National Science Foundation
Office of Polar Programs
Arlington, Virginia

ENVIRONMENTAL DOCUMENT CONCURRENCE

Activity:
Construct Alpha Airfield Facility at McMurdo Station, Antarctica

MCST1601.IEE

I have read the attached document and concur with the findings and recommendation. I concur that the proposed activity can commence.

\s\\ Susanne LaFratta — August 21, 2015
Susanne LaFratta — Date
Section Head, Polar Environment, Safety and Health

National Science Foundation
Office of Polar Programs
Arlington, Virginia

ENVIRONMENTAL DOCUMENT AND FINDING OF NO SIGNIFICANT AND NOT MORE THAN MINOR OR TRANSITORY ENVIRONMENTAL IMPACT

Construct Alpha Airfield Facility at McMurdo Station, Antarctica

MCST1601.IEE

FINDING

The U.S. Antarctic Program (USAP) proposes to construct and perform a proof of concept action for a new airfield facility in the McMurdo Station area. The facility, currently designated the Alpha Runway, is located on the Ross Ice Shelf approximately 17 kilometers (km) from McMurdo Station. The Alpha Runway will be designed and constructed to support wheeled aircraft used by the USAP including LC-130s and C-17s. The proposed action would involve the construction of the runway, and subsequent certification for use. Future use of the runway and subsequent development as an airfield facility including construction of taxiways, and aircraft parking apron, and potential integration of the facility into the USAP's air mobility resources will depend upon the results of the proof of concept test. However, the potential operational impacts also are considered in this analysis.

Based on the analyses in the environmental document, the National Science Foundation (NSF) Division of Polar Programs (PLR) has determined that implementing the actions listed is not a major federal action that would have a significant effect on the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969. The action is not one that would create more than a minor or transitory effect on the Antarctic environment, within the meaning of NSF's implementing requirements for the Protocol on Environmental Protection to the Antarctic Treaty. Therefore, an environmental impact statement and/or comprehensive environmental evaluation will not be prepared.

I recommend the activity proceed based on the implementation of Alternative A. The proposed action provides for the construction of an airfield at McMurdo Station to meet applicable specifications and, if deemed successful, provide for safe operation to support USAP logistics. This proposed action is consistent with NSF's efforts to promote scientific investigation and provides for the safety of its participants, while protecting the Antarctic environment.

\s\\ Polly Penhale	8/21/2015	Margaret Knuth	8/13/15
Recommending Official	**Date**	**Recommending Official**	**Date**
Polly Penhale		Margaret Knuth	
Environmental Officer		Manager, Operations	
Polar Environment, Safety and Health		Antarctic Infrastructure and Logistics	

INTRODUCTION

The National Science Foundation (NSF) Division of Polar Programs (PLR) proposes to construct a new airfield on the snow-covered Ross Ice Shelf near McMurdo Station (Figure 1). The airfield would be 3,000-meters (m) long, 76-m wide compacted snow runway capable of supporting wheeled aircraft. The USAP currently operates two airfields in the McMurdo Station area, including the Pegasus Glacial (White) Ice Runway (Pegasus Runway) and the skiway at Williams Field (Figure 1). The Alpha Site (Figure 1) was selected due to its optimal location that is relatively unaffected by soil deposition from Black Island and effects of local snow accumulation.

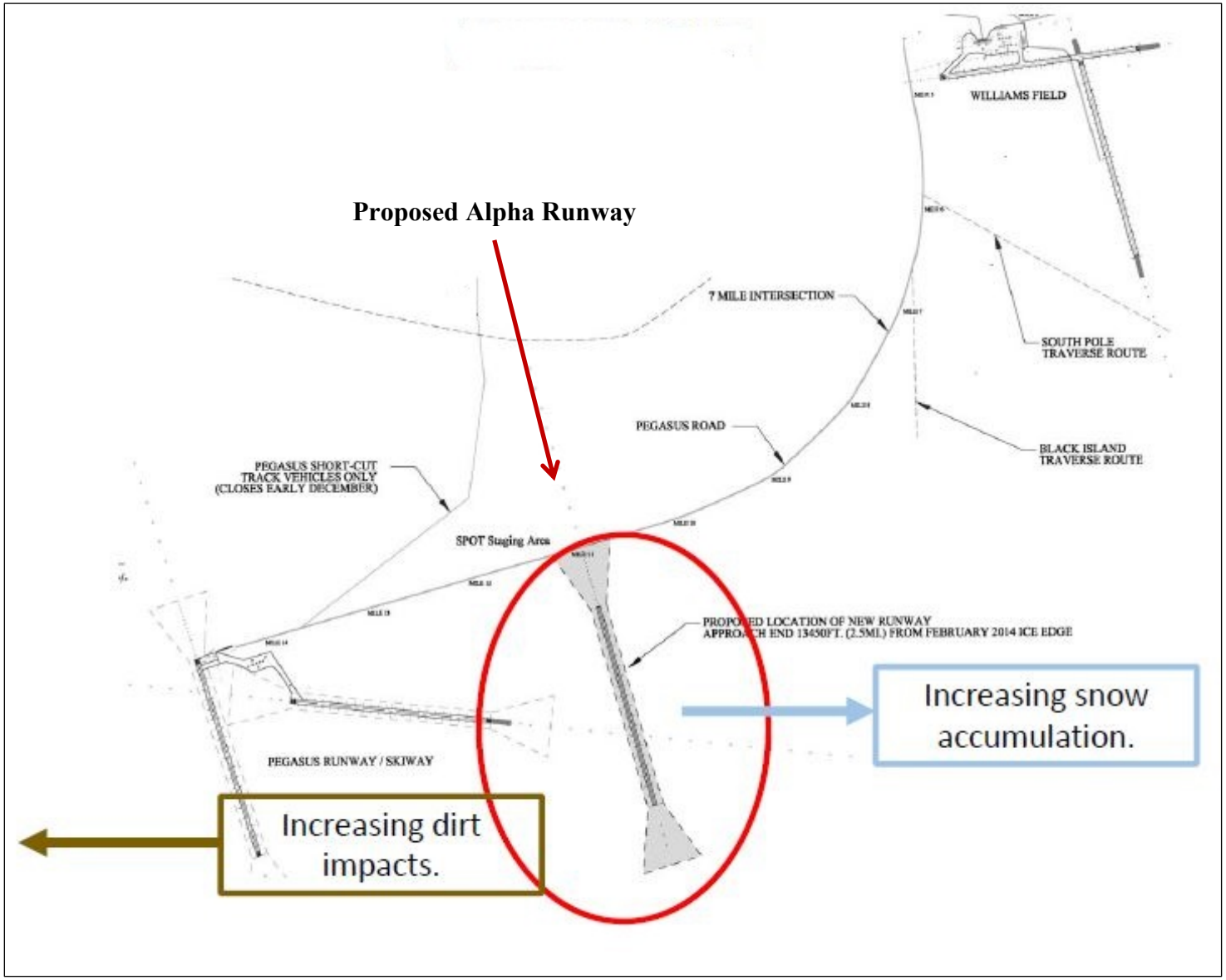
The proof of concept (construction and certification) and potential use of the Alpha Site Airfield would be implemented in phases. The proposed schedule for each phase (discussed below) may need to be extended for 12 to 24 months to account for weather, logistical demands, or program tempo. Phase 1 would involve the construction of the snow-packed runway surface during the 2015/2016 austral summer season (August – December 2015) followed by initial evaluation using test carts and LC-130 aircraft (January-February 2016). Phase 2 would occur during the 2016/17 austral summer and focus on certification testing using LC-130 and C-17 aircraft (October-November 2016). Based on the success of the proof of concept (i.e., Phases 1 and 2), NSF could decide to initiate Phase 3, which would be to operate Alpha Site along with at least Williams Field.

1.0 PURPOSE AND NEED

USAP aircraft operations supported by airfield operations in the McMurdo Station area provide essential logistical support resources each year by transporting personnel and cargo primarily during the austral summer season (October through February) to the South Pole and field sites. The McMurdo Station area is also the intercontinental gateway for flights to and from Christchurch, New Zealand. Fixed-wing aircraft typically use McMurdo area airfield resources, primarily during the austral summer season (October through February), for intercontinental operations including C-17, A-319, B-757, and C-130 wheeled aircraft. Intracontinental flight operations supported out of McMurdo Station (at Williams Field) include LC-130 aircraft, Twin Otter, and Basler aircraft which are equipped both with skis and wheels. In addition, Pegasus Runway is being tested for winter use (i.e., March through September).

For a number of years, the USAP has operated the Pegasus Runway airfield facility on the Ross Ice Shelf to accommodate wheeled aircraft for intercontinental flights, and Williams Field for ski-equipped aircraft, associated with intracontinental flights. The Pegasus Runway is located approximately 23 kilometers (km) from McMurdo Station and was first developed in the 1993/94 austral summer season (NSF, 1993). However, use of Pegasus Runway has experienced several operational challenges. First, the Pegasus Runway is located downwind and in proximity to Black Island which causes wind-blown soil from the island to contaminate the surface of the snow, thereby reducing the albedo and creating insolation gain. As a result of these conditions during the austral summer, snowmelt occurs at an increased rate, accumulating in meltwater pools on and adjacent to the Runway. The meltwater must be removed to make the runway

Figure 1. Proposed Alpha Runway Location



usable thereby increasing maintenance requirements and creating flight operations delays, including periods when the runway is out of service.

In addition, the time and resources needed to transport flight crews, flight operation support personnel, passengers, and cargo overland to the Pegasus Site 23 km away is substantial and an airfield for wheeled aircraft closer to the station would reduce worker and passenger travel time and ground vehicle fuel use. Therefore, a replacement for Pegasus Runway is needed to better ensure safe and continuous flight operations and improve operational efficiency.

Because the Pegasus Runway poses these maintenance and operational challenges, NSF proposes to evaluate the Alpha Site for a runway on the Ross Ice Shelf which would be less affected by wind-blown contaminants from Black Island, capable of maintaining surface quality conditions suitable for wheeled aircraft operations, and closer to McMurdo Station to reduce transportation requirements. Furthermore, the long-term goals for airfield operation in the McMurdo Station area include maintaining year-round access to provide continuous logistical support for McMurdo Station.

The Alpha Runway would provide a compacted snow runway capable of year-round operations and available for extended operations, emergency transport during the winter, and capable of providing access to the suite of aircraft currently used in the program.

2.0 ALTERNATIVES

2.1 Alternative A – Construct the Alpha Runway on the Ross Ice Shelf near McMurdo Station, Antarctica

Under the proposed action alternative, the Alpha Runway would be constructed, tested and certified, and if deemed suitable, utilized as a runway facility by the USAP to meet the long-term goals for airfield operations.

2.2 Alternative B – Do Not Construct the Alpha Runway (No Action); Continue to Operate the Skiway at Williams Field, the Pegasus Runway, and as needed, a Seasonal Sea Ice Runway.

Under the No Action alternative (Alternative B), the Williams Field Skiway would be used for seasonal support of intracontinental ski-equipped aircraft and the Pegasus Runway would continue to be operated for wheeled-aircraft. In addition, the Seasonal Sea Ice Runway may be opened and used as needed. The impacts of these activities were previously assessed (NSF, 2009).

2.3 Alternatives considered but Not Analyzed

Several alternatives to the development of the proposed Alpha Runway site for wheeled aircraft were identified and considered but were not analyzed. These included:

- Renovating or reconfiguring the Pegasus facility to minimize or mitigate snowmelt impacts
- Expanding Williams Field to accommodate wheeled aircraft and support intercontinental flights
- Developing runway for wheeled aircraft even closer to McMurdo or Williams Field

These alternatives were dismissed for a number of reasons, including known site conditions that would preclude suitability for a runway and constructability concerns.

3.0 PROPOSED ACTION

The proposed action is to construct and test a new proof of concept airfield facility in the McMurdo Station area. The Alpha Runway would be located on the Ross Ice Shelf approximately 17 km from McMurdo Station, directly adjacent to the existing snow road to Pegasus Runway, near Milepost 11 (see Figure 1). The Alpha Runway would be designed and constructed to support wheeled aircraft used by the USAP, including LC-130 and C-17 aircraft. The proposed action would progress in three phases: 1) construction, 2) testing and certification and, 3) conditional operation based on proof of concept results. The phases are further described below.

3.1 Phase 1 - Construct Compacted Snow Runway on the Ross Ice Shelf

The USAP would construct a runway on the snow-covered surface of the Ross Ice Shelf, located near Milepost 11 on the Pegasus Road (see Figure 1). The runway, designated the Alpha Runway, would be approximately 3,000-m long and 76-m wide and would consist of compacted snow. Critical data has already been collected at the Alpha Runway site and evaluated to verify its suitability as an airfield based upon snow/ice core density and stratigraphic measurements plus wind speed and direction (ASC, 2015).

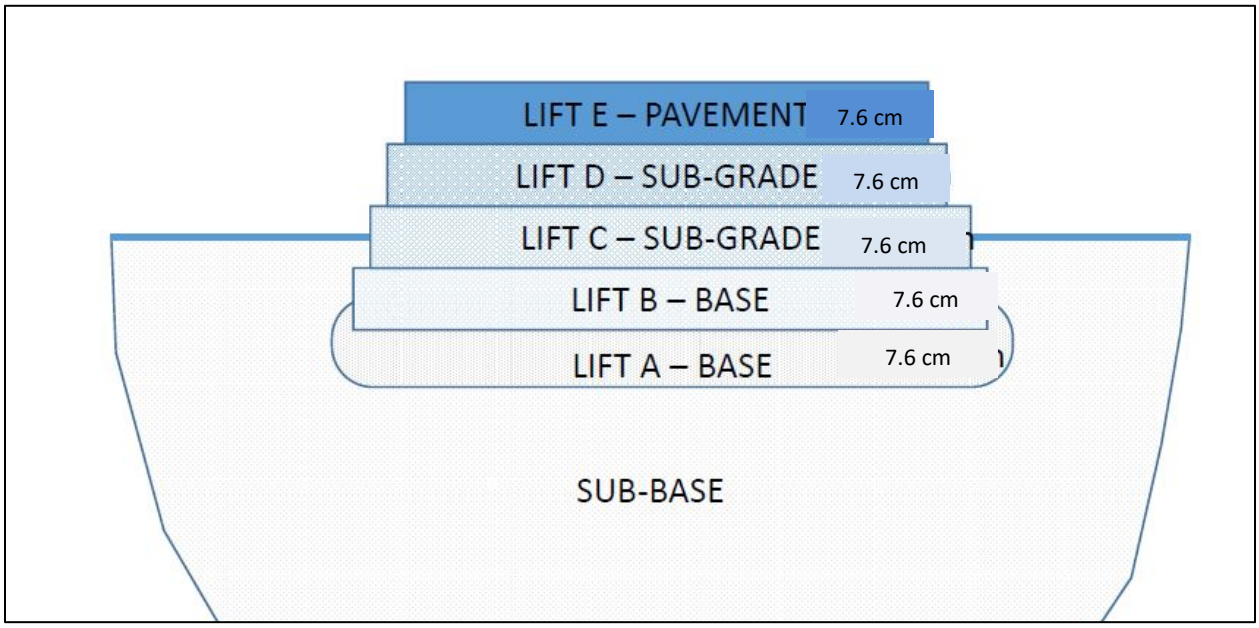
The runway would be constructed by creating a series of approximately five "lifts" using snow from the local area, each approximately 7.6 centimeters (cm) in height (see Figure 2) and compacted using tractors, rollers, and scrapers to achieve the desired density (grams/centimeter^3) and horizontal surface. The final lift for the runway surface pavement would be compacted to a density of 0.675 grams/cubic centimeter (g/cm^3) and graded to a level and smoothness consistent with allowable standards for aircraft.

Initially, snow would be compacted in place in the 3,000 m x 76 m alignment. As needed, additional snow for each lift would be obtained from the surrounding area. It is estimated that a total of 0.5 km^2 of area would be disturbed for runway preparation.

During construction, fuel for heavy equipment would be transported to the site and stored in one or more day tanks. Several structures would be used at the site including a warming hut and outhouse. Sanitary wastewater and human waste would be containerized and transported back to McMurdo Station for disposition.

It is expected that runway preparation and compacting in Phase 1 would be initiated early in the austral summer season (August 2015) and would require approximately 3,200 hours of equipment operation to complete over a period of 120 days. It is estimated that the heavy equipment would consume approximately 170,000 liters (L) of fuel during the construction effort.

Figure 2. Profile View of Proposed Alpha Runway Compacted Lifts



3.2 Phase 2 - Testing and Certification

Phase 2 of the proposed proof of concept involves testing the compacted snow runway for suitability of use by wheeled aircraft followed by subsequent certification. For testing, the USAP has built a series of test carts that duplicate the likely ground pressures that would be seen in the aircraft landing at the site. These test carts would be towed on the runway to monitor to effects such as movement or displacement of the compacted snow.

Following successful completion of the initial tests, actual aircraft would be used to determine if the runway meets applicable certification standards. While the exact procedure is still to be determined, it is expected that a process similar to the following would take place. The first step would involve one or more "touch and go" landings on the runway using a LC-130 and touching down on skis with its wheels retracted. Following this test, runway conditions would be evaluated and maintenance performed, if necessary. The next step in the certification process would involve a wheeled LC-130 landing. The final step of certification process would involve a C-17 landing. Throughout the runway certification process, experts at NSF, Cold Regions Research and Engineering Laboratory (CRREL) and U.S. Air Force would review the results and provide input accordingly.

3.3 Phase 3 - Conditional Decision for Runway Use

Phase 3 of the proposed action will depend on the results of the proof of concept construction, testing, and certification process. If the Alpha Site Runway is certified for use, there are multiple options on how it might be integrated into USAP air mobility operations.

3.3.1 Alpha Site Runway Certified for Use

If the runway proof of concept is proven to be successful and the runway is certified, then NSF likely would decide to use the runway and determine the extent and capacity of use. In the event NSF opts to use the Alpha Runway Site as the primary airfield for wheeled aircraft in the McMurdo Station area, it is assumed that Pegasus operations and capabilities would be moved to the Alpha Runway. Therefore, level of flight and support operations including deployment of physical resources at the Alpha Site runway would be comparable or less intense than operations historically conducted at the Pegasus Runway. As a result, the activities addressed in the USAP Master Permit for the Pegasus Runway and the associated environmental releases and impacts would be consistent with those anticipated at the Alpha Runway Site. Using the current Pegasus Runway configuration as a model (see Figure 3), a more detailed description of these resources that may be operated at the Alpha Runway Site under Phase 3 are described below.

Alpha Runway Setup

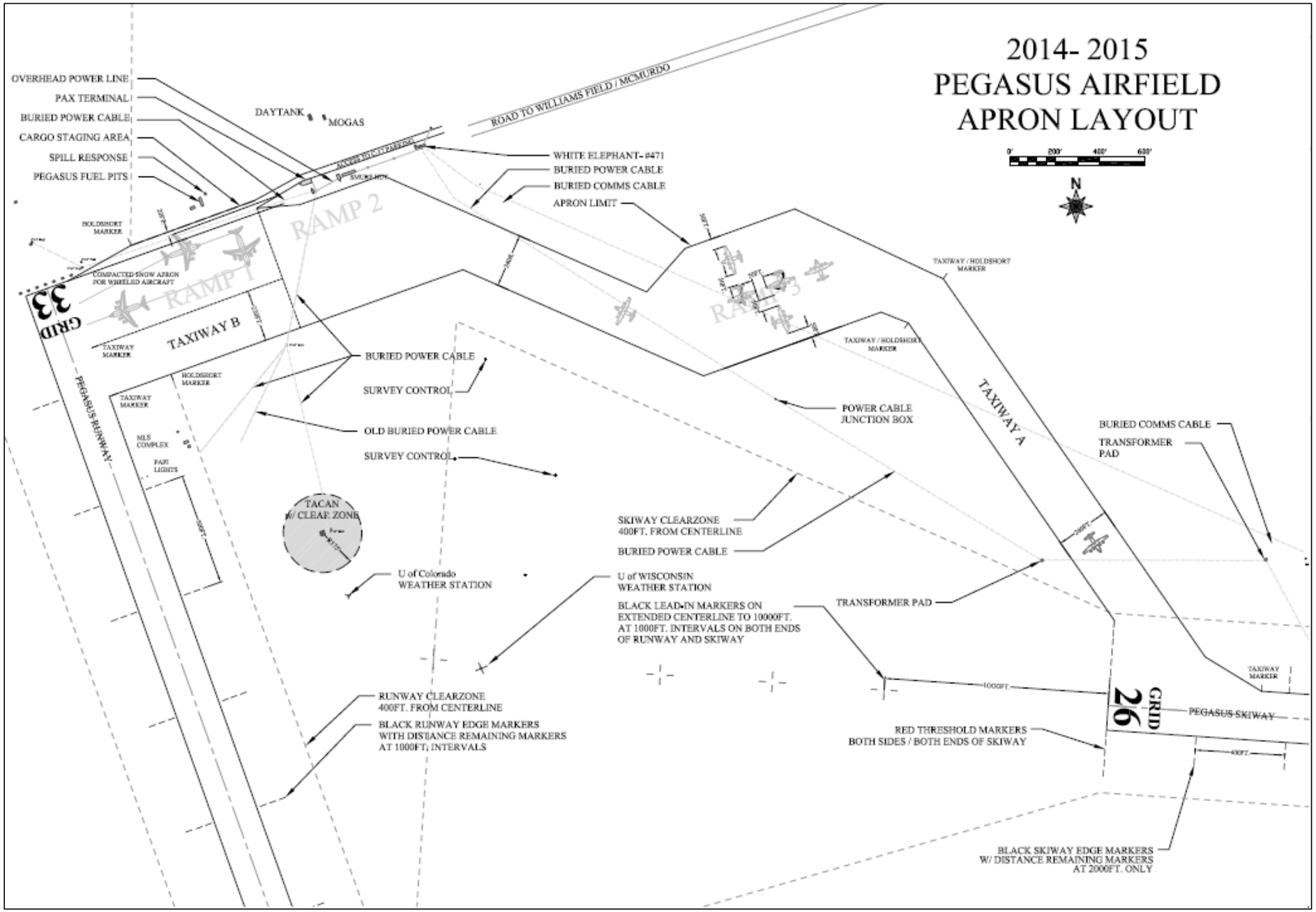
The Alpha Runway would be developed further to include a taxiway, aircraft apron, and related support facilities. Support facilities would include structures such as modular buildings, tents, and huts. These structures would be used for fuel management, cargo, bathrooms, and personnel support. The structures would be moved in place using an assortment of tractors, pickup trucks, deltas, and tractors with haul trailers. Generally, the runway structures would be mounted on skis or built on wooden supports and anchored to the surface with cables. Other resources such as cargo containers (milvans), pallets, and waste storage boxes or drums may be placed on ski-mounted platforms or directly on the snow surface. At the end of each season use, and consistent with past airfield practices, the structures would be moved and placed on snow berms to facilitate recovery and setup during the following season.

Alpha Runway Operations

If the Alpha Runway proof of concept is successful and NSF decides to operate an airfield at this location, it expected to handle approximately 100-wheeled aircraft intercontinental flights during the austral summer. In addition, an initial limited number of intercontinental flights may be accommodated on an as-needed basis during the austral winter or WINFLY (i.e., end of winter) season. If winter flights are deemed appropriate and needed by NSF, then Alpha Runway may be used to support increased austral winter flights if needed.

Support operations at the runway would include regular maintenance (e.g., compacting, grooming) of runway surfaces, snow management, and connecting roadways to the other airfields and McMurdo Station. The roadways to the site would be maintained, as well as transport resources for airfield personnel, passenger, and cargo. Grooming would require heavy equipment such as bulldozers, rollers, graders, snowblowers, and setup of support facilities. It is anticipated that the Alpha Site would require an equal, or potentially lower, level of effort for

Figure 3. Pegasus Apron and Site Layout



snow management compared to the nearby Pegasus Site. The Alpha Site would not be subject to the same level of effects of dirt or soil deposition and associated snowmelt as the Pegasus Runway, but would be in a higher accumulation zone, and therefore, may require more regular storm recovery.

Regular inspections of the runway surface and periodic measurement of air and snow temperatures would continue. Snow management and compaction activities would be guided by these measurements to ensure continued safe airfield operations.

Measures to reduce the effects of solar heating and localized melting during warm weather conditions would continue. Examples include minimizing soot emissions from aircraft, parking aircraft away from the runway and ramp areas.

It is anticipated that only small amounts of materials containing Designated Pollutants (i.e., hazardous materials) such as fuel, glycol, oils and lubricants, propane, compressed gases, and various maintenance materials for wheeled aircraft would be transported, used, and stored at the airfield, and on an as-needed basis. Other materials containing Designated Pollutants may be temporarily stored at the airfield as cargo awaiting shipment.

Diesel fuel for aircraft would be delivered to the airfield using 11,400-liter (L) steel tanks or bladders. These sleds and bladders would be pulled to the site using tractors or bulldozers where the fuel may be transferred to larger tanks (75,700-L) for storage.

A fuel dispensing area would be centrally located at the Alpha Runway and configured and equipped for efficient refueling. Flexible hoselines with booster pumps would be the primary mechanism to deliver fuel aircraft at the runway. The hoselines would be continuously monitored during fuel transfer activities. Near the end of the austral summer, the hoseline would be "pigged" with a device to remove and collect residual fuel and allow the line to be retrieved for storage over the austral winter.

Fuel would also be stored at the airfields in a 37,800-L day tank to refuel ground support equipment and vehicles. A tanker truck would be used to deliver fuel for runway power and heating. A small amount of gasoline may be stored and dispensed from 208-L drums to refuel snowmobiles and other ancillary equipment. To the maximum extent practical, fuel storage containers (e.g., 208-liter drums, jerry cans) would be placed in containment devices such as portable berms, impermeable liners, pans, or similar barriers having the capacity to hold the volume of liquid in the largest container.

Sanitary wastewater generated at the Alpha Runway would primarily include blackwater (human liquid and solid waste) from the airfield toilet facility. Sanitary wastewater and waste would be contained and trucked to McMurdo Station for ultimate disposal in the U.S.

3.3.2 Alpha Runway Fails Certification

If the runway cannot be certified and the proof of concept fails, it is unlikely that NSF would attempt to develop the Alpha Runway further. Current airfields would continue to be maintained

and operated to meet logistical support needs of the USAP, as well as manage existing operational and maintenance challenges (e.g., No Action alternative).

4.0 EXISTING CONDITIONS

4.1 Environmental Setting

The Alpha Runway site (166º35'E, 78ºS) is located between the Pegasus Runway and Williams Field on the McMurdo Ice Shelf portion of the larger Ross Ice Shelf (see Figure 1). The site is in a transition between snow accumulation and ablation (evaporation) regions on the McMurdo Ice Shelf. The winds in the area are variable, but the prevailing wind is generally from the east. There are no rock exposures in the vicinity. McMurdo Sound lies approximately 6.5 km to the northwest, and is typically covered by seasonal sea ice that may extend approximately 40-50 km from McMurdo Station and may break up during the austral summer season.

The Alpha Runway site is strategically located on the Ice Shelf where wind-blown dirt and mineral material from Black Island would not significantly accumulate, and only moderate snow accumulation would be realized. The Alpha Site exhibits a thin, but permanent and complete, snow cover. The snow is underlain by a contiguous mass of glacial ice. Seasonal melting may occur during December and the first half of January, when relatively high temperatures and intense (24-hour/day) sunshine predominate in the McMurdo area. Significant melting as experienced at the Pegasus Site is not expected at the Alpha Site; however, any melting that may occur would take place either on the surface or at a level slightly below the top of the ice.

The ice sheet at the Alpha Site is approximately 30 m thick. Depending on the temperature, crystallographic structure, and impurities, the ice has a flexural strength of 5 to 10 kg/cm^2 (490 to 980 kilopascals), which is capable of supporting heavy wheeled aircraft (NSF, 2009).

4.2 Biota

Wildlife does not inhabit the airfield area but occasionally transient Skuas and other wildlife (e.g., seals or penguins) may be seen in the vicinity. McMurdo Sound, located approximately 6.5 km to the northwest and is an important area for marine mammals and birds. Weddell seals, Adelie penguins, and Emperor penguins use the area for breeding. Historically, seals and penguins have been affected by anthropogenic activities in the McMurdo vicinity but current impacts are minimal (NSF, 1991).

4.3 Antarctic Protected or Managed Areas

Northwest White Island Antarctic Specially Protected Area (ASPA 137) is located approximately 15 km southeast of the Alpha Runway site. The Northwest White Island ASPA is protected because it contains an unusual breeding population of Weddell seals which have been physically isolated from other populations by the advance of the McMurdo and Ross Ice Shelves. Protective measures described in the ASPA Management Plan include entry and overflight restrictions.

5.0 ENVIRONMENTAL ANALYSIS

This section of the IEE identifies the potential environmental effects resulting from the construction and operation of the Alpha Runway. It is noted that impacts related to the operation of multiple airfields in the McMurdo area were previously assessed (NSF, 2009). The anticipated impacts from the operation of the Alpha Runway would be similar to or less than impacts from operating Pegasus Runway. In addition, the proposed actions associated with the Alpha Runway would not alter the number or type of aircraft missions flown by the USAP.

Specific to the proposed proof of concept action to construct, test, and certify the Alpha Runway, environmental impacts may result from physical disturbances, the storage, handling, and use of materials containing Designated Pollutants (i.e., fuel), the release of substances to the environment (air emissions), noise, effects on biota, and visual impacts.

Based on the results of proposed proof of concept actions and if a decision is made to proceed with the routine use and maintenance of the Alpha Site runway, similar environmental impacts would result. However, it is noted that these related environmental releases or effects would not exceed what is currently delineated in the USAP Master Permit for an operating airfield.

5.1 Physical Disturbances

Physical disturbance to the environment is a certain outcome resulting from the construction of the Alpha Runway. These disturbances would encompass approximately 0.5 km^2 of area from terrain alteration caused by the grading and compaction of snow surfaces, placement of support structures, storage of materials, and the use of fuel-powered equipment.

As a result of any decision to operate and maintain the Alpha Runway, disturbances to the snow surface would continue, with a slight increase in disturbance to the snow surface created by construction of the aircraft taxiway and apron and berms for winter storage.

Consistent with current operations, the existing 23-km snow roadway from McMurdo Station to the Pegasus Site passes the Alpha Runway site and Williams Field and would continue to be routinely used and maintained.

The extent of these physical disturbances is considered minor and localized in the context of the environmental setting and vast expanse of the Ross Ice Shelf. These physical changes would be surficial and continue to be visually apparent during the time the airfield is in operation. Should the airfield be decommissioned and removed in the future, snow will accumulate and return the area to a relatively undisturbed condition.

Physical disturbances may also result from the generation of meltwater enhanced by the ambient heating effects or solar gain due to the presence of the airfield, structures, equipment, and operations needed to maintain the facility. The USAP would implement measures to reduce the release of foreign substances (e.g., soot, dirt) which could accelerate the adverse effect of solar heating during warm weather conditions; however, localized meltwater pools may form

occasionally and require redistribution by pumping to prevent hindering of aircraft operations. Meltwater effects at the Alpha Site, if any, are expected to be significantly less than experienced at the Pegasus Site. Therefore, the environmental effects resulting from the management of meltwater at the airfield are expected to be minor.

5.2 Handling, Storage, and Use of Materials Containing Designated Pollutants

Diesel aviation fuel (i.e., AN-8) represents the primary material containing Designated Pollutants constituents (i.e., hazardous substances) that would be stored and used at the Alpha Runway during construction. During the construction phase, fuel would be stored in one or more day tanks (11,300- to 37,900-L capacity) or delivered via tanker truck; it is anticipated that less than 50,000 L of fuel may be stored at the Alpha Runway site at one time during the construction phase. Up to 170,000 L of fuel would be used for construction.

Should the Alpha Runway facilities be developed to become an operational airfield, the maximum fuel storage capacity at the facility would be up to approximately 900,000 L; fuel would be transferred to the site via tanker sleds or bladders. Other materials containing Designated Pollutants that may be stored and used at the airfield include glycol, oils, lubricants, solvents, propane, and compressed gases. Generally, Designated Pollutant storage and use would remain consistent with the scale of activity associated with current airfield operations.

Consistent with current USAP practices for airfield operations, best management practices (BMPs) would be consistently implemented to prevent the release of fuel and other materials containing Designated Pollutants to the environment. For example, during fuel transfer operations, the hoselines would be continuously monitored for leaks by personnel traversing on snowmobiles. Similarly, bulk fuel storage tanks would be inspected regularly to detect leaks. To the maximum extent practical, fuel storage containers such as 208-L drums and jerry cans would be placed in containment devices such as portable berms, impermeable liners, pans, or similar barriers having the capacity to hold the volume of liquid in the largest container.

Through the consistent use of BMPs, environmental impacts resulting from the use of materials containing Designated Pollutants are expected to be less than minor.

5.3 Releases to the Environment

Air Emissions

Fuel combustion emissions would be released to the ambient air at the Alpha Runway and would originate from heavy equipment, vehicles, and ancillary equipment used for construction. Additional air emissions would be generated during operation and maintenance of the runway and would originate from the equipment and vehicles and power generators and heaters used for the runway facilities. Emissions from airborne aircraft would not be affected by the operation of the Alpha Runway or other combination of the existing airfields. Emissions were evaluated in the IEE Operate a Single Airfield Facility at McMurdo Station, Antarctica. MCST1001.IEE. (NSF, 2009). The quantity of fuel combustion emissions would be directly proportional to the volume of fuel consumed. Fuel combustion byproducts and fuel evaporative emissions would be

estimated for all USAP facilities in the McMurdo Station area and reported for the Master Permit (NSF, 2014).

Fuel combustion and evaporative emissions from equipment and ground vehicles at the Alpha Runway during construction are expected to rapidly disperse by steady winds and dissipate in the atmosphere. The total volume of exhaust emissions from equipment used to support operations and maintenance at the Alpha Runway would be similar to emissions in past years contributed by individual airfields operated in the McMurdo area. Overall, the exhaust emissions are not expected to accumulate to levels that would alter the physical and chemical properties of the terrain or adversely affect local air quality. The effects of air emissions are expected to be localized, minor and transitory.

Operational Materials

Certain operational materials may be intermittently released to the environment as a result of common operation and maintenance activities at typical USAP facilities. These releases may include items such as utility poles, wood, metal supports, anchor pins, marker flags, or cables which may become frozen in the ice and impractical to retrieve. Operational materials are not expected to be released during construction of the Alpha Runway. If NSF decides to operate and maintain the Alpha Runway facility, the structures that would be used at the Alpha Runway would be mobile (i.e., mounted on skis) to facilitate annual relocation to snow berms for storage during the austral winter. Therefore, loss of irretrievable items is expected to be minimal. Impacts resulting from these types of incidental releases at the Alpha Runway, if operated, are expected to be minor.

Accidental Releases

Accidental releases typically involve unplanned events such as spills, leaks, or the unintentional loss of equipment or materials, including items containing Designated Pollutants or wastes. Since accidental releases are not planned, their frequency, magnitude, composition, and resulting environmental effects cannot be projected. The potential for spills and the resulting impacts during the construction phase is significantly less than would be realized during the operation and maintenance of the runway. In each phase of the proposed action, appropriate best management practices would routinely be used to prevent the accidental release of fuel or other materials containing Designated Pollutants. These measures include the use of secondary containment or spill prevention devices during fuel storage and handling and spill detection monitoring during pipeline transfer activities. Spill kits and absorbent materials will be available at locations where fuel or other Designated Pollutants are handled and stored. Airfield personnel will be trained in the proper use of spill kits and response actions.

Although the overall probability of spills is low due to the use of spill prevention measures, the frequency at which fuel would be handled at the airfield and the quantity that would routinely be transferred to the facility suggests that a spill or leak from the hoselines or a container is possible. In addition, during periods when maximum flight operations occur, the quantity of fuel handled at the operating airfields on a daily basis would increase.

Historical spill data for the airfields and associated roadways indicate that on average several spills occur each year, typically as the result of human error during fueling operations or vehicle

equipment failure. Due to effective spill detection and response procedures implemented by the USAP in recent years, most spills have been relatively minor involving less than 38 L (10 gallons) of liquid. If a spill occurs, resources would continue to be available to contain the spilled material and facilitate cleanup or removal of contaminated media to the maximum extent practical. As needed, large or complex spill or leak incidents may be cleaned up by a designated Spill Response Team deployed to the site.

If a liquid is accidentally released on the snow-covered ice shelf, the fate and transport of the material will depend on the environmental setting. Spilled liquid is expected to migrate vertically through the snow cover and spread laterally on the glacial ice/sea ice or accumulate in depressions on the ice (Christensen, 2008). The flexible hoselines used to fuel aircraft potentially would affect the environment anywhere along its length if a leak occurred. Except in proximity to the land/ice sheet transition zone, there is no pathway for fuel accidently released from the hoseline to reach openings in the ice and migrate into the sea. The environmental effect of a fuel release on the ice sheet may be detectable on a long-term basis in proximity to the release source but the overall severity likely would be minimal. If a release occurs, cleanup procedures would be promptly implemented to remove contaminated media (i.e., snow and ice) to the maximum extent practical. An impact resulting from an accidental spill is expected to be localized and minor. All spills would be documented and reported consistent with the requirements of 45 CFR §671 and the USAP Master Permit.

5.5 Noise

Noise is a certain outcome of construction of the Alpha Runway, any subsequent operations of the facility, and along the roadways connecting the airfield to McMurdo Station. Sources of noise and vibrations include mobile equipment (tracked and wheeled) used to construct the runway. The noise effects during construction would be minor, transitory, and of a short-term duration.

During operations and maintenance, use of stationary equipment at the airfield, and mobile equipment used to maintain the airfield and connecting roadways would generate noise and vibrations. Because nearby Williams Field will be used for ski-equipped aircraft, there would be times when more than one airfield would be operating simultaneously. Therefore, noise sources would be at two locations rather than one location. Overall the effects from noise are expected to be minor and transitory.

5.6 Biota

With the exception of an occasional transient seal, penguin, or seabird, flora and fauna are not expected to be present at the Alpha Runway. The nearest known sensitive biological community is the seal colony in the Northwest White Island ASPA (ASPA No. 137) approximately 15 km away. Neither the proposed construction of the Alpha Runway nor possible use as an airfield facility is expected to displace or disturb seals at the ASPA or adversely affect the normal behavior patterns of any other transient wildlife in the area.

Certain animals, particularly seals, are routinely present at the Scott Base land/ice shelf transition zone and near cracks or openings in the seasonal sea ice. The Antarctic Conservation Act prohibits acts which may disturb or adversely affect these animals. The configuration of the existing McMurdo area roadways and the transportation procedures have been designed to mitigate adverse effects on the biota. Therefore, operations related to the Alpha Runway are not expected to create disturbances which would displace animals or alter their behavior patterns.

On occasion, individual animals may come onto a roadway or one of the operating airfields. USAP has a procedure that allows trained and ACA-permitted staff to herd the animal from the area to protect the animal and allow operations to continue safely. ASC fuel and air operations personnel are trained to herd animals away from operational areas to protect the animals and maintain operations.

5.7 Visual Characteristics

Aesthetic resources in Antarctica are not readily defined, but can generally be characterized as the wilderness value, absence of permanent improvements, or visible evidence of human activity. The remote areas of the Antarctic continent that exist beyond established stations, support facilities, and research sites, allow visitors to experience the remoteness of the continent and the unique landscapes, particularly those characterized by the sweeping glaciers, and ice-free ridges and valleys, islands, and coastal regions.

The number of flights to McMurdo area would not change because of the proposed action only and location of flights would change. While the construction of the Alpha Runway would create a short-term visual impact, the operation of the Alpha Runway in addition to the nearby airfields at different times throughout the year represents a continuation of the existing intensity of USAP activities in McMurdo Station area and therefore would detract from the aesthetic wilderness value of this portion of the Ross Ice Shelf. However, this impact would be similar to the impact from continuing to operate Pegasus Runway.

5.8 Indirect and Cumulative Effects

The proposed construction and testing of the Alpha Runway combined with the continued operation of Williams Field and Pegasus Runways, and potentially the Sea Ice Runway, would require logistical support from McMurdo Station. The Alpha Runway proof of concept would involve construction and testing the runway on this portion of the Ross Ice Shelf, resulting in a short-term increase in heavy equipment operation and labor hours expended by the USAP during Phase 1 and Phase 2 of the project.

Other impacts associated with operation of multiple runways in the McMurdo area including the Alpha Runway would be similar to historic levels of effort and would include:

- Use of a roadways system between McMurdo Station and the airfields to transport flight crews, airfield support personnel, equipment, and supplies
- Maintenance of the vehicle fleet needed to transport personnel, equipment, and supplies

- Maintenance of the roadway system to transport personnel, equipment, and supplies between McMurdo Station and the airfields (grooming, filling, compacting)

Effective planning and resource management would be used to mitigate potential conflicts; therefore, the indirect impacts of Alpha Runway operations on McMurdo operations are expected to be minor.

It is unlikely that operation of the Alpha Runway, Williams Field, Pegasus Runway, and the Sea Ice Runway (if needed) would have a significant cumulative effect on the environment. It is anticipated that cumulative environmental impacts would be similar as they have been the past several years when Pegasus and the Sea Ice Runway were operated. The cumulative effects of the activities such as physical disturbances would increase but would be localized to the runways, support facilities and roads. Other activities that occur in the general area include opening and operation of the Long Duration Balloon Facility and overland traverse preparation and staging activities.

5.9 Summary

The potential environmental impacts associated with the proposed action to construct and test the Alpha Runway have been identified and evaluated in this IEE. Table 1 summarizes the potential environmental impacts that may result from these activities.

Overall, the findings of this assessment indicate that the proposed action to operate the Alpha Runway would provide an effective resource for wheeled aircraft at McMurdo Station while significantly avoiding disruptions associated with meltwater and other operational challenges.

Table 1. Summary of Impacts Resulting from Construction, Testing, and Conditional Operation of Alpha Runway at McMurdo Station

Activity	Output	Environmental and Operational Impacts					
		Affected Environment	**Duration**	**Extent**	**Intensity**	**Impact Probability**	**Overall Rating (see note)**
Phase 1: Construct Runway (five compacted lifts)	Physical Disturbance	Snow and Ice	Short-term	Localized (≤ 0.5 km^2)	Low	Certain	2
		Biota	Short-term	Localized	Low	Unlikely	1
	Air Emissions	Air	Short-term	Localized	Low	Unlikely	1
	Noise	Biota	Short-term	Localized	Low	Possible	1
	Alteration of Visual Characteristics	Aesthetic & Wilderness Values	Short-term	Localized	Low	Certain (reversible)	1
Phase 2:Test and Certify Runway	Air Emissions	Air	Short-term	Localized	Low	Unlikely	1
	Noise	Biota	Short-term	Localized	Low	Possible	1
Phase 3: Conditional Operation and maintenance of runways, buildings, and roadways, and use of ground vehicles	Physical Disturbance	Snow and Ice	Short-term	Localized	Low	Certain	2
	Air Emissions	Air	Short-term	Localized	Low	Unlikely	1
	Releases (operational materials)	Snow and Ice	Long-term	Localized	Low	Unlikely	3
	Noise	Biota	Short-term	Localized	Low	Unlikely	1

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Activity	Output	Environmental and Operational Impacts					
		Affected Environment	**Duration**	**Extent**	**Intensity**	**Impact Probability**	**Overall Rating (see note)**
	Alteration of Visual Characteristics	Aesthetic & Wilderness Values	Short-term	Localized	Low	Certain (reversible)	1
	Accidental Releases (spills)	Snow and Ice	Long-term	Localized	Low	Possible	3
	Indirect Effects	Airfield Personnel; McMurdo Station Operations	Long-term	Localized	Low	Possible	3

Notes: + = environmental improvement; 0 = no substantial effect; 1 = minor, short-term effect; 2 = minor effect that continues for a limited period of time after the activity is completed; 3 = minor, localized long-term effect; 4 = environmental effects may be substantial or long-term

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