DRAFT
FINDING OF NO SIGNIFICANT IMPACT (FONSI)

UH-1N REPLACEMENT BEDDOWN
MALMSTROM AIR FORCE BASE, MONTANA

Introduction
This Finding of No Significant Impact (FONSI) was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA); the President's Council on Environmental Quality regulations for implementing the procedural provisions of NEPA, 40 Code of Federal Regulations (CFR) Parts 1500–1508; and the Environmental Impact Analysis Process, 32 CFR 989. The decision in this FONSI is based on information contained in the Preliminary Draft Environmental Assessment (EA) for the UH-1N Replacement Beddown on Malmstrom Air Force Base (AFB), Montana, which is hereby incorporated by reference. The purpose of the EA was to determine the extent of environmental impacts that might result from the proposed replacement beddown on Malmstrom AFB and evaluate whether any of the impacts would be significant.

Description of Proposed Action and Alternatives
The Proposed Action includes the beddown of 11 Boeing MH-139 aircraft (eight Primary Aircraft Inventory [PAI] and three Backup Aircraft Inventory [BAI]) to replace the eight current Bell UH-1N helicopters at Malmstrom AFB. The proposed beddown would require a transition from the current eight UH-1N aircraft to the MH-139 aircraft. Two MH-139s would be delivered to Malmstrom AFB in early 2021 (this would increase the total number of aircraft on the base to 10), and the transition would be complete in 2023. A surge in personnel is anticipated during the overlap of UH-1N and MH-139 aircraft, after which personnel would decrease to a steady-state. Overall, this Proposed Action would result in slightly more personnel at Malmstrom AFB.

Only minor impacts would be expected from implementation of the selected alternative. During construction and operation, the selected alternative would result in less than significant impacts or no effects to airspace, noise / acoustic environment, air quality and climate change, water resources, biological / natural resources, earth resources, hazardous materials / waste, cultural resources, land use, infrastructure / utilities, safety and occupational health, socioeconomic resources, and environmental justice.

Alternative 1: Renovate building 1450 for initial MH-139s and delay building 1440 renovation
As described in the EA, Alternative 1 would provide sufficient space for the initial phase of the beddown while minimizing impacts to the 819th REDHORSE Squadron (RHS) and avoiding mission impacts to the 341st Maintenance Group (MXG). The 819th RHS would relocate and consolidate personnel and equipment currently in Building 1450 to Buildings 1460 and 1464 (these buildings are presently utilized by the 819th RHS). Building 1450 would be renovated to accommodate the initial phases of the proposed MH-139 beddown in early 2021. Hangar 1440 would continue to house the UH-1N aircraft but would be renovated at a later time to accommodate MH-139s arriving at a later date. No external alterations to the buildings would be required to implement this alternative.

Alternative 2: Construct Large Area Maintenance Shelters (LAMS) for Temporary UH-1N Parking
This alternative would require the construction of two LAMS to provide temporary UH-1N parking space during the beddown transition. Building 1440 would be renovated later to house the MH-139 aircraft. Benefits of this alternative include that it would not require relocation of the 819th RHS and it would not

impact the 341st MXG mission. However, the UH-1Ns and MH-139s would initially occupy the same space for maintenance (Building 1440, Bay 5). This would require maintenance contractors for both aircraft to occupy the same space during the transition, which could lead to conflicts with space and scheduling. Malmstrom AFB would be required to provide swing space for initial additional personnel arriving with the replacement aircraft until Building 1440 is renovated. Because the LAMS are temporary structures, they would be dismantled and removed after Building 1440 is renovated.

Alternative 3: Temporary 341st MXG Move to Building 1450 or 1464
Under this alternative, the 341st MXG would temporarily relocate to Building 1464 or 1450, and the 819th RHS would be consolidated. Building 1440 would be renovated prior to the beddown and would be ready to house the replacement aircraft. This alternative is advantageous because it fully accommodates the beddown schedule by completing the Building 1440 renovation earlier. It would provide required vehicle and storage space, but would not adequately address personnel space. Additionally, this alternative would require two 341st MXG relocations and would temporarily increase 341st MXG dispatch times. It would also reduce 341st MXG storage space from 10,000 square feet to 8,000 square feet. The 819th RHS concrete block structure inside Building 1450 would be removed, leading to the loss of RHS office space and the need for an alternate location. Building 1464 houses the 819th RHS armory and would need to be relocated as well. Requiring 819th RHS to temporarily relocate increases the cost of this alternative; RHS would have to consolidate in the remaining area and relocate again at a later date.

Alternative 4: No Action Alternative
CEQ regulations recommend consideration of the No Action Alternative for EAs. The No Action Alternative serves as a baseline against which the impacts of the Proposed Action and other potential action alternatives can be evaluated. Under the No Action Alternative, the USAF would not implement the beddown of the MH-139 at Malmstrom AFB. Deficiencies of function and operational capability that would result from continuing to use aging UH-1N helicopters would persist.

Finding of No Significant Impact
The potential impacts on the human and natural environment were evaluated relative to the existing environment. For each environmental resource or issue, anticipated direct and indirect effects were assessed considering short- and long-term project effects.

Based on my review of the facts and analysis in the attached UH-1N Replacement Beddown EA, I conclude that the Preferred Alternative would not have a significant effect on the environment either by itself or considering cumulative impacts. Accordingly, this action will not require preparation of an Environmental Impact Statement.

A notice of availability (NOA) for the EA and FONSI was published in The Great Falls Tribune. The NOA initiated a 30-day public review and comment period beginning October 06, 2019 and ending on November 04, 2019. TBD comments were received.

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Colonel, USAF
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DRAFT ENVIRONMENTAL ASSESSMENT

FOR

UH-1N REPLACEMENT BEDDOWN ON MALMSTROM AIR FORCE BASE, MONTANA

Prepared for:

Department of the Army, Corps of Engineers Omaha District

Malmstrom Air Force Base
341ST Missile Wing

October 2019

PRIVACY ADVISORY This EA is provided for public comment in accordance with the National Environmental Policy Act (NEPA), the President's Council on Environmental Quality (CEQ) NEPA Regulations (40 CFR Parts 1500-1508), and 32 CFR Part 989, Environmental Impact Analysis Process (EIAP). The EIAP provides an opportunity for public input on Air Force decision making, allows the public to offer inputs on alternative ways for the Air Force to accomplish what it is proposing, and solicits comments on the Air Force's analysis of environmental effects. Public commenting allows the Air Force to make better, informed decisions. Letters or other written or oral comments provided may be published in the EA. As required by law, comments provided will be addressed in the EA and made available to the public. Providing personal information is voluntary. Any personal information provided will be used only to identify your desire to make a statement during the public comment portion of any public meetings or hearings or to fulfill requests for copies of the EA or associated documents. Private addresses will be compiled to develop a mailing list for those requesting copies of EA; however, only the names of the individuals making comments and specific comments will be disclosed. Personal home addresses and phone numbers will not be published in the EA.

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ACRONYMS AND ABBREVIATIONS

ACAM	Air Conformity Applicability Model
ACM	Asbestos Containing Material
ACP	Asbestos Control Program
AFB	Air Force Base
AFFF	Aqueous Film Forming Foam
AFGSC	Air Force Global Strike Command
AFI	Air Force Instruction
AGE	Aerospace Ground Equipment
AICUZ	Air Installation Compatible Use Zone
BAI	Backup Aircraft Inventory
BASH	Bird/Wildlife Aircraft Strike Hazard
BLM	Bureau of Land Management
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CES	Civil Engineer Squadron
CFR	Code of Federal Regulations
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2-e	Carbon Dioxide Equivalent
COA	Course of Action
DoD	Department of Defense
DoDI	Department of Defense Instruction
DNRC	Department of Natural Resources and Conservation
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
FONSI	Finding of No Significant Impact
GHG	Greenhouse Gases
GIS	Geographic Information System
HAP	Hazardous Air Pollutants
HFC	Hydrofluorocarbon
HS	Helicopter Squadron
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
ITLO	Installation Tribal Liaison Officer
LAMS	Large Area Maintenance Shelter

LBP	Lead Based Paint
MAF	Missile Alert Facility
MBTA	Migratory Bird Treaty Act
MDEQ	Montana Department of Environmental Quality
MFWP	Montana Fish, Wildlife, and Parks
MMDF	Missile Maintenance Dispatch Facility
MW	Missile Wing
MXG	Maintenance Group
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NEI	National Emission Inventory
NEPA	National Environmental Policy Act
NF_3	Nitrogen Trifluoride
NMODD	Noise Model Operational Data Documentation
NO_2	Nitrogen Dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen Oxide
NRHP	National Register of Historic Places
O_3	Ozone
OSHA	Occupational Safety and Health Administration
PAI	Primary Aircraft Inventory
PFC	Perfluorocarbon
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter less than or equal to 2.5 micrometers in diameter
PM_{10}	Particulate Matter less than or equal to 10 micrometers in diameter
RED HORSE	Rapid Engineer Deployable, Heavy Operational Repair Squadron Engineer
RHS	RED HORSE Squadron
ROI	Region of Influence
RONA	Record of Non-Applicability
SF	Sulfur Hexafluoride
shp	shaft horsepower
SHPO	State Historic Preservation Office
SO_2	Sulfur Dioxide
THPO	Tribal Historic Preservation Office
USAF	United States Air Force
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile Organic Compounds
WRCC	Western Regional Climate Center

1. PURPOSE OF AND NEED FOR ACTION

1.1 Introduction

The Air Force Global Strike Command (AFGSC) and the 341st Missile Wing (341 MW) at Malmstrom Air Force Base (AFB), Montana have identified the need to beddown replacement aircraft for the current inventory of UH-1N helicopters at Malmstrom AFB. This Environmental Assessment (EA) evaluates the potential environmental effects of this proposed project in compliance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] 4331 et seq.), the regulations of the President's Council on Environmental Quality (CEQ) that implement NEPA procedures (40 Code of Federal Regulations [CFR] 1500-1508), the United States Air Force (USAF) Environmental Impact Analysis Process (EIAP) regulations at 32 CFR Part 989, and Air Force Instruction (AFI) 32-7061, *The Environmental Impact Analysis Process*.

Malmstrom AFB, located in central Montana (Figure 1), is home to the 341 MW and is assigned to the AFGSC. The 341 MW's mission is to defend America with safe, secure, and effective nuclear forces and combat-ready Airmen. Malmstrom AFB encompasses approximately 3,278 acres, with an additional 438 acres of restrictive easements on adjacent lands. In addition, the Malmstrom AFB 341 MW missile complex, also known as the Malmstrom AFB deployment area, consists of 15 missile alert facilities (MAFs) and 150 launch facilities, distributed throughout a 13,800 square-mile area in north central Montana. Malmstrom AFB houses only helicopter aircraft; the 40th Helicopter Squadron (HS) provides aerial surveillance of the missile complex, rapid airlifts, security forces responses, and personnel transport.

The information presented in this document will serve as the basis for deciding whether the Proposed Action would result in a significant impact to the human environment, requiring the preparation of an environmental impact statement (EIS), or whether no significant impacts would occur, in which case a Finding of No Significant Impact (FONSI) would be appropriate.

1.2 Purpose of the Action

The purpose of the Proposed Action is to replace the current Bell UH-1N helicopters at Malmstrom AFB with Boeing MH-139 helicopters and to provide facilities to house and maintain the replacement aircraft.

1.3 Need for the Action

The Proposed Action is needed because the aging fleet of Bell Helicopter UH-1N "Huey" aircraft (the USAF has relied on this fleet since the early 1970s) is increasingly difficult to maintain and does not satisfy current mission requirements. The USAF has identified the requirement for a helicopter that is faster, quieter, more resilient, and has a higher payload capacity and extended range to handle the escort of convoys, missile field contingencies, transportation of government officials, and range support. In September 2018 the USAF selected the Boeing MH-139 aircraft as the best replacement to fully meet requirements for the USAF's crucial missile site and utility support missions at Malmstrom AFB. Because the MH-139 has five rotor blades (the UH-1N has two), storage and maintenance facilities would need to be larger to accommodate storage and maintenance operations.

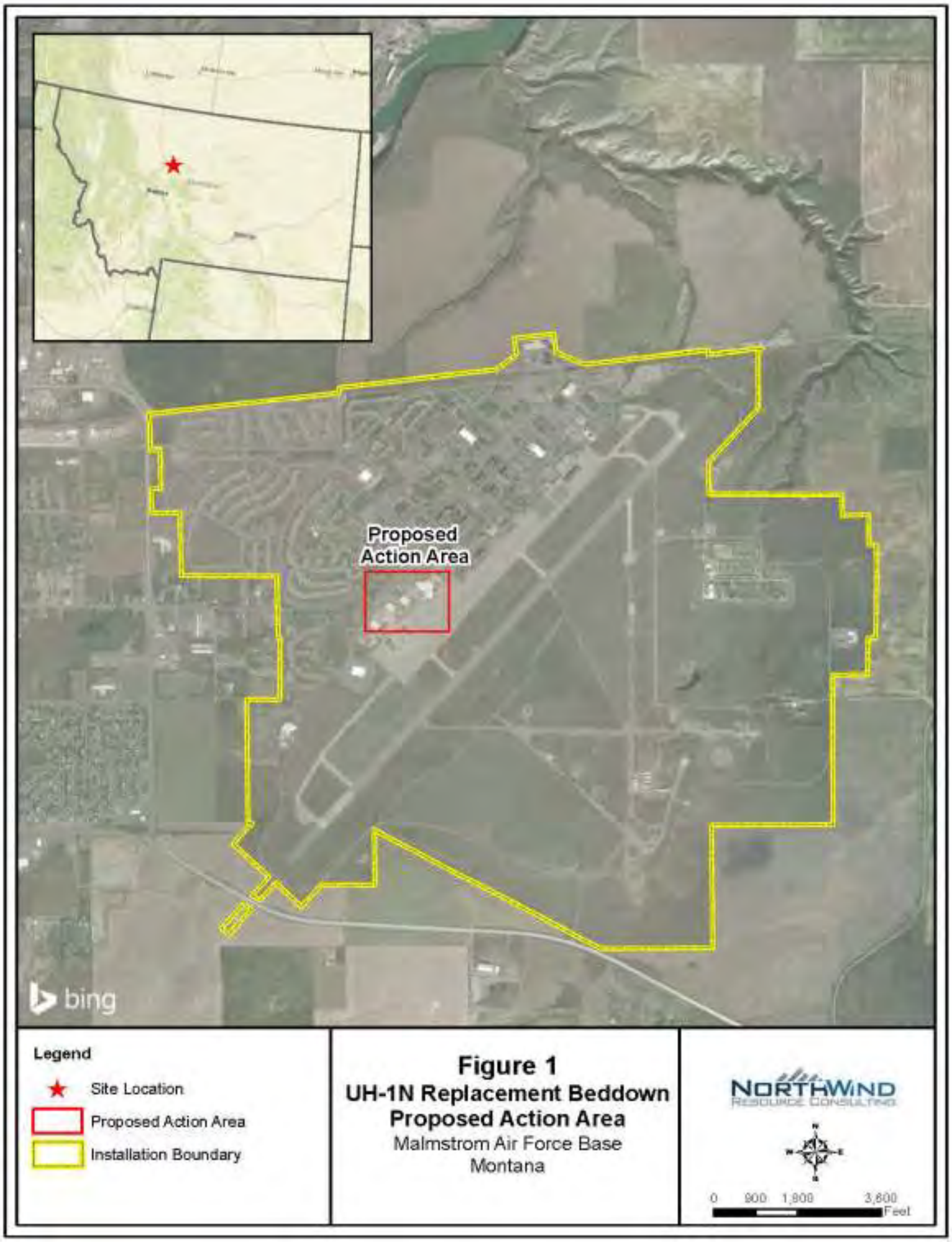

Figure 1. Location of Malmstrom AFB and Proposed Action Area.

1.4 Interagency/Intergovernmental Coordination and Consultation

1.4.1 Interagency Coordination and Consultation

Scoping is an early and open process for developing the breadth of issues to be addressed in the EA and for identifying significant concerns related to a Proposed Action. Per the requirements of the Intergovernmental Cooperation Act of 1968 (42 USC 4231(a)) and Executive Order (EO) 12372, *Intergovernmental Review of Federal Programs*, federal, state, and local agencies with jurisdiction that could be affected by the Proposed Action will be notified during the development of this EA.

Section 6 contains a list of agencies consulted during this analysis and copies of correspondence.

1.4.2 Government to Government Consultations

EO 13175, *Consultation and Coordination with Indian Tribal Governments*, directs federal agencies to coordinate and consult with Native American tribal governments whose interests might be directly and substantially affected by activities on federally administered lands. Consistent with that EO, Department of Defense Instruction (DoDI) 4710.02, *Interactions with Federally-Recognized Tribes*, and AFI 90-2002, *Air Force Interaction with Federally-recognized Tribes*, federally-recognized tribes that are historically affiliated with the Malmstrom AFB geographic region will be invited to consult on all proposed undertakings that have a potential to affect properties of cultural, historical, or religious significance to the tribes. The tribal consultation process is distinct from NEPA consultation or the interagency coordination process, and it requires separate notification of all relevant tribes. The timelines for tribal consultation are also distinct from those of other consultations. The Malmstrom AFB point-of-contact for Native American tribes is the Installation Tribal Liaison Officer (ITLO). The Malmstrom AFB point-of-contact for consultation with the Tribal Historic Preservation Office (THPO) and the Advisory Council on Historic Preservation is the Cultural Resources Manager.

The Native American tribal governments that will be consulted with regarding these actions are listed in Appendix A.

1.4.3 Other Agency Consultations

In compliance with EO 12372, *Intergovernmental Review of Federal Programs*, Malmstrom AFB notified and consulted with federal, state, and local agencies with jurisdiction that could be affected by the Proposed Action during the development of this EA. A list of the agencies consulted during the analysis and representative copies of correspondence are included in Appendix A of the EA.

1.5 Public and Agency Review of the EA

A Notice of Availability (NOA) of the Draft EA and FONSI will be published in the Great Falls Tribune (the newspaper of record), announcing the availability of the EA for review on October 06, 2019. The NOA will invite the public to review and comment on the Draft EA. The public and agency review period ended on November 04, 2019. The NOA and public and agency comments are provided in Appendix A. Native American Tribes were provided a copy of the Draft EA electronically for their review. Malmstrom AFB also made copies of the Draft EA and FONSI available for review at the following locations:

Great Falls Public Library 301 Second Avenue North Great Falls, MT 59401	University of Providence Library 1301 20th Street South Great Falls, MT 59405

1.6 Decision to be Made

The EA evaluates whether the Proposed Action is a major Federal action significantly affecting the quality of the human environment. If significant effects are identified, Malmstrom AFB could undertake mitigation to reduce effects to below the level of significance, undertake the preparation of an EIS addressing the Proposed Action, or abandon the Proposed Action.

This EA is a planning and decision-making tool that will be used to guide Malmstrom AFB in implementing the Proposed Action in a manner consistent with USAF standards for environmental stewardship.

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

The USAF proposes to beddown MH-139 helicopters to replace the current UH-1N helicopters at Malmstrom AFB to satisfy the "Purpose of" and "Need for" the action described in Sections 1.2 and 1.3. The location of the proposed beddown is shown on Figure 1.

The Proposed Action includes the beddown of 11 MH-139 aircraft (eight Primary Aircraft Inventory [PAI] and three Backup Aircraft Inventory [BAI]) to replace the eight current UH-1N helicopters at Malmstrom AFB (the BAI would not result in an increase in flight operations but would ensure that mission requirements are consistently satisfied). The proposed beddown would require a transition from the current eight UH-1N aircraft to the MH-139 aircraft. Two MH-139s would be delivered to Malmstrom AFB in early 2021 (this would increase the total number of aircraft on the base to 10), and the transition would be complete in 2023. A surge in personnel is anticipated during the overlap of UH-1N and MH-139 aircraft, after which personnel would decrease to a steady-state. Overall, this Proposed Action would result in slightly more personnel at Malmstrom AFB.

2.2 Selection Standards

NEPA, CEQ regulations, and 32 CFR Part 989 require an EA to evaluate reasonable alternatives to the Proposed Action. Alternatives that are eliminated from detailed analysis must be identified along with a brief discussion of the reasons for eliminating them. "Reasonable alternatives" are those that also could be utilized to meet the purpose of and need for the Proposed Action. For purposes of analysis, an alternative is considered "reasonable" only if it enables Malmstrom AFB to satisfy requirements related to the continued mission of patrolling and protecting America's land-based nuclear weapons. "Unreasonable" alternatives would not enable Malmstrom AFB to meet the purpose of and need for the Proposed Action and therefore would not be retained for further analysis.

Per the requirements of 32 CFR Part 989, the USAF EIAP regulations, The USAF developed selection standards to identify alternatives that meet the purpose of and need for the Proposed Action. In addition, the USAF developed selection standards that identify whether an alternative would be considered reasonable. As a result, the USAF developed the following eight selection standards:

1. Achieves the desired campus plan (this includes separate, adjacent campuses for storage and maintenance of the new helicopters; the 819th Rapid Engineer Deployable, Heavy Operational Repair Squadron Engineer (RED HORSE) Squadron (RHS); and the 341st Maintenance Group (MXG))[1].
2. Provides parts and supplies storage and aircraft maintenance space.

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[1] In order to support the beddown of the UH-1N replacement aircraft, an adequately sized and configured integrated helicopter operations facility is needed to provide proper command and control, maintenance, and fueling capabilities for helicopter operations. A series of buildings is required that would become the main control point for all unit flight and flying training tasks including planning, briefing, administration, alert response, life support system maintenance, crew equipment, and storage. The USAF determined that it is desirable to collocate the squadron operations facility and alert crew sleeping quarters with the aircraft to minimize crew response times and enhance rescue / security team effectiveness.

3. Meets proposed schedule for the replacement aircraft beddown.
4. Avoids effects to 341st MXG mission.
5. Provides flexibility for potential beddown schedule acceleration.
6. Avoids co-mingling of MXG contractors during transition (i.e., when both UH-1N and MH-139 aircraft are operating on the installation).
7. Avoids temporary facility costs.
8. Avoids moving the 819th RHS.

2.3 Screening of the Alternatives

The USAF developed three potential courses of action (COAs) that would meet the purpose and need of the Proposed Action. All three COAs have disadvantages related to operational inefficiencies, scheduling, and cost, but could result in the successful beddown of the replacement aircraft. These three COAs are listed below as action alternatives along with the No Action alternative.

- **Alternative 1:** Renovate building 1450 for initial MH-139s and delay building 1440 renovation.
- **Alternative 2:** Construct large area maintenance shelters **(**LAMS) for temporary UH-1N parking.
- **Alternative 3:** Temporary 341st MXG move to building 1450 or 1464.
- **Alternative 4:** No Action.

The USAF applied the selection standards described in Section 2.2 to these alternatives (Table 1) to determine which alternative(s) would satisfy the purpose and need for the Proposed Action while best satisfying the selection standards. As shown in Table 1, Alternative 1 would satisfy the purpose and need as well as seven of the eight selection standards. Alternatives 2 and 3 would meet three of the eight selection standards. The USAF has not yet identified a Preferred Alternative. Alternative 4 – No Action, would meet four of the eight selection standards but would not meet the purpose of or need for the Proposed Action. However, it will be analyzed in the EA to provide a comparative baseline, as required under USAF and CEQ regulations (32 CFR Part 989.8(a) and (d), and 40 CFR Part 1502.14, respectively).

Table 1. Screening of the Alternatives.

Alternatives	Selection Standards							
	Achieves the desired campus plan at Malmstrom AFB.	Provides parts and supplies storage and aircraft maintenance space.	Meets proposed schedule for the replacement aircraft beddown.	Avoids effects to 341st MXG mission.	Provides flexibility for beddown schedule acceleration.	Avoids co-mingling of MXG contractors during transition.	Avoids temporary facility costs.	Avoids moving 819th RHS.
	1	2	3	4	5	6	7	8
Alternative 1:	Y	Y	Y	Y	Y	Y	Y	N
Alternative 2:	N	N	Y	Y	N	N	N	Y
Alternative 3:	N	N	Y	N	Y	Y	N	N
Alternative 4: No Action	N	N	N	Y	N	Y	Y	Y

2.4 Detailed Description of the Alternatives

2.4.1 Alternative 1 — Renovate Building 1450 for Initial Beddown and Delay Building 1440 Renovation

Alternative 1 (Figure 2) would provide sufficient space for the initial phase of the beddown while minimizing effects to the 819th RHS and avoiding mission effects to the 341st MXG. This alternative would meet the purpose of and need for the Proposed Action by renovating existing infrastructure on Malmstrom AFB. Existing buildings would be renovated to provide space for the beddown; no new construction or demolition of existing buildings would be required. The 819th RHS would relocate and consolidate personnel and equipment currently in Building 1450 to Buildings 1460 and 1464 (these buildings are presently utilized by the 819th RHS). Building 1450 would be renovated to accommodate the initial phases of the proposed MH-139 beddown in early 2021 (two MH-139s are anticipated at that time, and the building would be altered to hold four). Hangar 1440 would continue to house the UH-1N aircraft but would be renovated at a later time to accommodate MH-139s arriving at a later date. No external alterations to the buildings would be required to implement this alternative.

Alternative 1 meets the purpose and need of the Proposed Action and satisfies seven of the eight identified Selection Standards. This alternative achieves the desired Wing Campus end state for aircraft operations and an 819th RHS campus, and the 341st MXG would not have to relocate to accommodate the beddown. The two maintenance contractors (one team each for the UH-1N and MH-139 aircraft) would not occupy the same space and the 819th RHS would only have to move once. The USAF originally constructed Building 1450 as an aircraft hangar, and it would provide adequate parts / supply storage and maintenance space for four of the replacement aircraft. This alternative also provides flexibility for unforeseen construction or beddown schedule acceleration. Space is available for both MH-139s and UH-1Ns during the transition, which allows flexibility for aircraft storage in the event that construction of the Missile Maintenance Dispatch Facility (MMDF) (which the 341st MXG will be relocating to) is delayed (the Commander of the 341 Missile Wing signed the FONSI for this action on 14 August 2017, and construction is scheduled for completion in mid-2021), or Malmstrom AFB receives more than two MH-139s before 2023. Disadvantages of this alternative include the high cost of renovating Building 1450, and the requirement for 819th RHS to relocate and consolidate into existing space.

2.4.2 Alternative 2 — Construct LAMS for Temporary UH-1N Parking

This alternative would require the construction of two LAMS to provide temporary UH-1N parking space during the beddown transition. Building 1440 would be renovated later to house the MH-139 aircraft. Benefits of this alternative include that it would not require relocation of the 819th RHS and it would not affect the 341st MXG mission. However, the UH-1Ns and MH-139s would initially occupy the same space for maintenance (Building 1440, Bay 5). This would require maintenance contractors for both aircraft to occupy the same space during the transition, which could lead to conflicts with space and scheduling. Malmstrom AFB would be required to provide swing space for initial additional personnel arriving with the replacement aircraft until Building 1440 is renovated. There are a number of uncertainties associated with this alternative including 341st Civil Engineer Squadron (CES)/819th RHS troop labor needed to construct the LAMS; Fire Protection design required for LAMS; and availability of the LAMS. Additionally, since the LAMS are temporary structures, they would be dismantled and removed after Building 1440 is renovated. Therefore, all costs incurred for the LAMS construction and removal would be for a short-term benefit.

2.4.3 Alternative 3 — Temporarily Move 341st MXG to Building 1450 or 1464

Under this alternative, the 341st MXG would temporarily relocate to Building 1464 or 1450, and the 819th RHS would be consolidated. Building 1440 would be renovated prior to the beddown and would be ready to house the replacement aircraft. This alternative is advantageous because it fully accommodates the beddown schedule by completing the Building 1440 renovation earlier. It would provide required vehicle and storage space, but would not adequately address personnel space. Additionally, this alternative would require two 341st MXG relocations and would temporarily increase 341st MXG dispatch times. It would also reduce 341st MXG storage space from 10,000 square feet to 8,000 square feet and the vehicle spacing in Building 1450 is tight, making it difficult to move vehicles in and out. The 819th RHS concrete block structure inside Building 1450 would be removed, leading to the loss of RHS office space and the need for an alternate location. Building 1464 houses the 819th RHS armory and would need to be relocated as well. Requiring 819th RHS to temporarily relocate increases the cost of this alternative; they would have to consolidate in the remaining area and relocate again at a later date.

2.4.4 Alternative 4 — No-Action

Under the No Action Alternative (Alternative 4), Malmstrom AFB would not complete the UH-1N Replacement Beddown. This alternative would not address the purpose and need for the action.

2.5 Alternatives Eliminated From Further Consideration

An additional alternative was also considered but was dismissed from full analysis. The alternative would have utilized LAMS for temporary relocation of the 341st MXG. Hangar 1440 would have been renovated earlier. This alternative addressed vehicle and storage space, but not personnel space and therefore was removed from consideration.

Figure 2. Alternative 1

Figure 3. Alternative 2

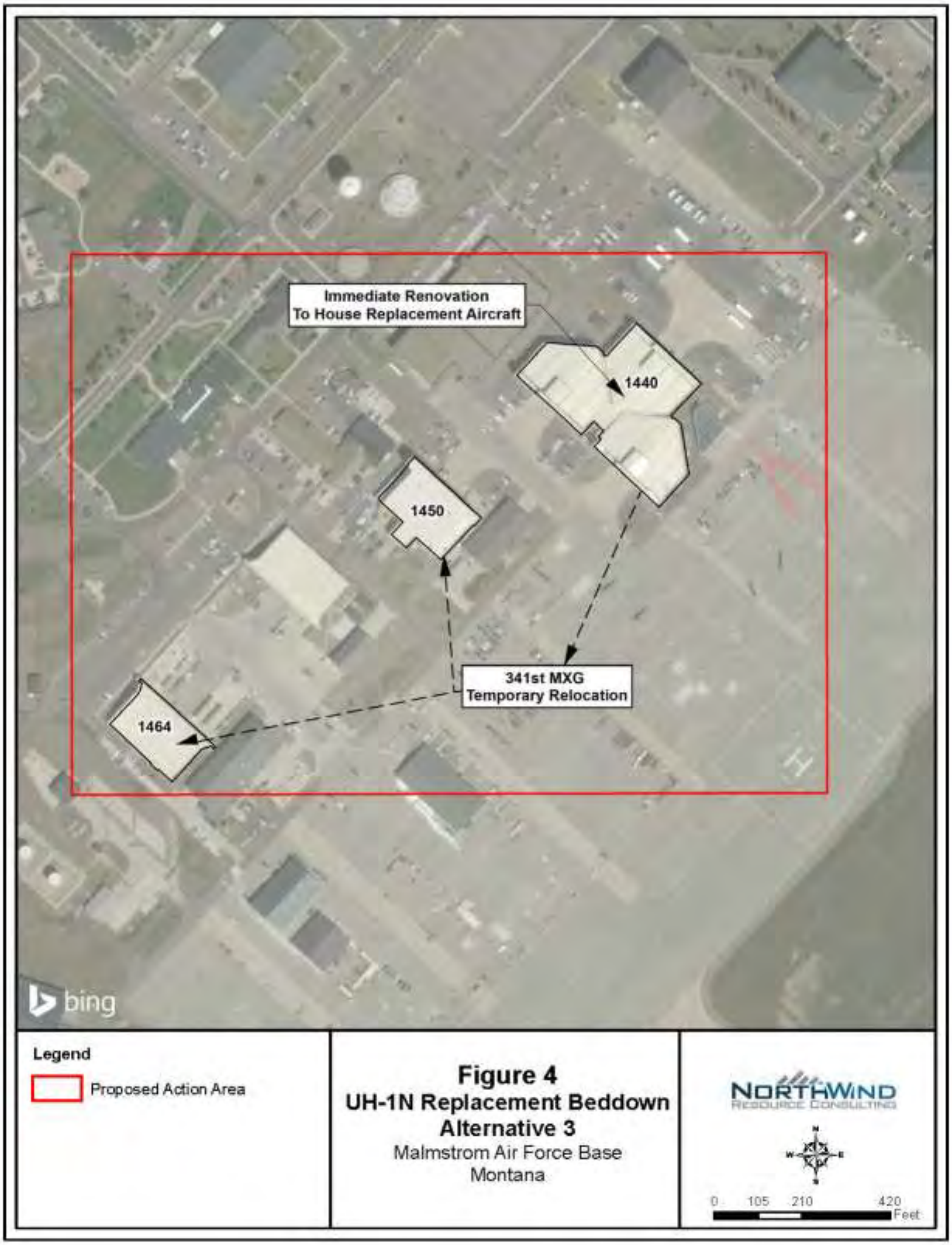

Figure 4. Alternative 3

2.6 Summary of Anticipated Environmental Effects

Table 2 provides a brief summary of the anticipated effects to resource areas that would result if the USAF implements one of the action alternatives or the No Action Alternative. Effects would not be expected to approach the significance threshold for any resource area.

Table 2. Summary of Anticipated Environmental Effects

Resource	Alternative 1: Renovate Building 1450 for Initial Beddown and Delay Building 1440 Renovation	Alternative 2: Construct LAMS for Temporary UH-1N Parking	Alternative 3: Temporarily Move 341st MXG to Building 1450 or 1464	Alternative 4: No Action
Airspace	No effect.	No effect.	No effect.	No effect.
Noise / Acoustic Environment	Beneficial effect.	Beneficial effect.	Beneficial effect.	Less than significant effect.
Air Quality and Climate Change	Less than significant effect.	Less than significant effect.	Less than significant effect.	Less than significant effect.
Water Resources	No effect.	No effect.	No effect.	No effect.
Biological / Natural Resources	Less than significant effect.	Less than significant effect.	Less than significant effect.	Less than significant effect.
Earth Resources	No effect.	No effect.	No effect.	No effect.
Hazardous Materials and Waste	Less than significant effect.	Less than significant effect.	Less than significant effect.	No effect.
Cultural Resources	No effect.	No effect.	No effect.	No effect.
Land Use	No effect.	No effect.	No effect.	No effect.
Infrastructure / Utilities	No effect.	No effect.	No effect.	No effect.
Safety and Occupational Health	Less than significant effect. Contractor would protect worker health and safety.	Less than significant effect. Contractor would protect worker health and safety.	Less than significant effect. Contractor would protect worker health and safety.	No effect.
Socioeconomic Resources	Beneficial effect.	Beneficial effect.	Beneficial effect.	No effect.
Environmental Justice	No effect.	No effect.	No effect.	No effect.

3. AFFECTED ENVIRONMENT

3.1 SCOPE OF THE ANALYSIS

The potentially affected human environment is interpreted comprehensively to include natural and physical resources and the relationship of people with those resources (40 CFR 1508.14). Information presented in this section serves as a baseline from which to identify and evaluate any individual or cumulative effects likely to result from implementation of the No Action Alternative or one of the action alternatives presented in Chapter 2. In compliance with NEPA, CEQ regulations, and 32 CFR 989, the description of the affected environment focuses on those resources and conditions potentially subject to project effects, thus laying the groundwork for discussions of potential environmental effects to each resource. As such, Malmstrom AFB selected relevant natural and physical resources for analysis in this section.

The affected environment includes existing environmental, cultural, and socioeconomic conditions within the Region of Influence (ROI) for the proposed actions. For the purposes of this analysis, the ROI is generally defined as the proposed action area where the helicopters would beddown and the surrounding local area.

Subject matter experts (SMEs) obtained resource information for this EA through a review of existing environmental documents, available Geographic Information System (GIS) data, field observations, and communications with Malmstrom AFB staff, regulatory agencies, and other agencies and organizations. Information is presented to the level of detail necessary to support the analysis of potential direct and indirect effects in Section 4, Environmental Consequences. Qualified technical SMEs examined each action component for potential effects on each technical resource area considering the scope of the action and available resource information. The examination resulted in certain resources being dismissed from detailed analysis. Dismissed resources are addressed in Section 3.1.2.

3.1.1 Resources Analyzed

Based on the components of the Proposed Action and internal scoping and coordination, Malmstrom AFB identified which resources would potentially be affected by the proposed actions. As a result, Malmstrom AFB identified six resource areas for detailed analysis based on their potential to be affected by one of the action alternatives or the No Action Alternative. These include the following:

- Noise / Acoustic Environment,
- Air Quality and Climate Change,
- Biological / Natural Resources,
- Hazardous Materials / Waste,
- Cultural Resources, and
- Safety and Occupational Health.

These resources are described in Sections 3.2 through 3.7.

3.1.2 Resources Eliminated from Detailed Analysis

Several resources were not fully evaluated in this EA because SMEs determined through a preliminary screening process that implementation of any of the alternatives would have negligible to no effects on those resources. The resources eliminated from detailed analysis are:

- Airspace,
- Water Resources,
- Earth Resources,
- Land Use,
- Infrastructure and Utilities,
- Socioeconomics, and
- Environmental Justice and Protection of Children.

A brief explanation of why each of these resources was eliminated from further consideration is provided in Sections 3.1.2.1 – 3.1.2.7 below.

3.1.2.1 Airspace

The considered alternatives would not involve changes to airspace management or use. Management of the airspace would remain consistent with current practices. As a result, the Air Force anticipates no short- or long-term effects to airspace from the considered alternatives. Therefore, this resource is not carried forward for detailed analysis.

3.1.2.2 Earth Resources

Earth resources include topography, geology, and soils. Protection of unique geological features, minimization of soil erosion, and the siting of facilities in relation to potential geologic hazards are considered when evaluating potential effects of a proposed action on geological resources. None of the alternatives under consideration would affect earth resources. The only potential new construction would be the LAMS included in Alternative 2. However, the LAMS proposed under that alternative would be placed on currently paved ramp areas. Therefore, no effects would be anticipated and this resource is not carried forward for detailed analysis.

3.1.2.3 Water Resources

Water resources include groundwater, surface water, wetlands, floodplains, and stormwater. Both shallow and deep groundwater is present on Malmstrom AFB. Shallow groundwater can be found at depths of 3 to 20 feet and is a result of near surface geological features or human impacts. Deep groundwater resources include the Kootenai and Madison aquifers. Shallow groundwater on the Base is thought to be heavily influenced by man-induced activities such as trenching and filling in the developed areas (Malmstrom AFB 2018). The considered alternatives would have no effects on groundwater on the installation and would not result in an increase in impervious surface. There are no surface water features, wetlands, or floodplains in the vicinity of the project area. Therefore, water resources are not further evaluated in this EA.

3.1.2.4 Land Use

The considered alternatives would be sited on land currently designated as Aircraft Operations and Airfield Surface (Malmstrom AFB 2015). Siting of all three action alternatives would be consistent with these land uses. Therefore, land use is not further evaluated in this EA.

3.1.2.5 Infrastructure and Utilities

Infrastructure and utilities typically include transportation, water supply, sanitary sewage/wastewater, natural gas, electrical, communications, and liquid fuels. The Proposed Action site currently has adequate utility services, access, and infrastructure to support the facilities. Existing utilities are present at all of the buildings. The utility infrastructure at Malmstrom AFB has adequate capacity to support growth on the installation, and adequate utility capacity to meet the demands of the renovated facilities. Therefore, this resource area is not further evaluated.

3.1.2.6 Socioeconomics

Socioeconomic resources are defined as the basic attributes associated with the human environment, and generally include factors associated with economic activity, population and housing, and public services and social conditions. Economic activity is typically described in terms of employment, personal income, and regional industries. Changes to these fundamental components can influence other community resources, such as housing availability, utility capabilities, and public services. The estimated population of the city of Great Falls in 2017 was 59,000 (U.S. Census Bureau 2017), and in 2016 Malmstrom AFB had an estimated population of 4,060 assigned military and civilian personnel, 3,276 active duty dependents, and 643 non-appropriated fund civilians, contractors, and private business employees. Indirect effects to the region from Malmstrom AFB include 1,571 jobs and an estimated 367 million dollars (Malmstrom AFB 2016).

The proposed facility renovation would result in minor, short-term beneficial effects to the local economy and region from an increase in construction jobs. Workers may or may not be hired locally, but would be likely to stay in the area while they work and purchase a variety of products. There would be a short-term surge of approximately 40 personnel (primarily due to maintenance crews for both aircraft and pilot trainers for the replacement aircraft) during the overlap of UH-1N and MH-139 aircraft, after which personnel would decrease to a steady-state. Overall, the Proposed Action would result in slightly more personnel at Malmstrom AFB. Activities associated with renovation of the facilities would temporarily generate construction income and increase Base personnel and thus result in a temporary beneficial effect; however, when considering the existing economic contribution to the region from Malmstrom AFB, any changes positive or negative to socioeconomic current conditions attributable to the proposed actions would be negligible, beneficial to the region at large, and less than significant. Therefore, this resource is not further evaluated in this EA.

3.1.2.7 Environmental Justice and Protection of Children

The U.S. Environmental Protection Agency (EPA) defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, sex, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations, and policies." EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires federal agencies to consider disproportionately high adverse effects on the human or environmental health to minority and low-income populations resulting from implementation of a proposed action. EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, states that each federal agency "(a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks."

Per CEQ guidance, minority populations should be identified where either the minority population of the affected area exceeds 50% or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997). Poverty thresholds established by the U.S. Census Bureau are used to identify low-income populations. Poverty status is reported as the number of persons or families with income below a defined threshold level. Based on data obtained from 2018 Census estimates, the percentage of the population in the city of Great Falls living below the poverty level was 14.5%, as compared to 12.3% for the U.S. as a whole (U.S. Census Bureau 2019). The percentage of minority residents in the city of Great Falls (12.4%) is lower than the percentage of the total population nationwide (23.4%) (U.S. Census Bureau 2019).

Residents within Great Falls would not be affected by short-term effects associated with implementation of the alternatives, which would largely be confined to construction activities on site. These construction activities would not affect the surrounding communities. Therefore, the considered alternatives would not disproportionately and adversely affect environmental and human health of minority or low-income populations nor would they result in increased exposure of children to environmental health or safety risks. No effects to these resources are anticipated, and the resource is not further evaluated in this EA.

3.2 NOISE / ACOUSTIC ENVIRONMENT

Noise is considered unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. It may be intermittent or continuous, steady or impulsive, stationary or transient. Stationary sources are normally related to specific land uses (e.g., housing tracts or industrial plants). Transient noise sources move through the environment, either along relatively established paths (e.g., highways, railroads, aircraft flight tracks), or randomly.

The USAF Air Installation Compatible Use Zone (AICUZ) Resource Book (USAF 2014) states aircraft noise does not affect off-installation areas at levels triggering land use recommendations. The USAF conducted a noise modeling analysis for this Proposed Action that included a validation of current flight operations on Malmstrom AFB (Appendix B). SMEs assembled data describing flight track distances and turns, altitudes, airspeeds, power settings, flight track operational utilization, maintenance locations, ground run-up engine power settings, and number and duration of runs by type of aircraft/ engine. Trained personnel processed the data for input into the NOISEMAP computer program. The 40th HS points of contact reviewed the aircraft operations parameters for accuracy prior to running the noise model.

The airframes involved in the current condition and Proposed Action scenarios were not available in the NOISEMAP databases. Based upon the best professional judgement of SMEs the current UH-1N flight and static operations were modeled with the AH-1W Super Cobra and UH-1M Iroquois Huey[2], respectively. The proposed MH-139 flight and static operations were modeled with the SH-60B Seahawk and UH-60A Blackhawk [3], respectively. The modeling analysis verified that aircraft noise levels that would trigger land use recommendations are still confined to areas well within the installation boundary (Figure 5).

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[2] Noise modeling data for the UH-1N is not available in the Advanced Acoustics Model (AAM), presumably because the aircraft is on its way to retirement, and run-up noise data for the UH-1N was not included in legacy noise modeling software. Therefore, noise SMEs used the most comparable available aircraft. The UH-1M Gunship only has one engine whereas the UH-1N has two, but the UH-1M's engine develops 1,400 shaft horsepower (shp) while the UH-1N's engines each develop 1,250 shp. Data from https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104464/uh-1n-iroquois/ and http://www.combatairmuseum.org/aircraft/bellhueyuh1m.html, accessed July 10, 2019.

[3] The MH-139 is a new aircraft and noise modeling data is not yet available. Therefore, noise SMEs used the most comparable available aircraft. The H-60 (SH-60B and UH-60A variants) and the MH-139 have similar blade loading at their maximum takeoff weights, i.e., 9 and 11 pounds per square foot of rotor area for the H-60 and MH-139, respectively; same number of engines (2) and similarly rated engines at 1,750-1,800 shaft horsepower from each engine). Data from http://www.blueskyrotor.com/performance/datasheet/Sikorsky/Sea__Hawk-SH_60-B and https://www.militaryfactory.com/aircraft/detail.asp?aircraft_id=1907#specs, accessed July 10, 2019).

561 Figure 5. Current and Proposed Aircraft Noise Contours

3.3 AIR QUALITY AND CLIMATE CHANGE

3.3.1 Air Quality Resources

The following sections describe the air quality resources in the Proposed Action area. Potential effects to this resource are based on the change in annual air emissions that would be caused by the Proposed Action (both directly and indirectly) when compared to current emissions levels.

Air quality is the degree to which the air is suitable or clean enough for humans, animals, or plants to remain healthy. Air quality is described in terms of the type and amount of pollutants that are present in the local atmosphere. The amount of air pollutant in the air is generally expressed as a concentration in units of parts per million, parts per billion, or micrograms per cubic meter ($\mu g/m^3$).

Factors that contribute to or affect air quality are local and regional air emissions, geographical size of the air basin, topography, and prevailing meteorological conditions. Air emissions can occur from human activities (e.g., industrial process, fuel combustion, motor vehicles, aircraft) and natural events (e.g., wildfires, wind-blown dust). Meteorological conditions (temperature, wind speed, wind direction, amount of sunshine, and temperature inversions) influence the extent to which pollutants are dispersed and transported both vertically and horizontally within the atmosphere. Pollutant concentrations in the atmosphere near emission sources are generally highest with light winds or strong temperature inversions, both of which limit the transport of pollutants away from the emission source. The EPA has divided air pollutants into several categories: criteria pollutants, hazardous air pollutants, and greenhouse gases; each of these are discussed below.

3.3.1.1 Criteria Pollutants

Under the Clean Air Act (CAA), the EPA established the National Ambient Air Quality Standards (NAAQS) for six common air pollutants referred to as the "criteria pollutants". These include carbon monoxide (CO), lead, ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM). Particulate matter is presented in the NAAQS in terms of particulate matter less than or equal to 10 micrometers in diameter (PM_{10}) and particulate matter less than or equal to 2.5 micrometers in diameter ($PM_{2.5}$). These are the most common pollutants associated with human activities and natural events. The NAAQS represent maximum levels of air pollution that are considered safe for public health and the environment. The State of Montana has established additional ambient air quality standards under Administrative Rules 17.8.210 through 17.8.223 which must be considered along with the NAAQS for describing air quality conditions within the state.

The EPA is responsible for characterizing and designating a region's air quality status with respect to the NAAQS. A regional designation is made for each criteria pollutant based on ambient air monitoring data collected and verified by the state environmental agencies:

- Attainment – in compliance with the NAAQS.
- Non-attainment – the NAAQS is not being met.
- Maintenance – a region that was previously classified as "nonattainment," but is now in compliance with the NAAQS may be redesignated as "maintenance" if the state has completed an air quality maintenance plan and has successfully demonstrated that the plan is effective in producing necessary emission reductions along with air quality improvements.
- Unclassified – no monitoring data is available. By default, these areas are considered to be in attainment.

3.3.1.2 Hazardous Air Pollutants

Hazardous air pollutants (HAPs) include a group of 187 pollutants identified by the EPA as having the potential to cause cancer or other serious health effects such as reproductive effects, birth defects, or adverse environmental and ecological effects. These are generally associated with solvents and chemicals used in industrial processes, and usually emitted in much lower quantities than the criteria pollutants.

3.3.1.3 Greenhouse Gases

Greenhouse gases (GHGs) have the tendency to affect the earth's atmospheric temperature through physical processes involving both light and thermal energy. GHGs exist in the atmosphere as a result of both natural processes and human activity. Among the most prominent GHGs associated with human activities are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). A significant amount of these gases are a combustion byproduct of fossil fuel (i.e., gasoline, diesel, oil, coal, and natural gas) and other organic matter such as wood. Other pollutants that are considered to be GHGs, but which are much less prevalent in the atmosphere, include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF), and nitrogen trifluoride (NF_3). In recent years, GHG emissions from human activity have become a focus of concern and scrutiny as these relate to climate change. GHGs are presented in terms of CO_2 equivalent (CO_2-e) [4] emissions per year.

3.3.1.4 Regulations

Regulatory requirements at the federal and state levels associated with air quality have been established to protect air quality. These requirements include the air quality standards, State Implementation Plans, air permitting programs, emissions monitoring programs, and protection of environmentally sensitive areas. As a means of tracking and managing air pollutant emissions within a state's borders, the federal and state air quality regulations require any regulated new or modified stationary emission source (facility) to obtain a permit to construct and operate if its potential emissions would be above certain thresholds of criteria and non-criteria pollutants. This air permitting establishes regulatory control over both small and large industrial activities, providing a means for monitoring their effect on air quality. An air permit identifies the facility's operating air emission sources, allowable emission levels, and conditions of operation. However, the regulations also provide exemptions from air permitting requirements for certain types and sizes of emission activities. Although regulated stationary sources require an air permit for certain air emission sources at a facility, the air emissions associated with mobile sources (such as motor vehicles and aircraft) and construction activities are not covered under the permitting process.

In addition to the air quality regulations referenced above, Congress established the General Conformity Rule under CAA §176(c)(4) to ensure that actions taken by federal agencies do not cause or contribute to:

- New violations of an NAAQS;
- Additional or worsening of existing violations of an NAAQS; and
- Delays in attaining a NAAQS.

[4] Greenhouse Gases are typically presented as CO_2 Equivalent = (1 × Carbon Dioxide emissions) + (25 × Methane emissions) + (298 × Nitrous Oxide emissions). The three main greenhouse gases are carbon dioxide, methane, and nitrous oxide. Methane and nitrous oxide have a 25 and 298 times higher, respective, global warming potential than carbon dioxide. The other four GHGs have very high global warming potentials, but these are generally countered by much lower levels of emissions.

This rule generally applies to proposed federal actions located in nonattainment or maintenance areas but can extend to attainment areas for actions with a potential to cause a new NAAQS violation.

Unlike the air permitting programs that only consider emissions from stationary sources, the General Conformity Rule requires federal agencies to consider emissions from all activities associated with the proposed federal action including new or modified stationary, mobile, and fugitive emission sources. When applied, this rule requires federal government agencies to prepare a written conformity analysis for a proposed federal action. The analysis begins with an estimate of air emissions that would be generated by the proposed action and comparing these to threshold levels defined in the rule. If the proposed action is to be located in a NAAQS nonattainment or maintenance area and emission levels are below the threshold levels, a Record of Non-Applicability (RONA) is prepared and documented. If the emission levels are above the threshold levels, an in-depth conformity determination is required.

3.3.1.5 Existing Conditions

3.3.1.5.1 Climate

The Proposed Action would occur in Cascade County, Montana which has an annual mean temperature of 45°F. Monthly average temperatures range from 22°F in January to 68°F in July. Total precipitation averages 15 inches per year with spring and summer being the wettest seasons. Winter snowfall averages 60 inches per year (Western Regional Climate Center [WRCC] 2019). The prevailing wind direction is from the southwest, and annual average wind speed is 12 miles per hour (National Oceanic and Atmospheric Administration [NOAA] 2015).

3.3.1.5.2 Local Air Quality

The Montana Department of Environmental Quality (MDEQ) operates air quality monitor sites throughout the state for the six criteria pollutants. The information obtained from these monitors is used for evaluating the air quality status relative to the NAAQS. Cascade County, where the proposed project is located, is currently considered to be in attainment for the majority of the NAAQS pollutants (40 CFR §81.327 - Montana). The exception to this is a Phase 2 Maintenance Area for CO located in Great Falls about 0.5 mile from the southwest corner of Malmstrom AFB. In July 2002 the EPA approved a request by Montana to redesignate the Great Falls CO NAAQS nonattainment area to “attainment” (Federal Register / Vol. 67, No. 90 / May 9, 2002 / Rules and Regulations / Page 31150). Subsequently, in April 2015, a second 10-year maintenance plan was approved by EPA (Federal Register / Vol. 80, No. 60 / April 1, 2015 / Proposed Rules / Page 17331). Therefore, although the area is considered “attainment for CO,” it is still subject to a Phase 2 (i.e., second 10-year) maintenance plan. Ultimately, the direct project emissions would not occur within this CO maintenance area.

In addition to monitoring for the six criteria pollutants, the EPA maintains a national database of air pollutant emissions using data provided by each state on a county-by-county basis. The National Emissions Inventory (NEI) is used for monitoring emission trends and evaluating the effectiveness of emission reduction strategies. It includes reported criteria pollutants and HAP emissions from permitted stationary sources, a wide range of non-permitted sources, mobile sources, and fugitive sources. Although the EPA conducts a comprehensive emissions inventory every three years, developing and updating the inventory is time-consuming. The most recent NEI data available to the public is for the year 2014, and can be obtained through the EPA website http://www.epa.gov/air-emissions-inventories. Table 3 presents the most recently available baseline emissions inventory of criteria pollutants for Cascade County. Ozone is not included in the NEI data, because it is generally not emitted directly into the atmosphere. Instead, it is formed in the lower atmosphere by chemical reactions between precursor pollutants in the presence of sunlight. Nitrogen oxides (NOx) and Volatile Organic Compounds (VOCs) are the main precursors of O_3.

Table 3. 2014 Baseline Emissions for Cascade County, Montana

Source Category	Emissions (ton/year) (A)							
	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPs	GHGs (B)
Stationary	1,555	520	496	269	211	1,833	198	---
Mobile	16,188	2,767	165	122	15	1,601	456	546,612
Fugitive	7,822	1,056	10,890	1,947	33	14,531	2,727	56,452
Total	**25,566**	**4,344**	**11,552**	**2,337**	**259**	**17,964**	**3,381**	**603,064**

(A) County level emission totals reported in tons per year from the 2014 National Emissions Inventory.
(B) National Emissions Inventory only provides Greenhouse Gas emissions for mobile and fugitive sources. Value shown is for CO_2 equivalent.

3.3.1.6 Emissions at Malmstrom AFB

Potential emission levels from a facility are used to define which air permitting program is applicable. Malmstrom AFB is a major source under the Title V air permitting program because it has the potential to emit several criteria pollutants in excess of certain major source thresholds. However, potential emissions of HAPs are below the major source threshold. The base currently operates under Montana State air permit 1427-10 (to be issued 27 June 2019) that covers its stationary air emission sources. The permit, issued by MDEQ, identifies the facility's air emission sources along with any conditions and requirements of operation.

Malmstrom AFB also performs annual air emissions inventories that identify the actual level of air emissions based on the actual (not potential) operations at the base. The most recent available air emissions inventory for Malmstrom AFB is for year 2017 and presented in Table 4. It includes stationary sources and mobile sources. However, the mobile source category in this emissions inventory excludes emissions from the aircraft and ground support equipment.

Table 4. 2017 Facility Emissions for Malmstrom AFB

Source Category	Emissions (ton/year) (A)							
	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAPs	GHGs (D)
Stationary Sources (B)	13.86	22.01	0.75	0.63	4.22	0.59	1.60	---
Mobile Sources (C)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---
Total	**13.86**	**22.01**	**0.75**	**0.63**	**4.22**	**0.59**	**2.6**	**15,385**

Emissions obtained from the 2017 Air Program Information Management System report for Malmstrom AFB.
Stationary sources included external combustion (boiler) and internal combustion (power generator) units at the base.
Mobile sources included only government vehicle emissions at the base. Emissions from aircraft and aerospace ground equipment were not counted in the 2017 Air Program Information Management System emissions inventory.
Greenhouse Gas emissions provided only as facility-wide totals. Value shown is for CO_2 equivalent.

3.4 BIOLOGICAL / NATURAL RESOURCES

Biological resources include native or naturalized plants and animals and the habitats in which they occur. Sensitive biological resources are defined as those plant and animal species listed as threatened or endangered or proposed for listing by the U.S. Fish and Wildlife Service (USFWS) or Montana Department of Fish, Wildlife, and Parks (MFWP). Much of the information in this section is from the current Malmstrom AFB Integrated Natural Resources Management Plan (INRMP) (Malmstrom AFB 2018).

3.4.1 Vegetation Resources

Native vegetation on Malmstrom AFB has been altered or modified by Base operations. A large part of Malmstrom AFB, including the main Base area, consists of improved grounds that are occupied by a variety of structures and pavements. Vegetation in these areas is restricted to turf and landscaping that are planted with grasses, shrubs, and trees, and managed for aesthetics and erosion control. Vegetation present on improved grounds includes crested wheatgrass (*Agropyron cristatum*), Kentucky bluegrass (*Poa pratensis*), and western wheatgrass (*Pascopyrum smithii*), along with alfalfa (*Medicago saliva*) and sweet clover (*Melilotus* sp.) (Malmstrom AFB 2018). A number of trees are also present throughout the cantonment area, such as green ash (*Fraxinus pennsylvanica*), plains cottonwood (*Populus deltoides*), honey locust (*Gleditsia triacanthos*), American elm (*Ulmus americana*), Scotch pine (*Pinus sylvestris*), Austrian pine (*Pinus nigra*), and Colorado blue spruce (*Picea pungens*) (Malmstrom AFB 2018). On the southeast portion of the Base, open fields have been plowed and planted with introduced grasses for many years. Vegetation within and near helicopter movement areas on the Base is mowed to satisfy Bird/Wildlife Aircraft Strike Hazard (BASH) requirements. There is no vegetation on the Proposed Action site.

Numerous surveys of the Base have been conducted for noxious and invasive weeds. A survey in 2014 identified approximately 652 acres of the Base with relatively high invasive species densities (SWCA 2015). The most common invasive weed species present include spotted knapweed (*Centaurea stoebe*), Canada thistle (*Cirsium arvense*), field bindweed (*Convolvulus arvensis*), and Russian olive (*Elaeagnus angustifolia*).

3.4.2 Wildlife

3.4.2.1 Mammals

Wildlife habitat at Malmstrom AFB is limited due to the relatively small size of the Base and the existing uses that occur there. Most of the Base's open areas are comprised of non-native grasses and have historically been used for grazing and hay production. As a result of these conditions, mammals that are present are those that are typical of human-influenced environments. An 8-foot-tall chain link fence surrounds the perimeter of Malmstrom AFB and limits the movement of large mammals on and off the Base. Mammals that may be present include: mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), white-tailed jack rabbit (*Lepus townsendii*), cottontail rabbit (*Sylvilagus* sp.), badger (*Taxidea taxus*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), beaver (*Castor canadensis*), skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), black-tailed prairie dog (*Cynomys ludovicianus*), Richardson's ground squirrel (*Urocitellus richardsonii*), muskrat (*Ondatra zibethicus*), porcupine (*Erethizon dorsatum*), and a variety of species of mice, voles, and shrews. There is no habitat for mammals on or in the vicinity of the Proposed Action site.

3.4.2.2 Birds

The presence of birds on or near airfields represents a potential source of conflict between natural resource management and USAF missions. The BASH Reduction Program (USAF 2016) focuses on reducing bird activity around airfields through habitat alteration and direct control. The integration of biological diversity objectives, mission flying requirements, and safety are achieved at Malmstrom AFB by wildlife hazing and harassment, habitat alteration, prey-base management, and limited lethal control deemed necessary to ensure the safe operation of aircraft.

A variety of songbirds, shorebirds, waterfowl, and raptors have been observed on the Base. Commonly observed species include: European starling (*Sturnus vulgaris*), American robin (*Turdus migratorius*), American crow (*Corvus brachyrhynochos*), black-billed magpie (*Pica hudsonia*), brown-headed cowbird (*Molothrus ater*), western meadowlark (*Sturnella neglecta*), turkey vulture (*Cathartes aura*), northern flicker (*Colaptes auratus*), common nighthawk (*Chordeiles minor*), and various blackbird, sparrow, dove, and swallow species. Several birds of prey species are also present at Malmstrom AFB: bald eagle (*Haliaeetus leucocephalus*), American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), northern harrier (*Circus cyaneus*), osprey (*Pandion haliaetus*), short-eared owl (*Asio flammeus*), burrowing owl (*Athene cunicularia*), and great horned owl (*Bubo virginianus*). Various species of gulls, geese, and ducks also occur on Base.

Migratory birds, as listed in 50 CFR 10.13, are ecologically and economically important for recreational activities – including bird watching, studying, feeding, and hunting – practiced by many Americans. In 2001, EO 13186 *Responsibilities of Federal Agencies to Protect Migratory Birds* was issued to focus attention of Federal agencies on the environmental effects to migratory bird species and, where feasible, implement policies and programs that support the conservation and protection of migratory birds. The Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Act are incorporated in this EO.

Federal permits are required to take, possess, transport, and dispose of migratory birds, bird parts, feathers, nests, or eggs. Permits are obtained annually for BASH actions from the USFWS Migratory Bird Permit Office in Denver, Colorado.

Flocks of gulls feed and rest within the helicopter movement area (located immediately east of Buildings 1440 and 1450) and operations area during late summer. California gulls (*Larus californicus*) are present year-round, but thousands of migratory gull species pass through Malmstrom AFB each fall, usually in August and September. In the morning hours, birds use the runway overruns to warm up and feed in the grassy areas on grasshoppers, other insects and carrion from mowing activities. Gulls, raptors, and pelicans have been observed riding thermals approximately 300 – 500 feet above ground level directly over the helicopter movement area. Control techniques include pyrotechnics, vehicle disturbance, propane cannons, grass height management, insect control, and limited lethal control (USAF 2016).

3.4.2.3 Reptiles and Amphibians

The following reptile and amphibian species have been documented on Malmstrom AFB: gopher snake (*Pituophis catenifer*), prairie rattlesnake (*Crotalus viridis*), plains garter snake (*Thamnophis radix*), common garter snake (*Thamnophis sirtalis*), painted turtle (*Chrysemys picta*), tiger salamander (*Ambystoma tigrinum*), boreal chorus frog (*Pseudacris maculata*), and northern leopard frog (*Lithobates pipiens*) (Malmstrom AFB 2018).

3.4.2.4 Threatened, Endangered, Proposed, and Special Concern Species

No threatened, endangered, or candidate species or critical habitat have been found (or designated) on the main Base (Malmstrom AFB 2018). However, there are two Montana Potential Species of Concern (porcupine [*Erethizon dorsatum*] and short-eared owl) and several state Species of Concern and USFWS Birds of Conservation Concern that have been found on the main Base (see list and additional information from the INRMP at Appendix C).

The USAF sent letters describing the Proposed Action to the USFWS Montana Field Office and MFWP on 07 May 2019. The USFWS replied on 06 June that they had no comments or concerns regarding effects to federally-listed or proposed threatened or endangered species or critical habitat that would result from implementation of the Proposed Action (Appendix C). The MFWP did not respond.

The Malmstrom AFB Missile Complex is spread across nine Montana Counties. A number of the sites are located within the known ranges of, or potential habitat for, federally listed threatened, endangered, or candidate species (Malmstrom AFB 2018; see Appendix C).

Greater Sage-grouse: The greater sage-grouse is sensitive to disturbance during the breeding season (Manier et al. 2014). It is a state Species of Concern, and is considered by USFWS as a Bird of Conservation Concern. Although the species is not listed as threatened or endangered, the USFWS is currently monitoring the mountain-prairie populations of greater sage-grouse, and a conservation assessment for this species will be conducted by the USFWS and other partners by 2020. In Montana, the species is managed by the State of Montana (MFWP and Department of Natural Resources and Conservation [DNRC]) as well as by the Bureau of Land Management (BLM) on BLM-administered lands. The DNRC Conservation and Resource Development Division administers Montana EO 12-2015, *Amending and Providing for Implementation of the Montana Sage Grouse Conservation Strategy*.

During 2015-16 surveys, greater sage-grouse were found at a distance of 3.5 miles (5.6 km) or less at a total of 17 Missile Complex sites. These sites are occasionally visited by aircraft for security surveillance, maintenance, or to satisfy other requirements. This distance is generally within the species disturbance buffer distance (Manier et al. 2014). The USAF is planning to repeat these surveys during the 2019-2020 field season, and is in the process of developing appropriate greater sage-grouse management strategies.

3.5 HAZARDOUS MATERIALS / WASTE

Hazardous materials are substances that are considered severely harmful to human health and the environment. The use or release of hazardous materials usually results in the generation of hazardous waste.

Hazardous waste is defined under the Resource Conservation and Recovery Act of 1976 (42 U.S.C. §6901 et seq.) as a solid waste (or combination of solid wastes) which, because of its quantity, concentration, or physical, chemical, or infectious characteristics may: (1) cause or contribute to an increase in mortality or an increase in serious irreversible, or incapacitating illness, or (2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Four characteristics determine whether a substance is considered hazardous. These include ignitability, corrosiveness, reactivity, and toxicity. Any solid waste that exhibits one or more of these characteristics is considered a hazardous waste.

Hazardous materials currently utilized within Building 1440 include oils, solvents, and other materials required to conduct aircraft maintenance and repairs. Floor drains and trenches are located in the hangar bay space, shops, and storage rooms. These drain to an oil water separator and are then conveyed to the

Great Falls Public-Owned Treatment works. The small amount of hazardous waste generated is disposed of accordance with all applicable federal regulations governing the disposal of hazardous waste.

The Administrative Rules of Montana 17.74.354 requires an asbestos inspection be completed for all building materials prior to scheduled renovation activities to determine if asbestos containing materials (ACM) are present. The MDEQ Asbestos Control Program (ACP) oversees the permitting of asbestos abatement projects, the accreditation of asbestos-related occupations, and provides compliance assistance to the regulated community and interested parties. The ACP is also delegated by the EPA to administer the National Emission Standards for Hazardous Air Pollutants 40 CFR Part 61 Subpart A, and the National Emission Standard for Asbestos, 40 CFR Part 61 Subpart M.

Lead-based paint (LBP) is of concern both as a source of direct exposure through ingestion of paint chips and as a contributor to lead in interior dust and exterior soil. The EPA's Renovation, Repair, and Painting Rule requires that contractors completing renovation, repair, and painting projects that disturb LBP in schools, childcare facilities, and homes built before 1978 use certified renovators who are trained to follow lead-safe practices. There is no state program for LBP.

A pre-renovation inspection of Building 1450 occurred in November 2018, and project-specific ACM and LBP surveys have been conducted in areas of Building 1440 prior to small-scale renovations. A 2017 survey that included collection and analysis of 49 suspect building materials identified one sample of nonfriable exhaust duct sealant that was presumed ACM. All other surveys conducted had negative results for both ACM and LBP. Appropriate surveys would be conducted prior to renovation in any of the Proposed Action buildings to determine whether hazardous materials are present.

A site inspection related to the presence of Aqueous Film Forming Foam (AFFF) was conducted on Malmstrom AFB in April 2018 (USACE 2018). Hangar 1440 historically conducted annual fire suppression system testing which resulted in the release of AFFF solution to the apron. The AFFF evaporated or drained into a grated drop inlet stormwater drain. A subsurface soil analysis indicated that AFFF was not present in soil at concentrations above the screening levels for water. However, one perched groundwater sample had concentrations of AFFF constituents above screening levels.

3.6 CULTURAL RESOURCES

Cultural resources include any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. They include archaeological resources, historic properties, and traditional resources. Archaeological resources are found at locations where prehistoric or historic activity measurably altered the earth or produced deposits of physical remains (e.g., arrowheads, bottles, etc.). Historic properties (as defined in 36 CFR 60.4) are significant archeological, architectural, or traditional resources eligible for listing, or listed in, the National Register of Historic Places (NRHP). Traditional resources are associated with cultural practices and beliefs of a living community that are rooted in its history and important in maintaining the community's continuing cultural identity.

Section 106 of the National Historic Preservation Act of 1966 requires that federal agencies consider what effects their actions, funding, permit, or license may have on historic properties, and that they give the Advisory Council on Historic Preservation a "reasonable opportunity to comment" on such actions. Actions in areas outside of a Historic District also need to be reviewed for their potential visual effects on the Historic District.

Cultural resource management requirements on USAF installations are established in AFI 32-7065, *Cultural Resources Management*. AFI 32-7065 details compliance requirements for protecting cultural resources through an Integrated Cultural Resources Management Plan (ICRMP). The most recent study of historic structures and resources of Malmstrom AFB did not find any of the buildings in the Proposed Action area NRHP eligible. The USAF initiated consultation with the Montana State Historic Preservation Office (SHPO) on 07 May 2019. The SHPO responded on 31 May with no comment (Appendix A).

CEQ regulations (40 CFR 1501.2) require consultation with "… Indian tribes and with interested private persons and organizations when its own involvement is reasonably foreseeable." In 1999, the Department of Defense (DoD) promulgated its American Indian and Alaska Native Policy, which emphasized the importance of respecting and consulting with tribal governments on a government-to-government basis. The policy requires an assessment, through consultation, of the effect proposed DoD actions have on the potential to significantly affect protected tribal resources, tribal rights, and Indian lands before decisions are made by the services.

Malmstrom AFB has identified seven federally-recognized tribes that could be potentially affected by activities on the installation. Malmstrom AFB has facilitated four tribal relations meetings inviting the seven tribal governments in 2009, 2016, 2017, and 2018. None of the tribes have identified sites or issues of religious or cultural significance in the context of Malmstrom AFB actions. The Malmstrom AFB ITLO initiated consultation on the Proposed Action with tribal leaders on 17 April 2019. All letters sent and responses received are provided in Appendix A.

3.7 SAFETY AND OCCUPATIONAL HEALTH

Safety and occupational health includes risks to the public and workers from conducting daily activities, noise exposure, and exposure to unsafe or unhealthful environments. Although many routine activities involve some degree of risk, there are numerous ways to enhance safety and minimize health risks.

Safety and occupational health requirements are codified in the Occupational Safety and Health Act of 1970 (PL 91-596, December 29, 1970, with amendments through January 1, 2004) and are regulated by the Occupational Safety and Health Administration (OSHA). Montana does not have an OSHA state plan but does have regulations related to health and safety, including those found in the Montana Code Annotated 39-71. The Montana Department of Labor & Industry's Safety and Health Bureau is the primary state agency charged with addressing occupational health and safety.

4. ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This section describes the anticipated environmental effects for resources that would be affected by the considered alternatives. Effects are evaluated in terms of type (beneficial or adverse), context (setting or location), intensity (none, negligible, minor, moderate, severe), and duration (short-term/temporary or long-term/permanent). The type, context, and intensity of an effect on a resource are explained under each resource area. Unless otherwise noted, short-term effects are those that would result from the activities associated with the project's renovation phase, and that would end upon the completion of that phase. Long-term effects are generally those resulting from operation of the proposed project.

4.2 NOISE / ACOUSTIC ENVIRONMENT

4.2.1 Alternative 1 — Renovate Building 1450 for Initial Beddown and Delay Building 1440 Renovation

The number of operations would not change from existing conditions under this alternative; the BAI would be used only to ensure that mission requirements are consistently satisfied. As Figure 5 shows, the Noise Model Operational Data Documentation (NMODD) analysis (Appendix B) determined that implementation of Alternative 1 would reduce aircraft noise, and that aircraft noise levels that would trigger land use recommendations (65 dB) would be confined to areas well within the installation boundary (the area of the 65 dB contour would be reduced from the current 7.8 acres to 3.3 acres, a 58 percent decrease). Construction-related noise would be short-term and very localized as it would be limited to interior renovations. Therefore, Alternative 1 would result in a short-term negligible, localized increase in construction noise, and a long-term decrease in noise caused by aircraft operations.

4.2.2 Alternative 2 — Construct LAMS for Temporary UH-1N Parking

Effects to noise / acoustic environment resources that would result from the implementation of this alternative would be essentially the same as for Alternative 1 and would be less than significant. There would be some additional construction noise in the short-term during assembly and removal of the LAMS, but this would be extremely localized. The decrease in noise caused by aircraft operations would be the same as for Alternative 1.

4.2.3 Alternative 3 — Temporarily Move 341st MXG to Building 1450 or 1464

Effects to noise / acoustic environment resources that would result from the implementation of this alternative would be essentially the same as for Alternative 1 and would result in a short-term negligible, localized increase in construction noise, and a long-term decrease in noise caused by aircraft operations.

4.2.4 No Action Alternative

Under the No Action Alternative, there would be no change in the current noise / acoustic environment. Aircraft noise levels that would trigger land use recommendations or result in noise-related complaints would still be confined to areas well within the installation boundary.

4.3 AIR QUALITY AND CLIMATE CHANGE

4.3.1 Approach to Analysis

AFI 32-7040, Air Quality Compliance and Resource Management, provides a framework for ensuring that USAF actions conform to appropriate CAA, federal/state air regulations, and General Conformity Rule requirements.

Section 3.4 of AFI 32-7040 (Conformity Rule Planning) applies to and addresses the evaluation of federal actions located in NAAQS nonattainment and maintenance areas, and how the action would conform to applicable State Implementation Plans.

Section 3.5 of AFI 32-7040 (NEPA and Environmental Impact Analysis Process Planning) outlines requirements under NEPA for analysis of air quality effects and permitting requirements associated with a proposed action. The analysis shall consider net emission changes of any NAAQS attainment pollutants, HAPs, or other CAA-regulated pollutants. This section also requires, for completeness, that a General Conformity applicability analysis be performed.

Both Sections 3.4 and 3.5 instruct that the USAF Air Conformity Applicability Model (ACAM) be used as the air quality affect assessment tool. The ACAM has been designed to provide a uniform and consistent method for calculating air emissions associated with various construction and operational activities. ACAM (version 5.0.12) was authorized by the Malmstrom AFB Air and Water Resources Manager and populated by the air quality SME to quantify effects of the Proposed Action. ACAM assumptions and model results are provided in Appendix D.

Effects to air quality are evaluated in terms of the change in annual air emissions that would result from the Proposed Action alternatives relative to baseline emissions levels. Any air emissions from construction activity are considered to be temporary and result in short-term effects since these are associated with one-time construction events. Any air emissions from operational activity are considered to be a long-term effect because these are associated with recurring activities that would continue for the foreseeable future. The alternatives under consideration would have the potential to increase operational air emissions. However, there would be little or no construction-related air emissions.

There is no requirement to do conformity for any of the criteria pollutants at Malmstrom AFB, MT.

4.3.2 Alternative 1 — Renovate Building 1450 for Initial Beddown and Delay Building 1440 Renovation

Construction Emissions

Several existing structures would be renovated to house the new aircraft. However, no new construction or demolition would occur. There would be no ground-disturbance activities (i.e., site preparation, grading, excavation, paving, etc.). Therefore, there would be no short-term construction-related emissions.

Operational Emissions

Alternative 1 would involve replacing the current fleet of eight UH-1N helicopters with a total of 11 new MH-139 aircraft (eight primary and three backup). The total number of continually active aircraft would remain at eight. The backup aircraft would be inactive and only swapped out with the primary aircraft as needed to maintain a full-strength fleet. The replacement beddown would occur from 2021 to 2023. A surge in personnel would be anticipated during the overlap of UH-1N and MH-139 aircraft, after which personnel would decrease to a steady-state. Overall, this alternative would result in slightly more personnel at Malmstrom AFB after the replacement beddown is completed. For the purpose of estimating emissions associated with personnel vehicular traffic, it was assumed that an additional forty (40) temporary personnel would be deployed to the base for three years to support this project.

Under this alternative, operational air emissions would occur from fuel combustion in the aircraft during flight operations and associated aerospace ground equipment (AGE). Specifically, emissions from the new aircraft and AGE would replace emissions from the old aircraft and AGE units. The net change in emissions between new and old equipment will be used to define the level of affect to air quality resources.

The Air Quality SME entered appropriate inputs into the ACAM to determine the net change in emissions from the operational activities based on the project timeline. Emission activities entered in the model included the new aircraft / AGE flight operations and increase in vehicular traffic (from increased base personnel) as added emission sources. The old aircraft / AGE flight operations were entered as removed emission sources. A typical helicopter flight operation at Malmstrom AFB involves an ascent, hovering, and descent phase. The annual number of flight operations effects in such a large, remote area would be minor and less than significant.

4.3.3 Alternative 2 — Construct LAMS for Temporary UH-1N Parking

4.3.3.1 Vegetation Resources

This alternative would take place on areas that are currently developed. Therefore, no effects to vegetation resources would occur.

4.3.3.2 Wildlife

The LAMS would be constructed on currently paved area. Effects to wildlife would be the same as for Alternative 1 and would be less than significant.

4.3.3.3 Threatened, Endangered, and Sensitive Species

Effects to threatened, endangered, and sensitive species would be the same as for Alternative 1 and would be less than significant.

4.3.4 Alternative 3 — Temporarily Move 341st MXG to Building 1450 or 1464

4.3.4.1 Vegetation Resources

This alternative would take place on areas that are currently developed. Therefore, no effect to vegetation resources would occur.

4.3.4.2 Wildlife

Effects to wildlife would be the same as for Alternative 1 and would be less than significant.

4.3.4.3 Threatened, Endangered, and Sensitive Species

Effects to threatened, endangered, and sensitive species would be the same as for Alternative 1 and would be less than significant.

4.3.5 No Action Alternative

4.3.5.1 Vegetation Resources

No effects to vegetation resources would occur under the No Action Alternative.

4.3.5.2 Wildlife

Effects to wildlife would be similar to those that would occur under Alternative 1 and would be less than significant.

4.3.5.3 Threatened, Endangered, and Sensitive Species

Effects to threatened, endangered, and sensitive species would be similar to those that would occur under Alternative 1 and would be less than significant.

4.4 HAZARDOUS MATERIALS / WASTE

4.4.1 Alternative 1 — Renovate Building 1450 for Initial Beddown and Delay Building 1440 Renovation

The implementation of Alternative 1 would result in a slight short-term increase in the use of hazardous materials and generation of hazardous waste during the beddown overlap period. Malmstrom AFB has the capacity and established protocols to properly handle these materials and wastes in accordance with all applicable federal regulations governing the storage of hazardous materials and the disposal of hazardous waste. The amount of these materials would return to a steady state once the beddown is complete.

ACM and LBP inspections would be conducted prior to any building renovation. Based upon previous project-specific inspections the amount of ACM and LBP present would likely be very small. Any materials testing positive that must be disturbed would be abated and disposed of under permit and oversight of the MDEQ ACP. Therefore, effects related to hazardous materials / waste would be less than significant.

4.4.2 Alternative 2 — Construct LAMS for Temporary UH-1N Parking

Effects related to hazardous materials / waste would the similar to those for Alternative 1 and would be less than significant.

4.4.3 Alternative 3 — Temporarily Move 341st MXG to Building 1450 or 1464

Effects related to hazardous materials / waste would the same as those for Alternative 1 and would be less than significant.

4.4.4 No Action Alternative

Effects related to hazardous materials / waste would be similar to those for Alternative 1 and would be less than significant.

4.5 CULTURAL RESOURCES

The USAF initiated consultation with the Montana SHPO on 07 May 2019. The SHPO responded on 31 May with no comment (Appendix A).

Malmstrom AFB consulted with seven federally-recognized affiliated reservations in Montana. Although none of the tribes have ever identified any sites or issues of religious or cultural significance in the context of Malmstrom AFB actions, Malmstrom AFB initiated government-to-government consultation with the seven tribes via certified mail on 07 April 2019. The Rocky Boy Reservation – Chippewa Cree Tribe responded on 09 May with a finding of No Adverse Effect. Malmstrom AFB sent a follow-up email to the non-responding tribes on 30 May. The Northern Cheyenne Tribe responded to that email on 07 June and stated that they would provide comment when the draft EA is released for public review and comment. Tribal letters and all responses to date are included in Appendix A.

4.5.1 Alternative 1 — Renovate Building 1450 for Initial Beddown and Delay Building 1440 Renovation

Based upon the responses to date from the SHPO and Native American Tribes and the fact that the Proposed Action does not include any ground disturbing activities or alterations to the viewshed, no effect to Cultural Resources would be anticipated from the implementation of Alternative 1.

4.5.2 Alternative 2 — Construct LAMS for Temporary UH-1N Parking

Based upon the responses to date from the SHPO and Native American Tribes and the fact that the Proposed Action does not include any ground disturbing activities or permanent alterations to the viewshed, no effect to Cultural Resources would be anticipated from the implementation of Alternative 2.

4.5.3 Alternative 3 — Temporarily Move 341st MXG to Building 1450 and 1464

Based upon the responses to date from the SHPO and Native American Tribes and the fact that the Proposed Action does not include any ground disturbing activities or alterations to the viewshed, no effect to Cultural Resources would be anticipated from the implementation of Alternative 3.

4.5.4 No Action Alternative

No effect to Cultural Resources would occur under the No Action Alternative.

4.6 SAFETY AND OCCUPATIONAL HEALTH

4.6.1 Alternative 1 — Renovate Building 1450 for Initial Beddown Delay Building 1440 Renovation

All USAF standards, protocols, and programs to protect Air Force personnel and / or contractors from death, injuries, or occupational illnesses would be followed. During renovation, workers would be provided with appropriate personal protective equipment, which would include, but not be limited to, approved hard hats, safety shoes, gloves, goggles, eye / face protection, hearing protection, and traffic safety vests, where necessary. Therefore, no significant effect to safety and occupational health would be anticipated with the implementation of Alternative 1.

4.6.2 Alternative 2 — Construct LAMS for Temporary UH-1N Parking

As discussed for Alternative 1, no significant effect to safety and occupational health would be anticipated with the implementation of Alternative 2.

4.6.3 Alternative 3 — Temporarily Move 341st MXG to Building 1450 and 1464

As discussed for Alternative 1, no significant effect to safety and occupational health would be anticipated with the implementation of Alternative 3.

4.6.4 No Action Alternative

No effect to safety and occupational health would occur under the No Action Alternative.

4.7 OTHER NEPA CONSIDERATIONS

4.7.1 Unavoidable Adverse Effects

This EA identifies unavoidable adverse effects that would result from implementation of the considered alternatives and the significance of the potential effect to resources and issues. A determination of significance requires consideration of context and intensity as specified in 40 CFR §1508.27. Unavoidable adverse effects include those effects that cannot be avoided due to constraints in alternatives.

Renovation of the existing facilities would temporarily affect the project area at Malmstrom AFB. Unavoidable short-term adverse effects associated with implementing the considered alternatives would include: the relocation of personnel, a minor increase in personnel for renovations, maintenance, and aircraft crew training. These effects are considered minor and temporary, and have been minimized to the extent practicable through design. The action is required for Malmstrom AFB to conduct its mission.

4.7.2 Relationship of Short-Term Uses and Long-Term Productivity

The relationship between short-term uses and enhancement of long-term productivity from project implementation is evaluated from the standpoint of short-term effects and long-term effects. Short-term effects would be those associated with the renovation activities. The long-term enhancement of productivity would be those effects associated with operation of more efficient, state-of-the-art aircraft to fulfill mission requirements after implementation of the Proposed Action.

The considered alternatives represent an enhancement of long-term productivity for aircraft related requirements at Malmstrom AFB. The short-term adverse effects during renovation activities would be minor compared to the benefits from use of the renovated facilities. Immediate and long-term benefits would be realized for many years after completion of the action.

4.7.3 Irreversible and Irretrievable Commitments of Resources

This EA identifies irreversible and irretrievable commitments of resources associated with the considered alternatives. An irreversible effect is one that results from the use or destruction of resources that cannot be replaced within a reasonable time; for example, the use of energy associated with project implementation. An irretrievable effect is one that results from loss of resources that cannot be restored. Short-term irreversible commitments of resources associated with this project include planning and engineering costs, renovation materials and supplies and their cost, use of energy resources during renovation, and labor. No long-term irretrievable commitments of resources are anticipated.

4.8 CUMULATIVE EFFECTS

In accordance with CEQ NEPA implementation regulations (CEQ 1997), any past, present, and reasonably foreseeable future actions with the potential to cumulatively affect the same resources as the alternatives presented in Chapter 2 are presented below, followed by an analysis of cumulative effects. Future actions proposed in the area may require site-specific NEPA analysis prior to implementation.

Cumulative effects on environmental resources result from incremental effect of an action, when combined with other past, present, and reasonably foreseeable future projects in the area. Cumulative effects may arise from single or multiple actions and may result in additive or interactive effects. Cumulative effects can result from minor, but collectively substantial, actions undertaken over time by various agencies (i.e., federal, state, and local) or individuals.

Past actions are those that occurred within the same geographic scope of cumulative effects that have shaped the current environmental conditions of the project area. Generally, past actions have altered the resources that are the existing conditions described in Chapter 3. Past, present, and reasonably foreseeable future actions with the potential to affect the same resources as the Proposed Action are summarized below.

<u>Completed Projects:</u>
Construct snow barn, and

Repair helicopter pad.

<u>Short Range Projects (less than 5 years)</u>:
Construct a Tactical Response Force Alert Facility and Missile Maintenance Dispatch Facility,

Construct a Weapons Storage Maintenance Facility,

Construct a Helicopter Slide Area, and

Construct a Missile Transfer Facility.

<u>Medium Range Projects (5 to 10 years)</u>
Construct an Alert Fire Team Facility, and

Construct a Fire Station.

4.8.1 Noise / Acoustic Environment

Some of the short-range projects could occur at the same time as the Proposed Action, which would result in a short-term cumulative increase in construction noise that would be limited to the airfield area of the base. The Proposed Action would result in a long-term decrease in noise levels due to the quieter replacement aircraft. Therefore, no significant cumulative effects would be expected.

4.8.2 Air Quality and Climate Change

The Proposed Action would result in a negligible increase in air emissions. The other past, present, and reasonably foreseeable actions would result in a short-term increase in air emissions during construction. Cumulative effects to regional air quality would not change the current attainment status for NAAQS pollutants. Therefore, no significant cumulative effects would be expected.

4.8.3 Biological / Natural Resources

The Proposed Action would not result in effects to biological / natural resources beyond current conditions. Therefore, no significant cumulative effects would be expected.

4.8.4 Hazardous Materials / Waste

Malmstrom AFB has the capacity to handle and dispose of the small amounts of hazardous materials and waste generated on the Base. Therefore, no significant cumulative effects would be expected.

4.8.5 Cultural Resources

The Proposed Action would not have any effects on cultural resources. Therefore, no significant cumulative effects to cultural resources would occur.

4.8.6 Safety and Occupational Health

Projects in the vicinity of the Proposed Action would have common construction site safety risks. These risks would be minimized through best construction practices and implementing a health and safety plan to promote occupational safety. Operation of projects would not be expected to have appreciable effects on safety, health, or emergency services. None of the past, present, or reasonably foreseeable projects, alone or in combination with the Proposed Action, would likely result in disproportionately high and adverse environmental health or safety risks to workers or the public Therefore, cumulative effects on safety and occupational health would not be significant.

4.9 POTENTIAL MITIGATION MEASURES

Because the effects associated with the considered alternatives to implement the Proposed Action are minor or less in magnitude, no mitigation measures are necessary. The USAF will, however, continue to support the Montana Sage Grouse Conservation Strategy and adjust operations as the mission allows.

5. LIST OF PREPARERS

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6. PERSONS AND AGENCIES CONSULTED / COORDINATED

Persons and agencies with whom the Air Force consulted to date as part of this EA include:

- U.S. EPA - Region 8
- USFWS Ecological Services, Montana Field Office
- U.S. EPA Montana Operations Office
- Federal Aviation Administration – Helena Airports District Office
- MDEQ – Water Quality Division
- Montana Fish, Wildlife, and Parks – Region 4
- Montana SHPO
- Assiniboine and Sioux Tribes of the Fort Peck Reservation
- Blackfeet Nation
- Chippewa Cree Tribe of the Rocky Boy's Reservation
- Crow Tribe of Indians
- Fort Belknap Indian Community of the Fort Belknap Reservation
- Northern Cheyenne Tribe
- Confederated Salish and Kootenai Tribes

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7. REFERENCES

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36 CFR 800, "Protection of Historic Properties," *Code of Federal Regulations*.

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Appendix A.

Public, Agency, and Native American Correspondence and Consultation

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A-1.1 USFWS Consultation

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

John W. Hale
Deputy Base Civil Engineer, 341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

U.S. Fish and Wildlife Service
Montana Field Office, Ecological Services
Attn: Ms. Jodi Bush, Field Supervisor
585 Shepard Way, Suite 1
Helena, MT 59601

Dear Ms. Bush,

The U.S. Air Force (USAF) is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N helicopters at Malmstrom Air Force Base (AFB), Montana.

This EA is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321, et seq.), the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and the Air Force Environmental Impact Analysis Process (32 CFR Part 989).

The purpose of this action is to replace the current Bell UH-1N "Huey" helicopters at Malmstrom AFB with Boeing MH-139 helicopters and to provide facilities to house the replacement aircraft. The aging fleet of UH-1N aircraft (the USAF has relied on this fleet since the early 1970s) is increasingly difficult to maintain and does not satisfy current mission requirements. The new MH-139 aircraft would provide a faster, more resilient fleet that can accommodate a higher payload. It also has an extended range to more effectively handle the escort of convoys, missile field contingencies, transport of government officials, and range support. The USAF selected the MH-139 aircraft as the best replacement to fully meet requirements for the crucial missile site and utility support. In addition to the new MH-139 fleet, storage and maintenance facilities would need to be larger to accommodate the five rotor-blade aircraft (the UH-1N has two) and adequately provide proper command and control, maintenance, and fueling capabilities for aircraft operations.

The USAF is considering three alternatives to implement the Proposed Action. These alternatives are described in the attached Description of Proposed Action and Alternatives (DOPAA). The USAF has not yet selected a Preferred Alternative.

The USAF invites government agency representatives and private citizens to participate in the environmental process. As such, we would appreciate any information that your agency believes would assist us in this process. To ensure the USAF has time to address your input prior to preparing the EA for public comment, we would appreciate your response within two weeks of receipt of this letter. The

environmental issues analyzed in the EA will be used in the decision-making process by the USAF for determining appropriate actions for the beddown of the UH-1N replacement aircraft.

Written comments should be addressed to Mr. Rob Brown, NEPA Program Manager, 341 CES/CEIE, 39 78th Street North, Malmstrom AFB, MT 59402-7536, or emailed to robert.brown.124@us.af.mil. Mr. Brown can also be reached at (406) 731-7099 if you have any questions or concerns pertaining to this correspondence.

Sincerely

JOHN W. HALE, GS-14, USAF
Deputy Base Civil Engineer

Attachment:
1. Description of Proposed Action and Alternatives

BROWN, ROBERT A GS-12 USAF AFGSC 341 CES/CEIE

From: Bush, Jodi <jodi_bush@fws.gov>
Sent: Thursday, June 6, 2019 1:57 PM
To: BROWN, ROBERT A GS-12 USAF AFGSC 341 CES/CEIE
Cc: George Jordan; Jeff Berglund
Subject: [Non-DoD Source] UH-1N Replacement Beddown on Malmstrom Air Force Base, Montana

Mr. Brown,

Thank you for your May 9, 2019 letter and Environmental Assessment (EA) requesting U.S. Fish and Wildlife Service comments on the proposed replacement of Bell UH-1N helicopters at Malmstrom Air Force Base with Boeing MH-139 helicopters and to provide facilities on the Base to house the replacement aircraft. This email represents our official response to your inquiry for your records.

The U.S. Fish and Wildlife Service reviewed the maps, project description, and EA and has no comments or concerns regarding federally-listed or proposed threatened or endangered species or critical habitat. Such species that occur in greater Cascade County are not supported within the proposed currently developed project footprint and would not be affected.

Thank you for the opportunity to comment. Do not hesitate to contact Jeff Berglund at jeff_berglund@fws.gov or (406) 449-5225, ext. 206 if we may be of any further assistance. Thank you. JB

Jodi L. Bush
Office Supervisor
Montana State Ecological Services Office
585 Shepard Way, Suite 1
Helena, MT 59601
(406) 449-5225, ext.205

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A-1.2 Agency Consultation

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

John W. Hale
Deputy Base Civil Engineer, 341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

U.S. Environmental Protection Agency – Region 8
Attn: Mr. Doug Benevento, Regional Administrator
1595 Wynkoop Street
Denver, CO 80202-1129

Dear Mr. Benevento,

The U.S. Air Force (USAF) is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N helicopters at Malmstrom Air Force Base (AFB), Montana.

This EA is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321, et seq.), the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and the Air Force Environmental Impact Analysis Process (32 CFR Part 989).

The purpose of this action is to replace the current Bell UH-1N "Huey" helicopters at Malmstrom AFB with Boeing MH-139 helicopters and to provide facilities to house the replacement aircraft. The aging fleet of UH-1N aircraft (the USAF has relied on this fleet since the early 1970s) is increasingly difficult to maintain and does not satisfy current mission requirements. The new MH-139 aircraft would provide a faster, more resilient fleet that can accommodate a higher payload. It also has an extended range to more effectively handle the escort of convoys, missile field contingencies, transport of government officials, and range support. The USAF selected the MH-139 aircraft as the best replacement to fully meet requirements for the crucial missile site and utility support. In addition to the new MH-139 fleet, storage and maintenance facilities would need to be larger to accommodate the five rotor-blade aircraft (the UH-1N has two) and adequately provide proper command and control, maintenance, and fueling capabilities for aircraft operations.

The USAF is considering three alternatives to implement the Proposed Action. These alternatives are described in the attached Description of Proposed Action and Alternatives (DOPAA). The USAF has not yet selected a Preferred Alternative.

The USAF invites government agency representatives and private citizens to participate in the environmental process. As such, we would appreciate any information that your agency believes would assist us in this process. To ensure the USAF has time to address your input prior to preparing the EA for public comment, we would appreciate your response within two weeks of receipt of this letter. The

environmental issues analyzed in the EA will be used in the decision-making process by the USAF for determining appropriate actions for the beddown of the UH-1N replacement aircraft.

Written comments should be addressed to Mr. Rob Brown, NEPA Program Manager, 341 CES/CEIE, 39 78th Street North, Malmstrom AFB, MT 59402-7536, or emailed to robert.brown.124@us.af.mil. Mr. Brown can also be reached at (406) 731-7099 if you have any questions or concerns pertaining to this correspondence.

Sincerely

JOHN W. HALE, GS-14, USAF
Deputy Base Civil Engineer

Attachment:
1. Description of Proposed Action and Alternatives

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

John W. Hale
Deputy Base Civil Engineer, 341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

U.S. EPA Montana Operations Office
Federal Building
10 West 15th Street, Suite 3200
Helena, MT 59626

Dear Sir or Madame,

The U.S. Air Force (USAF) is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N helicopters at Malmstrom Air Force Base (AFB), Montana.

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Sincerely

JOHN W. HALE, GS-14, USAF
Deputy Base Civil Engineer

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1. Description of Proposed Action and Alternatives

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341st MISSILE WING (AFGSC)

John W. Hale
Deputy Base Civil Engineer, 341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Montana Fish, Wildlife, and Parks
Region 4 Office
4600 Giant Springs Road
Great Falls, MT 59405

Dear Sir or Madame,

The U.S. Air Force (USAF) is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N helicopters at Malmstrom Air Force Base (AFB), Montana.

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Sincerely

JOHN W. HALE, GS-14, USAF
Deputy Base Civil Engineer

Attachment:
1. Description of Proposed Action and Alternatives

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

John W. Hale
Deputy Base Civil Engineer, 341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Federal Aviation Administration
Northwest Mountain Region
1601 Lind Avenue, Southwest
Helena, MT 59626

Dear Sir or Madame,

The U.S. Air Force (USAF) is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N helicopters at Malmstrom Air Force Base (AFB), Montana.

This EA is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321, et seq.), the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and the Air Force Environmental Impact Analysis Process (32 CFR Part 989).

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Written comments should be addressed to Mr. Rob Brown, NEPA Program Manager, 341 CES/CEIE, 39 78th Street North, Malmstrom AFB, MT 59402-7536, or emailed to robert.brown.124@us.af.mil. Mr. Brown can also be reached at (406) 731-7099 if you have any questions or concerns pertaining to this correspondence.

Sincerely

JOHN W. HALE, GS-14, USAF
Deputy Base Civil Engineer

Attachment:
1. Description of Proposed Action and Alternatives

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341st MISSILE WING (AFGSC)

John W. Hale
Deputy Base Civil Engineer, 341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Federal Aviation Administration
Helena Airport District Office
2725 Skyway Drive, Suite 2
Helena, MT 59626

Dear Sir or Madame,

The U.S. Air Force (USAF) is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N helicopters at Malmstrom Air Force Base (AFB), Montana.

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Sincerely

JOHN W. HALE, GS-14, USAF
Deputy Base Civil Engineer

Attachment:
1. Description of Proposed Action and Alternatives

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

John W. Hale
Deputy Base Civil Engineer, 341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Montana Department of Environmental Quality
Water Quality Division
Attn: Mr. Tim Davis, Administrator
1520 East Sixth Avenue, PO Box 200901
Helena, MT 59620

Dear Mr. Davis,

The U.S. Air Force (USAF) is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N helicopters at Malmstrom Air Force Base (AFB), Montana.

This EA is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321, et seq.), the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and the Air Force Environmental Impact Analysis Process (32 CFR Part 989).

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Sincerely

JOHN W. HALE, GS-14, USAF
Deputy Base Civil Engineer

Attachment:
1. Description of Proposed Action and Alternatives

A-1.3 SHPO Consultation

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

John W. Hale
Deputy Base Civil Engineer, 341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Montana State Historic Preservation Office
Dr. Mark Baumler, Montana SHPO
225 North Roberts, PO Box 201201
Helena, MT 59620

Dear Dr. Baumler,

The U.S. Air Force (USAF) is in the process of preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N helicopters at Malmstrom Air Force Base (AFB), Montana.

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Sincerely

JOHN W. HALE, GS-14, USAF
Deputy Base Civil Engineer

Attachment:
1. Description of Proposed Action and Alternatives

BROWN, ROBERT A GS-12 USAF AFGSC 341 CES/CEIE

From:	Brown, Peter <pebrown@mt.gov>
Sent:	Friday, May 31, 2019 9:03 AM
To:	ELLSWORTH, CANDACE GS-12 USAF AFGSC 341 CES/CEIE
Cc:	BROWN, ROBERT A GS-12 USAF AFGSC 341 CES/CEIE
Subject:	[Non-DoD Source] RE: Helicopter Beddown EA

Candace,

I went over the EA earlier this week. SHPO has no comment.

Thanks for asking.

Pete

From: ELLSWORTH, CANDACE GS-12 USAF AFGSC 341 CES/CEIE [mailto:candace.ellsworth@us.af.mil]
Sent: Thursday, May 30, 2019 4:02 PM
To: Brown, Peter <pebrown@mt.gov>
Cc: BROWN, ROBERT A GS-12 USAF AFGSC 341 CES/CEIE <robert.brown.124@us.af.mil>
Subject: Helicopter Beddown EA

Pete,

Just following up to see if your office received our letter concerning the Helicopter Beddown EA at Malmstrom. If you have any questions, please let us know. I am going to be TDY next week, but Rob will be available if you need anything (406-731-7099).

v/r

Candace R Ellsworth, P.E.
Environmental Engineer
Cultural and Tanks Program Manager, Malmstrom AFB
341st CES/CEIEC
COMM 406-731-7128
DSN 632-7128

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A-1.4 Tribal Consultation

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

17 APR 2019

Mr. Tony Lucas, Installation Tribal Liaison Officer
341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Honorable Andrew Werk, Jr.
President
Fort Belknap Indian Community of the Fort Belknap Reservation
656 Agency Main Street
Harlem, MT 59526

Dear President Werk,

The United States Air Force (USAF) is preparing an Environmental Assessment (EA) under the National Environmental Policy Act to evaluate potential environmental impacts associated with the proposed beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N "Huey" helicopters at Malmstrom Air Force Base (AFB), Montana. Per Section 306108 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 Code of Federal Regulations (CFR) Part 800, the USAF is evaluating various environmental concerns and engaging early with tribal governments as it formulates the undertaking.

The USAF is considering three alternatives to implement the Proposed Action. These alternatives are described in the attached Description of Proposed Action and Alternatives. The USAF has not yet selected a Preferred Alternative.

In accordance with the NHPA, the USAF would like to initiate government-to-government consultation regarding the UH-1N Replacement Beddown project. The USAF requests your input in identifying any issues or areas of concern you feel should be addressed in the environmental analysis. Additionally, please let us know if you believe this undertaking might adversely affect any historic properties of religious and cultural significance to the Fort Belknap Indian Community. An electronic copy of the Draft EA will be provided when it is made available for public review and comment.

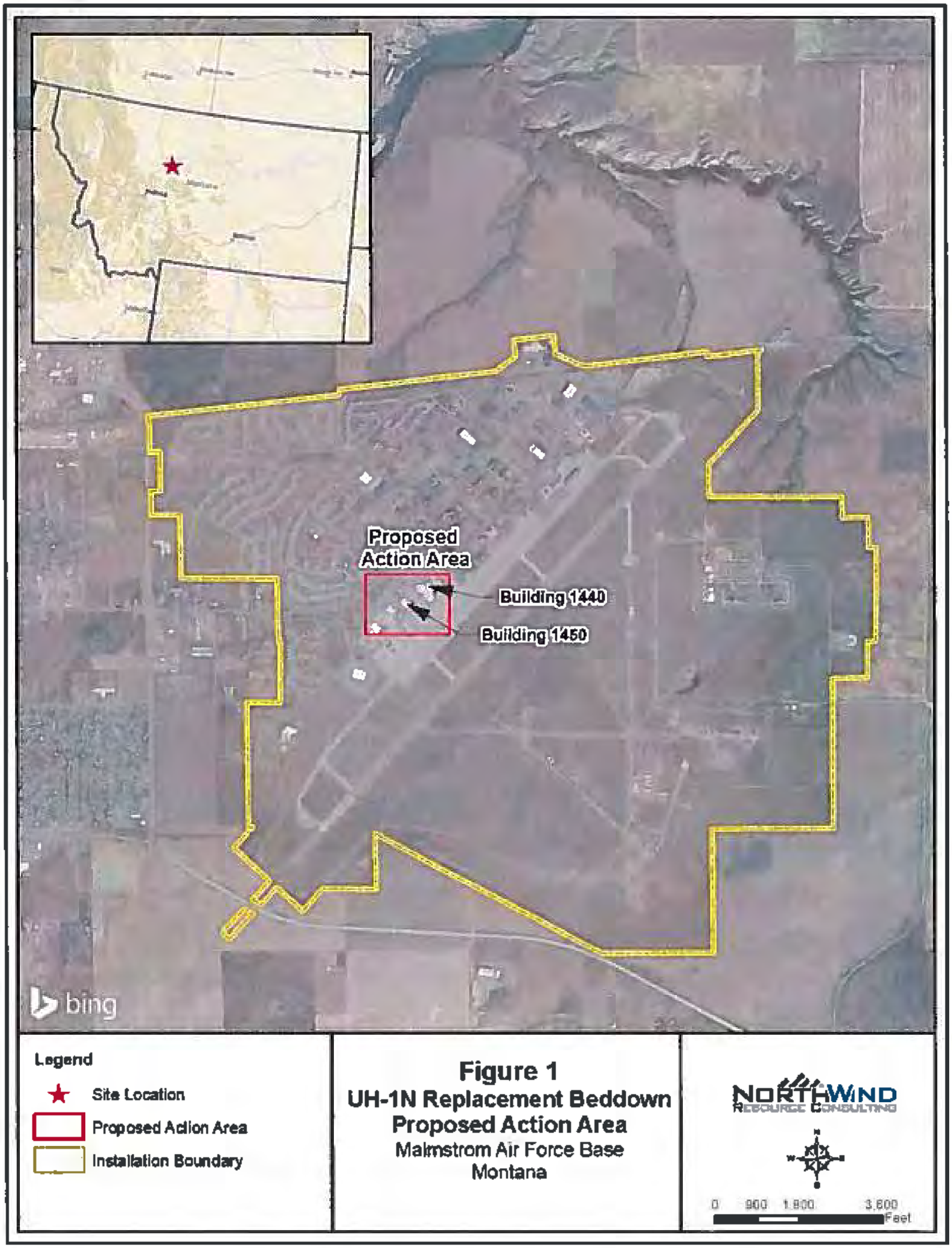
If you have any questions, please contact Mr. Tony Lucas, Installation Tribal Liaison Officer, at (406) 731-7794; tony.lucas@us.af.mil; or 39 78th Street North, Malmstrom AFB, MT 59402-7536. You may also contact Mr. Rob Brown, NEPA Program Manager, at (406) 731-7099 341, robert.brown.124@us.af.mil, or at the same mailing address as Mr. Lucas. Thank you in advance for your assistance in this effort.

Sincerely,

Tony Lucas, Installation Tribal Liaison Officer
Malmstrom AFB

Attachment 1: Description of Proposed Action and Alternatives
CC: Mr. Michael J. Black Wolf, THPO

Attachment 1. Proposed Action Area



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

17 APR 2019

Mr. Tony Lucas, Installation Tribal Liaison Officer
341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Honorable Rynalea Whiteman Pena
President
Northern Cheyenne Tribe
600 Cheyenne Avenue
PO Box 128
Lame Deer, MT 59043

Dear President Whiteman Pena,

The United States Air Force (USAF) is preparing an Environmental Assessment (EA) under the National Environmental Policy Act to evaluate potential environmental impacts associated with the proposed beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N "Huey" helicopters at Malmstrom Air Force Base (AFB), Montana. Per Section 306108 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 Code of Federal Regulations (CFR) Part 800, the USAF is evaluating various environmental concerns and engaging early with tribal governments as it formulates the undertaking.

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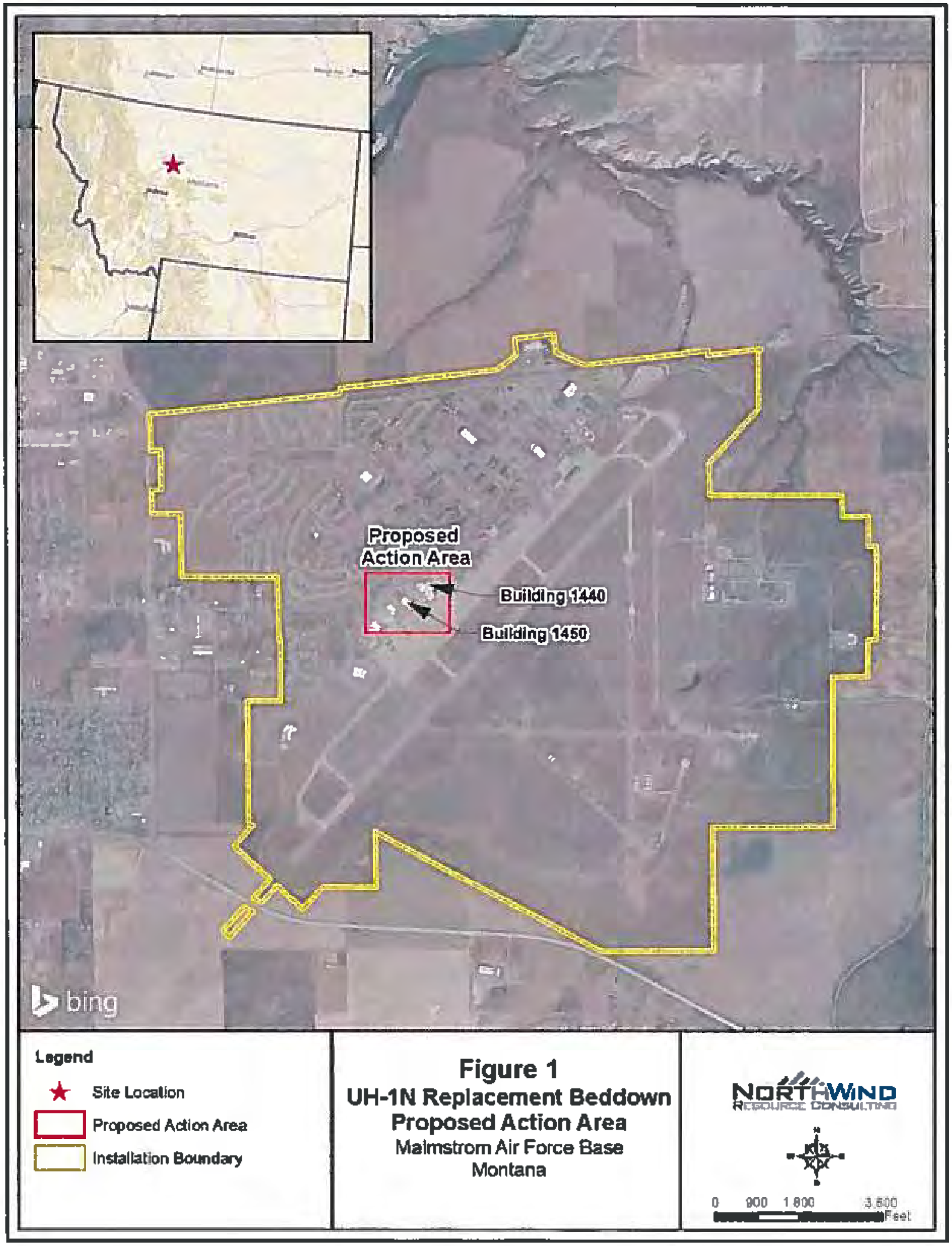
If you have any questions, please contact Mr. Tony Lucas, Installation Tribal Liaison Officer, at (406) 731-7794; tony.lucas@us.af.mil; or 39 78th Street North, Malmstrom AFB, MT 59402-7536. You may also contact Mr. Rob Brown, NEPA Program Manager, at (406) 731-7099 341, robert.brown.124@us.af.mil, or at the same mailing address as Mr. Lucas. Thank you in advance for your assistance in this effort.

Sincerely,

Tony Lucas, Installation Tribal Liaison Officer
Malmstrom AFB

Attachment 1: Description of Proposed Action and Alternatives
CC: Ms. Teanna Limpy, THPO

Attachment 1. Proposed Action Area



BROWN, ROBERT A GS-12 USAF AFGSC 341 CES/CEIE

From:	Teanna Limpy <teanna.limpy@cheyennenation.com>
Sent:	Friday, June 7, 2019 5:46 PM
To:	BROWN, ROBERT A GS-12 USAF AFGSC 341 CES/CEIE
Subject:	[Non-DoD Source] RE: Helicopter Beddown EA

Mr. Brown,
Thank you for the inquiry. We will provide comment when the draft EA is ready for public review, just keep us informed on any actions requiring our attention.

Thanks,
Teanna Limpy, THPO
Tribal Historic Preservation Office
Northern Cheyenne Tribe
14 E. Medicine Lodge Drive
P.O. Box 128
Lame Deer, MT. 59043
Work: (406) 477-4839/4838
Cell: (406) 850-7691

From: BROWN, ROBERT A GS-12 USAF AFGSC 341 CES/CEIE [mailto:robert.brown.124@us.af.mil]
Sent: Thursday, May 30, 2019 3:07 PM
To: William Big Day <William.BigDay@crow-nsn.gov>; Teanna Limpy <teanna.limpy@cheyennenation.com>; mblackwolf@ftbelknap.org; kyle.felsman@cskt.org; John Murray <jmflysdown@gmail.com>; d.youpee@fortpecktribes.net
Cc: BROWN, ROBERT A GS-12 USAF AFGSC 341 CES/CEIE <robert.brown.124@us.af.mil>
Subject: Helicopter Beddown EA

Good Morning

I am writing to do a follow up for the proposed action for the Beddown of new Helicopters at Malmstrom AFB. This proposed action consists of bedding down new helicopters which Malmstrom AFB will be using in the near future. The action involves remodeling several existing hangars on MAFB in the developed area near the flight line on base. We will be providing a copy of the Draft EA when it goes out for public review for your review and comments, in the near future.

A Letter of Notification for this proposed action was sent on April 17, 2019. If you would like me to resend a copy of that letter please let us know. Do not hesitate to contact me if you have any questions or comments about the proposed action.

v/r

Rob Brown

Robert A Brown (Rob)

NEPA Manager
Malmstrom AFB, Montana
406-731-7099
DSN632-7099

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

17 APR 2019

Mr. Tony Lucas, Installation Tribal Liaison Officer
341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Honorable Alvin Not Afraid, Jr.
Chairman
Crow Tribe of Indians
Bacheeitche Avenue
PO Box 159
Crow Agency, MT 59022

Dear Chairman Not Afraid, Jr.,

The United States Air Force (USAF) is preparing an Environmental Assessment (EA) under the National Environmental Policy Act to evaluate potential environmental impacts associated with the proposed beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N "Huey" helicopters at Malmstrom Air Force Base (AFB), Montana. Per Section 306108 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 Code of Federal Regulations (CFR) Part 800, the USAF is evaluating various environmental concerns and engaging early with tribal governments as it formulates the undertaking.

The USAF is considering three alternatives to implement the Proposed Action. These alternatives are described in the attached Description of Proposed Action and Alternatives. The USAF has not yet selected a Preferred Alternative.

In accordance with the NHPA, the USAF would like to initiate government-to-government consultation regarding the UH-1N Replacement Beddown project. The USAF requests your input in identifying any issues or areas of concern you feel should be addressed in the environmental analysis. Additionally, please let us know if you believe this undertaking might adversely affect any historic properties of religious and cultural significance to the Crow Tribe. An electronic copy of the Draft EA will be provided when it is made available for public review and comment.

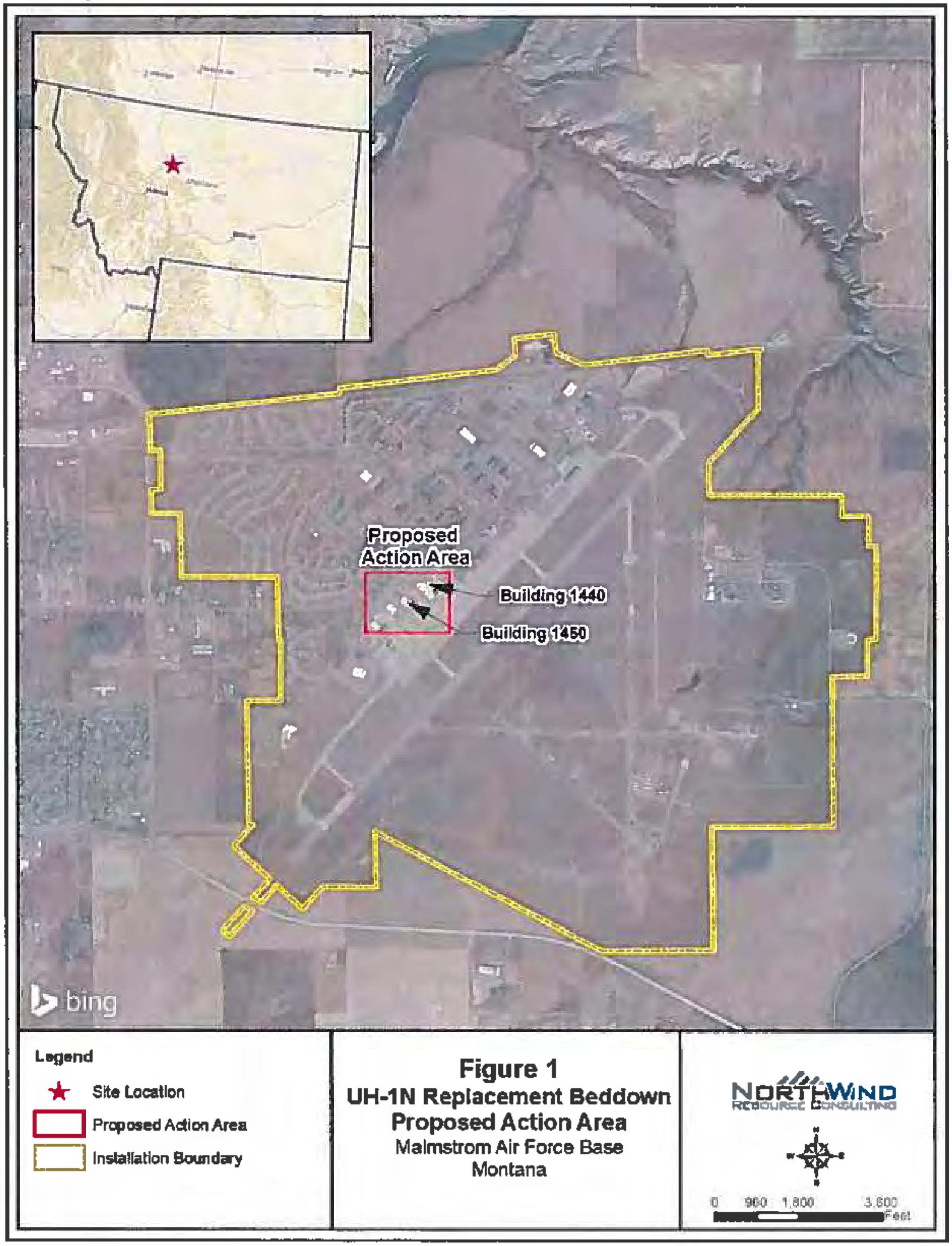
If you have any questions, please contact Mr. Tony Lucas, Installation Tribal Liaison Officer, at (406) 731-7794; tony.lucas@us.af.mil; or 39 78th Street North, Malmstrom AFB, MT 59402-7536. You may also contact Mr. Rob Brown, NEPA Program Manager, at (406) 731-7099 341, robert.brown.124@us.af.mil, or at the same mailing address as Mr. Lucas. Thank you in advance for your assistance in this effort.

Sincerely,

Tony Lucas, Installation Tribal Liaison Officer
Malmstrom AFB

Attachment 1: Description of Proposed Action and Alternatives
CC: Mr. William Big Day, THPO

Attachment 1. Proposed Action Area



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

Mr. Tony Lucas, Installation Tribal Liaison Officer
341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

17 APR 2019

Honorable Ronald Trahan
Chairman
Confederated Salish and Kootenai Tribes
PO Box 278
42487 Complex Boulevard
Pablo, MT 59855

Dear Chairman Trahan,

The United States Air Force (USAF) is preparing an Environmental Assessment (EA) under the National Environmental Policy Act to evaluate potential environmental impacts associated with the proposed beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N "Huey" helicopters at Malmstrom Air Force Base (AFB), Montana. Per Section 306108 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 Code of Federal Regulations (CFR) Part 800, the USAF is evaluating various environmental concerns and engaging early with tribal governments as it formulates the undertaking.

The USAF is considering three alternatives to implement the Proposed Action. These alternatives are described in the attached Description of Proposed Action and Alternatives. The USAF has not yet selected a Preferred Alternative.

In accordance with the NHPA, the USAF would like to initiate government-to-government consultation regarding the UH-1N Replacement Beddown project. The USAF requests your input in identifying any issues or areas of concern you feel should be addressed in the environmental analysis. Additionally, please let us know if you believe this undertaking might adversely affect any historic properties of religious and cultural significance to the Confederated Salish and Kootenai Tribe. An electronic copy of the Draft EA will be provided when it is made available for public review and comment.

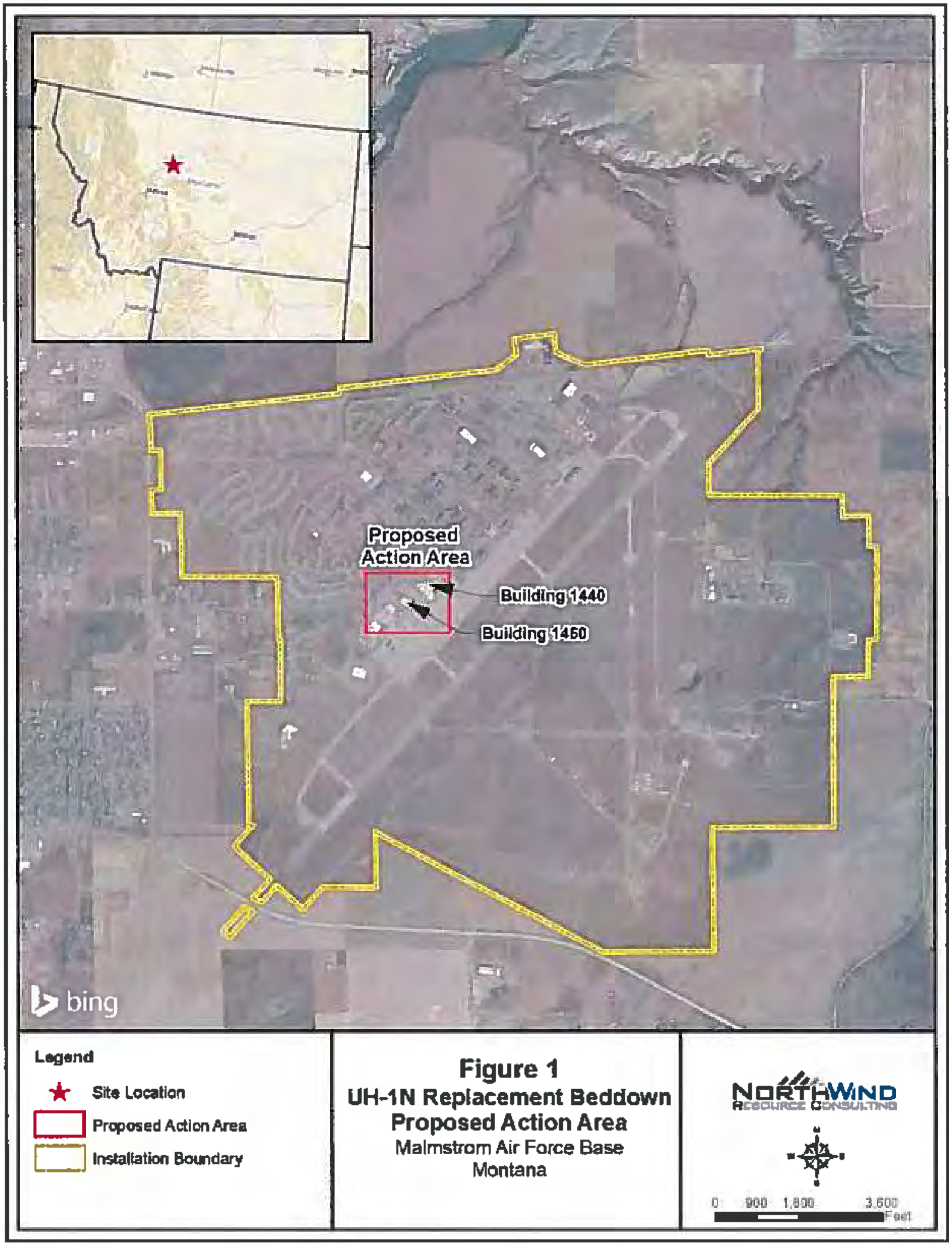
If you have any questions, please contact Mr. Tony Lucas, Installation Tribal Liaison Officer, at (406) 731-7794; tony.lucas@us.af.mil; or 39 78th Street North, Malmstrom AFB, MT 59402-7536. You may also contact Mr. Rob Brown, NEPA Program Manager, at (406) 731-7099 341, robert.brown.124@us.af.mil, or at the same mailing address as Mr. Lucas. Thank you in advance for your assistance in this effort.

Sincerely,

Tony Lucas, Installation Tribal Liaison Officer
Malmstrom AFB

Attachment 1: Description of Proposed Action and Alternatives
CC: Mr. Kyle Felsman, THPO

Attachment 1. Proposed Action Area



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

17 APR 2019

Mr. Tony Lucas, Installation Tribal Liaison Officer
341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Honorable Harlan Baker
Chairman
Chippewa Cree Tribe of the Rocky Boy's Reservation
PO Box 230
96 Clinic Road North
Box Elder, MT 59521

Dear Chairman Baker,

The United States Air Force (USAF) is preparing an Environmental Assessment (EA) under the National Environmental Policy Act to evaluate potential environmental impacts associated with the proposed beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N "Huey" helicopters at Malmstrom Air Force Base (AFB), Montana. Per Section 306108 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 Code of Federal Regulations (CFR) Part 800, the USAF is evaluating various environmental concerns and engaging early with tribal governments as it formulates the undertaking.

The USAF is considering three alternatives to implement the Proposed Action. These alternatives are described in the attached Description of Proposed Action and Alternatives. The USAF has not yet selected a Preferred Alternative.

In accordance with the NHPA, the USAF would like to initiate government-to-government consultation regarding the UH-1N Replacement Beddown project. The USAF requests your input in identifying any issues or areas of concern you feel should be addressed in the environmental analysis. Additionally, please let us know if you believe this undertaking might adversely affect any historic properties of religious and cultural significance to the Chippewa Cree Tribe. An electronic copy of the Draft EA will be provided when it is made available for public review and comment.

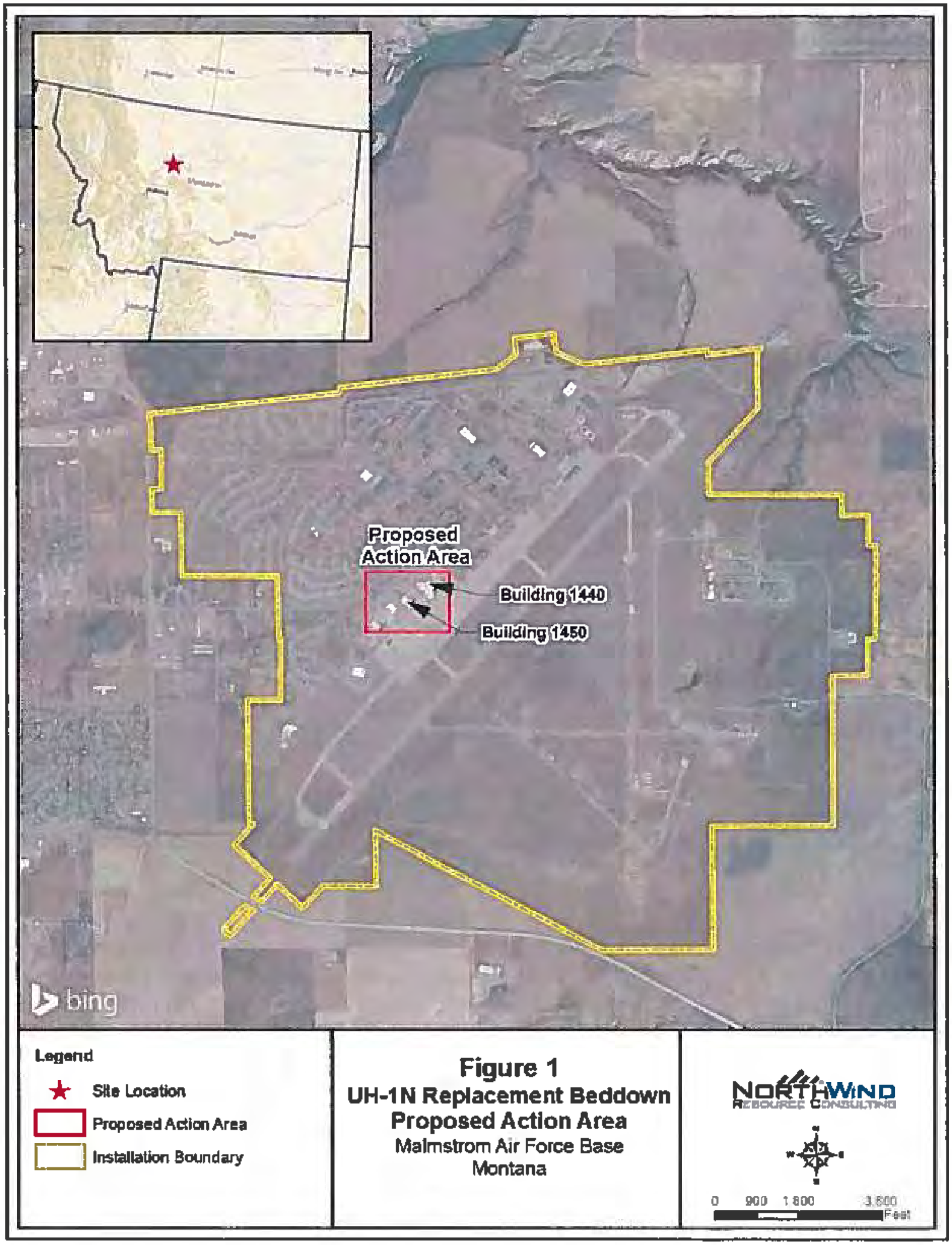
If you have any questions, please contact Mr. Tony Lucas, Installation Tribal Liaison Officer, at (406) 731-7794; tony.lucas@us.af.mil; or 39 78th Street North, Malmstrom AFB, MT 59402-7536. You may also contact Mr. Rob Brown, NEPA Program Manager, at (406) 731-7099 341, robert.brown.124@us.af.mil, or at the same mailing address as Mr. Lucas. Thank you in advance for your assistance in this effort.

Sincerely,

Tony Lucas, Installation Tribal Liaison Officer
Malmstrom AFB

Attachment 1: Description of Proposed Action and Alternatives
CC: Mr. Jonathan Windy Boy, THPO

Attachment 1. Proposed Action Area



CCCRPD
Chippewa Cree Cultural Resources Preservation Department

"Our mission is to maintain and inspire the traditional values that relate to the Ojibwa and Nei-yahw way of life for its people through established principles: Culture, History, Language and Life."

To: Tony Lucus
Date: May 9, 2019
Project: UH-1N Replacement Beddown, Malmstrom AFB

X	FINDING OF NO ADVERSE EFFECT – While there may be cultural resources directly affected by the proposed undertaking, the integrity of this resource is not compromised. The Chippewa Cree Tribe does not recommend this site as eligible for listing on the National Register of Historic Places. However, if cultural materials are discovered during construction please notify the Chippewa Cree Tribal Historic Preservation Office.

Under the authority of Section 106 of the National Historic Preservation Act of 1966 and in accordance with 36 CFR 800.2A4, after reviewing the materials you provided for the *Harlan Baker's Homesite Project*, the Chippewa Cree Tribal Historic Preservation Office finds that there is low potential for an adverse effect impacting cultural resources significant to the Chippewa Cree Tribe.

The proposed undertaking does not directly affect a documented tribal cultural resource. The vicinity of the project is significant to the Chippewa Cree Tribe. According to our tribal elders, historians, and archaeological/anthropological evidence, the Chippewa & Cree Tribes have a long and storied history throughout Pennsylvania, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, North Dakota, and Montana. That history includes major sacred events, encampments, medicinal plants and other significant markers that indicate our footprint throughout this entire region. Since the area around the project was heavily utilized in prehistoric times, it is particularly important for the ground disturbance to remain in the areas designated in the original site plans.

No further cultural resource work is necessary for this project as long as the areas outlined are adhered to. If additional work is necessary outside the areas designated, please notify our department to make the necessary arrangements. In the unlikely event that an artifact of unknown cultural origin is uncovered during ground disturbing activities, we request that all construction activities cease and that our office is contacted immediately for a review.

Thank you,

Jonathan Windy Boy.
Tribal Historic Preservation Officer

9740 Upper Box Elder Road | P.O. Box 230 | Box Elder, MT 59521 |PHONE 406-395-4700 | FAX 406-395-5444

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

17 APR 2019

Mr. Tony Lucas, Installation Tribal Liaison Officer
341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

Honorable Timothy Davis
Chairman
Blackfeet Nation
P.O. Box 850
Browning, MT 59417

Dear Chairman Davis,

The United States Air Force (USAF) is preparing an Environmental Assessment (EA) under the National Environmental Policy Act to evaluate potential environmental impacts associated with the proposed beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N "Huey" helicopters at Malmstrom Air Force Base (AFB), Montana. Per Section 306108 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 Code of Federal Regulations (CFR) Part 800, the USAF is evaluating various environmental concerns and engaging early with tribal governments as it formulates the undertaking.

The USAF is considering three alternatives to implement the Proposed Action. These alternatives are described in the attached Description of Proposed Action and Alternatives. The USAF has not yet selected a Preferred Alternative.

In accordance with the NHPA, the USAF would like to initiate government-to-government consultation regarding the UH-1N Replacement Beddown project. The USAF requests your input in identifying any issues or areas of concern you feel should be addressed in the environmental analysis. Additionally, please let us know if you believe this undertaking might adversely affect any historic properties of religious and cultural significance to the Blackfeet Tribe. An electronic copy of the Draft EA will be provided when it is made available for public review and comment.

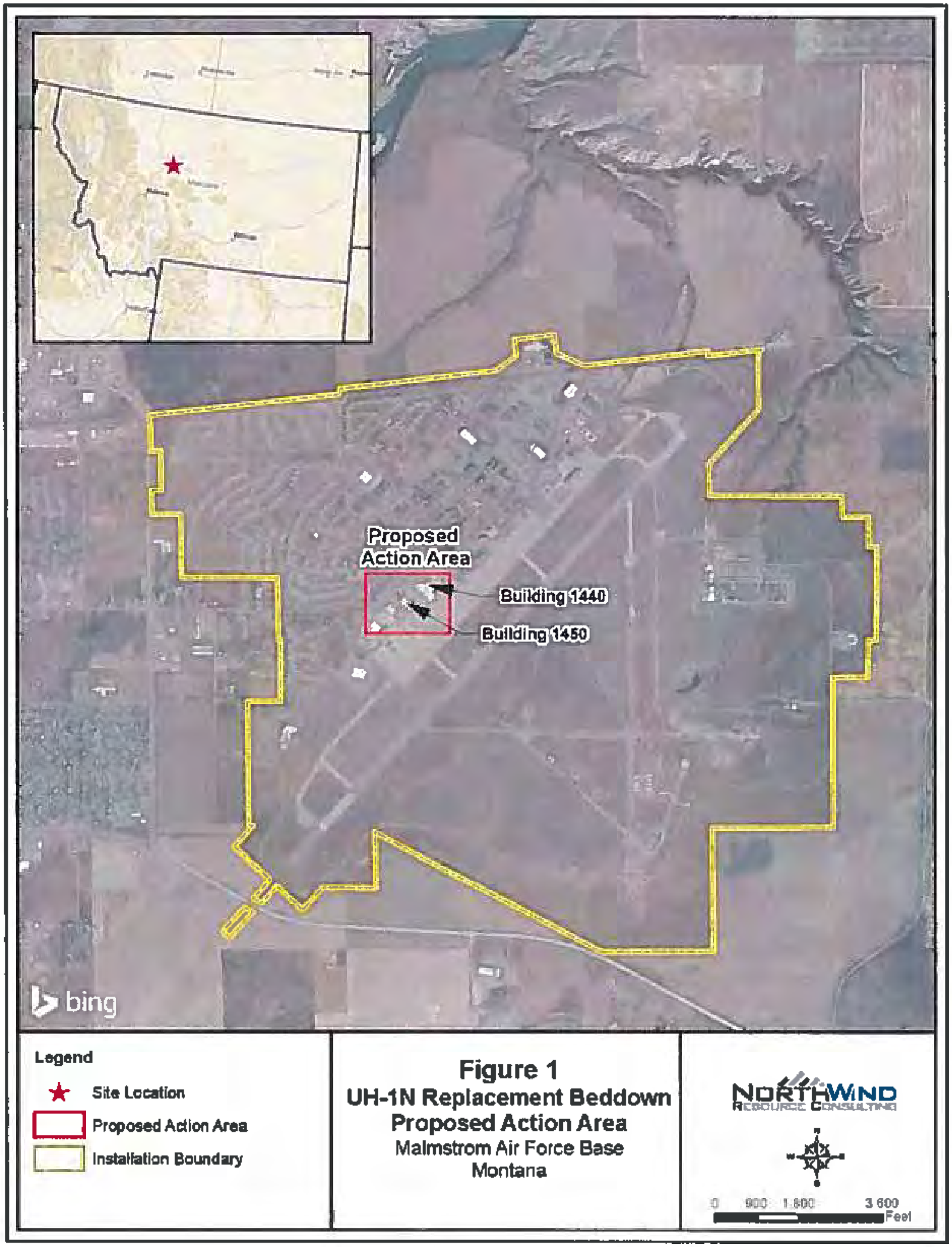
If you have any questions, please contact Mr. Tony Lucas, Installation Tribal Liaison Officer, at (406) 731-7794; tony.lucas@us.af.mil; or 39 78th Street North, Malmstrom AFB, MT 59402-7536. You may also contact Mr. Rob Brown, NEPA Program Manager, at (406) 731-7099 341, robert.brown.124@us.af.mil, or at the same mailing address as Mr. Lucas. Thank you in advance for your assistance in this effort.

Sincerely,

Tony Lucas, Installation Tribal Liaison Officer
Malmstrom AFB

Attachment 1: Description of Proposed Action and Alternatives
CC: Mr. John Murray, THPO

Attachment 1. Proposed Action Area



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 341ST MISSILE WING (AFGSC)

Mr. Tony Lucas, Installation Tribal Liaison Officer
341st Civil Engineer Squadron
39 78th Street North
Malmstrom AFB, MT 59402-7536

17 APR 20__

Honorable Floyd Azure
Chairman
Assiniboine and Sioux Tribes of the Fort Peck Reservation
PO Box 1027
501 Medicine Bear Road
Poplar, MT 59255-1027

Dear Chairman Azure,

The United States Air Force (USAF) is preparing an Environmental Assessment (EA) under the National Environmental Policy Act to evaluate potential environmental impacts associated with the proposed beddown of the Boeing MH-139 helicopter to replace the current fleet of Bell UH-1N "Huey" helicopters at Malmstrom Air Force Base (AFB), Montana. Per Section 306108 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 Code of Federal Regulations (CFR) Part 800, the USAF is evaluating various environmental concerns and engaging early with tribal governments as it formulates the undertaking.

The USAF is considering three alternatives to implement the Proposed Action. These alternatives are described in the attached Description of Proposed Action and Alternatives. The USAF has not yet selected a Preferred Alternative.

In accordance with the NHPA, the USAF would like to initiate government-to-government consultation regarding the UH-1N Replacement Beddown project. The USAF requests your input in identifying any issues or areas of concern you feel should be addressed in the environmental analysis. Additionally, please let us know if you believe this undertaking might adversely affect any historic properties of religious and cultural significance to the Assiniboine and Sioux Tribes. An electronic copy of the Draft EA will be provided when it is made available for public review and comment.

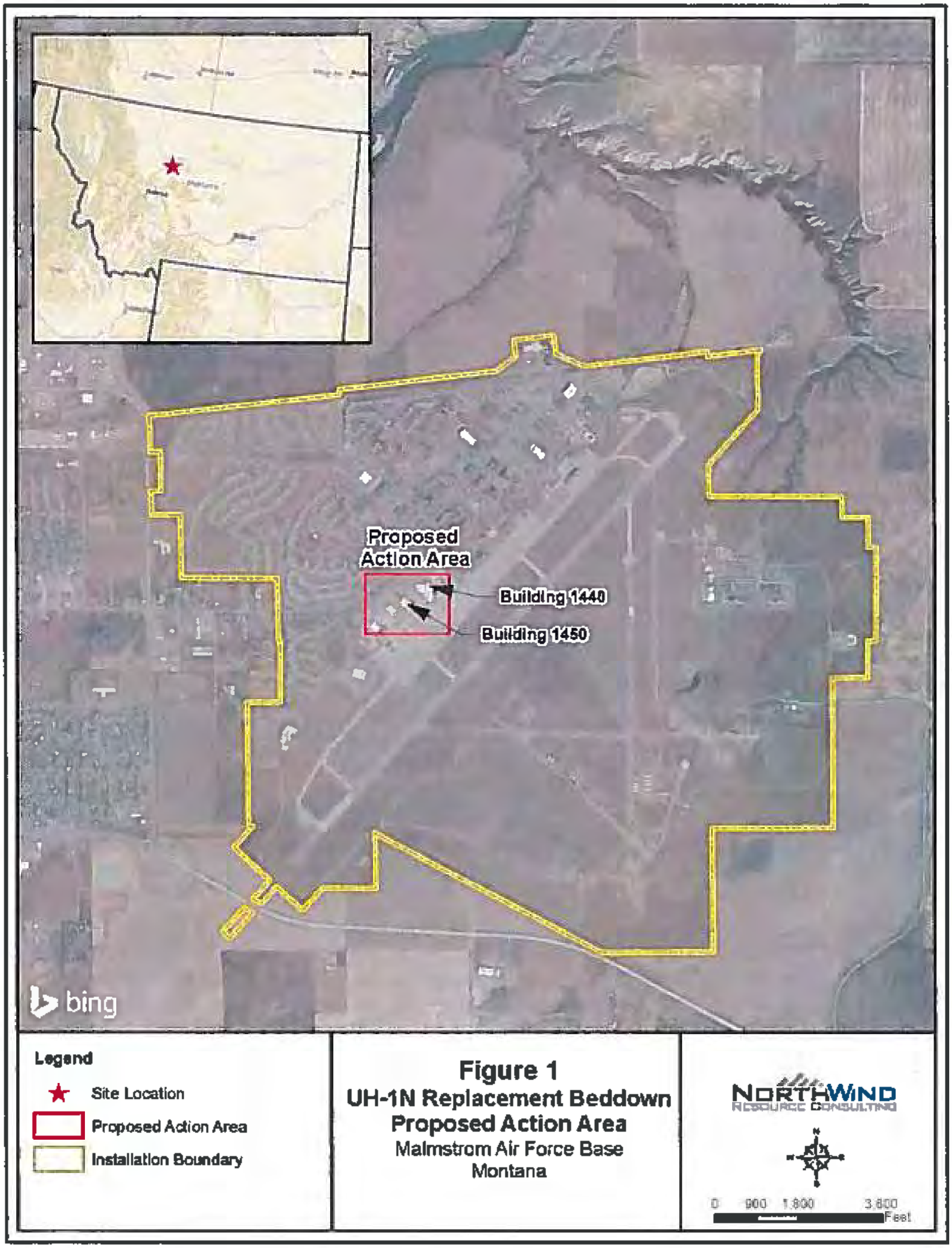
If you have any questions, please contact Mr. Tony Lucas, Installation Tribal Liaison Officer, at (406) 731-7794; tony.lucas@us.af.mil; or 39 78th Street North, Malmstrom AFB, MT 59402-7536. You may also contact Mr. Rob Brown, NEPA Program Manager, at (406) 731-7099 341, robert.brown.124@us.af.mil, or at the same mailing address as Mr. Lucas. Thank you in advance for your assistance in this effort.

Sincerely,

Tony Lucas, Installation Tribal Liaison Officer
Malmstrom AFB

Attachment 1: Description of Proposed Action and Alternatives
CC: Ms. Dyan Youpee, THPO

Attachment 1. Proposed Action Area



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A-1.5 Notice of Availability and Public Comments

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NOTICE OF AVAILABILITY

U.S. Air Force UH-1N Replacement Beddown
Malmstrom Air Force Base, Montana

The U.S Air Force is proposing to replace the current fleet of Bell UH-1N “Huey” helicopters with Boeing MH-139 helicopters and provide facilities to house and maintain the replacement aircraft. The proposed aircraft are required because *while the UH-1 is reliable and capable, it is a Vietnam-era aircraft that does not meet nuclear missile convoy escort and emergency security response mission requirements*. The U.S. Air Force has identified the need for a helicopter that is faster, quieter, more resilient, and has a higher payload capacity and extended range to handle the escort of convoys, missile field contingencies, transportation of government officials, and range support. *The MH-139 will meet the needs to secure and defend the nation’s ICBMs and provide continuity of government flights, training, testing, and operational support airlift.*

The U.S. Air Force has prepared an Environmental Assessment (EA) and Finding of No Significant Impact, (FONSI), pursuant to the National Environmental Policy Act (NEPA), that is available for public comment. The EA and FONSI evaluate the environmental impacts from the proposed beddown and renovations. The public comment period for the EA and FONSI is 30 days from the date of this posting.

The EA and FONSI can be reviewed online at https://www.malmstrom.af.mil/About-Us/Environmental-Resources/ and at the following libraries:

Great Falls Public Library
301 2nd Ave N
Great Falls, MT 59401

University of Providence Library
1301 20th St S
Great Falls, MT 59405

To submit comments, send an email to:
341CES.CEIE.NEPAWorkFlow@us.af.mil or
write to:
Robert Brown
39 78th St N
Malmstrom AFB MT 59406

Comments must be received by 04 November 2019 to be considered

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Appendix B.

Noise Model Operational Data Documentation

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Noise Model Operational Data Documentation for Malmstrom AFB, Great Falls, MT

Environmental Assessment for UH-1N Replacement Beddown

HMMH Report No. 310140.001

May 2019

Prepared for:

North Wind Resource Consulting
535 N. Pleasantburg Drive,
Suite 136
Greenville, SC 29607

Noise Model Operational Data Documentation for Malmstrom AFB, Great Falls, MT

Environmental Assessment for UH-1N Replacement Beddown

HMMH Report No. 310140.001
May 2019

Prepared for:

North Wind Resource Consulting
535 N. Pleasantburg Drive,
Suite 136
Greenville, SC 29607

Prepared by:

Joseph J. Czech PE

Jessie Rancourt

HMMH
300 South Harbor Boulevard, Suite 516
Anaheim, CA 92805-3717
T 310.738.5943

Executive Summary

This Noise Model Operational Data Documentation (NMODD) is in support of an Environmental Assessment (EA), pursuant to the National Environmental Policy Act (NEPA), for the proposed beddown by the US Air Force (USAF) of eleven (11) Augusta Westland MH-139 helicopters, replacing eight (8) Bell UH-1N Huey helicopters, at Malmstrom Air Force Base (AFB), in Great Falls, MT. By the end of Calendar Year (CY) 2023 (CY23), it is proposed that all eight (8) UH-1N helicopter would be gone, eight (8) of the MH-139 aircraft would be in operation and three (3) would be held in maintenance on standby.

Operational Scenarios Modeled

This NMODD considers two scenarios for the EA:

1. Baseline/No Action Alternative (referred to as simply "Baseline" for brevity) and

2. Proposed Action. The Proposed Action considers all based aircraft operations would be by the MH-139, with no activity by the UH-1N.

Modeling was accomplished with the Advanced Acoustic Model (AAM) and the legacy core program of the NOISEMAP suite (NMAP). AAM was used for flight operations. NMAP was used for static operations. Noise exposure was computed in terms of Day-Night Average Sound Level (DNL) for annual average daily operations. DNL contours of 65, 70 and 75 decibels (dB) are shown.

Interviews Conducted

Major Jeffrey S. Miser (jeffrey.miser@us.af.mil; AFGSC 40 HS/ADO) of the 40th Helicopter Squadron (40HS) provided the necessary updates to flight and static operations occurring at GFA. The USAF anticipates no change in the quantity of aircraft operations for the Proposed Action, by either based or transient aircraft.

Results Summary

The 65 DNL contour would remain within the base's boundary for the Proposed Action.

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Contents

Figures

Tables

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1 Modeling Overview

The International Civil Aviation Organization's (ICAO) abbreviation for Malmstrom AFB is KGFA, shortened to just "GFA" for brevity for the purposes of this NMODD.

1.1 Noise Metric and Levels of Significance

The noise contour methodology used herein is the Day-Night Average Sound Level (DNL) metric of describing the noise environment. Efforts to provide a national uniform standard for noise assessment have resulted in the U.S. Environmental Protection Agency adopting DNL as the standard noise descriptor for use in land use planning.

The DNL metric can be used to describe different types of sounds. Because human hearing picks up noise energy in certain frequency ranges better than others, sound energy in certain frequency bands is emphasized when measuring noise to best predict effects. For aircraft noise and most other types of sound, the frequencies most easily audible to humans are emphasized using a function known as A-weighting. Because A-weighting is prevalent, sounds can be assumed to be A-weighted unless otherwise specified.

The Air Force uses the DNL descriptor in assessing the amount of aircraft noise exposure and as a metric for community response to the various levels of exposure. The DNL values most commonly used for planning purposes are 65, 70, 75, and 80 decibels (dB). Land use guidelines are based on the compatibility of various land uses with these noise exposure levels. It is generally recognized that a noise environment descriptor should consider, in addition to the annoyance of a single event, the effect of repetition of such events and the time of day in which these events occur. DNL begins with a single-event descriptor and adds corrections for the number of events and the time of day. Since the primary development concern is residential, nighttime events are considered more annoying than daytime events and are weighted by a factor of 10. DNL values are computed from the single-event noise descriptor, plus corrections for number of flights and time of day (see Figure 1-1).

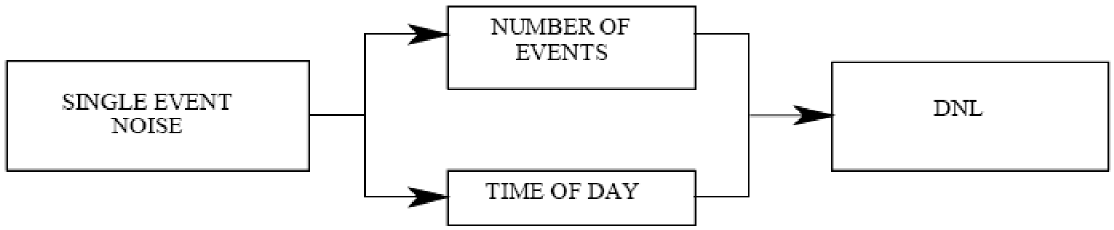

Figure 1-1. A-weighted Day-Night Average Sound Level

As part of the extensive data collection process, detailed information is gathered on the type of aircraft, time of day, and the number of flying operations for each flight track during a typical day. This information is used in conjunction with the single-event noise descriptor to produce DNL values. These values are combined on an energy summation basis to provide single DNL values for the mix of aircraft operations at the base. Equal value points are connected to form the contour lines.

1.2 Computer Noise Model

Data describing flight track distances and turns, altitudes, airspeeds, power settings, flight track operational utilization, maintenance locations, ground run-up engine power settings, and number and duration of runs by type of aircraft/engine are assembled. Trained personnel process the data for input into the NOISEMAP computer program. Aircraft operations parameters are reviewed for accuracy by operational unit points of contact prior to running the noise model.

Table 1-1 lists the computerized noise models used for this NMODD and pertinent modeling parameters discussed herein. The models used are described briefly below.

NOISEMAP is a suite of computer programs and components developed by the US Department of Defense to predict noise exposure near an airfield due to aircraft flight, maintenance, and ground run-up operations. The components of NOISEMAP are as follows:

- BASEOPS is the input module for NOISEMAP and is used to enter detailed aircraft flight track and profile and ground maintenance operational data.
- NOISEFILE is a comprehensive database of measured military and civil aircraft noise data. Aircraft operational information is matched with the noise measurements in NOISEFILE after the detailed aircraft flight and ground maintenance operational data have been entered into BASEOPS.
- NMAP and AAM (the Advanced Acoustics Model) are the core computational modules in NOISEMAP. NMAP and AAM take BASEOPS input and uses the NOISEFILE database to calculate the noise levels caused by aircraft events at specified grid points in the airbase vicinity. The output of NMAP is a series of georeferenced data points, specific grid point locations, and corresponding noise levels.
- NMPLOT is the program for viewing and editing the sets of georeferenced data points. NMPLOT plots the NMAP output from the aforementioned noise contour grid and can export the noise contours as files used in mapping programs for analyzing the noise impacts.

For the purposes of this project, AAM was used for flight operations. NMAP was used for static operations. Noise exposure was computed in terms of Day-Night Average Sound Level (DNL) for annual average daily operations. DNL contours of 65, 70 and 75 decibels (dB) are shown.

The airframes involved in the Baseline and Proposed Action scenarios are not available in the AAM's or NMAP's databases. The Baseline UH-1N flight operations were modeled with AAM's AH-1W Super Cobra. The proposed MH-139 flight operations were modeled with AAM's SH-60B Seahawk. The static operations were modeled with NMAP's UH-1M Iroquois Huey and its UH-60A Blackhawk. The suite's BaseOps and NMPlot programs were used to compute grids of DNL from NMAP and AAM and logarithmically sum each noise grid to compute the resultant DNL contours, respectively.

The airfield modeling uses a local coordinate system with the origin at the GFA Airfield Reference Point (ARP), which has geographical coordinates of 47.506024° North / 111.18976° West and an elevation of 3,478 feet above Mean Sea Level (MSL). The current magnetic declination is 12.4º East. All maps in this report depict a north arrow pointing to true north.

Table 1-1 Noise Models and Parameters

Aircraft Noise Models			
Software	Analysis		Version
Advanced Acoustic Model (AAM)	AH-1W (UH-1N surrogate) flight noise SH-60B (MH-139 surrogate) flight noise (see note 1)		2.0
NMAP	UH-1M (UH-1N surrogate) and UH-60A (MH-139 surrogate) run-up noise		7.3
Modeling Parameters			
Modeling Parameter			Description
Receiver Grid Spacing			500 ft in x and y
Modeled flying days			365
Magnetic Declination			12.4 deg East
Reference Point Elevation			3,478 ft MSL
Topography (source unknown; see note 2)			
Elevation and Impedance Grid Spacing			500 ft in x and y
Flow Resistivity of Land Areas (soft)			225 kPa-s/m^2
Flow Resistivity of Water Areas (hard)			100,000 kPa-s/m^2
Weather (modeled condition chosen by BaseOps program highlighted; Malmstrom AFB 1988-2017)			
Month	Temperature (deg F)	Relative Humidity (%)	Pressure (inHg)
January	26.8	62.1	1013.80
February	29.6	59.4	1014.02
March	27.8	55.4	1012.50
April	46.2	53.5	1012.39
May	54.3	55.4	1013.55
June	62.9	54.3	1006.33
July	71.0	44.8	1015.60
August	69.0	43.9	1015.98
September	59.7	43.4	1015.98
October	48.3	54.6	1015.08
November	36.6	56.6	1013.36
December	27.9	59.8	1012.57

Notes:

1) permission to use NCfiles for each of these airframes obtained from NAVFAC HQ (Danesi 2018)

2) Elevation and impedance files from AFCEC's 2014 modeling of Malmstrom AFB

The modeling used the topography data files from the Air Force Civil Engineer Center's (AFCEC) 2014 work for a potential update of Malmstrom AFB's Air Installation Compatible Use Zone (AICUZ) study[1]. AFCEC's files had grid spacings of 500 feet and were presumably based on data obtained from the US Geological Survey. AFCEC specified areas of land as acoustically "soft" surfaces, with a flow resistivity of 225 kPa-s/m^2, and bodies of water as "hard" surface, with a flow resistivity of 100,000 kPa-s/m^2. No large bodies of water exist near GFA.

[1] Electronic mail from Robert Brown, GS-12 AFGSC 341 CES/CEIE, to Brandon Robinette and Joseph Czech, HMMH, re: "Data Needs => EA for the UH-1N Replacement Beddown at Malmstrom AFB", October 15, 2018.

Local weather conditions (e.g., temperature, relative humidity, and air pressure) influence how quickly sound is absorbed by the atmosphere as it travels outward from its source. This report utilized detailed daily average weather conditions for each month from GFA. Average daily temperature and relative humidity values are plotted in Figure 1-2. The average temperatures for summer months (May to September) and winter months (October to April) are 63°F and 35°F, respectively, and the average temperature overall is 47°F. Relative humidity for the same periods over the course of an entire day are 48 percent for the summer months and 57 percent for winter months. The NOISEMAP suite's BaseOps program computes absorption coefficients for each month and selects the median coefficient to use in the noise exposure modeling (U.S. Air Force 1992). The modeled conditions selected by the BaseOps program correspond to the month of August with a temperature of 69°F and a relative humidity of nearly 44 percent.

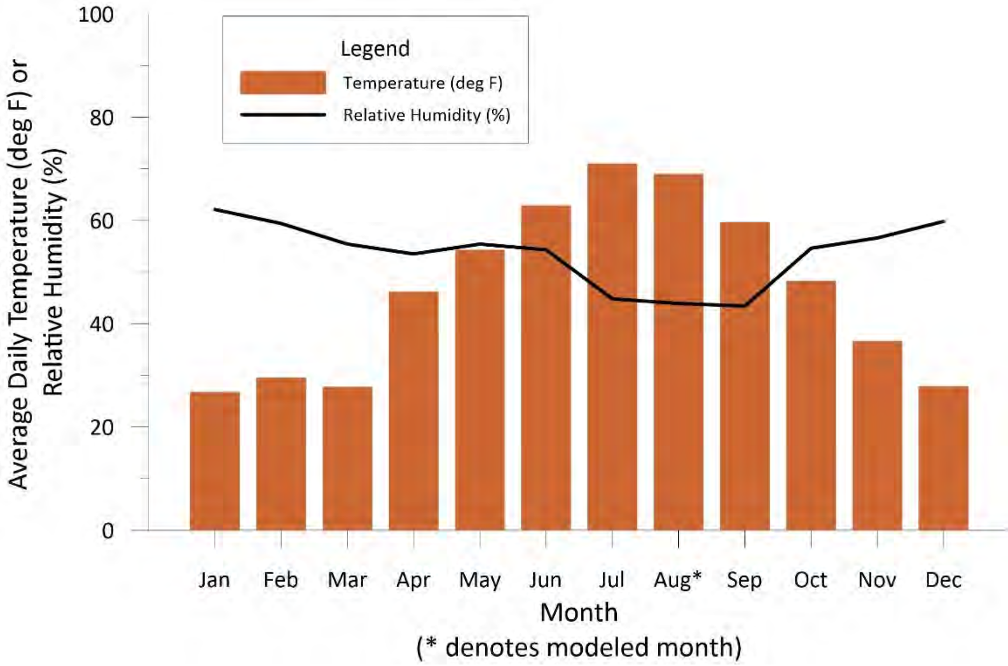

Figure 1-2. Average Daily Temperature and Relative Humidity for Each Month

2 Flight Operations

Table 2-1 summarizes the annual flight operations. The 40th Helicopter Squadron (HS) contributes nearly all of the annual flight operations at GFA. Transient operations were not modeled for any scenario due to their lack of significant contribution to the overall DNL. The Baseline operations total nearly 7,600. The No Action scenario would be identical to the Baseline scenario. The Proposed Action scenario would be identical to the No Action and Baseline scenarios except the aircraft type would be the MH-139, instead of the UH-1N.

The 40th HS indicated 20 percent of their annual departure and arrival operations are during the DNL nighttime period (2200-0700).

Table 2-1 Summary of Annual Flight Operations, by Scenario

			Baseline			No Action			Proposed Action		
Squadron/ Unit	PAA	Representing Aircraft Type	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total
40th HS	8	UH-1N	7,114	452	7,566	7,114	452	7,566			
	11	MH-139							7,114	452	7,566
Transient		CH-47	2	-	-	2	-	2	2	-	2
		UH-60	2	-	-	2	-	2	2	-	2
Total			7,118	452	7,566	7,118	452	7,570	7,118	452	7,570

Table 2-2 shows the UH-1N/MH-139's annual flight operations in greater detail. The operation subtypes listed in the table pertain to the modeled flight tracks depicted in Section 3. The 40th HS indicated less than 1 percent of their annual closed pattern operations are during the DNL nighttime period (2200-0700). None of their practice emergency closed operations are during the DNL nighttime period.

Table 2-2 Annual Flight Operations by Type and Subtype

Operation Type	subtype1	subtype2	Annual Flight Operations: Day (0700-2200)	Night (2200-0700)	Total
Departure	Southwest		125	31	156
	South1		88	22	110
	South2		88	22	110
	Cat1/Convoy		292	73	365
	Mountains		117	29	146
	Northwest		125	31	156
Arrival	Southwest		125	31	156
	South1		88	22	110
	South2		88	22	110
	Cat1/Convoy		292	73	365
	Mountains		117	29	146
	Northwest		125	31	156
Closed Pattern*	Local VFR	Tight	386	30	416
		Avoid	86	6	92
		West	10	-	10
	Emergency	Autorotation	1,850	-	1,850
		Other	2,960	-	2,960
	Tactical		104	-	104
Hover Checks			48	-	48
Subtotals and Grand Total					
Departure			835	208	1,043
Arrival			835	208	1,043
Closed Pattern*			5,396	36	5,432
Hover			48	-	48
TOTAL			**7,114**	**452**	**7,566**

*Shown as two operations for each circuit

3 Flight Tracks and their Utilization

The flight tracks shown in this section represent actual ground paths followed by aircraft flying to and from Malmstrom AFB runways/helipads. It is fully recognized that flying operations, particularly when conducted under Visual Flight Rules (VFR), vary from one operation to the next even when conducting the same procedure. Variations may be a result of winds, other air traffic, pilot preference, or a multitude of other factors. Instrument Landing System (ILS) operations have less variability.

Departure flight operations occur only from the “Pedro Pad”. Arrivals are to either the “Pedro Pad”, the “Paved Slide Area” or the “Grass Slide Area”. Figures 3-1 through 3-6 show the modeled departure and arrival flight paths, grouped by their mission/type, e.g., “Northwest” listed in Table 2-2 above.

Figures 3-7 through 3-12 show the modeled closed pattern flight tracks, grouped similarly to the operations in Table 2-2.

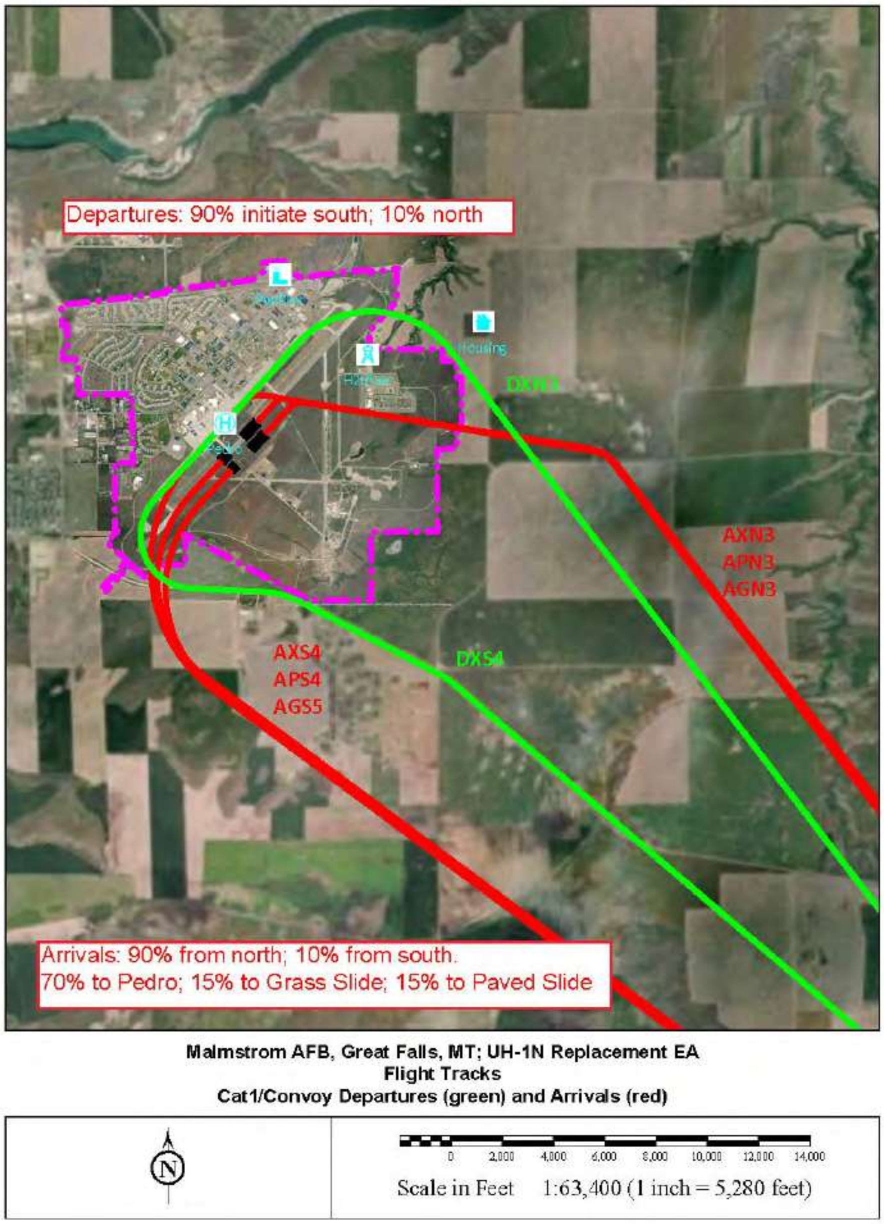

Figure 3-1. Cat1/Convoy Departures and Arrivals

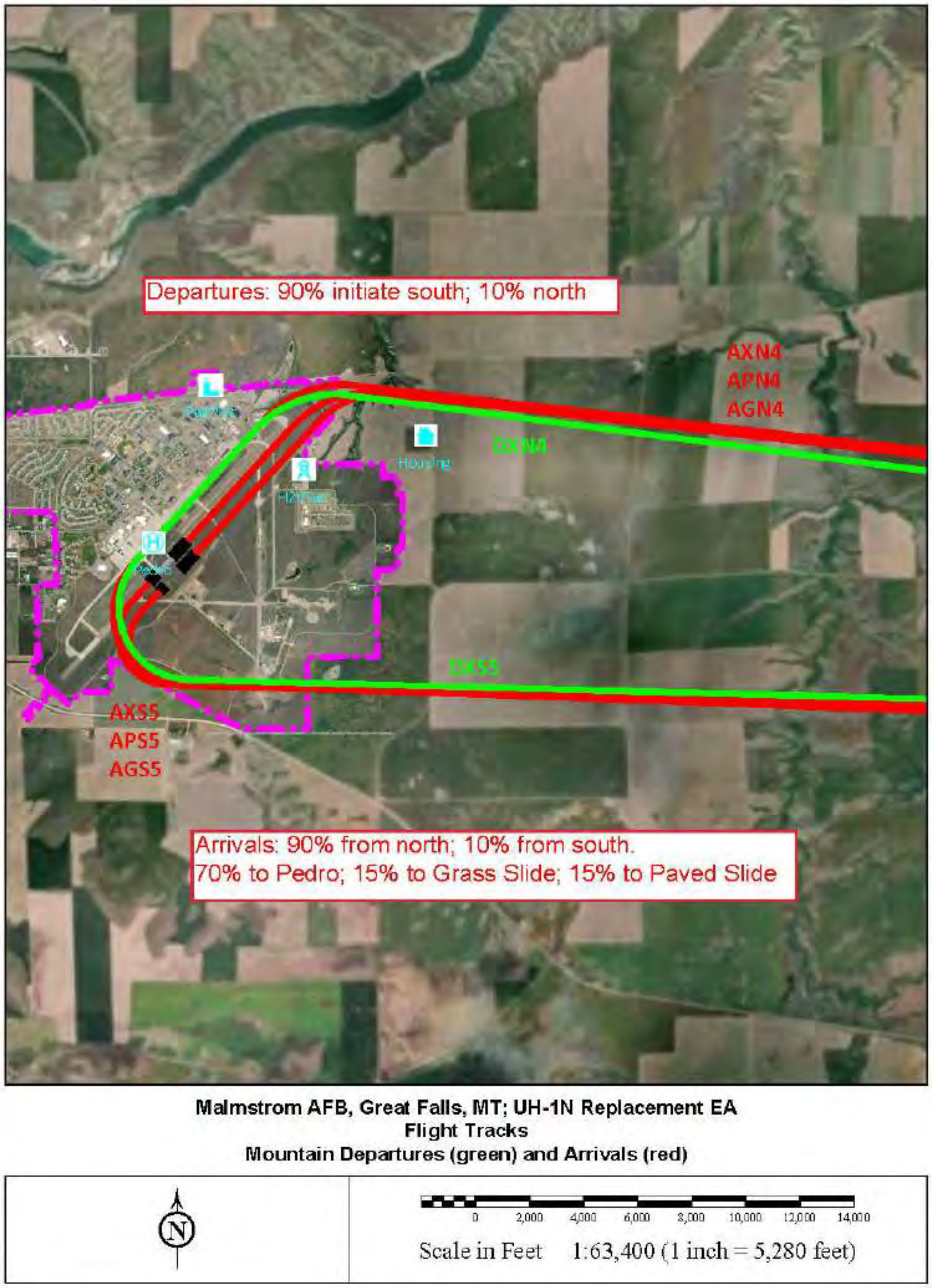

Figure 3-2. Mountain Departures and Arrivals

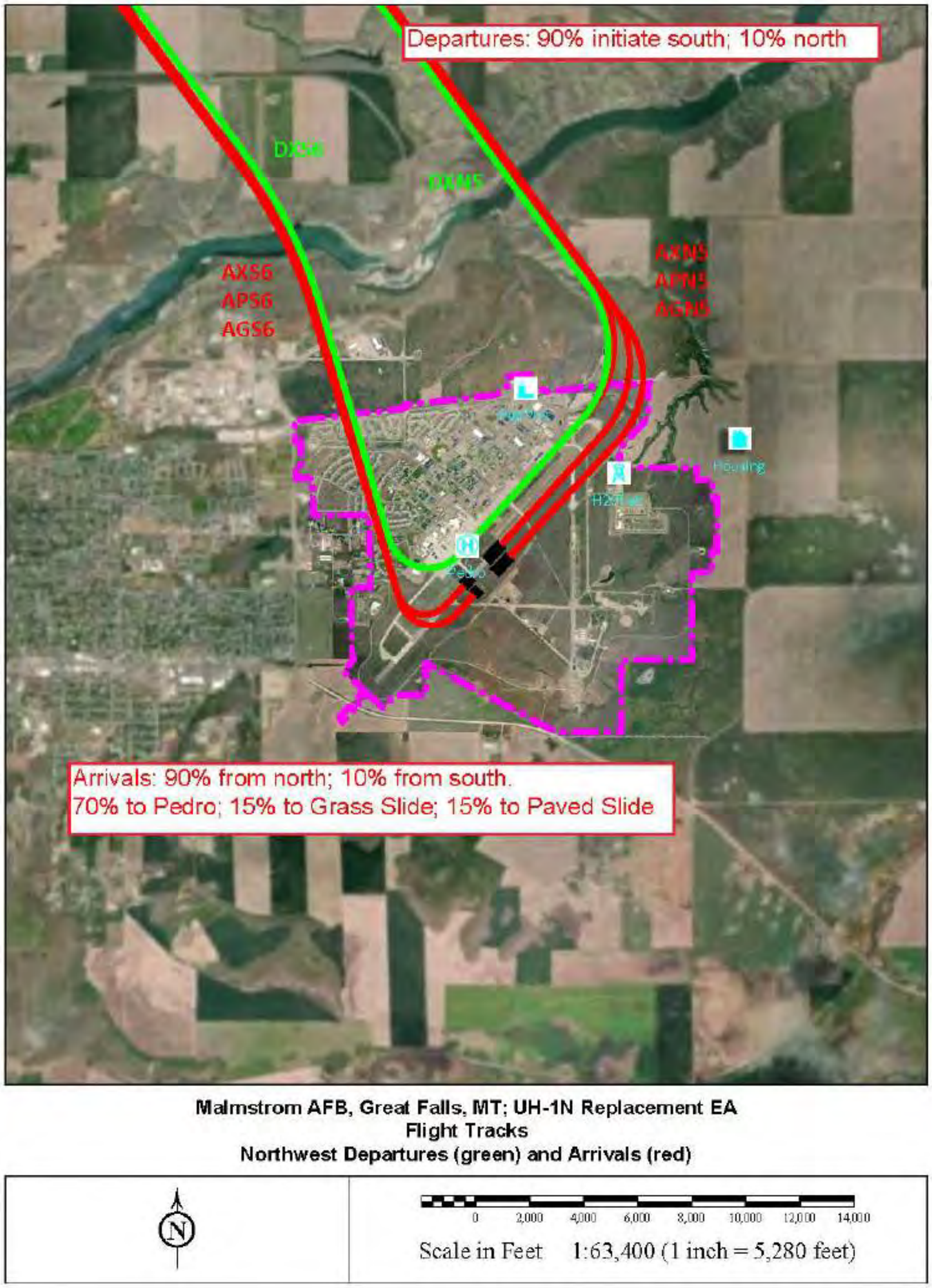

Figure 3-3. Northwest Departures and Arrivals

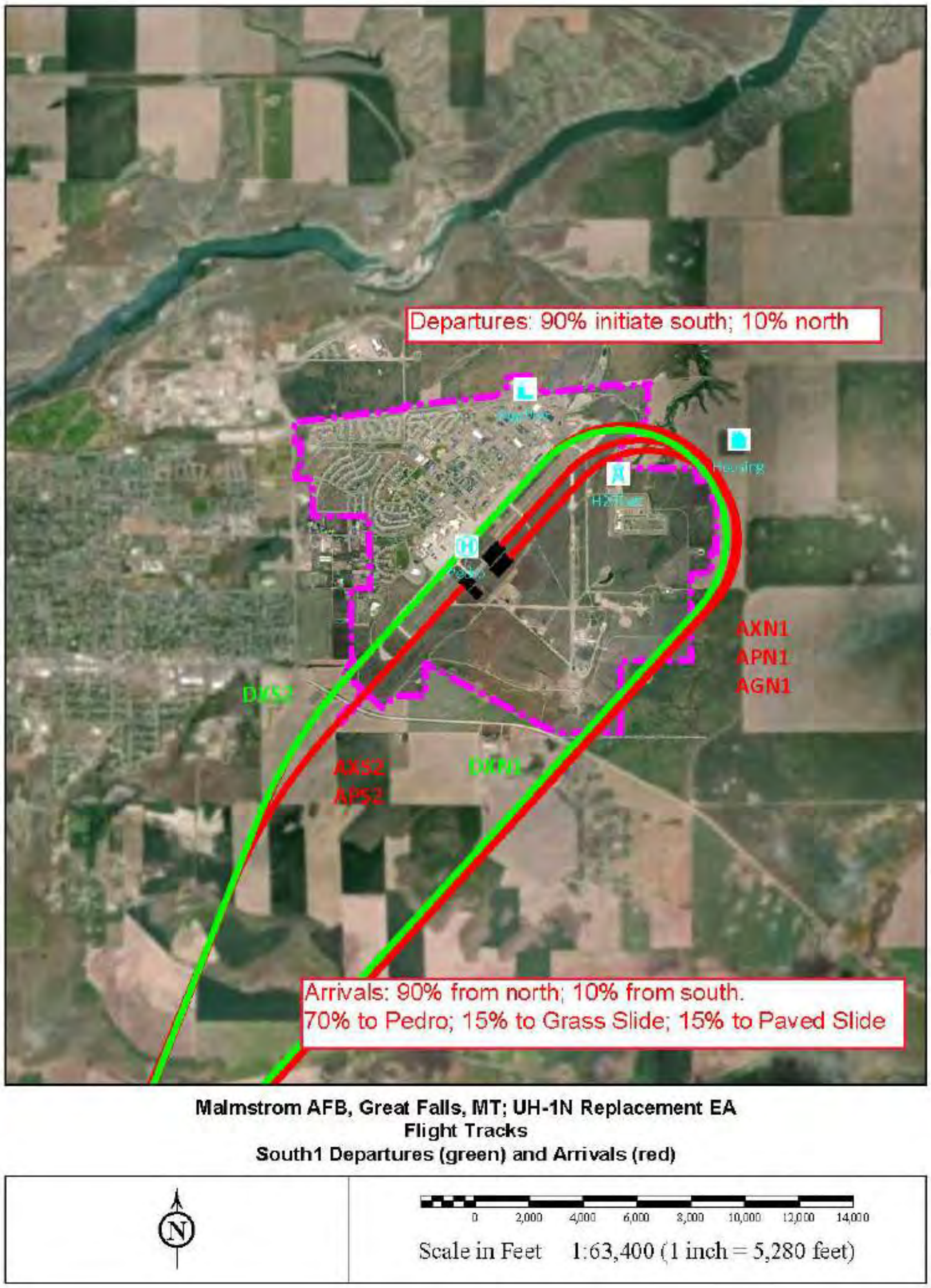

Figure 3-4. South1 Departures and Arrivals

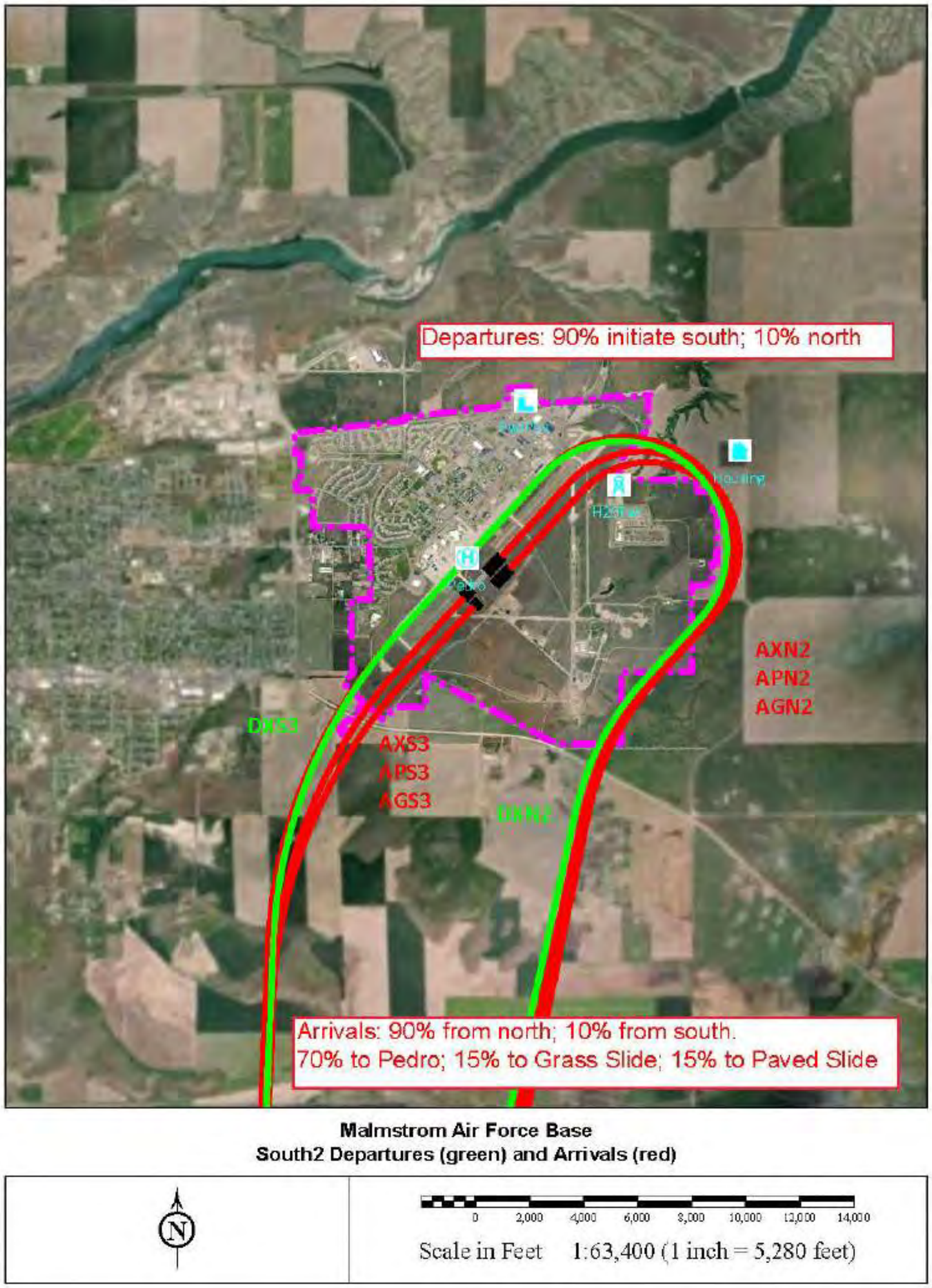

Figure 3-5. South2 Departures and Arrivals

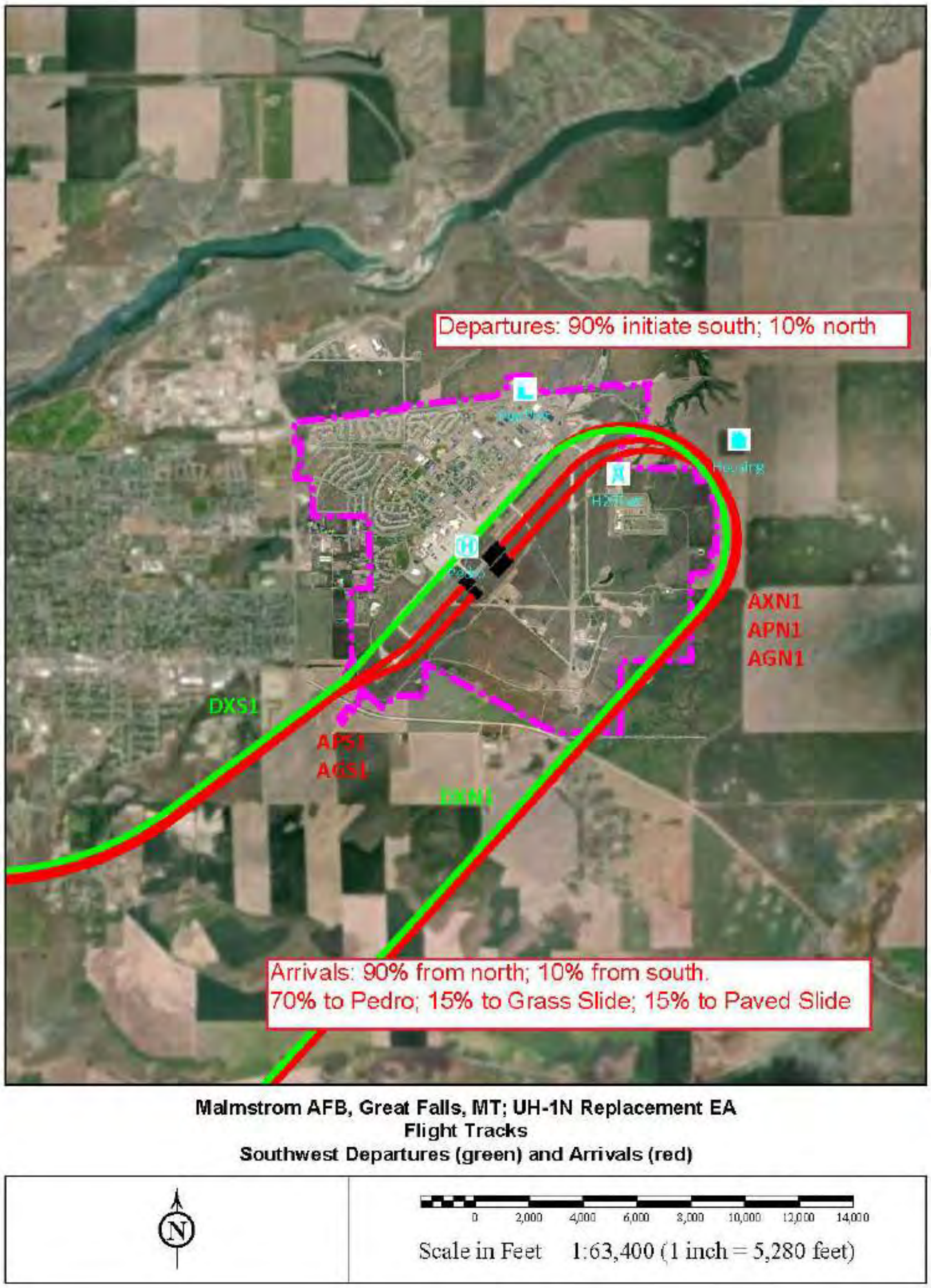

Figure 3-6. Southwest Departures and Arrivals

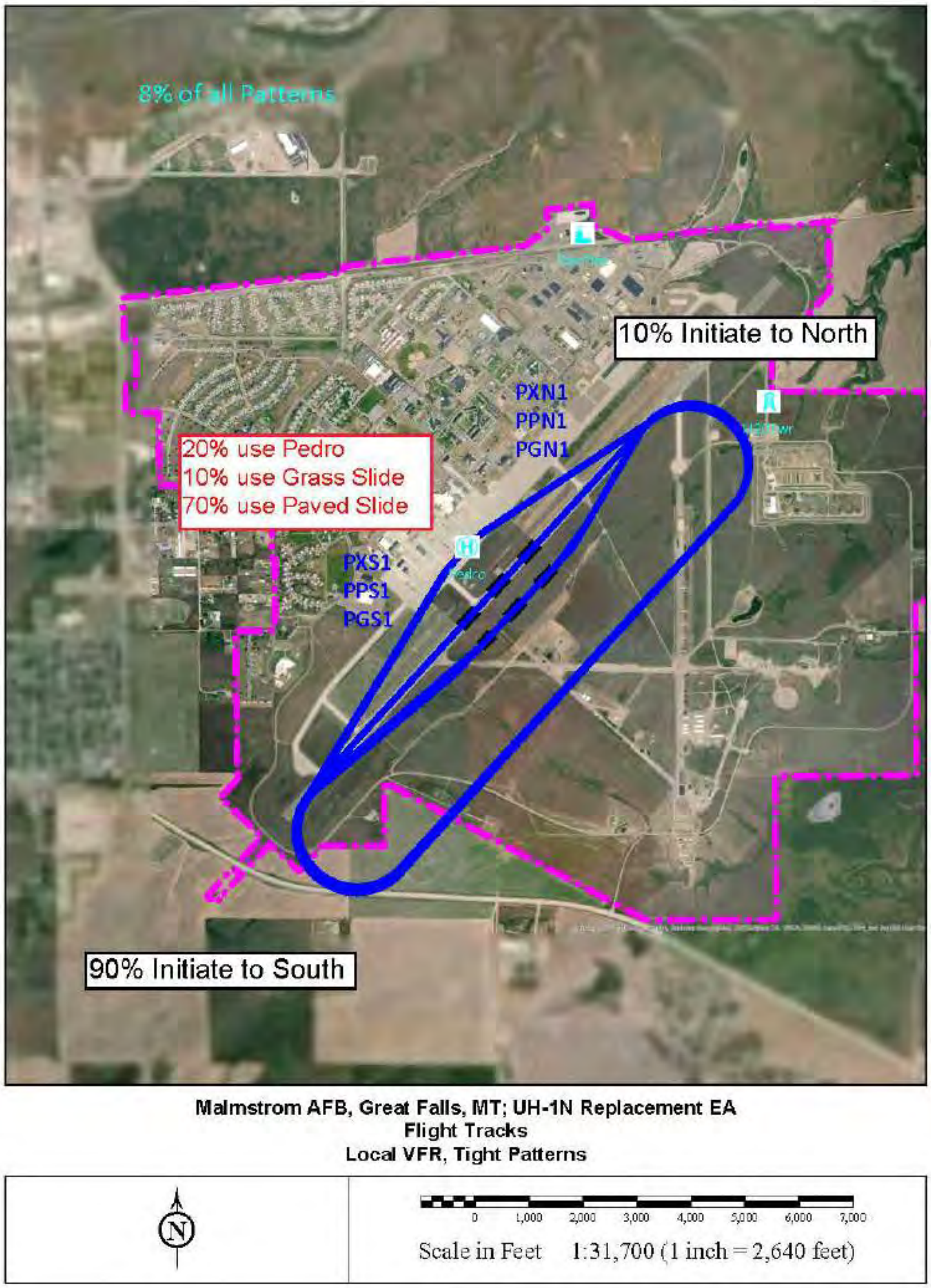

Figure 3-7. Local VFR (Tight) Patterns

Figure 3-8. Local VFR (Avoid) Patterns

Figure 3-9. Local VFR (West) Patterns

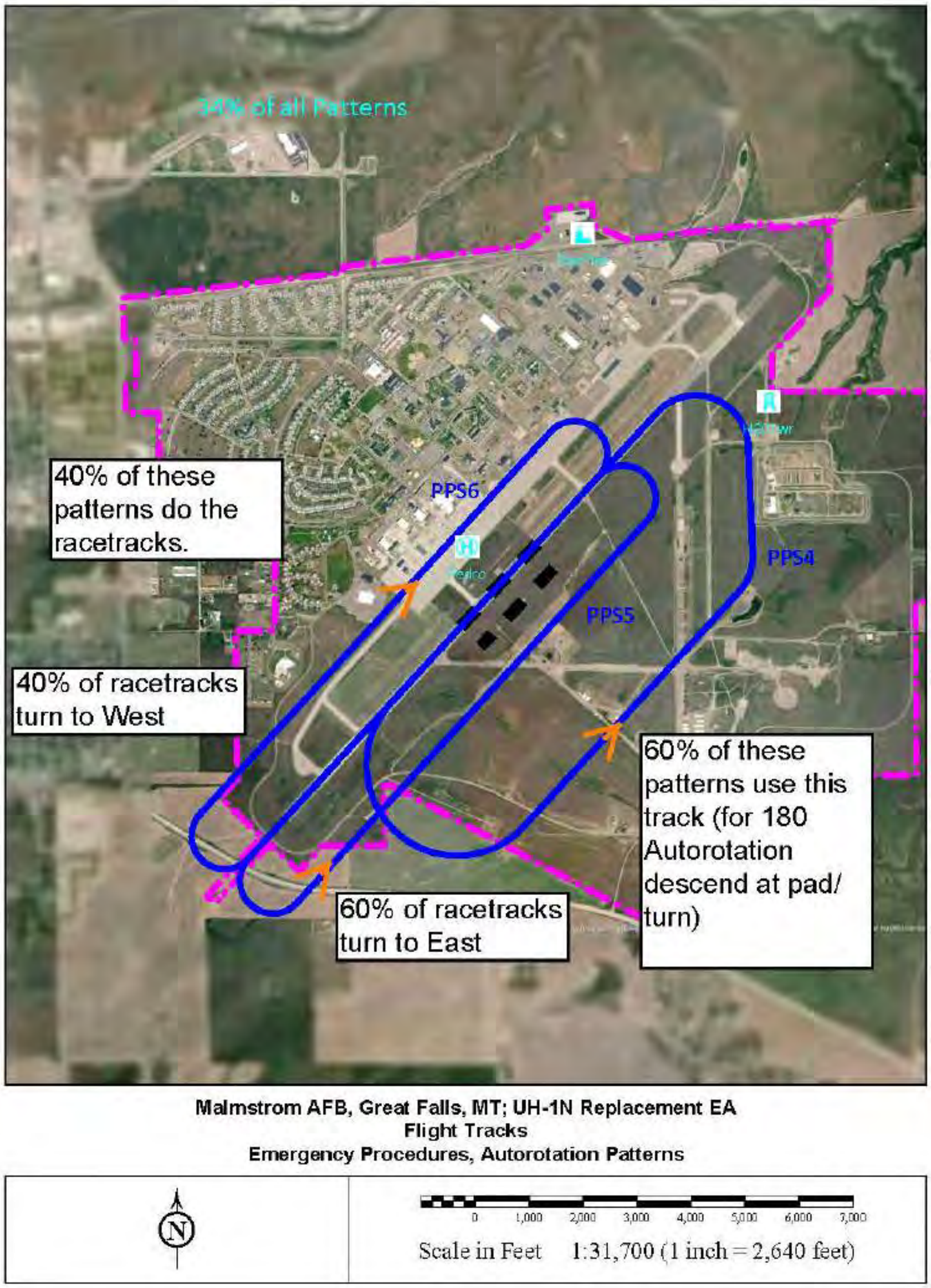

Figure 3-10. Emergency Procedure Patterns for Autorotations

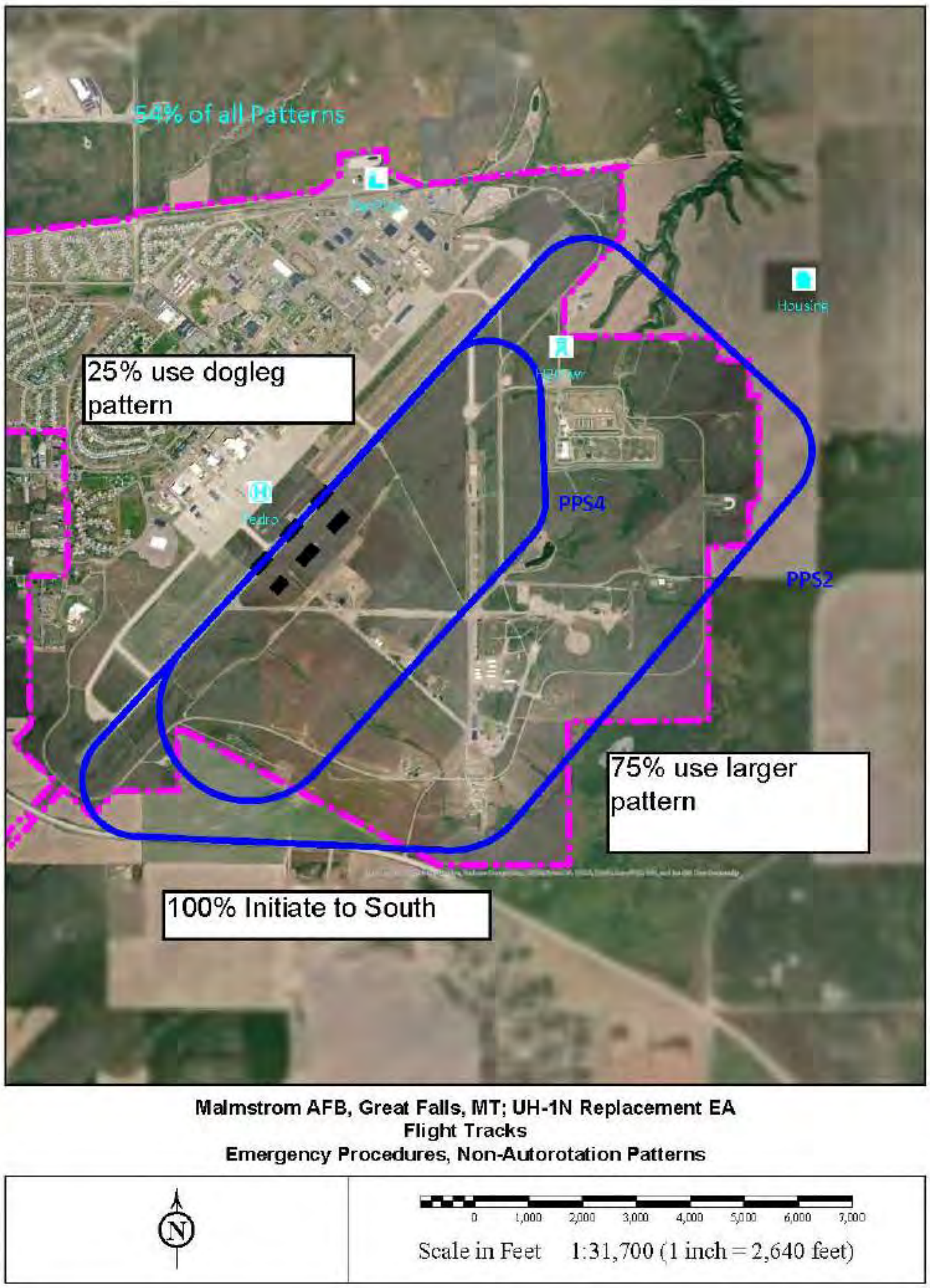

Figure 3-11. Emergency Procedure Patterns for Non-Autorotations

Figure 3-12. Tactical Patterns

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4 Flight Profiles and their Utilization

Profiles data, i.e., altitude, speed and aircraft attitude (essentially roll, pitch and yaw), were provided by Malmstrom AFB via the data collection process (interview and follow-up data validation) through the use of *representative* profiles. Representative profiles consisted of those profiles with most operations for each type of operation and mission, allowing for any profile variation. The only profile variation was for arrivals from the missions of Cat1/Convoy, Mountains, Northwest, and South2, which had a 'normal' altitude profile and a 'low' altitude profile. Malmstrom AFB confirmed that the representative profiles could be copied to flight tracks of similar mission/operation type, allowing for changes in track geometry.

In terms of profile utilization, departures had only one profile per track. Arrivals for the Southwest and South1 missions had only one profile per track. As previously mentioned, arrivals for Cat1/Convoy, Mountains, Northwest and South2 had two types of profiles ('normal' and 'low' altitudes) whose operations were validated to be equally split among the two profile types. Patterns had only one profile per track, except track PPS2 was applicable to the Local VFR (Avoid) Pattern and the Emergency Procedure (non-autorotation) Avoid Pattern.

Tables 4-1 through 4-3 show the modeled average DNL daytime and nighttime daily events modeled for each flight profile. The representative profiles have red-boxed IDs in these tables. The events shown in these tables were computed by the following steps:

a) Dividing the operations shown in Table 2-2 by 365 (per Table 1-1),

b) Further dividing the closed pattern operations by 2,

c) Multiplying the results from (a) and (b) by the percentages shown in Tables 4-1 through 4-3 for corresponding missions.

The events are shown (and modeled) rounded to the nearest 4th decimal place.

Table 4-1 Modeled Average Daily Departure Flight Events and Track/Profile IDs (all from Pedro Pad)

Mission	Initial Departure Direction	%	Track ID	Profile ID	Daytime (0700-2200) Events	Nighttime (2200-0700) Events
Southwest	North	10%	DXN1	108	0.0342	0.0085
	South	90%	DXS1	111	0.3082	0.0764
South 1	North	10%	DXN1	108	0.0241	0.0060
	South	90%	DXS2	107	0.2170	0.0542
South 2	North	10%	DXN2	110	0.0241	0.0060
	South	90%	DXS3	109	0.2170	0.0542
Cat1/Convoy	North	10%	DXN3	102	0.0800	0.0200
	South	90%	DXS4	101	0.7200	0.1800
Mountains	North	10%	DXN4	104	0.0321	0.0079
	South	90%	DXS5	103	0.2885	0.0715
Northwest	North	10%	DXN5	106	0.0342	0.0085
	South	90%	DXS6	105	0.3082	0.0764

Table 4-2 Modeled Average Daily Arrival Flight Events and Track/Profile IDs

Mission	Pad / Runway	%	Landing Direction	%	Track ID	Altitude	%	Profile ID	Daytime (0700-2200) Events	Nighttime (2200-0700) Events
Southwest	Pedro	70%	North	90%	AXN1	normal	100%	143	0.2158	0.0535
			South	10%	AXS1	normal	100%	153	0.0240	0.0059
	Grass Slide Area	15%	North	90%	AGN1	normal	100%	139	0.0462	0.0115
			South	10%	AGS1	normal	100%	151	0.0051	0.0013
	Paved Slide Area	15%	North	90%	APN1	normal	100%	141	0.0462	0.0115
			South	10%	APS1	normal	100%	152	0.0051	0.0013
South 1	Pedro	70%	North	90%	AXN1	normal	100%	143	0.1519	0.0380
			South	10%	AXS2	normal	100%	144	0.0169	0.0042
	Grass Slide Area	15%	North	90%	AGN1	normal	100%	139	0.0325	0.0081
			South	10%	AGS2	normal	100%	140	0.0036	0.0009
	Paved Slide Area	15%	North	90%	APN1	normal	100%	141	0.0325	0.0081
			South	10%	APS2	normal	100%	142	0.0036	0.0009
South 2	Pedro	70%	North	90%	AXN2	normal	50%	149	0.0759	0.0190
			North	90%	AXN2	low	50%	149L	0.0759	0.0190
			South	10%	AXS3	normal	100%	150	0.0169	0.0042
	Grass Slide Area	15%	North	90%	AGN2	normal	50%	145	0.0163	0.0041
			North	90%	AGN2	low	50%	145L	0.0163	0.0041
			South	10%	AGS3	normal	100%	146	0.0036	0.0009
	Paved Slide Area	15%	North	90%	APN2	normal	50%	147	0.0163	0.0041
			North	90%	APN2	low	50%	147L	0.0163	0.0041
			South	10%	APS3	normal	100%	148	0.0036	0.0009
Cat1/Convoy	Pedro	70%	North	90%	AXN3	normal	50%	125	0.2520	0.0630
			North	90%	AXN3	low	50%	125L	0.2520	0.0630
			South	10%	AXS4	normal	100%	126	0.0560	0.0140
	Grass Slide Area	15%	North	90%	AGN3	normal	50%	121	0.0540	0.0135
			North	90%	AGN3	low	50%	121L	0.0540	0.0135
			South	10%	AGS4	normal	100%	122	0.0120	0.0030
	Paved Slide Area	15%	North	90%	APN3	normal	50%	123	0.0540	0.0135
			North	90%	APN3	low	50%	123L	0.0540	0.0135
			South	10%	APS4	normal	100%	124	0.0120	0.0030
Mountains	Pedro	70%	North	90%	AXN4	normal	50%	131	0.1010	0.0250
			North	90%	AXN4	low	50%	131L	0.1010	0.0250
			South	10%	AXS5	normal	100%	132	0.0224	0.0056
	Grass Slide Area	15%	North	90%	AGN4	normal	50%	127	0.0216	0.0054
			North	90%	AGN4	low	50%	127L	0.0216	0.0054
			South	10%	AGS5	normal	100%	128	0.0048	0.0012
	Paved Slide Area	15%	North	90%	APN4	normal	50%	129	0.0216	0.0054
			North	90%	APN4	low	50%	129L	0.0216	0.0054
			South	10%	APS5	normal	100%	130	0.0048	0.0012
Northwest	Pedro	70%	North	90%	AXN5	normal	50%	137	0.1079	0.0268

Mission	Pad / Runway	%	Landing Direction	%	Track ID	Altitude	%	Profile ID	Daytime (0700-2200) Events	Nighttime (2200-0700) Events
			North	90%	AXN5	low	50%	137L	0.1079	0.0268
			South	10%	AXS6	normal	100%	138	0.0240	0.0059
	Grass Slide Area	15%	North	90%	AGN5	normal	50%	133	0.0231	0.0057
			North	90%	AGN5	low	50%	133L	0.0231	0.0057
			South	10%	AGS6	normal	100%	134	0.0051	0.0013
	Paved Slide Area	15%	North	90%	APN5	normal	50%	135	0.0231	0.0057
			North	90%	APN5	low	50%	135L	0.0231	0.0057
			South	10%	APS6	normal	100%	136	0.0051	0.0013

Table 4-3 Modeled Average Daily Closed Pattern Flight Events and Track/Profile IDs

Mission / Pattern Type	Location	%	Sub-Mission	Description	%	Track ID	Profile ID	Daytime (0700-2200) Events	Nighttime (2200-0700) Events
Local VFR Traffic Patterns	Pedro	20%	Tight Pattern	Initiate to North	10%	PXN1	175	0.0106	0.0008
				Initiate to South	90%	PXS1	176	0.0952	0.0074
	Paved Slide Area	70%		Initiate to North	10%	PPN1	173	0.0370	0.0029
				Initiate to South	90%	PPS1	174	0.3331	0.0259
	Grass Slide Area	10%		Initiate to North	10%	PGN1	171	0.0053	0.0004
				Initiate to South	90%	PGS1	172	0.0476	0.0037
	Pedro	20%	Avoid Pattern	Initiate to North	10%	PXN2	181	0.0024	0.0002
				Initiate to South	90%	PXS2	182	0.0212	0.0015
	Paved Slide Area	70%		Initiate to North	10%	PPN2	179	0.0082	0.0006
				Initiate to South	90%	PPS2	180	0.0742	0.0052
	Grass Slide Area	10%		Initiate to North	10%	PGN2	177	0.0012	0.0001
				Initiate to South	90%	PGS2	178	0.0106	0.0007
	Pedro	20%	West Pattern	Initiate to North	10%	PXN3	187	0.0003	0.0000
				Initiate to South	90%	PXS3	188	0.0025	0.0000
	Paved Slide Area	70%		Initiate to North	10%	PPN3	185	0.0010	0.0000
				Initiate to South	90%	PPS3	186	0.0086	0.0000
	Grass Slide Area	10%		Initiate to North	10%	PGN3	183	0.0001	0.0000
				Initiate to South	90%	PGS3	184	0.0012	0.0000
Emergency Procedures	Paved Slide Area	100%	Auto-Rotation	180 AR-descend at pad	12%	PPS4	189	0.3041	0.0000
				180 AR descend at turn	48%	PPS4	189	1.2164	0.0000
				90° East Patt	24%	PPS5	190	0.6082	0.0000
				90° West Patt	16%	PPS6	191	0.4055	0.0000
			Non-Auto Rotation	Avoid Pattern	75%	PPS2	180	3.0411	0.0000
				Dogleg Pattern	25%	PPS4	192	1.0137	0.0000
Tactical Pattern		100%	n/a	East, Initiate to North	81%	PGS4N	193	0.1154	0.0000
				West, Initiate to North	9%	PGN4N	194	0.0128	0.0000

Mission / Pattern Type	Location	%	Sub-Mission	Description	%	Track ID	Profile ID	Daytime (0700-2200) Events	Nighttime (2200-0700) Events
	Grass Slide Area			East, Initiate to South	9%	PGS4S	195	0.0128	0.0000
				West, Initiate to South	1%	PGN4S	196	0.0014	0.0000

Maps of all flight profiles, including the representative profiles, are contained in Appendix A.

5 Maintenance and Pre-Flight Run-up Operations and Locations

Tables 5-1 and 5-2 list the modeled maintenance and pre-flight run-up operations as provided by the 40th HS. These would apply to all scenarios for the EA, changing only the aircraft type from UH-1N to MH-139 (modeled surrogates of UH-1M to UH-60A). Modeled average daily events were assigned to each run-up profile by dividing the annual operations by 365 (per Table 1-1).

Table 5-1 Maintenance Run-Up Operations

Maintenance Type	Power Setting	# Engines Running	Duration of Each Event (Minutes)	Duration (Sec)	Annual Events during Day (0700-2200)	Annual Events during Night (2200-0700)	Total Annual Events	Run Location
Phase Maintenance	power	2	60	3600	42	0	42	Parking 1
Tail Rotor, Driveshaft Lube/ Balance	power	2	20	1200	42	0	42	Parking 1
Engine Wash	idle	2	25	1500	36	0	36	Parking 1
Unscheduled Maintenance/ Leak Check	idle	2	10	600	42	0	42	Parking 1
	power	2	5	300				

Table 5-2 Pre-flight Run-Up Operations

Type	Power Setting	# Engines Running	Duration of Each Event (Minutes)	Duration (Sec)	Annual Events during Day (0700-2200)	Annual Events during Night (2200-0700)	Total Annual Events	Run Location
warmup	power	2	7	420	835	208	1,043	Parking 1
cool down	idle	2	1	60	835	208	1,043	Parking 1

The single maintenance location "Parking 1" is shown as the airplane symbol in Figure 5-1 below. It is the 40th HS's ramp.

Figure 5-1. Maintenance Run-up Location (airplane symbol)

6 Noise Exposure Calculations

6.1 Results

The DNL contours for the Baseline scenario are shown in Figure 6-1. The 65 DNL is confined within the base boundary, within an area between the airfield buildings and the paved slide area.

The DNL contours for the Proposed scenario are shown in Figure 6-2. Again, the 65 DNL is confined within the base boundary, an area even smaller than the Baseline 65 DNL.

Figure 6-1. DNL Contours/Shading for Baseline Scenario

Figure 6-2. DNL Contours/Shading for Proposed Scenario

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Appendix A Flight Profiles

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,760	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	15,050	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	14,601	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn
d	13,670	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
e	13,233	4,000 MSL	90	0	0	0	0	0	0.0	0	end turn
f	12,152	4,000 MSL	90	0	0	0	0	0	-1.4	-200	
g	3,038	300 AGL	70	0	0	0	0	0	-5.5	-700	half mile out, 300 AGL
h	2,200	220 AGL	70	0	0	0	0	0	-3.9	-500	begin roll
i	2,054	210 AGL	70	0	0	30	0	0	-5.1	-600	begin turn
j	1,490	160 AGL	70	0	0	30	0	0	-3.8	-500	begin rollout
k	1,341	150 AGL	70	0	0	0	0	0	-4.3	-500	end turn
l	0	50 AGL	50	0	0	0	0	0			threshold

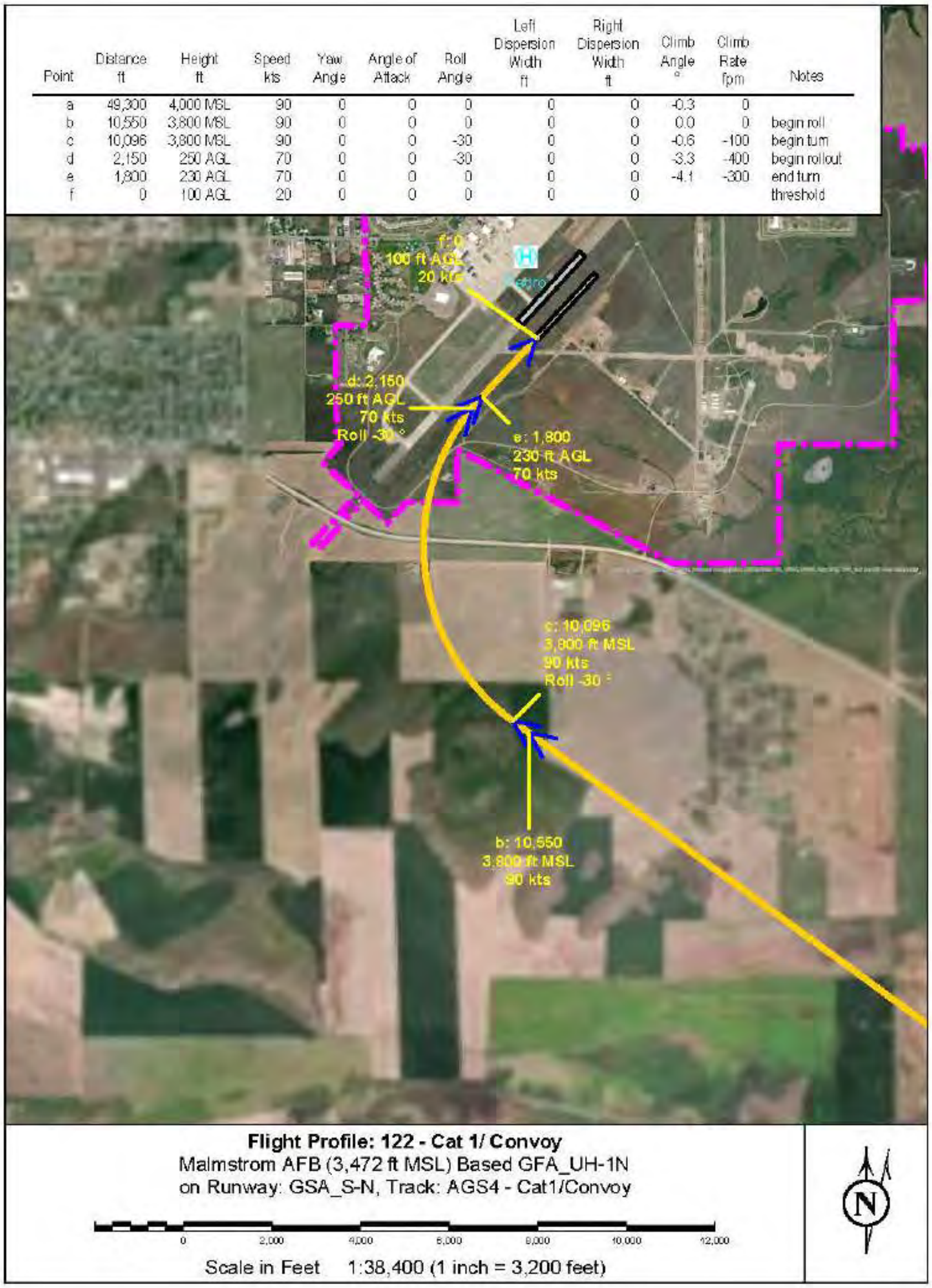
Flight Profile: 121 - Cat 1/ Convoy
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: AGN3 - Cat1/Convoy

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

Scale in Feet 1:30,500 (1 inch = 2,540 feet)

N

Figure A-1. Arrival Flight Profile 121



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,300	4,000 MSL	90	0	0	0	0	0	-0.3	0	
b	10,550	3,800 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	10,096	3,800 MSL	90	0	0	-30	0	0	-0.6	-100	begin turn
d	2,150	250 AGL	70	0	0	-30	0	0	-3.3	-400	begin rollout
e	1,800	230 AGL	70	0	0	0	0	0	-4.1	-300	end turn
f	0	100 AGL	20	0	0	0	0	0			threshold

Figure A-2. Arrival Flight Profile 122

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,938	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	15,000	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	14,552	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn
d	14,140	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
e	13,686	4,000 MSL	90	0	0	0	0	0	-1.2	-200	end turn, begin descent
f	3,038	300 AGL	70	0	0	0	0	0	-4.4	-500	
g	1,600	190 AGL	70	0	0	0	0	0	-3.8	-500	begin roll
h	1,451	180 AGL	70	0	0	30	0	0	-4.2	-500	begin turn
i	1,180	160 AGL	70	0	0	30	0	0	-3.8	-500	begin rollout
j	1,028	150 AGL	70	0	0	0	0	0	-5.0	-500	end turn
k	0	60 AGL	50	0	0	0	0	0			threshold

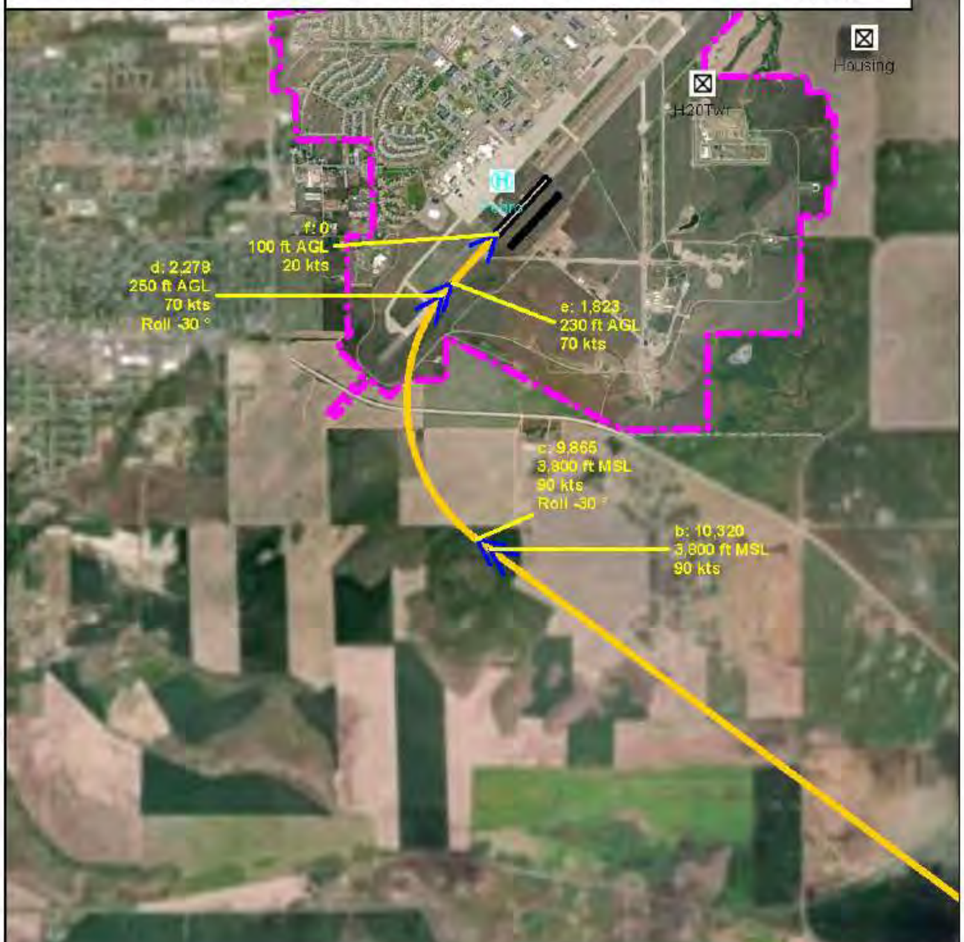
Flight Profile: 123 - Cat 1/ Convoy
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: APN3 - Cat1/Convoy

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000

Scale in Feet 1:28,200 (1 inch = 2,350 feet)

Figure A-3. Arrival Flight Profile 123

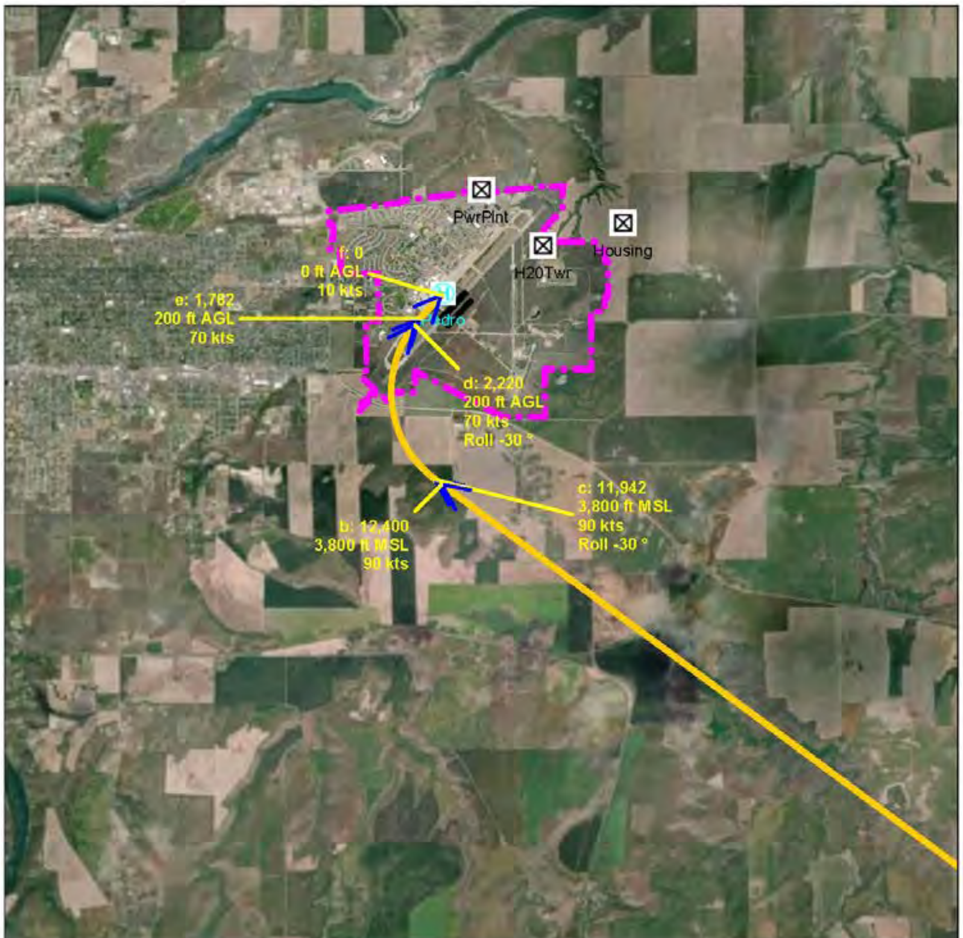
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,960	4,000 MSL	90	0	0	0	0	0	-0.3	0	
b	10,320	3,800 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	9,865	3,800 MSL	90	0	0	-30	0	0	-0.6	-100	begin turn
d	2,278	250 AGL	70	0	0	-30	0	0	-2.5	-300	begin rollout
e	1,823	230 AGL	70	0	0	0	0	0	-4.1	-300	end turn
f	0	100 AGL	20	0	0	0	0	0			threshold



Flight Profile: 124 - Cat 1/ Convoy
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA_S-N, Track: APS4 - Cat1/Convoy

Scale in Feet 1:48,900 (1 inch = 4,070 feet)

Figure A-4. Arrival Flight Profile 124



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,950	4,000 MSL	90	0	0	0	0	0	-0.3	0	
b	12,400	3,800 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	11,942	3,800 MSL	90	0	0	-30	0	0	-0.8	-100	begin turn & descent
d	2,220	200 AGL	70	0	0	-30	0	0	0.0	0	begin rollout
e	1,762	200 AGL	70	0	0	0	0	0	-6.5	-500	end turn
f	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 126 - Cat 1/ Convoy
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: AXS4 - Cat1/Convoy

Scale in Feet 1:98,600 (1 inch = 8,210 feet)

Figure A-5. Arrival Flight Profile 126

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	16,250	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	15,794	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn
d	15,340	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
e	14,883	4,000 MSL	90	0	0	0	0	0	0.0	0	end turn
f	12,152	4,000 MSL	90	0	0	0	0	0	-1.4	-200	
g	3,038	300 AGL	70	0	0	0	0	0	-5.3	-700	half mile out, 300 AGL
h	1,970	200 AGL	70	0	0	0	0	0	-3.8	-500	begin roll
i	1,819	190 AGL	70	0	0	30	0	0	-4.1	-500	begin turn
j	1,122	140 AGL	70	0	0	30	0	0	-3.8	-500	begin rollout
k	972	130 AGL	70	0	0	0	0	0	-7.6	-500	end turn
l	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 125 - Cat 1/ Convoy (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: AXN3 - Cat1/Convoy

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

Scale in Feet 1:31,000 (1 inch = 2,580 feet)

N

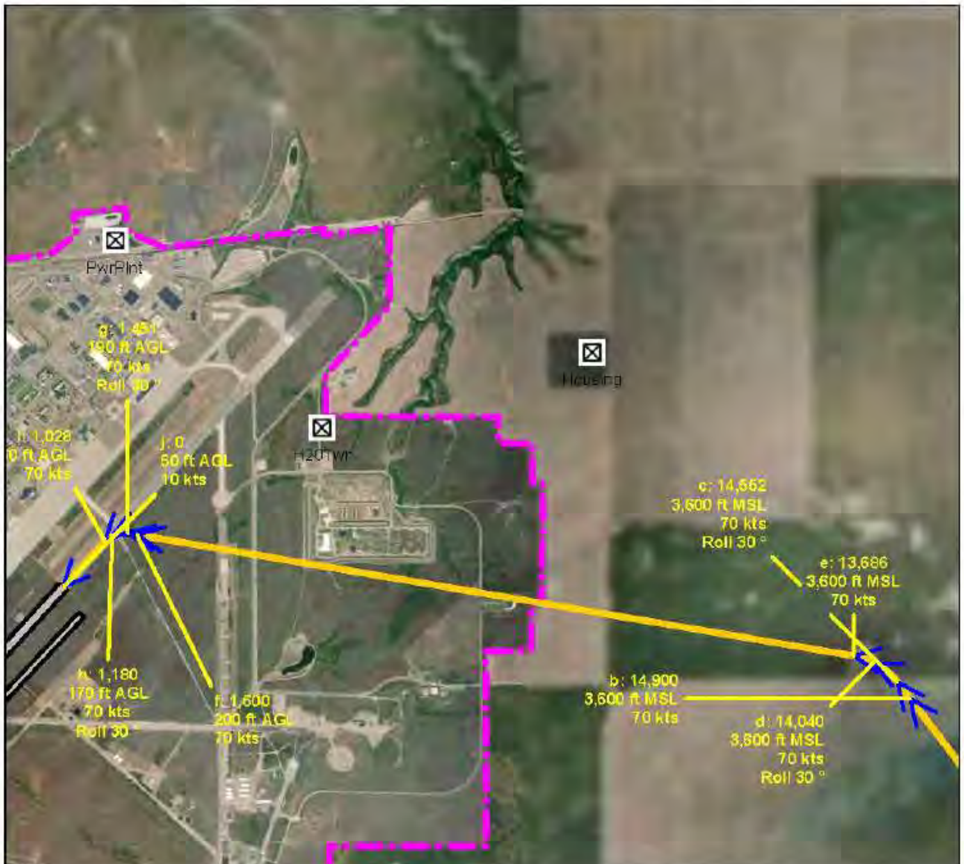
Figure A-6. Arrival Flight Profile 125

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,760	3,600 MSL	90	0	0	0	0	0	0.0	0	
b	14,960	3,600 MSL	70	0	0	0	0	0	0.0	0	begin roll
c	14,601	3,600 MSL	70	0	0	30	0	0	0.0	0	begin turn
d	13,590	3,600 MSL	70	0	0	30	0	0	0.0	0	begin rollout
e	13,233	3,600 MSL	70	0	0	0	0	0	0.4	0	end turn, begin descent
f	2,200	200 AGL	70	0	0	0	0	0	-3.9	-500	begin roll
g	2,054	190 AGL	70	0	0	30	0	0	-2.1	-300	begin turn
h	1,500	170 AGL	70	0	0	30	0	0	-3.6	-400	begin rollout
i	1,341	160 AGL	70	0	0	0	0	0	-3.1	-400	end turn
j	972	140 AGL	70	0	0	0	0	0	-5.3	-400	
k	0	50 AGL	10	0	0	0	0	0			threshold

Flight Profile: 121L - Cat 1/ Convoy low approach
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: AGN3 - Cat1/Convoy

Scale in Feet 1:27,000 (1 inch = 2,250 feet)

Figure A-7. Arrival Flight Profile 121L



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,940	3,600 MSL	90	0	0	0	0	0	0.0	0	
b	14,900	3,600 MSL	70	0	0	0	0	0	0.0	0	begin roll
c	14,552	3,600 MSL	70	0	0	30	0	0	0.0	0	begin turn
d	14,040	3,600 MSL	70	0	0	30	0	0	0.0	0	begin rollout
e	13,686	3,600 MSL	70	0	0	0	0	0	0.3	0	end turn, begin descent
f	1,600	200 AGL	70	0	0	0	0	0	-3.8	-500	begin roll
g	1,451	190 AGL	70	0	0	30	0	0	-4.2	-500	begin turn
h	1,180	170 AGL	70	0	0	30	0	0	-3.8	-500	begin rollout
i	1,028	160 AGL	70	0	0	0	0	0	-6.1	-400	end turn
j	0	50 AGL	10	0	0	0	0	0			threshold

Flight Profile: 123L - Cat 1/ Convoy low approach
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: APN3 - Cat1/Convoy

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

Scale in Feet 1:29,300 (1 inch = 2,440 feet)

N

Figure A-8. Arrival Flight Profile 123L

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	3,600 MSL	90	0	0	0	0	0	0.0	0	
b	16,150	3,600 MSL	70	0	0	0	0	0	0.0	0	begin roll
c	15,794	3,600 MSL	70	0	0	30	0	0	0.0	0	begin turn
d	15,240	3,600 MSL	70	0	0	30	0	0	0.0	0	begin rollout
e	14,883	3,600 MSL	70	0	0	0	0	0	0.3	0	end turn, begin descent
f	1,970	200 AGL	70	0	0	0	0	0	-7.5	-900	begin roll
g	1,819	180 AGL	70	0	0	30	0	0	-6.5	-800	begin turn
h	1,122	100 AGL	70	0	0	30	0	0	0.0	0	begin rollout
i	972	100 AGL	70	0	0	0	0	0	-5.9	-400	end turn
j	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 125L - Cat 1/ Convoy low approach (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: AXN3 - Cat1/Convoy

Scale in Feet 1:31,900 (1 inch = 2,660 feet)

Figure A-9. Arrival Flight Profile 125L

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,980	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	12,152	4,000 MSL	90	0	0	0	0	0	0.0	0	2 nm out, begin descent
c	10,175	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
d	9,719	4,000 MSL	90	0	0	30	0	0	0.3	0	begin turn
e	7,140	540 AGL	70	0	0	30	0	0	0.0	0	begin rollout
f	6,684	540 AGL	70	0	0	0	0	0	-3.3	-400	end turn
g	2,520	300 AGL	70	0	0	0	0	0	-5.7	-500	half mile out
h	0	50 AGL	20	0	0	0	0	0			threshold

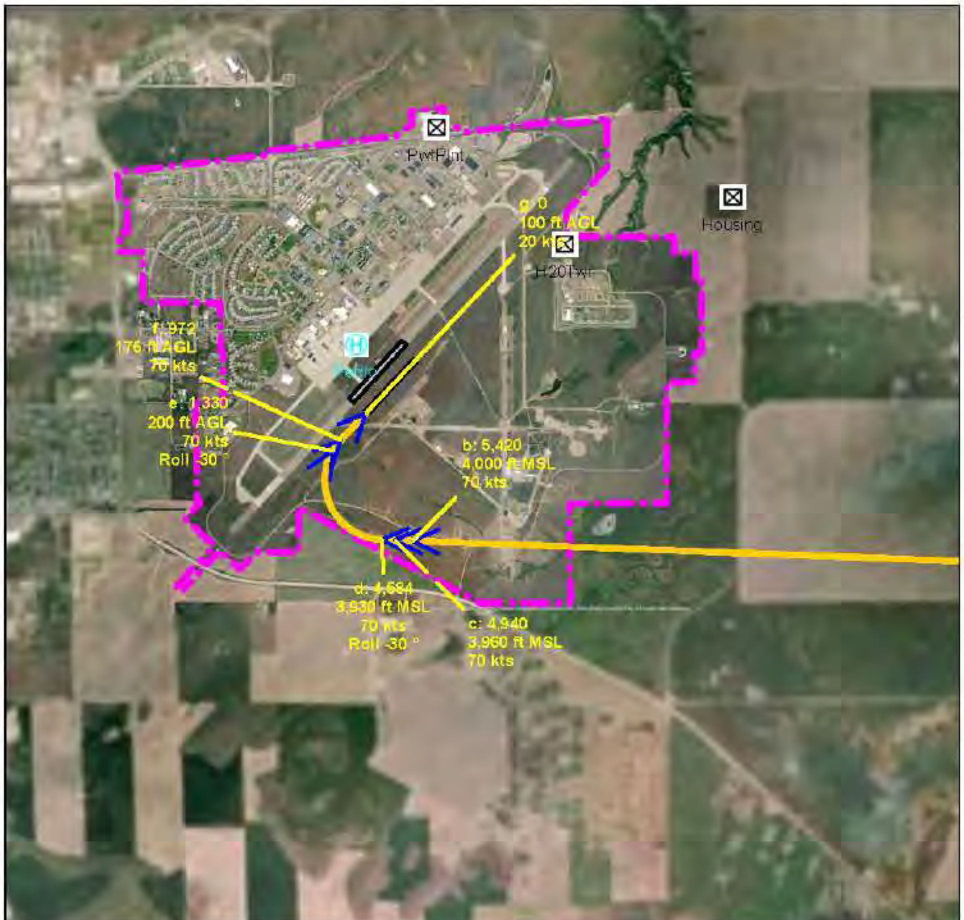
Flight Profile: 127 - Mountains
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: AGN4 - Mountains

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

Scale in Feet 1:29,800 (1 inch = 2,490 feet)

N

Figure A-10. Arrival Flight Profile 127



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	5,420	4,000 MSL	70	0	0	0	0	0	-4.8	-600	start descent
c	4,940	3,960 MSL	70	0	0	0	0	0	-4.8	-600	begin roll
d	4,584	3,930 MSL	70	0	0	-30	0	0	-4.5	-600	begin turn; begin final desc
e	1,330	200 AGL	70	0	0	-30	0	0	-4.0	-500	begin rollout
f	972	175 AGL	70	0	0	0	0	0	-4.4	-400	end turn
g	0	100 AGL	20	0	0	0	0	0			threshold

Flight Profile: 128 - Mountains
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: AGS5 - Mountains

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000

Scale in Feet 1:47,100 (1 inch = 3,930 feet)

Figure A-11. Arrival Flight Profile 128

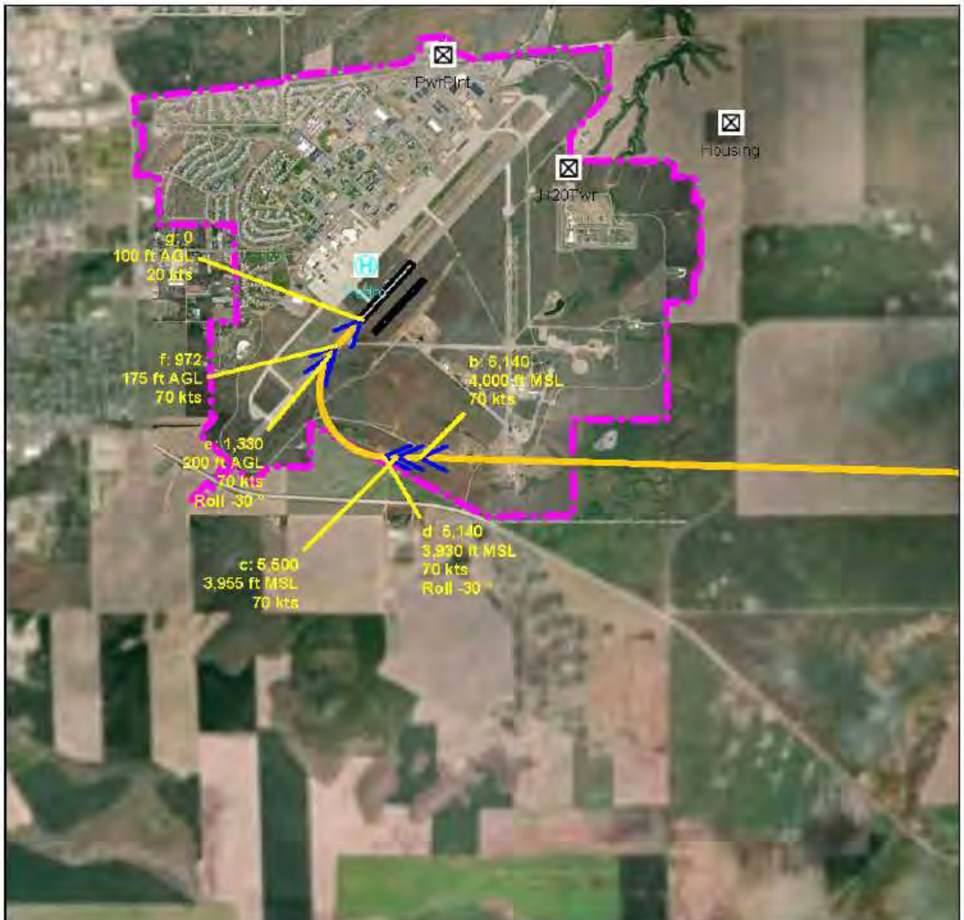
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	12,152	4,000 MSL	90	0	0	0	0	0	0.0	0	2 mi out, begin descent
c	9,790	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll
d	9,434	4,000 MSL	70	0	0	30	0	0	0.4	0	begin turn
e	6,070	550 AGL	70	0	0	30	0	0	0.0	0	begin rollout
f	5,712	550 AGL	70	0	0	0	0	0	-4.3	-500	end turn
g	2,350	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile out
h	0	70 AGL	20	0	0	0	0	0			threshold

Flight Profile: 129 - Mountains
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: APN4 - Mountains

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Scale in Feet 1:22,500 (1 inch = 1,880 feet)

Figure A-12. Arrival Flight Profile 129

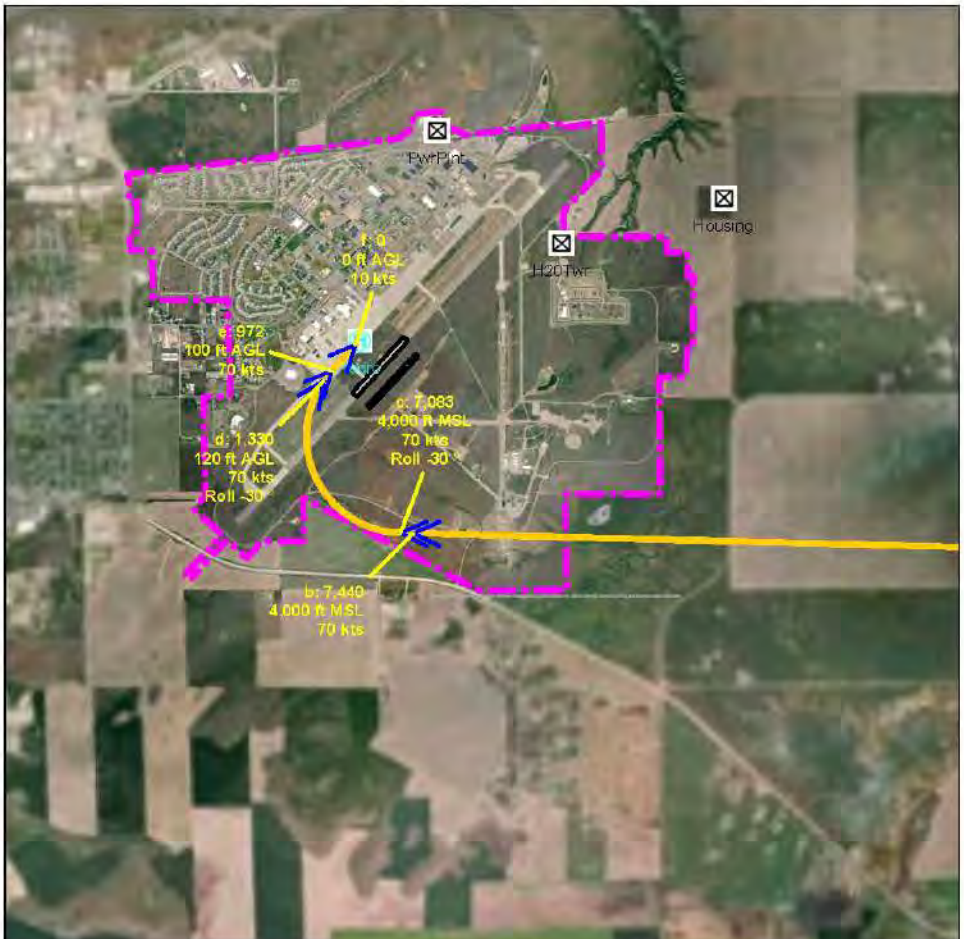


Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	6,140	4,000 MSL	70	0	0	0	0	0	-4.0	-500	begin descent
c	5,500	3,955 MSL	70	0	0	0	0	0	-4.0	-500	begin roll
d	5,140	3,930 MSL	70	0	0	-30	0	0	-3.9	-500	begin turn
e	1,330	200 AGL	70	0	0	-30	0	0	-4.0	-500	begin rollout
f	972	175 AGL	70	0	0	0	0	0	-4.4	-400	end turn
g	0	100 AGL	20	0	0	0	0	0			threshold

Flight Profile: 130 - Mountains
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA_S-N, Track: APS5 - Mountains

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000
Scale in Feet 1:48,600 (1 inch = 4,050 feet)

Figure A-13. Arrival Flight Profile 130



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	7,440	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll
c	7,083	4,000 MSL	70	0	0	-30	0	0	-4.1	-500	begin turn & descent
d	1,330	120 AGL	70	0	0	-30	0	0	-3.2	-400	begin rollout
e	972	100 AGL	70	0	0	0	0	0	-5.9	-400	end turn
f	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 132 - Mountains
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: AXS5 - Mountains

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000
Scale in Feet 1:48,700 (1 inch = 4,060 feet)

N

Figure A-14. Arrival Flight Profile 132

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	13,800	4,000 MSL	90	0	0	0	0	0	0.0	0	begin descent
c	10,040	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll
d	9,684	4,000 MSL	70	0	0	30	0	0	0.4	0	begin turn
e	6,430	550 AGL	70	0	0	30	0	0	0.0	0	begin rollout
f	6,076	550 AGL	70	0	0	0	0	0	-4.7	-600	end turn, 1 mile out
g	3,038	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile out
h	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 131 - Mountains (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: AXN4 - Mountains

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000

Scale in Feet 1:44,800 (1 inch = 3,740 feet)

Figure A-15. Arrival Flight Profile 131

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,980	3,600 MSL	90	0	0	0	0	0	0.0	0	
b	10,075	3,600 MSL	70	0	0	0	0	0	0.0	0	begin roll
c	9,719	3,600 MSL	70	0	0	30	0	0	-0.1	0	begin turn & descent
d	7,040	125 AGL	70	0	0	30	0	0	0.0	0	begin rollout
e	6,684	125 AGL	70	0	0	0	0	0	0.0	0	end turn
f	6,076	125 AGL	70	0	0	0	0	0	-1.2	-100	1 mile out
g	0	0 AGL	10	0	0	0	0	0			threshold

Flight Profile: 127L - Mountains low approach
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: AGN4 - Mountains

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000

Scale in Feet 1:24,200 (1 inch = 2,020 feet)

Figure A-16. Arrival Flight Profile 127L

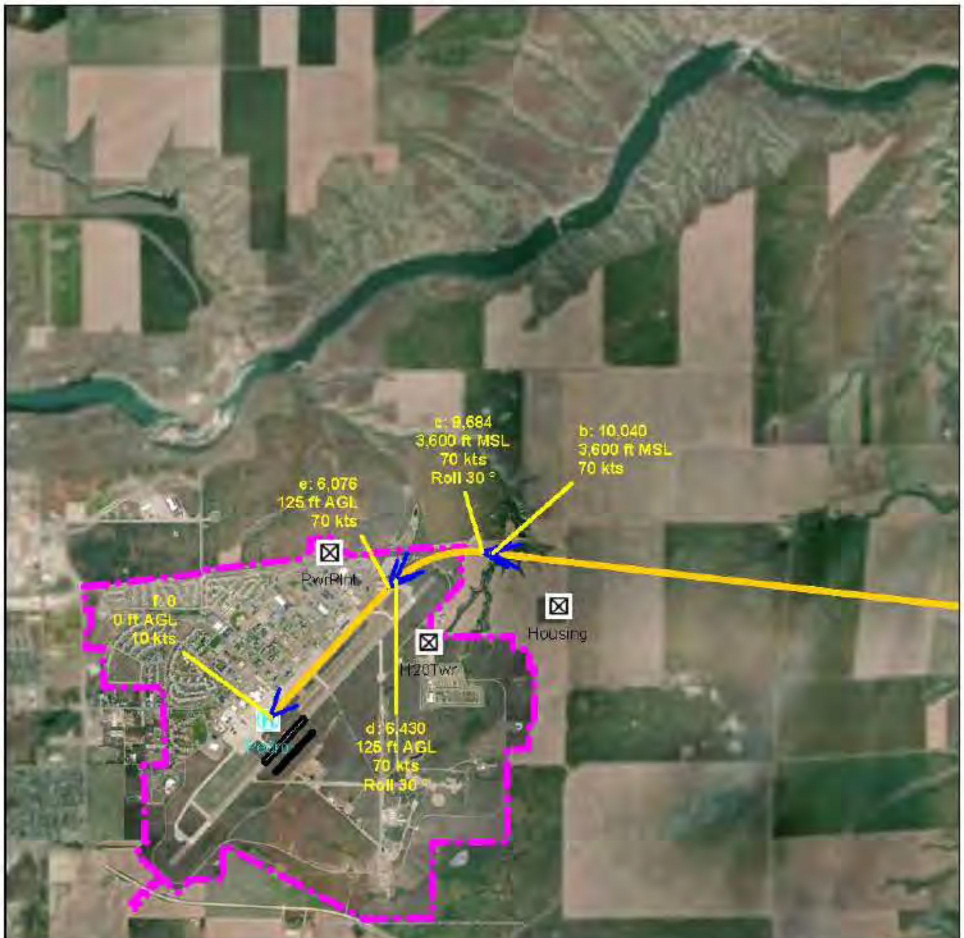
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	3,650 MSL	90	0	0	0	0	0	-0.1	0	
b	9,780	3,600 MSL	70	0	0	0	0	0	0.0	0	begin roll
c	9,434	3,600 MSL	70	0	0	30	0	0	-0.1	0	begin turn & descent
d	6,070	125 AGL	70	0	0	30	0	0	0.0	0	begin rollout
e	5,712	125 AGL	70	0	0	0	0	0	-1.3	-100	end turn
f	0	0 AGL	10	0	0	0	0	0			threshold

Flight Profile: 129L - Mountains low approach
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: APN4 - Mountains

0 1,000 2,000 3,000 4,000 5,000 6,000
Scale in Feet 1:20,400 (1 inch = 1,700 feet)

N

Figure A-17. Arrival Flight Profile 129L



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	3,650 MSL	90	0	0	0	0	0	-0.1	0	
b	10,040	3,600 MSL	70	0	0	0	0	0	0.0	0	begin roll
c	9,684	3,600 MSL	70	0	0	30	0	0	-0.1	0	begin turn
d	6,430	125 AGL	70	0	0	30	0	0	0.0	0	begin rollout & descent
e	6,076	125 AGL	70	0	0	0	0	0	-1.2	-100	end turn, 1 mile out
f	0	0 AGL	10	0	0	0	0	0			

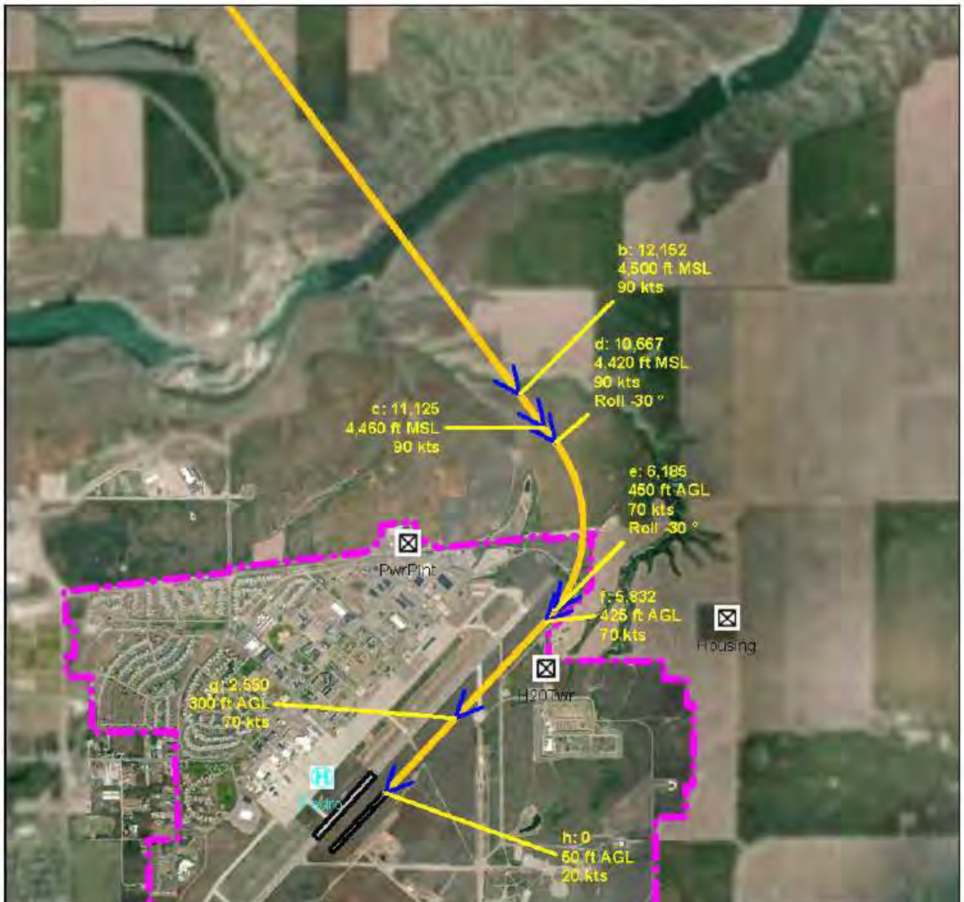
Flight Profile: 131L - Mountains low approach (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: AXN4 - Mountains

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000

Scale in Feet 1:61,100 (1 inch = 5,090 feet)

N

Figure A-18. Arrival Flight Profile 131L



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,500 MSL	90	0	0	0	0	0	0.0	0	
b	12,152	4,500 MSL	90	0	0	0	0	0	-2.2	-400	2 miles out
c	11,125	4,460 MSL	90	0	0	0	0	0	-5.0	-800	begin roll
d	10,667	4,420 MSL	90	0	0	-30	0	0	-6.3	-900	begin turn
e	6,185	450 AGL	70	0	0	-30	0	0	-4.1	-500	begin rollout
f	5,832	425 AGL	70	0	0	0	0	0	-2.2	-300	end turn
g	2,550	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile out
h	0	50 AGL	20	0	0	0	0	0			threshold

Flight Profile: 133 - Northwest
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: AGN5 - Northwest

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000

Scale in Feet 1:43,800 (1 inch = 3,650 feet)

Figure A-19. Arrival Flight Profile 133

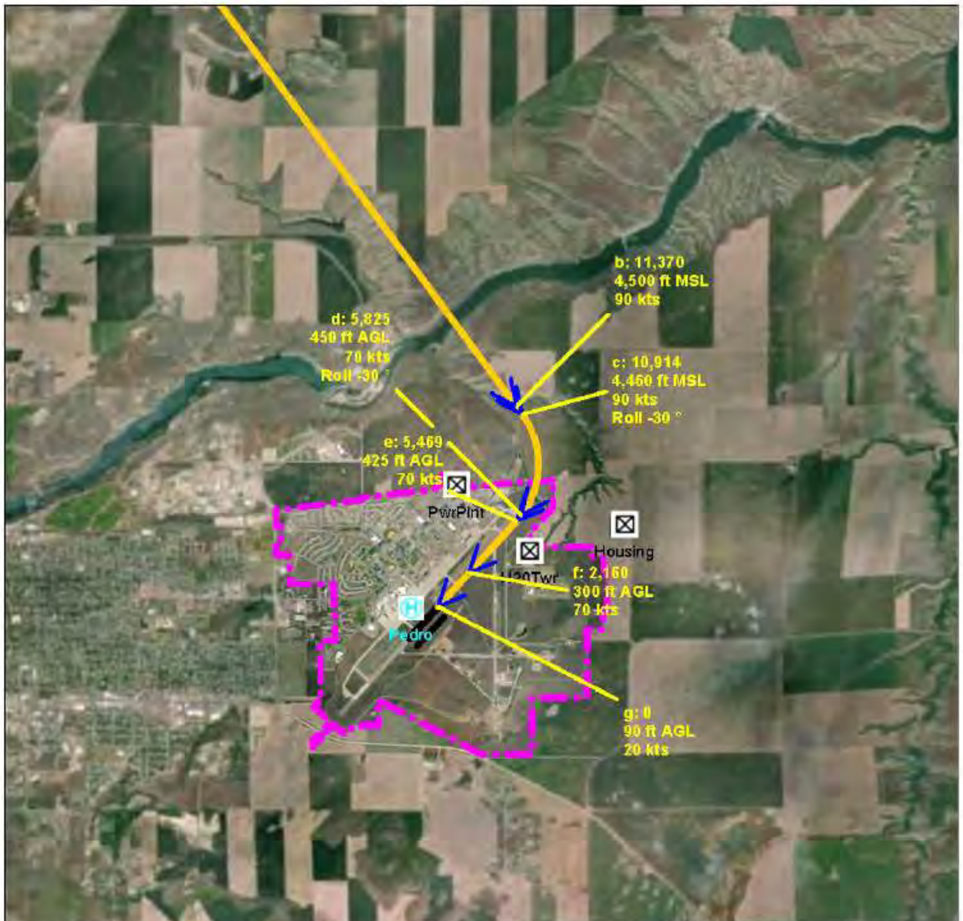
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,500 MSL	90	0	0	0	0	0	0.0	0	
b	14,060	4,500 MSL	90	0	0	0	0	0	-5.0	-700	begin descent
c	5,720	300 AGL	70	0	0	0	0	0	0.0	0	300 AGL
d	3,900	300 AGL	70	0	0	30	0	0	-3.2	-400	begin roll
e	3,541	280 AGL	70	0	0	30	0	0	-2.9	-400	begin turn
f	1,350	170 AGL	70	0	0	30	0	0	-3.2	-400	begin rollout
g	996	150 AGL	70	0	0	0	0	0	-3.4	-400	end turn
h	0	90 AGL	70	0	0	0	0	0			threshold

Flight Profile: 134 - Northwest
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: AGS6 - Northwest

0 2,000 4,000 6,000 8,000 10,000

Scale in Feet 1:35,200 (1 inch = 2,930 feet)

Figure A-20. Arrival Flight Profile 134



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,980	4,500 MSL	90	0	0	0	0	0	0.0	0	
b	11,370	4,500 MSL	90	0	0	0	0	0	-5.0	-800	begin roll
c	10,914	4,460 MSL	90	0	0	-30	0	0	-6.0	-900	begin turn
d	5,825	450 AGL	70	0	0	-30	0	0	-4.0	-500	begin rollout
e	5,469	425 AGL	70	0	0	0	0	0	-2.2	-300	end turn
f	2,160	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile from touch
g	0	90 AGL	20	0	0	0	0	0			threshold

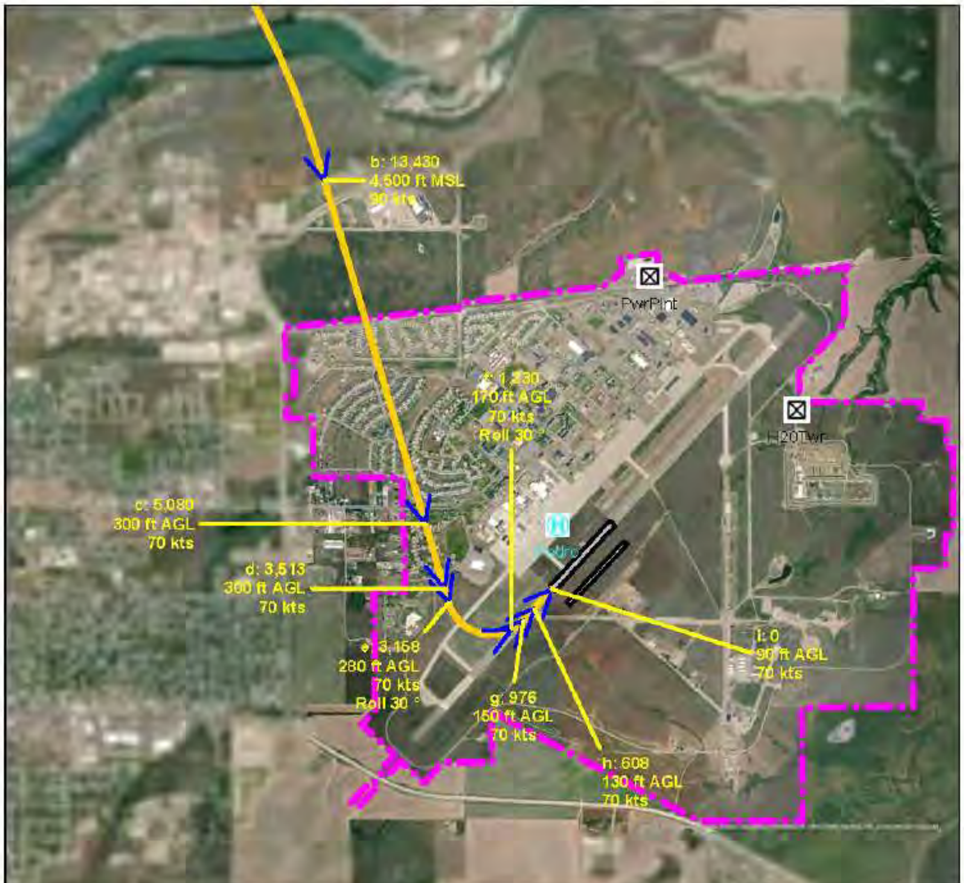
Flight Profile: 135 - Northwest
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: APN5 - Northwest

0 4,000 8,000 12,000 16,000 20,000 24,000

Scale in Feet 1:83,100 (1 inch = 6,920 feet)

N

Figure A-21. Arrival Flight Profile 135



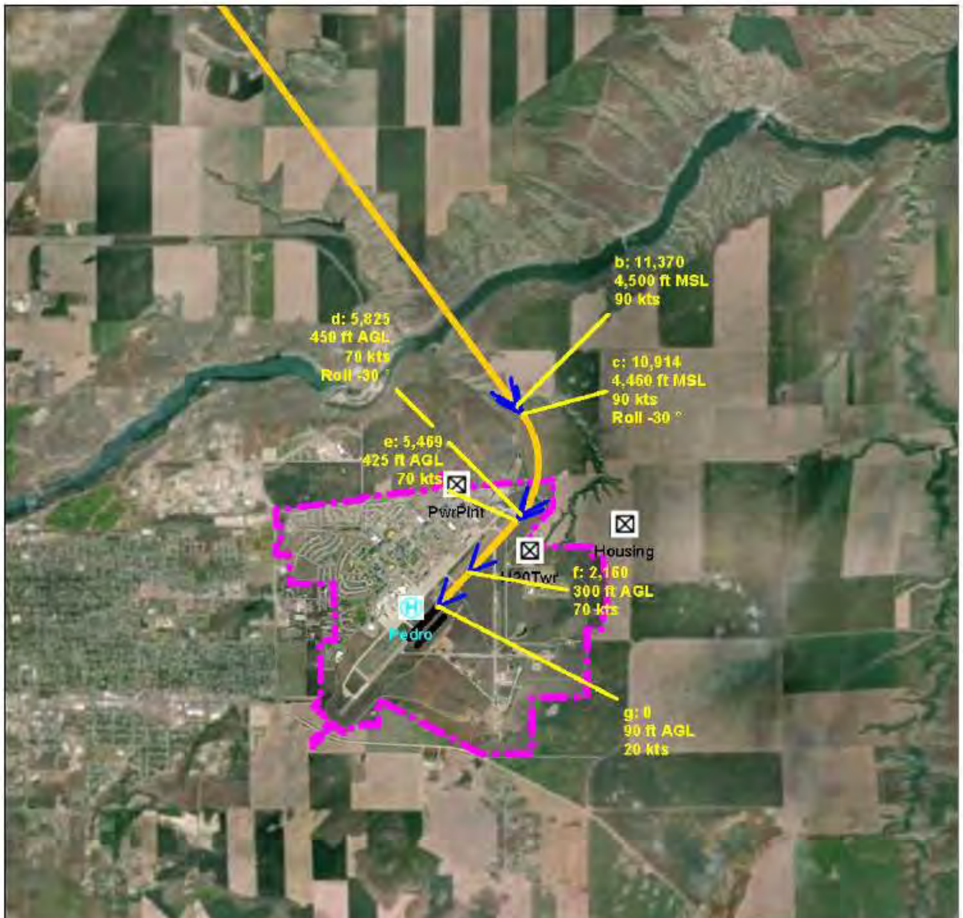
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,500 MSL	90	0	0	0	0	0	0.0	0	
b	13,430	4,500 MSL	90	0	0	0	0	0	-5.0	-700	2 miles out, begin descent
c	5,080	300 AGL	70	0	0	0	0	0	0.0	0	
d	3,513	300 AGL	70	0	0	0	0	0	-3.2	-400	begin roll
e	3,158	280 AGL	70	0	0	30	0	0	-3.4	-400	begin turn
f	1,330	170 AGL	70	0	0	30	0	0	-3.2	-400	begin rollout
g	976	150 AGL	70	0	0	0	0	0	-3.1	-400	end turn
h	608	130 AGL	70	0	0	0	0	0	-3.8	-500	
i	0	90 AGL	70	0	0	0	0	0			threshold

Flight Profile: 136 - Northwest
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA_S-N, Track: APS6 - Northwest

0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:41,100 (1 inch = 3,430 feet)

Figure A-22. Arrival Flight Profile 136



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,980	4,500 MSL	90	0	0	0	0	0	0.0	0	
b	11,370	4,500 MSL	90	0	0	0	0	0	-5.0	-800	begin roll
c	10,914	4,460 MSL	90	0	0	-30	0	0	-6.0	-900	begin turn
d	5,825	450 AGL	70	0	0	-30	0	0	-4.0	-500	begin rollout
e	5,469	425 AGL	70	0	0	0	0	0	-2.2	-300	end turn
f	2,160	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile from touch
g	0	90 AGL	20	0	0	0	0	0			threshold

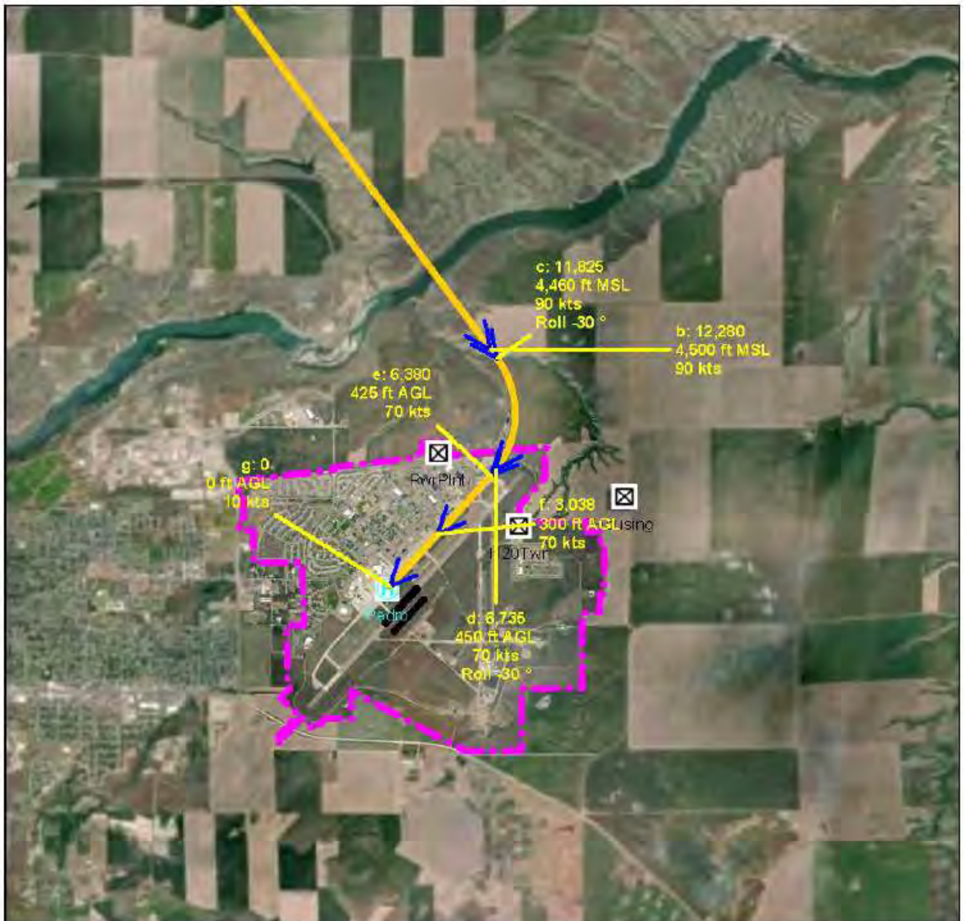
Flight Profile: 135 - Northwest
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: APN5 - Northwest

0 4,000 8,000 12,000 16,000 20,000 24,000

Scale in Feet 1:83,100 (1 inch = 6,920 feet)

N

Figure A-23. Arrival Flight Profile 135

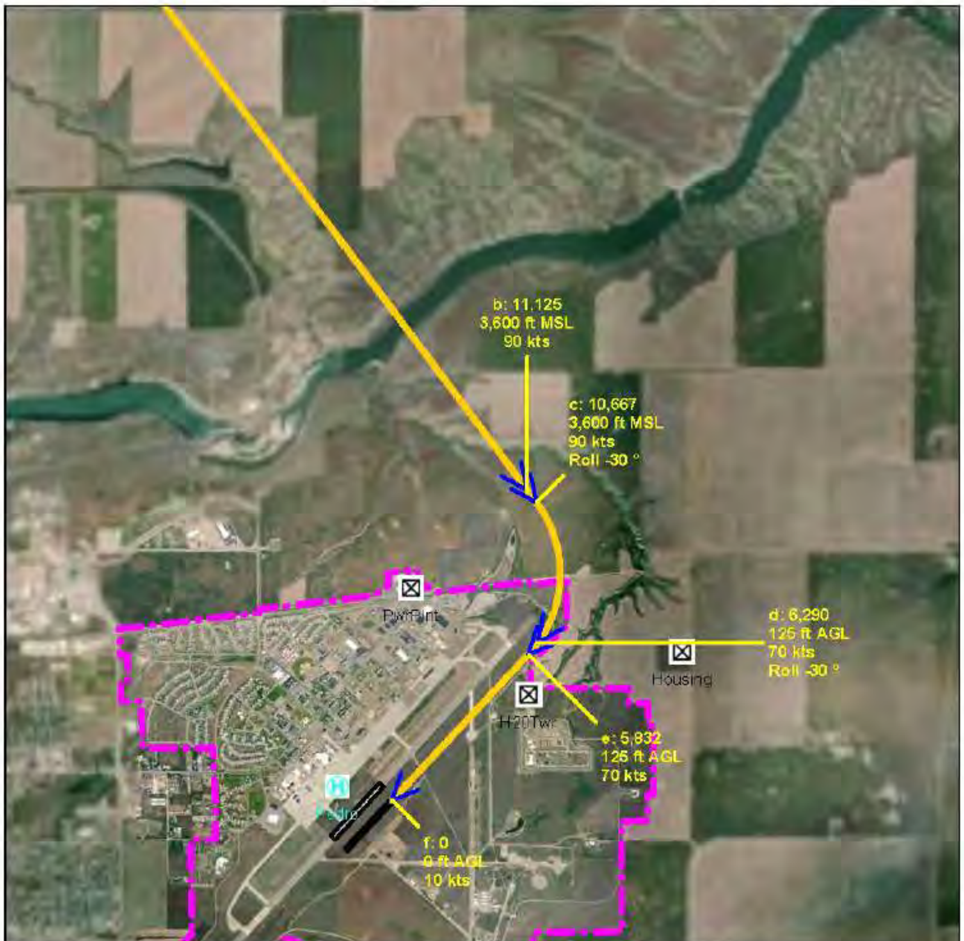


Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,980	4,500 MSL	90	0	0	0	0	0	0.0	0	
b	12,280	4,500 MSL	90	0	0	0	0	0	-5.0	-800	2 miles out; begin roll & des
c	11,825	4,460 MSL	90	0	0	-30	0	0	-6.0	-900	begin turn
d	6,735	450 AGL	70	0	0	-30	0	0	-4.0	-500	begin rollout
e	6,380	425 AGL	70	0	0	0	0	0	-2.1	-300	end turn
f	3,038	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile out
g	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 137 - Northwest (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: AXN5 - Northwest

Scale in Feet 1:75,200 (1 inch = 6,260 feet)

Figure A-24. Arrival Flight Profile 137



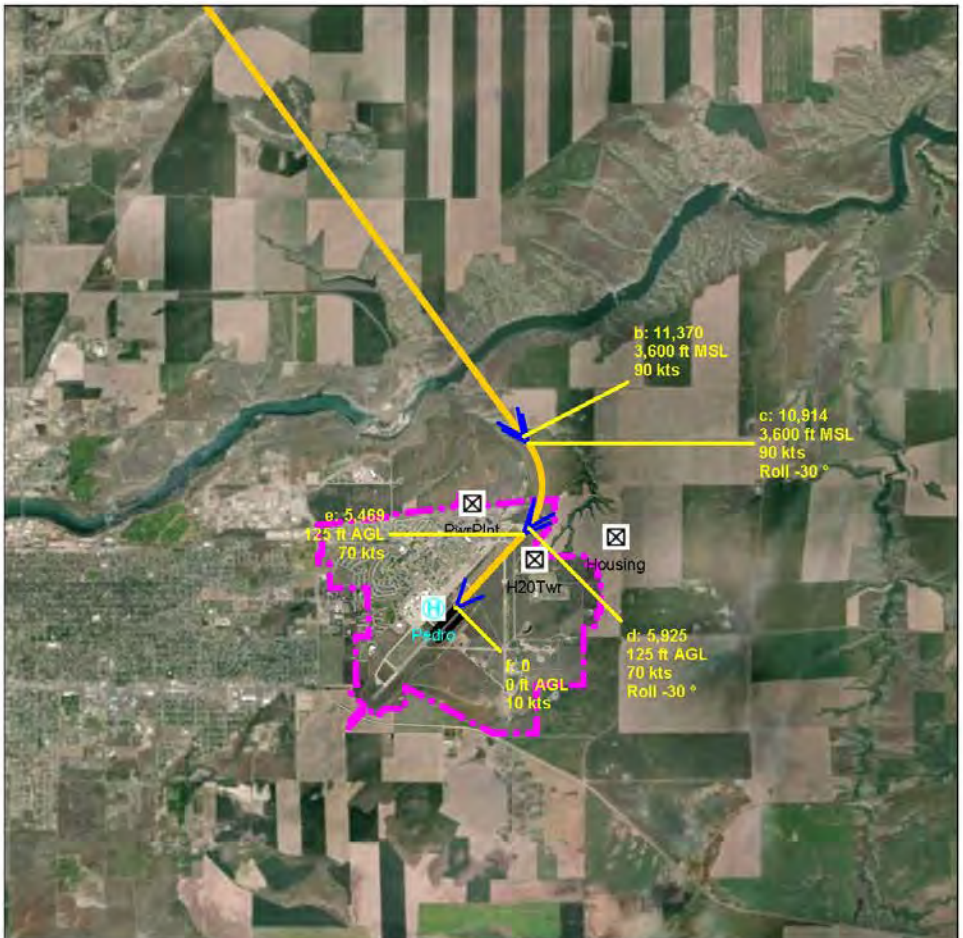
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	3,850 MSL	90	0	0	0	0	0	-0.4	-100	
b	11,125	3,600 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	10,667	3,600 MSL	90	0	0	-30	0	0	-0.0	0	begin turn
d	6,290	125 AGL	70	0	0	-30	0	0	0.0	0	begin roll
e	5,832	125 AGL	70	0	0	0	0	0	-1.2	-100	end turn
f	0	0 AGL	10	0	0	0	0	0			threshold

Flight Profile: 133L - Northwest low approach
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: AGN5 - Northwest

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000

Scale in Feet 1:51,500 (1 inch = 4,290 feet)

Figure A-25. Arrival Flight Profile 133L



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,980	3,850 MSL	90	0	0	0	0	0	-0.4	-100	
b	11,370	3,600 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	10,914	3,600 MSL	90	0	0	-30	0	0	-0.0	0	begin turn
d	5,925	125 AGL	70	0	0	-30	0	0	0.0	0	begin roll
e	5,469	125 AGL	70	0	0	0	0	0	-1.3	-100	end turn
f	0	0 AGL	10	0	0	0	0	0			threshold

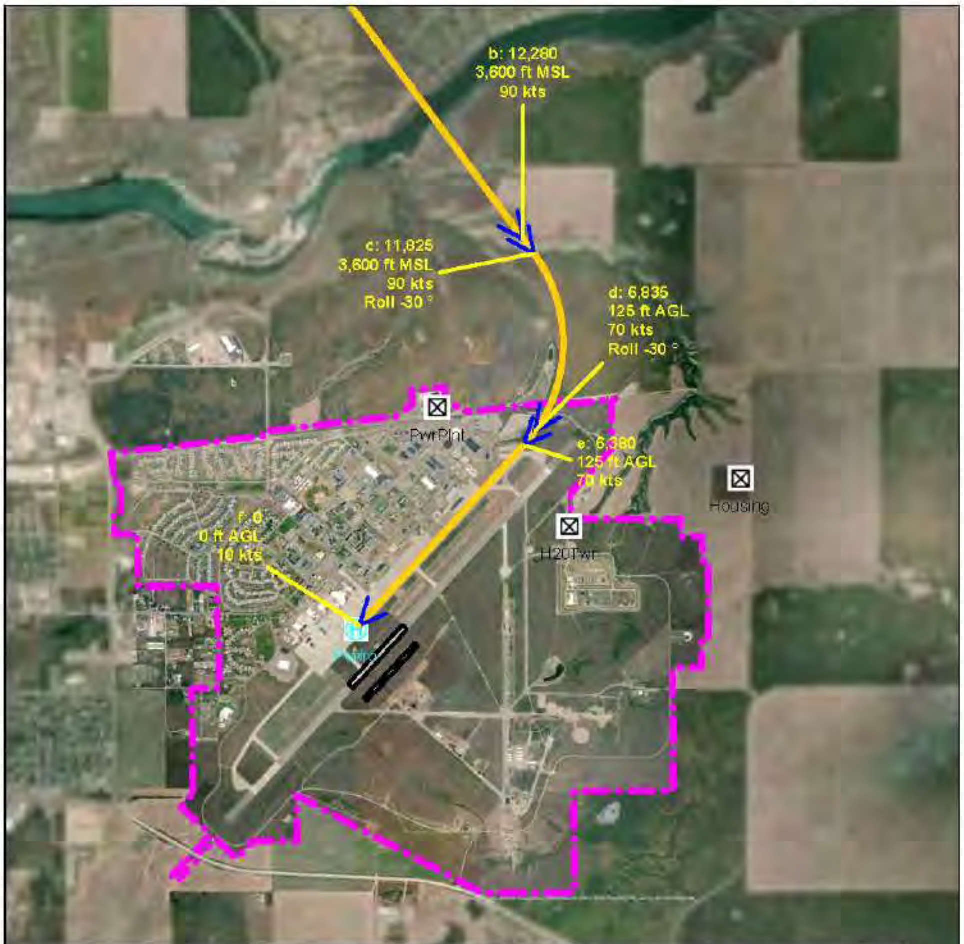
Flight Profile: 135L - Northwest low approach
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: APN5 - Northwest

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000

Scale in Feet 1:97,300 (1 inch = 8,110 feet)

N

Figure A-26. Arrival Flight Profile 135L



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,980	3,850 MSL	90	0	0	0	0	0	-0.4	-100	
b	12,280	3,600 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	11,825	3,600 MSL	90	0	0	-30	0	0	-0.0	0	begin turn
d	6,835	125 AGL	70	0	0	-30	0	0	0.0	0	begin rollout
e	6,380	125 AGL	70	0	0	0	0	0	-1.1	-100	end turn
f	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 137L - Northwest low approach (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: AXN5 - Northwest

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000
Scale in Feet 1:46,200 (1 inch = 3,850 feet)

N

Figure A-27. Arrival Flight Profile 137L

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,940	4,500 MSL	90	0	0	0	0	0	0.0	0	
b	10,700	4,500 MSL	90	0	0	0	0	0	-5.9	-800	2 miles out; begin descent
c	5,850	4,000 MSL	70	0	0	0	0	0	-3.5	-400	
d	2,120	300 AGL	70	0	0	0	0	0	-5.4	-400	half mile
e	0	100 AGL	20	0	0	0	0	0			threshold

Flight Profile: 140 - South 1
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: AGS2 - South1

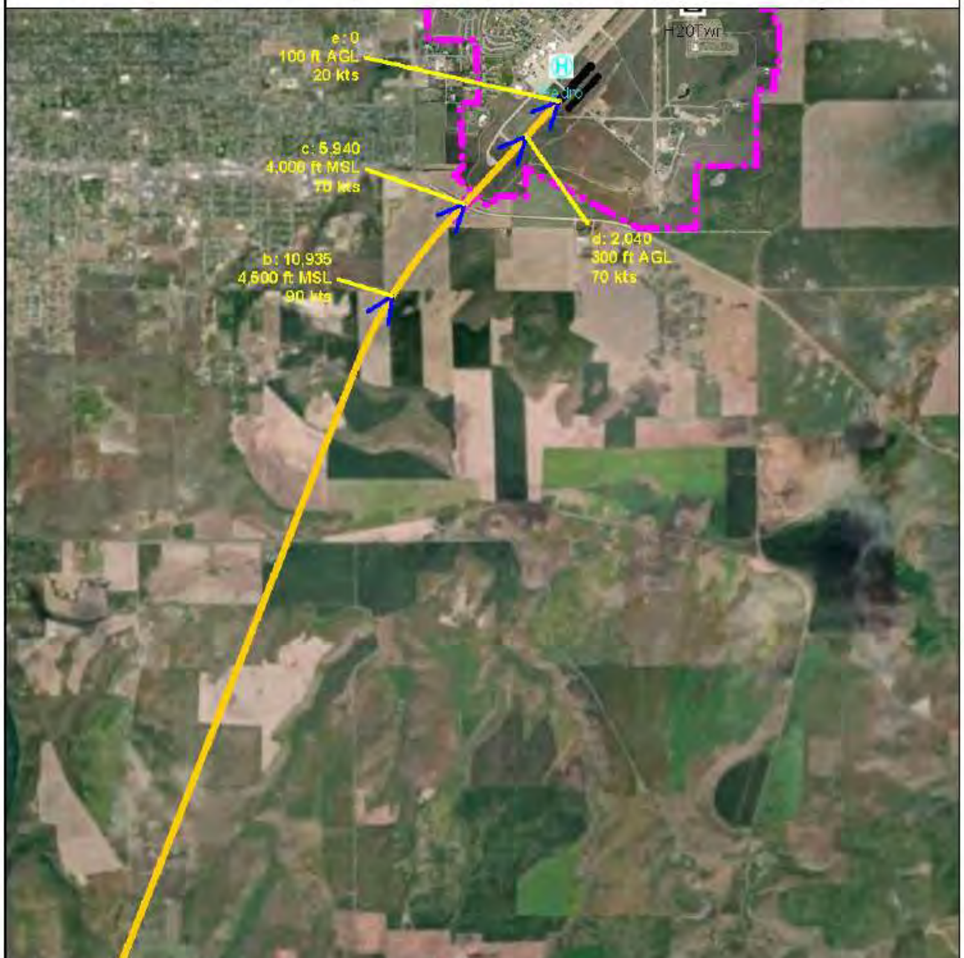
0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:41,700 (1 inch = 3,470 feet)

N

Figure A-28. Arrival Flight Profile 140

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,500 MSL	90	0	0	0	0	0	0.0	0	
b	10,935	4,500 MSL	90	0	0	0	0	0	-5.7	-800	2 miles out; begin descent
c	5,940	4,000 MSL	70	0	0	0	0	0	-3.3	-400	4000 MSL
d	2,040	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile out
e	0	100 AGL	20	0	0	0	0	0			threshold

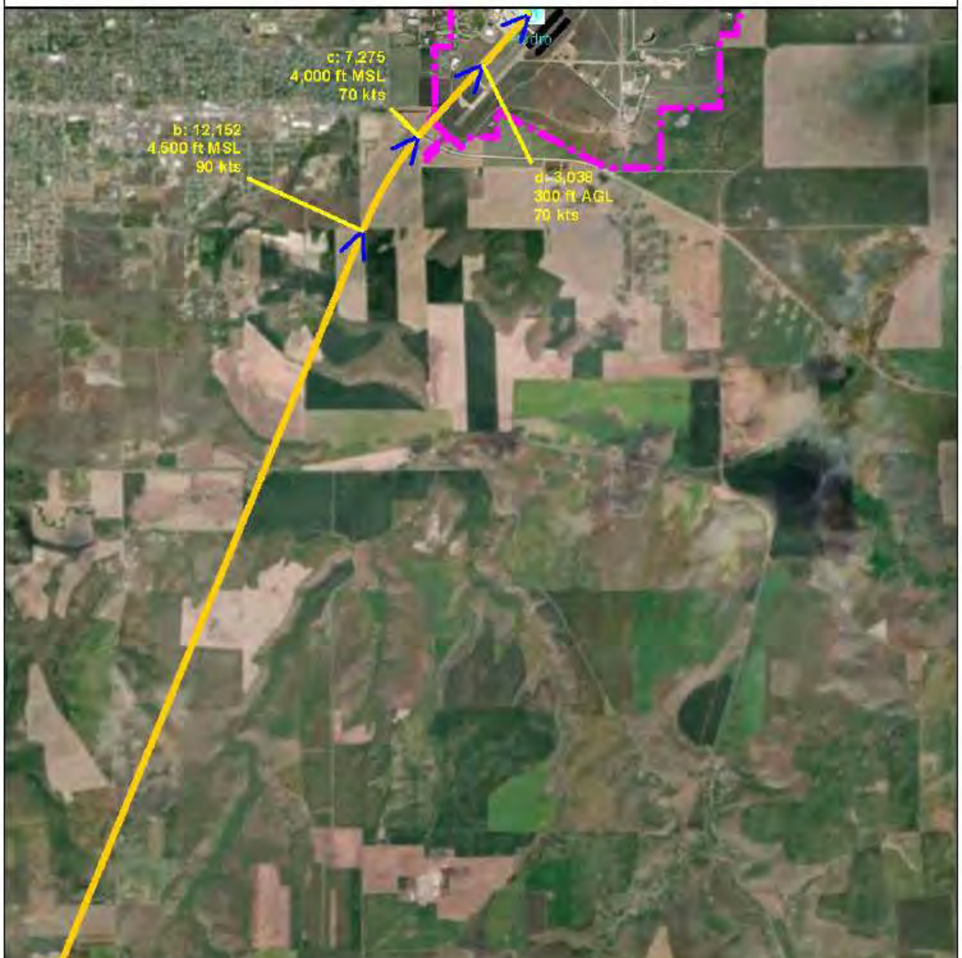


Flight Profile: 142 - South 1
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA_S-N, Track: APS2 - South1

Scale in Feet 1:75,100 (1 inch = 6,260 feet)

Figure A-29. Arrival Flight Profile 142

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,880	4,500 MSL	90	0	0	0	0	0	0.0	0	
b	12,152	4,500 MSL	90	0	0	0	0	0	-5.9	-800	2 miles out, begin descent
c	7,275	4,000 MSL	70	0	0	0	0	0	-3.1	-400	
d	3,038	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile out
e	0	0 AGL	10	0	0	0	0	0			



Flight Profile: 144 - South 1
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: AXS2 - South1

0 4,000 8,000 12,000 16,000 20,000 24,000
Scale in Feet 1:77,800 (1 inch = 6,480 feet)

Figure A-30. Arrival Flight Profile 144

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,500 MSL	90	0	0	0	0	0	-0.8	-100	
b	14,904	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	14,449	4,000 MSL	90	0	0	30	0	0	-0.7	-100	begin turn; begin descent
d	4,405	400 AGL	70	0	0	30	0	0	-3.8	-500	begin rollout
e	3,950	370 AGL	70	0	0	0	0	0	-2.9	-400	end turn
f	2,550	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile out
g	0	50 AGL	20	0	0	0	0	0			threshold

Flight Profile: 139 - South 1 and Southwest
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: AGN1 - South1

Scale in Feet 1:24,000 (1 inch = 2,000 feet)

Figure A-31. Arrival Flight Profile 139

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,500 MSL	90	0	0	0	0	0	-0.8	-100	
b	15,555	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	15,100	4,000 MSL	90	0	0	30	0	0	-0.7	-100	begin turn & descent
d	4,100	400 AGL	70	0	0	30	0	0	-3.8	-500	begin rollout
e	3,646	370 AGL	70	0	0	0	0	0	-2.7	-300	end turn
f	2,160	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile from touch
g	0	90 AGL	20	0	0	0	0	0			threshold

Flight Profile: 141 - South 1 and Southwest
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: APN1 - South1

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000
Scale in Feet 1:25,600 (1 inch = 2,130 feet)

Figure A-32. Arrival Flight Profile 141

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,500 MSL	90	0	0	0	0	0	-0.9	-100	
b	17,371	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	16,921	4,000 MSL	90	0	0	30	0	0	-0.6	-100	begin turn & descent
d	4,587	400 AGL	70	0	0	30	0	0	-3.8	-500	begin rollout
e	4,132	370 AGL	70	0	0	0	0	0	-3.7	-500	end turn
f	3,038	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile out
g	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 143 - South 1 and Southwest (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: AXN1 - South1

0 2,000 4,000 6,000 8,000 10,000

Scale in Feet 1:31,500 (1 inch = 2,620 feet)

Figure A-33. Arrival Flight Profile 143

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,100	4,500 MSL	90	0	0	0	0	0	-0.8	-100	
b	14,770	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	14,316	4,000 MSL	90	0	0	30	0	0	-0.7	-100	begin turn & descent
d	4,400	400 AGL	70	0	0	30	0	0	-3.8	-500	begin rollout
e	3,949	370 AGL	70	0	0	0	0	0	-2.6	-300	end turn
f	2,430	300 AGL	70	0	0	0	0	0	-5.6	-500	half mile out
g	0	60 AGL	20	0	0	0	0	0			threshold

Flight Profile: 145 - South 2
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: AGN2 - South2

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000
Scale in Feet 1:29,700 (1 inch = 2,470 feet)

Figure A-34. Arrival Flight Profile 145

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,500 MSL	90	0	0	0	0	0	-0.8	-100	
b	15,555	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	15,100	4,000 MSL	90	0	0	30	0	0	-0.7	-100	begin turn and descent
d	4,100	400 AGL	70	0	0	30	0	0	-3.8	-500	begin rollout
e	3,646	370 AGL	70	0	0	0	0	0	-2.7	-300	end turn
f	2,160	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile from touch
g	0	90 AGL	20	0	0	0	0	0			threshold

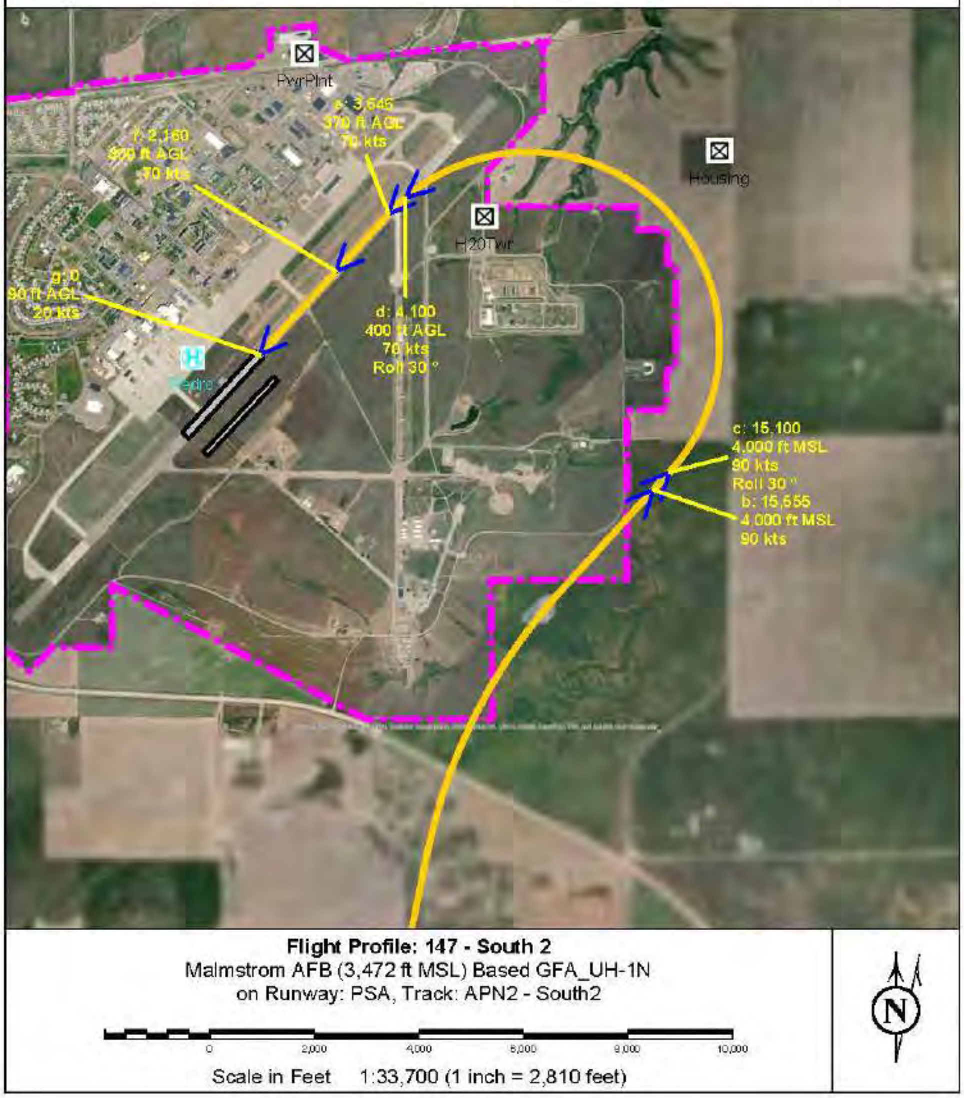


Figure A-35. Arrival Flight Profile 147

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	16,900	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	16,440	4,000 MSL	90	0	0	-15	0	0	0.0	0	begin turn
d	9,710	4,000 MSL	70	0	0	-15	0	0	0.0	0	start descent
e	5,830	4,000 MSL	70	0	0	-15	0	0	-3.7	-500	
f	4,170	420 AGL	70	0	0	-15	0	0	-3.8	-500	begin rollout
g	3,714	390 AGL	70	0	0	0	0	0	-3.0	-400	end turn
h	1,980	300 AGL	70	0	0	0	0	0	-5.8	-500	half mile out
i	0	100 AGL	20	0	0	0	0	0			threshold

Flight Profile: 146 - South 2 (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: AGS3 - South2

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000

Scale in Feet 1:54,700 (1 inch = 4,560 feet)

Figure A-36. Arrival Flight Profile 146

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	16,462	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	16,007	4,000 MSL	90	0	0	-15	0	0	0.0	0	begin turn
d	9,940	4,000 MSL	70	0	0	-15	0	0	0.0	0	start descent
e	5,950	4,000 MSL	70	0	0	-15	0	0	-3.8	-500	
f	3,736	380 AGL	70	0	0	-15	0	0	-3.8	-500	begin rollout
g	3,281	350 AGL	70	0	0	0	0	0	-2.3	-300	end turn
h	2,050	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile
i	0	100 AGL	20	0	0	0	0	0			threshold

Flight Profile: 148 - South 2 (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA_S-N, Track: APS3 - South2

0 4000 8,000 12,000 16,000 20,000 24,000

Scale in Feet 1:73,900 (1 inch = 6,160 feet)

N

Figure A-37. Arrival Flight Profile 148

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,900	4,500 MSL	90	0	0	0	0	0	-0.9	-100	
b	17,325	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	16,870	4,000 MSL	90	0	0	30	0	0	-0.6	-100	begin turn & descent
d	4,590	400 AGL	70	0	0	30	0	0	-3.7	-500	begin rollout
e	4,132	370 AGL	70	0	0	0	0	0	-3.7	-500	end turn
f	3,038	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile out
g	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 149 - South 2 (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: AXN2 - South2

0 2,000 4,000 6,000 8,000 10,000

Scale in Feet 1:33,600 (1 inch = 2,800 feet)

N

Figure A-38. Arrival Flight Profile 149

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	16,887	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	16,432	4,000 MSL	90	0	0	-15	0	0	0.0	0	begin turn
d	11,540	4,000 MSL	70	0	0	-15	0	0	0.0	0	start descent
e	7,135	4,000 MSL	70	0	0	-15	0	0	-3.8	-500	
f	4,160	3,800 MSL	70	0	0	-15	0	0	-1.6	-200	begin rollout
g	3,706	315 AGL	70	0	0	0	0	0	-1.3	-200	end turn
h	3,038	300 AGL	70	0	0	0	0	0	-5.6	-400	half mile
i	0	0 AGL	10	0	0	0	0	0			

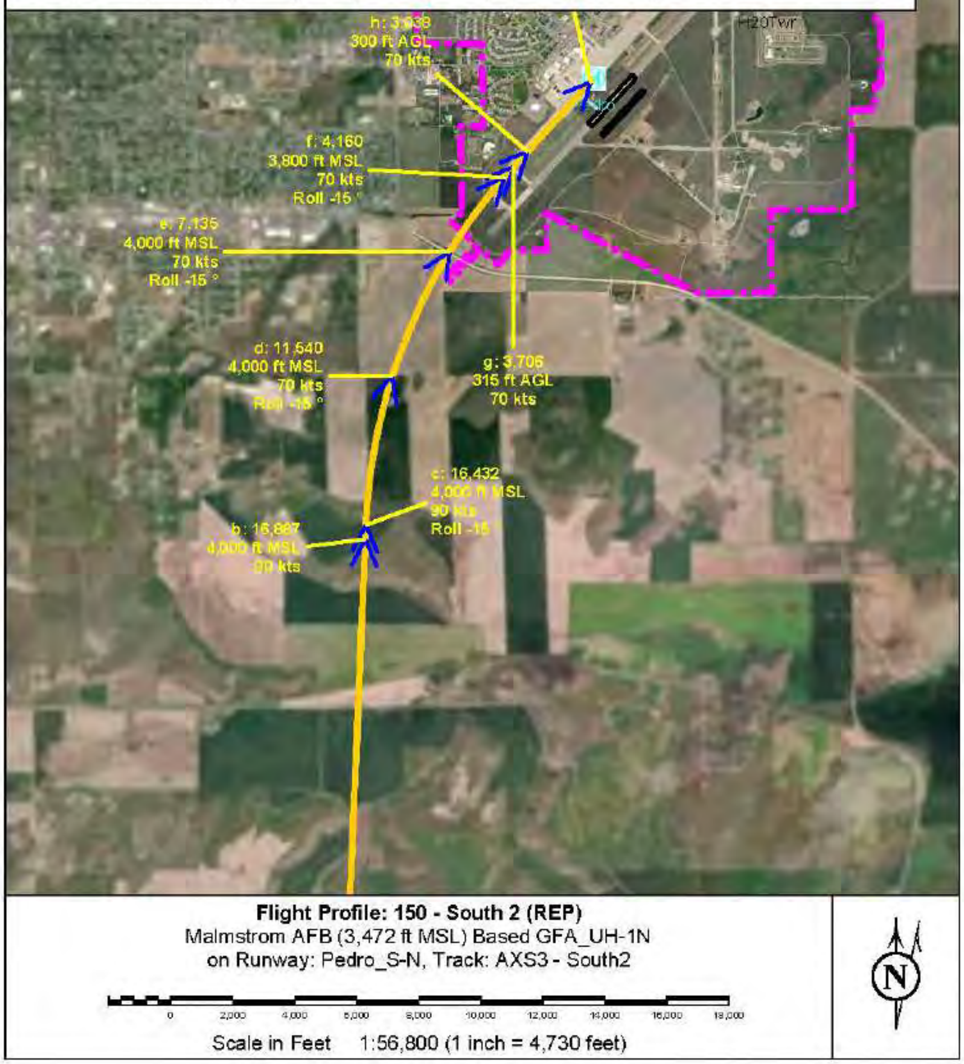


Figure A-39. Arrival Flight Profile 150

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,100	3,600 MSL	90	0	0	0	0	0	0.0	0	0.0 deg, -10 fpm, 218 sec
b	14,771	3,600 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	14,316	3,600 MSL	90	0	0	30	0	0	0.0	0	begin turn
d	4,404	3,600 MSL	70	0	0	30	0	0	0.0	0	begin rollout
e	3,949	3,600 MSL	70	0	0	0	0	0	-1.6	-100	end turn, begin descent
f	0	15 AGL	20	0	0	0	0	0			threshold

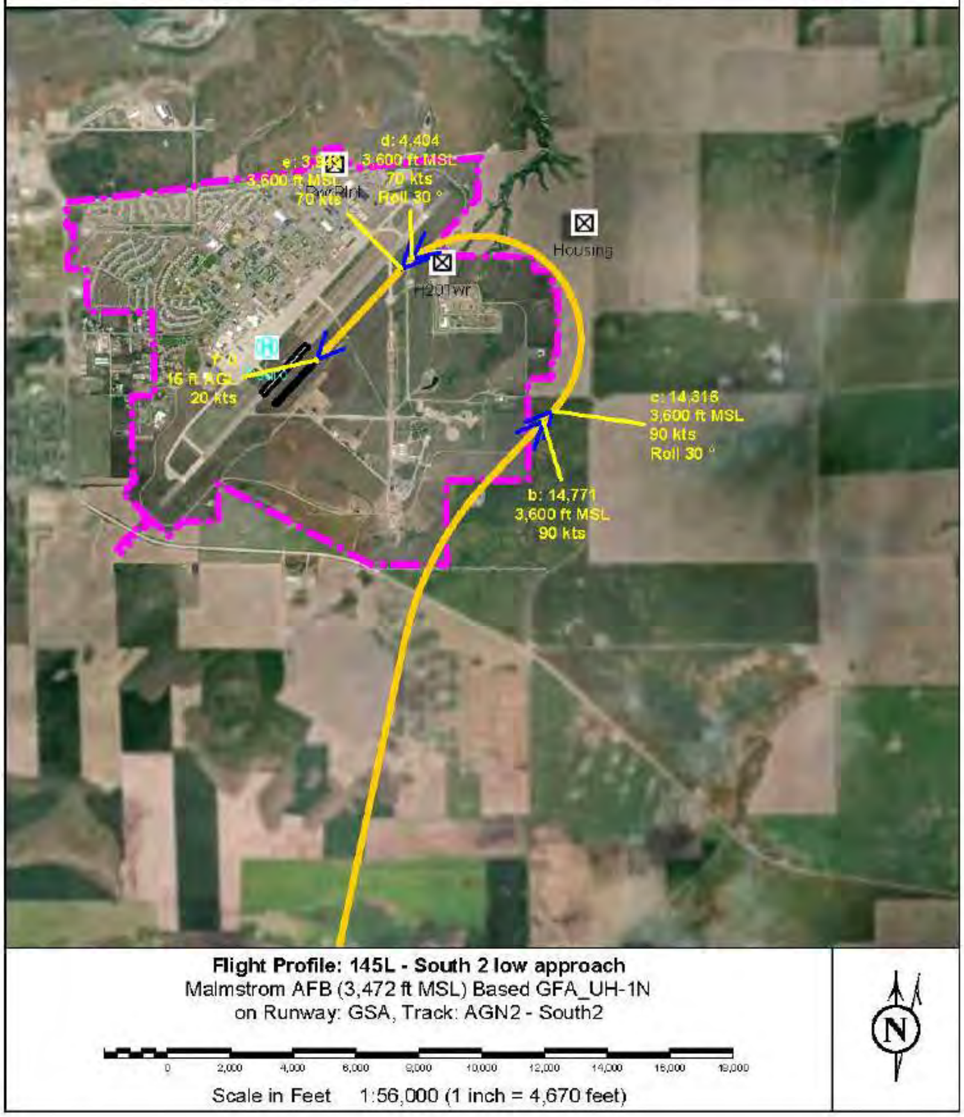


Figure A-40. Arrival Flight Profile 145L

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	3,600 MSL	90	0	0	0	0	0	0.0	0	
b	15,555	3,600 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	15,100	3,600 MSL	90	0	0	30	0	0	0.0	0	begin turn
d	4,101	3,600 MSL	70	0	0	30	0	0	0.0	0	begin rollout
e	3,646	3,600 MSL	70	0	0	0	0	0	-1.8	-100	end turn, begin descent
f	0	15 AGL	20	0	0	0	0	0			threshold

Flight Profile: 147L - South 2 low approach
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: APN2 - South2

Scale in Feet 1:77,600 (1 inch = 6,470 feet)

Figure A-41. Arrival Flight Profile 147L

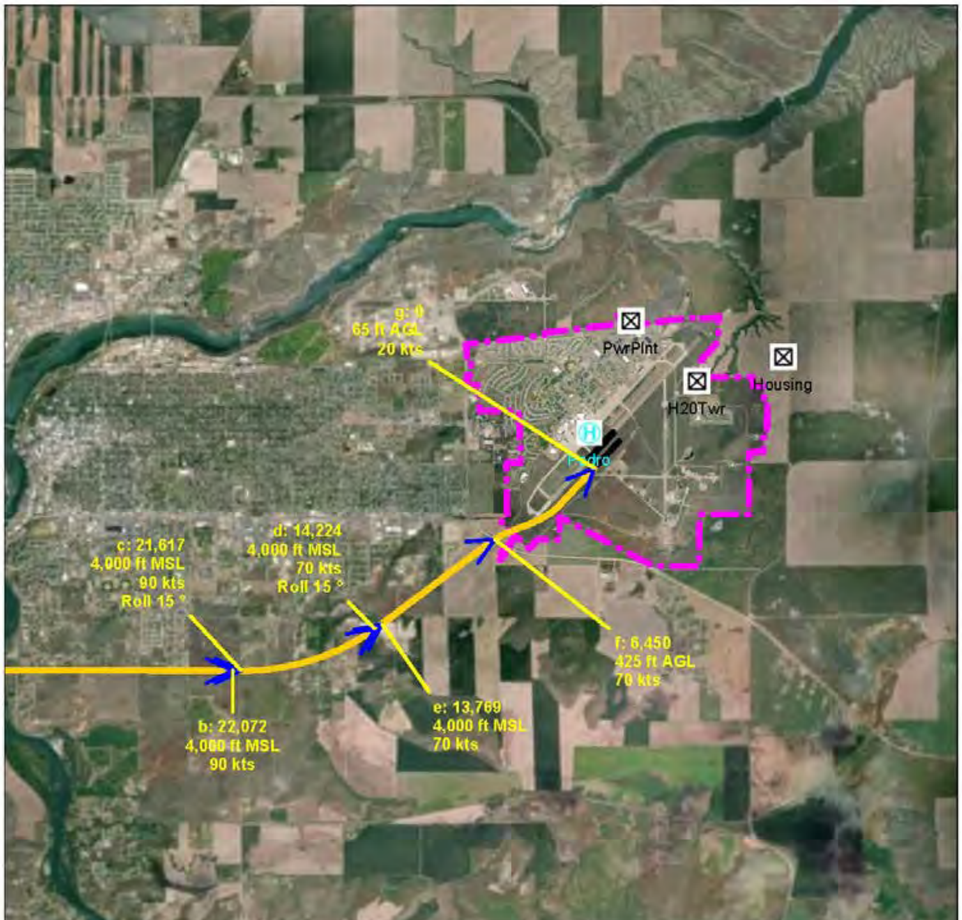
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,900	3,600 MSL	90	0	0	0	0	0	0.0	0	
b	17,325	3,600 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	16,863	3,600 MSL	90	0	0	30	0	0	0.0	0	begin turn
d	4,586	3,600 MSL	70	0	0	30	0	0	0.0	0	begin rollout
e	4,132	3,600 MSL	70	0	0	0	0	0	-1.8	-100	end turn, begin descent
f	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 149L - South 2 low approach (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: AXN2 - South2

0 4,000 8,000 12,000 16,000 20,000
Scale in Feet 1:62,900 (1 inch = 5,240 feet)

N

Figure A-42. Arrival Flight Profile 149L



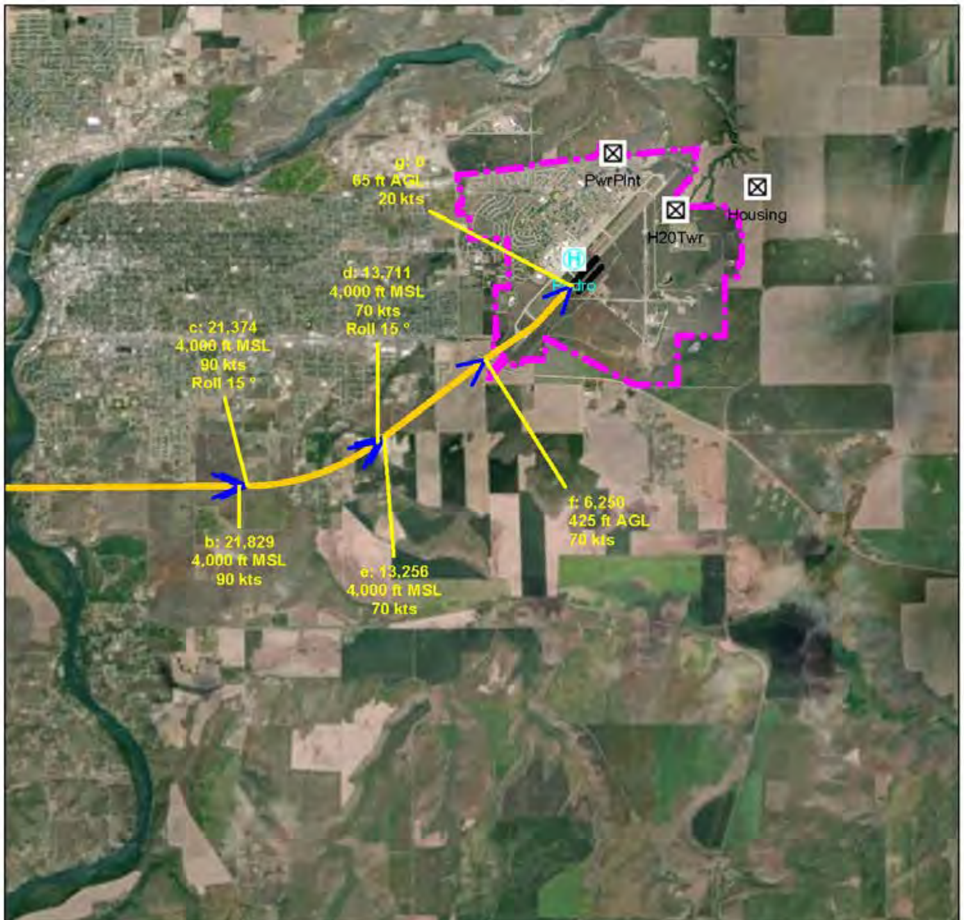
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,890	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	22,072	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	21,617	4,000 MSL	90	0	0	15	0	0	0.0	0	begin turn
d	14,224	4,000 MSL	70	0	0	15	0	0	0.0	0	begin rollout
e	13,769	4,000 MSL	70	0	0	0	0	0	-0.8	-100	end turn
f	6,450	425 AGL	70	0	0	0	0	0	-3.2	-300	
g	0	65 AGL	20	0	0	0	0	0			threshold

Flight Profile: 151 - Southwest (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: AGS1 - Southwest

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000

Scale in Feet 1:91,500 (1 inch = 7,620 feet)

Figure A-43. Arrival Flight Profile 151



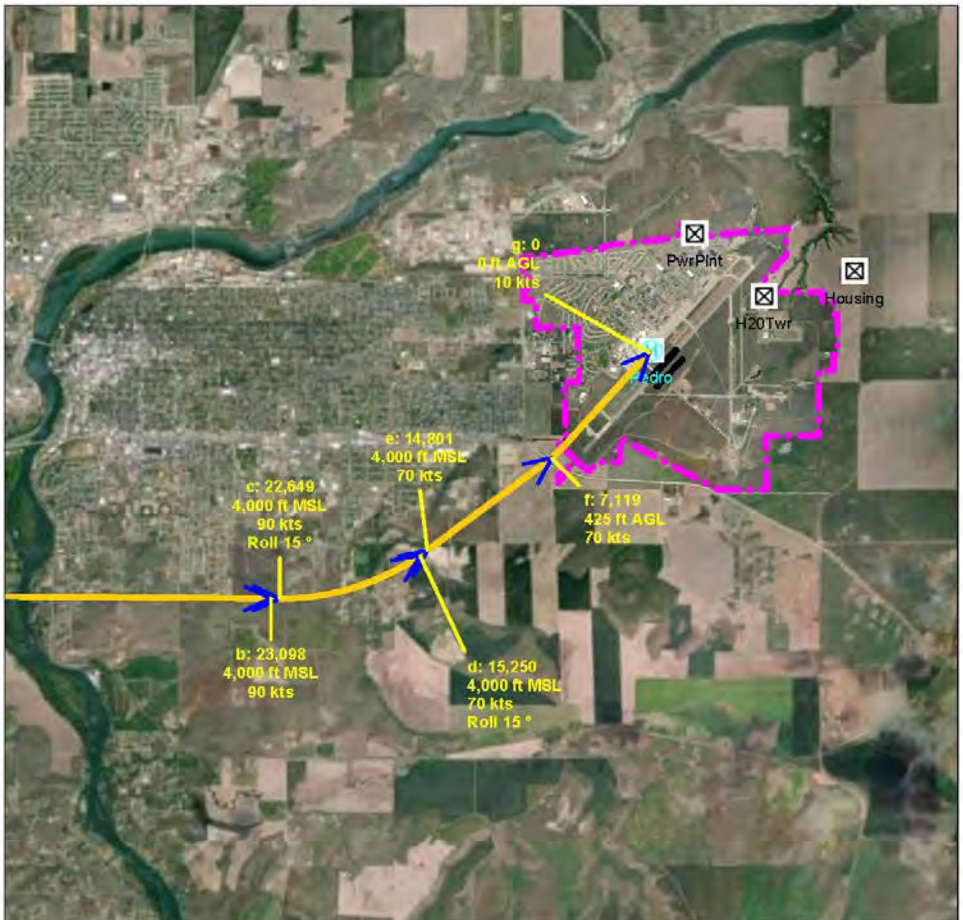
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	49,890	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	21,829	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	21,374	4,000 MSL	90	0	0	15	0	0	0.0	0	begin turn
d	13,711	4,000 MSL	70	0	0	15	0	0	0.0	0	begin rollout
e	13,256	4,000 MSL	70	0	0	0	0	0	-0.8	-100	end turn
f	6,250	425 AGL	70	0	0	0	0	0	-3.3	-300	
g	0	65 AGL	20	0	0	0	0	0			threshold

Flight Profile: 152 - Southwest (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA_S-N, Track: APS1 - Southwest

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000
Scale in Feet 1:96,800 (1 inch = 8,070 feet)

N

Figure A-44. Arrival Flight Profile 152



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	50,000	4,000 MSL	90	0	0	0	0	0	0.0	0	
b	23,098	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
c	22,649	4,000 MSL	90	0	0	15	0	0	0.0	0	begin turn
d	15,250	4,000 MSL	70	0	0	15	0	0	0.0	0	begin rollout
e	14,801	4,000 MSL	70	0	0	0	0	0	-0.8	-100	end turn; begin descent
f	7,119	425 AGL	70	0	0	0	0	0	-3.4	-200	
g	0	0 AGL	10	0	0	0	0	0			

Flight Profile: 153 - Southwest (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: AXS1 - Southwest

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000

Scale in Feet 1:87,400 (1 inch = 7,290 feet)

N

Figure A-45. Arrival Flight Profile 153

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.8	400	
b	3,859	390 AGL	70	0	0	0	0	0	5.0	600	begin roll
c	4,314	430 AGL	70	0	0	-30	0	0	4.4	600	begin turn
d	10,756	4,400 MSL	90	0	0	-30	0	0	12.5	2000	begin roll out
e	11,206	4,500 MSL	90	0	0	0	0	0	0.0	0	end turn
f	49,900	4,500 MSL	90	0	0	0	0	0			

Flight Profile: 102 - Cat 1/ Convoy (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: DXN3 - Cat1/Convoy

0 2,000 4,000 6,000 8,000 10,000 12,000 14000
Scale in Feet 1:44,800 (1 inch = 3,730 feet)

Figure A-46. Departure Flight Profile 102

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	4.4	300	
b	3,743	290 AGL	70	0	0	0	0	0	1.3	200	begin roll
c	4,193	300 AGL	70	0	0	30	0	0	5.6	700	begin turn
d	8,431	4,190 MSL	70	0	0	30	0	0	7.6	900	begin roll out
e	8,881	4,250 MSL	70	0	0	0	0	0	5.3	800	end turn
f	11,567	4,500 MSL	90	0	0	0	0	0	0.0	0	reaches 4500 MSL, 90 kts
g	49,900	4,500 MSL	90	0	0	0	0	0			

Flight Profile: 101 - Cat 1/ Convoy (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: DXS4 - Cat1/Convoy

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000

Scale in Feet 1:54,500 (1 inch = 4,540 feet)

N

Figure A-47. Departure Flight Profile 101

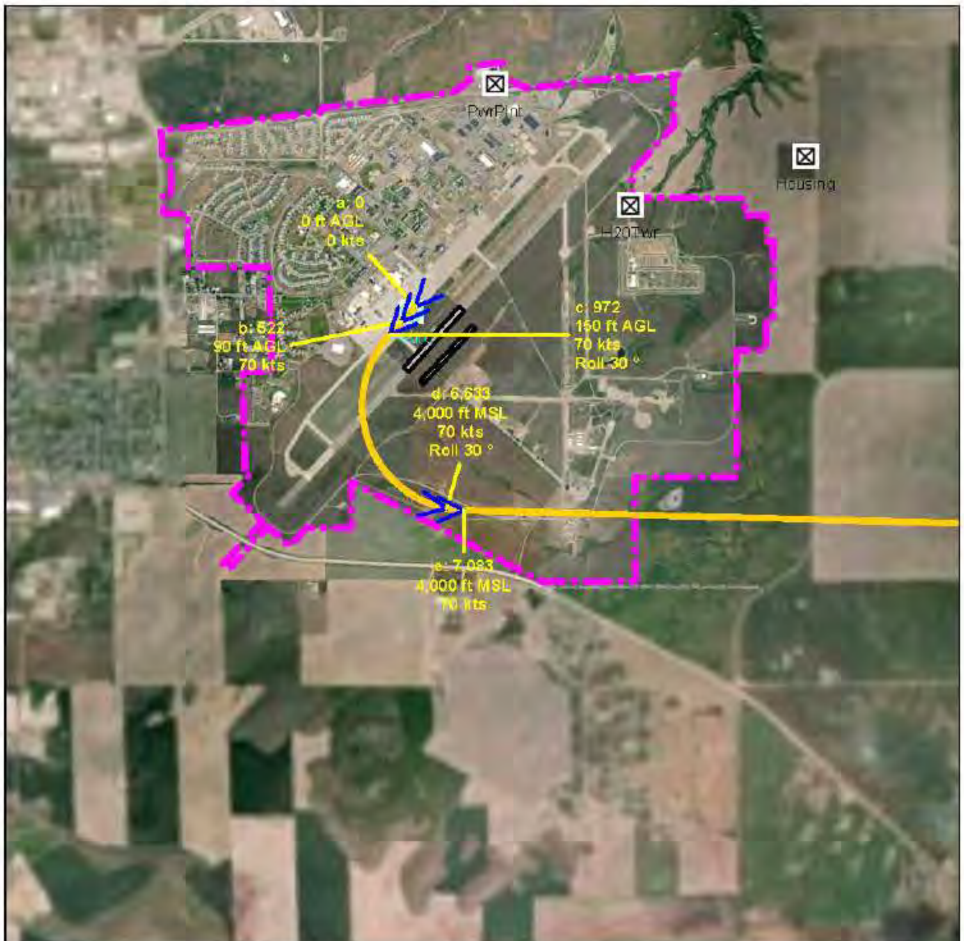
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	4.9	600	
c	5,383	500 AGL	70	0	0	0	0	0	5.1	600	begin roll
d	5,833	540 AGL	70	0	0	-30	0	0	4.9	600	begin turn
e	9,174	4,300 MSL	70	0	0	-30	0	0	6.3	900	begin rollout
f	9,624	4,350 MSL	90	0	0	0	0	0	5.4	900	end turn, reaches 90 kts
g	11,200	4,500 MSL	90	0	0	0	0	0	0.0	0	4500 MSL
h	50,000	4,500 MSL	90	0	0	0	0	0			

Flight Profile: 104 - Mountains (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: DXN4 - Mountains

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000

Scale in Feet 1:47,900 (1 inch = 3,990 feet)

Figure A-48. Departure Flight Profile 104



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	9.8	600	
b	522	90 AGL	70	0	0	0	0	0	7.6	900	begin roll
c	972	150 AGL	70	0	0	30	0	0	3.8	500	begin turn
d	6,633	4,000 MSL	70	0	0	30	0	0	0.0	0	begin roll out
e	7,083	4,000 MSL	70	0	0	0	0	0	0.7	100	end turn
f	50,000	4,500 MSL	90	0	0	0	0	0			

Flight Profile: 103 - Mountains (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: DXS5 - Mountains

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000
Scale in Feet 1:45,000 (1 inch = 3,750 feet)

Figure A-49. Departure Flight Profile 103

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	4.7	600	
c	4,010	380 AGL	70	0	0	0	0	0	4.5	600	
d	5,930	530 AGL	70	0	0	0	0	0	3.8	500	begin roll
e	6,380	560 AGL	70	0	0	30	0	0	5.1	700	begin turn
f	11,375	4,475 MSL	90	0	0	30	0	0	3.2	500	begin rollout
g	11,825	4,500 MSL	90	0	0	0	0	0	0.0	0	end turn
h	50,000	4,500 MSL	90	0	0	0	0	0			

Flight Profile: 106 - Northwest (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: DXN5 - Northwest

0 4,000 8,000 12,000 16,000 20,000 24,000

Scale in Feet 1:78,800 (1 inch = 6,560 feet)

N

Figure A-50. Departure Flight Profile 106

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	8.2	500	
b	208	30 AGL	70	0	0	0	0	0	5.7	700	begin roll
c	608	70 AGL	70	0	0	-30	0	0	6.8	800	begin turn
d	3,366	400 AGL	70	0	0	-30	0	0	6.1	800	begin rollout
e	3,816	3,920 MSL	70	0	0	0	0	0	3.7	500	end turn
f	12,811	4,500 MSL	90	0	0	0	0	0	0.0	0	
g	49,990	4,500 MSL	90	0	0	0	0	0			

Flight Profile: 105 - Northwest (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: DXS6 - Northwest

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000
Scale in Feet 1:28,200 (1 inch = 2,350 feet)

Figure A-51. Departure Flight Profile 105

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm
a	0	0 AGL	0	0	0	0	0	0	5.6	400
b	3,038	300 AGL	70	0	0	0	0	0	3.7	500
c	6,562	4,000 MSL	70	0	0	0	0	0	0.0	0
d	13,110	4,000 MSL	90	0	0	0	0	0	0.8	100
e	50,000	4,500 MSL	90	0	0	0	0	0		

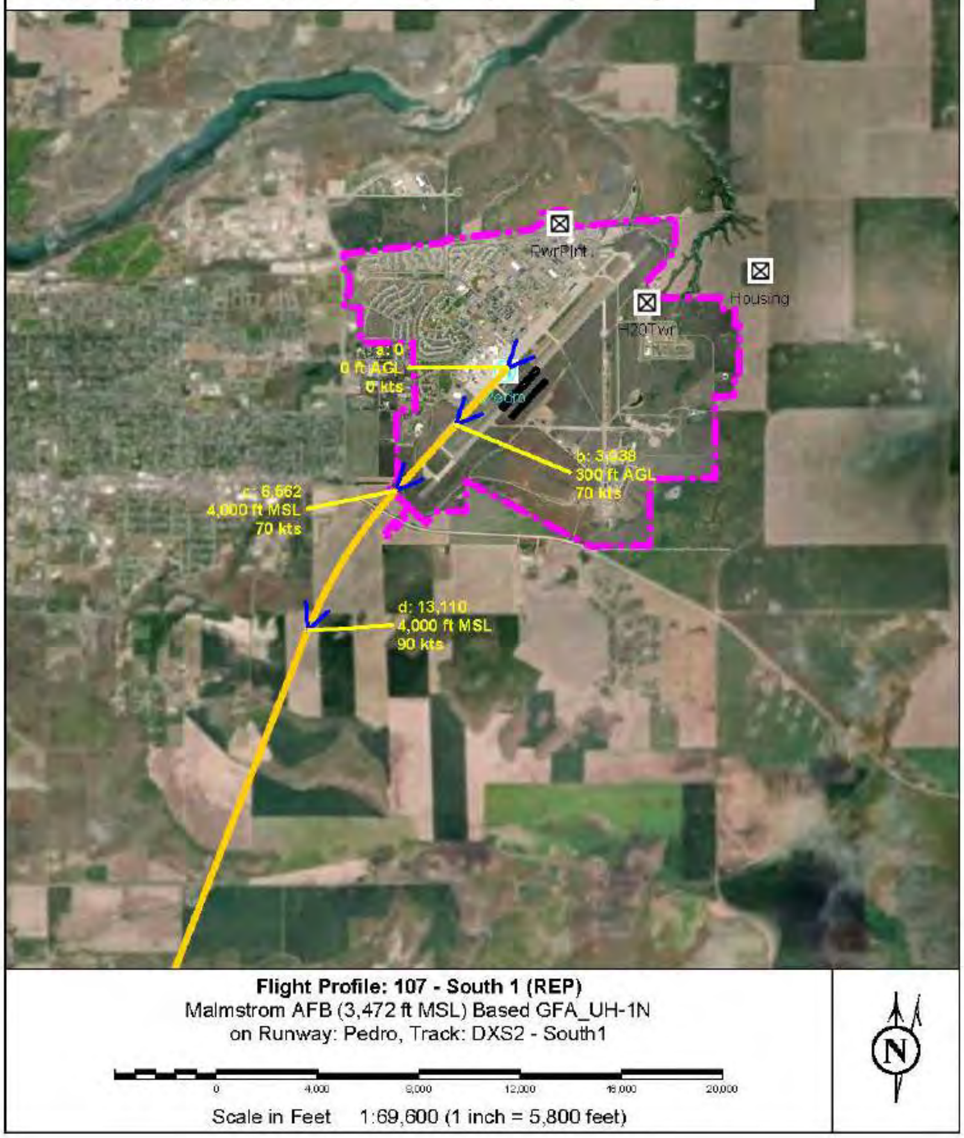


Figure A-52. Departure Flight Profile 107

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	7.5	900	
c	3,800	400 AGL	70	0	0	0	0	0	6.3	800	begin roll
d	4,253	450 AGL	70	0	0	-30	0	0	4.2	600	begin turn
e	12,152	4,500 MSL	90	0	0	-30	0	0	0.0	0	reaches 4500 MSL, 90 kts
f	16,200	4,500 MSL	90	0	0	-30	0	0	0.0	0	begin roll out
g	16,659	4,500 MSL	90	0	0	0	0	0	0.0	0	end turn
h	49,990	4,500 MSL	90	0	0	0	0	0			

Flight Profile: 108 - South 1 and Southwest (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: DXN1 - South1

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000
Scale in Feet 1:58,200 (1 inch = 4,850 feet)

Figure A-53. Departure Flight Profile 108

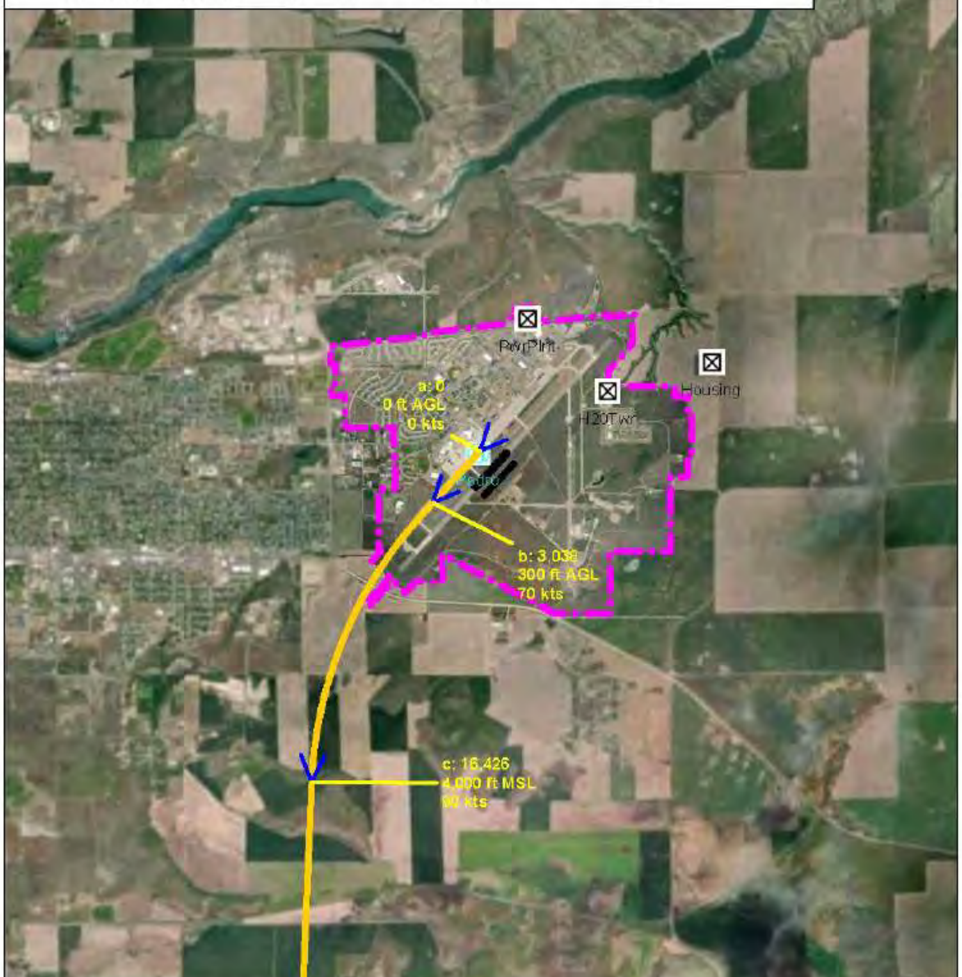
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	7.5	900	
c	3,800	400 AGL	70	0	0	0	0	0	6.3	800	begin roll
d	4,253	450 AGL	70	0	0	-30	0	0	4.2	600	begin turn
e	12,152	4,500 MSL	90	0	0	-30	0	0	0.0	0	reaches 4500 MSL, 90 kts
f	16,200	4,500 MSL	90	0	0	-30	0	0	0.0	0	begin roll out
g	16,659	4,500 MSL	90	0	0	0	0	0	0.0	0	end turn
h	19,497	4,500 MSL	90	0	0	0	0	0	0.0	0	begin roll
i	19,697	4,500 MSL	90	0	0	15	0	0	0.0	0	begin turn
j	25,065	4,500 MSL	90	0	0	15	0	0	0.0	0	begin roll out
k	25,265	4,500 MSL	90	0	0	0	0	0	0.0	0	end turn
l	49,990	4,500 MSL	90	0	0	0	0	0			

Flight Profile: 110 - South 2 (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: DXN2 - South2

Scale in Feet 1:46,500 (1 inch = 3,880 feet)

Figure A-54. Departure Flight Profile 110

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm
a	0	0 AGL	0	0	0	0	0	0	5.6	400
b	3,038	300 AGL	70	0	0	0	0	0	1.0	100
c	16,426	4,000 MSL	90	0	0	0	0	0	0.9	100
d	50,000	4,500 MSL	90	0	0	0	0	0		



Flight Profile: 109 - South 2 (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: DXS3 - South2

0 4,000 8,000 12,000 16,000 20,000 24,000
Scale in Feet 1:76,000 (1 inch = 6,330 feet)

Figure A-55. Departure Flight Profile 109

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	3.7	500	
c	14,350	4,500 MSL	90	0	0	0	0	0	0.0	0	begin roll
d	14,801	4,500 MSL	90	0	0	-30	0	0	0.0	0	begin turn
e	22,193	4,500 MSL	90	0	0	-30	0	0	0.0	0	begin roll out
f	22,649	4,500 MSL	90	0	0	0	0	0	0.0	0	end turn
g	50,000	4,500 MSL	90	0	0	0	0	0			

Flight Profile: 111 - Southwest (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: DXS1 - Southwest

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000

Scale in Feet 1:99,900 (1 inch = 8,330 feet)

N

Figure A-56. Departure Flight Profile 111

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	6.1	400	
b	7,545	800 AGL	70	0	0	0	0	0	0.0	0	begin roll
c	7,900	800 AGL	70	0	0	-30	0	0	7.3	900	begin xwind turn
d	9,455	1,000 AGL	70	0	0	-30	0	0	0.0	0	begin rollout; reach 1k AGL
e	9,810	1,000 AGL	70	0	0	0	0	0	0.0	0	begin downwind
f	18,955	1,000 AGL	90	0	0	0	0	0	0.0	0	begin roll & autorotate
g	19,410	1,000 AGL	90	0	0	-30	0	0	-14.4	-2100	begin turn & descent
h	20,965	600 AGL	70	0	0	-30	0	0	-15.7	-2000	begin rollout
i	21,320	500 AGL	70	0	0	0	0	0	-16.4	-1000	on final
j	23,020	0 AGL	0	0	0	0	0	0			

Flight Profile: 191 - EP, Auto-Rotation, 90
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: PPS6 - Autorotation

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

Scale in Feet 1:29,400 (1 inch = 2,450 feet)

N

Figure A-57. Closed Pattern Flight Profile 191

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	6.1	400	
b	7,545	800 AGL	70	0	0	0	0	0	0.0	0	begin roll
c	7,900	800 AGL	70	0	0	30	0	0	7.3	900	begin xwind turn
d	9,455	1,000 AGL	70	0	0	30	0	0	0.0	0	begin rollout, reach 1k AGL
e	9,810	1,000 AGL	70	0	0	0	0	0	0.0	0	begin downwind
f	18,955	1,000 AGL	90	0	0	0	0	0	0.0	0	begin roll & autorotate
g	19,410	1,000 AGL	90	0	0	30	0	0	-7.3	-1000	begin base turn
h	20,965	800 AGL	70	0	0	30	0	0	0.0	0	begin rollout
i	21,320	800 AGL	70	0	0	0	0	0	-25.2	-1700	on final
j	23,020	0 AGL	0	0	0	0	0	0			

Flight Profile: 190 - EP, Auto-Rotation, 90 (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: PPS5 - Autorotation

0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:38,500 (1 inch = 3,210 feet)

N

Figure A-58. Closed Pattern Flight Profile 190

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	3.1	200	
b	3,655	200 AGL	70	0	0	0	0	0	0.0	0	begin roll
c	4,010	200 AGL	70	0	0	30	0	0	1.5	200	begin turn
d	8,930	3,800 MSL	70	0	0	30	0	0	0.0	0	begin rollout
e	9,288	3,800 MSL	70	0	0	0	0	0	1.9	300	begin downwind
f	15,182	4,000 MSL	90	0	0	0	0	0	0.0	0	reach 4k MSL
g	15,945	4,000 MSL	90	0	0	0	0	0	-5.5	-900	begin descent
h	17,495	3,850 MSL	90	0	0	0	0	0	-5.0	-800	begin roll
i	17,950	3,810 MSL	90	0	0	30	0	0	-4.1	-600	begin turn
j	19,885	200 AGL	70	0	0	30	0	0	0.0	0	begin rollout
k	20,241	200 AGL	70	0	0	0	0	0	-3.5	-200	on final
l	23,541	0 AGL	0	0	0	0	0	0			0 ft AGL

Flight Profile: 192 - EP, Non-autorotation, Dogleg pattern (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: PPS4 - Autorotation

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

Scale in Feet 1:30,600 (1 inch = 2,550 feet)

N

Figure A-59. Closed Pattern Flight Profile 192

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	3.4	500	half mile upwind
c	3,550	330 AGL	90	0	0	0	0	0	2.5	400	begin roll
d	4,010	350 AGL	90	0	0	30	0	0	1.8	300	begin xwind turn
e	8,830	500 AGL	90	0	0	30	0	0	0.0	0	begin roll out; reach 500 AGL
f	9,288	500 AGL	90	0	0	0	0	0	0.0	0	begin downwind
g	17,500	500 AGL	90	0	0	0	0	0	0.0	0	begin roll
h	17,950	500 AGL	90	0	0	30	0	0	-5.0	-700	begin turn & descent
i	19,890	330 AGL	70	0	0	30	0	0	-4.9	-600	begin roll out; initiate final des
j	20,241	300 AGL	70	0	0	0	0	0	-5.2	-300	on final
k	23,541	0 AGL	0	0	0	0	0	0			

Flight Profile: 189 - EP, auto-rotation, 180 (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: PPS4 - Autorotation

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000
Scale in Feet 1:29,100 (1 inch = 2,430 feet)

Figure A-60. Closed Pattern Flight Profile 189

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	2.9	400	half mile upwind
c	7,480	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	7,838	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin xwind turn
e	9,060	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
f	9,518	4,000 MSL	90	0	0	0	0	0	0.0	0	begin xwind leg
g	12,590	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	13,042	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to downwind
i	14,306	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
j	14,761	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	22,700	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	23,161	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to base
m	23,680	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
n	24,135	4,000 MSL	90	0	0	0	0	0	0.0	0	begin base leg
o	29,030	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
p	29,485	4,000 MSL	90	0	0	-30	0	0	-6.9	-1000	begin turn to final
q	31,367	300 AGL	70	0	0	-30	0	0	0.0	0	begin rollout
r	31,722	300 AGL	70	0	0	0	0	0	-3.0	-200	begin final leg
s	35,747	90 AGL	0	0	0	0	0	0			threshold

Flight Profile: 177 - Local VFR, Avoid Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: PGN2 - Avoid Pattern

Scale in Feet 1:55,100 (1 inch = 4,590 feet)

Figure A-61. Closed Pattern Flight Profile 177

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	5.2	700	half mile upwind
c	5,560	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	6,016	4,000 MSL	90	0	0	30	0	0	0.0	0	begin xwind turn
e	7,780	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
f	8,238	4,000 MSL	90	0	0	0	0	0	0.0	0	begin xwind leg
g	13,190	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	13,646	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn
i	14,350	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
j	14,804	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	22,675	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	23,128	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn to base
m	24,390	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
n	24,847	4,000 MSL	90	0	0	0	0	0	-3.8	-600	begin base leg
o	27,890	3,800 MSL	90	0	0	0	0	0	0.0	0	begin roll
p	28,347	3,800 MSL	70	0	0	30	0	0	-3.9	-500	begin turn to final leg
q	29,650	240 AGL	70	0	0	30	0	0	-4.0	-500	begin rollout
r	30,008	215 AGL	70	0	0	0	0	0	-2.1	-100	end turn
s	35,908	0 AGL	0	0	0	0	0	0			

Flight Profile: 178 - Local VFR, Avoid Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: PGS2 - Avoid Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000

Scale in Feet 1:55,200 (1 inch = 4,600 feet)

N

Figure A-62. Closed Pattern Flight Profile 178

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	2.9	400	half mile upwind
c	7,600	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	7,960	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to xwind
e	9,220	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
f	9,678	4,000 MSL	90	0	0	0	0	0	0.0	0	begin xwind leg
g	13,416	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	13,871	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn
i	15,120	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
j	15,571	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	23,501	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	23,956	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to base
m	24,475	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
n	24,930	4,000 MSL	90	0	0	0	0	0	0.0	0	begin base leg
o	30,275	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
p	30,730	4,000 MSL	90	0	0	-30	0	0	-6.5	-900	begin turn to final
q	32,720	300 AGL	70	0	0	-30	0	0	0.0	0	begin rollout
r	33,073	300 AGL	70	0	0	0	0	0	-3.0	-200	end turn
s	37,273	80 AGL	0	0	0	0	0	0			threshold

Flight Profile: 179 - Local VFR, Avoid Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA_S-N, Track: PPN2 - Avoid Pattern

Scale in Feet 1:55,200 (1 inch = 4,600 feet)

Figure A-63. Closed Pattern Flight Profile 179

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	3.6	500	half mile upwind
c	6,630	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	6,987	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to xwind
e	8,100	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
f	8,553	4,000 MSL	90	0	0	0	0	0	0.0	0	begin xwind leg
g	12,475	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	12,928	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn
i	14,285	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
j	14,740	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	22,550	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	23,004	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn
m	23,652	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
n	24,107	4,000 MSL	90	0	0	0	0	0	0.0	0	begin base leg
o	30,150	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll
p	30,607	4,000 MSL	70	0	0	-30	0	0	-6.3	-800	begin turn to final
q	32,660	300 AGL	70	0	0	-30	0	0	0.0	0	begin rollout
r	33,013	300 AGL	70	0	0	0	0	0	-3.0	-200	end turn
s	38,706	0 AGL	0	0	0	0	0	0			at pad

Flight Profile: 181 - Local VFR, Avoid Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: PXN2 - Avoid Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000

Scale in Feet 1:55,100 (1 inch = 4,590 feet)

N

Figure A-64. Closed Pattern Flight Profile 181

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	5.2	700	half mile upwind
c	5,520	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	5,975	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn to xwind
e	7,925	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
f	8,380	4,000 MSL	90	0	0	0	0	0	0.0	0	begin xwind leg
g	14,370	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	14,821	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn
i	15,360	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
j	15,814	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	23,805	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	24,260	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn to base
m	25,525	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
n	25,979	4,000 MSL	90	0	0	0	0	0	-2.9	-500	begin base leg
o	29,960	3,800 MSL	90	0	0	0	0	0	0.0	0	begin roll
p	30,415	3,800 MSL	90	0	0	30	0	0	0.0	0	begin turn to final
q	31,525	3,800 MSL	90	0	0	30	0	0	-3.5	-600	begin rollout
r	31,980	300 AGL	90	0	0	0	0	0	-2.6	-200	end turn
s	38,671	0 AGL	0	0	0	0	0	0			

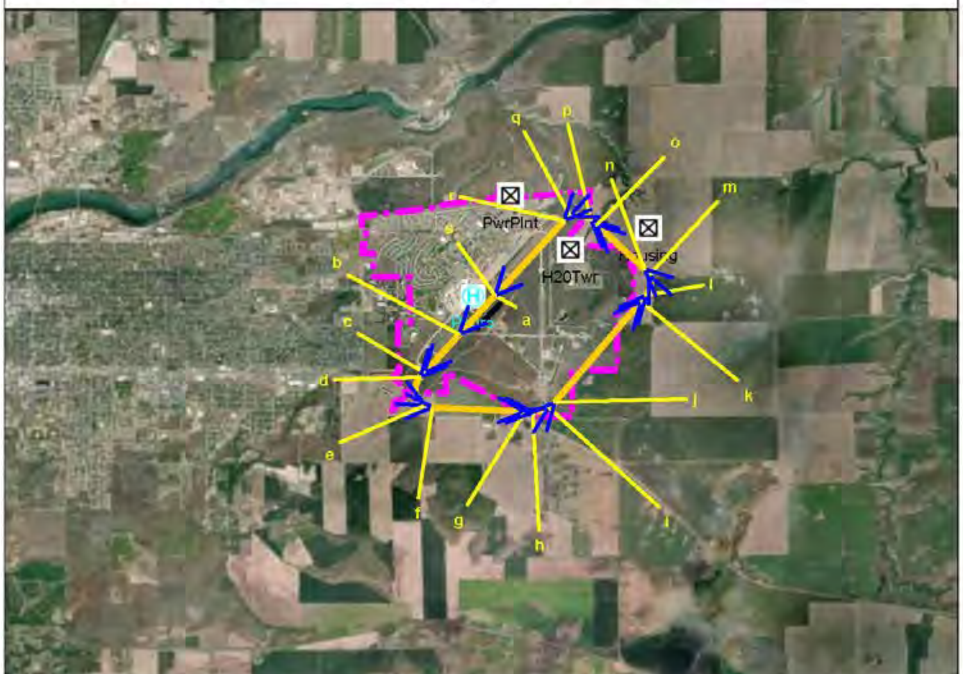
Flight Profile: 182 - Local VFR, Avoid Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: PXS2 - Avoid Pattern

Scale in Feet 1:54,900 (1 inch = 4,570 feet)

N

Figure A-65. Closed Pattern Flight Profile 182

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	4.4	600	half mile upwind
c	6,025	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	6,380	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn to xwind
e	8,270	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
f	8,724	4,000 MSL	90	0	0	0	0	0	0.0	0	begin xwind leg
g	14,040	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	14,496	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn
i	15,475	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
j	15,930	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	23,556	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	24,011	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn to base
m	25,240	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
n	25,691	4,000 MSL	90	0	0	0	0	0	-3.1	-500	begin base leg
o	29,430	3,800 MSL	90	0	0	0	0	0	0.0	0	begin roll
p	29,884	3,800 MSL	90	0	0	30	0	0	0.0	0	begin turn
q	31,150	3,800 MSL	90	0	0	30	0	0	-3.5	-600	begin rollout
r	31,602	300 AGL	90	0	0	0	0	0	-2.9	-200	begin final
s	37,446	0 AGL	0	0	0	0	0	0			



Flight Profile: 180 - Local VFR, Avoid Pattern and EP Non-autorotation, Avoid Pattern (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: PPS2 - Avoid Pattern

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000
Scale in Feet 1:101,000 (1 inch = 8,440 feet)

N

Figure A-66. Closed Pattern Flight Profile 180

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	0.0	0	half mile upwind
c	4,525	300 AGL	70	0	0	0	0	0	0.0	0	begin roll
d	4,880	300 AGL	90	0	0	-30	0	0	4.1	600	begin xwind turn
e	8,090	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout, reaches 4k M
f	8,546	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
g	17,265	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	17,721	4,000 MSL	90	0	0	-30	0	0	-3.1	-400	begin base turn & descent
i	20,960	350 AGL	70	0	0	-30	0	0	0.0	0	begin rollout
j	21,311	350 AGL	70	0	0	0	0	0	-3.7	-300	end base turn
k	25,304	90 AGL	10	0	0	0	0	0			

Flight Profile: 171 - Local VFR, Tight Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: PGN1 - Tight Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:37,300 (1 inch = 3,110 feet)

Figure A-67. Closed Pattern Flight Profile 171

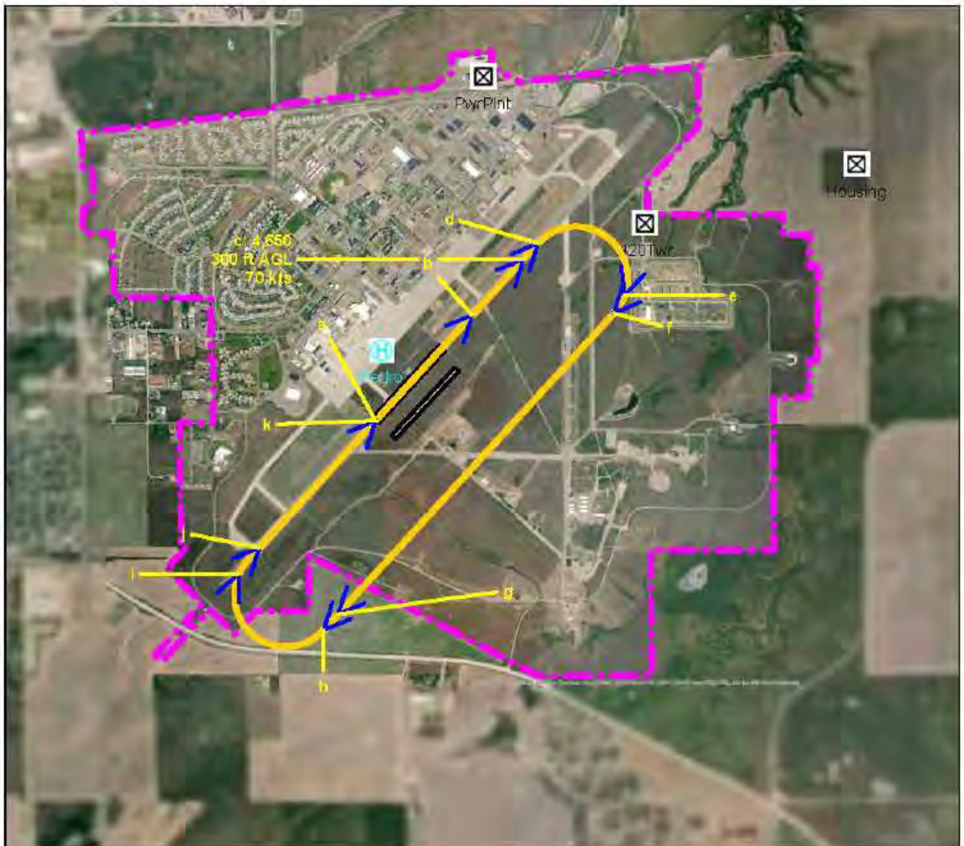
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	5.2	700	half mile upwind
c	5,530	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	5,986	4,000 MSL	90	0	0	30	0	0	0.0	0	begin xwind turn
e	9,100	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
f	9,556	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
g	18,375	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll
h	18,731	4,000 MSL	70	0	0	30	0	0	-3.6	-400	begin base turn & descent
i	22,042	320 AGL	70	0	0	30	0	0	-3.2	-400	begin rollout
j	22,397	300 AGL	70	0	0	0	0	0	-4.2	-300	end base turn
k	25,298	85 AGL	10	0	0	0	0	0			threshold

Flight Profile: 172 - Local VFR, Tight Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: PGS1 - Tight Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:37,300 (1 inch = 3,110 feet)

Figure A-68. Closed Pattern Flight Profile 172



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	0.0	0	half mile upwind
c	4,650	300 AGL	70	0	0	0	0	0	0.0	0	begin roll
d	5,104	300 AGL	90	0	0	-30	0	0	4.4	700	begin xwind turn
e	8,090	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout; reaches 4k M
f	8,541	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
g	17,200	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	17,655	4,000 MSL	90	0	0	-30	0	0	-3.3	-500	begin base turn & descent
i	20,740	350 AGL	90	0	0	-30	0	0	0.0	0	begin rollout
j	21,450	350 AGL	70	0	0	0	0	0	-3.7	-300	end base turn
k	25,102	115 AGL	10	0	0	0	0	0			

Flight Profile: 173 - Local VFR, Tight Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA_S-N, Track: PPN1 - Tight Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:37,400 (1 inch = 3,120 feet)

N

Figure A-69. Closed Pattern Flight Profile 173

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	2.8	300	half mile upwind
c	4,060	350 AGL	70	0	0	0	0	0	4.0	500	end turn
d	4,414	375 AGL	70	0	0	-30	0	0	3.2	500	begin xwind turn
e	7,130	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout, reaches 4k M
f	7,584	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
g	16,240	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	16,698	4,000 MSL	90	0	0	-30	0	0	-3.5	-500	begin base turn
i	19,570	350 AGL	70	0	0	-30	0	0	0.0	0	begin roll
j	19,924	350 AGL	70	0	0	0	0	0	-3.7	-200	end base turn
k	25,292	0 AGL	0	0	0	0	0	0			

Flight Profile: 175 - Local VFR, Tight Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: PXN1 - Tight Pattern

Scale in Feet 1:37,200 (1 inch = 3,100 feet)

Figure A-70. Closed Pattern Flight Profile 175

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	5.8	800	half mile upwind
c	5,300	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	5,751	4,000 MSL	90	0	0	30	0	0	0.0	0	begin xwind turn
e	8,520	4,000 MSL	90	0	0	30	0	0	0.0	0	begin roll
f	8,977	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
g	17,700	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	18,152	4,000 MSL	90	0	0	30	0	0	-4.6	-700	begin base turn
i	20,970	300 AGL	70	0	0	30	0	0	0.0	0	begin roll
j	21,322	300 AGL	70	0	0	0	0	0	-4.2	-300	end base turn
k	25,432	0 AGL	0	0	0	0	0	0			

Flight Profile: 176 - Local VFR, Tight Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: PXS1 - Tight Pattern

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000

Scale in Feet 1:28,600 (1 inch = 2,380 feet)

N

Figure A-71. Closed Pattern Flight Profile 176

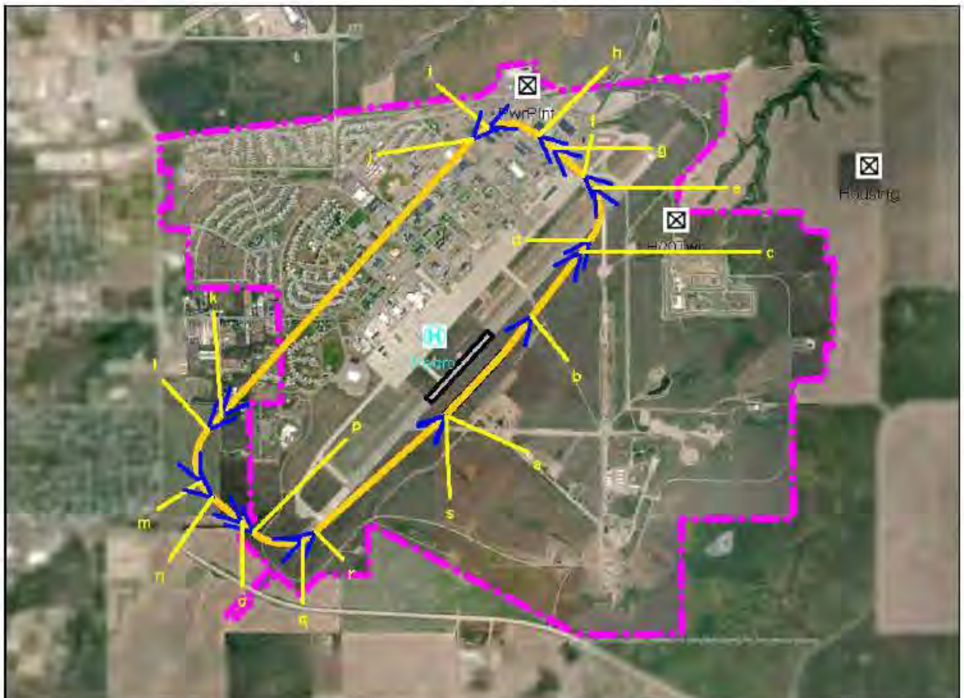
Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	4.9	700	half mile upwind
c	5,680	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	6,137	4,000 MSL	90	0	0	30	0	0	0.0	0	begin xwind turn
e	9,120	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
f	9,574	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
g	18,295	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	18,749	4,000 MSL	90	0	0	30	0	0	-4.2	-600	begin base turn & descent
i	21,830	300 AGL	70	0	0	30	0	0	0.0	0	begin rollout
j	22,186	300 AGL	70	0	0	0	0	0	-4.2	-300	end base turn
k	25,224	75 AGL	10	0	0	0	0	0			threshold

Flight Profile: 174 - Local VFR, Tight Pattern (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: PPS1 - Tight Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:37,400 (1 inch = 3,110 feet)

Figure A-72. Closed Pattern Flight Profile 174



Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	3.0	400	half mile upwind
c	4,925	400 AGL	70	0	0	0	0	0	3.2	400	begin roll
d	5,279	420 AGL	70	0	0	30	0	0	3.1	400	begin turn to xwind
e	6,560	490 AGL	70	0	0	30	0	0	3.2	400	begin rollout
f	6,921	510 AGL	90	0	0	0	0	0	1.1	200	begin xwind leg
g	7,870	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
h	8,321	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn
i	9,565	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
j	10,020	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	18,665	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	19,120	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn to base
m	20,425	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
n	20,877	4,000 MSL	70	0	0	0	0	0	0.0	0	begin base leg; initiate des
o	21,770	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll
p	22,127	4,000 MSL	70	0	0	30	0	0	-6.0	-700	begin turn
q	23,340	400 AGL	70	0	0	30	0	0	-4.9	-600	begin rollout
r	23,693	370 AGL	70	0	0	0	0	0	-4.5	-300	end turn; initiate final desce
s	27,743	50 AGL	0	0	0	0	0	0			threshold

Flight Profile: 183 - Local VFR, West Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: PGN3 - West Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:40,800 (1 inch = 3,400 feet)

Figure A-73. Closed Pattern Flight Profile 183

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	5.1	700	half mile upwind
c	5,610	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	6,067	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to xwind
e	7,235	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
f	7,690	4,000 MSL	90	0	0	0	0	0	0.0	0	begin xwindleg
g	8,450	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	8,905	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn
i	10,150	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
j	10,604	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	19,260	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	19,718	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to base; start de
m	20,980	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
n	21,437	4,000 MSL	90	0	0	0	0	0	0.0	0	begin base leg
o	22,230	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll
p	22,587	4,000 MSL	70	0	0	-30	0	0	-5.1	-600	begin turn to final
q	23,790	420 AGL	70	0	0	-30	0	0	-4.9	-600	begin rollout
r	24,143	390 AGL	70	0	0	0	0	0	-5.7	-400	end turn, initiate final desce
s	27,548	50 AGL	0	0	0	0	0	0			threshold

Flight Profile: 184 - Local VFR, West Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: PGS3 - West Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:40,900 (1 inch = 3,400 feet)

Figure A-74. Closed Pattern Flight Profile 184

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	2.9	400	half mile upwind
c	4,810	390 AGL	70	0	0	0	0	0	3.2	400	begin roll
d	5,165	410 AGL	70	0	0	30	0	0	3.8	500	begin turn
e	6,530	500 AGL	90	0	0	30	0	0	4.5	700	begin rollout
f	6,883	4,000 MSL	90	0	0	0	0	0	0.0	0	begin xwind leg; reaches 4I
g	7,530	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
h	7,983	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn
i	9,250	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
j	9,702	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	18,360	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	18,816	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn to base
m	20,080	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
n	20,534	4,000 MSL	90	0	0	0	0	0	0.0	0	begin base leg; start desce
o	21,280	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll
p	21,634	4,000 MSL	70	0	0	30	0	0	-5.4	-700	begin turn
q	23,000	400 AGL	70	0	0	30	0	0	-4.9	-600	begin rollout
r	23,353	370 AGL	70	0	0	0	0	0	-4.6	-300	end turn; start final descent
s	27,302	50 AGL	0	0	0	0	0	0			threshold

Flight Profile: 185 - Local VFR, West Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA_S-N, Track: PPN3 - West Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000

Scale in Feet 1:40,800 (1 inch = 3,400 feet)

Figure A-75. Closed Pattern Flight Profile 185

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	0.8	100	half mile upwind
c	3,726	310 AGL	70	0	0	0	0	0	1.6	200	begin roll
d	4,081	320 AGL	70	0	0	30	0	0	2.9	400	begin turn to xwind
e	5,440	390 AGL	90	0	0	30	0	0	3.5	600	begin rollout
f	5,894	3,890 MSL	90	0	0	0	0	0	2.9	500	begin xwind & roll
g	6,294	3,910 MSL	90	0	0	30	0	0	3.2	500	begin turn
h	7,530	3,980 MSL	90	0	0	30	0	0	2.5	400	begin rollout
i	7,984	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind; reaches 4
j	16,660	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
k	17,115	4,000 MSL	90	0	0	30	0	0	0.0	0	begin turn
l	18,360	4,000 MSL	90	0	0	30	0	0	0.0	0	begin rollout
m	18,815	4,000 MSL	90	0	0	0	0	0	0.0	0	begin base leg & roll
n	19,405	4,000 MSL	90	0	0	30	0	0	-5.2	-800	begin turn
o	20,800	400 AGL	90	0	0	30	0	0	-5.0	-700	begin rollout
p	21,257	360 AGL	70	0	0	0	0	0	-3.6	-200	end turn; start final descent
q	26,175	50 AGL	0	0	0	0	0	0			threshold

Flight Profile: 187 - Local VFR, West Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro_S-N, Track: PXN3 - West Pattern

Scale in Feet 1:40,800 (1 inch = 3,400 feet)

Figure A-76. Closed Pattern Flight Profile 187

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	7.2	900	half mile upwind
c	4,845	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll; reaches 4k MSL
d	5,200	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to xwind
e	6,600	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
f	7,052	4,000 MSL	90	0	0	0	0	0	0.0	0	begin xwind leg & roll
g	7,627	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn
h	8,850	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
i	9,308	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
j	17,950	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
k	18,408	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to base
l	19,750	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
m	20,203	4,000 MSL	90	0	0	0	0	0	0.0	0	begin base leg & roll
n	20,553	4,000 MSL	90	0	0	-30	0	0	-5.3	-800	begin turn & descent
o	21,920	400 AGL	70	0	0	-30	0	0	-4.9	-600	begin rollout
p	22,271	370 AGL	70	0	0	0	0	0	-5.6	-300	end turn
q	26,021	0 AGL	0	0	0	0	0	0			

Flight Profile: 188 - Local VFR, West Pattern
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: Pedro, Track: PXS3 - West Pattern

Scale in Feet 1:40,500 (1 inch = 3,380 feet)

Figure A-77. Closed Pattern Flight Profile 188

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	5.6	400	
b	3,038	300 AGL	70	0	0	0	0	0	0.5	100	half mile upwind
c	5,720	325 AGL	70	0	0	0	0	0	4.0	500	begin roll
d	6,076	350 AGL	70	0	0	-30	0	0	4.2	500	begin xwind turn
e	7,440	450 AGL	70	0	0	-30	0	0	2.4	300	begin rollout
f	7,794	465 AGL	70	0	0	0	0	0	4.8	600	begin xwind leg
g	8,540	4,000 MSL	70	0	0	0	0	0	0.0	0	begin roll; reaches 4K MSL
h	8,894	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn
i	10,160	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
j	10,613	4,000 MSL	90	0	0	0	0	0	0.0	0	begin downwind
k	19,270	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
l	19,727	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin turn to base leg
m	20,990	4,000 MSL	90	0	0	-30	0	0	0.0	0	begin rollout
n	21,445	4,000 MSL	90	0	0	0	0	0	0.0	0	begin base leg; begin desc
o	22,090	4,000 MSL	90	0	0	0	0	0	0.0	0	begin roll
p	22,545	4,000 MSL	90	0	0	-30	0	0	-5.4	-800	begin turn to final
q	23,900	400 AGL	70	0	0	-30	0	0	-5.5	-700	begin roll
r	24,264	365 AGL	70	0	0	0	0	0	-5.5	-300	end turn
s	27,302	70 AGL	0	0	0	0	0	0			threshold

Flight Profile: 186 - Local VFR, West Pattern (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: PSA, Track: PPS3 - West Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000

Scale in Feet 1:59,800 (1 inch = 4,980 feet)

N

Figure A-78. Closed Pattern Flight Profile 186

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	1.6	100	
b	3,650	100 AGL	90	0	0	0	0	0	0.0	0	begin roll
c	4,106	100 AGL	90	0	0	30	0	0	0.0	0	begin turn
d	8,156	100 AGL	90	0	0	30	0	0	0.0	0	begin rollout
e	8,611	100 AGL	90	0	0	0	0	0	0.0	0	begin downwind
f	16,514	100 AGL	90	0	0	0	0	0	0.0	0	begin roll
g	16,969	100 AGL	90	0	0	30	0	0	0.0	0	begin turn
h	18,635	100 AGL	90	0	0	30	0	0	0.0	0	begin rollout
i	19,090	100 AGL	90	0	0	0	0	0	-1.8	-100	end turn
j	22,200	0 AGL	0	0	0	0	0	0			

Flight Profile: 195 - Tactical Pattern, East
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: PGS4S - Tactical Pattern

Scale in Feet 1:22,500 (1 inch = 1,880 feet)

Figure A-79. Closed Pattern Flight Profile 195

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	1.2	100	
b	4,660	100 AGL	90	0	0	0	0	0	0.0	0	begin roll
c	5,111	100 AGL	90	0	0	-30	0	0	0.0	0	begin turn
d	6,730	100 AGL	90	0	0	-30	0	0	0.0	0	begin rollout
e	7,189	100 AGL	90	0	0	0	0	0	0.0	0	begin xwind dogleg
f	15,100	100 AGL	90	0	0	0	0	0	0.0	0	begin roll
g	15,561	100 AGL	90	0	0	-30	0	0	0.0	0	begin turn
h	19,580	100 AGL	90	0	0	-30	0	0	0.0	0	begin rollout
i	20,038	100 AGL	90	0	0	0	0	0	-2.7	-200	end turn
j	22,148	0 AGL	0	0	0	0	0	0			

Flight Profile: 193 - Tactical Pattern, East (REP)
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: PGS4N - Tactical Pattern

Scale in Feet 1:29,200 (1 inch = 2,430 feet)

Figure A-80. Closed Pattern Flight Profile 193

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	1.0	0	
b	5,540	100 AGL	40	0	0	0	0	0	0.0	0	begin roll
c	5,894	100 AGL	90	0	0	30	0	0	0.0	0	begin turn
d	8,875	100 AGL	90	0	0	30	0	0	0.0	0	begin rollout
e	9,331	100 AGL	90	0	0	0	0	0	0.0	0	begin downwind
f	16,590	100 AGL	90	0	0	0	0	0	0.0	0	begin roll
g	17,048	100 AGL	90	0	0	30	0	0	0.0	0	begin turn
h	20,030	100 AGL	90	0	0	30	0	0	0.0	0	begin roll
i	20,485	100 AGL	90	0	0	0	0	0	-3.1	-200	end turn
j	22,308	0 AGL	0	0	0	0	0	0			

Flight Profile: 194 - Tactical Pattern, West
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA_S-N, Track: PGN4N - Tactical Pattern

Scale in Feet 1:22,500 (1 inch = 1,870 feet)

Figure A-81. Closed Pattern Flight Profile 194

Point	Distance ft	Height ft	Speed kts	Yaw Angle	Angle of Attack	Roll Angle	Left Dispersion Width ft	Right Dispersion Width ft	Climb Angle °	Climb Rate fpm	Notes
a	0	0 AGL	0	0	0	0	0	0	1.7	100	
b	3,411	100 AGL	70	0	0	0	0	0	0.0	0	begin roll
c	3,766	100 AGL	90	0	0	-30	0	0	0.0	0	begin turn
d	6,370	100 AGL	90	0	0	-30	0	0	0.0	0	begin rollout
e	7,269	100 AGL	90	0	0	0	0	0	0.0	0	begin downwind
f	14,480	100 AGL	90	0	0	0	0	0	0.0	0	begin rollout
g	14,939	100 AGL	70	0	0	-30	0	0	0.0	0	begin turn
h	18,090	100 AGL	70	0	0	-30	0	0	0.0	0	begin rollout
i	18,442	100 AGL	40	0	0	0	0	0	-1.5	-100	end turn
j	22,346	0 AGL	0	0	0	0	0	0			

Flight Profile: 196 - Tactical Pattern, West
Malmstrom AFB (3,472 ft MSL) Based GFA_UH-1N
on Runway: GSA, Track: PGN4S - Tactical Pattern

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

Scale in Feet 1:29,200 (1 inch = 2,430 feet)

N

Figure A-82. Closed Pattern Flight Profile 196

Appendix C.
Threatened, Endangered, and Sensitive Species

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Table 5. Species of Concern or Potential Concern Documented on the Installation (USFWS 2008, MNHP 2017).

Common Name	Scientific Name	State and Federal designations
American white pelican	*Pelecanus erythrorhynchos*	MT State Rank: S3B USFWS: MBTA
Bald Eagle	*Haliaeetus leucocephalus*	MT State Rank: S4 USFWS: BGEPA; MBTA; BCR10, 11, & 17
Burrowing Owl*	*Athene cunicularia*	MT State Rank: S3B USFWS: MBTA; BCR17; BLM: SENSITIVE
Ferruginous Hawk	*Buteo regalis*	MT State Rank: S3B USFWS: MBTA; BCR10&17
Franklin's Gull	*Leucophaeus pipixcan*	MT State Rank S3B; BLM: SENSITIVE USFWS: MBTA
Golden Eagle	*Aquila chrysaetos*	MT State Rank: S3 USFWS: BGEPA; MBTA; BCR10&17
Grasshopper Sparrow*	*Ammodramus savannarum*	MT State Rank: S4B USFWS: MBTA; BCR17
Great Blue Heron	*Ardea herodias*	MT State Rank: S3; USFWS: MBTA
Long-billed curlew	*Numenius americanus*	MT State Rank: S3B USFWS: BGEPA; MBTA; BCR10, 11, & 17
Short-eared owl	*Asio flammeus*	MT State Rank: S4 USFWS: MBTA; BCR11 & 17
Swainson's Hawk*	*Buteo swainsoni*	MT State Rank: S3 USFWS: MBTA; BCR10&11
Peregrine falcon	*Falco peregrinus*	MT State Rank: S3; BLM: SENSITIVE USFWS: MBTA; BCR10, 11, & 17
Prairie falcon	*Falco mexicanus*	MT State Rank: S4 USFWS: MBTA; BCR 17
Upland sandpiper	*Bartramia longicauda*	MT State Rank: S4B USFWS: BGEPA; MBTA; BCR10, 11, & 17
Black-tailed Prairie Dog*	*Cynomys ludovicianus*	MT State Rank: S3; BLM: SENSITIVE
Little brown bat	*Myotis lucifugus*	MT State Rank: S3

The data and ranking in Table 5 were obtained from the Montana Natural Heritage Program website (MNHP 2017) and are defined below.

Symbol	Definition
*	**Breeding on Base.**
S1	At high risk because of extremely limited and/or rapidly declining population numbers, range and/or habitat. Highly vulnerable to global extinction or extirpation in the state.
S2	At risk due to very limited and/or potentially declining population numbers, range and/or habitat. Vulnerable to global extinction or extirpation in the state.
S3	Potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas.
S4	Apparently secure, though may be quite rare in parts of its range, and/or suspected to be declining
BGEPA	**The Bald and Golden Eagle Protection Act of 1940 (BGEPA)** (16 U.S.C. 668-668c) prohibits anyone, without a permit issued by the Secretary of the Interior, from taking Bald or Golden eagles, including their parts, nests, or eggs. BGEPA provides criminal and civil penalties for persons who take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any Bald eagle ... [or any Golden eagle], alive or dead, or any part, nest, or egg thereof. BGEPA defines "take" as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagles return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.
MBTA	**The Migratory Bird Treaty Act (MBTA)** - (16 U.S.C. §§ 703-712, July 3, 1918, as amended 1936, 1960, 1968, 1969, 1974, 1978, 1986 and 1989) implements 4 treaties that provide for international protection of migratory birds. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a USFWS permit or regulatory authorization, are a violation of the MBTA. The MBTA states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase …ship, export, import …transport or cause to be transported …any migratory bird, any part, nest, or eggs of any such bird ….[The Act] prohibits the taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior." The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." The USFWS maintains a list of species protected by the MBTA at 50 CFR 10.13. The USFWS also maintains a list of species not protected by the MBTA. MBTA does not protect species that are not native to the U.S. or species groups not explicitly covered under the MBTA; these include species such as the house (English) sparrow, European starling, rock pigeon, Eurasian collared-dove, and non-migratory upland game birds.
BCR	"The 1988 amendment to the Fish and Wildlife Conservation Act mandates USFWS to identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA. Birds of Conservation Concern 2008 (USFWS, 2008) is the most recent effort to carry out this mandate. The overall goal of this report is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the Service's highest conservation priorities." (USFWS, 2008).

Potential Species of Concern on Malmstrom AFB, main installation:

- *Porcupine*

The porcupine in Montana is listed as a "Potential Species of Concern" (MNHP, 2017). Causes of mortality include predation, loss of habitat, and hunting (MNHP, 2017). The Porcupine has been observed on the main installation during game camera surveillance work as recently as 2017. Management recommendations include increasing awareness among Base residents to avoid vehicle collisions with the slow-moving Porcupine. Caution should be taken driving vehicles off-road at night and during summer.

- *Short-eared owl*

The Short-eared owl has been observed frequenting grassland areas south and southeast of the Combat Arms Training complex during the breeding season and is a likely nester there. This is a "Potential Species of Concern," which describes those species native to Montana for which current information suggests potential vulnerability (MNHP 2017). Because Short-eared owls are ground nesters that require relatively large areas of grassland, they are susceptible to increased predation pressure often associated with fragmented habitats and nearby rural developments. As a result, they seem to be especially sensitive to habitat loss and fragmentation (Wiggins et al., 2006; Vickery, 1996). Their main prey items are small mammals (Wiggins et al., 2006). While Short-eared owls tend to avoid highly altered areas, management actions that maintain lower vegetation heights, i.e., wowing, burning or rotational grazing, can create suitable conditions for this species (Wisconsin Department of Natural Resources, 2017).

Species of Concern on Malmstrom AFB, main installation

REPTILES

The main installation hosts no known threated, endangered, or species of special concern reptiles.

AMPHIBIANS

The Northern Leopard Frog is associated with ponds and other water features in lower elevations (MNHP, 2017), and has been documented on the main installation (Melton, 2018). This species was found to be not warranted for federal listing under the ESA in 2011 (76 FR 61896) and in Montana, east of the Rockies, it is not designated a "Species of Concern" (MNHP, 2017). Thus, currently there are no known amphibians considered threated, endangered, or species of special concern on the main installation.

Management recommendations: To minimize impacting the species on Base, avoid mowing and construction-related activities on the eastern portion of the Base during the nesting season (June - late August). Individual grassland site disturbances may be accomplished, but on a long rotating schedule (3-8 years), or limit disturbance to 20%-30% of a site in any given year.

FISH and CRUSTACEANS

There are no known fish or crustaceans considered threated, endangered, or species of special concern on the main installation.

PLANTS

- *Many-headed sedge*

There is one high-risk, sensitive plant species whose ranges overlap with the main installation: Many-headed sedge (*Carex sychnocephala*; State Rank: S1S2; MNHP, 2017). It is unknown if this species is present on the main installation. However, because the ranges of this species overlaps with the Base (MNHP, 2017), surveys for this plant on the main installation are recommended.

MAMMALS

- *Black-tailed prairie dog*

The state of Montana lists the Black-tailed prairie dog (*Cynomys ludovicianusas*) as a state Species of Concern, due to a range of threats that caused recent declines in Montana (MNHP, 2017). MFWP's Montana Prairie Dog Working Group manages the species under a Conservation Plan for Black-tailed and White-tailed Prairie Dogs (Montana Prairie Dog Working Group, 2002). The species has been observed in small numbers on the main installation; i.e. two burrows (Dr. Elin Pierce, USFWS). Management recommendations for this species include mapping the burrows, and maintaining awareness to ensure pest removal actions for Richardson's ground squirrel exclude active Black-tailed prairie dog burrows.

- *Little Brown Bat / Little Brown Myotis*

The Little Brown Myotis, despite its widespread U.S. distribution, is considered vulnerable to extinction and a Montana Species of Concern (MNHP, 2017). A variety of threats have contributed to their decline (e.g. wind energy turbines), but the rapid spread of an introduced fungal disease has caused significant mortality (white-nose syndrome; Kunz and Reichard, 2010). Management recommendations for this species include conducting night-time surveys on the main installation to determine location and numbers, and dependent on findings, collaborate with MFWP bat specialists for management recommendations.

BIRDS

On Malmstrom AFB main installation, several avian Species of Concern, as designated by the State of Montana (MNHP, 2017) and/or USFWS (2008), as well as Bald and Golden eagles which occasionally fly over the Base have been observed (Dr. Elin Pierce, USFWS). Management actions for these species (Table 5) requires compliance with the Migratory Bird Treaty Act and The Bald and Golden Eagle Protection Act.

- *Burrowing Owl*

Malmstrom should afford the Burrowing Owl additional management consideration as a state "Species of Concern" (MNHP, 2017), as well as a "Mission-sensitive species" by the DoD Partners in Flight steering committee. The Burrowing Owl has been observed nesting on Base using previously excavated animal burrows in the south and southeast horse pastures leased to the Base Riding Club (Dr. Elin Pierce, USFWS). Management recommendations: To minimize project impacts during the nesting season, presence/absence surveys should be conducted during the nesting and fledging times during May – July.

Threatened, Endangered, or Candidate species in Malmstrom AFB Missile Complex:

Currently, no LF or MAF occurs within designated critical habitat for any listed T&E species. However, within the missile complex, a number of sites are located within the known ranges of, or potential habitat for, federally listed threatened, endangered, or candidate species (see Table 6).

Table 6. Threatened, Endangered, or Candidate species in Malmstrom AFB Missile Complex.

Missile Squadron	Counties	ESA Listed and Proposed Species
564th (Demolished/Care-taker Status)	Chouteau, Pondera, Teton and Toole	Piping Plover (LT), Grizzly Bear (LT), Canada Lynx (LT, CH), Red Knot (LT), Wolverine (PT)
12th	Cascade, Chouteau, Lewis and Clark, and Teton	Grizzly Bear (LT), Canada Lynx (LT, CH), Wolverine (PT), Pallid Sturgeon (LE), Red Knot (LT), Whitebark Pine (C)
10th	Cascade, Fergus, and Judith Basin	Pallid Sturgeon (LE), Red Knot (LT)
490th	Fergus, Judith Basin, and Wheatland	Wolverine (PT), Pallid Sturgeon (LE)
LE (Listed Endangered), LT (Listed Threatened), PT (Proposed Threatened), C (Candidate),		

Data from MNHP (2017) and USFWS (2017).

REPTILES

There are no known Federally-listed, proposed, or candidate reptile species in Montana (USFWS, 2017). There are three state Species of Concern with habitat types and ranges that overlap the missile complex.

These are: Plains Hog-nosed Snake (*Heterodon nasicus*), Western Milksnake (*Lampropeltis gentilis*), and Greater Short-horned lizard (*Phrynosoma hernandesi*) (MNHP, 2017). Data are lacking on presence/absence of this species or its habitats on or near LFs or MAFs.

AMPHIBIANS

Great Plains Toad (*Anaxyrus cognatus*) is a state Species of Concern in Montana that has a range overlapping the missile complex (MNHP, 2017). Data are lacking on presence/absence of this species or its habitats on or near LFs or MAFs.

Plains Spadefoot (*Spea bombifrons*) is a state Species of Concern in Montana that has a range overlapping the missile complex (MNHP, 2017). Data are lacking on presence/absence of this species or its habitats on or near LFs or MAFs.

FISH and CRUSTACEANS

- *Pallid Sturgeon*

The Pallid sturgeon is a bottom-dwelling fish native to and inhabiting the Missouri, Yellowstone, Marias, Milk, Poplar, Powder, and Tongue rivers (USFWS, 2014), none of which occur within the missile field.

PLANTS

- *Whitebark Pine*

The Whitebark pine is a Candidate species for listing under the ESA (81 FR 87246). The species habitat and range is higher elevation forested areas in central and western Montana, where it favors high-elevation upper montane habitat near the tree line (MNHP, 2017; USFWS, *pers. comm.*). Whitebark pine has been reported in the vicinity of two or more LFs (A-05, C-08) in the Belt Mountain range in both Cascade and Judith Basin counties (MNHP, 2017).

MAMMALS

Montana has a number of sensitive large mammals that are either considered state Species of Concern, or have a designated status under the ESA. These include the Wolverine (*Gulo gulo*), Fisher (*Pekania pennanti*), Grizzly Bear (*Ursus arctos*), Canada Lynx (*Lynx canadensis*), Black-footed Ferret (*Mustela nigripes*), and Swift Fox (*Vulpes velox*).

- *Black-footed Ferret*

The Black-footed Ferret is listed as federally endangered under the ESA (32 FR 4001) and is also a Montana State Species of Concern (MNHP, 2017). The Black-footed Ferret is a now very rare species whose range once encompassed large areas of central Montana, including areas that overlapped the current missile complex location. The ferret's natural habitat is closely tied to their prey, prairie dogs, in grasslands, steppe, and shrub steppe. The Black-footed Ferret has been eliminated throughout much of their historic range. Their decline is thought to be directly related to widespread disease outbreaks, primarily sylvatic plague, land-use modifications to its native rangeland habitat, and large-scale use of toxicants to control prairie dogs, the ferret's primary prey. The ferret was thought to be extinct in 1979, but was re-discovered in Wyoming in 1981. From 1989, the USFWS conducted extensive surveys for the Black-footed Ferret in potentially suitable habitats in an attempt to locate additional extant populations. However, no other extant, wild populations have been detected to date.

Based on the failure to locate additional populations and with the ubiquity of sylvatic plague throughout the historic range of the species, the USFWS determined that the Black-footed Ferret has been extirpated throughout its range, except where reintroduced. Under the authority of Section 10(j) of the ESA, experimental, non-essential populations have been established in portions of Arizona, Colorado, Montana, South Dakota, Utah, and Wyoming since 1991. More recently, ferrets have been reintroduced through the Black-footed Ferret Programmatic Safe Harbor Agreement, which uses authorities described in Section 10(a)(1)(A) of the ESA. No Black-footed Ferret reintroductions have occurred in the Malmstrom AFB deployment area. Consequently, it is reasonable to not anticipate any occurrence of the Black-footed Ferret within the missile complex.

- *Grizzly Bear*

While the Grizzly Bear population in the Greater Yellowstone Ecosystem was delisted in 2017 (82 FR 30502), the Grizzly Bear is still designated as Threatened in the continental United States under the ESA (40 FR 31734) and is also a Montana State Species of Concern (MNHP, 2017). The Grizzly Bear inhabits alpine/subalpine coniferous forest and plains, and is typically found in western and central Montana (MNHP, 2017). The specie's range overlaps the mountainous portions of the southwestern and western missile complex.

- *Canada lynx*

The Canada lynx is listed as federally threatened under the ESA (65 FR 16053) and is also a Montana State Species of Concern (MNHP, 2017). It is a resident in core montane spruce/fir forests. In secondary/peripheral forested habitat however, it is a transient. Critical habitat has been designated for this species (79 FR 54782). Though designated critical habitat does not overlap the missile complex, the boundary does extend to approximately 3 miles (4.8 km) to the southwest of the Golf-08 LF (490th missile squadron). Additionally, MNHP (2017) range maps overlaps with two missile sites in the mountains portions of the southwestern and western missile complex.

- *Wolverine*

The Wolverine is proposed for listing under the ESA as a federally threatened species (81 FR 87246) and is also a Montana State Species of Concern (MNHP, 2017). This species tends to occupy higher elevations wooded habitats (Hornecker and Hash, 1981), though dispersing individuals do not seem obligated to these habitat types. In Montana, the range and habitats of this species approaches and potentially overlaps the missile complex (MNHP, 2017).

- *Northern Rocky Mountain Fisher*

The Northern Rocky Mountain Fisher is a Montana State Species of Concern (MNHP, 2017), though it was recently determined it did not warrant listing under the ESA (82 FR 46618). The range of the Fisher approaches the western LFs in the missile complex (MNHP, 2017).

- *Swift Fox*

The Swift Fox is a Montana State Species of Concern (MNHP, 2017), though it was removed as a candidate species under the ESA (66 FR 1295). The Swift Fox inhabits open prairie and arid plains, including areas intermixed with winter wheat fields in north-central Montana. It was once extirpated throughout much of eastern Montana, but has since showed signs of population recovery. Potential habitat and historic ranges for this species have been mapped in the western and southern portions of the deployment area i.e., in the western parts of Pondera, Teton, Lewis & Clark counties, and Cascade County (MNHP, 2017). Thus this species has a range overlapping the missile complex.

While, the ranges of the other above-mentioned species overlap with part of the missile complex, data are lacking for any of the above large mammals to determine their use of habitat in the vicinity of the LFs or MAFs. Thus, in 2017, a joint AF and USFWS MFWCO project was initiated to conduct remote surveys with the use of game camera surveillance techniques. Game camera traps were mounted in locations near 25 missile complex sites found within the current, mapped ranges of Wolverine, Fisher, Grizzly Bear and Canada lynx. The project will be conducted for a period of 2-3 years.

BIRDS

- *Piping plover*

The Northern Great Plains populations of the Piping Plover is listed as Threatened by the USFWS (50 FR 50726). Their foraging habitat includes the Missouri and Yellowstone River sandbars, on alkali beaches in west-central and northeastern Montana. Within central Montana, Piping Plover are only known to breed at Alkali Lake on the Blackfeet Indian Reservation in Pondera County. During migration, Piping Plover have been reported just east of the Rocky Mountains (MNHP, 2017). Within the missile complex, Piping Plover have been observed as migrants at Freezeout Lake and Benton Lake NWR (Jeff Berglund, USFWS, pers. comm.).

- *Red Knot*

The *rufa* Red Knot (*C. canutus rufa*) was listed Threatened by USFWS in 2015 (79 FR 73706-73748). The species migrates through Montana with stopovers within the deployment area at wetlands near Freezeout Lake, Benton Lake National Wildlife Refuge, and Lake Bowdoin National Wildlife Refuge (MNHP, 2017).

Species of Concern within the Malmstrom AFB missile complex

There are 9 species of small mammals and over 35 migratory bird species that have been determined to be Montana Species of Concern (MNHP, 2017), or Birds of Conservation Concern (FWS, 2008) that are anticipated to occur within the missile complex (USFWS, 2008; MNHP, 2017). At present, data are minimal regarding presence/absence or proximity to LFs or MAFs. Following is a summary for several bird species for which there are observational data (see also Table 7).

- *Golden Eagle*

During Greater sage-grouse surveys (2015-16) within the missile complex, Golden eagles (*Aquila chrysaetos*) were incidentally observed roosting or nesting within 0.5-5 miles (0.8-8.0 km) of several LFs (Dr. Elin Pierce, USFWS, pers. comm.). The Golden eagle is a “special status” species, and is protected by the Bald & Golden Eagle Protection Act. Thus, management recommendations include conducting Golden eagle surveys in the vicinity of LFs and MAFs during their breeding season to determine the potential of future training or construction activities to impact nesting eagles.

- *Greater Sage-grouse*

The Greater sage-grouse is sensitive to disturbance during the breeding season (Manier et al. 2014; MNHP 2017). It is a state Species of Concern, and is considered by USFWS as a Bird of Conservation Concern (USFWS, 2008; MNHP, 2017). Although the species is not listed as endangered, the USFWS is currently monitoring the mountain-prairie populations of Greater sage-grouse, and a conservation assessment for this species will be conducted by the USFWS and other partners by 2020. In Montana, the species is managed by the State of Montana (MFWP and Department of Natural Resources and Conservation [DNRC]) as well as by the Bureau of Land Management (BLM) on BLM-administered lands. The DNRC Conservation and Resource Development Division administers Montana Executive Order 12-2015 and the Montana sage-grouse conservation strategy. On BLM administered lands, BLM oversees execution of and project compliance with applicable Resource Management Plans (BLM, 2015).

During 2015-16 surveys, Greater sage-grouse were found at a distance of 3.5 miles (5.6 km) or less at a total of 17 sites (Pierce and Jordan, 2018a; Table 7). This distance is generally within the species' disturbance buffer distance (Manier et al., 2014).

- *Long-billed curlew*

The Long-billed curlew (*Numenius americanus*) can be found breeding in habitat adjacent to numerous missile facilities (Dr. Elin Pierce, USFWS, pers. comm.). This curlew is a Montana State Species of Concern because of its limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas (MNHP, 2017).

Table 7. USFWS and Montana Species of Conservation Concern – Occurrence in Missile Complex. (USFWS 2008; MNHP 2017; Pierce and Jordan, 2018a; Dr. Elin Pierce, USFWS, Pers. comm.)

Common Name	Species Latin Name	Occurrence at Missile Sites
American bittern	*Botaurus lentiginosus*	*unknown*
American Golden-plover	*Pluvialis dominica*	*unknown*
Baird's sparrow	*Ammodramus bairdii*	*unknown*
Bald eagle	*Haliaeetus*	*unknown*
Black swift	*Cypseloides niger*	*unknown*
Black tern	*Chlidonias niger*	*unknown*
Black-billed cuckoo	*Coccyzus*	*unknown*
Bobolink	*Dolichonyx oryzivorus*	*unknown*
Brewer's sparrow	*Spizella breweri*	*unknown*
Burrowing owl	*Athene cunicularia*	*unknown*
Cassin's finch	*Carpodacus cassinii*	*unknown*
Chestnut-collared longspur	*Calcarius ornatus*	*unknown*
Common tern	*Sterna hirundo*	*Unknown*
Ferruginous hawk	*Buteo regalis*	J-01, L-08
Franklin's Gull	*Leucophaeus pipixcan*	*Unknown*
Golden eagle	*Aquila chrysaetos*	*Unknown*
Grasshopper sparrow	*Ammodramus*	*Unknown*
Greater Sage-grouse	*Centrocercus urophasianus*	E-02, E-03, E-04, E-05,E-06, K-04, K-07, N-02, N-03, O-1, O-2, O-3, O-4, O-5, O-6, O-7, O-11 O-11 O-7
Hudsonian Godwit	*Limosa haemastica*	*unknown*
Lark Bunting	*Calamospiza*	*unknown*
Lesser Yellowlegs	*Tringa flavipes*	*unknown*
Lewis's woodpecker	*Melanerpes lewis*	Q19
Loggerhead shrike	*Lanius ludovicianus*	B-11
Long-billed curlew	*Numenius americanus*	A-05, A-09, A-10, B-04, B-07, B-11, C-04, E-05, E-06, E-08, E-09, F-01, F-02, F-05, F-09, F10, G-03, G-06, G-09, G-11, H-07, H08, I-06, I-08 I-11, J-03, L-04, L-06, L-08, P-03, P-07, R30, S0, T48
Long-eared Owl	*Asio otus*	*unknown*
Marbled godwit	*Limosa fedoa*	*unknown*
McCown's longspur	*Calcarius mccownii*	*unknown*
Mountain plover	*Charadrius montanus*	*unknown*
Olive-sided flycatcher	*Contopus cooperi*	*unknown*
Peregrine falcon	*Falco peregrinus*	*unknown*
Pinyon jay	*Gymnorhinus*	*unknown*
Red-headed woodpecker	*Melanerpes*	*unknown*

Common Name	Species Latin Name	Occurrence at Missile Sites
Rufous hummingbird	*selasphorus rufus*	*unknown*
Sage thrasher	*Oreoscoptes montanus*	*unknown*
Semipalmated sandpiper	*Calidris pusilla*	*unknown*
Short-billed dowitcher	*Limnodromus griseus*	*unknown*
Short-eared owl	*Asio flammeus*	C-03, O-06
Sprague's pipit	*Anthus spragueii*	C-07, F-02, F-03, F-05, F-10, G-06, G-08, L-04, L-06
Swainson's hawk	*Buteo swainsoni*	*unknown*
Upland sandpiper	*Bartramia longicauda*	*unknown*
Western grebe	*aechmophorus*	*unknown*
Willow flycatcher	*Empidonax traillii*	*unknown*
Willet	*Tringa semipalmata*	*unknown*
SMALL MAMMALS	**Species Latin Name**	**Occurrence at Missile Sites**
Townsend's Big-eared bat	*Corynorhinus*	*unknown*
Spotted Bat	*Euderma maculatum*	*unknown*
Hoary Bat	*Lasiurus cinereus*	*unknown*
Little Brown Myotis	*Myotis lucifugus*	*unknown*
Fringed Myotis	*Myotis thysanodes*	*unknown*
Black-tailed Prairie Dog	*Cynomys ludovicianus*	*unknown*
Merriam's Shrew	*Sorex merriami*	*unknown*
Dwarf Shrew	*Sorex nanus*	*unknown*
Preble's Shrew	*Sorex preblei*	*unknown*
REPTILES	**Species Latin Name**	**Occurrence at Missile Sites**
Plains Hog-nosed Snake	*Heterodon nasicus*	*unknown*
Western Milksnake	*Lampropeltis gentilis*	*unknown*
Greater Short-horned lizard	*Phrynosoma hernandesi*	*unknown*
AMPHIBIANS	**Species Latin Name**	**Occurrence at Missile Sites**
Great Plains Toad	*Anaxyrus cognatus*	*unknown*
Plains Spadefoot	*Spea bombifrons*	*unknown*

Appendix D.
Air Emissions Model Report

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AIR CONFORMITY APPLICABILITY MODEL REPORT
– DETAIL –

1. General Information

- Action Location
Base: MALMSTROM AFB
State: Montana
County(s): Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: Malmstrom AFB - Environmental Assessment for UH-1N Replacement Beddown

- Project Number/s (if applicable): Contract No. W9128F17A0002, Order No. W9128F18F0293

- Projected Action Start Date: 1 / 2021

- Action Purpose and Need:
Replace the current UH-1N helicopters at Malmstrom AFB with MH-139 helicopters and provide facilities to house the replacement aircraft.

- Action Description:
The Proposed Action is replacing the current fleet of 8 UH-1N helicopters with a total of 11 new MH-139 aircraft (8 as primary and 3 as backup). The total number of continually active aircraft will remain at 8. The backup aircraft will be inactive and only swapped out with the primary as needed to maintain a full strength fleet of 8 aircraft. The aircraft replacement is scheduled to occur during years 2021 and 2023. Two MH-139s would be delivered to Malmstrom AFB in early 2021 (this would increase the total number of aircraft on the base to 10), and the transition would be complete in 2023. The total annual flight operations will remain unchanged at 7,566 (946 per aircraft). The average duration of a flight operation duration is assumed to be 4 minutes.

To support the beddown of the replacement aircraft, an adequately sized and configured integrated helicopter operations facility is needed to provide proper command and control, maintenance, and fueling capabilities for helicopter operations. A series of buildings is required that would become the main control point for all unit flight and flying training tasks. This will be acheived through renovation of exisiting buildings. A surge in personnel is anticipated during the overlap of UH-1N and MH-139 aircraft, after which personnel would decrease to a steady-state. Overall, this Proposed Action would result in slightly more personnel at Malmstrom AFB. No interior construction or demolition would occur. Any new structures would be temporary and consist of prefabricated shelters requiring only assembly in place.

There are 4 Alternaive Actions under consideration:
• Alternative 1: Renovate building 1450 for initial MH-139s and delay building 1440 renovation.
• Alternative 2: Construct large area maintenance shelters (LAMS) for temporary UH-1N parking.
• Alternative 3: Temporary 341st MXG move to building 1450 or 1464.
• Alternative 4: No Action.

Alternatives 1 through 3 each include the same aircraft replacement schedule. There will be no ground preparation, demolition, or major construction under any of the action alternatvies. Therefore, a single ACAM model run (identified as Alternative 1) will adequately support analyses for Action Alternatives 1, 2 and 3.

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AIR CONFORMITY APPLICABILITY MODEL REPORT
– DETAIL –

- Activity List:

Activity Type		Activity Title
2.	Personnel	Years 2021-2023 - Addition of Temporary Support Personnel
3.	Aircraft	Year 2021 - Addition of Two MH-139 Helicopters (Primary Inventory Aircraft)
4.	Personnel	Year 2021 - Addition of Permanent Support Personnel for First Two MH-139 Aircraft
5.	Aircraft	Year 2021 - Removal of Two UH-1N Helicopters
6.	Aircraft	Year 2022 - Addition of Three MH-139 Helicopters (Primary Inventory Aircraft)
7.	Personnel	Year 2022 - Addition of Permanent Personnel to Support Next Three MH-139 Aircraft
8.	Aircraft	Year 2022 - Removal of Three UH-1N Helicopters
9.	Aircraft	Year 2023 - Addition of Three MH-139 Helicopters (Primary Inventory Aircraft)
10.	Personnel	Year 2023 - Addition of Permanent Personnel to Support Last Three MH-139 Aircraft
11.	Aircraft	Year 2023 - Removal of Three UH-1N Helicopters

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Personnel

2.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Years 2021-2023 - Addition of Temporary Support Personnel

- Activity Description:
A surge in personnel is anticipated during the overlap of UH-1N and MH-139 aircraft, after which personnel would decrease to a steady-state. Overall, this Proposed Action would result in slightly more personnel at Malmstrom AFB. It is assumed that an additional forty (40) temporary personnel will be deployed to the base for three years to support this project. It is also assumed that five (5) permanant support personnel will be added for each new MH-139 aircraft.

This Personnel Activity accounts for the additional temporary personnel deployed to Malmstrom AFB for the three-year period 2021-2023 in support of this project.

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.284356
SO_x	0.001807
NO_x	0.258492
CO	3.214587
PM 10	0.007939

Pollutant	Total Emissions (TONs)
PM 2.5	0.007226
Pb	0.000000
NH_3	0.016374
CO_2e	254.7

2.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 40
Civilian Personnel: 0
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

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- Personnel Work Schedule

Active Duty Personnel: 5 Days Per Week (default)
Civilian Personnel: 5 Days Per Week (default)
Support Contractor Personnel: 5 Days Per Week (default)
Air National Guard (ANG) Personnel: 4 Days Per Week (default)
Reserve Personnel: 4 Days Per Month (default)

2.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

2.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.343	000.002	000.257	003.756	000.010	000.009		000.022	00313.875
LDGT	000.400	000.003	000.434	004.961	000.012	000.011		000.024	00404.284
HDGV	000.657	000.005	001.065	014.900	000.026	000.023		000.044	00740.723
LDDV	000.141	000.003	000.139	002.353	000.004	000.004		000.008	00301.516
LDDT	000.270	000.004	000.389	003.971	000.007	000.006		000.008	00428.585
HDDV	000.614	000.013	005.915	001.983	000.169	000.155		000.030	01487.496
MC	002.246	000.003	000.875	013.744	000.028	000.025		000.055	00398.991

2.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3. Aircraft

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Year 2021 - Addition of Two MH-139 Helicopters (Primary Inventory Aircraft)

- Activity Description:
As part of the helicpter fleet replacement, eight (8) new MH-139 primary aircraft inventory will be placed into service over a three year period 2021 through 2023. Three (3) additional MH-139 will be included as backup aircraft inventory. The backup aircraft will remain inactive unless swapped out with primary aircraft in order to maintain a full fleet strength of 8 active aircraft. The ACAM model will be set up to account for only the active aircraft. There will be 946 annual flight operations per primary inventory aircraft with an average duration of 4 minutes (assumed equally distributed over Takeoff, Climb Out, and Approach) per operation. Taxi/Idle-Out and Taxi/Idle-In assumed as 8.0 and 7.0 minutes, respectively, based on "Air Emissions Guide for Air Force Mobile Sources" (USAF Jan 2013) Table 2-4 (Default Time-in-Mode for Military Helicopter). Ground Support Equipment operations based on USAF Jan 2013 Table 3-3 (Military Aircraft and GSE Assignments - Generic Helicopter).

This activity represents the first year, 2021, of the three-year project implementation schedule during which two (2) new aircraft will replace two (2) old aircraft.

The MH-139 helicopter is powered by two PT6C-67C turboshaft engines rated at 1750 hp each. The ACAM model does not include MH-139 aircraft within the Aircraft Activity module. Therefore, the C-23B aircraft was chosen as the surrogage based on engine number and type. The C-23B is powered by two PT6A-65AR turboshaft engines rated at 1424 hp each which are the closest match to the PT6C-67C in terms of engine family and horsepower.

There will be 946 annual flight operations per primary inventory aircraft with an average duration of 4 minutes (assumed equally distributed over Takeoff, Climb Out, and Approach) per operation. Taxi/Idle-Out and Taxi/Idle-In assumed as 8.0 and 7.0 minutes, respectively, based on "Air Emissions Guide for Air Force Mobile Sources" (Jan 2013) Table 2-4 (Default Tim-in-Mode for Military Helicopter).

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	6.195388
SO_x	0.764928
NO_x	31.496037
CO	18.372853
PM 10	1.464728

Pollutant	Emissions Per Year (TONs)
PM 2.5	1.412241
Pb	0.000000
NH_3	0.000000
CO_2e	1870.2

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- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	3.505483
SO_x	0.140363
NO_x	0.543615
CO	11.299006
PM 10	0.107161

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.096616
Pb	0.000000
NH_3	0.000000
CO_2e	428.2

- Activity Emissions [Aerospace Ground Equipment (AGE) part]:

Pollutant	Emissions Per Year (TONs)
VOC	2.689905
SO_x	0.624566
NO_x	30.952422
CO	7.073847
PM 10	1.357566

Pollutant	Emissions Per Year (TONs)
PM 2.5	1.315624
Pb	0.000000
NH_3	0.000000
CO_2e	1442.0

3.2 Aircraft & Engines

3.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: C-23B
Engine Model: PT6A-65AR
Primary Function: General - Turboprop
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: MW-139 (Helicopter)
Original Engine Name: PT6C-67C

3.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	131.43	53.66	1.06	1.89	166.43	1.23	1.11	3234
Approach	339.89	3.31	1.06	4.59	20.86	0.74	0.67	3234
Intermediate	570.64	0.72	1.06	6.69	6.72	0.29	0.26	3234
Military	633.06	0.53	1.06	7.08	5.36	0.26	0.23	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

3.3 Flight Operations

3.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 2
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 1892
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 24

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military and/or After Burn] (mins): 1.33
Climb Out [Intermediate] (mins): 1.33

Approach [Approach] (mins): 1.33
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner.

- Trim Test
Idle (mins): 12
Approach (mins): 27
Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

3.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year
$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year
$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year
$AEPS_{POL}$ = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year
$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

3.4 Auxiliary Power Unit (APU)

3.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: Yes

- Auxiliary Power Unit (APU) (default)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer

3.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e

3.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year
APU_{POL} = APU * OH * LTO * EF_{POL} / 2000

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

3.5 Aerospace Ground Equipment (AGE)

3.5.1 Aerospace Ground Equipment (AGE) Assumptions

- Default Settings Used: No

- AGE Usage

Number of Annual LTO (Landing and Take-off) cycles for AGE: 1892

- Aerospace Ground Equipment (AGE)

Total Number of AGE	Operation Hours for Each LTO	Exempt Source?	AGE Type	Designation
1	1	No	Air Compressor	MC-1A - 18.4hp
1	2.5	No	Air Compressor	MC-2A
1	2	No	Air Conditioner	MA-3D - 110hp
1	3	No	Generator Set	A/M32A-86D
1	2	No	Heater	H1
1	2.5	No	Hydraulic Test Stand	MJ-1-1
1	1	No	Hydraulic Test Stand	MJ-2/TTU-228 - 125hp
1	2	No	Light Cart	FL-1D
1	0.5	No	Start Cart	A/M32A-95

3.5.2 Aerospace Ground Equipment (AGE) Emission Factor(s)

- Aerospace Ground Equipment (AGE) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
MC-1A - 18.4hp	1.1	0.267	0.008	0.419	0.267	0.071	0.068	24.8
MC-2A	7.4	0.195	0.053	3.396	0.794	0.089	0.086	168.8
MA-3D - 110hp	4.6	0.284	0.032	0.640	0.058	0.063	0.061	103.8
A/M32A-86D	6.5	0.294	0.046	6.102	0.457	0.091	0.089	147.0
H1	0.4	0.100	0.011	0.160	0.180	0.006	0.006	8.9
MJ-1-1	2.5	0.026	0.018	0.757	0.043	0.109	0.105	57.2
MJ-2/TTU-228 - 125hp	4.9	0.292	0.035	0.937	0.083	0.083	0.080	111.8
FL-1D	0.0	0.025	0.043	0.170	0.130	0.160	0.155	30.7
A/M32A-95	0.0	0.070	0.264	1.470	5.860	0.110	0.107	190.4

3.5.3 Aerospace Ground Equipment (AGE) Formula(s)

- Aerospace Ground Equipment (AGE) Emissions per Year

$AGE_{POL} = AGE * OH * LTO * EF_{POL} / 2000$

AGE_{POL}: Aerospace Ground Equipment (AGE) Emissions per Pollutant (TONs)
AGE: Total Number of Aerospace Ground Equipment
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

4. Personnel

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Year 2021 - Addition of Permanent Support Personnel for First Two MH-139 Aircraft

- Activity Description:
This Personnel Activity accounts for the additional permanent personnel deployed to Malmstrom AFB to support the first two new aircraft (5 for each aircraft).

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.023696
SO_x	0.000151
NO_x	0.021541
CO	0.267882
PM 10	0.000662

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000602
Pb	0.000000
NH_3	0.001365
CO_2e	21.2

4.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 10
Civilian Personnel: 0
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule
Active Duty Personnel: 5 Days Per Week (default)
Civilian Personnel: 5 Days Per Week (default)
Support Contractor Personnel: 5 Days Per Week (default)
Air National Guard (ANG) Personnel: 4 Days Per Week (default)
Reserve Personnel: 4 Days Per Month (default)

4.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

4.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.343	000.002	000.257	003.756	000.010	000.009		000.022	00313.875
LDGT	000.400	000.003	000.434	004.961	000.012	000.011		000.024	00404.284
HDGV	000.657	000.005	001.065	014.900	000.026	000.023		000.044	00740.723
LDDV	000.141	000.003	000.139	002.353	000.004	000.004		000.008	00301.516
LDDT	000.270	000.004	000.389	003.971	000.007	000.006		000.008	00428.585
HDDV	000.614	000.013	005.915	001.983	000.169	000.155		000.030	01487.496
MC	002.246	000.003	000.875	013.744	000.028	000.025		000.055	00398.991

4.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

AIR CONFORMITY APPLICABILITY MODEL REPORT
– DETAIL –

5. Aircraft

5.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Remove

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Year 2021 - Removal of Two UH-1N Helicopters

- Activity Description:
As part of the helicopter fleet replacement, the existing eight (8) UH-1N helicopters will be removed from service over a three year period 2021 through 2023.

This activity represents the first year, 2021, of the three-year project implementation schedule during which two (2) old aircraft will decomissioned from service.

The UH-1N helicopter is powered by a T400-CP-400 (PT6T) twinpac turboshaft engine rated at 1800 hp (total). The ACAM model does not include UH-1N aircraft within the Aircraft Activity module. Therefore, the C-12C aircraft was chosen as the surrogage based on engine number and type. It is powered by twin PT6A-41 turboshaft engines rated at 850 hp each. This is the closest match in the ACAM model to the PT6T engine in terms of engine family and total power rating.

There will be 946 annual flight operations per primary inventory aircraft with an average duration of 4 minutes (assumed equally distributed over Takeoff, Climb Out, and Approach) per operation. Taxi/Idle-Out and Taxi/Idle-In assumed as 8.0 and 7.0 minutes, respectively, based on "Air Emissions Guide for Air Force Mobile Sources" (Jan 2013) Table 2-4 (Default Time-in-Mode for Military Helicopter). Ground Support Equipment operations based on USAF Jan 2013 Table 3-3 (Military Aircraft and GSE Assignments - Generic Helicopter).

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	-11.520317
SO_x	-0.759315
NO_x	-31.473199
CO	-16.088199
PM 10	-1.404324

Pollutant	Emissions Per Year (TONs)
PM 2.5	-1.357885
Pb	0.000000
NH_3	0.000000
CO_2e	-1853.1

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	-8.830412
SO_x	-0.134749
NO_x	-0.520777
CO	-9.014352
PM 10	-0.046758

Pollutant	Emissions Per Year (TONs)
PM 2.5	-0.042261
Pb	0.000000
NH_3	0.000000
CO_2e	-411.1

- Activity Emissions [Aerospace Ground Equipment (AGE) part]:

Pollutant	Emissions Per Year (TONs)
VOC	-2.689905
SO_x	-0.624566
NO_x	-30.952422
CO	-7.073847
PM 10	-1.357566

Pollutant	Emissions Per Year (TONs)
PM 2.5	-1.315624
Pb	0.000000
NH_3	0.000000
CO_2e	-1442.0

5.2 Aircraft & Engines

5.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: C-12C
Engine Model: PT6A-41
Primary Function: General - Turboprop
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: UH-1N (Helicopter)
Original Engine Name: T400-CP-400

5.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	147.00	116.88	1.06	1.97	115.31	0.50	0.45	3234
Approach	273.00	26.12	1.06	4.65	34.80	0.10	0.09	3234
Intermediate	473.00	2.34	1.06	7.57	6.49	0.25	0.23	3234
Military	510.00	2.01	1.06	7.98	5.10	0.24	0.22	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

5.3 Flight Operations

5.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 2
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 1892
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 24

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military and/or After Burn] (mins): 1.33
Climb Out [Intermediate] (mins): 1.33
Approach [Approach] (mins): 1.33
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner.

- Trim Test
Idle (mins): 12
Approach (mins): 27

Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

5.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year
$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year
$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year
$AEPS_{POL}$ = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds

EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year
$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

5.4 Auxiliary Power Unit (APU)

5.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: Yes

- Auxiliary Power Unit (APU) (default)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer

5.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e

5.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year
$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

5.5 Aerospace Ground Equipment (AGE)

5.5.1 Aerospace Ground Equipment (AGE) Assumptions

- Default Settings Used: No

- AGE Usage
Number of Annual LTO (Landing and Take-off) cycles for AGE: 1892

- Aerospace Ground Equipment (AGE)

Total Number of AGE	Operation Hours for Each LTO	Exempt Source?	AGE Type	Designation
1	1	No	Air Compressor	MC-1A - 18.4hp
1	2.5	No	Air Compressor	MC-2A
1	2	No	Air Conditioner	MA-3D - 110hp
1	3	No	Generator Set	A/M32A-86D
1	2	No	Heater	H1
1	2.5	No	Hydraulic Test Stand	MJ-1-1
1	1	No	Hydraulic Test Stand	MJ-2/TTU-228 - 125hp
1	2	No	Light Cart	FL-1D
1	0.5	No	Start Cart	A/M32A-95

5.5.2 Aerospace Ground Equipment (AGE) Emission Factor(s)

- Aerospace Ground Equipment (AGE) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
MC-1A - 18.4hp	1.1	0.267	0.008	0.419	0.267	0.071	0.068	24.8
MC-2A	7.4	0.195	0.053	3.396	0.794	0.089	0.086	168.8
MA-3D - 110hp	4.6	0.284	0.032	0.640	0.058	0.063	0.061	103.8
A/M32A-86D	6.5	0.294	0.046	6.102	0.457	0.091	0.089	147.0
H1	0.4	0.100	0.011	0.160	0.180	0.006	0.006	8.9
MJ-1-1	2.5	0.026	0.018	0.757	0.043	0.109	0.105	57.2
MJ-2/TTU-228 - 125hp	4.9	0.292	0.035	0.937	0.083	0.083	0.080	111.8
FL-1D	0.0	0.025	0.043	0.170	0.130	0.160	0.155	30.7
A/M32A-95	0.0	0.070	0.264	1.470	5.860	0.110	0.107	190.4

5.5.3 Aerospace Ground Equipment (AGE) Formula(s)

- Aerospace Ground Equipment (AGE) Emissions per Year

$AGE_{POL} = AGE * OH * LTO * EF_{POL} / 2000$

AGE_{POL}: Aerospace Ground Equipment (AGE) Emissions per Pollutant (TONs)
AGE: Total Number of Aerospace Ground Equipment
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

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6. Aircraft

6.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Year 2022 - Addition of Three MH-139 Helicopters (Primary Inventory Aircraft)

- Activity Description:
This activity represents the second year, 2022, of the three-year project implementation schedule during which three (3) new aircraft will be added to replace three (3) old aircraft.

There will be 946 annual flight operations per primary inventory aircraft with an average duration of 4 minutes (assumed equally distributed over Takeoff, Climb Out, and Approach) per operation. Taxi/Idle-Out and Taxi/Idle-In assumed as 8.0 and 7.0 minutes, respectively, based on "Air Emissions Guide for Air Force Mobile Sources" (Jan 2013) Table 2-4 (Default Time-in-Mode for Military Helicopter). Ground Support Equipment operations based on USAF Jan 2013 Table 3-3 (Military Aircraft and GSE Assignments - Generic Helicopter).

- Activity Start Date
Start Month: 1
Start Year: 2022

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	9.293082
SO_x	1.147393
NO_x	47.244056
CO	27.559279
PM 10	2.197091

Pollutant	Emissions Per Year (TONs)
PM 2.5	2.118361
Pb	0.000000
NH_3	0.000000
CO_2e	2805.4

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	5.258225
SO_x	0.210544
NO_x	0.815423
CO	16.948509
PM 10	0.160742

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.144925
Pb	0.000000
NH_3	0.000000
CO_2e	642.4

- Activity Emissions [Aerospace Ground Equipment (AGE) part]:

Pollutant	Emissions Per Year (TONs)
VOC	4.034858
SO_x	0.936848
NO_x	46.428633
CO	10.610770
PM 10	2.036349

Pollutant	Emissions Per Year (TONs)
PM 2.5	1.973436
Pb	0.000000
NH_3	0.000000
CO_2e	2163.0

6.2 Aircraft & Engines

6.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: C-23B
Engine Model: PT6A-65AR
Primary Function: General - Turboprop
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: MW-139 (Helicopter)
Original Engine Name: PT6C-67C

6.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	131.43	53.66	1.06	1.89	166.43	1.23	1.11	3234
Approach	339.89	3.31	1.06	4.59	20.86	0.74	0.67	3234
Intermediate	570.64	0.72	1.06	6.69	6.72	0.29	0.26	3234
Military	633.06	0.53	1.06	7.08	5.36	0.26	0.23	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

6.3 Flight Operations

6.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 3
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 2838
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 24

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military and/or After Burn] (mins): 1.33
Climb Out [Intermediate] (mins): 1.33
Approach [Approach] (mins): 1.33
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner.

- Trim Test
Idle (mins): 12
Approach (mins): 27
Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

6.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year
$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year
$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year
$AEPS_{POL} = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000$

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year
$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

6.4 Auxiliary Power Unit (APU)

6.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: Yes

- Auxiliary Power Unit (APU) (default)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer

6.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e

6.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year
$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

6.5 Aerospace Ground Equipment (AGE)

6.5.1 Aerospace Ground Equipment (AGE) Assumptions

- Default Settings Used: No

- AGE Usage
Number of Annual LTO (Landing and Take-off) cycles for AGE: 2838

- Aerospace Ground Equipment (AGE)

Total Number of AGE	Operation Hours for Each LTO	Exempt Source?	AGE Type	Designation
1	1	No	Air Compressor	MC-1A - 18.4hp
1	2.5	No	Air Compressor	MC-2A
1	2	No	Air Conditioner	MA-3D - 110hp
1	3	No	Generator Set	A/M32A-86D
1	2	No	Heater	H1
1	2.5	No	Hydraulic Test Stand	MJ-1-1
1	1	No	Hydraulic Test Stand	MJ-2/TTU-228 - 125hp
1	2	No	Light Cart	FL-1D
1	0.5	No	Start Cart	A/M32A-95

6.5.2 Aerospace Ground Equipment (AGE) Emission Factor(s)

- Aerospace Ground Equipment (AGE) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
MC-1A - 18.4hp	1.1	0.267	0.008	0.419	0.267	0.071	0.068	24.8
MC-2A	7.4	0.195	0.053	3.396	0.794	0.089	0.086	168.8
MA-3D - 110hp	4.6	0.284	0.032	0.640	0.058	0.063	0.061	103.8
A/M32A-86D	6.5	0.294	0.046	6.102	0.457	0.091	0.089	147.0
H1	0.4	0.100	0.011	0.160	0.180	0.006	0.006	8.9
MJ-1-1	2.5	0.026	0.018	0.757	0.043	0.109	0.105	57.2
MJ-2/TTU-228 - 125hp	4.9	0.292	0.035	0.937	0.083	0.083	0.080	111.8
FL-1D	0.0	0.025	0.043	0.170	0.130	0.160	0.155	30.7
A/M32A-95	0.0	0.070	0.264	1.470	5.860	0.110	0.107	190.4

6.5.3 Aerospace Ground Equipment (AGE) Formula(s)

- Aerospace Ground Equipment (AGE) Emissions per Year

$AGE_{POL} = AGE * OH * LTO * EF_{POL} / 2000$

AGE_{POL}: Aerospace Ground Equipment (AGE) Emissions per Pollutant (TONs)
AGE: Total Number of Aerospace Ground Equipment
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

7. Personnel

7.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Year 2022 - Addition of Permanent Personnel to Support Next Three MH-139 Aircraft

- Activity Description:
This Personnel Activity accounts for the additional permanent personnel deployed to Malmstrom AFB to support the next three new aircraft (5 for each aircraft).

- Activity Start Date
Start Month: 1
Start Year: 2022

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.035545
SO_x	0.000226
NO_x	0.032312
CO	0.401823
PM 10	0.000992

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000903
Pb	0.000000
NH_3	0.002047
CO_2e	31.8

7.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 15
Civilian Personnel: 0
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule
Active Duty Personnel: 5 Days Per Week (default)
Civilian Personnel: 5 Days Per Week (default)
Support Contractor Personnel: 5 Days Per Week (default)
Air National Guard (ANG) Personnel: 4 Days Per Week (default)
Reserve Personnel: 4 Days Per Month (default)

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7.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

7.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.343	000.002	000.257	003.756	000.010	000.009		000.022	00313.875
LDGT	000.400	000.003	000.434	004.961	000.012	000.011		000.024	00404.284
HDGV	000.657	000.005	001.065	014.900	000.026	000.023		000.044	00740.723
LDDV	000.141	000.003	000.139	002.353	000.004	000.004		000.008	00301.516
LDDT	000.270	000.004	000.389	003.971	000.007	000.006		000.008	00428.585
HDDV	000.614	000.013	005.915	001.983	000.169	000.155		000.030	01487.496
MC	002.246	000.003	000.875	013.744	000.028	000.025		000.055	00398.991

7.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

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8. Aircraft

8.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Remove

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Year 2022 - Removal of Three UH-1N Helicopters

- Activity Description:
This activity represents the second year, 2022, of the three-year project implementation schedule during which three (3) old aircraft will decomissioned from service.

There will be 946 annual flight operations per primary inventory aircraft with an average duration of 4 minutes (assumed equally distributed over Takeoff, Climb Out, and Approach) per operation. Taxi/Idle-Out and Taxi/Idle-In assumed as 8.0 and 7.0 minutes, respectively, based on "Air Emissions Guide for Air Force Mobile Sources" (Jan 2013) Table 2-4 (Default Time-in-Mode for Military Helicopter). Ground Support Equipment operations based on USAF Jan 2013 Table 3-3 (Military Aircraft and GSE Assignments - Generic Helicopter).

- Activity Start Date
Start Month: 1
Start Year: 2022

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	-17.280476
SO_x	-1.138972
NO_x	-47.209799
CO	-24.132299
PM 10	-2.106487

Pollutant	Emissions Per Year (TONs)
PM 2.5	-2.036828
Pb	0.000000
NH_3	0.000000
CO_2e	-2779.7

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	-13.245618
SO_x	-0.202124
NO_x	-0.781166
CO	-13.521528
PM 10	-0.070137

Pollutant	Emissions Per Year (TONs)
PM 2.5	-0.063391
Pb	0.000000
NH_3	0.000000
CO_2e	-616.7

- Activity Emissions [Aerospace Ground Equipment (AGE) part]:

Pollutant	Emissions Per Year (TONs)
VOC	-4.034858
SO_x	-0.936848
NO_x	-46.428633
CO	-10.610770
PM 10	-2.036349

Pollutant	Emissions Per Year (TONs)
PM 2.5	-1.973436
Pb	0.000000
NH_3	0.000000
CO_2e	-2163.0

8.2 Aircraft & Engines

8.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: C-12C
Engine Model: PT6A-41
Primary Function: General - Turboprop
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: UH-1N (Helicopter)
Original Engine Name: T400-CP-400

8.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	147.00	116.88	1.06	1.97	115.31	0.50	0.45	3234
Approach	273.00	26.12	1.06	4.65	34.80	0.10	0.09	3234
Intermediate	473.00	2.34	1.06	7.57	6.49	0.25	0.23	3234
Military	510.00	2.01	1.06	7.98	5.10	0.24	0.22	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

8.3 Flight Operations

8.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 3
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 2838
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 24

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military and/or After Burn] (mins): 1.33
Climb Out [Intermediate] (mins): 1.33
Approach [Approach] (mins): 1.33
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner.

- Trim Test
Idle (mins): 12
Approach (mins): 27
Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

8.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year
$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year
$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year
$AEPS_{POL} = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000$

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year
$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

8.4 Auxiliary Power Unit (APU)

8.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: Yes

- Auxiliary Power Unit (APU) (default)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer

8.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e

8.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year

$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

8.5 Aerospace Ground Equipment (AGE)

8.5.1 Aerospace Ground Equipment (AGE) Assumptions

- Default Settings Used: No

- AGE Usage
Number of Annual LTO (Landing and Take-off) cycles for AGE: 2838

- Aerospace Ground Equipment (AGE)

Total Number of AGE	Operation Hours for Each LTO	Exempt Source?	AGE Type	Designation
1	1	No	Air Compressor	MC-1A - 18.4hp
1	2.5	No	Air Compressor	MC-2A
1	2	No	Air Conditioner	MA-3D - 110hp
1	3	No	Generator Set	A/M32A-86D
1	2	No	Heater	H1
1	2.5	No	Hydraulic Test Stand	MJ-1-1
1	1	No	Hydraulic Test Stand	MJ-2/TTU-228 - 125hp
1	2	No	Light Cart	FL-1D
1	0.5	No	Start Cart	A/M32A-95

8.5.2 Aerospace Ground Equipment (AGE) Emission Factor(s)

- Aerospace Ground Equipment (AGE) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
MC-1A - 18.4hp	1.1	0.267	0.008	0.419	0.267	0.071	0.068	24.8
MC-2A	7.4	0.195	0.053	3.396	0.794	0.089	0.086	168.8
MA-3D - 110hp	4.6	0.284	0.032	0.640	0.058	0.063	0.061	103.8
A/M32A-86D	6.5	0.294	0.046	6.102	0.457	0.091	0.089	147.0
H1	0.4	0.100	0.011	0.160	0.180	0.006	0.006	8.9
MJ-1-1	2.5	0.026	0.018	0.757	0.043	0.109	0.105	57.2
MJ-2/TTU-228 - 125hp	4.9	0.292	0.035	0.937	0.083	0.083	0.080	111.8
FL-1D	0.0	0.025	0.043	0.170	0.130	0.160	0.155	30.7
A/M32A-95	0.0	0.070	0.264	1.470	5.860	0.110	0.107	190.4

8.5.3 Aerospace Ground Equipment (AGE) Formula(s)

- Aerospace Ground Equipment (AGE) Emissions per Year

$AGE_{POL} = AGE * OH * LTO * EF_{POL} / 2000$

AGE_{POL}: Aerospace Ground Equipment (AGE) Emissions per Pollutant (TONs)
AGE: Total Number of Aerospace Ground Equipment
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

9. Aircraft

9.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Year 2023 - Addition of Three MH-139 Helicopters (Primary Inventory Aircraft)

- Activity Description:
This activity represents the thrid year, 2023, of the three-year project implementation schedule during which three (3) new aircraft will added to replace three (3) old aircraft.

There will be 946 annual flight operations per primary inventory aircraft with an average duration of 4 minutes (assumed equally distributed over Takeoff, Climb Out, and Approach) per operation. Taxi/Idle-Out and Taxi/Idle-In assumed as 8.0 and 7.0 minutes, respectively, based on "Air Emissions Guide for Air Force Mobile Sources" (Jan 2013) Table 2-4 (Default Time-in-Mode for Military Helicopter). Ground Support Equipment operations based on USAF Jan 2013 Table 3-3 (Military Aircraft and GSE Assignments - Generic Helicopter).

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	9.293082
SO_x	1.147393
NO_x	47.244056
CO	27.559279
PM 10	2.197091

Pollutant	Emissions Per Year (TONs)
PM 2.5	2.118361
Pb	0.000000
NH_3	0.000000
CO_2e	2805.4

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	5.258225
SO_x	0.210544
NO_x	0.815423
CO	16.948509
PM 10	0.160742

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.144925
Pb	0.000000
NH_3	0.000000
CO_2e	642.4

- Activity Emissions [Aerospace Ground Equipment (AGE) part]:

Pollutant	Emissions Per Year (TONs)
VOC	4.034858
SO_x	0.936848
NO_x	46.428633
CO	10.610770
PM 10	2.036349

Pollutant	Emissions Per Year (TONs)
PM 2.5	1.973436
Pb	0.000000
NH_3	0.000000
CO_2e	2163.0

9.2 Aircraft & Engines

9.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: C-23B
Engine Model: PT6A-65AR
Primary Function: General - Turboprop
Number of Engines: 2

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: MW-139 (Helicopter)
Original Engine Name: PT6C-67C

9.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	131.43	53.66	1.06	1.89	166.43	1.23	1.11	3234
Approach	339.89	3.31	1.06	4.59	20.86	0.74	0.67	3234
Intermediate	570.64	0.72	1.06	6.69	6.72	0.29	0.26	3234
Military	633.06	0.53	1.06	7.08	5.36	0.26	0.23	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

9.3 Flight Operations

9.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 3
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 2838
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 24

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military and/or After Burn] (mins): 1.33
Climb Out [Intermediate] (mins): 1.33
Approach [Approach] (mins): 1.33
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner.

- Trim Test

Idle (mins): 12
Approach (mins): 27
Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

9.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year

AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year

$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year

$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year

$AEPS_{POL} = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000$

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year

$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

9.4 Auxiliary Power Unit (APU)

9.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: Yes

- Auxiliary Power Unit (APU) (default)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer

9.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e

9.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year
$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

9.5 Aerospace Ground Equipment (AGE)

9.5.1 Aerospace Ground Equipment (AGE) Assumptions

- Default Settings Used: No

- AGE Usage
Number of Annual LTO (Landing and Take-off) cycles for AGE: 2838

- Aerospace Ground Equipment (AGE)

Total Number of AGE	Operation Hours for Each LTO	Exempt Source?	AGE Type	Designation
1	1	No	Air Compressor	MC-1A - 18.4hp
1	2.5	No	Air Compressor	MC-2A
1	2	No	Air Conditioner	MA-3D - 110hp
1	3	No	Generator Set	A/M32A-86D
1	2	No	Heater	H1
1	2.5	No	Hydraulic Test Stand	MJ-1-1
1	1	No	Hydraulic Test Stand	MJ-2/TTU-228 - 125hp
1	2	No	Light Cart	FL-1D
1	0.5	No	Start Cart	A/M32A-95

9.5.2 Aerospace Ground Equipment (AGE) Emission Factor(s)

- Aerospace Ground Equipment (AGE) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
MC-1A - 18.4hp	1.1	0.267	0.008	0.419	0.267	0.071	0.068	24.8
MC-2A	7.4	0.195	0.053	3.396	0.794	0.089	0.086	168.8
MA-3D - 110hp	4.6	0.284	0.032	0.640	0.058	0.063	0.061	103.8
A/M32A-86D	6.5	0.294	0.046	6.102	0.457	0.091	0.089	147.0
H1	0.4	0.100	0.011	0.160	0.180	0.006	0.006	8.9
MJ-1-1	2.5	0.026	0.018	0.757	0.043	0.109	0.105	57.2
MJ-2/TTU-228 - 125hp	4.9	0.292	0.035	0.937	0.083	0.083	0.080	111.8
FL-1D	0.0	0.025	0.043	0.170	0.130	0.160	0.155	30.7
A/M32A-95	0.0	0.070	0.264	1.470	5.860	0.110	0.107	190.4

9.5.3 Aerospace Ground Equipment (AGE) Formula(s)

- Aerospace Ground Equipment (AGE) Emissions per Year

$AGE_{POL} = AGE * OH * LTO * EF_{POL} / 2000$

AGE_{POL}: Aerospace Ground Equipment (AGE) Emissions per Pollutant (TONs)
AGE: Total Number of Aerospace Ground Equipment
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

10. Personnel

10.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Year 2023 - Addition of Permanent Personnel to Support Last Three MH-139 Aircraft

- Activity Description:
This Personnel Activity accounts for the additional permanent personnel deployed to Malmstrom AFB to support the last three new aircraft (5 for each aircraft).

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.035545
SO_x	0.000226
NO_x	0.032312
CO	0.401823
PM 10	0.000992

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000903
Pb	0.000000
NH_3	0.002047
CO_2e	31.8

10.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 15
Civilian Personnel: 0
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule
Active Duty Personnel: 5 Days Per Week (default)
Civilian Personnel: 5 Days Per Week (default)
Support Contractor Personnel: 5 Days Per Week (default)
Air National Guard (ANG) Personnel: 4 Days Per Week (default)
Reserve Personnel: 4 Days Per Month (default)

AIR CONFORMITY APPLICABILITY MODEL REPORT
– DETAIL –

10.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

10.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.343	000.002	000.257	003.756	000.010	000.009		000.022	00313.875
LDGT	000.400	000.003	000.434	004.961	000.012	000.011		000.024	00404.284
HDGV	000.657	000.005	001.065	014.900	000.026	000.023		000.044	00740.723
LDDV	000.141	000.003	000.139	002.353	000.004	000.004		000.008	00301.516
LDDT	000.270	000.004	000.389	003.971	000.007	000.006		000.008	00428.585
HDDV	000.614	000.013	005.915	001.983	000.169	000.155		000.030	01487.496
MC	002.246	000.003	000.875	013.744	000.028	000.025		000.055	00398.991

10.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

VMT_P = NP * WD * AC

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

AIR CONFORMITY APPLICABILITY MODEL REPORT – DETAIL –

11. Aircraft

11.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Remove

- Activity Location
County: Cascade
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Year 2023 - Removal of Three UH-1N Helicopters

- Activity Description:
This activity represents the thrid year, 2023, of the three-year project implementation schedule during which three(3) old aircraft will decomissioned from service.

There will be 946 annual flight operations per primary inventory aircraft with an average duration of 4 minutes (assumed equally distributed over Takeoff, Climb Out, and Approach) per operation. Taxi/Idle-Out and Taxi/Idle-In assumed as 8.0 and 7.0 minutes, respectively, based on "Air Emissions Guide for Air Force Mobile Sources" (Jan 2013) Table 2-4 (Default Time-in-Mode for Military Helicopter). Ground Support Equipment operations based on USAF Jan 2013 Table 3-3 (Military Aircraft and GSE Assignments - Generic Helicopter).

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	-17.280476
SO_x	-1.138972
NO_x	-47.209799
CO	-24.132299
PM 10	-2.106487

Pollutant	Emissions Per Year (TONs)
PM 2.5	-2.036828
Pb	0.000000
NH_3	0.000000
CO_2e	-2779.7

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	-13.245618
SO_x	-0.202124
NO_x	-0.781166
CO	-13.521528
PM 10	-0.070137

Pollutant	Emissions Per Year (TONs)
PM 2.5	-0.063391
Pb	0.000000
NH_3	0.000000
CO_2e	-616.7

- Activity Emissions [Aerospace Ground Equipment (AGE) part]:

Pollutant	Emissions Per Year (TONs)
VOC	-4.034858
SO_x	-0.936848
NO_x	-46.428633
CO	-10.610770
PM 10	-2.036349

Pollutant	Emissions Per Year (TONs)
PM 2.5	-1.973436
Pb	0.000000
NH_3	0.000000
CO_2e	-2163.0

11.2 Aircraft & Engines

11.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: C-12C
Engine Model: PT6A-41
Primary Function: General - Turboprop
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: UH-1N (Helicopter)
Original Engine Name: T400-CP-400

11.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	147.00	116.88	1.06	1.97	115.31	0.50	0.45	3234
Approach	273.00	26.12	1.06	4.65	34.80	0.10	0.09	3234
Intermediate	473.00	2.34	1.06	7.57	6.49	0.25	0.23	3234
Military	510.00	2.01	1.06	7.98	5.10	0.24	0.22	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

11.3 Flight Operations

11.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 3
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 2838
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 24

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military and/or After Burn] (mins): 1.33
Climb Out [Intermediate] (mins): 1.33
Approach [Approach] (mins): 1.33
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner.

- Trim Test
Idle (mins): 12
Approach (mins): 27
Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

11.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year
$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year
$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year
$AEPS_{POL} = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000$

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year
$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

11.4 Auxiliary Power Unit (APU)

11.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: Yes

- Auxiliary Power Unit (APU) (default)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer

11.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e

11.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year
$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

11.5 Aerospace Ground Equipment (AGE)

11.5.1 Aerospace Ground Equipment (AGE) Assumptions

- Default Settings Used: No

- AGE Usage
Number of Annual LTO (Landing and Take-off) cycles for AGE: 2838

- Aerospace Ground Equipment (AGE)

Total Number of AGE	Operation Hours for Each LTO	Exempt Source?	AGE Type	Designation
1	1	No	Air Compressor	MC-1A - 18.4hp
1	2.5	No	Air Compressor	MC-2A
1	2	No	Air Conditioner	MA-3D - 110hp
1	3	No	Generator Set	A/M32A-86D
1	2	No	Heater	H1
1	2.5	No	Hydraulic Test Stand	MJ-1-1
1	1	No	Hydraulic Test Stand	MJ-2/TTU-228 - 125hp
1	2	No	Light Cart	FL-1D
1	0.5	No	Start Cart	A/M32A-95

11.5.2 Aerospace Ground Equipment (AGE) Emission Factor(s)

- Aerospace Ground Equipment (AGE) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
MC-1A - 18.4hp	1.1	0.267	0.008	0.419	0.267	0.071	0.068	24.8
MC-2A	7.4	0.195	0.053	3.396	0.794	0.089	0.086	168.8
MA-3D - 110hp	4.6	0.284	0.032	0.640	0.058	0.063	0.061	103.8
A/M32A-86D	6.5	0.294	0.046	6.102	0.457	0.091	0.089	147.0
H1	0.4	0.100	0.011	0.160	0.180	0.006	0.006	8.9
MJ-1-1	2.5	0.026	0.018	0.757	0.043	0.109	0.105	57.2
MJ-2/TTU-228 - 125hp	4.9	0.292	0.035	0.937	0.083	0.083	0.080	111.8
FL-1D	0.0	0.025	0.043	0.170	0.130	0.160	0.155	30.7
A/M32A-95	0.0	0.070	0.264	1.470	5.860	0.110	0.107	190.4

11.5.3 Aerospace Ground Equipment (AGE) Formula(s)

- Aerospace Ground Equipment (AGE) Emissions per Year

$AGE_{POL} = AGE * OH * LTO * EF_{POL} / 2000$

AGE_{POL}: Aerospace Ground Equipment (AGE) Emissions per Pollutant (TONs)
AGE: Total Number of Aerospace Ground Equipment
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons