Condor. 103(3): 606-615.

Stalmaster, M.V. and J.L. Kaiser. 1997. Flushing responses of wintering bald eagles to military activity. Journal of wildlife management. 61(4): 1307-1313.

ATTACHMENT 1

EIS Alternatives to Date

Alternative A - Runway (RW) 34 Focus: RW 34 would be used for nearly all F 22 departures and RW 06 would be used for nearly all arrivals (see opposite page for illustration of JBER's runways). Alternative A improves flexibility and efficiency for F-22 operations by relaxing the constraint on using RW 34 for departures; addresses the 2014 FAA ODO guidance; continues safety issues with RW 06 arrivals in congested airspace; and has the potential to increase off-base noise over residential areas.

Alternative B - RW 34 Focus with RW 16 Extension: RW 34 would be used for nearly all F 22 departures and RW 06 would be used for nearly all arrivals. A 2,000-foot extension of RW 16/34 would be constructed to the north with associated taxiways and lighting. Alternative B improves flexibility; has construction and additional maintenance costs; addresses the FAA ODO guidance; continues safety issues with RW 06 arrivals; and has the potential to decrease off-base noise over residential areas.

Alternative C - RW 34 Focus with RW 16 Extension/ Arrivals: RW 34 would be used for nearly all F 22 departures and an extended RW 16 would be used for nearly all arrivals. The RW 16/34 2,000 foot extension would be as described for Alternative B. Alternative C improves flexibility; has construction and additional maintenance costs; requires substantial runway management to address FAA ODO guidance; improves safety with RW 34 departures; improves safety with RW 16 arrivals; increases overflight of Sixmile Lake; and has the potential to decrease off-base noise over residential areas.

Alternative D - RW 06 Focus: RW 06 would be used for nearly all F-22 departures and arrivals. Alternative D does not improve efficiency and substantially increases F-22 taxi and hold time. Alternative D addresses the FAA ODO guidance; improves safety for departures; continues safety issues with RW 06 arrivals; and has the potential to decrease off-base noise over residential areas.

Alternative E - RW 24 Focus: RW 24 would be used for nearly all F-22 departures and RW 06 would be used for nearly all arrivals. Alternative E improves flexibility and efficiency; requires substantial runway management to address FAA ODO guidance; would not change safety for departures; continues safety issues with RW 06 arrivals; and has the potential to decrease off-base noise over residential areas.

Alternative F - RW 24 Focus with RW 16 Extension/Arrivals: RW 24 would be used for nearly all F 22 departures and an extended RW 16 would be used for nearly all arrivals. The RW 16/34 2,000 foot extension would be as described for Alternative B. Alternative F improves flexibility; has construction and additional maintenance costs; addresses the FAA ODO guidance; would not change safety for departures; improves safety with RW 16 arrivals; increases overflight of Sixmile Lake; and has the potential to decrease off-base noise over residential areas.

No Action - The No Action Alternative (required by NEPA) identifies the baseline conditions for environmental analysis. No Action does not improve flexibility or efficiency; requires substantial runway management to address FAA ODO guidance; does not change safety for departures; continues safety issues with RW 06 arrivals; and does not change off-base noise conditions.

F-22 Flight Operations for the Proposed Action and Alternatives

Unit	Sorties/Year*	Departure Operations				Arrival Operations			
		RW 34	RW 06	RW 24	RW 16	RW 34	RW 06	RW 24	RW 16
Alternative A (RW 34 Focus)									
3 WG F-22	5,710	4,335	900	470	5	444	5,231	7	28
Alternative B (RW 34 Focus with RW 16 Extension)									
3 WG F-22	5,710	4,235	900	570	5	444	5,231	7	28
Alternative C (RW 34 Focus with RW 16 Extension/Arrivals)									
3 WG F-22	5,710	4,235	900	570	5	144	800	7	4,759
Alternative D (RW 06 Focus)									
3 WG F-22	5,710	470	4,765	470	5	444	5,231	7	28
Alternative E (RW 24 Focus)									
3 WG F-22	5,710	470	900	4,335	5	444	5,231	7	28
Alternative F (RW 24 Focus with RW 16 Extension/Arrivals)									
3 WG F-22	5,710	470	900	4,335	5	144	800	7	4,759
No Action Alternative									
3 WG F-22	5,710	1,422	970	3,313	5	144	5,531	7	28

* Each sortie includes one departure and one arrival

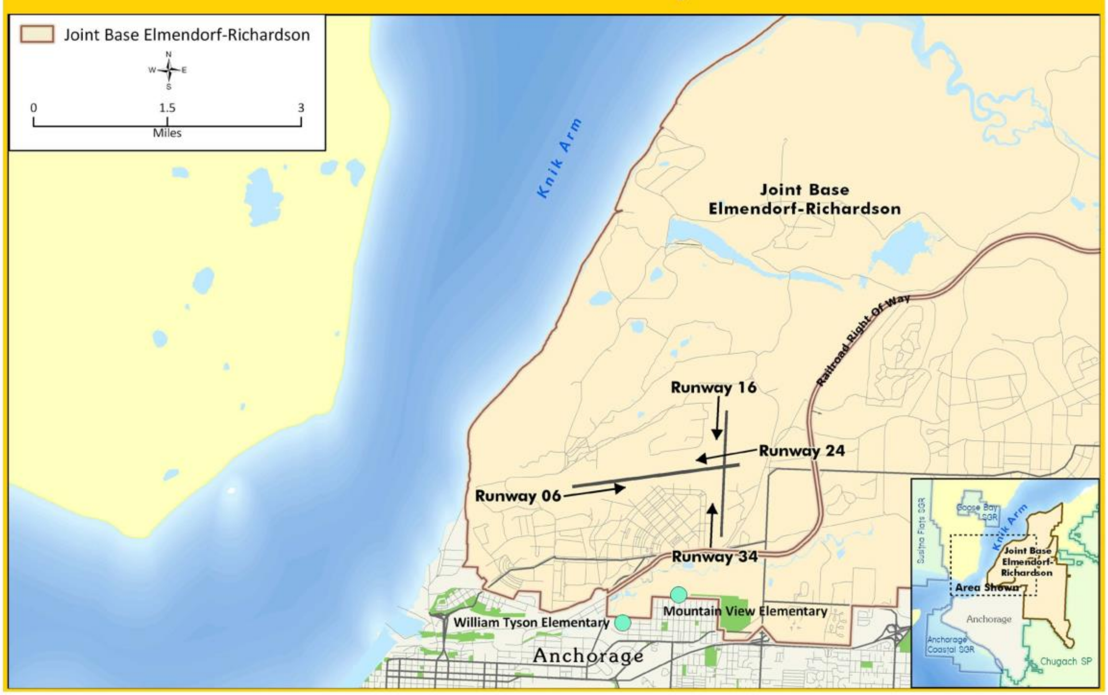
Environmental Analysis

The Environmental Resources Analyzed for Each Alternative:

- Airspace Management and Air Traffic Control
- Noise
- Air Quality
- Water Resources/Wetlands
- Geology/Soils
- Biological Resources
- Cultural Resources (Including Alaska Native Concerns)
- Land Use/Zoning
- Health and Safety
- Hazardous Materials and Waste Management
- Infrastructure
- Traffic
- Socioeconomics (Including Environmental Justice)

Changes to F-22 runway operations could potentially affect on-base infrastructure, airfield snow removal, on-base terrain, altitudes overflown of on-base areas, and off-base noise.

JBER Airfield and Vicinity



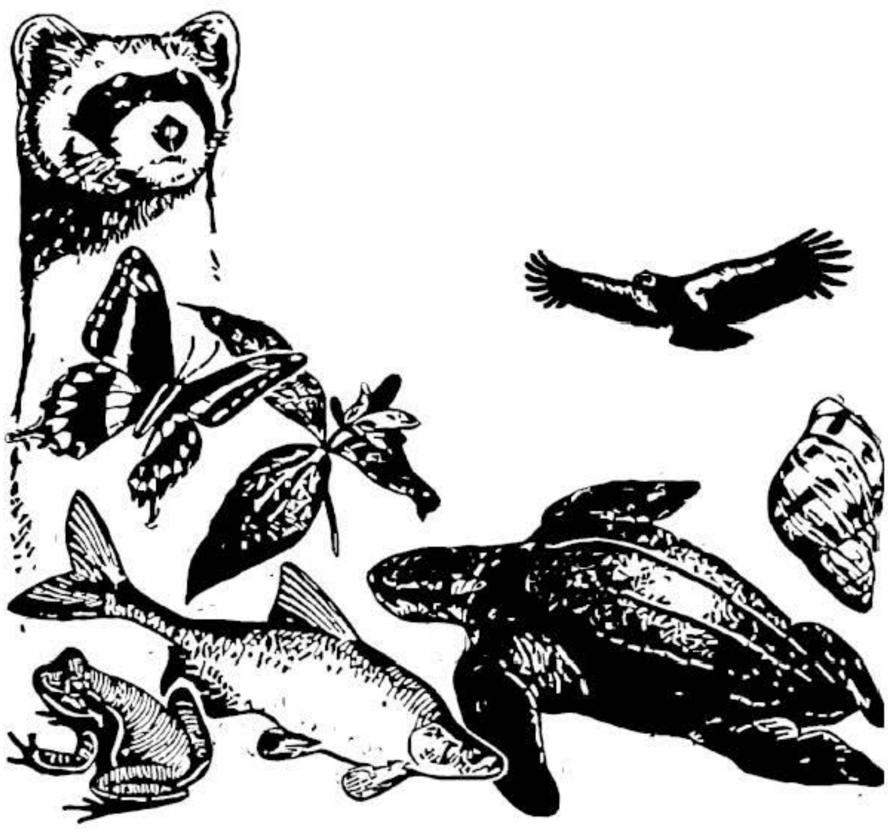
ATTACHMENT 2

U.S. Fish & Wildlife Service

IPaC Trust Resource Report

Generated January 20, 2016 04:13 PM MST, IPaC v2.3.2

This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Documents page.



IPaC - Information for Planning and Conservation (http://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish & Wildlife Service environmental review process.

IPaC Trust Resource Report

ATTACHMENT 2

US Fish & Wildlife Service

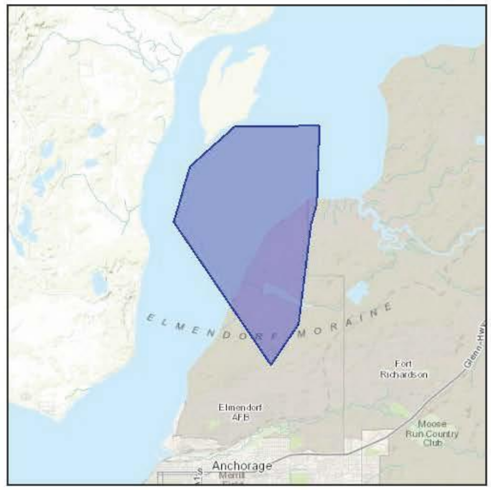
IPaC Trust Resource Report

LOCATION

Anchorage and Matanuska-Susitna counties, Alaska

IPAC LINK

http://ecos.fws.gov/ipac/project/LKFUL-2OVAR-AARFF-RD3RX-K6NRYM



U.S. Fish & Wildlife Contact Information

Trust resources in this location are managed by:

Anchorage Fish And Wildlife Field Office
4700 Blm Road
Anchorage, AK 99507
(907) 271-2888

ATTACHMENT 2

Endangered Species

Proposed, candidate, threatened, and endangered species are managed by the Endangered Species Program of the U.S. Fish & Wildlife Service.

This USFWS trust resource report is for informational purposes only and should not be used for planning or analyzing project level impacts.

For project evaluations that require FWS concurrence/review, please return to the IPaC website and request an official species list from the Regulatory Documents section.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list from the Regulatory Documents section in IPaC.

There are no endangered species in this location

Critical Habitats

There are no critical habitats in this location

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity which results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service (1). There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

Additional information can be found using the following links:

- Birds of Conservation Concern
  http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/akn-histogram-tools.php

The following species of migratory birds could potentially be affected by activities in this location:

Aleutian Tern Sterna aleutica — Bird of conservation concern
Season: Breeding

Arctic Tern Sterna paradisaea — Bird of conservation concern
Season: Breeding

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B008

Fox Sparrow Passerella iliaca — Bird of conservation concern
Season: Breeding

Horned Grebe Podiceps auritus — Bird of conservation concern
Season: Wintering

Lesser Yellowlegs Tringa flavipes — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0MD

Olive-sided Flycatcher Contopus cooperi — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0AN

Pink-footed Shearwater Puffinus creatopus — Bird of conservation concern
Year-round

ATTACHMENT 2

Rufous Hummingbird selasphorus rufus — Bird of conservation concern

Season: Breeding

https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0E1

Short-eared Owl Asio flammeus — Bird of conservation concern

Season: Breeding

https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HD

Solitary Sandpiper Tringa solitaria — Bird of conservation concern

Season: Breeding

Refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuges in this location

IPaC Trust Resource Report

ATTACHMENT 2

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

This location overlaps all or part of the following wetlands:

Estuarine And Marine Deepwater

E1UBL 32100.0 acres

Estuarine And Marine Wetland

E2USN 48600.0 acres

Freshwater Emergent Wetland

PEM1B 28.5 acres

PEM1C 18.6 acres

PEM1F 4.81 acres

PEM1Ch 1.67 acres

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Freshwater Forested/shrub Wetland

PFO4B	472.0 acres
PSS1B	219.0 acres
PSS4B	113.0 acres
PFO1B	8.47 acres

Freshwater Pond

PUBH	56.5 acres

Lake

L1UBHh	84.4 acres
L2AB3H	37.9 acres
L2AB3Hh	3.61 acres

A full description for each wetland code can be found at the National Wetlands Inventory website: http://107.20.228.18/decoders/wetlands.aspx

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

Mr. Jon Kurland
NOAA Fisheries
National Marine Fisheries Service
Protected Resources Division
P.O. Box 21668
709 West 9th Street
Juneau, AK 99802

SUBJECT: BIOLOGICAL EVALUATION OF THE PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA: REQUEST FOR CONCURRENCE

Dear Mr. Kurland:

1. The United States Air Force (Air Force) is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER), Alaska. Under the Proposed Action and Alternatives, there would be no change in the number of F-22 aircraft or the number of F-22 operations.

2. As described in the attached Biological Evaluation (BE), the EIS analyzes six alternatives to achieve the Proposed Action, which include the redistribution of F-22 flight operations among the east-west runway (RW 06/24) and north-south runway (RW 16/34). Three of the six alternatives in the EIS are "action alternatives" that are eligible for being selected for implementation in the Record of Decision (ROD). The other three alternatives analyzed in the EIS are "programmatic" alternatives, and are not eligible for a decision for implementation in the ROD because they are in the preliminary stages of planning. The programmatic alternatives also involve a 2,000- to 2,500-foot northward extension of RW 16/34.

3. The attached BE is being submitted to fulfill requirements of Section 7 of the Endangered Species Act (ESA) and provides our analysis of the potential effects of the proposed action on listed species and critical habitat in the Action Area. This BE provides a detailed analysis of the potential for behavioral reaction of Cook Inlet beluga whales (CIBW) and Steller Sea Lions from F-22 overflight in combination with the potential for behavioral reaction from other aircraft based at JBER. The analysis also evaluates the potential for adverse modification of the CIBW critical habitat.

4. The analysis in the BE supports a determination of "may affect not likely to adversely affect" for both the Cook Inlet beluga whale and Steller sea lion. The analysis additionally concludes that there would be no adverse modification of Cook Inlet beluga whale critical habitat.

5. We request your concurrence with the "may affect not likely to adversely affect" determinations for these species and with the "no adverse modification" determination for the Cook Inlet beluga whale critical habitat.

6. If you have questions regarding this letter or the biological evaluation, please contact Mr. Chris Garner at (907) 602-0860, Mr. Brent Koenen at (907) 384-6224, or myself at (907) 384-3003. Thank you for your assistance in this matter.

MARK A. PRIEKSAT, GS-13
Chief, Installation Management Flight

USAF Attachment:
Biological Evaluation

cc: Greg Balogh Greg.Balogh@noaa.gov

SECTION 7 (ENDANGERED SPECIES ACT) COMPLIANCE –

BIOLOGICAL EVALUATION

Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson, Alaska

March 2016

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Acronyms

3 WG	3d Wing
AFB	Air Force Base
Air Force	United States Air Force
BE	Biological Evaluation
CH	critical habitat
dB	decibels
dB re: 1 µPa	decibels referenced to 1 microPascal
DPS	Distinct Population Segment
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Units
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FR	*Federal Register*
GIS	geographic information system
Hz	hertz
JBER	Joint Base Elmendorf-Richardson
JO	Joint Order
kHz	kilohertz
km	kilometer
km^2	square kilometers
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MSL	mean sea level
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ODO	Opposite Direction Operations
PACAF	Pacific Air Force
PCEs	primary constituent elements
POA	Port of Anchorage
ROD	Record of Decision
RW	runway
SPL	sound pressure levels
TTS	temporary threshold shift

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1.0 INTRODUCTION

The United States Air Force (Air Force) is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER), Alaska.

This Biological Evaluation (BE), prepared by the Air Force, addresses the Proposed Action in compliance with Section 7 of the Endangered Species Act (ESA). Section 7 assures that, through consultation (or conferencing for proposed species) with the National Marine Fisheries Service (NMFS), federal actions do not jeopardize the continued existence of any threatened, endangered or proposed species, or result in the destruction or adverse modification of critical habitat. The purpose of this BE is to provide an analysis of potential effects of the proposed project on endangered and threatened species and critical habitat for the purposes of compliance with Section 7 of the ESA. This BE is intended to support informal consultation under the ESA.

1.1 Purpose

The *purpose* of this action is to improve the Air Force's 3d Wing (3 WG) operational flexibility and efficiencies through a combination of runway use and infrastructure utilization. The improved flexibility would permit JBER to address existing and future challenges to flight operations.

1.2 Need

The 3 WG needs to reassess JBER flight operations, with a focus on the F-22 operational squadrons. Five factors have created the need for more flexibility in runway use:

(1) The Air Force must maintain all F-22 mission capabilities at JBER and maintain operational efficiencies in the PACAF region while concurrently reducing costs and implementing operational efficiencies which could have long-term cost savings;

(2) The Air Force must address the use of JBER runways to respond to 2014 FAA ODO guidance (FAA 2014a; 2014b). ODO guidance addresses the use of one active runway for departure and landing in both directions (counterflow) in response to a number of events in the National Airspace System in which ODO were identified as a safety risk. The FAA issued Joint Order (JO) 7210.3, *Facility Operation and Administration*, restricting ODO traffic when using one runway for two-directional traffic. Strict application of this restriction could limit the use of JBER's runways and introduce inefficiencies into F-22 flight operations;

(3) The Air Force must address 3 WG operational flexibility on JBER runways to reduce restrictions on flight operations derived from the F-22 Plus-Up EA (EA/FONSI) (Air Force 2011);

(4) The Air Force must address existing and increasing civil aircraft traffic and identify ways to improve safe transit within the Anchorage Bowl airspace segments, especially where airspace constrains JBER arrivals; and

(5) The Air Force must address F-22 runway operations which have the potential to reduce noise over residential and other noise sensitive areas.

To the extent practicable, F-22 flight operation efficiencies and runway use flexibility need to be achieved within the constraints of infrastructure, air traffic, counterflow, weather, and noise effects.

2.0 DESCRIPTION OF THE ACTION AND THE ACTION AREA

Under the Proposed Action, there would be no change in the number of F-22 aircraft or the number of F-22 operations. The EIS analyzes six alternatives to achieve the Proposed Action, which include the redistribution of F-22 flight operations among the east-west runway (RW 06/24) and north-south runway (RW 16/34). Three of the six alternatives in the EIS are "action alternatives" that are eligible for being selected for implementation in the Record of Decision (ROD). The other three alternatives analyzed in the EIS are "programmatic" alternatives, and are not eligible for a decision to implement in the ROD because they are in the preliminary stages of planning. The programmatic alternatives involve a 2,000- to 2,500-foot northward extension of RW 16/34, in addition to redistribution of F-22 operations among the two runways. These runways are shown in Figure 1. Proceeding with the northward runway extension, which is evaluated programmatically in the EIS and this BE, would require additional engineering design, environmental surveys and analysis prior to implementation, should a decision be made and funding be available to implement a runway extension. Extension of RW 16/34 and the associated military flight operations are evaluated in this BE because arrivals and departures on an extended runway would cross Cook Inlet beluga whale critical habitat at lower altitudes than would arrivals and departures on the existing RW 16/34. Additionally, the grading associated with extension of RW 16/34 could permit future establishment of an instrument approach by F-22s from the north, which are not conducted at present. We analyze the overflight effects of that instrument approach under the extended runway alternatives. For the purposes of this BE, we focus on two of the alternatives considered in the EIS (Alternatives C and E). These two alternatives represent the extremes of what could be selected by the Air Force. For comparison, Table 1 presents data on all the alternatives analyzed in the EIS, including No Action. Alternative C (programmatic) and Alternative E (action) would bracket the potential for causing a behavioral reaction by Cook Inlet beluga whale. Programmatic Alternative C emphasizes operations on the north-south RW 16/34 and considers a 2,500-foot runway extension to the north, whereas Action Alternative E emphasizes departures and arrivals on the east-west RW 06/24. Selection of other alternatives, with other mixes of F-22 flight operations and runways, would have a potential for a behavioral reaction between these two extremes. The analysis considers the potential for behavioral reaction from F-22 overflight in combination with the potential for behavioral reaction from other aircraft based at JBER (primarily C-17, E-3a, and C-130) as well as transient aircraft such as F-15Es that are based elsewhere but may visit JBER to participate in an exercise. It should be noted that the focus of the EIS and this BE is 3 WG F-22 operations, and other flying operations at JBER are included in the analysis to provide additional context.

The Action Area encompasses the geographic extent of all the project's potential effects on listed or proposed endangered or threatened species and includes portions of the Knik Arm where F-22 flight activities associated with the Proposed Action have the potential to produce in-water sound pressure levels above 120 decibels (dB), which could have the potential to affect listed species. Figure 2 shows the extent of the Action Area, which includes waters of Knik Arm adjacent to JBER from approximately Ship

Creek on the south extending northward to the west end of Eagle Bay and on the west side of Knik Arm from Point MacKenzie northward to a point northeastward of Goose Bay.

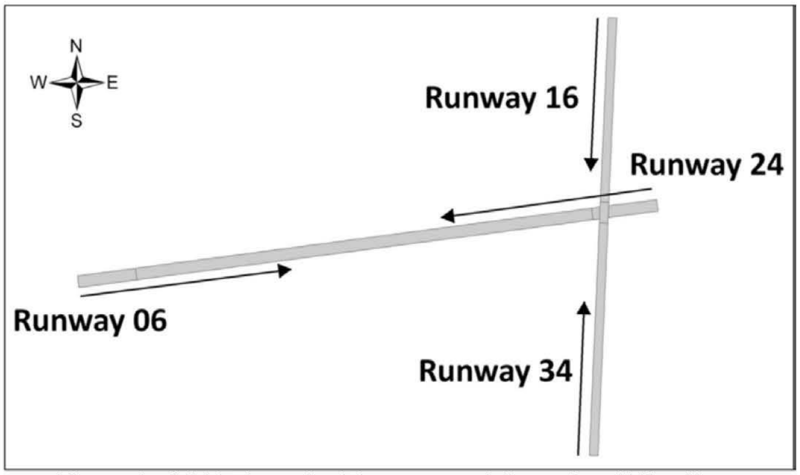

Figure 1. JBER-Elmendorf Runways and Operational Directions

Table 1. F-22 Total Sorties and Flight Operations by Runway for the Proposed Alternatives to Accomplish the Proposed Action

Unit	Sorties / Year[1]	Departure Operations				Arrival Operations			
		RW 34	RW 06[2]	RW 24[3]	RW 16	RW 34	RW 06	RW 24	RW 16
Action Alternative A (RW 34 Departure; RW 06 Arrival)									
3 WG F-22	5,710	4,335	900	470	5	444	5,231	7	28
Action Alternative D (RW 06 Departure and Arrival)									
3 WG F-22	5,710	470	4,765	470	5	444	5,231	7	28
Action Alternative E (RW 24 Departure; RW 06 Arrival)									
3 WG F-22	5,710	470	900	4335	5	444	5,231	7	28
Programmatic Alternative B (RW 16/34 Extension; RW 34 Departure; RW 06 Arrival)									
3 WG F-22	5,710	4,235	900	570	5	444	5,231	7	28
Programmatic Alternative C (RW 16/34 Extension; RW 34 Departure; RW 16 Arrival)									
3 WG F-22	5,710	4,235	900	570	5	144	800	7	4759[4]
Programmatic Alternative F (RW 16/34 Extension; RW 24 Departure; RW 16 Arrival)									
3 WG F-22	5,710	470	900	4335	5	144	800	7	4759[4]
No Action Alternative[5] (Departure 25% on RW 34; 75% on RW 06/24; RW 06 Arrival)									
3 WG F-22	5,710	1,422	970	3313	5	444	5,231	7	28

Notes:
1. Each sortie normally includes one departure operation and one arrival operation and may include a second approach. Sorties/year are representative for the EIS analysis and are based on both F-22 squadrons at full strength all year.
2. RW 06 operations are proportioned from FY13 recorded use including weather, runway maintenance, and recorded hot pits.
3. RW 24 departures based on mission requirements.
4. RW 16 arrivals assume a new F-22 flight profile and precision approach for the extended runway.
5. No Action Alternative assumes runway use adheres to the runway distribution in the 2011 EA/FONSI.

Key:
RW = runway
3 WG = 3d Wing

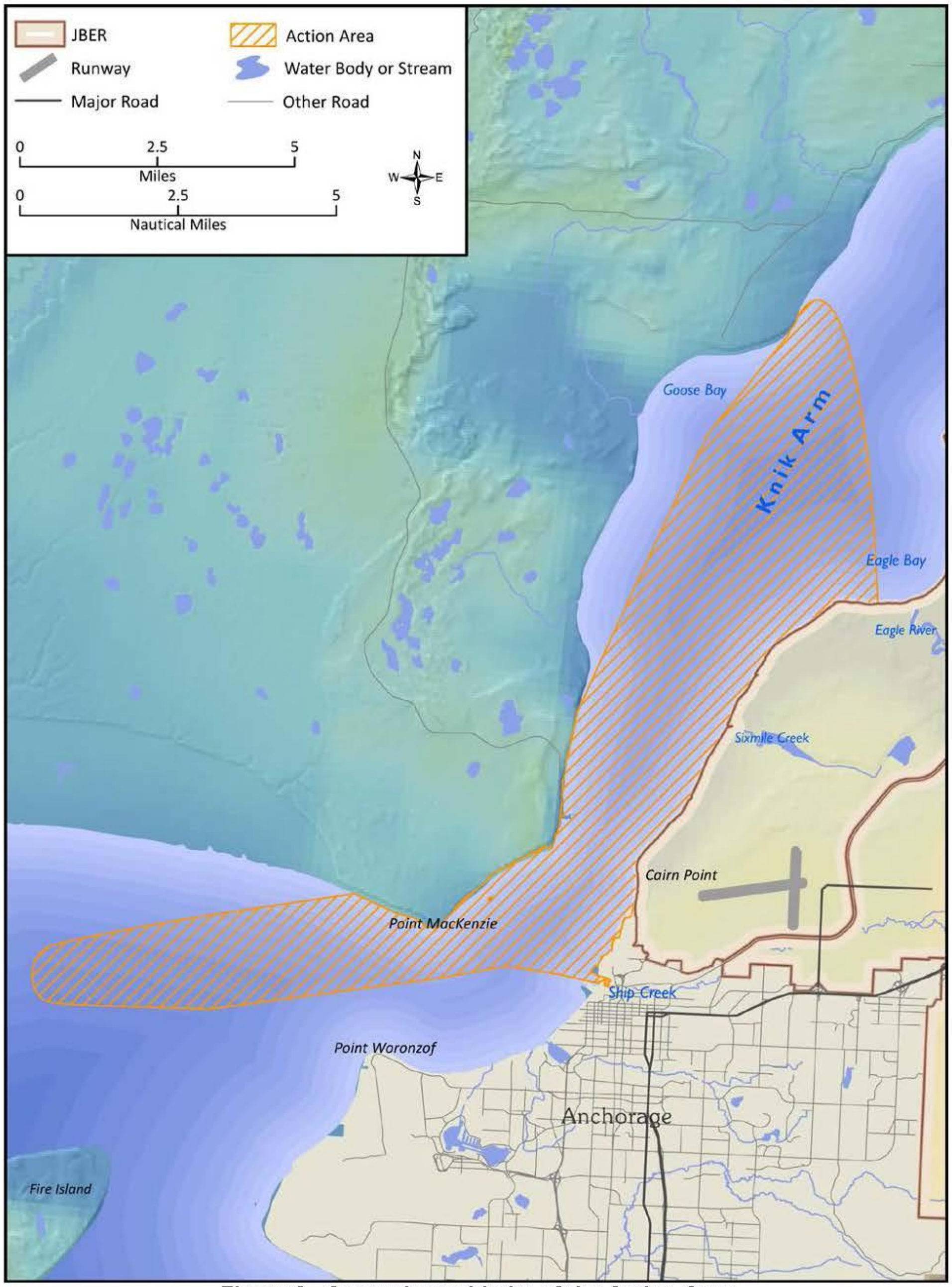

Figure 2. Approximate Limits of the Action Area

3.0 LISTED SPECIES AND CRITICAL HABITAT IN THE ACTION AREA

Table 2 summarizes information about ESA-listed, proposed, and candidate endangered or threatened species that may occur within the Action Area and proposed or designated critical habitat that may be affected by the Proposed Action. Following this summary, more detailed information on the species and their occurrence within or near the Action Area are provided.

Table 2. Threatened, Endangered, and Candidate Species Identified by National Marine Fisheries Service (2010a) Suspected or Recorded in Upper Cook Inlet Project Area

Common Name	Scientific Name	ESA Status	Location Description
Beluga Whale (Cook Inlet Distinct Population Segment [DPS])	*Delphinapterus leucas*	Endangered	Occupies Cook Inlet waters including Knik Arm and waters of North Gulf of Alaska (NMFS 2008a). Designated Critical Habitat includes most of Knik Arm.
Steller Sea Lion* (Western AK DPS)	*Eumetopias jubatus*	Endangered	Includes sea lions born on rookeries from Prince William Sound westward (NMFS 2008b).
Chinook Salmon Evolutionarily Significant Units (ESU)*: Lower Columbia River (spring) Puget Sound Snake River (spring/summer) Snake River (fall) Upper Columbia River (spring) Upper Willamette River	*Onchorhynchus tshawytshca*	 Threatened Threatened Threatened Threatened Endangered Threatened	These ESUs range throughout the North Pacific. However, the specific occurrence of listed salmonids within close proximity to JBER is highly unlikely (NMFS 2010a).
Steelhead *: Lower Columbia River Middle Columbia River Snake River Basin Upper Columbia River Upper Willamette River	*Onchorhynchus mykiss*	 Threatened Threatened Threatened Threatened Threatened	These stocks range throughout the North Pacific. However, the specific occurrence of listed salmonids within close proximity to JBER is highly unlikely (NMFS 2010a).

Notes:

* Individuals of ESA-listed Chinook salmon or steelhead stocks may potentially occur in proximity to JBER, but occur so infrequently that projects are expected to have no effect on them (U.S. Fish and Wildlife Service 2010; NMFS 2010a). Listed salmon and steelhead stocks are not discussed further in this document because of the unlikelihood of their occurrence in the Action Area and lack of potentially harmful project-related noise levels in their environment.

Species by species discussions of threatened, endangered, and candidate species recorded in the Anchorage/Upper Cook Inlet Area are presented in the following sections.

3.1 Beluga Whale, Cook Inlet Distinct Population Segment (DPS)

Biology: See "National Marine Fisheries Service. 2008a. Conservation Plan for the Cook Inlet beluga whale (*Delphinapterus leucas*). National Marine Fisheries Service, Juneau, Alaska. 122 pages." A Draft Recovery Plan was released in May 2015 (NMFS 2015).

Status: Endangered (October 2008) (73 *Federal Register* [FR] 62919)

Critical Habitat: Final Rule (76 FR 20180-20214) April 11, 2011. Area 1 of the designated critical habitat (CH) includes most of Knik Arm, except for specific areas near JBER (Figure 3). The Final Rule excludes from CH sites owned or controlled by the Department of Defense, or of interest to national security. CH does not include the following areas owned by the Department of Defense or for which the

Secretary has determined to exclude for reasons of national security: (1) all property and overlying waters of JBER between Mean Higher High Water and Mean High Water; and (2) all waters off the Port of Anchorage that are east of a line connecting Cairn Point (61°15.4′ N., 149°52.8′ W.) and Point MacKenzie (61°14.3′ N., 149°59.2′ W.) and north of a line connecting Point MacKenzie and the north bank of the mouth of Ship Creek (61°13.6′ N., 149°53.8′ W.). Because of coverage by an Integrated Natural Resources Management Plan, which provides a benefit to Cook Inlet beluga whales, the Eagle River Flats Range (known as the Eagle River Flats impact area) is excluded from CH (Figure 3).

The primary constituent elements (PCEs) identified in the Critical Habitat Final Rule (NMFS 2011a) as "essential to the conservation of Cook Inlet beluga whales" are:

1. Intertidal and subtidal waters of Cook Inlet with depths less than 30 feet Mean Lower Low Water (MLLW) and within 5 miles of high and medium flow anadromous fish streams.
2. Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.
3. Waters free of toxins or other agents of a type or amount harmful to Cook Inlet beluga whales.
4. Unrestricted passage within or between the critical habitat areas.
5. Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales.

Local Records: Abundance estimates by NMFS for the Cook Inlet beluga whale have totaled fewer than 400 individuals during the period of 2001 through 2014; the 2014 estimate is 340 (Shelden *et al.* 2015). Since management of the hunt began in 1999, there has been a declining trend of -1.5 percent per year (Hobbs *et al.* 2015). For management purposes, the NMFS considers the historical abundance estimate of 1,300 beluga whales as the carrying capacity of the Cook Inlet (NMFS 2008a). The Conservation Plan goal is to restore an increasing or sustained population of at least 780 Cook Inlet beluga whales (i.e., maintaining a minimum optimal sustainable population level), and appropriate habitat to support a restored population (NMFS 2008a). This Plan also includes the Knik Arm in Type 1 habitat, considered the most valuable habitat for beluga whales as well as having the greatest potential for impact from anthropogenic threats (NMFS 2008a).

While it is difficult to quantify the importance of various habitats in terms of the health, survival, and recovery of the Cook Inlet beluga whale, NMFS believes that certain areas are particularly important. For instance, during ice-free months beluga whales often concentrate near shallow tidal flats, estuarine areas, or river mouths where salmon runs occur during summer and fall (NMFS 2011b). Individuals/groups are considered seasonally common in Knik Arm waters adjacent to JBER from May to November, with the highest numbers from August to November.

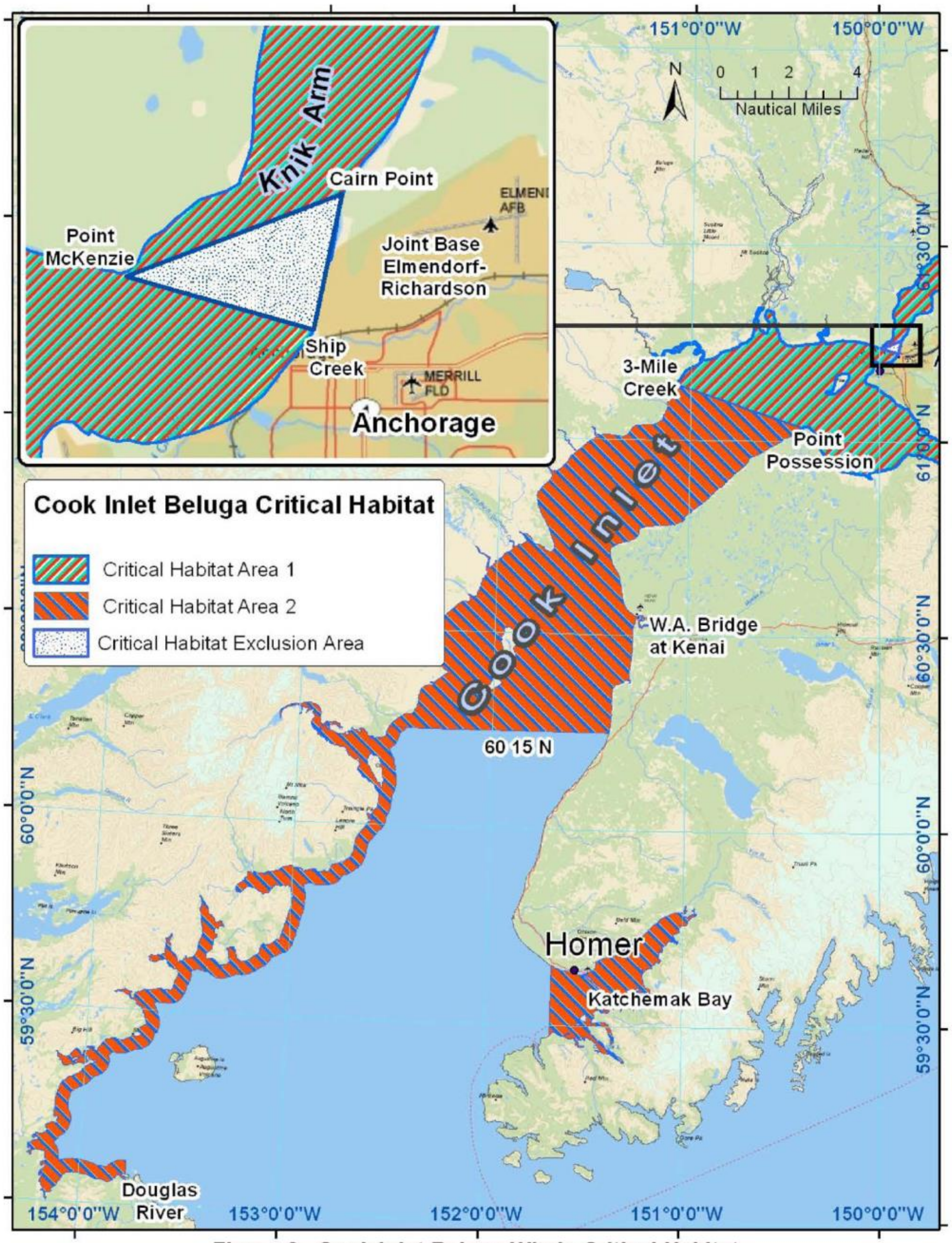

Figure 3. Cook Inlet Beluga Whale Critical Habitat
(NMFS 2015)

Within Knik Arm, beluga abundance is highly variable. Aerial surveys conducted during the first weeks of June by NMFS between 1993 and 2014 show beluga abundance in Knik Arm ranging from 259 (high count in 1997) (Rugh *et al*. 1997) to 0 (in 1994, 2004, 2008–2014) (Rugh *et al*. 1995, 2005; Shelden *et al*. 2008, 2009, 2010, 2011, 2012, 2015). Beluga abundance in the Knik Arm varies seasonally (Figure 4) and is generally highest during the months of August through November, which account for 90 percent of land and boat-based observations (NMFS 2010b).

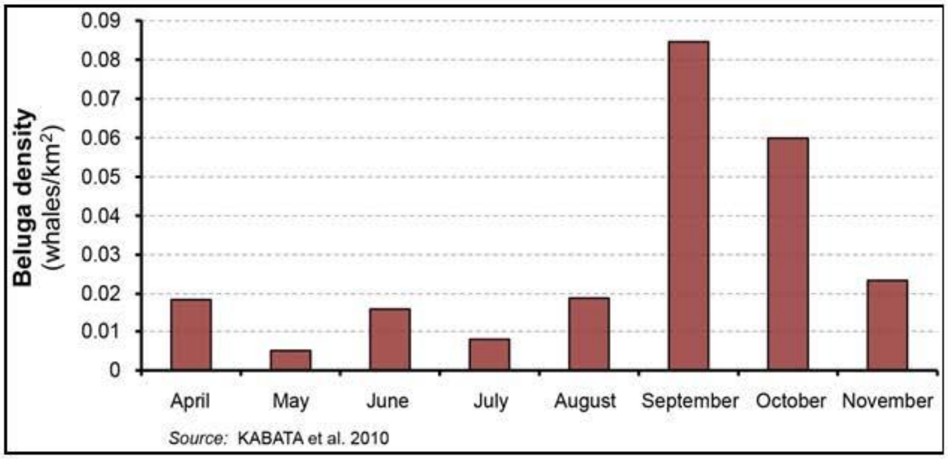

Figure 4. Monthly Cook Inlet Beluga Whale Density Estimates

Adapted from Markowitz, Funk, et al. (2005) using land based observational data from Cairn Point, Sixmile Creek, and Point MacKenzie, within the 18 AGRS Action Area (Knik Arm Bridge and Toll Authority [KABATA] et al. 2010). Numbers are believed to be very low during between December through March, when sea ice is generally prevalent.

Cook Inlet belugas seasonally concentrate at mouths of anadromous fish streams where they feed on Pacific salmon (five species) and Pacific eulachon. Other diet items include cod, pollock, and sole. In Knik Arm, belugas are noted to transit between stream mouths (NMFS 2010c) where behaviors including milling, feeding, and socializing by belugas have been identified (Stewart 2010). In Knik Arm these activity areas include Sixmile Creek, Eagle Bay, Eagle River, and near Point MacKenzie, with transit of belugas primarily along the east side of the Lower Knik Arm (Stewart 2010; Funk *et al.* 2005). Most beluga activity in Knik Arm is noted during August, September, and October, coinciding with the coho salmon run (NMFS 2010b).

According to Markowitz *et al.* (2005) Cook Inlet beluga whales show seasonal changes in distribution concurrent with changes in sea-ice concentration, apparently preferring relatively ice free or ice edge areas. In Cook Inlet, sea ice concentration fluctuates widely by season. In the Action Area (e.g., at Cairn Point), sea ice is prevalent between November and April and beluga sighting rates were lowest during December through February (Markowitz *et al.* 2005). Beluga whales show seasonal shifts in distribution, and generally move from summer-fall use areas in the upper Cook Inlet, such as the Knik Arm, to more open waters to the south during winter. Although Cook Inlet beluga whales may move seasonally in relation to sea ice concentration in winter, sea ice may not be as important as prey availability in determining their seasonal ranging and distribution patterns. The National Oceanic and Atmospheric Administration (NOAA) satellite tagging data as well as observations by JBER and KABATA *et al.* (2010) indicate that belugas do use Knik Arm to some extent during all months of the year but that this use is heavily concentrated in the late summer-fall (August–November), as shown in Figure 4, and is greatly diminished during the months of December–July (Ezer 2011). Beluga movements within Cook Inlet appear to be influenced by the direction of the tides and timing and location of major fish runs (Ezer *et al.* 2008; Moore *et al.* 2000; Hobbs *et al.* 2005; Rugh *et al.* 2010), ice cover (Goetz *et al.* 2012), water temperature, and peak discharge of major rivers in Cook Inlet (Ezer *et al.* 2013; Ashford *et al.* 2013).

Scientific monitoring studies conducted for the Port of Anchorage provide considerable detail on beluga abundance in the southern portion of the Action Area during spring, summer, and fall, including the months when they are most abundant. Table 3 summarizes data taken during the period 2005–2011 for observation points on the east side of the Knik Arm within the Action Area. In 568 days of monitoring totaling 3,674 monitoring-hours, belugas were sighted on 20.8 percent of the days between April and November. Individuals (or groups) were recorded less than once in every 10 hours. Group size averaged 3.8 whales. The monitoring effort was focused in the summer and fall months, when beluga presence in the Action Area is highest.

Table 3. Summary of Cook Inlet Beluga Whale Sightings in the Action Area 2005–2011; Data from Scientific Monitoring Studies Conducted on Behalf of the Port of Anchorage

Year	Sampling Effort			Sightings					
	Months	Days	Hours	# of Days with Whale Sightings	# Whales	# Groups	Percent of Total Days with Whale Sightings	Groups per Observation-hour (group = 1 or more whales)	Whales per Group
2005	Aug–Nov	51	374	14	156	23	27.5%	0.06	6.8
2006	Apr–Nov	95	564	21	82	26	22.1%	0.05	3.2
2007	Oct–Nov	28	139	9	86	20	32.1%	0.14	4.3
2008	Jun–Nov	91	612	20	283	74	22.0%	0.12	3.8
2009	May–Nov	112	779	14	166	54	12.5%	0.07	3.1
2010	Jun–Nov	87	600	23	115	42	26.4%	0.07	2.7
2011	Jun–Nov	104	606	17	171	37	16.3%	0.06	4.6
Total 2005–2011		**568**	**3,674**	**118**	**1,059**	**276**	**--**	**--**	**--**
Average		**81.1**	**525**	**16.9**	**151.3**	**39.4**	**20.8%**	**0.08**	**3.8**

Sources:
2005-2008 data from Kendall (2010)
2009 data from Cornick *et al.* (2010)
2010 data from Cornick and Pinney (2011)
2011 data from Cornick *et al.* (2011)

In 2009, 2010, and 2011, the duration of each sighting was reported, enabling the proportion of monitoring time that the whales were observable to be determined. Table 4 summarizes this information. During this three-year period, whales were observed on average for 10.1 hours out of an average of 663 monitoring hours per year, or about 1.5 percent of the time. The data were relatively consistent from year to year and were collected from May or June into November, encompassing the highest use months of the year. These data are consistent with the southern part of the Action Area being used mainly for transit into and out of feeding areas in the Knik Arm. For comparison, Table 5 shows data taken by JBER within Eagle Bay and Eagle River for the same general time period. Eagle River and Eagle Bay are used by belugas for feeding and socializing and belugas were observed there for an average of 17.1 percent of the monitoring time compared to 1.5 percent of the monitoring time for the southern portion of the Action Area. Figure 5 shows the pattern of beluga whale detections within Eagle Bay and Eagle River from 2007–2011 in relation to the eastern boundary of the Action Area. The areas of highest beluga use are outside the Action Area.

Table 4. Percentage of Observation hours when Cook Inlet Beluga Whales were Observed within POA Monitoring Area (which overlaps the southern portion of the JBER Action Area)

Year	Observation Months	Total Monitoring Time (hours)	Duration of Whale Observations (hours)	Percentage of Monitoring Time Whales were Observed
2009	May–November	782.6	10.4	1.3%
2010	June–November	599.7	9.97	1.7%
2011	June–November	605.6	10.0	1.7%
Total 2009–2011		**1,987.9**	**30.3**	**1.5%**
Average 2009–2011		**662.6**	**10.1**	**1.5%**

Sources:
Cornick *et al.* 2010; Cornick and Pinney 2011; and Cornick *et al.* 2011

Table 5. Percentage of Observation Hours When Cook Inlet Beluga Whales Were Observed within Eagle Bay or Eagle River (which is partially overlapped by the northern portion of the JBER Action Area)

Year	Observation Months	Total Monitoring Time (hours)	Duration of Whale Observations (hours)	Percentage of Monitoring Time Whales were Observed
2009	1 June–28 October	322.8	36.9	11.4%
2010	9 June–16 November	720.1	136.7	19.0%
2011	3 June–14 December	651.9	116.3	17.8%
Total 2009–2011		**1,694.8**	**289.9**	**17.1%**
Average 2009–2011		**564.9**	**96.6**	**17.1%**

Source:
U.S. Air Force 2015

The waters of Knik Arm are extremely turbid and subject to wide tidal fluctuations, with a mean diurnal range of 30 feet in Anchorage, resulting in currents ranging from about 3 knots to 12 knots locally (Blackwell and Greene 2002). Belugas ascend to upper Knik Arm on the flooding tide and often retreat to lower portions of the Knik Arm during low tides. In the narrows of the lower reaches of Knik Arm they tend to follow the tide within 1 kilometer (km) of either shoreline. Above the narrows, they may travel up the east side of the Knik Arm following the channel along Eagle Bay on incoming tides and belugas are observed to hug the western shoreline when moving out of the Knik Arm (NMFS 2010b); however, from vantage points on the east side of the Arm above the narrows, many of the same individuals observed swimming up on the east side during the flood tide are also observed to swim down on the same side during the ebb tide (Garner personal communication 2011, 2013).

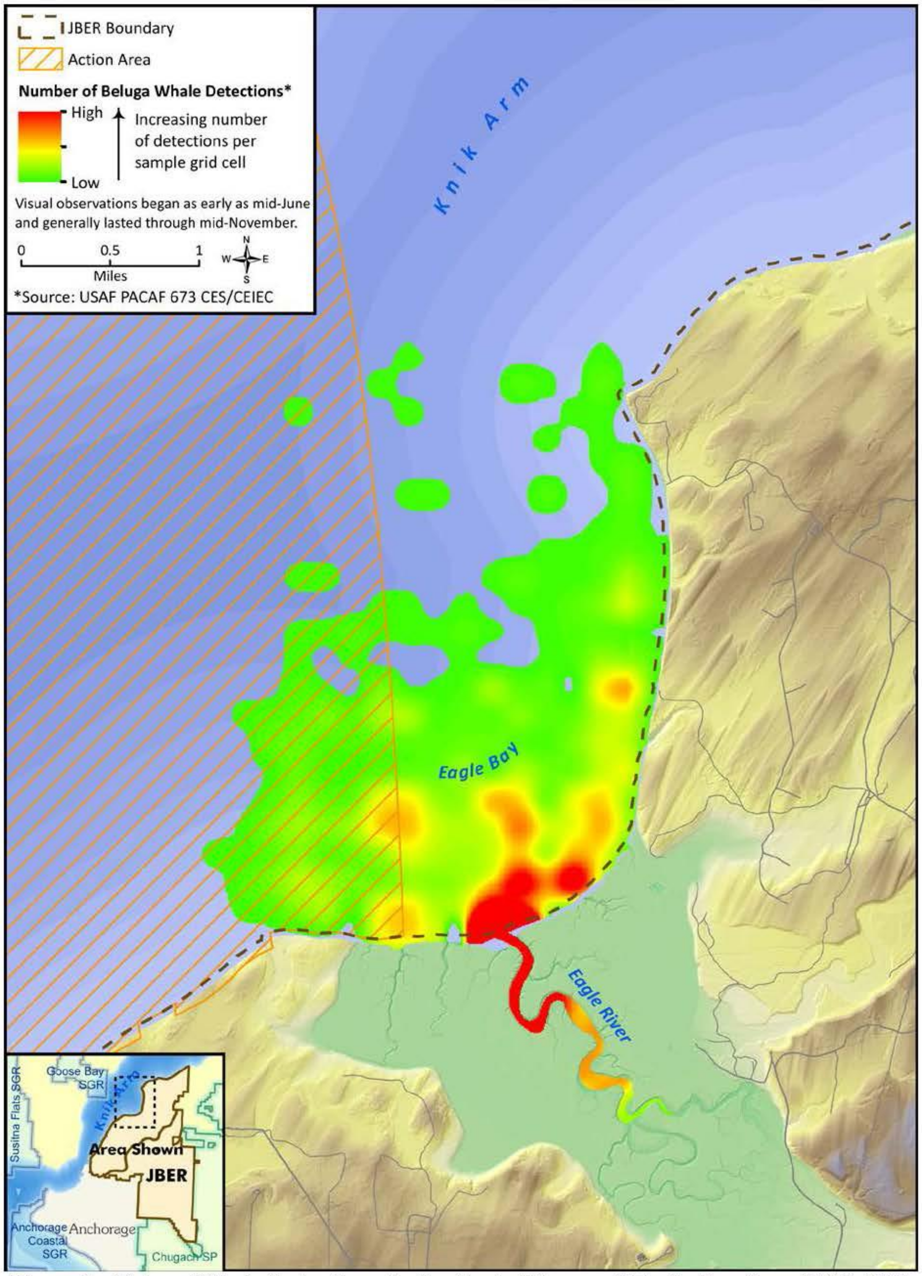

Figure 5. Beluga Whale Detections in the Eagle River and Eagle Bay Area 2007–2011 Showing the Eastern Boundary of the Action Area

3.2 Steller Sea Lion, Western DPS

Biology: See "National Marine Fisheries Service. 2008. Recovery Plan for the Steller Sea Lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, MD. 325 pages."

Status: Endangered (1997) (62 FR 24345, 62 FR 30772).

Critical Habitat: Designated August 27, 1993 (58 FR 45269) – none in Upper Cook Inlet.

Local Records: Steller sea lions have been observed in Knik Arm on rare occasions. During the fall of 2009 a lone Steller sea lion was observed in transit in Eagle Bay and during the spring of 2011, another lone Steller sea lion was observed just north of the Port of Anchorage (NMFS 2012a). These sightings represent rare occurrences, consistent with NMFS (2010b), which indicates that there is little likelihood that the species would enter the Knik Arm in the vicinity of JBER in the future.

4.0 ENVIRONMENTAL BASELINE CONDITIONS

This section identifies and describes all known human-induced sources of impact to the listed species in the Action Area, except those caused by the Proposed Action. The purpose of the environmental baseline is to provide context for the effects of the Proposed Action with regard to other human activities that are also affecting the listed species. This section describes the environmental baseline in the Upper Cook Inlet region and identifies past and present human-induced factors that have potentially contributed to the current status of the Cook Inlet beluga whale and its habitat within the Action Area. Much of the information on human-induced factors discussed in this section was taken directly from the *Conservation Plan for the Cook Inlet Beluga Whale* (NMFS 2008a). Additionally, NMFS (2009) issued a biological opinion on the Port of Anchorage Expansion Project and Associated Dredging at the Port of Anchorage, Alaska. Due to the location of this project within and adjacent to the Action Area for the Proposed Action, much of the information in the following sections was taken from that Biological Opinion.

The Cook Inlet beluga whale population may be affected by various natural and anthropogenic factors, including subsistence harvest removals, pollution, predation, disease, contamination, fisheries interactions, vessel traffic, small stock size, restricted summer range, and habitat alteration (NMFS 2015). While a number of known and potential threats have been identified, there is not enough known about the effect of each specific threat to definitively know the level of impact that each threat has on the Cook Inlet beluga whale (NMFS 2008a). In addition, Cook Inlet beluga whales may be affected by multiple threats at any given time, compounding the impacts of the individual threats (NMFS 2008a).

The documented decline of the Cook Inlet beluga whale population during the mid-1990s has been attributed to subsistence harvest removals at a level that this small population could not sustain. In response, cooperative efforts between NMFS and subsistence users have dramatically reduced subsistence harvests. These harvest reductions should have allowed the Cook Inlet beluga population to recover if subsistence harvests had been the only factor limiting the population at that time. Abundance data collected during the past several years, however, show that the population is not recovering as expected with the regulation of subsistence harvest. According to Hobbs *et al.* (2012), during the period since management of the hunt began in 1999 (i.e., 1999–2012), there has been a declining trend of -1.3 percent per year.

4.1 Development

Large numbers of people in a relatively small area are cause for concern regarding the natural environment and Cook Inlet beluga whales. Anchorage is the most populated area of the state, with the 2010 population estimate of the Municipality of Anchorage at 291,826 (U.S. Census Bureau 2010). Anchorage is a highly developed city, with a port, airports, highways, and railroads all situated near the coastline. This development has resulted in both the loss and alteration of nearshore beluga habitat and changes in habitat quality due to vessel traffic, noise, and pollution. There is concern that increased development may prevent beluga whales from reaching important feeding areas in upper Knik Arm. Their frequent use of shallow nearshore and estuarine habitats makes beluga whales particularly prone to regular interaction with human activities (NMFS 2015), and are thus likely to be affected by those activities.

The following development projects have occurred within or near the Action Area.

Port of Anchorage. Operations began at the Port of Anchorage (POA) in 1961 with a single berth. Since 1964, the Port has expanded to a five-berth terminal that moves more than four million tons of material across its docks each year. Construction associated with the current Marine Terminal Development Project has been ongoing on a seasonal basis since 2006, and has included both in-water and out-of-water activities in four areas of the Port (North Backlands, Barge Berths, South Backlands, and North Extension). Some in-water activities have the potential to incidentally harass beluga whales due to underwater noise disturbance in the area.

Port maintenance dredging has occurred annually since 1965. The current operations and maintenance plan at the Port authorizes the U.S. Army Corps of Engineers to dredge to -35 feet MLLW. The footprint dredged at the Port fluctuates annually, varying from 95 acres in 1999 to 117 acres in 2004. Over the last nine years the average size of the dredged footprint has been about 100 acres. The amount of dredging required to maintain the Port varies from year to year, with a maximum of about 2.1 million cubic yards of material dredged in 2004. Maintenance dredging is conducted by one or more dredges and lasts from mid-May through November, depending on the weather. Two to five barge trips per day transport about 1,500 cubic yards of material from each dredge to the disposal site (U.S. Army Corps of Engineers 2008).

Alaska Railroad Corporation. Construction for a Road and Rail Extension Project began in 2004 (POA 2004), and was completed in 2006. The purpose of this project was to improve the transportation of goods within the POA and to the Alaska Railroad Corporation intermodal yard, and to also support military deployments. The project involved relocating and extending an existing road within the POA, and constructing three tracks, and an intermodal yard. The Maritime Administration's environmental analysis of this project culminated with a FONSI on February 4, 2004 (POA 2004). The rail line extends along the coastline south of the POA. This project was a component of the Port of Anchorage Intermodal Expansion Project.

JBER. Elmendorf Air Force Base (AFB) began operations in 1940 and since joint basing with Fort Richardson became part of JBER. It maintains and operates runways near and airspace directly over Knik Arm. Cargo is routinely transported between the POA and JBER, including the off-loading of jet fuel for the Base.

Port MacKenzie. Port MacKenzie development began in 2000 with the construction of a barge dock. The first shipments arrived in July 2001. Additional construction has occurred since then and Port MacKenzie currently consists of a 500-foot bulkhead barge dock, a 1,200-foot deep-draft dock with a conveyor system, a landing ramp, and over 8,000 acres of adjacent uplands.

4.2 Vessel Traffic

Vessels traveling in Knik Arm and Cook Inlet can be a threat to beluga whales. The potential for ship strikes exists whenever ships and belugas are in the area at the same time. While ship strikes have not been definitively confirmed in a Cook Inlet beluga whale death, in October 2007 a dead whale washed ashore with "wide, blunt trauma along the right side of the thorax" (NMFS 2008a), suggesting a ship strike was the cause of the injury. Vessel traffic can also produce noise disturbance to beluga whales and pollution from the vessels may decrease the quality of their habitat.

There are eight port facilities located in Cook Inlet. Commercial shipping occurs year round, with containerships transiting between the Seattle/Puget Sound areas and Anchorage. Other commercial shipping includes bulk cargo freighters and tankers. Currently, with the exception of the Fire Island Shoals and the POA, no other large-vessel routes or port facilities in Cook Inlet occur in high value beluga whale habitat. Various commercial fishing vessels operate throughout Cook Inlet. Sport fishing and recreational vessels travel between Anchorage and several popular fishing streams that enter the upper Inlet. Several small boat launches exist along the shores of upper Cook Inlet and the Knik Arm, including a float system for small watercraft near Ship Creek, maintained by the Municipality of Anchorage.

Due to their slower speed and straight-line movement, ship strikes from large vessels are not believed to pose a significant threat to Cook Inlet beluga whales. Beluga whales are regularly sighted in and around the POA (Rugh *et al.* 2005) passing near or under vessels (Blackwell and Greene 2002), indicating that these animals may have a high tolerance of large vessel traffic. However, smaller boats that travel at high speed and capable of abrupt changes in direction often present a greater threat. In Cook Inlet, the concentration of beluga whales near river mouths predisposes them to strikes by high speed watercraft associated with sport fishing and general recreation. High-speed vessels operating in these whale concentration areas have an increased probability of striking a whale, as evidenced by observations of Cook Inlet belugas with propeller scars (Burek 1999). Small boats and jet skis, which are becoming more abundant in Cook Inlet and the Knik Arm, are also more likely to approach and disturb any whales that are observed.

4.3 Noise

Beluga whales use sound rather than sight for many important functions. They are often found in turbid waters in northern latitudes where darkness extends over many months. Beluga whales use sound to communicate, locate prey, and navigate, and may make different sounds in response to different stimuli. Beluga whales produce high frequency sounds that they use as a type of sonar for finding and pursuing prey, and likely for navigating through ice-laden waters.

In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic sounds. Human-induced noises include large and small vessels, aircraft, pile driving, shore-based activities, dredging, filling, and other activities. The effects of human-caused noise on beluga whales and associated increased background noises may be similar to reduced visibilities when humans are confronted with heavy fog or darkness. These effects depend on several factors including the intensity, frequency, and duration of the noise, the location and behavior of the whale, and the nature of the acoustic environment. High frequency noise diminishes more rapidly than low frequency noises. Sound also dissipates more rapidly in shallow waters and over soft bottoms (sand and mud). Much of upper Cook Inlet is characterized by its shallow depth, sand/mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002), thereby making it a poor environment for propagating acoustics.

Several notable studies may offer insight on the effect of ship and aircraft noise on Cook Inlet beluga whales. A 2001 acoustic research program within upper Cook Inlet identified underwater noise levels (broadband) as high as 149 decibels referenced to 1 microPascal (dB re: 1 μPa) (Blackwell and Greene 2002). That noise was associated with a tug boat that was docking a barge. Ship and tug noise have been present at the POA for several decades and are expected to continue into the future.

Cook Inlet also experiences significant levels of aircraft traffic from the Ted Stevens Anchorage International Airport, JBER, and several smaller runways. Even though sound is attenuated by the water surface, Blackwell and Greene (2002) found aircraft noise can be detected underwater when jet aircraft are directly overhead at low altitudes (e.g., on takeoff or approach to the runway).

Beluga whales in the Beaufort Sea have been observed to dive or swim away when low-flying (less than 500 meters) aircraft passed directly over them Richardson et al. (1995); Patenaude et al. (2002). Visual cues, including the sight of the aircraft or its shadow, have been hypothesized to contribute to the reaction of belugas to low-level overflight by survey aircraft. Patenaude et al. (2002) studied the responses of bowhead and beluga whales in the Beaufort Sea to overflights by a Bell 212 helicopter and a Twin Otter fixed-wing propeller-driven aircraft. They reported an overt reaction rate of 3.2% (24 out of 760 beluga singletons or groups) of belugas when overflown by the fixed wing aircraft. Reactions consisted of immediate dives with tail thrash, unusual turns or changes in heading, twisting to look up at the aircraft and changes in behavioral state (travelling to milling and increased swimming speed). The authors noted that in general, belugas reacted more strongly to aircraft at lower altitudes and reasoned that this could either be from visual or acoustic cues, or both. The Beaufort Sea localities for these studies are likely quieter than in the Knik Arm and whales there likely experience far fewer overflights per year than do the belugas in the Knik Arm.

However, beluga survey aircraft flying at approximately 244 meters in Cook Inlet observed little or no change in beluga swim directions (Rugh *et al.* 2000). This is likely because belugas in Cook Inlet have habituated to routine small aircraft overflights. Belugas may be less sensitive to aircraft noise than vessel noise, but individual responses may be highly variable and may depend on previous experiences, beluga activity at the time of the noise, and characteristics of the noise.

The Eagle River Flats Impact Area at JBER-Fort Richardson has been used for weapons training since the 1940s, and supported heavy year-round use until February 1990 when U.S. Army Alaska voluntarily implemented a temporary firing suspension. In December 1991, live-fire weapons training within Eagle River Flats Impact Area was resumed, restricted to winter months only, when specified ice conditions are met. A Biological Assessment was submitted to NMFS in December 2015 to address JBER's Proposed Expanded Firing Opportunities at Eagle River Flats Impact Area.

5.0 EFFECTS OF THE ACTION

5.1 Cook Inlet Beluga Whale

Potential project effects to Cook Inlet beluga whales include the possibility of behavioral responses to the overflight of F-22s. Animals may react to the sound of the jet aircraft or the sight of the aircraft overhead by avoiding the area or altering their natural behavior patterns, which could constitute behavioral harassment. The following analysis and discussion focuses on the potential effects on belugas from overflight by F-22s.

Under the Proposed Action, the number of F-22 aircraft and the number of annual F-22 sorties would remain the same as at present. F-22 aircraft would continue to conduct up to approximately 5,710 sorties per year from JBER, an average of about 22 sorties per work day. Approaches and departures would follow previously established and defined approach and departure patterns from JBER that are currently in use, except for departure and arrival patterns involving an extended RW 16/34, which is a potential future scenario addressed programmatically in the EIS for this program and in this BE. A sortie may consist of multiple operations with an operation being a departure, arrival, or half of a closed pattern. The Action Area depicted in Figure 2 encompasses the portion of Knik Arm where there is the potential for the F-22 overflight on established approach and departure patterns to produce in-water sound levels at or above 120 dB, which have the potential to harass the Cook Inlet beluga whale (NMFS 2015). The Action Area encompasses portions of the Knik Arm west of JBER RW 06/24 and north of RW 16/34. A detailed analysis of noise associated with F-22 approaches and departures has been conducted for this assessment and is presented in Appendix A. Of the total daily sorties at JBER, F-22s would account for 51 percent, other based aircraft 38 percent, and transient aircraft 11 percent. Some background information and a summary of the analysis are provided here.

5.1.1 Aircraft Overflight Noise Background

Sound is transmitted from an airborne source to a receptor underwater by four principal means (Richardson *et al.* 1995; Eller and Cavanagh 2000):

- Direct path, refracted upon passing through the air-water interface;
- Direct-refracted paths reflected from the bottom in shallow water;
- Lateral (evanescent) transmission through the interface from the airborne sound field directly above; and
- Scattering from interface roughness due to wave motion (Urick 1972; Richardson *et al.* 1995).

Aircraft noise is chiefly transmitted from air into the water within a narrow band centered on the flight path. A large portion of the acoustic energy is reflected from the air-water interface during transmission of sound from air to water. For an overhead sound source such as an aircraft much of the sound at angles greater than 13 degrees from the vertical is reflected and does not penetrate the water (Richardson *et al.* 1995). The area of maximum transmission can therefore be visualized as a 13-degree cone (26-degree aperture) with the aircraft at its apex (Figure 6).

Aircraft will be audible for longer as they climb and the base of the cone increases; however, the acoustic energy reaching the water surface diminishes with increasing altitude of the aircraft. Outside the conical area of maximum transmission, sound may be reflected back into the air or transmitted shallowly into the water where it stays near the surface, but could be heard by an animal on or near the surface outside the cone.

Most sound is actually transmitted to water within the 13-degree "cone," especially in calm conditions. Outside the cone most sound is reflected except where appropriately oriented faces of waves and chop enable some sound to be transmitted across the air-water interface. The sound that penetrates outside the cone does not penetrate deeply. The analysis conducted for this project is described in Appendix A, and the text below treats the area ensonified as if the cone did not exist. This simplifying assumption results in an overstatement of the amount of noise transmitted into the water from the air-water interface and results in an overestimation of the area affected by elevated noise levels in the water.

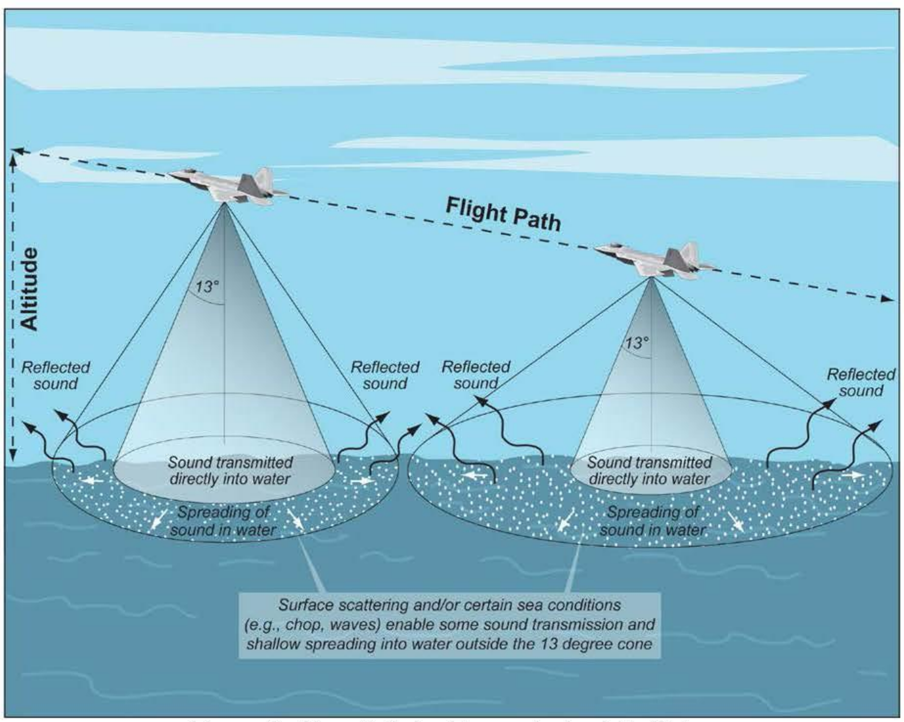

Figure 6. Aircraft Noise Transmission Into Water

Exposures to elevated noise levels from aircraft overflight would be brief in duration (seconds) as the aircraft passes overhead and would diminish rapidly due to the speed of the aircraft. For example, Blackwell and Greene, in their study of underwater noise in the Cook Inlet near Elmendorf AFB, found that a landing F-15 passing directly overhead only generated underwater noise levels exceeding the ambient noise level for approximately three seconds (Figure 3C in Blackwell and Greene 2002). The exposed animal would need to be nearly directly underneath the overflight in order to be exposed to elevated noise levels from an aircraft overflight due to lack of or greatly diminished transmission of sound into water at angles greater than 13 degrees from the vertical. Furthermore, a noise would generally need to be louder than ambient (background) noise levels in order to be perceived by the animal.

Blackwell and Greene (2002) also measured high ambient noise levels in the Knik Arm. They found a 119 dB re 1 µPa average in-water reading adjacent to Elmendorf AFB and 106 dB re 1 µPa at Anchorage International Airport while no overflights were taking place. The same investigators measured ambient noise of 124 dB re 1 µPa at Point Possession (a nearby locality south of Anchorage) during a changing tide. An EA for the Port of Anchorage reported noise levels on shipping days averaged 134–143 dB re 1 µPa and the Knik Arm Bridge EIS (Underwater Measurements of Pile-Driving Sound) reported background levels of 115–133 dB re 1 µPa. Additionally, KABATA *et al.* (2010) summarized a variety of existing noise studies conducted within the Knik Arm and concluded that measured background levels rarely are below 125 dB re 1 µPa, except in conditions of no wind and slack tide. While conditions in Knik Arm often lead to background sound levels approaching and even exceeding 120 dB, there are periods of time with lower levels. Castellote *et al.* (2015), for instance, reported received sound pressure levels for the quietest day off of Cairn Point at 116.2 dB_{rms} dB re 1 µPa, Six Mile at 115.9 and Eagle River at 110.8 dB while the quietest 30 second periods at these same locations were 99.5 dB, 97.0 dB and 95.2dB respectively.

Ambient noise energy in the Knik Arm is typically concentrated at sound frequencies below 10 kilohertz (kHz) (Blackwell and Greene 2002). Noise from military jet aircraft, which is generated primarily by turbulent mixing of air, is also concentrated in relatively low frequency bands, primarily below 4,000 hertz (Hz) (which is 4 kHz) (Wyle Labs 2001, see also Appendix A, Figure A-2). Spectral characteristics of F-22 noise in water have not been measured, but are expected to be similar to dominant ambient noise sources in the Knik Arm, which would decrease the detectability of jet aircraft noise that is at or near the same levels as the ambient noise.

Of F-15 aircraft overflights measured in air and in water while on approach for landing at the former Elmendorf AFB (JBER) by Blackwell and Greene (2002), the sounds of overflight were detectable in water in only two of the eleven overflights, one at 90 degrees (i.e., directly overhead) and one at 80 degrees overhead. The peak in-water noise measured was 134 dB re 1 µPa for the F-15 landing straight overhead; the second measured overflight (at 80 degrees overhead) was 122 dB re 1 µPa. The sounds from the remainder of the overflights could not be detected in the water. The authors attributed this to two factors: angles exceeding 13 degrees from vertical, which reduces penetration of sound energy into the water, and high ambient in-water noise. For those events where aircraft noise was detectable in the water, it was only detectable for approximately three seconds.

F-22 engines are more powerful than those used in F-15 or F-16 aircraft, and have the potential to be louder than engines of F-16, F-15C, or F-15E aircraft, if other factors (such as altitude and angle of climb) that influence perception of noise on the ground are held constant.

F-22s replaced the F-15s at JBER beginning in 2007, with the last F-15s being relocated from JBER in 2010. In 2011, the existing F-22 operational wing received an additional 7 (6 primary and 1 backup) F-22 aircraft, after the Cook Inlet beluga whale had been listed as endangered, for a total of 47 aircraft at JBER (Air Force 2011).

The effects of the additional seven F-22 aircraft were considered in the Section 7 (Endangered Species Act) Compliance Wildlife Analysis for F-22 Plus-Up Environmental Assessment, which was released in February 2011 (Air Force 2011). NMFS (2011b) concluded the informal consultation with a letter of concurrence with the "may affect, but not likely to adversely affect" determination of the Wildlife Analysis (Air Force 2011).

5.1.2 Potential Overflight Effects

F-22 overflights would produce airborne noise and some of this energy would be transmitted into the water. Cook Inlet beluga whales could be exposed to noise associated with the F-22 overflights while at the surface or while submerged. In addition to sound, marine mammals could react to the visual aspects and/or shadow of a low-flying aircraft. Beluga whales are known for the variety of their vocalizations and have good hearing sensitivity at medium to high frequencies (Appendix B).

In-water exposure to F-22 aircraft noise would be brief (seconds) as an aircraft quickly passes overhead. In general, exposure of whales to jet aircraft over Knik Arm would be shorter in duration and the aircraft would be higher in altitude than for most small aircraft to which behavioral reactions (e.g., diving, slapping the water with flukes, swimming away from the track of low-flying survey aircraft (Richardson *et al.* 1995; Patenaude *et al.* 2002) have been reported. Generally the survey aircraft fly lower and slower than F-22s and may circle or track the swimming whales. Sound from F-22s would normally be louder (at a given altitude) and would have a more rapid onset, but F-22s would overfly on a straight line without altering course in proximity to belugas. Additionally, compared to the environment over the Beaufort Sea where the above-mentioned observations were made, the upper Cook Inlet and Knik Arm experience frequent aircraft overflight associated with aircraft activities at Ted Stevens International Airport, JBER, and several local general aviation airfields, possibly leading to some degree of habituation to aircraft overflight in the Upper Cook Inlet and Knik Arm. Habituation was suggested by Rugh *et al.* (2000), who noted little or no change in beluga swim directions in response to beluga survey aircraft flying at approximately 244 meters over Cook Inlet and the Knik Arm.

The visual aspect of an F-22 overflight over the Knik Arm would be minimal, because of its altitude, small size, and rapidity of the overflight. The F-22's closest approach to the water surface ranges from 536 to 18,158 feet mean sea level (MSL), depending on the flight procedure being conducted (data in Appendix A, Table A-1). The visual experience of an F-22 overflight would be similar to that of an F-15 or F-16 overflight. The F-22 is similar in size to an F-15 or F-16 and is much smaller than cargo aircraft, such as the C-17 and C-130, and the E-3A Sentry (AWACS) aircraft, which are currently based at JBER. F-22 climb rates on departure exceed the climb rate of F-15 and F-16 aircraft, enabling them to be at higher altitude when they cross over the Knik Arm, than F-15 or F-16 aircraft. Descent rates during runway approaches are roughly the same for all three aircraft types. Airspeeds in the runway vicinity are similar for all three aircraft types meaning that the duration of the visual experience is similar. Because of its altitude, small size, and rapidity of the overflight, adverse visual behavioral response to F-22 overflight on established flight tracks over Knik Arm is not expected.

As reported by F-22 pilots during interviews, airspeeds when crossing the Knik Arm range from 180 to 440 knots. Reported airspeeds were used to calculate time spent over Knik Arm in configurations that generate in-water sound pressure levels (SPL) greater than 120 dB. The total time per flight event in flight configurations that result in underwater noise levels greater than 120 dB SPL over the Knik Arm is between 3 and 136 seconds with the number of seconds depending on the flight procedure being conducted (Figure 7 through Figure 15). Due to the F-22's airspeed, at any given point within the overflown portion of Knik Arm, exposures to underwater noise levels greater than 120 dB SPL would be very brief—approximately 2 to 5 seconds. Consecutive overflights (e.g., "two-ship" departures) could cause the period of exposure to noise level greater than 120 dB SPL to be longer (e.g., up to about 10 seconds). A variety of effects may result from exposure to sound-producing activities. The severity of these effects can vary greatly between minor effects that have no realizable cost to the animal, to more severe effects that may have lasting consequences. Potential acoustic effects to marine mammals fall into five major categories: (1) Direct Trauma; (2) Auditory Fatigue; (3) Auditory Masking; (4) Stress Response; and (5) Behavioral Reactions.

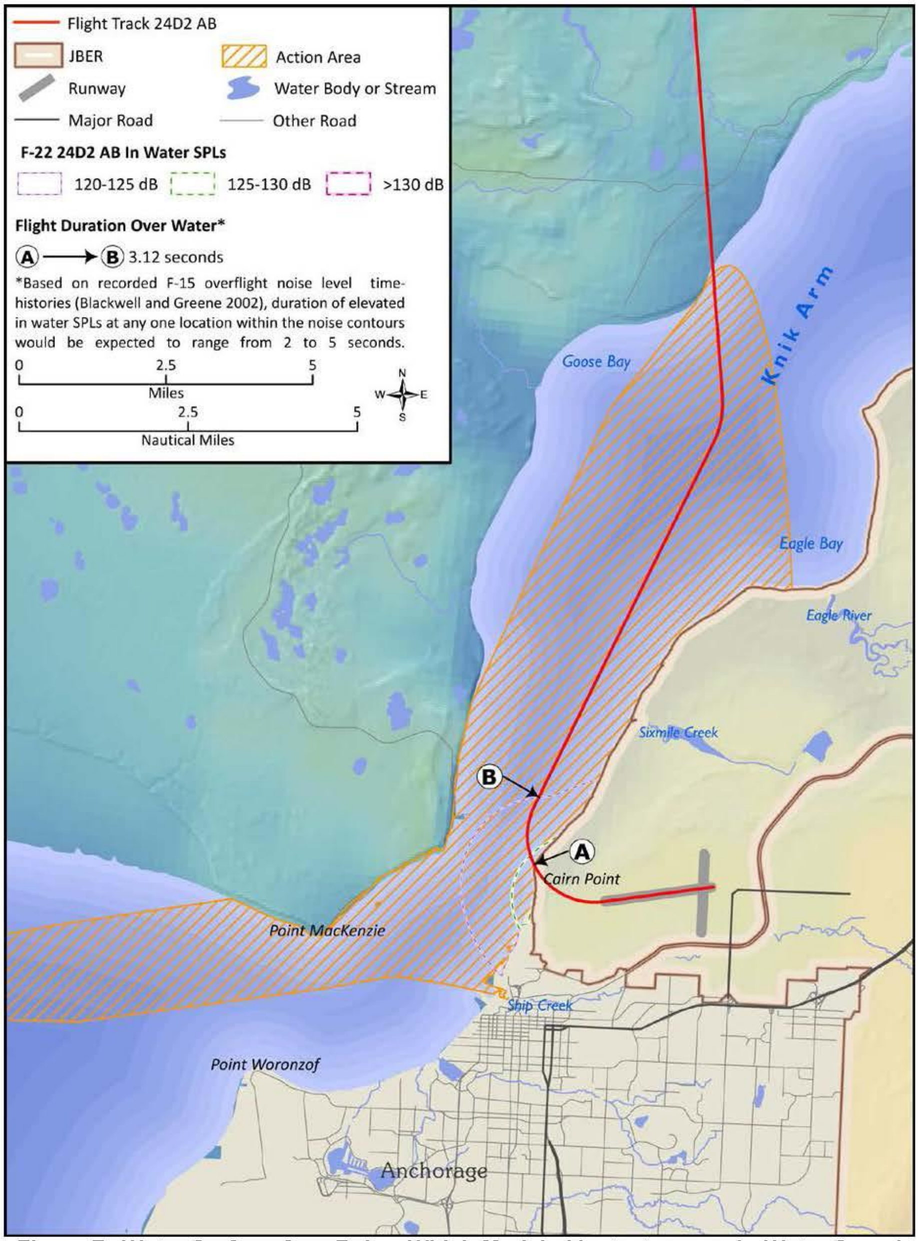

Figure 7. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on EEEGL2 Departure From Runway 24 Using Afterburner Power (Track F-22 24D2 A/B)

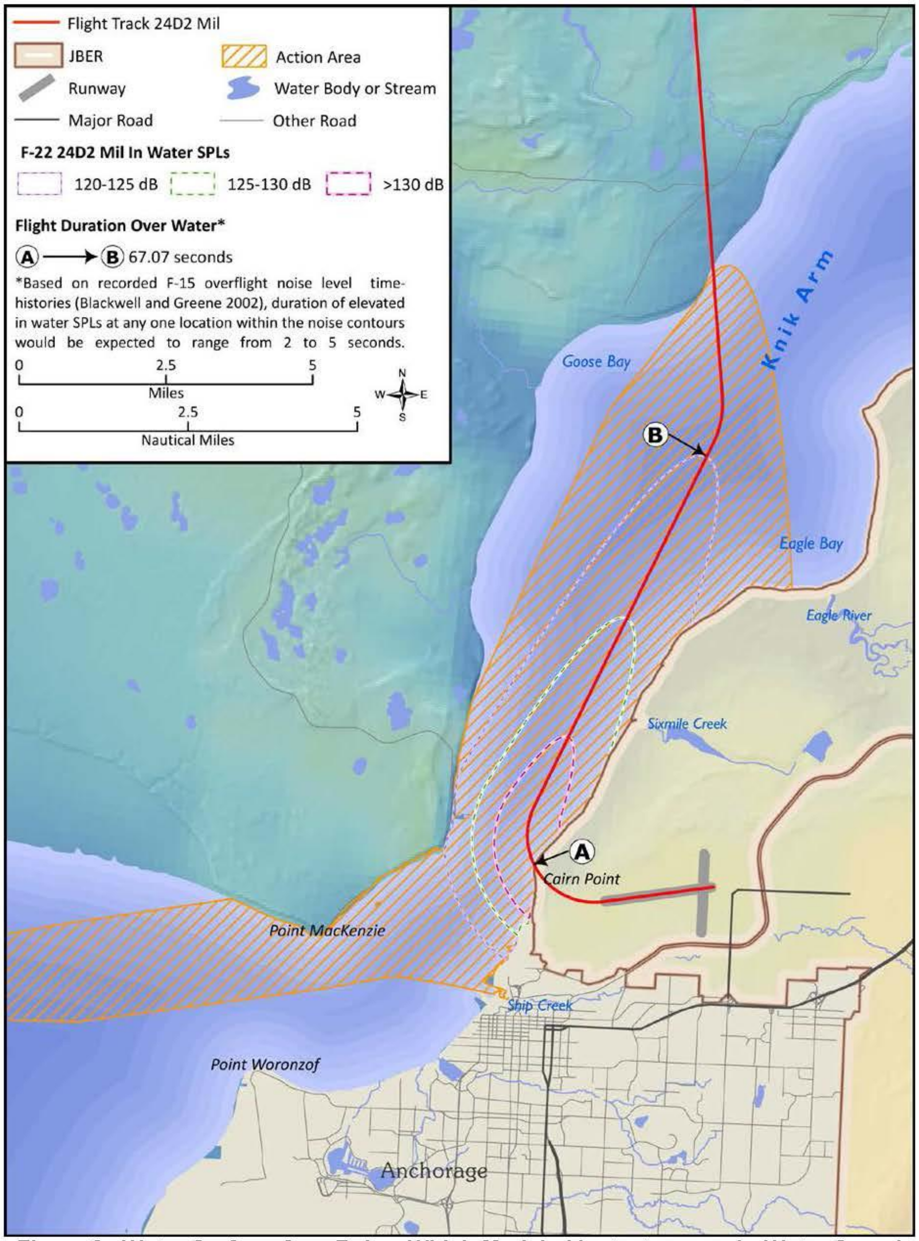

Figure 8. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on EEEGL2 Departure from Runway 24 Using 'Military' Power (Track F-22 24D2 Mil)

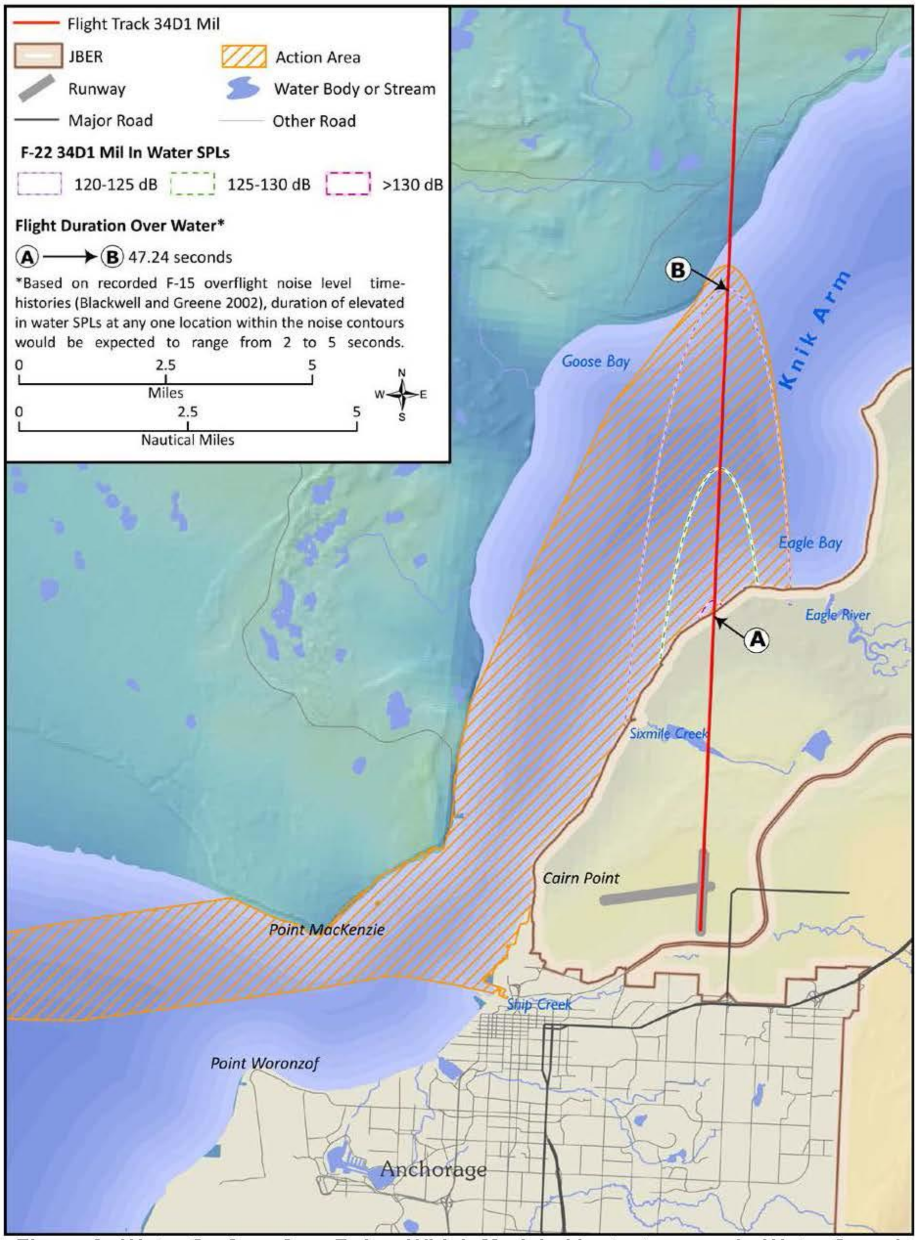

Figure 9. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on EEEGL2 Departure on Runway 34 Using 'Military' Power (Track F-22 34D1 Mil)

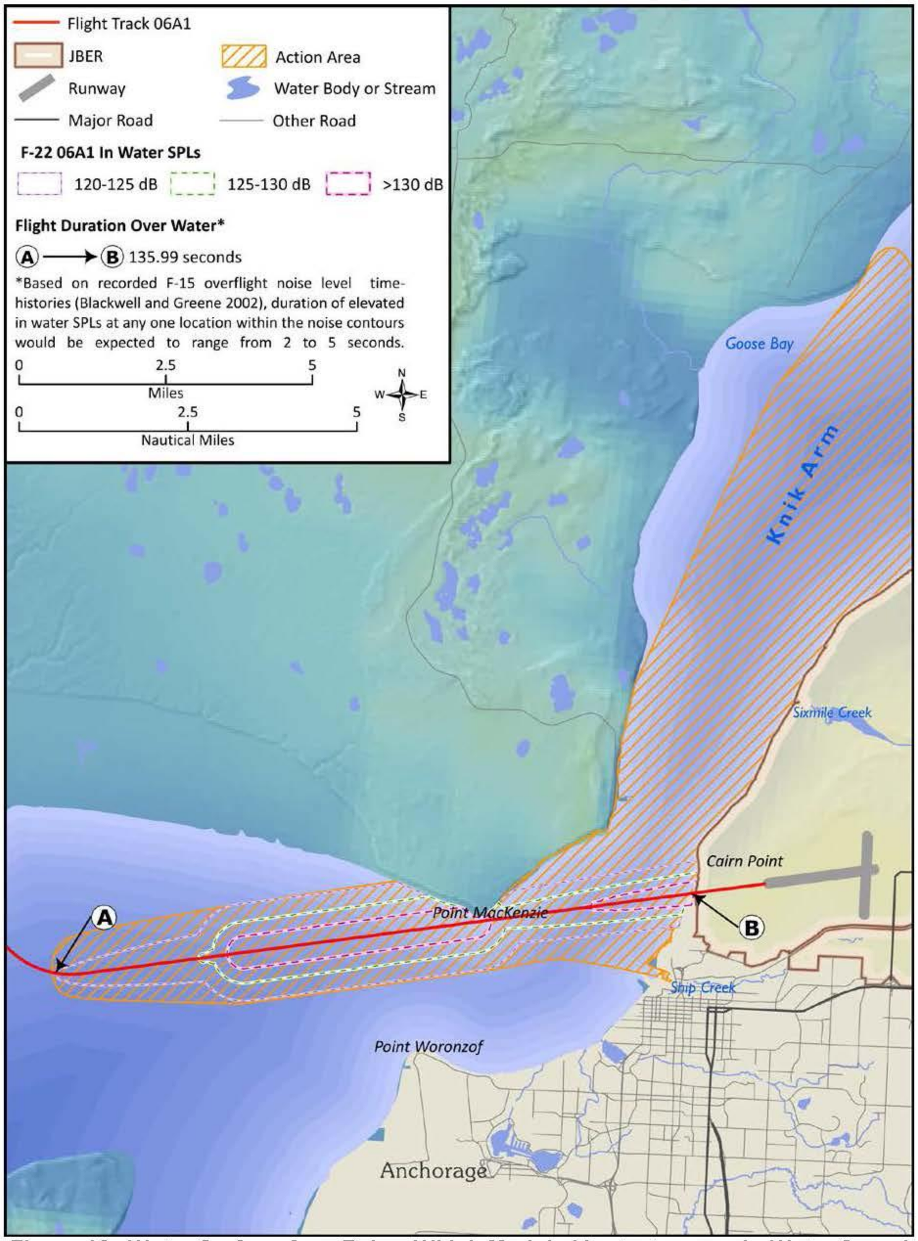

Figure 10. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on IFR Approach to Runway 06 (Track F-22 06A1)

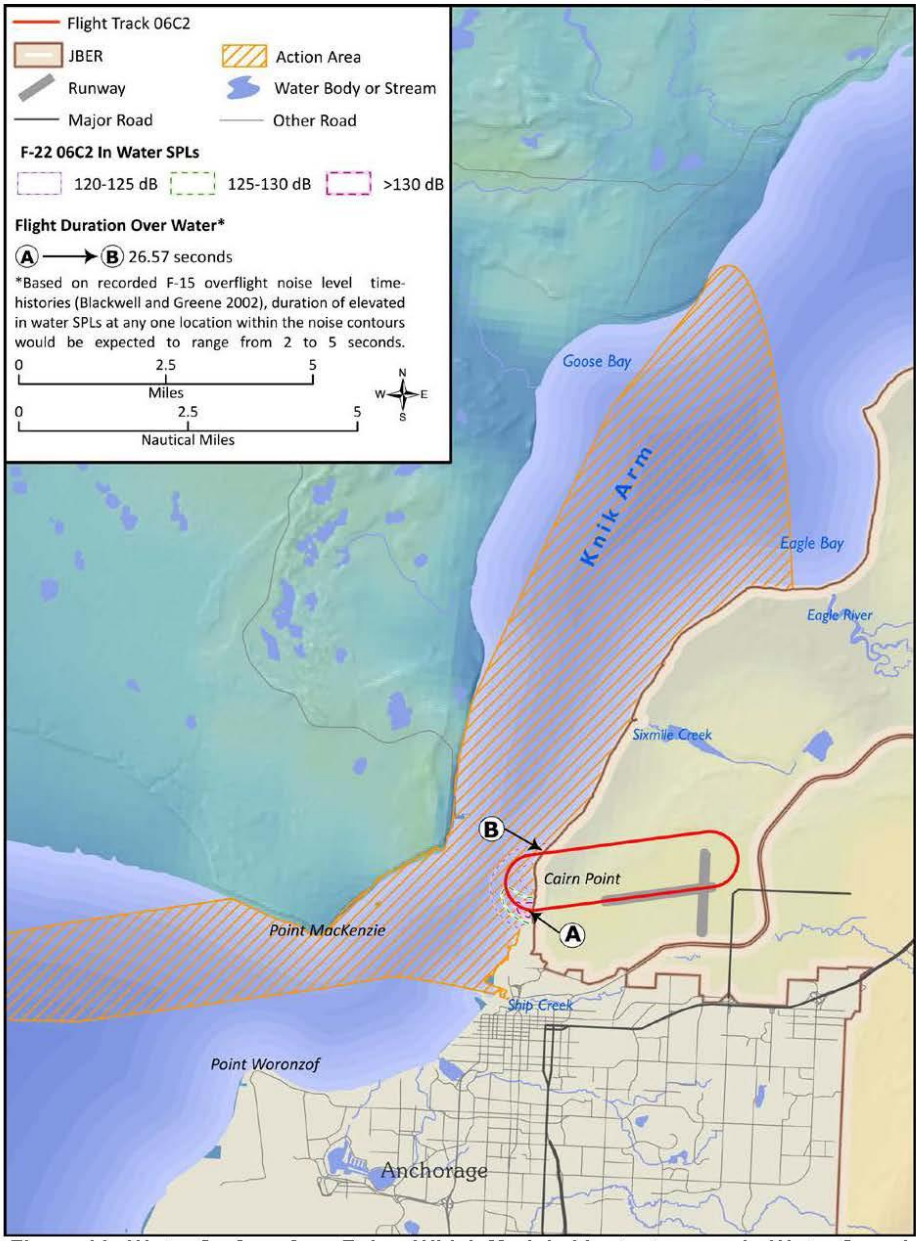

Figure 11. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on VFR Approaches with Overhead Break and Visual Closed Patterns to Runway 06 (Track F-22 06C2)

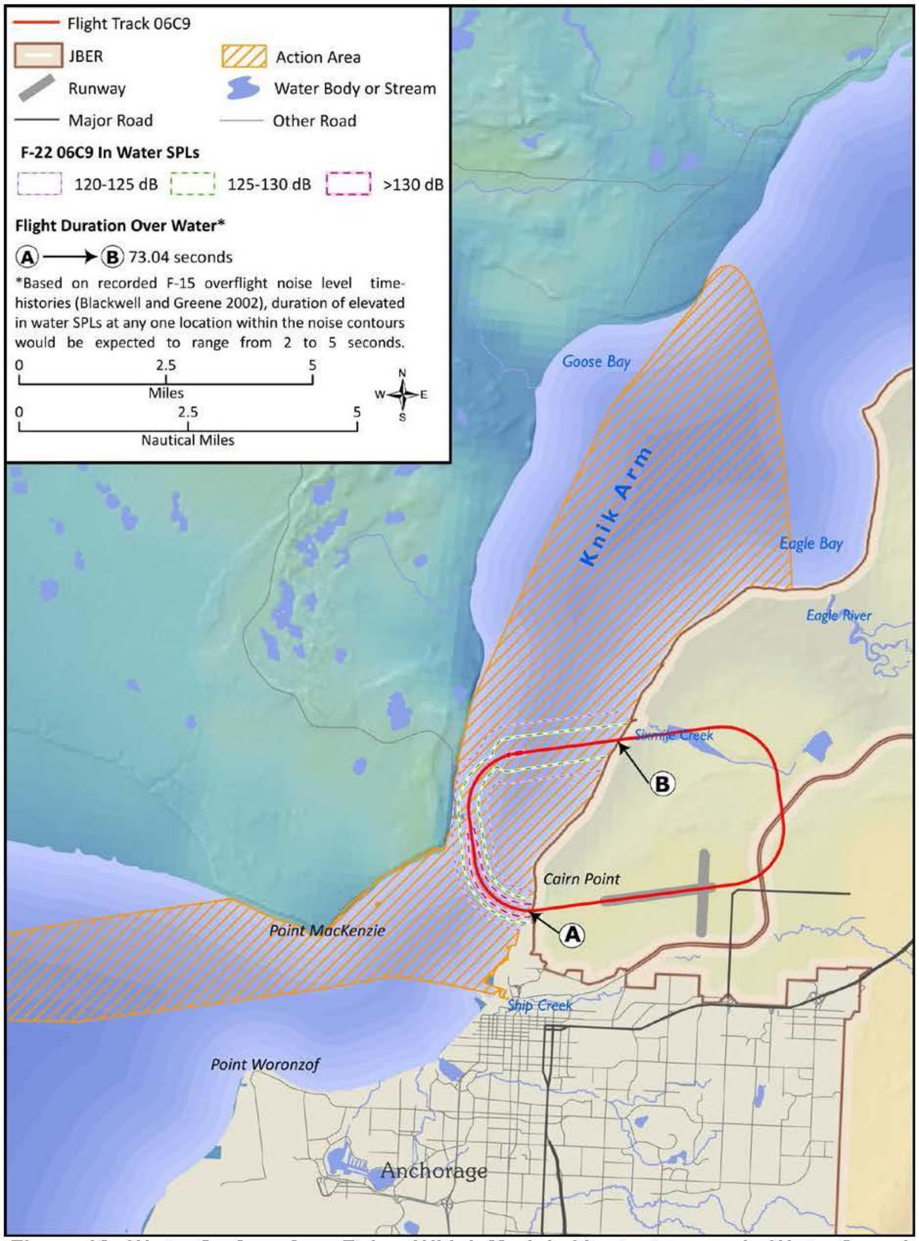

Figure 12. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on VFR Closed to Runway 06 (Track F-22 06C9)

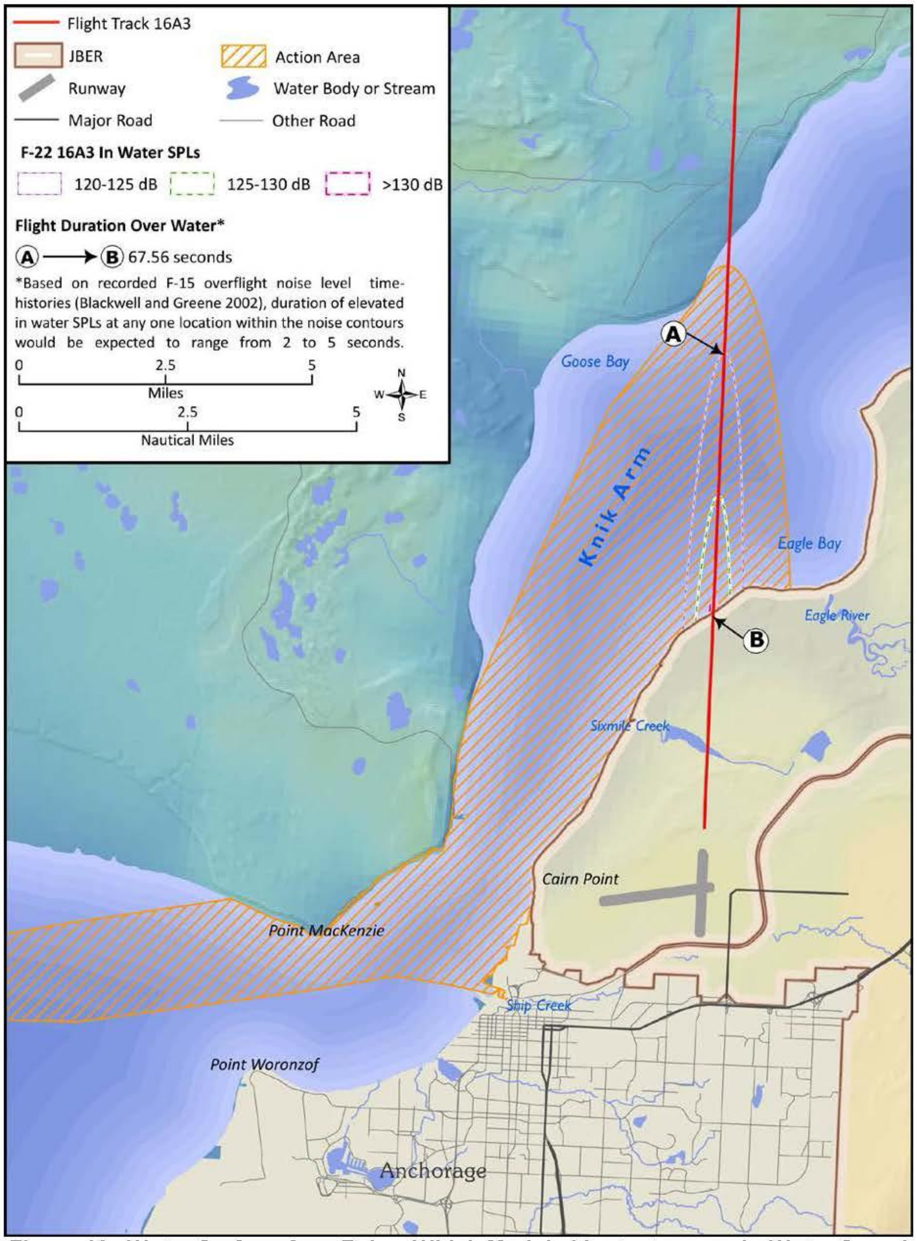

Figure 13. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on IFR Approach to Extended Runway 16/34 (Track F-22 16A3)

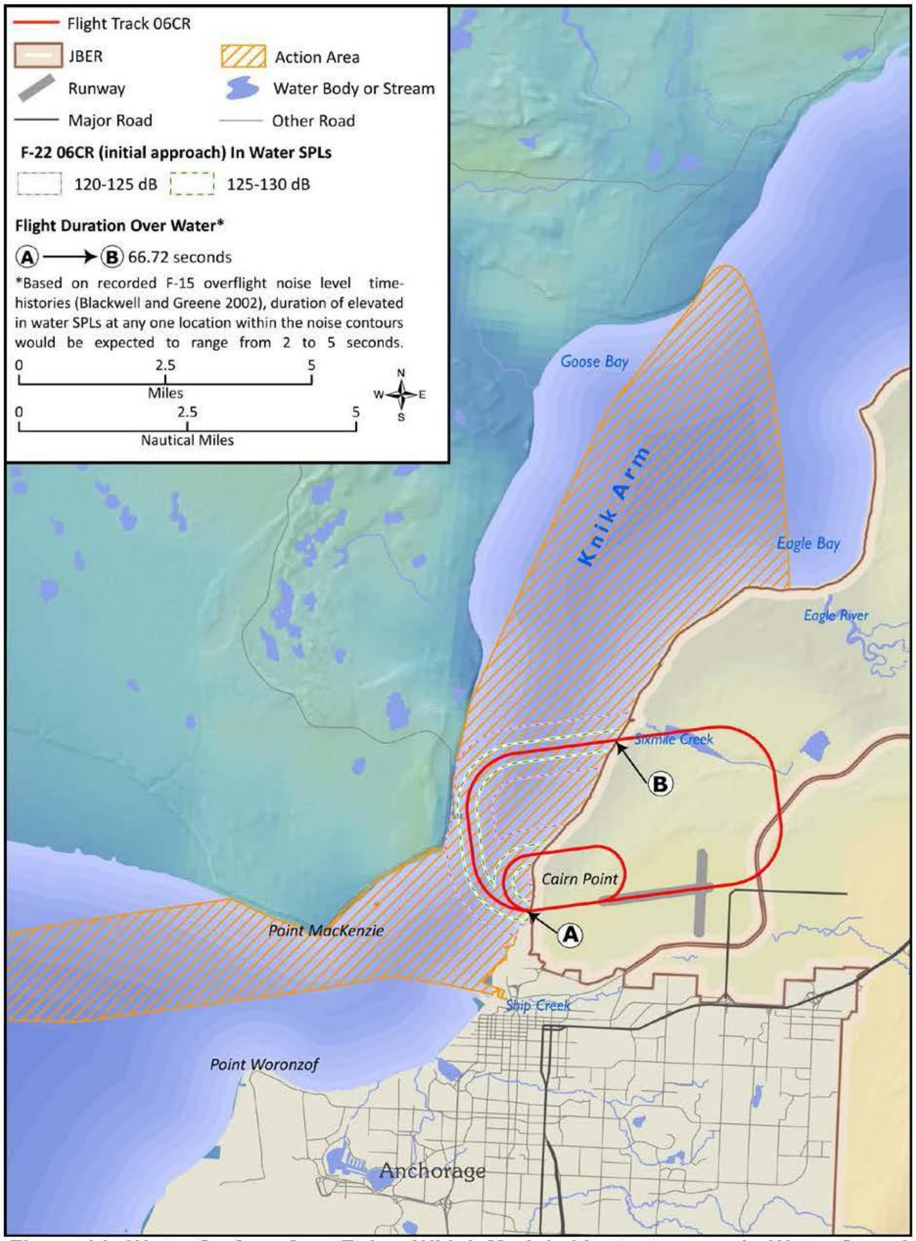

Figure 14. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on Re-entry Pattern (initial approach) to Runway 06 (Track F-22 06CR Initial Approach)

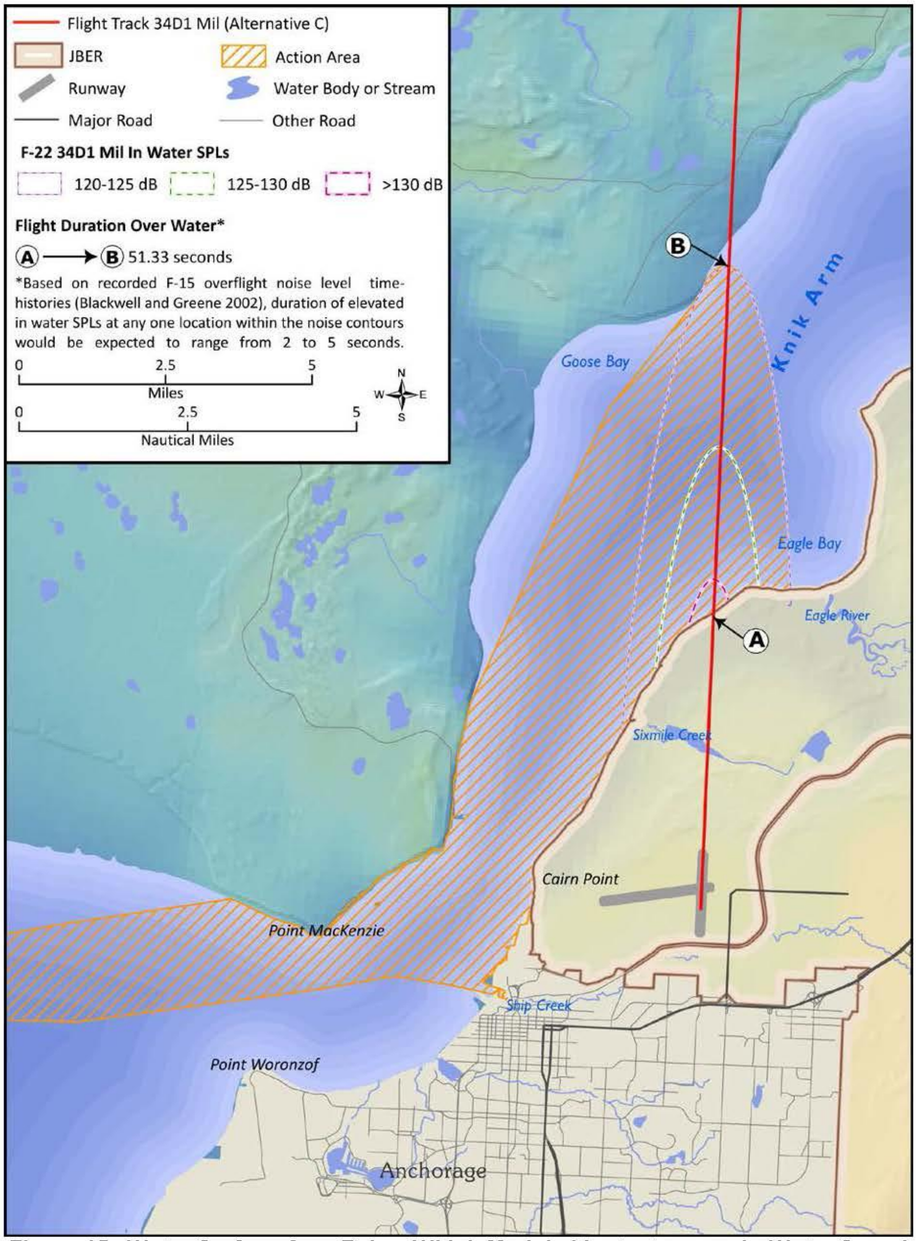

Figure 15. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on Alt C EEEGL 2 Departure on Extended RW 16/34 Military Power (Track F-22 Alt C 34D1 Mil)

Direct trauma refers to injury to organs or tissues of an animal as a direct result of an intense sound wave or shock wave impinging upon or passing through their body. This has only been shown with close proximity to very intense sources such as explosions. Therefore, direct trauma as a result of F-16 overflights would not occur.

Auditory fatigue may result from overstimulation of the delicate hair cells and tissues within the auditory system. The maximum sound pressure level predicted within the water from the F-22s project is 136.8 dB re 1 μPa for few seconds duration at any given point in the water (Section 5.1.3 and Figure 7 through Figure 15, and Table A-1 in Appendix A). A temporary hearing loss (temporary threshold shift [TTS]) threshold of 195 dB re 1 μPa^2-s is primarily based on the cetacean TTS data from Schlundt *et al.* (2000) and corroborated by the short-duration tone data of Finneran *et al.* (2001, 2003, 2005) and the long-duration sound data from Nachtigall *et al.* (2003). This is the best threshold to predict temporary hearing loss for non-impulsive sound, which is the lowest order direct physiological effect (with the exception of stress). An animal would need to be exposed to 136.8 dB re 1 μPa continuously for over 1,700 hours to reach the 195 dB re 1 μPa^2-s sound exposure level threshold. Therefore, auditory fatigue as a result of F-22 overflights would not occur.

Auditory masking occurs when the perception of a sound (such as a vocalization) is interfered with by a second sound and the probability of masking increases as the two sounds increase in similarity and the masking sound increases in level. The maximum predicted in-water sound from F-22 overflights is 136.8 dB re 1 μPa for a duration of a few seconds. During most flight operations and in most places under the flight path the maximum noise levels would be significantly less. As described above, ambient noise levels in the northern Cook Inlet and Knik Arm frequently exceed 120 dB re 1 μPa. Therefore, since predicted F-22 overflight in-water noise levels are often very close to ambient in-water noise levels, and the noise from aircraft would only be heard for a few seconds at any given point within the water, masking of whale vocalizations, should they occur during overflight, would at most occur only for a few seconds.

Physiological stress and behavioral reactions may occur at the predicted in-water sound levels. The data to predict physiological stress based on specific sound levels do not exist for marine mammals. Therefore, the following analysis examines the possibility that F-22 overflights will cause a behavioral reaction (and possible physiological stress response) in Cook Inlet beluga whales. An analytical model was used to quantify potential behavioral disturbances based on (1) predicted in-water sound levels; (2) thresholds derived from reactions of animals to similar intermittent, non-impulsive sounds; and (3) Cook Inlet beluga whale density estimates. The most appropriate acoustic threshold is currently the odontocete Behavioral Response Function, which assesses the probability of a behavioral reaction from 120 dB SPL to 195 dB SPL for non-pulse sound as described in Appendix A. The results of this model were studied and a number of contextual factors were considered to ascertain the potential effects of F-22 overflights on the beluga whales.

5.1.3 F-22 Overflight Analysis

As described in Appendix A, all expected flight profiles that would be used by F-22s at JBER were modeled, taking into account engine power settings, altitudes, and maneuvers at points along each flight track. Each of the flight profiles consists of multiple segments (initial approach to the airfield, circling to land, etc.). Each flight profile segment that overflies the Knik Arm was assessed for potential to impact beluga whales. Noise levels in air were calculated at increments along each flight path. Appropriate conversions were made to account for the transmission of sound across the air/water interface as described in Appendix A, and the maximum in-water sound pressure levels associated with overflights were calculated. As stated above, maximum modeled in-water SPLs associated with F-22 overflight of the Knik Arm do not exceed 136.8 dB re 1 µPa (Appendix A).

The threshold for potential effects was then established using the odontocete behavioral response function, an "S"-shaped curve that assesses the probability of a behavioral reaction by an odontocete in the interval between 120 dB SPL to 195 dB SPL for non-pulse sound (Appendix A, page A-2, and Appendix A, Figure A-1). The odontocete behavioral response function as applied in this analysis was designed based on findings of several studies, including numerous whales, and, therefore, takes into account variation among individuals in sensitivity to stimulus. Highly sensitive individuals (or groups) would have a slightly higher likelihood of behavioral response than indicated by the behavioral response function at a given received level and unusually insensitive individuals would have a slightly lower likelihood of behavioral response than indicated by the odontocete behavioral response function. Given this threshold range, all areas in which modeled in-water SPL exceeds 120 dB re 1 µPa at the loudest point were delineated and broken down into subareas or "bins" within which in-water SPLs ranged from 120 to 125 dB and 125 to 130 dB re 1 µPa, respectively. These were mapped for each type of flight path and their areas determined using geographic information system (GIS) data. The affected area was then multiplied by a value estimating beluga population density. Beluga density was estimated by dividing the latest (2014) estimated Cook Inlet beluga whale population of 340 individuals (Shelden *et al.* 2015) divided by 2,800 square kilometers (km^2), the area estimated to contain 95 percent of the Cook Inlet beluga whale population (Rugh *et al.* 2010), thus yielding a density estimate of 0.12 beluga whales/km^2. This number represents a year-around average density throughout the area and densities in local areas at specific seasons could be higher or lower. For comparison, independently derived density estimates based on observations within the Action Area (Cairn Point, Sixmile Creek, Point MacKenzie) ranged from a low of 0.0051 whales/km^2 in May to a high of 0.0846 whales/km^2 in September, as shown in Figure 4, above (KABATA *et al.* 2010). Densities during summer months in the vicinity of Eagle River, which lies just outside the Action Area, are likely to be higher than in the Action Area during the months of August through November (Figure 5, Table 5) due to the aggregation of belugas feeding there.

The results are shown in Figure 7 through Figure 15, which portray all flight profiles in which in-water SPLs were calculated to equal or exceed 120 dB.

As detailed in Appendix A, the analysis was conservative (i.e., overestimates effects), calculating the largest possible footprint of sound levels exceeding 120 dB. In addition, much of the noise energy generated by jet aircraft is at low frequencies (below 4 kHz), which is below the best hearing range of belugas (10–80 kHz). Although beluga hearing is most sensitive at frequencies from about 10 to 80 kHz, their overall hearing range extends from about 40 Hz to at least 130 kHz (NMFS 2008a; Awbrey *et al.* 1988; Finneran *et al.* 2005). Based on this, belugas would likely be able to detect sounds made by F-22s that sufficiently exceed background sound levels. Beluga whales in the lower Knik Arm are generally transiting when present (KABATA *et al.* 2010; Cornick and Pinney 2011). The probability and consequences of altering a transiting animal's behavior are unknown; however, biologically significant effects would be less likely than those associated with disturbing feeding or social behavior. Given the regular occurrence of overflight of belugas by jet aircraft at Stevens International Airport and JBER, the brief duration of the exposure to elevated in-water noise (seconds, as described above), and the absence of direct physical harm or injury to belugas from overflight, there is potential for diminution of any behavioral response to overflight over time (habituation). Blackwell and Greene (2002) indicated this appears to be the case with belugas, which are thought to habituate and become tolerant of vessels, when exposed to substantial boat traffic. Additionally, for animals to detect and respond to a noise it needs to be louder than background by greater than a value known as the "critical ratio." Odontocete critical ratios are typically between 10 and 20 dB, with the actual value varying by frequency and species (Richardson *et al.* 1995). Given that measured in-water noise levels in the Knik Arm near JBER are frequently 120 to 125 dB re 1 μPa or more (NMFS 2010b; Blackwell and Greene 2002; Castellote *et al.* 2015), it is possible that elevated in-water noise from overflights would not be perceived as a distinct noise source by the belugas because of the high levels of ambient in-water noise. The high levels of ambient in-water noise are not accounted for in the quantitative analytical approach employed in this document (Appendix A), and this is another factor that may result in overestimation of the likelihood of behavioral reaction to overflights.

The impacts of currently ongoing aircraft operations were also assessed. Application of the impacts assessment model took into account the differing spectral characteristics of different aircraft types (Appendix A) but was otherwise applied uniformly across all aircraft types. Attachment 1 (to Appendix A) provides graphical composites of the flight tracks of F-22s and other aircraft based at JBER (C-17, C-130, and E-3A) predicted to create in-water ensonification of 120 dB or higher as well as the activities of transient aircraft (aircraft based elsewhere but temporarily using JBER). The activities of these other aircraft based at JBER coupled with the activities of transient aircraft have the potential to result in in Level B behavioral harassment of approximately 0.018 belugas per year. Combining the existing F-22 operations (i.e., "No Action") with existing operations of other aircraft based at JBER and transient aircraft gives a predicted total of 0.059 belugas that would be behaviorally harassed annually. When combined with existing operations of other aircraft based at JBER and transient aircraft, Alternative C (RW 34 focus with RW 16/34 extension/arrivals) has a predicted total of 0.030 belugas that would be harassed annually, while Alternative E (with a focus on RW 06/24) has a predicted total of 0.065 belugas that would be harassed annually, very slightly higher than 0.059 belugas annually predicted for the current situation ("No Action").

The resulting estimated number of behavioral reactions associated with the range of alternatives being considered to achieve operational efficiency of F-22s are small (ranging from 0.030 to 0.065 predicted behavioral harassments per year) and are similar to the value (0.059 predicted behavioral harassments per year) predicted for existing activities of F-22s ("No Action"). Each of these totals includes the activities of other aircraft based at JBER as well as transient aircraft. This very low likelihood of behavioral reaction is so low as to be discountable, and it is, therefore, concluded that the project *may affect but is unlikely to adversely affect* the Cook Inlet beluga whale.

The potential for project effects on the critical habitat for Cook Inlet beluga whale was evaluated as summarized below with respect to the five PCEs in the designated critical habitat (Federal Register 76(69): 20180-20212). The PCEs are listed above in Section 3.1 of this report.

1. Because there would be no onshore or in-water construction, earth moving, or vegetation removal associated with the proposed redistribution of F-22 operations among existing runways to achieve

operational efficiency at JBER (action alternatives) there would be no effects on the water quality or hydrology of waters of the Knik Arm or its tributaries. Addressing the water quality and hydrologic effects of potential future extension of RW 16/34, which is addressed in the flight operations analysis above for completeness, would require additional information. Extension of the runway would require engineering design, environmental surveys and analysis and funding before it could be built. The potential effects of that construction, should a decision be made to proceed with design, would need to be addressed separately.

2. Overflights by F-22s, including elevated sound levels, are not expected to affect prey species consumed by Cook Inlet beluga whales. In the Knik Arm project area, these primarily include four salmon species and Pacific eulachon; however, Pacific cod, walleye pollock, saffron cod, and yellowfin sole may also be present. Salmon and most marine fish are hearing generalists with their best hearing sensitivity at low frequencies (below 300 Hz) where they can detect particle motion induced by low frequency sound at high intensities (Amoser and Ladich 2005; Popper and Hastings 2009), not approached by projected sound levels associated with F-22 overflight. Studies of Atlantic salmon conclude that they are unlikely to detect sounds originating in air (Hawkins and Johnstone 1978). It is unlikely that the fish species listed as beluga prey would detect the noise from any jet overflights. If overflight sounds were detected by fish species, any effects would be short-term and minor, given the low projected sound pressure levels (maximum of 136.8 dB re 1 µPa), short duration, and intermittent nature of elevated in-water sound associated with F-22 overflight.
3. There would be no introduction of toxins or other agents of a type or amount harmful to beluga whales as part of the Proposed Action.
4. The project would not affect passage of beluga whales within or between critical habitat areas.
5. Based on the analysis in this report, there would be "absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales."

Therefore, the project is not expected to result in adverse modification of the critical habitat for the Cook Inlet beluga whale.

In conclusion, although Cook Inlet beluga whales are likely to be present during some of the proposed F-22 overflights, analysis of modeled underwater noise levels shows that exposure to projected in-water noise levels exceeding 120 dB re 1 µPa would be exceedingly unlikely to result in behavioral harassment and would not adversely modify critical habitat.

Determinations: May affect but not likely to adversely affect Cook Inlet beluga whale. Will not result in adverse modification of Cook Inlet beluga whale designated critical habitat.

5.2 Steller Sea Lion

This species is expected to occur rarely in the project area (NMFS 2010b), and the combined likelihood of its occurrence in the project area and being in the area of elevated noise levels from F-22 overflight is so low as to be discountable.

Therefore, this proposal will have no direct, indirect, or cumulative effects in regards to Western population of Steller sea lion or its habitat.

Determination: May affect, but not likely to adversely affect the Steller sea lion.

6.0 CUMULATIVE EFFECTS

This section describes all non-federal actions reasonably certain to occur in the foreseeable future. These "non-federal" actions include state, local, private, and tribal actions (residential developments, watershed enhancement, etc.). Projects that have undergone or will undergo Section 7 Consultation (e.g., Port of Anchorage Expansion; Knik Arm Bridge, JBER's proposed Expanded Firing Opportunities at Eagle River Flats Impact Area) are not included in cumulative effects analysis under the ESA. Section 7 regulations require the federal action agency to provide an analysis of cumulative effects, along with other information, when requesting initiation of formal consultation. Note that "cumulative effects" under the ESA is defined more narrowly than under the National Environmental Policy Act (NEPA)[1].

NMFS recognizes that not enough is known about the effects of each specific threat, and they do not definitively understand the level of impact each threat has on Cook Inlet beluga whales. Cook Inlet beluga whales may be affected by multiple threats at any given time, compounding the impacts of the threats. Without an understanding of how individual threats impact beluga whales, the cumulative effects of all the threats on Cook Inlet beluga whales remain unknown.

Port MacKenzie. Port MacKenzie is the center of transportation and development plans for the west side of northern Knik Arm. It currently consists of a 500-foot bulkhead barge dock, a 1,200-foot deep-draft dock with a conveyor system, a landing ramp, and 8,000 acres of adjacent uplands available for commercial or industrial development. The Matanuska-Susitna Borough plans to provide services for bulk commodity storage, a floatplane base to serve Anchorage air taxi and private pilots, and a public boat launch ramp for commercial and private use. The Port MacKenzie project includes plans for the Knik Arm Crossing Bridge, a Cook Inlet ferry service, and an Alaska Railroad Corporation rail extension.

The new development at Port MacKenzie will add to the disturbance of Cook Inlet beluga whales. Noise levels will increase from construction activities. The build-up of infrastructure at Port MacKenzie will lead to greater vessel traffic on the west side of Knik Arm, with the associated increase in noise and risk of ship strikes and hazardous material releases. The planned floatplane base will increase aircraft noise. There is concern that all of the increases in development within the Action Area may prevent beluga whales from reaching important feeding areas in upper Knik Arm. The current Marine Terminal Redevelopment Project associated with the POA expansion is causing disturbance on the east side of Knik Arm, and the new development at Port MacKenzie will increase disturbance on the west side. However, usage to date of Port MacKenzie has been very low and levels of increased activity and the timeframe of any increase are uncertain.

[1] "Cumulative impacts," as defined by NEPA [Title 40 Code of Federal Regulations [C.F.R.] Section 1508.7], are the impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts are distinct from "cumulative effects," as defined by the ESA [50 C.F.R. Section 402.02], which are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area.

Ship Creek. Ship Creek is a popular area for recreational fishing in Anchorage and currently has a small boat launch located at its mouth. Plans for the Ship Creek area include continued use of the harbor for recreational fishing and small boat traffic, construction of a loading facility for the Cook Inlet ferry service, and habitat improvements to mitigate the effects of the POA Marine Terminal Redevelopment Project.

Small vessel activity and the use of a ferry near the mouth of Ship Creek can increase noise disturbance and the risk of ship strikes to beluga whales. The improvements made at the Ship Creek harbor may increase its use by small boats. Noise levels will increase during construction of the ferry terminal and as habitat improvements are being made. Any habitat improvements to the Ship Creek watershed will help to reduce the amount of pollution from runoff entering the Knik Arm, which will help to improve beluga whale habitat.

Tourism/Whale Watching. There currently are no boat-based commercial whale-watching companies in upper Cook Inlet. The popularity of whale watching and the close proximity of beluga whales to Anchorage make it possible that such operations may exist in the near future. However, it is unlikely this industry will reach the levels of intensity seen elsewhere because of upper Cook Inlet's climate and navigation hazards such as shallow waters, extreme tides, and currents.

Vessel-based whale-watching may cause additional stresses to the beluga population through increased noise and intrusion into beluga habitat not ordinarily accessed by boats. Avoidance reactions have often been observed in belugas when approached by watercraft, particularly small, fast-moving craft that are able to maneuver quickly and unpredictably; larger vessels which do not alter course or motor speed around these whales seem to cause little, if any, reaction (NMFS 2008a). The small size and low profile of belugas, and the poor visibility within the Cook Inlet waters, may increase the temptation for whale-watchers to approach the belugas more closely than usually permitted for marine mammals. General marine mammal viewing guidelines would be adopted, and possibly enhanced, for any commercial beluga whale watching tours.

Pollution. The potential for pollution from all sources will increase with population growth, more development, and new commercial activities in upper Cook Inlet. There are many non-point sources of pollution within the Action Area. Pollutants can pass from streets, construction and industrial areas, and airports into Ship Creek, Chester Creek, and Fish Creek and then into beluga whale habitat.

Hazardous materials can potentially be released from vessels, aircraft, the Port of Anchorage, Port Mackenzie, or JBER. There is a possibility an oil spill could occur from vessels traveling within the Action Area, or that oil will migrate into the Action Area from a nearby spill. The effects of oil spills on beluga whales are generally unknown; however, some generalizations can be made regarding impacts of oil on individual whales based on present knowledge. Although cetaceans are capable of detecting oil, they do not seem to avoid the oil (Geraci 1990). Belugas swimming through an oil spill could be affected in several ways: skin contact with the oil, ingestion of oil, respiratory distress from inhalation of hydrocarbon vapors, ingestion of contaminated food sources, and displacement of whales from feeding areas. Actual impacts would depend on the extent and duration of contact, and the characteristics (type and age) of the oil.

Pollutants discharged to Cook Inlet are quickly diluted and dispersed by the strong tides and currents, but those same effects may also obscure the transport and distribution of hazardous chemicals. In general, Cook Inlet belugas appear to have a lower body-load of chemical contaminants than other Alaskan beluga populations; however, the impact of contaminants on the belugas' health is unknown (NMFS 2008a).

Based on the foregoing analysis in Section 5.0 of this document, the Proposed Action is not expected to adversely affect the Cook Inlet beluga whale or its CH and, therefore, the non-federal actions summarized above would not combine with the Proposed Action to have cumulative effects on the Cook Inlet beluga whale or its CH.

7.0 CONCLUSION

A determination of "*may affect, but not likely to adversely affect*" is found for all species analyzed. There would be *no adverse modification* of Cook Inlet beluga whale critical habitat, as described in Section 5.1. Therefore, no formal Section 7 consultation is required for this project. This analysis will be provided to NMFS for their review and concurrence.

8.0 ADDITIONAL CONSIDERATIONS

8.1 Marine Mammal Protection Act (MMPA)

All marine mammals are protected under the Marine Mammal Protection Act (MMPA). Because behavioral reactions by beluga whales are not predicted (less than 1 behavioral reaction per year) there would be no harassment of this species under MMPA. Harbor seals (*Phoca vitulina)* are frequent in the upper Cook Inlet into the Knik Arm (Air Force 2012). Other marine mammal species occasionally documented in the Knik Arm include Steller sea lion (discussed above), harbor porpoise (*Phocoena phocoena*), and orca (*Orcinus orca*). Their occurrences are infrequent and in much lower abundance in the Knik Arm than the Cook Inlet beluga whales. Potential project effects identified above for the beluga whale are considered to be possible, but even less likely given the very low abundance of these species in the Knik Arm. Adverse effects associated with the Proposed Action, including behavioral reactions to overflight, are not expected to occur for any marine mammal.

8.2 National Environmental Policy Act

This analysis has been prepared in conjunction with an EIS being prepared by the Air Force to evaluate the potential environmental consequences of the proposed improvement of operational efficiency of F-22 flight activities at JBER.

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APPENDIX A

NOISE IMPACTS ASSESSMENT METHODOLOGY AND QUANTITATIVE RESULTS

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Noise Impacts Assessment Methodology and Quantitative Results

A.1 Introduction

This appendix describes a methodology for estimation of potential behavioral effects on Cook Inlet beluga whales associated with proposed changes to F-22 use of existing runways and/or extension of one of the runways at Joint Base Elmendorf-Richardson (JBER), Alaska. Results of the analysis include potential behavioral effects generated by the F-22, other based aircraft, and transient aircraft operations.

A.2 Methodology

The steps involved in predicting potential behavioral reactions are described below:

Step 1: Calculate maximum *in-air* noise level associated with overflights. Current flight procedures (e.g., engine power settings, altitudes, and airspeed at several points along each flight track) are described in a report titled *Noise Analysis for the Airfield Operations at JBER, AK* (U.S. Air Force 2014). Each of the flight profiles consists of multiple segments (e.g., initial approach to the airfield, circling to land). Each flight profile segment that overflies the Knik Arm was assessed for potential to impact beluga whales.

Maximum A-weighted noise level referenced to 20 micropascals (re 20 µPa) (A-weighted maximum sound level [LA_{max}] re 20 µPa) at sea level associated with each flight profile segment was calculated at the location over the Knik Arm where aircraft altitude is lowest. Calculations were made using the program SEL_CALC under median atmospheric noise propagation conditions at JBER (59 degrees Fahrenheit and 71 percent relative humidity). Variable weather conditions (e.g., wind direction, wind intensity, temperature profile, and relative humidity) have a limited effect on received aircraft noise levels. For example, monthly average atmospheric sound absorption coefficients at JBER vary from median value by less than 1.3 decibels (dB) per 1,000 feet. The term "A-weighted" denotes adjustment of component frequency band sound pressure levels to reflect human hearing. Decibels are a way of expressing sound levels that involves the ratio of a sound pressure against a reference pressure level. By convention, sound levels in air are stated as referenced to 20 µPa.

Step 2: Calculate maximum *in-water* noise level associated with overflights. The A-weighted noise levels re 20 µPa reported by SEL_CALC were converted to estimated unweighted sound pressure level (SPL) referenced to 1 micropascal (re 1 µPa). A-weighted and unweighted aircraft noise levels from the NOISEMAP NOISEFILE database were compared for the various configurations (e.g., approach, military power) used by each of the categories of aircraft operating at JBER. For example F-22 aircraft, unweighted noise levels were 2.7 to 3.1 dB higher than A-weighted noise levels on average, depending on power setting. Different aircraft types have different spectral characteristics and, as a result, the conversion between A-weighted noise levels and unweighted noise levels differs from one aircraft type to another. A conversion factor was calculated for the following aircraft categories: fighter jet, nonfighter jet, and propeller-driven aircraft. For nonfighter jet aircraft, unweighted noise levels were calculated by adding 3.5 dB to the A-weighted noise levels. For propeller-driven aircraft, unweighted noise levels were, on average, 9.1 dB higher than A-weighted noise levels. These average conversion factors are summarized in Table A-1 through Table A-4.

Table A-1. Calculation of Average Difference Between LAmax and SPL for Various F-22 Flight Configurations

	A/B	Mil	43 ETR	33 ETR	Average Difference
SPL (dB)	120.0	115.7	106.8	100.2	N/A
LAmax (dB)	116.9	112.6	104.1	97.4	N/A
Difference (dB)	3.1	3.1	2.7	2.8	**2.9**

dB = decibels; LAmax = A-weighted maximum sound level; N/A = not applicable; SPL = sound pressure level

Table A-2. Calculation of Average Difference Between LAmax and SPL for Various "Fighter Jet Aircraft" Flight Configurations (Not F-22)

	A/B	Mil	Approach	Intermediate	Max Endurance.	Average Difference
SPL (dB)	118.4	115.7	84.9	101.3	78.2	N/A
LAmax (dB)	114.2	112.6	81.9	96.6	76.9	N/A
Difference (dB)	4.2	3.1	3.0	4.7	1.3	**3.3**

dB = decibels; LAmax = A-weighted maximum sound level; N/A = not applicable; SPL = sound pressure level

Table A-3. Calculation of Average Difference Between LAmax and SPL for Various "Propeller-Driven Aircraft" Flight Configurations

	Cruise	Approach	Takeoff	Intermediate	Max Endurance	Average Difference
SPL (dB)	n/a	89.1	96.8	n/a	n/a	N/A
LAmax (dB)	n/a	83.0	84.6	n/a	n/a	N/A
Difference (dB)	n/a	6.1	12.2	n/a	n/a	**9.1**

dB = decibels; LAmax = A-weighted maximum sound level; N/A = not applicable; SPL = sound pressure level

Table A-4. Calculation of Average Difference Between LAmax and SPL for Various "Non-Fighter Jet" Aircraft Flight Configurations

	Cruise	Idle	Approach	Intermediate	Max Thrust	Derated Thrust	Average Difference
SPL (dB)	88.5	85.2	92.0	92.2	102.1	96.2	N/A
LAmax (dB)	87.1	82.1	89.0	89.2	96.1	91.4	N/A
Difference (dB)	1.4	3.1	3.0	3.0	6.0	4.8	**3.5**

dB = decibels; LAmax = A-weighted maximum sound level; N/A = not applicable; SPL = sound pressure level

Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors and has been studied extensively (Richardson *et al.* 1995; Young 1973; Urick 1972). In this analysis, 62 dB were added to SPL re 20 µPa to convert to SPL re 1 µPa for all three aircraft types, as shown in column 2 of Table A-5. For fighter jets, 3 dB were added to A-weighted noise levels to estimate unweighted SPL, 4 dB were added to A-weighted noise levels to estimate unweighted SPL for nonfighter jets, and 9 dB were added to A-weighted noise levels to estimate unweighted SPL for propeller-driven aircraft. This step is shown in column 3 of Table A-5. Lastly, reflectance due to water is incorporated by subtracting 30 decibels for all aircraft types, as shown in column 4 of Table A-5. Taking into account sound metric conversion and the reflectance of noise energy at the air-water interface, noise levels in water (SPL re 1 µPa) due to fighter jets (including F-22s) were calculated by adding 35 dB (62 + 3-30 dB) to the predicted noise level in air just above the water's surface (LA_{max} re 20 µPa). For nonfighter jets, noise levels in water (SPL re 1 µPa) were calculated by adding 36 dB (62 + 4-30 dB) to the predicted noise level in air just above the water's surface (LAmax re 20 µPa). For propeller-driven aircraft, noise levels in water (SPL re 1 µPa) were calculated by adding 41 dB (62 + 9-30 dB) to the predicted noise level in air just above the water's surface (LAmax re 20 µPa).

Table A-5. Calculation Metric of SPL Beneath Surface for Fighter, Nonfighter, and Propeller-Driven Aircraft

Aircraft Type	Conversion to SPL re 1 µPa (dB)	LAmax to SPL (dB)	Reflectance (dB)	Total (dB)
Fighter	+62	+3*	-30	+35
Nonfighter	+62	+4	-30	+36
Propeller	+62	+9	-30	+41

dB re 1 µPa = decibels referenced to 1 micropascal; LAmax = A-weighted maximum sound level; N/A = not applicable; SPL = sound pressure level

***Note:**
LAmax to SPL for F-22 and non-F-22 fighter jets both round to 3.

It should be noted that odontocete (toothed whales, including belugas, killer whales, and dolphins) hearing is not as strong at low frequencies (Southall *et al.* 2007), where much of the noise energy generated by aircraft is located, than at higher frequencies. Therefore, use of unweighted SPL yields conservative estimates of noise impacts to belugas.

Additional discussion on transmission of aircraft noise into water provided under "Step 4: Establish area exposed to noise exceeding thresholds."

Step 3: Establish threshold for potential effects. Calculated noise levels generated by JBER-based aircraft in the Knik Arm do not exceed 139 dB SPL re 1 µPa, well below the threshold for probable harassment (165 dB SPL) and would also not exceed thresholds for temporary hearing loss (195 dB sound exposure level [SEL]) or permanent hearing loss (215 dB SEL) for nonpulse sound (National Oceanic and Atmospheric Administration [NOAA] 2009; National Marine Fisheries Service [NMFS] 2009; Schlundt *et al.* 2000; Finneran *et al.* 2001, 2003, 2005; Nachtigall *et al.* 2003). At the maximum in-water SPL, an animal would have to be exposed continuously for multiple days (theoretically 73 days) to approach the temporary hearing loss threshold of 195 dB SEL and much longer to reach the permanent hearing loss threshold of 215 dB SEL. As overflights would generate elevated noise levels for 10 seconds or less, SEL values would remain well below temporary or permanent hearing loss thresholds. However, these noise levels do have some probability of causing a behavioral reaction.

The most appropriate acoustic threshold is currently the odontocete behavioral response function, which assesses the probability of a behavioral reaction from 120 dB SPL to 195 dB SPL for nonpulse sound (U.S. Navy 2008). The behavioral response function was developed by the U.S. Navy and NMFS to determine effects from mid-frequency sonar. However, the behavioral response function is currently the best available science for predicting behavioral effects from intermittent, nonimpulsive (nonpulse) sound.

The behavioral response function is used to estimate the percentage of an exposed population that is likely to exhibit behaviors at a given received level of sound (NOAA 2009; NMFS 2009). For example, at 165 dB SPL (dB re: 1 µPa rms)—a higher level than expected to occur for the proposed action—the risk (or probability) of harassment is 50 percent, and NMFS applies that 50 percent of the individuals exposed at that received level are likely to respond by exhibiting behavior that NMFS would classify as behavioral harassment (NOAA 2009; NMFS 2009).

The values used in the behavioral response function are based on three sources of data: (1) temporary threshold shift experiments conducted at Space and Warfare Systems Center and documented in Finneran *et al.* (2001, 2003, and 2005) and Finneran and Schlundt (2004); (2) reconstruction of sound fields produced by the USS SHOUP associated with the behavioral responses of killer whales observed in Haro Strait and documented in NMFS (2005), Department of the Navy (2004), and Fromm (2004a, 2004b); and (3) observations of the behavioral response of North Atlantic right whales exposed to alert stimuli containing mid-frequency components documented in Nowacek *et al.* (2004).

The behavioral response function represents a general relationship between acoustic exposures and behavioral responses. The behavioral response function, as currently derived, treats the received level as the only variable that is relevant to a marine mammal's behavioral response. However, we know that many other variables—the marine mammal's gender, age, and prior experience; the activity it is engaged in during an exposure event, its distance from a sound source, the number of sound sources, and whether the sound sources are approaching or moving away from the animal—can be critically important in determining whether and how a marine mammal will respond to a sound source (Southall *et al.* 2007). The data that are currently available do not allow for incorporation of these other variables in the current behavioral response function; however, the behavioral response function represents the best use of the data that are available (NOAA 2009).

The odontocete behavioral response function curve shown in Figure A-1 was adapted from Feller (1968, Figure 3).

$$R = \frac{1-\left(\frac{L-B}{K}\right)^{-A}}{1-\left(\frac{L-B}{K}\right)^{-2A}}$$

Where: R = risk (0 – 1.0);

L = received level (RL) in dB;

B = basement RL (i.e. lowest RL at which behavioral reaction possible) in dB;

K = the RL increment above basement in dB at which there is 50 percent risk;

A = risk transition sharpness parameter

Feller function parameter values used in this analysis were selected in keeping with values used to predict behavioral reaction from nonimpulsive noise to odontocetes in the U.S. Navy Atlantic Fleet Active Sonar Training (AFAST) Environmental Impact Statement (EIS) (U.S. Navy 2008). The values published in the AFAST EIS (A=10, K=45 dB SPL, and B = 120 dB SPL) were selected based on extensive research and coordination with NMFS.

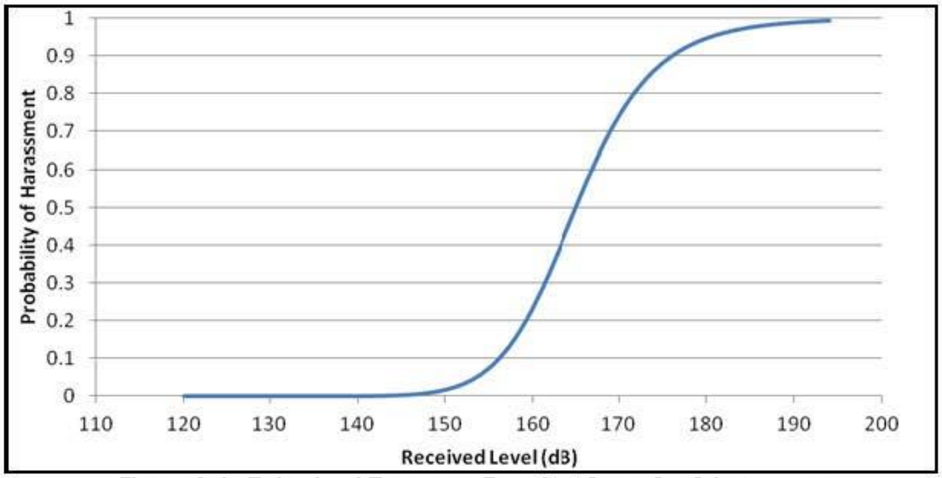

Figure A-1. Behavioral Response Function Curve for Odontocetes
Source: U.S. Navy 2008

Establishment of a risk modeling basement threshold (e.g., lowest noise level at which impacts could potentially occur) of 130 dB re 1 µPa was considered and eventually rejected. Average measured ambient (i.e., background) noise levels in the portion of the Knik Arm due west of the JBER runway have been reported as being 119 dB re 1 µPa and 125 dB re 1 µPa (Blackwell and Greene 2002; Knik Arm Bridge and Toll Authority *et al.* 2010). Ambient noise can include such natural sounds as wind, wave, ice movement, and tidal action and can be especially loud under conditions of turbulent flow or high surface roughness. Recent studies by Castellote *et al.* (2015) indicate that lower background levels occur on the quietest days, but the temporal prevalence and levels of anthropogenic noise measured by Castellote *et al.* (2015) indicate that beluga communication and hearing is largely masked by anthropogenic noise in most of the locations and periods sampled. For animals to detect and respond to a noise, it needs to be louder than background by greater than a value known as the "critical ratio." Sounds that are louder than ambient noise levels by less than the "critical ratio" and that are in the same frequency band as ambient noise sources would not typically be perceived by the animal as a distinct noise source and would not be expected to generate any direct behavioral reaction (Richardson *et al.* 1995). These introduced sounds are essentially masked by the typical background noises in an area. Odontocete critical ratios are typically between 10 and 20 dB at the lower frequencies concerned here, with the actual value varying by frequency and species (Richardson *et al.* 1995). Figure A-2 shows F-22 noise energy in frequency bands between 10 and 10,000 hertz (Hz) in several aircraft configurations, as taken from the NOISEFILE database. Jet noise is most intense in low-frequency bands (e.g., less than 4,000 Hz). Although jet noise does occur in frequency bands less than 40 Hz, it is of relatively low intensity and is not included in the NOISEFILE database. Ambient noise sources in the Knik Arm also have a majority of their noise energy at similarly low frequencies (Blackwell and Greene 2002). Therefore, aircraft overflight noise events less than 130 dB re 1 μPa (120 dB re 1 μPa ambient noise level plus 10 dB critical ratio) would be expected to be heard only indistinctly by belugas and would not be expected to generate any behavioral reaction.

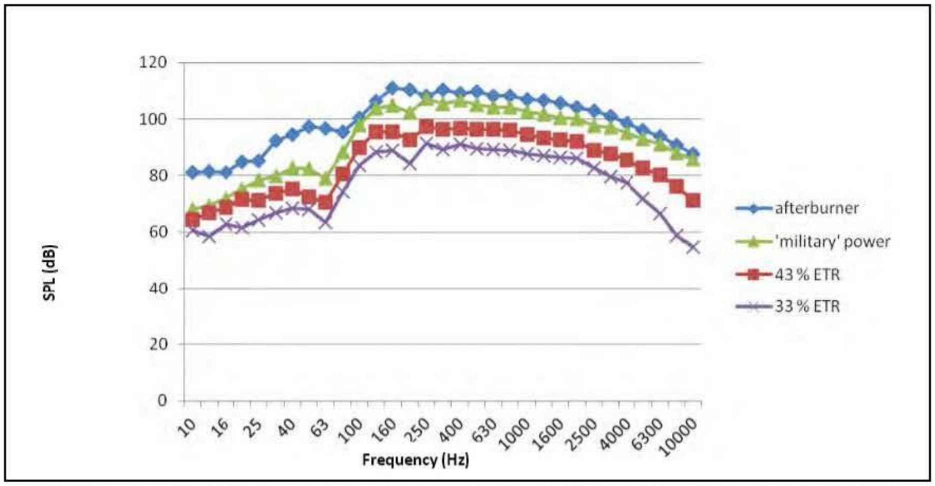

Figure A-2. Unweighted SPL re 20 μPa (In-Air) at 10–10,000 Hz Generated by F-22 Overflight at 1,000 Above Ground Level in Several Aircraft Configurations

However, although unlikely, it is possible that belugas could perceive F-22 noise at levels below 130 dB re 1 μPa and have a behavioral reaction to the sound. To ensure conservative analysis results (i.e., overestimation of potential effects), 120 dB re 1 μPa was adopted as the basement threshold for impacts.

Step 4: Establish area exposed to noise exceeding thresholds. For each F-22 event type for which SPL exceeds 120 dB re 1 μPa at the loudest point, SEL_CALC was used to calculate the slant range at which noise level drops below 120, 125, and 130 dB re 1 μPa. Along each representative aircraft flight track, the aircraft altitude at several increments was calculated based on data reported by F-22 pilots and JBER Air Traffic Control. At each distance increment, the lateral distance from the flight track at which the critical slant range would be exceeded was calculated (Figure A-3). At a certain distance from the airfield, aircraft altitude is high enough that noise levels at the water's surface would not exceed 120 dB SPL re 1 μPa even directly beneath the flight track. Flight tracks and lateral distance to threshold noise level were plotted using ESRI Geographic Information System software and compared with shoreline to allow calculation of water area affected at 120 to 125 dB re 1 μPa, 125 to 130 dB re 1 μPa, and greater than 130 dB re 1 μPa.

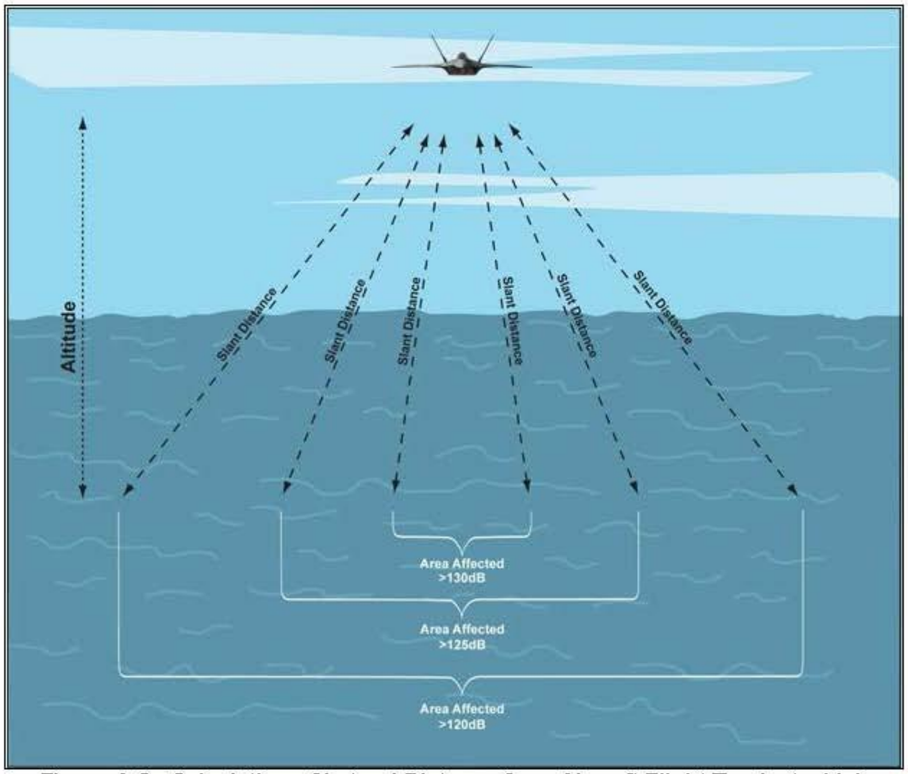

Figure A-3. Calculation of Lateral Distance from Aircraft Flight Track at which Surface Water is Ensonified at >120, >125, and >130 dB SPL

According to Snell's law, noise energy that intersects the water's surface at more than 13 degrees from vertical is almost entirely reflected. Therefore, the area of maximum transmission can be visualized as a 13-degree cone (26 degree aperture) with the aircraft at its apex. Outside of this area, only the upper few meters of the water column would typically be affected by elevated noise levels during an overflight. However, when the sea surface is rough, a common condition in the Knik Arm, reflectance of noise energy is highly variable, depending on the angle at which incoming sound waves impact individual wave surfaces. In general, when the wave face is close to perpendicular to inbound sound rays, more energy enters the water. When sound rays happen to impact a wave face that is oblique to the direction of the ray, more energy is reflected from the water's surface. This variable transmission can lead to isolated volumes of water being very briefly exposed to higher noise levels than would occur under calm sea conditions. The location and extent of this phenomenon depend heavily on specific sea conditions. For simplicity, this analysis assumed equal transmission of sound waves across the air-water interface for anywhere the basement threshold of 120 dB re 1 μPa is exceeded at the water's surface. Snell's law dictates sound waves are only directly transmitted into the water at 13 degrees or less from the vertical. By ignoring Snell's law in the model, different sea states causing sound to enter the water in multiple transmission paths, and evanescent surface scattering can be conservatively accounted for by calculating the largest possible footprint.

It is also assumed for the analysis that the footprint extends from the surface to the bottom, even for areas outside of the 13-degree cone (26-degree aperture) dictated by Snell's law that would limit sound energy to the first few meters of the water column. Animals at depth would also experience lower sound levels than at the surface due to transmission loss in the water column. Because sound waves would have decreased to below threshold noise levels prior to reaching the bottom at any but the shallowest water depths, reflected sound energy from the bottom was not considered as part of this study.

Step 5: Estimate the density of Cook Inlet beluga whales in Knik Arm. Beluga density was estimated by dividing the latest (2015) estimated Cook Inlet beluga whale population of 340 individuals (Shelden *et al.* 2015) by 2,800 square kilometers (km^2), the area estimated to contain 95 percent of the Cook Inlet beluga whale population (Rugh *et al.* 2010). This method yields a density estimate of 0.12 beluga whales/km^2. The seasonal variability in beluga density in the Knik Arm was estimated based on data collected between 2007 and 2011 (Kendall 2010; Cornick *et al.* 2010; Cornick and Penny 2011; Cornick *et al.* 2011). Data was grouped by season (spring [May–June], summer [July–September], and fall [October–November]) to reduce effects of randomness of whale sightings during observations periods. The number of whales observed per hour was calculated from this data and was listed as a percentage of the maximum number of whales per hour observed. This percentage was then multiplied by the overall density estimate above (0.12 beluga whales/km^2) to estimate the beluga density for each month. Whale density during unsurveyed winter months was conservatively assumed to be the same as density in lowest density season (i.e., spring).

Step 6: Calculate average number of potential behavioral reactions. The average number of harassment events per year was calculated using information on beluga density (see Step 5) with information on the frequency-of-occurrence and intensity of aircraft overflight noise. The F-22 EEEGL2 departure from RW 24 using afterburner (A/B) (see Figure 7) will be used as an example to illustrate the process. The same process was repeated for each flight profile flown.

First, the number of events per month was determined by multiplying the total number of events per year as reported by the JBER operational community (e.g., 131 for A/B EEEGL 2 Departures on RW24) by the three-year-average percentage of total annual sorties in each month (e.g., 6.7% of total annual sorties occur in the month of January). This yielded a total of 8.8 A/B EEEGL2 Departures on RW24 for the month of January, and was subsequently done for the remaining months, yielding 12 values.

Next, the number of events in each month (calculated above) was multiplied by the water surface area affected at 120–125 dB, 125–130 dB, and greater than 130 dB re 1 μPa (see Step 4) and the estimated beluga density in that month (see Step 5). The A/B EEEGL2 departure from RW24 affects 0.37 square kilometers at 120-125 dB re 1 μPa and, in the month of January, there was an average beluga population density of 0.037 whales per square kilometer. Therefore, the average number of Cook Inlet beluga whales in the 120-125 dB SPL footprint in January for A/B EEEGL 2 Departures on RW24 equals 0.37 (sq km affected in this dB SPL range) by 0.037 (beluga density in January). This results in an average number of Cook Inlet belugas in the footprint for this flight profile in January of 0.01. Similar steps were taken to determine Cook Inlet belugas affected in all three dB SPL ranges (e.g., 120–125 dB, 125–130 dB, and greater than 130 dB re 1 μPa) for each month for each profile exceeding 120 dB.

Finally, within each footprint range, the number of animals that would likely exhibit a behavioral response was predicted by multiplying the number of events per month under each flight profile by the number of animals exposed per month by the probability of behavioral response at the highest sound level within that footprint range according to the behavioral response function (see step 3 above for an explanation of the behavioral response function). To yield conservative impact estimates, the probability corresponding to 125 dB re 1 µPa was used for the 120–125 dB re 1 µPa footprint range, the probability corresponding to 130 dB re 1 µPa was used for the 125–130 dB re 1 µPa footprint range, and the probability corresponding to 135 dB re 1 µPa was used for the greater than 130 dB re 1 µPa footprint range. For example, the following formula is used to calculate the average number of Cook Inlet belugas harassed in the 120-125 dB range by F-22 EEEGL2 Departures from RW24:

> 8.8 (*events in January*) * 0.01 (*average number of Cook Inlet belugas in area affected at 120-125 dB SPL*) * 2.9E-10 (*Harassment probability within 120-125 dB SPL*)

This general formula is used to calculate number of harassments for each month of the year, and then summed to total **9.3E-10** Cook Inlet beluga whales harassed within the 120-125 dB SPL footprint under this flight profile. The same general summation formula is used to determine harassments within 125-130 dB and >130 dB SPL footprints, with the probability of level B harassment increased appropriately in accordance with the Feller function. For EEEGL2 Departures from RW24, the average number of Cook Inlet beluga whales affected within the 125-130 and >130 dB SPL footprints is **0.00**, as the SPL just below the surface does not exceed 125 dB. For each overflight type, the predicted behavioral reactions in each footprint range are added to yield the predicted annual behavioral responses for that type of overflight. The number of animals predicted to exhibit a behavioral response annually for each type of event is then added together to yield the annual total number of predicted behavioral responses for all proposed overflight events. This method results in an average of **0.041** Cook Inlet beluga whales harassed under the No Action Alternative. Similar methods are performed for each Alternative.

Attachment 1 has figures showing the location of predicted areas of in-water ensonification greater than 120 dB re 1 µPa for existing aircraft resident at JBER (F-22, C-17, C-130, E-3A) as well as a composite figure for transient aircraft, which include F-15E, C-12, C-130H, C-17, C-21A, B-737, KC-135R, UH-60A, and C-5A.

A1.3 Results

Based on application of the methodology described above, between approximately 0.012 (Alternative C) and 0.047 (Alternative E) belugas would be behaviorally harassed annually resulting from proposed F-22 flying operations depending on the alternative chosen (Table A-6 through Table A-12). Approximately 0.041 belugas are behaviorally harassed annually due to existing F-22 aircraft operations at JBER (Table 1 on page 3 of the Biological Evaluation). Other based aircraft at JBER cause approximately 0.013 behavioral harassments annually, and transient aircraft cause approximately 0.0046. Combining the potential F-22 operations with existing aircraft operations at JBER (other based and transient aircraft) gives a predicted total of between 0.0296 (Alternative C) and 0.0646 (Alternative E) belugas that would be behaviorally harassed annually from the combined operations. Table A-13 summarizes the predicted total number of belugas harassed by alternative.

Table A-6. Estimated Annual Beluga Behavioral Responses Resulting From Proposed F-22 Flying Operations (No Action)

Event Type (Bolded Event Types Exceed Threshold)	Aircraft Configuration		Noise Levels		Ops Frequency	Number of Belugas in Affected Area			Risk of Behavioral Effects			
	Lowest Altitude Over Water (MSL)	Power (% ETR)	LA_{max} Just Above Surface (dB re 20 µPa)	SPL Just Below Surface (dB re 1 µPa)	Total Events Per Year	Avg. # Belugas in Area Affected at 120-125 dB SPL	Avg. # Belugas in Area Affected at 125-130 dB SPL	Avg. # Belugas in Area Affected at >130 dB SPL	Prob. of Level B Harassment at Highest Level Within 120-125 dB SPL	Prob. of Level B Harassment at Highest Level Within 125-130 dB SPL	Prob. of Level B Harassment at Highest Level >130 dB SPL (0 if max SPL <130)	Avg. # Belugas Harassed Per Year by Seasonality
A/B EEEGL 2 Dep on 24	**9,754**	**150**	**87.4**	**122.4**	**131.40**	**0.04**	**0.00**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**9.3E-10**
Mil EEEGL 2 Departure on RW 24	**2,347**	**90**	**101.1**	**136.1**	**3,179.15**	**2.79**	**1.45**	**0.71**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.2E-02**
Mil EEEGL 2 Departure on RW 34	**4,005**	**90**	**95.1**	**130.1**	**1,417.66**	**2.62**	**0.87**	**0.03**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**6.0E-04**
A/B EEEGL 2 Dep on 34	18,158	150	77	112	3.65	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ILS to 06	**652**	**33**	**101.8**	**136.8**	**2,000.20**	**1.77**	**1.16**	**0.92**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.7E-02**
Cujak Transition (initial approach Lead + Wing)	3,500	33	82.3	117.3	1,591.40	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Transition (initial approach Lead)	3,715	10	67.4	102.4	795.70	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Tactical Wing	3,894	10	66	101	795.70	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ALL VFR approaches (overhead break) AND visual closed patterns	**709**	**33**	**90.5**	**125.5**	**4,036.90**	**0.17**	**0.05**	**0.02**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**6.9E-04**
Re-entry Pattern (initial approach)	**1,700**	**33**	**91.3**	**126.3**	**7.84**	**0.95**	**0.69**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**8.7E-07**
ILS to 16- **N/A for No Action**	**N/A**											
Std Initial to 16	3,,288	33	83.2	118.2	1.07	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
VFR Closed	**536**	**10**	**91.5**	**126.5**	**149.07**	**0.59**	**0.61**	**0.13**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.9E-04**
TOTAL												**0.041**

dB re 1 µPa = decibels referenced to 1 micropascal; dB re 20 µPa = decibels referenced to 20 micropascals; MSL = mean sea level; N/A = not applicable; RW = Runway; SPL = sound pressure level; VFR = visual flight rules

Table A-7. Estimated Annual Beluga Behavioral Responses Resulting From Proposed F-22 Flying Operations (Alternative A)

Event Type (Bolded Event Types Exceed Threshold)	Aircraft Configuration		Noise Levels		Ops Frequency	Number of Belugas in Affected Area			Risk of Behavioral Effects			
	Lowest Altitude Over Water (MSL)	Power (% ETR)	LA_{max} Just Above Surface (dB re 20 µPa)	SPL Just Below Surface (dB re 1 µPa)	Total Events Per Year	Avg. # Belugas in Area Affected at 120-125 dB SPL	Avg. # Belugas in Area Affected at 125-130 dB SPL	Avg. # Belugas in Area Affected at >130 dB SPL	Prob. of Level B Harassment at Highest Level Within 120-125 dB SPL	Prob. of Level B Harassment at Highest Level Within 125-130 dB SPL	Prob. of Level B Harassment at Highest Level >130 dB SPL (0 if max SPL <130)	Avg. # Belugas Harassed Per Year by Seasonality
A/B EEEGL 2 Dep on 24	9,754	150	87.4	122.4	18.80	0.04	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	1.3E-10
Mil EEEGL 2 Departure on RW 24	2,347	90	101.1	136.1	451.21	2.79	1.45	0.71	2.9E-10	2.9E-07	1.7E-05	3.1E-03
Mil EEEGL 2 Departure on RW 34	4,005	90	95.1	130.1	4,322.00	2.62	0.87	0.03	2.9E-10	2.9E-07	1.7E-05	1.8E-03
A/B EEEGL 2 Dep on 34	18,158	150	77	112	12.99	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ILS to 06	652	33	101.8	136.8	1,998.48	1.77	1.16	0.92	2.9E-10	2.9E-07	1.7E-05	1.7E-02
Cujak Transition (initial approach Lead + Wing)	3,500	33	82.3	117.3	1,591.40	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Transition (initial approach Lead)	3,715	10	67.4	102.4	799.04	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Tactical Wing	3,894	10	66	101	799.02	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ALL VFR approaches (overhead break) AND visual closed patterns	709	33	90.5	125.5	4036.90	0.17	0.05	0.02	2.9E-10	2.9E-07	1.7E-05	6.9E-04
Re-entry Pattern (initial approach)	1,700	33	91.3	126.3	7.84	0.95	0.69	0.00	2.9E-10	2.9E-07	1.7E-05	8.7E-07
ILS to 16- **N/A for Alternative A**	N/A											
Std Initial to 16	3,288	33	83.2	118.2	1.09	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
VFR Closed	536	10	91.5	126.5	149.07	0.59	0.61	0.13	2.9E-10	2.9E-07	1.7E-05	1.9E-04
TOTAL												0.023

dB re 1 µPa = decibels referenced to 1 micropascal; dB re 20 µPa = decibels referenced to 20 micropascals; MSL = mean sea level; N/A = not applicable; RW = Runway; SPL = sound pressure level; VFR = visual flight rules

Table A-8. Estimated Annual Beluga Behavioral Responses Resulting From Proposed F-22 Flying Operations (Alternative B)

Event Type (Bolded Event Types Exceed Threshold)	Aircraft Configuration		Noise Levels		Ops Frequency	Number of Belugas in Affected Area			Risk of Behavioral Effects			
	Lowest Altitude Over Water (MSL)	Power (% ETR)	LA_{max} Just Above Surface (dB re 20 µPa)	SPL Just Below Surface (dB re 1 µPa)	Total Events Per Year	Avg. # Belugas in Area Affected at 120-125 dB SPL	Avg. # Belugas in Area Affected at 125-130 dB SPL	Avg. # Belugas in Area Affected at >130 dB SPL	Prob. of Level B Harassment at Highest Level Within 120-125 dB SPL	Prob. of Level B Harassment at Highest Level Within 125-130 dB SPL	Prob. of Level B Harassment at Highest Level >130 dB SPL (0 if max SPL <130)	Avg. # Belugas Harassed Per Year by Seasonality
A/B EEEGL 2 Dep on 24	**9,754**	**150**	**87.4**	**122.4**	**22.81**	**0.04**	**0.00**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.6E-10**
Mil EEEGL 2 Departure on RW 24	**2,347**	**90**	**101.1**	**136.1**	**547.21**	**2.79**	**1.45**	**0.71**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**3.7E-03**
Mil EEEGL 2 Departure on RW 34	**3,731**	**90**	**96.1**	**131.1**	**4,222.28**	**2.76**	**1.01**	**0.11**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**5.0E-03**
A/B EEEGL 2 Dep on 34	16,765	150	78.5	113.5	12.70	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ILS to 06	**652**	**33**	**101.8**	**136.8**	**1,998.48**	**1.77**	**1.16**	**0.92**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.7E-02**
Cujak Transition (initial approach Lead + Wing)	3,500	33	82.3	117.3	1,598.04	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Transition (initial approach Lead)	3,715	10	67.4	102.4	799.02	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Tactical Wing	3,894	10	66	101	799.02	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ALL VFR approaches (overhead break) AND visual closed patterns	**709**	**33**	**90.5**	**125.5**	**4,036.90**	**0.17**	**0.05**	**0.02**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**6.9E-04**
Re-entry Pattern (initial approach)	**1,700**	**33**	**91.3**	**126.3**	**7.84**	**0.95**	**0.69**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**8.7E-07**
ILS to 16	**1,184**	**33**	**95.4**	**130.4**	**0.00**	**0.75**	**0.26**	**0.01**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**0.0E+00**
Std Initial to 16	3,288	33	83.2	118.2	1.09	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
VFR Closed	**536**	**10**	**91.5**	**126.5**	**149.07**	**0.59**	**0.61**	**0.13**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.9E-04**
TOTAL												**0.027**

dB re 1 µPa = decibels referenced to 1 micropascal; dB re 20 µPa = decibels referenced to 20 micropascals; MSL = mean sea level; RW = Runway; SPL = sound pressure level; VFR = visual flight rules

Table A-9. Estimated Annual Beluga Behavioral Responses Resulting From Proposed F-22 Flying Operations (Alternative C)

Event Type (Bolded Event Types Exceed Threshold)	Aircraft Configuration		Noise Levels		Ops Frequency	Number of Belugas in Affected Area			Risk of Behavioral Effects			
	Lowest Altitude Over Water (MSL)	Power (% ETR)	LA_{max} Just Above Surface (dB re 20 µPa)	SPL Just Below Surface (dB re 1 µPa)	Total Events Per Year	Avg. # Belugas in Area Affected at 120-125 dB SPL	Avg. # Belugas in Area Affected at 125-130 dB SPL	Avg. # Belugas in Area Affected at >130 dB SPL	Prob. of Level B Harassment at Highest Level Within 120-125 dB SPL	Prob. of Level B Harassment at Highest Level Within 125-130 dB SPL	Prob. of Level B Harassment at Highest Level >130 dB SPL (0 if max SPL <130)	Avg. # Belugas Harassed Per Year by Seasonality
A/B EEEGL 2 Dep on 24	**9,754**	**150**	**87.4**	**122.4**	**22.81**	**0.04**	**0.00**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.6E-10**
Mil EEEGL 2 Departure on RW 24	**2,347**	**90**	**101.1**	**136.1**	**547.21**	**2.79**	**1.45**	**0.71**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**3.7E-03**
Mil EEEGL 2 Departure on RW 34	**3,749**	**90**	**96.1**	**131.1**	**4,222.28**	**2.75**	**1.00**	**0.10**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**4.7E-03**
A/B EEEGL 2 Dep on 34	16,854	150	78.5	113.5	12.70	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ILS to 06	**652**	**33**	**101.8**	**136.8**	**332.84**	**1.77**	**1.16**	**0.92**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.9E-03**
Cujak Transition (initial approach Lead + Wing)	3,500	33	82.3	117.3	244.40	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Transition (initial approach Lead)	3,715	10	67.4	102.4	122.20	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Tactical Wing	3,894	10	66	101	122.20	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ALL VFR approaches (overhead break) AND visual closed patterns	**709**	**33**	**90.5**	**125.5**	**617.20**	**0.17**	**0.05**	**0.02**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.1E-04**
Re-entry Pattern (initial approach)	**1,700**	**33**	**91.3**	**126.3**	**1.20**	**0.95**	**0.69**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.3E-07**
ILS to 16	**1,184**	**33**	**95.4**	**130.4**	**1,665.64**	**0.75**	**0.26**	**0.01**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.5E-04**
Std Initial to 16	3,288	33	83.2	118.2	185.60	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
VFR Closed	**536**	**10**	**91.5**	**126.5**	**22.80**	**0.59**	**0.61**	**0.13**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.9E-05**
TOTAL												0.012

dB re 1 µPa = decibels referenced to 1 micropascal; dB re 20 µPa = decibels referenced to 20 micropascals; MSL = mean sea level; RW = Runway; SPL = sound pressure level; VFR = visual flight rules

Table A-10. Estimated Annual Beluga Behavioral Responses Resulting From Proposed F-22 Flying Operations (Alternative D)

Event Type (Bolded Event Types Exceed Threshold)	Aircraft Configuration		Noise Levels		Ops Frequency	Number of Belugas in Affected Area			Risk of Behavioral Effects			
	Lowest Altitude Over Water (MSL)	Power (% ETR)	LA_{max} Just Above Surface (dB re 20 µPa)	SPL Just Below Surface (dB re 1 µPa)	Total Events Per Year	Avg. # Belugas in Area Affected at 120-125 dB SPL	Avg. # Belugas in Area Affected at 125-130 dB SPL	Avg. # Belugas in Area Affected at >130 dB SPL	Prob. of Level B Harassment at Highest Level Within 120-125 dB SPL	Prob. of Level B Harassment at Highest Level Within 125-130 dB SPL	Prob. of Level B Harassment at Highest Level >130 dB SPL (0 if max SPL <130)	Avg. # Belugas Harassed Per Year by Seasonality
A/B EEEGL 2 Dep on 24	**9,754**	**150**	**87.4**	**122.4**	**18.80**	**0.04**	**0.00**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.3E-10**
Mil EEEGL 2 Departure on RW 24	**2,347**	**90**	**101.1**	**136.1**	**451.21**	**2.79**	**1.45**	**0.71**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**3.1E-03**
Mil EEEGL 2 Departure on RW 34	**4,005**	**90**	**95.1**	**130.1**	**468.59**	**2.62**	**0.87**	**0.03**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.0E-04**
A/B EEEGL 2 Dep on 34	18,158	150	77	112	1.42	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ILS to 06	**652**	**33**	**101.8**	**136.8**	**1,998.48**	**1.77**	**1.16**	**0.92**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.7E-02**
Cujak Transition (initial approach Lead + Wing)	3,500	33	82.3	117.3	1,591.40	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Transition (initial approach Lead)	3,715	10	67.4	102.4	799.02	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Tactical Wing	3,894	10	66	101	799.02	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ALL VFR approaches (overhead break) AND visual closed patterns	**709**	**33**	**90.5**	**125.5**	**4,036.90**	**0.17**	**0.05**	**0.02**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**6.9E-04**
Re-entry Pattern (initial approach)	**1,700**	**33**	**91.3**	**126.3**	**7.84**	**0.95**	**0.69**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**8.7E-07**
ILS to 16- **N/A for Alternative D**							**N/A**					
Std Initial to 16	3,288	33	83.2	118.2	1.09	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
VFR Closed	**536**	**10**	**91.5**	**126.5**	**149.07**	**0.59**	**0.61**	**0.13**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.9E-04**
TOTAL												**0.022**

dB re 1 µPa = decibels referenced to 1 micropascal; dB re 20 µPa = decibels referenced to 20 micropascals; MSL = mean sea level; N/A = not applicable; RW = Runway; SPL = sound pressure level; VFR = visual flight rules

Table A-11. Estimated Annual Beluga Behavioral Responses Resulting From Proposed F-22 Flying Operations (Alternative E)

Event Type (Bolded Event Types Exceed Threshold)	Aircraft Configuration		Noise Levels		Ops Frequency	Number of Belugas in Affected Area			Risk of Behavioral Effects			
	Lowest Altitude Over Water (MSL)	Power (% ETR)	LA_{max} Just Above Surface (dB re 20 µPa)	SPL Just Below Surface (dB re 1 µPa)	Total Events Per Year	Avg. # Belugas in Area Affected at 120-125 dB SPL	Avg. # Belugas in Area Affected at 125-130 dB SPL	Avg. # Belugas in Area Affected at >130 dB SPL	Prob. of Level B Harassment at Highest Level Within 120-125 dB SPL	Prob. of Level B Harassment at Highest Level Within 125-130 dB SPL	Prob. of Level B Harassment at Highest Level >130 dB SPL (0 if max SPL <130)	Avg. # Belugas Harassed Per Year by Seasonality
A/B EEEGL 2 Dep on 24	**9,754**	**150**	**87.4**	**122.4**	**173.41**	**0.04**	**0.00**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.2E-09**
Mil EEEGL 2 Departure on RW 24	**2,347**	**90**	**101.1**	**136.1**	**4,161.58**	**2.79**	**1.45**	**0.71**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.8E-02**
Mil EEEGL 2 Departure on RW 34	**4,005**	**90**	**95.1**	**130.1**	**468.59**	**2.62**	**0.87**	**0.03**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.0E-04**
A/B EEEGL 2 Dep on 34	18,158	150	77	112	1.42	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ILS to 06	**652**	**33**	**101.8**	**136.8**	**1,998.48**	**1.77**	**1.16**	**0.92**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.7E-02**
Cujak Transition (initial approach Lead + Wing)	3,500	33	82.3	117.3	1,591.40	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Transition (initial approach Lead)	3,715	10	67.4	102.4	799.02	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Tactical Wing	3,894	10	66	101	799.02	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ALL VFR approaches (overhead break) AND visual closed patterns	**709**	**33**	**90.5**	**125.5**	**4,036.90**	**0.17**	**0.05**	**0.02**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**6.9E-04**
Re-entry Pattern (initial approach)	**1,700**	**33**	**91.3**	**126.3**	**7.84**	**0.95**	**0.69**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**8.7E-07**
ILS to 16- **N/A for Alternative E**						**,N/A**						
Std Initial to 16	3,288	33	83.2	118.2	1.09	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
VFR Closed	**536**	**10**	**91.5**	**126.5**	**149.07**	**0.59**	**0.61**	**0.13**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.9E-04**
TOTAL												**0.047**

dB re 1 µPa = decibels referenced to 1 micropascal; dB re 20 µPa = decibels referenced to 20 micropascals; MSL = mean sea level; N/A = not applicable; RW = Runway; SPL = sound pressure level; VFR = visual flight rules

ESA Section 7 - Biological Evaluation

Table A-12. Estimated Annual Beluga Behavioral Responses Resulting From Proposed F-22 Flying Operations (Alternative F)

Event Type (Bolded Event Types Exceed Threshold)	Aircraft Configuration		Noise Levels		Ops Frequency	Number of Belugas in Affected Area			Risk of Behavioral Effects			
	Lowest Altitude Over Water (MSL)	Power (% ETR)	LA_{max} Just Above Surface (dB re 20 µPa)	SPL Just Below Surface (dB re 1 µPa)	Total Events Per Year	Avg. # Belugas in Area Affected at 120-125 dB SPL	Avg. # Belugas in Area Affected at 125-130 dB SPL	Avg. # Belugas in Area Affected at >130 dB SPL	Prob. of Level B Harassment at Highest Level Within 120-125 dB SPL	Prob. of Level B Harassment at Highest Level Within 125-130 dB SPL	Prob. of Level B Harassment at Highest Level >130 dB SPL (0 if max SPL <130)	Avg. # Belugas Harassed Per Year by Seasonality
A/B EEEGL 2 Dep on 24	**9,754**	**150**	**87.4**	**122.4**	**173.41**	**0.04**	**0.00**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.2E-09**
Mil EEEGL 2 Departure on RW 24	**2,347**	**90**	**101.1**	**136.1**	**4,161.58**	**2.79**	**1.45**	**0.71**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.8E-02**
Mil EEEGL 2 Departure on RW 34	**4,005**	**90**	**95.1**	**130.1**	**468.59**	**2.62**	**0.87**	**0.03**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.0E-04**
A/B EEEGL 2 Dep on 34	18,158	150	77	112	1.42	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ILS to 06	**652**	**33**	**101.8**	**136.8**	**332.84**	**1.77**	**1.16**	**0.92**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.9E-03**
Cujak Transition (initial approach Lead + Wing)	3,500	33	82.3	117.3	244.40	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Transition (initial approach Lead)	3,715	10	67.4	102.4	122.20	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
RAPTR Tactical Wing	3,894	10	66	101	122.20	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
ALL VFR approaches (overhead break) AND visual closed patterns	**709**	**33**	**90.5**	**125.5**	**617.20**	**0.17**	**0.05**	**0.02**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.1E-04**
Re-entry Pattern (initial approach)	**1,700**	**33**	**91.3**	**126.3**	**1.20**	**0.95**	**0.69**	**0.00**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**1.3E-07**
ILS to 16	**1,184**	**33**	**95.4**	**130.4**	**1,665.64**	**0.75**	**0.26**	**0.01**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.5E-04**
Std Initial to 16	3,288	33	83.2	118.2	185.60	0.00	0.00	0.00	2.9E-10	2.9E-07	1.7E-05	0.0E+00
VFR Closed	**536**	**10**	**91.5**	**126.5**	**22.80**	**0.59**	**0.61**	**0.13**	**2.9E-10**	**2.9E-07**	**1.7E-05**	**2.9E-05**
TOTAL												**0A.032**

dB re 1 µPa = decibels referenced to 1 micropascal; dB re 20 µPa = decibels referenced to 20 micropascals; MSL = mean sea level; RW = Runway; SPL = sound pressure level; VFR = visual flight rules

Table A-13. Summary of Predicted Annual Beluga Behavioral Responses Resulting From Flying Operations by Alternative

No Action	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
0.0586	0.0406	0.0446	0.0296	0.0396	0.0646	0.0496

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ATTACHMENT 1. EXISTING RESIDENT AND TRANSIENT AIRCRAFT OPERATIONS AT JBER THAT MAY PRODUCE IN-WATER ENSONIFICATION EXCEEDING 120 DB RE 1 μPA

This attachment contains diagrams of water surface area below which modeled instantaneous in-water sound pressure levels are 120 decibels (dB) or greater resulting from overflights by existing JBER resident aircraft (including C-17, C-130, E-3A and F-22). There is present a composite figure for transient aircraft, which include F-15E, C-130H, C-12, C-17, C-21A, B-737, KC-135R, UH-60A, and C-5A. The figures for each aircraft type include all departures or approaches generating predicted in-water SPLs equaling or exceeding 120 dB referenced to 1 micropascal (re 1 μPa). For each aircraft type, except for transient aircraft, results are provided using existing and extended Runway 16/34. For the extended Runway 16/34 scenarios, arrivals are shifted up to 2,500 feet northward compared with arrivals on existing Runway 16/34, and the takeoff roll initiation point F-22s would be shifted up to 2,100 feet northward compared with the takeoff roll initiation point using existing Runway 16/34.

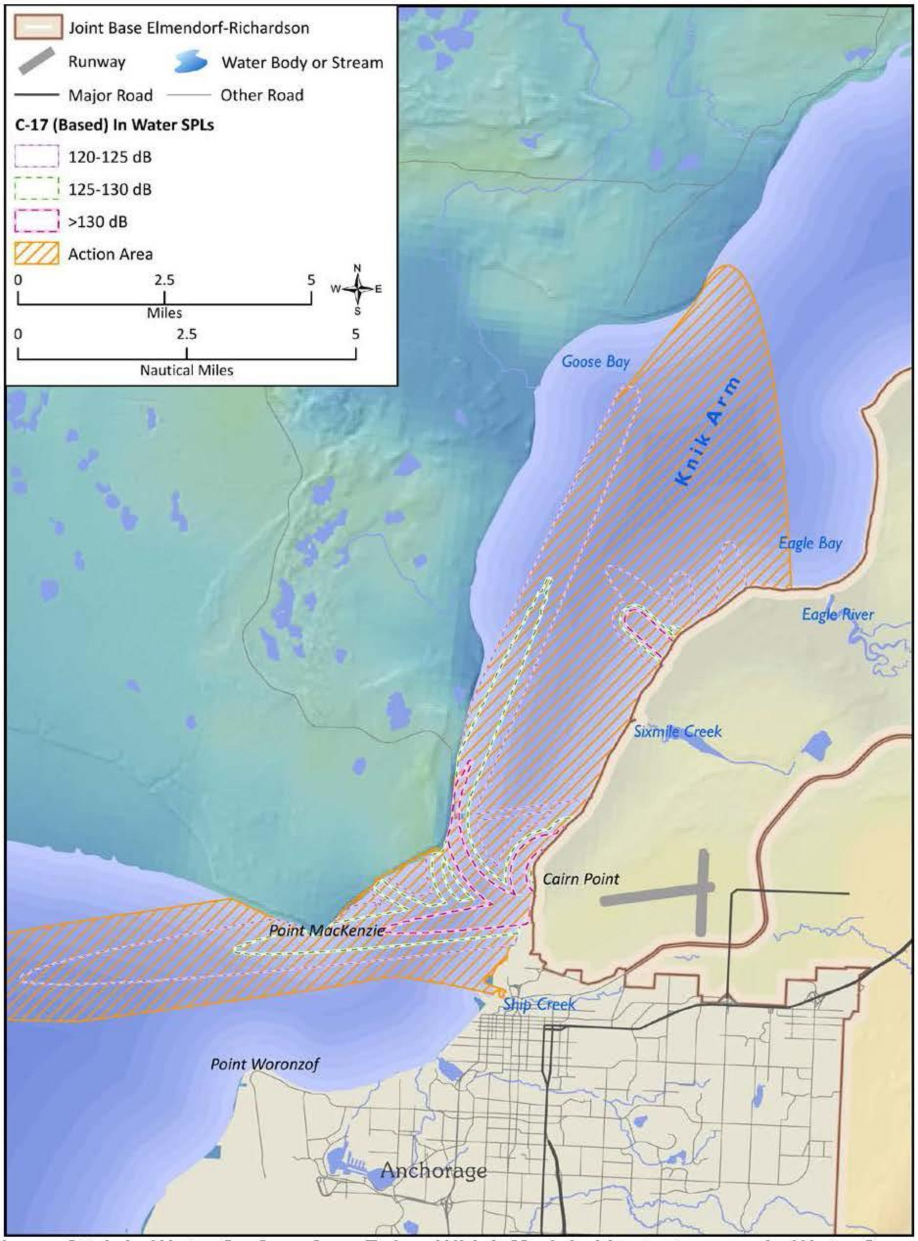

Figure Att 1-1. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From Overflights by Existing C-17 Aircraft (Existing Runway 16/34)

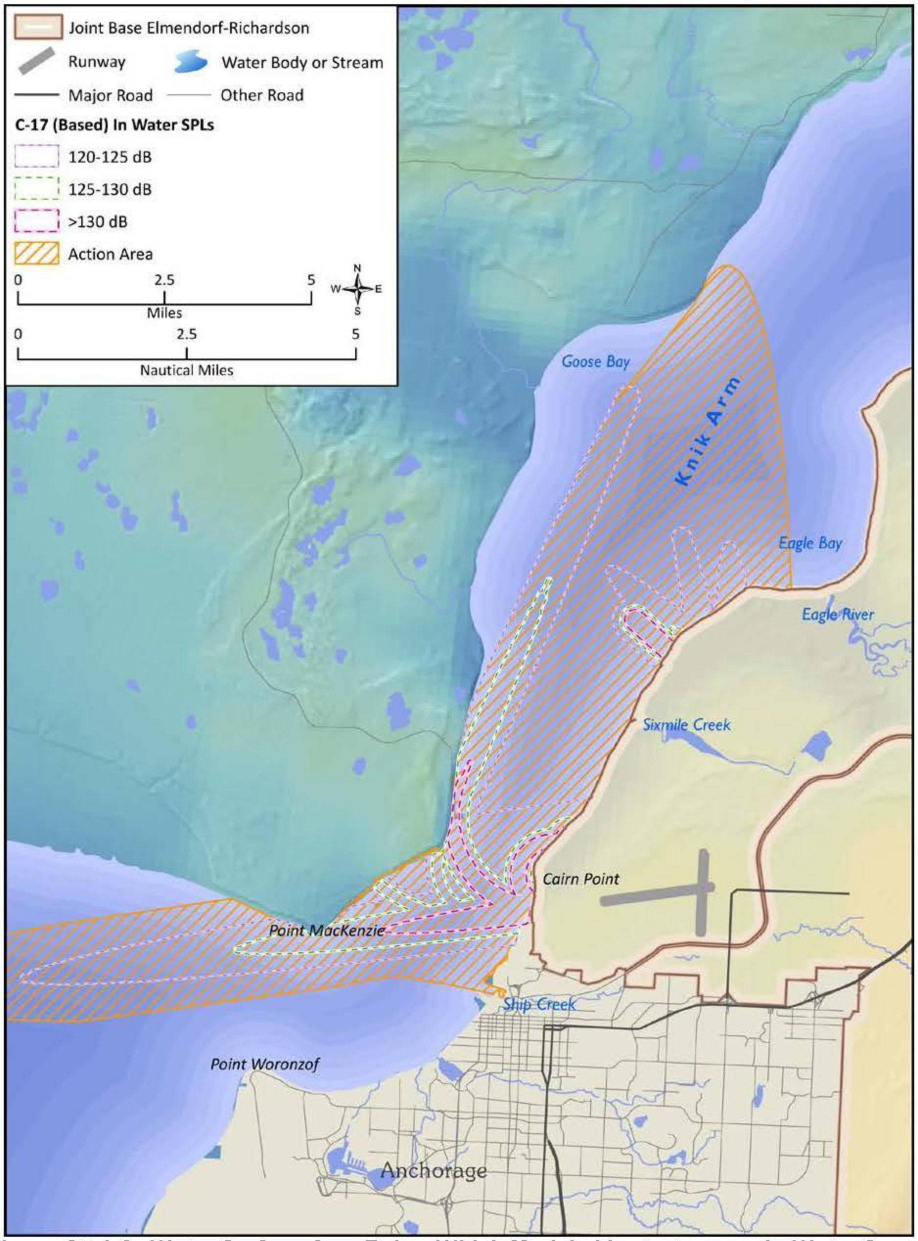

Figure Att 1-2. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From Overflights by Existing C-17 Aircraft (Runway 16/34 Extended)

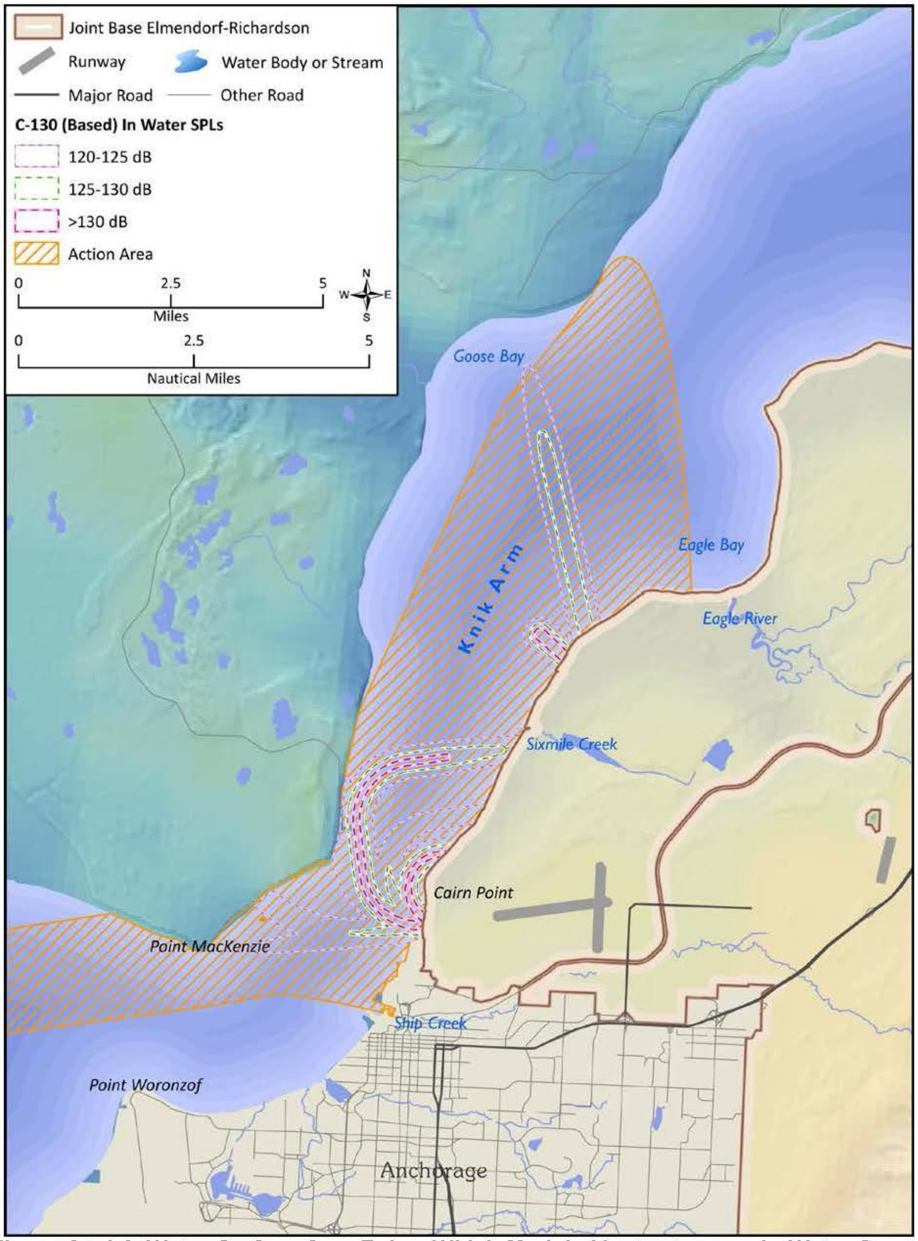

Figure Att 1-3. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From Overflights by Existing C-130 Aircraft (Existing Runway 16/34)

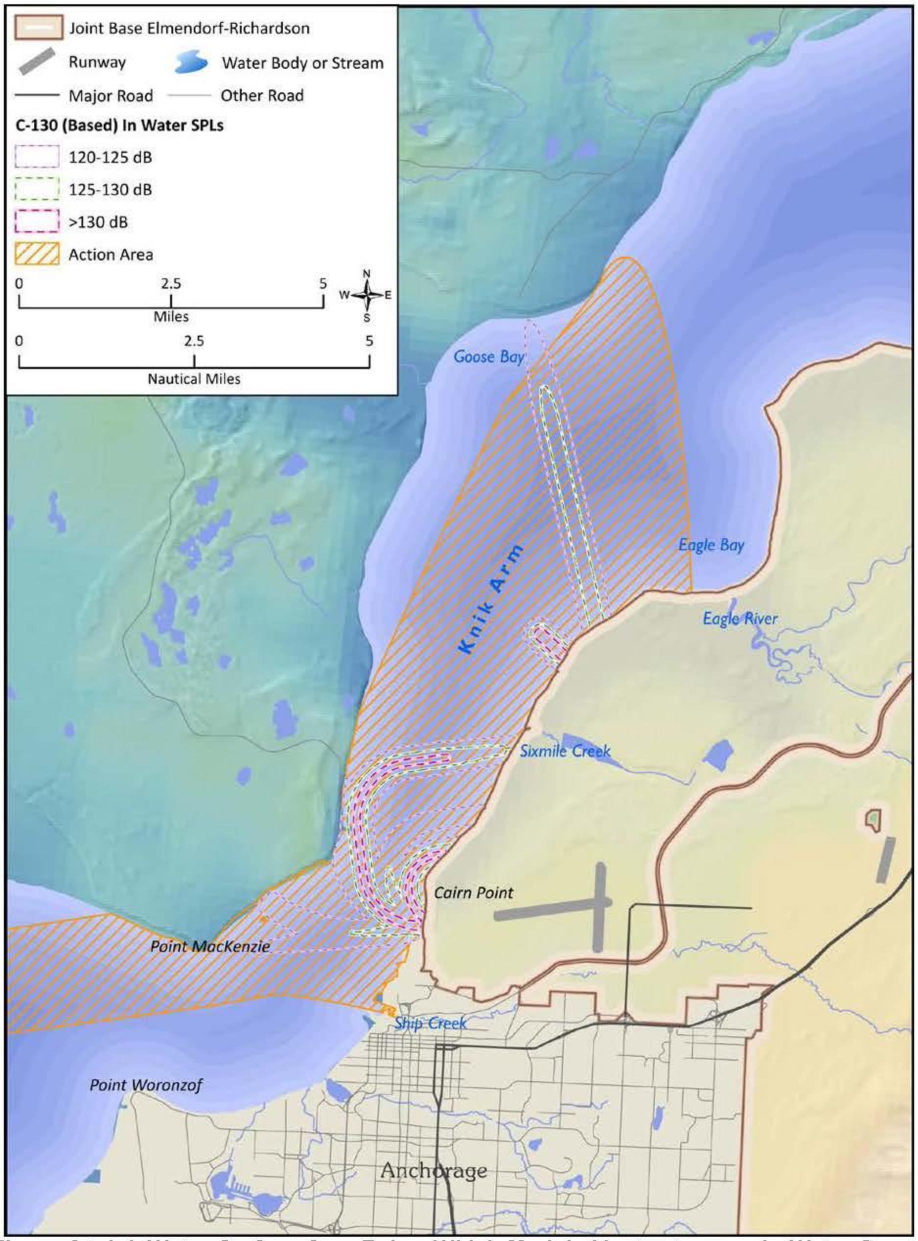

Figure Att 1-4. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From Overflights by Existing C-130 Aircraft (Runway 16/34 Extended)

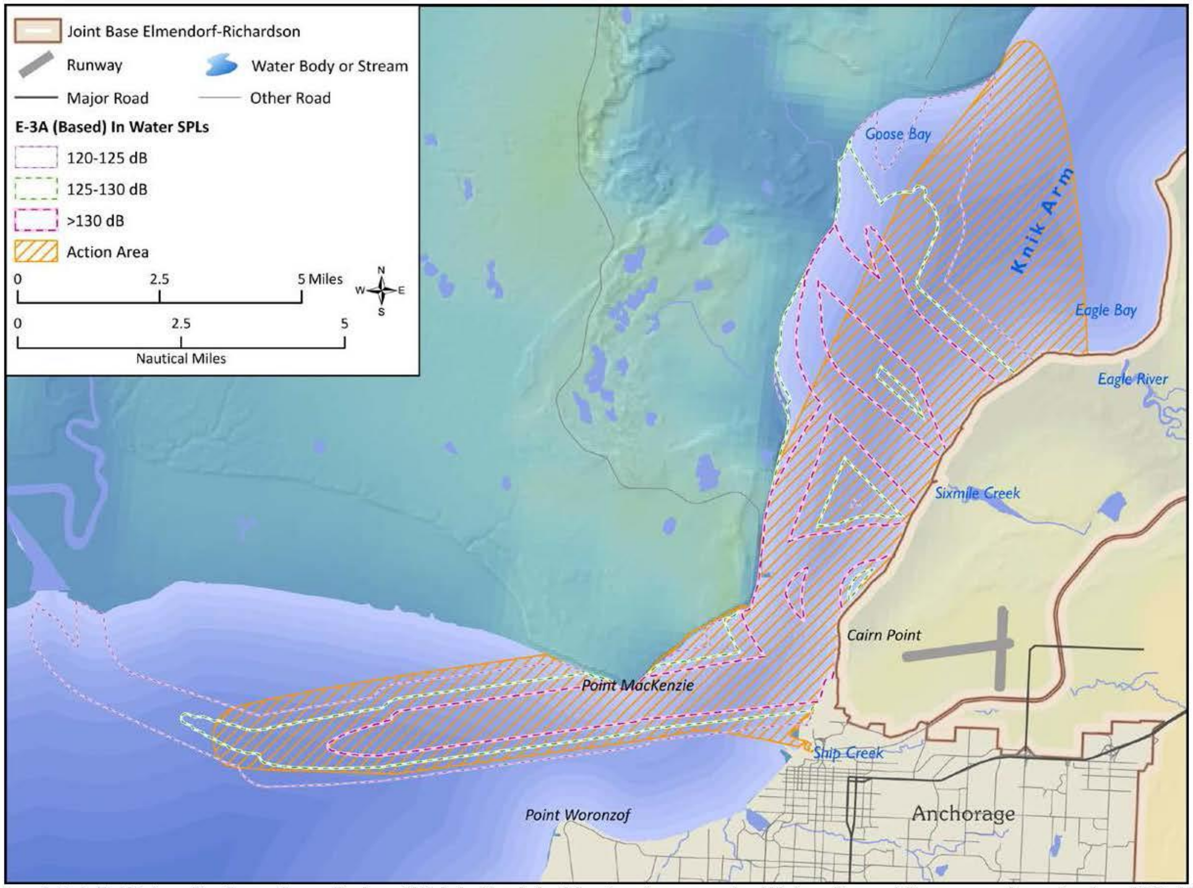

Figure Att 1-5. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From Overflights by Existing E-3A Aircraft (Existing Runway 16/34)

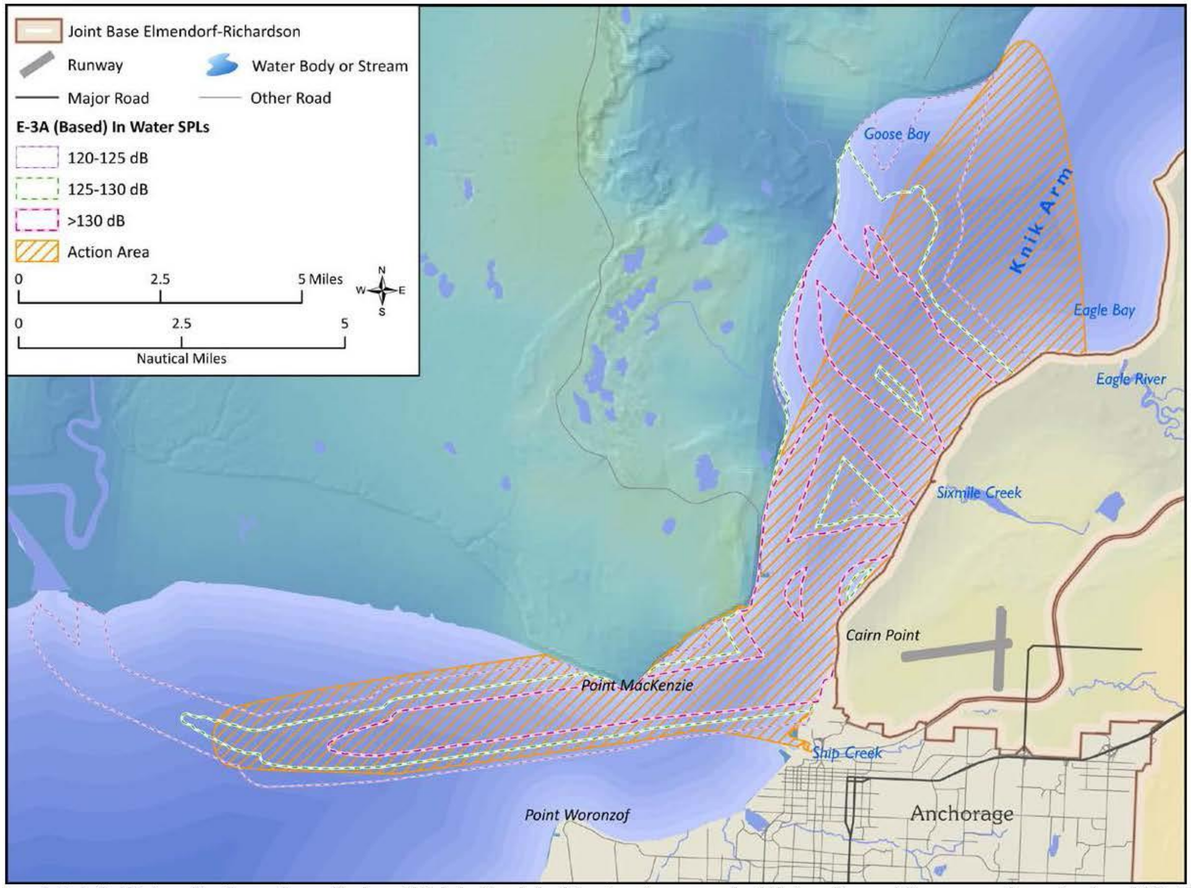

Figure Att 1-6. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From Overflights by Existing E-3A Aircraft (Runway 16/34 Extended)

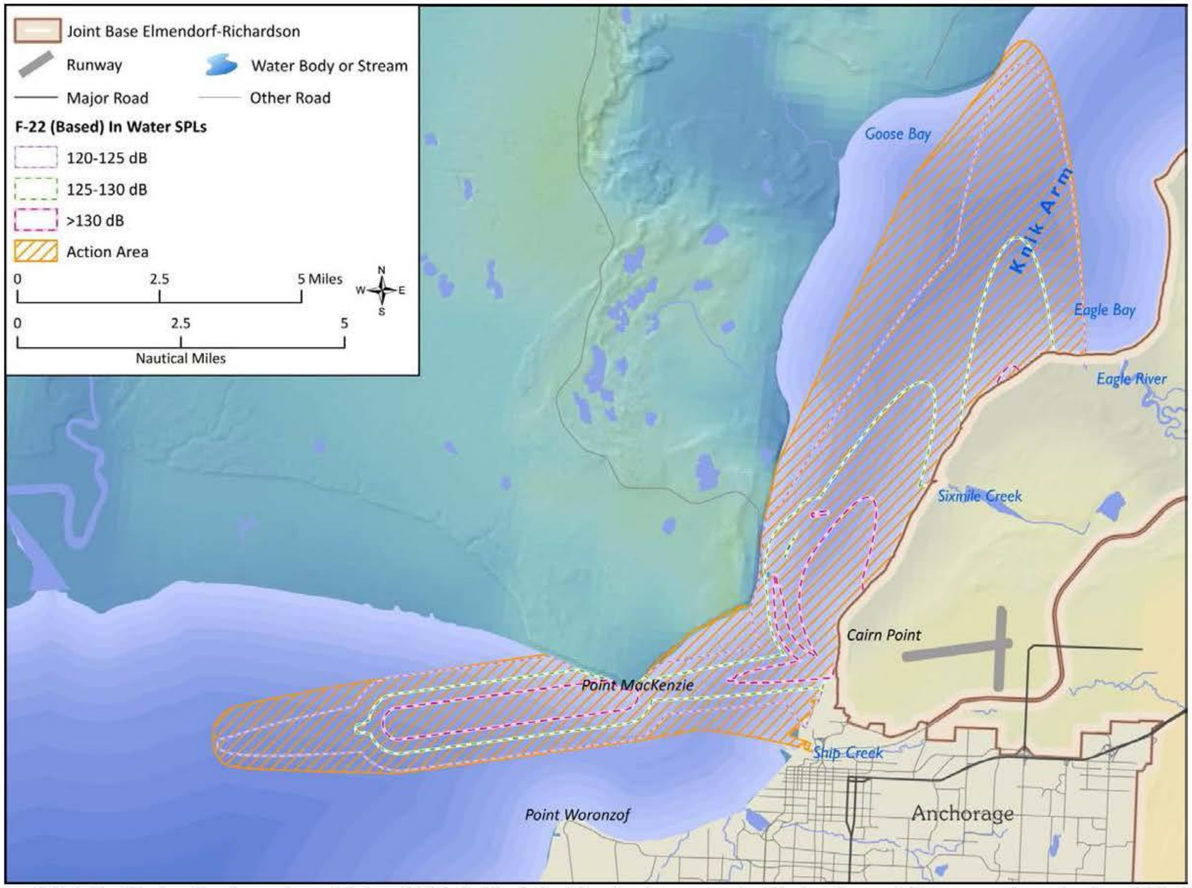

Figure Att 1-7. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From Overflights by Existing F-22 Aircraft (Existing Runway 16/34)

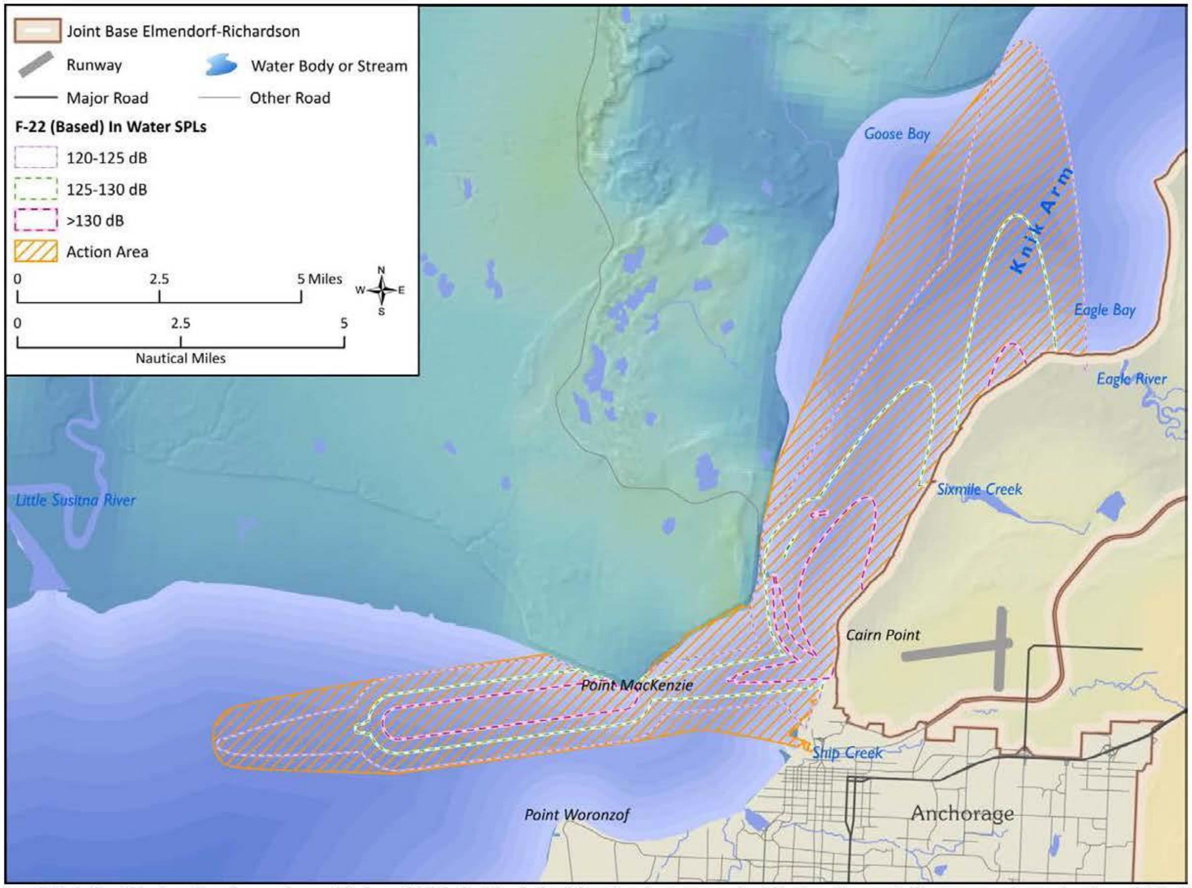

Figure Att 1-8. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From Overflights by Existing F-22 Aircraft (Extended Runway 16/34)

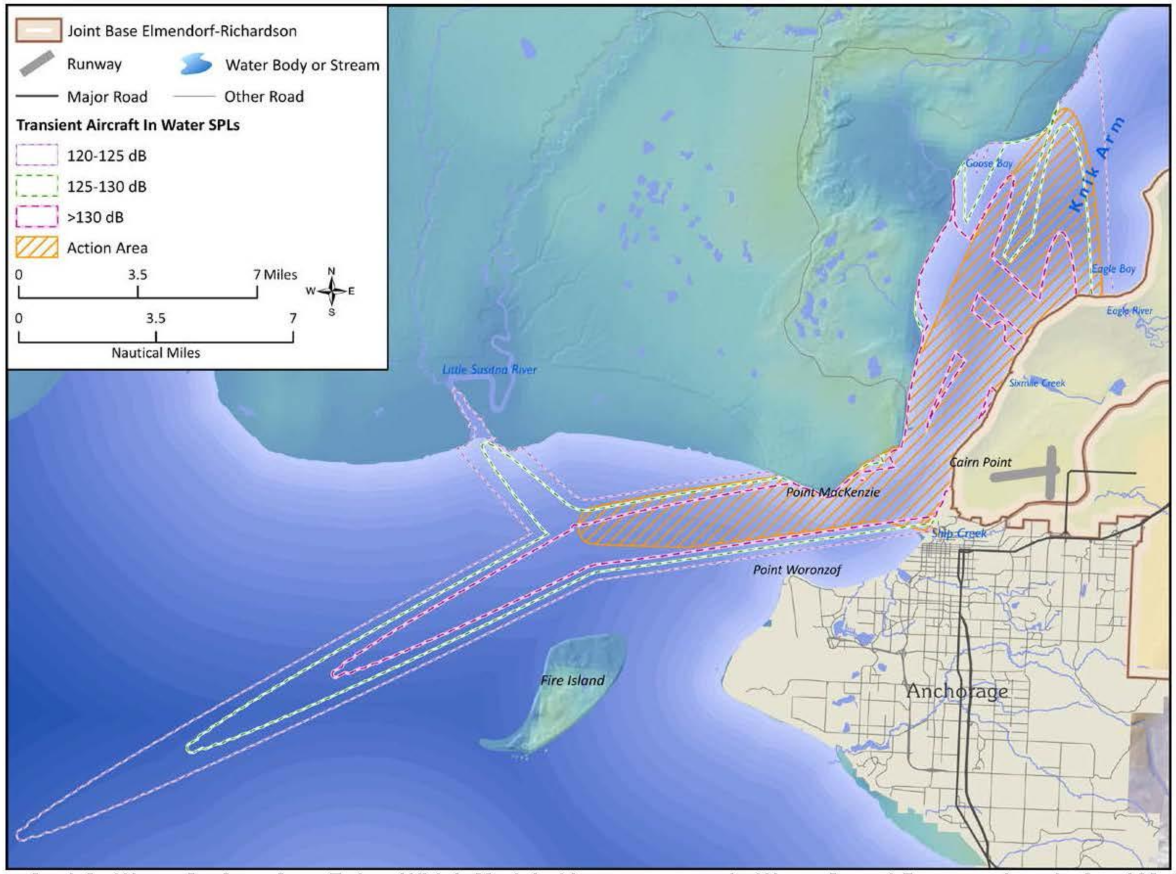

Figure Att 1-9. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From Overflights by Existing Transient Aircraft (a composite of transient F-15E, C-130, C-17, B-737, KC-135R, and C-5A)

APPENDIX B

INFORMATION ON BELUGA WHALE HEARING AND VOCALIZATIONS

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B1. Information on Beluga Whale Hearing and Vocalizations[2]

Beluga whale (*Delphinapterus leucas*) in-water vocalizations include whistles, squeals, bleats, yelps, bangs, chirps, trills, hums, peeps, yelps, blares, rasps, squawks, bangs, and growls and clicks and creaks associated with echolocation (Fish and Mowbray 1962; Anderson 1974; Ford 1975; Sjare 1986a,b; Thompson and Richardson 1995). Beluga whales have also been reported to produce high-pitched screams and a variety of squeaks and squeals above the water surface (Ford 1975). Ford (1975) reported frequencies for beluga whale in-water social vocalizations to range 0.80–29 kilohertz (kHz) with out-of-water vocalizations that ranged from 0.95 to 20 kHz. Flat contour, upsweep, and variable contour sounds were recorded from a beluga whale calf that ranged in frequency from 400 hertz (Hz) to 15.1 kHz (Van Parijs *et al.* 2003). Belikov and Bel'kovich (2007) identified 16 whistle types of beluga whales that had average values of maximum fundamental frequency between 1.4 and 4.5 kHz. Beluga whale echolocation vocalization frequencies have been reported to range from 1.0 to 120 kHz (Ford 1975, Au *et al.* 1985).

Measuring short-latent auditory evoked potentials of two male beluga whales with their heads above the water's surface, Popov and Supin (1987) reported their range of hearing to be limited to 110 kHz with a maximum sensitivity at 60–70 kHz. Using evoked potential methods, Klishin *et al.* (2000) also tested a captive beluga whale in a pool with its head out of water and reported a broader range of maximum sensitivities (32–108 kHz).

Results from behavioral tests conducted underwater in a concrete pool for two beluga whales indicated upper frequency limits around 122 kHz with maximum sensitivity around 30 kHz (White *et al.* 1978). Awbrey *et al.* (1988) measured the hearing sensitivity of a captive adult male, adult female, and juvenile male beluga whale tested in a concrete pool using underwater behavioral techniques at test frequencies between 125 Hz and 8 kHz and reported an average threshold of 65 decibels referenced to 1 micropascal (dB re 1 µPa) at 8 kHz. The juvenile male was slightly more sensitive to low frequencies than either of the adults. Ridgway *et al.* (2001) reported behavioral hearing thresholds for two beluga whales at depths of 5, 100, 200, and 300 meters in the open ocean at frequencies between 0.5 kHz and 100 kHz with maximum sensitivities between 8 and 24 kHz. In underwater behavioral tests conducted in San Diego Bay closer to the surface (i.e., 1.5 meters), Finneran *et al.* (2002) reported that two captive beluga whales were able to detect 0.4-kHz tones at 117±1.6 dB re 1 µPa. Finneran *et al.* (2005) obtained underwater hearing thresholds for two other beluga whales housed and tested behaviorally in an indoor facility. Test frequencies ranged from 2.0 to 130 kHz. Best sensitivities for one subject ranged from approximately 40 to 50 dB re 1 µPa at 50–80 kHz with functional hearing above 100 kHz. The second subject had best sensitivity that ranged from 40 to 50 dB re 1 µPa at 30–35 kHz and an upper frequency cutoff of about 50 kHz. The high-frequency hearing loss in the latter subject was attributed to the treatment with the aminoglycoside antibiotic amikacin, which is toxic to hair cells in the cochlea of the ear.

Schlundt *et al.* (2000) reported temporary threshold shifts in the masked hearing thresholds (MTTS) of two beluga whales exposed to 1-second pure tones at 0.4, 3, 10, and 20 kHz. One of the subjects experienced a 12-decibel (dB) MTTS in response to a 3-kHz tone of 195 dB re 1 µPa. The other subject

[2] *This section was originally prepared by Keith Jenkins, SPAWARSYSCEN-PACIFIC, 71510 [keith.a.jenkins@navy.mil].

experienced a 7-dB MTTS after exposure to a 10-kHz tone of 192 dB re 1 µPa. Both subjects had MTTSs of 6–12 dB following 20-kHz tones at levels between 197 and 201 dB re 1 µPa.

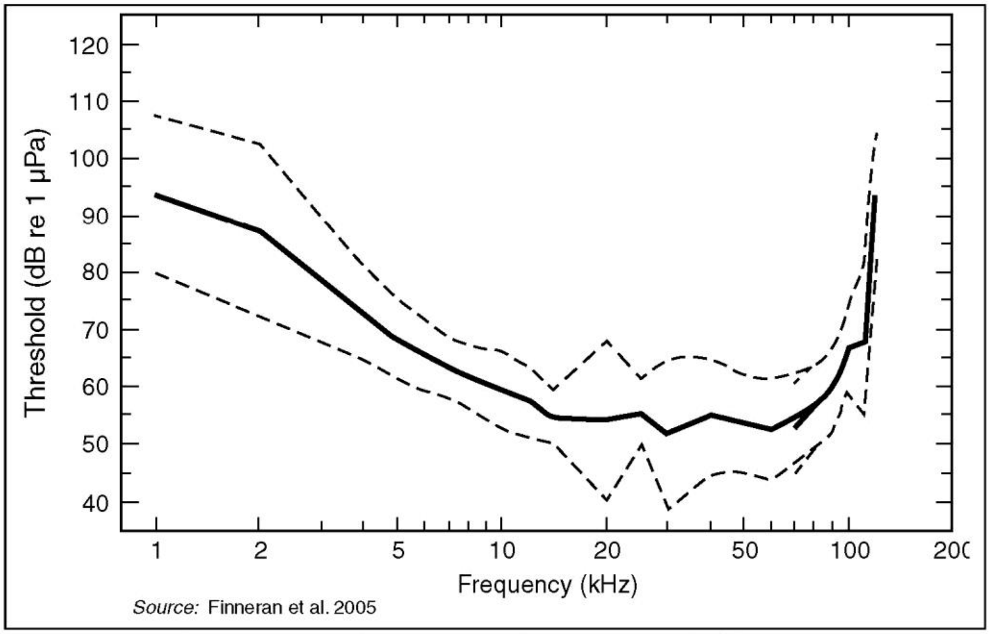

Figure B-1. Audiogram of a Beluga Whale (Finneran *et al.* 2005) Showing Hearing Thresholds at Different Frequencies

Neither subject experienced an MTTS after exposure to 0.4-kHz tones up to 193 dB re 1 µPa. Deviations in the whales' trained behaviors were observed following exposures that ranged from 180 to 196 dB re 1 µPa at all four exposure frequencies.

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

August 5, 2016

Mark A. Prieksat, Ph.D.
Chief, Installation Management Flight
730 Quartermaster Road
JBER, Alaska 99505

Re: Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER) Letter of Concurrence, NMFS #AKR-2016-9561

Dear Dr. Prieksat:

The National Marine Fisheries Service (NMFS) has completed informal consultation under section 7(a)(2) of the Endangered Species Act (ESA) regarding the proposed action to improve F-22 operational efficiency at JBER, Alaska (Figure 1). The Department of the Air Force (Air Force) requested written concurrence that the proposed action may affect, but is not likely to adversely affect, the endangered Cook Inlet beluga whale (*Delphinapterus leucas*), Cook Inlet beluga whale critical habitat, or the endangered western Distinct Population Segment (DPS) of the Steller sea lion (*Eumetopias jubatus*). There is no designated critical habitat for the Steller sea lion within the action area. Based on our analysis of the information you provided to us, and additional literature cited below, NMFS concurs with your determination. A complete administrative record of this consultation is on file in this office.

Consultation History

NMFS received your request for consultation and attached biological evaluation (BE) on April 7, 2016. Our office and Air Force personnel exchanged further information about the project via email between June 20 and July 15, 2016.

Description of the Proposed Action

The Air Force is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of proposed improvements to F-22 operational efficiency at JBER. Under the proposed action, there would be no change in the number of F-22 aircraft or the number of F-22 operations. F-22 aircraft would continue to conduct up to approximately 5,710 sorties per year from JBER, an average of about 22 sorties per work day. A sortie may consist of multiple operations, with an operation being a departure, arrival, or half of a closed pattern. Six alternatives are being considered to achieve the proposed action. Three alternatives would redistribute F-22 operations among the east-west and north-south runways (RW 06/24 and RW 16/34, respectively; Alternatives A, D, and E). In addition to redistribution of F-22 operations among the runways, the other three alternatives (Alternatives B, C, and F) would involve

ALASKA REGION - www.alaskafisheries.noaa.gov extending the north end of RW 16/34 by 610 to 762 m (2,000 to 2,500 ft). F-22 arrivals and departures on an extended runway would cross Knik Arm at lower altitudes than would arrivals and departures on the existing RW 16/34. Also, the grading associated with the extension of RW 16/34 could allow for future establishment of an instrument approach by F-22s from the north, which is not conducted at present.

The BE and analysis considered therein focus on the two alternatives that represent the minimum and maximum of the changes in flight operations that could be selected by the Air Force (Alternatives C and E). Total sorties and flight operations by runway under each of these two alternatives are summarized in Table 1. Extension of RW 16/34 under Alternative C would require engineering design, as well as environmental surveys and analysis, before it could be built. The potential effects of that construction, should a decision be made to proceed with the design, would need to be addressed separately. Implementation of Alternative C, if chosen, is unlikely to occur before 2019. Implementation of Alternative E, which does not involve a runway extension, would not occur before mid-2017.

Table 1. Total sorties by runway (adapted from BE, Table 1), JBER, Alaska.

Scenario[1]	Departures				Arrivals			
	RW34	RW06	RW24	RW16	RW34	RW06	RW24	RW16
Existing Operations[2]	1,422 (27%)	970 (19%)	3,313 (64%)	5 (0%)	444 (8%)	5,231 (92%)	7 (0%)	28 (0%)
Alternative C	4,235 (74%)	900 (16%)	570 (10%)	5 (0%)	144 (3%)	800 (14%)	7 (0%)	4,759[3] (83%)
Alternative E	470 (8%)	900 (16%)	4,335 (76%)	5 (0%)	444 (8%)	5,231 (92%)	7 (0%)	28 (0%)

[1]Each sortie normally includes one departure operation and one arrival operation and may include a second approach. Sorties/year are representative for the BE analysis and are based on both F-22 squadrons at full strength all year.
[2]Assumes runway use adheres to the runway distribution in Air Force (2011).
[3]Assumes a new F-22 flight profile and approach for the extended runway.

Action Area

The action area is defined in the ESA regulations (50 CFR 402.02) as the area within which all direct and indirect effects of the project will occur. The action area is distinct from and larger than the project footprint because some elements of the project may affect listed species some distance from the project footprint. The action area, therefore, extends out to a point where no measurable effects from the project are expected to occur.

Since 1997 NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater sounds that might result in impacts to marine mammals (70 FR 1871). NMFS is currently developing comprehensive guidance on sound levels likely to cause injury and behavioral disruption to marine mammals. However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels[1], expressed in

[1] Sound pressure is the sound force per unit micropascals (μPa), where 1 pascal (Pa) is the pressure resulting from a force of one newton exerted over an area of one square meter. Sound pressure level is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in acoustics is 1 μPa,

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root mean square[2] (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the Marine Mammal Protection Act (MMPA):

- impulsive sound: 160 dB re 1 μPa_{rms}
- continuous sound: 120 dB re 1μPa_{rms}

NMFS uses the following conservative thresholds for underwater sound pressure levels from broadband sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA:

- 180 dB re 1μPa_{rms} for whales
- 190 dB re 1μPa_{rms} for pinnipeds (seals and sea lions)

In addition, NMFS uses the following thresholds for in-air sound pressure levels from broadband sounds that cause Level B behavioral disturbance under section 3(18)(A)(ii) of the MMPA:

- 100 dB re 20μPa_{rms} for non-harbor seal pinnipeds

NMFS defines the action area for this project as the area within which F-22 flight activities associated with the proposed action have the potential to produce in water sound levels ≥120 dB re 1μPa_{rms} (i.e., the point where no measurable effect from the project would occur). As described in the BE, this area includes Knik Arm waters adjacent to JBER between approximately Ship Creek and Eagle Bay on the east side of Knik Arm and between Point MacKenzie and a point northeastward of Goose Bay on the west side of Knik Arm; as well as a portion of northern Cook Inlet (Figure 1).

Listed Species and Critical Habitat

Cook Inlet Belugas

The best available historical abundance estimate of the Cook Inlet beluga population was from a survey in 1979 which resulted in an estimate of 1,293 belugas (Calkins 1989). NMFS began conducting comprehensive and systematic aerial surveys of the beluga population in 1993. These surveys documented a decline in abundance from 653 belugas in 1994 to 347 belugas in 1998, a decline of nearly 50%. In response to this decline, in 2000, NMFS designated the Cook Inlet beluga population as depleted under the Marine Mammal Protection Act. Abundance data collected since 1999 indicate that the population did not increase, and the lack of population growth led NMFS to list the Cook Inlet beluga as endangered under the ESA on October 22, 2008 (73 FR 62919). The most recent comprehensive abundance survey (from 2014) indicates a population estimate of 340 belugas, with the population continuing to show a negative trend since 1999 (Shelden et al. 2015).

and the units for underwater sound pressure levels are decibels (dB) re 1 μPa.

[2] Root mean square (rms) is the square root of the arithmetic average of the squared instantaneous pressure values.

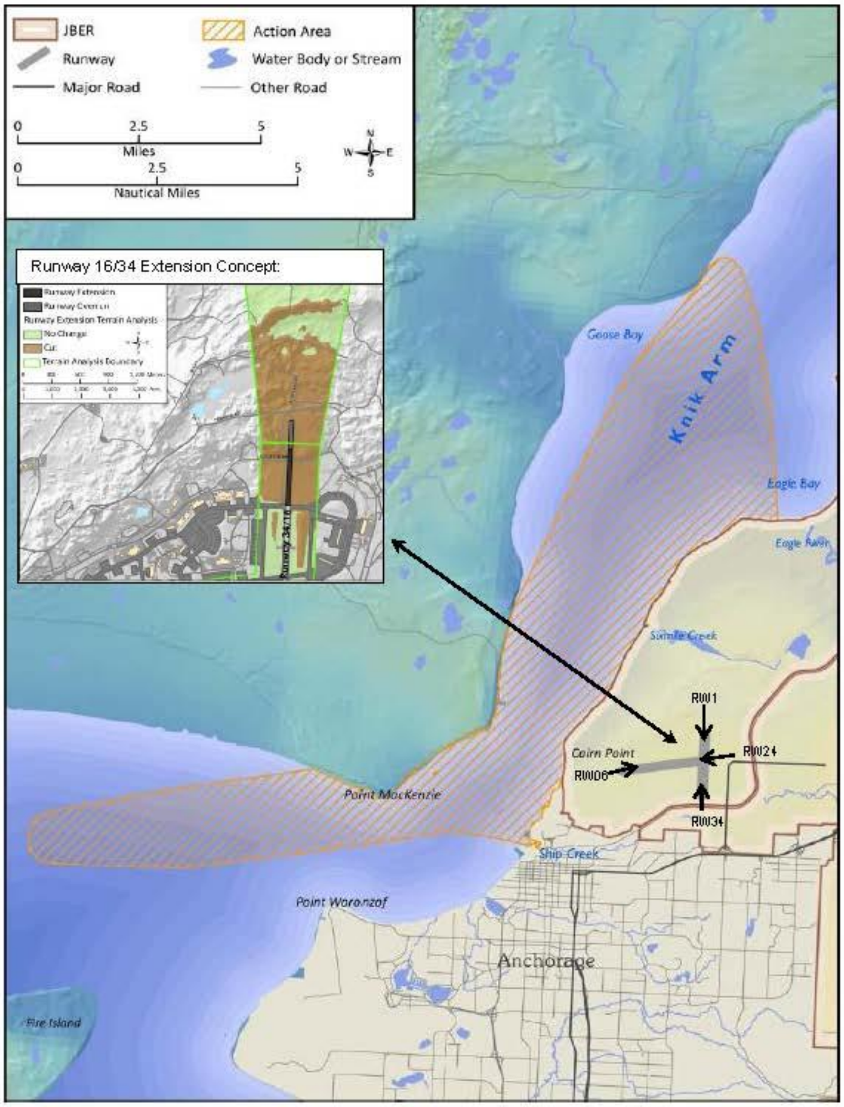

Figure 1. Approximate action area for proposed F-22 operational efficiency improvements, JBER, Alaska (adapted from BE, Figure 2); the inset map provides a conceptual illustration of the potential runway extension (from Air Force Civil Engineer Center 2015).

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The distribution of Cook Inlet belugas has changed significantly since the 1970s. Fewer sightings of belugas in the lower Inlet in recent decades (Hansen and Hubbard 1999; Rugh et al. 2000; Speckman and Piatt 2000; Rugh et al. 2010) indicate that the summer range has contracted to the mid and upper Inlet, coincident with their decline in population size (Goetz et al. 2012). Multiple data sources indicate that belugas exhibit seasonal shifts in distribution and habitat use within Cook Inlet. These seasonal shifts appear to be related to seasonal changes in the physical environment (e.g., ice and currents) and to shifts in food sources, specifically the timing of fish runs (NMFS 2015). Generally, belugas spend the ice-free months in the upper Inlet, often at discrete high-use areas (McGuire et al. 2014), then expand their distribution south and into more offshore waters of the middle Inlet in winter (Hobbs et al. 2005), although some portion of the beluga population is present in Upper Cook Inlet throughout the year.

Both individual belugas and groups are seasonally common in upper Cook Inlet and Knik Arm, adjacent to JBER. A year-round shore and boat-based observational study in Knik Arm (July 2004 to July 2005) revealed seasonal patterns in habitat use and abundance of this area, with peak abundances in fall (September) declining to lowest numbers in winter, and highest use of waters near river mouths and mud flats (Funk et al. 2005). Belugas have been noted to transit between stream mouths, where behaviors including milling, feeding, and socializing by belugas have been observed (Stewart 2010). In Knik Arm these activity areas include Sixmile Creek, Eagle Bay, Eagle River, and near Point MacKenzie, with transit of belugas primarily along the east side of the Lower Knik Arm (Funk et al. 2005; Stewart 2010). Most beluga activity in Knik Arm has been noted during August, September, and October, coinciding with the coho salmon run (NMFS 2008).

Belugas produce sounds for both communication and echolocation. NMFS categorizes belugas in the mid-frequency functional hearing group, which as a group, likely can hear frequencies between 0.15 and 160 kHz in water (NOAA 2015).

Information on Cook Inlet beluga biology and habitat (including critical habitat) is available at: http://alaskafisheries.noaa.gov/pr/ci-belugas.

Western DPS Steller Sea Lions

The Steller sea lion was listed as a threatened species under the ESA on November 26, 1990 (55 FR 49204). In 1997, NMFS reclassified Steller sea lions into two distinct population segments (DPS) based on genetic studies and other information (62 FR 24345); at that time the eastern DPS was listed as threatened and the western DPS was listed as endangered. On November 4, 2013, the eastern DPS was removed from the endangered species list (78 FR 66139). Information on Steller sea lion biology and habitat (including critical habitat) is available at: http://alaskafisheries.noaa.gov/pr/steller-sea-lions.

We are aware of only a very few reports of Steller sea lion sightings in the vicinity of the action area: three Steller sea lion sightings (thought to be a single animal observed three times) were recorded in June 2009 near the Port of Anchorage (Integrated Concepts and Research Corporation 2009); and a Steller sea lion was observed in Eagle Bay in October 2009 (Department of the Army 2010).

The ability to detect sound and communicate underwater is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. NMFS categorizes Steller sea lions in the otariid pinniped functional hearing group, which likely can hear frequencies between 0.1 and 48 kHz in water (NOAA 2015).

Critical Habitat
NMFS designated critical habitat for the Cook Inlet beluga on April 11, 2011 (76 FR 20180; Figure 2). NMFS excluded all waters off the Port of Anchorage east of a line connecting Cairn Point (61°15.4′ N., 149°52.8′ W.) and Point MacKenzie (61°14.3′ N., 149°59.2′ W.) and north of a line connecting Point MacKenzie and the north bank of the mouth of Ship Creek (61°13.6′ N., 149°53.8′ W.). The action area is located within designated critical habitat for the Cook Inlet beluga and also within the exclusion zone of this critical habitat.

The action area is not located within Steller sea lion critical habitat, and the nearest site designated as critical habitat (Nagahut Rocks haulout) is more than 250 km (155 mi) south of the action area.

Effects of the Action
For purposes of the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is "not likely to adversely affect" listed species or critical habitat is that all of the effects of the action are expected to be insignificant, discountable, or completely beneficial. Insignificant effects relate to the size of the impact and are those that one would not be able to meaningfully measure, detect, or evaluate, and should never reach the scale where take occurs. Discountable effects are those that are extremely unlikely to occur. Beneficial effects are contemporaneous positive effects without any adverse effects to the species.

Effects of the proposed action include F-22 overflight noise transmitted into the water, and the physical presence and/or shadow of low-flying aircraft. Given that Steller sea lions have been rarely observed in the action area, the possibility of a western DPS Steller sea lion being exposed to the F-22 overflights is extremely unlikely. Therefore, we conclude the potential effects of the proposed action on western DPS Steller sea lions are discountable. Because the proposed action would occur over 250 km (155 mi) from the nearest Steller sea lion critical habitat, it is not expected to impact any of the physical or biological features that define critical habitat for Steller sea lions. Below we consider the potential effects of the proposed action on Cook Inlet belugas and Cook Inlet beluga critical habitat.

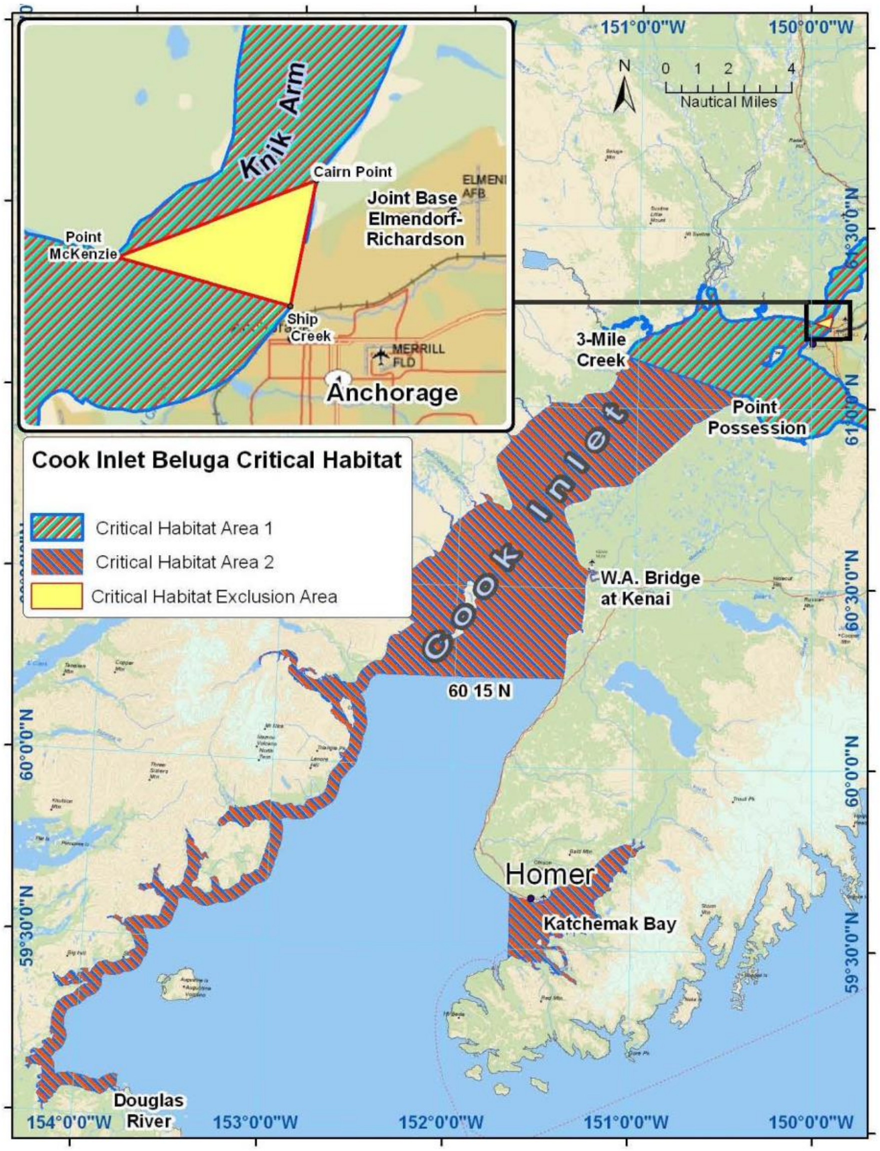

Figure 2. Cook Inlet beluga critical habitat.

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Aircraft Noise Background

Sound is transmitted from an airborne source to a receptor underwater by four principal means (Richardson et al. 1995; Eller and Cavanagh 2000): direct path, refracted upon passing through the air-water interface; direct refracted paths reflected from the bottom in shallow water; lateral (evanescent) transmission through the interface from the airborne sound field directly above; and scattering from interface roughness due to wave motion (Urick 1972; Richardson et al. 1995). Aircraft noise is chiefly transmitted from air into the water within a narrow band centered on the flight path. A large portion of the acoustic energy is reflected from the air-water interface during transmission of sound from air to water. For an overhead sound source, such as an aircraft, most sound at angles greater than 13 degrees from the vertical is reflected and does not penetrate the water (Richardson et al. 1995), especially in calm conditions. The area of maximum transmission can therefore be visualized as a 13-degree cone (26-degree aperture), with the aircraft at its apex.

Aircraft will be potentially audible in water longer as they climb and the base of the cone increases. However, the acoustic energy reaching the water surface diminishes with the aircraft's increasing altitude. Outside this cone of maximum transmission, sound is reflected back into the air, except where appropriately oriented faces of waves and chop enable some sound to be transmitted shallowly into the water. When the sea surface is rough, a common condition in Cook Inlet, reflectance of noise energy is highly variable, depending on the angle at which incoming sound waves impact individual wave surfaces.

Blackwell and Greene (2003) measured in-air and underwater (10 m [33 ft]) overflight noise from F-15 aircraft on approach for landing at the former Elmendorf AFB (now JBER). The overflight sounds were detectable in only two of the eleven F-15 overflights recorded; one of these detected flights passed directly overhead (i.e., at 90 degrees), while the other was nearly overhead (80 degrees). The peak in-water sound pressure level measured was 134 dB re 1 μPa_{rms} for the F-15 directly overhead; and 122 dB re 1 μPa_{rms} for the overflight nearly overhead. The authors attributed the low rate of F-15 detectability to two factors: angles exceeding 13 degrees from vertical, which reduced penetration of sound energy into the water, and high ambient in-water noise. The BE noted that F-22 engines are more powerful than those used in F-15 or F-16 aircraft, and have the potential to be louder than engines of F-16, F-15C, or F-15E aircraft, if other factors (such as altitude and angle of climb) that influence perception of noise on the ground are held constant.

The Air Force used airspeeds reported by F-22 pilots to calculate time spent over Knik Arm and upper Cook Inlet in configurations that generate in-water sound pressure levels greater than 120 dB re 1 μPa_{rms}. The total time per flight event in flight configurations that result in underwater sound levels greater than 120 dB re 1 μPa_{rms} was estimated at between 3 and 136 seconds, with the number of seconds depending on the flight procedure being conducted. Due to the F-22's airspeed, at any given point within the overflown portion of Cook Inlet waters, exposures to underwater sound levels greater than 120 dB re 1 μPa_{rms} would be very brief—approximately 2 to 5 seconds. Consecutive overflights (e.g., two-aircraft departures) could cause the period of exposure to sound levels greater than 120 dB re 1 μPa_{rms} to be longer (e.g., up to about 10 seconds).

Noise from military jet aircraft, which is generated primarily by turbulent mixing of air, is concentrated in relatively low frequency bands, primarily below 4 kHz (Sharp et al. 2001; see also, BE, Figure A-2), which is below the best hearing range of belugas. Spectral characteristics of F-22 noise in water have not been measured, but according to the BE, they are expected to be similar to dominant ambient noise sources in the action area, which would decrease the detectability of jet aircraft noise that is at or near the same levels as the ambient noise. Although beluga hearing is most sensitive at frequencies from about 10 to 80 kHz, their overall hearing range extends from about 40 Hz to at least 130 kHz (Awbrey et al. 1988; Finneran et al. 2005; NMFS 2008). Based on this, belugas would likely be able to detect sounds made by F-22s that sufficiently exceed background noise levels.

Beluga exposures to elevated sound levels from aircraft overflight would be brief in duration (seconds) as the aircraft passes overhead, and would diminish rapidly due to the aircraft's speed. A beluga that is below the surface would need to be nearly directly underneath the overflight in order to be exposed to elevated sound levels, due to lack of or greatly diminished transmission of sound into water at angles greater than 13 degrees from the vertical. Furthermore, a noise would generally need to be louder than ambient noise levels to be perceived by a beluga. A beluga at the surface of the water (i.e., breathing) during an overflight would have a minimal chance of being exposed to in-air noise because odontocetes, including belugas, are believed to receive sounds primarily through their lower jaw, including the pan bone region (side of the jaw) and the rostrum (tip of the lower jaw) (Mooney et al. 2008). The lower jaw areas are seldom above water, even when the whale is on the surface.

Aircraft Noise Effects Analysis

As detailed in the BE, modeling was used to estimate the maximum in-water sound pressure levels associated with all expected flight profiles that would be used by F-22s at JBER, and to delineate the acoustic footprints of all areas where in-water sound pressure levels exceeded 120 dB re 1μPa_{rms}. For simplicity, this analysis assumed equal transmission of sound waves across the air-water interface for anywhere 120 dB re 1μPa_{rms} is exceeded at the water surface. By ignoring the angle of incoming sound waves, different sea states causing sound to enter the water in multiple transmission paths and lateral surface scattering can be conservatively accounted for by calculating the largest possible footprint. This analysis also assumed that the footprint extends from the surface to the bottom, even for areas outside the 13-degree cone where sound energy would be limited to the first few meters of the water column. Because sound waves would have decreased to below threshold noise levels prior to reaching the bottom at any but the shallowest water depths, reflected sound energy from the bottom was not considered as part of the analysis.

The Air Force evaluated the modeled sound profiles of F-22 overflights in relation to the five major categories of acoustic effect, including direct trauma, auditory fatigue, auditory masking, stress response, and behavioral reactions. The maximum modeled in-water sound pressure level of an F-22 overflight did not exceed 136.8 dB re 1 μPa_{rms} for a duration of a few seconds, which was not considered sufficiently intense or long-lasting to result in direct trauma or auditory fatigue. Because predicted F-22 overflight in-water noise levels were often close to ambient in-

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water noise levels, and the noise from aircraft would only be heard for a few seconds at any given point within the water, masking of beluga vocalizations, should they occur during an overflight, would at most occur for only a few seconds.

Regarding behavioral effects (and possible physiological stress response), the Air Force used a probabilistic mathematical function (termed a behavioral response function [BRF]) to estimate the probability that belugas will show behavioral effects (and possible physiological stress response) at given received sound levels. This BRF was developed by the Navy and NMFS for analysis of Navy projects. Similar to the NMFS thresholds (identified above regarding identification of the action area), the BRF relies on the assumption that sound poses a negligible risk to marine mammals below a certain "basement" sound level. Above this basement exposure level, the probability of a response increases with increasing sound pressure level (U.S. Navy 2008; Finneran and Jenkins 2012), as shown in Figure 3. Although the behavioral response function has limitations, we consider it the best science available at this time.

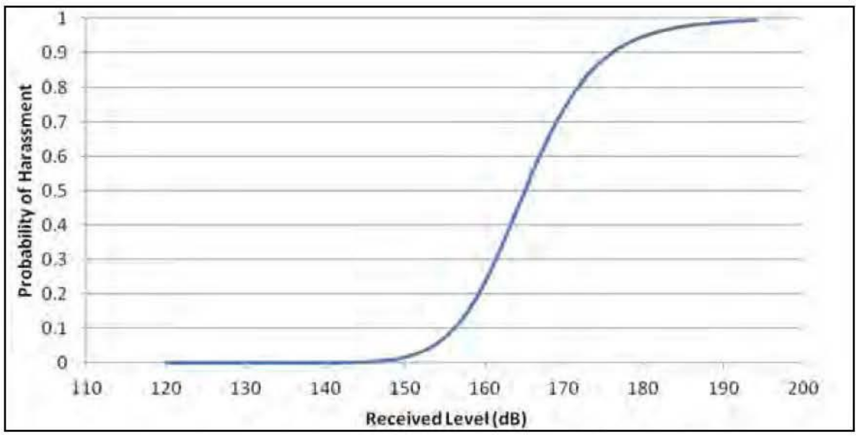

Figure 3. Behavioral response function curve for odontotocetes (BE, Figure A-1; source, U.S. Navy 2008).

The average number of potential behavioral reactions per year was calculated for each proposed alternative based on the predicted footprints of all areas where sound levels exceeded 120 dB re 1µPa$_{rms}$, monthly estimated beluga density, and the probability of behavioral response. The overall average beluga density was estimated by dividing the latest beluga population estimate of 340 individuals (Shelden et al. 2015) by 2,800 km^2, the area estimated to contain 95% of the Cook Inlet beluga population (Rugh et al. 2010). Seasonally-adjusted monthly density estimates were then derived from this overall density estimate using data on beluga sighting rates in lower Knik Arm documented between 2007 and 2011 (BE, Appendix A). For months with the highest sighting rate, the overall density estimate of 0.12 belugas/km^2 was used, while in months with lower sightings rates, the density estimate was scaled down based on relative differences in

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sighting rates. For comparison, independently derived density estimates based on observations within the action area (Cairn Point, Sixmile Creek, Point MacKenzie) ranged from a low of 0.0051 belugas/km^2 in May to a high of 0.0846 belugas/km^2 in September (KABATA 2010).

The number of beluga behavioral reactions associated with the proposed action was estimated at 0.012 to 0.047 per year. When added to the estimated number of beluga behavioral reactions associated with existing aircraft operations (approximately 0.018 per year), the total number is still fractionally small (0.0230 to 0.065 per year).

Given the short time during which any increased noise would be detectable to belugas, and the low probability of belugas occurring within the path of maximum sound pressure level, we conclude that acoustic effects on belugas associated with the proposed action are insignificant and discountable.

<u>Visual Effects</u>
In addition to sound, Cook Inlet belugas could react to the physical presence and/or shadow from low flying aircraft. The visual aspect of an F-22 overflight of the action area would be minimal because of its altitude, small size, and rapidity of the overflight. The F-22's closest approach to the water surface ranges from 536 to 18,158 feet mean sea level (MSL), depending on the flight procedure being conducted. The F-22 is similar in size to an F-15 or F-16 and is much smaller than cargo aircraft, such as the C-17 and C-130, and the E-3A Sentry (AWACS) aircraft, which are currently based at JBER. F-22 climb rates on departure exceed the climb rate of F-15 and F-16 aircraft, enabling them to be at higher altitude when they cross over the Knik Arm and upper Cook Inlet, than F-15 or F-16 aircraft. Descent rates during runway approaches are roughly the same for all three aircraft types. Airspeeds in the runway vicinity are similar for all three aircraft types meaning that the duration of the visual experience is similar. Given the altitude, small size, and rapidity of F-22 overflights, visual disturbance of belugas is not expected. We therefore conclude that any visual effects of the F-22 overflight activities are discountable.

<u>Effects on Cook Inlet Beluga Critical Habitat</u>
NMFS identified five physical and biological features essential for conservation of Cook Inlet belugas (also known as primary constituent elements, or PCEs) in the final rule to designate critical habitat (76 FR 20180; April 11, 2011). The proposed action may impact Cook Inlet beluga critical habitat by briefly increasing underwater noise levels. We evaluate effects to each of the physical and biological features below. We note that addressing the effects of a potential future extension of RW 16/34 on critical habitat would require additional information; therefore, such effects would need to be addressed separately.

1. Intertidal and subtidal waters of Cook Inlet with depths <30 feet (MLLW) and within 5 miles of high and medium flow anadromous fish streams.

Because there would be no onshore or in-water construction, earth moving, or vegetation removal associated with the proposed redistribution of F-22 operations among existing runways to achieve operational efficiency at JBER, there would be no effects on this habitat feature.

2. Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.

Overflights by F-22s, including elevated sound levels, are not expected to affect prey species consumed by Cook Inlet belugas. In the action area, these primarily include four salmon species and Pacific eulachon; however, Pacific cod, walleye pollock, saffron cod, and yellowfin sole may also be present. Salmon and most marine fish are hearing generalists, with their best hearing sensitivity at low frequencies (below 300 Hz), where they can detect particle motion induced by low frequency sound at high intensities (Amoser and Ladich 2005; Popper and Hastings 2009). Studies of Atlantic salmon conclude that they are unlikely to detect sounds originating in air (Hawkins and Johnstone 1978). It is unlikely that the fish species comprising beluga prey would detect the noise from any jet overflights. Given the low projected in-water sound pressure levels, short duration, and intermittent nature of elevated sound associated with F-22 overflights, the Air Force concluded that if overflight sounds were detected by fish species, any effects would be short-term and minor. We agree with this determination, and conclude that the effects to this habitat feature resulting from the proposed action are insignificant and discountable.

3. Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.

There would be no introduction of toxins or other agents of a type or amount harmful to Cook Inlet belugas as part of the proposed action. The only potential effect of this sort would stem from an unexpected F-22 crash into Cook Inlet. Therefore, NMFS concludes that any effects to this habitat feature resulting from the proposed action are discountable.

4. Unrestricted passage within or between the critical habitat areas.

The proposed action would occur strictly on land (storage) or in the air (overflights). No in-water structures or obstructions would result from the proposed activities, and, based on the analysis of likely acoustic effects above, the sound levels will not be continuous or high enough to restrict passage between critical habitat areas. Consequently, NMFS concludes that any effects to this habitat feature resulting from the proposed action are extremely unlikely, and therefore, discountable.

5. Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales.

Based on the aircraft overflight analysis using the odontocete behavioral response function, there would be very limited increases in in-water noise levels, and any such increases would be very unlikely to result in the abandonment of habitat by Cook Inlet belugas. Consequently, NMFS concludes that any effects on this habitat feature from the proposed action are very unlikely, and therefore, discountable.

Conclusion
Based on this analysis, NMFS concurs with your determination that the proposed action may affect, but is not likely to adversely affect, the Cook Inlet beluga, Cook Inlet beluga critical habitat, or the western DPS of the Steller sea lion. Reinitiation of consultation is required where discretionary federal involvement or control over the action has been retained or is authorized by law and if (1) take of listed species occurs, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this concurrence letter, or (4) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16).

Please direct any questions regarding this letter to Tammy Olson at tammy.olson@noaa.gov or 907-271-2373.

Sincerely,

Robert D Mecum

for James W. Balsiger, Ph.D.
Administrator, Alaska Region

cc: Christopher Garner (christopher.garner.9@us.af.mil)
Zachary Walker (Zachary.walker.25@us.af.mil)

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A.6 Government-to-Government Alaska Native Consultation

See Section A.2.5 for Government-to-Government consultation initiation. Additional Government-to-Government consultation correspondence and responses, if any, are presented in this section.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, JOINT BASE ELMENDORF-RICHARDSON
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

2 9 APR 2016

MEMORANDUM FOR THE CHICKALOON NATIVE VILLAGE
ATTN: MR. GARY HARRISON, TRADITIONAL CHIEF; AND
MR. DOUG WADE, CHAIRMAN

FROM: 673 ABW/CC
10471 20th Street, Suite 139
JBER AK 99506-2200

SUBJECT: Government-to-Government Consultation for the Proposal to Improve F-22 Operational Efficiency at JBER

1. The Air Force is proposing to permit F-22 squadrons to flexibly use Joint Base Elmendorf-Richardson (JBER) runways in as efficient a manner as possible within operational, airspace, and environmental constraints. There is no proposed change in aircraft numbers or to ongoing F-22 training in existing Alaskan airspace. An Environmental Impact Statement (EIS) is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and Air Force NEPA regulations at 36 CFR Part 989. This EIS includes two levels of alternatives—action and programmatic. Action alternatives include various options for changes to JBER runway usage patterns. Programmatic alternatives have an extension of the north-south runway and are included for early planning purposes only; they are not ready for a decision based on this EIS. Please see the attached brochure for a summary of information covering the proposal.

2. As a part of the NEPA process, government-to-government consultation with Federally recognized Native American tribal entities is required per Executive Order 13175: *Memorandum on Government-to-Government Relations with Native American Tribal Governments*; Department of Defense (DoD) Instruction 4710.02: *DoD Interactions with Federally-Recognized Tribes*; and Air Force Instruction (AFI) 90-2002: *Air Force Interactions with Federally-Recognized Tribes*. In addition, consultations are being conducted in accordance with the National Historic Preservation Act (NHPA) and regulations at 36 CFR Part 800.

3. The Air Force would like to initiate consultations on this proposal on a government-to-government basis. As the 673d Air Base Wing Commander, I am offering to discuss our proposal in detail with you, and would also like hear from you regarding any comments, concerns, and suggestions you may have.

4. If you wish to meet with me to discuss the F-22 proposal as well as your concerns about the effects on your interests if this proposal is implemented, contact our Native Liaison, Mr. Jon Scudder at (907) 384-6648, or via email at jon.scudder@us.af.mil, to arrange a time that is mutually convenient to discuss any concerns or issues.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, JOINT BASE ELMENDORF-RICHARDSON
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

29 APR 2016

MEMORANDUM FOR THE COOK INLET REGION INCORPORATED (CIRI)
ATTN: MS. SOPHIE MINICH, PRESIDENT AND CEO

FROM: 673 ABW/CC
10471 20th Street, Suite 139
JBER AK 99506-2200

SUBJECT: Consultation for the Proposal to Improve F-22 Operational Efficiency at JBER

1. The Air Force is proposing to permit F-22 squadrons to flexibly use Joint Base Elmendorf-Richardson (JBER) runways in as efficient a manner as possible within operational, airspace, and environmental constraints. There is no proposed change in aircraft numbers or to ongoing F-22 training in existing Alaskan airspace. An Environmental Impact Statement (EIS) is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and Air Force NEPA regulations at 36 CFR Part 989. This EIS includes two levels of alternatives—action and programmatic. Action alternatives include various options for changes to JBER runway usage patterns. Programmatic alternatives have an extension of the north-south runway and are included for early planning purposes only; they are not ready for a decision based on this EIS. Please see the attached brochure for a summary of information covering the proposal.

2. The Air Force would like to initiate consultations on this proposal. As the 673d Air Base Wing Commander, I am offering to discuss our proposal in detail with you, and would also like hear from you regarding any comments, concerns, and suggestions you may have.

3. If you wish to meet with me to discuss the F-22 proposal as well as your concerns about the effects on your interests if this proposal is implemented, contact our Native Liaison, Mr. Jon Scudder at (907) 384-6648, or via email at jon.scudder@us.af.mil, to arrange a time that is convenient to discuss any concerns or issues.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, JOINT BASE ELMENDORF-RICHARDSON
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

29 APR 2016

MEMORANDUM FOR EKLUTNA INCORPORATED
ATTN: MR. MICHAEL E. CURRY, CHAIRMAN AND PRESIDENT

FROM: 673 ABW/CC
10471 20th Street, Suite 139
JBER AK 99506-2200

SUBJECT: Consultation for the Proposal to Improve F-22 Operational Efficiency at JBER

1. The Air Force is proposing to permit F-22 squadrons to flexibly use Joint Base Elmendorf-Richardson (JBER) runways in as efficient a manner as possible within operational, airspace, and environmental constraints. There is no proposed change in aircraft numbers or to ongoing F-22 training in existing Alaskan airspace. An Environmental Impact Statement (EIS) is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and Air Force NEPA regulations at 36 CFR Part 989. This EIS includes two levels of alternatives—action and programmatic. Action alternatives include various options for changes to JBER runway usage patterns. Programmatic alternatives have an extension of the north-south runway and are included for early planning purposes only; they are not ready for a decision based on this EIS. Please see the attached brochure for a summary of information covering the proposal.

2. The Air Force would like to initiate consultations on this proposal on a government-to-government basis. As the 673d Air Base Wing Commander, I am offering to discuss our proposal in detail with you, and would also like hear from you regarding any comments, concerns, and suggestions you may have.

3. If you wish to meet with me to discuss the F-22 proposal as well as your concerns about the effects on your interests if this proposal is implemented, contact our Native Liaison, Mr. Jon Scudder at (907) 384-6648, or via email at jon.scudder@us.af.mil, to arrange a time that is convenient to discuss any concerns or issues.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, JOINT BASE ELMENDORF-RICHARDSON
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

29 APR 2016

MEMORANDUM FOR THE KNIK VILLAGE
ATTN: MS. DEBRA CALL, PRESIDENT

FROM: 673 ABW/CC
10471 20th Street, Suite 139
JBER AK 99506-2200

SUBJECT: Government-to-Government Consultation for the Proposal to Improve F-22 Operational Efficiency at JBER

1. The Air Force is proposing to permit F-22 squadrons to flexibly use Joint Base Elmendorf-Richardson (JBER) runways in as efficient a manner as possible within operational, airspace, and environmental constraints. There is no proposed change in aircraft numbers or to ongoing F-22 training in existing Alaskan airspace. An Environmental Impact Statement (EIS) is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and Air Force NEPA regulations at 36 CFR Part 989. This EIS includes two levels of alternatives—action and programmatic. Action alternatives include various options for changes to JBER runway usage patterns. Programmatic alternatives have an extension of the north-south runway and are included for early planning purposes only; they are not ready for a decision based on this EIS. Please see the attached brochure for a summary of information covering the proposal.

2. As a part of the NEPA process, government-to-government consultation with Federally recognized Native American tribal entities is required per Executive Order 13175: *Memorandum on Government-to-Government Relations with Native American Tribal Governments*; Department of Defense (DoD) Instruction 4710.02: *DoD Interactions with Federally-Recognized Tribes*; and Air Force Instruction (AFI) 90-2002: *Air Force Interactions with Federally-Recognized Tribes*. In addition, consultations are being conducted in accordance with the National Historic Preservation Act (NHPA) and regulations at 36 CFR Part 800.

3. The Air Force would like to initiate consultations on this proposal on a government-to-government basis. As the 673d Air Base Wing Commander, I am offering to discuss our proposal in detail with you, and would also like hear from you regarding any comments, concerns, and suggestions you may have.

4. If you wish to meet with me to discuss the F-22 proposal as well as your concerns about the effects on your interests if this proposal is implemented, contact our Native Liaison, Mr. Jon Scudder at (907) 384-6648, or via email at jon.scudder@us.af.mil, to arrange a time that is mutually convenient to discuss any concerns or issues.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, JOINT BASE ELMENDORF-RICHARDSON
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

29 APR 2016

MEMORANDUM FOR THE NATIVE VILLAGE OF EKLUTNA
ATTN: MR. LEE STEPHAN, PRESIDENT

FROM: 673 ABW/CC
10471 20th Street, Suite 139
JBER AK 99506-2200

SUBJECT: Government-to-Government Consultation for the Proposal to Improve F-22 Operational Efficiency at JBER

1. The Air Force is proposing to permit F-22 squadrons to flexibly use Joint Base Elmendorf-Richardson (JBER) runways in as efficient a manner as possible within operational, airspace, and environmental constraints. There is no proposed change in aircraft numbers or to ongoing F-22 training in existing Alaskan airspace. An Environmental Impact Statement (EIS) is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and Air Force NEPA regulations at 36 CFR Part 989. This EIS includes two levels of alternatives—action and programmatic. Action alternatives include various options for changes to JBER runway usage patterns. Programmatic alternatives have an extension of the north-south runway and are included for early planning purposes only; they are not ready for a decision based on this EIS. Please see the attached brochure for a summary of information covering the proposal.

2. As a part of the NEPA process, government-to-government consultation with Federally recognized Native American tribal entities is required per Executive Order 13175: *Memorandum on Government-to-Government Relations with Native American Tribal Governments*; Department of Defense (DoD) Instruction 4710.02: *DoD Interactions with Federally-Recognized Tribes*; and Air Force Instruction (AFI) 90-2002: *Air Force Interactions with Federally-Recognized Tribes*. In addition, consultations are being conducted in accordance with the National Historic Preservation Act (NHPA) and regulations at 36 CFR Part 800.

3. The Air Force would like to initiate consultations on this proposal on a government-to-government basis. As the 673d Air Base Wing Commander, I am offering to discuss our proposal in detail with you, and would also like hear from you regarding any comments, concerns, and suggestions you may have.

4. If you wish to meet with me to discuss the F-22 proposal as well as your concerns about the effects on your interests if this proposal is implemented, contact our Native Liaison, Mr. Jon Scudder at 907-384-6648, or via email at jon.scudder@us.af.mil, to arrange a time that is mutually convenient to discuss any concerns or issues.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, JOINT BASE ELMENDORF-RICHARDSON
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

29 APR 2016

MEMORANDUM FOR THE NATIVE VILLAGE OF TYONEK, MR. FRANK STANIFER

FROM: 673 ABW/CC
10471 20th Street, Suite 139
JBER AK 99506-2200

SUBJECT: Government-to-Government Consultation for the Proposal to Improve F-22 Operational Efficiency at JBER

1. The Air Force is proposing to permit F-22 squadrons to flexibly use Joint Base Elmendorf-Richardson (JBER) runways in as efficient a manner as possible within operational, airspace, and environmental constraints. There is no proposed change in aircraft numbers or to ongoing F-22 training in existing Alaskan airspace. An Environmental Impact Statement (EIS) is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and Air Force NEPA regulations at 36 CFR Part 989. This EIS includes two levels of alternatives—action and programmatic. Action alternatives include various options for changes to JBER runway usage patterns. Programmatic alternatives have an extension of the north-south runway and are included for early planning purposes only; they are not ready for a decision based on this EIS. Please see the attached brochure for a summary of information covering the proposal.

2. As a part of the NEPA process, government-to-government consultation with Federally recognized Native American tribal entities is required per Executive Order 13175: *Memorandum on Government-to-Government Relations with Native American Tribal Governments*; Department of Defense (DoD) Instruction 4710.02: *DoD Interactions with Federally-Recognized Tribes*; and Air Force Instruction (AFI) 90-2002: *Air Force Interactions with Federally-Recognized Tribes*. In addition, consultations are being conducted in accordance with the National Historic Preservation Act (NHPA) and regulations at 36 CFR Part 800.

3. The Air Force would like to initiate consultations on this proposal on a government-to-government basis. As the 673d Air Base Wing Commander, I am offering to discuss our proposal in detail with you, and would also like hear from you regarding any comments, concerns, and suggestions you may have.

4. If you wish to meet with me to discuss the F-22 proposal as well as your concerns about the effects on your interests if this proposal is implemented, contact our Native Liaison, Mr. Jon Scudder at 907-384-6648, or via email at jon.scudder@us.af.mil, to arrange a time that is mutually convenient to discuss any concerns or issues.

BRIAN R. BRUCKBAUER
Colonel, USAF
Commander

Attachment:
Project Brochure

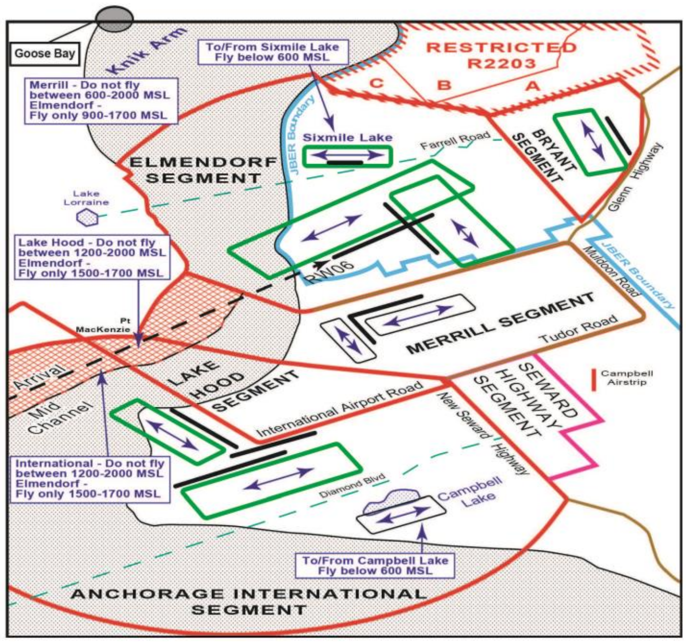
Purpose and Need

The Air Force needs to evaluate the distribution of F-22 departures and arrivals on JBER's runways to:

There is no proposed change in aircraft numbers or to training in existing Alaskan airspace.

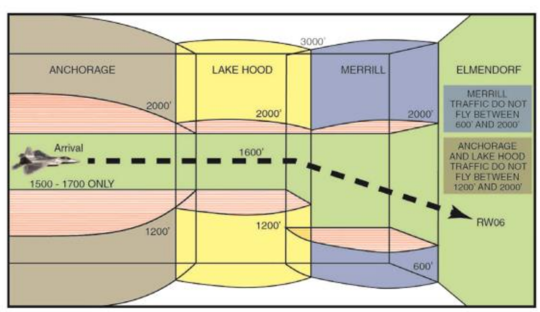
- Improve efficiencies in F-22 flight operations
- Respond to Federal Aviation Administration (FAA) 2014 guidance on the use of one runway for opposite direction flight operations (ODO)
- Address public/agency concerns regarding safety in the airspace around Anchorage
- Address off-base noise south of JBER

The Air Force is preparing the EIS in accordance with the National Environmental Policy Act (NEPA) to analyze potential environmental consequences associated with the proposal to improve F-22 operations efficiency at JBER.



The Anchorage airspace, known as the Anchorage bowl, is subdivided into the six segments pictured at right. The Anchorage International Segment primarily supports commercial air carriers at Ted Stevens Anchorage International Airport. The Merrill, Lake Hood, and Seward Highway Segments, as well as Sixmile Lake primarily support general aviation. The Elmendorf and Bryant Segments support military aviation.

The primary arrival runway for all JBER-based aircraft is RW 06. This approach, depicted on the right, passes through the complex Anchorage Airspace, which is used by multiple commercial, general aviation, and military aircraft.



EIS Alternatives to Date

Alternative A - Runway (RW) 34 Focus: RW 34 would be used for nearly all F 22 departures and RW 06 would be used for nearly all arrivals (see opposite page for illustration of JBER's runways). Alternative A improves flexibility and efficiency for F-22 operations by relaxing the constraint on using RW 34 for departures; addresses the 2014 FAA ODO guidance; continues safety issues with RW 06 arrivals in congested airspace; and has the potential to increase off-base noise over residential areas.

Alternative B - RW 34 Focus with RW 16 Extension: RW 34 would be used for nearly all F 22 departures and RW 06 would be used for nearly all arrivals. A 2,000-foot extension of RW 16/34 would be constructed to the north with associated taxiways and lighting. Alternative B improves flexibility; has construction and additional maintenance costs; addresses the FAA ODO guidance; continues safety issues with RW 06 arrivals; and has the potential to decrease off-base noise over residential areas.

Alternative C - RW 34 Focus with RW 16 Extension/ Arrivals: RW 34 would be used for nearly all F 22 departures and an extended RW 16 would be used for nearly all arrivals. The RW 16/34 2,000 foot extension would be as described for Alternative B. Alternative C improves flexibility; has construction and additional maintenance costs; requires substantial runway management to address FAA ODO guidance; improves safety with RW 34 departures; improves safety with RW 16 arrivals; increases overflight of Sixmile Lake; and has the potential to decrease off-base noise over residential areas.

Alternative D - RW 06 Focus: RW 06 would be used for nearly all F-22 departures and arrivals. Alternative D does not improve efficiency and substantially increases F-22 taxi and hold time. Alternative D addresses the FAA ODO guidance; improves safety for departures; continues safety issues with RW 06 arrivals; and has the potential to decrease off-base noise over residential areas.

Alternative E - RW 24 Focus: RW 24 would be used for nearly all F-22 departures and RW 06 would be used for nearly all arrivals. Alternative E improves flexibility and efficiency; requires substantial runway management to address FAA ODO guidance; would not change safety for departures; continues safety issues with RW 06 arrivals; and has the potential to decrease off-base noise over residential areas.

Alternative F - RW 24 Focus with RW 16 Extension/Arrivals: RW 24 would be used for nearly all F 22 departures and an extended RW 16 would be used for nearly all arrivals. The RW 16/34 2,000 foot extension would be as described for Alternative B. Alternative F improves flexibility; has construction and additional maintenance costs; addresses the FAA ODO guidance; would not change safety for departures; improves safety with RW 16 arrivals; increases overflight of Sixmile Lake; and has the potential to decrease off-base noise over residential areas.

No Action - The No Action Alternative (required by NEPA) identifies the baseline conditions for environmental analysis. No Action does not improve flexibility or efficiency; requires substantial runway management to address FAA ODO guidance; does not change safety for departures; continues safety issues with RW 06 arrivals; and does not change off-base noise conditions.

F-22 Flight Operations for the Proposed Action and Alternatives

Unit	Sorties/Year*	Departure Operations				Arrival Operations			
		RW 34	RW 06	RW 24	RW 16	RW 34	RW 06	RW 24	RW 16
Alternative A (RW 34 Focus)									
3 WG F-22	5,710	4,335	900	470	5	444	5,231	7	28
Alternative B (RW 34 Focus with RW 16 Extension)									
3 WG F-22	5,710	4,235	900	570	5	444	5,231	7	28
Alternative C (RW 34 Focus with RW 16 Extension/Arrivals)									
3 WG F-22	5,710	4,235	900	570	5	144	800	7	4,759
Alternative D (RW 06 Focus)									
3 WG F-22	5,710	470	4,765	470	5	444	5,231	7	28
Alternative E (RW 24 Focus)									
3 WG F-22	5,710	470	900	4,335	5	444	5,231	7	28
Alternative F (RW 24 Focus with RW 16 Extension/Arrivals)									
3 WG F-22	5,710	470	900	4,335	5	144	800	7	4,759
No Action Alternative									
3 WG F-22	5,710	1,422	970	3,313	5	144	5,531	7	28

* Each sortie includes one departure and one arrival

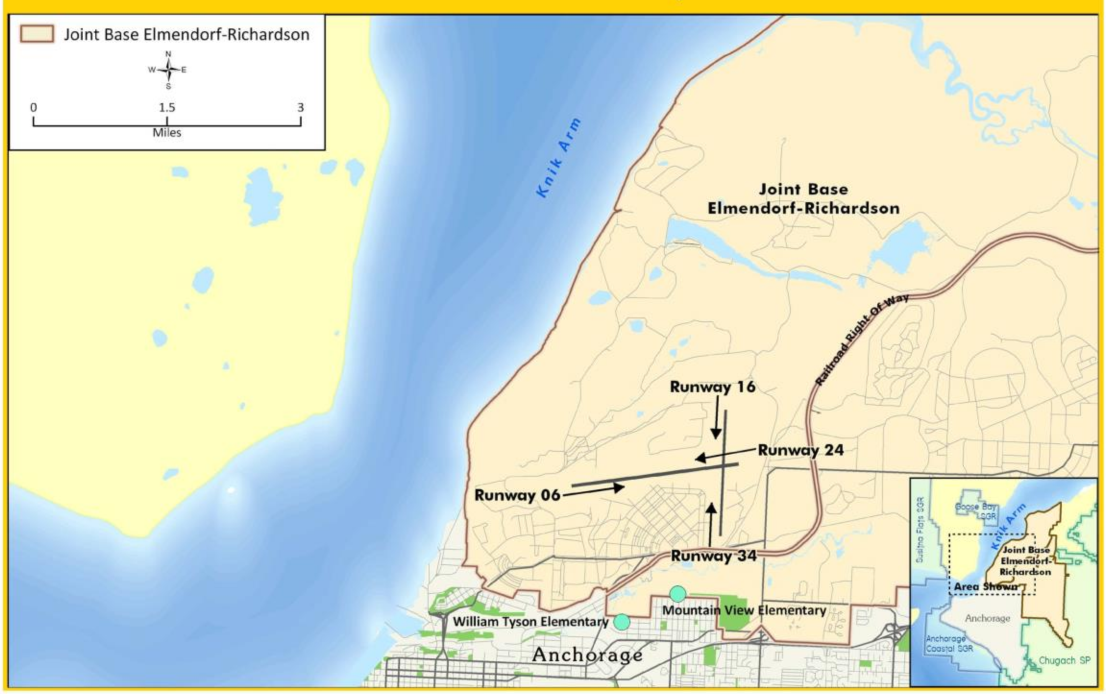
Environmental Analysis

The Environmental Resources Analyzed for Each Alternative:

- Airspace Management and Air Traffic Control
- Noise
- Air Quality
- Water Resources/Wetlands
- Geology/Soils
- Biological Resources
- Cultural Resources (Including Alaska Native Concerns)
- Land Use/Zoning
- Health and Safety
- Hazardous Materials and Waste Management
- Infrastructure
- Traffic
- Socioeconomics (Including Environmental Justice)

Changes to F-22 runway operations could potentially affect on-base infrastructure, airfield snow removal, on-base terrain, altitudes overflown of on-base areas, and off-base noise.

JBER Airfield and Vicinity



A.7 National Historic Preservation Act Section 106 Consultation

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

MEMORANDUM FOR ALASKA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF HISTORY AND ARCHAEOLOGY
ATTENTION: MS. JUDITH E. BITTNER

APR 21 2016

FROM: 673 CES/CEIEC
6346 Arctic Warrior Drive
JBER AK 99506-3240

SUBJECT: Findings of Effect and Request for Concurrence Pursuant to 36 CFR Part 800 Regarding the Proposed Action (Proposed Improvements to Facilitate F-22 Operational Efficiencies) at Joint Base Elmendorf Richardson (JBER), Alaska

1. We are requesting concurrence from the Alaska State Historic Preservation Officer that the undertaking (Proposed Improvements to Facilitate F-22 Operational Efficiencies) at JBER will have no indirect effect, and no adverse effect (direct effect), on known and undiscovered/ unevaluated historic properties.

2. As indicated in our prior correspondence (22 September 2015), JBER is preparing an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) to assess the environmental consequences associated with optimizing the distribution of F-22 departures and arrivals on JBER's existing runways. No additional aircraft are proposed for beddown at JBER as a part of this action. No additional airspace is proposed; the F-22s will operate within existing airspace (as will the other missions/flight operations out of JBER). The number of F-22 operations for the two squadrons based at JBER will not increase, but the pattern of runway usage (east-west vs north-south) will be modified.

The purpose of this action is to provide 3d Wing (3 WG) decision makers with operational flexibility so that F-22s can more efficiently and safely use existing JBER runways. JBER-based F-22 fighter aircraft at JBER are currently operating under restrictions that affect the pilot's ability to select a runway for departures based upon the airfield and traffic conditions at the time. These restrictions do not allow efficient use of F-22 flight time.

In addition, the Air Force is considering a runway extension as a component of some of the alternatives; these could address future challenges to efficient flight operations, and are at a programmatic level of detail. Early environmental planning helps JBER decision makers determine whether there are unacceptable environmental constraints to extending runway 16/34 (RW 16/34), and also includes preliminary consideration of engineering, cost, airspace and other factors before committing resources, when a full range of alternatives is available.

3. Six alternatives are currently under consideration; no preferred alternative has been identified at this point. Three alternatives (the "action alternatives") involve changes in the number of

departure(s) and arrival(s) on JBER's existing runways only; no construction/expansion of existing runways or other ground-disturbing activities would occur under these three alternatives. Three additional alternatives (the "programmatic alternatives"), involving changes in the number of departure(s) and arrival(s) on JBER's existing runways, but including extension of the north-south runway to the north, are also being considered.

4. In addition, the "no action" alternative is being analyzed, as required by the National Environmental Policy Act (NEPA). Implementation of the No Action Alternative would result in continuing the current constrained F-22 flight operations. Currently, F-22 departures on RW 34 (the north-south runway) are not to exceed 25 percent of total F-22 departures. The remaining 75 percent of F-22 departures are on RW 06/24 (the east-west runway), with the majority of departures on RW 24.

5. As a federal undertaking, this proposed action is subject to the requirements of 36 Code of Federal Regulations (CFR) Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (NHPA) (54 Code [USC] Section 306108).

6. Local tribes are being consulted as required by Section 106, National Historic Preservation Act (NHPA). Nearby native corporations are also being consulted per DoD American Indian and Alaska Native American policy.

7. We request your concurrence with our preliminary Finding of No Effect (indirect effects) for all alternatives and Finding of No Adverse Effect for alternatives involving extension of the north-south runway to the north by 2000-2500 linear feet (see attached).

8. If you wish to discuss the foregoing, or have additional information that you would like us to take into account in our formulation of our findings of effect, please contact us within 30 days. Our point of contact is Mr. Jon Scudder, 673 CES/CEIEC, at (907) 384-6648. If we do not hear from you within 30 days of your receipt of the information with a written request for additional information, or written, detailed objections to the findings, then we will proceed with the undertaking, per 36 CFR §800.5(c)(1).

Brent Koenen

BRENT A. KOENEN, GS-13, DAF
Chief, Environmental Conservation

Enclosure:
Description of Undertaking and Summary of Findings (including Attachments A – D)

cc: Native Village of Eklutna
Native Village of Tyonek
Knik Village
Chickaloon Native Village
Eklunta Incorporated
Cook Inlet Region Incorporated

DESCRIPTION OF UNDERTAKING AND FINDINGS OF EFFECT

Proposal to Optimize the Distribution of F-22 Departures and Arrivals on Existing Runways at Joint Base Elmendorf-Richardson, Alaska

SECTION I DESCRIPTION OF THE UNDERTAKING

A. **TITLE OF UNDERTAKING: Proposal to Optimize the Distribution of F-22 Departures and Arrivals on Existing Runways at Joint Base Elmendorf-Richardson (JBER), Alaska**

B. **LOCATION**: The location of the undertaking is largely within the boundaries of the Elmendorf portion of JBER (see Attachment A). Flight operations/overflights, as are occurring now, will include areas outside the boundaries, but no ground disturbing activities are proposed outside the boundaries of the base.

C. **DESCRIPTION OF PROPOSED UNDERTAKING:**

JBER-based F-22 fighter aircraft at JBER are currently operating under restrictions that affect the pilot's ability to select a runway for departures based upon the airfield and traffic conditions at the time. These restrictions do not allow efficient use of F-22 flight time. No additional aircraft are proposed for beddown at JBER as a part of this action. No additional airspace is proposed; the F-22s will operate within existing airspace (as will the other missions/flight operations out of JBER). The number of F-22 operations for the two squadrons based at JBER will not increase, but the pattern of runway usage (east-west vs north-south) will be modified. See Attachment B for additional detail regarding the undertaking and alternatives.

The purpose of this action is to provide 3d Wing (3 WG) decision makers with operational flexibility so that F-22s can more efficiently and safely use existing JBER runways. In addition, the Air Force is considering runway extensions as a component of some of the alternatives; these could address future challenges to efficient flight operations, and are at a programmatic level of detail. Early environmental planning aids JBER decision makers in determining whether there are unacceptable environmental constraints to extending runway 16/34 (RW 16/34), and also includes preliminary consideration of engineering, cost, airspace and other factors before committing resources, when a full range of alternatives is available.

Six alternatives are currently under consideration; see Attachment B. A preferred alternative has not been identified at this point.

- Three alternatives (the "action alternatives") involve changes in the number of departure(s) and arrival(s) on JBER's existing runways only; no construction/expansion of existing runways or other ground-disturbing activities would occur under these three alternatives. As impacts are similar for these three alternatives (and all are indirect), they are not described/analyzed separately.

- Three additional alternatives (the "programmatic alternatives"), involving changes in the number of departure(s) and arrival(s) on JBER's existing runways, but including extension of the north-south runway to the north, are also being considered. The indirect impacts of these alternatives are similar (and are also similar to those described for the "action alternatives". The direct impacts are attributable to the ground disturbance that would occur should a programmatic alternative (alternative involving extension of the north-south runway to the north). As the direct and indirect impacts related to implementation of any of the three programmatic alternatives do not differ, they are not described/analyzed separately.

No Action Alternative: In addition, the "no action" alternative is being analyzed, as required by the National Environmental Policy Act (NEPA). Implementation of the No Action Alternative would result in continuing the current constrained F-22 flight operations. Currently, F-22 departures on RW 34 (the north-south runway) are not to exceed 25 percent of total F-22 departures. The remaining 75 percent of F-22 departures are on RW 06/24 (the east-west runway), with the majority of departures on RW 24. No construction or ground-disturbing activities associated with F-22 operations would occur under the "no action" alternative.

SECTION II: DESCRIPTION OF AREA OF POTENTIAL EFFECT (APE)

The area of potential effect (APE) for cultural and traditional resources for all alternatives encompasses areas where overflights will occur, and encompasses the area where noise and visual effects attributable to F-22 flight operations at JBER are projected to occur (see Attachment C, APE for direct and indirect effects from the undertaking). The APE is three-dimensional, and effects on resources are analyzed for subsurface, surface, and airspace components. Most of the areas within the APE will experience only indirect effects. A smaller portion of the larger APE may also experience direct as well as indirect effects (see Attachment C), should a programmatic alternative be selected for implementation.

SECTION III: IDENTIFICATION OF HISTORIC PROPERTIES AND TRADITIONAL RESOURCES IN THE AREA OF POTENTIAL EFFECT (APE)

"Historic properties" include "… any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register" (54 U.S.C. §300308), and Traditional Cultural Properties. A Traditional Cultural Property (TCP) is a property that is eligible for inclusion in the National Register of Historic Places (NRHP) based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community (including but not limited to Native American communities).

Traditional resources are associated with specific traditional resources, sacred sites, or areas. These resources are protected under the Archaeological Resource Protection Act (16 USC Sections 470aa-19 470mm, PL 96-95 and amendments), the Native American Graves Protection and Repatriation Act (PL 101-20 601; 25 USC Sections 3001-3013), and/or the American Indian Religious Freedom Act (PL 95-341, 42 USC 21 Sections 1996 and 1996a). The NHPA and associated Section 106 compliance also include guidance for American Indian consultation regarding cultural significance of potential religious and sacred artifacts (16 USC Sections 470a [a][6][A] and [B]).

Per 36 CFR §800.4 (b) (1) and (2), the US Air Force has made a reasonable and good faith effort to carry out identification efforts, taking into account the magnitude and nature of the undertaking as well as the nature and extent of potential effects on historic properties that may result from this undertaking.

A. HISTORIC PROPERTIES AND TRADITIONAL CULTURAL PROPERTIES WITHIN THE APE SUBJECTED TO INDIRECT EFFECTS FROM THIS UNDERTAKING:

Indirect effects are those resulting from activities that do have direct physical impacts. In the context of these findings, indirect effects include noise, visual effects, and the like, due to operation of aircraft in proximity to the resources or in overflights. See Attachment D (Table 1) for identified properties eligible for listing in the National Register of Historic Places (NRHP) within the APE. There may be other eligible properties within the APE, but those properties are not specifically identified herein, as the effects upon those properties are not expected to differ from effects upon the eligible properties that have already been identified. No traditional cultural properties or historic properties that could be affected have been identified.

B. HISTORIC PROPERTIES, TRADITIONAL CULTURAL PROPERTIES, AND TRADITIONAL RESOURCES WITHIN THE APE SUBJECTED TO DIRECT EFFECTS FROM THIS UNDERTAKING:

Direct effects may result from additional removal of airfield obstructions (such as topographic points that are of sufficient elevation to interfere with aircraft approaches and departures, including vegetation as well as soil, subsoil, rocks, etc). Direct effects also include those resulting from cut and fill operations for site preparation and construction of a runway extension runway and associated infrastructure. See Attachment D (Table 2) for historic properties identified to date, including the eligibility determinations/status of these properties, within or near the projected runway extension to the north. Though the entire area of potential disturbance has not been surveyed, the resources within the area disturbed or close proximity have been identified. To date, none of the properties identified that are within the area likely to be disturbed have been determined eligible. Two properties in close proximity to the disturbed area lack data on eligibility (see Attachment D, Table 2). However, those two properties were originally surveyed in 1989, but could not be located in the survey done in 2009, and furthermore, even if those two properties still exist, they are just outside the disturbed area (see Attachment C). No other traditional cultural properties or historic properties that could be affected have been identified.

SECTION IV: HUMAN REMAINS, FUNERARY OBJECTS, SACRED OBJECTS, OR OBJECTS OF CULTURAL PATRIMONY

In areas where ground-disturbing activities are proposed, there is a potential that human remains or other associated items will be encountered, though based on previous surveys in the area, the probability is quite low. In these areas, any discoveries will be managed in accordance with applicable provisions of 43 CFR Part 10. In the event that human remains are inadvertently discovered during construction or other ground-disturbing activities, activities or work in the vicinity of the discovery will stop and the Air Force will take measures to help secure the remains and any associated context, per the "Inadvertent Discovery" procedures contained in the JBER Integrated Cultural Resources Management Plan.

SECTION V: DETERMINATION OF POTENTIAL EFFECT

Indirect Effects: Pursuant to 36 CFR §800.4 (d) (1), we have determined that this undertaking will have **no effect (indirect effect)** on known or undiscovered/unevaluated listed or eligible properties due to activities involving overflights, or operations from or within existing airfield operations areas.

Rationale for finding of no effect (indirect effect):

There are historic properties in proximity to the flightline, but all are associated with operations of aircraft typical for the base and are currently subject to indirect effects due to noise and visual effects. As no new operations are proposed, and these effects are consistent with those typically associated with an Air Force base, no effect is anticipated for implementation of any of the alternatives (including the no action alternative).

Direct Effects: Pursuant to 36 CFR §800.5 (b), we have determined that this undertaking will have **no adverse effect (direct effect)** on historic properties.

Rationale for finding of no adverse effect (direct effect):

In the portion of the APE where ground-disturbing activities will occur upon implementation of alternatives, no eligible properties have been identified to date (see Attachment D, Table 2). Though the entire area has not been surveyed, the probability that eligible properties will be encountered is low (but not zero).

No effect/no adverse effect to any as-yet undiscovered properties is anticipated, for the following reasons: (1) There are no known eligible properties located within the area of disturbance, (2) the probability of encountering unknown properties of National Register quality is low, (3) if subsequent information (e.g., gathered through survey efforts or implementation of other undertakings in the same area) indicates that the probability of encountering archaeological deposits or other properties is high, preconstruction surveys will be conducted prior to the initiation of any ground disturbing activities, and (4) regardless of whether preconstruction surveys are conducted, if archaeological or other cultural resources are inadvertently discovered during construction or other ground-disturbing activities, activities or work in the vicinity of the discovery will stop and the Air Force will take measures to help secure the remains and any associated context, per the "Inadvertent Discovery" procedures contained in the JBER Integrated Cultural Resources Management Plan. Therefore, any effects will be minimized to less than adverse.

Attachments:

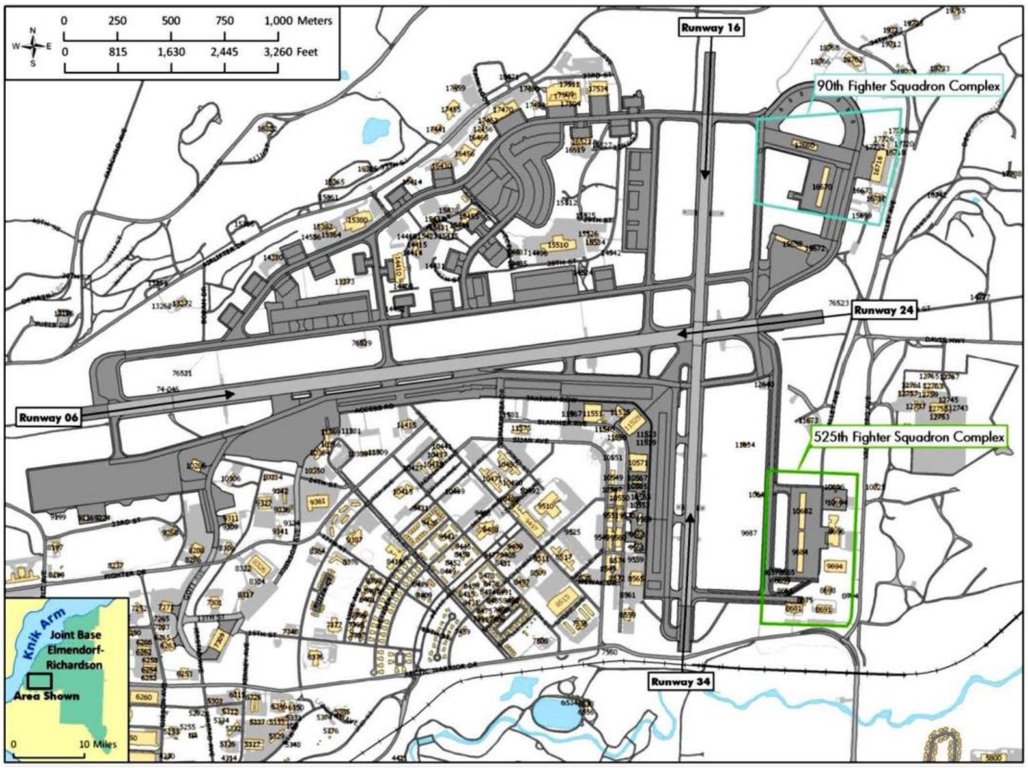
A – General Location of the Undertaking
B – Description of the Undertaking/Alternatives
C – Area of Potential Effect (APE)
D -- Historic Properties in the Area of Potential Effect (APE)
- Table 1. Eligible Historic Properties within the APE
- Table 2. Eligibility Status of Properties within the Area Affected by Runway Expansion Alternatives

Attachment A

Location of the Undertaking – Joint Base Elmendorf Richardson (JBER), Alaska

Attachment A

Location of the Undertaking – Joint Base Elmendorf Richardson (JBER), Alaska



Airfield Layout and Cantonment Area, Elmendorf portion of Joint Base Elmendorf Richardson (JBER), Alaska

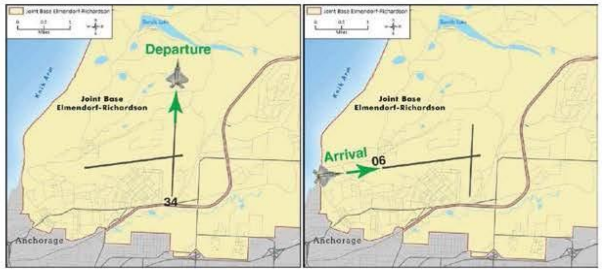
Attachment B

Description of the Undertaking – Alternatives

Action Alternatives *(Indirect Effects)*

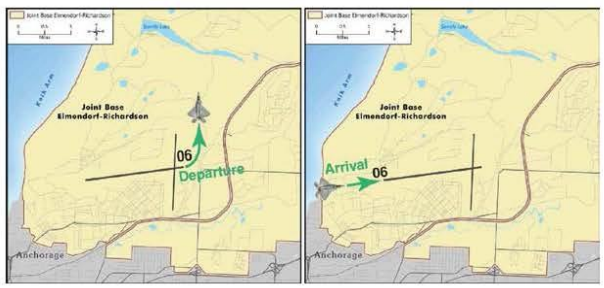
Action Alternative A: RW 34 Departures; RW 06 Arrivals

Cross runway operations would improve efficiency, meet FAA ODO guidance, reduce congestion in the Anchorage Bowl airspace, improve safety for departures, and address F-22 Plus-Up EA/FONSI restrictions. Safety issues would continue for arrivals on RW 06 through multiple Anchorage Bowl segments. No expanded/additional removal of obstructions or runway extension would be required.



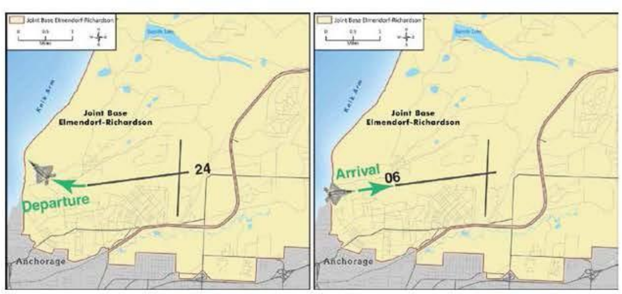
Action Alternative D: RW 06 Departures and Arrivals

Alternative D would have extensive F-22 taxi and hold times and would not improve efficiency. There would be continued congestion and safety issues for RW 06 arrivals. Alternative D adheres to FAA ODO guidance, improves safety for departures, and addresses F-22 Plus-Up EA/FONSI restrictions. No expanded/additional removal of obstructions or runway extension would be required.



Action Alternative E: RW 24 Departures; RW 06 Arrivals

Alternative E would generally improve efficiency, as F-22s are able to depart from RW 24 and vector toward regular training airspace prior to exiting the Elmendorf Airspace. Alternative E would require continued JBER tower management to address ODO, and safety issues for arrivals on RW 06 would continue. Alternative E addresses F-22 Plus-Up EA/FONSI restrictions. No expanded/additional removal of obstructions or runway extension would be required.



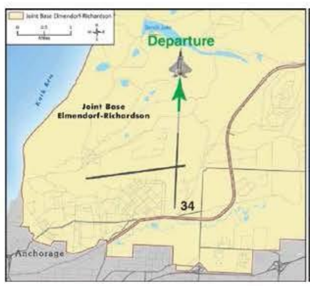
Programmatic Alternatives *(Indirect and Direct Effects)*

Programmatic Alternative B: RW 16/34 Extension, RW 34 Departures; RW 06 Arrivals

As for Action Alternative A, F-22s would use RW 34 for departures and RW 06 for arrivals. Ground-disturbing activities would include expanded obstruction removal and construction of a 2000-2500 ft runway extension to the north.

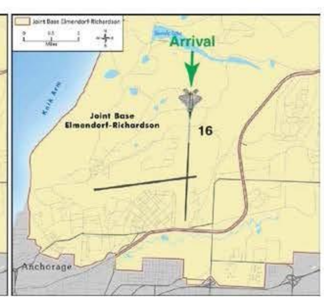
Programmatic Alternative C: RW 16/34 Extension; RW 34 Departures; RW 16 Arrivals

Alternative C would involve F-22 departures and arrivals on the same runway (the north-south runway), Ground-disturbing activities would include expanded obstruction removal and construction of a 2000-2500 ft runway extension to the north.



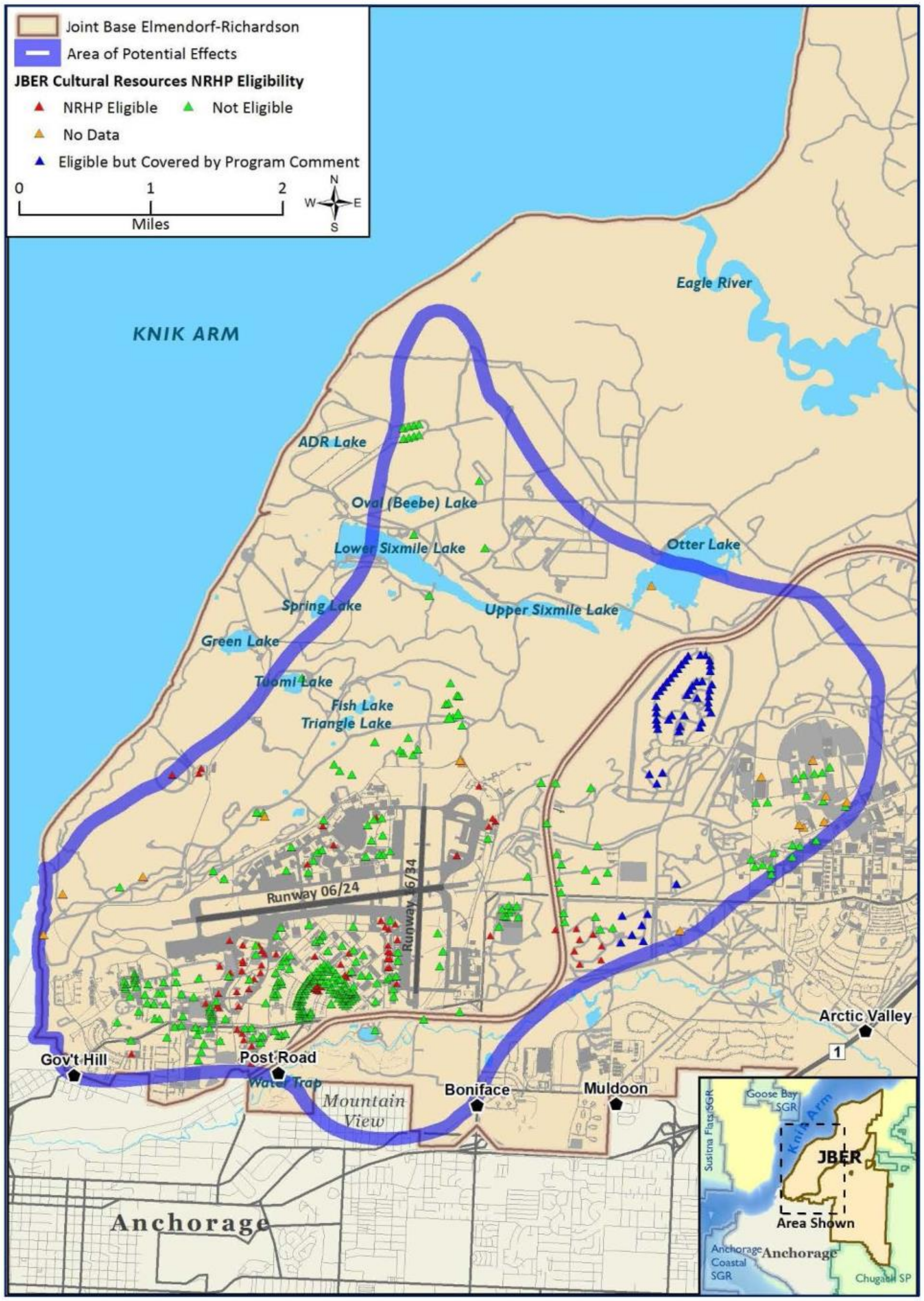
Programmatic Alternative F: RW 16/34 Extension; RW 24 Departures; RW 16 Arrivals

Alternative F involves arrivals on RW 16 and departures on RW 24. Ground-disturbing activities would include expanded obstruction removal and construction of a 2000-2500 ft runway extension to the north.

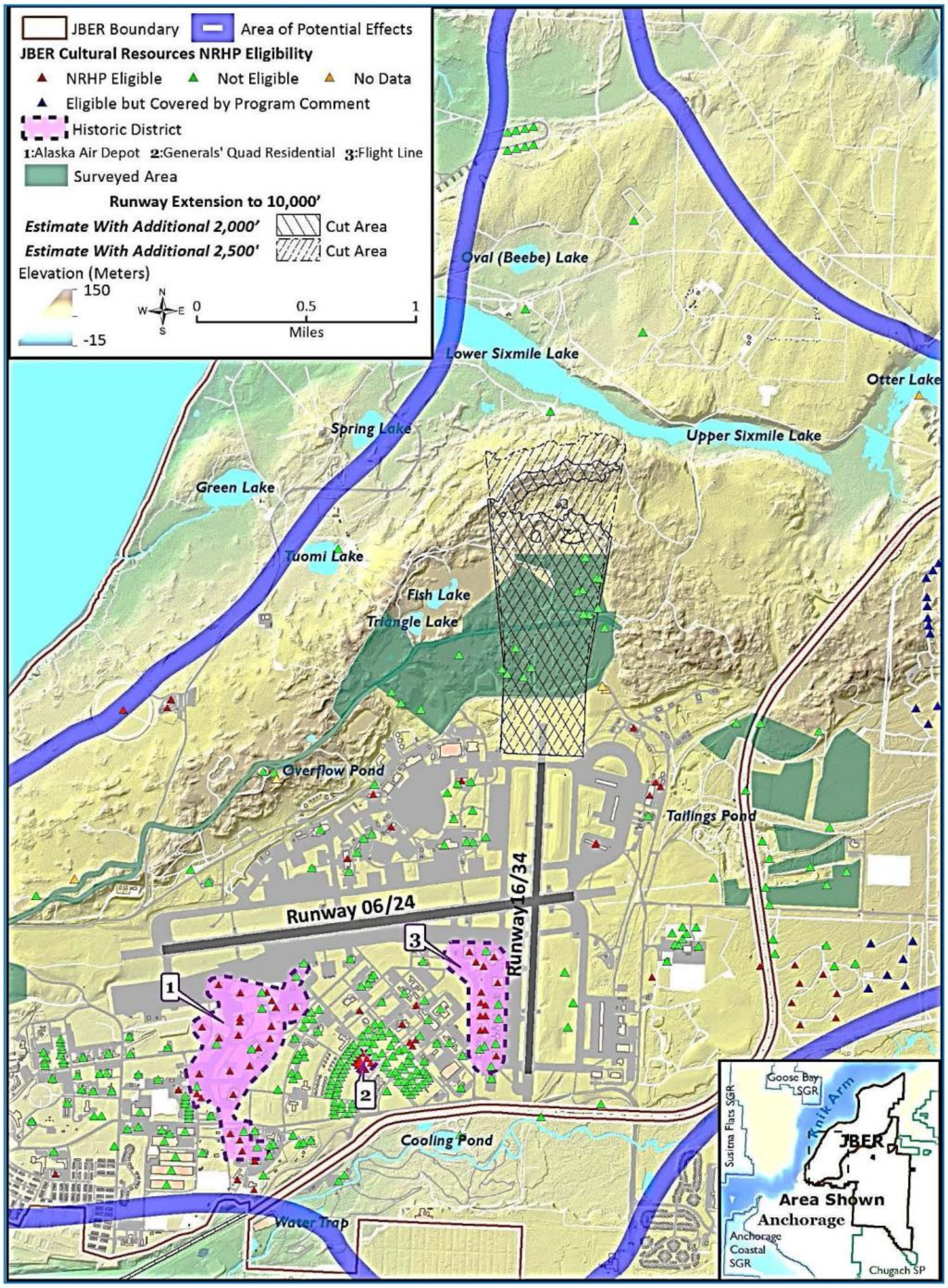


Attachment C

Area of Potential Effect



Area of Potential Effect (APE) for the Proposed Action and Alternatives



Area of Potential Effects (APE) Detail (Area North of the North-South Runway)

Attachment D

Historic Properties within the Area of Potential Effect

Table 1: Historic Properties Determined Eligible for Listing Within the Area of Potential Effect

AHRS-Number	Site Name	Current Bldg #	Old Bldg #	Construction Date	Determination Date
Alaska Air Depot Historic District					
ANC-00929	Hazardous Storage	4314	22-009	1944	5/12/2009
ANC-00930	Maintenance Shop	5327	22-021	1944	5/12/2009
ANC-00931	Engineering Maintenance(H)/3RD CES/EOD	5332	22-023	1943	11/21/2003
ANC-00932	3RD CES Prime Beef	5303	22-039	1944	11/21/2003
ANC-00935	Vehicle Operations	7250	31-360	1944	11/21/2003
ANC-00936	Corrosion Control	6263	32-050	1944	7/13/2010
ANC-00937	Hangar 5	7309	32-060	1944	11/21/2003
ANC-00938	Mobile Refueling	8317	32-069	1944	11/21/2003
ANC-00939	Outdoor Recreation Building	7301	32-079	1944	11/21/2003
ANC-00940	AGE Flight	8326	32-127	1944	11/21/2003
ANC-00941	Welding Shop(H)/Liquid Fuels & Fire Extinguisher Maintenance	8306	32-139	1944	11/21/2003
ANC-00942	Heavy Equipment	8288	32-141	1944	5/12/2009
ANC-00943	Cryogenics	9268	32-167	1944	7/23/2009
ANC-00944	Machine Shop Office(H)/Administration Office	9309	32-177	1943	7/23/2009
ANC-00945	Hangar 6	9311	32-179	1944	7/23/2009
ANC-00946	Plant Maintenance (H), Spill Response Team	9341	32-181	1944	11/21/2003
ANC-00949	Snow Barn	9361	32-187	1944	11/21/2003
ANC-00951	Armament Shop (H) / 3RD CES Liquid Fuels	10306	32-207	1944	11/21/2003
ANC-00952	Hangar 7, AERO club	10286	32-209	1944	5/12/2009
ANC-01086	Recreational Building	7271	31-375	1948	
Cold War Era Functional Area					
ANC-00818	COL. Everett Davis Building.	9480	5-800	1948	7/13/2010
ANC-00956	Elephant Cage	18176	41-759	1963	7/13/2010
ANC-00957	Hangar 16	15658	43-250	1954	7/13/2010
ANC-03125	Aircraft Maintenance	6265	31-362	1952	3/30/2000
ANC-03211	Hangar 11	16430	42-425	1957	7/13/2010
ANC-03215	Hangar 15 (H), Aircraft Maintenance Dock	16716	43-450	1956	7/13/2010
ANC-03216	Weapons Maintenance [EL AFB CW]	16718	44-510	1957	7/13/2010
ANC-03218	Administration & Control, 381ST IS	18220	41-760	1954	7/13/2010
ANC-03219	Weapons Shop, Rocket Assembly and Storage	18762	43-890	1955	7/13/2010
Flight Line Historic District					
ANC-00915	Hangar 4, Red Flag	8565	11-140	1941	2/16/2001
ANC-00916	3RD OSS Operations	9549	11-200	1943	2/16/2001
ANC-00918	Life Support	9551	11-300	1943	2/16/2001
ANC-00921	Heating Facility (H) / CES Storage	10550	11-330	1942	2/16/2001
ANC-00923	Hangar 3	10571	11-470	1942	2/16/2001
ANC-00924	Old Headquarters	11550	11-530	1942	2/16/2001
ANC-00925	Hangar 2 COPE Thunder	11525	11-570	1942	7/23/2009
ANC-00926	Photo Lab	11540	11-620	1943	11/21/2003
ANC-00927	Hangar 1	11551	11-670	1942	11/21/2003
General's Quad Residential Historic District					
ANC-00042	Alaska Chateau	8450	5-560	1942	8/22/1984
ANC-00043	Quarters One	8433	5-504	1942	8/22/1984
ANC-00995	Family Housing	8436	05-500	1942	11/29/2006
ANC-00996	Auto Garage	8434	05-501	1942	11/29/2006
ANC-00999	Auto Garage	8445	05-505	1942	
ANC-01000	Auto Garage	8411	05-515	1942	
Recreation/Chapel Functional Area					
ANC-00788	Base Chapel	9431	8-760	1942	
ANC-01082	Wildlife Museum	8481	04-803	1942	
ANC-01083	Band Building	9477	04-810	1942	
Functional Area Unassigned					
	Power Supply	18224		1952	
	Alert Hangar	15658		1954	
	Circularly Disposed Antenna Array	18176		1963	
ANC-00777	Alternate Command Post Train Cars			1945/1982	

Table 1: Historic Properties Determined Eligible for Listing Within the Area of Potential Effect

AHRS-Number	Site Name	Current Bldg #	Old Bldg #	Construction Date	Determination Date
ANC-00819	Battery Shop		32-129	1944	9/23/1999
ANC-00845	Double F.O. Quarters		5-510	1942	2/20/1996
ANC-00846	Double C.O. Quarters		5-540	1942	2/20/1996
ANC-00847	Double C.O. Quarters		5-550	1942	1996
ANC-00917	Cold Storage Building	9560	11-230	1942	2/16/2001
ANC-00919	Dry Cleaning(H)/Supply Warehouse	10547	11-310	1945	2/16/2001
ANC-00920	Medical Supply (H)	9570	11-320	1943	2/16/2001
ANC-00922	Laundry Facility(H)/Information Management & PUBLISHING	10549	11-420	1941	2/16/2001
ANC-00928	Indoor Firing Range(H)/Housing Maintenance	4305	22-007	1944	5/12/2009
ANC-00933	Housing Office	5312	22-041	1944	11/21/2003
ANC-00947	Hobby Shop	9340	32-184	1945	11/21/2003
ANC-00948	Carpenter Shop(H)/SPS Mobility & Supply	9342	32-185	1944	11/21/2003
ANC-00950	Start-Up Power Plant	10334	32-189	1945	11/21/2003
ANC-00955	Power Plant	18224	41-755	1952	7/13/2010
ANC-00997	FO/CO Housing	8419	05-502	1942	
ANC-00998	Auto Garage	8409	05-503	1942	
ANC-01001	Family Housing	8423	05-530	1942	
ANC-01002	Auto Garage	8439	05-535	1942	
ANC-01055	Ammunition Storage Igloos	11827	34-802	1942	7/23/2009
ANC-01056	Ammunition Storage Igloos	11863	34-808	1942	7/23/2009
ANC-01058	Ammunition Storage Igloos	11889	34-812	1942	5/12/2009
ANC-01059	Ammunition Storage Igloos	11865	34-814	1942	5/12/2009
ANC-01060	Ammunition Storage Igloos	10861	34-816	1942	7/23/2009
ANC-01061	Ammunition Storage Igloos	10871	34-818	1942	5/12/2009
ANC-01062	Ammunition Storage Igloos	10909	34-822	1942	12/15/2008
ANC-01063	Ammunition Storage Igloos	10907	34-824	1942	12/15/2008
ANC-01084	Log Cabin Mini Mall	9485	04-830	1945	
ANC-03094	Elementary School, Education Centre	4109	21-590	1968	7/13/2010
ANC-03192	Communications	10488		1949	
ANC-03203	Hangar 8	14410	42-300	1957	
ANC-03209	Hangar 10	15455		1957	
ANC-03213	Hangar 14	16521	43-550	1957	
ANC-03217	Water PUMP Station	17724	43-460	1957	

Table 2. Eligibility Status of Sites Within and In the Vicinity of the Runway Expansion

AHRS No.	Site Name	Construc-tion Date	NRHP Eligibi-lity	Determ-ination Date*	Era	Property Type & Description	Survey Date
ANC-01018	First-Aid Hut (former Bldg. 52-796)	1941	N	9/23/1999	WWII	Building. Moved to current location.	12/9/1997
ANC-02362	Log Cabin Remains	1938-1960	N	2/16/2007	WWII/Cold War	Euroamerican; log cabin remains	8/8/2006
ANC-03223	Recreation, Bldg 28590 (former 63-500)	1984	N	7/13/2007	Cold War	Lacks significance (Criteria A – D and Extended Criterion G)	9/23/2009
ANC-00431	Pits & Debris Piles	Unknown, circa 1945?	No data	None	Euroamerican (WWII?)	Historic site consisting of two pits and two piles of debris; description from 1989 survey, site could not be located during 2009 survey	3/29/1989; 2009
ANC-00432	Bunker	Unknown, circa 1945?	No data	None	Euroamerican (WWII?)	Remains of military acti-vities, including a concrete bunker, several small rectangular pits, and faint trail; description from 1989 survey, site could not be located during 2009 survey	3/29/1989; 2009
ANC-02003	Concrete Access Hatch	1938-1960	N	2/16/2007	WWII/Cold War	Concrete access hatch	2/22/2006
ANC-02004	Two Utility Poles	1938-1960	N	2/16/2007	WWII/Cold War	2 utility poles	2/22/2006
ANC-02005	Corrugated Shelter Site [Bunker/Igloo Complex]	1938-1960	PC	2/16/2007	WWII/Cold War	Remains of military activi-ties: metal structure on concrete foundation. Element of ANC-02577	2/22/2006
ANC-02006	Rock Fireplace Site	1938-1960	PC	2/16/2007	WWII/Cold War	Rock chimney and fire-place	2/22/2006
ANC-02008	Gun Emplacement & Pillbox	1938-1960	PC	2/16/2007	WWII/Cold War	Remains of military activi-ties: concrete gun emplacement and pillbox	2/22/2006
ANC-02577	Bunker/Igloo Complex	1938-1960	PC	2/16/2007	WWII/Cold War	Remains of military activi-ties: buried bunkers, trenches, guard shacks, and foxholes; Bunker/ Igloo Complex	10/7/2006

Table 2. Eligibility Status of Sites Within and In the Vicinity of the Runway Expansion

AHRS No.	Site Name	Construc-tion Date	NRHP Eligibi-lity	Deter-mination Date*	Era	Property Type & Description	Survey Date
ANC-02578	Aircraft Wreckage	1938-1960	PC	2/16/2007	WWII/Cold War	Remains of military training activities: aircraft wreckage, Army Air Corps	10/7/2006
ANC-02579	Anti-Aircraft Battery	1938-1960	PC	2/16/2007	WWII/Cold War	Remains of military activities: reinforced concrete gun emplacement and pillbox	10/7/2006
ANC-02580	Winter Training Area	1938-1960	PC	2/16/2007	WWII/Cold War	Remains of military training activities: collapsed wooden structures, foxholes, trenches	10/7/2006
ANC-04148	Collapsed Bunker	1950-1965	N	1/15/2016	Cold War	Remains of military training activities: earthen bunker	10/20/2015
ANC-04149	Hasty Bunker	1950-1965	N	1/15/2016	Cold War	Remains of military training activities: earthen bunker with trench	10/20/2015
ANC-04150	Hasty Bunker	1950-1965	N	1/15/2016	Cold War	Remains of military training activities: earthen bunker with barbed wire	10/20/2015
ANC-04151	Hasty Bunker	1950-1965	N	1/15/2016	Cold War	Remains of military training activities: earthen bunker	10/20/2015
ANC-04152	Hasty Bunker	1950-1965	N	1/15/2016	Cold War	Remains of military training activities: earthen bunker with logs	10/20/2015
ANC-04153	Hasty Bunker & Foxholes	1950-1965	N	1/15/2016	Cold War	Remains of military training activities: earthen bunker with 3 foxholes	10/20/2015
ANC-04154	Two Bunkers & 12 Foxholes	1950-1965	N	1/15/2016	Cold War	Remains of military training activities: earthen bunker, collapsed bunker, and 12 foxholes	10/20/2015
ANC-04155	Grouping of 12 Foxholes	1950-1965	N	1/15/2016	Cold War	Remains of military training activities: 12 foxholes	10/20/2015

Notes:
N=Not Eligible.
PC=Covered by the Program Comment for World War And Cold War Era (1939 - 1974) Ammunition Storage Facilities
*** Date of SHPO concurrence in eligibility determination**

Reference: ***Integrated Cultural Resources Management Plan, 2013 – 2017*** (Joint Base Elmendorf-Richardson)

From: SCUDDER, JON K GS-12 USAF PACAF 673 CES/CEIEC
To: RISTAU, TONI K GS-13 USAF AFCEC AFCEC/CZN
Cc: Jimenez, Joseph A.; WALKER, ZACHARY T GS-11 USAF PACAF 673 CES/CENPP; KOENEN, BRENT A CIV USAF PACAF 673 CES/CEIEC; PRIEKSAT, MARK A GS-13 USAF PACAF 673 CES/CEI; DOUGAN, MARY J GS-12 USAF PACAF 673 CES/673 CES/CENPP; MCELROY, ROBERT J GS-12 USAF PACAF 673 CES/CEPM
Subject: Cultural Resources Survey of area north of N/S Runway +DOE
Date: Tuesday, May 10, 2016 4:52:43 PM
Attachments: Planned Extension JBER N-S Runway.pdf

All,
The below email was the initial communication response back from the SHPO. The attachment she is referring to is a separate letter we already have on file and is for a small parcel at the end of the runway, not the entire area requested in the recent letter.

Today we received the written response that is attached. They will not make a determination of effect until a survey is conducted.

[redacted]

Sincerely,

Jon

Mr. Jon K. Scudder, GS-12, DAF
Cultural Resource Manager/Native Liaison
673 CES/CEIEC
724 Postal Service Loop #4500
JBER, Alaska 99505
Work Phone: (907) 384-6648
E-Mail: jon.scudder@us.af.mil

If urgent, please contact Mr. Brent Koenen at 384-6224.

-----Original Message-----
From: Elliott, Sylvia H (DNR) [mailto:sylvia.elliott2@alaska.gov]
Sent: Thursday, May 05, 2016 4:17 PM
To: SCUDDER, JON K GS-12 USAF PACAF 673 CES/CEIEC <jon.scudder@us.af mil>
Cc: Duvall, Shina A (DNR) <shina.duvall@alaska.gov>
Subject: FW: Cultural Resources Survey of area north of N/S Runway +DOE

Hi Jon,
I called you earlier this afternoon and left a voicemail to explain the following:

This message is regarding the letter our office received on 4-21-16 from Brett Koenen, about "proposed improvements to facilitate F-22 operations efficiency [on JBER]." The request was for a "finding of 'no adverse effect' for [known] historic properties" and also for "any undiscovered or unevaluated properties" for NEPA Alternatives B, C, and F, the alternatives that would require extension of the North/South Runway. We are unable to provide this type of determination for a pre-NEPA document. But the good news is: a cultural resources survey of the area to the north of the

North/South Runway was completed in Oct. 2015. SHPO wrote a Determination of Effect letter for this report in January 2016.

I've attached the first few pages of the "North/South Runway Expansion Project Area, JBER, Cultural Resources Study Report" (it's 120 pages) + the letter from Brett Koenen and the reply letter from SHPO. Please call me to discuss (in the office today until 5:30; tomorrow between 9:00 and 5:30).

Sylvia Elliott
Architectural Historian, Review & Compliance Office of History & Archaeology
550 West 7th Ave. Suite 1310
Anchorage, Alaska 99501-3565
907-269-8724
sylvia.elliott2@alaska.gov

-----Original Message-----
From: OHA@alaska.gov [mailto:OHA@alaska.gov]
Sent: Thursday, May 05, 2016 3:34 PM
To: Elliott, Sylvia H (DNR) <sylvia.elliott2@alaska.gov>
Subject: Scanned from a Xerox multifunction device

Please open the attached document. It was scanned and sent to you using a Xerox multifunction device.

Attachment File Type: pdf, Multi-Page

multifunction device Location: machine location not set
Device Name: XRX_9C934E03DC64

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Natural Resources

DIVISION OF PARKS & OUTDOOR RECREATION
Office of History & Archaeology

550 West 7th Ave. Suite 1310
Anchorage, Alaska 99501-3565
Main: 907.269.8721
http://dnr.alaska.gov/parks/oha

May 10, 2016

File No.: 3130-1R JBER
2016-00578

Brent A. Koenen
Chief, Environmental Conservation
Department of the Air Force
Headquarters, 673 CES/CEIEC
6346 Arctic Warrior Drive
Joint Base Elmendorf-Richardson, Alaska 99506

Subject: Proposed improvements to facilitate F-22 aircraft arrivals and departures on JBER runways

Dear Chief Koenen:

The Alaska State Historic Preservation Office (AK SHPO) received your letter on April 21, 2016, requesting concurrence with six proposed actions regarding the subject project, presented in the format of a "pre-NEPA" (National Environmental Policy Act) document.

One request was for a "finding of 'no effect' to historic properties" from Alternatives A, D, and E, which proposed adjusting aircraft arrival/departure times and/or use of the East/West Runway. The other was for a "finding of 'no adverse effect' on known and undiscovered/unevaluated properties" from Alternatives B, C, and F, which proposed adjusting aircraft arrival/departure times and extending the North/South Runway.

A review of our records confirms that on January 15, 2016, we concurred that eight sites (ANC-04148 through ANC-04155) identified during a 2015 survey of 46 acres of land adjacent to the north end of the North/South Runway were not eligible for the National Register of Historic Places. Based on this determination, we also concurred that "a finding of 'no historic properties affected' is appropriate for the subject runway expansion."

We spoke with Mr. Jon Scudder, Cultural Resources Manager for the 673 CES/CEIEC, on May 6 for clarification regarding the recent request for concurrence. He stated that JBER will hire a contractor in 2016 "to survey an area beyond the area surveyed in 2015." Based on this information, we believe it is appropriate to provide an updated Finding of Effect for the F-22 facilitation project after we have reviewed the information in the 2016 survey report.

We appreciate the opportunity to comment on this project. Please contact Sylvia Elliott at 269-8724 or sylvia.elliott2@alaska.gov if you have any questions or if we can be of further assistance.

Sincerely,

Judith E. Bittner

Judith E. Bittner
State Historic Preservation Officer

JEB: she

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

MEMORANDUM FOR ALASKA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF HISTORY AND ARCHAEOLOGY
ATTENTION: MS. JUDITH E. BITTNER

JUN 07 2016

FROM: 673 CES/CEIEC
6346 Arctic Warrior Drive
JBER AK 99506

SUBJECT: Clarification of Request for Concurrence in Findings of Effect for Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson, AK

1. On 21 April 2016, you received our letter requesting concurrence in findings of effect for the above proposal (the undertaking), which is currently being analyzed in an Environmental Impact Statement (EIS). Per Section 106 of the National Historic Preservation Act (NHPA) and regulations, we requested your concurrence in our initial findings of effect, or your specific written requests for additional information, within 30 days of date of receipt.

2. We received your 10 May 2016 letter addressing the ongoing removal of runway obstructions and associated surveys. This is a separate project/undertaking that is independent of the proposed action and alternatives, and is ongoing. We believe clarification is required because your 10 May letter indicates there may be confusion between the specific undertaking referenced above and other undertakings or planning surveys being performed in the same general area.

3. It appears that your 10 May letter indicates concurrence with the USAF's findings of effect (no effect/no adverse effect) related to the F-22 EIS proposed action being analyzed in an EIS. If that was your intent, we thank you for your concurrence.

3. However, it appears that your 10 May letter also addressed the planning survey(s) pursuant to Section 110 of the NHPA, in addition to the request for concurrence for the above referenced undertaking pursuant to Section 106 of the NHPA. Specifically, your letter indicated that, since the request was for concurrence in eligibility determinations for the most recent survey in the area (46 acres directly north of the north-south runway), you were waiting for the completion of additional surveys in the summer of 2016 to concur (or not) in the eligibility determinations related to any properties found during that additional survey.

4. Per our letter to you dated 21 April, the EIS is evaluating seven alternatives. The USAF requests concurrence in the "Finding of No Effect" for the four "action" alternatives (A, D, E, and No Action). These alternatives do not alter the buildings or landscape, including any indirect changes to the acoustic or visual environment. In addition, the USAF requests concurrence in the "Finding of No Adverse Effect" for Alternatives B, C, and F, based upon an analysis of the effects to historic properties within the Area of Potential Effect for the three

"programmatic" alternatives, which do involve ground disturbing activities (though the exact scope/extent of the disturbance cannot be determined at this time). For your convenience, we are attaching a copy of the 21 April 2016 letter and supporting analyses.

5. Due to the apparent confusion, we are renewing our request for concurrence in the USAF's findings of effect for the above referenced undertaking. Please verify that your concurrence in the 10 May letter covered the above referenced undertaking, or in the alternative, please provide a response within 30 days of receipt of this letter. If we do not hear from you within 30 days with a written request for additional information, or written, detailed objections to the findings, then we will assume your concurrence, per 36 CFR 800.3(c)(4).

Brent A. Koenen

BRENT A. KOENEN, GS-13, DAF
Chief, Environmental Conservation

Attachment:
Memorandum to SHPO dated 21 April 2016 and Supporting Analyses

THE STATE
of ALASKA
GOVERNOR BILL WALKER

Department of Natural Resources
DIVISION OF PARKS & OUTDOOR RECREATION
Office of History & Archaeology
550 West 7th Ave., Suite 1310
Anchorage, Alaska 99501-3565
Main: 907.269.8721
http://dnr.alaska.gov/parks/oha

June 29, 2016

File No.: 3130-1R Air Force
2016-00578

Brent Koenen
Chief, Environmental Conservation
Department of the Air Force
Headquarters, 673 CES/CEIEC
6346 Arctic Warrior Drive
Joint Base Elmendorf-Richardson, Alaska 99506

Subject: Proposed Improvements to Facilitate F-22 Aircraft Arrivals and Departures on JBER Runways

Dear Mr. Koenen:

The Alaska State Historic Preservation Office (AK SHPO) received your correspondence (dated June 7, 2016) on June 9, 2016.

We apologize for any confusion that was created by our May 10 letter. Our intention in reviewing past surveys and findings in the project vicinity was to gain a better understanding of what has been already surveyed in the area of the potential runway extension area, which, according to your documentation, would occur under Alternatives B, C, and F.

To clarify, we concur that a finding of **no historic properties affected** is appropriate for Alternatives A, D, E, and No Action for the subject undertaking. We are *unable to concur* that a finding of *no adverse effect* is appropriate for Alternatives B, C, and F. It would be inappropriate for us to concur with a finding of effect on "undiscovered/unevaluated properties." Our understanding is that JBER plans to have the proposed runway extension area surveyed in 2016 once the exact scope/extent of the disturbance areas are known. If that is still the case, we prefer to provide our formal concurrence following receipt of that survey report. If JBER believes that a survey is unnecessary in that area and no longer plans to do so, please provide an explanation along with formal finding of effect (in this case, the most applicable finding of effect would be 'no historic properties affected').

Thank you for the opportunity to comment. Please contact Please contact Sylvia Elliott at 269-8724 or sylvia.elliott2@alaska.gov if you have any questions or we can be of further assistance.

Sincerely,

Judith E. Bittner

Judith E. Bittner
State Historic Preservation Officer
JEB:she

DEPARTMENT OF THE AIR FORCE
PACIFIC AIR FORCES

MEMORANDUM FOR ALASKA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF HISTORY AND ARCHAEOLOGY
ATTENTION: MS. JUDITH E. BITTNER

AUG 3 1 2017

FROM: 673 CES/CEIEC
6346 Arctic Warrior Drive
JBER AK 99506-3240

SUBJECT: Request concurrence with the recommended finding of "No Historic Properties Affected" for the Proposed Improvements to Facilitate F-22 Operational Efficiencies, at Joint Base Elmendorf Richardson (JBER), Alaska.

1. We are requesting concurrence from the Alaska State Historic Preservation Officer that the undertaking, Proposed Improvements to Facilitate F-22 Operational Efficiencies, at JBER with the finding suggested by the SHPO in earlier correspondence (dated 10 May, 2016 and 29 June 2016) of "no historic properties affected" In addition, though there are architectural resources (eligible for listing in the NRHP) that may experience indirect effects, those effects will not rise to the level of adverse effect upon those resources; this finding was previously concurred in by the SHPO (correspondence dated 29 June 2016 (APE)).

2. Five archaeological surveys have been conducted which encompass the APE of potential ground-disturbing EIS alternatives. A map of the entire APE is in Tab 1. The five SHPO letters from the five surveys are attached in Tabs 2-6.

3. The EIS analyzes six alternatives in addition to a No Action Alternative. Alternatives considered in the EIS involve changes in the number of departure(s) and arrival(s) on JBER's existing runways as well as expansion of Runway 16/34 (north-south runway) to the north. The No Action alternative would result in continuing existing F-22 flight operations as described in the no action alternative in the EIS, with no runway extension.

4. The SHPO response letters corresponding to the archaeological surveys are included in Tabs 2-6. As a federal undertaking, this proposed action is subject to the requirements of 36 Code of Federal Regulations (CFR) Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (NHPA) (54 Code [USC] Section 306108).

5. Local tribes have been consulted as required by Section 106, National Historic Preservation Act (NHPA) (including the Native Village of Eklutna, Chickaloon Tribe, Native Village of Knik, and Native Village of Tyonek). Nearby native corporations also were consulted per DoD American Indian and Alaska Native American policy.

6. We request your office's concurrence the recommended finding of "No Historic Properties Affected" for the proposed undertaking. We also request affirmation of your previous finding of "no adverse effect" for indirect effects, per your letter dated

If you wish to discuss the foregoing, or have additional information that you would like us to take into account in our formulation of our findings of effect, please contact us within 30 days. Our point of contact is Mr. Jon Scudder, 673 CES/CEIEC, at (907) 384-6648. If we do not hear from you within 30 days of your receipt of this information with a written request for additional information, or written, detailed objections to the findings, then we will assume your concurrence, per 36 CFR 800.3(c)(4).

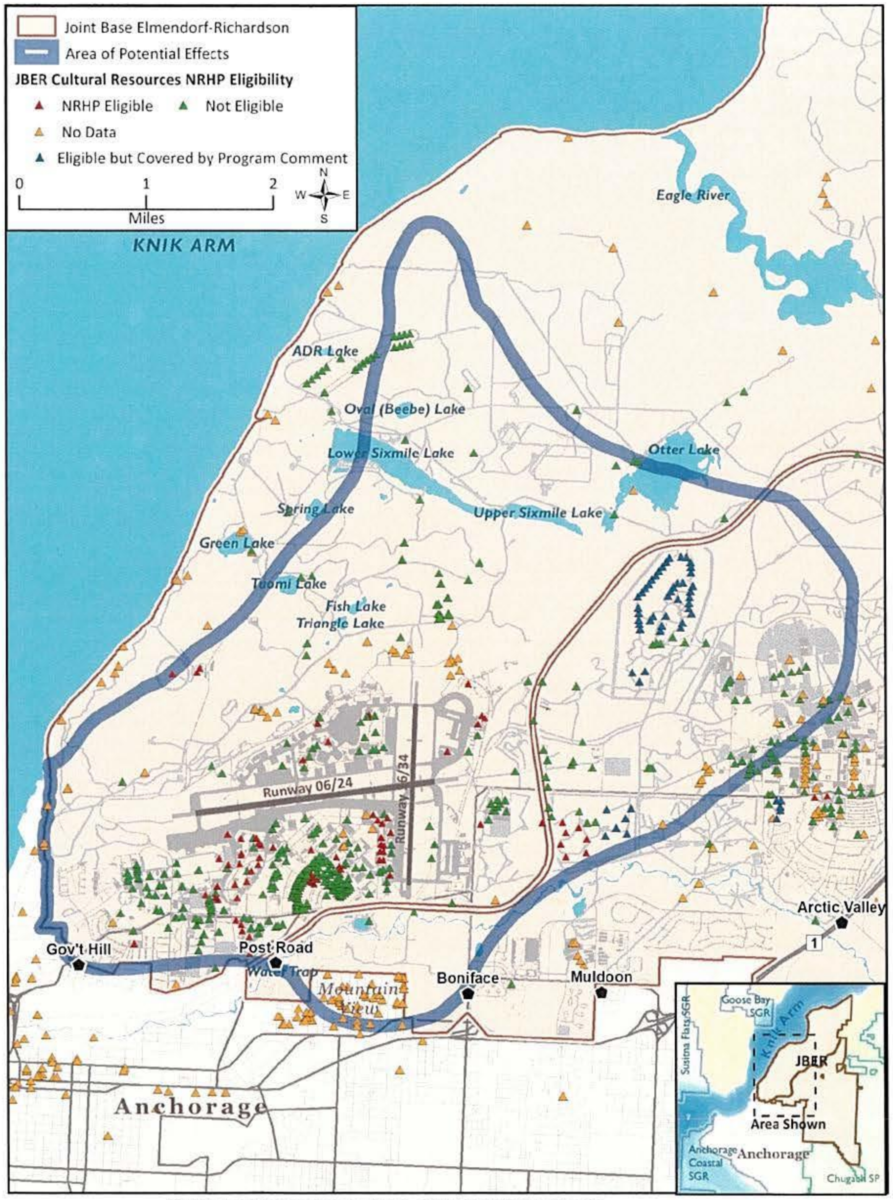
Brent Koenen

BRENT A. KOENEN, GS-13, DAF
Chief, Conservation

6 Tabs
1. APE Map
2. Port of Anchorage Intermodal Expansion Project, dated 14 Nov 2006
3. Final North/South Runway Expansion Archaeological Survey Report, dated 15 Jan 16
4. Runway Expansion Fill Area Archaeological Survey Project, dated 1 Feb 16
5. Proposed North/South Runway Expansion, dated 13 Oct 16
6. Draft N/S Runway Expansion Archaeological Survey Project Report, dated 28 Nov 16

2

Tab 1- Area of Potential Effect



Cultural Resources Area of Potential Effects

THE STATE of ALASKA

GOVERNOR BILL WALKER

Department of Natural Resources

DIVISION OF PARKS & OUTDOOR RECREATION
Office of History & Archaeology

550 West 7th Ave., Suite 1310
Anchorage, Alaska 99501-3565
Main: 907 269.8721
http://dnr.alaska.gov/parks/oha

September 14, 2017

File No.: 3130-1R Air Force
2017-01030

Brent Koenen, GS-13, DAF
Chief, Environmental Conservation
673 CES/CEIEC
6346 Arctic Warrior Drive
Joint Base Elmendorf-Richardson, Alaska 99506-3240

Subject: Finding of Effect—six alternatives proposed to optimize the distribution of F-22 departures and arrivals on the existing runways of Joint Base Elmendorf-Richardson (JBER), Alaska

Dear Mr. Koenen:

The Alaska State Historic Preservation Office (AK SHPO) received your most recent correspondence regarding the subject project on September 6, 2017. We reviewed the information presented pursuant to Section 106, the implementing regulations of the National Historic Preservation Act.

As stated in your letter, from January through December 2016, JBER conducted 5 archaeological surveys on JBER in the area of Runway 16/34 (north/south runway) proposed for expansion, and submitted determinations of National Register eligibility for the following 15 properties:

- ANC-04148
- ANC-04149
- ANC-04150
- ANC-04151
- ANC-04152
- ANC-04153
- ANC-04154
- ANC-04155
- ANC-04238
- ANC-04239
- ANC-04313
- ANC-04314
- ANC-04315
- ANC-04316
- ANC-04317

We concurred with your findings that the properties are not eligible for listing in the National Register of Historic Places. Based on these findings, and our review of the alternatives proposed in the Environmental Impact Statement, we also concur with your finding that expansion of Runway 16/34 will have no direct effect on historic properties and no adverse indirect effect on historic properties.

Thank you for the opportunity to comment. Please contact Sylvia Elliott at 269-8724 or sylvia.elliott2@alaska.gov if you have any questions or if we can be of further assistance.

Sincerely,

Judith E. Bittner

Judith E. Bittner
State Historic Preservation Officer
JEB:she

cc: Jon Scudder (jon.scudder@af.us.mil)

A.8 List of Draft EIS Repositories

ZJ Loussac Public Library
3600 Denali Street
Anchorage, AK 99503

Mountain View Branch Library
120 Bragaw Street
Anchorage, AK 99508

Muldoon Branch Library
1251 Muldoon Road
Anchorage, AK 99504

Chugiak-Eagle River Branch Library
12001 Business Blvd., #176
Eagle River, AK 99577

JBER Library
123 Chilkoot Avenue, Bldg 7
JBER, AK 99505

A.9 Draft EIS Distribution List

FEDERAL AGENCIES

Federal Aviation Administration
Alaska Region
222 West 7th Ave. # 14
Anchorage, AK 99513

U.S. Department of Agriculture
Natural Resources Conservation Service
800 W. Evergreen Ave., Ste. 216
Palmer, AK 99645-6546

U.S. Department of Interior
Office of Environmental Policy & Compliance
Anchorage Regional Office
1689 C Street, Room 119
Anchorage, AK 99501-5126

U.S. Department of Transportation
Federal Highway Administration, Alaska Division
709 W. 9th Street, Room 851
PO Box 21648
Juneau, AK 99802-1648

U.S. Department of Interior
Bureau of Indian Affairs, Alaska Regional Office
709 W 9th Street
PO Box 21647
Juneau, AK 99802

U.S. Department of Interior
Bureau of Indian Affairs, Anchorage Agency
3601 C Street, Ste. 1100
Anchorage, AK 99503-5947

U.S. Fish and Wildlife Service
Alaska Region, Anchorage Fish & Wildlife Field Office
605 West 4th Ave., Room G-61
Anchorage, AK 99501

National Marine Fisheries Service
Protected Resources Div/l-Habitat Conservation Divisions
222 W 7th Ave., Box 43
Anchorage, AK 99513

National Park Service
Alaska Regional Office
240 W 5th Ave., Ste. 114
Anchorage, AK 99501

Bureau of Land Management
Anchorage Field Office
4700 BLM Rd.
Anchorage, AK 99507-2599

U.S. Environmental Protection Agency, Region 10
EPA Alaska Operations Office
222 West 7th Ave. #19
Anchorage, AK 99513-7588

STATE AGENCIES

Alaska Department of Environmental Conservation
Division of Air Quality
410 Willoughby Ave., Ste. 303 (PO Box 111800)
Juneau, AK 99801

Alaska Department of Environmental Conservation
Division of Environmental Health
555 Cordova St.
Anchorage, AK 99501

Alaska Department of Environmental Conservation
Division of Spill Prevention and Response
410 Willoughby Ave., Ste. 303 (PO Box 111800)
Juneau, AK 99811-1800

Alaska Department of Environmental Conservation
Division of Water
555 Cordova Street
Anchorage, AK 99501-2617

Alaska Department of Fish and Game
Division of Wildlife Conservation
333 Raspberry Road
Anchorage, AK 99518-1599

Alaska Department of Natural Resources
Office of the Commissioner
Attn: Daniel S. Sullivan
550 W. 7th Ave., Ste. 1400
Anchorage, AK 99501

Alaska Department of Natural Resources
Commissioner
Attn: Mark Myers
550 W. 7th Ave. Ste. 1400
Anchorage, AK 99501

Alaska Department of Natural Resources
History & Archaeology
550 W. 7th Ave., Ste. 1310
Anchorage, AK 99501-3565

Alaska Department of Military and Veterans Affairs
PO Box 5800
Camp Denali
JBER, AK 99505

Alaska Department of Natural Resources
Office of the Commissioner
550 W. 7th Ave., Ste. 1400
Anchorage, AK 99501

Alaska Department of Transportation
Central Region
4111 Aviation Ave.
Anchorage, AK 99501

Alaska Railroad Corporation
PO Box 107500
Anchorage, AK 99510

LOCAL AGENCIES/ORGANIZATIONS

Ted Stevens Anchorage International Airport
Attn: John Parrot
PO Box 196960
Anchorage, AK 99519

Anchorage Assembly
PO Box 196650
Anchorage, AK 99519

Municipality of Anchorage
Anchorage Community Development Authority
245 W. 5th Ave., Ste. 122
Anchorage, AK 99501

Municipality of Anchorage
Community Planning & Development
4700 Elmore Road
Anchorage, AK 99507

Port MacKenzie
Matanuska-Susitna Borough
350 East Dahlia Ave.
Palmer, AK 99645

Port of Anchorage
2000 Anchorage Port Rd.
Anchorage, AK 99501

Anchorage Historic Preservation Commission
Community Development
PO Box 196650
Anchorage, AK 99519-6650

Eagle River Community Council
13135 Old Glenn Hwy, Ste. 200
Eagle River, AK 99577

Fairview Community Council
1121 E. 10th Ave.
Anchorage, AK 99501

Government Hill Community Council
1057 West Fireweed Lane, Ste. 100
Anchorage, AK 99503

Mountain View Community Council
161 Klevin St. Suite 204
Anchorage AK 99508

Northeast Community Council
1057 West Fireweed Lane Ste. 100
Anchorage, AK 99503

Municipality of Anchorage
Attn: Ethan Berkowitz
632 W. Sixth Ave., Ste. 840
Anchorage, AK 99501

Senator Lisa Murkowski
Attn: Kevin Sweeney
510 L Street, Ste. 550
Anchorage, AK 99501

State of Alaska
Attn: Bill Walker
PO Box 110001
Juneau, AK 99811-0001

Alaska Resources Library and Information Services
3211 Providence Dr., Ste. 111
Anchorage, AK 99508

Alaska State Court Law Library
303 K Street
Anchorage, AK 99501

Alaska Native Villages

Eklutna Nalive Village
Attn: Dorothy Cook
26339 Eklutna Village Road
Chugiak, AK 99567

Knik Village
Attn: Debra Call
PO Box 871565
Wasilla, AK 99687

Native Village of Tyonek
Attn: Frank Standifer
PO Box 82009
Tyonek, AK 99682-0009

Chickaloon Village Traditional Council
Attn: Gary Harrison
PO Box 1105
Chickaloon, AK 99674

Alaska Native Corporations

Cook Inlet Region, Inc (CIRI)
Attn: Margaret L. Brown
2525 C Street, Ste. 500
Anchorage, AK 99503

Eklutna, Inc.
Attn: Lee Stephan
16515 Centerfield Drive, Ste. 201
Eagle River, AK 99577

A.10 Draft EIS Public Comments and Responses

This Appendix contains comments received from federal, state, and local agencies, the general public, and Alaska Native Groups during the public comment period for the *Draft Environmental Impact Statement (EIS) for the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson (JBER), Alaska*. The Notice of Availability for the Draft EIS appeared in the *Federal Register* on August 4, 2017. This began a 45-day comment period. In accordance with the National Environmental Policy Act (NEPA), public and agency comments were reviewed and incorporated into the Final EIS. These public and agency comments will be taken into consideration by the Air Force in its decision making process.

Public comment was encouraged at the public hearing, newspaper display advertisements, press releases, public service announcements, and letters accompanying the direct mailing of the Draft EIS document. It was noted that these comments would be published in the Final EIS (and that providing personal information on those comments was considered consent to publish it). While all comments submitted were assessed and considered by the USAF, only substantive comments are addressed either individually or collectively in the Final EIS. Substantive comments are those that identify issues and concerns related to the quality of the document in consideration of the accuracy of the facts, adequacy of analysis, precision of language, consistency of analysis or facts, justifications for conclusions, and/or the merits of other alternatives than those discussed. Non-substantive comments are those that only express a conclusion, an opinion, or a vote for or against the proposal itself, or that otherwise state a personal preference or opinion. The following presents the Air Force's Comment and Response Process.

A.10.1 Comment Receipt and Review

Comment Receipt: Comments on the Draft EIS included both written correspondence via letters, website, or emails, and oral testimony received during the 45-day public comment period. All comments received during that period are included in the Comments section.

Comment Review: In accordance with 40 *Code of Federal Regulations* (CFR) 1503.4, comments were assessed and considered as follows:

- Each letter or testimony was assigned an identification number and each comment letter and each individual's oral comments were read and reviewed carefully.
- Within each comment letter or testimony, substantive comments were identified and bracketed. Three guidelines were used for determining substantive comments:
    1. The comment questions the Proposed Action and alternatives, or other components of the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson JBER.
    2. The methodology of the analysis or results was questioned.
    3. The use, adequacy, or accuracy of data was questioned.
- The bracketed comments were reviewed by environmental resource specialists who draft the responses. In some cases, similar comments were assigned the same response. If the same comment was repeated within the same letter or oral comments, it was bracketed the first time it appeared.

- The individual bracketed comments were assigned a comment number and a response code. These comments and responses are organized consecutively by number. The responses to comments appear in Section A.10.5 of this Appendix.

Comment Organization: The bracketed comment letters are presented in Sections A.10.6, A.10.7, and A.10.8 in numerical order and are organized into three sections:

- Written comments and submitted letters from Individuals and members of the general public (Section A.10.6) – comment numbers begin at 1000
- Agency/Organization/Company letters (Section A.10.7) – comment numbers begin at 2000
- Public hearing transcript of oral testimonies (Section A.10.8) – comment numbers begin at 3000

A.10.2 Locating Your Comments

The Directory of Letters and Public Hearing Comments begins on the next page and starts with a key that clarifies the naming convention that was used in the response codes. A directory to locate your name and the comment number and response code(s) for your comment (Table A-1) immediately follows the key to response codes. The directory provides an alphabetical listing of commenters by last name. Look for your last name and note the comment number in the second column. This is the number that was assigned to your comment, which is labeled on your letter or next to your oral comments. Comments are presented in Sections A.10.6, A.10.7, and A.10.8, in order of the assigned comment numbers.

As noted on the public displays, sign-in and comment forms, and copies of the Draft EIS and Executive Summary, providing your name in the EIS process meant that you understood that your name and comment would be made a part of the public record for this EIS.

A.10.3 Locating Responses to Comments

Air Force responses to comments are located in Section A.10.5, immediately following the Directory of Letters and Public Hearing Comments presented in Section A.10.4. Each substantive comment within each comment letter and each substantive oral comment in public hearing transcripts was bracketed and given a response code (see comment letters and transcripts presented in Sections A.10.6, A.10.7, and A.10.8). Every bracketed comment has a corresponding response. Response codes are printed next to the brackets in the margin of the comments. Each response is designed to be read along with the comment it addresses. Responses are organized alphabetically by response code. The first page of the following Section A.10.4 (Directory of Letters and Public Hearing Comments) provides a key that further clarifies the response codes. To find the response to your comment, first identify the response code(s) in Table A-1 corresponding to your comment and then locate the response code(s) in Table A-2. Note that some comment submissions are addressed by more than one response code.

The responses refer to both the Draft EIS and Final EIS documents, as appropriate. For example, if the commenter suggests a deficiency in the Draft document, the response may refer to the Draft EIS for clarification. If the Final EIS includes amended information, including mitigations, the reader will be directed to that section of the Final EIS.

Public and agency involvement is an important part of the NEPA process, and all comments whether bracketed or not are taken into consideration by the Air Force in its decision making process.

A.10.4 Directory of Letters and Public Hearing Comments

The following response codes were applied during the bracketing of substantive comments in the preparation of the responses to comments. Note that some comment submissions have more than one response code.

Code Prefix	Resource Area/Category
AE	Acoustic Environment
AM	Airspace Management and Use
AQ	Air Quality
BI	Biological Resources
CR	Cultural Resources
EJ	Environmental Justice
GE	General
HM	Hazardous Materials and Waste Management
IN	Infrastructure
LU	Land Use and Recreation
MI	Mitigations and Cumulative
NP	NEPA/Public Involvement
PA	Proposed Action/Description of Proposed Action and Alternatives
PN	Purpose and Need
PR	Physical Resources (Soils and Water)
SA	Safety
SO	Socioeconomics
TN	Transportation and Circulation

Table A-1 provides an alphabetical listing of commenters by last name, along with the comment number and response code(s) assigned to each comment number.

Table A-1. Alphabetical Directory for Individual Letters, Agency/Organization/Company Letters, and Public Hearing Transcripts

Name	Comment Identification #	Submission Method	Notes	Comment Response Codes Applied*
Brown, John	1005	Website		PA-2, PA-3, PN-1
Burns, Robin	3015	Public Hearing - Oral		PA-4
Charles, Nicholas	1012	Website		PA-4
Crandall, Donald	3002	Public Hearing - Oral		SO-1
DeCarli, Marcie	1009	Website		GE
Don, John	1013	Website		EJ-3, MI-1
Duke, Rune	2005	Letter	Director, Airspace and Air Traffic, AOPA	AM-1, AM-2, AM-3, AM-4, AM-5
Fielding, Claudia	3006	Public Hearing - Oral		EJ-2
Filoialii Jr., Tauveve	1020	Website		EJ-2
George, Daniel	3012	Public Hearing - Oral		EJ-1, MI-2, PA-4
Gilbert, Loren	1001	Public Hearing - Written		MI-1
Gould, Mark	3009	Public Hearing - Oral		EJ-2, SO-1
Graham, Carolyn	1002	Public Hearing - Written		AE-2, EJ-2, MI-2
Grizzell, January	3013	Public Hearing - Oral		AE-3, EJ-3, PA-1
Grober, Marc	1007	Website		AE-2, EJ-2, PA-1, SA-2
Hart, Hal H.	2004	Letter	Planning Director, Municipality of Anchorage	CR-1, MI-2, PA-4
Heaney-Mead, Diane	1006	Website		EJ-2, PA-1
Hotch, Tosha	3016	Public Hearing - Oral		AE-4, EJ-2
Hughes, Genie	1019	Website		PA-4
Kennedy, Ryan	1004, 3004	Public Hearing - Written Public Hearing - Oral		MI-3
Kesler, Judy	1022	E-mail		NP-1
Krishna, Radhika	3010	Public Hearing - Oral		AE-1, AE-4, AE-5, MI-2, NP-2
Nogi, Jill A.	2002	Letter	Manager, Environmental Review and Sediments Management Unit, USEPA	AE-3, HM-1, MI-7, NP-3, PA-4, PR-1
Olson, Vern	1014	Website		PA-1, SA-1
Palinski, Paul	3008	Public Hearing - Oral		PA-4
Plunkett, Rex	1003, 3005	Public Hearing - Written Public Hearing - Oral		PA-4
Porter, Richard	2003	Letter	Executive Director, Knik Tribal Council	EJ-2, EJ-3, MI-4, MI-5, MI-6. PA-4
Reece, Neva	3011	Public Hearing - Oral		AE-2, AE-3, AE-4, EJ-2, EJ-3, PR-1
Renkel, Don	3003	Public Hearing - Oral		GE
Roberson, Tina	1010	Website		GE
Sheppard, Les	3014	Public Hearing - Oral		MI-1
Tarr, Geran	3001	Public Hearing - Oral	Alaska State Representative - Mountain View	AE-3, EJ-2
Teela, Glenn	1008	Website		GE

Table A-1. Alphabetical Directory for Individual Letters, Agency/Organization/Company Letters, and Public Hearing Transcripts

Name	Comment Identification #	Submission Method	Notes	Comment Response Codes Applied*
Todd, Guy	1017	Website		EJ-2
Walker, Bill, The Honorable	2001	Letter	Governor of Alaska	GE
Waters, Phil	1015	Website		PA-4
Webb, Peggy	3007	Public Hearing - Oral		AE-3, EJ-3, SA-1, SO-1
Welker, James Glen	1016	Website		PA-1
Wirschem, Chuck	1021	E-mail		GE
Wirschem, Kelly	1021	E-mail		GE
No name	1011	Website		GE
Last name not provided, John	1018	Website		GE

* See Table A-2 for responses to these coded comments.

A.10.5 Responses to Comments

To find the response to your comment, first identify the response code(s) in Table A-1 corresponding to your comment and then locate that response code(s) in the Table A-2 below. Note that some comments are addressed by more than one response code.

Table A-2. Comment and Response Matrix

Code	Comment ID	Comment	Response
AE-1	3010	Showing average annual noise levels of daily noise levels is not a useful way to express noise - we don't experience noise impacts as background noise.	EIS Section 3.2, 4.2, and Appendix E explain that the Ldn (day-night average sound level) is a standard metric used for noise analysis. The EIS Section 4.2.1 presents multiple additional noise measures, including equivalent noise levels during school days, number of events per day with the potential to interrupt speech with windows closed or open, sleep disturbance, and other noise effects.
AE-2	1002, 1007, 3011	Effects of noise and vibration on structures, vehicles, and windows from the Proposed Action, especially in the Mountain View area.	Vibration and noise effects on structures are explained in Appendix E. Damage to windows which can be directly attributed to JBER aircraft can be addressed by contacting JBER Public Affairs to initiate a claim.
AE-3	2002, 3001, 3007, 3011, 3013	Noise negatively impacts the quality of life and/or the health and well-being of Anchorage residents, especially noise sensitive persons and those living near JBER.	EIS Section 4.2.1 recognizes that noise affects multiple facets of human action and explains the negative impact of different measurements of noise on specific groups of persons, including noise-sensitive persons. EIS Appendix E.2.6 contains discussion of health effects of noise.
AE-4	3010, 3011, 3016	Actual on-the-ground studies should be done rather than projections; questions about noise measurement methodology.	Field studies cannot be used to measure future operational conditions, so the Air Force uses models to predict noise levels. The use of noise meters to measure current sound levels will only provide the sound levels for a single over flight, and the sound level of every overflight will vary depending on weather and exactly how the aircraft is flown. That inherent variability is one of the reasons why the Air Force develops projections for noise across a 24-hour period, with penalties for late night operations rather than stating a single overflight sound level. Using noise meters to collect data over 365 days a year, 24 hours a day at all locations of interest is not a simple task. Furthermore, that approach will result in the collection of all noise sources occurring during that time, making it more difficult to calculate the aircraft noise levels. The models use controlled noise inputs derived from multiple measurements of noise, including different aircraft ground and overflight distances and altitudes, engine power settings and

Table A-2. Comment and Response Matrix (continued)

Code	Comment ID	Comment	Response
			speed, and aircraft configuration (departing, arriving, etc.) measured in varying meteorological conditions and with varying topographic features. The NOISEMAP model used for this EIS is the standard approach for calculating military aircraft noise levels, and versions of the model have been in use since the 1970s.
AE-5	3010	Would like to see some discussion of peak noise levels. What is the maximum decibel level that would be experienced in the Mountain View neighborhood?	Because the primary action being considered in this EIS is the shifting of flying operations from one runway to another (i.e., aircraft types are constant and flight procedures remain essentially unchanged), the sound levels generated by individual aircraft operations would remain essentially unchanged, but the number of loud events heard per hour could potentially change substantially (i.e., if there is an increased number of operations on a closer runway that are much louder than operations on a more distant runway). The number of events per hour exceeding a maximum noise level of 50 decibels (denoted as “NA50”) was selected as a supplemental noise metric that reflects changes in the frequency of potentially disturbing events. The NA50 was calculated at Mountain View Elementary School. As is noted in the text beneath Table 4.2-3, the noise level at representative locations would be similar to noise levels in adjacent areas. Because the elementary school is the closest location in the Mountain View neighborhood to the JBER-Elmendorf runways, NA50 values at residences that are slightly farther from the airfield would be similar but slightly lower. Finally, quoting a single maximum noise level at a location has the potential to be misleading because the sound level of individual overflights will vary depending on weather and exactly how the aircraft is flown. That inherent variability is one of the reasons why noise metrics that summarize noise levels over time often provide a more complete picture of acoustic conditions than stating a single overflight sound level.
AM-1	2005	The DEIS does not address the airspace modifications that are likely to be required following the utilization of new runway configurations. We believe the USAF must fully document the airspace modifications that may be triggered by this action and that may upset the current balance between civil and military operational needs.	EIS Chapter 1 (Purpose and Need) and the explanation of alternatives in Chapter 2 do not involve any change in JBER Class D airspace or any other airspace in the Anchorage Bowl (see Figures 1.1-1 and 2.2-3). The JBER runway use alternatives addressed in the EIS have no proposal to change the JBER Class D Airspace. As explained for Alternatives A, B, and C (Sections 4.1.1, 4.1.2, and 4.1.3), increased use of RW 34 for departures could decrease airspace congestion in the Anchorage Bowl. Section 4.1.6 explains that F-22 departures on RW 24 and a turn north within JBER Class D airspace, combined with arrival on RW 16, would improve airspace safety, expedite arrivals and

Table A-2. Comment and Response Matrix (continued)

Code	Comment ID	Comment	Response
			departures, and reduce civilian and military hold times when compared with F-22 extensive use of RW 06. Although the EIS has no proposal to change the JBER Class D airspace, the following text has been added to provide further clarification. The first paragraph in Section 2.2.3 is edited to include the following before the last sentence: "The proposed improvements in F-22 operations efficiency does not require or include any proposed change in JBER Class D airspace or in any other Anchorage Bowl airspace (see Figures 1.1-1 and 3.1-1)." Also the second sentence in Section 4.1 is edited to include: "There is no proposed change in the boundaries of JBER Class D airspace as part of any F-22 alternative runway use."
AM-2	2005	General aviation and other civil aviation stakeholders have been unable to participate in the USAF and FAA effort to define a scoping document for an Anchorage airspace study. The need for such a study is directly tied to the USAF's desire for an additional Instrument Landing System (ILS) approach at JBER. Installing an ILS approach for Runway 16 at JBER could have significant airspace impacts in the congested and complicated Anchorage Bowl airspace. The proposals laid out in the DEIS could further increase air traffic 's utilization of unusual landing and departing configurations that will eventually overtax the existing airspace structure such that a redesign becomes required. The USAF must address their parallel proposal to install the Runway 16 ILS and what the airspace impact would be in concert with this action.	EIS Section 2.2.3 explains that there is no proposed change in the total number of F-22 flight operations. The relative environmental effects of Alternative C or Alternative F (or Alternative B) using an extended RW 16 for Visual Flight Rules (VFR) and Tactical Air Navigation (TACAN) arrivals without an ILS system are described in Section 2.7.2.5. An independent FAA/Air Force study of the Anchorage Bowl airspace is identified as a reasonably foreseeable action in the FEIS Cumulative Chapter 5. (See also response to AM-1.)
AM-3	2005	The DEIS mentions the "Cartee" airspace located south of JBER but the document does not discuss what the proposed change's impact will be on the utilization of this airspace cutout. Understanding JBER must control "Cartee" airspace to ensure safe operations while in certain configurations, the USAF must detail what increase or decrease in "Cartee" activation will be a result of this proposal. "Cartee" airspace activation has a negative impact on operational efficiency at Merrill Field, and more frequent activation could result in pilot confusion, increased workload, and needless airspace violations unless additional mitigations are put in place. The USAF should be transparent about their proposal's effect on this airspace segment to ensure general aviation is aware of the impact.	EIS Section 3.1.2 explains that the Merrill Class D airspace adjacent to the JBER Class D airspace is locally referred to as "Cartee." The F-22 Operational Efficiency EIS alternatives for runway use do not propose changes in the use of the Cartee airspace or in any other Anchorage Bowl airspace (see response to AM-1). The Cartee activation is expected to be comparable to what has been historically experienced.

Table A-2. Comment and Response Matrix (continued)

Code	Comment ID	Comment	Response
AM-4	2005	The change proposed for the F-22's runway utilization at JBER could have an adverse impact on IFR general aviation traffic flying in and out of Merrill Field and Ted Stevens Anchorage International Airport. An increase in arrival and departure delays is foreseen for civil IFR traffic due to the new flight patterns by the F-22. The USAF should document the anticipated impact on IFR aircraft, either awaiting a departure release or inbound for an instrument approach, for those operations at airfields located in the Anchorage Bowl, and the USAF should note which alternative results in the most minimal impact.	The only potential new F-22 flight track change associated with any EIS alternatives would be a new arrival flight track to an extended RW 16 primarily with Alternatives C or F. As explained in EIS Sections 4.1.1, 4.1.3, and 4.1.6, increased departures on RW 34 associated with Alternatives A, B, or C and increased arrivals on an extended RW 16 primarily with Alternatives C or F have the potential to reduce congestion in the Anchorage Bowl by directing military traffic to the north and away from airspace commonly used by civil traffic. Runway use alternatives which direct military traffic to the north would have the potential to reduce civil or military departure delays. (See response to AM-1.)
AM-5	2005	The utilization of new runway configurations could over time strain the existing airspace structure and lead to an unsustainable situation. The USAF must address this oversight in the DEIS given airspace changes are not being fully considered. This proposal has the possibility of disrupting general aviation operations in the Anchorage Bowl so the impacts must be fully considered before any alternative selected.	There is no proposed change in the Anchorage Bowl airspace associated with this EIS. The only change proposed in the EIS would be lower arrival and departure F-22 flight profiles (EIS Section 2.4.6, 4.1.3) within the JBER Class D airspace associated with RW 16/34 extension alternatives. As explained in Section 4.1.3, F-22 overflights near Sixmile Lake could increase general aviation encounters. Coordination among FAA, Air Force, AOPA, and others continues to be needed to insure that all aircraft adhere to altitude restrictions (see Figure 2.2-3) This coordination will be added to mitigations for Airspace and Management and Use. Military VFR or TACAN arrivals on an extended RW 16 would not be expected to affect the existing Knick Arm or Sixmile Lake area FAA altitude restrictions. (See response to AM-1.)
CR-1	2004	The Anchorage Historic Preservation Commission would like to be informed of any impacts to historic or cultural properties, or historic or cultural artifacts that may be found during construction. Any artifacts found in the Area of Potential Effect should be handled in compliance with Section 106 of the [National Historic Preservation Act]. [NOTE: the letter says "NEPA," but the NHPA is the applicable regulation.]	EIS Section 4.8 specifies that any runway extension construction would be handled in compliance with Section 106 and be consistent with the JBER Integrated Cultural Resources Management Plan Standard Operating Procedure (SOP) 5.2, Reporting Unanticipated Cultural Resources, and 5.3, Unanticipated Human Remains, for cultural resources that may be encountered during clearing, excavation, or construction related activities. Notification of the Anchorage Historic Preservation Commission would be included.
EJ-1	3012	Subjecting the long-established, minority and disadvantaged community of Mountain View to day and night average levels in excess of 65 decibels would create an environment, which under DoD guidelines would be considered "generally unacceptable for noise-sensitive land uses, such as residences, schools, hospitals, and public services."	EIS Section 4.12.1 quantifies the disproportionate effects to Environmental Justice population with Alternative A. Section 4.2.1 explains that noise sensitive land uses (including residences) are not normally considered to be compatible with noise levels greater than 65 dB Ldn. See also Section 4.9.1 and Appendix E.

Table A-2. Comment and Response Matrix (continued)

Code	Comment ID	Comment	Response
EJ-2	1002, 1006, 1007, 1017, 1020, 2003, 3001, 3006, 3009, 3011, 3016	Does the EIS consider the effects of existing and/or increased noise on schools and school children in the Mountain View area, including Mountain View Elementary School.	EIS Section 4.2.1 details the effects on children and classrooms associated with increased noise calculated with Alternative A, and includes supplemental noise metrics to characterize the noise effects during school hours. Appendix E expands upon the effects of noise on learning.
EJ-3	1013, 2003, 3007, 3011, 3013	Noise effects on the elderly and other sensitive populations needs to be considered.	EIS Section 4.12.1 describes the potential for increased noise on Environmental Justice populations, children, and elderly within the Mountain View neighborhood. The 424 individuals that would be newly exposed to an average annual noise level of 65 dB Ldn or greater includes a calculated 353 minority and 140 low income persons. The 424 individuals includes 158 children and 23 elderly persons newly exposed to an average annual noise level of 65 dB Ldn or greater under Alternative A.
GE		General comment expressing a conclusion, opinion, or vote or personal preference for or against the proposal itself.	Thank you for your comment submission.
HM-1	2002	Due to the potential for encountering undocumented contaminated soils during runway construction, close coordination with USEPA Superfund Project Manager is encouraged if Alternatives B, C, or F are chosen (which include runway extension).	EIS Section 4.6.2 explains that there is the possibility that undocumented contaminated soils could be present in Alternative B, C, or F construction areas. Any undocumented contaminated soils encountered would be handled in accordance with JBER OPLAN 19-3 (JBER 2016) procedures which include any needed coordination with the USEPA Superfund Project Manager.
MI-1	1001, 1013, 3014	What information is there about potential mitigations (for noise impacts) for the Proposed Action? Will there be any changes or additions to existing noise mitigation measures? Are there criteria for expending mitigation funding?	EIS Section 2.6 describes mitigation measures, including potential mitigation measures for increased off-base noise associated with Alternative A. Structural walls or barriers are not included as potential mitigation measures because of the distance from potential noise receptors and for safety reasons. Alternative A would result in unavoidable adverse impacts to a calculated additional 424 persons in the community of Mountain View (see EJ-3 response).
MI-2	1002, 2004, 3010, 3012	Noise mitigation by window replacement is encouraged at the Mountain View Elementary School and the Government Hill Elementary School and single-family and multi-family housing located within 50 feet of the JBER fence line in both Government Hill and Mountain View.	Techniques that home owners and others can use to reduce noise in existing residential or other units are identified in *Guidelines for Sound Insulation of Residences Exposed to Aircraft Operations* (Ehrlich, et al., 2005).* EIS Section 2.6 explains that the Air Force is not authorized to expend funds for noise attenuation off-base.
MI-3	1004	Suggested potential mitigation for noise impacts for the Proposed Action.	Thank you for providing information on techniques that home owners can use to attenuate noise. Additional information on methods that can be used to increase residential structure sound insulation is available in the 2005 study titled *Guidelines for Sound Insulation of Residences Exposed to Aircraft Operations* (Ehrlich, et al., 2005).*

Table A-2. Comment and Response Matrix (continued)

Code	Comment ID	Comment	Response
MI-4	2003	While Alternative C is inconsistent with FAA ODO policy, JBER can institute a management plan required to address ODO policy. Deliberations between JBER and FAA should begin and a management plan be developed and incorporated into the Final EIS. This management plan should also include managing interactions with general aviation at Sixmile Lake.	EIS Section 2.4.7 explains that the Air Force and FAA have agreed-to arrival/departure configurations which permit departures and arrivals on runways that do not conflict with FAA ODO directives. This F-22 operational use of runways under FAA ODO directives is presented as the EIS No Action Alternative. As explained in Section 4.1.3, F-22 lower overflights near Sixmile Lake could increase in frequency. Coordination among FAA, Air Force, AOPA, and others continues to be needed to insure that all aircraft adhere to altitude restrictions (see Figure 2.2-3). This coordination has been added as a mitigation measure for Airspace Management and use in EIS Sections ES.6, 2.6, and 4.1.8.
MI-5	2003	Wetlands mitigation planning should begin with the U.S. Army Corps of Engineers (USACE) to determine wetlands delineations, jurisdiction and mitigations.	The anticipated impact to wetlands and appropriate mitigation measures can be found at Sections ES.6, 2.6, and 4.5.8 in the EIS. In conjunction with runway design, if additional wetlands are delineated by the USACE or additional mitigation measures are identified, the Air Force will conduct additional analysis if required by applicable law or regulation.
MI-6	2003	JBER should also prepare a BASH mitigation plan for the increased runway at RW 16/34 to reduce bird collisions with JBER aircraft.	EIS Section 4.1 explains that the existing F-22 runway departure and arrival routes would not change with Alternatives A, D, or E. Alternatives B, C, or F would have an adjusted extended RW 16 arrival profile. The EIS includes a discussion of the VFR and TACAN approaches to an extended RW 16 (Section 4.1.3) and explains that a lower glideslope would require review and possible adjustment of BASH risks and associated avoidance planning (Section 4.3.3).
MI-7	2002	Several mitigation discussions conclude with the statement the impacts are less than significant, and therefore, mitigation is not required. As per the CEQ 40 Questions document, Question 19a. Mitigation Measures, "mitigation measures...must include such things as design alternatives that would decrease pollution emissions, construction impacts, esthetic intrusion, as well as relocation assistance, possible land use controls that could be enacted, and other possible efforts. Mitigation measures must be considered even for impacts that by themselves would not be considered 'significant.' Once the proposal itself is considered as a whole to have significant effects, all of its specific effects on the environment (whether or not 'significant') must be considered, and mitigation measures must be developed where it is feasible to do so. Sections 1502.14(f), 1502.16(h), 1508.14."	The FEIS mitigation sections are revised to not have any statements that “impacts are less than significant, and therefore, mitigation is not required” and to ensure that mitigation measures are clearly identified for impacts where appropriate” Revised Executive Summary and Section 2.6 text make it more clear which mitigation measures are appropriate for which alternatives by bringing forward some of the environmental consequences summary text from the respective sections of Chapter 4.

Table A-2. Comment and Response Matrix (continued)

Code	Comment ID	Comment	Response
		Recommend the Final EIS for this project clearly identify mitigation measures for impacts where appropriate.	
NP-1	1022	I am a person with a disability. I would like to review the material on the EIS for improving the F22 operations at JBER, and I would like to have the same amount of time to review that information as individuals do that are not disabled. The information provided on the website is provided electronically by posting a series of inaccessible PDFs that do not meet the requirements for Section 508, an amendment to the United States Workforce Rehabilitation Act of 1973, is a federal law mandating that all electronic and information technology developed, procured, maintained, or used by the federal government be accessible to people with disabilities. I request that I be provided the information in an accessible electronic format and that I have the same amount of time as other able bodied individuals do to review the material and provide comments. The comment period ends September 19, 2017. For this reason, I request an extension of the commenting period and accessible electronic copies of all information on the website for review.	The Air Force used standard check programs to ensure that the website was functional, met the requirements for Section 508 of the United States Workforce Rehabilitation Act of 1973 Act (29 USC §794d), and the links to documents worked properly throughout the comment period. The comment was submitted to via email to JBER Public Affairs (PA). In an effort to accommodate the commenter's specific needs, JBER PA attempted to contact the commenter on two occasions by responding to the sender's email address, to no avail. No other comments about problems accessing the information were received. Paper copies of the Draft EIS were available at five libraries in the Anchorage area, including Z. J. Loussac Public Library, Mountain View Branch Library, Muldoon Branch Library, Chugiak-Eagle River Branch Library, and JBER Library, as published in the Notice of Availability.
NP-2	3010	Although the public hearing was an open forum, some Mountain View residents may not have voiced their concerns due to language barriers, child-care issues, schedules, or unfamiliarity with the process.	Explanations of how to obtain the DEIS and how to comment on the DEIS as well how to participate in the EIS public hearing were provided to the public in the Federal Register of August 4, 2017, and in the Anchorage Dispatch News on Saturday and Sunday, August 12-13. A substantial number of Mountain View residents and others participated in the public hearing.
NP-3	2002	Recommend identification of a preferred alternative in the Final EIS per 40 CFR 1502.15(e).	Final EIS Section 2.3.2.2 identifies the preferred alternative.
PA-1	1006, 1007, 1014, 1016, 3013	Are there alternatives being explored that would result in a reduction or minimization of noise directed at the Mountain View area? Can the F-22 be flown using short take-off and landing (STOL) procedures?	There are multiple alternatives explained in EIS Section 2.4 which would result in a reduction or no increase in noise in Mountain View (see EIS Section 4.2). As examples, runway extension alternatives reduce engine noise directed toward Mountain View during taxi and take-off. Section 2.7, Table 2.7.1 summarizes the noise effects for each alternative. The F-22 is not designed for, and cannot perform STOL procedures.
PA-2	1005	Why weren't changes in other aircraft operations (e.g., C-17) or moving other JBER flight operations to other facilities (ANC or EIL) considered?	The purpose and need is to improve F-22 operational efficiencies. The EIS does not include any changes in other aircraft operations, as explained in EIS Section 2.2.1.

Table A-2. Comment and Response Matrix (continued)

Code	Comment ID	Comment	Response
PA-3	1005	Couldn't the FAA ODO directive be mitigated by a runway use program that changes the arrival/departure configuration after the departures have left the area?	The Air Force is working closely with the FAA to address ODO issues. As described in Section 2.4.7, the Air Force and FAA have reached agreement on arrival/departure configurations which permit departures and arrivals on runways that do not conflict with FAA ODO directives. This F-22 operational use of runways under FAA ODO directives is presented as the EIS No Action Alternative.
PA-4	1012, 1015, 2002, 2003, 2004, 3005, 3008, 3012, 3015	Identification of a preferred alternative based on environmental effects.	The EIS provides detailed information and analysis of potential environmental consequences for each alternative in Chapter 4. EIS Section 2.3.2.2 explains the Air Force's preferred alternative.
PN-1	1005	Why is this action being proposed? It seems unnecessary - can't the F-22s be moved somewhere else or some other action be taken?	As described in EIS Section 2.4.8.1, the mission purpose and the need to improve efficiencies cannot be achieved by relocating the F-22 aircraft operations from JBER and replicating all the facilities required for the F-22 at a different location.
PR-1	2002, 3011	What are the effects to wetlands and potential loss of wetlands on JBER as a result of the Proposed Action.	EIS Section 4.5.2, and by extension Sections 4.5.3 and 4.5.6, explains that Alternatives B, C, and F would result in a direct impact to a preliminary estimate of 28 acres of wetlands. This represents approximately 0.37 percent of the wetlands on JBER (Section 4.5.2). The extent to which wetlands would be directly and/or indirectly affected would be defined as construction design details are fully developed should there be a runway extension and a funding decision. Mitigation measures which would include compensatory mitigation would be determined with the USACE at that time, and are discussed in EIS Sections ES.6, 2.6, and 4.5.8.
SA-1	1014, 3007	Has the safety of the Proposed Action been addressed, including the potential for accidents or fuel spills during flight operations in the vicinity of the airfield.	EIS Sections 3.3 and 4.3 explain the accident potential associated with the F-22 flight operations. Sections 3.5 and 4.5 explain the Accident Potential Zones of the JBER airfield, and that none of the alternatives would introduce changes to the APZs over populated areas. Fuel is not discharged from the F-22 aircraft during flight. Existing and proposed aircraft engine emissions are analyzed in EIS Section 4.4.
SA-2	1007	Threat of interfering with Air Force aircraft using RW 16/34 with airborne devices.	Any attempt to interfere with military aircraft or any other aircraft overflight through the use of any airborne or ground-based device would be reported to the U. S. Department of Homeland Security.
SO-1	3002, 3007, 3009	Effects of the Proposed Action on property values from increased noise, especially in the Mountain View area. Didn't see any information about property values in the Draft EIS.	The Draft EIS Appendix E.2.9 explains the effects of noise on property values. Property value text from the EIS Appendix E.2.9 has been summarized in the Final EIS Section 4.11.1 and summary Tables 2.7-1 and ES-3.

* Ehrlich, G., M. Burn, C. Murrow, and A. Stefaniw 2005. *Guidelines for Sound Insulation of Residences Exposed to Aircraft Operations*. Prepared for Department of the Navy, Naval Facilities Engineering Command, Washington Navy Yard. April.

A.10.6 Individual Forms, Letters, and Emails

1001

ENVIRONMENTAL IMPACT STATEMENT (EIS)

Draft EIS Written Comment Form

PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA

PLEASE PRINT LEGIBLY

Location: CLARK Middle School **Date:** 8-23-17

MI-1

F-22 run up area, install Noise barrier, diverter, whu to direct noise 90° upward. It made a BIG difference at MyrTle Beach AFB. in 1977 with the A-7s run up noise.

**** CONTINUE ON BACK FOR MORE SPACE ****

Individual respondents may request confidentiality. If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act (FOIA), you must state this prominently at the beginning of your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals or officials representing organizations or businesses, will be made available for public inspection in their entirety.

Name: Loren Gilbert

Organization: Retired AF

Address: [redacted]

City/State/Zip: [redacted]

☑ **Yes, include my name and address on the mailing list so I can receive information on the *Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson, Alaska EIS.***

☐ **No, do not include my name and address on the mailing list.**

Please turn in this form or mail by September 19, 2017, to:
JBER Public Affairs, Bldg. 10480 Sijan Ave., Suite 123, JBER, AK 99506

For additional project information, please visit our website: www.jberf22eis.com

1002

ENVIRONMENTAL IMPACT STATEMENT (EIS)

Draft EIS Written Comment Form

PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA

PLEASE PRINT LEGIBLY

Location: [redacted] Date: 08-23-17

I was @ Polar Bear Park on Pine St. today while the F22's were flying right over head. I do not know how anyone in that living vicinity can stand to live there because of the noise. My brave little 3½ yr old grandson put his hands over his ears as they were flying over head scared to death of the loudness

EJ-2

I reside in Chester Valley subdivision where the F22's circle right over head of my house. The windows rattle so much at times you think the windows will break

AE-2

Some of my company from "lower 48" thought we were having earthquake while in bed and put pillow over their head. We need Sound proof windows like they installed near

MI-2

international airport. I love the military being here and am honored to live here.

**** CONTINUE ON BACK FOR MORE SPACE ****

Individual respondents may request confidentiality. If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act (FOIA), you must state this prominently at the beginning of your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals or officials representing organizations or businesses, will be made available for public inspection in their entirety.

Name: Carolyn Graham

Organization:

Address: [redacted]

City/State/Zip: [redacted]

☑ Yes, include my name and address on the mailing list so I can receive information on the *Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson, Alaska EIS.*

☐ No, do not include my name and address on the mailing list.

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1003

ENVIRONMENTAL IMPACT STATEMENT (EIS)

Draft EIS Written Comment Form

PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA

PLEASE PRINT LEGIBLY

Location: Clark Jr High School, Anc AK **Date:** 8-23-17

The USAF has done its homework well and presented its work well. I agree with its approach and favor the alternatives that include the NS runway extension. It should be noted that ALT B, E & F all have the added benefit of allowing better fulfillment of JBER's mission in time of war should runway 06/24 become inoperable.

I have lived in the 16-34 flight path in 1971-2 and continually since 1977. I do not see better alternatives than are presented and support the draft EIS.

While I am not an expert in air safety it also appears that extending the NS runway significantly ~~reduces chance~~ improves safety of air operations.

**** CONTINUE ON BACK FOR MORE SPACE ****

Individual respondents may request confidentiality. If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act (FOIA), you must state this prominently at the beginning of your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals or officials representing organizations or businesses, will be made available for public inspection in their entirety.

Name: G. Rex Plunkett

Organization: UAA

Address: [redacted]

City/State/Zip: [redacted]

☒ Yes, include my name and address on the mailing list so I can receive information on the *Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson, Alaska EIS.*

☐ No, do not include my name and address on the mailing list.

Please turn in this form or mail by September 19, 2017, to:
JBER Public Affairs, Bldg. 10480 Sijan Ave., Suite 123, JBER, AK 99506

For additional project information, please visit our website: www.jberf22eis.com

1004

ENVIRONMENTAL IMPACT STATEMENT (EIS)

Draft EIS Written Comment Form

PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA

PLEASE PRINT LEGIBLY

Location: Clark JR. High. **Date:** 8-23-17

I WANted people to be AwaRe
MI-3 of A cheap and effective product to mitigate Noise in residences and Businesses. It's an Acrylic window
insert creating another layer of ACCoustical shielding. The Accoustical version reduces dBa 10-12 dBa in a typical residence with existing double paNE windows. It HAS A STC. rating of 42-45.

Perhaps giving residents effected By the New Noise pollution would be helPFul.

Link to product. iNdowwindows.com

**** CONTINUE ON BACK FOR MORE SPACE ****

Individual respondents may request confidentiality. If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act (FOIA), you must state this prominently at the beginning of your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals or officials representing organizations or businesses, will be made available for public inspection in their entirety.

Name: Ryan Kennedy

Organization:

Address: [redacted]

City/State/Zip: [redacted]

☒ **Yes, include my name and address on the mailing list so I can receive information on the *Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson, Alaska EIS*.**

☐ **No, do not include my name and address on the mailing list.**

Please turn in this form or mail by September 19, 2017, to:
JBER Public Affairs, Bldg. 10480 Sijan Ave., Suite 123, JBER, AK 99506

For additional project information, please visit our website: www.jberf22eis.com

1005	8/23/2017	john brown	self, private pilot	PN-1 PA-3 PA-2	I do not think a substantial change is necessary to gain the efficiencies this effort is seeking. The operations I have observed at EDF over the years involve departure surges followed by arrival surges with 30+ minutes in between. The impact of the FAA ODO directive could easily be mitigated by a runway use program, that changes the arrival/departure configuration after the departures have left the area. Aircraft returning early or departing late might have to use the slightly less efficient RY for their operations, but this would impact very few aircraft. EDF could also restrict itinerant aircraft arrivals and/or heavy jet operations during certain times of the day to accommodate the fighter jet operation. Moreover, one part of the solution should be to move the transient heavy lift operations away from EDF altogether. These operations could easily be relocated to ANC or to Eielson AFB (EIL). Both these airports have existing facilities that could handle these aircraft and EIL is well suited to these operations with a local fuel supply, huge runway and superior location for many great circle routes to/from Asia. The EDF based C17s should also be considered for relocation. These aircraft are already conducting much of their in flight training away from EDF due to the congestion in and around EDF. They are frequently at Kenai and at the Fairbanks area airports conducting training flights. These inefficiencies should be considered as part of this effort. I oppose any major permanent changes to the current EDF fighter jet operations. The Air Force should instead look to more flexible use of their existing facilities.
1006	8/23/2017	Diane Heaney-Mead	Resident	EJ-2 PA-1	Any changes that would increase noise in Mountain View is unacceptable. The current noise levels already have adverse impact on the ability of infants to sleep and develop language skills. While the elementary school has made improvements our homes and yards where our young children play are not protected. In addition to extending the runway, I would like to see JBER look at options for minimizing the engine noise directed at Mountain View during taxi and take off.

1007	8/23/2017	Marc Grober	ICS	SA-2 AE-2 EJ-2 PA-1	As JBER has been repeatedly advised over the past decade, noise pollution for which it is responsible already exceeds any civil standards for the neighboring communities. Indeed, the touch and goes now engaged in by heavy body aircraft out of the north-south runway has been so intrusive that some members of the community bordering the base were considering floating barrage balloons as the aircraft were thundering in below 500 feet and were breaking windows. In fact, the FAA had to admit that when they tried to contact JBER about this, the FAA could not make effective contact with anyone at JBER for three days, and then they were told that JBER had explained what was going to happen ahead of time, and frankly, that was all JBER had to say about it. The exercises that the jets are at JBER are currently participating in produces sound waves that would require hearing protection for students at Nunaka Elementary School, while the arms fire worries people and pets who are frightened that there are home invasions taking place. But JBER already knows all this, as it also knows that its proposals with regard to lifting the already inadequate constraints are wholly unacceptable. And infiltrating the local school district with military castoffs does not alter the situation. The fact of the matter is that JBER is a bad neighbor. I live over a mile from the JBER gate and have regularly complained about the loudspeakers, and yet every day I can hear reveille clear as a bell, despite the fact that sound is directional and I live in the opposite direction. No matter what the local community has to say, JBER is going to produce unacceptable levels of noise; frankly JBER always has, and we have seen nothing from JBER that suggests that JBER is in any way really considering putting an end to the noise. Indeed, as we see in the Air Force's intended action, that the Air Force fully intends to make living in North Anchorage untenable. I think the best way to increase operation efficiency is to shut the F-22 wing down completely. Short of that the most important aspect of operations should not be punishing the people you are supposed to be serving. Use the east-west runway and do not engage in high thrust maneuvers or high acceleration in the vicinity of the civilian community (i.e. within 5 miles). Practice landings in Adak. Try and show some respect for the local community (as opposed to assuming your welcome simply because you think you have bought your welcome).

1008	8/23/2017	Glenn Teela		We live and own a home near the corner of [redacted] and we truly do appreciate the time and training required to maintain operational readiness for all crews involved. Please do your best to maximize the operational efficiency of the F-22's into and out of JBER. The increase in sound from more flights is a small price to pay in support of your mission. Thank you ladies and gentleman for your service, and bring the noise.
1009	8/24/2017	Marcie DeCarli		I'm IN FAVOR of the change.
1010	8/24/2017	Tina Roberson		Good Afternoon, I was not able to attend the public meeting at Clark yesterday, August 23rd, 2017. I'd like to share with you my thoughts on the noise in the Mountain View neighborhood... It doesn't bother me in the slightest. It's actually quite the opposite. My 3 year old daughter and I live on [redacted] and we thoroughly enjoy the military flying over us and the noise that comes with it. It's gives us a sense of protection. Many times I've had her watch the planes fly over with me and I tell her that they keep us safe. I want her to understand that that's what the military is and I want her to grow up respecting those who serve our country and keep us safe. I've actually thought about moving out of the neighborhood but then I've thought, "no, I would miss my planes" and I shrug it off! I can't imagine NOT having the F-22's flying over us. Thank you for protecting and serving! Tina L. Roberson

1011	8/25/2017	[redacted]	Homeowner		I request confidentiality in regard to using my name and address. I live across Glenn Hwy from Elmendorf air field. The noise of jet aircraft flying over my house at low altitudes is very very loud. I have dealt with this for many years and agree that by living in a home close to an air base this should be expected. Hearing that the noise may become even louder in the future disturbs me greatly. My windows rattle now. I cannot talk on the phone until the plane passes over head, My husband teases me that I can tell the color of the pilot's eyes, they fly so low sometimes. Please don't make the noise worse for the residents near the air base. We support our military and know their training is very important to our countries safety. Economy on fuel is important as well but we all need to take into consideration the well-being of those who live here. Is the savings the only consideration?
1012	8/25/2017	Nicholas Charles	Knik Tribe	PA-4	Hi, My wife and I have a daughter and two granddaughters that live, work and attend school in Mountain View. We also have other friends and relatives that live there. My wife and I are concerned about noise pollution that would increase with the proposed action to increase efficiency for the F22 aircraft departing and leaving JBER runways. We believe that Alternative C that allows take-off on RW34 and landing on RW16 would be best considering the health and welbeing of our family members in Mountain View. Alternative C would also be beneficial for increasing employment and income during construction of the runway extension. Sincerely, Nicholas & Maria Charles [redacted]
1013	8/27/2017	John Don		EJ-3 MI-1	Please, do not make changes that will create more noise for the Mt. View neighborhood. It is a proven fact that noise can make people physically and emotionally ill. I am in my senior years, retired. I can remember when jet engines were removed for testing, the noise was horrible until some sort of baffles were built, that noise effected me greatly as did the Hercs when reversing engines. Please use some quieter alternative. I appreciate the military and served myself when young.

1014	8/31/2017	vern olson	home owner SA-1 PA-1	jets flying over schools in mt view are verydisruptive and dangerous!!! open an airfiekd on the north pole (tactica advantage). ALSO, SEND AIRFORCE PILOTS TO AIRCRAFT TRAINING FOR 3 TO 6 MONTHS,SHORT TAEOFF /LANDING EXERIENCE. THEN INSTALL AIRARRIER TYPE EQUIPMENT ON LAND-FUEL SAVINGS WOULD CVER CSTS, it is a disgrace byelmendorfto disrupt everyday lives of mt.view people!!!!
1015	9/5/2017	phil waters	PA-4	As a resident of MT. View on [redacted]. I'M already exposed to noise levels exceeding 114 db produced by the F22 flights above [redacted] Extending the runway to the north should help with the current noise problem and future noise created by more takeoffs to the north. With the current federal administration, this might be the best time to get it done. Have a good day!
1016	9/7/2017	James Glen Welker	Personal PA-1	I live with in 1/2 mile of the Boniface Gate, and when the jets fly over my house, I am unable to here even my lawn mower running. I am sure the jets are several hundred feet off theground, but they seem as if they are in my driveway. If there is anyway to move your flight pattern away from this residential area, we all would be very appreciative!!!
1017	9/8/2017	Guy todd	EJ-2	North to south landing at night is so loud. During the day hey I get it most of the city is up then. But after 9pm it's so loud going over my house scares my kids sometimes
1018	9/12/2017	John		Waaaaaaaaaaaaaaay tooooooooooo much noise on [redacted] street in Mt.View. Please find a quieter solution!. Long time resident.
1019	9/19/2017	Genie Hughes	Mt. View resident PA-4	At the most recent Mt. View Community Council meeting, it was shared that the following day construction on runways would stop so that community residents could hear what noise levels with Proposal A would be. I let a number of friends know that this would be occurring since I would be at work. They all informed me that noise levels were very high. I also noticed that upon my return home from work my cat and dog were on edge: agitated and jumpy. It is very difficult to determine which proposal would be best for all because I don't know what pilots require for take-off and landing, and I don't know how the sound will carry from different rundways; therefore, I simply request that the approach/arrival paths chosen be those that leave Mt. View as quiet as possible and have the least environmental impact. I understand that there is a need for increased efficiency, but as members of JBER deploy and transfer, it is the residents of Mt. View who will be made to suffer any long-term increases in noise. Thank you very much for your

				consideration.
1020	9/20/2017	Tauveve Filoialii Jr.	EJ-2	I have a family of six and it is very difficult for my kids to do their studies when these planes fly over. I support the military being that I once served myself, but an increase of fly overs would truly disturb our quality of life.

1021 Dear Sirs:

We totally support whatever it takes to REDUCE JET NOISE over east ANC. We live at E 16th and Karluk (south Fairview). When JBER is using their north/south rw, it's just awful-------to the point we talk about moving. We think that extending the n/s rw is a great idea.

Chuck/Kelly Wirschem

[redacted]

1022 I am trying to review the information available to me at this website:
http://www.jberf22eis.com/index.aspx

NP-1

I am a person with a disability.

I would like to review the material on the EIS for improving the F22 operations at JBER, and I would like to have the same amount of time to review that information as individuals do that are not disabled.

The information provided on the website is provided electronically by posting a series of inaccessible PDFs that do not meet the requirements for Section 508, an amendment to the United States Workforce Rehabilitation Act of 1973, is a federal law mandating that all electronic and information technology developed, procured, maintained, or used by the federal government be accessible to people with disabilities.

I request that I be provided the information in an accessible electronic format and that I have the same amount of time as other able bodied individuals do to review the material and provide comments.

The comment period ends September 19, 2017. For this reason, I request an extension of the commenting period an accessible electronic copies of all information on the website for review.

Thank you.

Please submit response and documents to:

judy_kesler@[redacted]

A.10.7 Agency/Organization/Company Letters

2001

STATE CAPITOL
P.O. Box 110001
Juneau, AK 99811-0001
907-465-3500
fax: 907-465-3532

Governor Bill Walker
STATE OF ALASKA

550 West Seventh Avenue, Suite 1700
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907-269-7450
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www.Gov.Alaska.Gov
Governor@Alaska.Gov

September 15, 2017

673 ABW/PA
10480 Sijan Avenue, Suite 123
Joint Base Elmendorf-Richardson, AK 99506

RE: Draft Environmental Impact Statement for the proposal to improve F-22 operational efficiency at Joint Base Elmendorf-Richardson, Alaska

To Whom It May Concern:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson. The State of Alaska appreciates the U.S. Air Force's (USAF) commitment to present and future mission sets in Alaska and looks forward to fostering and expanding our strong partnership. Both the USAF and the State support actions which best meet military mission requirements while minimizing potential impacts to Alaska communities; we look forward to continuing this mutually beneficial relationship.

The State of Alaska Supports the Proposed Action.

The Proposed Action enhances the 90th and 525th Fighter Squadrons' ability to rapidly deploy combat aircraft to training and live action situations by maximizing runway availability for departures and arrivals. The Proposed Action increases flexibility of runway and airspace use by eliminating or minimizing present constraints, and takes into account air traffic safety and noise concerns. Flying directly to training areas will increase time spent actually engaged in training activities and maximize benefits of pilot training exercises. Use of all available runways will allow for more efficient use of fuel, reduce air traffic congestion – thus improving air safety and reducing civilian and military flight delays – and help minimize operations which might create additional noise over residential and noise-sensitive areas.

The USAF presents extensive analysis of potential noise and other impacts to multiple neighborhoods under each alternative, and offers several useful mitigation measures. When it envisions unavoidable impacts, the USAF clearly identifies them. The Air Force will inform residents of affected communities of operations, exercises, and other circumstances that may change noise patterns, and clearly commits to long-term work with those communities to seek solutions to ongoing concerns.

2001
cont'd

Draft Environmental Impact Statement for the proposal to improve F-22 operational efficiency at Joint Base Elmendorf-Richardson, Alaska
September 15, 2017
Page 2

Overall, the Proposed Action is a thoughtful blending of meeting military mission requirements and accommodating community concerns. The State of Alaska is pleased to support it.

Sincerely,

Bill Walker

Bill Walker
Governor

cc: Major General Laurie Hummel, The Adjutant General, Alaska National Guard, and Commissioner, Department of Military and Veterans Affairs
The Honorable Marc Luiken, Commissioner, Alaska Department of Transportation and Public Facilities

2002

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101-3140

OFFICE OF
ENVIRONMENTAL REVIEW
AND ASSESSMENT

September 15, 2017

JBER Public Affairs
Bldg. 10480
Sijan Ave., Suite 123
Joint Base Elmendorf-Richardson, Alaska 99506

Dear Sir or Madam:

We have reviewed the US Air Force Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson, Alaska, Draft Environmental Impact Statement (CEQ Project Number: 20170146/EPA Region 10 Project Number: 15-0054-DOD). Our review was conducted pursuant to the National Environmental Policy Act, the Council on Environmental Quality regulations (40 CFR §1500-1508) and Section 309 of the Clean Air Act. Section 309 directs the EPA to review and comment in writing on the environmental impacts associated with all major federal actions.

Our review of the Draft EIS prepared for the proposed action considers expected environmental impacts and the adequacy of the EIS in meeting procedural and public disclosure requirements of the NEPA. We are assigning the Draft EIS an overall adequacy rating of 1 (Adequate Information). We found the Draft EIS to be well-written and complete with helpful tables and diagrams. We also believe the five action alternatives reflect a wide range of reasonable alternatives and are responsive to issues identified in the scoping process, as well as meet the purpose and need.

Because a preferred alternative is not identified in the Draft EIS, we have also assigned an impact rating for each alternative (see table below). Rationale for the impacts ratings is given below by alternative; a copy of our rating system with more information is attached.

	Alternative	Rating	Justification
PA-4 AE-3	Alt A (RW 34 for Departure; RW 06 Arrival)	LO (Lack of Objections)	Do not object but note measurable noise impacts to off-base populations
PR-1 HM-1	Alt B (RW 16/34 Extension; RW 34 for Departure; RW 06 for Arrival)	EC (Environmental Concerns)	Impacts to approximately 28 acres of wetlands; potential for contaminated soils
PR-1 HM-1	Alt C (RW 16/34 Extension; RW 34 for Departure; RW 16 Arrival)	EC (Environmental Concerns)	Impacts to approximately 28 acres of wetlands; potential for contaminated soils
	Alt D (RW 06 for Departure and Arrival)	LO (Lack of Objections)	Do not object
	Alt E (RW 24 for Departure; RW 06 Arrival)	LO (Lack of Objections)	Do not object

2002
cont'd

PR-1 HM-1 Alt F (RW 16/34 Extension; RW 24 for Departure; RW 16 Arrival)	EC (Environmental Concerns)	Impacts to approximately 28 acres of wetlands; potential for contaminated soils

PA-4 NP-3 Overall, we believe Alternatives A, D and E are environmentally preferable due to the lack of impacts to wetlands and avoidance of potentially contaminated soils. We do not object, however, to the selection of any of the other action alternatives in the Record of Decision. We strongly recommend the identification of a preferred alternative in the Final EIS per 40 CFR 1502.14(e) unless expression of such a preference is prohibited by law.

Mitigation

MI-7 Mitigation discussions are included throughout Chapter 4. We appreciate that mitigation is identified in the effects analysis on each resource. We are concerned, however, that several mitigation discussions conclude with the statement the impacts are less than significant, and therefore, mitigation is not required.

We note that the CEQ 40 Questions document, Question 19a. Mitigation Measures, addresses this issue and states the "mitigation measures discussed in an EIS must cover the range of impacts of the proposal. The measures must include such things as design alternatives that would decrease pollution emissions, construction impacts, esthetic intrusion, as well as relocation assistance, possible land use controls that could be enacted, and other possible efforts. Mitigation measures must be considered even for impacts that by themselves would not be considered "significant." Once the proposal itself is considered as a whole to have significant effects, all of its specific effects on the environment (whether or not "significant") must be considered, and mitigation measures must be developed where it is feasible to do so. *Sections 1502.14(f), 1502.16(h), 1508.14*." We recommend the Final EIS for this project clearly identify mitigation measures for impacts where appropriate[1].

Coordination with EPA CERCLA Program

HM-1 The Draft EIS identifies the possibility of contaminated soils within the runway expansion area with Alternatives B, C and F. We encourage close coordination with our Superfund Program Remedial Project Manager, Sandra Halsted, should any of these alternatives be selected and as project construction proceeds. Ms. Halsted can be reached at (907) 271-1218 or halstead.sandra@epa.gov.

Thank you for this opportunity to provide comments on the Draft EIS. If you have any questions, please contact Jennifer Curtis of my staff at (907) 271-6324 or curtis.jennifer@epa.gov, or contact me at (206) 553-0248 or nogi.jill@epa.gov.

Sincerely,

Jill A. Nogi, Manager
Environmental Review and Sediments Management Unit

Enclosure:
1. U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements

[1] https://energy.gov/nepa/downloads/forty-most-asked-questions-concerning-ceqs-national.-environmental-policy-act

2

2002
cont'd

U.S. Environmental Protection Agency Rating System for
Draft Environmental Impact Statements
Definitions and Follow-Up Action*

Environmental Impact of the Action

LO – Lack of Objections

The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns

EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections

EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory

EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

2003

KNIK TRIBAL COUNCIL

KNIK, THE OLDEST VILLAGE IN COOK INLET

August 25, 2017

Mathew D. Smith, P.E., Capt, USAF
673 ABW/PA
10480 Sijan Ave., Ste. 123
Joint Base Elmendorf Richardson, AK 99506

RE: ENVIRONMENTAL IMPACT STATEMENET (EIS) FOR THE PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCY AT JOINT BASE ELEMENDORF-RICHARDSON, ALASKA.

Dear Capt. Smith:

Knik Tribe has reviewed the above Draft EIS outlining the proposed alternatives for improving the operational efficiency for F-22 aircraft departures and arrivals on JBER's runways. Knik Tribe's traditional territories extend throughout the Upper Cook Inlet including JBER. The tribe has significant cultural and historical resources throughout its traditional territories. The tribe's membership includes members and other family members who live in the Anchorage Bowl, particularly in the directly affected Mountain View area.

PA-4 The Tribe has considered the proposed action, Alternative A against Alternatives B, C, D, E, F, and the No Action Alternative, and has determined that Alternative C provides the most in terms of protecting the well-being, health and safety of its members and other family members who are affected by and live in the directly affected area. While potentially reducing noise over off-base residential and other noise sensitive areas, Alternative C would increase efficiency and provide more airspace training time, a significant factor in air force preparedness. EJ-2 The tribe agrees with many of the responses at the recent public hearing that noise pollution is a daily fact of life for residents, and vulnerable elders and children. EJ-3 Proposing to increase the noise pollution to residents, vulnerable elders and children is an important consideration in determining what alternative is selected to be implemented.

MI-4 While Alternative C is inconsistent with FAA ODO policy, JBER can institute a management plan required to address ODO policy. Deliberations between JBER and FAA should begin and a management plan be developed and incorporated into the Final EIS. This management plan should also include managing interactions with general aviation at Sixmile Lake. MI-5 Wetlands mitigation planning should begin with the USACE to determine wetlands delineations, jurisdiction and mitigations. MI-6 JBER should also prepare a BASH mitigation plan for the increased runway at RW 16/34 to reduce bird collisions with JBER aircraft.

Sincerely,

Richard Porter
Executive Director

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(907) 373-7991
(907) 373-7993
FAX: (907) 373-2161 E-MAIL: RPORTER@KNIKTRIBE.ORG

2004

MUNICIPALITY OF ANCHORAGE

Planning Department (907) 343-7931

Mayor Ethan Berkowitz

September 19, 2017

Submitted via email: jber.pa.3@us.af.mil

Captain Mathew D. Smith, P.E., USAF
Deputy, Air Force NEPA Division
Environmental Management Directorate
Department of the Air Force
c/o 673 ABW/PA
10480 Sijan Avenue, Suite 123
JBER, AK 99506

RE: EIS FOR THE PROPOSAL TO IMPROVE F-22 OPERATIONAL EFFICIENCEY AT JBER, AK

Dear Captain Smith:

PA-4

Thank you for the opportunity to review and submit comments on this vital project. Please consider this a letter of support for the F-22 Operational Efficiency ES.4.1.6 Alternative F. Alternative F will reduce over-flights of the Mountain View neighborhood, which is located in Accident Protection Zone-1 (APZ-1), while increasing flights near the Government Hill neighborhood. Alternative F would therefore reduce noise and environmental impacts on Anchorage's most economically-challenged and ethnically-diverse neighborhood Mountain View, while potentially increasing impacts on Government Hill by increased departures and approaches over the Cook Inlet.

The JBER-edge neighborhoods of Government Hill and Mountain View will be impacted most by the proposec F-22 increase in operational efficiency. We have provided background information and recommendations tc assist the USAF in mitigating noise and operational impacts that may result from project implementation.

The following information and comments relate to two programs managed by the municipal Long-Range Planning Division of the Planning Department. This includes the Anchorage Historic Preservation Program and the Neighborhood Planning and Neighborhood Plan Implementation.

Anchorage Historic Preservation Program

CR-1

The Anchorage Historic Preservation Commission (AHPC) received an invitation to comment on the F-22 EIS on July 26, 2017. The AHPC would like to be immediately informed of any impacts to historic or cultural properties, or historic or cultural artifacts that may be found during construction. Mitigation would also include input from the AHPC. We understand that any Dena'ina or homesteader artifacts found in the Area of Potential Effect should be handled in compliance with Section 106 of the National Environmental Policy Act.

Neighborhood Planning and Neighborhood Plan Implementation

The Anchorage 2020—Anchorage Bowl Comprehensive Plan contains a policy (#7) that seeks to avoid incompatible uses adjoining one another. The following comment and recommendations address potential mitigation of JBER operational impacts on JBER-edge neighborhoods.

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Captain Mathew D. Smith, P.E., USAF
September 19, 2017
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The Mountain View Targeted Neighborhood Plan (MVTNP) (adopted in 2016) acknowledges the impact of JBER on the land uses in this part of Anchorage, as well as noise impacts due to JBER's proximity to Mountain View. The Plan states that aircraft noise impacts are "heard throughout most of the neighborhood as well as inside Mountain View Elementary School during the school day" (MVTNP, p. 33). The Plan is silent on the issue of noise mitigation remedies, while seeking to retain existing single-family residential units located within the APZ-1, which is deemed a high-risk zone.

The Government Hill Neighborhood is not located within the APZ-1; however, there is also noise impact from JBER flight operations on this neighborhood. The construction of ES.4.1.6 Alternative F would increase F-22 flights in an area adjacent to Government Hill. The following recommendations also include noise-impact mitigation for both Mountain View and Government Hill.

Recommendations

CR-1
* The AHPC agrees with Section 4.8 of the EIS that includes the recommendation to "implement the JBER ICRMP SOP 5.2, Reporting Unanticipated Cultural Resources, and 5.3 Unanticipated Human Remains, for cultural resources that may be encountered during clearing, excavation, or construction related activities."

MI-2
* Noise mitigation by window replacement is encouraged at the Mountain View Elementary School and the Government Hill Elementary School.

* Noise-mitigation window replacement is also encouraged for single-family and multi-family housing located within 50 feet of the JBER fence line in both Government Hill and Mountain View.

PA-4
* ES.4.1.6 Alternative F: RW 24 for Departure; RW 16; RW 16/34 Extension as described in the EIS, and as presented to the public on August 23, 2017, is the most viable option to reduce impacts to the JBER edge neighborhoods.

Please contact me at 343-7901 or at harthh@muni.org for any questions or comments on these recommendations.

Sincerely,

Hal H. Hart

Hal H. Hart, AICP
Planning Director

cc: Kristine Bunnell, Senior Planner
Jon Cecil, Senior Planner
File

2005

AOPA
your freedom to fly

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September 13, 2017

JBER Public Affairs
Bldg. 10480, Sijan Ave., Suite 123
JBER, AK 99506

Re: ***Proposal to Improve F-22 Operational Efficiency at Joint Base Elmendorf-Richardson, Alaska: Draft Environmental Impact Statement.***

To Whom It May Concern:

The Aircraft Owners and Pilots Association (AOPA), the world's largest aviation membership association, submits the following comment in response to the Draft Environmental Impact Statement (DEIS) prepared by the United States Air Force (USAF) to improve F-22 operational efficiency at Joint Base Elmendorf-Richardson, Alaska (JBER). AOPA supports the mission of the USAF and understands their need to operate continuously at JBER.

General aviation has a long history of collaborating with the military to ensure each other's airspace needs are understood and safely accommodated. In review of the DEIS, we are concerned the long-term airspace impacts of the proposed runway changes are not being fully considered and communicated to the public. We believe the DEIS is incomplete given the lack of transparency on airspace modifications the changes in runway utilization are likely to trigger. The USAF must work with the Federal Aviation Administration (FAA) to document the airspace actions that are likely subsequent to any proposed alternative being implemented.

Alaska's reliance on aviation

Alaska relies on aviation more than any other state in the union. According to *The Economic Contribution of the Alaska Aviation Industry to Alaska's Economy*, Northern Economics, Inc., the aviation industry in Alaska contributes \$3.5 billion, or approximately 8%, of the gross state product. This 2009 report highlights the fact that this is almost 40% greater than the industry's role in the national economy. This figure demonstrates the importance of the aviation industry to Alaska's economy. An estimated 47,000 jobs are directly and indirectly related to aviation in the state of Alaska.

Aviation not only has a significant economic impact in Alaska, it is the only manner many communities are accessible. On February 17, 2017, the FAA published a story in the *FAA Daily Broadcast* stating 82% of Alaska's communities are not accessible by road. Some communities may be accessible by barge; however, much of the year the water ways freeze over leaving only aviation to provide basic access, deliver healthcare, food, and to ensure these communities can send and receive mail on a year-round basis. The average number of enplanements per capita for off-road communities in Alaska is between eight and thirty times higher than in comparable communities in western rural states. Alaskans tend to rely on air freight 39 times more than

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comparable communities according to a 2009 study published by the Alaska Department of Transportation & Public Facilities.

Parallel Anchorage Bowl airspace study not addressed

The DEIS notes the large number of civil aircraft operations in close proximity to JBER. General aviation is heavily concentrated in the Anchorage Bowl, operating in and out of airports and seaplane bases only a few miles apart. The DEIS states "the overall manner in which the high density Anchorage Bowl airspace is configured, managed, and used…has provided a safe, efficient, and reasonably compatible airspace environment that meets both military and civilian aviation needs." AOPA concurs with this statement and agrees it is through our collaboration with the military that this airspace has worked so well. We are concerned that the DEIS does not address the airspace modifications that are likely to be required following the utilization of new runway configurations. We believe the USAF must fully document the airspace modifications that may be triggered by this action and that may upset the current balance between civil and military operational needs.

AM-1

General aviation and other civil aviation stakeholders have been unable to participate in the USAF and FAA effort to define a scoping document for an Anchorage airspace study. The need for such a study is directly tied to the USAF's desire for an additional Instrument Landing System (ILS) approach at JBER. Installing an ILS approach for Runway 16 at JBER could have significant airspace impacts in the congested and complicated Anchorage Bowl airspace. The proposals laid out in the DEIS could further increase air traffic's utilization of unusual landing and departing configurations that will eventually overtax the existing airspace structure such that a redesign becomes required. The USAF must address their parallel proposal to install the Runway 16 ILS and what the airspace impact would be in concert with this action.

AM-2

The DEIS mentions the "Cartee" airspace located south of JBER but the document does not discuss what the proposed change's impact will be on the utilization of this airspace cutout. Understanding JBER must control "Cartee" airspace to ensure safe operations while in certain configurations, the USAF must detail what increase or decrease in "Cartee" activation will be a result of this proposal. "Cartee" airspace activation has a negative impact on operational efficiency at Merrill Field (PAMR), and more frequent activation could result in pilot confusion, increased workload, and needless airspace violations unless additional mitigations are put in place. The USAF should be transparent about their proposal's effect on this airspace segment to ensure general aviation is aware of the impact.

AM-3

Impact on civil IFR aircraft not addressed

The change proposed for the F-22's runway utilization at JBER could have an adverse impact on IFR general aviation traffic flying in and out of PAMR and Ted Stevens Anchorage International Airport (PANC). In our review of the proposal, we foresee an increase in arrival and departure delays for civil IFR traffic due to the new flight patterns by the F-22. The USAF should document the anticipated impact on IFR aircraft, either awaiting a departure release or inbound for an instrument approach, for those operations at airfields located in the Anchorage Bowl, and the USAF should note which alternative results in the most minimal impact.

AM-4

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

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Conclusion

AM-5

AOPA recognizes and fully supports the USAF's need to train as they fight and to do so economically and efficiently. We can foresee the proponent utilizing new runway configurations that overtime strain the existing airspace structure and lead to an unsustainable situation. The USAF must address this oversight in the DEIS given airspace changes are not being fully considered. This proposal has the possibility of disrupting general aviation operations in the Anchorage Bowl so the impacts must be fully considered before any alternative selected.

Thank you for reviewing our comment on this important issue. Please feel free to contact me at 202-509-9515 if you have any questions.

Sincerely,

Rune Duke
Director, Airspace and Air Traffic

The Aircraft Owners and Pilots Association (AOPA) is a not-for-profit individual membership organization of General Aviation Pilots and Aircraft Owners. AOPA's mission is to effectively serve the interests of its members and establish, maintain and articulate positions of leadership to promote the economy, safety, utility, and popularity of flight in General Aviation aircraft. Representing two thirds of all pilots in the United States, AOPA is the largest civil aviation organization in the world.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

A.10.8 Public Hearing Transcripts

PUBLIC COMMENTS

GERAN TARR

3001

MS. GERAN TARR: Good evening. Geran Tarr, G-e-r-a-n T-a-r-r, the State Representative for the Mountain View area.

This has been something that the neighbors here have been working on for a number of years and have been actively engaged in, regarding the sound issues. Recently the Mountain View Elementary School was remodeled, in large part to upgrade it to be able to accommodate the noise. It's very disruptive for the students. They have to stop classes for the entire time that the flights are happening overhead.

EJ-2

So as we move forward in this process, I hope, you know, those considerations are taken seriously and -- and that we really think about the long-term impact to the neighborhood.

We'll study it more carefully, and hopefully, the community council will discuss this at length at the upcoming meeting and probably have formal comments.

But this is a disadvantaged area and the residents have a lot of changes, you know, just dealing with some of the neighborhood issues. Certainly the sound adds to that and could really impact the quality of life. So -- so we'll be really focused on those issues in our

AE-3

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3001 cont'd

comments and hope you will, as well. And that we think really more long term about what this means, you know, 10, 20 years from now. And if now is the right time to push for construction of that extended runway, that will accommodate, you know, the more long-term needs, then -- then hopefully that's what we can push for at this time.

Thank you.

LIEUTENANT COLONEL JIMENEZ: Donald Crandall.

DONALD CRANDALL

3002

MR. DONALD CRANDALL: My name is Donald Crandall, C-r-a-n-d-a-l-l.

I would just like to kind of ditto what Geran Tarr said. I think I would like to emphasize the importance of safety and efficiency and reducing aircraft congestion in the Anchorage Bowl area. And I think those can be done by extending the Runway 34. And I think that's the best solution, the best long-term solution, the best economic solution.

You mentioned the number $150 million.

SO-1

There's been a lot of money that's been put into the Mountain View neighborhood in the last 12, 15 years: Well over a million dollars just in improving the quality of housing, to say nothing about a renovated school -- two renovated schools, a library; and dozens of businesses have invested their own money to make improvement, to make

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3002 cont'd

SO-1

this a more viable and vital neighborhood. I would hate to see that degraded by something that's out of our control and that can be remedied in other ways.

The extension is, I think, the long-term benefit and the efficient one, and I hope that this is something that the military and our congressional delegation will be looking into carefully.

Thank you.

LIEUTENANT COLONEL JIMENEZ: Don Renkel.

DON RENKEL

3003

MR. DON RENKEL: I'll be brief. I'm very proud to say that I'm a vet. Operations like this are something that really make me feel good about the military, as compared to what goes on in a lot of other countries. But I'm -- I stand right by you, I love being around you, and I think you've got a real good system here. And I hope you get a better turnout for it, because I think more people ought to be interested in it and appreciate it.

Thank you.

LIEUTENANT COLONEL JIMENEZ: Ryan Kennedy

RYAN KENNEDY

3004

MR. RYAN KENNEDY: Howdy. I'm a -- I'm a carpenter by trade, and I do -- I do a lot of low income weather- -- weatherization, and I wanted -- I wanted to

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make you guys aware of a -- I know that the Anchorage airport, they had -- I don't know the details. I was given short notice on this. But they had a program to retrofit houses with new windows on, you know, places that were affected by new -- you know, all the noise and whatnot. That's very expensive. And I wanted to make you aware of a product that I found.

I did -- I did a lot of lower-income weatherization, and we never touched windows. And the reason we didn't is because they're very intensive to replace.

But last year I discovered this product. It's called Indow Windows, and it's -- it's a plastic acrylic, and it's friction fit, and it reduces -- you know, the acoustic -- I'm sorry, I don't like public speaking. That's why I'm a carpenter. You don't have to speak in public. Right?

It reduces -- the acoustical grade, it has a sound -- it reduces decibels by 10 to -- 10 to 12 decibels, which is equiva- -- on a single -- on a double-pane window, which is equivalent to a 50 percent reduction.

So my idea is, like, maybe if you had some sort of program, to give the people most affected, the residents, you know, these friction fit -- you know, this

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3004
cont'd

is just the corner of it, (Lifting demonstrative), you know, friction fit in there, that would be a cheap way to help people out. And it has a sound-transmission class rating of 48 to 54. And a sound-transmission class is -- is a rating given to different products that -- it measures the sound resistance.

A typical wall has a sound resistance of 48 to 52, and this product has a sound transmission class of 42. Which that's pretty remarkable, you know? Anyway...

So it's a -- it's a pretty cheap way to -- so my idea would be to have some sort of program to give folks this product. And that would be great.

And so if anyone's curious, I've got brochures and stuff. In the interest of full disclosure, like, I hope to be a franchisee; I'm not a franchisee, but I hope to be, to install this stuff; in the interest of full disclosure. And the reason -- the reason I'm -- I'm enthusiastic, I mean, it's not like -- I was just monkeying around on the Internet, and I just found this product. And the more I learned about it, I was like, "Wow, that is neat stuff." Because we never touched windows. They're just too expensive to mess with. But this is a real cheap alternative.

Thanks.

LIEUTENANT COLONEL JIMENEZ: Rex Plunkett.

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REX PLUNKETT

3005 MR. REX PLUNKETT: Hi, there. My name is Rex Plunkett, P-l-u-n-k-e-t-t.

I happen to live in the glide path of the north-south runway. And I think your presentation did very well in taking care of some of my fears.

PA-4 One thing I would specifically like to say is that north-south runway extension options, all of them improve also safe operation of -- for air operations, and if bad things should happen, like a war or something like that, would improve the changes of Elmendorf fulfilling their military mission because now they would have two long runways, not just one. And I think these are things that are important enough that they should be included in the final plan.

Thank you.

LIEUTENANT COLONEL JIMENEZ: Claudia Fielding.

CLAUDIA FIELDING

3006 MS. CLAUDIA FIELDING: Hi, Claudia Fielding here. F, like Frank, i-e-l-d-i-n-g.

First of all, thank you very much for your service. I'm an Army brat, so I understand the need for the maneuvers and all the operations. But I've been a resident since -- what's? -- 2013, I believe, and the runway noise is just unbelievable sometimes. And I really

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3006 cont'd

EJ-2 am concerned about our children and the decibel levels.

And, you know, there's a lot of good ideas out here, but I would really like you to consider the runway extension and not option A.

Thank you very much.

LIEUTENANT COLONEL JIMENEZ: Peggy Webb.

3007 PEGGY WEBB

MS. PEGGY WEBB: Hi, I'm Peggy Webb, W-e-b-b, and I live on [redacted] right in the -- I mean, they fly right over -- our fourplex is there. And I've been in Mountain View for 13 years, and the planes have come over my fourplex since then. At that time I was told they would only use the north-south runway when the east-west runway is being repaired. And there were some years that there wasn't as much activity. It seems like the last -- I'll just say five years, every summer it's pretty -- it's been pretty, I'll just say, thick. And I'm usually gone to work, but my -- my husband is retired, and I have tenants there. Of course, I'm trying to protect them, and keep them in the property, too. Which it's not been bad; I'm just saying that's one of my concerns.

Now, 13 years ago, I mean, it was loud, but I didn't -- I didn't feel like I was, like, afraid of it. And maybe I'm just getting older. I'm 64 now. But when

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3007
cont'd

they go over, I just feel like -- I mean, I honestly feel in my core like I'm, you know, cringing and -- I mean, I don't have any emotional, mental health problems or anything, but I actu- -- I really feel like there's a vibration going on in my -- my core, and I don't like it. It scares me. And I guess that's what I wanted to say. Especially if I'm outside, it's almost unbearable.

My building -- I think my roofline is about 27 feet. I'm going to be kind of in the range here with some of these figures, but... And I remember I took out a 40-foot tree. And I know the trees across the street in the forest are about that high, maybe 40 to 50 on the tallest. But the planes come just right above that, sometimes right -- right at the treeline. And the wind shear is just -- I mean, those trees, those tall trees, are -- are moving like -- I don't know -- five... I won't say eight feet, but, you know, maybe some of them. And so it's just like, wow, I just feel like I'm in the -- in the zone, and it -- it doesn't feel good anymore.

And so -- I grew up in the Air Force. My dad was in the Air Force 691st Security Group. I understand, you know? And I'm -- I'm not "all about" the military, but I -- I grew up in it, and I've been all over the world, and I -- I could -- I love it on that level. But I think there are physical repercussions that need to be

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3007 cont'd

considered for our, you know, people that are living in that -- in that zone.

And let's see. I'll try to wrap it up here.

EJ-3 AE-3

I guess the things that I think you should look at, at what could be happening to children, elders, which I'm becoming one, I guess, now, maybe the health-challenged and definitely the mentally -- you know, I know health -- mental health is also health.

People walk the streets, you know, and I -- I just think there can be a lot of anxiety be created from -- from that traffic. And I -- I think I -- and also... So the property issues. And I also have often wondered how much jet fuel is -- is coming down over us. I -- I just forget about it, but it's something that, you know, we don't know until we know.

SO-1

SA-1

But maybe if you could consider those things, I'd appreciate it.

Thank you.

LIEUTENANT COLONEL JIMENEZ: Paul Palinski.

PAUL PALINSKI

3008

MR. PAUL PALINSKI: My name's Paul Palinski, P-a-l-i-n-s-k-i. I live at [redacted] in Mountain View. And I'm not right under the runway, but you guys can see my house, I'm sure. I'm the flag pole on your left wing, about 250 feet down.

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3008 cont'd

PA-4

I would like to concur with Representative Tarr and Mr. Crandall. I believe the best option for you folks is to extend the runway, both for noise mitigation for Mountain View, but also for pilot safety and operational readiness on the airfield.

Heaven knows that Congress blows enough money as it is, and they can certainly afford another $150 million. It's no big deal to them. And I'm abundantly aware of your requirements to fly, having flown in combat myself, and the critical need to continue training aircrews, so they can function quickly and efficiently in combat. You don't have time to mess around then trying to figure out what you're doing.

And I also personally want to thank each and every one of you ladies and gentlemen in uniform here tonight for your service. It does this old heart good to know there are still good men and women willing to step forward and take care of this country.

Thank you.

LIEUTENANT COLONEL JIMENEZ: Mark Gould.

MARK GOULD

3009

MR. MARK GOULD: My name's Mark Gould, G-o-u-l-d. I live at [redacted] It's about four blocks from Pine, where the flight path is.

First of all, I would also like to thank

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3009 cont'd

everybody in uniform today in the military, members of the military, for their service. And also the community members here today, that I know a few of, that have worked so hard to really try to revitalize Mountain View and just make it a safer place to live.

I've been here about 11 or 12 years, and I also work here. I have a small business. And I guess I'm not going to comment on which alternative is best or not. I think it's a little early for that. But I just want to encourage everybody not to go backwards in -- in looking at our community here in Mountain View.

You know, we've come so far. Signing we've -- we've really done well. I've seen big changes. And I really feel like we can work with you guys and -- and come to a compromise here that will -- will be beneficial for everybody.

EJ-2

Of particular concern to me is the safety of the children's hearing. You know, the potential risk to their hearing. I have hearing loss in my -- from my woodworking business. So it's -- it's no -- it's a very serious issue.

SO-1

And then, also, I guess just property values are going to be affected, if the noise levels do rise. And I didn't -- I didn't read anything about projected property values in the draft.

But anyway, that's all I have to say.

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Thanks.

LIEUTENANT COLONEL JIMENEZ: Radhika Krishna.

RADHIKA KRISHNA

3010

MS. RADHIKA KRISHNA: Hi, I'm Radhika Krishna, K-r-i-s-h-n-a. I'm the Community Development Manager at the Anchorage Community Land Trust, which is a neighborhood nonprofit that works in Mountain View, and I'm also the Treasurer of the Mountain View Community Council.

First of all, thank you for having this hearing here at Clark Middle School, so we can participate.

I do want to make a comment about participation. JBER does own probably about a third of the land within our neighborhood boundaries, and a lot of the neighborhood is also in the Accident Potential Zone, so there are significant impacts from a variety of JBER things on our neighborhood. And we do have a low-income, you know,

NP-2

minority neighborhood. And forums such as this one, while definitely needed, we have a lot of neighbors that because of language barriers, child-care issues, nontraditional schedules, are simply not being familiar, where they're empowered to participate in forums like this one, can't voice their concerns, even though they are significantly impacted by projects like this. So I just encourage you to keep that in mind.

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3010 cont'd

I do have a few comments about the EIS. I do agree with the past speakers that the runway extension seems like the alternative that both meets the needs of the neighborhood and also, you know, meets the needs of the Base.

MI-2

I have two specific comments about the EIS, too: One is that in the EIS it says that there won't be mitigation funds. And I would just ask for clarification: Are there criteria for expending mitigation funds; and what about this does or doesn't meet that? What similar projects have used mitigation funds? You know, some reasoning behind that would be useful.

AE-1

I also do want to continue the discussion about decibel levels and measurement. As all of the past speakers have pointed out, we don't experience the noise impacts as background noise. They're noise events. So I don't find the study showing average annual levels or daily levels to be useful.

AE-5

I would like to see some discussion of peak levels: What is the maximum decibel level that we hear in this neighborhood?

AE-4

And I do agree with the residents on Pine Street that we do need some actual on-the-ground studies rather than projections.

Thank you.

LIEUTENANT COLONEL JIMENEZ: Neva Reece.

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NEVA REECE

3011 MS. NEVA REECE: My name is Neva Reece. My last name is spelled R-e-e-c-e.

Do you need my first name?

(Court stenographer indicated in the negative.)

MS. NEVA REECE: Okay.

I thank you, also, for coming. And I really want to emphasize the points that the previous speaker made about our population in our community. And though many of us are here to represent the many people that really this is impacting, will not be able, for one reason or another, to be able to be here. So please, please, please keep that in mind.

I heard someone mention compromise. I think that really we need to look at the hard data on the sound, the quality -- how it impacts our community. I think that

AE-3 the -- the quality of life of our neighborhood is not something we can compromise on. I think that it should be looked at as a hard line that needs to be taken into

EJ-2 consideration. Because there are so many children in our community, it's not something we can compromise on. Because we already have challenges with the quality in our neighborhood. And I really want to challenge you to look at it as a piece of something that you can't -- you can't limit how important it is to consider it something you can

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3011 cont'd

AE-4

compromise. I think it's very important.

I hear that you said you did some studies with the sound. It sounds like you were maybe in an open field and perhaps taking sound data there. I would suggest to you that unless you come into the neighborhood and hear what the sound is, like when you're in the midst of many buildings, that the sound level may be different in our circumstance than it would be in the studies that you did. And I think that -- I would encourage you to come to our neighborhoods and do that, and maybe even involve some of the kids from Mountain View. How exciting that would be for them to participate in a scientific activity that affects them every day. So I would like to ask you to consider that.

EJ-3

So I've lived in Mountain View for 14 years. For about four years I was on Klevin Street, and I was barely aware of the planes. Only during the air show did I really notice. And I moved just a few blocks. And the day I signed the papers on my house is the first day I really realized what was going on with the airport, with the Air Force and the planes. I would have not bought that house had I known; I really wouldn't have. Because I'm very sensitive of loud -- like how -- really loud sounds. And it was very difficult. The first summer I was there, there was a lot of construction, so many, many

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3011 cont'd

EJ-3

planes went over my house. I spent almost the whole summer away from my new house, because I -- I couldn't take the noise.

AE-2

So it's a little better now, I think, but it has been worse lately, just the last few months, to the extent that cars parked on the street, their alarms go off after the planes go over. The only time I've been in a situation where that happened before is Santa Cruz, in 1989, in the earthquake, the Loma Prieta Earthquake. That's the only place I've ever been where I had that experience of car alarms going off because of... So that's not sound; that's vibration. So that vibration is all through our neighborhood. So please consider that.

And I don't say it to be contradictory, but we really have to stand up for that stuff. Our neighborhood has challenges. Please don't ask us to compromise for -- for the changes.

And you're doing a good process, you're looking at good alternatives, and I thank you.

LIEUTENANT COLONEL JIMENEZ: Daniel George.

DANIEL GEORGE

3012

MR. DANIEL GEORGE: Good evening. My name is Daniel George, G-e-o-r-g-e.

Thank you for the opportunity to discuss and comment on this Draft Environmental Impact Statement.

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3012 cont'd

Mountain View residents support our military and love our boisterous neighbors to the immediate north. It's not lost on us the significance that this hearing has. You protect us and our freedoms, and that includes the ability to candidly weigh in at this impartial hearing.

Your professionalism and responsiveness inspires confidence in this NEPA process. This is not the first NEPA process that this neighborhood has dealt with noise issues, and in fact, we did one in 2013. And I was very pleased with the responsiveness and professionalism.

All though I serve on the board of the Mountain View Community Council, I'm here tonight to express my own personal viewpoints, because the council has not met to take a position or pass a resolution on this particular environmental impact statement.

However, in 2013, we did address the F-16, relocation of the 18th Aggressor Squadron EIS, and we did weigh in with a letter as well as a resolution. And I will provide those for a comment tonight, because they are a formal opinion of the Community Council, which we voted on.

That resolution and the letter dealt with several issues, specifically including housing characteristics and composition in Mountain View. As an older neighborhood, the construction quality is sometimes

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3012 cont'd

what would be considered substandard for modern type of construction. Windows aren't triple paned. A lot of homes or log cabins were built from crates. It's an older neighborhood.

We also dealt with noise impacts on Mountain View residents and environmental justice, which I know was required to be taken into consideration in this NEPA process.

PA-4

Personally, I support the extension of Runway 16/34, under Alternative F, and its associated improvements, as they would serve the mission well and reduce noise impacts in Mountain View.

EJ-1

Subjecting the long-established, minority and disadvantaged community of Mountain View to day and night average levels in excess of 65 decibels would create an environment, which under DoD guidelines would be considered, quote, "generally unacceptable for noise-sensitive land uses, such as residences, schools, hospitals and public services." That is according to 2013 guidelines. They may have changed. I don't know. But that's what it was in 2013.

MI-2

Additionally, there is no money included in this proposal for mitigation of noise impacts. I think it's been stated well by previous speakers, but I would be supportive of that consideration, should noise increase in

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3012
cont'd

MI-2 the neighborhood under one of the alternatives chosen.

PA-4 Noise levels of 75 decibels and above are considered under DoD guidelines unacceptable for noise-sensitive land uses. And I note that Mountain View Elementary would be subjected to more than 70 decibels as an average under Alternative A. That's quite a fine line.

Therefore, I speak in favor of the No Action Alternative or -- or I also speak in favor of Alternative F, and I speak in opposition to Alternative A.

Thank you

LIEUTENANT COLONEL JIMENEZ: January Grizzell.

JANUARY GRIZZELL

3013 MS. JANUARY GRIZZELL: My name is January Grizzell. It's G-r-i-z-z-e-l-l. I'm a long-time resident of Mountain View. We live on [redacted] I'm also a member of the Mountain View Community Council and a life member of the VFW.

I'm here just to put in my two cents about the noise. I -- I love the military. I -- my dad was a lifer in the Army. My stepdad was an lifer in the Air Force. My uncle was in the Air Force. I love living near the Base. I'm one of those people that normally when the planes would come over, I run to the back windows to watch them, because they flip right by our window when they come back in and they show me their belly and stuff, so...

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3013 cont'd

But -- let's see.

I used to work in emergency services. For a long time I worked in Fire and Rescue, and I worked as a security guard, armed security guard, at Knik-Goose Bay Missile Site.

Two years ago I was in the house over there, and we had -- I was the only one in the house. We have pets that live indoors as well as outdoors, and two propane tanks blew up while I was in the house. So I have post-traumatic stress from my past history of high-stress jobs, as well as being in the house with the concussion affect. And I had just the year before that had surgery on my ears for Meniere's.

So the minute that -- a couple days ago I was in the back yard, and -- and one of the planes start- -- it came over, and when it did it was, like, louder and louder and louder, and I'm like, "What the heck?" And I thought, "Is somebody going to crash again?" You know? And -- and it got so bad that our animals started running. They didn't know where to run. And I -- I tried to put my hands over my ears. And then I saw -- I guess it was one of the new babies, the F-22. I don't know. It was gorgeous. But it was -- it seemed like it was like two car lengths above my head.

AE-3

So the first thing I thought of was the other

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3013
cont'd

AE-3

vets that live in Mountain View that have post-traumatic stress from being in the wars. Because if it bothers me, and I've never been in a war, I always think about that, with noise on 4th of July and all that. Let alone, the animals. Our animals were in the house. I got them out, but they were in there when it exploded, as well.

So high noise volumes really affect me and -- and them, and I suppose, other neighbors.

EJ-3

So that's basically all I just wanted to say, is that there's a lot of seniors like me. I'll be 70 next year. And my life has drastically changed from trying -- from working all my life at being a Wonder Woman, so I need a little bit of peace and quiet now.

So there's probably many more like me that --

PA-1

that have been long time residents that would -- you know, and I -- and I love them coming over, it's just I'm not -- I don't know -- I don't know what your new plans are, but if they could go up a little higher, it would be better.

Thank you.

LIEUTENANT COLONEL JIMENEZ: As I mentioned, the hearing is scheduled to end at 9:00 p.m. We've heard from everyone who signed up to speak and still have some time left. Please raise your hand if you haven't spoken yet but would like to do so, and we'll get you a card and a microphone.

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Oh, I have a couple.

I would remind you to say your name and spell your last name, please.

LES SHEPPARD

3014 MR. LES SHEPPARD: I'm Les Sheppard. My last name is -- it's -- excuse me -- S-h-e-p-p-a-r-d.

I've lived in Anchorage since 1957. I've seen things change, and I feel that with the F-111 -- the F-22 is a wonderful airplane, and we should support it. There's one place that I'm concerned, and that is the sound.

I had, in the last couple of days, maybe about a week, there has been two -- I live out off of [redacted] -- I live [redacted] and two -- two F-22s came over. They were landing on the north-south runway, and the noise was quite surprising. And the reason why I'm here tonight, to ask for this to be looked at, because of Mountain View. If we have a lot of... The noise from the F-22s can be very -- something that would be hard to put up with. I think it needs to be -- attention, some attention.

MI-1

I know along International Airport Road they insulated and also changed the windows on all the apartments along it. Maybe that's something that they could look at for Mountain View. Because I know the

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3014 cont'd

MI-1

excess noise would be something that you wouldn't want to live with.

I have nothing more to say.

Thank you.

LIEUTENANT COLONEL JIMENEZ: I saw another hand in the back, if I could have you step forward.

Just a reminder to say your name and spell your last name, please.

ROBIN BURNS

3015

MS. ROBIN BURNS: Good evening. My name is Robin Burns, and it's B-u-r-n-s.

I've been a resident of the Mountain View area for quite a few years. My husband was born -- he's in the back there. He was born here in Anchorage, Alaska. We live in the house that the planes fly pretty low, to the point where I think, at one time, I think I waved at one of the pilots.

I thank God for the Air Force. My dad was military, Air Force, for 25 years. He was Elmendorf -- I'm sorry -- Eielson Air Force Base. And I thank God for the military.

PA-4

I am concerned, like a lot of other people, who got up and spoke, regarding the noise. That's my main concern. If we were to choose any of the alternatives, I'd rather go with B through F, or either "No"

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3015 cont'd

PA-4

Alternative.

I just want to say the noise is the major part, because there are -- like -- like people have gotten up and said that windows shatter and what have you. And I think I might get a brochure from the gentleman back there that had the little window thing.

But I just want to take this time, again, to say thank you. I'm proud of Mountain View. We've lived here, like I said, for many, many years, and we've come a long way, we've come a very long way. New housing, new construction on the schools and what have you, and I am proud to live in Mountain View.

Thank you.

LIEUTENANT COLONEL JIMENEZ: Is there anyone who has already spoken that would like another three minutes?

MS. NEVA REECE: I would, yes.

LIEUTENANT COLONEL JIMENEZ: Just a reminder, again...

MS. NEVA REECE: Uh-huh.

NEVA REECE

3011 part 2

MS. NEVA REECE: My name, again, is Neva Reece.

I don't really need another three minutes, but I did want to ask, because I'm sure it will come up with someone, I understand there's 23 acres of wetlands that would be affected by the construction. I wondered how

PR-1

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3011
part 2
cont'd

PR-1

large the whole wetland area is, what percentage that might be of loss of wetlands on Base. Does anybody know the answer to that?

LIEUTENANT COLONEL JIMENEZ: At this time we're only taking comments.

MS. NEVA REECE: Oh, I'm sorry. Well, that's my comment: That it's something that we might want to look at, then. I guess that's my comment.

LIEUTENANT COLONEL JIMENEZ: Looks like we have no remaining speakers. As I mentioned earlier, the Air Force representatives will continue to be available by the display boards to discuss things with you.

And again, oral and written comments receive equal weight.

We will convene again closer to the nine o'clock hour. And with that, we are in recess.

(A recess was taken.)

LIEUTENANT COLONEL JIMENEZ: Okay. We had one more individual who would like to make a comment for the record.

Tosha Hotch, if you would step forward, the microphone is yours. If you could say your name and spell your last name, please.

MS. TOSHA HOTCH: Thank you.

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3016

TOSHA HOTCH

MS. TOSHA HOTCH: Tosha Hotch, last name is H-o-t-c-h.

I live in the Mountain View community over on [redacted] and I've noticed the increase in the vibrations that I feel in my home because of the flights coming over. And so I'm not sure really which proposal I am a fan of just yet. I think that there are some that I'm really interested in, but I'm going to go do a little bit more research.

EJ-2

But I did just want to say that I've been involved with our Community Council, as well, as our Education Chair, and worked really closely with our school, tried to make it a safe place for our students. And like concerns that I heard when I walked in, that's also a concern for me; not just for the students at the school, that are going to school there, but the students that go and play outside. Because there are I think a lot of great places along McPhee, where kids love to play since there's a greenbelt on the side. So I'm curious what the impact would actually be.

AE-4

The studies, I'm always a fan of real life studies. If we could get some- -- something to test the decibel rate, like by my home and by the school, I think that that would give a much better idea of what the impact

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3016
cont'd

AE-4

would be, so that I can make a more informed decision.

Thank you very much for the opportunity to speak.

WRITTEN COMMENTS

LIEUTENANT COLONEL JIMENEZ: Again, for comments to be included in the Final EIS, they must be postmarked by September 19th, 2017, which is the close of the Draft EIS public comment period.

THANK YOU FOR ATTENDING

LIEUTENANT COLONEL JIMENEZ: I thank you for your time and interest. Tonight is not the end of your opportunity to participate in the environmental review process. Again, written comment sheets are available at the registration table, and you can turn the sheets in tonight or mail them later.

The Air Force welcomes public comments in writing during the Environmental Impact Analysis Process. To receive timely consideration for the Final EIS, all comments, again, must be submitted by September 19th, 2017

If you would like your own copy of the Final EIS, you may download it from the project website listed on the brochure and on the comment forms available at the tables in the back. You can also request one from the representatives at the registration table or send a letter or postcard asking for your own copy. The Air Force will

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send copies of the Final EIS to you.

There being no more speakers, the hearing is adjourned.

(Public Hearing record adjourned at 9:56 p.m.)

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APPENDIX B
RESOURCE DEFINITION & METHODOLOGY FOR ANALYSIS

ACRONYMS AND ABBREVIATIONS

Acronym	Defintion
$\mu g/m^3$	micrograms per cubic meter
AAC	Alaska Administrative Code
AADT	average annual daily trips
AAQS	Ambient Air Quality Standards
ACAM	Air Conformity Applicability Model
ADCM	Anchorage Debit-Credit Method
ADEC	Alaska Department of Environmental Conservation
AFCEC	Air Force Civil Engineer Center
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPD	Air Force Planning Document
BACT	Best Available Control Technology
BASH	bird/wildlife aircraft strike hazards
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2e	carbon dioxide-equivalent
COC	community of comparison
CWA	Clean Water Act
dB	decibels
DoD	Department of Defense
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
ETR	engine thrust request
FAA	Federal Aviation Administration
FR	Federal Register
GHGs	greenhouse gases
IMPLAN	Impact Analysis for Planning
INRMP	Integrated Natural Resources Management Plan
JBER	Joint Base Elmendorf-Richardson
L_{dn}	day-night average sound level
LOS	level of service
mg/m^3	milligrams per cubic meter
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System

Acronym	Defintion
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O_3	ozone
PM_{10}	particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
Q-D	quantity-distance
ROI	region of influence
RW	runway
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide
THPO	Tribal Historic Preservation Officer
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

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B.1 Airspace Management and Use

B.1.1 Resource Definition

Airspace management generally refers to the manner in which the Federal Aviation Administration (FAA), U.S. Department of Defense (DoD), and other responsible agencies coordinate and integrate the use of the nation’s navigable airspace so as to ensure all aviation activities are conducted safely and efficiently. Airspace use for pilot training is the basis for defining efficiency in this Environmental Impact Statement (EIS).

Sections B.1.1 and B.1.2 describe how the National Airspace System (NAS) airspace is classified and regulated to meet both military and civil aviation needs. Section B.1.4 describes the methodology for calculating airspace use as a measure of pilot training efficiency. Section B.1.5 presents the calculations for quantifying efficiency for the EIS Proposed Action and alternatives, including the No Action Alternative.

B.1.2 Regulatory Setting

As the responsible agency for the NAS, FAA has designated four types of airspace within the United States according how each is regulated and used for different aviation activities. The four types are Controlled, Uncontrolled, Special Use, and Other. Controlled airspace includes five separate Classes (A through E) within which all aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements. Air Traffic Control services are provided within controlled airspace in accordance with those FAA rules and regulations governing each classification. Airspace Management discusses Class D “Other” airspace classifications associated with JBER-Elmendorf (Elmendorf airfield component of the Joint Base Elmendorf-Richardson [JBER] installation).

The Air Force manages and conducts its airspace activities in accordance with processes and procedures detailed in Air Force Instruction (AFI) 13-201, *Air Force Airspace Management*, which implements Air Force Planning Document 13-2 (AFPD 13-2), *Air Traffic Control, Airspace, Airfield, and Range Management*, and DoD Directive 5030.19, *DoD Responsibilities on Federal Aviation and National Airspace System Matters*. Specific procedures for managing and conducting operations within those airspaces affected by the Proposed Action are contained in 3d Wing Instructions, JBER procedures/policies, and an FAA Letters of Agreement. The airspace discussions in this EIS describe the management and baseline uses of the JBER airfield and the controlled airspace surrounding the airfield associated with this Proposed Action and alternatives.

FAA manages the National Airspace to support all users and achieve safe operations. The Air Force adheres to FAA directives and works with the FAA and civil aircraft operators to support flight operations. Air Force flight operations and/or runway use could improve flight operations, although there are no statutory regulations that could be used to define a significant or less than significant environmental impact. Air Force adherence to FAA directives results in less than significant airspace environmental effects.

B.1.3 Methodology for Assessing Airspace Management

The airspace management analysis examines the potential environmental consequences of the F-22 operations efficiency alternatives relative to current baseline and projected aircraft operations within the airfield areas potentially affected by this proposal.

The Proposed Action and alternatives do not include any modifications or additions to the existing airspace structure nor is it anticipated that they would require any changes to those routes/corridors currently used by military aircraft for transiting to/from JBER and the training airspace units. Nor would there be any changes to airspace units associated with runway use alternatives.

Any changes that may be required to internal procedures or agreements to safely and effectively integrate extended RW 16 approach and arrival operations associated with Alternative C (depart RW 34; arrive RW 16) or Alternative F (depart RW 24; arrive RW 16) into the JBER airfield/Anchorage airspace environment would be appropriately identified and coordinated among the responsible Air Force and FAA interests prior to implementation. The airspace management analyses in this EIS focused on what effects, if any, F-22 operations alternatives may have on the current airspace.

B.1.4 Methodology for Calculating Airspace Use

Calculated training airspace use is the basis for defining and comparing runway use alternatives in terms of pilot training time using F-22 internal fuel. The amount of productive training time is dependent upon multiple factors, including, but not limited to, the mission, pilot performance, aircraft weight, weather conditions, fuel available from departure to arrival, time to transit to the training airspace, and time to transit from the training airspace to JBER. The efficiency measure for airspace use focusses on the runway use alternatives. The analysis uses simplifying assumptions to hold factors such as the mission, pilot, fuel available, aircraft weight, weather, etc. constant for an F-22 sortie. The factors which are allowed to vary are those directly related to runway use. Efficiency is defined in this EIS as the productive time spent by a pilot training in the airspace using internal fuel which begins at 18,000 pounds and is approximately 2,500 pounds at touch down. The available 15,500 pounds of fuel are available for taxi, departure, transit to the airspace, training in the airspace, transit from the airspace, and arrival to touchdown.

B.1.4.1 Representative Mission Duration as a Basis for Efficiency

A representative mission was used to distribute time and throttle settings and to calculate average fuel consumption. The representative 1.4-hour mission includes fuel for taxi, hold, departure, transit to the training airspace, training in the airspace, return from the airspace to the vicinity of the airfield, approach, arrival, and reserve fuel for taxi.

The estimate for runway taxi and hold times associated with the 90 FS and 525 FS as well as departure and arrival times associated with representative F-22 flight tracks are based upon the aircraft squadron and the departure runway. The 90 FS is located near the end of RW 24, and the 525 FS is located near the end of RW 34 (see EIS Figure 1.1-2). The specific locations of the different squadrons are assumed to have nominal taxi time of five minutes to depart RW 24 or RW 34 (RW 16 departures are very rare). Taxi and wait time to RW 06 is assumed to be an additional average of 20 minutes. The Proposed Action and each alternative have an estimated allocation of the 5710 F-22 sorties in EIS Table 2.4.1 (see EIS Section 2.4).

These allocations are based on the availability of the runways for use and operational requirements. The allocation of operations to specific runways is not a restriction on runway use but rather an estimate which can be used for comparison of efficient operations.

B.1.4.2 Calculating Departure Time and Fuel Flow

Table B.1-1 presents the estimated taxi throttle setting for departures on JBER runways. The “Departure Equivalent Flight Minutes” column represents the fuel flow associated with the taxi throttle as a percentage of the average fuel flow during a mission. This means that, from Table B.1-1, 20 minutes of taxi and hold time is equivalent to 5.05 minutes of flight time at an average throttle setting.

RW 34 departures are directly toward the primary training airspaces of the Stony, Susitna, and Fox MOAs. Table B.1-1 includes an estimated one-half minute at MIL power for any runway departure then throttled back to transit power as calculated by timed observations from the JBER tower. An F-22 departure from RW 24 requires approximately 30 seconds of additional flight time from initial rollout to a right turn to be at a comparable point intersecting a departure from RW 34. An F-22 departure from RW 06 requires approximately 30 seconds of additional flight time for a left turn to be at a comparable point intersecting a departure from RW 34. The additional 30 seconds are estimated at a transit power setting to reflect the increase in departure time from RW 24 or RW 06 when compared with a RW 34 departure.

Table B.1-1. Departure Flight Minutes

Taxi and Hold Minutes			Equivalent Flight Minutes			
Activity	Throttle	Time in Minutes	% Throttle	Average Flight % Throttle	Fuel lb/ min	Departure Equivalent Flight Minutes
Taxi to RW 24 or RW 34	idle	5	7	45	46	1.26
Additional RW 06 Taxi and Hold	idle	20	7	45	46	5.05
Additional depart RW 06 or RW 24	transit	0.5	40	45	150	0.41
Depart any RW	MIL	0.5	100	45	620	1.70

Notes:
[1] Throttle setting and fuel flow from AFCEC 2013.

Key:
Lb/min = Pounds per minute
RW = Runway

B.1.4.3 Calculating Arrival Time and Fuel Flow

JBER flight profiles provide F-22 pilots with a three dimensional perspective for arrival and departure. Each profile provides altitude, speed, distance, and throttle setting (in terms of percent of engine thrust request [ETR]). Each flight profile is on an established flight track and published for pilots. The different runway times for arrival calculated in this analysis are based upon the approved F-22 flight profiles and JBER flight tracks. An approach distance from 13,000 feet mean sea level (MSL) was obtained from the flight profiles or estimated for consistency in comparing runway arrival times. In most cases the published F-22 flight profiles either have the ETR for distance segments from 13,000 feet MSL or, where not included, the distance to arrival from a 13,000 feet MSL altitude can be extrapolated using similar flight tracks. The different flight tracks used for this analysis, the estimated distances for arrival from 13,000 feet MSL, and the estimated time from 13,000-feet MSL to touch down are presented in Table B.1-2. The estimated nautical miles from 13,000 feet MSL to touch down and the calculated speed in knots derived from the F-22 arrival profiles are also included in Table B.1-2. The average arrival speed for each flight track is calculated by summing the speed times each segment distance and dividing the total by the distance from 13,000 feet MSL to arrival on the runway. This results in comparable arrival durations for each F-22 arrival profile.

Table B.1-2 presents the estimated distance, speed, and minutes of travel for each arrival flight profile. Table B.1-2 demonstrates that an F-22 using profile F22AA and flight track 06A1 from 13,000 feet MSL is estimated to take 8.83 minutes at an average approach throttle setting of 91 pounds of fuel per minute. When compared with the average fuel burn or average throttle setting during a mission, these 8.83 minutes translate to 4.41 equivalent flight minutes at a mission average fuel burn of 182 pounds per minute. For comparison, an F-22 arrival on flight track 16A2 using different VFR and IFR arrival combinations (from Table B.1-2) is estimated to take an average of 4.63 to 6.00 minutes from 13,000 feet MSL at an approach throttle setting that results in an estimated 2.31 to 3.00 equivalent flight minutes. The net effect is that each F-22 arrival on flight track 16A2 new, as compared with an F-22 arrival on flight track 06A1, has the calculated potential for from 4.41 – 2.31 = 2.1 to 4.41 – 3.0 = 1.41 equivalent flight minutes at a fuel burn of 182 pounds per minute. The 1.41 to 2.1 minutes of flight time could be available for pilot training in the airspace at no increase in fuel consumption (see Table B.1-2).

Fuel flow for the missions was calculated using the Air Force Civil Engineer Center (AFCEC) F-22 fuel flow by throttle setting data (AFCEC 2013). These fuel flow data have been used for air quality analysis for F-22 operations at every location where F-22s are based. The percent ETR, which determines fuel flow, is affected by multiple variables including speed, altitude, attitude, temperature, and others. For the purpose of JBER EIS comparison of runways for departures and arrivals, the percent ETR from each flight track by altitude and distance was estimated to be comparable to the throttle setting. Within the airfield environs, where aircraft are departing or arriving, this is a reasonable assumption for consistently comparing alternatives.

Table B.1-3 is a summary of arrival flight minutes by runway derived from Table B.1-2. Table B.1-3 demonstrates the calculated minutes for each runway based on the arrival average throttle setting. The Arrival Equivalent Flight Minutes column includes the arrival minutes from 13,000 feet factored by the typical mission average of 182 lb/min fuel consumption.

Section B.1.5 incorporates the flight time departures and arrivals from a representative mission to calculate efficiency associated with the different runway use alternatives presented in EIS Table 2.4.1.

Table B.1-2. Average Flight Minutes by F-22 Arrival Profile1

Flight Profile	Flight Track	Altitude (MSL)	Distance (NM)	Average Speed (knots)	Approach Fuel Burn (lb/min)	Minutes from 13,000 ft	Flight Average Fuel Burn (lb/min)	Equivalent Flight Minutes
F22IFR	16 A2 new IFR	13000	30	300	91	6.00	182	3.00
F22AU	16 A2 low IFR	13000	34	275	91	7.42	182	3.71
F22AA	06 A1 est	13000	39	265	91	8.83	182	4.41
F22AD	06 A2 est	13000	39	285	91	8.21	182	4.10
F22AF	06 A11	13000	39	315	91	7.43	182	3.71
F22AG	06 A12	13000	39	310	91	7.55	182	3.77
F22AN	06 A13	13000	36	310	91	6.97	182	3.48

Table B.1-2. Average Flight Minutes by F-22 Arrival Profile1

Flight Profile	Flight Track	Altitude (MSL)	Distance (NM)	Average Speed (knots)	Approach Fuel Burn (lb/min)	Minutes from 13,000 ft	Flight Average Fuel Burn (lb/min)	Equivalent Flight Minutes
F22AO	06 A14	13000	36	310	91	6.97	182	3.48
F22AVFR	16 A2 new VFR	13000	22	285	91	4.63	182	2.31
F22AK	16 A2	13000	22	285	91	4.63	182	2.31
F22AI	16 A11	13000	37	325	91	6.83	182	3.41
F22AJ	16 A12	13000	37	320	91	6.94	182	3.47
F22AL	34 A11	13000	36	325	91	6.65	182	3.32
F22A24	24 est using 34 A12	13000	37	325	91	6.83	182	3.41
F22A16 35/65	16 A2 VFR+IFR	13000	25	295	91	5.08	182	2.55
F22A06 35/65	16 A2; 06A1	13000	29	285	91	6.08	182	3.05

Notes:

[1] See Table B.1-5 for fuel consumption

est = Distance estimated from other profiles

[2] F22AU, etc. represent published F22 flight profiles. F22XX represent estimated flight profiles not yet established, but defined for analytical purposes for this study and based on 35 percent ILS from 6,000 feet MSL

[3] F22A 16 35/65 and F22A 06 35/65 represent flight profiles not yet established, but defined for analytical purposes for this study and based on 35 percent IFR from 8,000 feet MSL on RW 16 or 35 percent IFR on RW 06.

Key:

ft = feet
lb/min = pounds per minute
MSL = mean sea level
NM = nautical mile

Table B.1-3. Summary of Arrival Flight Minutes by Runway

Arrival	Throttle	Minutes from 13,000 ft	Throttle %	Average Flight % Throttle	Fuel lb/Min	Arrival Equivalent Flight Minutes
RW 34	approach	6.65	30	45	91	3.32
RW 06	approach	8.83	30	45	91	4.41
RW 24	approach	6.83	30	45	91	3.41
RW 16A2	approach	4.63	30	45	91	2.31
RW 16 new VFR	approach	4.63	30	45	91	2.31
RW 16 IFR	approach	6.00	30	45	91	3.00
RW 16 VFR 65%; IFR 35%	approach	5.08	30	45	91	2.55
RW 16 VFR 65%; RW 06 IFR 35%	approach	6.08	30	45	91	3.05

B.1.5 Calculations to Quantify Efficiency

Efficiency is defined in this EIS as the training time in the airspace available to a pilot based on the variable factors of ground taxi and hold time and associated fuel flow, runway departure time and fuel flow, and runway arrival time and fuel flow. The taxi begins with 18,000 lb of fuel and touchdown is desired to have approximately 2,500 lb of fuel which results in a sortie availability of 15,500 lb of fuel. Aircraft were mathematically “flown” on a representative training mission using the alternative-specific different runway operations from EIS Table 2.4.1. The amount of fuel used to depart and arrive on the different runways was calculated for 14 departure-arrival runway combinations. Fuel required for departure and arrival was calculated using the method explained in Section B.1.4. Transit time and fuel flow to and from the training airspace after departure from the airfield and until reaching 13,000 feet MSL on arrival was assumed to be a constant for all alternatives. The time in the airspace for training was based on the fuel supply available after allowing for runway specific departure, transit to the airspace, transit from the airspace, and runway specific arrival. If a runway departure required more taxi and hold minutes or if a runway arrival required more minutes to transit multiple airspace segments, those departures and arrivals consumed fuel which otherwise would have been available for training.

B.1.5.1 Mission Sortie Minutes

Table B.1-4 summarizes the 14 runway departure and arrival combinations in terms of the ground taxi time, transit time which includes departure, transit to and from the airspace, and arrival time, and training time in the airspace. The Proposed Action and alternatives use the different proportions from EIS Table 2.4.1 to apply to the Departure/Arrival Runway combinations from Table B.1-4 to calculate the alternative specific Average Training Minutes/Sortie presented in Table B.1-6.

Table B.1-4. Summary of Sortie Minutes by Runway Departure/Arrival

Departure/Arrival Runway	Summary Mission Sortie Minutes		
	Taxi	Transit	Airspace Training
1. RW34 Departure; RW06 Arrival	10	54.0	29.9
2. RW34 Departure; RW16 Arrival	10	49.8	32.3
3. RW06 Departure; RW06 Arrival	30	60.7	25.1
4. RW24 Departure; RW06 Arrival	10	54.5	29.4
5. RW24 Departure; RW16 Arrival	10	50.3	31.8
6. RW24 Departure; RW16 Arrival VFR	10	51.8	31.0
7. RW34 Departure; RW24 Arrival	10	52.0	31.0
8. RW24 Departure; RW24 Arrival	10	52.5	30.6
9. RW34 Departure; RW34 Arrival	10	52.0	31.0
10. RW06 Departure; RW34 Arrival	30	58.7	26.3
11. RW34 Departure; RW16 Arrival VFR	10	51.3	31.4
12 RW06 Departure; RW16 Arrival	30	56.5	27.5
13. RW24 Departure; RW34 Arrival	10	52.5	30.6
14. RW06 Departure; RW024 Arrival	30	58.7	26.2

B.1.5.2 Calculating Efficiency

Table B.1-5 is an example of a representative mission fuel use for departure on RW 34 and arrival on RW 06, which is case number 1 in Table B.1-4.

Table B.1-5. (Number 1 from Table B.1-4). Representative Mission Fuel Use by Throttle Setting and Equivalent Flight Minutes

1. RW 34 Departure; RW 06 Arrival F-22 Aircraft Fuel Usage							
Mode	**% Full Throttle**	**Fuel lb/min[1]**	**Taxi Minutes**	**Mission Flight Times (minutes)**	**Equivalent Fuel Consumption per Hour**	**Total Pounds Fuel Consumption**	**Equivalent Flight Minutes**
Taxi (idle)	7	46	5		0.021	230	1.26
Take Off MIL	100	620		0.5	0.028	310	1.70
Transit	40	150		27.0	0.371	4,050	22.27
Mission Low	45	160		19.9	0.292	3,184	17.50
Mission Intermediate	70	337		6.7	0.207	2,258	12.41
Mission MIL	100	620		3.0	0.170	1,860	10.23
Mission A/B	130	1600		0.3	0.044	480	2.64
Transit	40	150		12.3	0.169	1,845	10.14
Approach	30	91		14.2	0.118	1,292	7.10
Taxi (idle)	7	46	5		0.021	230	1.26
Flight Mission Average	45	182	10	83.9	1.400	15,525 lb/mission	84.00
Mission Summary:				Check Summary	1.400	15,509 lb/mission check	
				Average Fuel/hr	10,914	18,000 lb capacity w/o tanks	
	Average Mission minutes	84		Fuel goal in lb at arrival	2,500	2,491	
	Training Minutes	29.9					
	Average throttle %	45					
	Flight fuel lb/min	182					
	Taxi fuel lb/min	46					

Notes:
[1] Source: Fuel burn below 3,000 ft AGL from AFCEC 2013, Table 2-8

Key:
lb/hr = pounds per hour
lb/min = pounds per minute
LTO = landing and take-off cycle
MIL = military power

Table B.1-6 presents the average number of training minutes calculated for a 1.4 hour representative mission sortie for each runway use alternative. The average training minutes per sortie (or hours per year) in Table B.1-6 can be used to compare the training airspace efficiency of the different alternatives. For example, the Proposed Alternative, Alternative A, is calculated to have an average of 29.24 minutes of efficient pilot training in training airspace. No Action is calculated to have an average of 28.04 minutes of efficient pilot training in training airspace. Dividing the efficiency of Alternative A by the efficiency for No Action equals 1.043. This means that Alternative A is calculated to result in 4.3% more efficient pilot training time in the airspace than No Action with the same amount of fuel. In this example, because Alternative A uses RW 34 primarily for departure and RW 06 primarily for arrival, Alternative A runway use is not constrained by FAA ODO requirements.

The No Action Alternative runway use is constrained by the Plus-Up EA/FONSI and by FAA ODO requirements as of summer 2016. A typical high year with both F-22 squadrons present at JBER results in a total of 5,710 sorties. Existing constraints on runway use are the Plus-Up EA/FONSI limitation of not more than 25 percent of total annual sorties on RW 34 (calculated to be 1,422 per year). As of summer 2016, FAA ODO restricts the use of RW 24 to approximately 470 approved missions per year, plus the first go of the day of 4 to 8 aircraft (estimated at 1,440 sorties per year) plus other operations, including weather, maintenance, and emergencies (other departures are estimated to total 230 per year). ODO operations are coordinated with FAA. This results in a baseline, or No Action, of 2,140 annual sorties departing on RW 24. After a nominal five departures annually are estimated on RW 16, the remaining 2,143 sorties would be expected to depart on RW 06. This is the No Action distribution of departures on EIS Table 2.4.1.

As presented in Table B.1-6, No Action under the existing Plus-Up EA/FONSI and FAA ODO constraints, using the assumptions in this analysis, results in an estimated 2,669 hours of annual training for 3 WG pilots. The Proposed Action, Alternative A, is calculated to result in 2,783 annual training hours, or an additional 114 pilot training hours per year (a 4.3 percent increase in training time) in training airspace with no additional fuel use. Alternative F, assuming RW 16 is the primary arrival runway, would result in a calculated 2,917 annual training hours, or 248 more annual pilot training hours than No Action with no additional fuel use. As noted in Section B.1.4, this number of annual training hours is based on a set of simplifying assumptions which apply to all the alternatives.

Table B.1-6. Efficiency Comparison of Each Alternative with the No Action Alternative

Efficiency Measure by Alternative: F-22 Training Hours/Year in Training Airspace			
EIS Alternative	Average Training Minutes/Sortie	Hours/yr	Efficiency Compared with No Action
Proposed Action, Alternative A (RW 34 Departure; RW 06 Arrival)	29.24	2,783	+4.3%
Alternative B (RW 34 Departure; RW 06 Arrival; RW 16/34 Extension)	29.16	2,775	+4.0%
Alternative C (RW 34 Departure; RW 16 Arrival; RW 16/34 Extension)	30.98	2,948	+10.5%
Alternative D (RW 06 Departure; RW 06 Arrival)	25.97	2,471	-7.4%
Alternative E (RW 24 Departure; RW 06 Arrival)	29.05	2,764	+3.6%
Alternative F (RW 24 Departure; RW 16 Arrival; RW 16/34 Extension)	30.65	2,917	+9.3%
No Action Alternative (NA) (Departure RW 06/24: 75% under ODO restrictions; RW 16/34: 25%; Arrival RW 06)	28.04	2,669	0.0%

B.1.5.2 Efficiency Conclusions

The results from Table B.1-6 in terms of efficient time in training airspace for the Proposed Action and alternatives are summarized below:

- Proposed Action (Alternative A) (highest achievable RW 34 departure; RW06 arrival) produces approximately 4.3 percent more annual airspace training than the No Action. The Proposed Action removes the Plus-Up EA/FONSI constraints and also meets FAA ODO requirements.

- Alternative B (highest achievable departure RW 34; arrival RW06; extend RW 16/34) results in approximately 4.0 percent more annual airspace training time than No Action. Alternative B has less annual training than the Proposed Action to reflect the additional annual maintenance time required for an extended RW 16/34. Alternative B removes the Plus-Up EA/FONSI constraints and meets FAA ODO requirements.
- Alternative C (highest achievable departure RW 34; arrival RW16; extend RW 16/34) results in approximately 10.5 percent more annual airspace training time than No Action. Alternative C removes the Plus-Up EA/FONSI constraints. Alternative C would require concurrence and management of ODO on RW 16/34 to address FAA ODO restrictions.
- Alternative D (highest achievable departure RW 06; arrival RW 06), results in approximately 7.4 percent less annual airspace training time than No Action. This is primarily the result of the typical time required to taxi to, hold, and depart RW 06. Alternative D avoids the Plus-Up EA/FONSI constraints and meets FAA ODO requirements.
- Alternative E (highest achievable departure RW 24; arrival RW 06) results in approximately 3.6 percent more annual airspace training time than No Action. Alternative E avoids the Plus-Up EA/FONSI constraints and would require concurrence and management of ODO on RW 16/34 to address FAA ODO restrictions.
- Alternative F (highest achievable departure RW 24; arrival RW; extend RW 16/34;) results in approximately 9.3 percent more annual airspace training time than No Action. Alternative F is more efficient than Alternative E primarily because arrival times on RW 16 require less flight time than arrival on RW 06. Alternative F avoids the Plus-Up EA/FONSI constraints and use of RW 16 as the primary arrival runway would address FAA ODO requirements.
- No Action (Plus-up EA restrictions for depart 25% RW 34; 75% RW 24 with ODO restrictions to depart 37 percent RW 24 and 37 percent RW 06; Arrival RW 06) represents the baseline for measuring efficiency changes associated with runway use alternatives. No Action does not address Plus-Up EA/FONSI restrictions and meets FAA ODO requirements as of summer 2016.

As described in the EIS, the efficient Alternative C and Alternative E do not meet FAA ODO requirements. Assuming an extended RW 16/34 could become the primary JBER arrival runway, Alternative F could use an extended RW 16 for arrivals to avoid ODO with departures on RW 24. Alternative F is calculated to result in an estimated 9.3 percent increase in F-22 pilot training efficiency with no increase in fuel requirements when compared with No Action.

B.1.5.3 Calculation Tables

Table B.1-7 through Table B.1-20 apply the assumptions for representative runway specific missions to calculate estimated time available in the training airspace by training activity for each runway combination included in Table B.1-4. These tables permit a reconstruction of all assumptions and results presented in this efficiency analysis.

Table B.1-7. RW34-RW06 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW34 Depart; RW06 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.26
Take Off MIL	100	620		0.5	0.028	310	1.70
Transit	40	150		27.0	0.371	4,050	22.27
Mission Low	45	160		19.9	0.292	3,184	17.50
Mission Intermediate	70	337		6.7	0.207	2,258	12.41
Mission MIL	100	620		3.0	0.170	1,860	10.23
Mission A/B	130	1600		0.3	0.044	480	2.64
Transit	40	150		12.3	0.169	1,845	10.14
Approach	30	91		14.2	0.118	1,292	7.10
Taxi (idle)	7	46	5		0.021	230	1.26
Flt Mission Avg	45	182	10	83.9	1.398	15,509 lb/mission	
				Check Summary	1.400	15,721 lb/mission check	
				Average fuel lb/hr	10,914	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2500	2,491	
Mission Summary:	Avg Mission min	84					
	Avg throttle %	45					
	Flight fuel lb/min	182					
	Taxi fuel lb/min	46					

Table B.1-8. RW34-RW16 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW34 Depart; RW16 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.24
Take Off MIL	100	620		0.5	0.028	310	1.67
Transit	40	150		27.0	0.363	4,050	21.76
Mission Low	45	160		22.3	0.319	3,568	19.17
Mission Intermediate	70	337		6.7	0.202	2,258	12.13
Mission MIL	100	620		3.0	0.167	1,860	9.99
Mission A/B	130	1600		0.3	0.043	480	2.58
Transit	40	150		12.3	0.165	1,845	9.91
Approach	30	91		10.0	0.081	910	4.89
Taxi (idle)	7	46	5		0.021	230	1.24
Flt Mission Avg	45	186	10	82.1	1.368	15,511 lb/mission	

Table B.1-8. RW34-RW16 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW34 Depart; RW16 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
				Check Summary	1.368	15,741 lb/mission check	
				Average fuel lb/hr	11,168	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,489	
Mission Summary:	Avg Mission min	82					
	Avg throttle %	45					
	Flight fuel lb/min	186					
	Taxi fuel lb/min	46					

Table B.1-9. RW06-RW06 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW06 Depart; RW06 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	25	6.2	0.113	920	6.76
Take Off MIL	100	620		0.5	0.030	310	1.82
Transit	40	150		27.5	0.404	4,125	24.26
Mission Low	45	160		15.1	0.237	2,416	14.21
Mission Intermediate	70	337		6.7	0.221	2,258	13.28
Mission MIL	100	620		3.0	0.182	1,860	10.94
Mission A/B	130	1600		0.3	0.047	480	2.82
Transit	40	150		12.3	0.181	1,845	10.85
Approach	30	91		14.2	0.127	1,292	7.60
Taxi (idle)	7	46	5		0.023	230	1.35
Flt Mission Avg	41	170	30	85.8	1.430	15,506 lb/mission	
				Check Summary	1.430	14,816 lb/mission check	
				Average fuel lb/hr	10,200	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,494	
Mission Summary:	Avg Mission min	86					
	Avg throttle %	41					
	Flight fuel lb/min	170					
	Taxi fuel lb/min	46					

Table B.1-10. RW24-RW06 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW24 Depart; RW06 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.26
Take Off MIL	100	620		0.5	0.028	310	1.70
Transit	40	150		27.5	0.378	4,125	22.66
Mission Low	45	160		19.4	0.284	3,104	17.05
Mission Intermediate	70	337		6.7	0.207	2,258	12.40
Mission MIL	100	620		3.0	0.170	1,860	10.22
Mission A/B	130	1600		0.3	0.044	480	2.64
Transit	40	150		12.3	0.169	1,845	10.13
Approach	30	91		14.2	0.118	1,292	7.10
Taxi (idle)	7	46	5		0.021	230	1.26
Flt Mission Avg	45	182	10	83.9	1.398	15,504 lb/mission	
				Check Summary	1.398	15,734 lb/mission check	
				Average fuel lb/hr	10,923	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,496	
Mission Summary:	Avg Mission min	84					
	Avg throttle %	45					
	Flight fuel lb/min	182					
	Taxi fuel lb/min	46					

Table B.1-11. RW24-RW16 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW24 Depart; RW16 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.24
Take Off MIL	100	620		0.5	0.028	310	1.67
Transit	40	150		27.5	0.369	4,125	22.17
Mission Low	45	160		21.8	0.312	3,488	18.75
Mission Intermediate	70	337		6.7	0.202	2,258	12.14
Mission MIL	100	620		3.0	0.167	1,860	10.00
Mission A/B	130	1600		0.3	0.043	480	2.58
Transit	40	150		12.3	0.165	1,845	9.92
Approach	30	91		10.0	0.082	910	4.89
Taxi (idle)	7	46	5		0.021	230	1.24
Flt Mission Avg	45	186	10	82.1	1.368	15,506 lb/mission	
				Check Summary	1.368	15,736 lb/mission check	
				Average fuel	11,164	18,000 lb	

Table B.1-11. RW24-RW16 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW24 Depart; RW16 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
				lb/hr		capacity w/o tanks	
				goal in lb at arrival	2,500	2,494	
Mission Summary:	Avg Mission min	83					
	Avg throttle %	45					
	Flight fuel lb/min	186					
	Taxi fuel lb/min	46					

Table B.1-12. RW24-RW16 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW24 Depart; RW16 Arrive VFR)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.25
Take Off MIL	100	620		0.5	0.028	310	1.68
Transit	40	150		27.5	0.372	4,125	22.35
Mission Low	45	160		21.0	0.303	3,360	18.20
Mission Intermediate	70	337		6.7	0.204	2,258	12.23
Mission MIL	100	620		3.0	0.168	1,860	10.08
Mission A/B	130	1600		0.3	0.043	480	2.60
Transit	40	150		12.3	0.167	1,845	9.99
Approach	30	91		11.5	0.094	1,047	5.67
Taxi (idle)	7	46	5		0.021	230	1.25
Flt Mission Avg	45	185	10	82.8	1.380	15,514 lb/mission	
				Check Summary	1.380	15,744 lb/mission check	
				Average fuel lb/hr	11,076	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,486	
Mission Summary:	Avg Mission min	83					
	Avg throttle %	45					
	Flight fuel lb/min	185					
	Taxi fuel lb/min	46					

Table B.1-13. RW34-RW24 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW34 Depart; RW24 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.25
Take Off MIL	100	620		0.5	0.028	310	1.68
Transit	40	150		27.0	0.367	4,050	22.01
Mission Low	45	160		21.0	0.304	3,360	18.26
Mission Intermediate	70	337		6.7	0.205	2,258	12.27
Mission MIL	100	620		3.0	0.168	1,860	10.11
Mission A/B	130	1600		0.3	0.043	480	2.61
Transit	40	150		12.3	0.167	1,845	10.03
Approach	30	91		12.2	0.101	1,110	6.03
Taxi (idle)	7	46	5		0.021	230	1.25
Flt Mission Avg	45	184	10	83.0	1.383	15,503 lb/mission	
				Check Summary	1.383	15,733 lb/mission check	
				Average fuel lb/hr	11,041	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,497	
Avg Mission min	83						
Avg throttle %	45						
Flight fuel lb/min	184						
Taxi fuel lb/min	46						

Table B.1-14. RW24-RW24 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW24 Depart; RW24 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.25
Take Off MIL	100	620		0.5	0.028	310	1.69
Transit	40	150		27.5	0.374	4,125	22.43
Mission Low	45	160		20.6	0.299	3,296	17.92
Mission Intermediate	70	337		6.7	0.205	2,258	12.28
Mission MIL	100	620		3.0	0.169	1,860	10.11
Mission A/B	130	1600		0.3	0.043	480	2.61
Transit	40	150		12.3	0.167	1,845	10.03
Approach	30	91		12.2	0.101	1,110	6.04
Taxi (idle)	7	46	5		0.021	230	1.25
Flt Mission Avg	45	184	10	83.1	1.385	15,514 lb/mission	
				Check Summary	1.385	15,744 lb/mission check	
				Average fuel lb/hr	11,035	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,486	

Table B.1-14. RW24-RW24 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW24 Depart; RW24 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Mission Summary:	Avg Mission min	83					
	Avg throttle %	45					
	Flight fuel lb/min	184					
	Taxi fuel lb/min	46					

Table B.1-15. RW34-RW34 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW34 Depart; RW34 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.25
Take Off MIL	100	620		0.5	0.028	310	1.68
Transit	40	150		27.0	0.367	4,050	22.01
Mission Low	45	160		21.0	0.304	3,360	18.26
Mission Intermediate	70	337		6.7	0.205	2,258	12.27
Mission MIL	100	620		3.0	0.168	1,860	10.11
Mission A/B	130	1600		0.3	0.043	480	2.61
Transit	40	150		12.3	0.167	1,845	10.03
Approach	30	91		12.2	0.101	1,110	6.03
Taxi (idle)	7	46	5		0.021	230	1.25
Flt Mission Avg	45	184	10	83.0	1.383	15,503 lb/mission	
				Check Summary	1.383	15,733 lb/mission check	
				Average fuel lb/hr	11,041	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,497	
Mission Summary:	Avg Mission min	83					
	Avg throttle %	45					
	Flight fuel lb/min	184					
	Taxi fuel lb/min	46					

Table B.1-16. RW06-RW34 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW06 Depart; RW34 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	25	6.2	0.112	920	6.70
Take Off MIL	100	620		0.5	0.030	310	1.81
Transit	40	150		27.5	0.400	4,125	24.02
Mission Low	45	160		16.3	0.253	2,608	15.19
Mission Intermediate	70	337		6.7	0.219	2,258	13.15
Mission MIL	100	620		3.0	0.181	1,860	10.83
Mission A/B	130	1600		0.3	0.047	480	2.80
Transit	40	150		12.3	0.179	1,845	10.74
Approach	30	91		12.2	0.108	1,110	6.47
Taxi (idle)	7	46	5		0.022	230	1.34
Flt Mission Avg	42	172	30	85.0	1.417	15,516 lb/mission	
		LTO min		Check Summary	1.417	15,976 lb/mission check	
				Average fuel lb/hr	10,303	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,484	
Mission Summary:	Avg Mission min	85.0					
	Avg throttle %	42					
	Flight fuel lb/min	172					
	Taxi fuel lb/min	46					

Table B.1-17. RW34-RW16 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW34 Depart; RW16 Arrive VFR)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.25
Take Off MIL	100	620		0.5	0.028	310	1.68
Transit	40	150		27.0	0.365	4,050	21.93
Mission Low	45	160		21.4	0.309	3,424	18.54
Mission Intermediate	70	337		6.7	0.204	2,258	12.23
Mission MIL	100	620		3.0	0.168	1,860	10.07
Mission A/B	130	1600		0.3	0.043	480	2.60
Transit	40	150		12.3	0.167	1,845	9.99
Approach	30	91		11.5	0.094	1,047	5.67
Taxi (idle)	7	46	5		0.021	230	1.25
Flt Mission Avg	45	185	10	82.7	1.378	15,503 lb/mission	
				Check Summary	1.378	15,733 lb/mission check	

Table B.1-17. RW34-RW16 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW34 Depart; RW16 Arrive VFR)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
				Average fuel lb/hr	11,081	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,497	
Mission Summary:	Avg Mission min	83					
	Avg throttle %	45					
	Flight fuel lb/min	185					
	Taxi fuel lb/min	46					

Table B.1-18. RW06-RW16 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW06 Depart; RW16 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	25	6.2	0.110	920	6.62
Take Off MIL	100	620		0.5	0.030	310	1.79
Transit	40	150		27.5	0.396	4,125	23.75
Mission Low	45	160		17.5	0.269	2,800	16.12
Mission Intermediate	70	337		6.7	0.217	2,258	13.00
Mission MIL	100	620		3.0	0.179	1,860	10.71
Mission A/B	130	1600		0.3	0.046	480	2.76
Transit	40	150		12.3	0.177	1,845	10.62
Approach	30	91		10.0	0.087	910	5.24
Taxi (idle)	7	46	5		0.022	230	1.32
Flt Mission Avg	42	174	30	84.0	1.400	15,508 lb/mission	
				Check Summary	1.400	15,968 lb/mission check	
				Average fuel lb/hr	10,420	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,492	
Mission Summary:	Avg Mission min	84					
	Avg throttle %	42					
	Flight fuel lb/min	174					
	Taxi fuel lb/min	46					

Table B.1-19. RW24-RW34 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW24 Depart; RW34 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	5		0.021	230	1.25
Take Off MIL	100	620		0.5	0.028	310	1.69
Transit	40	150		27.5	0.374	4,125	22.43
Mission Low	45	160		20.6	0.299	3,296	17.92
Mission Intermediate	70	337		6.7	0.205	2,258	12.28
Mission MIL	100	620		3.0	0.169	1,860	10.11
Mission A/B	130	1600		0.3	0.043	480	2.61
Transit	40	150		12.3	0.167	1,845	10.03
Approach	30	91		12.2	0.101	1,110	6.04
Taxi (idle)	7	46	5		0.021	230	1.25
Flt Mission Avg	45	184	10	83.1	1.385	15,514 lb/mission	
				Check Summary	1.385	15,744 lb/mission check	
				Average fuel lb/hr	11,035	18,000 lb capacity w/o tanks	
				goal in lb at arrival	2,500	2,486	
Mission Summary:	Avg Mission min	83					
	Avg throttle %	45					
	Flight fuel lb/min	184					
	Taxi fuel lb/min	46					

Table B.1-20. RW06-RW24 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW06 Depart; RW24 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
Taxi (idle)	7	46	25	6.2	0.112	920	6.70
Take Off MIL	100	620		0.5	0.030	310	1.81
Transit	40	150		27.5	0.400	4,125	24.02
Mission Low	45	160		16.2	0.252	2,592	15.09
Mission Intermediate	70	337		6.7	0.219	2,258	13.15
Mission MIL	100	620		3.0	0.181	1,860	10.83
Mission A/B	130	1600		0.3	0.047	480	2.80
Transit	40	150		12.3	0.179	1,845	10.74
Approach	30	91		12.2	0.108	1,110	6.46
Taxi (idle)	7	46	5		0.022	230	1.34
Flt Mission Avg	42	172	30	84.9	1.415	15,500 lb/mission	
				Check Summary	1.415	15,960 lb/mission check	
				Average fuel lb/hr	10,304	18,000 lb capacity w/o tanks	

Table B.1-20. RW06-RW24 Representative Mission Fuel Use by Throttle Setting and Flight Minutes (RW06 Depart; RW24 Arrive)

Mode	F-22 Aircraft Engine Fuel Usage		Mission Flight Time		Equivalent Fuel/hr	Mode lb Fuel Consumption	Equivalent Flight Min
	% Full Throttle	Fuel lb/min	Taxi Minutes	Flight Minutes			
				goal in lb at arrival	2,500	2,040	
Mission Summary:	Avg Mission min	85					
	Avg throttle %	42					
	Flight fuel lb/min	172					
	Taxi fuel lb/min	46					

B.2 Acoustic Environment

Refer to Appendix E.

B.3 Safety

B.3.1 Resource Definition

Safety addresses the ground safety and flight safety associated with the F-22 operations efficiency alternatives. Ground safety considers issues associated with facility construction, operations, and maintenance activities that support flight operations. Ground safety also considers the safety of personnel and facilities on the ground that may be placed at risk from flight operations in the vicinity of the airfield and in the airspace. Although ground and flight safety are addressed independently, it should be noted that, in the immediate vicinity of the runway, risks associated with safety-of-flight issues are interrelated with ground safety concerns.

This resource area considers safety issues associated with the potential for bird/wildlife aircraft strike hazards (BASH) or result in incompatible lands uses within airfield safety zones.

B.3.2 Regulatory Setting

Numerous federal, civil, and military laws and regulations govern operations at installations and in the surrounding airspace. Individually and collectively, they prescribe measures, processes, and procedures required to ensure safe operations and to protect the public, military, and property.

Safety of flight operations within the Anchorage Bowl are regulated by FAA, and the Air Force adheres to FAA directives, including the ODO directives. That adherence results in no impacts to airspace safety. JBER runway Clear Zones and Accident Potential Zones are established to protect runway approach zones. These zones have limited permitted land use to avoid potential impacts. JBER has an extensive BASH program to avoid potential safety hazards. Adherence to that program avoids, to the extent practicable, safety impacts. JBER has extensive procedures and contract directions for adherence to construction and airfield safety standards. Air Force adherence to established safety standards results in less than significant safety environmental effects.

B.3.3 Methodology

The elements of the F-22 operations efficiency alternatives that could potentially affect safety are evaluated relative to the degree to which the action increases or decreases safety risks to the public or private property. Ground, fire, and flight safety are assessed for the potential to increase risk and the capability to manage that risk by responding to emergencies.

Siting requirements for munitions and ammunition storage and handling facilities are based on safety and security criteria. Defined distances are maintained between munitions storage areas and a variety of other types of facilities. These distances, called quantity-distance (Q-D) arcs, are determined by the type and quantity of explosive material to be stored. Each explosive material storage or handling facility has Q-D arcs extending outward from its sides and corners for a prescribed distance. Within these Q-D arcs, development is either restricted or prohibited altogether to ensure personnel safety and to minimize potential for damage to other facilities in the event of an accident. In addition, explosives storage and handling facilities must be located in areas where security of the munitions can be maintained at all times. Identifying the Q-D arcs ensures that construction does not occur within these areas.

The alternatives do not involve changing the number of F-22 operations at JBER. This means that the potential aircraft mishaps associated with mid-air collisions, mechanical failure, or pilot error would not change from current conditions and is not discussed further.

B.4 Air Quality

B.4.1 Resource Definition

Air quality in a given location is defined by the size and topography of the air basin, the local and regional meteorological influences, and the types and concentrations of pollutants in the atmosphere, which are generally expressed in units of parts per million or micrograms per cubic meter. One aspect of significance is a pollutant's concentration in comparison to a federal and/or state ambient air quality standard. These standards represent the maximum allowable atmospheric concentrations that may occur and still protect public health and welfare and include a reasonable margin of safety to protect the more sensitive individuals in the population.

B.4.2 Regulatory Setting

The Clean Air Act (CAA) and its subsequent amendments establish air quality regulations and the National Ambient Air Quality Standards (NAAQS) and delegate the enforcement of these standards to the states. The CAA establishes air quality planning processes and requires areas in nonattainment of an NAAQS to develop a State Implementation Plan that details how the state will attain the standard within mandated timeframes. In Alaska, the Division of Air Quality of the Alaska Department of Environmental Conservation (ADEC) is responsible for enforcing air pollution regulations. The Division of Air Quality enforces the NAAQS by monitoring statewide air quality and developing rules to regulate and permit stationary sources of air emissions. The Alaska Air Quality Rules are found in the Alaska Administrative Code (AAC) Title 18, Environmental Conservation, Chapter 50, Air Quality Control (ADEC 2015).

The U.S. Environmental Protection Agency (USEPA) established the NAAQS to regulate the following criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than or equal to 10 microns in diameter (PM_{10}), particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead. The NAAQS generally may not be exceeded more than once per year, except for annual standards, which may never be exceeded.

CAA gives states the authority to establish air quality rules and regulations. These rules and regulations must be equivalent to, or more stringent than, the federal program. The ADEC Air Quality Division administers the state's air pollution control program under the authority of the federal CAA and Amendments, federal regulations, and state laws. The national and state of Alaska ambient air quality standards are presented in Table B.4-1.

Table B.4-1. National and Alaska State Ambient Air Quality Standards

Pollutant	Averaging Time	Alaska AAQS	National AAQS	
			Primary	Secondary
Carbon Monoxide	8-hour[1]	10 mg/m^3	9 ppm (10 mg/m^3)	None
	1-hour[1]	40 mg/m^3	35 ppm (40 mg/m^3)	
Nitrogen Dioxide	Annual (arithmetic average)	100 $\mu g/m^3$	53 ppb[3] (100 $\mu g/m^3$)	Same as Primary
	1-hour[2]	188 $\mu g/m^3$	100 ppb	None
Particulate Matter (PM_{10})	24-hour[3]	150 $\mu g/m^3$	150 $\mu g/m^3$	Same as Primary
Particulate Matter ($PM_{2.5}$)	Annual[4] (arithmetic average)	15 $\mu g/m^3$	12 $\mu g/m^3$	Same as Primary
	24-hour[5]	35 $\mu g/m^3$	35 $\mu g/m^3$	Same as Primary
Ozone	8-hour[6]	0.075 ppm	0.075 ppm (2008 std)	Same as Primary
Lead	Rolling 3-month average	0.15 $\mu g/m^3$	0.15 $\mu g/m^3$	Same as Primary
Sulfur Dioxide	Annual (arithmetic average)	80.0 $\mu g/m^3$	None	None
	24-hour[1]	365 $\mu g/m^3$	None	None
	3-hour	1,300 $\mu g /m^3$ [7]	None	0.5 ppm (1,300 $\mu g /m^3$)
	1-hour	196 µg /m	75 ppb[8]	None
Reduced sulfur compounds measured as sulfur dioxide	30-minute[1]	50 $\mu g/m^3$	None	None
Ammonia	8-hour[1]	2.1 mg/m^3	None	None

Notes:
1. Not to be exceeded more than once per year.
2. To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb.
3. Not to be exceeded more than once per year on average over 3 years.
4. To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15 $\mu g/m^3$.
5. To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 $\mu g/m^3$.
6. To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm.
7. 30-minute average of 50 $\mu g/m^3$ not to be exceeded more than once each year.
8. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

Key: AAQS = Ambient Air Quality Standards
ppm = parts per million
ppb = parts per billion
mg/m^3 = milligrams per cubic meter
$\mu g/m^3$ = micrograms per cubic meter
$PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns

Sources: ADEC 2015 and USEPA 2015a

Greenhouse Gases - Greenhouse gases (GHGs) are chemical compounds in the earth's atmosphere that trap heat in the atmosphere, thus regulating the Earth's temperature. Gases exhibiting greenhouse properties come from both natural and human sources. Water vapor, CO_2, methane, and nitrous oxide are examples of GHGs that have both natural and manmade sources, while other gases such as those used for aerosols are exclusively manmade. The six primary GHGs, which are internationally recognized and regulated under the Kyoto Protocol, are CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

Federal agencies address climate change and emissions of GHGs by reporting and meeting reductions mandated in federal laws, Executive Orders (EOs), and agency policies. Some of these requirements include EO 13693, *Planning for Federal Sustainability in the Next Decade* (March 19, 2015), the *USEPA Final Mandatory Reporting of Greenhouse Gases Rule* (for facilities whose stationary sources emit 25,000 metric tons or more per year of carbon dioxide-equivalent [CO_2e], for example), and the Federal Renewable Fuels Standard. The goal of EO 13693 is to maintain federal leadership in sustainability and GHG emission reductions. To achieve this goal, EO 13693 specifies several energy targets for federal agencies. Together these policies aim to reduce carbon pollution and increase renewable energy generation.

B.4.3 Methodology

Potential impacts to air quality are evaluated with respect to the extent, context, and intensity of the impact in relation to relevant regulations, guidelines, and scientific documentation. The Council on Environmental Quality (CEQ) defines significance in terms of context and intensity in Title 40 of the Code of Federal Regulations (CFR) Section 1508.27. This requires that the significance of the action must be analyzed in respect to the setting of the Proposed Action and based relative to the severity of the impact. The CEQ NEPA regulations (40 CFR 1508.27[b]) provide 10 key factors to consider in determining an impact's intensity.

The air quality analysis estimated the magnitude of emissions that would occur from F-22 operations and/or construction of a 2,500-foot extension to RW 16/34 at JBER. Construction emissions include combustive emissions from equipment and haul trucks and fugitive dust emissions (PM_{10}/$PM_{2.5}$) due to the operation of equipment and trucks on exposed soils. Impacts are considered significant if emissions from a project alternative would increase ambient air pollution concentrations to above any NAAQS. In addition, JBER is in proximity to the Eagle River PM_{10} and Municipality of Anchorage CO Maintenance Areas. Therefore, the analysis determined the net change in emissions that would occur from potential F-22 operations within these areas and compared these net emissions to applicable annual conformity thresholds that require a conformity determination. If proposed net emissions within these areas remain below the applicable conformity threshold, the alternative would conform to the applicable State Implementation Plan and would produce less than significant air quality impacts. Detailed emissions assumptions and calculation methods are included in Appendix D, *Air Quality*.

The analysis estimated GHG emissions generated from proposed activities for informational and comparative purposes among the alternatives. In addition, the analysis determined how future climate change would affect implementation of the proposed alternatives.

B.5 Physical Resources

B.5.1 Resource Definition

Physical resources include topography, geology, soils, and water resources, including wetlands. Topography characterizes surface form of the landscape and provides a description of the physical setting. Geologic resources include subsurface and exposed rock. The inherent properties of local bedrock affect soil formation and properties, groundwater sources and availability, and terrain. Soils include particulate, unconsolidated materials formed from in place underlying bedrock or other parent material or transported from distant sources via glacial transport, water, and wind. Soils play a critical role in the natural and human environment, affecting vegetation and habitat, water and air quality, and the success of the construction and stability of roads, buildings, and shallow excavations. Water resources include surface water, such as lakes, rivers, streams and wetlands, and groundwater (subsurface hydrologic resources). These resources may have scientific, historical, economic, ecological, and recreational value.

Wetlands are areas of transition between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water (Mitsch and Gosselink 2000). The CFR, Title 33, Part 328.3(b) classes wetlands as a subset of waters of the United States and "means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." The definition excludes unvegetated areas such as streams, ponds, and mudflats.

The U.S. Army Corps of Engineers (USACE) definition of wetlands states that wetlands must possess hydrophytic vegetation, wetland hydrology, and hydric soils (Environmental Laboratory 1987). Hydrophytic vegetation means that the dominant plant type must be adapted to living in areas with saturated soils. Wetland hydrology means an area that has saturated soils or is covered by water for some period of time during the growing season. Hydric soils are soils that are saturated or covered by water for a sufficient amount of time during the growing season that anaerobic (without air) conditions exist.

B.5.2 Regulatory Setting

The Clean Water Act (CWA) of 1977 (Title 33 of the United States Code [U.S.C.] 1251 et seq.) and the USEPA Storm Water General Permit regulate pollutant discharges. Pollutants regulated under the CWA include "priority" pollutants, including various toxic pollutants, such as biochemical oxygen demand, total suspended solids, fecal coliform, oil and grease, and pH. Section 404 of the CWA and EO 11990, *Protection of Wetlands*, regulate development activities in or near streams or wetlands. Potential development actions that may affect streams and/or wetlands require a permit from the USACE for dredging and filling in wetlands. EO 11988, *Floodplain Management*, requires federal agencies to take action to reduce the risk of flood damage; minimize the impacts of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. Federal agencies are directed to consider the proximity of their actions to or location within floodplains.

With respect to soil erosion, Section 402(p) of the CWA regulates non-point source discharges of pollutants, under the National Pollutant Discharge Elimination System (NPDES) program, or state equivalent program. This section of the CWA was amended to require the USEPA to establish regulations for discharges from active construction sites. NPDES General Construction Permits require preparation of a Storm Water Pollution Prevention Plan for projects greater than 1 acre.

Section 404 of the CWA established a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Activities in waters of the United States that are regulated under this program include fills for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and conversion of wetlands to uplands for farming and forestry. The USACE is the lead agency in protecting wetland resources. This agency maintains jurisdiction over federal wetlands (33 CFR 328.3) under Section 404 of the CWA (30 CFR 320-330) and Section 10 of the Rivers and Harbors Act (30 CFR 329). The USEPA assists the USACE (in an administrative capacity) in the protection of wetlands (40 CFR 225.1 to 233.71). In addition, the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service provide support with important advisory roles.

Furthermore, EO 11990, *Protection of Wetlands*, requires federal agencies, including the USAF, to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. EO 11990 requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative; if construction in wetlands cannot be avoided, the Air Force will issue a Finding of No Practicable Alternative.

Executive Order 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input*, is a recent EO that was signed on January 30, 2015. Guidance for implementing this EO was published on October 8, 2015. One of the primary changes in this EO is to change the methods for determining the floodplain of concern. The guidance for the EO also indicates that the regulations and procedures for floodplain management will frequently apply to wetlands. The USACE published a guidance document entitled “Applicability of Floodplain Management and FFRMS Executive Orders to USACE Permitting Authorities” (USACE, nd). The USACE states in this document that the portion of EO 13690 that changes the method for determining a floodplain of concern does not apply to the USACE Regulatory Program.

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with CWA Section 401.

The USACE, Anchorage District has developed the Anchorage Debit-Credit Method (ADCM) as a means of determining compensatory mitigation for unavoidable adverse wetland impacts. The ADCM is a mathematical tool that expresses adverse impacts ad debits and beneficial impacts as credits. Use of the ADCM is not a requirement of obtaining a wetland permit but it use is recommended.

B.5.3 Methodology

Impacts on soils and surface water can result from earth disturbance that would expose soil to wind or water erosion. Analysis of impacts on soils and surface water examines the potential for such erosion and describes typical measures employed to minimize erosion. In addition, soil limitations and associated typical engineering remedial measures are evaluated with respect to proposed construction. Flooding impacts are evaluated by determining whether proposed construction is located within a designated floodplain. Groundwater impacts are evaluated by determining whether groundwater beneath the project site would be used for the Proposed Action, and if so, by determining the potential to adversely affect those groundwater resources.

The first step in the analysis of potential impacts on wetland resources was to determine the locations of sensitive habitats and species in relation to the proposed action. Wetland data provided by JBER was used to determine the known locations of wetland resources in the project area; however the entire installation has not been surveyed for wetlands. Data utilized included information collected in a 2012 wetland inventory, which included field reconnaissance of designated areas where future projects were anticipated. No field verification is known to have occurred in the vicinity of the runway project expansion. As stated in the JBER Integrated Natural Resources Management Plan (INRMP), the inventory is not comprehensive and is not equivalent to a wetland delineation or jurisdictional determination. Unmapped wetlands may still exist on JBER. The INRMP indicates that a field survey would need to be completed to definitively determine the location and jurisdictional status of wetlands in a given project area. As stated in the EIS Section 1.1, additional studies would be conducted prior to a decision on a runway extension.

Determination of the significance of wetland impacts is based on (1) loss of wetland acreage, (2) the function and value of the wetland, and (3) the proportion of the wetland that would be affected relative to the occurrence of similar wetlands in the region. Impacts on wetland resources are considered significant if high-value wetlands would be adversely affected or if significant wetland acreage is lost.

In assessing impacts to wetlands the types of wetland impacts (direct and indirect), were assessed and described using the best available information regarding potential construction of an extension and use of RW 16/34. An estimate of these impacts was evaluated by comparing the known wetland areas with the terrain analysis boundary and the region of proposed grading, staging, and spoil disposal areas to determine an estimate of the direct impacts of constructing a runway extension at JBER. Since no field evaluation of wetlands has been conducted, these numbers can only serve as an estimate of potential impacts that could occur with the construction of a runway extension. A field evaluation would also allow a comparison of pre-construction wetland functions with post-development functions and more accurately assess the value and functions of the wetland within the project area. Once a field evaluation is conducted additional assessment of the wetland impacts would need to occur in a follow on NEPA document.

B.6 Hazardous Materials and Waste Management

B.6.1 Resource Definition

The terms “hazardous materials” and “hazardous waste” refer to substances that, due to their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to environment or public health when released into the environment. Products containing hazardous materials used at JBER primarily consist of aviation fuel, ground vehicle fuel, lubricants, hydraulic fluids, antifreeze, degreasers, and solvents, chemical batteries, cleaning materials, and paint-related materials. Federal, state, and Air Force regulations determine requirements for hazardous materials and waste. The key regulatory requirements include:

- Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 et seq.).
- Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. 11001–11050).
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. 9601–9675).
- Community Environmental Response Facilitation Act of 1992 (42 U.S.C. 9620).
- Asbestos Hazard Emergency Response Act (15 U.S.C. 2651).
- Spill Prevention, Control and Countermeasure Rule (40 CFR 112).
- USEPA Regulation on Identification and Listing of Hazardous Waste (40 CFR 261).
- USEPA Regulation on Standards for the Management of Used Oil (40 CFR 279).
- USEPA Regulation on Designation, Reportable Quantities, and Notification (40 CFR 302).
- Clean Water Act (CWA) (Section 402 of 40 CFR 122).

The NPDES permit program is administered by the State of Alaska, through the ADEC.

B.6.2 Regulatory Setting

State Regulations - The State of Alaska, acting through the ADEC, also has authority to regulate the handling, storage, transport, and disposal of hazardous materials and waste within the state. ADEC's authority is derived from legislation enacted as *Title 18, Environmental Conservation, AAC*. In addition to its Title 18 authority, the ADEC has oversight responsibility of DoD CERCLA sites. Applicable ADEC regulations include the following: *Hazardous Waste* (18 AAC 62), *Oil and Other Hazardous Substances Pollution Control* (18 AAC 75), *Soil Cleanup Levels*; Tables (18 AAC 75.341), *Best Available Technology Review* (18 AAC 75.445[k]), and *Underground Storage Tanks* (18 AAC 78).

Air Force Regulations - Several Air Force regulations address the management and safe handling of hazardous waste and materials in accordance with applicable federal and state regulations. These include AFI 32-7086, *Hazardous Material Management;* AFI 32-7042, *Solid and Hazardous Waste Compliance*; and AFI 32-1052, *Facility Asbestos Management*. Air Force Instruction 32-1052 establishes asbestos management requirements and also establishes a program to ensure compliance with 40 CFR 61.140, *National Emission Standard for Asbestos*, and 29 CFR 1926.1101, *Asbestos Construction Standards*.

B.6.3 Methodology

The qualitative and quantitative assessment of impacts from hazardous materials and waste management focuses on how and to what degree each alternative may affect hazardous materials usage and management, hazardous waste generation and management, and hazardous waste disposal. An impact was considered significant if (1) the generation of hazardous waste types or quantities could not be accommodated by the current management system, or (2) there was an increased likelihood of an uncontrolled release of hazardous materials that could contaminate the soil, surface water, groundwater, or air.

B.7 Biological Resources

B.7.1 Resource Definition

The biological resources discussion refers to plants and animals and the habitats in which they occur on and within JBER that could potentially be affected by the proposed action. Assemblages of plant and animal species within a defined area that are linked by ecological processes are referred to as natural communities. The existence and preservation of these resources are intrinsically valuable; they also provide aesthetic, recreational, and socioeconomic values to society. This section focuses on plant and animal species or vegetation types that typify or are important to the function of the ecosystem, are of special societal importance, or are protected under federal or state law or statute. For purposes of the analysis the discussion is organized into three major categories: (1) vegetation and habitat, including wetlands; (2) fish and wildlife; and (3) special-status species. In this section, the ROI for biological resources is JBER and its immediate vicinity, including the lower portion of the Knik Arm of the upper Cook Inlet.

Vegetation includes all existing terrestrial plant communities and does not include special-status plants, which are discussed under special-status species below. The composition of plant species within a given area defines ecological communities and determines the types of wildlife that may be present. Wetlands are a special category of sensitive habitats and are subject to regulatory authority under Section 404 of the CWA, EO 11990 *Protection of Wetlands*, and EO 19988 *Floodplain Management*. The USACE administers the CWA, and has jurisdiction over all waters of the U.S., including wetlands. Jurisdictional wetlands are those areas that meet all the criteria defined in the USACE's *Wetlands Delineation Manual* (Environmental Labs 1987). Wetlands are discussed in Section B.5.2.

Fish and Wildlife includes all vertebrate animals, with the exception of special-status species, which are discussed separately below. Typical animals include vertebrate groups such as fish, amphibians, songbirds, waterfowl, hoofed animals, carnivores, bats, rodents and other small mammals. The attributes and quality of available habitats determine the composition, diversity, and abundance patterns of wildlife species assemblages, or communities. Each species has its own set of habitat requirements and interspecific interactions driving its observed distribution and abundance. Community structure is derived from the net effect of the diverse resource and habitat requirements of each species within a geographic setting. For this reason, an assessment of habitat types and area affected by the Proposed Action can serve as an overriding determinant in the assessment of impacts for wildlife populations.

Special-Status Species are defined as those plant and animal species listed as threatened, endangered, candidate, or species of concern by the USFWS or the National Marine Fisheries Service, as well as those species with special-status designations by the State of Alaska. The Endangered Species Act (ESA) protects federally listed threatened and endangered plant and animal species. Candidate species are species that USFWS is considering for listing as threatened or endangered but for which a proposed rule has not yet been developed. Candidates do not benefit from legal protection under ESA. In some instances, candidate species may be emergency listed if USFWS determines that the species population is at risk due to a potential or imminent impact. The USFWS encourages federal agencies to consider candidate species in their planning process because they may be listed in the future and, more importantly, because current actions may prevent future listing. Additionally, the USFWS maintains a list of Birds of Conservation Concern (USFWS 2008), which has a goal of accurately identifying the migratory and non-migratory bird species (beyond those already federally designated as threatened or endangered) that represent the USFWS' highest conservation priorities.

B.7.2 Regulatory Setting

Federal laws and regulations that apply to biological resources relevant to this project include the Migratory Bird Treaty Act, the CWA, NEPA, ESA, the Bald and Golden Eagle Protection Act, the Sikes Act, the Marine Mammal Protection Act, state hunting regulations, and state laws protecting plants and nongame wildlife.

B.7.3 Methodology

Mapping and other data for biological resources including vegetation and wildlife; wetlands and marine communities; and threatened, endangered, and special-status species were obtained from a number of past NEPA documents, DoD sources, and federal and state agencies. Specific species of interest were mapped along with proposed project components (bases, flight lines, and airspace) to aid in determination of effects. Impact analyses were conducted using knowledge of wildlife habitat and sensitive species occurrence data, where available, based on where construction-related ground disturbance, airfield operations (takeoffs, landings), and activities in airspace would occur. Assessing the significance of direct and indirect impacts on biological resources is based on federal and state determinations of: (1) the importance (legal, commercial, recreational, ecological, or scientific) of the resource, (2) the rarity of a species or habitat regionally, (3) the sensitivity of the resource to proposed construction and training activities, (4) the proportion of the resource that would be affected relative to its occurrence in the region, and (5) the duration of the impact. Federal or state agencies consider impacts on biological resources to be greater if priority species or habitats are adversely affected, if substantial effects occur over relatively large areas, and/or if disturbances cause reductions in population size or distribution of a priority species. Specialists also reviewed many similar regional project documents and used professional judgment in interpreting published findings of experimental and observational studies of overflight effects on wildlife. Analysis has taken into consideration the public and agency comments received during the scoping period.

B.8 Cultural Resources

B.8.1 Resource Definition

Cultural resources are any prehistoric or historic district, site, or building, structure, or object considered important to a culture or community for scientific, traditional, religious, or other purposes. They include archaeological resources, historic architectural resources, and traditional resources. Archaeological resources are locations where prehistoric or historic activity measurably altered the earth or produced deposits of physical remains (e.g., arrowheads, bottles). Historic architectural resources include standing buildings and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for inclusion in the National Register of Historic Places (NRHP), although resources dating to defined periods of historical significance, such as the Cold War era (1945-1989) may also be considered eligible. Traditional resources are associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Historic properties (as defined in 36 CFR 60.4) are significant archaeological, architectural, or traditional resources that are either eligible for listing, or listed on, NRHP. Both historic properties and significant traditional resources identified by Alaska Natives are evaluated for potential adverse impacts from an action.

B.8.2 Regulatory Setting

A number of federal regulations and guidelines have been established for the management of cultural resources. Section 106 of the National Historic Preservation Act (NHPA), as amended, requires federal agencies to take into account the effects of their undertakings on historic properties. Historic properties are cultural resources that are listed in, or eligible for listing in, NRHP. Eligibility evaluation is the process by which resources are assessed relative to NRHP significance criteria for scientific or historic research, for the public, and for traditional cultural groups. Under federal law, impacts to cultural resources may be considered adverse if the resources have been determined eligible for listing in NRHP or have been identified as important to Alaska Natives as outlined in the *American Indian Religious Freedom Act* and EO 13007, *Indian Sacred Sites*. DoD Alaska Native Policy (1999) provides guidance for working with federally-recognized Alaska Native governments. DoD policy requires that installations provide timely notice to, and consult with, tribal governments prior to taking any actions that may have the potential to significantly affect protected Alaska Native resources, rights, or lands.

Laws pertinent to the Proposed Action include the NHPA of 1966, as amended; the Antiquities Act of 1906; the Historic Sites Act of 1935; NEPA; the Archaeological and Historic Preservation Act of 1974; the Archaeological Resources Protection Act of 1979; the Native American Graves Protection and Repatriation Act of 1990; and the American Indian Religious Freedom Act of 1978.

Under Section 106 of NHPA (54 U.S.C. 306108), the Air Force is required to consider the effects of its undertakings at each alternative location on historic properties that are listed, or eligible for listing, in the NRHP and to consult with the State Historic Preservation Officer (SHPO), the Tribal Historic Preservation Officer (THPO), and others regarding potential effects as per 36 CFR 800. Under AFI 32-7065, recorded cultural resources not evaluated for NRHP eligibility must be managed as eligible. Under Section 110 of NHPA, each base is mandated to maintain an active historic preservation program and provide stewardship of cultural resources that are consistent with the preservation of such properties and the mission of the agency (54 U.S.C. 306101 and 306102).

Federal regulations governing cultural resource activities include the following: 36 CFR 800, *Protection of Historic* Properties (incorporating amendments effective August 5, 2004); 36 CFR 79, *Curation of Federally Owned and Administered Archaeological Collections*; 43 CFR 7, *Protection of Archaeological Resources*; 36 CFR 60, *National Register of Historic Places*; and 36 CFR 63, *Determinations of Eligibility for Inclusion in the National Register*. Cultural resource-related EOs that may affect the alternative locations include the following: EO 11593, *Protection and Enhancement of the Cultural Environment*; EO 13007, *Indian Sacred Sites*; EO 13175, *Consultation and Coordination with Indian Tribal Governments*; and EO 13287, *Preserve America*.

Department of Defense Instruction 4715.16, *Cultural Resources Management*, and AFI 32-7065, *Cultural Resources Management*, outline and specify proper procedures for cultural resource management on Air Force installations.

B.8.3 Methodology

Analysis of potential impacts to cultural resources considers direct impacts that may occur by physically altering, damaging, or destroying all or part of a resource; altering characteristics of the surrounding environment that contribute to the resource's significance; introducing visual or audible elements that are out of character with the property or alter its setting; or neglecting the resource to the extent that it deteriorates or is destroyed. Direct impacts can be assessed by identifying the types and locations of proposed activity and determining the exact location of cultural resources that could be affected. Indirect impacts occur later in time or farther from the Proposed Action. Indirect impacts to cultural resources generally result from the effects of project-induced population increases, such as the need to develop new housing areas, utility services, and other support functions to accommodate population growth.

B.9 Land Use and Recreation

B.9.1 Resource Definition

Natural land use classifications include wildlife areas, forests, and other open or undeveloped areas. Human land uses include residential, commercial, industrial, utilities, agricultural, recreational, and other developed uses. Management plans, policies, ordinances, and regulations determine the types of uses that are allowable, and protect specially designated or environmentally sensitive areas.

Recreation resources consider outdoor recreational activities that take place away from the residences of participants. This includes activities in remote and natural areas and use of manmade facilities developed for outdoor public recreational use (such as campgrounds and trails). Federal, state, and local entities set priorities for recreation as a public purpose and value.

B.9.2 Regulatory Setting

Federal and state laws and regulations concerning land use include the following:

- The Federal Land Policy and Management Act
- Wilderness Act (16 U.S.C. 1131–1136 et seq.)
- Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.)
- Multiple-Use Sustained Yield Act, 1960
- National Forest Management Act, 1976
- Alaska National Interest Lands Conservation Act (15 U.S.C. 3101–3223)

B.9.3 Methodology

The attributes of JBER and nearby land use addressed in this analysis include general land use patterns, land ownership, and applicable plans and ordinances. General land use patterns characterize the types of uses within a particular area including human land uses, such as agricultural, residential, commercial, industrial, institutional, and recreational, or natural land uses, such as forests, refuges, and other open spaces. Land ownership categorizes land by owner; the major land ownership categories include federal, state, local jurisdiction, Alaska Native corporations, and private holdings. Ownership influences how land is managed and the types of controls that govern the use of the land. Land use plans and ordinances, policies, and guidelines influence goals and management actions for current and future use.

For this analysis, the ROI for land use and recreation consists of JBER.

B.10 Transportation and Circulation

B.10.1 Resource Definition

Transportation resources include the infrastructure required for the movement of people, materials, and goods. Transportation resources consider the transportation network on JBER-Elmendorf (roads, railway, and access gates) and the surrounding area.

B.10.2 Regulatory Setting

Federal and state laws and regulations concerning transportation include:

- Joint Regulation (Army Regulation 55-80/Air Force Manual [AFMAN] 32-1017) Department of Transportation, *Transportation Engineering Program, Transportation, and Travel*.
- EO 13693, *Planning for Federal Sustainability in the Next Decade* (March 19, 2015).

B.10.3 Methodology

The analysis for transportation resources considers potential impacts on the efficiency and performance of local transportations systems that could result from implementation of the F-22 operations efficiency alternatives.

For the purpose of this analysis, transportation and circulation resources include the infrastructure required for the movement of people, materials, and goods. The ROI for transportation and circulation resources include primary and secondary roads on JBER, access gates, the roadway network leading to and from JBER, and rail lines adjacent to or running though JBER.

Significance for transportation and circulation is based on the roadway level of service (LOS). The LOS criteria for arterials is classified as A through F depending on the average traffic speed. In general, an arterial declines by one level of service (from A, uncongested operations, to B, very light congestion or from C, light congestion, to D, significant congestion) with a reduction in speed of 25 percent to 30 percent. An example of using LOS to evaluate transportation at JBER gates and on JBER roadways is to extrapolate to the measured average annual daily trips (AADT) used at the gates (EIS Section 3.10). At JBER, commercial vehicles, including construction equipment, would enter through the Post Road Gate which is open for inspection of commercial vehicles from 6 AM to 6 PM and has an AADT of 3,000 vehicles. Other JBER gates have a cumulative AADT of approximately 58,400 vehicles. An estimated 108 AADT for construction vehicles would represent a 3.6 percent increase at the Post Road Gate. Depending on the entrance gate selected by the estimated peak of 350 construction-related workers, temporary traffic at specific JBER gates could be from 2 percent to 8 percent more than the existing AADT. The LOS designation does not directly apply to base access gates, although a 2 percent to 8 percent temporary increase in gate AADT would be less than a change in one LOS classification and would, therefore, be less than significant.

B.11 Socioeconomics

B.11.1 Methodology

The socioeconomic analysis focuses on the effects resulting from noise associated with runway use alternatives and construction associated with RW 16/34 extension alternatives. The nationally and regionally recognized IMPLAN economic model was used to estimate the employment and expenditure effects within the ROI. The IMPLAN model uses data from the U.S. Bureau of Labor Statistics and the U.S. Bureau of Economic Analysis to construct a mathematical representation of the Anchorage economy using region-specific spending patterns, economic multipliers, and industries (IMPLAN Group LLC 2015a).

Economic impacts are analyzed by introducing a change to a specific industry such as an increase or decrease in employment or spending; the IMPLAN model mathematically calculates the resulting changes in the local economy. For this analysis, the IMPLAN model estimated the economic effects of the construction expenditures on spending and employment in the municipality of Anchorage.

The economic impact analysis separates effects into three components: direct, indirect, and induced. *Direct effects* are the changes in employment and income generated directly by the expenditures related to the construction activities. *Indirect effects* are generated by any resulting changes in business-to-business expenditures as local businesses adjust their activities in response to changes in the amount of goods and services demanded. An example of an indirect effect would be a store purchasing more retail goods from a local producer because of an increase in demand. *Induced effects* are the changes in household spending or employment generated by the direct and indirect effects, such as an increase in the retail supplier's income from the previous example. The IMPLAN model uses extensive data and mathematical calculations to aggregate the successive waves of economic effects. The resultant total effect from the economic impact analysis is the sum of the direct, indirect, and induced effects throughout the ROI.

There is not a general agreement for determination of significance for socioeconomic effects that result from an increase in employment. Short-term direct construction employment and indirect and induced employment are associated with construction expenditures. Small changes in employment in a large regional economy are able to be absorbed as part of the normal economic variation in employment and expenditures. For example, this EIS discusses that the Anchorage ROI has a 2015 population of approximately 300,000 and full- and part-time employment of approximately 205,000. The construction of an extension of RW 16/34 was calculated to support 1,300 direct, indirect, and induced jobs for the equivalent of one year. This level of employment would be less than 1 percent of Anchorage's employment level. Temporary employment during construction is not considered significant in the Anchorage employment market. Some employment sectors could have demand at a higher percentage, but in no case would the expected demand for specific employees be in excess of 3.2 percent of that specific skill level in Anchorage. The socioeconomic effect on the Anchorage economy would be less than significant.

Socioeconomic analysis of noise in the vicinity of JBER focuses on noise levels greater than 65 decibels (dB) day-night average sound level (L_{dn}). The USEPA has identified a L_{dn} of 55 dB to be a level protective of the public health and welfare. This represents a threshold below which adverse noise effects are generally not expected. The FAA and DoD have identified residential use as incompatible with annual noise levels above 65 dB L_{dn} unless special measures are taken to reduce residential interior noise levels. Residential use is identified as incompatible regardless of noise attenuation at noise levels greater than 75 dB L_{dn} (32 CFR 256.8).

There are a number of factors that affect property values that make predicting impacts difficult. Factors directly related to the property, such as size, improvements, and location of the property, as well as current conditions in the real estate market, interest rates, and housing sales in the area, are more likely to have a direct adverse impact on property values. Several studies have analyzed property values as they relate to military and civilian aircraft noise. In one study, a regression analysis of property values as they relate to aircraft noise at two military installations was conducted (Fidell et al. 1996). This study found that, while aircraft noise at these installations may have had minor impacts on property values, it was difficult to quantify that impact. Other factors, such as the quality of the housing near the installations and the local real estate market, had a larger impact on property values. Therefore, the regression analysis was not able to predict the impact of aircraft noise on the property values of two comparable properties.

Another study analyzed 33 other studies attempting to quantify the impact of noise on property values (Nelson 2003). The result of the study supports the idea that the potential for an adverse impact on property values as a result of aircraft noise exists and estimates that the value of a specific property could be discounted between 0.5 and 0.6 percent per decibel when compared to a similar property that is not affected by aircraft noise. Additional data indicate that the discount for property values as a result of noise would be higher for noise levels above 75 dB L_{dn}.

These studies apply to large sample sizes and compare residential property not affected by aircraft noise with similar residential properties within the different aircraft-generated noise contours near airfields. It would not be accurate to apply these studies to the very small sample size of the estimated total of 20 residential units in the community of Mountain View, which would be calculated to be within the 65 dB L_{dn} noise contour under Action Alternative A. There are multiple factors affecting housing value, and, with a very small sample size and no similar residential properties not affected by noise, it would not be possible to statistically determine whether there was a 0.5 percent to 1.0 percent difference in housing values that could be attributable to Mountain View properties within the 65 dB L_{dn} noise contour.

B.12 Environmental Justice

B.12.1 Resource Definition

Environmental justice is defined by the USEPA as, "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (Air Force 2014). EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, is designed to ensure that disproportionately high and adverse human health or environmental effects on citizens in either of these categories are identified and addressed, as appropriate. The terms "minority" and "low income" are defined below for purposes of this analysis.

- Minority: The term "minority" for purposes of environmental justice analysis includes those individuals who have identified themselves as having one of the following origins: "Hispanic," "Asian-American," "Native Hawaiian and Other Pacific Islander," "Black or African-American," "American Indian or Alaska Native," or "Some Other Race" (which does not include "White," "Black or African-American," "American Indian or Alaska Native," "Asian," and "Native Hawaiian or Other Pacific Islander" race categories) (Air Force 2014).
- Low income: The U.S. Census Bureau defines the term "poverty" (also referred to as "low income") as "a set of money income thresholds that vary by family size and composition to determine who is in poverty" (U.S. Census Bureau 2015). A family and each individual in the

family is considered in poverty if the total family income is less than the family's threshold or the dollar amount calculated by the U.S. Census to determine poverty status.

Additionally, potential health and safety impacts that could disproportionately affect children are considered in this EIS under the guidelines established by EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*. For purposes of this analysis, the term "children" refers to any person age 17 or younger.

While there are currently no standard or regulatory requirements for including elderly in the environmental justice analysis, the USEPA and the Air Force Environmental Impact Analysis Process (EIAP) guidance stress the importance of considering an elderly person as a sensitive receptor to potential environmental impacts. For this analysis, the term "elderly" refers to any person age 65 or older.

B.12.2 Regulatory Setting

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs federal agencies to address environmental and human health conditions in minority and low-income communities. In addition to environmental justice issues are concerns pursuant to EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, which directs federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children.

Air Force guidance for implementation of the EO is contained in the Guide *for Environmental Justice Analysis with the Environmental Impact Analysis Process,* dated November 2014 (Air Force 2014). Minority populations include all persons identified by the 2010 census to be of Hispanic origin, regardless of race, and all persons not of Hispanic origin other than White (i.e., non-Hispanic persons who are Black, American Indian, Eskimo or Aleut, Asian or Pacific Islander, or other race).

B.12.3 Methodology

Analysis of environmental justice is conducted pursuant to EO 12898 and EO 13045 and follows the guidelines outlined in the 2014 Air Force EIAP (Air Force 2014). The EIAP guidance includes the seven steps summarized in Table B.12-1.

Table B.12-1. Environmental Justice Environmental Impact Analysis Process Summary

1. National Environmental Policy Act (NEPA) scoping/public involvement.
2. Identify potential environmental impacts.
3. Identify which impacts (from Step 2) would be considered adverse.
4. Identify the affected area and map the footprint of adverse environmental impacts.
5. Identify the region of influence (ROI) and collect data for the affected area.
6. Identify the community of comparison (COC) and collect data for threshold analysis.
7. Calculate and compare the ROI and the COC data and determine whether there are disproportionate effects.

Source: Air Force 2014

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All CFRs can be accessed through http://www.ecfr.gov/.

29 CFR 1910.95. Occupational Noise Exposure.

29 CFR 1926. Safety and Health Regulations for Construction.

32 CFR 256.8. Land Use Compatibility Guidelines for Accident Potential.

32 CFR 1052. Facilities Asbestos Management. 4 January 2013.

36 CFR 60. National Register of Historic Places Program.

40 CFR 50. National Primary and Secondary Ambient Air Quality Standards

40 CFR 51. Subpart W, Federal CAA Toolbox, General Conformity.

40 CFR 61. National Emission Standards for Hazardous Air Pollutants.

40 CFR 112. Oil Pollution Prevention

40 CFR 122. USEPA Administered Permit Programs: The National Pollutant Discharge Elimination System.

40 CFR 240-244. Non-Hazardous Waste Regulations. Guidelines for the Thermal Processing of Solid Wastes.

40 CFR 257. Criteria for Classification of Solid Waste Disposal Facilities and Practices.

40 CFR 258. Criteria for Municipal Solid Waste Landfills.

40 CFR 261. Identification and Listing of Hazardous Waste

40 CFR 279. Standards for the Management of Used Oil

40 CFR 302. Designation, Reportable Quantities, and Notification.

40 CFR 1500-1508. Council on Environmental Quality.

B.13.2 Executive Orders (EO)

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EO 12898. Executive Order 12898. Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. 59 FR 7629. 16 February 1994. Accessed through http://www.epa.gov/regulations/ laws/eo12898.html.

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74 FR 66496. Environmental Protection Agency. Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act.

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15 U.S.C. 2651. Asbestos Hazard Emergency Response Act (AHERA).

15 U.S.C. 3101-3223. Alaska National Interest Lands Conservation Act. (ANILCA).

16 U.S.C. 1131-1136. Wilderness Act.

16 U.S.C. 1271. Wild and Scenic Rivers Act.

40 CFR 112. Spill Prevention, Control and Countermeasure (SPCC) Rule.

40 CFR 122. Clean Water Act, Section 402.

40 CFR 261. USEPA Regulation on Identification and Listing of Hazardous Waste.

40 CFR 279. USEPA Regulation on Standards for the Management of Used Oil.

40 CFR 302. USEPA Regulation on Designation, Reportable Quantities, and Notification.

33 U.S.C. 1251. Congressional declaration of goals and policy.

42 U.S.C. 9601-9675. Superfund Amendments and Reauthorization Act (SARA) of 1986.

42 U.S.C. 9620. Community Environmental Response Facilitation Act of 1992 (CERFA).

APPENDIX C
AIRSPACE MANAGEMENT AND USE

ACRONYMS AND ABBREVIATIONS

Acronym	**Definition**
AGL	Above Ground Level
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
CFA	Controlled Firing Areas
FAA	Federal Aviation Administration
FL	Flight Level
IFR	Instrument Flight Rule
JBER	Joint Base Elmendorf-Richardson (combination of Elmendorf AFB and Fort Richardson)
KIAS	Knots Indicated Airspeed
LATN	Low Altitude Tactical Navigation
MACA	Midair Collision Avoidance
MOA	Military Operation Area
MSL	Mean Sea Level
MTR	Military Training Route
NM	nautical mile
SUA	Special Use Airspace
U.S.	United States
VFR	Visual Flight Rule

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C.1 National Airspace System Description

The nation's airspace is designed and managed by the Federal Aviation Administration (FAA) in a manner that strives to meet both the individual and common needs of all military, commercial, and general aviation interests. In general, all navigable airspace is categorized as either regulatory or non-regulatory. Within those two categories are four types of airspace: Controlled, Special Use, Uncontrolled, and Other. Airspace is further defined in terms of classifications according to the operating and flight rules that apply to each airspace area. The manner in which airspace is classified is dependent on (1) the complexity or density of aircraft operations within an airspace area; (2) the nature of those operations; (3) the level of safety required; and (4) national and public interest. Airspace management discussions reference these types/classifications, where appropriate, as they relate to the proposed F-22 operations efficiency alternatives at JBER.

Controlled airspace is airspace of defined dimensions within which Air Traffic Control (ATC) services are provided to Instrument Flight Rule (IFR) and Visual Flight Rule (VFR) flights in accordance with the airspace classification (USDOT 2013). Controlled airspace is categorized into five separate classes: Classes A through E. These classes identify airspace that is controlled, airspace supporting airport operations, and designated airways affording en route transit from place-to-place. The classes also dictate pilot qualification requirements, rules of flight that must be followed, and the type of equipment necessary to operate within that airspace class. Military aircrews fly under FAA rules when not training in SUA. Uncontrolled airspace (designated as Class G airspace) has no specific prohibitions associated with its use. Figure C.1-1 illustrates the different types of airspace designations.

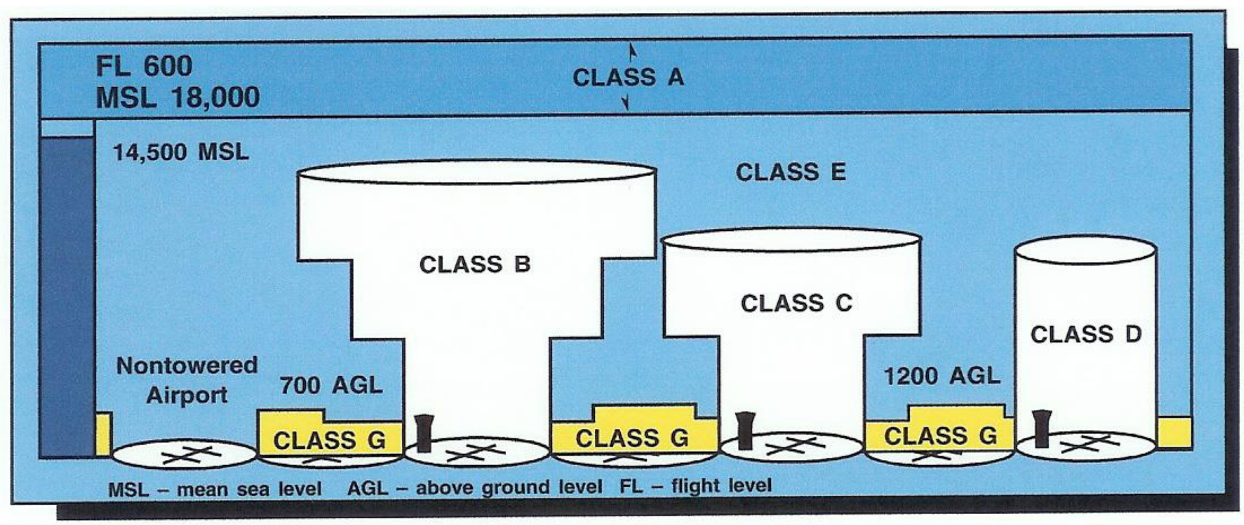


Figure C.1-1. Airspace Designations

C.2 Airspace Definitions

Class A airspace, generally, is that airspace from 18,000 feet MSL up to, and including, Flight Level (FL) 600. Unless otherwise authorized, all aircraft must operate under IFR within Class A airspace.

Class B airspace, generally, is that airspace from the surface to 10,000 feet MSL around the nation's busiest airports. The actual configuration of Class B airspace is individually tailored and consists of a surface area and two or more layers, and is designed to contain all published instrument procedures (USDOT 2013).

Class C is generally that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the actual configuration of Class C airspace is individually tailored, it usually consists of a surface area with a 5 nautical mile (NM) radius, and an outer circle with a 10 NM radius that extends from 1,200 feet to 4,000 feet above the airport elevation (USDOT 2013).

Class D airspace, generally, is that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival extensions for instrument approach procedures may be designated as Class D or Class E airspace (USDOT 2013).

Class E airspace is controlled airspace that is not Class A, B, C, or D. The floor of Class E airspace is generally 700 feet Above Ground Level (AGL). There are areas where Class E airspace begins at either the surface or 700 feet AGL that are used to transition to/from the terminal or en route environment (around non-towered airports). These areas are designated by VFR sectional charts. In most areas of the United States (U.S.), Class E airspace extends from 1,200 feet AGL up to, but not including, 18,000 feet MSL, the lower limit of Class A airspace. No ATC clearance or radio communication is required for VFR flight in Class E airspace. VFR visibility requirements below 10,000 feet MSL are 3 statute miles visibility and cloud clearance of 500 feet below, 1,000 feet above, and 2,000 horizontal. Above 10,000 feet MSL the requirement is 5 statute miles visibility, and cloud clearance of 1,000 feet below, 1,000 feet above, and 1 mile laterally (USDOT 2013). There are seven types of Class E airspace:

Surface Area Designated for an Airport - When so designated, this type of Class E airspace will be configured to contain all instrument procedures.

Extension to a Surface Area - Class E airspace areas that serve as extensions to Class B, C, and D surface areas designated for an airport. This airspace provides controlled airspace to contain standard instrument approach procedures without imposing a communications requirement on pilots operating under VFR.

Airspace Used for Transition - Class E airspace areas beginning at either 700 or 1,200 feet AGL used to transition to/from the terminal or en route environment.

En Route Domestic Airspace Areas - Class E airspace areas that extend upward from a specified altitude to provide controlled airspace where there is a requirement for IFR en route air traffic control services, but where the Federal Airway system is inadequate.

Federal Airways (Victor Airways) - Class E airspace areas, and, unless otherwise specified, extend upward from 1,200 feet to, but not including, 18,000 feet MSL.

Other - Unless designated at a lower altitude, Class E airspace begins at 14,500 feet MSL up to, but not including, 18,000 feet MSL overlying the following:

a) The 48 contiguous states, including the waters within 12 miles from the coast of the 48 contiguous states;
b) b) The District of Columbia;
c) c) Alaska, including the waters within 12 miles from the coast of Alaska and that airspace above FL600;

d) d) Excluding the Alaska peninsula west of 160o00'00" west longitude, and the airspace below 1,500 feet above the surface of the earth unless specifically so designated.

Offshore/Control Airspace Areas - This includes airspace areas beyond 12 NM from the coast of the U.S., wherein air traffic control services are provided (USDOT 2013).

Airspace that has not been designated as Class A, B, C, D, or E airspace is Uncontrolled Airspace (Class G). Class "G" airspace generally underlies Class E airspace with vertical limits up to 700 feet AGL, 1,200 feet AGL, or 14,500 feet AGL, whichever applies. Cloud clearance and visibility requirements differ by altitude and day versus night.

FAA has charted and published Special Use Airspace (SUA) for military and other governmental activities. SUA is designated airspace within which flight activities require confinement of participating aircraft or place operating limitations on non-participating aircraft. Military Operation Areas (MOA), Restricted Areas, Controlled Firing Areas, and Warning Areas are examples of SUA. Other airspace consists of advisory areas, areas that have specific flight limitations or designated prohibitions, areas designated for parachute jump operations, Military Training Routes (MTRs), Low Altitude Tactical Navigation (LATN) areas and Aerial Refueling Tracks. This category also includes Air Traffic Control Assigned Airspace (ATCAA).

Management of SUA considers how airspace is designated, used, and administered to best accommodate the individual and common needs of commercial aviation, general aviation, the military, resource management agencies, and others. The FAA considers multiple and sometimes competing demands for aviation airspace in relation to airport operations, Federal Airways, Jet Routes, military flight training activities, and other special needs to determine how the National Airspace System can best be structured to accommodate all user requirements. Airspace currently used for military training activities in Alaska includes the types of airspace defined below:

Military Operation Area (MOA) - MOAs are established to separate or segregate certain non-hazardous military activities from IFR aircraft traffic and to identify VFR aircraft traffic where these military activities are conducted. A MOA is SUA of defined vertical and lateral limits established outside Class A airspace to separate and segregate certain non-hazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted (USDOT 2013). MOAs are considered "joint use" airspace whereas non-participating aircraft operating under VFR are permitted to enter a MOA, even when the MOA is active for military use. Aircraft operating under IFR must remain clear of an active MOA unless approved by the responsible ATC. If an IFR aircraft is approved to transit a MOA that part of the MOA, it is effectively made not active for military training during the IFR aircraft transit.

Air Traffic Controlled Assigned Airspace (ATCAA) - Airspace of defined vertical and lateral limits, assigned by Air Traffic Control to provide air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic (USDOT 2013). When not required for other needs, an ATCAA is airspace authorized for military use by the managing Air Route Traffic Control Center (ARTCC). ATCAAs are in Class A airspace and are frequently structured and used to extend the horizontal and/or vertical boundaries of MOAs. ATCAAs can extend from Flight Level (FL) 180 to FL600 or higher.

Restricted Area – A restricted area is designated airspace that supports ground or flight activities that could be hazardous to non-participating aircraft. A Restricted Area is airspace designated under 14 Code of Federal Regulations (CFR) Part 73, within which the flight of aircraft is subject to restriction. Most restricted areas are designated "joint-use" and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency (USDOT 2013).

Military Training Routes (MTRs) - MTRs are flight corridors developed and used by the DoD to practice high-speed, low-altitude flight, generally below 10,000 feet MSL. Specifically, MTRs are airspace of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds in excess of 250 Knots Indicated Airspeed (KIAS).

Warning Areas – Warning areas is airspace of defined dimensions, extending from 3 NM outward from the coast of the U.S. that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both.

Controlled Firing Areas (CFAs) - A CFA is established to contain activities, which if not conducted in a controlled environment, would be hazardous to nonparticipating aircraft.

Low Altitude Tactical Navigation (LATN) Areas - Airspace outside a MOA used by aircraft such as the A-10 and C-130 for low altitude training that can safely operate at speeds of 250-knots/287 mph, or less. At these speeds, these aircraft are capable of safely merging with general aviation traffic. Military aircraft engaged in this type of exercise, like all other aircraft, are required to comply with federal aviation regulations to see and avoid other aircraft and obstacles. FAA and Air Force regulations also require aircraft utilizing the LATN area to avoid airfields, towns, noise sensitive areas, and wilderness areas by prescribed vertical and/or horizontal distances

C.2.1 Midair Collision Avoidance (MACA) Pamphlet for JBER

The following is the JBER MACA pamphlet that provides meaningful information on how and where routine aircraft operations are conducted at JBER with the objective of increasing flight safety for all concerned in the JBER/Anchorage airspace environment.

Midair Collision Avoidance (MACA) Pamphlet for Joint Base Elmendorf-Richardson (JBER)

176TH WING

673D AIR BASE WING

ELEVENTH AIR FORCE

NON SOLUM ARMIS

APRIL 2011

DEPARTMENT OF THE AIR FORCE
PACIFIC AIR FORCES
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

21 Apr 11

MEMORANDUM FOR ALL AVIATORS

FROM: Joint Base Elmendorf-Richardson

SUBJECT: Midair Collision Avoidance

1. As more and more civilian and military aircraft take to the skies around Alaska, midair collision avoidance (MACA) becomes increasingly complicated. At Joint Base Elmendorf-Richardson a coordinated effort by all of our units, to include the Alaska Air National Guard and Army Guard, is required to maintain vigilance and ensure safety in the air. Our goal is to make our MACA program details known to all aviators with the expectation that understanding when and where typical military traffic operates will increase our margin of safety and minimize the chance of a midair mishap.

2. The attached pamphlet includes information on routine aircraft operations flown at Joint Base Elmendorf-Richardson. Though not all-inclusive, it provides guidance on locations of military aircraft entering and departing Elmendorf airspace. Please refer to this pamphlet while operating near the JBER area. The Air Force is a 24-hour/7-day a week operation and pilots must always be alert for possible traffic conflicts and related hazards such as wake turbulence.

3. Close cooperation and effective communication with the local general aviation community on the unique challenges of flying in the vicinity of Elmendorf airspace has resulted in an outstanding aviation safety record. Let's keep this streak going. Please call the 3rd Wing (Active Duty) Flight Safety offices at (907) 552-4681 and/or the 176th Wing (Air National Guard) Safety offices at (907) 551-0248/0263 with any questions or suggestions about local flying. For statewide Air Force flying information, refer to the "Alaska Airspace Info" link at www.jber.af.mil, or call the 611th Air Operations Squadron at (907) 552-5103.

CHARLES E. FOSTER
Brigadier General, AKANG
Commander, 176 WG

JOHN K. McMULLEN
Colonel, USAF
Commander, 3 WG

Attachment:
MACA Pamphlet

Considerations with this years MACA Pamphlet

-The use of the official base name, Joint Base Elmendorf Fort Richardson (JBER), is not being used in this pamphlet to avoid conflicts with already existing publications that identify "Elmendorf AFB" or "Elmendorf Air Field" with specific instructions on the safety of flight.

-F-15 aircraft information has been removed from this pamphlet.

-C-130's and the HH-60 Pavehawk helicopter are now assigned to Elmendorf AFB.

1

Elmendorf Airfield Aircraft

F-22A RAPTOR - The F-22A Raptor is the Air Force's newest fighter aircraft. Its combination of stealth, supercruise, maneuverability, and integrated avionics, coupled with improved supportability, represents an exponential leap in warfighting capabilities. The Raptor performs both air-to-air and air-to-ground missions. F-22As are equipped with both UHF and VHF radios. In training areas, expect them at all altitudes and airspeeds. In the traffic pattern, they maintain 150-350 knots.

APPROACH SPEEDS	150 - 170 KIAS
CRUISING SPEEDS	300 - 550 TAS
CEILING	60,000 FT

2

F-22 Avoidance

- **F-22 Training Areas:**
  - R-2202, R-2205, R-2211, Stony, Susitna, Galena, Yukon, Fox, Eielson, Birch, Buffalo, Viper, Naknek MOA's
  - Low Level Military Training Routes (MTRs) primarily used are VR1900, VR937, VR1905, IR900 and IR919.
- **F-22 Avoidance Information:**
  - Summer fighter operations are primarily during daylight hours, Monday through Friday. In the winter months, flying operations outside the MOAs may occur late into the night.
  - In training areas, expect them at all altitudes and airspeeds.
  - While in training areas, fighters monitor UHF Guard and are not normally on a frequency with Anchorage Center.
  - On low level routes, expect to see the fighters at 500' AGL flying about 510 knots. When flying in the vicinity of an MTR, you must ask FSS for MTR activity. MTRs are not listed in the NOTAMs.
  - Fighters on low level routes monitor Flight Service Station (FSS) frequencies (255.4 UHF) and UHF Guard.
  - Fighters primarily fly in formations of two to four aircraft. If you see one, look for more, 500' to 3NM either abreast or in-trail.

3

Elmendorf Airfield Aircraft (Con't)

C-130H/HC-130N HERCULES The C-130 performs airdrop and airland resupply while the HC-130N performs in-flight helicopter refueling, search and rescue and airdrop missions. C/HC-130s are equipped with UHF and VHF radios and all are equipped with TCAS. They can be difficult to see because of their gray camouflage paint scheme. In the pattern they fly at 150-200 knots.

APPROACH SPEEDS	120 - 145 KIAS
CRUISING SPEEDS	260 - 300 KTAS
CEILING	35,000 FT

4

Elmendorf Airfield Aircraft (Con't)

C-17 GLOBEMASTER III - The C-17 is the newest, most flexible cargo aircraft to enter the airlift force, performing airdrop and air-land resupply. Elmendorf has received a full squadron of C-17s. They are equipped with UHF and VHF radios as well as TCAS. They are often hard to see because of their gray camouflage paint scheme. In the pattern they fly at 150-250 knots.

APPROACH SPEEDS	110 - 160 KIAS
CRUISING SPEEDS	400 - 450 KTAS
CEILING	41,000 FT

5

C/HC-130/C-17 Avoidance

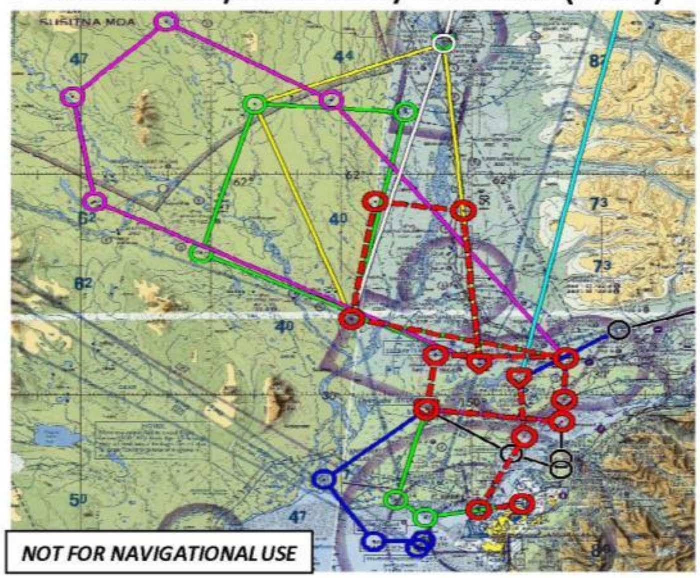
- **Training Areas:**
  - C-130s and C-17s fly in the Mat-Su Valley and surrounding areas as low as 300' AGL and up to 6,000' MSL between 130-300 Knots.
- **Avoidance Information:**
  - Alaska C-130s and C-17s are equipped with TCAS. **Using your transponder (if equipped) will help them avoid you.**
  - They operate VFR and IFR in the Mat-Su Valley primarily during daylight hours, Monday through Friday. During winter months, both C-130s and C-17s operate late into the night.
  - Often fly in formations of two to six aircraft at co-altitudes. If you see one, look for more 2,000' to 4,000' in-trail.
  - After a flight through the Mat-Su Valley, C-130s/C-17s commonly will use R-2203 as a drop zone.
  - When R-2203 is used, they enter from the north or west and may be performing an airdrop as high as 18,000 feet MSL.
  - Typical recovery from R-2203 includes a turn-out to the west and climb to 2,000' MSL.
  - Crews usually monitor ATC during IFR and Common Traffic Advisory Frequency (CTAF), during VFR low level, using their VHF radio.
- **NOTE**: See pg 13 for more R2203 information

6

C-17 Operations in the Matanuska Valley

- **Cruise Speeds:** 200-250 KIAS
- **Low Level Altitude:** 300' – 2000' AGL
- **Flight Times:** normally 1000-0100
- **NVG Operations:** Navigation and Anti-Collision lights on, White lights pointed to sides
- **Ops vicinity Wasilla/Big Lake**: Usually 1500' -2000' MSL
- **Ops into R2203**: Usually 500' – 2000' AGL from North Shore Knik Arm to R2203 (see pg 13 for more R2203 info)
- **Radios/Transponder**: Mode 3C, S (TCAS), VHF (ATC), UHF (R2203)

General C-17/C-130 Valley Low Levels (South)



7

Elmendorf Airfield Aircraft (Con't)

BOEING E-3B SENTRY (AWACS) - The E-3 is an airborne warning and control system (AWACS) aircraft providing command and control, and capable of all-weather long range surveillance. E-3s are equipped with UHF and VHF radios , and TCAS. In the local pattern their radar is not operating and therefore they are using basic see and avoid techniques for traffic separation. They are usually seen flying in the Elmendorf traffic pattern or holding over Goose Bay, and are very visible due to their white paint scheme and large radome attached to fuselage. In the pattern they fly at 150-225 knots.

APPROACH SPEEDS	130 - 180 KIAS
CRUISING SPEEDS	380 - 450 TAS
CEILING	45,000 FT

8

Elmendorf Airfield Aircraft (Con't)

C-12 F - The C-12 is the military version of the Beechcraft Super King Air 200 and 1900C. It performs airlift support for DV's and long range radar sites. C-12's are equipped with UHF and VHF radios as well as TCAS. The C-12 is difficult to see due to its small size. It flies at 270 KTAS at altitude, and 130-180 knots in the pattern.

UC-35A - The UC-35 the military version of a Cessna Citation 560 Ultra V twin engine aircraft. It is a medium range executive and priority cargo jet aircraft, providing airlift throughout the state. The UC-35 is equipped with UHF and VHF radios as well as TCAS. It flies at 415 KTAS at altitude, and 140-180 knots in the pattern.

HH-60G PAVEHAWK - The HH-60G is the USAF's primary combat rescue helicopter. It performs a 24-hour alert search and rescue mission and flies at very low altitudes from the surface to 1,000 AGL between 120 and 150 knots.

9

Elmendorf Airfield Aircraft (Con't)

VISITING AIRCRAFT TO ELMENDORF AIRFIELD - Elmendorf Airfield serves as a major refueling stop for large USAF cargo aircraft. The most common transient aircraft are the C-5, KC-135, and KC-10. They are most often seen on final approach and departure to/from Runway 06, at airspeeds from 150 to 250 knots.

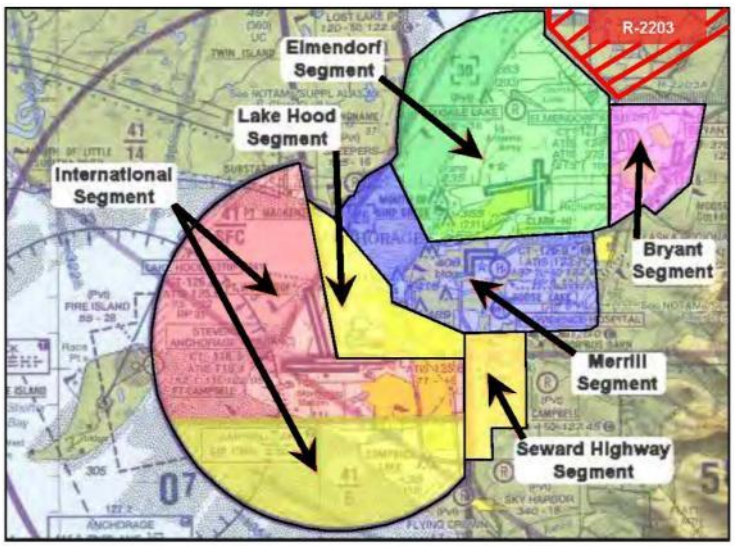
10

Anchorage Terminal Area

The Anchorage Terminal Area is subdivided as follows:

(a) International segment
(b) Merrill segment
(c) Lake Hood segment
(d) Elmendorf segment
(e) Bryant segment
(f) Seward Highway segment

Full description of the Anchorage terminal area available at:
http://www.faa.gov/about/office_org/headquarters_offices/ato/tracon/anchorage/pilots_info/locproc/vtp/

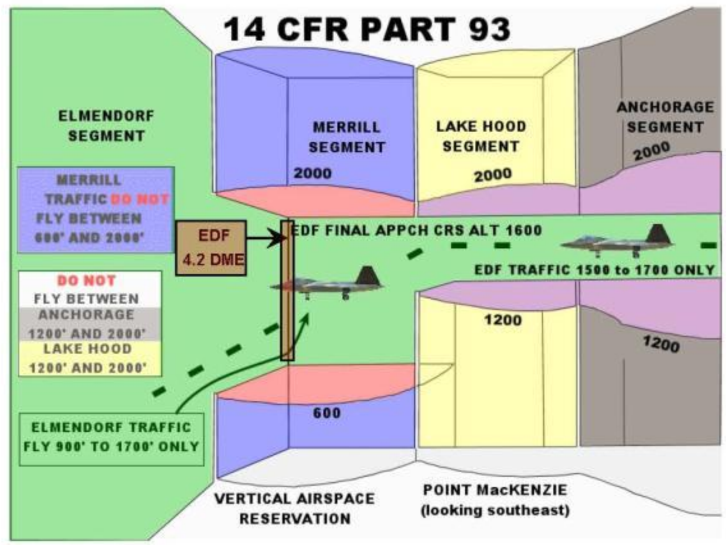


11

PART 93 Airspace

All aircraft operating in the Anchorage terminal area are required to adhere to 14CFR93 restrictions. VFR procedures have been established for each field, and must be reviewed prior to operation. These procedures are now available in the NOTICES section of the Alaska Supplement.

14CFR93 also establishes a "vertical airspace reservation" over Knik Arm. The graphic simulates cockpit perspective from Point Mackenzie looking SE



NOTE: EDF traffic and Merrill/Lake Hood traffic are separated by **only 300'.** Wake turbulence from heavy aircraft has been experienced and a collision potential exists between VFR traffic and final approach corridor traffic. It is vital that EDF traffic maintain assigned altitude of 1600 +/- 100', and that civil traffic maintain appropriate altitudes.

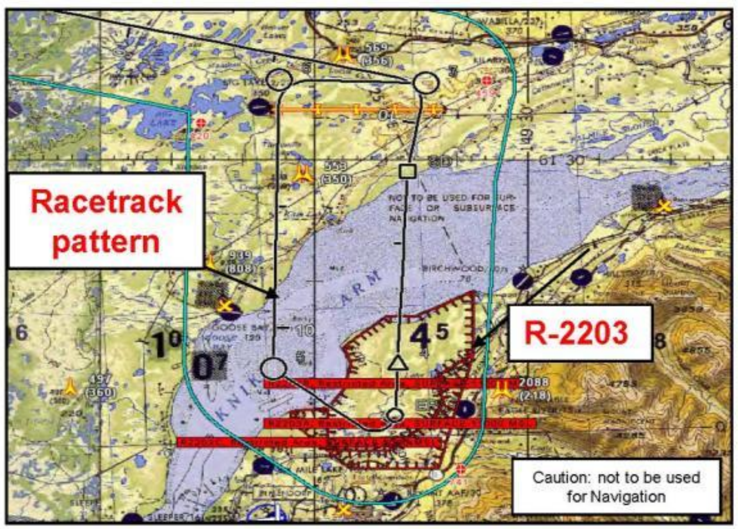
12

Restricted Area R-2203

R-2203 is a three-part restricted area established on the Fort Richardson complex. It's used for weapons and artillery training. The Malemute drop and landing zones is used for pattern and landing work, and C-130, C-17 and HH-60 personnel and equipment airdrops.

Run-ins to the Drop Zone are normally flown from the north, starting west of the New Wasilla airport southbound into R-2203. Occasionally, a westerly run-in into R2203 is flown. Aircraft operating on the Landing Zone and Drop Zones within R-2203 will normally exit the area to the west toward Goose Bay, setting up for landings at Elmendorf Airfield or Anchorage International. C-17s may spend an hour or more conducting multiple drops via oval -racetrack" patterns.

R-2203 is a very active military training area, with actual drops of equipment and personnel and live artillery firing. Do not overfly when status is -HOT". Status can he obtained from Elmendorf Tower (127.2), ATIS (124.3), or Anchorage Approach (118.6/119.1).

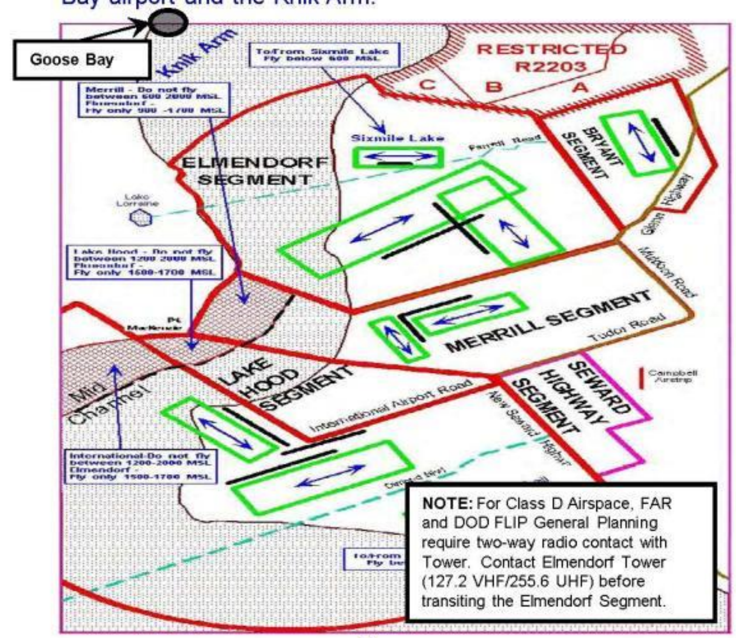


Elmendorf Airfield Airspace

Elmendorf Airspace is Class D airspace, surface to 3,000' MSL. It is extremely busy with local and transient aircraft. The primary runway is usually Runway 06 with aircraft using all runways for training.

Visual Pattern: The visual pattern is busy with multiple aircraft from sunrise to early evening hours, Monday through Friday. Primary pattern altitudes are 1,200' MSL and 1,700' MSL (800' MSL for light planes and helicopters), but local aircraft can be anywhere from surface to 4,500' MSL.

Goose Bay is used by Elmendorf aircraft for VFR holding and traffic sequencing. C-130s and E-3s may be seen holding between 1,500' MSL and 2,500' MSL over Goose Bay airport and the Knik Arm.

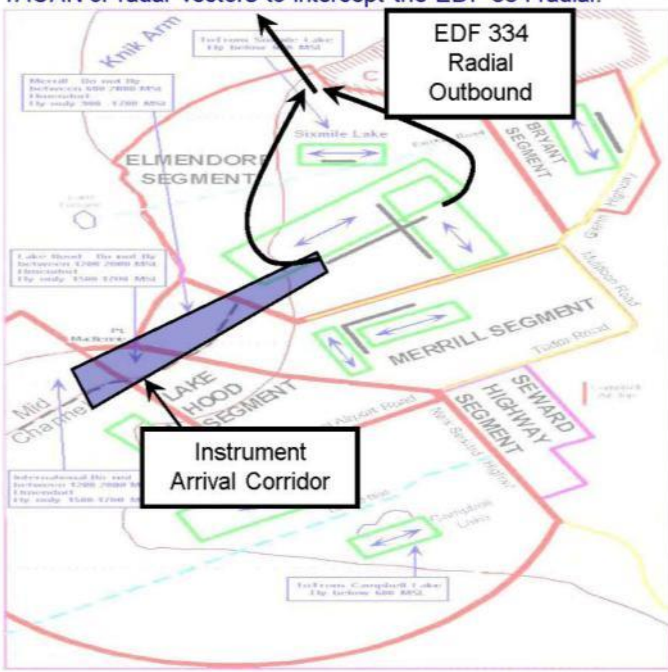


Instrument Departures and Arrivals

Typical Elmendorf Departures:

Runway 06: Fly heading 290 to intercept the EDF 334 radial outbound.

Runway 24: Fly heading 340, turn within 4 DME of the EDF TACAN or radar vectors to intercept the EDF 334 radial.



Typical Elmendorf Arrival: Instrument Landing System (ILS) to Runway 06, circle north of Runway 06 to Runway 24 or circle east of Runway 06 to Runway 34.

Elmendorf Final Approach: The FAF is located 1 NM southeast of Pt MacKenzie inside the Lake Hood Segment.

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Elmendorf Airfield Pattern Overview

Pattern Alts: Overhead – 1700'; Downwind (Fighter) – 1700'; Downwind (Cargo A/C) – 1200'; Downwind (Helo) – at or below 800'. All altitudes in the diagram are MSL.

Cartee Airspace: Airspace within the Merrill Class D Surface Area released to EDF for extended Rwy 16/34 operations. The Cartee airspace begins at the surface and extends to 2,500' MSL. An aircraft remaining North of the Southern edge of the Cartee baseball fields and flying no further East than Conifer Park and the bend in the Glenn Highway will remain inside of the Cartee Airspace.

Restrictions: Don't fly South of the Glenn Hwy w/o Merrill/Cartee Airspace Extension. Don't overfly the hospital.

Protection of Overhead: To provide separation from the overhead pattern during VMC, pilots executing other than full stop landings on Rwy 06/24 and Rwy 16/34 will remain at or below 1,200 feet MSL until the departure end of the runway, unless the tower approves a deviation. VFR aircraft executing other than a full stop landing on Rwy 16/34 may be instructed to remain at or below 700 feet MSL until passing the departure end of the runway to avoid crossing traffic.

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Helicopter Departure and Arrival

<u>VFR</u>: 210th RQS Helicopter operations in and out of the Jolly Pad at Hangar 11 will remain at or below 600' MSL. Departures and arrivals will proceed via Hillberg and then North or East along a Cujac/Six-Mile transition. West departures will be via Pt. No-Name, avoiding the Antenna Farm. South departures will be via a Six-Mile or Hospital transition.

Arrivals via an Instrument approach may sidestep when VMC to a Hillberg arrival avoiding over flight of the North side of the base. Low approaches may extend to the runway intersection, and then hook north for a normal arrival into the Jolly Pad. (Dashed line in figure above).

<u>IFR:</u> To minimize FOD hazard, air taxi operations will be preferred for arrival and departure between the Jolly Pad and the active IFR runway unless visibility conditions require hover or ground taxi.

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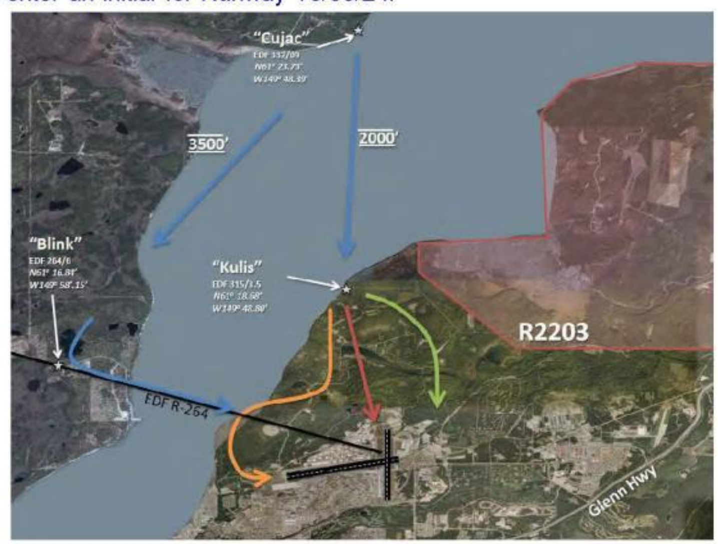
VFR Arrivals into Elmendorf AFB (C-130/C-17)

<u>Cujac Transition:</u> Flown from CUJAC to BLINK. Aircraft will cross BLINK at 3500'MSL. Aircraft will request overhead Rwy 06, or to enter downwind patterns for Rwy 16/24/34 with tower.
<u>Kulis Transition:</u> Flow from CUJAC to KULIS at 2000' MSL. Proceed VFR direct KULIS. Thence: Straight In: Once passing KULIS, descend as necessary to 1200'MSL and proceed direct Rwy 16 for the straight-in approach.
<u>Shallow Abeam:</u> The Shallow maneuver will be flown at or above 500 feet AGL. Over-fly KULIS, descend to no lower than 500' AGL and proceed inbound to the Runway 06/24 & 16/34 intersection for a left/right turn to Runway 16/06/34.

NOTE: *When below 800 feet MSL, aircraft inbound for these approaches will normally broadcast position and intentions on Six Mile Lake CTAF 122.8*

<u>Downwind:</u> Once passing KULIS, descend to 1200'MSL and enter a downwind for Runway 06/34/24.
<u>Overhead:</u> Once passing KULIS, descend to 1700'MSL and enter an initial for Runway 16/06/24.



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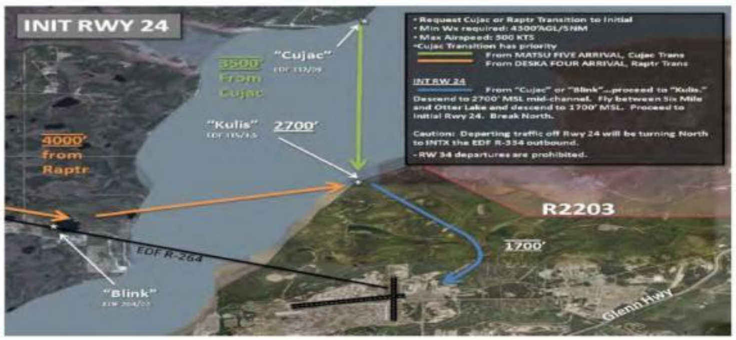
Fighter Pattern Operations



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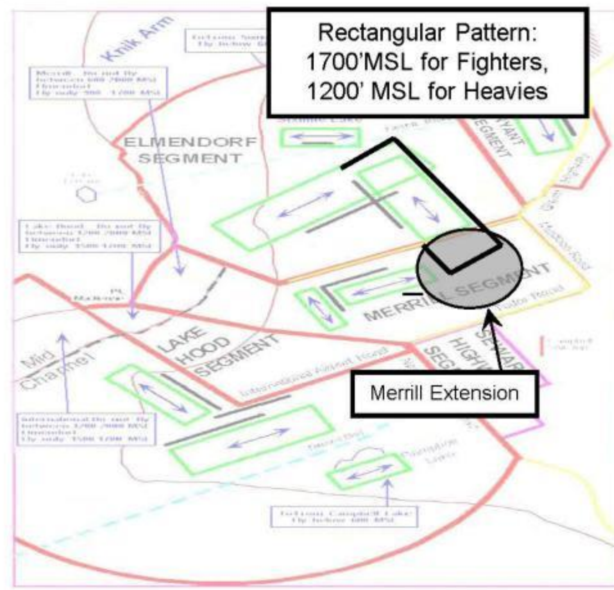
Runway 16 and 34 Operations

Runway 16 and 34 are generally used for training during day or night in VMC conditions.

Instrument Weather Condition (IMC): During IMC, Runway 16/34 may be used for instrument recovery using circling procedures from Runway 06, or from TACAN approach to runway 16.

Merrill Extension: If Runway 34 is needed for landing fighters, pilots will fly the base leg south of the Glenn Highway and enter into Merrill's airspace. Other Elmendorf aircraft will fly the base leg north of the Glenn Highway. There are established procedures in place for Elmendorf and Merrill towers to coordinate and communicate possible conflicts. **NOTE:** Both Elmendorf and Merrill aircraft must be especially vigilant for traffic avoidance in this area.



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Aero Club

The **Aero Club** operates multiple light aircraft from Elmendorf on a daily basis. This facility also houses the Civil Air Patrol.

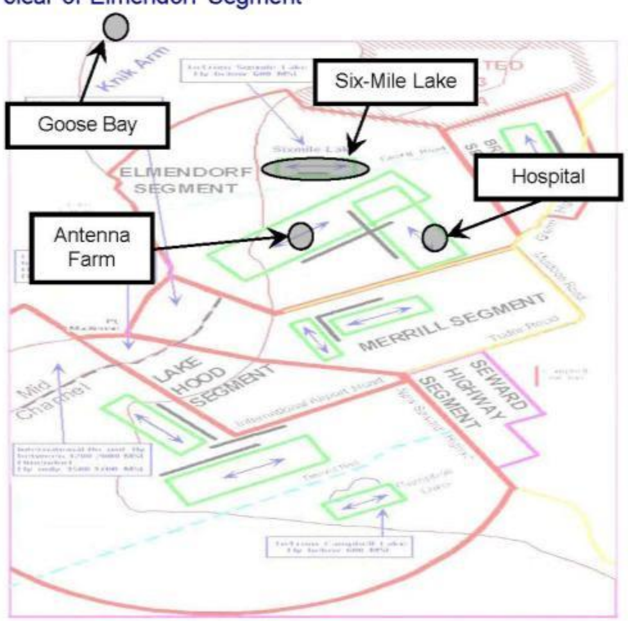
VFR Departures

Hospital Departure: Left/Right climbing turn toward the Hospital

Goose Bay Departure: Left/Right climbing turn, direct Goose Bay

Six-Mile Lake Departure: Left/Right climbing turn, direct to West end of Six-Mile Lake

Note: Unless cleared —Climbing departure," Light aircraft and helicopters will **maintain 800' MSL** until past Six-Mile Lake or clear of Elmendorf Segment

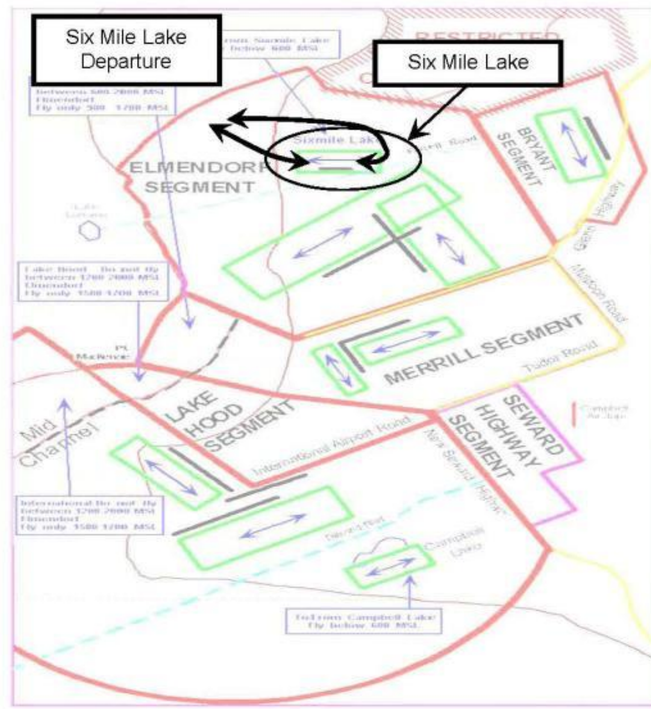


Six Mile Lake

Six Mile Lake is located two miles north west of Elmendorf Airfield. Light aircraft departing and arriving VFR frequent this lake during both the summer and winter months.

Six Mile Lake Departure: Left/right climbing turn, proceed to the west end of Six Mile Lake. Remain **at or below 600' MSL** until clear of the Elmendorf segment.

NOTE: Light aircraft and helicopters will **maintain 800' MSL** until passing Six Mile/Otter Lake when departing north or until clear of the Elmendorf segment when departing east.

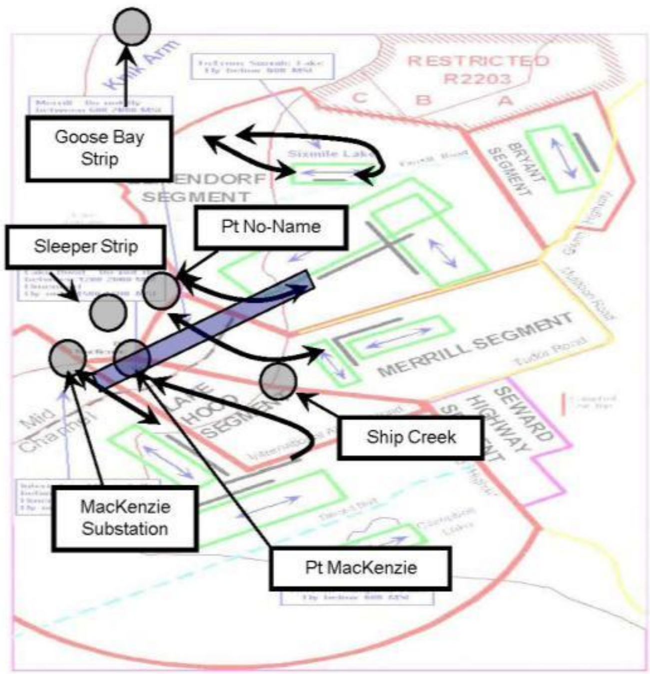


Anchorage Bowl VFR Traffic

Arrows depict the normal **VFR departure and arrival** routing from Merrill Field, Lake Hood, and Anchorage International.

Areas of high VFR traffic and potential conflict are circled and named.

(Note the number of departures and arrivals that cross the Elmendorf instrument arrival corridor!)



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RED FLAG - Alaska

RED FLAG - Alaska is a series of two week, large exercises that are primarily based out of Elmendorf and Eielson. It consists of joint military flying operations by units from around the world. RED FLAG - Alaska exercises significantly increase the volume and intensity of military air traffic in the Elmendorf and Anchorage area. The earliest exercise for RED FLAG - Alaska usually begins in March and the last one usually finishes in October.

During RED FLAG - Alaska operations, as many as 30 aircraft will be departing simultaneously from Elmendorf for the Fox and Yukon Military Operating Areas (MOA) and the restricted areas near the Fox and Yukon areas. You can find what days RED FLAG - Alaska will be taking place at the web page, http://www.jber.af.mil/11af/alaskaairspaceinfo/index.asp. Over 10,000 SUAIS pamphlets are distributed annually. Contact your local FSS or Merrill Field management office for a free copy. Furthermore, during RED FLAG - Alaska operations, Flight Service Station or Anchorage Approach Control (118.6) can confirm the operating times for high density traffic periods and give you a good idea of their routing.

These exercises bring an enormous number of aircraft and pilots unfamiliar with the challenges of Alaska aviation. This includes pilots/aircraft from foreign militaries.

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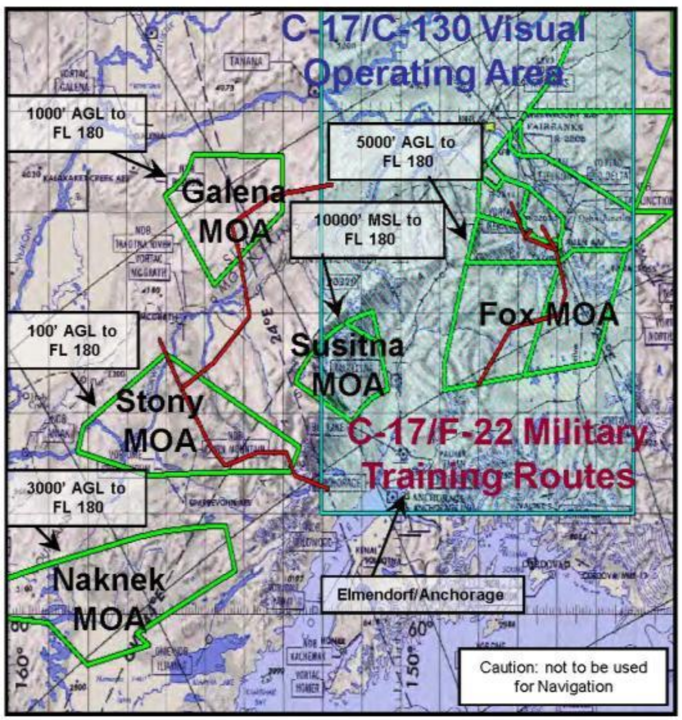
Training Areas and Low Level Routes

Military Operations Areas (MOA) are primarily used by fighter aircraft at all altitudes and airspeeds.

Military Training Routes (MTR) are used by C-17s and F-22s as low as 300' AGL at speeds up to 550 knots.

C-17A/C-130 Visual Operating Area is an area used by C-130s and C-17s for low level VFR training as low as 300' AGL at speeds up to 250 knots.



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Military Operations Areas

Military Operations Areas (MOA) are used by military aircraft for air-to-air and air-to-ground training. If you are flying through an active MOA, it is a good idea to consult Anchorage Center to determine if operations are being conducted and their general location. If possible, please deconflict laterally or vertically from the other participating aircraft in the MOA. According to the Aeronautical Information Manual, —Pilots operating under VFR should exercise extreme caution while flying within a MOA when military activity is being conducted. The activity status (active/inactive) of MOA's may change frequently. Therefore, pilots should contact FSS within 100 miles of the area to obtain accurate real-time information concerning the MOA hours of operation. Prior to entering an active MOA, pilots should contact the controlling agency for traffic advisories". When flying in and near the interior MOAs near Fairbanks and Delta Junction you can receive SUAIS service from Eielson Range Control at 125.3. Visit SUAIS website, http://www.jber.af.mil/11af/alaskaairspaceinfo or call 1-800-758-8723 for more information.

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Lights-Out Operations

The FAA has approved military aircraft to operate with no external lighting in local MOAs and Air Traffic Control Assigned Areas (ATCAAs are all above 18,000' MSL). These operations are required to perform realistic training at night and on Night Vision Goggles (NVG's).

It is imperative that all users of Alaskan airspace be familiar with the areas where this training occurs. There are two types of reduced-light training:

Reduced Lighting – Aircraft anti-collision lights (strobes) off, but position lights on. This may occur in any special-use airspace (such as MOAs) without a NOTAM or in the case of the HH-60G in any airspace.

Lights-out – Anti-collision and position lights off. These operations will be announced at least 48 hours in advance via NOTAM and will be carried out with public safety in mind.

For real-time information, please refer to NOTAMS, contact Anchorage Center, Eielson Range Control at 1-800-758-8723 or on 125.3, and visit the SUAIS website, http://www.jberaf.mil/11af/alaskaairspaceinfo.

When calling 1-800-WX-BRIEF, you must ASK the briefer for NOTAM information on each MOA you plan to transit.

When checking http://www.notams.jcs.mil/ lights-out MOA NOTAMs may be listed under Elmendorf Airfield (PAED) or Eielson AFB (PAEI), or both.

Lights-out operation will be conducted above:

5,000'+	Eielson, Birch, Stony A/B, Naknek A/B MOAs
10,000'+	Fox 1/2, Buffalo, Yukon 1/2 MOAs
15,000'+	Fox 3, Susitna MOAs

C-130 and C-17s – C-130/C-17's will be operating with reduced lighting in the Mat-Su valley at low level. They will also operate in the Elmendorf pattern with reduced lighting, by NOTAM.

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Your Role In Collision Avoidance

- Studies of midair collisions involving aircraft by the National Transportation Safety Board (NTSB) determined that:
  - Most of the aircraft involved in collisions are engaged in recreational flying, not on any type of flight plan.
  - Most midair collisions occur in VFR weather conditions during weekend daylight hours.
  - The vast majority of accidents occurred at or near uncontrolled airports and at altitudes below 1,000 feet.
  - Pilots of all experience levels were involved in midair collisions, from pilots on first solo ride, to 20,000+ hours.
  - Flight instructors were on board the aircraft during 37 percent of the accidents in the study.
  - Most collisions occur in daylight with visibility greater than 3 miles.
- Here's how you can contribute to professional flying and reduce the odds of becoming involved in a midair collision:
  - Practice the **"see and avoid"** concept at all times regardless of whether the operation is conducted under Instrument (IFR) or Visual (VFR) Flight Rules.
  - **Always use transponder with Alt Encoding (if equipped) when VFR, even when out of radar coverage. Aircraft equipped with Traffic Collision Avoidance Systems (TCAS) can receive traffic and resolution advisories directly from the system, providing immediate instructions for separation.**
  - Under IFR control, don't always count on ATC to keep you away from other aircraft. They're human, and can make mistakes.
  - Understand the limitations of your eyes and use proper visual scanning techniques. Remember, if another aircraft appears to have no relative motion, but is increasing in size, it is likely to be on a collision course.
  - Execute appropriate clearing procedures before all climbs, descents, turns, maneuvers, or aerobatics.
  - Be aware of the type airspace in which you intend to operate in and comply with the applicable rules.

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Your Role In Collision Avoidance (Con't)

- Adhere to the necessary communications requirements.
- Traffic advisories should be requested and used when available to assist the pilot's own visual scanning -- This in no way lessens the pilots obligation to see and avoid.
- If not practical to initiate radio contact for traffic information, at least monitor the appropriate frequency.
- Make frequent position reports along your route and at uncontrolled airports broadcast your position and intentions on common traffic advisory frequency **(CTAF).**
- Make your aircraft as visible as possible - turn on exterior lights below 10,000 MSL and landing lights when operating within 10 miles of any airport, in conditions of reduced visibility, where any bird activity is expected or under special VFR clearance.
- **If the aircraft is equipped with a transponder, turn it on and adjust it to reply both Mode 3/A and Mode C** (if installed). According to the Aeronautical Information Manual (AIM): —Transponders substantially increase the capability of radar to see all aircraft and the Mode C feature enables the controller to quickly determine where potential traffic conflicts exist. Even VFR pilots who are not in contact with ATC will be afforded greater protection from IFR aircraft receiving traffic advisories". **Not to mention the protection provided from TCAS equipped aircraft**. Furthermore, the AIM states: —In all cases, while in controlled airspace, each pilot operating an aircraft equipped with an operable ATC transponder maintained in accordance with FAR part 91.413 shall operate the transponder, including Mode C if installed, on the appropriate Mode or as assigned by ATC. In Class G airspace, the transponder should be operating while airborne unless otherwise requested by ATC".
- Above all, **AVOID COMPLACENCY**.

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Traffic Collision Avoidance System (TCAS)

TCAS is a computerized avionics device which is designed to reduce the danger of mid-air collisions between aircraft. It monitors the airspace around an aircraft, **independent of air traffic control**, and warns pilots of the presence of other aircraft which may present a threat of midair collision.

- TCAS indication
  - **Traffic Advisory (TA):** The TA warns the pilot that another aircraft is in near vicinity, announcing *"traffic, traffic"*, but does not offer any suggested remedy; it is up to the pilot to decide what to do. **Without altitude encoding, TCAS is unable to show whether you are at the same altitude or not!**
  - **Resolution Advisory (RA):** The RA provides the pilot direct vocalized instructions to avoid danger. By knowing the **altitude and location** of the conflicting traffic, they system is able to determine the safest action and advise a change in altitude by announcing, *"descend, descend"* or *"climb, climb"*.
- TCAS alert depends on **YOUR** transponder setting.

Conflicting Aircraft Equipment	*TCAS Response*
No transponder	No TCAS indications
Transponder w/out Alt	TA Only
Transponder w/ Alt	TA/RA

- VFR traffic is strongly encouraged to operate an altitude reporting transponder in all classes of airspace.
- Bottom Line - **TCAS needs YOU to squawk altitude**!

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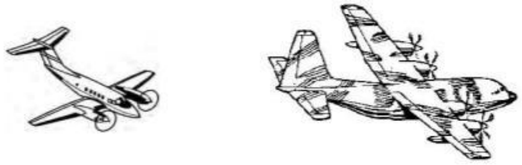
Vision In Flight

Vision In Flight: The most advanced piece of flight equipment in any aircraft is the human eye, and since the number one cause of Midair Collisions is the failure to adhere to the see-and-avoid concept, efficient use of visual techniques and knowledge of the eye's limitations will help pilots avoid collisions. Your vision's clarity is influenced by some characteristics of the objects you are viewing, including:

- Your distance from the object
- The size, shape, and movement of the object
- The amount of light reflected by the object
- The object's contrast with the surrounding environment



You cannot see all objects in your field of vision with equal clarity. Visual acuity is best in a central area of about 10 to 15 degrees and decreases steadily toward the periphery of the visual field. A similar limitation of the eyes is binocular vision. For the brain to believe what is being seen, visual cues must be received from both eyes. The mind seldom believes that the object is really there if it is visible to one eye but obstructed from the other by a strut or windshield frame.

A visual limitation that few pilots are aware of is the time the eyes require to focus on an object. Focusing is an automatic reaction, but to change focus from a nearby object, such as an instrument panel, to an aircraft one mile away, may take two or more seconds.

Vision In Flight (Con't)

- **PROPER CLEARING/SCANNING TECHNIQUES:**
  - An efficient scan pattern is paramount to visual collision avoidance procedures. In developing a proper scan technique, remember that when your head is in motion, vision is blurred and the brain will not be able to identify conflicting traffic. Therefore a constant motion scan across the windscreen is practically useless.
  - A proper scan technique is to divide your field of vision into blocks approximately 10 to 15 degrees wide. Examine each block individually using a system that you find comfortable, perhaps from left to right or starting from the left and moving to the right, then back to the left again. This method enables you to detect any movement in a single block. It takes only a few seconds to focus on a single block and detect conflicting traffic.
  - Remember to refocus your eyes on an object far from your aircraft (> 5 miles) after each check of your instruments… otherwise, your eyes will still be focused for close vision, making your visual lookout virtually useless.
- **A moving target attracts attention and is relatively easy to see. A stationary target or one that is not moving in your windscreen is very difficult to detect and is the one that can result in a MIDAIR COLLISION**.
- The time to perceive and recognize an aircraft, become aware of a collision potential and decide on appropriate action, may vary from as little as 2 seconds to as much as 10 seconds or more depending on the pilot, type of aircraft and geometry of the closing situation. Aircraft reaction time must also be added. By the way, any evasive maneuver contemplated should include maintaining visual contact with the other aircraft, if practical.

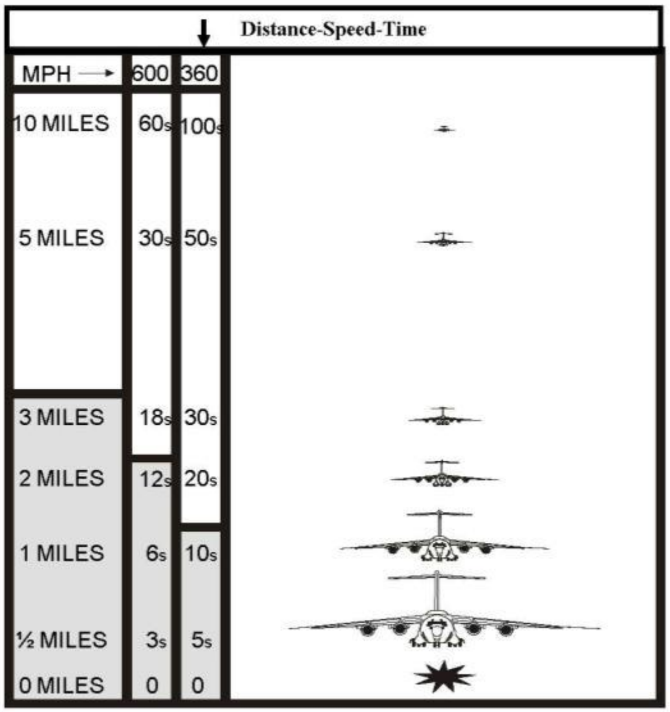
Vision In Flight (Con't)

- **Will you have time to react?**

12.5 seconds to perceive an aircraft and avoid it!

SEE OBJECT	0.1
RECOGNIZE AIRCRAFT	1.0
BECOME AWARE OF COLLISION	5.0
DECISION TO TURN LEFT OR RIGHT	4.0
MUSCULAR REACTION	0.4
AIRCRAFT LAG TIME	2.0
Total	**12.5**

The ***360mph*** column depicts a large, relatively slow moving aircraft. (Based on combined airspeed of two aircraft)



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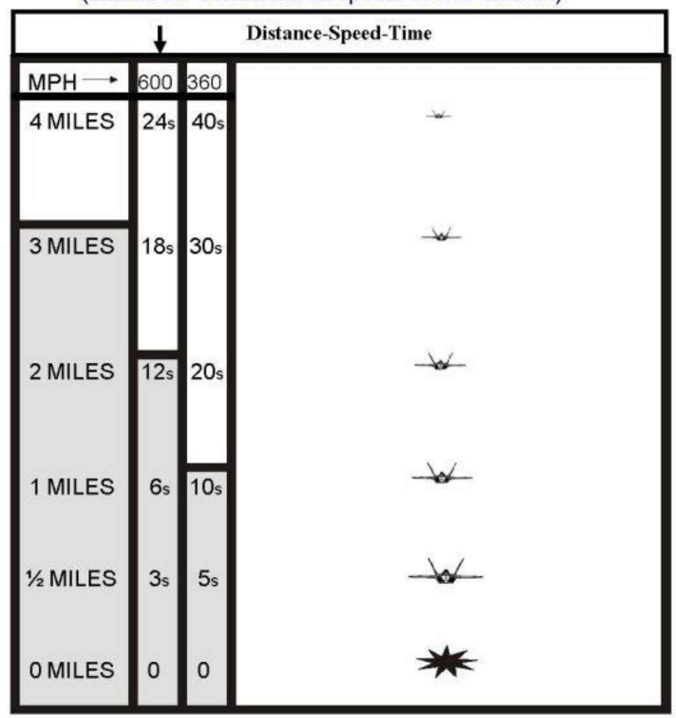
Vision In Flight (Con't)

- **Will you have time to react?**

Compare this chart with the last page and notice the dramatic decrease in reaction time with a high performance, fast moving fighter in a head-on course.

This chart shows an F-22 closing in from 4 miles – a midair collision quickly developing!

The ***600mph*** column depicts a small, fast moving aircraft. (Based on combined airspeed of two aircraft)



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Radar Advisory Service

As an aid to midair collision avoidance, Anchorage Approach Control provides radar advisories to VFR aircraft upon request. A transponder is required within Class C Airspace. To obtain radar advisories, state your position, altitude, and intentions, then request radar advisories. Once radar contact is established, traffic advisories will be issued for IFR and known VFR traffic (controller workload permitting).

Hazardous Air Traffic Reports (HATR)

- **Who can file a HATR?**

  Any person assigned, attached, or under contract to the Air Force and is aware of a reportable air traffic condition.

- **When should a HATR be filed?**
  - Near Mid-Air Collision (NMAC): Evasive action was taken to avoid a collision
  - Hazardous Air Traffic Condition: Less than required separation existed between aircraft IAW applicable directives or any occurrence that did or could compromise flight safety
  - Communication or NAVAID Anomalies: Any equipment indication that did or could contribute to a hazardous air traffic condition
  - Hazardous Procedures: Any system, publication, or directive that did or could contribute to a hazardous air traffic condition
  - Hazardous Ground Incident: Any occurrence, including vehicle operations, on the movement area that endangered an airborne aircraft or an aircraft on the ground

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Hazardous Air Traffic Reports (Con't)

- **How do I file a HATR?**
  - Report the details of the hazardous condition on AF Form 651 within 24 hours to the base safety office if located on an Air Force base
    - Submit the AF Form 651 to the nearest Air Force Base Safety Office after landing if the incident occurred in flight
- **Near Mid-Air Collision (FAA report)**
  - For NMACs, inform the nearest air traffic control agency or flight service station and provide the following information:
    - Your Call Sign
    - Time and Place of incident
    - Altitude
    - Description of other aircraft involved
    - Advise them you intend to file a NMAC report and request they save all available data
- **Immunity**
  - To encourage reporting, individuals submitting HATRs are granted immunity from disciplinary action if:
    - The violation was not deliberate
    - They committed no criminal offense
    - No mishap occurred
    - The incident was properly and promptly reported
  - The investigation is required to be complete within 10 days
  - After the investigation is complete, it may be released to the public (no privilege protection)

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Aviation Safety Reporting System

- **What is it?**
  - An aviation safety program funded by the FAA and administered by NASA that allows for hazard or incident reporting.
  - The program is voluntary, confidential and non-punitive.
  - The ASRS collects, analyzes, and responds to voluntarily submitted aviation safety incident reports in order to lessen the likelihood of aviation accidents.
  - Civilian or military aviators, air traffic controllers, flight attendants, mechanics, ground personnel, and others involved in aviation operations submit reports to the ASRS when they are involved in, or observe, an incident or situation in which aviation safety was compromised.
- **How do I report a hazard or incident?**
  - Go to the ASRS website @ **http://asrs.arc.nasa.gov/**
  - Click on the link for the appropriate form — your browser should start the free Adobe Acrobat Reader. (If not, download the form and start Acrobat Reader manually.) You have two choices for submitting an incident report.
  - Fill out the form on your computer, print the completed form, attach all pages together, enclose in an envelope, seal, affix sufficient postage, and mail to ASRS at the address below, or
  - Print the uncompleted form, fill it out by hand, attach all pages together, enclose in an envelope, seal, affix sufficient postage, and mail to ASRS.
- Electronic report submission is now available.
- Mail your completed form to:

  NASA AVIATION SAFETY REPORTING SYSTEM
  POST OFFICE BOX 189
  MOFFETT FIELD, CALIFORNIA 94035-0189

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ASRS (Con't)

The Immunity Concept: Pilots

- The filing of a report with the National Aeronautics and Space Administration (NASA) is considered by FAA to be indicative of a constructive attitude. Such an attitude will tend to prevent future violations. Accordingly, although a finding of a violation may be made, neither a civil penalty nor certificate suspension will be imposed if:
  - The violation was inadvertent and not deliberate;
  - The violation did not involve a criminal offense, accident, or action showing lack of competence or qualification;
  - The person has not been found in any prior FAA enforcement action for a period of 5 years prior to the date of the occurrence;
  - The person proves that, within 10 days after the violation, he or she completed and delivered or mailed a written report of the incident or occurrence to NASA under ASRS.
- **NOTE:** For air traffic controllers the immunity rules are not the same. For exact regulation details, see FAA Advisory Circular Number 00-46D and Facility Operation and Administration Handbook, 7210.3R.

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Additional Information

For additional information, check out these websites:

- Elmendorf AFB Flight Safety @ http://www.jber.af.mil/units/3rdwingsafety/index.asp
- Alaska Military Operations Areas/Special Use Airspace Information Service @ http://www.jber.af.mil/11af/alaskaairspaceinfo/index.asp
- FAA Safety Team - FAAST @ http://www.faasafety.gov/default.aspx
- FAA Anchorage Terminal Area Pilot Bulletin @ http://www.faa.gov/about/office_org/headquarters_offices/ato/tracon/anchorage/
- Aviation Safety Reporting System @ http://asrs.arc.nasa.gov/

Or call us at:

3 Wing Safety - (907)-552-4681 / 4798
176th Wing Safety - (907) 551-0248 / 0263

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A SUPERIOR PILOT USES SUPERIOR JUDGMENT TO AVOID SITUATIONS WHICH MIGHT REQUIRE THE USE OF SUPERIOR SKILLS!

3 WG/SE MACA CALL (907) 552-4681 OR (907) 552-4798
176 WG/SE MACA CALL (907) 551-0248 OR (907) 551-0263

Electronic Version Available On-line @

http://www.jber.af.mil/units/3rdwingsafety/index.asp

C.3 References

14 CFR 73. Special Use Airspace. Accessed through http://www.gpo.gov/fdsys/pkg/CFR-2011-title14-vol2/pdf/CFR-2011-title14-vol2-part73.pdf.

USDOT 2013. United States Department of Transportation. Federal Aviation Administration. Aeronautical Information Manual. Change 2 March 7, 2013.

APPENDIX D
AIR QUALITY SUPPORTING INFORMATION

TABLE OF CONTENTS

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AIR QUALITY

D.1 Introduction

This appendix presents the methods used to estimate air emissions associated with the proposed project alternatives at JBER. The emissions estimates are presented in tabular form in Attachment 1 of this appendix.

D.2 Construction Emission Calculation Methods

Alternatives B, C, and F would extend RW 16/34 2,500 feet to the north. For the purpose of this EIS, runway construction is assumed to involve the following components: (1) excavate terrain to remove topographic barriers, (2) cut and fill operations to create the runway foundation, (3) construct the runway pavements, (4) construct taxiways on both sides of the proposed extension, (5) construct/relocate support features, such as Navaids, arrestor barriers, signage, and drainage, and (6) relocate the roadway around the north end of the runway extension. The air quality analysis evaluated impact scenarios to extend RW 16/34 by 2,500 feet. The analysis assumed that construction activities would require three years to complete.

Alternatives A, D, and E would not include any facility improvements and therefore would not generate any construction emissions.

Assumed runway extension construction activities would produce emissions from three main sources:

1. Nonroad construction equipment.
2. On-road haul trucks.
3. Fugitive dust generated from the operation of equipment and trucks on unpaved surfaces.

Activity data were developed to estimate equipment and truck usages and associated combustive and fugitive dust emissions for the proposed construction activities. These data were based on (1) the metrics identified in a Pre-Final Requirements Document report for a 2,500-foot runway extension (Jacobs 2016) and (2) similar types of construction projects to those proposed by the project alternatives. The analysis assumes that construction vehicles would deposit cut materials within, or very near to the disturbed area depicted on EIS Figure 2.4-5. The following summarizes the methodologies used to estimate both criteria air pollutants and greenhouse gas (GHG) emissions generated from proposed construction activities.

D.2.1 Calculation Methods for Nonroad Equipment

Data needed to estimate emissions for nonroad construction equipment include the following:

1. Horsepower (hp) rating.
2. Engine load factor as a fraction of full power.
3. Hours per day, days per year, and total years of operation.
4. Equipment emission factors, in units of grams per hp-hour (gm/hp-hr).

Items 1 through 3 are activity data that were estimated by taking into consideration the types and magnitudes of potential construction activities, production rates of applicable equipment (such as hourly loading rates of scrapers), and construction scheduling. Factors needed to derive construction equipment source emission rates were obtained from the EPA NONROAD2008a model for an average Anchorage Borough fleet and assuming summer climate conditions (EPA 2009). The model outputs these emission factors into ranges of equipment hp categories.

The analysis used nonroad emission factors for year 2018. For construction activities that extend beyond 2018, this would be a conservative approach, as due to the infusion of newer and lower-emitting models into the Anchorage Borough equipment fleet, average equipment emission rates would decrease to below 2018 levels after this time. The analysis estimated total hp-hrs for each piece of equipment and then multiplied these by the applicable emission factor in units of gm/hp-hr to obtain total grams (converted to pounds [lb] and tons) of emissions.

D.2.2 Calculation Methods for On-road Vehicles

Assumed data to estimate emissions for on-road vehicles include the following:

1. Vehicle category, as defined by the EPA MOVES2014 model on-road mobile source emissions model (EPA 2014).
2. Trips per day, days per year, and total years of operation of each vehicle type.
3. Miles per round trip of travel.
4. Fraction of total round trip that occurs within speed ranges of 5 miles per hour (mph) increments to match the form of the MOVES2014 emission factors.
5. Vehicle emission factors, in units of grams per mile (gm/mi).

All project haul trucks were evaluated as heavy-heavy duty diesel trucks with a gross vehicle weight (GVW) greater than 33,000 pounds. Vehicle trips were based on the requirements of potential activities, such as concrete and runway base materials volumes. Haul truck trip lengths were based on the distances between JBER and locations of potential sources of supplies and aggregates needed for construction.

Vehicle emission factors were obtained from the EPA MOVES2014 model and developed for an average Anchorage Borough fleet. Like the analyses of nonroad equipment, on-road emission factors were developed for year 2018. The analysis developed composite emission factors to define the travel conditions expected along the project truck routes. These include travel 40/60 percent of the time at 25/50 mph. The analysis estimated total vehicle miles travelled (VMT) for each type of vehicle and then multiplied these by the applicable emission factor in units of gm/mi to obtain total grams (converted to lb and tons) of emissions.

D.2.3 Calculation Methods for Fugitive Dust Sources

Data needed to estimate emissions of fugitive dust are based on the assumed acreages where equipment and trucks would operate on exposed soils and the assumed durations of these disturbances for each construction activity. Fugitive dust emission factors were obtained from the WRAP Fugitive Dust Handbook (Table 3-2) for active large-scale earth moving operations (units in lb per acre-day) (Countess Environmental 2006). Factors were reduced by 74 percent from uncontrolled levels to simulate the relatively moist soil conditions that would exist at JBER during summer conditions and water application/use of best management practices for fugitive dust control (Table 3-7 Countess Environmental

2006). The analysis estimated total activity data for each construction activity and then multiplied these by the applicable emission factor to obtain total mass emissions.

D.2.4 Estimation of Peak Annual Construction Emissions

The analysis estimated emissions for each year of construction and also determined the peak annual period of emissions. The following activities would occur during the three-year construction period:

1. Year 1 – (a) Vegetation Removal - Cut and Fill Operations and (b) Building Demolition.
2. Years 1 and 2 - (a) excavate terrain/cut and fill operations.
3. Year 2 - (a) Runway Overrun - Remove Existing Asphalt, (b) Paved Road - Remove Existing Asphalt, and (c) Install Gravel For Erosion Control.
4. Years 2 and 3 - (a) Install Gravel and Backfill and (b) Construct/Relocate Requisite Support Features Activities.
5. Year 3 – Asphalt and Resurfacing.

Peak annual emissions would occur in construction year two and would include (1) half of excavate terrain/cut and fill operations, (2) runway overrun - remove existing asphalt, (3) paved road - remove existing asphalt, (4) install gravel for erosion control, (5) half of install gravel and backfill, and (6) half of construct/relocate requisite support features activities.

D.3 Operational Emissions

The typical depth of the atmospheric mixing layer where the release of aircraft emissions would affect ground-level pollutant concentrations is 3,000 feet (914 meters). The analysis of proposed aircraft emissions focuses on operations that would occur within the lowest 3,000 feet (914 meters) of the atmosphere. In general, aircraft emissions released above the mixing layer would not appreciably affect ground-level air quality. The project alternatives include changes in F-22 aircraft departure and arrival patterns that could affect F-22 operations below 3,000 feet above ground level (AGL) and emissions below 3,000 feet are included in the analysis of alternatives. Emission effects of F-22 operations would occur within the immediate airspace surrounding JBER and the JBER-Elmendorf runways. The air quality analysis for proposed F-22 aircraft operations focuses on emission effects within this domain. Generally, emissions of CO and PM_{10} from operations or from potential runway construction would minimally impact the air quality maintenance areas identified in Section 3.4.1 of the EIS, due to the low strengths and/or substantial distances associated with the emission sources.

Changes to F-22 operations or improvements to runways and facilities proposed for all project alternatives other than Alternative D would result in no more than minor increases in F-22 aircraft and support equipment emissions compared to existing conditions at JBER. Due to the mobile and intermittent operation of these sources over the large expanse of JBER, their emissions would produce minimal ambient impacts at any location. As a result, operation of any project alternative would not contribute to an exceedance of an ambient air quality standard and would produce less than significant air quality impacts. Therefore, quantification of proposed operational emissions for these project alternatives was deemed unnecessary for the analysis.

Alternative D would change runway use patterns for F-22 departures and arrivals but would not increase maintenance activities. Shifting existing F-22 departures to RW 06 would require F-22s to taxi an additional 10 to 15 minutes compared to takeoffs from other runways, and potentially be on hold another 5 minutes due to arriving aircraft. During taxiing and holding activities, the F-22 engine would operate in idle mode. Therefore, the analysis estimated emissions from additional F-22 engine idling times due to departures from RW 06 under Alternative D. Factors needed to estimate emissions for the F-22 engine (F119-PW-100) were obtained from the *Air Emissions Guide for Air Force Mobile Sources* (Air Force Civil Engineer Center 2014).

Due to the mobile and intermittent operation of F-22s over such a large taxiway, these emission increases would produce nominal ambient impacts in a localized area compared to existing conditions. As a result, implementation of Alternative D would not contribute to an exceedance of an ambient air quality standard, and, therefore, would produce less than significant air quality impacts.

D.3.1 Conformity Evaluation

Regarding potential operational air quality impacts to the nearby Eagle River PM_{10} and Municipality of Anchorage CO Maintenance Areas, F-22 operations and resulting emissions below 3,000 feet AGL within the Eagle River PM10 Maintenance Area would not change compared to baseline operations for any project alternative. Alternatives C and F would slightly reduce F-22 flight operations below 3,000 feet AGL within the Municipality of Anchorage CO Maintenance Area. F-22 flights operations and resulting emissions within the Municipality of Anchorage CO Maintenance Area would not change compared to baseline operations for Alternatives A, B, D, and E.

Currently, F-22s fly about 355 times per year for very brief time intervals within the Municipality of Anchorage CO Maintenance Area below 3,000 feet AGL. The number of F-22 flights through the CO maintenance area would decrease to 115 per year under Alternatives C and F, although the modes of operation for each flight would be the same as baseline operations.

The noise analysis determined that F-22s in approach mode pass through the MOA CO maintenance area below 3,000 feet AGL for a duration of ~28 seconds per flight and at an engine power setting of approximately 20 percent ETR. Departures on Runway 16 are very rare (about 5 times per year) because of the potential to interfere with non-JBER air traffic. Unrestricted departures from RW 16 climb above 3,000 feet AGL before reaching the maintenance area boundary. Military power departures from RW 16 reach about 1,500 feet AGL by the time they reach the maintenance area boundary and climb above 3,000 feet AGL before leaving the area; the F-22 operates within the maintenance area below 3,000 feet AGL for about 15 seconds during this mode of operation. Regardless, F-22 departures and resulting emissions within this area from any project alternative would not change compared to baseline operations. Therefore, the focus of the analysis for the CO maintenance area is limited to F-22s as they approach JBER under Alternatives C and F.

D.4 Organization of Attachment 1 Emissions Tables

Attachment 1 presents the project emissions estimates in tabular form for potential construction activities and F-22 operations. The construction emissions tables (D-1 through D-12) are organized by the following sequence: (1) table of contents, (2) emissions data for nonroad equipment, on-road vehicles, and fugitive dust sources for each construction activity, (3) source emission factors, and (4) mass emissions for each construction activity. The operational emissions tables (D-13 through D-17) are organized by the following sequence: (1) F-22 operational activity data, (2) source emission factors, and (3) mass emissions for each mode of operation.

D.5 References

Air Force. No date. FY 2017 Military Construction Project Data – Joint Base Elmendorf Richardson – Extend Runway 16-34. Form 1391.

Air Force Civil Engineer Center. 2014. *Air Emissions Guide for Air Force Mobile Sources - Methods for Estimating Emissions of Air Pollutants for Mobile Sources at U.S. Air Force Installations*.

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Countess Environmental. 2006. *WRAP Fugitive Dust Handbook*.

USEPA. 2014. MOVES (Motor Vehicle Emission Simulator) Model. Available at http://www.epa.gov/otaq/models/moves.

USEPA. 2009. *NONROAD Model (nonroad engines, equipment, and vehicles)*. Web site http://www3.epa.gov/otaq/nonrdmdl.htm.

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ATTACHMENT 1 - CONSTRUCTION AND OPERATIONAL EMISSION CALCULATIONS FOR PROPOSED F 22 OPERATIONAL EFFICIENCIES - JBER

Attachment Table D-1. Emission Source Data for Conceptual Construction Activities for Proposed F-22 Operational Efficiencies – JBER – Year 1

Construction Activity/Equipment Type	Hp Rating	Ave. Daily Load Factor	Number Active	Hours/ Day	Daily Hp-Hrs	Work Days	Total Hp-Hrs
Vegetation Removal - Cut and Fill Operations							
Bulldozer - D-9	405	0.43	2	10	3,483	150	522,450
Loader	215	0.36	4	12	3,715	150	557,280
Haul Truck - 20 CY - Vegetation/Debris (1)	NA	NA	3	13	40	150	5,925
Building Demolition							
Backhoe	160	0.55	2	8	1,408	4	5,632
Bulldozer - D-8	310	0.43	2	10	2,666	4	10,664
Crane w/Wrecking Ball	180	0.29	1	10	522	4	2,088
Loader	215	0.36	4	12	3,715	8	29,722
Haul Truck - 20 CY - Debris (1)	NA	NA	8	48	384	8	3,072

Notes: (1) Number Active = miles/roundtrip, Hours/Day = daily truck trips, Daily Hp-Hrs = daily miles, and Total Hp-Hrs = total miles.
(2) Number Active is acres disturbed at one time and Total Hp-Hrs is acre-days for the entire activity.

Attachment Table D-2. Emission Source Data for Conceptual Construction Activities for Proposed F-22 Ops Efficiencies - JBER - Years 1 and 2

Construction Activity/Equipment Type	Hp Rating	Ave. Daily Load Factor	Number Active	Hours/ Day	Daily Hp-Hrs	Work Days	Total Hp-Hrs
Excavate Terrain/Cut and Fill Operations							
Backhoe	160	0.55	2	6	1,056	540	570,240
Bulldozer - D-9	405	0.43	2	12	4,180	540	2,256,984
Grader	180	0.41	2	8	1,181	540	637,632
Loader	430	0.36	4	12	7,430	540	4,012,416
Scraper	550	0.48	8	12	25,344	540	13,685,760
Haul Truck - 20 CY - Soils Off-road (1)	NA	NA	3	1,276	3,828	540	2,066,943
Haul Truck - 20 CY - Soils On-road (1)	NA	NA	8	142	1,134	540	612,264
Supply Trucks (1)	NA	NA	20	2	40	231	9,240
Fugitive Dust (2)	NA	NA	5	8	NA	540	2,700

Notes: (1) Number Active = miles/roundtrip, Hours/Day = daily truck trips, Daily Hp-Hrs = daily miles, and Total Hp-Hrs = total miles.
(2) Number Active is acres disturbed at one time and Total Hp-Hrs is acre-days for the entire activity.

Attachment Table D-3. Emission Source Data for Conceptual Construction Activities for Proposed F-22 Ops Efficiencies - JBER - Year 2

Construction Activity/Equipment Type	Hp Rating	Ave. Daily Load Factor	Number Active	Hours/ Day	Daily Hp-Hrs	Work Days	Total Hp-Hrs
Runway Overrun - Remove Existing Asphalt							
Asphalt Profiler	950	0.50	1	12	5,700	2	10,059
Loader - 938G	160	0.36	2	8	922	2	1,626
Water Truck - 5000 Gallons	175	0.38	1	8	532	2	939
Haul Truck - 20 CY - Debris (1)	NA	NA	3	35	105	2	186
Fugitive Dust (2)	NA	NA	0.1	12	NA	2	2
Paved Road - Remove Existing Asphalt							
Asphalt Profiler	950	0.50	1	12	5,700	10	56,241
Loader - 938G	160	0.36	2	8	922	10	9,093
Water Truck - 5000 Gallons	175	0.38	1	8	532	10	5,249
Haul Truck - 20 CY - Debris (1)	NA	NA	3	6	19	10	186
Fugitive Dust (2)	NA	NA	0.1	12	NA	10	12
Install Gravel for Erosion Control - Runway/Taxiway/Arm Disarm Pad							
Bulldozer - D-8	310	0.43	2	9	2,133	12	4,958
Grader	180	0.41	2	12	1,771	50	88,560
Loader	215	0.36	2	12	1,858	50	92,880
Haul Truck - 20 CY - Gravel (1)	NA	NA	8	27	215	50	10,744

Notes: (1) Number Active = miles/roundtrip, Hours/Day = daily truck trips, Daily Hp-Hrs = daily miles, and Total Hp-Hrs = total miles.
(2) Number Active is acres disturbed at one time and Total Hp-Hrs is acre-days for the entire activity.

Attachment Table D-4. Emission Source Data for Conceptual Construction Activities for Proposed F-22 Ops Efficiencies - JBER - Years 2 and 3

Construction Activity/Equipment Type	Hp Rating	Ave. Daily Load Factor	Number Active	Hours/ Day	Daily Hp-Hrs	Work Days	Total Hp-Hrs
Install Gravel and Backfill - Runway/Taxiway/Arm Disarm Pad/Roads/Water Storm Sewer/Misc. Projects							
Backhoe	160	0.55	2	10	1,408	120	3,273
Bulldozer - D-8	310	0.43	2	8	2,133	60	4,958
Compactive Roller	165	0.38	1	10	2,133	160	4,958
Grader	180	0.41	2	12	1,771	240	425,088
Loader	215	0.36	2	12	1,858	240	445,824
Haul Truck - 20 CY - Gravel/Sand (1)	NA	NA	8	66	527	240	126,520
Construct/Relocate Requisite Support Features							
Air Compressor - 100 CFM	50	0.60	2	8	480	144	69,120
Backhoe	160	0.55	2	8	1,408	120	168,960
Concrete/Industrial Saw	84	0.73	1	4	245	70	17,170
Crane	190	0.29	2	6	661	144	95,213
Forklift	94	0.40	2	6	451	144	64,973
Generator	45	0.60	2	10	540	144	77,760
Concrete Trucks (1)	NA	NA	15	2	30	50	1,500
Supply Trucks (1)	NA	NA	20	5	100	120	12,000
Fugitive Dust (2)	NA	NA	0.50	12	NA	144	72

Notes: (1) Number Active = miles/roundtrip, Hours/Day = daily truck trips, Daily Hp-Hrs = daily miles, and Total Hp-Hrs = total miles.
(2) Number Active is acres disturbed at one time and Total Hp-Hrs is acre-days for the entire activity.

Attachment Table D-5. Emission Source Data for Conceptual Construction Activities for Proposed F-22 Ops Efficiencies - JBER - Year 3

Construction Activity/Equipment Type	Hp Rating	Ave. Daily Load Factor	Number Active	Hours/ Day	Daily Hp-Hrs	Work Days	Total Hp-Hrs
Asphalt and Resurfacing							
Backhoe	160	0.55	2	6	1,056	120	126,720
Compactive Roller	165	0.38	2	10	1,254	240	300,960
Grader	180	0.41	2	12	1,771	240	425,088
Loader	215	0.36	3	12	2,786	240	668,736
Paving Machine	200	0.42	2	12	2,016	240	483,840
Water Truck - 5000 Gallons	175	0.38	2	8	1,064	220	234,080
Haul Truck - 20 CY - Asphalt (1)	NA	NA	8	62	498	240	119,608
Supply Trucks (1)	NA	NA	15	2	30	160	4,800
Fugitive Dust (2)	NA	NA	3	12	NA	240	720

Notes: (1) Number Active = miles/roundtrip, Hours/Day = daily truck trips, Daily Hp-Hrs = daily miles, and Total Hp-Hrs = total miles.
(2) Number Active is acres disturbed at one time and Total Hp-Hrs is acre-days for the entire activity.

Attachment Table D-6. Air Emission Factors for Conceptual Construction Activities for Proposed F-22 Operational Efficiencies – JBER

Project Year/Source Type	Fuel Type	Emission Factors (Grams/Horsepower-Hour)							References
		VOC	CO	NOx	SO2	PM10	PM2.5	CO2	
Year 2018									
Nonroad Equipment - 41 - 50 Hp	D	0.25	0.99	3.60	0.00	0.15	0.15	614	(1)
Nonroad Equipment - 51 - 75 Hp	D	0.32	2.10	3.72	0.00	0.27	0.26	609	(1)
Nonroad Equipment - 76 - 100 Hp	D	0.32	2.23	2.47	0.00	0.31	0.30	609	(1)
Nonroad Equipment - 101 - 175 Hp	D	0.25	0.89	2.09	0.00	0.19	0.18	547	(1)
Nonroad Equipment - 176 - 300 Hp	D	0.19	0.53	1.70	0.00	0.10	0.10	539	(1)
Nonroad Equipment - 301 - 600 Hp	D	0.18	0.85	2.27	0.00	0.12	0.12	535	(1)
Nonroad Equipment - 601 - 750 Hp	D	0.17	1.11	2.26	0.00	0.12	0.12	535	(1)
Nonroad Equipment - 751 - 1000 Hp	D	0.24	0.97	3.63	0.00	0.13	0.13	534	(1)
Heavy Duty Diesel Vehicles - Idle (Gms/Hr)	D	38.84	88.07	222.19	0.08	2.22	2.04	9,024	(2)
HDDV - 25 mph	D	0.39	2.00	7.41	0.02	0.36	0.33	2,110	(3)
HDDV - 50 mph	D	0.24	1.36	5.67	0.01	0.20	0.18	1,601	(3)
HDDV - Composite (4)	D	0.30	1.61	6.37	0.02	0.26	0.24	1,805	(3)
All Years									
Disturbed Ground - Fugitive Dust						9.93	0.99		(4)

Notes: (1) Emissions factors estimated with the EPA NONROAD2008a model for Anchorage Borough, Alaska, assuming summer climate conditions. Composite emission factors were calculated for each Hp category by averaging all equipment types within the same Hp category. Model was used to produce factors for year 2018.
(2) Estimated with the use of the EPA MOVES2014 model and based upon default parameters for Anchorage Borough, Alaska and year 2018 conditions. The analysis assumes that each truck trip would idle for 5 minutes onsite.
(3) Equal to 40/60% 25 mph/50 mph conditions.
(4) From Table 3-2 for active large-scale earth moving operations (Countess Environmental 2006). Emissions reduced by 74% from uncontrolled levels to simulate relatively moist soil conditions and water application/use of best management practices for fugitive dust control (Table 3-7 Countess Environmental 2006). Converted to units of lbs/acre-day of disturbance assuming 22 work days/month.

Attachment Table D-7. Total Emissions for Conceptual Construction Activities for Proposed F-22 Operational Efficiencies – JBER – Year 1

Construction Activity/Equipment Type	Tons						
	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
Vegetation Removal - Cut and Fill Operations							
Bulldozer - D-9	0.10	0.49	1.31	0.00	0.07	0.07	308.09
Loader	0.12	0.33	1.05	0.00	0.06	0.06	331.36
Haul Truck - 20 CY - Vegetation/Debris	0.01	0.03	0.09	0.00	0.00	0.00	15.42
Subtotal	**0.23**	**0.85**	**2.44**	**0.00**	**0.13**	**0.13**	**654.87**
Building Demolition							
Backhoe	0.00	0.01	0.01	0.00	0.00	0.00	3.40
Bulldozer - D-8	0.00	0.01	0.03	0.00	0.00	0.00	6.29
Crane w/Wrecking Ball	0.00	0.00	0.00	0.00	0.00	0.00	1.24
Loader	0.01	0.02	0.06	0.00	0.00	0.00	17.67
Haul Truck - 20 CY - Debris	0.00	0.01	0.03	0.00	0.00	0.00	7.46
Subtotal	**0.01**	**0.04**	**0.13**	**0.00**	**0.01**	**0.01**	**36.06**

Attachment Table D-8. Total Emissions for Conceptual Construction Activities for Proposed F-22 Ops Efficiencies – JBER – Years 1 and 2

Construction Activity/Equipment Type	Tons						
	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
Excavate Terrain/Cut and Fill Operations							
Backhoe	0.16	0.56	1.32	0.00	0.12	0.11	344
Bulldozer - D-9	0.44	2.12	5.66	0.01	0.30	0.29	1,331
Grader	0.13	0.37	1.20	0.00	0.07	0.07	379
Loader	0.79	3.77	10.05	0.01	0.54	0.52	2,366
Scraper	2.68	12.87	34.29	0.05	1.83	1.77	8,071
Haul Truck - 20 CY - Soils Off-road	3.34	10.13	30.95	0.05	0.96	0.88	5,379
Haul Truck - 20 CY - Soils On-road	0.53	1.97	6.56	0.01	0.26	0.24	1,488
Supply Trucks	0.00	0.02	0.07	0.00	0.00	0.00	19
Fugitive Dust					13.40	1.34	
Subtotal	**8.08**	**31.81**	**90.10**	**0.13**	**17.47**	**5.22**	**19,376**

Attachment Table D-9. Total Emissions for Conceptual Construction Activities for Proposed F-22 Ops Efficiencies – JBER – Year 2

Construction Activity/Equipment Type	Tons						
	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
Runway Overrun - Remove Existing Asphalt							
Asphalt Profiler	0.00	0.01	0.02	0.00	0.00	0.00	5.98
Loader - 938G	0.00	0.00	0.00	0.00	0.00	0.00	0.98
Water Truck - 5000 Gallons	0.00	0.00	0.00	0.00	0.00	0.00	0.57
Haul Truck - 20 CY - Debris	0.00	0.00	0.00	0.00	0.00	0.00	0.48
Fugitive Dust					0.00	0.00	
Subtotal	**0.00**	**0.01**	**0.03**	**0.00**	**0.00**	**0.00**	**8.01**
Paved Road - Remove Existing Asphalt							
Asphalt Profiler	0.01	0.03	0.11	0.00	0.01	0.01	33.44
Loader - 938G	0.00	0.01	0.02	0.00	0.00	0.00	5.48
Water Truck - 5000 Gallons	0.00	0.01	0.01	0.00	0.00	0.00	3.16
Haul Truck - 20 CY - Debris	0.00	0.00	0.00	0.00	0.00	0.00	0.48
Fugitive Dust					0.00	0.00	
Subtotal	**0.02**	**0.05**	**0.14**	**0.00**	**0.01**	**0.01**	**42.57**
Install Gravel for Erosion Control - Runway/Taxiway/ Arm Disarm Pad							
Bulldozer - D-8	0.00	0.00	0.01	0.00	0.00	0.00	2.92
Grader	0.02	0.05	0.17	0.00	0.01	0.01	52.66
Loader	0.02	0.05	0.17	0.00	0.01	0.01	55.23
Haul Truck - 20 CY - Gravel	0.01	0.03	0.12	0.00	0.00	0.00	26.10
Subtotal	**0.05**	**0.15**	**0.47**	**0.00**	**0.03**	**0.02**	**136.91**

Attachment Table D-10. Total Emissions for Conceptual Construction Activities for Proposed F-22 Ops Efficiencies - JBER - Years 2 and 3

Construction Activity/Equipment Type	Tons						
	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
Install Gravel and Backfill - Runway/Taxiway/Arm Disarm Pad/Roads/Water Storm Sewer/Misc. Projects							
Backhoe	0.00	0.00	0.01	0.00	0.00	0.00	1.97
Bulldozer - D-8	0.00	0.00	0.01	0.00	0.00	0.00	2.92
Compactive Roller	0.00	0.00	0.01	0.00	0.00	0.00	2.99
Grader	0.09	0.25	0.80	0.00	0.05	0.05	252.76
Loader	0.09	0.26	0.84	0.00	0.05	0.05	265.09
Haul Truck - 20 CY - Gravel/Sand	0.11	0.41	1.36	0.00	0.05	0.05	307.40
Subtotal	**0.30**	**0.93**	**3.02**	**0.01**	**0.15**	**0.14**	**833.13**
Construct/Relocate Requisite Support Features							
Air Compressor - 100 CFM	0.02	0.08	0.27	0.00	0.01	0.01	46.79
Backhoe	0.05	0.17	0.39	0.00	0.03	0.03	101.87
Concrete/Industrial Saw	0.01	0.04	0.05	0.00	0.01	0.01	11.52
Crane	0.02	0.06	0.18	0.00	0.01	0.01	56.61
Forklift	0.02	0.16	0.18	0.00	0.02	0.02	43.59
Generator	0.02	0.09	0.31	0.00	0.01	0.01	52.64
Concrete Trucks	0.00	0.00	0.01	0.00	0.00	0.00	3.57
Supply Trucks	0.01	0.03	0.10	0.00	0.00	0.00	24.37
Fugitive Dust					0.00	0.00	
Subtotal	**0.14**	**0.61**	**1.49**	**0.00**	**0.10**	**0.10**	**340.97**

Attachment Table D-11. Total Emissions for Conceptual Construction Activities for Proposed F-22 Ops Efficiencies - JBER - Year 3

Construction Activity/Equipment Type	Tons						
	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
Asphalt and Resurfacing							
Backhoe	0.03	0.12	0.29	0.00	0.03	0.03	76.40
Compactive Roller	0.08	0.30	0.69	0.00	0.06	0.06	181.45
Grader	0.09	0.25	0.80	0.00	0.05	0.05	252.76
Loader	0.14	0.39	1.25	0.00	0.07	0.07	397.63
Paving Machine	0.10	0.28	0.91	0.00	0.05	0.05	287.69
Water Truck - 5000 Gallons	0.06	0.23	0.54	0.00	0.05	0.05	141.13
Haul Truck - 20 CY - Asphalt	0.10	0.38	1.28	0.00	0.05	0.05	290.60
Supply Trucks	0.00	0.01	0.04	0.00	0.00	0.00	9.81
Fugitive Dust					0.01	0.00	
Subtotal	**0.62**	**1.97**	**5.81**	**0.01**	**0.37**	**0.35**	**1,637.48**

Attachment Table D-12. Total Emissions Summary to Extend Runway 16/34 2,500 feet - Proposed F-22 Operational Efficiencies at JBER

Year/Construction Activity	Tons						
	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
Year 1							
Vegetation Removal - Cut and Fill Operations	0.23	0.85	2.44	0.00	0.13	0.13	655
Building Demolition	0.01	0.04	0.13	0.00	0.01	0.01	36
Excavate Terrain/Cut and Fill Operations (1)	4.04	15.91	45.05	0.07	8.73	2.61	9,688
Year 1 Emissions	**4.28**	**16.80**	**47.63**	**0.07**	**8.87**	**2.75**	**10,379**
Year 2							
Excavate Terrain/Cut and Fill Operations (1)	4.04	15.91	45.05	0.07	8.73	2.61	9,688
Runway Overrun - Remove Existing Asphalt	0.00	0.01	0.03	0.00	0.00	0.00	8

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Attachment Table D-12. Total Emissions Summary to Extend Runway 16/34 2,500 feet - Proposed F-22 Operational Efficiencies at JBER

Year/Construction Activity	Tons						
	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
…continued from previous page							
Paved Road - Remove Existing Asphalt	0.02	0.05	0.14	0.00	0.01	0.01	43
Install Gravel for Erosion Control	0.05	0.15	0.47	0.00	0.03	0.02	137
Install Gravel and Backfill (1)	0.15	0.46	1.51	0.00	0.08	0.07	417
Construct/Relocate Requisite Support Features (1)	0.07	0.31	0.74	0.00	0.05	0.05	170
Year 2 Emissions	**4.33**	**16.88**	**47.94**	**0.07**	**8.90**	**2.77**	**10,462**
Year 3							
Install Gravel and Backfill (1)	0.15	0.46	1.51	0.00	0.08	0.07	417
Construct/Relocate Requisite Support Features (1)	0.07	0.31	0.74	0.00	0.05	0.05	170
Asphalt and Resurfacing	0.62	1.97	5.81	0.01	0.37	0.35	1,637
Year 3 Emissions	**0.84**	**2.74**	**8.06**	**0.01**	**0.50**	**0.47**	**2,225**
Peak Annual Emissions (1)	**4.33**	**16.88**	**47.94**	**0.07**	**8.90**	**2.77**	**10,462**

Note: (1) Equal to half of the total emissions for a given activity.

Table D-13. F-22 Departures/Taxing Times via Runway 06 - JBER F-22 Operational Efficiencies EIS – Alternative D

Scenario/Aircraft Type	Annual Sorties	Additional Idling Time per Sortie (Hr)	Total Annual Increase in Idling Times (Hr)
Baseline			
F-22	970	0.25	242.5
Alternative D			
F-22	4,765	0.25	1,191.3
Net Change in Annual Idling Times			**948.8**

Attachment Table D-14. F-22 Aircraft Engine Emission Factors - JBER F-22 Operational Efficiencies EIS – Alternative D

Engine Power Setting	Fuel Flow Rate (Lb/Hr)	Engine Emission Factors - Pounds/1000 Pounds Fuel (1)							References
		VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	
Idle	1,377.0	1.67	48.15	3.01	1.06	2.42	2.40	3,255	1

Notes: The F-22 has 2 engines.
(1) Data are for a single F119-PW-100 engine (Table 2-8 of Air Force Civil Engineer Center 2014).

Attachment Table D-15. Annual Emissions from F-22 Departures/Taxing Times via Runway 06 - JBER F-22 Operational Efficiencies EIS – Alternative D

Scenario/Aircraft Type	Annual Departures	Additional Taxing Time/Departure (Hr)	Total Annual Increase in Taxing Times (Hr)	Annual Emissions (Tons)						
				VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2
Baseline										
F-22	970	0.25	242.5	0.56	6.08	1.01	0.35	0.81	0.80	1,087
Alternative D										
F-22	4,765	0.25	1,191.3	2.74	78.98	4.94	1.74	3.97	3.93	5,340
Annual Emissions Increase (Tons/Year) (1)				**2.18**	**62.90**	**3.93**	**1.38**	**3.16**	**3.13**	**4,253**

Notes: (1) Equal to Alternative D minus baseline emissions.

Attachment Table D-16. F-22 Aircraft Engine Emission Factors - JBER F-22 Operational Efficiencies Project EIS Alternative D

Engine Power Setting	Fuel Flow Rate (Lb/Hr)	Engine Emission Factors - Pounds/1000 Pounds Fuel (1)							References
		VOC	CO	NOx	SO2	PM10	PM2.5	CO2	
Idle	1,377	1.67	48.15	3.01	1.06	2.42	2.40	3,234	1
Approach	2,740	0.05	7.92	6.59	1.06	1.96	1.94	3,234	1

Notes: The F-22 has 2 engines.
(1) Data are for a single F119-PW-100 engine (Table 2-8 of Air Force Civil Engineer Center 2016).

Attachment Table D-17. Changes in Annual F-22 Operations and Emissions within the MOA CO Maintenance Area - JBER F-22 Operational Efficiencies Project EIS

Scenario/Aircraft Type	Annual Sorties	Time in Mode per Sortie (Hr)	Total Annual Duration (Hr)	Annual Emissions (Tons)						
				VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Baseline										
F-22	355	0.01	2.8	0.00	0.06	0.05	0.01	0.01	0.01	24.47
Alternatives C and F										
F-22	115	0.01	0.9	0.00	0.02	0.02	0.00	0.00	0.00	7.93
Annual Emissions Decrease (Tons/Year) (1)				**(0.00)**	**(0.04)**	**(0.03)**	**(0.01)**	**(0.01)**	**(0.01)**	**(16.54)**

Notes: Flight activities below 3,000 feet AGL within the MOA CO Maintenance Area only would occur during arrival operations. The engine throttle setting for this operation is approach mode.
(1) Equal to Alternative C or F minus Baseline emissions.

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APPENDIX E
ACOUSTIC ENVIRONMENT

ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AAD	Annual Average Daily
AGL	Above Ground Level
ANSI	American National Standards Institute
ASHLA	American Speech-Language-Hearing Association
CHABA	Committee on Hearing, Bioacoustics, and Biomechanics
CNEL	Community Noise Equivalent Level
CNELmr	Onset-Rate Adjusted Monthly Community Noise Equivalent Level
dB	Decibel
dBA	A-Weighted Decibels
dB(A)	A-Weighted Decibels
DLR	German Aerospace Center (Deutsches Zentrum für Luft und Raumfahrt e.V.)
DNL	Day-Night Average Sound Level
DoD	Department of Defense
FAA	Federal Aviation Administration
FICAN	Federal Interagency Committee on Aviation Noise
FICON	Federal Interagency Committee on Noise
HA	Highly Annoyed
HYENA	Hypertension and Exposure to Noise near Airports
Hz	Hertz
ISO	International Organization for Standardization
L	Sound Level
Ldn	Day-Night Average Sound Level
Ldnmr	Onset-Rate Adjusted Monthly Day-Night Average Sound Level
Leq	Equivalent Sound Level
Leq(16)	Equivalent Sound Level over 16 hours
Leq(24)	Equivalent Sound Level over 24 hours
Leq(30min)	Equivalent Sound Level over 30 minutes
Leq(8)	Equivalent Sound Level over 8 hours
Leq(h)	Hourly Equivalent Sound Level
Lmax	Maximum Sound Level
Lpk	Peak Sound Level
mmHg	millimeters of mercury
MOA	Military Operations Area
MTR	Military Training Route
NA	Number of Events at or Above a Selected Threshold
NATO	North Atlantic Treaty Organization
NDI	Noise Depreciation Index
NIPTS	Noise-induced Permanent Threshold Shift
NSDI	Noise Sensitivity Depreciation Index
OR	Odd Ratio
POI	Point of Interest
PTS	Permanent Threshold Shift
RANCH	Road Traffic and Aircraft Noise Exposure and Children's Cognition and Health
SEL	Sound Exposure Level
SIL	Speech Interference Level
SUA	Special Use Airspace
TA	Time Above
TTS	Temporary Threshold Shift
U.S.	United States
UKDfES	United Kingdom Department for Education and Skills
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WHO	World Health Organization

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LIST OF TABLES

Section E.1 of this appendix discusses sound and noise and their potential effects on the human and natural environment. The largest section, Section E.2, reviews the potential effects of noise, focusing on effects on humans but also addressing effects on property values, terrain, structures, and animals. Section E.3 contains the list of references cited.

E.1 Noise

Section E.1.1 provides an overview of the basics of sound and noise. Section E.1.2 defines and describes the different metrics used to describe noise.

E.1.1 Basics of Sound

The following four subsections describe sound waves, sounds levels and types of sounds, and workplace noise.

E.1.1.1 Sound Waves and Decibels

Sound consists of minute vibrations in the air that travel through the air and are sensed by the human ear. Figure E-1 is a sketch of sound waves from a tuning fork. The waves move outward as a series of crests where the air is compressed and troughs where the air is expanded. The height of the crests and the depth of the troughs are the amplitude or sound pressure of the wave. The pressure determines its energy or intensity. The number of crests or troughs that pass a given point each second is called the frequency of the sound wave.

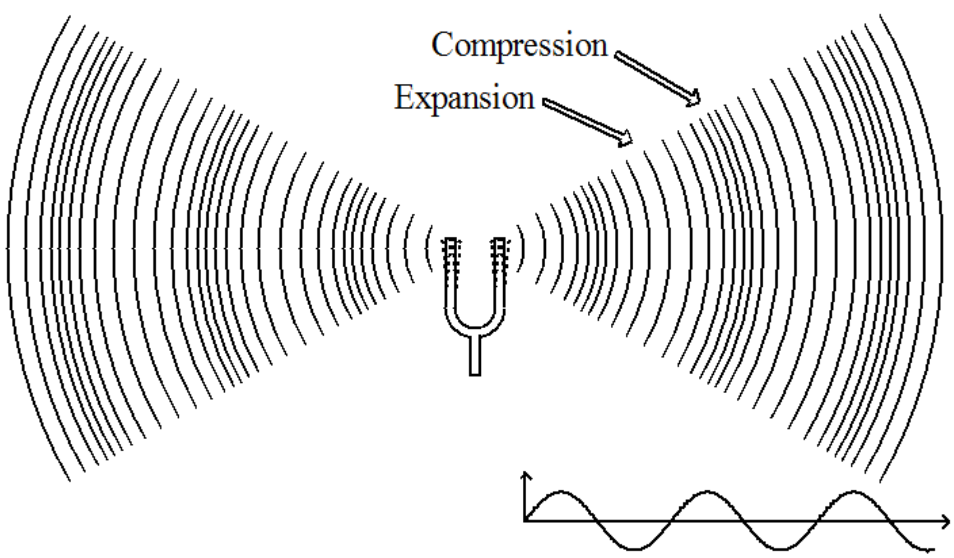

Figure E-1. Sound Waves from a Vibrating Tuning Fork

Source: Wyle Laboratories

The measurement and human perception of sound involves three basic physical characteristics: intensity, frequency, and duration.

- Intensity is a measure of the acoustic energy of the sound and is related to sound pressure. The greater the sound pressure, the more energy carried by the sound and the louder the perception of that sound.
- Frequency determines how the pitch of the sound is perceived. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches.
- Duration or the length of time the sound can be detected.

As shown in Figure E-1, the sound from a tuning fork spreads out uniformly as it travels from the source. The spreading causes the sound's intensity to decrease with increasing distance from the source. For a source such as an aircraft in flight, the sound level will decrease by about 6 dB for every doubling of the distance. For a busy highway, the sound level will decrease by 3 to 4.5 dB for every doubling of distance.

As sound travels from the source it also gets absorbed by the air. The amount of absorption depends on the frequency composition of the sound, the temperature, and the humidity conditions. Sound with high frequency content gets absorbed by the air more than sound with low frequency content. More sound is absorbed in colder and drier conditions than in hot and wet conditions. Sound is also affected by wind and temperature gradients, terrain (elevation and ground cover) and structures.

The loudest sounds that can be comfortably heard by the human ear have intensities a trillion times higher than those of sounds barely heard. Because of this vast range, it is unwieldy to use a linear scale to represent the intensity of sound. As a result, a logarithmic unit known as the decibel (abbreviated dB) is used to represent the intensity of a sound. Such a representation is called a sound level. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB begin to be felt inside the human ear as discomfort. Sound levels between 130 and 140 dB are felt as pain (Berglund and Lindvall 1995).

Because of the logarithmic nature of the decibel unit, sound levels cannot simply be added or subtracted and are somewhat cumbersome to handle mathematically. However, some simple rules are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. For example:

$$60 \text{ dB} + 60 \text{ dB} = 63 \text{ dB, and}$$

$$80 \text{ dB} + 80 \text{ dB} = 83 \text{ dB.}$$

Second, the total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

$$60.0 \text{ dB} + 70.0 \text{ dB} = 70.4 \text{ dB.}$$

Because the addition of sound levels is different than that of ordinary numbers, this process is often referred to as "decibel addition."

The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. On average, a person perceives a change in sound level of about 10 dB as a doubling (or halving) of the sound's loudness. This relation holds true for loud and quiet sounds. A decrease in sound level of 10 dB actually represents a 90% decrease in sound intensity but only a 50% decrease in perceived loudness because the human ear does not respond linearly.

Sound frequency is measured in terms of cycles per second or hertz (Hz). The normal ear of a young person can detect sounds that range in frequency from about 20 Hz to 20,000 Hz. As we get older, we lose the ability to hear high frequency sounds. Not all sounds in this wide range of frequencies are heard equally. Human hearing is most sensitive to frequencies in the 1,000 to 4,000 Hz range. The notes on a piano range from just over 27 Hz to 4,186 Hz, with middle C equal to 261.6 Hz. Most sounds (including a single note on a piano) are not simple pure tones like the tuning fork in Figure E-1, but contain a mix, or spectrum, of many frequencies.

Sounds with different spectra are perceived differently even if the sound levels are the same. Weighting curves have been developed to correspond to the sensitivity and perception of different types of sound. A-weighting and C-weighting are the two most common weightings. A-weighting puts emphasis on the 1,000 to 4,000 Hz range.

E.1.1.2 Sound Levels and Types of Sounds

Most environmental sounds are measured using A-weighting. They are called A-weighted sound levels, and sometimes use the unit dBA or dB(A) rather than dB. When the use of A-weighting is understood, the term "A-weighted" is often omitted and the unit dB is used. Unless otherwise stated, dB units refer to A-weighted sound levels.

Sound becomes noise when it is unwelcome and interferes with normal activities, such as sleep or conversation. Noise is unwanted sound. Noise can become an issue when its level exceeds the ambient or background sound level. Ambient noise in urban areas typically varies from 60 to 70 dB, but can be as high as 80 dB in the center of a large city. Quiet suburban neighborhoods experience ambient noise levels around 45-50 dB (U.S. Environmental Protection Agency (USEPA) 1978).

Figure E-3 is a chart of A-weighted sound levels from common sources. Some sources, like the air conditioner and vacuum cleaner, are continuous sounds whose levels are constant for some time. Some sources, like the automobile and heavy truck, are the maximum sound during an intermittent event like a vehicle pass-by. Some sources like "urban daytime" and "urban nighttime" are averages over extended periods. A variety of noise metrics have been developed to describe noise over different time periods.

Aircraft noise consists of two major types of sound events: flight (including takeoffs, landings and flyovers), and stationary, such as engine maintenance run-ups. The former are intermittent and the latter primarily continuous. Noise from aircraft overflights typically occurs beneath main approach and departure paths, in local air traffic patterns around the airfield, and in areas near aircraft parking ramps and staging areas. As aircraft climb, the noise received on the ground drops to lower levels, eventually fading into the background or ambient levels.

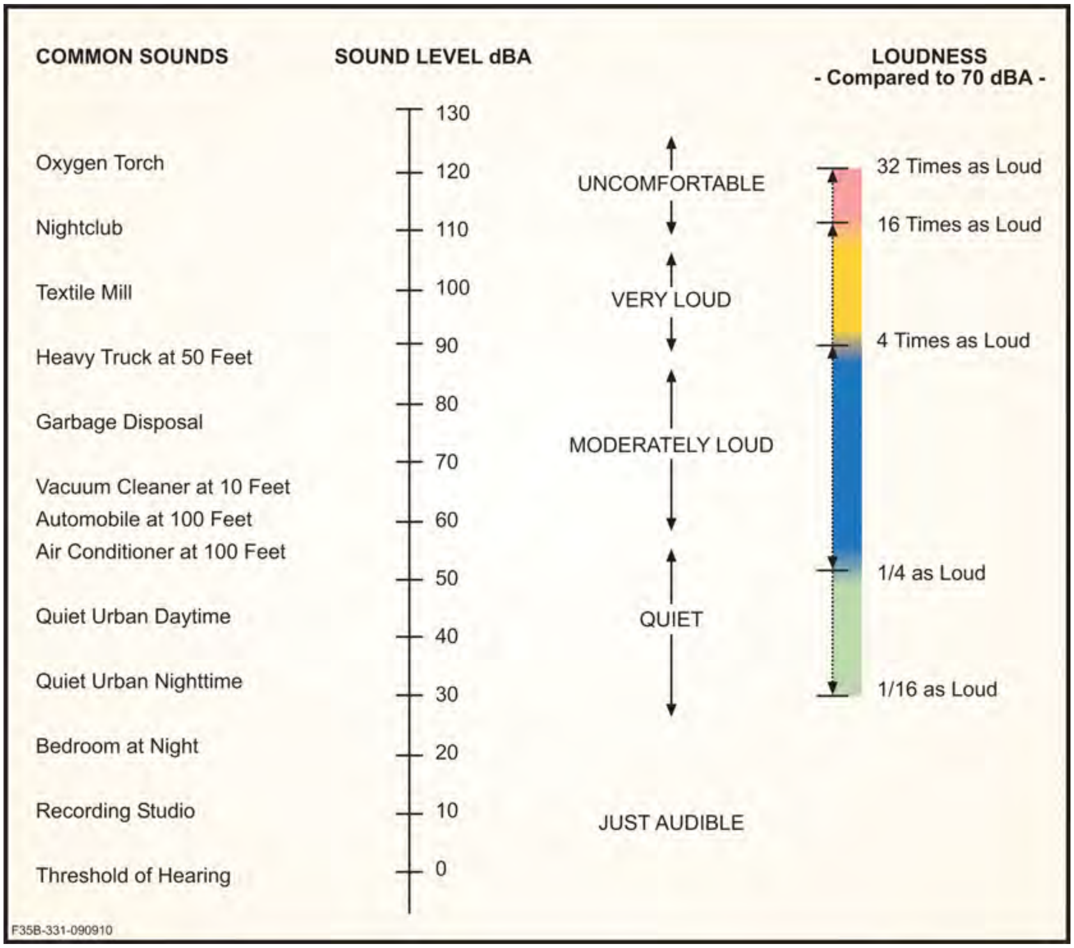

Figure E-2. Typical A-weighted Sound Levels of Common Sound
Sources: Harris 1979; Federal Interagency Committee on Aviation Noise (FICAN) 1997

E.1.1.3 Workplace Noise

In 1972, the National Institute for Occupational Safety and Health (NIOSH) published a criteria document with a recommended exposure limit of 85 dB as an 8-hour time-weighted average. This exposure limit was reevaluated in 1998 when NIOSH made recommendations that went beyond conserving hearing by focusing on the prevention of occupational hearing loss (NIOSH 1998). Following the reevaluation using a new risk assessment technique, NIOSH published another criteria document in 1998 which reaffirmed the 85 dB recommended exposure limit (NIOSH 1998). Active-duty and reserve components of the Air Force (including the ANG), as well as civilian employees and contracted personnel working on Air Force bases and Air Guard stations must comply with Occupational

Safety and Health Administration (OSHA) regulations (29 CFR § 1910.95 Occupational Noise Exposure), DoD Instruction 6055.12, Hearing Conservation Program; Air Force Occupational Safety and Health (AFOSH) Standard 48-20 (June 2006), and Occupational Noise and Hearing Conservation Program (including material derived from the International Standards Organization 1999.2 Acoustics-Determination of Occupational Noise Exposure and Estimation of Noise Induced Impairment). Per AFOSH Standard 48-20, the Hearing Conservation Program is designed to protect workers from the harmful effects of hazardous noise by identifying all areas where workers are exposed to hazardous noise. The following are main components of the program:

1. Identify noise hazardous areas or sources and ensure these areas are clearly marked.
2. Use engineering controls as the primary means of eliminating personnel exposure to potentially hazardous noise. All practical design approaches to reduce noise levels to below hazardous levels by engineering principles shall be explored. Priorities for noise control resources shall be assigned based on the applicable risk assessment code. Where engineering controls are undertaken, the design objective shall be to reduce steady-state levels to below
3. 85 dBA, regardless of personnel exposure time, and to reduce impulse noise levels to below 140 dB peak sound pressure level.
4. Ensure workers with an occupational exposure to hazardous noise complete an initial/reference audiogram within 30 days from the date of the workers' initial exposure to hazardous noise.
5. Ensure new equipment being considered for purchase has the lowest sound emission levels that are technologically and economically possible and compatible with performance and environmental requirements. 42 USC § 4914, Public Health and Welfare, Noise Control, Development of Low-Noise Emission Products, applies.
6. Education and training regarding potentially noise hazardous areas and sources, use and care of hearing protective devices, the effects of noise on hearing, and the Hearing Conservation Program.

E.1.2 Noise Metrics

Noise metrics quantify sounds so they can be compared with each other, and with their effects, in a standard way. The simplest metric is the A-weighted level, which is appropriate by itself for constant noise such as an air conditioner. Aircraft noise varies with time. During an aircraft overflight, noise starts at the background level, rises to a maximum level as the aircraft flies close to the observer, then returns to the background as the aircraft recedes into the distance. This is sketched in Figure E-3, which also indicates two metrics (L_{max} and SEL) that are described in Sections E.2.1 and E.2.3 below. Over time there can be a number of events, not all the same.

There are a number of metrics that can be used to describe a range of situations, from a particular individual event to the cumulative effect of all noise events over a long time. This section describes the metrics relevant to environmental noise analysis.

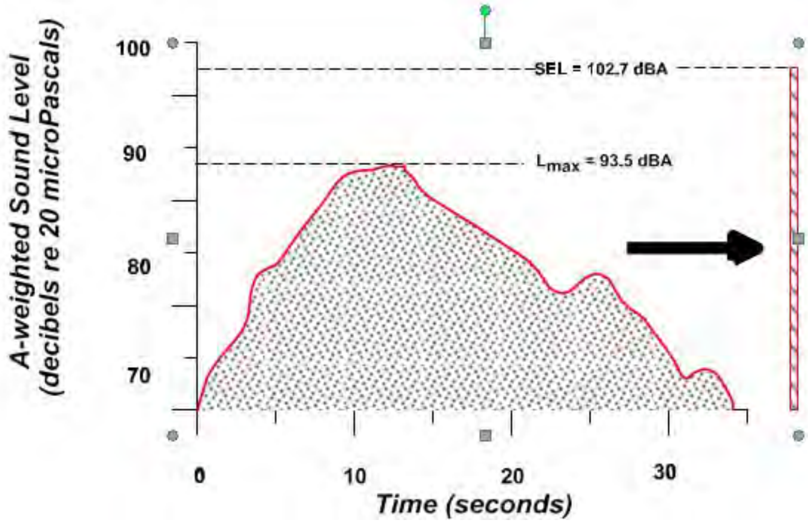

Figure E-3. Example Time History of Aircraft Noise Flyover
Source: Wyle Laboratories

E.1.2.1 Single-Events

Sound Level (Lmax)

The highest A-weighted sound level measured during a single event in which the sound changes with time is called the maximum A-weighted sound level or Maximum Sound Level and is abbreviated Lmax. The Lmax is depicted for a sample event in Figure E-3.

Lmax is the maximum level that occurs over a fraction of a second. For aircraft noise, the "fraction of a second" is one-eighth of a second, denoted as "fast" response on a sound level measuring meter (ANSI 1988). Slowly varying or steady sounds are generally measured over 1 second, denoted "slow" response. Lmax is important in judging if a noise event will interfere with conversation, TV or radio listening, or other common activities. Although it provides some measure of the event, it does not fully describe the noise, because it does not account for how long the sound is heard.

Table E-1 reflects Lmax values for typical aircraft associated with this assessment operating at the indicated flight profiles and power settings. On takeoff through 1,000 ft AGL, the F-22 has the highest Lmax of 112 dB with the F-35A ranked a close second with 111 dB Lmax. On approach through 1,000 ft AGL, the F-22 has the highest Lmax of 104 dB with the B-1 and F-15 tied for second with 97 dB Lmax.

Table E-1. Representative Instantaneous Maximum Sound Levels (Lmax)[1]

Aircraft (engine type)	Power Setting	Power Unit[2]	Lmax (in dBA) At Varying Altitudes (In Feet)				
			500	1,000	2,000	5,000	10,000
Takeoff/Departure Operations							
A-10A	6200	NF	100	92	82	68	58
B-13	97.5%	RPM	113	105	97	84	72
F-15 (PW220)	90%	NC	111	104	97	85	75
F-16 (PW229)	93%	NC	114	106	98	86	76
F-22	100%	ETR	120	112	105	93	83
F-35A	100%	ETR	119	111	103	91	81
Landing/Arrival Operations[4]							
A-10A	5225	NF	97	89	79	60	46
B-1	90%	RPM	104	97	89	76	65
F-15 (PW220)	75%	NC	104	97	89	77	66
F-16 (PW229)	83.5%	NC	93	86	78	66	56
F-22	43%	ETR	111	104	96	84	73
F-35A[5]	40%	ETR	100	93	85	73	62

Source: NOISEMAP OPX file using standard weather conditions of 59 degrees Fahrenheit and 70 percent relative humidity

1. Power settings indicated may not be comparable across aircraft that all numbers are rounded, and power settings are typical but not constant for departure/arrival operations.
2. RPM—Revolutions Per Minute; ETR—Engine Thrust Request; NC—Engine Core RPM; and NF—Engine Fan RPM.
3. B-1 Takeoff/Departure modeled with Afterburner, all other departure aircraft modeled without afterburner (if available).
4. All Landing/Arrival aircraft modeled with “parallel-interpolation” power setting for gear down configuration (except if noted).
5. Based on 2013 Edwards measurements.

Sound Exposure Level (SEL)

Sound Exposure Level combines both the intensity of a sound and its duration. For an aircraft flyover, SEL includes the maximum and all lower noise levels produced as part of the overflight, together with how long each part lasts. It represents the total sound energy in the event. Figure E-7 indicates the SEL for an example event, representing it as if all the sound energy were contained within 1 second.

Because aircraft noise events last more than a few seconds, the SEL value is larger than L_{max}. It does not directly represent the sound level heard at any given time, but rather the entire event. SEL provides a much better measure of aircraft flyover noise exposure than L_{max} alone.

Table E-2 shows SEL values corresponding to the aircraft and power settings reflected in Table E-1. At 1,000 ft AGL on takeoff, the F-22 has the highest SEL of 121 dB, with the F-35A closed behind with 119 dB SEL. At 1,000 ft AGL on approach, the F-22 has the highest SEL of 109 dB, with the B-1 ranked second with 105 dB SEL.

C-weighted SEL can be computed for impulsive sounds, and the results denoted CSEL or LCE. SEL for A-weighted sound is sometimes denoted ASEL. Within this study, SEL is used for A-weighted sounds and CSEL for C-weighted.

E.1.2.2 Cumulative Events

Equivalent Sound Level (Leq)

Equivalent Sound Level is a "cumulative" metric that combines a series of noise events over a period of time. L_{eq} is the sound level that represents the decibel average SEL of all sounds in the time period. Just as SEL has proven to be a good measure of a single event, L_{eq} has proven to be a good measure of series of events during a given time period.

The time period of an L_{eq} measurement is usually related to some activity, and is given along with the value. The time period is often shown in parenthesis (e.g., $L_{eq(24)}$ for 24 hours). The L_{eq} from 7 a.m. to 3 p.m. may give exposure of noise for a school day.

Figure E-4 gives an example of $L_{eq(24)}$ using notional hourly average noise levels ($L_{eq(h)}$) for each hour of the day as an example. The $L_{eq(24)}$ for this example is 61 dB.

Table E-2. Representative Sound Exposure Levels (SEL)[1]

Aircraft (engine type)	Power Setting	Power Unit2	SEL (in dBA) At Varying Altitudes (In Feet)				
			500	1,000	2,000	5,000	10,000
Takeoff/Departure Operations3							
A-10A	6200	NF	105	99	91	80	71
B-14	97.5%	RPM	119	113	106	96	86
F-15 (PW220)	90%	NC	120	115	109	100	91
F-16 (PW229)	93%	NC	119	114	107	98	89
F-22	100%	ETR	127	121	115	106	98
F-35A	100%	ETR	125	119	113	103	95
Landing/Arrival Operation5							
A-10A	5225	NF	98	92	83	67	55
B-1	90%	RPM	111	105	98	88	79
F-15 (PW220)	75%	NC	99	94	88	79	71
F-16 (PW229)	83.5%	NC	97	92	86	77	68
F-22	43%	ETR	115	109	103	94	85
F-35A6	40%	ETR	107	102	95	86	76

Source: NOISEMAP OPX file using standard weather conditions of 59 degrees Fahrenheit and 70 percent relative humidity.

1. Power settings indicated may not be comparable across aircraft, that all numbers are rounded, and power settings are typical but not constant for departure/arrival operations.
2. RPM—Revolutions Per Minute; ETR—Engine Thrust Request; NC—Engine Core RPM; and NF—Engine Fan RPM.
3. Takeoff/Departure modeled at 160 knots airspeed for SEL purposes.
4. B-1 Takeoff/Departure modeled with Afterburner, all other departure aircraft modeled without afterburner (if available).
5. All Landing/Arrival aircraft modeled at 160 knots airspeed for SEL purposes.
6. Based on 2013 Edwards measurements.

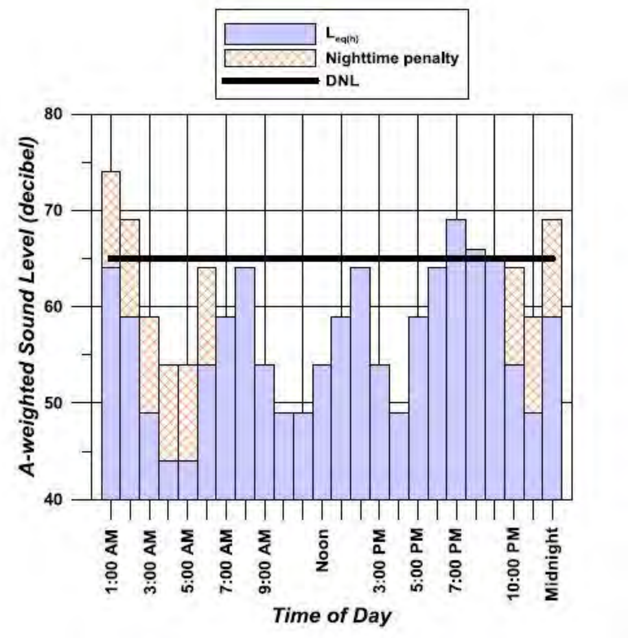

Figure E-4. Example of $L_{eq(24)}$, DNL Computed from Hourly Equivalent Sound Levels
Source: Wyle Laboratories

Day-Night Average Sound Level (DNL or Ldn)

Day-Night Average Sound Level is a cumulative metric that accounts for all noise events in a 24-hour period. However, unlike $L_{eq(24)}$, DNL contains a nighttime noise penalty. To account for our increased sensitivity to noise at night, DNL applies a 10 dB penalty to events during the nighttime period, defined as 10:00 p.m. to 7:00 a.m. The notations DNL and L_{dn} are both used for Day-Night Average Sound Level and are equivalent.

For airports and military airfields outside of California, DNL represents the average sound level for annual average daily aircraft events. Figure E-4 gives an example of DNL using notional hourly average noise levels ($L_{eq(h)}$) for each hour of the day as an example. Note the $L_{eq(h)}$ for the hours between 10 p.m. and 7 a.m. have a 10 dB penalty assigned. The DNL for this example is 65 dB. Figure E-5 shows the ranges of DNL that occur in various types of communities. Under a flight path at a major airport the DNL may exceed 80 dB, while rural areas may experience DNL less than 45 dB.

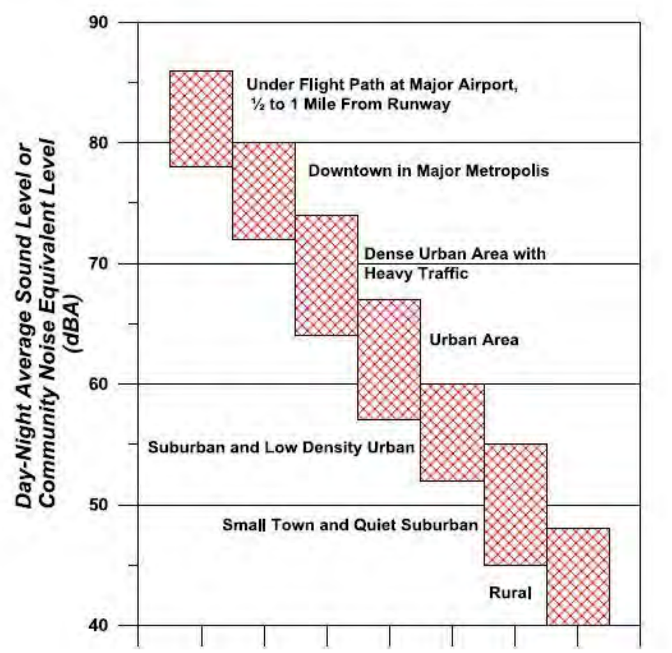

Figure E-5. Typical DNL Ranges in Various Types of Communities
Source: DoD 1978

The decibel summation nature of these metrics causes the noise levels of the loudest events to control the 24-hour average. As a simple example, consider a case in which only one aircraft overflight occurs during the daytime over a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23 hours, 59 minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The DNL for this 24-hour period is 65.9 dB. Assume, as a second example that 10 such 30- second overflights occur during daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The DNL for this 24- hour period is 75.5 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events.

A feature of the DNL metric is that a given DNL value could result from a very few noisy events or a large number of quieter events. For example, 1 overflight at 90 dB creates the same DNL as 10 overflights at 80 dB.

DNL does not represent a level heard at any given time, but represent long term exposure. Scientific studies have found good correlation between the percentages of groups of people highly annoyed and the level of average noise exposure measured in DNL (Schultz 1978; USEPA 1978).

E.1.2.3 Supplemental Metrics

Number-of-Events Above (NA) a Threshold Level (L)

The Number-of-Events Above (NA) metric gives the total number of events that exceed a noise level threshold (L) during a specified period of time. Combined with the selected threshold, the metric is denoted NAL. The threshold can be either SEL or L_{max}, and it is important that this selection is shown in the nomenclature. When labeling a contour line or point of interest (POI), NAL is followed by the number of events in parentheses. For example, where 10 events exceed an SEL of 90 dB over a given period of time, the nomenclature would be NA90SEL(10). Similarly, for L_{max} it would be NA90L_{max}(10). The period of time can be an average 24-hour day, daytime, nighttime, school day, or any other time period appropriate to the nature and application of the analysis.

NA is a supplemental metric. It is not supported by the amount of science behind DNL/CNEL, but it is valuable in helping to describe noise to the community. A threshold level and metric are selected that best meet the need for each situation. An L_{max} threshold is normally selected to analyze speech interference, while an SEL threshold is normally selected for analysis of sleep disturbance.

The NA metric is the only supplemental metric that combines single-event noise levels with the number of aircraft operations. In essence, it answers the question of how many aircraft (or range of aircraft) fly over a given location or area at or above a selected threshold noise level.

Time Above (TA) a Specified Level (L)

The Time Above (TA) metric is the total time, in minutes, that the A-weighted noise level is at or above a threshold. Combined with the threshold level (L), it is denoted TAL. TA can be calculated over a full 24-hour annual average day, the 15-hour daytime and 9-hour nighttime periods, a school day, or any other time period of interest, provided there is operational data for that time.

TA is a supplemental metric, used to help understand noise exposure. It is useful for describing the noise environment in schools, particularly when assessing classroom or other noise sensitive areas for various scenarios. TA can be shown as contours on a map similar to the way DNL contours are drawn.

TA helps describe the noise exposure of an individual event or many events occurring over a given time period. When computed for a full day, the TA can be compared alongside the DNL in order to determine the sound levels and total duration of events that contribute to the DNL. TA analysis is usually conducted along with NA analysis so the results show not only how many events occur, but also the total duration of those events above the threshold.

E.2 Noise Effects

Noise is of concern because of potential adverse effects. The following subsections describe how noise can affect communities and the environment, and how those effects are quantified. The specific topics discussed are:

- Annoyance;
- Land use compatibility;
- Speech interference;
- Sleep disturbance;

- Noise-induced hearing impairment;
- Non-auditory health effects;
- Performance effects;
- Noise effects on children;
- Property values;
- Noise-induced vibration effects on structures and humans;
- Noise effects on terrain;
- Noise effects on historical and archaeological sites; and
- Effects on domestic animals and wildlife.

E.2.1 Annoyance

With the introduction of jet aircraft in the 1950s, it became clear that aircraft noise annoyed people and was a significant problem around airports. Early studies, such as those of Rosenblith *et al.* (1953) and Stevens *et al.* (1953) showed that effects depended on the quality of the sound, its level, and the number of flights. Over the next 20 years considerable research was performed refining this understanding and setting guidelines for noise exposure. In the early 1970s, the USEPA published its "Levels Document" (USEPA 1974) that reviewed the factors that affected communities. DNL (still known as L_{dn} at the time) was identified as an appropriate noise metric, and threshold criteria were recommended.

Threshold criteria for annoyance were identified from social surveys, where people exposed to noise were asked how noise affects them. Surveys provide direct real-world data on how noise affects actual residents.

Surveys in the early years had a range of designs and formats, and needed some interpretation to find common ground. In 1978, Schultz showed that the common ground was the number of people "highly annoyed," defined as the upper 28% range of whatever response scale a survey used (Schultz 1978). With that definition, he was able to show a remarkable consistency among the majority of the surveys for which data were available. Figure E-6 shows the result of his study relating DNL to individual annoyance measured by percent highly annoyed (%HA).

Schultz's original synthesis included 161 data points. Figure E-7 compares revised fits of the Schultz data set with an expanded set of 400 data points collected through 1989 (Finegold *et al.* 1994). The new form is the preferred form in the US, endorsed by the Federal Interagency Committee on Aviation Noise (FICAN 1997). Other forms have been proposed, such as that of Fidell and Silvati (2004), but have not gained widespread acceptance.

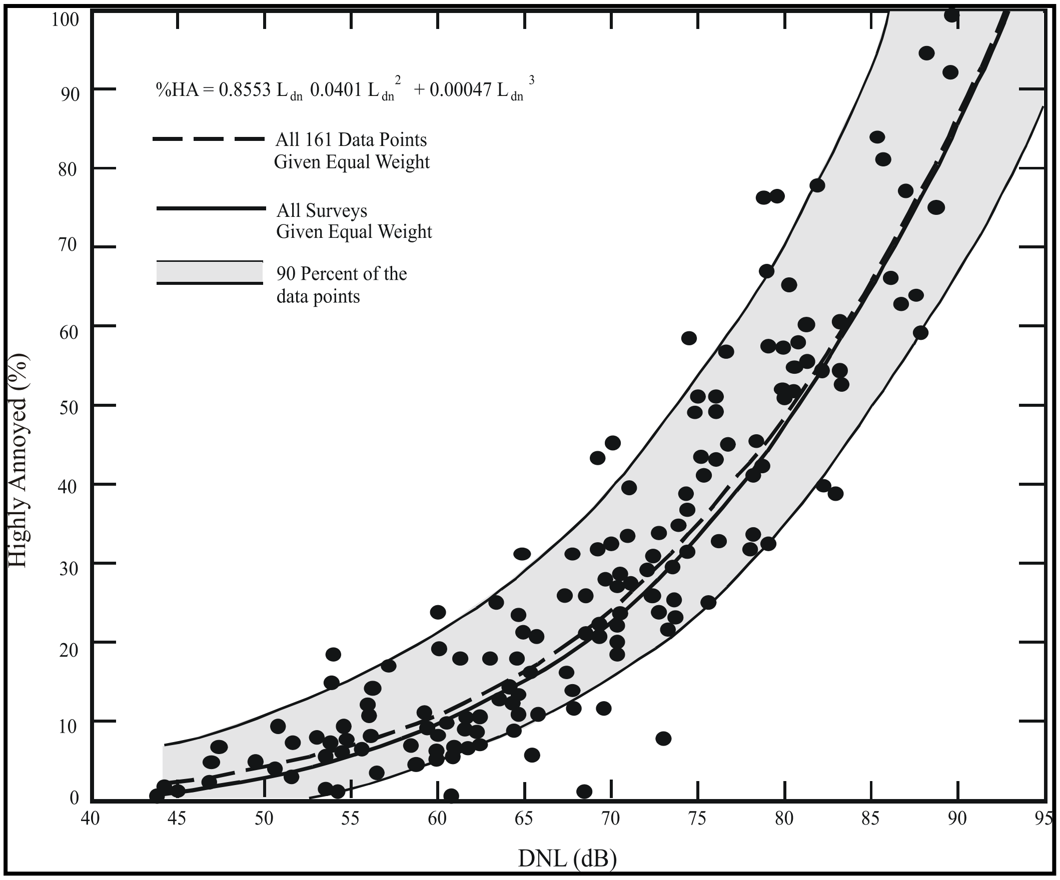

Figure E-6. Schultz Curve Relating Noise Annoyance to DNL (Schultz 1978)

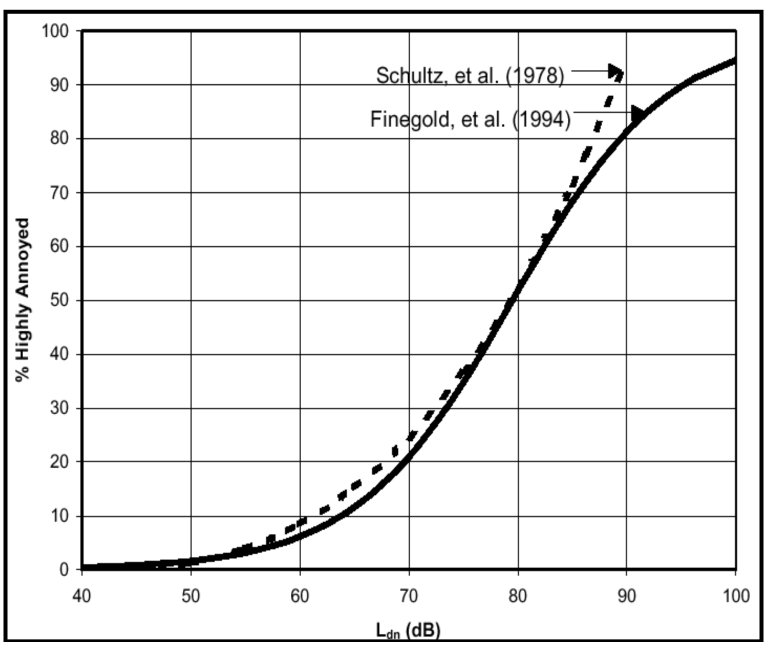

Figure E-7. Response of Communities to Noise; Comparison of Original Schultz (1978) with Finegold *et al.* (1994)

When the goodness of fit of the Schultz curve is examined, the correlation between groups of people is high, in the range of 85-90%. The correlation between individuals is lower, 50% or less. This is not surprising, given the personal differences between individuals. The surveys underlying the Schultz curve include results that show that annoyance to noise is also affected by non-acoustical factors. Newman and Beattie (1985) divided the non-acoustic factors into the emotional and physical variables shown in Table E-3.

Table E-3. Non-Acoustic Variables Influencing Aircraft Noise Annoyance

Emotional Variables	Physical Variables
Feeling about the necessity or preventability of the noise;	Type of neighborhood;
Judgment of the importance and value of the activity that is producing the noise;	Time of day;
Activity at the time an individual hears the noise;	Season;
Attitude about the environment;	Predictability of noise;
General sensitivity to noise;	Control over the noise source; and
Belief about the effect of noise on health; and	Length of time individual is exposed to a noise;
Feeling of fear associated with the noise.	

Schreckenberg and Schuemer (2010) recently examined the importance of some of these factors on short term annoyance. Attitudinal factors were identified as having an effect on annoyance. In formal regression analysis, however, sound level (L_{eq}) was found to be more important than attitude.

A recent study by Plotkin *et al.* (2011) examined updating DNL to account for these factors. It was concluded that the data requirements for a general analysis were much greater than most existing studies. It was noted that the most significant issue with DNL is that it is not readily understood by the public, and that supplemental metrics such as TA and NA were valuable in addressing attitude when communicating noise analysis to communities (DoD 2009a).

A factor that is partially non-acoustical is the source of the noise. Miedema and Vos (1998) presented synthesis curves for the relationship between DNL and percentage "Annoyed" and percentage "Highly Annoyed" for three transportation noise sources. Different curves were found for aircraft, road traffic, and railway noise. Table E-4 summarizes their results. Comparing the updated Schultz curve suggests that the percentage of people highly annoyed by aircraft noise may be higher than previously thought.

Table E-4. Percent Highly Annoyed for Different Transportation Noise Sources

	Percent Highly Annoyed (%HA)			
	Miedema and Vos			Schultz Combined
(dB)	Air	Road	Rail	
55	12	7	4	3
60	19	12	7	6
65	28	18	11	12
70	37	29	16	22
75	48	40	22	36

Source: Miedema and Vos 1998.

As noted by the World Health Organization (WHO), however, even though aircraft noise seems to produce a stronger annoyance response than road traffic, caution should be exercised when interpreting synthesized data from different studies (WHO 1999).

Consistent with WHO's recommendations, the Federal Interagency Committee on Noise (FICON 1992) considered the Schultz curve to be the best source of dose information to predict community response to noise, but recommended further research to investigate the differences in perception of noise from different sources.

E.2.2 Land Use Compatibility

As noted above, the inherent variability between individuals makes it impossible to predict accurately how any individual will react to a given noise event. Nevertheless, when a community is considered as a whole, its overall reaction to noise can be represented with a high degree of confidence. As described above, the best noise exposure metric for this correlation is the DNL or Ldnmr for military overflights. Impulsive noise can be assessed by relating CDNL to an "equivalent annoyance" DNL, as outlined in Section E.2.1.

In June 1980, an ad hoc Federal Interagency Committee on Urban Noise published guidelines (Federal Interagency Committee on Urban Noise 1980) relating DNL to compatible land uses. This committee was composed of representatives from DoD, Transportation, and Housing and Urban Development; USEPA; and the Veterans Administration. Since the issuance of these guidelines, federal agencies have generally adopted these guidelines for their noise analyses.

Following the lead of the committee, the DoD adopted the concept of land-use compatibility as the accepted measure of aircraft noise effect. Air Force guidelines are presented in Table E-5, along with the explanatory notes included in the regulation. These guidelines are not mandatory (note the footnote "*" in the table), rather they are recommendations to provide the best means for determining noise impact for communities adjacent to bases. Again, these are recommendations only; it is up to the city/county zoning and planning entities to determine what land uses are compatible and how they will deal with incompatibilities (e.g., what type of development is allowed, instituting residential buyouts, or whether noise attenuation efforts will be done in residential units). In general, residential land uses normally are not compatible with outdoor DNL values above 65 dB, and the extent of land areas and populations exposed to DNL of 65 dB and higher provides the best means for assessing the noise impacts of alternative aircraft actions. In some cases a change in noise level, rather than an absolute threshold, may be a more appropriate measure of impact.

Table E-5. Air Force Land Use Compatibility Recommendations

Land Use		Accident Potential Zones			Noise Zones			
SLUCM No.	Name	Clear Zone	APZ I	APZ II	65-69 dB	70-74 dB	75-79 dB	80+ dB
10	**Residential**							
11	**Household units**							
11.11	Single units; detached	N	N	Y[1]	A[11]	B[11]	N	N
11.12	Single units; semidetached	N	N	N	A[11]	B[11]	N	N
11.13	Singe units; attached row	N	N	N	A[11]	B[11]	N	N
11.21	Two units; side-by-side	N	N	N	A[11]	B[11]	N	N
11.22	Two units; one above the other	N	N	N	A[11]	B[11]	N	N
11.31	Apartments; walk up	N	N	N	A[11]	B[11]	N	N
11.32	Apartments; elevator	N	N	N	A[11]	B[11]	N	N
12	Group quarters	N	N	N	A[11]	B[11]	N	N
13	Residential hotels	N	N	N	A[11]	B[11]	N	N
14	Mobile home parks or courts	N	N	N	N	N	N	N

Table E-5. Air Force Land Use Compatibility Recommendations

Land Use		Accident Potential Zones			Noise Zones			
SLUCM No.	Name	Clear Zone	APZ I	APZ II	65-69 dB	70-74 dB	75-79 dB	80+ dB
15	Transient lodgings	N	N	N	A[11]	B[11]	C[11]	N
16	Other residential	N	N	N[1]	A[11]	B[11]	N	N
20	Manufacturing							
21	Food and kindred products; manufacturing	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]
22	Textile mill products; manufacturing	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]
23	Apparel and other finished products made from fabrics, leather, and similar materials; manufacturing	N	N	N[2]	Y	Y[12]	Y[13]	Y[14]
24	Lumber and wood products (except furniture); manufacturing	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
25	Furniture and fixtures; manufacturing	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
26	Paper and allied products; manufacturing	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
27	Printing, publishing, and allied industries	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
28	Chemicals and allied products; manufacturing	N	N	N[2]	Y	Y[12]	Y[13]	Y[14]
29	Petroleum refining and related industries	N	N	N	Y	Y[12]	Y[13]	Y[14]
30	**Manufacturing**							
31	Rubber and misc. plastic products, manufacturing	N	N[2]	N[2]	Y	Y[12]	Y[13]	Y[14]
32	Stone, clay and glass products; manufacturing	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]
33	Primary metal industries	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]
34	Fabricated metal products; manufacturing	N	N[2]	Y	Y	Y[12]	Y[13]	Y[14]
35	Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks; manufacturing	N	N	N[2]	Y	A	B	N
39	Miscellaneous manufacturing	N	Y[2]	Y[2]	Y	Y[12]	Y[13]	Y[14]
40	**Transportation, communications, and utilities**							
41	Railroad, rapid rail transit, and street railroad transportation	N[3]	Y[4]	Y	Y	Y[12]	Y[13]	Y[14]
42	Motor vehicle transportation	N[3]	Y	Y	Y	Y[12]	Y[13]	Y[14]
43	Aircraft transportation	N[3]	Y[4]	Y	Y	Y[12]	Y[13]	Y[14]
44	Marine craft transportation	N[3]	Y[4]	Y	Y	Y[12]	Y[13]	Y[14]
45	Highway and street right-of-way	N[3]	Y	Y	Y	Y[12]	Y[13]	Y[14]
46	Automobile parking	N[3]	Y[4]	Y	Y	Y[12]	Y[13]	Y[14]
47	Communications	N[3]	Y[4]	Y	Y	A[15]	B[15]	N
48	Utilities	N[3]	Y[4]	Y	Y	Y	Y[12]	Y[13]
49	Other transportation communications and utilities	N[3]	Y[4]	Y	Y	A[15]	B[15]	N
50	**Trade**							
51	Wholesale trade	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]

Table E-5. Air Force Land Use Compatibility Recommendations

Land Use		Accident Potential Zones			Noise Zones			
SLUCM No.	Name	Clear Zone	APZ I	APZ II	65-69 dB	70-74 dB	75-79 dB	80+ dB
52	Retail trade-building materials, hardware and farm equipment	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
53	Retail trade-general merchandise	N[2]	N[2]	Y[2]	Y	A	B	N
54	Retail trade-food	N[2]	N[2]	Y[2]	Y	A	B	N
55	Retail trade-automotive, marine craft, aircraft and accessories	N[2]	N[2]	Y[2]	Y	A	B	N
56	Retail trade-apparel and accessories	N[2]	N[2]	Y[2]	Y	A	B	N
57	Retail trade-furniture, home furnishings and equipment	N[2]	N[2]	Y[2]	Y	A	B	N
58	Retail trade-eating and drinking establishments	N	N	N[2]	Y	A	B	N
59	Other retail trade	N	N[2]	Y[2]	Y	A	B	N
60	**Services**							
61	Finance, insurance, and real estate services	N	N	Y[6]	Y	A	B	N
62	Personal services	N	N	Y[6]	Y	A	B	N
62.4	Cemeteries	N	Y[7]	Y[7]	Y	Y[12]	Y[13]	Y[14,2,1]
63	Business services	N	Y[8]	Y[8]	Y	A	B	N
64	Repair services	N	Y[2]	Y	Y	Y[12]	Y[13]	Y[14]
65	Professional services	N	N	Y[6]	Y	A	B	N
65.1	Hospitals, nursing homes	N	N	N	A*	B*	N	N
65.1	Other medical facilities	N	N	N	Y	A	B	N
66	Contract construction services	N	Y[6]	Y	Y	A	B	N
67	Governmental services	N[6]	N	Y[6]	Y*	A*	B*	N
68	Educational services	N	N	N	A*	B*	N	N
69	Miscellaneous services	N	N[2]	Y[2]	Y	A	B	N
70	**Cultural, entertainment and recreational**							
71	Cultural activities (including churches)	N	N	N[2]	A*	B*	N	N
71.2	Nature exhibits	N	Y[2]	Y	Y*	N	N	N
72	Public assembly	N	N	N	Y	N	N	N
72.1	Auditoriums, concert halls	N	N	N	A	B	N	N
72.11	Outdoor music shell, amphitheaters	N	N	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	N	N	N	Y[17]	Y[17]	N	N
73	Amusements	N	N	Y[8]	Y	Y	N	N
74	Recreational activities (including golf courses, riding stables, water recreation)	N Y	Y[8,9,10]	Y	Y*	A*	B*	N
75	Resorts and group camps	N	N	N	Y*	Y*	N	N
76	Parks	N	Y[8]	Y[8]	Y*	Y*	N	N
79	Other cultural, entertainment, and recreation	N[9]	Y[9]	Y[9]	Y*	Y*	N	N
80	**Resources production and extraction**							
81	Agriculture (except livestock)	Y[16]	Y	Y	Y[18]	Y[19]	Y[20]	Y[20,21]
81.5 to 81.7	Livestock farming and animal breeding	N	Y	Y	Y[18]	Y[19]	Y[20]	Y[20,21]
82	Agricultural related activities	N	Y[5]	Y	Y[18]	Y[19]	N	N

Table E-5. Air Force Land Use Compatibility Recommendations

Land Use		Accident Potential Zones			Noise Zones			
SLUCM No.	Name	Clear Zone	APZ I	APZ II	65-69 dB	70-74 dB	75-79 dB	80+ dB
83	Forestry activities and related services	N[5]	Y	Y	Y[18]	Y[19]	Y[20]	Y[20,21]
84	Fishing activities and related services	N[5]	Y[5]	Y	Y	Y	Y	Y
85	Mining activities and related services	N	Y[5]	Y	Y	Y	Y	Y
89	Other resources production and extraction	N	Y[5]	Y	Y	Y	Y	Y

1 Suggested maximum density of 1-2 dwelling units per acre possibly increased under a Planned Unit Development where maximum lot coverage is less than 20 percent.

2 Within each land use category, uses exist where further definition may be needed due to the variation of densities in people and structures. Shopping malls and shopping centers are considered incompatible in any APZ.

3 The placing of structures, buildings, or above ground utility lines in the clear zone is subject to severe restrictions. In a majority of the clear zones, these items are prohibited. See AFI 32-7063 and AFI 32-1026 for specific guidance.

4 No passenger terminals and no major above ground transmission lines in APZ I.

5 Factors to be considered: labor intensity, structural coverage, explosive characteristics, and air pollution.

6 Low-intensity office uses only. Meeting places, auditoriums, etc., are not recommended.

7 Excludes chapels.

8 Facilities must be low intensity.

9 Clubhouse not recommended.

10 Areas for gatherings of people are not recommended.

11a Although local conditions may require residential use, it is discouraged in DNL 65-69 dB and strongly discouraged in DNL 70-74 dB. An evaluation should be conducted prior to approvals, indicating that a demonstrated community need for residential use would not be met if development were prohibited in these zones, and that there are no viable alternative locations.

11b Where the community determines the residential uses must be allowed, measures to achieve outdoor to indoor NLR for DNL 65-69 dB and DNL 70-74 dB should be incorporated into building codes and considered in individual approvals.

11c NLR criteria will not eliminate outdoor noise problems. However, building location and site planning, and design and use of berms and barriers can help mitigate outdoor exposure, particularly from near ground level sources. Measures that reduce outdoor noise should be used whenever practical in preference to measures which only protect interior spaces.

12 Measures to achieve the same NLR as required for facilities in the DNL 65-69 dB range must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

13 Measures to achieve the same NLR as required for facilities in the DNL 70-74 dB range must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

14 Measures to achieve the same NLR as required for facilities in the DNL 75-79 dB range must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

15 If noise sensitive, use indicated NLR; if not, the use is compatible.

16 No buildings.

17 Land use is compatible provided special sound reinforcement systems are installed.

18 Residential buildings require the same NLR required for facilities in the DNL 65-69 dB range.

19 Residential buildings require the same NLR required for facilities in the DNL 70-74 dB range.

20 Residential buildings are not permitted.

21 Land use is not recommended. If the community decides the use is necessary, hearing protection devices should be worn by personnel.

Key:

Table E-5. Air Force Land Use Compatibility Recommendations

Land Use		Accident Potential Zones			Noise Zones			
SLUCM No.	Name	Clear Zone	APZ I	APZ II	65-69 dB	70-74 dB	75-79 dB	80+ dB

SLUCM = Standard Land Use Coding Manual, U.S. Department of Transportation
Y = Yes; land use and related structures are compatible without restriction.
N = No; land use and related structures are not compatible and should be prohibited.
A, B, or C = Land use and related structures generally compatible; measures to achieve Noise Level Reduction of A (25 dB), B (30 dB), or C (35 dB) should be incorporated into the design and construction of structures.
A*, B*, or C* = Land use generally compatible with Noise Level Reduction. However, measures to achieve an overall noise level reduction do not necessarily solve noise difficulties and additional evaluation is warranted. See appropriate footnotes.
* = The designation of these uses as "compatible" in this zone reflects individual federal agency and program consideration of general cost and feasibility factors, as well as past community experiences and program objectives. Localities, when evaluating the application of these guidelines to specific situations, may have different concerns or goals to consider.

E.2.3 Speech Interference

Speech interference from noise is a primary cause of annoyance for communities. Disruption of routine activities such as radio or television listening, telephone use, or conversation leads to frustration and annoyance. The quality of speech communication is important in classrooms and offices. In the workplace, speech interference from noise can cause fatigue and vocal strain in those who attempt to talk over the noise. In schools it can impair learning.

There are two measures of speech comprehension:

1. *Word Intelligibility* - the percent of words spoken and understood. This might be important for students in the lower grades who are learning the English language, and particularly for students who have English as a Second Language.
2. *Sentence Intelligibility* – the percent of sentences spoken and understood. This might be important for high-school students and adults who are familiar with the language, and who do not necessarily have to understand each word in order to understand sentences.

U.S. Federal Criteria for Interior Noise

In 1974, the USEPA identified a goal of an indoor $L_{eq(24)}$ of 45 dB to minimize speech interference based on sentence intelligibility and the presence of steady noise (USEPA 1974). Figure E-8 shows the effect of steady indoor background sound levels on sentence intelligibility. For an average adult with normal hearing and fluency in the language, steady background indoor sound levels of less than 45 dB L_{eq} are expected to allow 100% sentence intelligibility.

The curve in Figure E-8 shows 99% intelligibility at Leq below 54 dB, and less than 10% above 73 dB. Recalling that Leq is dominated by louder noise events, the USEPA Leq(24) goal of 45 dB generally ensures that sentence intelligibility will be high most of the time.

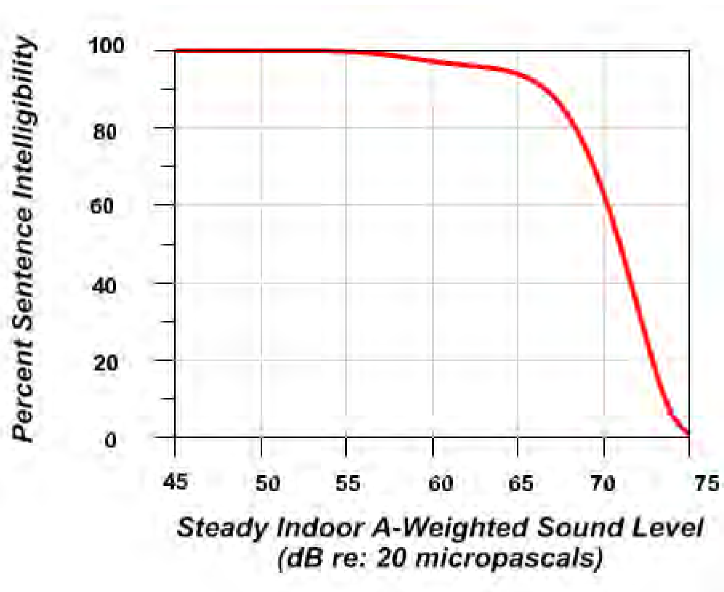

Figure E-8. Speech Intelligibility Curve (digitized from USEPA 1974)

Classroom Criteria

For teachers to be understood, their regular voice must be clear and uninterrupted. Background noise has to be below the teacher's voice level. Intermittent noise events that momentarily drown out the teacher's voice need to be kept to a minimum. It is therefore important to evaluate the steady background level, the level of voice communication, and the single-event level due to aircraft overflights that might interfere with speech.

Lazarus (1990) found that for listeners with normal hearing and fluency in the language, complete sentence intelligibility can be achieved when the signal-to-noise ratio (i.e., a comparison of the level of the sound to the level of background noise) is in the range of 15 to 18 dB. The initial ANSI classroom noise standard (ANSI 2002) and American Speech-Language-Hearing Association (ASLHA 1995) guidelines concur, recommending at least a 15 dB signal-to-noise ratio in classrooms. If the teacher's voice level is at least 50 dB, the background noise level must not exceed an average of 35 dB. The National Research Council of Canada (Bradley 1993) and WHO (1999) agree with this criterion for background noise.

For eligibility for noise insulation funding, the Federal Aviation Administration (FAA) guidelines state that the design objective for a classroom environment is 45 dB L_{eq} during normal school hours (FAA 1985).

Most aircraft noise is not continuous. It consists of individual events like the one sketched in Figure E-7. Since speech interference in the presence of aircraft noise is caused by individual aircraft flyover events, a time-averaged metric alone, such as L_{eq}, is not necessarily appropriate. In addition to the background level criteria described above, single-event criteria that account for those noisy events are also needed.

A 1984 study by Wyle for the Port Authority of New York and New Jersey recommended using Speech Interference Level (SIL) for classroom noise criteria (Sharp and Plotkin 1984). SIL is based on the maximum sound levels in the frequency range that most affects speech communication (500-2,000 Hz). The study identified an SIL of 45 dB as the goal. This would provide 90% word intelligibility for the short time periods during aircraft overflights. While SIL is technically the best metric for speech interference, it can be approximated by an L_{max} value. An SIL of 45 dB is equivalent to an A-weighted L_{max} of 50 dB for aircraft noise (Wesler 1986).

Lind *et al*. (1998) also concluded that an L_{max} criterion of 50 dB would result in 90% word intelligibility. Bradley (1985) recommends SEL as a better indicator. His work indicates that 95% word intelligibility would be achieved when indoor SEL did not exceed 60 dB. For typical flyover noise this corresponds to an L_{max} of 50 dB. While WHO (1999) only specifies a background Lmax criterion, they also note the SIL frequencies and that interference can begin at around 50 dB.

The United Kingdom Department for Education and Skills (UKDfES) established in its classroom acoustics guide a 30-minute time-averaged metric of $L_{eq(30min)}$ for background levels and the metric of $L_{A1,30min}$ for intermittent noises, at thresholds of 30-35 dB and 55 dB, respectively. LA1,30min represents the A-weighted sound level that is exceeded 1% of the time (in this case, during a 30-minute teaching session) and is generally equivalent to the L_{max} metric (UKDfES 2003).

Table E-6 summarizes the criteria discussed. Other than the FAA (1985) 45 dB L_{max} criterion, they are consistent with a limit on indoor background noise of 35-40 dB L_{eq} and a single event limit of 50 dB L_{max}. It should be noted that these limits were set based on students with normal hearing and no special needs. At-risk students may be adversely affected at lower sound levels.

Table E-6. Indoor Noise Level Criteria Based on Speech Intelligibility

Source	Metric/Level (dB)	Effects and Notes
U.S. FAA (1985)	$L_{eq(during\ school\ hours)}$=45 dB	Federal assistance criteria for school sound insulation; supplemental single-event criteria may be used.
Lind *et al.* (1998), Sharp and Plotkin (1984) Wesler (1986)	L_{max}=50 dB/SIL 45	Single-event level permissible in the classroom.
WHO (1999)	L_{eq}=35 dB L_{max}=50 dB	Assumes average speech level of 50 dB and recommends signal to noise ratio of 15 dB.
U.S. ANSI (2010)	L_{eq}=35 dB, based on room volume (e.g., cubic feet)	Acceptable background level for continuous and intermittent noise.
U.K. DFES (2003)	$L_{eq(30\ min)}$=30-35 dB L_{max}=55 dB	Minimum acceptable in classroom and most other learning envrions.

E.2.4 Sleep Disturbance

Sleep disturbance is a major concern for communities exposed to aircraft noise at night. A number of studies have attempted to quantify the effects of noise on sleep. This section provides an overview of the major noise-induced sleep disturbance studies. Emphasis is on studies that have influenced U.S. federal noise policy. The studies have been separated into two groups:

1. Initial studies performed in the 1960s and 1970s, where the research was focused on sleep observations performed under laboratory conditions.

2. Later studies performed in the 1990s up to the present, where the research was focused on field observations.

Initial Studies

The relation between noise and sleep disturbance is complex and not fully understood. The disturbance depends not only on the depth of sleep and the noise level, but also on the non-acoustic factors cited for annoyance. The easiest effect to measure is the number of arousals or awakenings from noise events. Much of the literature has therefore focused on predicting the percentage of the population that will be awakened at various noise levels.

FICON's 1992 review of airport noise issues (FICON 1992) included an overview of relevant research conducted through the 1970s. Literature reviews and analyses were conducted from 1978 through 1989 using existing data (Griefahn 1978; Lukas 1978; Pearsons *et al*. 1989). Because of large variability in the data, FICON did not endorse the reliability of those results.

FICON did recommend, however, an interim dose-response curve, awaiting future research. That curve predicted the percent of the population expected to be awakened as a function of the exposure to SEL. This curve was based on research conducted for the U.S. Air Force (Finegold 1994). The data included most of the research performed up to that point, and predicted a 10% probability of awakening when exposed to an interior SEL of 58 dB. The data used to derive this curve were primarily from controlled laboratory studies.

Recent Sleep Disturbance Research – Field and Laboratory Studies

It was noted that early sleep laboratory studies did not account for some important factors. These included habituation to the laboratory, previous exposure to noise, and awakenings from noise other than aircraft. In the early 1990s, field studies in people's homes were conducted to validate the earlier laboratory work conducted in the 1960s and 1970s. The field studies of the 1990s found that 80-90% of sleep disturbances were not related to outdoor noise events, but rather to indoor noises and non-noise factors. The results showed that, in real life conditions, there was less of an effect of noise on sleep than had been previously reported from laboratory studies. Laboratory sleep studies tend to show more sleep disturbance than field studies because people who sleep in their own homes are used to their environment and, therefore, do not wake up as easily (FICAN 1997).

Federal Interagency Committee on Aviation Noise

Based on this new information, in 1997 FICAN recommended a dose-response curve to use instead of the earlier 1992 FICON curve (FICAN 1997). Figure E-13 shows FICAN's curve, the red dashed line, which is based on the results of three field studies shown in the figure (Ollerhead *et al*. 1992; Fidell *et al*. 1994; Fidell *et al*. 1995a, 1995b), along with the data from six previous field studies.

The 1997 FICAN curve represents the upper envelope of the latest field data. It predicts the maximum percent awakened for a given residential population. According to this curve, a maximum of 3% of people would be awakened at an indoor SEL of 58 dB. An indoor SEL of 58 dB is equivalent to an outdoor SEL of 83 dB, with the windows closed (73 dB with windows open).

Number of Events and Awakenings

It is reasonable to expect that sleep disturbance is affected by the number of events. The German Aerospace Center (DLR Laboratory) conducted an extensive study focused on the effects of nighttime aircraft noise on sleep and related factors (Basner 2004). The DLR study was one of the largest studies to examine the link between aircraft noise and sleep disturbance. It involved both laboratory and in-home field research phases. The DLR investigators developed a dose-response curve that predicts the number of aircraft events at various values of Lmax expected to produce one additional awakening over the course of a night. The dose-effect curve was based on the relationships found in the field studies.

A different approach was taken by an ANSI standards committee (ANSI 2008). The committee used the average of the data shown in Figure E-9 (i.e., the blue dashed line) rather than the upper envelope, to predict average awakening from one event. Probability theory is then used to project the awakening from multiple noise events.

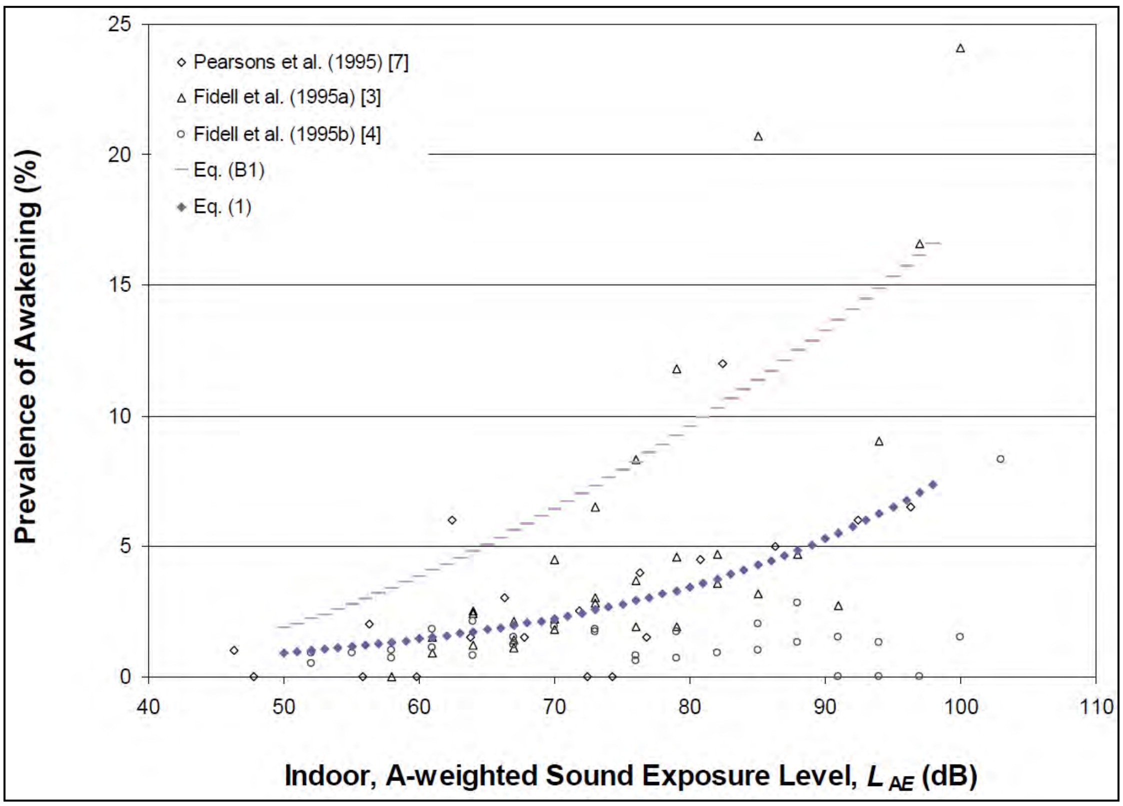

Figure E-9. Sleep Disturbance Dose-Response Relationships

Source: DoD 2009

Currently, there are no established criteria for evaluating sleep disturbance from aircraft noise, although recent studies have suggested a benchmark of an outdoor SEL of 90 dB as an appropriate tentative criterion when comparing the effects of different operational alternatives. The corresponding indoor SEL would be approximately 25 dB lower (at 65 dB) with doors and windows closed, and approximately 15 dB lower (at 75 dB) with doors or windows open. According to the ANSI (2008) standard, the probability of awakening from a single aircraft event at this level is between 1 and 2% for people habituated to the noise sleeping in bedrooms with windows closed, and 2-3% with windows open. The probability of the exposed population awakening at least once from multiple aircraft events at noise levels of 90 dB SEL is shown in Table E-7.

Table E-7. Probability of Awakening from NA90SEL

Number of Aircraft Events at 90 dB SEL for Average 9-Hour Night	Minimum Probability of Awakening at Least Once	
	Windows Closed	Windows Open
1	1%	2%
3	4%	6%
5	7%	10%
9 (1 per hour)	12%	18%
18 (2 per hour)	22%	33%
27 (3 per hour)	32%	45%

Source: DoD 2009.

In December 2008, FICAN recommended the use of this new standard. FICAN also recognized that more research is underway by various organizations, and that work may result in changes to FICAN's position. Until that time, FICAN recommends the use of the ANSI (2008) standard (FICAN 2008).

Summary

Sleep disturbance research still lacks the details to accurately estimate the population awakened for a given noise exposure. The procedure described in the ANSI (2008) Standard and endorsed by FICAN is based on probability calculations that have not yet been scientifically validated. While this procedure certainly provides a much better method for evaluating sleep awakenings from multiple aircraft noise events, the estimated probability of awakenings can only be considered approximate.

E.2.5 Noise-Induced Hearing Impairment

Residents in surrounding communities express concerns regarding the effects of aircraft noise on hearing. This section provides a brief overview of hearing loss caused by noise exposure. The goal is to provide a sense of perspective as to how aircraft noise (as experienced on the ground) compares to other activities that are often linked with hearing loss.

Hearing Threshold Shifts

Hearing loss is generally interpreted as a decrease in the ear's sensitivity or acuity to perceive sound (i.e., a shift in the hearing threshold to a higher level). This change can either be a Temporary Threshold Shift (TTS) or a Permanent Threshold Shift (PTS) (Berger *et al*. 1995).

TTS can result from exposure to loud noise over a given amount of time. An example of TTS might be a person attending a loud music concert. After the concert is over, there can be a threshold shift that may last several hours. While experiencing TTS, the person becomes less sensitive to low-level sounds, particularly at certain frequencies in the speech range (typically near 4,000 Hz). Normal hearing eventually returns, as long as the person has enough time to recover within a relatively quiet environment.

PTS usually results from repeated exposure to high noise levels, where the ears are not given adequate time to recover. A common example of PTS is the result of regularly working in a loud factory. A TTS can eventually become a PTS over time with repeated exposure to high noise levels. Even if the ear is given time to recover from TTS, repeated occurrence of TTS may eventually lead to permanent hearing loss. The point at which a TTS results in a PTS is difficult to identify and varies with a person's sensitivity.

Criteria for Permanent Hearing Loss

It has been well established that continuous exposure to high noise levels will damage human hearing (USEPA 1978). A large amount of data on hearing loss have been collected, largely for workers in manufacturing industries, and analyzed by the scientific/medical community. The Occupational Safety and Health Administration (OSHA) regulation of 1971 places the limit on workplace noise exposure at an average level of 90 dB over an 8-hour work period or 85 dB over a 16-hour period (U.S. Department of Labor 1971). Some hearing loss is still expected at those levels. The most protective criterion, with no measurable hearing loss after 40 years of exposure, is an average sound level of 70 dB over a 24-hour period.

The USEPA established 75 dB $L_{eq(8)}$ and 70 dB $L_{eq(24)}$ as the average noise level standard needed to protect 96% of the population from greater than a 5 dB PTS (USEPA 1978). The National Academy of Sciences Committee on Hearing, Bioacoustics, and Biomechanics (CHABA) identified 75 dB as the lowest level at which hearing loss may occur (CHABA 1977). WHO concluded that environmental and leisure-time noise below an $L_{eq(24)}$ value of 70 dB "will not cause hearing loss in the large majority of the population, even after a lifetime of exposure" (WHO 1999).

Hearing Loss and Aircraft Noise

The 1982 USEPA Guidelines report (USEPA 1982) addresses noise-induced hearing loss in terms of the "Noise-Induced Permanent Threshold Shift" (NIPTS). This defines the permanent change in hearing caused by exposure to noise. Numerically, the NIPTS is the change in threshold that can be expected from daily exposure to noise over a normal working lifetime of 40 years. A grand average of the NIPTS over time and hearing sensitivity is termed the Average NIPTS, or Ave. NIPTS for short. The Ave. NIPTS that can be expected for noise measured by the $L_{eq(24)}$ metric is given in Table E-8 and assumes exposure to the full outdoor noise throughout the 24 hours. When inside a building, the exposure will be less (Eldred and von Gierke 1993).

Table E-8. Average NIPTS and 10th Percentile NIPTS as a Function of DNL

DNL	Ave. NIPTS dB*	10th Percentile NIPTS dB*
75-76	1.0	4.0
76-77	1.0	4.5
77-78	1.6	5.0
78-79	2.0	5.5
79-80	2.5	6.0
80-81	3.0	7.0
81-82	3.5	8.0
82-83	4.0	9.0
83-84	4.5	10.0
84-85	5.5	11.0
85-86	6.0	12.0
86-87	7.0	13.5
87-88	7.5	15.0
88-89	8.5	16.5
89-90	9.5	18.0

Source: DoD 2012
Note: *Rounded to the nearest 0.5 dB

The Ave. NIPTS is estimated as an average over all people exposed to the noise. The actual value of NIPTS for any given person will depend on their physical sensitivity to noise – some will experience more hearing loss than others. The USEPA Guidelines provide information on this variation in sensitivity in the form of the NIPTS exceeded by 10% of the population, which is included in the Table E-9 in the "10th Percentile NIPTS" column (USEPA 1982). For individuals exposed to $L_{eq(24)}$ of 80 dB, the most sensitive of the population would be expected to show degradation to their hearing of 7 dB over time.

To put these numbers in perspective, changes in hearing level of less than 5 dB are generally not considered noticeable or significant. Furthermore, there is no known evidence that a NIPTS of 5 dB is perceptible or has any practical significance for the individual. Lastly, the variability in audiometric testing is generally assumed to be ±5 dB (USEPA 1974).

The scientific community has concluded that noise exposure from civil airports has little chance of causing permanent hearing loss (Newman and Beattie 1985). For military airbases, DoD policy requires that hearing risk loss be estimated for population exposed to L_{dn} of 80 dB or higher (DoD 2009c), including residents of on-base housing. Exposure of workers inside the base boundary is assessed using DoD regulations for occupational noise exposure.

Noise in low-altitude military airspace, especially along MTRs where Lmax can exceed 115 dB, is of concern. That is the upper limit used for occupational noise exposure (e.g., U.S. Department of Labor 1971). One laboratory study (Ising *et al*. 1999) concluded that events with Lmax above 114 dB have the potential to cause hearing loss. Another laboratory study of participants exposed to levels between 115 and 130 dB (Nixon *et al*. 1993), however, showed conflicting results. For an exposure to four events across that range, half the subjects showed no change in hearing, a quarter showed a temporary 5 dB decrease in sensitivity, and a quarter showed a temporary 5 dB increase in sensitivity. For exposure to eight events of 130 dB, subjects showed an increase in sensitivity of up to 10 dB (Nixon *et al*. 1993).

Summary

Aviation noise levels are not comparable to the occupational noise levels associated with hearing loss of workers in manufacturing industries. There is little chance of hearing loss at levels less than 75 dB DNL. Noise levels equal to or greater than 75 dB DNL can occur near military airbases, and DoD policy specifies that NIPTS be evaluated when exposure exceeds 80 dB L_{dn} (DoD 2009c). There is some concern about L_{max} exceeding 115 dB in low altitude military airspace, but no research results to date have definitely related permanent hearing impairment to aviation noise.

E.2.6 Non-Auditory Health Effects

Studies have been performed to see whether noise can cause health effects other than hearing loss. The premise is that annoyance causes stress. Prolonged stress is known to be a contributor to a number of health disorders. Cantrell (1974) confirmed that noise can provoke stress, but noted that results on cardiovascular health have been contradictory. Some studies have found a connection between aircraft noise and blood pressure (e.g., Michalak *et al*. 1990; Rosenlund *et al*. 2001), while others have not (e.g., Pulles *et al*. 1990).

Kryter and Poza (1980) noted, "It is more likely that noise related general ill-health effects are due to the psychological annoyance from the noise interfering with normal everyday behavior, than it is from the noise eliciting, because of its intensity, reflexive response in the autonomic or other physiological systems of the body."

The connection from annoyance to stress to health issues requires careful experimental design. Some highly publicized reports on health effects have, in fact, been rooted in poorly done science. Meecham and Shaw (1979) apparently found a relation between noise levels and mortality rates in neighborhoods under the approach path to Los Angeles International Airport. When the same data were analyzed by others (Frerichs *et al.* 1980) no relationship was found. Jones and Tauscher (1978) found a high rate of birth defects for the same neighborhood. But when the Centers For Disease Control performed a more thorough study near Atlanta's Hartsfield International Airport, no relationships were found for levels above 65 dB (Edmonds *et al.* 1979).

A carefully designed study, Hypertension and Exposure to Noise near Airports (HYENA), was conducted around six European airports from 2002 through 2006 (Jarup *et al.* 2005, 2008). There were 4,861 subjects, aged between 45 and 70. Blood pressure was measured, and questionnaires administered for health, socioeconomic and lifestyle factors, including diet and physical exercise. Hypertension was defined by WHO blood pressure thresholds (WHO 2003). Noise from aircraft and highways was predicted from models.

HYENA results were presented as an odds ratio (OR). An OR of 1 means there is no added risk, while an OR of 2 would mean risk doubles. An OR of 1.14 was found for nighttime aircraft noise, measured by L_{night}, the L_{eq} for nighttime hours. For daytime aircraft noise, measured by Leq(16), the OR was 0.93. For road traffic noise, measured by the full day $L_{eq(24)}$, the OR was 1.1.

Note that OR is a statistical measure of change, not the actual risk. Risk itself and the measured effects were small, and not necessarily distinct from other events. Haralabidis *et al*. (2008) reported an increase in systolic blood pressure of 6.2 millimeters of mercury (mmHg) for aircraft noise, and an increase of 7.4 mmHg for other indoor noises such as snoring.

It is interesting that aircraft noise was a factor only at night, while traffic noise is a factor for the full day. Aircraft noise results varied among the six countries so that result is pooled across all data. Traffic noise results were consistent across the six countries.

One interesting conclusion from a 2013 study of the HYENA data (Babisch *et al*. 2013) states there is some indication that noise level is a stronger predictor of hypertension than annoyance. That is not consistent with the idea that annoyance is a link in the connection between noise and stress. Babisch *et al*. (2012) present interesting insights on the relationship of the results to various modifiers.

Two recent studies examined the correlation of aircraft noise with hospital admissions for cardiovascular disease. Hansell *et al*. (2013) examined neighborhoods around London's Heathrow airport. Correia *et al*. (2013) examined neighborhoods around 89 airports in the United States. Both studies included areas of various noise levels. They found associations that were consistent with the HYENA results. The authors of these studies noted that further research is needed to refine the associations and the causal interpretation with noise or possible alternative explanations.

Summary

The current state of scientific knowledge cannot yet support inference of a causal or consistent relationship between aircraft noise exposure and non-auditory health consequences for exposed residents. The large scale HYENA study, and the recent studies by Hansell *et al.* (2013) and Correia *et al.* (2013) offer indications, but it is not yet possible to establish a quantitative cause and effect based on the currently available scientific evidence.

E.2.7 Performance Effects

The effect of noise on the performance of activities or tasks has been the subject of many studies. Some of these studies have found links between continuous high noise levels and performance loss.

Noise-induced performance losses are most frequently reported in studies where noise levels are above 85 dB. Little change has been found in low-noise cases. Moderate noise levels appear to act as a stressor for more sensitive individuals performing a difficult psychomotor task.

While the results of research on the general effect of periodic aircraft noise on performance have yet to yield definitive criteria, several general trends have been noted including:

- A periodic intermittent noise is more likely to disrupt performance than a steady-state continuous noise of the same level. Flyover noise, due to its intermittent nature, might be more likely to disrupt performance than a steady-state noise of equal level.
- Noise is more inclined to affect the quality than the quantity of work.
- Noise is more likely to impair the performance of tasks that place extreme demands on workers.

E.2.8 Noise Effects on Children

Recent studies on school children indicate a potential link between aircraft noise and both reading comprehension and learning motivation. The effects may be small but may be of particular concern for children who are already scholastically challenged.

E.2.8.1 Effects on Learning and Cognitive Abilities

Early studies in several countries (Cohen *et al*. 1973, 1980, 1981; Bronzaft and McCarthy 1975; Green *et al*. 1982; Evans *et al*. 1998; Haines *et al*. 2002; Lercher *et al*. 2003) showed lower reading scores for children living or attending school in noisy areas than for children away from those areas. In some studies noise exposed children were less likely to solve difficult puzzles or more likely to give up.

More recently, the Road Traffic and Aircraft Noise Exposure and Children's Cognition and Health (RANCH) study (Stansfeld *et al*. 2005; Clark *et al*. 2005) compared the effect of aircraft and road traffic noise on over 2,000 children in three countries. This was the first study to derive exposure-effect associations for a range of cognitive and health effects, and was the first to compare effects across countries.

The study found a linear relation between chronic aircraft noise exposure and impaired reading comprehension and recognition memory. No associations were found between chronic road traffic noise exposure and cognition. Conceptual recall and information recall surprisingly showed better performance in high road traffic noise areas. Neither aircraft noise nor road traffic noise affected attention or working memory (Stansfeld *et al*. 2005; Clark *et al*. 2006).

Figure E-10 shows RANCH's result relating noise to reading comprehension. It shows that reading falls below average (a z-score of 0) at L_{eq} greater than 55 dB. Because the relationship is linear, reducing exposure at any level should lead to improvements in reading comprehension.

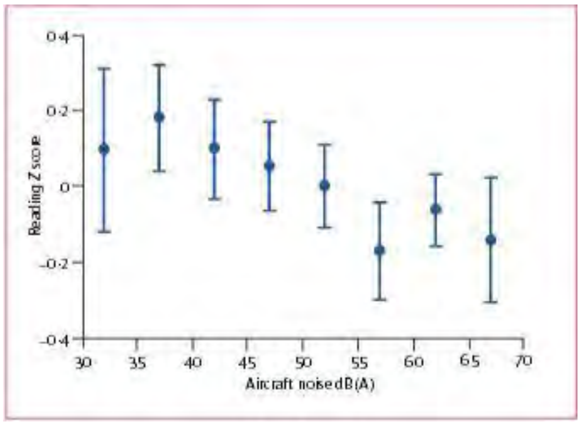

Figure E-10. RANCH Study Reading Scores Varying with L_{eq}
Sources: Stansfeld *et al.* 2005; Clark *et al.* 2006

An observation of the RANCH study was that children may be exposed to aircraft noise for many of their childhood years and the consequences of long-term noise exposure were unknown. A follow-up study of the children in the RANCH project is being analyzed to examine the long-term effects on children's reading comprehension (Clark *et al*. 2009). Preliminary analysis indicated a trend for reading comprehension to be poorer at 15-16 years of age for children who attended noise-exposed primary schools. There was also a trend for reading comprehension to be poorer in aircraft noise exposed secondary schools. Further analysis adjusting for confounding factors is ongoing, and is needed to confirm these initial conclusions.

FICAN funded a pilot study to assess the relationship between aircraft noise reduction and standardized test scores (Eagan *et al*. 2004; FICAN 2007). The study evaluated whether abrupt aircraft noise reduction within classrooms, from either airport closure or sound insulation, was associated with improvements in test scores. Data were collected in 35 public schools near three airports in Illinois and Texas. The study used several noise metrics. These were, however, all computed indoor levels, which makes it hard to compare with the outdoor levels used in most other studies.

The FICAN study found a significant association between noise reduction and a decrease in failure rates for high school students, but not middle or elementary school students. There were some weaker associations between noise reduction and an increase in failure rates for middle and elementary schools. Overall the study found that the associations observed were similar for children with or without learning difficulties, and between verbal and math/science tests. As a pilot study, it was not expected to obtain final answers, but provided useful indications (FICAN 2007).

While there are many factors that can contribute to learning deficits in school-aged children, there i s increasing awareness that chronic exposure to high aircraft noise levels may impair learning. This awareness has led WHO and a North Atlantic Treaty Organization (NATO) working group to conclude that daycare centers and schools should not be located near major sources of noise, such as highways, airports, and industrial sites (NATO 2000; WHO 1999). The awareness has also led to the classroom noise standard discussed earlier (ANSI 2002).

E.2.8.2 Health Effects

A number of studies, including some of the cognitive studies discussed above, have examined the potential for effects on children's health. Health effects include annoyance, psychological health, coronary risk, stress hormones, sleep disturbance and hearing loss.

Annoyance. Chronic noise exposure causes annoyance in children (Bronzaft and McCarthy 1975; Evans *et al.* 1995). Annoyance among children tends to be higher than for adults, and there is little habituation (Haines *et al.* 2001a). The RANCH study found annoyance may play a role in how noise affects reading comprehension (Clark *et al.* 2005).

Psychological Health. Lercher *et al.* (2002) found an association between noise and teacher ratings of psychological health, but only for children with biological risk defined by low birth weight and/or premature birth. Haines *et al.* (2001b) found that children exposed to aircraft noise had higher levels of psychological distress and hyperactivity. Stansfeld *et al.* (2009) replicated the hyperactivity result, but not distress.

As with studies of adults, the evidence suggests that chronic noise exposure is probably not associated with serious psychological illness, but there may be effects on well-being and quality of life. Further research is needed, particularly on whether hyperactive children are more susceptible to stressors such as aircraft noise.

Coronary Risk. The HYENA study discussed earlier indicated a possible relation between noiseand hypertension in older adults. Cohen *et al.* (1980, 1981) found some increase in blood pressure among school children, but within the normal range and not indicating hypertension. Hygge *et al.* (2002) found mixed effects. The RANCH study found some effect for children at home and at night, but not at school. Overall the evidence for noise effects on children's blood pressure is mixed, and less certain than for older adults.

Stress Hormones. Some studies investigated hormonal levels between groups of children exposed to aircraft noise compared to those in a control group. Two studies analyzed cortisol and urinary catecholamine levels in school children as measurements of stress response to aircraft noise (Haines *et al.* 2001a, 2001b). In both instances, there were no differences between the aircraft-noise-exposed children and the control groups.

Sleep Disturbance. A sub-study of RANCH in a Swedish sample used sleep logs and the monitoring of rest/activity cycles to compare the effect of road traffic noise on child and parent sleep (Ohrstrom *et al.* 2006). An exposure-response relationship was found for sleep quality and daytime sleepiness for children. While this suggests effects of noise on children's sleep disturbance, it is difficult to generalize from one study.

Hearing loss. A few studies have examined hearing loss from exposure to aircraft noise. Noise- induced hearing loss for children who attended a school located under a flight path near a Taiwan airport was greater than for children at another school far away (Chen *et al.* 1997). Another study reported that hearing ability was reduced significantly in individuals who lived near an airport and were frequently exposed to aircraft noise (Chen and Chen 1993). In that study, noise exposure near the airport was greater than 75 dB DNL and L_{max} were about 87 dB during overflights. Conversely, several other studies reported no difference in hearing ability between children exposed to high levels of airport noise and children located in quieter areas (Andrus *et al.* 1975; Fisch 1977; Wu *et al.* 1995). It is not clear from those results whether children are at higher risk than adults, but the levels involved are higher than those desirable for learning and quality of life.

Ludlow and Sixsmith (1999) conducted a cross-sectional pilot study to examine the hypothesis that military jet noise exposure early in life is associated with raised hearing thresholds. The authors concluded that there were no significant differences in audiometric test results between military personnel who as children had lived in or near stations where fast jet operations were based, and a similar group who had no such exposure as children.

E.2.9 Property Values

Noise can affect the value of homes. Economic studies of property values based on selling prices and noise have been conducted to find a direct relation.

The value-noise relation is usually presented as the Noise Depreciation Index (NDI) or Noise Sensitivity Depreciation Index (NSDI), the percent loss of value per dB (measured by the DNL metric). An early study by Nelson (1978) at three airports found an NDI of 1.8-2.3% per dB. Nelson also noted a decline in NDI over time which he theorized could be due to either a change in population or the increase in commercial value of the property near airports. Crowley (1978) reached a similar conclusion. A larger study by Nelson (1980) looking at 18 airports found an NDI from 0.5 to 0.6% per dB.

In a review of property value studies, Newman and Beattie (1985) found a range of NDI from 0.2 to 2% per dB. They noted that many factors other than noise affected values.

Fidell *et al.* (1996) studied the influence of aircraft noise on actual sale prices of residential properties in the vicinity of a military base in Virginia and one in Arizona. They found no meaningful effect on home values. Their results may have been due to non-noise factors, especially the wide differences in homes between the two study areas.

Recent studies of noise effects on property values have recognized the need to account for non-noise factors. Nelson (2004) analyzed data from 33 airports, and discussed the need to account for those factors and the need for careful statistics. His analysis showed NDI from 0.3 to 1.5% per dB, with an average of about 0.65% per dB. Nelson (2007) and Andersson et al. (2013) discuss statistical modeling in more detail.

Enough data is available to conclude that aircraft noise has a real effect on property values. This effect falls in the range of 0.2 to 2.0% per dB, with the average on the order of 0.5% per dB. The actual value varies from location to location, and is very often small compared to non-noise factors.

E.2.10 Noise-Induced Vibration Effects on Structures and Humans

High noise levels can cause buildings to vibrate. If high enough, building components can be damaged. The most sensitive components of a building are the windows, followed by plaster walls and ceilings. Possibility of damage depends on the peak sound pressures and the resonances of the building. In general, damage is possible only for sounds lasting more than one second above an unweighted sound level of 130 dB (CHABA 1977). That is higher than expected from normal aircraft operations. Even low altitude flyovers of heavy aircraft do not reach the potential for damage (Sutherland 1990a).

Noise-induced structural vibration may cause annoyance to dwelling occupants because of induced secondary vibrations, or "rattle", of objects within the dwelling – hanging pictures, dishes, plaques, and bric-a-brac. Loose window panes may also vibrate noticeably when exposed to high levels of airborne noise, causing homeowners to fear breakage. In general, rattling occurs at peak unweighted sound levels that last for several seconds at levels above 110 dB, which is well above that considered normally compatible with residential land use Thus, assessments of noise exposure levels for compatible land use will also be protective of noise-induced rattle.

The sound from an aircraft overflight travels from the exterior to the interior of the house in one of two ways: through the solid structural elements and directly through the air. Figure E-11 illustrates the sound transmission through a wall constructed with a brick exterior, stud framing, interior finish wall, and absorbent material in the cavity. The sound transmission starts with noise impinging on the wall exterior. Some of this sound energy will be reflected away and some will make the wall vibrate. The vibrating wall radiates sound into the airspace, which in turn sets the interior finish surface vibrating, with some energy lost in the airspace. This surface then radiates sound into the dwelling interior. As the figure shows, vibrational energy also bypasses the air cavity by traveling through the studs and edge connections.

Normally, the most sensitive components of a structure to airborne noise are the windows, followed by plastered walls and ceilings. An evaluation of the peak sound pressures impinging on the structure is normally sufficient to determine the possibility of damage. In general, at unweighted sound levels above 130 dB, there is the possibility of structural damage. While certain frequencies (such as 30 Hertz for window breakage) may be of more concern than other frequencies, conservatively, only sounds lasting more than one second above a unweighted sound level of 130 dB are potentially damaging to structural components (von Gierke and Ward 1991).

In the assessment of vibration on humans, the following factors determine if a person will perceive and possibly react to building vibrations:

1. Type of excitation: steady state, intermittent, or impulsive vibration.

2. Frequency of the excitation. International Organization for Standardization (ISO) standard 2631-2 (ISO 1989) recommends a frequency range of 1 to 80 Hz for the assessment of vibration on humans.
3. Orientation of the body with respect to the vibration.
4. The use of the occupied space (i.e., residential, workshop, hospital)
5. Time of day

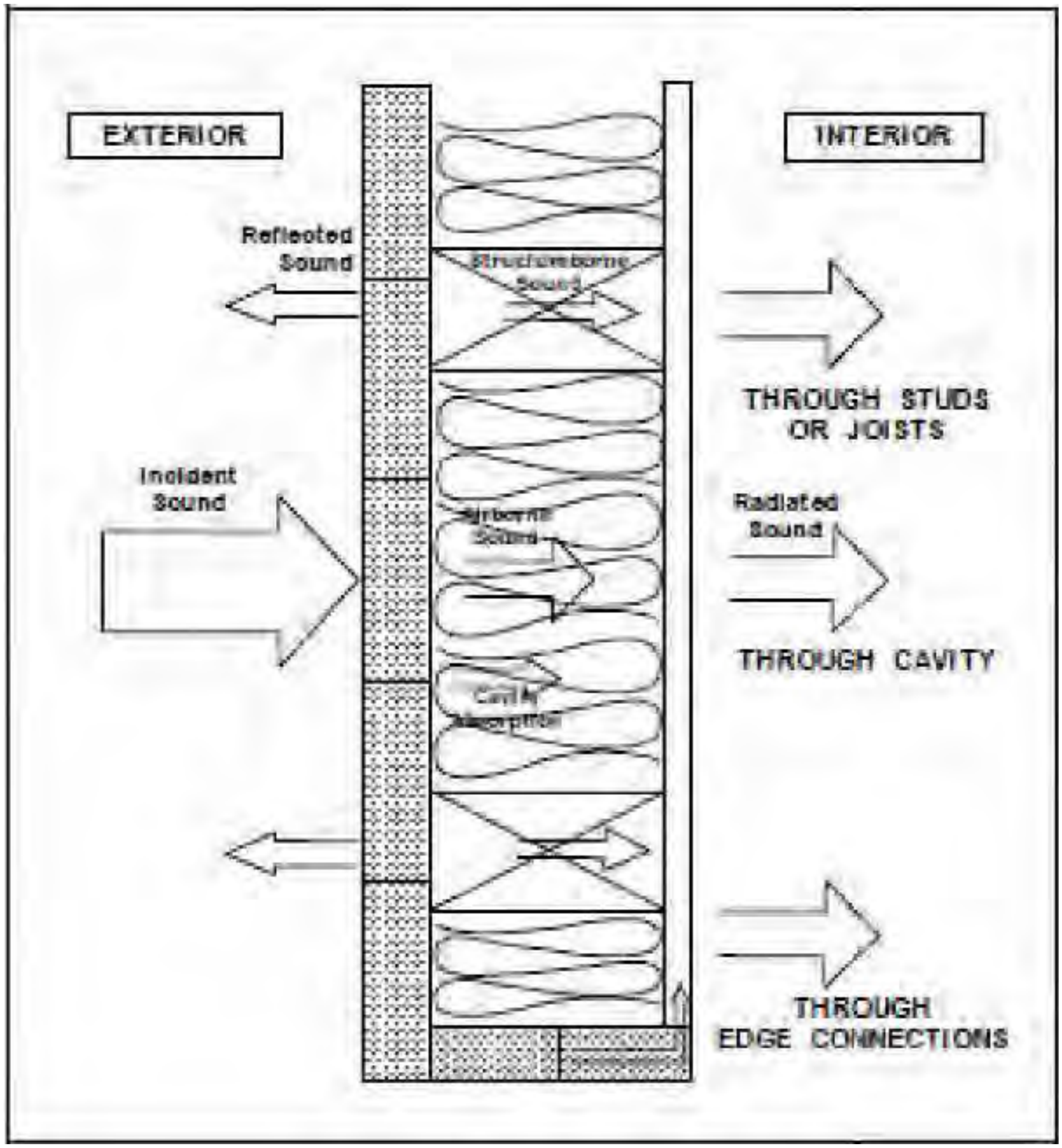

Figure E-11. Depiction of Sound Transmission through Built Construction

Table E-9 lists the whole-body vibration criteria from ISO 2631-2 for one-third octave frequency bands from 1 to 80 Hz.

Table E-9. Vibration Criteria for the Evaluation of Human Exposure to Whole-Body Vibration

	RMS Acceleration (m/s/s)		
(Hz)	Combined Criteria Base Curve	Residential Night	Residential Day
1.00	0.0036	0.0050	0.0072
1.25	0.0036	0.0050	0.0072
1.60	0.0036	0.0050	0.0072
2.00	0.0036	0.0050	0.0072
2.50	0.0037	0.0052	0.0074
3.15	0.0039	0.0054	0.0077
4.00	0.0041	0.0057	0.0081
5.00	0.0043	0.0060	0.0086
6.30	0.0046	0.0064	0.0092
8.00	0.0050	0.0070	0.0100
10.00	0.0063	0.0088	0.0126
12.50	0.0078	0.0109	0.0156
16.00	0.0100	0.0140	0.0200
20.00	0.0125	0.0175	0.0250
25.00	0.0156	0.0218	0.0312
31.50	0.0197	0.0276	0.0394
40.00	0.0250	0.0350	0.0500
50.00	0.0313	0.0438	0.0626
63.00	0.0394	0.0552	0.0788
80.00	0.0500	0.0700	0.1000

Source: ISO 1989.

E.2.11 Noise Effects on Terrain

It has been suggested that noise levels associated with low-flying aircraft may affect the terrain under the flight path by disturbing fragile soil or snow, especially in mountainous areas, causing landslides or avalanches. There are no known instances of such events. It is improbable that such effects would result from routine subsonic aircraft operations.

E.2.12 Noise Effects on Historical and Archaeological Sites

Historical buildings and sites can have elements that are more fragile than conventional structures. Aircraft noise may affect such sites more severely than newer, modern structures. In older structures, seemingly insignificant surface cracks caused by vibrations from aircraft noise may lead to greater damage from natural forces (Hanson *et al*. 1991). There are few scientific studies of such effects to provide guidance for their assessment.

For example, one study involved measurements of noise and vibration in a restored plantation house, originally built in 1795. It is located 1,500 feet from the centerline at the departure end of Runway 19L at Washington Dulles International Airport. The aircraft measured was the Concorde. There was special concern for the building’s windows, since roughly half of the 324 panes were original. No instances of structural damage were found. Interestingly, despite the high levels of noise during Concorde takeoffs, the induced structural vibration levels were actually less than those induced by touring groups and vacuum cleaning (Wesler 1977).

As for conventional structures, noise exposure levels for normally compatible land uses should also be protective of historic and archaeological sites. Unique sites should, of course, be analyzed for specific exposure.

E.2.13 Effects on Domestic Animals and Wildlife

Hearing is critical to an animal's ability to react, compete, reproduce, hunt, forage, and survive in its environment. While the existing literature does include studies on possible effects of jet aircraft noise on wildlife, there appears to have been little concerted effort in developing quantitative comparisons of aircraft noise effects on normal auditory characteristics. Behavioral effects have been relatively well described, but the larger ecological context issues, and the potential for drawing conclusions regarding effects on populations, has not been well developed.

The relationships between potential auditory/physiological effects and species interactions with their environments are not well understood. Manci *et al.* (1988), assert that the consequences that physiological effects may have on behavioral patterns are vital to understanding the long-term effects of noise on wildlife. Questions regarding the effects (if any) on predator-prey interactions, reproductive success, and intra-inter specific behavior patterns remain.

The following discussion provides an overview of the existing literature on noise effects (particularly jet aircraft noise) on animal species. The literature reviewed here involves those studies that have focused on the observations of the behavioral effects that jet aircraft have on animals.

The abilities to hear sounds and noise and to communicate assist wildlife in maintaining group cohesiveness and survivorship. Social species communicate by transmitting calls of warning, introduction, and other types that are subsequently related to an individual's or group's responsiveness.

Animal species differ greatly in their responses to noise. Noise effects on domestic animals and wildlife are classified as primary, secondary, and tertiary. Primary effects are direct, physiological changes to the auditory system, and most likely include the masking of auditory signals. Masking is defined as the inability of an individual to hear important environmental signals that may arise from mates, predators, or prey. There is some potential that noise could disrupt a species' ability to communicate or could interfere with behavioral patterns (Manci *et al*. 1988). Although the effects are likely temporal, aircraft noise may cause masking of auditory signals within exposed faunal communities. Animals rely on hearing to avoid predators, obtain food, and communicate with, and attract, other members of their species. Aircraft noise may mask or interfere with these functions. Other primary effects, such as ear drum rupture or temporary and permanent hearing threshold shifts, are not as likely given the subsonic noise levels produced by aircraft overflights.

Secondary effects may include non-auditory effects such as stress and hypertension; behavioral modifications; interference with mating or reproduction; and impaired ability to obtain adequate food, cover, or water. Tertiary effects are the direct result of primary and secondary effects, and include population decline and habitat loss. Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) also influence secondary and tertiary effects, and confound the ability to identify the ultimate factor in limiting productivity of a certain nest, area, or region (Smith *et al*. 1988). Overall, the literature suggests that species differ in their response to various types, durations, and sources of noise (Manci *et al*. 1988).

Many scientific studies have investigated the effects of aircraft noise on wildlife, and some have focused on wildlife "flight" due to noise. Animal responses to aircraft are influenced by many variables, including size, speed, proximity (both height above the ground and lateral distance), engine noise, color, flight profile, and radiated noise. The type of aircraft (e.g., fixed wing versus rotor-wing [helicopter]) and type of flight mission may also produce different levels of disturbance, with varying animal responses (Smith *et al*. 1988). Consequently, it is difficult to generalize animal responses to noise disturbances across species.

One result of the Manci *et al*. (1988) literature review was the conclusion that, while behavioral observation studies were relatively limited, a general behavioral reaction in animals from exposure to aircraft noise is the startle response. The intensity and duration of the startle response appears to be dependent on which species is exposed, whether there is a group or an individual, and whether there have been some previous exposures. Responses range from flight, trampling, stampeding, jumping, or running, to movement of the head in the apparent direction of the noise source. Manci *et al.* (1988) reported that the literature indicated that avian species may be more sensitive to aircraft noise than mammals.

E.2.13.1 Domestic Animals

Although some studies report that the effects of aircraft noise on domestic animals is inconclusive, a majority of the literature reviewed indicates that domestic animals exhibit some behavioral responses to military overflights but generally seem to habituate to the disturbances over a period of time. Mammals in particular appear to react to noise at sound levels higher than 90 dB, with responses including the startle response, freezing (i.e., becoming temporarily stationary), and fleeing from the sound source. Many studies on domestic animals suggest that some species appear to acclimate to some forms of sound disturbance (Manci *et al.* 1988). Some studies have reported such primary and secondary effects as reduced milk production and rate of milk release, increased glucose concentrations, decreased levels of hemoglobin, increased heart rate, and a reduction in thyroid activity. These latter effects appear to represent a small percentage of the findings occurring in the existing literature.

Some reviewers have indicated that earlier studies, and claims by farmers linking adverse effects of aircraft noise on livestock, did not necessarily provide clear-cut evidence of cause and effect (Cottereau 1978). In contrast, many studies conclude that there is no evidence that aircraft overflights affect feed intake, growth, or production rates in domestic animals.

Cattle

In response to concerns about overflight effects on pregnant cattle, milk production, and cattle safety, the U.S. Air Force prepared a handbook for environmental protection that summarized the literature on the impacts of low-altitude flights on livestock (and poultry) and includes specific case studies conducted in numerous airspaces across the country. Adverse effects have been found in a few studies but have not been reproduced in other similar studies. One such study, conducted in 1983, suggested that 2 of 10 cows in late pregnancy aborted after showing rising estrogen and falling progesterone levels. These increased hormonal levels were reported as being linked to 59 aircraft overflights. The remaining eight cows showed no changes in their blood concentrations and calved normally. A similar study reported abortions occurred in three out of five pregnant cattle after exposing them to flyovers by six different aircraft. Another study suggested that feedlot cattle could stampede and injure themselves when exposed to low-level overflights (U.S. Air Force 1994a).

A majority of the studies reviewed suggests that there is little or no effect of aircraft noise on cattle. Studies presenting adverse effects to domestic animals have been limited. A number of studies (Parker and Bayley 1960; Casady and Lehmann 1967; Kovalcik and Sottnik 1971) investigated the effects of jet aircraft noise on the milk production of dairy cows. Through the compilation and examination of milk production data from areas exposed to jet aircraft noise, it was determined that milk yields were not affected. This was particularly evident in those cows that had been previously exposed to jet aircraft noise.

A study examined the causes of 1,763 abortions in Wisconsin dairy cattle over a 1-year time period and none were associated with aircraft disturbances (U.S. Air Force 1993). In 1987, researchers contacted seven livestock operators for production data, and no effects of low-altitude flights were noted. Of the 43 cattle previously exposed to low-altitude flights, 3 showed a startle response to an F/A-18 aircraft flying overhead at 500 feet above ground level (AGL) and 400 knots by running less than 10 meters (m). They resumed normal activity within 1 minute (U.S. Air Force 1994a). Beyer (1983) found that helicopters caused more reaction than other low-aircraft overflights, and that the helicopters at 30-60 feet overhead did not affect milk production and pregnancies of 44 cows in a 1964 study (U.S. Air Force 1994a).

Additionally, Beyer (1983) reported that five pregnant dairy cows in a pasture did not exhibit fright flight tendencies or disturb their pregnancies after being overflown by 79 low-altitude helicopter flights and 4 low-altitude, subsonic jet aircraft flights. A 1956 study found that the reactions of dairy and beef cattle to noise from low-altitude, subsonic aircraft were similar to those caused by paper blowing about, strange persons, or other moving objects (U.S. Air Force 1994a).

In a report to Congress, the U. S. Forest Service concluded that "evidence both from field studies of wild ungulates and laboratory studies of domestic stock indicate that the risks of damage are small (from aircraft approaches of 50-100 m), as animals take care not to damage themselves (U.S. Forest Service 1992). If animals are overflown by aircraft at altitudes of 50-100 m, there is no evidence that mothers and young are separated, that animals collide with obstructions (unless confined) or that they traverse dangerous ground at too high a rate." These varied study results suggest that, although the confining of cattle could magnify animal response to aircraft overflight, there is no proven cause-and-effect link between startling cattle from aircraft overflights and abortion rates or lower milk production.

Horses

Horses have also been observed to react to overflights of jet aircraft. Several of the studies reviewed reported a varied response of horses to low-altitude aircraft overflights. Observations made in 1966 and 1968 noted that horses galloped in response to jet flyovers (U.S. Air Force 1993). Bowles (1995) cites

Kruger and Erath as observing horses exhibiting intensive flight reactions, random movements, and biting/kicking behavior. However, no injuries or abortions occurred, and there was evidence that the mares adapted somewhat to the flyovers over the course of a month (U.S. Air Force 1994a). Although horses were observed noticing the overflights, it did not appear to affect either survivability or reproductive success. There was also some indication that habituation to these types of disturbances was occurring.

LeBlanc *et al.* (1991) studied the effects of F-14 jet aircraft noise on pregnant mares. They specifically focused on any changes in pregnancy success, behavior, cardiac function, hormonal production, and rate of habituation. Their findings reported observations of "flight-fright" reactions, which caused increases in heart rates and serum cortisol concentrations. The mares, however, did habituate to the noise. Levels of anxiety and mass body movements were the highest after initial exposure, with intensities of responses decreasing thereafter. There were no differences in pregnancy success when compared to a control group.

Swine

Generally, the literature findings for swine appear to be similar to those reported for cows and horses.

While there are some effects from aircraft noise reported in the literature, these effects are minor. Studies of continuous noise exposure (i.e., 6 hours, 72 hours of constant exposure) reported influences on short-term hormonal production and release. Additional constant exposure studies indicated the observation of stress reactions, hypertension, and electrolyte imbalances (Dufour 1980). A study by Bond *et al.* (1963), demonstrated no adverse effects on the feeding efficiency, weight gain, ear physiology, or thyroid and adrenal gland condition of pigs subjected to observed aircraft noise. Observations of heart rate increase were recorded; noting that cessation of the noise resulted in the return to normal heart rates. Conception rates and offspring survivorship did not appear to be influenced by exposure to aircraft noise.

Similarly, simulated aircraft noise at levels of 100-135 dB had only minor effects on the rate of feed utilization, weight gain, food intake, or reproduction rates of boars and sows exposed, and there were no injuries or inner ear changes observed (Gladwin *et al.* 1988; Manci *et al.* 1988).

Domestic Fowl

According to a 1994 position paper by the U.S. Air Force on effects of low-altitude overflights (below 1,000 feet) on domestic fowl, overflight activity has negligible effects (U.S. Air Force 1994b). The paper did recognize that given certain circumstances, adverse effects can be serious. Some of the effects can be panic reactions, reduced productivity, and effects on marketability (e.g., bruising of the meat caused during "pile-up" situations).

The typical reaction of domestic fowl after exposure to sudden, intense noise is a short-term startle response. The reaction ceases as soon as the stimulus is ended, and within a few minutes all activity returns to normal. More severe responses are possible depending on the number of birds, the frequency of exposure, and environmental conditions. Large crowds of birds, and birds not previously exposed, are more likely to pile up in response to a noise stimulus (U.S. Air Force 1994b). According to studies and interviews with growers, it is typically the previously unexposed birds that incite panic crowding, and the tendency to do so is markedly reduced within five exposures to the stimulus (U.S. Air Force 1994b). This suggests that the birds habituate relatively quickly. Egg productivity was not adversely affected by infrequent noise bursts, even at exposure levels as high as 120-130 dB.

Between 1956 and 1988, there were 100 recorded claims against the Navy for alleged damage to domestic fowl. The number of claims averaged three per year, with peak numbers of claims following publications of studies on the topic in the early 1960s. Many of the claims were disproved or did not have sufficient supporting evidence. The claims were filed for the following alleged damages: 55% for panic reactions, 31% for decreased production, 6% for reduced hatchability, 6% for weight loss, and less than 1% for reduced fertility (U.S. Air Force 1994b).

E.2.13.2 Wildlife

Studies on the effects of overflights on wildlife have been focused mostly on avian species and ungulates such as caribou and bighorn sheep. Few studies have been conducted on marine mammals, small terrestrial mammals, reptiles, amphibians, and carnivorous mammals. Generally, species that live entirely below the surface of the water have also been ignored due to the fact they do not experience the same level of sound as terrestrial species (National Park Service 1994). Wild ungulates appear to be much more sensitive to noise disturbance than domestic livestock. This may be due to previous exposure to disturbances. One common factor appears to be that low-altitude flyovers seem to be more disruptive in terrain where there is little cover (Manci *et al.* 1988).

Mammals

TERRESTRIAL MAMMALS

Studies of terrestrial mammals have shown that noise levels of 120 dB can damage mammals' ears, and levels at 95 dB can cause temporary loss of hearing acuity. Noise from aircraft has affected other large carnivores by causing changes in home ranges, foraging patterns, and breeding behavior. One study recommended that aircraft not be allowed to fly at altitudes below 2,000 feet AGL over important grizzly and polar bear habitat. Wolves have been frightened by low-altitude flights that were 25-1,000 feet AGL. However, wolves have been found to adapt to aircraft overflights and noise as long as they were not being hunted from aircraft (Dufour 1980).

Wild ungulates (American bison, caribou, bighorn sheep) appear to be much more sensitive to noise disturbance than domestic livestock (Weisenberger et al. 1996). Behavioral reactions may be related to the past history of disturbances by such things as humans and aircraft. Common reactions of reindeer kept in an enclosure exposed to aircraft noise disturbance were a slight startle response, rising of the head, pricking ears, and scenting of the air. Panic reactions and extensive changes in behavior of individual animals were not observed. Observations of caribou in Alaska exposed to fixed-wing aircraft and helicopters showed running and panic reactions occurred when overflights were at an altitude of 200 feet or less. The reactions decreased with increased altitude of overflights, and, with more than 500 feet in altitude, the panic reactions stopped. Also, smaller groups reacted less strongly than larger groups. One negative effect of the running and avoidance behavior is increased expenditure of energy. For a 90-kilogram animal, the calculated expenditure due to aircraft harassment is 64 kilocalories per minute when running and 20 kilocalories per minute when walking. When conditions are favorable, this expenditure can be counteracted with increased feeding; however, during harsh winter conditions, this may not be possible. Incidental observations of wolves and bears exposed to fixed-wing aircraft and helicopters in the northern regions suggested that wolves are less disturbed than wild ungulates, while grizzly bears showed the greatest response of any animal species observed (Weisenberger et al. 1996).

It has been proven that low-altitude overflights do induce stress in animals. Increased heart rates, an indicator of excitement or stress, have been found in pronghorn antelope, elk, and bighorn sheep. As such reactions occur naturally as a response to predation, infrequent overflights may not, in and of themselves, be detrimental. However, flights at high frequencies over a long period of time may cause harmful effects. The consequences of this disturbance, while cumulative, are not additive. It may be that aircraft disturbance may not cause obvious and serious health effects, but coupled with a harsh winter, it may have an adverse impact. Research has shown that stress induced by other types of disturbances produces long-term decreases in metabolism and hormone balances in wild ungulates.

Behavioral responses can range from mild to severe. Mild responses include head raising, body shifting, or turning to orient toward the aircraft. Moderate disturbance may be nervous behaviors, such as trotting a short distance. Escape is the typical severe response.

MARINE MAMMALS

Many marine mammals, including beluga whales, use sound rather than sight for many important functions (e.g., communication, location of prey, and navigation). The effects of human-caused noise on beluga whales and associated increased background noises may be similar to reduced visibilities when humans are confronted with heavy fog or darkness. These effects depend on several factors including the intensity, frequency, and duration of the noise, the location and behavior of the whale, and the nature of the acoustic environment. High frequency noise diminishes more rapidly than low frequency noises. Sound also dissipates more rapidly in shallow waters and over soft bottoms (sand and mud). Beluga whales in the Beaufort Sea have been observed to dive or swim away when low-flying (less than 500 meters) aircraft passed directly over them Richardson et al. (1995). Visual cues, including the sight of the aircraft or its shadow, have been hypothesized to contribute to the reaction of belugas to low-level overflight by survey aircraft. However, beluga survey aircraft flying at approximately 244 meters in Cook Inlet observed little or no change in beluga swim directions (Rugh et al. 2005). This is likely because belugas in Cook Inlet have habituated to routine small aircraft overflights. Belugas may be less sensitive to aircraft noise than vessel noise, but individual responses may be highly variable and may depend on previous experiences, beluga activity at the time of the noise, and characteristics of the noise. A large portion of the acoustic energy generated by an aircraft overflight is reflected from the air-water interface during transmission of sound from air to water. For an overhead sound source such as an aircraft much of the sound at angles greater than 13 degrees from the vertical is reflected and does not penetrate the water (Richardson et al. 1995).

BIRDS

Auditory research conducted on birds indicates that they fall between the reptiles and the mammals relative to hearing sensitivity. According to Dooling (1978), within the range of 1,000 to 5,000 Hz, birds show a level of hearing sensitivity similar to that of the more sensitive mammals. In contrast to mammals, bird sensitivity falls off at a greater rate to increasing and decreasing frequencies. Passive observations and studies examining aircraft bird strikes indicate that birds nest and forage near airports. Aircraft noise in the vicinity of commercial airports apparently does not inhibit bird presence and use.

High-noise events (like a low-altitude aircraft overflight) may cause birds to engage in escape or avoidance behaviors, such as flushing from perches or nests (Ellis *et al*. 1991). These activities impose an energy cost on the birds that, over the long term, may affect survival or growth. In addition, the birds may spend less time engaged in necessary activities like feeding, preening, or caring for their young because they spend time in noise-avoidance activity. However, the long-term significance of noise-related impacts is less clear. Several studies on nesting raptors have indicated that birds become habituated to aircraft overflights and that long-term reproductive success is not affected (Ellis *et al*. 1991; Grubb and King 1991). Threshold noise levels for significant responses range from 62 dB for Pacific black brant to 85 dB for crested tern (Brown 1990; Ward and Stehn 1990).

Manci *et al*. (1988), reported a reduction in reproductive success in some small territorial passerines (i.e., perching birds or songbirds) after exposure to low-altitude overflights. However, it has been observed that passerines are not driven any great distance from a favored food source by a nonspecific disturbance, such as aircraft overflights (U.S. Forest Service 1992). Further study may be warranted.

A cooperative study between the DoD and the U.S. Fish and Wildlife Service (USFWS), assessed the response of the red-cockaded woodpecker to a range of military training noise events, including artillery, small arms, helicopter, and maneuver noise (Pater *et al.* 1999). The project findings show that the red-cockaded woodpecker successfully acclimates to military noise events. Depending on the noise level that ranged from innocuous to very loud, the birds responded by flushing from their nest cavities. When the noise source was closer and the noise level was higher, the number of flushes increased proportionately. In all cases, however, the birds returned to their nests within a relatively short period of time (usually within 12 minutes). Additionally, the noise exposure did not result in any mortality or statistically detectable changes in reproductive success (Pater *et al.* 1999). Red-cockaded woodpeckers did not flush when artillery simulators were more than 122 m away and SELs were 70 dB.

RAPTORS

In a literature review of raptor responses to aircraft noise, Manci *et al*. (1988) found that most raptors did not show a negative response to overflights. When negative responses were observed they were predominantly associated with rotor-winged aircraft or jet aircraft that were repeatedly passing within 0.5 mile of a nest.

Ellis *et al*. (1991), performed a study to estimate the effects of low-level military jet aircraft on nesting peregrine falcons and seven other raptors (common black-hawk, Harris' hawk, zone-tailed hawk, red-tailed hawk, golden eagle, prairie falcon, bald eagle). They observed responses to test stimuli, determined nest success for the year of the testing, and evaluated site occupancy the following year. Both long- and short-term effects were noted in the study. The results reported the successful fledging of young in 34 of 38 nest sites (all eight species) subjected to low-level flight. Twenty-two of the test sites were revisited in the following year, and observations of pairs or lone birds were made at all but one nest. Nesting attempts were underway at 19 of 20 sites that were observed long enough to be certain of breeding activity. Re-occupancy and productivity rates were within or above expected values for self-sustaining populations.

Short-term behavior responses were also noted. Overflights at a distance of 150 m or less produced few significant responses and no severe responses. Typical responses consisted of crouching or, very rarely, flushing from the perch site. Significant responses were most evident before egg laying and after young were "well grown." Incubating or brooding adults never burst from the nest, thus preventing egg breaking or knocking chicks out of the nest. Jet passes often caused noticeable alarm; however, significant negative responses were rare and did not appear to limit productivity or re-occupancy. Due to the locations of some of the nests, some birds may have been habituated to aircraft noise. There were some test sites located at distances far from zones of frequent military aircraft usage, and the test stimuli were often closer, louder, and more frequent than would be likely for a normal training situation (Ellis *et al.* 1991).

Manci *et al.* (1988), noted that a female northern harrier was observed hunting on a bombing range in Mississippi during bombing exercises. The harrier was apparently unfazed by the exercises, even when a bomb exploded within 200 feet. In a similar case of habituation/non-disturbance, a study on the Florida snail-kite stated the greatest reaction to overflights (approximately 98 dB) was "watching the aircraft fly by." No detrimental impacts to distribution, breeding success, or behavior were noted.

Bald Eagle. A study by Grubb and King (1991) on the reactions of the bald eagle to human disturbances showed that terrestrial disturbances elicited the greatest response, followed by aquatic (i.e., boats) and aerial disturbances. The disturbance regime of the area where the study occurred was predominantly characterized by aircraft noise. The study found that pedestrians consistently caused responses that were greater in both frequency and duration. Helicopters elicited the highest level of aircraft-related responses. Aircraft disturbances, although the most common form of disturbance, resulted in the lowest levels of response. This low response level may have been due to habituation; however, flights less than 170 m away caused reactions similar to other disturbance types. Ellis *et al.* (1991) showed that eagles typically respond to the proximity of a disturbance, such as a pedestrian or aircraft within 100 m, rather than the noise level. Fleischner and Weisberg (1986) stated that reactions of bald eagles to commercial jet flights, although minor (e.g., looking), were twice as likely to occur when the jets passed at a distance of 0.5 mile or less. They also noted that helicopters were four times more likely to cause a reaction than a commercial jet and 20 times more likely to cause a reaction than a propeller plane.

The USFWS advised Cannon AFB that flights at or below 2,000 feet AGL from October 1 through March 1 could result in adverse impacts to wintering bald eagles (USFWS 1998). However, Fraser et al. (1985), suggested that raptors habituate to overflights rapidly, sometimes tolerating aircraft approaches of 65 feet or less.

Golden Eagle. In their guidelines for aerial surveys, USFWS (Pagel *et al.* 2010) summarized past studies by stating that most golden eagles respond to survey aircraft (fixed- and rotary-wing) by remaining on their nests, and continuing to incubate or roost. Surveys take place generally as close as 10 to 20 meters from cliffs (including hovering less than 30 seconds if necessary to count eggs) and no farther than 200 meters from cliffs depending on safety (Pagel *et al.* 2010).

Grubb *et al*. (2007) experimented with multiple exposure to two helicopter types and concluded that flights with a variety of approach distances (800, 400, 200, and 100 meters) had no effect on golden eagle nesting success or productivity rates within the same year or on rates of renewed nesting activity the following year when compared to the corresponding figures for the larger population of non-manipulated nest sites (Grubb *et al*. 2007). They found no significant, detrimental, or disruptive responses in 303 helicopter passes near eagles. In 227 AH-64 Apache helicopter experimental passes (considered twice as loud as a civilian helicopter also tested) at test distances of 0–800 meters from nesting golden eagles, 96 percent resulted in no more response than watching the helicopter pass. No greater reactions occurred until after hatching when individual golden eagles exhibited five flatten and three fly behaviors at three nest sites. The flight responses occurred at approach distances of 200 meters or less. No evidence was found of an effect on subsequent nesting activity or success, despite many of the helicopter flights occurring during early courtship and nest repair. None of these responding pairs failed to successfully fledge young, except for one nest that fell later in the season. Excited, startled, avoidance reactions were never observed. Non-attending eagles or those perched away from the nests were more likely to fly than attending eagles, but also with less potential consequence to nesting success (Grubb *et al.* 2007). Golden eagles appeared to become less responsive with successive exposures. Much of helicopter sound energy may be at a lower frequency than golden eagles can hear, thus reducing expected impacts. Grubb *et al.* (2007) found no relationship between helicopter sound levels and corresponding eagle ambient behaviors or limited responses, which occurred throughout recorded test levels (76.7–108.8 dB, unweighted). The authors thought that the lower than expected behavioral responses may be partially due to the fact that the golden eagles in the area appear acclimated to the current high levels of outdoor recreational, including aviation, activities. Based on the results of this study, the authors recommended reduction of existing buffers around nest sites to 100 meters (325 feet) for helicopter activity.

Richardson and Miller (1997) reviewed buffers as protection for raptors against disturbance from ground-based human activities. No consideration of aircraft activity was included. They stressed a clear line of sight as an important factor in a raptor's response to a particular disturbance, with visual screening allowing a closer approach of humans without disturbing a raptor. A GIS-assisted viewshed approach combined with a designated buffer zone distance was found to be an effective tool for reducing potential disturbance to golden eagles from ground-based activities (Richardson and Miller 1997). They summarized recommendations that included a median 0.5-mile (800-meter) buffer (range = 200-1,600 m, n = 3) to reduce human disturbances (from ground-based activities such as rock climbing, shooting, vehicular activity) around active golden eagle nests from February 1 to August 1 based on an extensive review of other studies (Richardson and Miller 1997). Physical characteristics (i.e., screening by topography or vegetation) are important variables to consider when establishing buffer zones based on raptors' visual- and auditory-detection distances (Richardson and Miller 1997).

Osprey. A study by Trimper *et al.* (1998), in Goose Bay, Labrador, Canada, focused on the reactions of nesting osprey to military overflights by CF-18 Hornets. Reactions varied from increased alertness and focused observation of planes to adjustments in incubation posture. No overt reactions (e.g., startle response, rapid nest departure) were observed as a result of an overflight. Young nestlings crouched as a result of any disturbance until 1 to 2 weeks prior to fledging. Helicopters, human presence, float planes, and other ospreys elicited the strongest reactions from nesting ospreys. These responses included flushing, agitation, and aggressive displays. Adult osprey showed high nest occupancy rates during incubation regardless of external influences. The osprey observed occasionally stared in the direction of the flight before it was audible to the observers. The birds may have been habituated to the noise of the flights; however, overflights were strictly controlled during the experimental period. Strong reactions to float planes and helicopter may have been due to the slower flight and therefore longer duration of visual stimuli rather than noise-related stimuli.

Red-tailed Hawk. Anderson *et al.* (1989), conducted a study that investigated the effects of low-level helicopter overflights on 35 red-tailed hawk nests. Some of the nests had not been flown over prior to the study. The hawks that were naïve (i.e., not previously exposed) to helicopter flights exhibited stronger avoidance behavior (9 of 17 birds flushed from their nests) than those that had experienced prior overflights. The overflights did not appear to affect nesting success in either study group. These findings were consistent with the belief that red-tailed hawks habituate to low-level air traffic, even during the nesting period.

UPLAND GAME BIRDS

Greater Sage-grouse. The greater sage-grouse was recently designated as a candidate species for protection under the Endangered Species Act after many years of scrutiny and research (USFWS 2010). This species is a widespread and characteristic species of the sagebrush ecosystems in the Intermountain West. Greater sage-grouse, like most bird species, rely on auditory signals as part of mating. Sage-grouse are known to select their leks based on acoustic properties and depend on auditory communication for mating behavior (Braun 2006).

Booth *et al.* (2009) found, while attempting to count sage-grouse at leks (breeding grounds) using light sport aircraft at 150 meters (492 feet) to 200 meters (650 feet) AGL, that sage-grouse flushed from leks on 12 of 14 approaches when the airplane was within 656 to 984 feet (200–300 meters) of the lek. In the other two instances, male grouse stopped exhibiting breeding behavior and crouched but stayed on the lek. The time to resumption of normal behavior after disturbance was not provided in this study. Strutting ceased around the time when observers on the ground heard the aircraft. The light sport aircraft could be safely operated at very low speed (68 kilometers per hour or 37 nautical miles per hour) and was powered by either a two-stroke or a four-stroke engine. It is unclear how the response to the slow-flying light sport aircraft used in the study would compare to overflight by military jets, operating at speeds 10 to 12 times as great as the aircraft used in the study. It is possible that response of the birds was related to the slow speed of the light sport aircraft causing it to resemble an aerial predator.

Other studies have found disturbance from energy operations and other nearby development have adversely affected breeding behavior of greater sage-grouse (Holloran 2005; Doherty 2008; Walker *et al*. 2007; Harju *et al*. 2010). These studies do not specifically address overflight and do not isolate noise disturbance from other types (e.g., visual, human presence) nor do they generally provide noise levels or qualification of the noise source (e.g., continuous or intermittent, frequency, duration).

MIGRATORY WATERFOWL

Fleming *et al.* (1996) conducted a study of caged American black ducks found that noise had negligible energetic and physiologic effects on adult waterfowl. Measurements included body weight, behavior, heart rate, and enzymatic activity. Experiments also showed that adult ducks exposed to high noise events acclimated rapidly and showed no effects.

The study also investigated the reproductive success of captive ducks, which indicated that duckling growth and survival rates at Piney Island, North Carolina, were lower than those at a background location. In contrast, observations of several other reproductive indices (i.e., pair formation, nesting, egg production, and hatching success) showed no difference between Piney Island and the background location. Potential effects on wild duck populations may vary, as wild ducks at Piney Island have presumably acclimated to aircraft overflights. It was not demonstrated that noise was the cause of adverse impacts. A variety of other factors, such as weather conditions, drinking water and food availability and variability, disease, and natural variability in reproduction, could explain the observed effects. Fleming noted that drinking water conditions (particularly at Piney Island) deteriorated during the study, which could have affected the growth of young ducks. Further research would be necessary to determine the cause of any reproductive effects (Fleming *et al.* 1996).

Another study by Conomy *et al*. (1998) exposed previously unexposed ducks to 71 noise events per day that equaled or exceeded 80 dB. It was determined that the proportion of time black ducks reacted to aircraft activity and noise decreased from 38% to 6% in 17 days and remained stable at 5.8% thereafter. In the same study, the wood duck did not appear to habituate to aircraft disturbance. This supports the notion that animal response to aircraft noise is species-specific. Because a startle response to aircraft noise can result in flushing from nests, migrants and animals living in areas with high concentrations of predators would be the most vulnerable to experiencing effects of lowered birth rates and recruitment over time. Species that are subjected to infrequent overflights do not appear to habituate to overflight disturbance as readily.

Black brant studied in the Alaska Peninsula were exposed to jets and propeller aircraft, helicopters, gunshots, people, boats, and various raptors. Jets accounted for 65% of all the disturbances. Humans, eagles, and boats caused a greater percentage of brant to take flight. There was markedly greater reaction to Bell-206-B helicopter flights than fixed wing, single-engine aircraft (Ward *et al.* 1986).

The presence of humans and low-flying helicopters in the Mackenzie Valley North Slope area did not appear to affect the population density of Lapland longspurs, but the experimental group was shown to have reduced hatching and fledging success and higher nest abandonment. Human presence appeared to have a greater impact on the incubating behavior of the black brant, common eider, and Arctic tern than fixed-wing aircraft (Gunn and Livingston 1974).

Gunn and Livingston (1974) found that waterfowl and seabirds in the Mackenzie Valley and North Slope of Alaska and Canada became acclimated to float plane disturbance over the course of three days. Additionally, it was observed that potential predators (bald eagle) caused a number of birds to leave their nests. Non-breeding birds were observed to be more reactive than breeding birds. Waterfowl were affected by helicopter flights, while snow geese were disturbed by Cessna 185 flights. The geese flushed when the planes were less than 1,000 feet, compared to higher flight elevations. An overall reduction in flock sizes was observed. It was recommended that aircraft flights be reduced in the vicinity of pre-migratory staging areas.

Manci *et al*. 1988, reported that waterfowl were particularly disturbed by aircraft noise. The most sensitive appeared to be snow geese. Canada geese and snow geese were thought to be more sensitive than other animals such as turkey vultures, coyotes, and raptors (Edwards *et al.* 1979).

WADING AND SHOREBIRDS

Black *et al*. (1984), studied the effects of low-altitude (less than 500 feet AGL) military training flights with sound levels from 55 to 100 dB on wading bird colonies (i.e., great egret, snowy egret, tricolored heron, and little blue heron). The training flights involved three or four aircraft, which occurred once or twice per day. This study concluded that the reproductive activity—including nest success, nestling survival, and nestling chronology—was independent of F-16 overflights. Dependent variables were more strongly related to ecological factors, including location and physical characteristics of the colony and climatology.

Another study on the effects of circling fixed-wing aircraft and helicopter overflights on wading bird colonies found that at altitudes of 195 to 390 feet, there was no reaction in nearly 75% of the 220 observations. Approximately 90% displayed no reaction or merely looked toward the direction of the noise source. Another 6% stood up, 3% walked from the nest, and 2% flushed (but were without active nests) and returned within 5 minutes (Kushlan 1978). Apparently, non-nesting wading birds had a slightly higher incidence of reacting to overflights than nesting birds. Seagulls observed roosting near a colony of wading birds in another study remained at their roosts when subsonic aircraft flew overhead (Burger 1981). Colony distribution appeared to be most directly correlated to available wetland community types and was found to be distributed randomly with respect to military training routes. These results suggest that wading bird species presence was most closely linked to habitat availability and that they were not affected by low-level military overflights (U.S. Air Force 2000).

Burger (1986) studied the response of migrating shorebirds to human disturbance and found that shorebirds did not fly in response to aircraft overflights, but did flush in response to more localized intrusions (i.e., humans and dogs on the beach). Burger (1981) studied the effects of noise from JFK Airport in New York on herring gulls that nested less than 1 kilometer from the airport. Noise levels over the nesting colony were 85-100 dB on approach and 94-105 dB on takeoff. Generally, there did not appear to be any prominent adverse effects of subsonic aircraft on nesting, although some birds flushed when the Concorde flew overhead and, when they returned, engaged in aggressive behavior. Groups of gulls tended to loaf in the area of the nesting colony, and these birds remained at the roost when the Concorde flew overhead. In addition, laboratory tests of exposure of eggs to impulsive noises (Cottereau 1972; Cogger and Zegarra 1980; Bowles *et al.* 1991, 1994) failed to show adverse effects on hatching of eggs.

Burger (1981) observed no effects of subsonic aircraft on herring gulls in the vicinity of JFK International Airport. The Concorde aircraft did cause more nesting gulls to leave their nests (especially in areas of higher density of nests), causing the breakage of eggs and the scavenging of eggs by intruder prey. Clutch sizes were observed to be smaller in areas of higher-density nesting (presumably due to the greater tendency for panic flight) than in areas where there were fewer nests.

Fish and Amphibians

The effects of overflight noise on fish and amphibians have not been well studied, but conclusions regarding their expected responses have involved speculation based upon known physiologies and behavioral traits of these taxa (Gladwin et al. 1988). Although fish do startle in response to low- flying aircraft noise, and probably to the shadows of aircraft, they have been found to habituate to the sound and overflights. Amphibians that respond to low frequencies and those that respond to ground vibration, such as spadefoot toads, may be affected by noise.

Summary

Some physiological/behavioral responses such as increased hormonal production, increased heart rate, and reduction in milk production have been described in a small percentage of studies. A majority of the studies focusing on these types of effects have reported short-term or no effects. The relationships between physiological effects and how species interact with their environments have not been thoroughly studied. Therefore, the larger ecological context issues regarding physiological effects of jet aircraft noise (if any) and resulting behavioral pattern changes are not well understood.

Animal species exhibit a wide variety of responses to noise. It is therefore difficult to generalize animal responses to noise disturbances or to draw inferences across species, as reactions to jet aircraft noise appear to be species-specific. Consequently, some animal species may be more sensitive than other species and/or may exhibit different forms or intensities of behavioral responses. For instance, wood ducks appear to be more sensitive and more resistant to acclimation to jet aircraft noise than Canada geese in one study. Similarly, wild ungulates seem to be more easily disturbed than domestic animals.

The literature does suggest that common responses include the “startle” or “fright” response and, ultimately, habituation. It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. The majority of the literature suggests that domestic animal species (cows, horses, chickens) and wildlife species exhibit adaptation, acclimation, and habituation after repeated exposure to jet aircraft noise.

Animal responses to aircraft noise appear to be somewhat dependent on, or influenced by, the size, shape, speed, proximity (vertical and horizontal), engine noise, color, and flight profile of planes. Helicopters also appear to induce greater intensities and durations of disturbance behavior as compared to fixed-wing aircraft. Some studies showed that animals that had been previously exposed to jet aircraft noise exhibited greater degrees of alarm and disturbance to other objects creating noise, such as boats, people, and objects blowing across the landscape. Other factors influencing response to jet aircraft noise may include wind direction, speed, and local air turbulence; landscape structures (i.e., amount and type of vegetative cover); and, in the case of bird species, whether the animals are in the incubation/nesting phase.

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