OPERATION DEEP FREEZE

50 YEARS OF US AIR FORCE AIRLIFT IN ANTARCTICA 1956-2006

Front Cover

Photo 1: In 1956, a dog sled waits near a C-124 Globemaster II parked on the ice at McMurdo Sound.

Photo 2: On 22 October 2002, CMSgt Richard LaPlante assesses this New York Air National Guard LC-130 Hercules after the aircraft was grounded because of a major storm. (National Science Foundation)

OPERATION DEEP FREEZE

50 YEARS OF US AIR FORCE AIRLIFT IN ANTARCTICA

1956-2006

Ellery D. Wallwork
with
Kathryn A. Wilcoxson

Office of History
Air Mobility Command
Scott Air Force Base, Illinois

October 2006

FOREWORD

On 21 October 1956, the first of many US Air Force aircraft, a C-124 nicknamed "Miss North Caroline," landed in Antarctica after a 12½-hour flight from Christchurch, New Zealand. This flight initiated the Air Force's participation in one of its longet running missions. Actually, the US Navy started this "temporary" Antarctic mission in 1955, with Air Force augmentation beginning the very next year. In the course of the next 50 years, the Air Force's role would continually evolve until it took over the mission's lead in 1998.

The personnel participating in Operation DEEP FREEZE have consistently exhibited the key competencies of the US Air Force. Time and again, they have demonstrated their courage, determination, innovation, and hard work to accomplish this mission, often in Spartan conditions. Their endurance ensured the success of the scientific research, providing transportation for the scientists and support personnel as well as their supplies and equipment. Between October 1956 and February 2006, US Air Force airlifters would fly over 5,800 missions, moving more than 78,900 tons of supplies and equipment and 94,500 passengers between New Zealand and Antarctica and around the Antarctic continent itself. And, that does not include the transportation of materials and passengers between the United States and New Zealand!

Leadership of the Air Force's portion of the mission began with the Tactical Air Command, which owned most of the troop transport C-124 aircraft in 1956. Once those aircraft transferred to the Military Air Transport Service, that organization and its successor, the Military Airlift Command, organized and directed the Air Force mission piece. This new arrangement lasted until the Air Force reorganized, inactivating the Military Airlift Command and activating the Air Mobility Command in its stead. Most recently, mission command transferred to the Pacific Air Forces. This last modification reflected a change in the overall concept, moving the leadership from a mission-related structure to a location-focused architecture. This is not to say one was better than the other, but it more closely reflected the Air and Space Expeditionary Force organization used throughout the Air Force for other operations.

The year this study was published marked the beginning of a year-long celebration of the 60th Anniversary of the Air Force, and it also witnessed the 50th Anniversary of the Service's inauguration in Operation DEEP FREEZE. This study reflects upon the accomplishments thus far in support of this rigorous mission. Yet, even though the mission continues, the monograph will not become dated, but will remain indispensable as it tracks the dedication, ingenuity, and labor behind those first 50 years of Antarctic operations. As we continue to learn more about operations in such a harsh environment, it will provide an insight into how far the men and women of the airlift community have come, and it will help to illuminate what they have yet to achieve. Perhaps, one day, a complementary study will highlight the accomplishments of the next 50 years of flight in Antarctica.

LILLIAN E. NOLAN
Air Mobility Command
Command Historian

PREFACE

Why spend time extensively reviewing a mission such as Operation DEEP FREEZE? On balance, it represents only a sliver of the overall airlift function. For example, Air Mobility Command flew over 44,850 airlift missions during 2005, and a mere 426 of them directly supported DEEP FREEZE.* Yet, Operation DEEP FREEZE now spans 50-plus years and occurs in one of the most unique locations in the world. It is precisely this microcosm, which covers a significant breadth of time and a depth of experience unobtainable from most conventional air mobility missions, that makes DEEP FREEZE worthy of an in-depth analysis. Looking at a year-by-year account of such a distinctive mission provides a fascinating model of air mobility. From this model, one can gain an appreciation of the perspective required for such an effort, the ingenuity achieved, and adversity overcome. This model can then serve as a baseline for other air mobility missions, whether transporting troops for a contingency, aid to a humanitarian disaster, or logistical support for routine daily operations.

As such, this study is primarily laid out in a chronological fashion, beginning with a quick look at the Navy's early aviation in Antarctica. The narrative looks at each year of the operation, but does not make an attempt to analyze every mission flown. Rather, it looks at the difficulties, unique approaches, failures, and successes during that particular year. Periodically (Chapters 3, 6, and 10), the narrative breaks away from this chronological approach and presents material in a more generalized fashion, focusing instead on some of those key issues that remained relatively constant throughout the 50 years (although, the material in these three chapters primarily looks at those topics relative to the time period in which they appear in the chronological narrative). The large number of photographs included in this study is not intended to make this a picture book; each one specifically illustrates a point in the narrative. Likewise, the appendices are intended to provide a quick reference for key dates and statistics, as well as information to augment the narrative.

This study is intended to review the air mobility operations of the US Air Force in Antarctica over the last 50 years. While it often mentions the parallel and overlapping efforts of US Navy, Coast Guard, and Army personnel, and civilian scientists and contractors, as well as the assistance of other nations, it was not feasible to cover their contributions in any great detail in this publication, although the Air Force could not have achieved this remarkable success in airlift operations on its own. Further research into each one's specific role is encouraged.

Likewise, one historian could not take full credit for such a product as this. It could only be accomplished because of the various historians, information managers, public affairs specialists, mission commanders, and many others who meticulously prepared DEEP

*Rpt, 18 AF TACC Executive Decision Support Division-Fusion Cell, "2005 Yearly Highlights (01 Jan 2005 to 31 Dec 2005)," 1 Feb 06.

FREEZE reports, collected statistical data, and preserved key documentation. Special thanks also belong to a number of folks. Kathryn Wilcoxson, AMC Office of History, for her expert editing and in-depth, fact-checking skills. Ginger Hickey, 375th Communications Squadron, Base Multimedia Center, for her professional photo restoration, comprehensive design layout, press setup, and creative cover design of this publication. Lillian Nolan, director of the AMC Office of History, for her overall support and for reviewing the first draft and providing feedback. Mark Morgan, AMC Office of History, for his valuable insight into US Navy terminology and aircraft technology resources. Archie Difante, Joe Caver, Toni Petito, and many others at the Air Force Historical Research Agency. Mark Stanley and TSgt Leigh Mahnesmith, USAF Historian Development School at the Ira Eaker College for Professional Development. Al Miller and CMSgt Dave Anderson, Air National Guard History Office. Gary Boyd, 305th Air Mobility Wing History Office. Steve Larsen, 22d Air Refueling Wing History Office. TSgt Kevan Kipp, 62d Airlift Wing History Office. TSgt Julie Meintel, 445th Airlift Wing History Office. John Lacomia, 60th Air Mobility Wing History Office. Margaret Nigra, US Transportation Command Research Center.

In studying Antarctica, one must always remember that it is a harsh and volatile environment. In 1965, one wing commander, Brigadier General James W. Chapman, Jr., personified the region this way: "The Antarctic, fascinating as a beautiful woman, is often as perverse and is always as unpredictable and dangerous."* While many today may disagree with his choice of analogy, few could argue with the sentiment. Such an environment demanded much from those who served there. For their efforts, this study is dedicated to all who supported the Operation DEEP FREEZE mission, especially those who gave their lives in pursuit of this important undertaking for science and international peace.

Ellery D. Wallwork
AMC Staff Historian

*Foreword to Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 65," n.d.

A NOTE ON SOURCES

The majority of sources used for this report were available in the Air Mobility Command's Office of History. Much of it existed in hardcopy, while some was available only through the medium of microfilm. Several of the official documents not found at AMC were available at the Air Force Historical Research Agency (AFHRA), Air National Guard Office of History, or the applicable wing history offices. Those documents found in the USAF Collection at AFHRA include the call number and IRIS (inferential retrieval and indexing system) identifier in parentheses as part of the footnote, whereby the first number of "K490.04-1, IRIS 00508382" refers to the call number and the second the IRIS identifier. Most of the documents found at the AMC or wing offices are most likely available at AFHRA as well. Additionally, a few references also used websites of the US Naval Historical Center, US Antarctic Program, various DEEP FREEZE veterans groups, contractor organizations, and the University of Canterbury, New Zealand.

While this report is unclassified in its entirety, many of the histories and some of the documents referenced are not, since they covered much more than Operation DEEP FREEZE. For simplicity in building this study, I have not listed the classification of the individual reports. However, the reader should be aware that requests to view such documents may fall under the appropriate restrictions associated with classified information.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

PROLOGUE

OPENING A CONTINENT

By the mid-twentieth century, Antarctica remained a largely unknown region, even though a few explorers had ventured onto the Earth's southern-most continent. In 1739, a Frenchman documented the first sighting of an island in the Antarctic region, but evidence of the existence of a continent under the ice did not come until 1838-1839 when a US Navy expedition sailed from Cape Horn along the westward side of Antarctica to Australia. After wintering in Australia, the expedition revisited Antarctica before returning to the US.

By 1900, fishing, whaling, and sealing crews, and a few adventurers, had touched little more than the edges of the Antarctic ice cap. Serious exploration of the interior did not begin until 1911 when two groups, a Norwegian expedition, led by Roald Amundsen, and a British expedition, led by Robert F. Scott, set out for the South Pole--Amundsen reached the Pole first. On the return trip, a blizzard caught Scott's team, and all four of the scientists/explorers died in March 1912.

On 4 February 1902, Scott became the first person to rise above the Antarctic as he ascended 800 feet in a tethered balloon near the Ross Ice Shelf. Although he claimed the honor of being the "first aeronaut" in the Antarctic region, he reflected, "as I swayed about in what appeared a very inadequate basket and gazed down…I felt some doubts as to whether I had been wise in my choice."[1] A British expedition, led by Sir Hubert Wilkins, took the first aircraft, a Lockheed Vega monoplane, to the Antarctic in 1928. The first trial flight from Deception Island in November did not take the aircraft anywhere near the continent. Wilkins subsequently flew the second mission in December on a 600-mile aerial surveying flight across the Antarctic Peninsula.

In 1929, Rear Admiral Richard E. Byrd, US Navy, led an expedition that included three aircraft, a tri-motored Ford named "Floyd Bennett,"* a Fokker Super Universal, and a Fairchild folding-wing monoplane. From Little America, a base established near Rockefeller Mountains, Byrd flew the first mission over the South Pole in the "Floyd Bennett" in November 1929. Byrd accomplished the 1,600-mile round-trip flight in one day, versus the 99 days Amundsen took in 1911.[2]

Political claims in Antarctica soon followed the exploration. As early as 1908, the United Kingdom attempted to annex a portion of Antarctica. By World War II, several countries, including the United Kingdom, Chile, Argentina, Norway, Australia, France,

---

*Byrd named the aircraft after his close friend and fellow-Arctic explorer who had died earlier in 1928 after suffering injuries in a 1927 aircraft accident and contracting pneumonia after assisting in an April 1928 rescue in the Gulf of St. Lawrence. (Website, PBS, "Alone on the Ice: People & Events: Floyd Bennett," 1999.)

and New Zealand, laid territorial claim on parts of Antarctica. Despite a few mutual allied agreements, the international community as a whole refused to accept any particular claim on Antarctic territory. As interest in the region increased, so did the potential for conflict. Britain temporarily established three bases near the peninsula during the war to monitor German activities in the South Atlantic. In 1947, Britain, Argentina, and Chile dispatched naval ships to the Antarctic. A year later, all three agreed not to send warships south of 60 degrees South latitude. In 1952, Argentine personnel at Hope Bay used machinegun-fire to repel a British party landing to rebuild a base. The British returned with Marine escort and completed the reconstruction. In 1953, the British governor of the Falklands dismantled an Argentine and Chilean base on Deception Island.

Various American explorers claimed Antarctic territory for the US, but since the US government saw little immediate value in Antarctica, it did not formally declare a claim to the territory. Still, the US government outlined how it could lay as strong a claim as the other seven in the future. America remained interested in the exploration and science involved in Antarctica. However, in the post-war period, the US government focused on building alliances as part of its Soviet Union containment strategy. To the US, Antarctica raised an unnecessary potential for conflict among its allies. The American government accordingly proposed an international trusteeship of Antarctica. Initially, Britain, Argentina, and Chile remained skeptical of such an agreement. As discussion continued, the Soviet Union viewed a US-engineered agreement as an attempt to freeze it out of Antarctica. By 1950, the Soviets stated their historical and scientific interests and declared non-support for any Antarctic agreement they were not involved in. In response, the US government debated voicing its own Antarctic claim, but never formally did. Instead, in 1954, President Dwight D. Eisenhower shifted the US policy to maintaining a lasting scientific presence through periodic expeditions and permanent bases. To start with, the US would support Antarctic research during the International Geophysical Year (IGY), July 1957 to December 1958. The IGY included scientists from 40 nations cooperating in a program of geophysical observations throughout the world. The scientists chose this period because it corresponded with a period of maximum solar activity.

In all, 12 countries, including the US and Soviet Union, volunteered to establish 56 research sites (7 were US) in Antarctica as part of the IGY. These countries initially settled on an international "gentlemen's agreement" to suspend political claims and differences during the program. However, the US realized this hiatus would soon end--the Soviets, as well as the US, declared an intention to continue the research beyond the IGY. In an attempt to avoid further complications, the US invited the 11 other countries to a conference, with the intent to negotiate the freedom of scientific investigation in Antarctica beyond the IGY. Beginning in June 1958, representatives from the 12 countries met informally in 60-plus sessions to work out details of an international treaty. Formal negotiations began in October 1959 and, thanks to the informal sessions, went very quickly. All 12 countries

signed the agreement on 1 December 1959. The treaty went into effect on 23 June 1961 after all 12 governments ratified it.* By 2000, 45 countries had signed on to the treaty.

This amazing treaty guaranteed the peaceful foundation of Antarctic policies: "Recognizing that it is in the interest of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord." The framers of the treaty intended this foundation to focus on the expanded scientific study started during the IGY. The treaty, for all intents and purposes, demilitarized the continent:

Article I

1. Antarctica shall be used for peaceful purposes only. There shall be prohibited, *inter alia*, any measure of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapon.

2. The present Treaty shall not prevent the use of military personnel or equipment for scientific research or for any other peaceful purpose.[3]

*For a detailed discussion on US policy towards Antarctica, see Frank G. Klotz, *America on the Ice: Antarctic Policy Issues*, Fort McNair, Washington DC: National Defense University Press, 1990.

Photo 3: In August 2003, aircraft heaters create a eerie fog around a McChord Air Force Base C-17A Globemaster III parked on the Pegasus Site Runway, McMurdon Sound Station, Antarctica. (National Science Foundation)

CHAPTER 1

GETTING UNDERWAY (1946-1957)

For the International Geophysical Year (IGY), the Department of Defense agreed to support the logistical requirements of the US scientists in and around* Antarctica and assigned the mission, dubbed Operation DEEP FREEZE,** to the US Navy. The Navy had the most experience in the area. In fact, Admiral Richard E. Byrd had led several expeditions to the Antarctic. The largest, Operation HIGHJUMP, occurred in 1946-1947 when Byrd led a task force of 4,700 men aboard 13 ships, including the aircraft carrier *USS Philippine Sea*, icebreakers, and several seaplane tenders. The task force established a base, Little America IV,*** near the Bay of Whales. Six R4D (Navy version of the DC-3 or C-47) ski-wheel-equipped aircraft launched from the *USS Philippine Sea* and landed at Little America IV. Commander William M. "Trigger" Hawkes piloted the first aircraft, which ferried Byrd and his staff to the ice.**** From Little America IV, the R4Ds flew a total of 260 hours on 39 missions. Using the R4Ds, seaplanes, and helicopters, Byrd's expeditions surveyed and photographed much of the Antarctic coastline.[4]

Because of the limited environmental operating conditions found in Antarctica, the Navy divided Operation DEEP FREEZE into two parts, each corresponding to the southern hemisphere's summer months and placed Rear Admiral George J. Dufek, a veteran of several Arctic and Antarctic expeditions, including HIGHJUMP, in command. With just two years to prepare, Dufek's team needed to have five scientific stations ready no later than 1 July 1957, and the other stations had to be constructed by 1958. In addition to establishing coastal stations, this involved moving some 500 tons of equipment over 500 miles of ice to construct Byrd Base and delivering another 500 tons of equipment to the South Pole to build the Amundsen-Scott Station there.***** To accomplish this, Dufek planned to transport the equipment to the Bay of Whales and construct Little America V, including a snow-compact runway, during the 1955-1956 season (DEEP FREEZE I). A team of Navy construction engineers (Seabees) would winter over at Little America V and begin work at Byrd Base and the South Pole as early in the following spring (October) as weather would

*"Around" included locations as far away as Christchurch, New Zealand; Marion Island; and Punta Arenas, Chile.
**Operation DEEP FREEZE referred only to the logistical support provided to the US Antarctic Research Program. As the operation progressed, it started to encompass some logistical support for Antarctic research programs of other countries, primarily New Zealand.
***In previous visits, Admiral Byrd established Little America II in 1934 and Little America III in 1940, both near the Bay of Whales.
****Of note, this was also the first R4D takeoff from a carrier.
*****Keep in mind that only two parties (one led by Amundsen and one by Scott) had actually been on the South Pole up to that point and the Scott expedition did not survive the return trip.

permit. The Seabees would use a tractor train to move the equipment to Byrd Base, while the equipment for the South Pole would be airdropped.

However, plans soon changed. A study revealed the Bay of Whales was unsuitable as an unloading area. As a result, planners moved Little America V to Kainan Bay, some 30 miles to the east, but doubts remained that an ice runway could be constructed in time and whether that portion of the Ross Ice Shelf could support continued operations by heavy airlift. Admiral Dufek decided to continue with the plans for Marie Byrd Station from the new Little America V location, but moved the construction of the snow-compacted runway to McMurdo Sound,* where the ice was much thicker. The main drawback was that this moved the start point for the airdrop operations some 780 miles from the South Pole, but it was much more advantageous for the planned delivery flights from New Zealand.[5]

Admiral Dufek departed the US for New Zealand to lead Task Force 43 to Antarctica in November 1955. Dufek and the leaders of the Air Development Squadron Six (VXE-6) decided to include several types of aircraft in DEEP FREEZE I to see which operated best under the Antarctic conditions. These included two ski-wheeled P2V Neptunes for long-range missions, two ski-wheeled R4D Skytrains for medium-range airlift missions, two UF-1 Albatross seaplanes for rescue and light airlift work from ship to shore, two wheeled R5D Skymasters (C-54) for long-range airlift and photographic reconnaissance missions, four ski-wheeled UC-1 Otters (Canadian snow-designed utility planes), and three HO4S-3 helicopters.[6] After icebreakers (accompanied by a cargo ship with enough personnel and equipment to start working on the ice runway at McMurdo) ensured the way was clear, the Task Force departed New Zealand for Antarctica on 16 December, while the VXE-6 Squadron kept the Skymasters, Neptunes, Skytrains, and Albatrosses at Christchurch, New Zealand, until the Seabees had prepared for their arrival. The distance from Christchurch to McMurdo Sound was well within the maximum range of the R5Ds and P2Vs, but just barely within that of the R4Ds and UF-1s (a wrong wind direction could actually prevent their flight).

The engineers had the ice runway** ready to accept aircraft by 19 December. As an added insurance and to monitor en route weather conditions, Dufek stationed ships at four ocean stations approximately 250 miles apart along the route. All eight aircraft departed on the morning of the 20th, but because of strong headwinds, the R4Ds and UF-1s returned to New Zealand from just short of the point of safe return (PSR). After a 14-hour flight, all four of the other aircraft landed safely at McMurdo, with a P2V Neptune (tail number 142465), piloted by Lieutenant Commander Joseph W. Entrikin,[7] becoming the first aircraft to take off from a landmass outside of Antarctica and land on the continent.***

---

*McMurdo Sound was also the starting point for the ill-fated Scott South Pole expedition.

**The Navy officially named the McMurdo Sound airfield as Williams Field Naval Air Facility in 1957. Various versions of the Williams Field developed over time. For simplicity, this report refers to both the scientific station and airfield as McMurdo Sound. See Appendix L.

***After severe conditions during the 1952-53 season prevented resupply by ship, the Argentine Air Force flew Avro Lincoln B-2s on long-range airdrop missions from Rio Gallegos on the South American mainland to their base at Marguerite Bay. Similar aircraft also flew photographic missions to the islands near the Palmer Peninsula. (Rpt, Henry M. Dater, Staff Historian, US Antarctic Projects Officer, "Aviation in the Antarctic," Jul 59.)

Tragedy struck soon after, with the first aircraft accident occurring on 22 December. An Otter was helping to move equipment offloaded on the bay ice to the McMurdo Sound base, a 40-mile shuttle mission. On one of the runs, the aircraft stalled from approximately 70 feet in the air and hit the ice tail first. No deaths occurred, but six of the seven on board sustained serious injuries. A Neptune flew to the scene and returned the injured to McMurdo. They were subsequently transferred to a ship on 26 December.[8]

The four large aircraft (two P2V, tail numbers 142465 and 124466, and two R5D, tail numbers 56505 and 56528) remained at the McMurdo base until 18 January 1956. During the month's operations, the crews overcame several obstacles and accomplished a number of objectives. However, operations had first to wait until 27 December when the *USS Nespelen*, a fuel ship which had served as the third ocean station, arrived at McMurdo Sound, and then until 3 January when icebreakers finally got the fuel ship as close to the base as possible. With no fuel storage tanks yet at the base and the only feasible way to move fuel from the ship 30 miles away was with 50-gallon containers via helicopter, the crews took the planes to the *Nespelen*. Although there was a risk of the ice breaking off under the aircraft's weight (it was only about four-feet thick beside the ship), the crews landed near the ship and refueled before hopping back to the prepared runway.

In a total of six flights, the P2V and R5D aircrews photographed much of Antarctica's coastline and several points of the interior, including the South Pole and Pole of Inaccessibility.* On the third flight, the aircrew used eight jet-assisted take-off (JATO) bottles because of the heavy fuel load. This mission was the first round-trip across the continent. As the summer continued, the ice at McMurdo Sound began to break up. Rather than take a chance on the runway area breaking off, Dufek decided to send all of the large aircraft back to New Zealand. However, right before releasing the aircraft, the crews flew three simultaneous flights on 13 January in different directions. One of these flights discovered four new mountain ranges and proved conclusively that Antarctica was not a split landmass.

During the fourth reconnaissance flight on 6 January, the starboard engine of the P2V (142465) began failing 1,000 miles from McMurdo Sound. Additionally, the troubled engine backfired violently and considerably increased fuel consumption. While Commander Entrikin sent a distress signal to warn McMurdo of their situation, the crew dumped everything save 45-days survival gear and some paperwork and turned off the cabin heaters to conserve fuel. McMurdo immediately sent an R5D and P2V to refuel at the *Nespelen* and then to escort Entrikin's plane back. The P2V's engine failed completely about 10 minutes out, but Entrikin landed the aircraft safely. Further investigation revealed the aircraft only had 150 gallons of fuel, or about 6.5 minutes of flight, left.[9]

After the large aircraft left on 18 January, an Otter with seven men aboard crashed on 3 February some 380 miles from Little America V. Poor weather the first couple of days severely hampered search and rescue efforts. In the meantime, officials moved an Otter

*The Pole of Inaccessibility was the point furthest inland from any shoreline. It is approximately 288 miles east of the South Pole. As part of the IGY, the Soviet Union selected this location to build a research station.

and a helicopter from McMurdo Sound to Little America to assist. While the Otter and two helicopters conducted a systematic search, Lieutenant Commander J. H. Torbert attempted to fly a P2V (122466)* from Patuxent River, Maryland, to Antarctica via South America to assist in the search. However, on 8 February, the P2V developed engine trouble and ditched in Venezuela. On 9 February, search and rescue found both the P2V and Otter. Amazingly, only minor injuries were reported from the Otter's personnel.[10]

Operation DEEP FREEZE I concluded on 30 March 1956 when the *USS Glacier*, an icebreaker, departed. Despite several injuries, two deaths,** and the loss of two aircraft, the US Navy personnel accomplished their objectives. When engineers completed the tank farm on 11 February and the *USS Nespelen* provided it the remainder of its fuel, McMurdo Sound had a complete air operating facility. Aircrews had accomplished nine long-range photographic missions. Engineers constructed main bases at Little America and McMurdo Sound as well as locating sites for another four stations. They also assembled materials for the South Pole Station at McMurdo Sound and for Marie Byrd Station at Little America.[11] During the winter months, 93 men, mostly Seabee engineers but also two Air Force aerial port specialists to prepare airdrop cargo, constructed a more permanent 6,000-foot ice runway,*** turn-around circle, and 2,000-foot by 300-foot parking ramp, at McMurdo Sound by clearing snow from the bay ice. They started work on 23 July and initially completed it on 22 August. Unfortunately, a blizzard in mid-September completely filled the ice runway with snow, forcing the engineers to start over. In order to meet the deadline to begin operations, the engineers cleared only the first 5,000 feet of the runway, completing the task by 15 October, in time to meet the scheduled arrival of the Navy aircraft. Weather prevented that arrival until the 17th.[12]

Detailed planning for Operation DEEP FREEZE II (the 1956-1957 season) commenced almost immediately after DEEP FREEZE I. While Admiral Dufek would again lead the operation, the Navy turned command of VXE-6 over to Captain Douglas Cordiner, the senior operations officer of DEEP FREEZE I. Cordiner planned to take one P2V Neptune, two R5D Skymasters, four R4D Skytrains, and several Otters and helicopters (the latter two carried aboard ships) back to Antarctica. After operations began, four additional P2V7 Neptunes, with two jet engines added to the standard propeller engines, would join the effort. Additionally, the US Air Force agreed to supply eight C-124 Globemaster aircraft with trained crews. The Globemasters' primary mission would be to airdrop equipment at the South Pole. The aircraft belonged to Eighteenth Air Force's 63d Troop Carrier Wing (TCW),**** commanded by Colonel E. Wade Hampton.[13]

As part of the preparations, Headquarters Tactical Air Command sent a survey team, headed by Captain Arthur H. Grafe of Eighteenth Air Force, to New Zealand and Antarctica

*The R5Ds at New Zealand could not move to Antarctica to help because the ice runway had broken up several days before.

**Both of these deaths occurred as a result of D-8 tractors falling through ice crevasses. In recognition of the first casualty, the Navy named the McMurdo Sound airfield after the driver, Richard T. Williams.

***Plus a snow-compacted runway for the Navy's ski-equipped aircraft.

****Both Eighteenth Air Force and the 63 TCW belonged to the Tactical Air Command at the time. The 63 TCW subsequently transferred to the Continental Division, Military Air Transport Service on 1 July 1957.

Photo 4: The first C-124 Globemaster II to land in Antarctica delivers a UC-1 DeHavilland Twin Otter on 21 October 1956. (Photo from National Science Foundation)

in January and February 1956. The survey team evaluated all aspects of the mission and made recommendations--from the unit airlifting some of its own vehicles to New Zealand to the minimum amount of long underwear each man should take. An Air Material Command team also modified each of the eight selected C-124s. This team installed 13 major modifications, including a three-phase emergency power unit and special compasses, navigation instruments, propellers, and communications equipment.[14]

Although Major General Chester E. McCarty, Commander of Eighteenth Air Force, would accompany the 63 TCW deployment, Colonel Horace A. Crosswell, Commander of the 63d Troop Carrier Group, served as Air Force Task Unit Commander during DEEP FREEZE II. The Air Force selected the 52d Troop Carrier Squadron (TCS) of the 63 TCW, stationed at Donaldson Air Force Base, South Carolina, because the squadron had played a major role in 1955's Operation ICE CUBE. During ICE CUBE, Air Force C-124s and C-119s airlifted supplies and equipment for construction of the Distant Early Warning (or DEW Line) sites in Alaska, Canada, and Greenland. The 63 TCW received the Distinguished Unit Citation for flying over 1.25 million ton-miles in the Arctic.[15]

Operation DEEP FREEZE II officially began on 28 October 1956 when the *USS Glacier*, of Task Force 43, arrived at McMurdo Sound. However, aircraft arrived earlier to bring fresh supplies to those who had wintered at McMurdo. On 16 October, a C-124 flew a weather reconnaissance mission from Harewood Aerodrome in preparation for the first Navy R5D departure from Christchurch. The C-124 crew reported heavy icing and advised the R5D to fly 50 to 75 miles west of the planned route. The R5D, carrying Admiral Dufek, arrived at McMurdo Sound without incident on 17 October.[16] The remaining Naval aircraft departed the next day, but one of the P2Vs (122465, piloted by Lieutenant David W. Carey) crashed on landing, killing four crewmembers. Poor weather--whiteout conditions--closed McMurdo Sound for several days after that. As soon as the weather cleared on 19 October, Dufek sent a message, "Runway considered satisfactory for C-124 operations,"[17] to the Air Force personnel and eight C-124s awaiting clearance in New Zealand. The first C-124 had departed Donaldson on 4 September and arrived at Christchurch six days later. Seven of the eight aircraft were in place at Christchurch and operationally ready by 15 October.

After Dufek's clearance, six C-124 aircraft departed Harewood Aerodrome at four-hour intervals. The first one (tail number 51-0207, "Miss North Caroline"), flown by Colonel Crosswell, landed on 21 October after a 12 hour and 25 minute flight, bringing in 15,610 pounds of cargo that included a Navy UC-1 Otter (Photo 4).[18] This C-124 returned to New Zealand with the injured from the Neptune crash.[19] The first three C-124s landed at McMurdo without incident, but reported "the runway was rough and undulating, and extreme caution must be exercised on landing and runway operations."[20] The excessive stress created by the runway conditions caused the nose gear of the fourth C-124 (52-0983, "The State of Washington") to collapse, causing extensive damage to the aircraft's clamshell doors and engines. Controllers turned the sixth C-124 around, but since the fifth had already passed the PSR, controllers advised it to continue to McMurdo Sound while personnel on the ground worked to clear the damaged C-124 off the runway.[21] Another Antarctic blizzard closed the operations on the 22d. In the meantime, engineers began work on a crosswind runway.

Examination of the runway revealed only 3,500 feet of it was safe to use until engineers could get it smoothed out. In fact, the runway had three particularly rough areas at 2,000, 4,200, and 5,200 feet. Engineers focused first on the 2,000-foot point and addressed the others as they could.[22] In addition to rough conditions, pilots had to contend with a large snow bank off the approach end of the runway. A shortage of tractors at McMurdo prevented this obstacle's removal. In late November, two aircraft struck this snow bank, one on the 27th and one on the 30th (discussed below). Shortly thereafter, available tractors were used to clear the snow mound.[23]

While planners believed the ice and snow pack at the South Pole would support air operations, it remained to be tested. As Dr. Paul Siple, the scientist in charge of the South Pole Station, told the men of the 52 TCS, "The Pole Station is the most important operation in the entire Antarctic and you are the key men to the whole thing. The lives of the scientific party which will be stationed at the Pole will depend on the accuracy and thoroughness of your dropping."[24] In preparation, engineers planned to build a small base near Beardmore

Photo 5: Rear Admiral George Dufek and Major General Chester E. McCarty at McMurdo Sound, Antarctica, on the occasion of the first airdrop at the South Pole during DEEP FREEZE II.

Glacier. Although this base was still 390 miles from the South Pole, it was a lot closer than McMurdo Sound if the aircraft crashed or could not take off. After evaluating the area, the engineers moved the base to Liv Glacier, about 80 miles to the east; however, the name Beardmore Glacier Station stuck.[25]

General McCarty arrived in New Zealand on 23 October, and on the 26th, went to McMurdo Sound. After a very brief stop, that same aircraft (52-1015, "State of Oregon,"* with Captain Wally Malone as the aircraft commander), with General McCarty, Colonel Crosswell, and 37 others (including a double flight crew) aboard, flew the first Air Force C-124 mission over the South Pole. Near Beardmore Glacier, the C-124 ran into near whiteout conditions, and with uncharted high mountains in the region, McCarty ordered the aircraft to a 16,500-foot elevation. They arrived over the South Pole at 1900 local and airdropped the first load (approximately 11,000 pounds), including 18 barrels of fuel and a "Grasshopper" automatic weather reporting station. The snow cap held under the airdropped equipment. The double crew then flew back to McMurdo Sound for a brief stopover (Photo 5) before returning to Christchurch.[26]

After returning to Christchurch, General McCarty told news reporters the C-124 work in Antarctica was "strictly routine."** It did not take long for one of the Navy pilots to

*Of note, General McCarty had flown over the North Pole in this same aircraft on 1 September 1956.

**Many early Air Force DEEP FREEZE reports made reference to this statement, often emphasizing how far from "routine" these operations really were.

come up with a tongue-in-check retort (sung to the traditional Naval aviation tune of *No Gear at All*) entitled *Strictly Routine*:

General McCarthy [*sic*.] flew to the Pole
At seventeen thousand,* so nary a soul
Could see very well while gasping for air
So nobody's sure if they ever got there.
Chorus
Strictly routine, strictly routine
Going to the Pole in a flying machine.

General McCarthy [*sic*.] returned to the strip,
Landing too short, a snow bank he clipped.
He shook us all up, but nobody died,
So with a great smile he quite truthfully cried,
Chorus

Now Scott and old Amundsen got to the Pole,
And McCarthy's [*sic*.] amazed that they ever did so,
He thinks it was marvelous, and what is more,
They got there without a C-124.
Chorus[27]

On 31 October, a C-124, flown by Lieutenant Colonel Cicero J. Ellen, 52 TCS Commander, took off from McMurdo Sound on a weather reconnaissance mission over the South Pole in preparation for the first landing by a ski-equipped R4D. A second C-124 accompanied the R4D, carrying emergency supplies, including a weasel (a tracked cargo carrier) (Photo 6), fuel, and sleds (to be pulled by the weasel), which were ready to airdrop should the R4D not be able to take off again. Piloted by Commander Hawkes, the R4D "Que Sera Sera" landed at the South Pole at 2034 local. Finding the temperature -58

Photo 6: A Weasel, rigged for airdrop to the construction party at the South Pole Station, is positioned beneath the elevator well of one of the C-124s used during DEEP FREEZE II.

*The South Pole (including the snow and ice cap) is approximately 9,840 feet above sea level. The snow and ice cap is over 8,800 feet deep at the Pole.

Photo 7: TSgt Richard J. Patton poses beside a C-124 in Antarctica. On 25 November 1956, Sergeant Patton became the first man to parachute over the South Pole.

degrees Fahrenheit, Admiral Dufek and the crew from the R4D quickly planted a US flag, assembled radar reflectors to guide future landings, and shot some photographs and film. Dufek reportedly said, "Let's get the hell out of here."[28] In that short time (approximately 45 minutes), the engines had begun leaking oil due to the extreme cold, and the skis had frozen into the surface. Firing four JATO bottles (approximately equal to the thrust of one additional engine) at a time, it took all fifteen bottles to break the aircraft free of the ice. At one point, the crew of the C-124 circling overhead thought the R4D had exploded because of the excessive smoke and snow in the air caused by the JATOs. The reduced oil pressure kept the aircraft's takeoff speed to a minimum, but they succeeded in taking off and flying to Beardmore Base to refuel before returning to McMurdo Sound.[29]

Because of the severe conditions, Dufek delayed construction until the situation improved.* After weather again delayed the start, a ski-equipped R4D delivered Navy construction personnel on 19 November, and C-124s began airdropping building materials and supplies later that same day. Several of the early drops at the South Pole failed because the parachute separated from the bundles soon after the canopy deployed. Personnel at the South Pole and Air Force aerial port personnel at McMurdo Sound could not figure out what was causing the problem. To help with the issue, Technical Sergeant Richard J. Patton, an aerial port specialist with 31 prior jumps to his credit, parachuted from a C-124 at a height of approximately 2,000 feet into the South Pole region on 25 November (Photo 7). Within a few hours, Sergeant Patton determined the cause of the problem--a release mechanism failure--and radioed the information back to McMurdo Sound.[30] For this jump, Sergeant Patton received the Distinguished Flying Cross and a presidential citation which read in part:

> As a result of Sergeant Patton's parachute jump and by applying corrective measures suggested by him, C-124 Globemasters were able to complete aerial delivery of 24 tons of vitally needed supplies and equipment the same day. Subsequent delivery of materials employing Sergeant Patton's corrective measures virtually assured the early construction of an International Geophysical Year Station at the South Pole.[31]

---

*The C-124s returned to Christchurch on 1 November to await operation commencement. They returned to McMurdo Sound on 13 November. [Hist, 63 TCW, Jan-Jun 57, (K-WG-63-HI, IRIS 451246) n.d.]

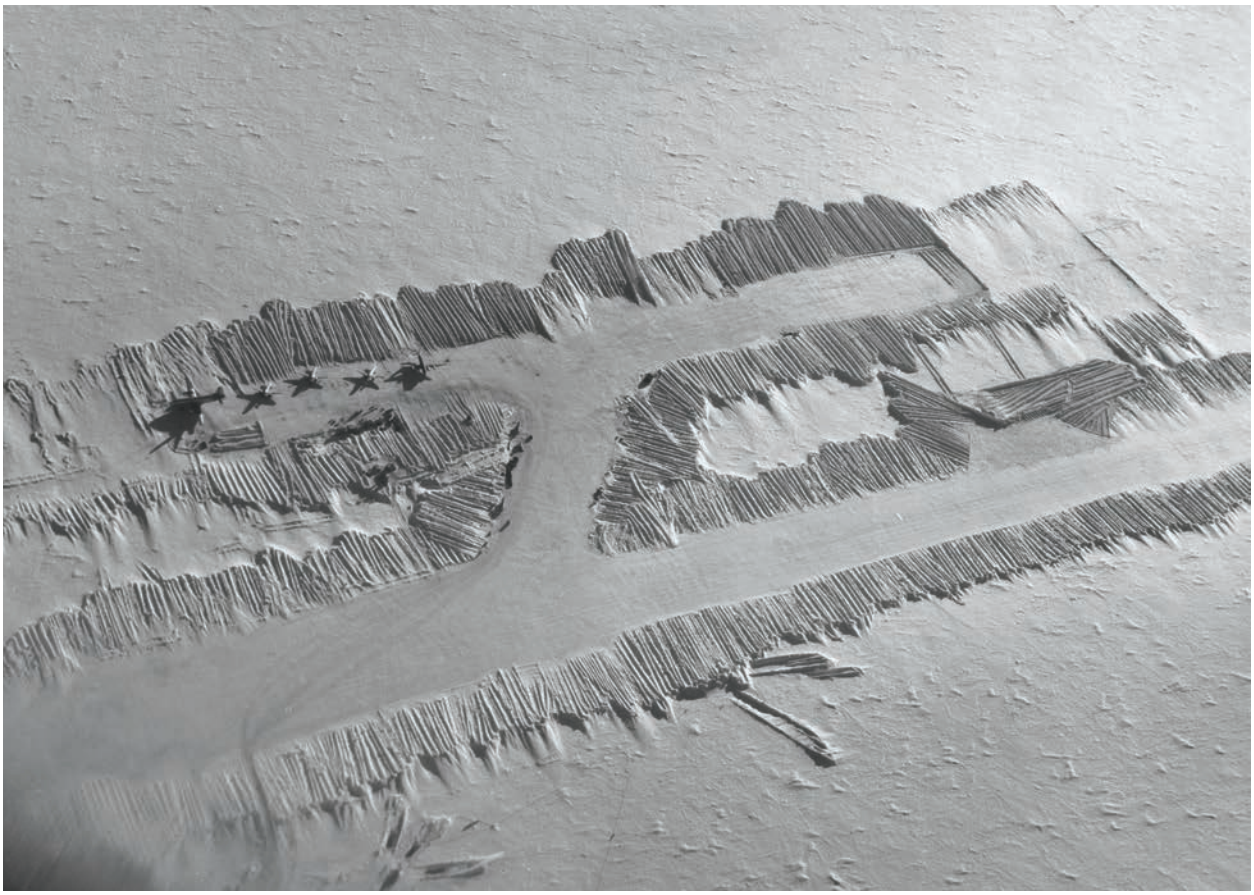


Photo 8: An aerial view of the ice landing strip and parking area at McMurdo Sound, Antarctica, during DEEP FREEZE II.

As the summer months progressed, the runway at McMurdo Sound became less reliable (Photo 8). On 28 November, another C-124 (tail number 52-0983) nose landing gear failed during landing, after it struck the snow bank off the approach end of the runway. On the 30th, an additional C-124 (52-1015, "State of Oregon") suffered a severe accident while delivering parts and repair specialists from the Douglas Aircraft Company. In this case, the left landing gear collapsed while landing, and, again, after it struck the snow bank.[32] As the left gear collapsed, the tires in the nose wheel assembly blew, but the pilot, Captain Warren J. Fair, successfully prevented the aircraft from leaving the runway. When the aircraft stopped, fire engulfed the entire forward section. As ground crews worked to extinguish the fire, the crew and passengers exited the aircraft, most using ropes. The pilot slipped the last 20 feet to the ice and broke his leg, and one of the Douglas representatives broke his heel; several others were treated for rope burns. The damage to this aircraft was beyond repair--maintainers used the remains as a parts store for the rest of the aircraft and a storage shed on the ice. While personnel made hourly checks on the condition of the runway, operations continued until 19 December. At that point, McMurdo Sound's aviation fuel had been virtually exhausted, and the runway had deteriorated to the point the C-124s had to be sent back to New Zealand to await colder weather and a refreezing of the ice.[33]

Although not originally part of the planning, the 63 TCW's C-124s also airdropped fuel to those building Marie Byrd Station.[34] This add-on mission started about the same time the December South Pole airdrops were wrapping up. The Seabee tractor train heading to Marie Byrd Station had encountered several critical delays and had to overcome several issues along the way. By the time they arrived, they were critically low on fuel. Before departing, the aircrews made four emergency airdrops of fuel. The first occurred on 12 December and the last on the 19th. After this, the resupply of Byrd Station was added to the planned airdrop mission.[35]

As the "warm" temperatures increased, Army engineers continued to monitor the deteriorating runway until the weather began to turn in early February. Under the direction of an Army contracted specialist, Dr. Andres Assur, they repaired holes by filling them with a mixture of snow, chopped ice, and water. On 9 February, the C-124s returned to McMurdo Sound and resumed operations.* Between 9 and 23 February, the C-124s mostly airdropped fuel and supplies to those preparing to winter at the South Pole and Marie Byrd Stations. During Operation DEEP FREEZE II, the C-124s conducted a total of 65 airlift missions to and from New Zealand and McMurdo Sound, delivering 732 passengers and 393 tons of cargo, and another 84 airdrop missions delivering 881.3 tons of cargo from McMurdo Sound to the South Pole, Marie Byrd, and Beardmore Glacier Stations.[36]

Those left behind in Antarctica prepared for a long winter filled with preparations for the return of the aircraft during the next austral summer. As one observer noted, "The last aircraft of the DEEP FREEZE II summer season had buzzed the runway at McMurdo on February 24, 1957…. Departure of the so-called tourists caused few low spirits among the men left behind. The next day was declared a holiday, and most of the men slept in."[37]

*In mid-February, a new concern developed as the ice shelf broke off to within a mile of the runway. However, colder weather and strong winds prevented any further ice-shelf deterioration. [Hist, 63 TCW, Jan-Jul 57, n.d.]

CHAPTER 2

FROM TEMPORARY TO PERMANENT (1957-1959)

As Operation DEEP FREEZE continued, the US Navy remained the executive agency for the logistical support of American International Geophysical Year (IGY) scientists in Antarctica. The Military Air Transport Service (MATS) assumed responsibility for the Air Force's portion of the operation when the 63d Troop Carrier Wing (TCW) transferred from the Tactical Air Command on 1 July 1957.* Deployed elements of the 63 TCW arrived in New Zealand in September 1957. For their part, the personnel of the 53d Troop Carrier Squadron (TCS) intended to learn from the 52 TCS's experiences during DEEP FREEZE II.

Photo 9: "The only trees in Antarctica" flank the American-built "Antarctic Snowman" on the ice runway at McMurdo Sound. (circa November 1957)

*MATS and the 63 TCW also continued to work a lot of issues and missions in the Arctic. For example, a C-124 of the 52 TCS flew an emergency airdrop to IGY scientists encamped on the T-3 Ice Island near the North Pole on 23 July 1957, and in 1959, MATS played a major role in reestablishing Project Ice Skate to support IGY scientists studying the Arctic.

To start with, pilots often had difficulty distinguishing the ice runway from the surrounding snow. As a result, several aircraft initially touched down short of the runway, adding additional stress on the aircraft. To help alleviate this during DEEP FREEZE III, one of the first C-124s, on 30 October, carried in 25 small evergreen trees, 4 to 6 feet in height. Navy Seabees "planted" these trees in double rows at the end of the runway as markers (Photo 9), thus providing a better contrast between the runway and the surrounding snow. To be honest, the Navy pilots of VXE-6 Squadron wanted to use the Navy's approach of using oil drums, some painted black and some bright orange to mark the runway. However, in their work in the Arctic, the 63 TCW had found that trees worked better because the moving branches could sometimes be seen in a severe snowstorm where even brightly colored stationary objects could become invisible. As the Navy and Air Force debated the decision, Colonel William G. Forwood, Commander, Air Force Task Unit, ordered the trees sent from New Zealand.

While the Navy Seabees installed 24 trees as runway markers,* the VXE-6 Squadron did not let it go lightly. They soon painted a sign outside the McMurdo Sound hut used by the Globemaster pilots: "53rd Troop Carrier Squadron Pine Tree Nursery, Quiet, Pine Trees Growing." Not to be outdone, Air Force crews erected a sign showing Smokey the Bear pointing to the 25th tree and the words, "Use that Ashtray, Keep Antarctica Green."[38]

During DEEP FREEZE II, aircrews had experienced some communications blackout conditions. These were magnified during DEEP FREEZE III because of increased solar disturbances (scientists had established 1957-1958 as the IGY precisely to study this same solar activity). Navy and Air Force crews did not work out an answer to these conditions. When severe communications blackout conditions existed, all aircraft launches stopped, even if the flying weather was good. As a result, the operation ran about 15 days behind schedule.[39]

As cold weather operations continued, personnel experience increased. MATS used several criteria to select personnel for DEEP FREEZE missions, including their willingness to participate, ability, experience, and availability. Each individual being considered received a special physical examination in accordance with Eighteenth Air Force's Operations Plan 53-56. In addition to the 53 TCS providing the bulk of the aircrews, numerous other organizations supplied support personnel, including air police, food service, medical, and weather specialists. This also included five MARS (Military Affiliate Radio System) technicians to provide official and personal communications from McMurdo Sound to New Zealand and the US. Finally, 63 TCW also sent a detachment from the 1710th Aerial Port Squadron (APS) with Master Sergeant Thomas A. Lee, Sr., as the Non-Commissioned Officer in Charge. The aerial porters were responsible for all of the aircraft loading and parachute preparations (Photo 10). Because of their efforts, 99.4 percent of the equipment and supplies dropped were recovered.[40]

---

*This controversy did not disappear right away. In an article published in *The MATS Flyer*, a safety journal, Col Frank H. Wilcox, MATS Chief of Safety, reported during a visit in October 1959 seeing used fuel drums marking the runway. In the same article, he presents a photograph of trees being planted that same year. [Article, Col Frank H. Wilcox, MATS Chief of Safety, "Deepfreeze V," *The MATS Flyer*, Jan 60.]

Photo 10: This C-124 delivers a Navy fire truck to McMurdo Sound, Antarctica. TSgt George McNamara of the 1710th Aerial Port Squadron is directing the offloading.

As expected from previous experience, aircraft maintenance caused some problems. The Air Force provided about 112 maintainers, and New Zealand made available facilities at Harewood Aerodrome at Christchurch as the main operating base. Most major repairs were accomplished at Harewood, but each aircraft had a maintenance crew chief and three assistants assigned. Upon arriving at McMurdo Sound, these maintainers would prepare the aircraft for the airdrop missions. In all, maintainers had to perform 12 engine changes, 5 of these at McMurdo Sound, despite the harsh open-air conditions (Photo 11). Analysts noted that most of these engine problems occurred on the A-model C-124s. Thus, MATS determined to send only C-model versions on subsequent operations.[41]

The first of eight C-124 Globemasters arrived at Christchurch, New Zealand, on 10 September. Captain Jack H. Wrinkle piloted the first C-124, which carried Colonel Forwood to McMurdo Sound, landing on 4 October.* Colonel Forwood found the ice runway improved from the previous year, but still not in compliance with the operations order--he temporarily suspended operations. On 11 October, Brigadier General E. Wade Hampton, Commander, 63 TCW, landed at McMurdo Sound, along with Captain Wally

*Three ski-equipped Navy aircraft, the first of the season, had arrived at McMurdo Sound on 1 October.

Photo 11: Aircraft maintainers work on a C-124 engine in the open air of McMurdo Sound's [Antarctica] ice runway.

Malone, a veteran of DEEP FREEZE II, to inspect the runway. General Hampton accepted the condition of the runway and waived the additional criteria. Operations resumed on 13 October.

Colonel Forwood conducted the first airdrop over the South Pole on 17 October, exactly eight months after the last airdrop to Marie Byrd Station during DEEP FREEZE II. The C-124 aircrews set a record on 18 November by dropping 56 net tons in two flights over the Pole and two over Marie Byrd Station. The 55 airdrop sorties averaged nearly 14 tons each, or over 2 tons per mission more than averaged in DEEP FREEZE II. As the 63 TCW later reported, "Literally everything from the kitchen sink and light bulbs to a three-ton weasel and seven-ton D-2 Caterpillar tractor was dropped at the two stations."[42] The C-124 aircrews used a variety of methods, including successfully dropping 12 tons of heavy timbers without parachutes from an altitude of approximately 50 feet above the snow cap.[43]

Perhaps the most significant airdrop cargo loss occurred on 10 November. During the first attempt to drop a D-2 Caterpillar tractor, the parachute opened as it was supposed to, but the main suspension line caught on the tractor and was severed. The tractor fell free.

It broke apart when it hit the ground, and most of the pieces buried themselves more than 20 feet into the snow.[44] Although the impact created a "snowquake" as the snow and ice settled over a large area, only one injury occurred. A piece of debris hit one man, knocking him down, but only breaking his tooth.[45] Aerial porters soon prepared another D-2. The second drop went so smoothly that the tractor was driven away 15 minutes after it landed.

Throughout DEEP FREEZE III, the aircraft performed well, and no accidents occurred. However, there were several serious incidents. On three separate occasions, Captain Vincent J. Decesare lost two engines, but successfully landed the aircraft each time without any further damage.* The most serious event occurred on 1 November when Captain James W. Thomas shut down the number one engine of his aircraft (51-5178) after the generator overheated. By the time Captain Thomas returned to McMurdo, visibility was down to 50 feet, and heavy icing had begun to accumulate on the aircraft's wings. Initially diverted to Cape Hallett, weather completely closed that runway, and Captain Thomas' aircraft returned to McMurdo. It took three attempts before the aircraft finally landed.[46]

In a joint Navy and Air Force effort (and with the consent of IGY scientists), the 63 TCW conducted a rather interesting side project: Operation HITCHHIKER, the transporting of penguins destined for study at Johns Hopkins University and zoos in Portland, Oregon, and San Diego, California. In previous attempts to move penguins by surface transport, most of the penguins had died because of the prolonged exposure to heat. On 12 November, ground crews loaded 36 Adelies and 30 Emperors into a C-124 returning to New Zealand.** With the penguins in the aircraft's recessed cargo elevator well (Photo 12) and with the cabin heat turned off, Captain Thomas flew the first leg of their journey. At Christchurch, a new crew led by Captain Friday Henman of the 61st Troop Carrier Group (an establishment assigned to the 63 TCW) took the penguins to Fiji for a 2-hour refueling stop, to Hickam Air Force Base, Hawaii, for a 12-hour crew rest, and finally to the US's west coast, arriving on the morning of 15 November. The normally flightless birds quickly adjusted to the situation and remained relatively comfortable throughout the roughly 10,000-mile journey from Antarctica to Portland. One Adelie penguin died, but two other Adelies laid eggs en route.[47]

Again, as temperatures continued to rise, the runway at McMurdo Sound became more and more unsafe to use. Captain Kennith W. Blan's crew completed the last drop of the season on 5 December 1957. Most of the Air Force Task Unit returned to the States in time for Christmas.[48] In February 1958, the 53 TCS sent three C-124s back to New Zealand in preparation for McMurdo Sound's runway refreezing hard enough to support the heavy aircraft. Unfortunately, the ice runway broke up and floated out to sea just after the aircraft arrived at Christchurch. Without a prepared runway, it became impossible to finish the remaining airdrops, and the aircraft returned to Donaldson Air Force Base, South Carolina, in late March.[49]

---

*The first one occurred over the ocean south of New Zealand and the other two over Antarctica.

**During the loading process, 16 birds made a last attempt to avoid the travel when the side of a transport box dropped off. McMurdo Sound spectators quickly rounded the penguins back up.

Photo 12: SSgt Robert E. Draper checks on the passengers of Operation HITCHHIKER. The penguins rode in the C-124's elevator well en route to the Portland Zoo. (circa 12 November 1957)

The 52 TCS and 1710 APS returned to Christchurch for Operation DEEP FREEZE IV in early October 1958. The last of 10 C-124s touched down in New Zealand on 3 October. Lieutenant Colonel Cicero J. Ellen returned to the operation, this time as the commander of the Air Force Task Unit of some 300 personnel. Initial operations began on 2 October when two of five aircraft departed for McMurdo Sound. Poor weather at Harewood Aerodrome forced the other three to delay. By 5 October, all five airdrop aircraft were at McMurdo Sound. Most early operations, beginning 5 October, focused on round-trip flights from Christchurch to McMurdo Sound. These "turn-around" flights averaged 23-hour flying days for the crews. To facilitate these long days, the operations staff augmented the aircrews and provided plenty of crew rest time between missions. With 250 tons of priority cargo scheduled, the 52 TCS actually delivered nearly 404 tons.[50]

Again as with DEEP FREEZE III, the 63 TCW used the most experienced personnel and intensified training even more. Crews and staff personnel received thorough briefings, indoctrination training, and a copy of a new aircrew information folder covering procedures and Antarctic conditions. Prior to the operation, aircrews had conducted practice airdrops

to determine the best drop procedures and rigging configurations. Maintainers and supply technicians also determined the types and amounts of equipment and spare parts that would most likely be needed. The Supply Officer then shipped 87,000 pounds of aircraft parts, spares, and organizational equipment. This equipment left Davisville, Rhode Island, by ship and arrived in New Zealand on 7 September.[51]

Airdrop operations began on 8 October and ended on 12 November. Poor weather in Antarctica and excessive flying time (aircrews averaged 125 flying hours per month) restricted operations to 23 of the 39 days taken to complete the mission. In all, the aircrews made 30 trips to the Amundsen-Scott Base, dropping 411 tons of material, and 33 trips to the Marie Byrd Station, dropping 480 tons. Airdropped material ranged from a 7,000-pound diesel generator to scientific equipment to mail to crates of fresh eggs. During all of this, only three parachutes malfunctioned, and five other loads were lost because of dry-rotted crates.[52]

Rear Admiral George J. Dufek, Commander, Naval Support Force, Antarctica (CNSFA),* accompanied Colonel Ellen on the season's first drop. From the rear of the C-124, he described the drop from less than 2,000 feet above the South Pole Station:

> The cargo doors opened, and a frigid blast of air filled the plane. Then the countdown--four, three, two, one! Chutes away! Ton after ton spilled down the ramp to be caught by billowing colored parachutes, red for mail, yellow for food, green for fuel.
>
> I saw a red parachute, in the grip of the wind, dragged miles from the drop zone. An orange "weasel" chased after it across the snow.** Mail from home. It would mean much to those men who had not seen their loved ones for a year.[53]

Two serious incidents occurred during DEEP FREEZE IV. The first occurred on 9 October when whiteout conditions at McMurdo Sound forced four C-124s returning from airdrop missions (one from the South Pole and three from Byrd Station) to divert to Cape Hallett.*** The crew of a Navy R4D which had landed there earlier in the day provided radio landing instructions from the ice. All four C-124s landed safely, but remained stuck at Cape Hallett for two days before the McMurdo airstrip could be cleared of snow and two Navy P2Vs could fly fuel to them. "Meanwhile the 40 members of the 4 crews were grateful for the crowded hospitality of the Naval officer, 11 sailors, and 4 scientists in the IGY station equipped to provide for 16 men."[54]

---

*This was Admiral Dufek's last year as the Operation DEEP FREEZE commander. He turned the job over to Rear Admiral David M. Tyree beginning with Phase V.

**Since ice and snow offered little friction to slow cargo caught in the wind, personnel at the ground stations later built snow barriers downwind to limit the distance cargo blew. For instance, the Marie Byrd Station had a 15-foot snow barricade up by Phase V. [Article, Col Frank H. Wilcox, MATS Chief of Safety, "Deepfreeze V," *The MATS Flyer,* Jan 60.]

***Fortunately, an ice-runway near Moubray Bay had just been established during the 1958-59 season to serve as an alternate landing field.

Shortly after this, Cape Hallett identified a critical need for supplies from Christchurch. On 15 October, a C-124 (tail number 52-1017, "The City of Christchurch") took off from Christchurch on a scheduled round-trip to McMurdo. En route, the aircrew was to airdrop the supplies needed at Cape Hallett before continuing on to McMurdo (only a few miles off the normal course). As the aircraft approached the Cape Hallett homing beacon and shoreline, the pilot observed low mountain ridges through the broken low cloud cover. However, the aeronautical charts gave incorrect elevations. As the aircraft descended through the overcast, it struck a ridge 20 to 30 miles north of the station.[55]

McMurdo immediately dispatched two weasel tractors towards Cape Hallett, while five aircraft brought survival gear, doctors, medical corpsmen, and supplies to the Cape Hallett Station to create an emergency hospital. However, the weasels ran into trouble on the ground and could not get to the accident site. Admiral Dufek dispatched a helicopter, piloted by Lieutenant Commander Edgar Potter. Within 26 hours of the accident, the helicopter had transported all of the injured to Cape Hallett. Three crewmembers and three passengers died during the accident. The seven remaining personnel, all in shock, survived until they were rescued, thanks in large part to their rigorous survival training.[56]

Although the IGY officially ended in December 1958, the US made the determination to continue its scientific research efforts in Antarctica, with the military continuing to provide logistical support.* In particular, the US intended to keep the South Pole, Marie Byrd, and Hallett (jointly operated with New Zealand) Stations opened, with McMurdo Sound as the primary base and air support station and auxiliary fields at Beardmore Glacier and Little Rockford. In addition to Air Force C-124s, the Navy continued to operate R4Ds, R7Vs, UC-1s, P2Vs, and helicopters at Little America, McMurdo Sound, and Ellsworth Stations.[57] Many other countries used aircraft from ships and floats to support their own research stations; the Soviet Union's IL-12s were the largest. As early as 22 December 1956, a Chilean national airline conducted the first commercial flight over Antarctica, carrying paying sightseers. A Pan American World Airways Stratocruiser on a charter flight became the first commercial aircraft to land in Antarctica, touching down at McMurdo Sound on 15 October 1957.**

This decision to continue scientific research, along with the success of building and maintaining the South Pole and Marie Byrd stations, clearly indicated the value of large cargo aircraft in Antarctica. However, aircraft operations continued to face limitations. The extreme cold and darkness of Antarctica's long winter night prevented operations for half the year. In the summer, the ice and snow tended to deteriorate and often floated out to sea. Thus, at McMurdo Sound, the effective operating season ran from early October

*In fact, early IGY planning expected the departure of all US "personnel, records, and recuperable equipment" by February 1959. [Plan, United States National Committee for the International Geophysical Year, "Antarctic Program," Apr 56.]

**This charter flight included two stewardesses. Although thus far, women had been a rare sight in Antarctica, these two were not the first. That distinction belonged to Mrs. Edith Ronne and Mrs. Jenny Darlington who accompanied their husbands on a privately-financed 1946-47 US expedition along the Atlantic Coast. The first documented the trip and the second was a scientist. [Article, Harry Gabbett, "Slip of Tongue Brings Admiral Byrd Icy Reminder of Lady's Polar Status," *The Washington Post*, ca Nov 55.]

to early December, with the possibility of operations from late February to early April. To improve the situation, planners looked at two probable solutions. The first, a dirt runway, presented an expensive alternative and would be difficult to maintain. The second was that two locations, at Marble Point on the western side of McMurdo Sound and near Australia's Davis Station, provided viable locations for short, approximately 1,700-foot runways. Those locations involved replacing the C-124s with another aircraft roughly equal in capabilities, but more adaptable to the environment. By the late 1950s, the Air Force and the Lockheed Corporation had begun discussing developing ski-equipped versions of the new C-130 Hercules aircraft. Such an option would lengthen the operating season as the aircraft would be less dependent on a set bay-ice runway and would ultimately reduce costs as the ski-equipped aircraft could land on the polar ice cap instead of delivering all the material via airdrop.[58]

The US decision to continue its scientific research in Antarctica also led to the military changing the naming convention to reflect the operation's now long-term nature. Previously, the name reflected the phase of the operation. Starting with phase five, the designation conformed to the fiscal year* in which that particular phase occurred. Thus, the fifth phase (1959-1960) officially became Operation DEEP FREEZE 60; however, references to DEEP FREEZE V continued to occur.[59]

For DEEP FREEZE 60, the 63 TCW sent the 9 TCS with the squadron commander, Lieutenant Colonel Dewey R. Bridges, in command of the Air Force Task Unit. As with previous years, preparations began early. In February 1959, the 9 TCS temporarily took over resupply missions to Thule, Greenland. Aircrews flew missions from Dover Air Force Base, Delaware, to Thule. From Thule, aircrews flew 8-hour round-robin training flights to the North Pole to requalify in polar navigation and cold weather operations. The 9 TCS continued this mission until it had 14 qualified aircrews. From 12 to 24 April 1959, Colonel Andrew B. Cannon, Commander, 63 TCW, headed a survey team to New Zealand to review routes, ground support stations, navigational aids, and communications, supply, and maintenance facilities.[60]

During DEEP FREEZE 60, the 9 TCS deployed 10 enhanced versions of the C-124. Earlier in the year, MATS had transferred 10 Dover-based C-124s equipped with gas turbine power units (GTPU) to the 63 TCW at Donaldson Air Force Base. The 63 TCW sent Dover nine of its standard C-124s. The GTPU provided an improved propulsion system over the standard C-124 engines. MATS authorized the 63 TCW to retrofit these 10 aircraft with the new tactical air navigation (TACAN) equipment and arranged a high-priority installation of the mechanical override control of the propellers. The override gave the pilots a more positive control over reversing C-124 propellers during landings.[61]

The 9 TCS deployed in September and began operations 3 October with the first C-124 turn-around mission to McMurdo Sound.** During 57 turn-around missions, the 9 TCS

*At this time, the US fiscal year ran from 1 July to 30 June. The Congressional Budget and Impoundment Control Act of 1974 changed this to 1 October to 30 September beginning with FY 1975.

**An advance party consisting of 5 officers and 50 enlisted Airmen arrived on 25 August.

Photo 13: The first helicopter ever carried to the Antarctic inside a MATS C-124 is unloaded at the Naval Air Facility, McMurdo Sound, Antarctica, on 8 October 1959.

delivered 453 passengers and 496.9 tons of cargo to McMurdo and returned 250 passengers and 99.4 tons to New Zealand. The cargo included an H-34 helicopter on 8 October, the first time the Air Force had delivered a helicopter to Antarctica (Photo 13). Although delayed 6 days because of unfavorable weather, the first airdrop occurred on 16 October and the last on 12 November, 15 days ahead of the pre-season schedule. In all, the squadron conducted 99 airdrop missions, delivering 1,443.3 tons of cargo to the Amundsen-Scott and Marie Byrd Stations.[62]

Planners realized drops to the Pole could be increased with a larger tractor on the ground to move supplies and equipment. Since no ground treks had been made or were planned to be made to the South Pole station, planners decided to airdrop two D-4 Caterpillar tractors early in the season. Each D-4 weighed about 19,600 pounds. For the first airdrop of the season to the South Pole, on 19 October, aerial port specialists rigged a D-4 on an airdrop platform with five 100-foot parachutes. At the drop site, approximately 2,000 feet above the surface, the loadmaster opened the elevator doors to drop the tractor. However, on the signal to drop, two of the four uplocks failed to release. As the partially released load shifted, it became wedged in the elevator well with the weight toward the back of the aircraft. This left the aircraft in a critical situation. The excessive weight at the rear meant the aircraft could not land safely. Plus, the misplaced weight meant the aircraft would likely not make the 800-mile return trip to McMurdo.

While the pilot fought to maintain a safe altitude, crewmembers moved the elevator hoists over the load. At the same time, they attached security chains to the tractor to keep it from shifting unexpectedly. Using the hoists' cables, they slowly raised the tractor and platform out of its wedged position. Once the load was level, they repositioned the security chains and cables to lift the tractor and platform over the main cabin floor and slowly worked it forward into the aircraft. They tightly secured the load into the position computed by the loadmaster--only then did they consider the crisis over. Back at McMurdo Sound, it took direct heat to unfreeze the uplocks that had failed.[63]

Photo 14: Crew and passengers of the C-124 that dropped the 9-ton Caterpillar D-4 tractor on 20 October 1959.

Front row (left to right): F. Kazukaitis (USN), TSgt Harvy C. Fenimore, Jr., TSgt Robert Combs, A1C William A. Stevens, A1C William A. McKinney, SSgt Theodore W. Whalen, SSgt John R. Austin, SSgt William E. Negley.
Back row (left to right): C. J. Hagerty (USN), Senator Henry M. Jackson (D-Wash), Lt Col Dewey R. Bridges, Rear Admiral David M. Tyree, Capt James E. Roesel, Lt John F. Weekly, Lt Col Michael Zinkovich, MSgt Marvin A. Stout, Maj Jackson L. Winchester.

The next day, 20 October, a C-124 crew successfully dropped a D-4 at the South Pole. This mission included several distinguished visitors, including Senator Henry M. Jackson (Democrat-Washington),* Colonel Frank H. Wilcox, MATS Chief of Safety, and Lieutenant Colonel William J. Gannon, Chief of MATS Pilot Division (Photo 14). Recovery personnel on the ground drove the D-4 away before the aircraft, which made two more runs on the drop zone, left the area. The MATS history report highlighted the significance of this event, "This D-4, weighing nearly 19,000 pounds [*sic*.], was the heaviest drop ever made in Antarctica, and quite likely the heaviest ever made from a C-124 anywhere."[64] The 9 TCS dropped the second D-4 on 22 October, greatly enhancing the station's cargo recovery capability.[65]

During DEEP FREEZE 60, the 9 TCS also stepped forward to assist a US University Traverse Party. This expedition planned to trek across 2,500 miles of Victoria Land, a largely unexplored region. With little knowledge of the area, aircrews of the 9 TCS planned to drop approximately 24.5 tons of fuel and food at two locations along the route. Using little more than the desired coordinates and celestial navigation, two aircraft dropped the required cargo. It took nearly two months for the traverse party to get to the supplies. When they did, the team radioed, "Arrived at designated coordinates and found all supplies intact."[66]

Once again, as the weather warmed, McMurdo Sound became unsafe for operations. The 9 TCS returned to Donaldson Air Force Base in late November, with the last plane getting home on 3 December. With each phase of the operation, the 63 TCW's personnel learned more about operating in the harsh Antarctic environment. The leadership at MATS and the wing recognized this and contemplated even more improvements in the future:

> The techniques that have been developed, sometimes by necessity, and always by ingenuity, on this "off the route" operation can be incorporated to further increase the worldwide capability of the Military Air Transport Service.
>
> Future operations may see the advent of adequate maps and charts that cover the entire continent and can be used for accurate pinpoint navigation. Ground radio aids to navigation…permanent landing strips and alternate airfields… communications [improvements]…. All of these could be in the future, and with their implementation, the operation of the Antarctic could become more or less routine.[67]

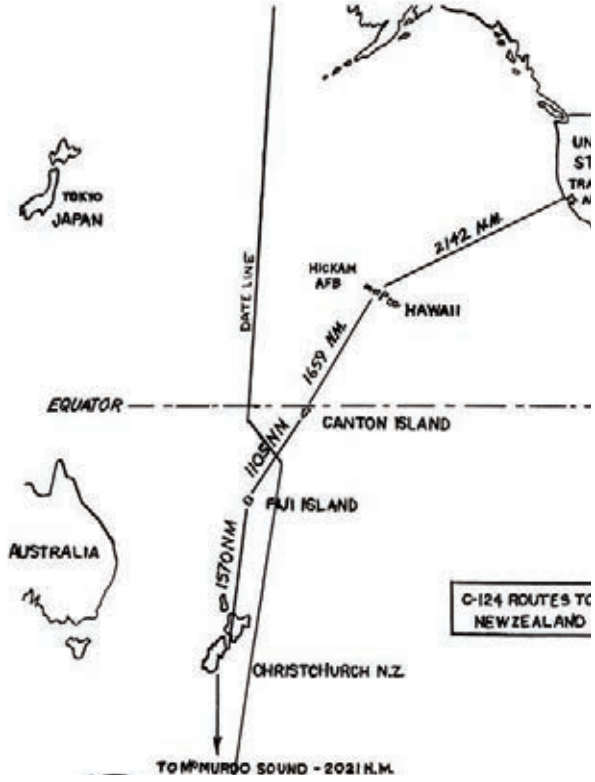
*Senator Jackson was not the first US politician to fly over the South Pole. That distinction belonged to Representative John P. Saylor (R-Pennsylvania) who flew on a C-124 mission in November 1957 during DEEP FREEZE III. [Hist, 63 TCW, Jul-Dec 57, n.d.]

CHAPTER 3

THE LIFE AND TIMES

From the first C-124 flight to Harewood Aerodrome, Christchurch, New Zealand, on 8 June 1956 when Colonel E. Wade Hampton, Commander, 63d Troop Carrier Wing (TCW), led a small site survey team in preparation for DEEP FREEZE II, Air Force aircraft followed much the same route to the mission area (see Map 1). The aircrews departed the continental United States from Travis Air Force Base, California, flying 2,142 nautical miles (nm) to Hickam Air Force Base, Hawaii. From Hickam, they flew 1,659 nm to Canton Island in the central Pacific, then 1,105 nm to Fiji, and finally the 1,570 nm to Christchurch. In addition to rest breaks and refueling stops, these locations also served as divert sites should an aircraft develop maintenance problems along the way. The trip from Donaldson Air Force Base, South Carolina, to Christchurch often took as long as a week to accomplish. Once at Harewood Aerodrome, the aircrews still had 2,021 nm to go to get to McMurdo Sound.[68]

Throughout the DEEP FREEZE operations, the American forces found the New Zealanders (often referred to as Kiwis) friendly, curious, and highly cooperative. Right from the beginning, Rear Admiral George J. Dufek reported that when the first ships left New Zealand at 1400 local on 16 December 1955, "Thousands of people were at the docks cheering and waiving. Bands were playing. As each ship left the dock a shower of white sailor hats descended on the people below. The harbor and estuary were filled with small craft tooting whistles and flying gay streamers. Whistles and sirens sounded from merchant ships docked and at anchor and from factories in Port Lyttleton."[69]



Map 1: C-124 Deployment Route from United States to Christchurch, New Zealand, and McMurdo Sound, Antarctica.

Photo 15: A view of the Royal New Zealand Air Force Station Weedons encampment, including airmen's quarters, officer's latrine (at end of street), and orderly room for the deployed USAF personnel (in foreground).

The members of US armed forces visiting New Zealand strived to continue this positive relationship. While the Airmen spent a large part of their time in New Zealand working, they also found time for sightseeing and visiting. Many Kiwis invited Airmen and Sailors into their homes for meals or a round at the local pubs. The Americans often provided local visits and talks, static displays, and tours of their operations in New Zealand. In November 1956, during DEEP FREEZE II, the 63 TCW dedicated one of their C-124C aircraft (tail number 52-1017) the "City of Christchurch." Mrs. Robert McFarlane, wife of the Mayor of Christchurch, christened the aircraft.[70] An information guide distributed to those participating in DEEP FREEZE 60 (Phase V) provided another glimpse of this mutual cooperation and the extent of the efforts taken to continue it:

> Yanks, as the Kiwis call us affectionately, are well advised to drink in pairs. Look after your buddy. Our troops came through DEEP FREEZE IV with a reputation for being gentlemen at all times. If any one showed signs of being squiffed, his buddies took care of him quietly. Airman [*sic*.] are treated with the same respect and hospitality in Christchurch as officers, largely because they set an example of conduct that labeled them as gentlemen.[71]

Upon arrival, New Zealand customs and agriculture agents fumigated each American aircraft and provided a customs check. They also exchanged money, since ownership of American currency was illegal in New Zealand, and no shopkeepers, publicans, or hotel owners would accept it as payment. Once the formalities were finished, buses took the personnel to their billeting, which were usually on Weedons Royal New Zealand Air Force Station, approximately 13 miles south of Harewood Aerodrome. At least in the early years, Weedons' billets consisted of 62 20-foot by 40-foot wooden huts. Each contained 800 square feet, enough room for six men to live in,* and used a 50,000 BTU (British Thermal Unit) oil stove for heat. The hut area had three latrine and shower facilities in permanent structures (Photo 15). Every subsequent year, the Americans found the working and living conditions in New Zealand improved, eventually moving from Weedons to barracks at Harewood, and when those became to expensive to upgrade by 1991, shifting to local hotels.[72]

In addition to billeting, Weedons also offered space for a dining facility, orderly room, supply section, photo-lab, MARS (Military Affiliate Radio System), and recreation. The remaining operations, including aircraft parking, maintenance, tool crib, communications, operations and aerial port facilities, search and rescue quarters,** and medical dispensary were established at Harewood Aerodrome. By and large, the deployed unit served as a self-contained unit, bringing its own air police, doctor, cooks, bus drivers, finance and personnel specialists, and even a field grade officer to serve as the Camp Commandant.[73]

The Royal New Zealand Air Force provided all building space and furniture free of charge, with the only stipulation that it be returned in serviceable order. The US Air Force agreed to compensate for any damage. The two organizations developed agreements in regards to mess and recreation facilities. The local Christchurch police department and the New Zealand Customs Department also willingly worked with the US Air Force. The police simplified procedures for the Americans to obtain New Zealand driver's licenses (required to operate a vehicle) and set up standard protocols to deal with Americans involved in minor infractions (primarily traffic). The Customs Department agreed to allow duty-free mail to be delivered to the Americans. They also suspended the import duties and sales tax on American cigarettes as long as the Americans shipped and rationed them.[74]

The deployed US Navy and Air Force personnel formed a close working relationship during DEEP FREEZE. The Navy retained overall responsibility for the operation, but the Air Force kept operational control of its unit. In that way, the Commander of the Naval Support Force, Antarctica, requested specific airlift flights, but the Air Force Task Unit Commander made the decision whether or not to fly operations on a particular day. He based that decision primarily on the day's weather. As part of that arrangement, the

*Normally, officers and non-commissioned officers were billeted four per room and airmen six per room.

**At least in the early years, the Air Force used C-124s equipped with droppable air-sea rescue kits and/or assigned two long-range SC-54 Rescuemasters [C-54 Skymasters set up for rescue missions] with pararescue personnel at Harewood during DEEP FREEZE missions. The Royal New Zealand Air Force and US Navy also provided search and rescue capabilities.

Air Force agreed to finance its portion of the operation. While the Air Force unit brought all the personnel and equipment it required, the Navy agreed to handle contracting and transportation, if needed, in New Zealand. The Air Force also brought personnel to augment Navy supply and weather functions. In New Zealand, the Air Force procured food and supplies through Royal New Zealand Air Force channels or from the local markets. In Antarctica, the Navy agreed to accommodate the subsistence requirements for the Air Force personnel.[75]

As one might expect, the living and working conditions in Antarctica were a little more on the primitive side when compared with New Zealand. Needless to say, since McMurdo Sound served as a major operational hub and as a central gathering point for most personnel entering or leaving Antarctica, it was often an overpopulated facility. The population often increased from 125 during the winter to 450 or more during the summer. By 1958, aircrew housing consisted of five Jamesway huts, each approximately 14 feet by 30 feet. During the peak summer season, aircrews were sometimes quartered

Photo 16: A view of McMurdo Sound Station, Antarctica, circa 1960. Buildings marked: 1) Aerial port operations quarters (Quonset). 2) Maintenance personnel quarters (Quonset). Each Quonset held up to 42 men in double-decked bunks.

ten men to a room on five double-deck bunk beds. The maintenance facility consisted of a Quonset hut, 20 feet by 40 feet, occupied by 35 to 40 personnel. Aerial port filled another Quonset hut with about 25 personnel (Photo 16). Air Force staff officers were quartered with Navy staff and air squadron officers in another Quonset hut (approximately 25 to 30 officers). Extra space in the aerial port hut and even in the Chapel was used to bed down transient personnel on occasion. In addition to personnel, the aerial port and maintenance Quonsets housed critical equipment items and served as locations for personnel to warm up. Nevertheless, the situation steadily improved. By 1959, engineers set up another four Clements Shelters (aluminum sectional huts with integral latrines that can be set up in any desired dimension) and more Jamesway huts. The Clements Shelters at McMurdo Sound were generally divided up into 8 foot by 10 foot rooms with two bunk beds to a room. Still later, a large structure called the Galley, Building 155, provided officer residence on the second floor and a series of hardened dormitories were added for the enlisted troops (the 200-series buildings).[76]

In addition to overcrowded conditions, the airmen dealt with the extreme cold and other often rudimentary facilities. Oil-burning space heaters provided the warmth for most of the huts. However, the space heaters provided inconsistent heating at best. Personnel measured as much as a 20-degree Fahrenheit temperature variation between the upper and lower bunks. The buildings occasionally let snow filter in during exceptionally strong wind conditions. The exhaust from the oil heaters often left pungent odors, with the only ventilation provided by leaving the outer airlock doors open. Restroom facilities provided no respite. After visiting McMurdo Sound in November 1958 during DEEP FREEZE IV, Major General Frederic E. Glantzberg, Vice Commander, Military Air Transport Service (MATS), described the situation:

> There were three four-hole honey bucket latrines, one for officers and two for airmen. The latrines were Clements Huts (15'x15') with toilets along one side and a row of four wash basins down the middle with hot and cold water in each basin. Outside access to the latrine buckets for purposes of cleaning was through poorly fitting plywood flaps which was all that protected the adventurous users from the outside sub-zero air. Invariably these flaps admitted a blast of cold air each time anyone entered the latrine, and temperatures at the time of my visit ran between -10 degrees and -20 degrees Centigrade.[77]

The overcrowded conditions, plus the long period of isolation, created another problem for those wintering over. During DEEP FREEZE II, the entire 93-man wintering-over party caught colds soon after aircrews began arriving from New Zealand. Additionally, the station doctor began noting increased cases of inflammation of the inner ear, causing many people periods of momentary vertigo. The medical equipment was as susceptible to the harsh environment as other equipment. For example, one of the DEEP FREEZE II wintering aerial porters, Airman Gority, crushed his right ankle between two crates in

the supply dump on 10 September 1956. Since the x-ray equipment was not working, the doctor placed a cast around his leg as a precaution. Gority was subsequently evacuated from McMurdo Sound on 21 October.[78]

Personnel at the camp obtained fresh water by melting snow. As noted, each latrine had hand-basins for limited washing. There were only four showers and four washing machines on the base. Thus, clean bodies and clean clothing rotated on a well-rationed schedule. The mess facility virtually operated 24-hours a day, serving four meals daily. While aircrews were fed outside of meal times to accommodate the mission flow, those personnel at the end of the line at meal times often took their chances being served Spam if the prepared food ran out.

To help the airmen compensate for the harsh conditions, the 63 TCW set up personnel rotations. As a general rule, aircrews remained at McMurdo Sound for six days at a time. A replacement crew flew in a C-124 with a load from New Zealand, and the McMurdo crew returned the round-trip mission back to Harewood. Ground personnel, primarily maintenance and aerial port, rotated back to Christchurch about every two weeks.

Transportation at McMurdo consisted of mostly tracked Weasels, nine-passenger Sno Cats, and 6x6 transports. In the early years, most transportation between McMurdo base and the flightline consisted of a taxi service run on two 6x6 transports pulling two sleds, one open and one covered (Photo 17). In either case, the trip took about 30 minutes, and most personnel arrived at their destination covered in a light layer of snow. By 1959, engineers constructed two well-insulated huts near the flightline. One served as a snack bar and shelter big enough for 10 men (or one C-124 crew). The other provided sleeping quarters for nine maintenance specialists. These provided essential shelter near the flightline and eased the transition time between the base and work area.[79]

During Operation DEEP FREEZE missions, each aircraft, as a minimum, was equipped with M-1 life raft kits, URC-11 UHF (ultra high-frequency) emergency radios, emergency rations, and other arctic survival equipment. Aircrews typically wore layers of light, warm clothing, beginning with loose-fitting waffle-weave long underwear. Over this went wool liners resembling shirts and slacks, fur-lined parkas, cold-weather trousers, fur-lined caps, goggles, and elbow-length mittens with liners and inner gloves. On their feet, they wore several layers of light and heavy wool socks covered with two heavy felt mukluk liners. The outer liner then went into canvas and rubber mukluks. Aircrews usually carried extra socks, underwear, knives, rope, extra rations, and personal equipment for emergencies.[80]

In addition to equipment, aircrews underwent thorough cold weather survival training. Most of this occurred in the US or Arctic, but aircrews also conducted cold weather survival training in the mountains of southern New Zealand. In a typical exercise, the crews "bailed out" of one-and-a-half ton trucks near Lake Taylor. After being dropped off in the mountains with little instruction, the crew walked about nine miles before establishing a camp large enough for the seven crewmembers and five instructors and observers. They made lean-to shelters using parachutes and equipment they had carried. Three days later, the truck returned for them.

Photo 17: A C-124 aircrew boards the "McMurdo Shuttle," a trailer on sled runners towed by a tracked Sno-cat vehicle, for the four-mile trip from the station in Antarctica to the ice runway.

A unique mission like DEEP FREEZE also called for numerous innovations. As early as 1955, Captain Oscar T. Cassity and the aerial port specialists assigned to the 63 TCW's 1st Aerial Port Squadron began looking for ways to adapt wartime airdrop methods and materials to the harsh environment of Antarctica. They needed to develop ways to drop large, heavy loads such as the D-2 Caterpillar tractor and construction material, as well as delicate scientific instruments and food. For the large loads, they modified a standard 6,000-pound platform with an H-frame tailored to fit the C-124's elevator uplocks. This reinforced platform could handle up to a 15,000-pound load.[81]

The aerial port specialists also realized the standard static line parachute disconnect system would not work because of the strong winds, extreme temperatures, and excessive load sizes. The standard system tended to freeze, leaving the load on the ground attached to the parachute and at the mercy of the wind. They developed two new types of disconnects, one used an electronically exploded charge for the large loads, and the other used a pre-set timing device for the standard A-22 drop bundle.[82] They also developed a method to bundle four 55-gallon drums of fuel using the A-22 bundle. They then strapped them to a

one-foot thick honeycombed paper shock absorber. This not only stabilized the freefall, it also reduced packaging costs and improved drop accuracy. After a brief visit to McMurdo Sound, which included a C-124 airdrop mission flown by Lieutenant Colonel Cicero J. Ellen, Admiral Jerauld Wright, Commander in Chief of the Atlantic Fleet, complimented the professionalism of the aircrews and aerial port innovations: "I was amazed at the efficiency of the techniques used by the Air Force pilots. Colonel Ellen and his crew dropped ten tons of cargo including four dozen eggs without so much as breaking an egg."[83]

The 63 TCW had been granted three standing waivers from standard airdrop procedures to give the unit the flexibility it needed to accomplish the mission. First, the wing could exceed the set parachute load limits as required. Second, it could surpass established platform load ratings. Finally, the 63 TCW served as the approval authority for all non-standard aerial systems (including containers and slings) needed to deliver irregular items.[84]

To publicize all of the events, the Navy and Air Force developed separate public information plans. However, since the Navy served as the executive agency, they required the Air Force to coordinate all media relations, news releases, and press visits/tours with the Navy Chief of Information and to maintain a liaison with the Officer in Charge, US Antarctic Programs. In essence, the two Air Force Information Services Officers (one assigned to work with the Navy Public Information office in New Zealand and one to serve in Antarctica as needed) and photographers* forwarded copies of all news releases and planned media events through the office of the Commander, Naval Support Force, Antarctica. This system tended to slow the process down, often ruining the stories' timeliness. Major Benjamin T. Griffin, Jr., MATS Chief of Public Information Division, accompanied General Glantzberg during DEEP FREEZE IV. Major Griffin observed the relatively low coverage afforded the MATS mission, especially in light of the importance of the airlift mission. He recommended an experienced Information Services Officer, preferably from Headquarters Military Air Transport Service, accompany each deployment as a special assistant to the commander. An experienced officer from this level would have more success minimizing delays and assuring full credit for MATS, as well as the Air Force Task Unit. Working for the on-scene Air Force commander also increased the Information Services Officer's visibility and authority. Of course, a good dose of humor from the unit-level often accompanied the visibility from higher headquarters (Figure 1).[85]

Figure 1: Information Officer Humor. Source: Rpt, 1st Lt Leonard M. Kacher, MATS DEEP FREEZE 63 Information Officer, " Operation DEEP FREEZE 63, Final Information Activity Report," 2 Jan 63.

*Air Force photographers accompanied the first DEEP FREEZE deployment. Thereafter, Navy photographers provided the majority, but not all, of the support.

CHAPTER 4

THE MISSION BEGINS TO EVOLVE (1960-1962)

Air Force and Navy officials realized airdropping supplies and equipment did not provide the optimal solution. Airdrops provided an expensive and not always reliable way to deliver goods. A significant portion of the C-124's total cargo capacity was taken up with chutes and dunnage (primarily pallets and packing materials). In most cases, this operational material was not reused since there was no feasible way to retrieve it from the South Pole or Marie Byrd Stations. Likewise, landing the C-124s or other wheeled aircraft on the snow packs remained a dangerous, at best, option, and building an ice runway such as the one at McMurdo Sound proved impractical since no one knew how deep they would have to dig to reach ice dense enough to support a larger, fully-loaded cargo aircraft's weight. By early 1959, Navy planners were looking at the practicality of using Marine ski-equipped C-130 aircraft as the primary intracontinental airlift aircraft. Although not followed up on at that time, this idea would also have reduced, by nearly 200 people, the living and work requirements.[86]

By August 1959, Air Force planners had decided to experiment with using the ski-equipped C-130s. They notified a Tactical Air Command squadron, the 61st Troop Carrier Squadron (TCS) of the 314th Troop Carrier Wing (TCW) stationed at Sewart Air Force Base, Tennessee, that it would deploy seven ski-equipped C-130s (designated as C-130Ds) to McMurdo Sound in January 1960 as part of DEEP FREEZE 60. The 61 TCS referred to their portion as Operation ICE FLOW. The squadron had accumulated a vast amount of knowledge on operations in cold climates while supporting Distant Early Warning (or DEW Line) sites in the Arctic. Still, the crews had no experience with using the jet-assisted take-off (JATO) system that the Navy recommended for Antarctic operations. In October 1959, Lieutenant Colonel Wilbert Turk, the 61 TCS Commander,* selected 10 qualified aircrews and began intensive training in artic survival, grid navigation, and cruise control. In December, these crews went to a snow airfield in Bemidji, Minnesota, where they received JATO training. At Bemidji, each crew practiced with various take-off weights, including the maximum allowable gross weight of 124,200 pounds. Despite this intensive training, the crews found snow conditions in Antarctica excellent and did not use any JATO bottles.[87]

In addition to saving time, equipment, and money, the C-130D offered several other advantages over the C-124 airdrop missions. Four Allison T-56 prop-jet engines powered the C-130s. If needed, the C-130 could use up to eight JATO units, adding 8,000 pounds of thrust to the engines' 15,000 horsepower. The ski-version used a combination of low-pressure tires and 20-foot skis, making it capable of landing on standard airfields, ice

*Colonel Turk also served as the Air Force Task Unit Commander during the deployment.

runways, snow-compacted surfaces, and primitive airstrips. Lockheed engineers developed the skis using a new Dupont Teflon material to minimize its freezing to the surface.[88]

The deployment occurred in January 1960 with seven C-130Ds and one C-130A accompanying them as additional airlift and an en route support aircraft. Following the standard route, all of the C-130s arrived in New Zealand by 17 January. The 63 TCW also supported the deployment with four C-124 Globemaster IIs, which transported 45 tons of equipment from Sewart to Christchurch. After personnel rested and the aircraft went through maintenance checks, three ski-equipped Hercules departed Christchurch on the 19th at one-hour intervals. Unfortunately, the first C-130D experienced extremely strong headwinds, and three hours into the flight returned to New Zealand.* The wind forecast remained unfavorable until 23 January. Again, the C-130Ds departed in one-hour intervals. After an 8-hour and 40-minute flight, the first C-130D arrived at McMurdo Sound's 12,000-foot snow-compacted runway.[89]

Personnel of the 61 TCS went straight to work. Since loads had not been preplanned, the Air Force loadmasters planned and supervised the loading, while Navy personnel provided loading crews and equipment. The crews also found McMurdo Sound's refueling capabilities very limited. In fact, on the first day of operations, 25 January, the single-point refueling pump was not serviceable, and the spare pump was damaged while moving it into place. Repairs delayed the first departure (for Marie Byrd Station) by two hours. Before ground crews could service the other aircraft, weather deteriorated, and those missions were canceled.[90]

After this initial slow start, the operation proceeded much more smoothly. The first C-130D (tail number 57-0492), piloted by Colonel Turk, landed at the South Pole as scheduled on 27 January (Photo 18). In a typical day between 27 January and 5 February, loadmasters and ground personnel prepared seven flights with the first departing at 0600 local and the remaining ones in 30-minute intervals. Nearly all of the loads leaving McMurdo Sound put the aircraft at their maximum gross weight of 124,200 pounds. The aircraft flew to their designated unloading sites at 25,000 feet altitude and returned at 24,000 feet. This system provided a safe operating environment in an area with limited navigational aids and

Photo 18: The first C-130D to land at the South Pole Station is unloaded on 27 January 1960.

*The rate of fuel consumption at that point meant the aircrew would arrive at McMurdo Sound without a safe fuel reserve.

communications equipment. In 11 days of operations, the C-130Ds moved nearly 407 tons of cargo.[91]

Throughout the operation, the aircraft performed well. Maintainers succeeded in keeping a 92 percent in-commission rate on the aircraft while at McMurdo Sound. Maintainers only had to change one engine on the ice because of a cracked gear box. However, they noted an interesting situation: The extreme cold weather, combined with the consistent high gross-weight operations, caused a number of valve seals in the nose struts to fail. This resulted in the nose skis drooping. These same conditions caused a number of ski indicator problems as well. Aircraft 57-0492 experienced the most difficulties with its skis. The maintainers finally solved this aircraft's problems by increasing the hydraulic and nitrogen charge pressures in the main skis and resetting the indicator limit switches.[92]

With the operations completed on 5 February, the maintainers performed a final check on all the aircraft before the redeployment commenced on the 7th. Several aircraft required programmed maintenance in New Zealand, so the last aircraft did not return to Sewart until 3 March.* In a message to Colonel Turk, Rear Admiral David M. Tyree, Commander Task Force 43, said:

> Your timely assistance to Operation DEEP FREEZE in delivering critical material to Pole and Byrd Stations is greatly appreciated. All hands at McMurdo were much impressed with the outstanding performance of your personnel and aircraft in the rapid movement of cargo to these isolated outposts. Your courtesy in affording personnel of Air Development Squadron Six opportunity to observe your operations is also appreciated. The experience derived will be of great benefit to future Antarctic operations.[93]

Admiral Tyree was referring to the Navy's decision to purchase four ski-equipped Hercules from Lockheed. Dubbed C-130BL, the Navy began using these aircraft during DEEP FREEZE 61. In addition to flying similar supply missions, Navy aircrews also flew airdrop and search and rescue missions. With its limited number of C-130Ds committed to operations in the Arctic, the Air Force continued to use the C-124 as its primary tool through Operation DEEP FREEZE 63.[94]

With the Navy's C-130BLs beginning operations, Navy and Air Force planners expected the C-124 airdrop missions to decrease drastically, while the airlift portion from New Zealand to McMurdo Sound would likely increase. Therefore, the 9 TCS initially sent only seven C-124s in September 1960 for DEEP FREEZE 61. In actuality, the number of airdrops in DEEP FREEZE 61 and 62 did decrease from the peak during DEEP FREEZE 60, but remained similar to those in previous years. Planners also decided to make a final airdrop push in 1962. Because the overall mission load remained so high, the 9 TCS sent nine aircraft in 1962 and 1963. The squadron commander, Lieutenant Colonel Foy B. Frost, served as the Air Force Task Unit commander for all three phases.[95]

---

*Again, the 63 TCW supported the redeployment with two C-124 missions. [Hist, 63 TCW, Jan-Jun 60, n.d.]

Photo 19: Lt Col Foy B. Frost (standing) talks with passengers on the first C-124 mission to Antarctica of DEEP FREEZE 61.

Three factors caused problems for the Air Force Task Unit early in DEEP FREEZE 61. First, adverse weather for the first three weeks troubled airlift operations. A low-pressure system settled over much of the Antarctic, creating numerous snowstorms, extremely cold temperatures, and whiteout conditions. Most turnaround flights from Christchurch ended up returning before reaching McMurdo Sound because of the weather, and none of the scheduled airdrops occurred. Second, airlift and airdrop requirements increased. A survey of the requirements,* conducted in October, showed an increase of 300 tons for the turnaround flights (Photo 19) and an additional 20 airdrop missions--including one mission to deliver 72 barrels of fuel to a traverse party. In late October, Colonel Frost requested and the Military Air Transport Service (MATS) approved an augmentation deployment of three C-124s, including four additional aircrews and 52 support personnel. The last augmentation C-124 arrived at Harewood Aerodrome on 5 November. Conditions improved considerably for most of November, but a seven-day communications blackout,** 12 to 19 November, delayed the mission further.[96]

The weather caused particularly dangerous situations for two aircrews.*** The first, on 20 October, occurred with two aircraft flying turnaround missions from New Zealand. Because of a low-pressure system centered just south of the point of safe return (PSR), the aircraft flew into a severe headwind. Due to the fuel consumption and the near whiteout conditions at McMurdo Sound, the decision to turn the aircraft around came just before the first C-124 reached the PSR. The aircraft nearer to New Zealand, piloted by Brigadier General Andrew B. Cannon, Commander of the 63 TCW, during a brief visit to the Air Force Task Unit, returned without incident. The second aircraft, flown by Captain Witmer B. Wilcox, ran into another severe headwind (caused by a shifting low just south of New Zealand) about an hour after turning around. With this new headwind, the navigator, Captain Noel A. Arsenault, recalculated the aircraft's fuel and announced that, at current consumption, the C-124 would run out of fuel 30 minutes before reaching Christchurch. The cargo's bulk prevented the crew from jettisoning it, a standard approach to saving the aircraft in such a situation.

Rechecking the charts, Wilcox and Arsenault decided to land at a 4,000-foot runway at Invercargill on the southern tip of New Zealand (about an hour and 20-minute flight south of Christchurch). Because of its short length, this runway was not considered adequate for the C-124 and had not been designated as an emergency field. In the meantime, an SC-54D Rescuemaster launched as a precautionary measure to escort the C-124 back to

*Including 14 additional Jamesway huts to increase personnel living space at McMurdo Sound.

**A solar disturbance in November 1960 disrupted communications throughout the world and completely shut down communications between New Zealand and McMurdo Sound.

***Although not weather related, one Navy WV-2 Warning Star (a variation of the C-121 Constellation) working on a project to survey the world's magnetic field crashed while landing at McMurdo Sound on 31 October. [Msg, CNSFA to Chief of Naval Information, [WV-3 accident], 010810Z Nov 60.]

New Zealand.* At approximately 0300 local, Wilcox used 3,200 feet of the runway to land the C-124 successfully. Six minutes later, the SC-54 also landed at Invercargill.[97]

In the second incident, a C-124 returning from an airdrop mission faced whiteout conditions at McMurdo Sound, plus the ground controlled approach (GCA) unit failed. Without adequate fuel reserves to reach Cape Hallett, the pilot decided to make one attempt at landing on the ice runway, and, if that failed, proceed to a clear area on the Ross Ice Shelf to crash-land. The navigator found the APS-42 radar scope provided an adequate reflection of the oil drums outlining the runway. Using a box-type pattern, the pilot monitored the airspeed and altitude while adjusting his heading based on the navigator's instructions using the APS-42 scope.** Ground personnel reported seeing nothing in the milk-like fog, only hearing the drone of the engines and the reverberating noise of the four engines going into reverse. Then the pilot called over the radio, "Tower, we're down and stopped, and I think we are on the runway. I can't be sure because I can't see 10 feet, and I'm shutting down the engines."[98]

Overall, the C-124s again performed well during the mission. Maintainers observed a similar recurring problem with landing gear strut leaks while the aircraft were parked on the ice. The struts tended to go flat with no warning. In most cases, once heat was applied, a strut would not leak again for several days, indicating a lack of elasticity in the seals or an ill-fitting piston and cylinder. Another concern at McMurdo involved the refueling pit. This year, in addition to being only large enough to service one aircraft at a time, the seals in the nozzles leaked, either from being frozen or worn out. During nearly every refueling, fuel leaked out, causing a rapid deterioration of the ice in the refueling area.[99]

DEEP FREEZE 61 also had a couple of firsts. On 5 October, two C-133 Cargomasters, of the 1501st Air Transport Wing, Travis Air Force Base, California, participated when they picked up two (one each) 37,000-pound Swiss-made snow-milling machines*** from Chatearoux Air Station, France. They then flew to Quonset Point, Rhode Island, to pick up more equipment, including two automatic weather stations and spare parts for them and the C-130BLs, for DEEP FREEZE operations. With a load of nearly 30 tons apiece, they proceeded to Christchurch, arriving on 15 October. With the planned arrival of the C-133s, the Harewood Aerodrome, in conjunction with the Air Force and Navy, held an open house. Approximately 70,000 New Zealanders**** came out to view the C-133s, C-124s, C-130BLs, P2Vs, snow-milling machines, and other equipment. After the open house, Navy technicians disassembled the snow-milling machines (Photo 20) and four C-124s

*Air Force SC-54Ds (later redesignated HC-54Ds) provided search and rescue north of the PSR and the Navy covered the remainder. Generally, the SC-54s launched during any kind of emergency situation as a precautionary measure. They launched five times for potential emergencies and performed an emergency drop of radar equipment to a Navy vessel at sea for DEEP FREEZE 61. [Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE Sixty One," n.d.]

**Airborne radar approaches had been a standard training requirement of the mission. The practice had helped to improve aircrew coordination procedures.

***Engineers intended to use the machines to excavate large trenches, up to 16 feet deep, in the South Pole ice cap. They would then build prefabricated buildings and roofed passageways in the trenches.

****An open house occurred almost every year, but this was one of the largest crowds reported.

Photo 20: US Navy men dismantle a snow-milling machine in New Zealand. Two C-133s delivered two of these machines to Christchurch. After being dismantled, C-124s carried the parts to McMurdo Sound, Antarctica, and Navy ski-equipped C-130s delivered them to the South Pole where they were reassembled. (circa 16 October 1960)

Photo 21: Maj Robert O'Conner, a communications officer, makes a radio call with the single side-band radio from over the South Pole to Donaldson Air Force Base, South Carolina. (circa October 1961)

took the pieces to McMurdo Sound. Navy C-130BLs then carried the snow-milling machines to the South Pole Station where technicians reassembled them.[100]

Another first was the addition of the Collins KWM-2A* single side-band (SSB) radio (Photo 21). Tested on a C-124C mission to New Zealand in August 1960 and installed on the original seven aircraft before the deployment, a radio operator using the KWM-2A contacted the Donaldson Air Force Base, South Carolina, MARS (Military Affiliate Radio System) station 15 minutes after takeoff and maintained this contact throughout the trip to Christchurch and back. During the operation, communication specialists found the equipment performed virtually trouble-free. Operator error proved the most troublesome, as inexperience with the SSB radio caused them to overload the power to the system. Overall, communicators noted how the KWM-2A proved most suitable for the mission: "The ease of operation, the basic simplicity and flexibility and almost complete lack of maintenance made this set the ideal equipment."[101] After careful training, communicators participating in DEEP FREEZE 62 reported the KWM-2A communications system worked without any problems during the entire mission. The single side-band radio also let both the McMurdo Sound and Christchurch SSB stations stay in contact with each mission. Control responsibility continued to change, however, as the aircraft passed 60 degrees south latitude.[102]

*Communication specialists also tested 618S-1M and 618/T sets, but found the KWM-2A the most suitable for the operation.

For the first time, the Air Force Task Unit found the Antarctic weather most cooperative during DEEP FREEZE 62. In fact, the weather was so cooperative that by the end of October 1961, the turn-around tonnage was far ahead of schedule. Initially, cold temperatures at the South Pole and Marie Byrd Stations proved the only exception.* Additionally, aviation fuel was in short supply at McMurdo Sound since a Navy fuel vessel with 200,000 gallons of aviation fuel was lost during a winter storm. Despite starting almost two weeks late, the airdrops to both stations were finished by 11 November.** In fact, the mission went so smoothly that four of the nine C-124s redeployed home in mid-November.

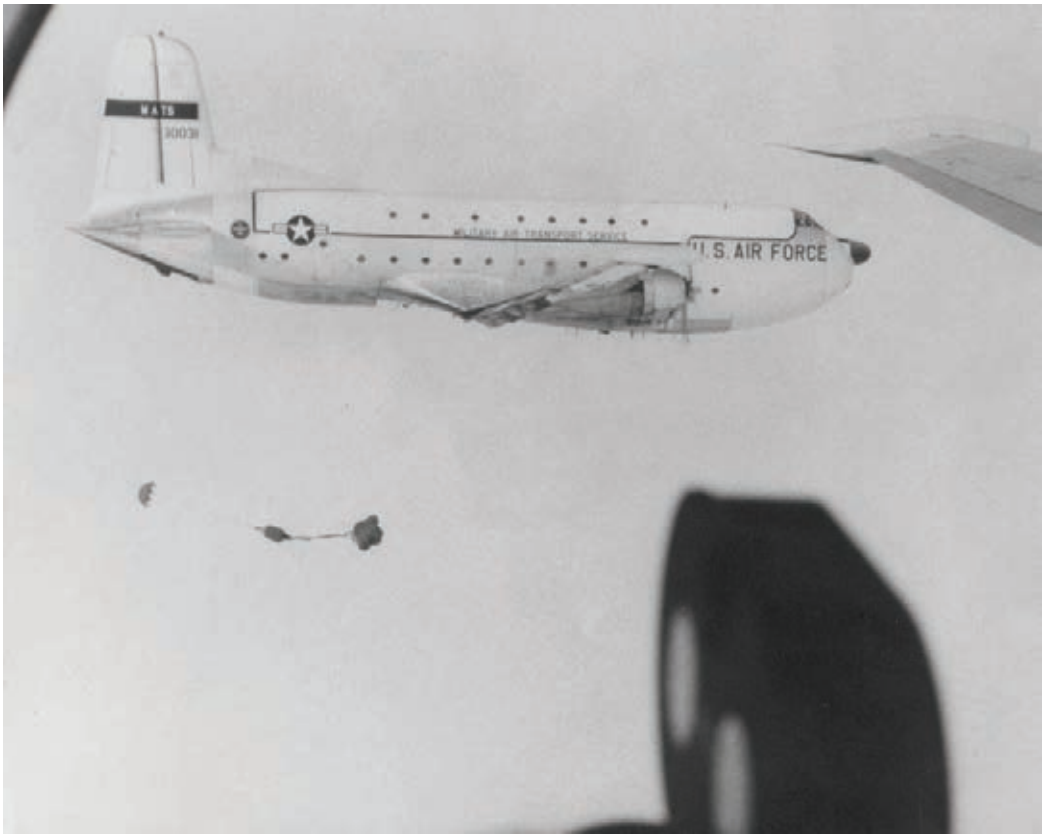


Photo 22: A set of four fuel barrels falls free from a C-124 over the US scientific station at the South Pole. Each package of fuel barrels was rigged on a honeycomb pack with a 15-foot extraction chute and a nylon parachute with a 63-foot canopy.

Airdrops to the South Pole and Marie Byrd Stations consisted entirely of fuel drums. During this year, aerial port specialists used a "stabilized free fall" extraction system. This consisted of a honeycomb pack over four drums and a 15-foot extraction parachute (Photo 22). While this system stabilized the load in poor visibility and high winds, it tended to cause the bundles to bury themselves approximately 2 feet deep in the South Pole's ice cap,

*Recovery teams needed temperatures above -50 degrees Fahrenheit.

**Because of the fuel situation, planners reduced the actual number of airdrops and increased Navy C-130BL missions later in the year to transport some of the fuel.

making it difficult for the recovery teams to retrieve. An Air Force aerial port officer went to the South Pole Station to instruct the recovery teams on the best method to retrieve the fuel with the equipment they had available.[103] Colonel Frost, again serving as the Air Force Task Unit Commander, said of the effort: "The remarkable spirit of cooperation between the USAF, Navy, and civilian personnel in working toward the successful accomplishment of the mission was a decided asset in its attainment."[104]

The highlight of DEEP FREEZE 62 was six airdrop missions for crews preparing to construct the new Eights Station (sometimes called Ski-Hi or Sky High Site).* Because of the distance from McMurdo Sound, 2,800 nautical miles roundtrip over largely unmapped territory, mission planners decided to send three C-124s at a time at five-minute intervals. This plan accomplished three tasks: 1) the aircraft provided their own rescue coverage, 2) the navigators could cross-check each other, and 3) it provided an additional back-up communications system. Planners intended for a Navy R4D to land with the construction crew and the first three C-124 missions to occur the same day. Originally scheduled for 15 December, poor weather at the drop site sent the R4D and three C-124s back to McMurdo Sound. After the initial delay, the R4D successfully landed on 24 November, and the first flight of three C-124s airdropped fuel, motor vehicle parts, and rations. After another weather delay, those same three C-124s returned to drop the remaining supplies on 1 December.[105]

Throughout DEEP FREEZE 61 and 62, ice experts had been watching a large crevasse in part of the Ross Ice Shelf. They were very concerned the current runway would soon break off the permanent ice shelf and float out to sea. With the end of DEEP FREEZE 62, Navy construction engineers decided to close the runway. They began constructing a new one further up the Ross Ice Shelf where there would be no danger of a break-off during DEEP FREEZE 63.

The weather for DEEP FREEZE 63 proved less cooperative than the previous year. Even so, the C-124 aircrews made a push to make this, their final year supporting Antarctic operations, a highly successful operation. Antarctic storms prevented a planned early start to the turnaround missions. Additionally, the storms, combined with equipment breakdowns, slowed down construction of the new runway, and when C-124 operations began on 7 October 1962, offloading and maintenance had to be accomplished on the runway as the parking area was not ready. Later, whiteout conditions forced two C-124s returning from airdrop missions to divert to the Cape Hallett Station even though the ice depth there was questionable.[106]

Although the construction ran late, the new runway at first appeared to be in excellent condition, and airlift planners foresaw no problems. However, equipment problems had prevented the engineers from using graders and plows to smooth out the surface. In an attempt to level out the rough areas, the engineers flooded the low areas with sea water and allowed it to freeze. This "reasonable" solution worked only as long as the temperature

*Located near the Bellingshausen Sea at 75°10' South and 77°10' West, Eights served scientists during the study of upper atmosphere physics from January 1963 to January 1965.

Photo 23: TSgt Meryle Chase (second from right) explains the new refueling system at McMurdo Sound, Antarctica, to (left to right) A1C Donald F. Miller, TSgt Lester I. Crocker, Jr., A1C Hugh J. Bryant, and SSgt Carol L. Larkins. (DEEP FREEZE 63)

remained below -20 degrees Celsius. As the weather warmed in early November, the high saline content in these sections melted. The salted slush also created holes and pits in the permanent ice below. On 18 November, Colonel Frost, the Air Force Task Unit Commander for the third straight year,* elected to cease all C-124 operations from the new runway. Upon inspection, he found the old runway in superb condition. Engineers took two days to clear the main runway, while the crosswind strip required very little snow removal. Once the snow had been removed, the C-124s began using the old runway again. Of course, the move to the old runway created additional problems with transportation, housing, and refueling operations, but the unit's personnel quickly worked those out.

As part of the new runway, the engineers had installed a gravity-fed tank farm at McMurdo Sound. The main tanks sat approximately five miles from the airfield. An

*Rear Admiral James R. Reedy became the Commander, Naval Support Force, Antarctica and Task Force 43, in November 1962.

assault pipe transferred the fuel to four fuel bags, each with a 10,000-gallon capacity, next to the aircraft parking area (Photo 23). Although an improvement, this system caused a few delays initially. After all the bags were filled, they had to settle for up to four hours before the fuels specialists could fill the aircraft. The installation of shut-off valves between the bags resolved this--the specialists could fuel the aircraft from one bag while the others were being refilled. At one point, condensation at several points in the pipeline froze, stopping the fuel flow for 30 hours. The process of thawing the lines caused a rupture and the loss of over 200,000 gallons of fuel. After the move to the old runway, Navy engineers terminated the line at the end of the crosswind runway. However, this soon proved unsatisfactory as the aircraft had to taxi between the refueling area and maintenance/loading area, and refueling operations stopped all use of the crosswind runway. It took seven days, but Navy engineers moved the refueling pit to the aircraft parking area.[107]

The loss of 200,000 gallons of aviation fuel aggravated an already critical fuel situation at McMurdo Sound. Navy ice breakers and refueling ships were having a difficult time breaking through the 6- to 10-foot ice to get to the offload location. Additionally, a delay in the startup of the new PM-3A nuclear power plant meant the McMurdo Sound Station continued to rely more heavily on diesel fuel than planned. The nuclear power plant failure actually caused several airdrop missions to Eights Station to delay as the diesel was held

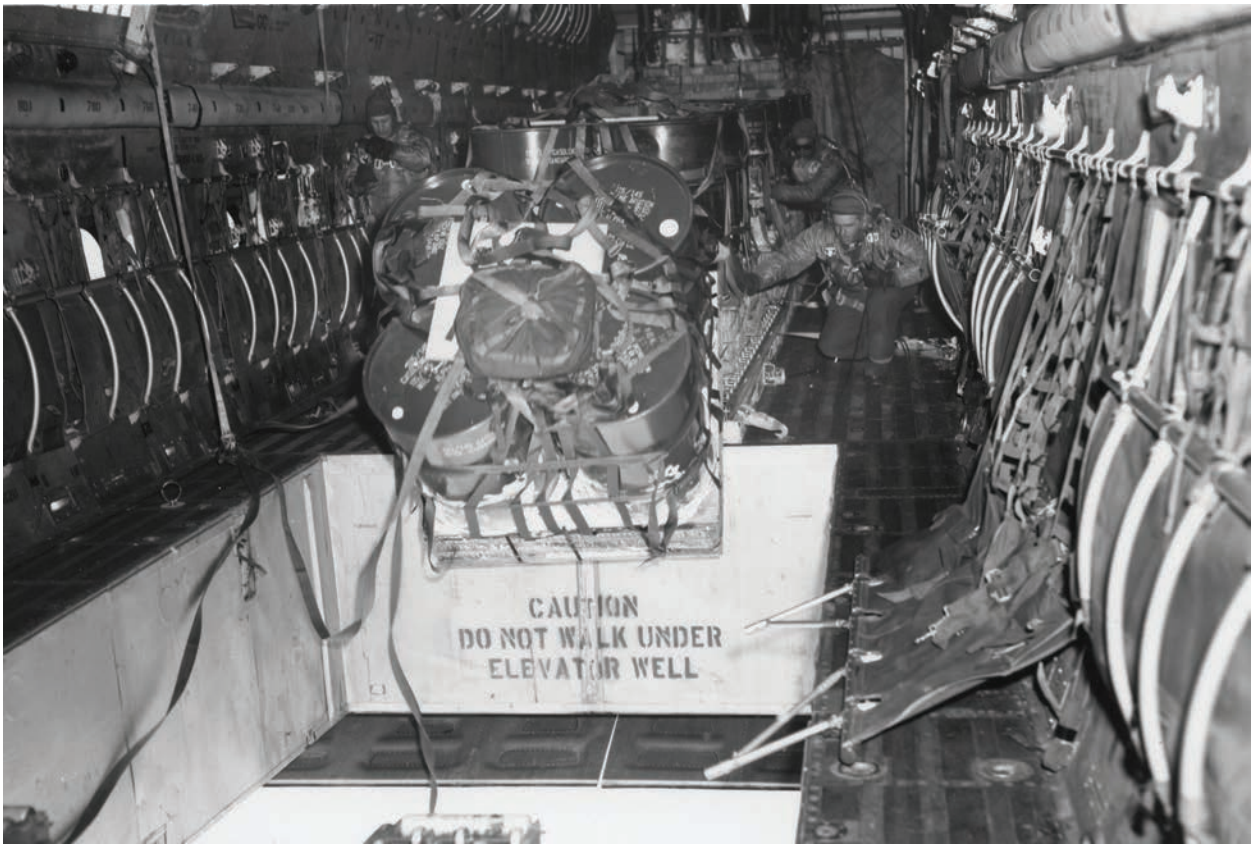


Photo 24: "Drop!" is the command, and the first aerial delivery to the South Pole Station is underway on DEEP FREEZE 63. The C-124 dropped 80 barrels of fuel to the scientific station.

back for use at McMurdo Sound. The fuel situation improved once the refueling ships reached the offload location. When the ships offloaded another 200,000 gallons of aviation fuel, the Navy requested an additional 20 airdrop missions to support the South Pole and Marie Byrd Stations (Photo 24).* Even this new load of fuel only provided enough to complete the planned schedule, plus 15 of the 20 requested additional missions.[108]

Photo 25: Two C-124s make their first pass over the Eights Station drop zone on 21 November 1962.

Despite the difficulties, the C-124s completed the mission well and supported a couple of interesting tasks during DEEP FREEZE 63. To build up the Eights Station's reserves, C-124 aircrews completed 25 of 26 scheduled flights.** As with the previous year, the C-124s generally flew in threes to this distant location and conducted the airdrops using free-fall delivery systems with extraction parachutes, meaning they were dependent on clear weather conditions. On 8 November, a Navy C-130BL delivered radar reflectors and instructions for setting up a drop zone with them. Eights Station ground recovery crews successfully set up the drop zone so the aircrews could use radar to drop supplies under any weather condition (Photo 25). More than half the drops used the radar reflectors.[109]

*This request came primarily because the Navy's ski-equipped C-130BLs unexpectedly had to return to the Georgia factory for repair of maintenance problems.

**An analysis of the first few flights to Eights Station revealed that by increasing the payload of each mission by one bundle, planners could save one required mission--more importantly, save the aviation fuel from one mission.

On 6 November, a C-124, piloted by Captain Pierre E. Sheppard, made an airdrop of fuel and supplies at a planned mid-point location for a traverse party. The New Zealanders' expedition left the Australian station at Wilkes to go across Victoria Land to an inland Russian station. The traverse party successfully recovered the entire drop and sent a radio message of genuine appreciation to those at McMurdo Sound.[110]

Photo 26: Lt Col Russell C. Clarke upon his return from the mission survey trip to Antarctica. (circa 10 December 1962)

On a flight back to the US, a 63 TCW C-124 again transported penguins to Portland, Oregon, for display in the Portland Zoo. Only six Emperors and one Adelie of the previous shipment still resided at the zoo. While the zoo had traded a few to other institutions, most had died of a lung infection (aspergillosis). Mr. Jack L. Marks, the Portland Zoo Director, captured 23 Emperor and 23 Adelie penguins, and accompanied them on their flight to the US. A C-124 carried the penguins, in mesh cages in its cargo elevator well, from McMurdo Sound to Christchurch, New Zealand, on 30 November. After a short stop at Christchurch, where the birds were given some time in the open air and sprayed with an antibacterial mist to protect their lungs, a new aircrew took them to Portland with refueling stops at Canton Island, Fiji, and Hickam Air Force Base, Hawaii. A number of other New Zealand animals, including 30 hedgehogs, 13 magpies, 14 opossums, and a rook, joined the penguins in Christchurch. All of the animals arrived on 1 December after a 36-hour flight.[111]

Two other unique things happened during DEEP FREEZE 63. First, a C-135 Stratolifter assisted the 63 TCW to deploy and redeploy from Christchurch.* The deployment C-135, arriving on 11 September, was the first US Air Force jet transport to land in New Zealand.[112] Second, a C-130E (tail number 62-1785) of the 1608th Air Transport Wing stationed at Charleston Air Force Base, South Carolina, brought a site survey team to Christchurch, from 16 November to 9 December. The survey team, led by Lieutenant Colonel Russell C. Clarke, Commander of the 76th Air Transport Squadron, arrived to review the operations, facilities, and equipment of DEEP FREEZE 63 because MATS had decided to use C-130Es as the primary Air Force transport system to support the mission beginning with DEEP FREEZE 64 (Photo 26). Overall, the site survey backed up 63 TCW's lessons learned

*Previously, C-118 Liftmasters had assisted with the deployments and redeployments. C-135s assisted with deployments through DEEP FREEZE 65.

of the last seven years. The survey team estimated that 8 aircraft and 14 aircrews (plus 1 additional crewman per position) would be enough to cover the requirements of DEEP FREEZE 64. Besides being newer, the C-130E could take off and land in a shorter distance and fly faster and further than the C-124.[113]

Through the years, the 63 TCW had developed a close working relationship with the scientists and Navy personnel involved in Antarctica. So much so, that the last Globemaster II, leaving on 10 December 1962 paid tribute. "As the last C-124 mission aircraft departed McMurdo Sound for Christchurch, it flew over the camp site and dipped its wings in salute to those personnel still remaining in the Antarctic."[114]

New Zealanders, likewise, looked on the final departure of the C-124, often referred to as "Old Shaky," with a bit of sadness. Many related the arrival of the first C-124 with Christchurch's entry into the modern airlift era, and most understood the important role the aircraft and the city had played in Antarctic operations. Through many open houses and school tours, well over 200,000 had visited the operation in the last 7 years. They also appreciated the Airmen's efforts to cultivate a positive relationship. As one local reporter humorously put it, "Fathers have looked critically at every part inside the huge monster, mothers have looked critically at the US servicemen, daughters have gazed somewhat less critically at the servicemen, and the kids have just carried on like kids do anywhere."[115] One local New Zealander, C. S. Stevens of Ashburton, even built a large-scale powered C-124 model (wingspan of 7 feet 6 inches). He built it to scale entirely from photographs and the occasional visit to the airport to check details against the actual aircraft.[116]

CHAPTER 5

A TASK FOR HERCULES (1963-1968)

As Colonel Roland J. Barnick, Commander, 63d Troop Carrier Wing, wrote at the end of DEEP FREEZE 63, a new aircraft would improve the mission, but the hazards would still remain:

> A new era is beginning with the advent of a newer and faster aircraft to perform this arduous mission. The utilization of the C-130-E may resolve some of the operational problems, but difficulties such as the unpredictable Antarctic weather, the extreme cold, and the mental and physical demands on personnel will always exist.[117]

The C-130E Hercules mission started with a controversy. The Navy wanted the Air Force to stop airdrop operations in favor of ski-landings to resupply the stations. However, Lockheed had no plans to develop skis for the "E" model. Adding "B" model skis to the "E" would cost about $500,000 per aircraft and add approximately 6,000 pounds to the aircraft. Plus, missions to the South Pole, Eights, and Marie Byrd Stations would most likely require the jet-assisted take-off (JATO) system. Based on the Navy's experience, Air Force planners realized training, maintenance, and fuel requirements would all increase with ski operations. One report noted the significant savings achievable with ski landings due to the decreased parachute and dunnage waste associated with airdrops, but estimated an increase in aviation fuel consumption of 164,922 gallons (or $629,688 at the Navy's estimated cost of $4 per gallon at McMurdo Sound).[118]

This situation soon resolved itself, at least for DEEP FREEZE 64. Just prior to a pre-deployment meeting between Navy and Air Force officials held at Charleston Air Force Base, South Carolina, in April 1963,* the Navy announced drastic funding limitations. With the limited funding, the Navy changed its request for Air Force support from 40 turn-around flights to 34 (circumstances later returned the schedule to 40) and completely eliminated airdrop or Air Force ski-landing requirements. The message did contain the stipulation that the Air Force would support any unforeseen emergency airdrop, should the need occur. Accordingly, the 1608th Air Transport Wing (ATW) reduced its deployment to three C-130s** and 167 people.[119]

---

*Officials from the Naval Support Force, Antarctica and the Air Force unit providing airlift met each year, normally in the late Spring (after the previous year's DEEP FREEZE phase ended) to plan the following year's mission.

**The wing deployed a fourth C-130 to Christchurch for 10 days (22 October-2 November) to provide search and rescue coverage while maintainers worked programmed maintenance issues on one of the other aircraft during the peak workload period.

As part of its training, the 1608 ATW operated an Arctic resupply shuttle between Thule and Nord, Greenland, in April. Dubbed "Little DEEP FREEZE," the mission included 46 flights delivering mostly petroleum products to Nord. For DEEP FREEZE 64, the 1608 ATW deployed to Christchurch from 23 September to 12 October. Because of the flying characteristics of the C-130, the deployment route changed slightly. Instead of stopping at Canton Island and Fiji, the C-130s flew from Hickam Air Force Base, Hawaii, to Pago Pago, American Samoa (approximately 2,270 nautical miles), and then on to Christchurch (just over 1,950 nautical miles).[120]

Photo 27: Offloading cargo from the first C-130E to land at McMurdo Sound, Antarctica, on 14 October 1963.

Another issue with the C-130s involved search and rescue. Previously, two HC-54Ds from the Pacific Air Rescue Center deployed with the C-124s to provide search and rescue coverage. In general, the HC-54s covered the area from New Zealand to the C-124's point of safe return (PSR), and the US Navy covered the requirements south of the PSR. The switch to C-130s as the primary mission aircraft caused two problems. First, the primary function of the HC-54 was to meet and escort an aircraft in trouble back to New Zealand. The C-130's increased speed made this impractical--the HC-54 simply was not able to keep up. Second, many of the spare parts available for the C-124 also supported the HC-54. With the C-130 being such a different aircraft, the supply inventory would have to grow drastically to support both types of aircraft. To resolve this, the 1608 ATW (as did subsequent C-130 units) provided its own search and rescue from New Zealand to latitude 60 degrees South. In a typical day, one or two C-130s flew turn-around missions to McMurdo Sound, and one C-130 stood search and rescue alert.[121]

The first C-130E (tail number 62-1814) arrived at McMurdo Sound on 14 October after a 7-hour and 45-minute flight (Photo 27). On average, the C-130Es flew from Christchurch to McMurdo Sound in just under 8 hours, whereas the C-124s took nearly 11 hours.* This first C-130 carried Rear Admiral James R. Reedy, Commander, Naval Support Force, Antarctica, and Colonel Clarke, Commander of the Air Force Task Unit, along with the initial Air Force contingent and 20,000 pounds of ground support equipment that would stay at McMurdo Sound. Because of the smaller nature of this year's operation, Colonel Clarke decided to keep as few people at McMurdo Sound as possible, including the operations officer, fuels specialists, maintainers, aerial porters, and other support functions. These people rotated back to New Zealand every 8 to 10 days.[122]

While the C-130 operation progressed smoothly, two C-124s briefly reprised the Globemaster II role. Each of these C-124s, both belonging to the 1608 ATW, transported two US Army UH-1B helicopters from the US to McMurdo Sound and then returned to the US. The first mission started at Charleston Air Force Base on 8 November and returned home on the 18th. The second mission occurred from 6 to 16 December. Both missions required approximately 100 flying hours to complete.[123]

The C-130Es performed very well, and the 1608 ATW completed a total of 41 turn-around missions to Antarctica. Only one serious incident occurred. On 13 December, Colonel Clarke, flying aircraft 62-1814, ran into whiteout conditions at McMurdo Sound--

Photo 28: DEEP FREEZE personnel built a snow sled to pull a C-130E from the skiway after it had made an emergency landing there on 13 December 1963.

*These C-130 "turn-around" missions still averaged 20-21 hours with up to 3 hours on the ground at McMurdo Sound.

visibility dropped to 1/16th mile, with blowing snow. Colonel Clarke circled the airfield for four hours and attempted to land on the ice runway four times unsuccessfully. Because of the high snow banks and berms around the ice runway, Colonel Clarke finally decided to land on the nearby skiway after jettisoning 8,000 pounds of cargo. As expected, the wheels of the C-130 buried themselves in the snow, but only very minor damage to the gear doors occurred. Navy and Air Force ground personnel at McMurdo Sound spent many hours digging the aircraft out. They also constructed a sled specifically to pull the C-130 out of the snow and move it back to the ice runway (Photo 28).[124]

In preparation for the second year of C-130E operations, DEEP FREEZE 65, the Military Air Transport Service (MATS) selected the 1501 ATW from Travis Air Force Base, California. Leaders of the 1501 ATW visited New Zealand and Antarctica several times in preparation. The first two site surveys occurred in November 1963 to observe the operations of the 1608 ATW. During the second visit, Brigadier General James W. Chapman, Jr., 1501 ATW Commander, flew the first C-130E mission over the South Pole after leaving McMurdo Sound and before returning to New Zealand. The final visit, led by Lieutenant Colonel Robert D. Coffee, the next Air Force Task Unit Commander, occurred in January 1964. The DEEP FREEZE 65 budget remained as restrictive as the previous year's. Once again, plans called for only turn-around missions and no airdrops. Also in 1965, MATS designated Christchurch as a forward supply point. This permitted the unit to preposition aircraft parts and supplies and establish equipment stock levels.[125]

The DEEP FREEZE 65 season included the first programmed stops at Cape Hallett Station on the way to McMurdo Sound. The first occurred on 26 October 1964. Because of concerns over ice deflections during unloading operations, the aircrew kept one engine running in case the aircraft had to be moved quickly. Unloading 14,000 pounds of cargo took 1 hour and 45 minutes, but the ice showed little indication of problems. During the second mission, on 22 November, the ice deflection was measured at 3/4 of an inch, and cracks appeared around the aircraft's wheels, but the operation was still considered safe. When supporting future missions into Cape Hallett, the 1501 ATW emphasized aircrews should have full visibility during all such operations because of the high mountains and the associated turbulence in the area.[126]

On 3 December, General Howell M. Estes, Jr., the MATS Commander, flew on a C-130E (62-1828) to McMurdo Sound as part of his tour of MATS Pacific operations. His brief trip to observe the airlift operation made him the highest ranking military officer to date to visit Antarctica.[127]

With two weather-related exceptions, DEEP FREEZE 65 occurred efficiently, with the 1501 ATW flying all 36 planned missions (Photo 29). In addition to normal supplies, the C-130s also delivered the parts of a seawater distillation system to McMurdo Sound. Previously, personnel at McMurdo relied on "snow mining" for their water requirements. At the beginning of the operation, 14 October, the wing's ice operations officer, Major Donald P. Wegner, declared McMurdo Sound's ice runway unacceptable because of several cracks in the runway--most were 12 to 14 inches wide and, in some places, 40 feet deep.

The worst one ran 3,000 feet down the center of the runway. Despite temperatures of -30 degrees Fahrenheit, Navy engineers made repairs a priority, and operations began on the 18th. A late-season snowstorm started on 5 December. The storm, accompanied by high winds, caused whiteout conditions until the 11th and deposited 10 feet of snow on the ice runway. Faced with only five scheduled missions remaining, Colonel Coffee agreed to keep the deployment in place until all missions were completed. As soon as the weather allowed, Navy engineers cleared the runway, and operations began again on the 14th. By doubling flights each day, the 1501 ATW completed the mission only two days behind schedule.[128]

Photo 29: A2C Edward J. Rippentrop used the quickest means of transportation to tote a carton of tools across the ice runway to his sled after working on a C-130E. (circa November 1964)

The 1501 ATW aircrews emphasized a deficiency in the Arctic training they received prior to deployment to DEEP FREEZE. The Arctic training at Eielson Air Force Base, Alaska, provided excellent cold weather training, but did not encompass all of the elements that could be expected in the Antarctic. A crash in the Antarctic would be between an elevation of 5,000 and 10,000 feet and would offer none of the flora or fauna available in the Alaska training area. They also noted the training should include use of the primus stoves (that burned JP-4 aviation fuel) to familiarize crews with the equipment. These

new primus stoves were part of a newly redesigned survival kit packed only with items specifically appropriate for Antarctica.[129]

In 1964, the Department of the Interior recognized a member of the MATS staff. A list of 25 newly named glaciers, mountains, peaks, beaches, and bays included Loftus Glacier. The glacier was named after Master Chief Journalist Leo G. Loftus, US Navy, assigned to the MATS Public Information Division. Chief Loftus had served three seasons as a member of the Task Force Commander's Staff and traveled extensively in Antarctica. During DEEP FREEZE 65, Loftus accompanied the Air Force Task Unit.[130]

For DEEP FREEZE 66, MATS again assigned the mission to the 1501 ATW. However, MATS tasked one C-130E, two aircrews, and a couple of support personnel from its Naval Air Transport Wing, Pacific (NATWP), stationed at Moffett Field Naval Air Station, California. MATS tasked this crew in preparation for the NATWP to lead DEEP FREEZE 67. After DEEP FREEZE 66, the units at Travis planned to focus on bedding down the new C-141 Starlifter aircraft.[131]

Photo 30: Squadron Leader John J. Gordon, Royal New Zealand Air Force, points out similarities between his C-130 and that of his guest, Maj John H. Hallecy. (circa 29 October 1965)

Preparation for DEEP FREEZE 66 followed the standard pattern of site visits, Navy-Air Force planning meetings, and training. Since Christchurch now served as a forward supply point, the 1501 ATW left a lot of equipment, such as the special survival kits, behind at the end of DEEP FREEZE 65. They did return equipment with a shelf-life, time change, or in need of repair to Travis for disposition. As part of the survival training, Alaskan Air Command developed a Special Sea Ice Survival class. Key personnel of the Air Force Task Unit attended this training on the open Arctic ice offshore of Barter Island in April 1965.[132]

During the deployment phase, a recently assigned 1501 ATW C-141

(tail number 64-0623) delivered the bulk of the Air Force Task Force Unit's personnel. The C-141 arrived on 25 October. An estimated 10,000 New Zealanders came out to Harewood Aerodrome to view this new all-jet transport aircraft. Also on 25 October, a New Zealand C-130 took off with the US Air Force operations officer, Major John H. Hallecy, to inspect the runway at McMurdo Sound. This aircraft, however, returned to New Zealand with a maintenance problem. After repairs, it took off again on 27 October with Major Hallecy aboard, becoming the first Royal New Zealand Air Force C-130 flight to Antarctica (Photo 30). Although the Navy engineers were not finished, the operations officer declared the runway suitable at 7,000 feet long and 250 feet wide. By the third mission, the engineers had completed the total runway at 10,000 feet by 300 feet.[133]

Although planned as a much smaller airlift operation than in previous years, the Air Force Task Unit experienced numerous problems with equipment and runway conditions. Looking back on the deployment, Colonel Coffee, the commander for the second year, reported:

> The fact that our operation was an outstanding one is a tribute to the men of the Task Unit. Their technical skill and esprit de corps were unmatched. Complex radars, communications, and navigation equipment were rebuilt due to a lack of spares with the simple thought: "We need this gear, so let's fix it!" The rule of expecting the unexpected and preparing for the worst again proved out.[134]

Weather was anything but cooperative. Three missions air-aborted back to New Zealand because of weather at McMurdo Sound and had to be rescheduled. Of the 15 C-130 missions to Antarctica, 12 landed in whiteout and near-whiteout conditions.* A miscommunication during these near-whiteout conditions resulted in several aircraft taking off from a taxiway. On 15 November, one aircraft (62-1848) waited on McMurdo Sound's runway for whiteout conditions to lessen. Although only marginally better and meeting visibility minimums, the tower cleared the flight. As the aircraft rolled forward, it strayed left of the centerline and finally stopped in about 3 feet of snow 1,500 feet from where it started. Investigators ascribed the incident to unreported irregularities in the runway and poor visibility. Maintainers staying at McMurdo Sound spent 123 man-hours on repairs before the aircraft could return to New Zealand on 20 November. A snowstorm on 28 November closed the airfield for five days and set back the completion of the airlift by four days.[135]

Those members of the NATWP participating in DEEP FREEZE 66 took what they had learned back to others in their unit to prepare for DEEP FREEZE 67. Once again, preparations included meetings, thorough planning, and training (the open sea ice survival training was not available this year). This time, though, the Military Airlift Command

*Most of these missions had passed the PSR before the weather conditions deteriorated.

(MAC)* agreed to send two C-130s from Moffett Field Naval Air Station. According to schedule, one C-130 returned early, leaving one aircraft for the last four weeks of the operation. This only created a problem when the Navy's VXE-6 Squadron unexpectedly asked the remaining C-130 to pull some of the search and rescue alerts above 60 degrees South latitude. With careful coordination, Lieutenant Commander Frank A. Achille, the Task Unit Commander, was willing to do this, but obviously the unit could not fly turn-around missions and stand alert with the same aircraft at the same time.[136]

Weather cooperated more this year with only one C-130 mission held up at McMurdo Sound for 17 hours because of winds in excess of 60 knots. The Navy took advantage of the weather break and initiated several improvements to the airfield layout. Engineers improved the runway definition by adding additional barrels, black fabric panels as threshold and runway distance markers, and a depth flash optical landing system.[137]

Photo 31: Unloading the first C-141 to land at McMurdo Sound, Antarctica, on 14 November 1966.

*MATS redesignated as MAC on 1 January 1966 to better reflect its status as a major command and its assigned mission. Most of MAC's subordinate units also redesignated.

The first redeploying aircraft (63-7814) flew the "Penguin Express" on 4 November, transporting 44 Adelie and 3 Emperor penguins for the National Science Foundation. In this mission, maintainers rigged the C-130 cargo compartment to stay below 50 degrees Fahrenheit throughout the 12,000-mile, 42-hour flight from McMurdo Sound to LaGuardia Field, New York. To ensure the success of the mission, arrangements had been made well in advance for ground refrigeration units, fresh aircrews, and pre-approved customs clearances at en route stops at Christchurch, Fiji, Hawaii, and Moffett Field Naval Air Station. All 47 penguins, plus a bonus of two Adelie eggs, arrived safely.[138]

A trial run of the C-141 represented the other highlight of DEEP FREEZE 67. The 60th Military Airlift Wing (MAW) stationed at Travis Air Force Base deployed a C-141A (65-0229) to Christchurch in early November, with a plan to fly two missions to McMurdo Sound. On 11 November, Captain Howard Geddes took the partially loaded C-141 (12.9 tons and 28 passengers) to Antarctica. Although he flew over McMurdo Sound on that day, heavy crosswinds prevented a landing. The C-141 easily returned to New Zealand--the entire mission took 10 hours and 20 minutes, the "fastest flight time ever made by an aircraft on a round-robin flight between New Zealand and McMurdo."[139] Captain Geddes' second, and successful, attempt to land at McMurdo Sound occurred on the 14th, with the C-141 only using 4,000 feet of the 10,000-foot runway (Photo 31). One of the passengers, Rear Admiral Fred E. Bakutis, Commander Task Force 43,* described the flight as smooth, with ideal weather conditions. The flight proved the C-141 could handle the mission with only minor adaptations and relevant changes to current operational guidelines.[140]

Planners scaled back the airlift of DEEP FREEZE 68 in virtually every detail. MAC tasked the 438 MAW of McGuire Air Force Base, New Jersey, to send two C-130Es to Christchurch in October to fly 10 scheduled turn-around missions to McMurdo Sound. Alternating days, these two aircraft completed the operation with six missions in six days.

The exception to the reduced airlift was that units of the Twenty-First Air Force supported the deployment and redeployment of Navy units to Christchurch from September 1967 to February 1968. Aircraft used included C-141s, C-130s, and contract DC-8s. The last C-124 to visit Antarctica arrived in October. This aircraft of the 436 MAW from Dover Air Force Base, Delaware, (Photo 32) airlifted two US Army UH-1D helicopters, associated equipment (19,000 pounds total), and two passengers from Langley Air Force Base, Virginia, to McMurdo Sound.[141]

By the time DEEP FREEZE 69 started, the C-141 Starlifter took over as the airlift operation's workhorse.** From DEEP FREEZE 69 to DEEP FREEZE 74, units of MAC's Twenty-First Air Force on the United States' east coast shared the mission. During this period, MAC assigned the mission to Twenty-First Air Force because most of the onloads and offloads originated at Quonset Point Naval Air Station, Rhode Island. Assigning the mission to Twenty-Second Air Force on the west coast would have added approximately

*Admiral Bakutis took over from Admiral Reedy during DEEP FREEZE 66.

**This resulted not only because of the C-141's increased payload and delivery speed, but also because all of MAC's C-130s transferred to the Tactical Air Command which focused them on theater airlift missions.

228 non-productive flying hours per year just to position the aircraft from west coast bases to Rhode Island. By DEEP FREEZE 75, the Navy switched the primary origination point to Point Mugu Naval Air Station, California, and Twenty-Second Air Force's 60 MAW at Travis Air Force Base took over the DEEP FREEZE airlift mission.[142]

Photo 32: The last MAC C-124 to visit McMurdo Sound, Antarctica, sets on the ice.

CHAPTER 6

OF WEATHER, COMMUNICATIONS, AND OTHER CONCERNS

Through the years, McMurdo Sound Station continued to grow (Photo 33). With the cessation of airdrops during DEEP FREEZE 64, Navy C-130BL aircraft transported most of the supplies and equipment to the various remote stations. Beginning with DEEP FREEZE 62, the US Army agreed to temporarily supply UH-1 Iroquois helicopters to help sustain the remote sites. The US Army Aviation Detachment (Antarctica Support) proved so successful that the program lasted until DEEP FREEZE 69. During this period, the US Air Force airlift delivered several of these helicopters. Because of the performance of the UH-1's turbine engine in the Antarctic environment, the Navy's VXE-6 Squadron converted to the Iroquois as well.* In addition to supporting their own country's base, New Zealand C-130s supported US Antarctic airlift needs and provided search and rescue operations for the

Photo 33: "Main Street" McMurdo Sound Station, Antarctica, circa 1965.

*The VXE-6 squadron found the UH-1N with its twin-engine configuration and higher altitude capability especially safe and versatile in Antarctica.

northern half of the route to Antarctica. The British Royal Air Force began flying C-130 missions to Antarctica during DEEP FREEZE 73. In that first year alone (26 November to 15 December 1972), British C-130s flew 20 round-robin missions transporting 242 passengers and 207.9 tons of cargo for Task Force 43 and New Zealand operations. That same year (13 November to 7 December), the Royal New Zealand Air Force C-130Hs flew 10 missions, delivering 183 passengers and 101.1 tons of cargo.[143]

By DEEP FREEZE 82, the US Air Force's airlift mission success relied on several agencies providing critical support. While the US Air Force operated the aircraft and deployed personnel to augment the maintenance, logistics, and aerial port services of its

Photo 34: A C-124 takes off for an airdrop mission to the South Pole during DEEP FREEZE II. Note the sastrugi (wavelike ridges of hard snow formed by the wind) in the foreground.

permanent operating location in Christchurch, New Zealand, the US Navy still served as the executive agency and provided facilities, weather forecasting, and administrative services. The US Army managed all logistical movement, including land, sea, and air, to the Antarctic. The Royal New Zealand Air Force provided cargo and passenger specialists to assist aerial port operations, and the Royal New Zealand Army operated the cargo marshalling yard.[144]

Even with all the international and interagency support, weather and communications remained the most challenging aspects of the mission. A US Navy Welcome Guide from the 1960s noted, "Everybody knows one thing about Antarctic weather - it is cold. In fact, Antarctica is the coldest area in the world, on the average, about 30 degrees colder than the Arctic. The lowest surface temperature ever recorded, 126.9 degrees below zero Fahrenheit, was reported in 1960 by Russian scientists high on the polar plateau."[145] Winter lows at McMurdo Sound reached down as low as -59 degrees Fahrenheit, while summer highs could reach the 40 degree mark, but usually hovered around the freezing point.

Precipitation in Antarctica was actually quite low. Most blizzards consisted of snow blowing across the ground. Winds were usually quite strong, blowing off the polar plateau. They sometimes reached a hundred miles an hour and created hardened ripples in the snowscape known as sastrugi (Photo 34).* This wind often continued out over the water until it met the Southern Hemisphere's prevailing easterly winds. Weather forecasters found these winds difficult to predict and noted that they created a climate dangerous for men on the ground and often treacherous for those in the air.[146]

In most cases, aircrews found the whiteout conditions the worst situation to face. As an aircrew information brochure from 1983 stated, whiteouts did not always happen during windy conditions, but always presented a significant danger to aircrews:

> Whiteout, a polar atmospheric phenomenon resulting in loss of depth perception, remains the most hazardous weather problem for pilots--when large unbroken expanses of snow, illuminated by a sky overcast with dense low stratus clouds, blots out all trace of surface, texture, or shadow. The merged hollows and snow-covered objects with flattened white color cause loss of horizon discrimination, and the face of the ground disappears. Whiteouts, not necessarily associated with fog or blowing snow, happen just as easily in a crystal-clear environment or under a cloud ceiling with ample comfortable light. Diffused light results in a white shadowless effect.[147]

The brochure went on to point out that McMurdo Sound (Photo 35) offered another potential illusion since the airfield was on the ice shelf, while the station sat on the hillside of Ross Island:

*Sastrugi are very similar to sand ripples found on a windy beach or in a desert; however, they are often much larger.

Photo 35: McMurdo Sound, Antarctica, circa 1966, depicts a cold and isolated atmosphere for the Antarctic scientific exploration. In the background is Mount Erebus, the only consistently active volcano in Antarctica.

> Difficulty in assessing the condition of terrain is a particular problem for pilots in snow or ice landing. They cannot be avoided because they are not visible. The illusion of contrast traps the pilot when he sights dark-colored rocks or ridges above the snow. It may give the impression that good contrast conditions exist, resulting in a landing attempt on unsuitable terrain. Loss of distance judgment makes it difficult to estimate whether a perceived hill is in fact a distant hill or a small protusion [*sic*.] a few feet away. Loss of height perception is one of the most critical effects of a whiteout.[148]

Weather forecasters of the US Navy supported the missions between New Zealand and Antarctica, as well as those internal to the Antarctic continent. Of course, they received help from New Zealand's Weather Services and deployed US Air Force weather forecasters. The Christchurch "DEEP FREEZE" weather office consisted of two forecasters, one assistant forecaster, and three or four observers during each shift. This team continually monitored the weather between New Zealand and Antarctica, briefing and providing warning reports to the staff daily. All flight crews received a weather briefing approximately two hours before mission departure. Most of the forecasters and observers also rotated to McMurdo

Sound for 10 days of operations there. In 1971, Headquarters Military Airlift Command (MAC) drew attention to the lack of Antarctic weather information in normal weather reports and tasked the deployed weather personnel to keep the MAC command post informed of weather conditions and any mission impacts. MAC made this request in order to start building empirical data on the effects of Antarctic weather on airlift operations.[149]

Despite the hard work of these forecasters and observers, aircrews often found the weather could change very abruptly. They, therefore, did several things to compensate for such erratic weather. One of the most important for each and every mission from New Zealand to Antarctica was to calculate the point of safe return (PSR), that spot where the aircrew could return to Christchurch with the desired fuel reserve (see Figure 2). After passing the PSR, the aircrew was committed to the final destination even if the weather turned dreadful. While various factors, including cargo load and winds, influenced a particular mission's PSR location, the aircrew used a relatively straightforward mathematical formula to determine the radius of action (the maximum elapsed time an aircraft can fly outbound) and the PSR:

FIGURE 2
Point of Safe Return Calculation

$$\frac{GS1 + GS2}{T} = \frac{GS2}{PSR} \quad \text{or PSR} = \frac{(T)\,(GS2)}{(GS1) + (GS2)}$$

Where GS1 = ground speed out; GS2 = ground speed back;
T = fuel available; PSR = time to turn. [150]

Using mission planning data, the aircrew figured the PSR as part of the pre-mission sequence. Once airborne, aircrew refigured the PSR using winds and fuel consumption data they were actually experiencing. At approximately 3.5 hours into the flight, the flight engineer recalculated the aircraft's exact burn rate since takeoff. This data was then compared to the PSR calculations. If it did not match up, the PSR was calculated a third time. By keeping a close eye on the PSR and projected weather conditions (including all pressure ridge indications of continued good weather), the Air Force Task Unit commander could trade fuel for cargo, thus moving the PSR further from McMurdo, but potentially increasing the airlift's productivity.[151]

By the mid 1980s, one variation usually occurred to the PSR equation. The first mission carried no cargo in order to increase the fuel load. This mission's objective was to overfly the airfield at McMurdo Sound and return to Christchurch. This overflight was used to verify communications and the ice runway's navigation aids. In 1985, a C-141 aircrew attempted to land with the weather at minimums. The aircrew never saw the runway and returned to Christchurch, landing after an 11-hour flight. Later investigation revealed the radar equipment was 180 degrees off from the published approach.[152]

Photo 36: Maj Vinnie Wilson (navigator) plots a flight course in an LC-130 on 17 November 2004. (Photo from the National Science Foundation)

Aircrews had to consider another navigation factor in flying to and around Antarctica. Navigation equipment and compasses that relied on magnetism were notoriously unreliable in the Polar Regions because of the frequent weak directives and magnetic storms. For example, the aircrews quickly discovered the need to limit heading changes. If the pilot attempted to keep the course deviation indicator centered, each little turn caused the aircraft's gyros to become more erratic.[153] Additionally conventional navigation relied on latitude and longitude lines. However, south of 60 degrees south latitude these lines formed rectangles that become more elongated as they approach the pole. Thus, for example, a direct flight from McMurdo Station to the Russian Vostok base (near the Geomagnetic South Pole at the Pole of Inaccessibility) would start at a 240-

Figure 3

Antarctic Grid Navigation System

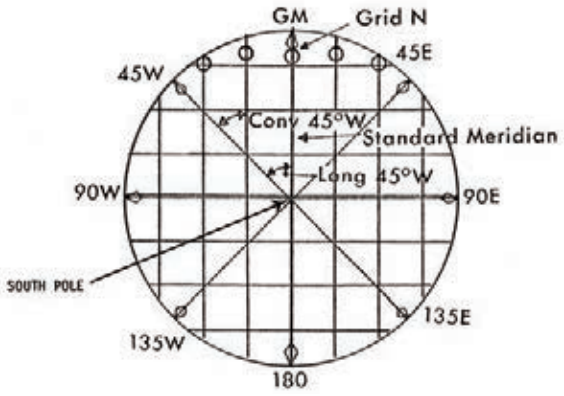


Figure 4
Grid Course Conversion Calculation

True Course + Longitude East = Grid Course
True Course - Longitude West = Grid Course

Note: This convergence relationship only applies to the polar grid.[157]

degree true heading and end at a 300-degree true heading, without making a single turn.[154] As one journalist put it, "The old joke among Antarctic navigators is that finding the pole is easy--just head south; the problem is knowing 'which north to take to get back home.'"[155]

To compensate, aircrews relied on older, but still reliable, methods such as hourly sextant readings and dead reckoning. Landmarks, in particular Mount Erebus, an active volcano at the edge of McMurdo Sound, provided an important navigational aid. Navigators also used a grid technique that simulated latitude and longitude lines at the equator (Photo 36). They assigned the Greenwich Meridian as the arbitrary Grid North, with the 180 degrees Meridian representing South, 90 degrees East Meridian signifying East, and 90 degrees West Meridian standing for West (Figure 3). With this method, a true course could be converted to a grid course with little thought because the true latitudes would be greater than 60 degrees (see Figure 4).[156]

Most aircrews found the C-141s performed well on the missions. In fact, the cold temperatures, combined with the often light loads, meant the C-141 could achieve a rate of climb of 5,000 to 6,000 feet per minute when leaving McMurdo Sound. The drawback was the aircraft's Doppler radar system would not always receive a lock-on with such a nose-up climb. If the system failed to achieve a lock-on during take off, the aircrew usually lost the use of the Doppler the entire route back to Christchurch. To limit this, pilots normally moderated the climb-out during takeoffs.[158]

Because of the inherent dangers, each aircraft also carried a basic survival kit. Beginning with DEEP FREEZE 65, these kits were designed especially for Antarctic operations. Each kit was equipped for 10 men (see Table 1), and with passengers, most carried a supplemental 10-man kit (see Table 2). The Air Force Task Unit placed the basic kit in a 1/2-inch plywood box (10.2 cubic feet in volume) painted a deep orange and the supplemental kit in a 1/2-inch plywood box (6.5 cubic feet) painted lavender. Small adjustments to the survival kits continued in subsequent phases. For example, in DEEP FREEZE 66, they added beacons, lights, and tissues. From the initial kits, the aircrews particularly noted the improvements in the survival kits' new MC-1 sleeping bags. These bags weighed only 6.5 pounds and took up half the space of the sleeping bags previously used.[159]

TABLE 1

COMPONENTS OF 10-MAN BASIC SURVIVAL KIT

Contained in a 1/2-inch plywood box (20 inches x 40 inches x 22 inches) painted deep orange.

ITEM	QUANTITY
MC-1 Sleeping Bags w/Case	10
Rations, Part 1 and 2	10
Axe	1
Shovels	2
Rope, Nylon 120 feet	2
Siphon Hose 20 feet	1
Survival Manuals 64-5	4
Fishing Kits	5
Saws, Survival Ice	2
Candles	35
Sterno Stoves	10
Sterno, Large Cans	20
Sterno, Small Cans	10
Heat Tabs, Boxes	20
Parachute Canopies	3
Nylon Cord Spool #3 Cord	1
Pocket Knives	10
Water Bags, 3-pint	10
Primus Stoves, JP-4 Burning	2
Individual First Aid Kits	10
Mirrors	10
Sun Ointment, Cans	10
Match Cases	30
Matches, Strike Anywhere	600
Razors	10
Goggles, Sun, Folding	10
Whistles	10
File, 6-Inch	2
NCR Beacon	1
Ice Creepers	4
Tents, Barren Land	2

SOURCE: Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, “Final Report: DEEP FREEZE 65,” n.d.

TABLE 2

COMPONENTS OF SUPPLEMENTAL SURVIVAL KIT

Contained in a 1/2-inch plywood box (20 inches x 40 inches x 14 inches) painted lavender.

ITEM	QUANTITY
MC-1 Sleeping Bags w/Case	10
Rations, Part 1 and 2	10
Individual First Aid Kits	10
Match Cases	10
Matches, Strike Anywhere	200
Water Bags	10
Sun Ointment, Cans	10
Whistles	10
Candles	10
Goggles, Sun, Folding	10
Razors	10
Stoves, Primus	2
Mirrors	10
Shovels	2
Axe	1
Saws, Survival Ice	2
Tents, Barren Land	2

SOURCE: Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 65," n.d.

Navy engineers also worked to improve the ice runway at McMurdo Sound. By DEEP FREEZE 66, they had expanded the runway to 10,000 by 300 feet,* with proportional expansions to taxiways and the aircraft parking area (Photo 37). Additionally, DEEP FREEZE 66 was the first year strobe lights marked the runway's ends. Over time, the Navy engineers added black fabric panels and runway distance markers to enhance the runway's definition. They also added updated equipment as it became available, such as a depth flash optical landing system and advanced radars. In 1980, the Navy turned over most of the runway construction and maintenance to Antarctic Services Inc., a contractor of the National Science Foundation. In 1990, the National Science Foundation began contracting runway maintenance with the Antarctic Support Associates contracting firm and in 2001 with the Raytheon Polar Services Company. As the Navy engineers had done, these companies worked to keep the runway and skiways clear and smooth. Of course,

*While 10,000 feet remained the goal, they did not reach that each year. Aircrews for DEEP FREEZE 70 operated on a 7,000 foot runway.

Photo 37: An aerial view of the ice runway and parking area at McMurdo Sound, Antarctica, circa 1970.

this often meant constructing a new runway when the ice broke off and carried the old one out to sea. They also coordinated closely with the Air Force to improve navigation and communication systems.[160]

As a general rule, the portion of the McMurdo Sound ice shelf, on which the runway was constructed, was 80 to 95 inches thick. Naturally, this ice shelf became thinner and/or soft and slushy over the summer season, but continued to be thick enough to support the C-141's weight well into December, and sometimes even longer. As long as the runway remained clear of snow, the C-141 performed well. Just prior to departing for DEEP FREEZE 72, Lieutenant Colonel William W. Hewitt, the USAF Mission Commander, described it this way:

> Landing on the ice is not a very difficult proposition…in fact, those ice runways are among the best around. Porous, ground ice lends much traction to the landing Starlifters. Our biggest problems will be poor communications and the unpredictable weather.[161]

Although improvements continued to be made, communications problems continued to plague the operation. During DEEP FREEZE 67, Air Force communications specialists found a way to improve air-to-ground communication at McMurdo Sound. The normal fixed ultra-high frequency (UHF) equipment was impractical because of its size and power requirements. Using Motorola HT-200 "handie-talkie" radios on dry alkaline batteries, they soon discovered the McMurdo Sound operations officer could contact the aircraft 35 miles away. These radios ensured positive communications and thus enhanced operational safety, but required a Task Force 43 waiver because of their fixed high frequency.[162]

Communications equipment continued to improve, including the addition of a limited satellite capability. However, solar and magnetic fluxes still created periods of communications blackout. Most such interruptions were short in duration, but some lasted several days. For instance, a solar disturbance during DEEP FREEZE 69 shut down communications between McMurdo Sound and Christchurch on 31 October 1968. By 3 November, minimal communications were established, and an aircraft launched on a turn-around mission. Just over half-way through the flight, the aircraft completely lost communications with DEEP FREEZE Control at McMurdo Sound for a brief period. Concern quickly arose that DEEP FREEZE Control would initiate a search and rescue effort, but an "in-the-blind" transmission told the ground control the aircraft was not in distress. Since both Rear Admiral J. C. Abbot, Jr., Commander, Task Force 43,* and Lieutenant Colonel Robert C. Huf, Air Force Mission Commander, were on the ice awaiting this aircraft, they set a new policy: an aircraft would not leave one high-frequency control area to enter another until definite contact had been established.[163]

To the extent possible, communications in Antarctica met International Civil Aviation Organization standards. However, the more reliable communications continued to be high frequency and satellite. In general, the greatest impact of any existing communications trouble was to slow operations. By the 1980s and later, it presented more of an aggravation than a serious problem as aircrews and mission planners sought immediate information on McMurdo Sound's weather and runway conditions.[164]

As noted earlier, the Air Force designated Christchurch as a forward supply point in 1965. This allowed the units to leave in place critical equipment and supplies rather than to transport them each year. By 1996, the Air Mobility Command and the 60th Air Mobility Wing (AMW) had sifted this prepositioned equipment list down to a fairly easily manageable set of vehicles and aircraft generation equipment (see Table 3). That same year, as an example, the 60 AMW brought in its own critical maintenance equipment and parts (see Table 4).[165]

*Admiral Abbot became the Commander, Naval Support Force, Antarctica and Task Force 43, in February 1967.

TABLE 3

PREPOSITIONED EQUIPMENT, 1996

ITEM	QUANTITY
Vehicles	
Warehouse Tractor	1
6 Passenger 4X2 Truck	2
Step Van	1
U-30 Tow Tractor	1
Aircraft Generation Equipment	
NF-2 Flood Light	1
MA1A Gas Turbine	1
Tow Bar, C-141	1
B-1 Maintenance Stand	1
B-4 Maintenance Stand	1
Fire Extinguisher, 150 lb*	3
A/M 32-86 Maintenance Kit	2
Ice Tool Box	1

*Provided by Christchurch Airport Fire Department.

SOURCE: Operations Order, AMC Director of Operations, "AMC OPORD-03-97 Operation DEEP FREEZE," 20 Jul 96.

TABLE 4

MAINTENANCE EQUIPMENT DEPLOYED, 1996

Vehicles

ITEM	QUANTITY
C-141/C-5 Mobility Readiness Spares or Mission Support Kit	As required
Wheel/Tires for C-5 and C-141	1 set
C-141 Aircraft Generation Kit	1 each
C-141 Aircraft Tow Bar	1 each
C-141 Pallet Jack w/40-ton jack and tire change kit	1 each
C-141 Engine Oil (MIL-L-23699)	10 cases
Hydraulic Fluid (MIL-H-83282)	10 cases
C-5 Aircraft Tow Bar (collapsible)	1 each
C-5 Aircraft Generation Kit	1 each
35-ton Axle Jack	1 each
C-5 Engine Oil (MIL-L-7808)	1 case
Nitrogen Servicing Cart	1 each
Liquid Oxygen Servicing Cart	1 each
B-5 Maintenance Stand	1 each
Electronics Maintenance Package	1 each

SOURCE: Operations Order, AMC Director of Operations, "AMC OPORD-03-97 Operation DEEP FREEZE," 20 Jul 96.

Photo 38: A portable control tower, radar, and communications unit sets on the ice during DEEP FREEZE 89.

Despite many advances, working near McMurdo Sound's ice runway remained a cold and difficult proposition. Because of the frequent mid-summer breakage of the ice around the runway, personnel placed a small control tower, warming facilities, and navigation radars on sleds (Photo 38). These could be pulled out and set up just before operations began and then moved back to McMurdo Sound Station by early January. Whenever possible, maintenance was performed at Christchurch. At McMurdo Sound, maintenance work was generally performed in the cold. For major work, two maintenance crews worked on the aircraft--swapping between the warming huts and aircraft frequently. Even with heaters blowing warm air on exposed hands and work areas, maintainers could only spend a limited time working on the aircraft. During DEEP FREEZE 81, one aircraft required major repairs and maintainers rigged a parachute shelter around the aircraft (Photo 39).

A lot of the work at McMurdo Sound involved the landing gear and the associated hydraulics. The extreme cold seemed to affect these the hardest. The nose skis of the LC-130s (both the Navy and Air Force used these later in the operation) proved sensitive to the cold and stress of the heavy loads often demanded of them--although one advantage they offered was having no aircraft tie-down points. Friction heated up the skis on landing and taxiing. Once stopped, the melted ice quickly reformed around the skis, holding the aircraft firmly in place even in a strong wind. To break this bond, the pilot simply raised the aircraft's wheels.[166]

The numerous difficulties experienced often required waivers to standard policies and procedures. For example, an aircrew performed a three-engine C-141 take-off from McMurdo Sound during DEEP FREEZE 72. Normally, Headquarters MAC served as the approval authority for such waivers. In this case, normal command and control communications through Travis Air Force Base, California, turned out to be impossible. To avoid leaving a C-141 parked on the ice for an extended period at a time when the weather was proving highly unpredictable, the USAF Mission Commander granted the non-standard launch. The transient maintenance at McMurdo Sound was not robust enough for an engine change, and an overexposure to the cold sometimes caused other problems for the aircraft. As a follow up to this incident, the Mission Commander strongly recommended developing general MAC policy guidance for such instances.[167]

Despite these numerous challenges, the C-141 proved quite capable in the Antarctic environment. For the first several C-141 seasons, the operations were reduced for a couple of reasons. The overall budget remained tight, but more importantly, need for construction material and equipment was far less than it once was--it had become primarily a resupply and personnel rotation mission. Additionally, the C-141's load capacity meant fewer trips were required to meet the same airlift need.

Photo 39: A heated parachute shelter provided a shirt-sleeve environment for maintainers to work on a C-141 engine. (11 October 1980)

CHAPTER 7

STARLIFTERS ON ICE (1968-1979)

The 438th Military Airlift Wing (MAW), McGuire Air Force Base, New Jersey, the last wing to deploy C-130Es to support Operation DEEP FREEZE round-robin missions, was also the first to send C-141s. During DEEP FREEZE 69, the Air Force portion of the mission again remained fairly small with only six round-robin missions programmed. The Air Force's role in the summer season deployment and redeployment, however, remained quite significant with 27 missions (23 C-141, 2 C-124, and 2 DC-8) airlifting some 2,125 passengers and 67 tons of cargo between the US and Christchurch, New Zealand. These missions occurred between October 1968 and March 1969.[168]

The 438 MAW deployed two C-141s to Christchurch in late October 1968. These two aircraft began operations shortly afterwards, with the round-robin operations beginning on the 29th. This first C-141 mission set a new record time, arriving at McMurdo Sound in 4 hours and 57 minutes.* Weather at McMurdo Sound delayed the second mission until the 31st, and a communications blackout stopped all subsequent missions until 3 November. During the fourth shuttle mission, Lieutenant Colonel Robert C. Huf, the Air Force Mission Commander, was told there was a significant increase in the priority cargo the C-141s were to deliver. To keep costs controllable, Colonel Huf elected to fly two additional missions, with the last three missions flying a 10,000-pound increased cargo load. This meant 10,000 pounds less fuel and a new point of safe return (PSR) 20 minutes short of McMurdo Sound.** Planners considered this figure was within a safe range for monitoring shifting wind and weather conditions.

As a general rule, the maintainers and loaders prepared one aircraft as the mission aircraft for the next day and quickly turned the second aircraft as a backup. Blowing wind again closed McMurdo Sound prior to the sixth mission. The next day, the weather-delayed mission launched based on reports of good weather and a promise to clear the snow from the runway before the aircraft arrived. The seventh mission launched three hours later to make up for the delays. When the aircraft arrived, ground crews had only cleared the sides of the ice runway. The barrels used to mark the runway precluded the aircraft from landing on the sides. Both aircraft landed on the snow-covered runway and then returned to Christchurch for repairs. Both suffered damage to the forward gear pods, and one aircraft's anti-skid junction box had dislocated.*** The final mission occurred without incident, and the C-141s and associated personnel returned to New Jersey by 15 November.[169]

---

*Also of note, C-141 unloading time at McMurdo Sound averaged 2 hours and 15 minutes.

**Planners set the threshold of a typical C-141A mission to McMurdo Sound at a 40,000-pound cargo load, 10 passengers, and 140,000 pounds of fuel. This configuration placed the PSR approximately 20 minutes beyond McMurdo Sound.

***Future deployments operated with a 1.5-inch snow limit on the runway.

As part of the summer season's deployment and redeployment, another 438 MAW C-141 transported a shipment of Antarctic animals. On 28 November, this aircraft (tail number 67-0010) flew from McGuire to Quonset Point, Rhode Island, to pick up 13 tons of cargo bound for McMurdo Sound. It then proceeded to Antarctica, with stops at Travis Air Force Base, California; Hickam Air Force Base, Hawaii; and Christchurch. At McMurdo Sound, ground crews rigged the C-141 to maintain a cabin temperature of 40 degrees Fahrenheit or less and loaded the aircraft with 48 Adelie penguins, 30 Emperor penguins, 30 Skua seagulls, 4 seal pups, and 112 passengers (including three zoo officials, several scientists, and Dr. R. L. Penny, a researcher with the New York Zoology Society). This C-141 then returned to the US using positioned stage crews at Christchurch and Hickam Air Force Base. The mission successfully delivered the live animals, without any losses, to San Diego, California; Grand Forks, North Dakota; Scott Air Force Base, Illinois; and Andrews Air Force Base, Maryland.[170]

For DEEP FREEZE 70, the Military Airlift Command (MAC) again selected the 438 MAW for the shuttle missions. The wing sent two C-141 aircraft, this time both were equipped with the all weather landing system (AWLS), an instrument landing system designed to assist the pilot during reduced visibility landings. Two non-AWLS-equipped aircraft participated in the previous year. The deployment included only one aircraft commander qualified with previous Antarctic experience. By doubling up pilots on the first few missions, the other seven pilots quickly received ice takeoff and landing qualification.[171]

Weather again caused several delays in the shuttle missions, and by 10 November, the date originally planned for mission completion, the round-robins were 13 days behind. At that point, Lieutenant Colonel Buford E. Stovall, USAF Mission Commander, changed the schedule. The plan called for the two aircraft to fly every other day. Colonel Stovall accelerated this to four missions in a three-day period. By 17 November, the unit completed 12 missions (Photo 40) for a total of 15 round-robins before heading home. All in all, Colonel Stovall considered the operation a complete success and fully credited the accomplishment to the C-141 and all personnel associated with Operation DEEP FREEZE 70:

> Several mission takeoff times were adjusted to accommodate Admiral Welch, Commander, Task Force Forty Three,* his operational staff, DVs, and members of TV and press personnel from the USA. These individuals did not hesitate to express their desire to fly in the C-141 and were obviously impressed with the aircraft performance. All personnel participating in DEEP FREEZE 70 should be highly commended for an outstanding performance. This includes the 438th Military Airlift Wing aircrews, load planners,

*Rear Admiral David F. Welch became the Commander, Naval Support Force, Antarctica and Task Force 43, in 1969.

> maintenance support personnel, and also the support personnel of OL-5 [operating location] at Christchurch. Finally, I must express on behalf of MAC, our sincere appreciation for the overall assistance and the extremely cooperative attitude displayed continuously by the Navy personnel involved with this operation.[172]

Once again, Twenty-First Air Force units also flew deployment and redeployment missions from the US (principally Quonset Point, Rhode Island) and Christchurch. C-141s flew most of the 23 missions, but MAC contracted two commercial DC-8s as well. On 25 October 1969, the 437 MAW, Charleston Air Force Base, South Carolina, flew a C-141 mission from Quonset Point to Punta Arenas, Chile, to support Navy DEEP FREEZE icebreaker operations. On 29 March 1970, the 437 MAW flew another C-141 mission to Punta Arenas to support the icebreaker redeployment.[173]

For the fourth straight year, the 438 MAW deployed two C-141s for DEEP FREEZE 71. Although weather and communication blackouts affected the mission somewhat, the aircrews completed the mission within the established schedule. For this season, mission planners intended to launch two aircraft approximately three hours apart each flying day. This allowed the C-141s to serve as search and rescue assets for each other and provided

Photo 40: Unloading a C-141 at McMurdo Sound, Antarctica.

Photo 41: A maintainer ensures the windscreen of the first and only C-133 to land in Antarctica remains free from debris and frost. (21 October 1970)

enough time for the first C-141 to depart McMurdo before the second one arrived. Two exceptions occurred in the 12 missions. On 4 November, the second aircraft air aborted for compass and radar malfunctions, but the first one continued since it was South of 70 degrees latitude. Planners scheduled a single aircraft mission near the end of the deployment to maintain the schedule.[174]

The first return trip (aircraft tail number 67-0003) served as a medical evacuation mission as the C-141 carried a sick Navy warrant officer from McMurdo Sound to Christchurch. One of the C-141s transported two Navy women to McMurdo Sound,* and another took a new salt-water distillation unit. During an orientation visit, General Jack J. Catton, MAC Commander, served as the aircraft commander of a C-141 (67-0003) flying a round-robin on 8 November. An ice-qualified pilot, Captain John Moline, and an Antarctic-qualified navigator, Captain Gerald Serine, served on his crew.[175]

For the Navy deployment and redeployment phases, C-141s flew most of the 19 missions between the US and Christchurch. Additionally, a C-133 Cargomaster from the

*These were not the first women to serve with the US National Science Foundation's Antarctic Research Program, but it was the first mention of the US Air Force airlifting any women during DEEP FREEZE. The Antarctic Research Program began allowing women to serve in Antarctica in 1968.

436 MAW, Dover Air Force Base, Delaware, departed Quonset Point on 13 October to deliver one LH-34 and two UH-1 helicopters to McMurdo Sound. This was the first and only C-133 mission to land in Antarctica (Photo 41). The C-133 arrived at McMurdo Sound on 21 October, prior to the commencement of the C-141 round-robin missions.[176]

A change in the operational concept occurred for DEEP FREEZE 72. Previously, a set number of aircraft and augmented aircrews flew the round-robin missions from Christchurch to McMurdo Sound. Now, aircraft and crews of the 438 MAW flying deployment and resupply missions from the US stayed at Christchurch and flew two to four shuttle missions to McMurdo Sound before returning to the US. Thus, the total aircraft and crews scheduled to fly the round-robin missions equaled 14, with only 1 to 3 remaining at Christchurch at any one time (see Table 5). Additionally, the 438 MAW deployed only 36 support personnel, including a command staff, to support all of the round-robin missions.[177]

Twenty-First Air Force wings flew at least 17 missions (plus three contracted commercial flights), transferring 2,862 passengers and 153.0 tons of material between the US and Christchurch. Of these, C-141s of the 438 MAW flew 14 deployment and redeployment missions. From October 1971 to January 1972, 12 of these C-141s also flew 38 round-robin missions (Photo 42), transporting 1,766 passengers and 608.0 tons of cargo between Christchurch and McMurdo Sound.* Brigadier General Keith L. Christensen, 438 MAW Commander, flew the first C-141 round-robin mission to McMurdo Sound,

Photo 42: A C-141 departs Williams Field, McMurdo Sound, Antarctica, after completing a DEEP FREEZE shuttle mission. (circa October 1971)

*The sudden increase in round-robin missions was partially attributed to construction of a new site, Simple Station, in Ellsworth Land, and continued work on the new South Pole Station complex begun the previous year. [Article, "16 McGuire Starlifters Support DEEP FREEZE 72 in Antarctica, *McGuire Airtides*, 1 Oct 71.]

with Major Malcolm Simpler supervising his ice qualification.[178] Even with the boss aboard, the crewmembers kept a characteristic friendly banter. One of the pilots reportedly commented, "Maybe we could pick up a bunch of penguins on the ice. We could use them to make up the navigator shortage." A navigator returned the jab, "Rog! At least they'd be neat…always wearing their mess dress uniforms."[179]

TABLE 5

DEEP FREEZE 72 MCMURDO SOUND SHUTTLE SCHEDULE

# Acft	Depart CONUS	Shuttle Dates	Depart NZ	Arrive CONUS
1	6 Oct 71	10-12-14 Oct	16 Oct	18 Oct
2	6 Oct 71	10-12-14-16 Oct	18 Oct	20 Oct
2	15 Oct 71	19-21-23 Oct	25 Oct	27 Oct
2	22 Oct 71	26-28-30 Oct	1 Nov	3 Nov
1	5 Nov 71	9-11-13-15 Nov	15 Nov	17 Nov
1	19 Nov 71	23-25-27 Nov	29 Nov	1 Dec
1	30 Nov 71	4-6 Dec	8 Dec	10 Dec
1	4 Dec 71	8-10 Dec	12 Dec	14 Dec
1	10 Dec 71	14-16 Dec	18 Dec	20 Dec
2	3 Jan 72	8-10 Jan	12 Jan	14 Jan

This new schedule worked well, with the exception that missions lost for weather, communications, or maintenance problems proved very difficult to make up. In particular, a storm from 10 to 18 October completely shut down McMurdo Station. The first three shuttle aircraft waited at Christchurch to complete their missions. As the storm persisted, concern soon rose over how much ramp space Christchurch had available to MAC aircraft. It turned out that Christchurch could effectively support six C-141s.[180] To avoid delaying the mission further, the next two C-141s arrived in New Zealand on the 18th. With five shuttle aircraft on the ground, the arrival of one C-141 channel mission completely saturated the ramp and support capabilities. Lieutenant Colonel William W. Hewitt, USAF Mission Commander,* reported, "All departures were made on time, however, the overlap of missions presented an almost impossible task for maintenance and support personnel."[181]

Colonel Hewitt went on to make several recommendations if this operational concept were to continue. First, the deployed element should include an additional augmented aircrew to maximize flexibility during periods of good weather. Second, planners should include provisions for changing US mission departures to accommodate prolonged periods

*Rear Admiral Leo B. McCudden became the Commander, Naval Support Force, Antarctica and Task Force 43, in 1971. Captain Alfred N. Fowler subsequently assumed command in September 1972.

of poor weather or communications blackouts. Finally, restrict, to the extent possible, mission additions or deletions after the aircraft left home station. Last-minute changes in the schedule added undue stress to the aircrews and often required waivers to flying-time limits.[182]

Photo 43: The 63 MAW airlifted Secretary of the Air Force Dr. Robert C. Seamans, Jr., and other dignitaries to McMurdo Sound. Antarctica, on 7 December 1972. Crewmembers pictured (left to right): standing, Maj Keith W. Lowrey, SSgt Michael C. Koperski, SSgt Verner M. Billingsley, TSgt Joe R. Cooper, Capt Crawford A. Deems, and kneeling, Capt Bobbie B. Evatt and MSgt Robin J. Plummer (holding the handwritten note presented to the crew by the Secretary). Not pictured: Capt Roger D. Cox, Maj Donald K. Huffine, and MSgt Joseph J. Marable.

With the exception of periods of heavy snow accumulation on the McMurdo Sound runway, the airlift of DEEP FREEZE 73 went very well. Again, the 438 MAW used the US resupply aircraft to fly round-robin missions from Christchurch to McMurdo Sound. This time, each aircraft flew four to six missions before returning to the US. In all, Twenty-First

Air Force flew 16 C-141 and 7 commercial contract flights to New Zealand, transporting 2,221 passengers and 182.2 tons between New Christchurch and the US. The 438 MAW's round-robins consisted of 43 missions moving 2,058 passengers and 705.9 tons of material between Christchurch and McMurdo Sound. The snow accumulation did not prevent any round-robin missions.[183]

A Twenty-Second Air Force C-141 also participated in DEEP FREEZE 73. A C-141 (tail number 66-0128) with an augmented crew of the 63 MAW flew from Norton Air Force Base, California, to Christchurch on 7 December. On 10 December, this aircraft flew to McMurdo Sound several distinguished visitors, including Dr. Robert C. Seamans, Jr., Secretary of the Air Force; Dr. Eugene Covert, Chief Scientist of the Air Force; Dr. H. G. Stever, Director of the National Science Foundation; and Mr. Chalmers B. Wood, American Ambassador to New Zealand. After delivering the important visitors, the crew spent 2.5 hours on the ice before returning to Christchurch. A Navy LC-130 flew the group to various locations in Antarctica. On 13 December, the 63 MAW C-141 aircrew returned to McMurdo Sound to pick up the group and return them to Christchurch (Photo 43).[184] The Secretary of the Air Force described the airlift support as "an unforgettable experience with a most professional team."[185]

For DEEP FREEZE 74, the 438 MAW again used the US resupply C-141s to fly round-robin missions from Christchurch to McMurdo Sound. Each aircraft flew three to six missions before returning to the US. Instead of sending a separate command element, the 438 MAW appointed the Airlift Control Element (ALCE) Commander, Major George Schleehauf, as the USAF Mission Commander. In all, the 438 MAW's round-robins consisted of 30 missions moving 453 passengers and 86.6 tons of material from Christchurch to McMurdo Sound, and 1,267 passengers and 392.6 tons back to Christchurch. Although four missions air aborted for weather at McMurdo Sound, no significant problems occurred.[186]

By this point, the Navy had begun shifting the origination point from Quonset Point Naval Air Station, Rhode Island, to Point Mugu Naval Air Station, California. As a result, many of Twenty-First Air Force's deployment and redeployment support missions stopped at both naval air stations. The deployment, September to December 1973, required 12 C-141 and 7 commercial contract flights to transport 3,880 passengers and 550 tons of equipment to Christchurch. The redeployment, February and March 1974, took four C-141 and four commercial missions to return 975 passengers and 24 tons to the US.[187]

By DEEP FREEZE 75, MAC transferred responsibility for the operation to Twenty-Second Air Force on the west coast and assigned the C-141 round-robin missions to the 60 MAW at Travis Air Force Base. The 60 MAW followed the same basic operational concept established by the 438 MAW. That is, the wing rotated five aircraft supporting the deployment phase at Christchurch to fly a total of 26 shuttles to McMurdo Sound. Each C-141 flew four to six shuttle missions between 8 October and 19 December 1974.[188]

The 60 MAW also assigned the ALCE Commander, Lieutenant Colonel Troy M. Brown, as the USAF Mission Commander. Since this was the first year, the wing sent three separate ALCEs, each supporting about a third of the operation, in order to expand

Photo 44: Scientists deplane at McMurdo Sound, Antarctica, during DEEP FREEZE 76.

the wing's experience base rapidly. These ALCE members, much like previous DEEP FREEZE deployed personnel, soon realized that a small group had to rely on each other and soon pitched in to work tasks outside their normal job specialties. Colonel Brown praised this effort, "The teamwork was the brightest part of the whole operation, from a personal point of view. The team concept really took hold, and every man and every crewmember worked toward the mission with each other." Technical Sergeant Fred L. Fisher, ALCE Command Post Technician, put it this way, "Everyone down here is just 100 percent mission oriented."[18]

Twenty-Second Air Force units also took over the deployment and redeployment phases of DEEP FREEZE 75. While most originated at Point Mugu Naval Air Station, a few still started at Quonset Point. Most of those few were accomplished by contract flights with stops at Quonset Point and Point Mugu. In total, seven C-141 and four contract flights covered the US to Christchurch and return channel missions. They moved 1,923 passengers and over 584.0 tons of cargo.[190]

With Point Mugu as the primary origination location, a typical DEEP FREEZE C-141 special airlift assignment mission would look something like this (flying times approximate): Travis to Point Mugu, 1 hour and 10 minutes. After loading there, the aircraft would

proceed to Hickam Air Force Base, Hawaii, in 5 hours and 15 minutes; then Pago Pago, American Samoa, in 5 hours and 20 minutes; and finally to Christchurch in 5 hours and 5 minutes. Often, the crews would remain overnight at Hickam and/or Pago Pago to meet crew-rest requirements.* Those flying round-robin missions to the ice spent another five hours flying from Christchurch to McMurdo Sound.[191]

The 60 MAW sustained DEEP FREEZE 76 with Colonel Brown again assigned as the ALCE and USAF Mission Commander. Wing C-141s flying DEEP FREEZE deployment missions flew a total of 25 round-robin missions between Christchurch and McMurdo Sound between 10 October and 17 December 1975. Most of these flights transferred equipment, supplies, fresh produce, and scientists and engineers to McMurdo Sound (Photo 44) and some personnel and scientific equipment and samples back to Christchurch. For the deployment and redeployment phases, MAC flew a total of 14 C-141 and four commercial missions between Point Mugu Naval Air Station and Christchurch from September 1975 until February 1976.[192]

As in the previous years, the C-141 Christchurch-to-McMurdo Sound shuttle mission typically operated with a 40,000-pound cargo load, 10 passengers, and 140,000 pounds of fuel. On rare occasions, loadmasters could increase the number of passengers by decreasing the cargo weight. Generally, total payload weight (including cargo, pallets and dunnage, seats, and passengers) could not exceed 45,000 pounds. This flying weight kept the PSR approximately 20 minutes beyond McMurdo Sound, or allowed the aircraft a brief period to overfly the ice runway if there was a chance for poor weather to improve rapidly. Since the aircraft refueled at McMurdo Sound (Photo 45) and generally had less cargo and more predictable weather back in New Zealand, planners allowed more passengers (normally up to 30) for the flights back to Christchurch. Of course, loadmasters maintained the discretion to decrease the number of passengers if cargo weight or other factors influenced their calculations.[193]

Photo 45: Flight engineer CMSgt Jack Culver talks to a flight engineer aboard the C-141 while it was being refueled in Antarctica. (circa Dec 1975)

One of the 60 MAW C-141s returning to the US transported 100 penguins and 23 scientists from McMurdo Sound to Miramar, California, on 24 November 1975. The National Science

*Most missions included an augmented aircrew to allow more time before a requisite crewrest.

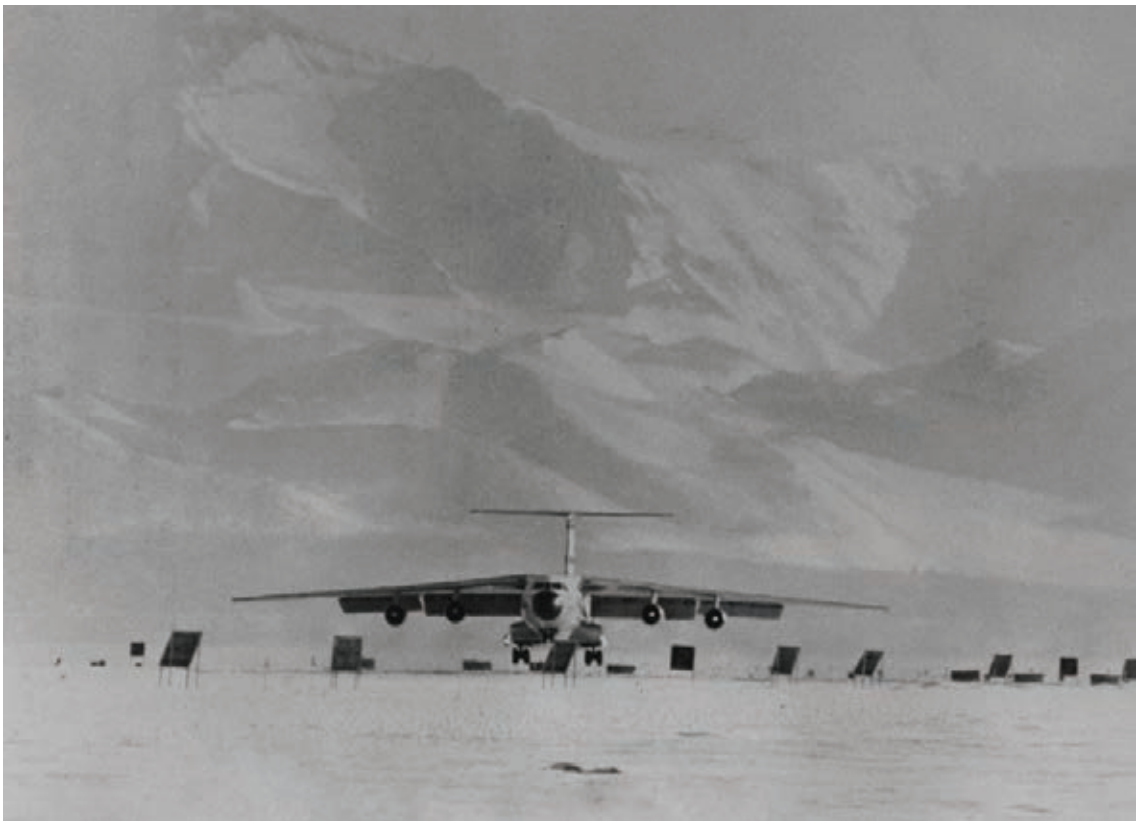


Photo 46: A 60 MAW C-141 landing on the ice of McMurdo Sound, Antarctica, during DEEP FREEZE 77.

Foundation intended to use the penguins to further their research and eventually distribute them to zoos across the country. To ensure the success of the penguin airlift, Senior Master Sergeant Billy Davis and a crew from the 602d Organizational Maintenance Squadron spent over 100 man-hours designing and installing a special rubberized thermal curtain in the C-141's cargo hold. The curtain, installed on a tight-fitting frame, allowed part of the hold to be kept cold, while the passengers and crew traveled in the heated section.[194]

The Air Force Reserve began to participate in the operation during DEEP FREEZE 76 under the Active-Reserve associate program. The 349 MAW, the associate unit of the 60 MAW at Travis Air Force Base, flew one of the deployment missions to Christchurch. By DEEP FREEZE 78, this augmentation had increased to two deployment missions, one of which incorporated six Christchurch-McMurdo Sound round-robins. The 349 MAW's Vice Commander, Colonel Robert G. Mortensen, served as the aircraft commander for the first mission to McMurdo Sound. Following that first round-robin, Colonel Mortensen said, "This year, with two missions, we were able to show the role played by the Reserve in the Total Force Policy and to demonstrate our ability as a global force."[195]

For DEEP FREEZE 77, MAC used 14 C-141 and 6 commercial contract missions for the US-to-Christchurch deployment and redeployment phases. Once again, the 60 MAW flew the C-141 missions from October through December, flying 30 shuttle missions between Christchurch and McMurdo Sound (Photo 46). Ice-qualified crewmembers continued to

fly with new crews on their first mission to McMurdo Sound. In this way, the 60 MAW expanded its aircrew experience base.[196]

On 24 November 1976, a 60 MAW C-141 returning to the US again transported 140 penguins (100 Adelie and 40 Emperor). This batch went to North Island Naval Air Station, near San Diego. The penguins were bound for San Diego's Sea World. Once again, maintainers rigged a thermal curtain to separate the aft compartment from the forward passenger compartment. The aft compartment was then kept at a temperature of 20 to 30 degrees Fahrenheit by placing blocks of ice on the floor. Although not the first such Antarctic animal-transfer flight, this one experienced two difficulties. First, the original plans included transporting 100 fertile penguin eggs as well. Maintainers arranged to install special incubators equipped with rechargeable battery packs to maintain the eggs at 96 degrees Fahrenheit. The Department of Agriculture, however, banned the egg shipment because of the possibility of disease or contamination. Second, the normally pre-approved customs communication broke down. Instead of a two-hour stop, the Hickam Air Force Base Command Post scheduled a four-hour stop, and the customs inspector was unaware of the pre-approved cargo. After lengthy discussions, the passengers and cargo were allowed to process customs at North Island Naval Air Station. Despite the difficulty, the C-141 aircrew delivered its cargo safely and on time.[197]

When the 60 MAW started DEEP FREEZE operations in 1974, the wing had no ice-qualified aircrews. By using the rotational concept of operations during the subsequent seasons, the 60 MAW worked to qualify as many aircrew members as possible. By the middle of DEEP FREEZE 78, the wing had 14 pilots, 5 navigators, 13 engineers, and 14 loadmasters. Additionally, the 60 MAW could draw from ice-qualified 349 MAW Reserve crewmembers. The 349 MAW had 12 pilots, 8 navigators, 5 engineers, and 5 loadmasters available. To qualify crewmembers, the 60 MAW required a wing or Twenty-Second Air Force Standardization and Evaluation crewmember participate in all initial ice shuttle missions per rotating aircrew.[198]

The 60 MAW again flew the C-141 missions for DEEP FREEZE 78. This season, MAC flew 12 C-141 and 6 commercial contract flights for the deployment and redeployment phases. Once again, the 60 MAW used seven of the rotation C-141s for the Christchurch-to-McMurdo Sound shuttles. Each flew five round-robin missions. Originally, planners called for six C-141s to support McMurdo Sound requirements, but the Navy requested an additional deployment mission, to include five shuttles, in November.[199]

The 60 MAW again transported penguins during DEEP FREEZE 78. A C-141 took off from Travis Air Force Base on 12 November and flew five round-robin missions between Christchurch and McMurdo Sound. During the last shuttle mission, it was loaded with 140 penguins (Photo 47).* Maintainers again equipped the cargo compartment with the rubberized thermal curtain to accommodate both the penguins and passengers. It then flew them back to Point Mugu Naval Air Station, without the customs problems experienced the previous year.[200]

---

*The MAC history referenced airlifting penguin eggs on this flight as well, but no other sources indicated such cargo.

For DEEP FREEZE 79, MAC used 14 C-141 and 4 commercial contract missions for the US-to-Christchurch deployment and redeployment phases. The 60 MAW once more flew the C-141 missions with those occurring in October through December flying 36 round-robin missions between Christchurch and McMurdo Sound. For the fifth consecutive year, the 60 MAW obtained a 100 percent mission reliability rate for Operation DEEP FREEZE, despite the distances, navigational challenges, and volatile weather.[201]

The 60 MAW set a new round-robin airlift record during DEEP FREEZE 79, with 1.9 million pounds (950 tons) of cargo moved between Christchurch and McMurdo Sound. The 60 MAW actually moved the first million pounds by the end of October. "This marked the first time that so much cargo had been carried 'to the ice' so rapidly."[202] The record-making shuttle carrying the millionth pound of cargo coincided with the staff visit made to Christchurch and McMurdo Sound by Colonel Allen L. Trott, Jr., 60 MAW Commander.[203]

Just as C-141 Antarctic operations appeared to have become routine, DEEP FREEZE 80 brought back a dose of reality. The deployment and redeployment missions went smoothly, with MAC flying 18 C-141 and 4 contract missions between August 1979 and February 1980. Although planners scheduled 30 Christchurch-to-McMurdo round-robin missions, unseasonably warm weather weakened the ice runway too much in mid-December.

Photo 47: Col Richard J. Trzaskoma, 60 MAW Assistant Deputy Commander for Operations, inspects potential cargo. (circa November 1977)

Thus, the 60 MAW completed only 25 shuttles before the runway was declared unsafe. In addition, poor weather had caused one air abort and two departure delays earlier in the season. Maintenance concerns caused another air abort and two departure delays.[204]

On 30 October, a C-141 (65-0249) departing McMurdo Sound experienced an inflight emergency. On takeoff, the aircrew received an indication that the right main landing gear was insecure. Ground personnel at McMurdo Sound also reported seeing debris fall from aircraft. A flyby of the tower confirmed that the right landing gear was hanging approximately 10 feet lower than the left. The aircraft commander, Captain Robert E. Colley and aircrew (a Reserve crew from the 349 MAW) elected to fly the disabled aircraft back to Christchurch where maintenance and crash rescue services were better. They pinned the right gear and retracted the left and front landing gear for the return flight. After a successful and relatively uneventful flight back to New Zealand, the crew performed a gear-down landing on Harewood's runway. During the nighttime landing, the right gear detached completely from the aircraft, allowing the right wing tip and number four engine pod to impact the runway.* This caused the aircraft to veer to its right before sliding to a halt with the right wing tip approximately 23 feet off the edge of the runway.[205] Lieutenant Colonel Frank B. Wells, Commander 349 MAW's 710th Military Airlift Squadron, praised the aircrew's efforts, "Captain Colley and crew's superior airmanship, procedural knowledge, and exceptional crew coordination were directly responsible for the safe recovery of a valuable aircraft and all personnel on board."[206]

Two special events occurred during the DEEP FREEZE 80 season. First, Major General Charles F. G. Kuyk, Twenty-Second Air Force Commander, arrived at Christchurch on one of the early 60 MAW C-141s. General Kuyk received an orientation tour of MAC operations at Christchurch, including those supporting DEEP FREEZE. He also flew as an additional crewmember on a Christchurch-McMurdo Sound shuttle mission on 10 October. Second, a 60 MAW C-141 carried 14 distinguished visitors to McMurdo Sound and back to Christchurch on 28 November for a commemoration of the 50th Anniversary of Admiral Byrd's first flight over the South Pole. The distinguished visitors, invited by the National Science Foundation, included political figures and senior scientists, but also included two members of Byrd's expedition, Dr. Laurence M. Gould and Mr. Norman D. Vaughan, and Byrd's grandson, Mr. Robert Breyer. This high-visibility mission soon became even more extraordinary.[207]

This flight flew approximately 45 minutes behind an Air New Zealand tourist DC-10 (Flight 901). Flight 901 was scheduled to fly to Antarctica, circle around Mount Erebus (about 20 miles from McMurdo Sound), and return to New Zealand. Because of the proximity of this commercial aircraft and similar route, the aircraft commander, Major Bruce L. Gumble, maintained communication with the DC-10 and monitored its position. As the DC-10 began to descend for its low-altitude circle around Mount Erebus, all radio contact was lost and presumed crashed. After landing at McMurdo Sound, Naval personnel

*Rated a Class B mishap because the damage was greater than $50,000 but less than $200,000.

requested Major Gumble take on extra fuel and assist in a search and rescue operation.* After taking off, the C-141 conducted a low-altitude (1,500 to 3,000 feet) visual search around Ross Island. The C-141 began turning towards what was later confirmed as the crash site when poor weather closed in making further visual observations impossible. Upon arrival back at Christchurch, Major Gumble and the navigator, 1st Lieutenant Marlin A. Knock, met with the New Zealand Minister of Transportation and with local reporters concerning the crash. A Navy LC-130 aircrew identified the crash site on the side of Mount Erebus on 29 November. All 257 passengers and crew lost their lives.[208]

Two personnel issues also affected DEEP FREEZE 80. First, over the last few years, the 61st Military Airlift Support Wing (MASW), from Hickam Air Force Base, Hawaii, augmented much of the maintenance support for the 60 MAW. However, to avoid sending a general maintenance recovery team, planners decided to send more specialized maintainers who were quick-service qualified.** Unfortunately, the 61 MASW maintenance specialists were not quick-service qualified. Therefore, the 60 MAW agreed to increase the number of maintainers they deployed as part of the airlift control element. Second, the Commander-in-Chief of Pacific Air Forces, with MAC's concurrence, ordered the initiation of orientation flights for Royal New Zealand Air Force personnel on C-141 round-robin missions. Between 11 November and 12 December, 16 Royal New Zealand Air Force officers, including 4 from the Air Staff, participated in 8 shuttle missions.[209]

Although scheduled for more Christchurch-McMurdo Sound shuttle missions, Major Gumble's C-141 and aircrew only completed two. At that point, MAC diverted the aircraft to support Majuro Atoll disaster relief, which began on 2 December. Two severe storms had battered the atoll in the Marshall Islands on 28 November and 3 December. This C-141 flew two Majuro Atoll support missions in the Pacific before returning to Travis Air Force Base. All told, 41 C-141 and 5 C-130 missions delivered 730.5 tons of supplies and 286 passengers for the relief effort.[210]

*A second C-141 (already scheduled to make the round-robin mission) carried additional supplies to aid the search operation.

**Quick-service qualification broadened the knowledge base of the specialists without providing enough breadth to make them airplane general personnel. Overall, it was less efficient to have specialists serving in general maintenance positions. This change allowed an increase in the deployed specialized maintenance capability and yet decreased the overall deployment by one person.

CHAPTER 8

AIRDROP REPRISE (1979-1984)

In 1978, Headquarters Military Airlift Command (MAC) consolidated the management of airlift forces in the Pacific region by establishing the 834th Airlift Division (ALD) and the Pacific Airlift Center (PACE) at Hickam Air Force Base, Hawaii. This reorganization created a single commander responsible for oversight of all airlift operations in the Pacific, including those of Operation DEEP FREEZE. By 1980, MAC further consolidated assets by inactivating the 61st Military Airlift Support Wing and PACE and merging their functions into the 834 ALD and its subordinate units.[211] Since these units reported to Twenty-Second Air Force, the impact on DEEP FREEZE of these changes primarily affected the management of the permanent operating location at Christchurch and provided the deployed personnel a more focused Pacific-theater command and control element. It also meant the operating location at Christchurch took over as the command element from the deployed unit. Flying units of the Twenty-Second Air Force continued to deploy personnel and aircraft needed to conduct the mission.[212]

Photo 48: Lance Corporal Clarke, a New Zealand serviceman, packs "freshies" in preparation of a midwinter airdrop mission. (June 1983)

One of the first DEEP FREEZE-related challenges* for this new command and control structure occurred in July 1979. The 63d Military Airlift Wing (MAW) from Norton Air Force Base, California, sent a C-141A with an augmented aircrew to Christchurch, New Zealand. This C-141 inaugurated the midwinter airdrop program. The

*The midwinter airdrop program, also referred to as "Ice Drop," was technically not part of DEEP FREEZE. However, this program complemented the operation and ultimately served the same end user. For that reason, it remained closely associated with the DEEP FREEZE mission.

834 ALD coordinated the airdrop, while personnel of the US Air Force operating location at Christchurch and the Royal New Zealand Air Force provided the necessary support for the C-141 and aircrew, including preparing mail (1,185 pounds), spare parts (2,068 pounds), and fresh fruit and vegetables (6,022 pounds--often referred to as "freshies" by the winter inhabitants of Antarctic stations) (Photo 48).[213]

On 14 July 1979, the C-141 flew a single airdrop mission over McMurdo Sound.* With calm winds and excellent visibility, the C-141 made five passes over the target area, taking 38 minutes to complete the drop. Ground personnel recovered the entire shipment within 40 minutes.[214] McMurdo residents reported the recovery of all 24 containers: "Mission success. All airdropped cargo recd [received] with only minor damage to freshies. Containers, slings, parachutes and associated jewelry retrieved without incident."[215]

The next Ice Drop mission occurred in July 1980. Again, the 63 MAW sent a C-141A to Christchurch for the airdrop mission. The coordination and support of this airdrop mission closely reflected that of the previous year. On 28 July, the C-141 dropped 23 bundles (10,331 pounds) of mail, spare parts, and freshies (including a case of champagne) to the residents of McMurdo Sound. Poor weather caused the aircrew to make five passes, which took nearly 1.5 hours to complete, and recovery took another 3 hours. Because of the lengthy period, plus some of the containers breaking open on impacting the ground, some of the fresh produce suffered minor frost damage.[216] Again, the personnel at McMurdo Sound sent a message showing their appreciation, "…many thanks to the officers and men/women who participated in bringing an early Christmas to our winter wonderland."[217]

These airdrops occurred completely in the dark and cold of the Antarctic winter as the C-141 flew approximately 800 to 1,000 feet above ground level. For these first two drops, airdrop technicians used cardboard containers measuring approximately 3 feet by 5 feet and packed with up to 500 pounds in weight. Personnel in the cargo compartment manhandled these boxes through the troop doors on the C-141's sides. Planners initially considered the extreme cold too risky to use the large "petal" doors at the rear of the aircraft. If they had malfunctioned or frozen open, the C-141 would not have had enough fuel to return to Christchurch. For these and the following midwinter airdrops, personnel on the ground set up an illuminated drop zone by placing burning smudge pots in a "C" shape in a 1,000- to 3,000-foot perimeter. During the poor weather of 1980's drop, the aircrew reported this pattern was still difficult to keep in sight.[218]

One journalist described the airdrop mission as extremely dangerous, "Everyone will tell you that this is just a routine airdrop--except for the extreme cold. Also, fuel is absolutely critical, there's no place to land for thousands of miles, and there's no possibility of rescue if you do."[219] The aircraft usually formed ice-crystal contrails in the cold altitudes. Illuminated by only the moon, the aircraft and its cloud presented an almost surrealistic environment. The outlandish environment and danger extended from the entire aircraft down to individual crewmembers. Whenever the doors were open, crewmembers in the

*Throughout the midwinter airdrop program, a portion of the materials dropped at McMurdo Sound were intended for New Zealand's nearby Scott Station.

cargo compartment were required to wear parachutes or safety straps. They also had to deal with the extremely cold temperatures and reduced oxygen levels at the drop altitudes.[220]

Even though the National Science Foundation benefited from these missions, the Foundation's budget did not include funding to pay for the midwinter airdrops. To perform this mission, the Air Force paid for the airdrops from its aircrew training time. For MAC, this meant the funding came from the Joint Airborne/Air Transportability Training (JA/ATT)--the account used to fund most airdrops, especially those missions dropping troops during exercises.* Lieutenant Colonel James M. Galyen, mission commander for the first four years of the Ice Drop missions, described the Air Force's payoff for this gratis service:

> …to demonstrate a capability for the emergency resupply of personnel on the Antarctic continent. We've made some vast improvements over the past four years on both the packaging and the aerial delivery techniques that are used down there--so we've gained quite a bit from that. Also, the training benefits…we take a lot of young people down with us, and it's really kind of 'off the wall' training; things are very non-standard. There's a lot of experience gained, therefore.[221]

While the 63 MAW handled the first midwinter airdrops, the 60 MAW, at Travis Air Force Base, California, continued supporting the airlift shuttle missions and most of the deployment and redeployment flights. The National Science Foundation experienced severe budget restraints during DEEP FREEZE 81 and requested fewer Air Force support missions than previously. Thus, MAC flew a total of only four C-141 deployment and redeployment flights from Point Mugu Naval Air Station, California, to Christchurch between September 1980 and March 1981. These did not include the five C-141s that flew from Travis Air Force Base to Christchurch to support the 17 scheduled shuttle missions.[222]

Even with the reduced schedule, Antarctica quickly reminded those involved of its harsh and unpredictable nature. Lieutenant Colonel Robert J. Byrne, the USAF Mission Commander and Chief, Operating Location D, 619th Military Airlift Support Squadron (MASS), Christchurch, observed, "DEEP FREEZE 81 will be known on the part of the Military Airlift Command as the year of ingenuity in Antarctica Air Operations. High winds, sudden storms, and soft ice threatened the project from the very first day, but in spite of these contingencies, DEEP FREEZE 81 came to a close without harm to man or aircraft."[223]

The season's first C-141 (tail number 64-0632) to McMurdo Sound arrived on 6 October. However, the number three engine would not start for the return trip. Although Navy C-130 electricians troubleshot the engine, they found they could not fix it.

---

*JA/ATT missions generally exercised combat readiness and the airdrop portion of joint training with other military services. Air transportability referred to the airland missions and static loading exercises, including short local orientation flights.

Photo 49: On 11 October 1980, US Air Force and Navy personnel dig out a C-141 stranded on the ice at McMurdo Sound, Antarctica, during DEEP FREEZE 81.

Twenty-Second Air Force elected to leave the aircraft at McMurdo Sound and send a specialized C-141 maintenance team rather than approve a three-engine takeoff waiver. The aircrew and passengers transferred to the day's second mission (approximately two hours behind the first) to return to Christchurch. While waiting for the repair team, weather* also created problems at McMurdo Sound, partially burying the C-141 in its parking space. Additionally, by 10 October, the Navy Operations officer reported the aircraft weight was causing it to sink into the ice and predicted a possible catastrophic ramp failure if the aircraft was not moved soon. Twenty-Second Air Force gave permission, and the Air Force and Navy personnel at McMurdo Sound quickly dug the aircraft out of the five-foot snow drifts (Photo 49), modified a C-130 tow bar to fit the C-141's nose gear, and successfully towed the aircraft to a new spot with a D-8 Caterpillar tractor on 11 October.[224]

The specialized maintenance team arrived later on the 11th and found the Navy personnel had constructed a parachute shelter over the number three engine and were providing heat to the shelter and cockpit. The team installed a new aircraft battery, connected a power cart, and started the auxiliary power unit. While an aircrew began preflight checks, the maintainers completed work on the engine (replacing the exciter box and igniter plugs) in less than two hours. However, the prolonged exposure to the cold

*One storm had winds in excess of 70 knots and temperatures as low as -50 degrees Celsius.

Photo 50: Capt J. Paul Lane, 60 MAW Standardization Evaluation Navigator (not on the crew, but an ice-qualification evaluator) poses in front of the first C-141B to land at McMurdo Sound, Antarctica, on 12 October 1980.

caused a number of seals to shrink, resulting in numerous hydraulic leaks, primarily in the wheel wells. Maintainers applied external heat and added 14 quarts of hydraulic fluid. The preflight and maintenance checks revealed only a few other minor concerns, such as some loose snow accumulation in engine intakes despite having had covers. After these quick repairs, the C-141 returned to Christchurch by the end of the day.[225]

The very next day, the first C-141B (65-0259) landed at McMurdo Sound. The aircraft commander, Captain Roger Purcell, landed the aircraft under whiteout conditions. Aircrew management played an important role as crewmembers called out altitudes and continually referenced the radar altimeter until a flare sighting allowed the aircraft commander to land safely on the ice runway. This aircraft stayed on the ice only 1.5 hours (Photo 50) to unload and load those returning to Christchurch. The C-141B offered increased cargo space (some 23 additional feet, or three additional pallets) and an air refueling capability, but it had a major drawback over the C-141A model in DEEP FREEZE operations. By this point, mission planners used a maximum C-141A cargo load of 55,000 pounds (cargo, dunnage, and passengers) to maintain a comfortable point of safe return (PSR) just beyond McMurdo Sound. Because of the additional operating weight--some 7,000 pounds of aircraft weight--the C-141B could only carry 48,000 pounds and still maintain a similar PSR. Adding air refueling to the operation, on the other hand, would eliminate the need for a PSR and could increase the maximum possible cargo load to some 70,000 pounds.[226]

During October, one of the 60 MAW aircrews attended a social gathering sponsored by the local chapter of the New Zealand Returned Servicemen's Association (a civic group similar to the US Veterans of Foreign Wars). Also in attendance were some of the players, including the chief piper, of the Christchurch Metropolitan Men's Highlander Bagpipe Band. On the morning of the next mission, 21 members of both the Men's and Women's Highlander Bagpipe Band played while the crew prepared the C-141 and boarded 136 passengers (Photo 51). The pipers continued to provide a full ceremonial flair and musical accompaniment as the aircraft taxied to the takeoff point. Upon their return, the crew invited the band members and their families and friends to tour the aircraft.[227]

Photo 51: The Christchurch Combined Metropolitan Band marches in front of a C-141 Starlifter preparing to depart New Zealand for McMurdo Sound, Antarctica, on 31 October 1980.

For Ice Drop 81, the 63 MAW again flew the mission. For the third year in a row, Colonel Galyen (Photo 52) served as the airdrop mission commander. This mission, however, used the C-141B's air refueling capability to include two drops, one at McMurdo Sound and a second at the South Pole Station. Transporting non-DEEP FREEZE related cargo from Norton Air Force Base to New Zealand, the C-141B (66-0128) departed on 17 June. In addition, three Strategic Air Command (SAC) KC-135 Stratotankers supported the mission. One served as an emergency backup and remained on alert at Auckland, New

Photo 52: Lt Col James M. Galyen (standing) briefs the aircrew prior to the 1981 midwinter airdrop. Colonel Galyen served as the mission commander for the first four midwinter airdrops.

Zealand,* for the duration of the C-141 mission. The other two refueled the C-141 three times with a total of 50,500 pounds of fuel during the flight.[228]

Although planning took into account possible problems, such as returning to Christchurch if the petal door froze open during the drop at McMurdo Sound, none occurred. Chief Warrant Officer Richard J. Langstratt, the US Army Liaison at Headquarters MAC, designed special containers and a unique rigging system. He also oversaw much of the container packing in New Zealand. Once over target at McMurdo Sound, the loadmasters used the aircraft's rear cargo door to drop all 30 bundles (13,000 pounds) in about 6 seconds. The aircrew then proceeded to the South Pole. Here, the aircraft made one pass while the loadmasters and other personnel opened the troop doors on both sides of the aircraft and aligned the first four containers. After circling back, the personnel on board pushed the first four containers out on the next pass (Photo 53). On the third pass, they pushed out the last two (for a total of 4,000 pounds). Colonel Galyen then referred to this airdrop mission as the one that went "around the world three times" for circling the South Pole three times.[229] They then closed the doors and returned to Christchurch. The entire trip took 15 hours and 20 minutes (Figure 5).[230]

For DEEP FREEZE 82, the C-141B took over the mission (Photo 54). As in previous years, the deployment and redeployment period lasted from early October 1981 until February 1982. Of those missions, five C-141Bs of the 60 MAW stayed at Christchurch to fly a total of 26 round-robin missions to McMurdo Sound. These five aircraft, with augmented aircrews, rotated the duties at Christchurch. The first two deployed on 1 October

Photo 53: Crewmembers push cargo destined for the South Pole Station out the troop doors.

*Planners considered Christchurch's runway too short to permit safe tanker operations.

Figure 5

New Zealand issued a commemorative reminder of the first C-141 midwinter airdrop to the South Pole.

and flew 11 missions to McMurdo Sound. The next three went individually: the first, on 17 October, flew five round-robin missions; the second, on 31 October, operated six shuttles; and the last, on 28 November, flew four round-robins.[231]

Although a few missions delayed for weather and solar flare-related communications problems, only the first day's missions on 5 October experienced any significant problems. Planners scheduled two missions on that day and both took off two hours apart as scheduled. The first landed on time, but whiteout conditions developed immediately behind it, and the second, flown by Major William R. Harris (Photo 55), air aborted for the weather and returned its 142 passengers to Christchurch. The weather also slowed down the unloading, servicing, and reloading of the C-141B at McMurdo Sound to just over 2.5 hours. If both aircraft had arrived as scheduled, the

Photo 54: Successfully tested in 1981, the C-141B took over the DEEP FREEZE mission in its entirety in 1982.

ice parking ramp and refueling area would have been quite congested.[232]

The first flight had to overcome another obstacle as well. Radar operators at McMurdo Sound set the surveillance radar 180 degrees out of phase. It, therefore, experienced significant trouble in establishing radar contact with the C-141. When radar contact was finally established in close proximity to the airfield, the controller received an indication showing the aircraft south of the field when in fact it was north. The controller's resulting attempt to vector the aircraft caused confusion on the part of both the pilot and the controller. Finally, the aircrew, confident of their position as determined by grid navigation and their airborne radar, flew an instrument approach (the weather had already begun to deteriorate) until they eventually established visual contact with the runway. Upon landing, Major Joseph C. Reichal, the 834 ALD Chief of Safety conducting a survey of the operation, went to speak with the radar operator. During their conversation, the operator indicated the radar had not been flight-checked because it had been broken whenever aircraft had been available. The radar operators properly aligned the surveillance radar after this incident.[233]

Photo 55: Maj Kenneth B. Smith (aircraft commander), Lt Col Pasquale Rosacci (navigator), and Maj William R. Harris (flight examiner) preflight a C-141B prior to takeoff from Christchurch's International Airport, New Zealand, for McMurdo Sound, Antarctica. (DEEP FREEZE 82 or 83)

Despite this rocky start, the operation proceeded efficiently. As the last C-141B prepared to return to Travis Air Force Base in December, Brigadier General Duane H. Cassidy, MAC Deputy Chief of Staff for Operations, congratulated those members of Twenty-Second Air Force who were involved:

> MAC can point with pride to your aircrews and support people for the conscientious completion of all 26 shuttles from Christchurch, New Zealand, to McMurdo, Antarctica. Despite the hostile weather environment and austere conditions, your people displayed exemplary professionalism and dedication to conduct this important mission safely and efficiently.[234]

Ice Drop 82 occurred on 22 June. This mission, flown again by the 63 MAW, followed a similar pattern dropping supplies and parts to McMurdo Sound and the South Pole station as the previous year, except one KC-10 air refueling tanker provided 67,400 pounds of fuel instead of using three KC-135s. This first use of a KC-10 Extender over Antarctica also set the milestone as the southernmost inflight refueling, just 750 miles north of the South Pole. Throughout the mission, the C-141B aircrew used high frequency radio,* except for a brief period when weather caused radio propagation and they switched to ultra-high frequency, to stay in communication with McMurdo Sound.[235]

Fortunately, Technical Sergeant Leonard L. Czepiel, from Detachment 14 of the 17th Weather Squadron, Norton Air Force Base, was on the flight. Sergeant Czepiel provided periodic weather updates and helped to determine "windows" in the weather best suited for the airdrop. As the C-141 approached McMurdo Sound, ground weather deteriorated, with high winds and blowing snow. The ground recovery team planned to withdraw from the drop zone because of the near-zero visibility and temperatures as low as 90 degrees below zero Fahrenheit. However, Colonel Galyen, the aircraft mission commander, pointed out that if the drop did not occur now, it may not happen that year since JA/ATT funding remained limited. To support this drop despite the severe weather, the recovery personnel quickly set up a "token" marking on the drop zone (setting up a 4,000-foot letter "C" with flares at 400-foot intervals). The C-141 and the KC-10 loitered in orbit for about 20 minutes while this happened. Colonel Galyen then described the drop from approximately 1,000 feet above McMurdo Station:

> Once they got the drop zone fixed, we went down and made our drop. This was probably the largest airdrop we've ever made at McMurdo; some 23,000 pounds of cargo, in 41 modified container delivery system (CDS) bundles. This was also the longest load; we had two rows of bundles that went from the forward bulkhead all the way back up the ramp, over the hinge. The bundles had high-velocity chutes on them (Photo 56). From the time we called 'green light' and cut the rope, it took 8.5 seconds for all 96 feet of that cargo to exit the airplane.[236]

The C-141 then proceeded to the South Pole Station with no problems. The plan called for a single pass to drop all seven bundles through the troop doors; however, the last two bundles (one on each side) jammed in the doorway. The problem resulted from the six-foot air deflectors built in at the doors. Since these deflectors did not cover the top of the seven-foot cardboard bundles, the air slipstream tended to push the tops of the boxes back into the doors. Furthermore, the lack of oxygen at the high altitude, plus the physical exertion of pushing the bundles through the door, took a toll on the personnel. With the wind still pushing back, it took three more attempts before all seven bundles were delivered.[237]

*These early airdrop missions used high-frequency radios to stay in contact with the ground stations throughout the drop.

Photo 56: Container delivery system bundles depart rear petal doors of C-141 over McMurdo Sound, Antarctica. (June 1983)

In addition to Mr. Langstratt's specially-designed CDS bundle system, airdrop technicians sought ways to help the ground recovery teams find the bundles in the Antarctic darkness.* In 1979, they tied standard flashlights to the bundles, but the batteries froze almost immediately after exiting the aircraft. The second year, they tried attaching "Ken-lights,"** but these lights also froze too quickly. In 1981, they found strobe lights operated with lithium batteries effective. Even with the lithium batteries, the extreme cold temperatures in 1982 caused the strobes to flash for only about 45 seconds after they reached the ground.[238]

DEEP FREEZE 83 experienced a unique beginning. While the deployment missions started in September, the Christchurch-McMurdo Sound shuttles were not scheduled to begin until 4 October. On 27 September 1982, a US Navy sailor, Terry W. Busler, slipped while repairing the pipeline equipment near the McMurdo Sound Station. In the accident,

*Planners scheduled the airdrops during periods of a full moon. This gave the aircrew and ground personnel the most natural light they were going to find in the long Antarctic winter.

**Colonel Galyen described the Ken-light as an incandescent light similar to those used in enclosed theme park rides.

he injured his back and neck and suffered a partial paralysis on one side of his body. The Navy doctor at McMurdo Sound recommended an air evacuation,* and a New Zealand neurosurgeon confirmed the decision. Neither the Air Force nor the Navy were completely ready for the mission. The ice runway was prepared, but the navigation aids had not yet been calibrated. All of the Navy's LC-130s were back in the US, and the first 60 MAW C-141 deployment aircraft was not set to leave Travis Air Force Base until 29 September. Nevertheless, a C-141 departed Christchurch 24 hours after the request was received.[239]

As soon as the request was made, the 834 ALD diverted a 63 MAW C-141 on a routine mission to Australia to Christchurch. The aircrew consisted of reservists from the 445 MAW, the 63 MAW's associate wing at Norton Air Force Base. Only the aircraft commander, Colonel Robert E. Dotson (445 MAW Commander), had any previous Antarctic experience, and that was over 10 years prior. Since he had some ice experience, Captain William H. Dudley, Commander of Detachment 2, 619 MASS, provided training and detailed briefings for the aircrew, and accompanied the flight to assist with fuel planning and grid procedures. The aircrew did their part by accepting a maximum crew duty day and less than normal crew rest to meet mission constraints. After only 12 hours of preparation, the C-141 took off from Christchurch. The National Science Foundation took advantage of the "free" ride,** sending 10 passengers and 20,000 pounds of cargo, as well as Navy Hospital Corpsman Michael Clark as an aeromedical technician. With the exception of a little ground fog at McMurdo Sound, the flight went very quickly, and an ambulance carried Busler, the injured man, to Christchurch Hospital less than 12 hours after the C-141 had departed Christchurch.[240]

Despite facing many of Antarctica's extreme environmental conditions (Photo 57), the 60 MAW completed the deployment without significant incident. Only two missions suffered delays, and both of those for maintenance problems. In general, the round-robin C-141B missions continued to operate with a 48,000-pound payload planning factor in order to keep the PSR just beyond McMurdo Sound. However, Captain Dudley, as the Detachment 2, 619 MASS, Commander, retained the option to review each mission and increase the payload to 51,000 pounds as long as there was no priority cargo or passengers involved. When weather predictions showed a continued calm and pressure ridges appeared to remain stable, Captain Dudley could trade up to 3,000 pounds of fuel for 3,000 pounds of cargo, thus moving the PSR to approximately 40 minutes prior to McMurdo Sound. Although the risk of more aborted missions increased, this approach successfully eliminated two missions, thus saving the National Science Foundation $90,070 ($20,546 per trip to Antarctica and $24,489 per trip back to Christchurch).[241]

The final DEEP FREEZE 83 C-141 mission out of McMurdo Sound on 14 December included several distinguished visitors. During a visit to New Zealand, Britain's Prince

*This was not the first aeromedical evacuation from Antarctica. For example, a Navy LC-130 evacuated five Russians injured in an IL-14 crash at the Soviet base of Molodezhnaya. Three separate aircrews flew the aircraft to the Russian base, back to McMurdo Sound for refueling, and finally to Dunedin, New Zealand. [Article, American Polar Society, "U.S. Mercy Flight to Soviet Plane Crash," *The Polar Times*, Jun 79.]

**As an aeromedical evacuation mission, payment came via medical funds.

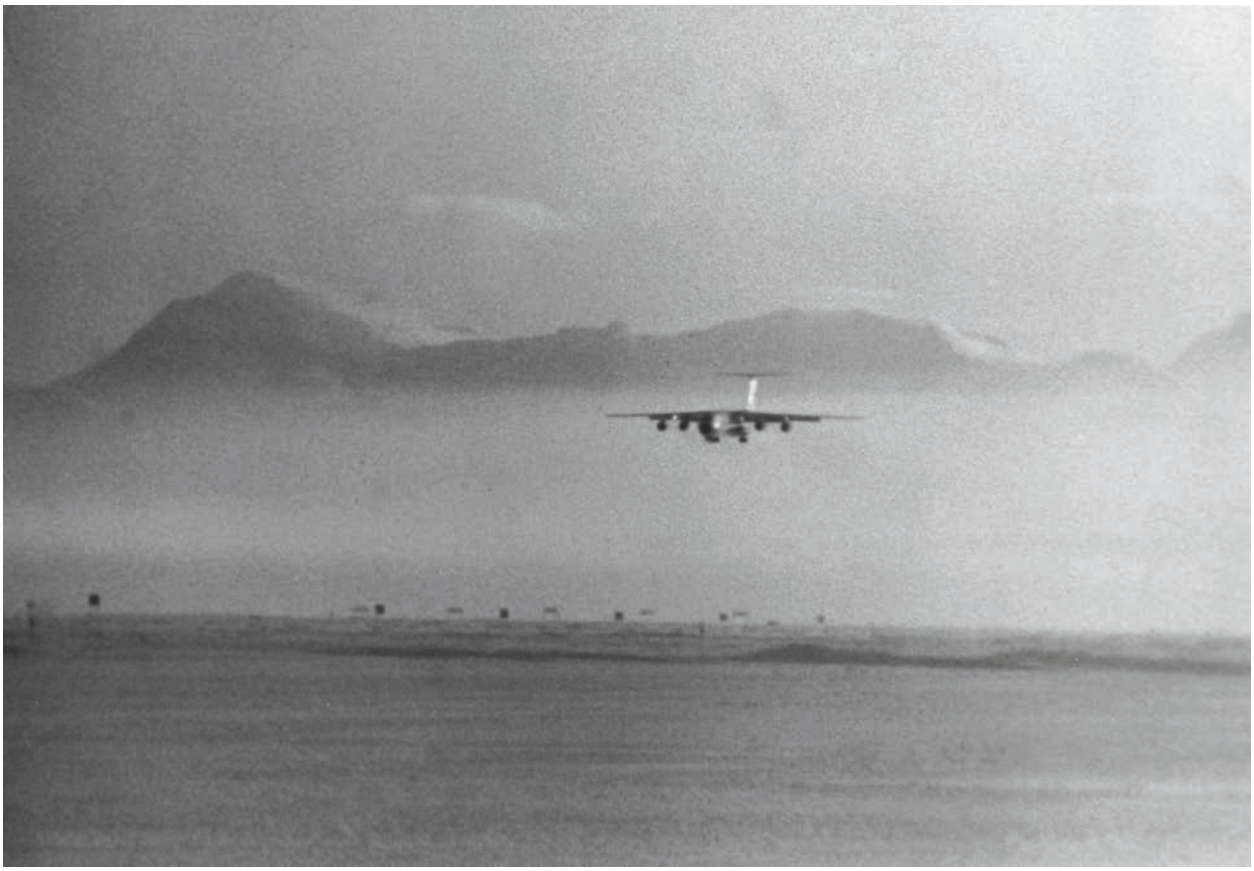


Photo 57: A whiteout moves in behind a C-141 landing on the ice runway. The storm quickly blotted out all traces of the surface. (circa 1981)

Edward accepted an invitation from the National Science Foundation to visit the research facilities in Antarctica. A Royal New Zealand Air Force C-130 transported him to McMurdo Sound Station on 8 December. After viewing Antarctic stations, the Prince and several other visitors boarded the C-141 back to New Zealand. As a private pilot, Prince Edward spoke to several crewmembers about their responsibilities and asked many questions about the Starlifter's instrumentation.[242]

For the first time, MAC scheduled two midwinter airdrops for 1983. It also assigned the mission to the 62 MAW, McChord Air Force Base, Washington. The 62 MAW sent one of its camouflage-painted C-141Bs, tail number 65-0229, to Australia on 11 June 1983. Of note, this C-141B was the first C-141 (then an A-model) to land at McMurdo Sound in 1966. In Australia, the aircrew flew channel missions until leaving for Christchurch on the 16th. Prior to the mission at Christchurch, maintainers added new baffles to the troop doors (Photo 58). Personnel at McChord developed the baffles specifically for this mission to extend into the wind slipstream to prevent the containers jamming in the door frames as happened during the previous Antarctic airdrop. Again, a KC-10, this one assigned to the 22d Bombardment Wing at March Air Force Base, California, supported the airdrop mission. The KC-10 flew from Auckland. The first airdrop mission launched on the

Photo 58: MSgt Michael L. Wright (loadmaster) provided a size comparison with a baffle installed in the right troop jump door of a C-141. This baffle extended into the slipstream to aid in pushing containers clear of the doorway. (circa June 1983)

morning of 21 June. The aircraft commander, Major John A. Kent, Jr., requested the KC-10 provide the maximum amount of fuel in case the rear cargo door froze open, with a "top-off" refueling just south of McMurdo Sound. If the petal door jammed open, the additional drag would have meant the C-141 would not have had enough fuel to return to Christchurch without the maximum fuel load. The extra fuel, however, meant the aircraft had to fly at 165 knots calibrated speed, or 15 knots faster than normal for airdrops, in order to provide a safe margin over the projected aerodynamic stall speed at that weight. Additionally, the aircrew performed a six-degree nose-high deck angle instead of the normal five degrees. This drop angle created a tighter pattern for the McMurdo Sound bundles. At McMurdo Sound, the aircrew dropped 28,500 pounds on 53 containers, releasing them just 6 hours after leaving Christchurch.[243]

While the aircraft proceeded to the South Pole, crewmembers reconfigured the floor rollers, removing the straight ones down the entire length of the aircraft and replacing them with curved sections leading to the side jump doors. On the first pass, personnel pushed five bundles out (two from the left door and three on the right). On the second pass (and planned final pass), two bundles exited on the left, but the first one on the right jammed in the doorway despite the new baffles (Photo 59). Loadmasters later figured the bundle

Photo 59: Crewmembers rush to extricate a container, which got wedged in the right troop door in spite of the new baffle. Note the tethering restraint harness in lieu of a parachute used by the crewmember with his back to the camera. (21 June 1983)

Photo 60: After heavy exertion, a 63 MAW crewmember gets some much-needed oxygen. (10 June 1987)

had been prepositioned too close to the slipstream, and when one person's grip slipped, the bundle shifted and jammed. On the third pass, the final two bundles exited the right troop door. One mission observer, Mr. Frederick A. Johnson, 62 MAW Historian, described the scene:

> As the bundles left the troop doors, their static ripcord lines beat against the fuselage, audible even over the howling slipstream and engines. Amid back-slapping and handshaking in celebration of a successful drop, TSgt [Technical Sergeant] Harold Harris [a loadmaster] monitored a walk-around oxygen bottle (Photo 60) for use by crewmembers who might have over-exerted in the cold Antarctic air at an altitude over 10,000 feet above sea level (the South Pole is on higher ground than McMurdo).[244]

For the first time, the crew used satellite communications (SATCOM) for an Antarctic mission. Maintainers had mounted a SATCOM antenna to the outside of a replacement overhead escape hatch. Using a SATCOM radio set, an operator onboard the aircraft dispatched and received messages via satellite. With this system, the aircrew maintained constant communications with Christchurch and McMurdo Sound.[245]

Photo 61: Line of cargo prepared for airdropping from the C-141 to McMurdo Sound, Antarctica, in June 1983.

Although planners intended to launch the second mission on 23 June, extremely poor Antarctic weather conditions with blowing ice and snow caused a 24-hour delay. The second JA/ATT mission only included a single drop of 48,358 pounds of parts and supplies in 80 bundles at McMurdo Sound (Photo 61). This drop returned to the standard five-degree angle as the loadmasters weighed the risk of the bundles tangling together at the steeper incline and decided it would be safer to have them separated a little more. After this drop and a crew rest period, the C-141 returned 58 crewmembers and passengers and miscellaneous cargo back to Norton Air Force Base on its way to McChord Air Force Base on the 25th.[246]

Photo 62: Passengers depart a camouflage-painted C-141B during DEEP FREEZE 86.

DEEP FREEZE 84 proved far less challenging than the previous year. The 60 MAW provided a total of three C-141Bs, sending one at a time, from 28 September to 18 October, 17 October to 2 November, and 4 to 15 December. The wing also used two channel missions to Australia to send additional rotation aircrews on 8 and 28 October. Additionally, a 62 MAW C-141B stopped at Christchurch on an Australian channel mission. This aircrew flew one Christchurch-McMurdo Sound round-robin on 13 October. The 63 MAW flew this mission because the National Science Foundation requested the movement of cargo and passengers earlier in the season than scheduled. As a result of this successful shuttle, a mission scheduled for December was canceled. Because of the success of using these channel missions for aircrew rotations and a shuttle mission, Lieutenant Colonel Leland W. C. Conner, USAF Mission Commander, recommended the 834 ALD explore further use of these options.[247]

Colonel Conner recognized that DEEP FREEZE 84 offered a number of other potential improvements for the future. The season included the first camouflage-painted C-141B. Ground personnel at McMurdo Sound noted how much this increased the visibility of the aircraft against the Antarctic snow and ice background (Photo 62). Colonel Conner recommended sending C-141s with such paint schemes whenever available. Additionally, the weather's cooperation allowed mission planners to increase the average cargo load from 48,000 pounds to 50,000 pounds. For actual statistics, DEEP FREEZE 83 averaged 51,406 pounds per mission, and DEEP FREEZE 84 averaged 50,796. Planners could easily reach this average by decreasing the PSR for most missions (under good weather conditions) by 1 to 1.5 hours before reaching McMurdo Sound. In addition to saving the National Science Foundation time and money, this increase also eased the Cargo Yard's flow plan. Finally, the Navy requested payload, runway weight limitations, and conditions for C-141 flights from McMurdo Sound to the South Pole. The Navy was contemplating attempting runway construction at the South Pole, where only a skiway landing strip existed.[248]

In December, the 60 MAW sent Squadron Leader John D. Snell, a British Royal Air Force exchange officer serving with the wing. Qualified in both the C-5 and C-141, Squadron Leader Snell flew an ice-qualification mission and served as the aircraft commander on the final two shuttle missions of the season. These missions included taking the Prime Minister of New Zealand's wife, Mrs. Thea Muldoon, to McMurdo Station on 6 December and returning her on the 12th. While in Antarctica, she visited New Zealand's Scott Base as well as McMurdo Sound.[249]

Once again, MAC scheduled two Ice Drop missions in 1984 and assigned them to the 62 MAW. Lieutenant Colonel Jerry L. McKimmey, a participant in the 1983 mission, served as the aircraft commander in 1984. The first airdrop occurred on 21 June and included drops at McMurdo Sound and the South Pole Stations. The second airdrop, on 23 June, dropped fresh provisions, mail, and repair parts at McMurdo Sound only. The airdrops again included refueling by a KC-10. The Christchurch runway had been upgraded since the previous year and could now handle KC-10 tanker operations. So, for the first time, the KC-10 and C-141 operated from the same base. This not only simplified mission planning, it also allowed planners to use three air refuelings because of the tanker's proximity.[250]

On 21 June, as the C-141B lined up for the first run over the South Pole, Colonel McKimmey found the aircraft's wing flaps would not extend. This forced him to pass over the station without making a drop. Lieutenant Colonel Harold D. Blagg, the mission navigator, quickly recomputed the drop time for the C-141 with its flaps retracted. This meant a faster speed (about 5 knots faster) than a normal airdrop and a four-degree steeper nose-up altitude (the plan had been for a two-degree nose-high deck angle). Although the increased deck angle increased the slope of the aircraft's floor and, thus, the difficulty of positioning the CDS bundles at the troop doors, the recalibrated drop experienced no significant difficulties. While all of this was going on, flight engineers searched for the problem. It took about an hour to find and fix the broken cable detector. The alternative to fixing the flaps was a long, low-haul all the way back to Christchurch, using 20 percent more fuel and probably requiring another refueling from the KC-10.[251]

CHAPTER 9

GIVING THE MISSION A LIFT (1984-1990)

While the tanker support for the midwinter airdrops had proven the viability of using KC-135 Stratotankers and KC-10 Extenders in Antarctic operations, air refueling operations had not been tried yet during the Operation DEEP FREEZE airlift missions. With the possible exception of air refueling C-141s deploying over the Pacific region to Christchurch, New Zealand, it appeared DEEP FREEZE planners had given little thought to using tankers to support the shuttle missions. A fortuitous situation in 1984 changed this.

A large-scale military exercise involving US, New Zealand, and Australian forces overlapped the beginning of DEEP FREEZE 85. This created a serious problem in that personnel and aircraft participating in the exercise competed for facility space at Christchurch, and exercise planners had set up the redeployment missions without considering the scheduling impact on DEEP FREEZE. Colonel Leland W. C. Conner, USAF Mission Commander, and his staff spent many hours reworking these scheduling issues. The key benefit, however, was the use of a KC-10 tanker to support the first DEEP FREEZE Christchurch-McMurdo Sound round-robin mission.[252]

DEEP FREEZE mission planners "borrowed" one of the exercise tankers. On 2 October, a KC-10 flew from Auckland to refuel, for the first time, a C-141B bound for McMurdo Sound. This allowed the C-141 to carry approximately 20,000 additional pounds (mostly in passengers and their baggage) on that first mission since the normal weather and point of safe return (PSR) concerns no longer applied. This proved doubly useful since the tactical air navigation radar was slightly misaligned, having settled four-tenths of a degree into the ice. After the refueling, the C-141 aircrew had plenty of fuel to take the time needed to perform all the calculations and double-checks required to land without the radar. Radar technicians corrected the problem, and Colonel John S. Baughman, aircraft commander, used the C-141, after departing McMurdo Sound's ice runway, to conduct two approaches to confirm the alignment before returning to Christchurch.[253]

Because of this success, DEEP FREEZE planners made a point of requesting air refueling support for at least the beginning of each season. In fact, the number of requested tanker missions quickly increased. The extra fuel added an important measure to the load capacity of the C-141. It also significantly increased the margin of safety, particularly for the season's first mission. Air refueling virtually eliminated the concern over PSR and navigational aid problems. If the season's first C-141B aircrew found the navigation aids misaligned and the weather too poor to land, air refueling ensured the aircraft had plenty of fuel to make the return trip back to New Zealand.[254]

Although DEEP FREEZE 85 was scaled back from previous years--only two 60 MAW C-141s deployed to conduct shuttle missions in October and November--weather wreaked havoc on the schedule. Before the C-141s completed the 17 scheduled missions, they experienced 19 delays from Christchurch and 15 delays from McMurdo Sound. While only seven delays and three airborne weather diversions resulted directly from the severe weather, the climactic conditions played a role in all the delays, whether causing sympathetic delays to keep the missions in order, creating cargo assembly problems at McMurdo Sound, or shifting a refueling requirement to support a higher-priority LC-130 mission first. In addition, Navy engineers were initially concerned about the ice thickness and weight-bearing capacity of the runway. Ice had formed slower during the winter than normal. After a stress-test, the engineers cleared it for the 275,000 pounds gross weight needed for the C-141 operations. By 6 November, the ice had shrunk to a maximum load of 260,000 pounds. Missions after this date were restricted to this maximum landing weight.[255]

Photo 63: Lt Col Stephen Toles, pilot; Capt James Bouska, co-pilot; and MSgt Robert Pakney, flight engineer, in the 22d Air Refueling Wing KC-10 cockpit after completing the air refueling of the C-141 Starlifter participating in the midwinter airdrop 1985 mission.

The deployed C-141s provided some slightly out of the ordinary support for the science community. The first flight flew a photographic reconnaissance mission for the New Zealand Department of Scientific and Industrial Research. After leaving McMurdo Sound, Colonel Baughman's crew flew past a hut on the side of Mount Erebus and took pictures. Scientists planned to use the hut for some upcoming experiments with Japanese scientists. Headquarters Military Airlift Command (MAC) also approved the conduction of a scientific experiment from a C-141 in mid-October. Dr. Alan Mason released approximately 20 kilograms of methane gas at varying altitudes, some as low as 18,000 feet. Maintainers designed a way for his equipment to fit a C-141 and release the gas through a vent port designed for the comfort pallet.* And, at the request of the National Science Foundation, a National Broadcasting Company film team traveled aboard a C-141 to obtain footage for a prime-time television program, "Ocean Quest." The crew also extensively filmed MAC operations at Christchurch during their two-week weather delay.[256]

Relations with the local New Zealanders took a couple of interesting turns. For the first time, officers and senior non-commissioned officers attended a special church service and a reception hosted by the National Science Foundation to mark the opening of the DEEP FREEZE season. In addition to the Air Force representatives, members of the US Navy, New Zealand government and military officials, and local clergy attended. The political climate in New Zealand, however, had changed after a July 1984 political election centered on the prohibition of visits by nuclear-powered ships or warships carrying nuclear weapons. On 27 September, approximately 200 women demonstrated at the Christchurch airport. The New Zealand government approved additional marches on 6 and 7 October. The demonstrators set up near the US Air Force-used facilities and marched to the US Navy hangar, where they stuck flowers and pictures of children onto the fence. While the demonstrations remained peaceful and no violence was expected, it raised concerns about future security and confrontation avoidance.[257]

Lieutenant Colonel Jerry L. McKimmey again commanded the 62 MAW C-141B flying the Ice Drop 85 mission. Once again, a Strategic Air Command (SAC) KC-10 flying from Christchurch provided air refueling--this time, a total of eight refuelings during the two missions (Photo 63).[258] In a message of appreciation, US Navy Captain Shoemaker, Commander of the US Naval Support Force, Antarctica, complimented the teamwork displayed, but also observed the extreme conditions the mission faced:

> Antarctic mid-winter airdrop 1985 was accomplished with characteristic efficiency and aplomb, despite experiencing worst airdrop weather ever - 130 knot head winds, 95 knot shear winds at drop altitude, minus 65 degree (F) temperatures, and 30 foot visibilities. 103,598 pounds (record high) of cargo, mail and fresh food were aerial delivered to McMurdo, Scott, and South Pole Stations during two drops flown from Christchurch New Zealand on 23 and 25 June.[259]

*Comfort pallet was a euphemism for a palletized porta-potty.

Photo 64: A 62d Military Airlift Wing C-141B receives fuel while flying over the snow- and ice-covered expanse of Antarctica during the midwinter airdrop of supplies and food to the winter-over personnel at the McMurdo Sound, Antarctica, and South Pole Stations. (June 1985)

Captain Shoemaker concluded his message with:

> It is gratifying to think we can execute and airdrop to the most remote spot on earth in the most hostile environment, in the dead of winter. By this demonstration of our ability, we have reassured our people who spend the winter in Antarctica that we have the capability to care for them in an emergency as well as routinely resupply them when events progress normally (Photo 64).[260]

The first mission of DEEP FREEZE 86 also included air refueling support from a SAC KC-10. Because of the success of "borrowing" the KC-10 support during the previous year, Colonel Conner (again the USAF Mission Commander) requested KC-10 support for the first mission. Headquarters SAC and MAC approved this request just prior to the start

of operations. The KC-10 refueled the first C-141B en route from Hickam Air Force Base, Hawaii, to Christchurch. It then supported the first three shuttle missions to McMurdo Sound before departing Christchurch to fulfill other requirements.[261]

In fact, the KC-10 refueling allowed planners to load an additional 28,000 pounds of cargo and passengers. This eliminated the PSR concern and still permitted this C-141 to flight-test McMurdo Sound's navigation aids.* However, when the C-141B arrived over McMurdo Sound, whiteout conditions prevailed. The C-141's aircrew was forced to miss the approach and return to Christchurch. This mission, thus, highlighted the tanker's new critical role: the equipment failed, the landing scrubbed, and the fully-loaded C-141 still returned to Christchurch safely.[262]

The Commander, Naval Support Force, Antarctica, originally requested two missions for Ice Drop 86, the first to McMurdo Sound and South Pole Stations and the second to McMurdo Sound and Siple Stations. However, he later deleted the Siple request and left just McMurdo Sound for the second mission. The aircrews used satellite communications because of the notoriously poor performance of the high-frequency radio reception. This mission also included the first attempt to drop eggs (1,440 to be exact) since the C-124 days. Prior to the mission, Air Force and Navy personnel assigned to Christchurch attempted several dropability tests to ensure the eggs would land intact. They finally settled on placing each egg, individually wrapped in a small plastic bag, in cavities scooped out of a piece of foam rubber mattress material.[263]

The two airdrop missions went seamlessly with a SAC KC-10 meeting the 64 MAW C-141B eight times to provide fuel. The first mission, on 21 June, supported drops at both McMurdo Sound and South Pole Stations. The second drop, on 23 June, occurred only at McMurdo Sound. Altogether, the crews dropped 88,574 pounds of repair parts, mail, and fresh provisions. Both ground stations reported complete success, but neither specifically mentioned the egg results.[264] In expressing their heartfelt thanks, the people at the South Pole Station asserted, "You made our day, week, month, year, (check one or all of the above). To see and hear you roar out of the night sky to drop our goodies was a very real thrill. And right on target too!! We appreciate your undertaking of this hazardous yet presumably exciting mission."[265]

For the first part of DEEP FREEZE 87, the 60 MAW sent two C-141Bs, while the 22d Air Refueling Wing sent one KC-10. The KC-10 served as both an airlift asset and tanker during the deployment. One of the C-141s completed the first shuttle, with the KC-10 providing an air refueling. The next five missions canceled because of weather. In fact, Antarctic weather accounted for 21 weather cancellations and 2 air aborts. The KC-10 waited at Christchurch, along with the C-141s, for the weather to break. Once it did, operations resumed. Because of the KC-10, a C-141 carried the heaviest single load--68,158 pounds of cargo--to date. Although scheduled to refuel 10 missions, the KC-10 actually refueled 11 since Lieutenant Colonel Patrick M. Henry, USAF Mission Commander, decided to

*Although US Navy LC-130s began flying operations in Antarctica in August under the winter fly in (WINFLY) program, they were not able to flight test the navigation equipment since it was not set up until the end of September.

launch two missions a day to make up the schedule. In fact, Colonel Henry recommended scheduling two C-141s in the future to take advantage of the KC-10's capability to refuel both.[266]

However, extending the deployment of the second C-141 and KC-10 to play catch-up presented two problems. Once the Navy's six LC-130s and support equipment arrived to begin their operations, the ramp at Christchurch quickly reached its saturation point. The Navy also operated with slightly different procedures than the Air Force. The differences in the two services' views on safe ground operations, in particular, were highlighted on the overtaxed airfield. Members of the Air Force Mission and the Navy's Antarctic Development Squadron Six quickly worked out the disparities. Additionally, personnel requirements in the operations order were based on single C-141 operations. If two aircraft were used in the future, adjustments to the deployed manning would be required.[267]

Maintainers found the deployed mission support kit lacked a few essential items. This resulted partly from the requirements of the additional aircraft, but more so because the kit had been tailored to reflect the desires and experiences of past maintenance personnel rather than presenting a standardized package. Despite a contract with the Mobile Oil Company several months earlier, the refueling specialists also received an inadequate supply of the JP4 (jet fuel) anti-ice additive.* For the first six missions, aircraft landing on the ice received the available JP4. Channel missions and even the KC-10's internal consumption used Jet A (jet aviation fuel) until the additive arrived.[268]

The 63 MAW conducted the Ice Drop 87 mission. Major Charles E. Fitzpatrick III led an augmented aircrew (17 members, including 4 pilots, 3 engineers, 3 navigators), departing Norton Air Force Base, California, on 29 May as a cargo mission to Australia. After completing that mission, the C-141B arrived at Christchurch on 2 June. This gave the aircrew approximately a week to prepare and the airdrop technicians a week to complete cargo preparations. Unfortunately, the 63 MAW aircraft they took developed a fuel leak in the aircraft's jettison valve. Because of the extreme distance involved in the airdrop missions, Major Fitzpatrick requested and received the back-up aircraft, a 62 MAW aircraft.[269]

The aircrew experienced no problems during the three airdrops themselves. On 10 June, a KC-10 provided fuel twice before the C-141 crew dropped 46 bundles at McMurdo Sound's skiway in one pass. The KC-10 then topped off the C-141 and returned to Christchurch (Photo 65). The C-141 proceeded to the South Pole where the crew dropped another 23 bundles from the side troop doors during four passes over the drop zone. For the third drop, the KC-10 refueled the C-141 shortly after take-off and again just before the drop. The C-141's crew dropped 68 additional bundles at McMurdo Sound. The drop included fresh fruit and vegetables--"freshies"--including watermelons and eggs, and various machine parts.[270]

The midwinter airdrops of 1986 and 1987 included support for scientific experiments. After the final McMurdo Sound airdrop, the 1986 aircrew dropped two data buoys on their

*The ship carrying the additive was running several weeks late.

return to Christchurch. For 1987, scientists requested an additional nine buoys to be dropped on the Ross Sea ice shelf. Scientists intended for the data buoys, powered by lithium batteries lasting more than a year, to report the buoy's location, sea ice velocity, sea ice strain rates, and surface temperature, air pressure, and winds, 13 times per day. Once the ice broke off, the buoys would continue reporting the same information. A check of the buoys as they approached the drop points revealed one was not responding. Crewmembers, therefore, only dropped eight (Photo 66). Major Fitzpatrick confirmed seven of the eight were reporting information by the time they reached Christchurch.[271]

Weather played a much smaller part in DEEP FREEZE 88 than in recent years. This was fortunate as no air refueling aircraft were assigned, although the National Science Foundation agreed to fund a KC-10 for the next year because of the increased safety and operational efficiency. Weather delayed the season's first three missions, but caused problems for only six others scattered throughout the rest of the operation. The 60 MAW supported DEEP FREEZE 88 with a total of five special assignment airlift missions (SAAM) and 26 shuttle missions (only 23 belonged to the National Science Foundation).[272]

Two unusual airlifts occurred during the season. The three missions not belonging to the National Science Foundation supported an Air Force Systems Command "Super Nova Project."* The three missions airlifted a balloon, instrument package, gondola, 15,500-pound launch arm, and gas

Photo 65: A KC-10 on its way to refuel the C-141B flying the 1987 midwinter airdrop mission.

Photo 66: TSgt David Brown (loadmaster) struggles to toss out a scientific buoy over the Ross Sea. (13 June 1987)

*This scientific study was originally scheduled for the space shuttle, but after the Challenger accident, shuttle missions were temporarily suspended.

cylinders in racks. The Air Force Systems Command planned to launch this balloon (large enough to cover the Eiffel Tower), capable of a 120,000-foot altitude, in January 1988 to study a super nova.[273]

In December, an Air Force C-141 carried replacement engines and propellers for a Navy LC-130 (tail number 321) that had crashed in December 1971. A jet-assisted take-off (JATO) bottle detached during take off and severely damaged the number 2 engine. Navy engineers began pulling the aircraft out of the snow and ice during DEEP FREEZE 87. Another Navy LC-130 delivered the parts to the crash site, about 125 miles from Dumont d'Urville. Maintainers replaced the engines and propellers, and, after 16 years, the aircraft flew under its own power in January 1988 to McMurdo Station and then to New Zealand for a complete overhaul.[274]

Headquarters MAC deliberated sending a C-5 to the ice during DEEP FREEZE 88. However, the command remained unsure of the capacity of the ice to support such a large, heavy aircraft. To evaluate McMurdo Sound's capability, MAC authorized the 60 MAW to send a two-person team comprised of Lieutenant Colonel Ronald E. Burks, 60 MAW Chief of Aircrew Standardization and Evaluation, and Senior Master Sergeant John W. Martin, Evaluation Loadmaster. They departed Travis Air Force Base, California, on a DEEP FREEZE SAAM on 31 October. After reviewing C-141 operations and the ice runway, they deemed C-5 operations to be feasible, with a few stipulations. If a C-5 was to fly to McMurdo Sound, they recommended landing, offloading, and taking off in a straight line as rapidly as possible. They felt the C-5's weight, combined with the pressure of turning the aircraft, would likely overstress the ice. Additionally, C-5 operations would require prepositioning aircraft-specific maintenance and loading equipment to expedite aircraft servicing and offloading. The C-5 "footprint" was lighter than the C-141 in terms of pounds per square foot and, therefore, could safely land on the ice. A loaded C-5's gross weight, however, could pose a problem--with the danger growing the longer the C-5 set on the ice.[275]

For Ice Drop 88, the 63 MAW sent a C-141B on a channel mission to Australia on 16 June with the intention of changing the designation to an airdrop mission after it reached New Zealand. Much like the previous year, the aircrew swapped C-141s in Australia because of maintenance concerns (this time elevator and cargo door problems). Once at Christchurch, the aircrew preformed the mission planning, while ground crews completed the preparation of repair parts and freshies for the airdrop (Photo 67).

A KC-10 again provided air refueling support. For the first airdrop mission on 28 June, the KC-10 refueled the C-141 twice prior to the McMurdo Sound drop and once afterwards before the C-141 proceeded to the South Pole. At McMurdo Sound, the C-141 crew dropped 46 containers during a single pass, and over the South Pole, the crew pushed 15 bundles through the left and right troop doors. The entire trip took 15.4 hours (Photo 68). For the second airdrop mission on 30 June, the KC-10 refueled the C-141 twice before the airdrop over McMurdo Sound. During the second drop, the C-141 released 72 containers through the back petal doors. After the second McMurdo Sound airdrop, the C-141

Photo 67: On 27 June 1988, A1C Jay Iapaolo and Sgt Steve Raveling, members of the 16th Mobile Aerial Port Flight, Elmendorf Air Force Base, Alaska, rig chutes on the crates that were airdropped in Antarctica.

refueled again and then returned to the airdrop altitude. The crew dropped nine more research buoys on the Ross Sea Ice Shelf. The pilot then proceeded to 160 degrees west latitude to drop a special buoy with a three-year lifespan on the largest piece of floating ice ever recorded. The iceberg had broken off the Ross Ice Shelf in October 1987, and scientists wanted a way to track it.[276]

The airdrop crew experienced three problems. First, a midwinter airdrop aircrew's worst fear occurred when the petal doors malfunctioned because of a frozen hydraulic line. After the loadmasters completed their override procedures, the co-pilot succeeded in closing the door by using his "all doors" switch. The second and third problems proved far less significant, but still caused additional airdrop runs at the South Pole. The aircrew had to abort the first run because the ground crews did not have the drop zone completed and lit with smudge pots. Then on the third pass, a misplaced strobe light on one of the bundles jammed into the left troop door. As the personnel in the rear worked to dislodge it, the aircraft commander, Major Larry Curtis, continued to circle the South Pole. On the eighth pass, the last bundle finally fell free. Despite all the difficulty, the bundle landed only 100 feet short and 200 feet to the left of the drop zone.[277]

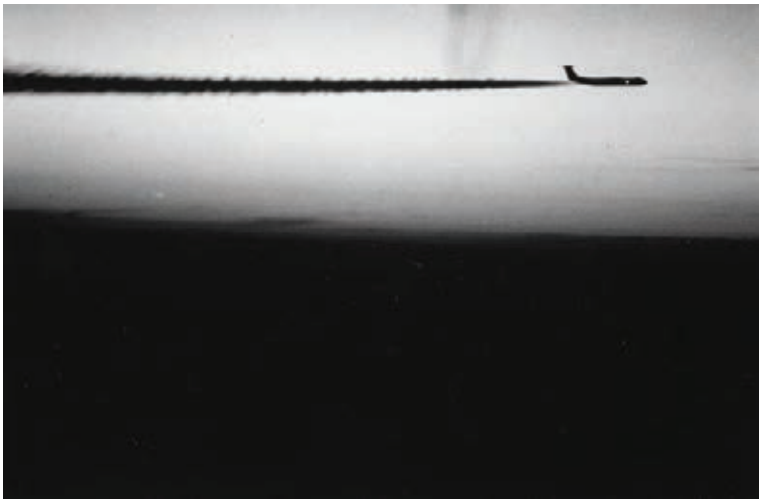


Photo 68: The 63 MAW C-141 departs the Antarctic drop zone heading back to Christchurch, New Zealand, after its final 1988 airdrop.

DEEP FREEZE 89 began on 28 September and again started with no KC-10 support. In all, the 60 MAW flew 4 support SAAMs from the US and 23 Christchurch-McMurdo Sound C-141B shuttle missions (Photo 69). Five 60 MAW channel missions to Australia also provided some support for operations at Christchurch. For the shuttle missions, the weather started off well, but deteriorated later in the season. Weather delayed a total of 13 missions. Additionally, nearly 50 percent of the missions flew with the Navy's new precision approach radar (PAR) out of commission. While the PAR was an improvement over the older tactical air navigation (TACAN) equipment, safety in the quickly shifting Antarctic weather required operable equipment with experienced controllers.[278]

Two special airlift missions occurred during DEEP FREEZE 89. First, a C-141B picked up four Emperor penguin chicks at McMurdo Sound on 16 November. Scientists placed each chick in an individual insulated case to minimize the stress on the young birds (Photo 70). With brief refueling stops at Christchurch and Hickam Air Force Base, the C-141 delivered its live cargo to North Island Naval Air Station, California, on the 17th. The collection of the four Emperor penguin chicks followed the requirements of

Photo 69: A 60 MAW C-141 departs McMurdo Sound, Antarctica, for Christchurch, New Zealand, after a resupply mission in support of DEEP FREEZE 89.

the US Antarctic Conservation Act of 1978. This act limited such collection of Antarctic mammals, birds, and plants to scientific study and zoological specimens only--and even then, only with a registered permit. Scientists at the Sea World park intended to study the juveniles' energy requirements to better understand the Antarctic food-chain balance.[279]

Also in November, a 60 MAW C-141B delivered a 20,150-pound liquid-helium tank from Travis Air Force Base to McMurdo Sound. The Union Carbide Corporation built the $20 million, 12,000-liter tank. A Navy LC-130 then took the tank to the South Pole Station. The liquid helium would be essential for the sensitive equipment scientists planned to use to study the universe's astronomical background microwave radiation.[280]

During a visit to the DEEP FREEZE 89 operations, General Duane H. Cassidy, MAC Commander, made clear his desire to use a C-5 during the next season. Although not an aspect of DEEP FREEZE, the first C-5A mission to New Zealand occurred as part of a Travis to Australia and return mission from 22 February to 1 March 1975. The en route stop at Christchurch demonstrated the capability of using C-5s to support Operation DEEP FREEZE, including the possibility of flying the huge aircraft to the ice runway. Other more recent reviews and tests supported that viability.[281]

Ice Drop 89 experienced a major funding change from previous years. Congressional budget cuts forced MAC to reevaluate its JA/ATT program. With fewer training hours,

Photo 70: During the flight back to the US in November 1988, Scott Drieshman monitored the penguin chicks closely. TSgt A. S. King, loadmaster, 60th Military Airlift Wing, helps Mr. Drieschman change the ice gel packs surrounding the penguin cases.

MAC informed the Navy that further midwinter airdrops would have to be funded under the SAAM program. The Commander Naval Support Force, Antarctica, agreed to fund the continuation of the airdrops and requested the primary C-141 mission days as 18 and 20 June. SAC also agreed to provide a KC-10 for mid-air refueling the C-141 during the mission.[282]

The 62 MAW C-141B performed two airdrops during the first mission, 18 to 19 June. The first consisted of 44 bundles dropped out the aircraft's rear petal doors at McMurdo Sound and 24 bundles out the side troop doors over the South Pole. The second mission on

21 June dropped 46 bundles at McMurdo Sound. In addition to freshies, spare parts, and mail, the bundles included sweaters, movies, light bulbs, a computer, and compact discs.[283] Even though several of the bundles were damaged, Senior Master Sergeant Michael Wright, on his seventh year in charge of the cargo end of the midwinter airdrop, praised the results, "You couldn't ask for a better drop! Everything's right on the drop zone. The Snow Cats [*sic*.] are already out. Within fifteen minutes they'll be putting the first bundles in the van."[284]

DEEP FREEZE 90 began on 27 September when the first of four C-141B support SAAMs departed Travis Air Force Base. In addition to the C-141 SAAMs, the 60 MAW supported DEEP FREEZE 90 with two C-141 channel and one training mission, and one C-5 SAAM and two trainers. The C-141s also flew a total of 22 shuttle missions to McMurdo Sound from Christchurch. Weather and communications greatly hampered the shuttle missions. In all, 11 missions weather-delayed. Poor communications between the aircraft and the McMurdo Sound Station affected several missions. One aircraft commander decided to return at the PSR because he could not contact the station, but weather turned out to be acceptable. The next mission flew with less cargo to increase the PSR to McMurdo Sound. Wherein previous years the weather had allowed increased cargo loads at the expense of the PSR, communications had begun to cause mission planners to decrease cargo loads to extend the PSR.[285]

For the first time, a 62 MAW aircraft, with Major William A. Burt as the aircraft commander, flew a JA/ATT-funded DEEP FREEZE C-141 airdrop mission. After arriving at Christchurch on 28 October, ground crews prepared the 62 MAW aircraft and cargo. On 1 November, a 62 MAW aircrew (augmented by three 60 MAW loadmasters) flew the C-141 (tail number 64-0245) from Christchurch to McMurdo Sound, where it refueled. This aircrew then proceeded to the South Pole. At the drop zone established near the South Pole Station, they successfully airdropped 33,500 pounds of timber and building supplies (including a "utilidoor" system) needed to repair the station's geodesic dome. The aircrew performed a "triple-sequential heavy equipment airdrop," which meant the three heavy pallets were sequentially tied together so the first pallet departing the aircraft deployed the extraction chute of the second, and the second did the same for the third. The triple-sequential drop required a significantly larger drop zone, 2,100 feet by 6,000 feet, but the flat terrain surrounding the South Pole and moderate Austral summer temperatures, minus 47 degrees Centigrade, posed no significant problems.[286]

Prior to DEEP FREEZE 90, participants held a meeting, 5 to 6 April 1989, at Travis Air Force Base to review the requirements and plan for the first C-5 contribution. While they discussed several aspects of the mission, they ultimately concluded C-5 landings in Antarctica were possible. Airlift using the C-5 during DEEP FREEZE 90 saved time and money for the National Science Foundation and US Navy. Planners intended to use the C-5 to haul four UH-1N helicopters to McMurdo Sound. The C-141 could carry a disassembled UH-1N, but the C-5 could carry two fully assembled helicopters, ready to fly after fueling.[287]

A 60 MAW C-5B (87-0042) departed Travis Air Force Base on 29 September and flew directly to Christchurch with a KC-10 air refueling en route. After a crew rest, the aircrew, commanded by Lieutenant Colonel Oakly L. Risser,* departed Christchurch late in the day of 3 October. The Galaxy landed at McMurdo Sound at 0320 Greenwich Mean Time of 4 October, after a 5-hour and 22-minute flight (Photo 71). In one landing

Photo 71: The first C-5B lands on the Ross Sea ice runway near McMurdo Sound Station, Antarctica, on 4 October 1989.

with 167,000 pounds of cargo, including two UH-1Ns, the C-5 tripled a single aircraft's load capacity to McMurdo Sound.[288] One of the C-5's passengers, Major General Richard J. Trzaskoma, Twenty-Second Air Force Commander, noted, "The folks at the National Science Foundation were ecstatic with the operation of the C-5 and its capabilities. It definitely demonstrated the ability of the Military Airlift Command to respond any place on the face of the earth."[289]

*Since no ice-qualified C-5 aircrews existed, the 60 MAW selected its most experienced C-5 crewmembers for the first two missions. Subsequent missions would use these newly ice-qualified crewmembers to qualify others.

Planners were also concerned about "kneeling" a C-5 in Antarctica. To unload rolling stock, such as helicopters, from a C-5, the aircraft had to be lowered by hydraulics. Normal unloading of pallets did not require kneeling unless it was to be done with a forklift instead of the standard material handling equipment. As seen in previous Antarctic operations, hydraulic systems sometimes had problems in the extreme cold, but that did not seem to be the case for the C-5.[290]

The first C-5 landing drew a lot of attention.* At McMurdo Sound, many of the curious rushed out to the flightline to watch the behemoth land. This would not have been so bad except even the flight controller rushed out of the control tower, leaving Colonel Risser in radio silence for the short distance to touchdown. Engineers waited particularly to measure the deflection of the ice caused by the C-5's weight. Even Christchurch officials had requested a C-5 static display. However, because of ongoing diplomatic differences over nuclear and security treaties, the US denied the request.[291]

Though the diplomatic differences would continue to fester, MAC approved a later request for a New Zealand television crew to fly on one of the two Ice Drop 90 missions. On 7 and 9 June, a 62 MAW C-141B dropped 72,100 pounds of supplies to the McMurdo Sound Station and 11,765 pounds to the South Pole Station. During the previous year, several bundles had been damaged in the airdrop, and some of the freshies had suffered frost damage. During the second mission of this year's airdrop to McMurdo Sound, two of the bundles collided with the burning smoke pots, igniting the parachutes. With the exception of some minor burn damage to one bundle, ground crews noted no significant damage to any of the materials dropped, including light bulbs packed in Styrofoam egg trays (this was the first time airdrop technicians tried this method).[292] The men and women at McMurdo Sound stated:

> The remarkable accuracy and lack of damage as the bundles impacted the drop zone at 55 plus miles per hour in negative 35 degree weather was testament to the professionalism and effort of each individual involved as a member of the air delivery team. As we received and unpacked the material, it was obvious that the success of this evolution depended upon the excellent planning, knowledge, skill and exemplary personal effort of all personnel involved.[293]

*This same C-5 conducted the second shuttle mission delivering the other two helicopters on 6 October.

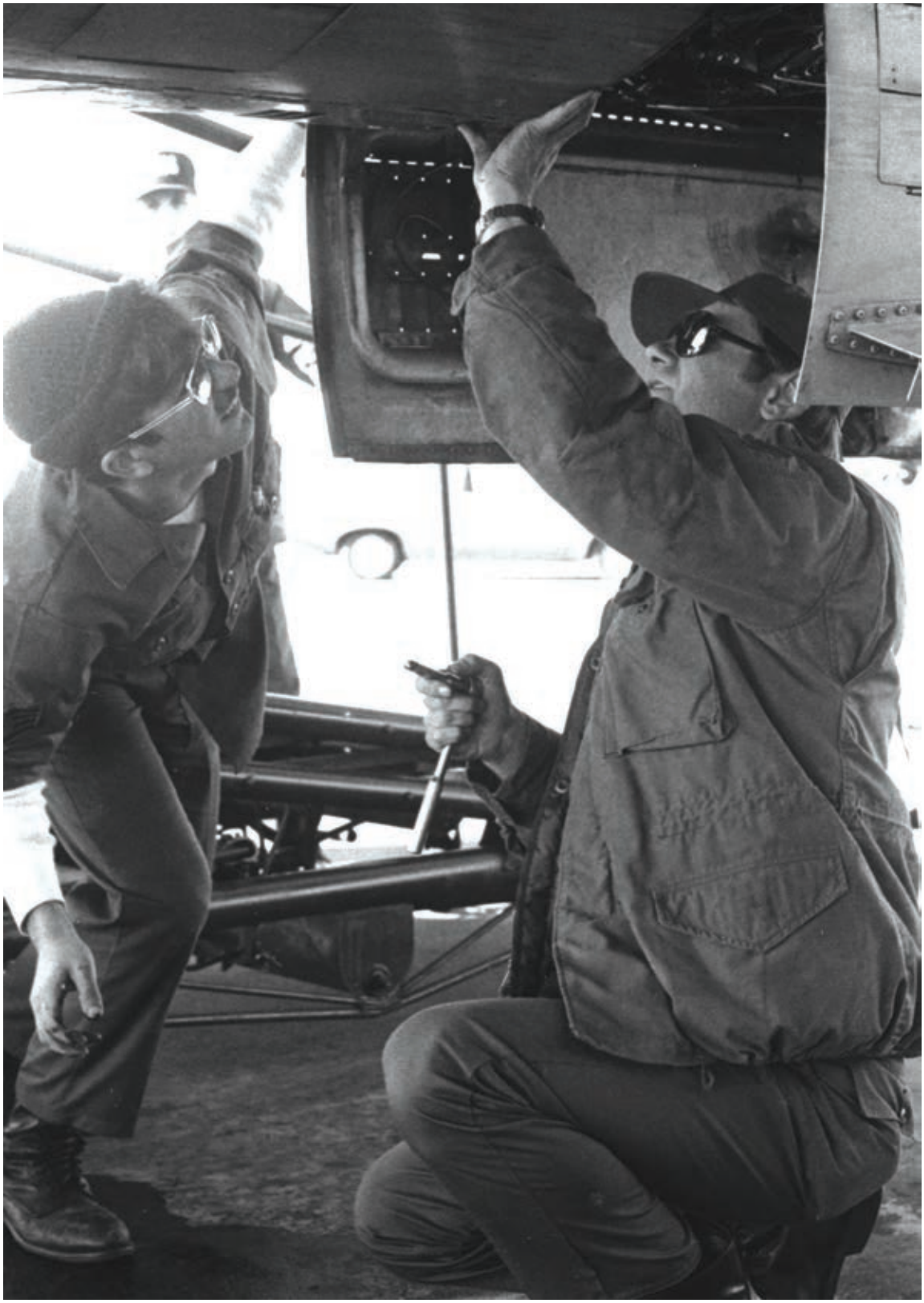


Photo 72: Personnel of Operating Location D, 619th Military Airlift Support Squadron, Christchurch, New Zealand, ensured only the finest and cleanest aircraft went to the ice. (circa 1983)

CHAPTER 10

IT ALL CAME DOWN TO PLANNING

Even before the Antarctic Treaty, which provided for international freedom of scientific investigation in Antarctica, went into effect in 1961, the Department of Defense planned and carried out operations in support of the US National Science Foundation's (NSF) Antarctic Research Program. Designated the Department of Defense's executive agent for this support, the US Navy performed these logistical support functions through the Commander, Naval Support Force, Antarctica (CNSFA). The Military Airlift Command (MAC), and later the Air Mobility Command (AMC), provided airlift support for DEEP FREEZE as arranged by the CNSFA, the Commander of the Naval Air Systems Command, and the Commander of MAC.[294]

In its efforts to improve the operation's efficiency, the Air Force established a permanent-party unit at Christchurch, New Zealand. Although this started with a very small supply detachment in 1959, the unit's effectiveness received a real boost when the Military Air Transport Service (MATS) designated Christchurch as a forward supply point in 1965.* Around that time, MATS established a detachment at Christchurch under the 1501st Air Transport Wing of Travis Air Force Base, California. (See Appendix I for a chronological listing of detachment and operating location designations at Christchurch.)** In January 1967, Twenty-Second Air Force requested MAC change the Christchurch operating location from a strictly DEEP FREEZE mission focus to an en route support focus--since the organization had begun supporting various other MAC channel and special assignment airlift missions, primarily bound for Australia. These missions operated throughout the year.[295]

The operational concept change of DEEP FREEZE 72 better utilized the personnel permanently stationed at Christchurch (Photo 72). At that point in time, the deployed Airlift Control Element, sent by the flying wing supplying the C-141 aircraft, overlapped and increased the capability of the Christchurch operating location during the peak operational period of DEEP FREEZE rotations. Additionally, when the midwinter airdrops started in 1979, only a few support personnel, primarily aerial port and/or airdrop technicians, needed to deploy to augment the US operating location personnel and New Zealand support forces. While the operating location's actual composition varied over the

*MATS established the forward supply system to handle the line items, equipment, and engine spares for the vast area its airlift forces covered. This system initially consisted of 54 forward supply points. [Hist, MAC, Jul 65-Jun 66, Aug 67.]

**While the unit at Christchurch received various designations as an operating location and a detachment, this narrative refers to it as a generically lower case "operating location" unless the specific name is referenced.

years, it typically consisted of one operations staff officer and approximately six to nine enlisted positions ranging from maintenance and supply specialists to airfield managers to administrative support. Additionally from DEEP FREEZE 79 to DEEP FREEZE 81, the operating location's rated officer took over as the USAF Mission Commander. This kept the deploying wing from having to keep a rated officer at Christchurch while the other aircrews rotated, and yet still ensured the continuity offered by having a single commander for the operation's duration.[296]

No matter which unit provided mission command and control, nothing happened without the higher-level planning between the National Science Foundation, US Navy, and US Air Force. Usually held sometime between April and July at a location in the US (often, Travis Air Force Base or Point Mugu Naval Air Station, California), this planning session laid out the overview of the coming year's mission. Generally, the National Science Foundation and Navy established their requirements into and out of Antarctica. The Navy and Air Force then divided out the responsibility for moving equipment and personnel via ship, intercontinental airlift, or intracontinental airlift, and decided how much support they would ask of the Royal New Zealand Air Force and others. They also reviewed the lessons, difficulties, and successes from the previous year, and negotiated any other unresolved issues. After this meeting, the responsible Air Force organization--MAC (later, AMC) or one of its subordinate units--developed the year's operations order, outlining airlift operations, plans, and policies for DEEP FREEZE.[297]

Each year's meeting worked very similar. In December 1996, Lieutenant Colonel Brock W. Eshleman, USAF Mission Commander for DEEP FREEZE 97, described that year's planning conference (held 31 July 1996 in Denver, Colorado) and its results:

> The NSF, the Navy, and [the Air Force] get together and plan out what we're going to do for that season. We plan how many missions, and when are they going to fly. We don't get into the details, like what cargo goes on each one, enough to know if it is cargo or passengers or a mix of both. It is an ongoing thing year to year, so we keep continuity books to keep the corporate knowledge and memory going…. That's the first step in the process…. From there, the mission commander starts planning out the missions. He does everything from picking out the crews to figuring out how many planes he'll need to get down there.[298]

The Air Force operating location at Christchurch also supported an annual coordination meeting in New Zealand. During this meeting, normally held just days before the first shuttle mission, local as well as deployed representatives from the Air Force, Navy, Army, New Zealand forces, and the airport's cargo yard finalized roles and agreements to conduct the airlift. A similar group usually met at McMurdo Sound Station (Photo 73) toward the end of the airlift to discuss the following year's requirements. This meeting often addressed

Photo 73: An aerial view of McMurdo Sound Station, Antarctica, during DEEP FREEZE 90.

expected cargo requirements, Antarctic airfield and navigation issues, and coordination between US and allied lift options.[299]

An excellent example of the results of mission analysis and planning occurred in the mid 1980s. Through the late 1970s and early 1980s, C-141 operations had fallen into a pattern of a heavy ice shuttle mission schedule in October and December, with a lull and often a long break in November. The 834th Airlift Division (ALD) at Hickam Air Force Base, Hawaii, consistently pointed out this was not the best use of resources. Most personnel and transportation costs occurred during the start-up and drawdown phases of an operation. This schedule also tied up spare parts and equipment at Christchurch between the phases. The ice runway's normal deterioration in December created more safety issues and also forced the aircraft to expend more power to taxi and take off in the slushy conditions. Instead, the 834 ALD pushed to have the National Science Foundation and the US Navy move more of the cargo and passenger traffic in October and November. Using channel missions to fly the occasional ice shuttle in December remained a viable option as well. By DEEP FREEZE 85, the shuttle missions ended in early to mid-November as the 834 ALD had suggested.[300]

Despite this careful planning, issues still tended to arise. For example, the NSF expressed concern about the number of MAC-sponsored visitors to Antarctica during DEEP

FREEZE 85. During that year, MAC hosted the six-member USAF Scientific Advisory Board escorted by Brigadier General Richard J. Trzaskoma, Twenty-Second Air Force Vice Commander, plus another five senior officers, a journalist, and a number of other mission observers. The National Science Foundation's concern highlighted the lack of understanding that persisted between the two organizations' procedures. However, it also reflected their position on visitors. Not only did visitors take room on aircraft and time, energy, and in some cases, supplies from McMurdo Sound personnel, they also posed burdens for the Christchurch staff, limited hotel arrangements, and increased overall costs. In response, the DEEP FREEZE 86 USAF Mission Commander further refined policy and procedures for approving non-mission essential visitors.[301]

A critical aspect of this planning involved operational costs. The Air Force designated DEEP FREEZE missions under the special assignment airlift mission (SAAM) program.* This meant they were not standard channel resupply missions. More importantly, it affected the funding of these missions. Under the SAAM program, the airlift requester, often referred to as the user, specially contracted the airlift to perform a certain task, generally outside normal resupply routes or available capacity, and consequently paid for each mission. In essence, the NSF (and the Navy in some cases) carefully selected and prioritized cargo and passengers to transport by airlift. At the same time, the Air Force continually sought ways to decrease user costs and/or increase cargo loads. Examples included adding air refueling operations, using available space on US-Australia channel missions, and even scheduling training missions to accomplish aircrew swap-outs. By 1995, AMC was again considering adding tankers to the DEEP FREEZE airlift schedule. In the previous years, the Air Force did not charge the NSF for the use of the tankers, but instead paid for them through training funds. However, as the discussions progressed, the Air Force realized they would need the NSF to pay for the tanker missions and the NSF realized they did not have the funding. Therefore, the idea was shelved. This also included recouping costs for KC-10 hours supporting the midwinter airdrop missions and thus helped bring about their demise.[302]

Moreover, Headquarters MAC (and later AMC) designated the deployment aircraft as "close watch" missions. That label meant each aircraft was carefully tracked throughout the mission to ensure minimal interruption should an aircraft experience mechanical or other problems. It also obligated the wing providing the mission aircraft to maintain a like-configured aircraft and aircrew on alert as a last minute replacement. For the 60th Mobility Airlift Wing (MAW), this alert usually lasted from the mission aircraft's departure from Travis Air Force Base, to loading and departure from Point Mugu Naval Air Station, and often until the aircraft left Hickam Air Force Base to head across the South Pacific.[303]

Throughout the 1980s, MAC and Twenty-Second Air Force charged the 834 ALD with mission command, including planning, coordinating, directing, and implementing. In meeting this directive, the 834 ALD worked to improve coordination with and to ensure a full understanding of MAC's capability by the US Navy and National Science

*This discussion does not include the midwinter airdrop missions prior to 1989 since they were paid for by Joint Airborne/Air Transportability Training (JA/ATT) funding as discussed earlier.

Foundation. In 1984, the division also developed a permanent operations order that would be supplemented annually. Prior to this, planners built the operations order largely from scratch each year. This perpetual order helped to standardize procedures from year to year and thus reduced confusion for those planners and aircrews participating in multiple seasons. This standardization also helped the 834 ALD reduce the number of personnel deployed and the associated costs.[304]

Initially, the 834 ALD turned over leadership of the mission to the operating location at Christchurch. However in 1981, the division appointed its Assistant Director of Operations as the USAF Mission Commander and made the operating location's chief/commander the Deputy USAF Mission Commander. The operating location's chief/commander consistently requested the mission command transfer back to Christchurch. He based this request on their year-round New Zealand point of contact role, pre-season coordination responsibilities, and primary responsibility for the aircraft and crews. The 834 ALD, however, kept mission leadership at its level because of the rank and position for dealing with the Navy, Army, and National Science Foundation officials. Additionally, the primary staff for planning, coordinating, directing, and managing DEEP FREEZE resided at Hickam Air Force Base. The central line of communication also allowed the Assistant Deputy Commander for Operations to coordinate the operation's long logistics arm more effectively. After the Air Force reorganized and deleted the airlift division command-level, AMC reverted back to assigning mission command responsibilities briefly to the numbered air force, then to the unit providing the airlift.[305]

During the 1980s, one critical controversy developed between the 834 ALD mission command and the 60 MAW as the aircrew force provider. The 60 MAW tried to rotate aircrews frequently through Christchurch in order to expand the wing's knowledge base in Antarctic operations. While the Mission Commander provided support for this rotation, he repeatedly complained about the difficulties imposed on the small deployment and the operations at McMurdo Sound. He also remained concerned over the lack of depth in the experience gained by the aircrews.[306] The 60 MAW, however, continued to pursue the idea of breadth over depth. At the end of DEEP FREEZE 88, Colonel Thomas D. Pilsch, Commander 60 MAW, acknowledged this concern, but re-emphasized the value to the 60 MAW:

> This year we were able to insert more crews into the flow than ever before and allow them to experience the unique challenges of the "ice mission." I realize that crew management becomes more labor intensive for the controlling agencies when we do this, but the results are worth the effort. By getting more crews to the ice, we not only expand our experience base, but also give a very positive boost to morale. This no-cost perquisite helps us maximize the benefits we can draw from the DEEP FREEZE operation.[307]

In the end, the two sides reached a compromise whereby 60 MAW aircrews swapped out during the special assignment airlift missions only. This allowed a reasonable number

Photo 74: An Antarctic fire truck stands by as a C-141B is unloaded in 1988. The track-style gear helps the vehicle move through the snow and ice environment.

to rotate without being excessive. During DEEP FREEZE 89, a total of eight different aircrews accomplished the 23 missions to the ice. A situation developed at the same time with aircrews misunderstanding the requirements of the Antarctic mission and not following a normal firm scheduled return time (FSRT). Under normal situations, an aircrew would leave their home station with an FSRT and could make plans on being home by that date. Although situations could develop that delayed such a return, they were generally infrequent or of a short-duration extension. Antarctic weather, in particular, required more flexibility and often crews stayed an extra week or longer to meet mission demands. The resolution relied simply on educating the aircrew of the needed flexibility before they left Travis.[308]

An Air Force safety officer often traveled to and from McMurdo Sound on the first ice mission. Prior to 1983, he generally traveled to and from on the same round-robin flight. After that, he tended to fly down on the first mission and return on the second a couple of days later. This gave him the opportunity to observe McMurdo Sound ground operations (Photo 74) and discuss procedures, policies, and potential problems. The most consistent safety-related observations resulted from differences between Air Force and Navy flightline operations. This was particularly obvious whenever C-141s and LC-130s crowded the available parking areas. The senior leaders often resolved these differences rather quickly.[309]

The second most common safety observations were the corollary of the unique operation. The Antarctic environment often required independent reactions, not strictly by the book as it were. For example, the first return DEEP FREEZE 87 mission from McMurdo Sound departed with an air evacuation patient onboard. As a basic rule, the air evacuation patient received the highest priority and required an expedient flight. In this case, the 60 MAW Standardization and Evaluation qualification pilot elected to perform one practice approach to flight-test the radar in case the second shuttle mission required its operational use. This type of decision further justified the need for the technical expertise and judgment of a flight examiner on the initial mission. Additionally, the limited manpower available meant a "specialist" had to be adaptable to other needs. For example, a maintainer might assist in loading pallets or a pilot could help direct air traffic.[310]

With the DEEP FREEZE mission's growth in the mid 1990s, AMC's and Fifteenth Air Force's (15 AF) leadership developed a concern for the operational safety in Antarctica. In 1995 and again in 1997, the 15 AF staff conducted an in-depth risk assessment. In the 1995 review, Lieutenant General Bruce L. Fister, 15 AF Commander, viewed the midwinter airdrop missions as a medium risk and recommended adding an additional air refueling aircraft mission and even perhaps another C-141 mission to shorten each mission's length, reduce the stress on the crew, and ensure another 78,000 pounds of fuel would be available in an emergency. He rated the use of the McMurdo Sound airfields as low based on the years of experience operating in Antarctica and the standard operating procedures in place. Still, he reminded everyone, "As we continue to operate in this hostile environment, we must and will strive to improve airdrop and airland procedures to make DEEP FREEZE as safe as humanly possible while providing the best service possible to our customer."[311] The 1997 review had similar results with concern about using the C-5 on the sea ice runway. In the end, the review concluded the size and weight of the C-5 would always present a risk, but the benefits of flying a limited number of C-5 missions, producing a reduction in overall missions and the ability to transport oversize loads outweighed the risk.[312]

While DEEP FREEZE relations with New Zealand had remained strong overall, in 1984, the disagreement between the US and New Zealand over US docking privileges for nuclear powered or armed ships had its impact on Operation DEEP FREEZE. The initial disagreement sparked a protest at Harewood Aerodrome in Christchurch. By 1986, both the US and New Zealand maintained security agreements with Australia, but not with each other.* To keep matters stirred up, New Zealand peace groups accused the US of using Christchurch as a transiting point in support of secret operations in Australia. By and large, the peace groups carefully excluded cargo destined for Antarctic activities in this accusation. However, they periodically raised questions about it also. As a general rule, the New Zealand government required a detailed schedule of the type and purpose of all aircraft visiting, but offered a blanket clearance for those supporting DEEP FREEZE.

*This disagreement effectively destroyed the ANZUS (Australia, New Zealand, and United States) Treaty for the defense of the South Pacific. Afterwards, both New Zealand and the US maintained security agreements with Australia, but not each other.

Because there was a chance New Zealand would ask for the removal of all US troops at the height of this disagreement, the 834 ALD staff looked at alternative sites able to support C-141 Antarctic operations. They concluded the only site reasonably suitable in the Pacific was Melbourne, Australia, with Tasmania providing an acceptable alternate emergency airfield. Melbourne International Airport had a 12,000-foot runway, but was 2,480 nautical miles from McMurdo Sound. The additional 459 nautical miles would decrease the C-141's cargo capacity another 12,000 pounds, further increasing the National Science Foundation's costs. Despite the international friction, the move never materialized beyond the initial planning stage.[313]

Still, non-violent demonstrations continued to occur for several years at the US Navy and Air Force facilities in Christchurch. While they never specifically targeted DEEP FREEZE missions, the demonstrations continued to cause concern for security. Generally, the specific target for the demonstrators was the weekly C-141 channel mission, which they contended was in support of Central Intelligence Agency operations in Australia. The demonstrators often picked up banners with slogans such as "Give MAC the Sack" as the aircraft circled Harewood Aerodome's perimeter.[314]

The use of KC-10 tankers created a small concern each year (Photo 75). The Strategic Air Command (SAC) maintained a standing requirement for a security presence directly assigned to a KC-10 outside the continental US. The small MAC operating location, even

Photo 75: A 22d Air Refueling Wing KC-10 flies into the Antarctic sun after completing an air refueling of the C-141 returning from an airdrop mission over McMurdo Sound, Antarctica, and South Pole Stations. (June 1985)

augmented by deployed personnel, did not have the manning to provide such security. Additionally, a guarded aircraft would present a poor image and likely have a negative impact on MAC operations in New Zealand (especially in light of the non-nuclear disagreement and periodic demonstrations). Each year, SAC willingly approved a waiver from the security standards, but it created one more task for planners to accomplish.[315]

During DEEP FREEZE 85, New Zealand required a canine customs check for all incoming aircraft, equipment, mail, and personal items as well as those departing for Antarctica. Generally, the US forces provided their own canines for this task. This, at least in part, resulted from a 1981 New Zealand customs seizure of 26 mail parcels transiting the country to Antarctica after "sniffer" dogs detected illicit drugs. Although not condoning the transfer of illegal substances, the National Science Foundation remained concerned about the friction created from the incident, but cooperated fully with the government of New Zealand. Other than food, mail remained the most important morale booster for the scientists and workers in Antarctica.[316]

On 1 October 1988, the government of New Zealand implemented new landing fees at Christchurch. The new user-pays policy was implemented with the establishment of separate corporations for various government services and facilities. The airport fell under the Christchurch International Airport Company, Limited, a corporation organized on 1 July 1988 and owned by the New Zealand government and city of Christchurch. The corporation's objective was a 10 percent return (after interest, but before taxes). Air Force planners found these new landing fees exorbitant, raising projected charges from $418 to nearly $2,600. Members of the 834 ALD Logistics Plans staff met with company officials on 21 October and negotiated fees acceptable to both sides (see Table 6). Planners expected this negotiated fee to continue to rise by as much as 25 percent each year.[317]

TABLE 6

LANDING FEES AT CHRISTCHURCH, 1988

	Charges 1 Jan 88	Company Charges Based on Consultation Study	Negotiated Charges 1 Nov 88
Charges	$380	$2,355	$1,284
10% Tax	38	235	128
TOTAL	$418	$2,590	$1,412

NOTE: All figures in US dollars.

SOURCE: Paper, Capt Artis, 834 ALD Logistics Plans, "Landing Fees at Christchurch New Zealand," 17 Jan 89.

Photo 76: Congress instituted the Antarctic Service Medal on 7 July 1960. The military authorized a corresponding ribbon in 1961, with the medal design approved in 1963. The medal is awarded to any member of the US Armed Forces, citizen, or resident alien who served on the Antarctic continent or in support of operations there. The first recipients of this award were members of the US Navy's Operation High Jump. The medal, designed by the US Mint, is a green-gold disc. On one side is a heroic figure of a man in Antarctic clothing, with hood thrown back, arms extended, hands closed, and legs spread to symbolize stability, determination, courage, and devotion. The figure stands on broken ground, with clouds in the background and mountains in the far distance. The reverse shows a polar projection map of the Antarctic Continent, with the words "Courage Sacrifice Devotion" set in three centered lines, all within a symbolic circular border of penguins and marine life. The ribbon has a white center stripe flanked by progressively darker shades of blue, with black at the edges.

Source: Website, Air Force Personnel Center, Air Force Recognition Programs, circa Jun 05.

By the early 1990s, there were more changes planned that would affect the DEEP FREEZE mission. With the end of the Cold War, Air Force leaders recognized the need to reorganize the Air Force. The reorganization directed the inactivation of the Military Airlift Command and the activation of the Air Mobility Command on 1 June 1992. As a new command, AMC (including its Air Force Reserve- and Air National Guard-gained

units) received most of the airlift assets previously owned by MAC and a considerable portion of the air refueling tanker force previously belonging to the inactivated SAC. This integration of an "air mobility" mission improved the rapid response of the global mobility mission and provided a single coordinating and scheduling agent for worldwide strategic airlift and air refueling.[318]

In another Air Force-level reorganization decision, all air divisions, including the 834 ALD, inactivated in the 1990s. While the 834 ALD had played a major role in the coordination and command and control of Operation DEEP FREEZE, that role would then be split between the wing supplying the airlift aircraft and AMC's new Tanker Airlift Control Center (TACC). Co-located at Scott Air Force Base, Illinois, with Headquarters AMC, the TACC served as the command's operations center, overseeing the planning, scheduling, tasking, and execution of all strategic airlift, most tactical airlift, and most air refueling missions worldwide. For DEEP FREEZE, the TACC took over the planning and coordination functions previously serviced by the 834 ALD. Meanwhile, the numbered air force and deploying wing fulfilled the mission command and detailed shuttle-mission planning functions.[319]

Of final note, military personnel serving on Operation DEEP FREEZE could become eligible for the Antarctic Service Medal (Photo 76). As the executive agent, the Commander, Naval Support Force, Antarctica, established the criteria for the award. Initially, award of this medal required 30 days on the ice or 30 missions. As the mission requirements decreased and the cargo capacity increased, the Navy lowered the criteria to 15 missions. By the mid 1980s, the CNSFA proposed a point system for awarding the medal. However, he muddled the issue by awarding the medals to all those personnel who had flown on the C-141B or KC-10 in support of the midwinter airdrop under his authority to recognize exceptional service and perils. To keep things equitable, the 834 ALD reached an agreement with the Navy Commander during DEEP FREEZE 86. Under this agreement, the 834 ALD submitted names and justifications for those meeting the established measure and those qualifying under the exceptional service principle. The intent remained to recognize those service members meriting the award.[320]

Photo 77: Cargo is unloaded from a C-5B Galaxy after its second landing during DEEP FREEZE 90.

CHAPTER 11

BLUE ICE (1990-1998)

For a number of years, glaciologists and engineers of the Soviet Union had tried to develop permanent runways capable of supporting wheeled, heavy aircraft. By 1979, they had achieved a fair amount of success, and the first wheeled aircraft landed at their permanent runway at the coastal station of Molodezhnaya in February 1980. The Ilyushin IL-18D flew from Maputo, Mozambique, approximately 2,600 nautical miles away. Regular service to this runway then began with IL-18d and IL-76 aircraft.[321]

American scientists, engineers, and aviators had also been searching for a way to install a permanent runway since at least 1963. By the late 1980s, the National Science Foundation (NSF) decided the most viable option rested with a runway built on the blue ice* approximately 8 miles from McMurdo Sound Station. The ice in this location was over 100 feet thick. If successful, it would be feasible that the blue ice runway could be open year round since it would be on land rather than the Ross Ice Shelf. With engineers working rapidly on the new permanent runway,** the NSF requested the Military Airlift Command (MAC) schedule one C-141 flight, the last of DEEP FREEZE 91, in November to test the new runway and four additional follow-up C-141 missions in February 1991. Speculation was that if the McMurdo Sound blue ice runway proved successful, a second glacial runway could possibly be set up near the South Pole.[322]

After the two successful C-5 landings during the previous year (Photo 77), MAC readily scheduled C-5 support as well as C-141s for DEEP FREEZE 91. The first of three 60th Military Airlift Wing (MAW) C-141s left Travis Air Force Base, California, on 26 September 1990. Once set up at Harewood International Airport, Christchurch, New Zealand, this C-141 flew the season's first Christchurch-McMurdo Sound shuttle mission on 2 October.[323]

The scheduled C-5 arrived on 1 October and was opened to local New Zealanders to tour on 2 October. The first C-5 shuttle mission subsequently launched on 3 October with Lieutenant Colonel Oakly L. Risser, the C-5 aircraft commander during DEEP FREEZE 90, in the right seat as the mission ice-qualifier. Although the C-5 carried over 73 passengers, a UH-1 helicopter, a disassembled Otter aircraft, and some other cargo (a total of 65,000 pounds), planners considered this a light load, and, without the support of a KC-10 Extender, navigation calculations placed the point of safe return (PSR) over McMurdo Sound. Almost

*Blue ice was a clean, compact ice formed in glaciers by recrystallization of snow, often in bands, and usually in shear zones.

**The Navy named the blue ice runway the Pegasus Site after a C-121 Super Constellation which crashed near the location on 8 October 1970.

immediately after takeoff, a hydraulic system failed, and the aircraft commander, Major Milt Brewer, decided to return the aircraft to Christchurch. The maintenance team in New Zealand quickly isolated and corrected the problem, and the C-5 launched again--just under three hours later. The aircraft commander reported a few other minor maintenance concerns, but pressed on for McMurdo Sound.

The C-5 landed without incident and parked at one of the three large and separated ramps. This parking scheme allowed room for the C-5 to be moved should the need arise. Scientists estimated an ice deflection of 9 inches would necessitate moving the aircraft. By the time the aircraft left, Navy engineers measured a 4-inch deflection in the ice (Photo 78). This greatly exceeded the previous year's effect, even though the C-5 carried a lighter cargo this time. Although not sure, NSF scientists speculated that any number of variables, such as the salinity of the water, could have caused it. Winds affected the timing of the next two C-5 shuttle missions, but by 10 October, all three missions were complete, and the C-5 returned to Travis Air Force Base.[324]

Photo 78: US Navy Equipment Operator Construction Apprentice Leon Williams measures the effects of a C-5B aircraft's weight on the ice layer on which it had been parked during DEEP FREEZE 91.

While MAC had agreed to test the Pegasus blue ice runway with the last C-141 mission of the season on 8 November, the Navy agreed to land an LC-130 on 3 November to test the new runway. After landing, the aircrew raised the skis and taxied on the surface with its wheels. Exposure to the sun and light blowing snow meant the wheels tended to cause significant ruts, which made the aircraft difficult to control. Engineers recut the

Photo 79: Norton's Finale! Members of the 63d Airlift Wing pose for a photo in the cargo bay of a C-141B while sitting on supplies that will be airdropped to McMurdo Sound Station, Antarctica. This was the last scheduled mission of this type for the 63 AW. Left to right are: TSgt J. Franz, SMSgt S. Spotts, MSgt B. McKey, MSgt R. Teal, CMSgt W. Wilson, Capt C. Trammel, SMSgt F. White, CMSgt C. Clark, TSgt W. Savage, and TSgt P. Vaughn.

runway, but when an LC-130 tested it again in December and January, much the same result occurred, and the runway was declared unsuitable for wheeled aircraft. Planners wisely canceled testing with the C-141 for this year.[325]

In June 1991, an aircrew of the 63d Military Airlift Wing, Norton Air Force Base, California, conducted the midwinter airdrops. On 25 June, a C-141B, refueled by a KC-10 from the 22d Air Refueling Wing (ARW), March Air Force Base, California, dropped 44 containers of fresh fruit and vegetables, repair parts, mail, and computer parts out the rear petal doors to McMurdo Sound Station. It then refueled again and proceeded to the South Pole Station where the aircrew pushed 21 bundles out the side troop doors. On the 27th, the aircrew returned to McMurdo Sound for the second drop. This time, they airdropped 78 bundles out the rear doors.[326]

For Operation DEEP FREEZE 92, the NSF requested airlift for twice the amount of cargo and passengers than any previous season the C-141 had supported. MAC, therefore, included both C-5 and C-141 support. In 10 weeks, beginning 26 September 1991, aircrews,

primarily of the 60 MAW, completed 30 C-141 and 7 C-5 turn-around missions. During this same period, aircrews of the 63 MAW flew six airdrop missions, and 62 MAW aircrews accomplished another four airdrops. All airdrop missions originated at Christchurch, flew to McMurdo Sound to refuel, and then proceeded to the South Pole. These aircrews used the triple-sequential heavy equipment airdrop to deliver construction material to rebuild the dome at the South Pole and also flew several of the turn-around missions while at Christchurch. A 62 MAW even flew one aeromedical evacuation mission to Antarctica.[327]

The NSF wanted to have the Pegasus Site operational for DEEP FREEZE 92 and, as they had the year before, requested four C-141 sorties for February 1992. Navy engineers worked hard to ready a blue ice runway since every C-141 mission would relieve the overtaxed LC-130s of at least three round-trip missions between Christchurch and McMurdo Sound. During the October missions, MAC aircraft carried a grader, snow blower, carts, and drags to Antarctica specifically for this project. By December, Navy engineers noted much progress, but were not optimistic that the runway would be ready by February. On 5 January, they canceled the C-141 request for a second year.[328]

Ice Drop 92 was scheduled to be the 63d Airlift Wing's (AW) last Antarctic mission of this type (Photo 79).* This operation followed the standard pattern--an airdrop mission to the McMurdo Sound and the South Pole Stations, followed by another mission to McMurdo Sound only. However, this year, the C-141's container delivery system (CDS) was equipped with the new center vertical restraint (CVR) rails, allowing the use of larger and heavier bundles.** During the second drop to McMurdo Sound, one of the parachutes failed to open, and the bundle landed well away from the drop zone. When dropping a large number of bundles (40 in this case) during a CDS drop, the row of parachutes opening rapidly in succession sometimes formed air pockets which then starved one of the chutes for air, thus preventing it from opening.[329]

With the inactivation of the 834th Airlift Division, Twenty-Second Air Force, the division's parent organization at Travis Air Force Base, took over mission command for DEEP FREEZE 93. Lieutenant Colonel George E. Meggers, Twenty-Second Air Force Chief of Aircrew Standardization and Evaluation, was appointed USAF Mission Commander. Once again, the 60th Airlift Wing provided the C-141 and C-5 for the Christchurch-McMurdo Sound shuttle missions, while the 62d Airlift Wing provided a C-141 for two airdrop missions. Weather and sunspot activity delayed several missions and forced both airdrop missions to air abort at the PSR--one for weather minimums at McMurdo Sound and one for a communications blackout. Additionally, one of the C-141 shuttle aircraft experienced mechanical problems at two different times because of the extreme cold temperatures (a cargo hatch froze open and the number 3 engine froze in the idle position for an hour).

---

*However, the 63 AW stepped forward in October to fulfill a National Science Foundation request for one regular season DEEP FREEZE airdrop mission. [Hist, 63 AW, Jul-Dec 92, 27 Apr 93.]

**According to one report, the previous bundles measured 24 inches long by 53.5 inches wide by 70 inches tall and weighed up to 700 pounds. The CVR rails allowed for bundles measuring 48 inches long by 48 inches wide by 80 inches tall and weighing up to 800 pounds.

Yet again, the NSF devoted a considerable amount of resources to developing the Pegasus Site. In late 1992, engineers considered the runway ready for testing and used a 320,000-pound test cart to simulate a loaded C-141. The cart revealed many weaknesses in the structural integrity of the ice surface. This was especially evident in the 5,000- to 7,000-foot section of the 10,000-foot runway where the cart's wheels sank up to 5 inches into the ice. Engineers filled the failed zones with fresh water and tested the integrity again in January, with similar results. With so many problems, the Air Force, Navy, and National Science Foundation agreed that an LC-130 with a C-141 acceptance pilot on board would flight test the runway before a strategic airlift aircraft would land there.[330]

En route to Christchurch for the midwinter airdrop 1993 mission, the aircrew, led by Lieutenant Colonel Jeff Cain, had to change to the backup aircraft at Hickam Air Force Base, Hawaii, when the primary aircraft failed a pre-flight inspection. Unfortunately, the backup aircraft had not been wired for satellite communications. Although a potential mission impact, it proved little problem since the high-frequency radio worked well throughout the mission. Because the aircraft change caused the mission to slip by a day, the mission received little support from the Tanker Airlift Control Center (TACC), Air Mobility Command's (AMC) new operations center, since the mission had not been added to its new computer command and control system, the Global Decision Support System (GDSS). Although a concern for the new command and control system, this had little overall effect on such a small operation. Otherwise, the Ice Drop mission followed the similar blueprint of previous years, with no significant difficulties.[331]

Once again, the 60 AW planned to support DEEP FREEZE 94 with one training C-5 mission, four C-141 missions, and one C-5 special assignment airlift missions (SAAM) from the US to Christchurch.* Unusually, thin ice around McMurdo Sound's runway precluded any C-5 missions from this year's shuttle schedule. Additionally, the NSF canceled 4 of the 25 scheduled C-141 shuttle missions because of a lack of funding (Photo 80). Weather played a significant factor in the shuttle operations, delaying four missions and causing another seven to air abort (five at the PSR). AMC continued to use PSR weather minimums of 3,000-foot ceilings and 3-mile visibility to continue a mission, but the Navy pressed for lower minimums to match what they used for the LC-130s, which were 1,500-foot ceilings and 2-mile visibility. AMC, however, stood its conservative ground because the C-141 and C-5 aircrews did not have the emergency options to land on the ice or skiways that the LC-130 aircrews had.[332]

By the end of 1993, the Navy had successfully used an LC-130 to test the blue ice runway and found it suitable for operations. On 7 February, Colonel Meggers commanded the first C-141 (tail number 65-0238) to land on the Pegasus Site. Upon touching down, the aircrew found a high-quality 10,000-foot runway. To become fully operational, it still required lights and runway markers. To protect the blue ice runway, engineers

*In addition to the 60 AW and support personnel deploying to Christchurch, the TACC tasked the 445 AW, a Reserve wing from March AFB CA, to send a five-person airlift control element (ALCE) to Point Mugu, CA, from 3 to 7 November. In the past, the 60 AW had provided its own ALCE to Point Mugu. [Hist, 445 AW, Jul-Dec 93, (K-WG-445-HI, IRIS 0116572) 21 May 94.]

Photo 80: A 60th Airlift Wing C-141 sets on the ice in Antarctica as part of DEEP FREEZE 94. (circa October 1993)

compacted a four-inch layer of snow into a white ice over the top. This covering protected the runway from the sun and warmer temperatures of late summer. The engineers projected that this new runway should last 10 to 20 years.[333] After the landing, Captain Jack Rector, Commander, Naval Support Force, Antarctica, stated:

> This landing culminated more than four years of intensive research and development. The fact that this landing was uneventful and somewhat anticlimactic is testament to the quality of effort and planning exercised by the various contractor, government, and military agencies involved in developing this resource. Sincere congratulations are in order to the construction crews, aircrews, planners, budgeters, and many conceptual thinkers who have given their all to achieve this worthy goal.[334]

Once again, Ice Drop 94 followed the pattern of one C-141 mission consisting of two airdrop events (one at McMurdo Sound and one at the South Pole) and a second mission with an airdrop at McMurdo Sound only.* The cargo bay crew (Photo 81) experienced difficulty with only one of the bundles at the South Pole. On the first pass, they successfully

*The KC-10 was provided by the 722d Air Refueling Wing, March AFB CA. The 722 ARW was a temporary active-duty unit as the 22 ARW was moved to McConnell AFB KS and March AFB was being turned over to the Air Force Reserve. The KC-10 aircraft subsequently moved to Travis AFB CA making that unit the 60th Air Mobility Wing.

dropped three bundles from each troop door. A bundle lodged itself against the right troop door on the second pass.[335] This incident made Captain John M. Wiprud, the flight surgeon onboard the aircraft,* quickly realize why a flight surgeon was on the mission:

> This was by far the most dangerous part of the mission as the exertion needed to try to free the bundle combined with the high altitude [above 10,000 feet] made for an extremely dangerous combination. Oxygen bottles were passed around as quickly as possible and a close eye was kept on all crewmembers. After several unsuccessful attempts to retrieve the bundle, it was decided to just throw it out of the aircraft and was accomplished with no injuries to the aircrew. The rest of the bundles were dropped without incident . . . .[336]

Ice Drop 94 included two significant firsts. The aircrew used night vision goggles. These low-light devices, along with the use of "blue lighting" in the cockpit, greatly aided the aircrew in locating the drop zone smudge pots, especially at the South Pole. They also used the global positioning system (GPS) for the first time during polar navigation. The system proved highly accurate.[337]

Photo 81: The load crew prepares for the airdrop during the 1994 midwinter airdrop.

*The first documented flight surgeon to accompany an Ice Drop mission was Colonel Thorpe in 1993. [Ltr, Lt Col Jeff Cain, 4 AS Commander, to 62 OG Commander *et al.*, "Trip Report for Midwinter Airdrop 93," 15 Jun 93.]

Mission command changed again for DEEP FREEZE 95. This time, the 60th Air Mobility Wing (AMW),* as the operating wing, provided its own mission commander and assigned the responsibility to Lieutenant Colonel Russell J. Frasz, 20th Airlift Squadron Director of Operations. Unfortunately, this was a problematic transfer as the numbered air force and the TACC continued to apply the previous years' command and control procedures, thus blurring the authority intended for the mission commander. Additionally, Air Force funding proved very limited this fiscal year. This lack of funding meant the Air Force could not fund one of the Travis Air Force Base-to-Christchurch missions as a training mission as planned. As a result, the NSF had to "buy" the C-141 deployment SAAM.[338]

The C-5 returned to the Christchurch-McMurdo Sound shuttle mission. An aircrew of the 60 AMW flew one shuttle mission on 5 October, delivering a helicopter to McMurdo Sound. An aircrew of the 349 AMW, Reserve associate of the 60 AMW, flew the second mission, with 158,000 pounds of cargo, on 7 October. Aircrews of the 60 and 349 AMWs flew 12 C-141 round-robin missions. An aircrew of the 452 AMW, March Air Reserve Base, California, flew two missions in November using the 60 AMW's C-141. With the retirement of the C-141 and the implementation of the C-17 fast approaching, AMC planners intended to increase the use of Air Force Reserve wings, eventually turning over mission command, during upcoming DEEP FREEZE seasons.[339]

Because of limited funding, the NSF planned only two airdrop events (one for McMurdo and one for the South Pole) during the 1995 midwinter airdrop. As it turned out, because of funding, Ice Drop 95 was the last scheduled midwinter airdrop. Although AMC proposed the airdrop mission for the next couple of years, the NSF canceled its request for fiscal year (FY) 1996 and 1997 before any detailed planning occurred. The 62 AW flew the 1995 mission, with three aircrew members from the 446 AW, the 62 AW's Reserve associate wing at McChord Air Force Base, Washington. Although originally scheduled to start 11 June, Antarctic winter storms pushed the missions back a week. During the week, the mission commander, Lieutenant Colonel David R. Smith, opened the C-141 to four days of static displays. During these displays, crewmembers allowed visitors as close a look at the airdrop loading process as safety would allow. Once McMurdo Sound's weather cleared on 14 June, the aircrew flew the McMurdo Sound airdrop first and reported complete success with only 1 squash damaged, even though 1 of 40 bundles' chutes failed to open and another one streamered from lack of air. The South Pole airdrop occurred on 16 June, with no damage reported on the 21 bundles dropped.[340]

The 60 and 349 AMWs again supported DEEP FREEZE 96. In addition to aircrews and support personnel from the two wings, the 615th Air Mobility Operations Group (AMOG) at Travis Air Force Base deployed a tanker airlift control element (TALCE) to Christchurch. Consisting of members of the 615 AMOG and two Air Force Reserve aerial port squadrons, the TALCE provided supervision, command and control, and aircraft and personnel support requirements. The TALCE deployed because the Air Force had reduced the size of the permanent operating location at Christchurch earlier in 1995.[341]

*The 60 AMW received this designation in 1994 because of the assignment of KC-10 refueling aircraft to the wing. The KC-10s came from March AFB. The 22 ARW moved with its KC-135 aircraft to McConnell AFB KS.

During this season, weather and communications produced far fewer effects than normal. In fact, only one aircraft air aborted after take off. In mid October, Secretary of the Air Force Sheila Widnall visited Christchurch to view the DEEP FREEZE operation. The C-141 aircraft, equipped with a distinguished visitor module* that she and 11 others were traveling in, launched for McMurdo Sound. As this aircraft approached the PSR, weather closed in at McMurdo Sound, and the C-141 returned to Christchurch. This year, the construction crew had built a crosswind runway capable of supporting C-141s and C-5s on the ice. Lieutenant Colonel Gregory L. Hergesell, the Mission Commander, credited the lack of air aborts and canceled missions to this crosswind runway.[342]

At this time, planners at AMC began to take a serious look at the future of Air Force strategic airlift operations in support of DEEP FREEZE. As already mentioned, the C-141 was destined to retire. In fact, the 60 AMW would lose all of its C-141s by FY 1997. As a near-term solution (FY 1997 to 2002), planners decided to move the mission to the 62 AW at McChord Air Force Base. They based this decision on the 62 AW's experience from the midwinter airdrops and the fact that at least five ice-qualified C-141 aircraft commanders would move from Travis to McChord by the 1997 deployment period.** During this near-term period, AMC would use more Reserve aircrews to build their experience-level. That way, when the 62 AW converted from the C-141 to the C-17, the Air Force Reserve would take over the mission lead (FY 2002 to 2006). Planners intended to introduce the C-17 to the DEEP FREEZE mission during this mid-term period, but would allow the fleet a chance to mature before turning the bulk of the mission over to it. For the long-term, FY 2006 and beyond, AMC planners proposed reviewing three options: 1) transfer the mission to the C-17; 2) privatize the operation; and 3) terminate Air Force support. As it turned out, option one provided the best long-term option.[343]

The timing of this discussion proved interesting as it occurred nearly simultaneously with the Department of Defense's decision to move the intracontinental airlift mission from the Navy's Antarctic Development Squadron Six (VXE-6) to the Air National Guard's 109th Airlift Wing, stationed at Stratton Air National Guard Base (ANGB), New York. The 109 AW*** flew the Air Force's only ski-equipped LC-130 Hercules aircraft. Starting in 1975, the 109 AW flew their LC-130 aircraft to support the Arctic's Distant Early Warning (or DEW Line) sites. In January 1988, wing aircrews began flying Antarctic missions in support of the VXE-6 Squadron. The aircrews primarily flew familiarization missions and served as the continent's emergency search and rescue capability in early 1988 and 1989, but briefly played a major airlift role in 1990 and 1991 when seven of the VXE-6 Squadron's aircraft cycled out of service for scheduled maintenance. After this period, the 109 AW continued to augment the VXE-6 Squadron (Photo 82). Typically, as in DEEP

*This module consisted of a palletized soundproof area with seating and communications equipment to aid the comfort and needs of distinguished visitors.

**Planners intended to continue using 60 AMW C-5s to support any outsized requirements.

***The wing was previously designated the 109th Tactical Airlift Group and then 109th Airlift Group. For simplicity, this discussion refers only to the 109 AW name.

FREEZE 96, the 109 AW rotated 2 LC-130s and about 34 personnel at a time to Antarctica on up to 6 rotations between November and February.[344]

By the early 1990s, the military was downsizing, and each service was turning towards a focus on its own core competencies. Because of this shift, the Department of Defense elected to consolidate LC-130 operations with the 109 AW. This included inactivating the Navy's VXE-6 Squadron and turning the intracontinental Antarctic support mission over to the Air National Guard by 1999. This transition was done in three phases. First, the Navy maintained the majority of the mission, but deleted 75 permanent support positions at Christchurch and McMurdo Sound. The next year, the Navy further reduced its manpower to aircrews, maintainers, and weather analysts. The Guard increased its mission support, but also kept personnel to these same types, with a small overhead command staff. For the third phase, the Guard took over nearly the entire operation, but it was limited to planning missions, and flying and fixing aircraft. The NSF contracted virtually everything else through civilian firms. This, for all intents and purposes, reduced the US's military manpower in Antarctica by two-thirds.[345]

Photo 82: A US Air Force LC-130H sets in front of the National Science Foundation's science dome at the South Pole Station in January 1994.

Since the increased responsibilities gave the 109 AW a year-round ski mission, the National Science Foundation paid for three new LC-130Hs--flown by the 109 AW, but owned by the NSF. Lockheed delivered these three aircraft between December 1995 and May 1996. Also in 1996, the NSF funded a $30 million expansion of Stratton ANGB. Finally, the Navy agreed to a two-year mission hand-off period to ensure uninterrupted support for the NSF. In preparation, during the off-season months of 1996, the 109 AW sent a team of 43 personnel of various specialties to Point Mugu Naval Air Station, California, to meet with representatives of the VXE-6 Squadron, the NSF, and private contractors to resolve the transition's logistical issues.[346]

Operation DEEP FREEZE actually consisted of three phases, although the Air Force, with the exception of the LC-130 augmentation, had only played in the main season phase. The winter fly in (WINFLY), usually held in August and early September, moved the personnel and equipment to McMurdo Sound to prepare the sea ice runway for the main season. This airlift also delivered critical spares and some fresh supplies to McMurdo Sound residents. The main season took place from October to early December and consisted of the largest portion of airlift as the Air Force strategic airlift brought supplies and personnel to McMurdo Sound, and the LC-130s distributed them to other sites. The final phase, often referred to as "reverse WINFLY," removed scientists and personnel not wintering over in Antarctica. These missions were usually in January and February, but sometimes occurred as late as early March. Until the completion of the Pegasus Site, only ski-equipped aircraft could fly the WINFLY and reverse-WINFLY airlift.[347]

With the 60 AMW scheduled to lose the last of its C-141s later in the fiscal year, the wing served as the lead operational organization for the last time during DEEP FREEZE 97. For the first time, an Air Force C-141 flew the WINFLY program, flying three Christchurch-McMurdo Sound shuttle missions between 20 and 24 August 1996. These three C-141 missions provided the same lift as ten LC-130 shuttles. To assist the mission's transition to other C-141 units, aircrews from the 62 AW, McChord Air Force Base; the 452 AMW, March Air Reserve Base; and the 436 AW, Dover Air Force Base, Delaware, supported the main season's operations. Altogether, they completed 16 C-141 shuttle flights, while 60 AMW aircrews flew another 2 C-5 missions (delivering at least 1 helicopter for the NSF). A C-141 of the 60 AMW also participated in the reverse WINFLY for the first time. A single C-141 mission removed 100 personnel on 2 March 1997. With the conclusion of DEEP FREEZE 97, mission command transferred to the 62 AW.[348]

Weather returned to something resembling normal for DEEP FREEZE 97's main season. It was responsible for 2 air abort missions (1 C-5 and 1 C-141) and 10 departure delays from Christchurch. Additionally, turbulent weather at Christchurch delayed one mission and caused one returning from McMurdo Sound to divert to Auckland, New Zealand, for a temporary landing. In addition to weather, the deployment experienced difficulty with computer flight plan support from the TACC. The TACC experienced problems that would not allow it to produce a normal flight plan for the leg from Christchurch to McMurdo Sound. Throughout the deployment, the TACC provided flight plans in various formats, but often lacked such critical information as wind factors and temperature deviations below

60 degrees south latitude. In the end, mission navigators took mission data from the TACC and local Navy support, tying it together to build usable flight plans.[349]

For the first year of transition, the 109 AW deployed a contingent very similar to the previous year's DEEP FREEZE 96. In November 1996, the wing sent two LC-130H aircraft and approximately 34 personnel. They then rotated the personnel via commercial aircraft for six periods of time. The final rotation returned to New York with the LC-130s in February 1997. The main difference from the previous year was that the 109 AW personnel spent time learning how the Navy's VXE-6 Squadron conducted its planning and coordination with the NSF.[350]

Because of the transition, the 109 AW received authorization to have a reporter accompany their deployment for the first time. The reporter was Gil Gross from the Columbia Broadcasting System Radio Network. Gross had worked with the 109 AW before and was a 1995 graduate of the wing's "Kool School." The 109 AW held the Arctic Aircraft Recovery School annually in Greenland, just three miles from a former DEW site (Photo 83). Gross recorded several five-minute segments at various locations throughout Antarctica between 7 and 10 January 1997. The segments were then aired on 21 January.[351]

The notoriety did not stop there. On 15 January, a 109 AW LC-130 aircrew flew a special mission from McMurdo Sound to the South Pole. The flight marked the 40th Anniversary of New Zealand's Scott Base (located near McMurdo Sound). Passengers on the flight included New Zealand's Prime Minister Jim Bolger, the first head of state to visit the South Pole, US Ambassador Josiah Beeman, Norwegian Borge Ousland (the first man to cross Antarctica alone--he arrived at Scott Base from the journey only 2 days prior), and Sir Edmund Hillary (the first man to travel alone to the South Pole some 40 years earlier, and the first man to reach the summit of Mount Everest). A New Zealand television crew documented the flight and ceremonies.[352] The aircraft commander, Major Jim Hunt, remarked on the crew's excitement about the flight, "Our South Pole arrival signaled the end of that historic passage uniting past and present explorers at the spot where Scott and Amundsen made their marks on Antarctic history. The pleasure and the memory were indeed all ours."[353]

As scheduled, the 62 AW took over for DEEP FREEZE 1997-98.* The 60 AMW contributed one C-5 for two missions in early October. For the WINFLY phase, the 62 AW deployed one C-141 and aircrew, commanded by Lieutenant Colonel Raymond R. Phillips who would also serve as the Mission Commander for the main season, to Christchurch on 16 August. From 21 to 27 August, the C-141 delivered personnel and cargo to the Pegasus Site runway. Many of these personnel set up the annual sea ice runway.

Although slated to start on 30 September, the first shuttle mission to McMurdo Sound's sea ice runway slipped 22 hours because of a landing gear malfunction. This also caused

*DEEP FREEZE 1997-98 refers to the season covering fiscal year 1998 (previously called DEEP FREEZE 98).The Air Force recognized the name change around this period. The 109 AW used this designation previously indicating the Navy probably used this format to distinguish the different seasons versus using the fiscal year only. Since the strategic airlift did not participate in the winter flight program (held in August and September) previous to this year, the fiscal year designation had continued to apply.

Photo 83: Students of the Arctic Aircraft Recovery School (a.k.a. "Kool School") sponsored by the 109th Airlift Wing are instructed how to build snow-block retaining walls. The school was located on the Greenland icecap just three miles from an abandoned Distant Early Warning site. (May 2001)

the season's first C-5 mission to delay a day in order to keep the scheduled airlift flow intact. As it turned out, maintenance concerns hampered several of this season's missions. Although the 62 AW brought a mission support kit to augment the supplies already at Christchurch, Colonel Phillips reported that most of the maintenance problems resulted from the 62 AW's lack of parts and adequately winterized and prepared aircraft. Channel missions delivered more parts, which assisted in the correcting the problem. As they waited for parts, maintainers cannibalized* several aircraft to bring mission aircraft to a fully mission capable status. They also borrowed equipment, such as a liquid oxygen cart, from the Air National Guard unit. Despite the maintenance problems, the aircrews were only one mission behind on the schedule and completed their portion on 15 November.[354]

The 109 AW started its second transition year (DEEP FREEZE 1997-98) by deploying five LC-130s along with aircrews and 30 support personnel to Christchurch and then

*"Cannibalization" was a maintenance term referring to taking parts from one aircraft to fix another. In this way, one aircraft would remain operational while one waited for all the required parts. This was not considered the most efficient way to fix aircraft, but it did provide a viable option.

McMurdo Sound. Once again, the 109 AW augmented the Navy's VXE-6 Squadron with the intent of learning more about how that unit had operated so successfully for over 40 years. During the season, the Air National Guard unit opened and closed the South Pole runway for the first time. This year's weather proved a critical factor in the transition's learning curve. With McMurdo Sound receiving 69 inches of snow (33 inches was the average), the LC-130 operations (both Air Force and Navy) canceled 300 missions, as compared to canceling 109 the year before. Despite this challenge, the LC-130 aircrews successfully completed their mission, delivering 5.3 million pounds of cargo just to the South Pole.[355]

CHAPTER 12

PHOENIX PENGUIN (1998-2004)

At the end of DEEP FREEZE 1997-98, the Air National Guard's (ANG) 109th Airlift Wing (AW) and the Navy's Antarctic Development Squadron Six (VXE-6) held ceremonies officially transferring the mission from the Navy to the Air Force. The first ceremony, on 18 February 1998, occurred at McMurdo Sound, Antarctica, and marked the transfer of responsibility for supporting the National Science Foundation's (NSF) US Antarctic Program. The second, and larger of the two ceremonies, took place in Christchurch, New Zealand, on 20 February. This ceremony marked the disestablishment of the Naval Support Force, Antarctica, and the transfer of Operation DEEP FREEZE to the Air National Guard unit.[356]

On 1 April 1998, a new Memorandum of Agreement between the Department of Defense and the National Science Foundation went into effect.* This formal agreement appointed the Secretary of the Air Force as the executive agent and the US Transportation Command, a joint command, as the Department of Defense manager for defense logistics movement for DEEP FREEZE, with Air Mobility Command (AMC) principally responsible for airlift operations.** The agreement also outlined the increased responsibility of the 109 AW for supporting the Antarctic operation. It formally established the Air National Guard as responsible for assigning a colonel as the Operation DEEP FREEZE Commander.[357]

To coincide with this mission responsibility, Headquarters Air National Guard activated a detachment at Christchurch on 1 April. ANG Detachment 13, consisting of 12 to 14 members, served as a support organization, providing policy and oversight to US forces supporting DEEP FREEZE. The Detachment Commander, Colonel Richard M. Saburro, was dual-hatted as the Department of Defense's Operation DEEP FREEZE Commander. This commander also synchronized the LC-130 and strategic airlift operations with the deployed AMC mission commander. In an effort to simplify the LC-130 and strategic airlift portions, AMC had decided to refer to the planning and operations orders for the C-141 and C-5 as Phoenix Penguin, leaving the ANG with the term DEEP FREEZE for its planning and operations orders. The overall designation remained Operation DEEP FREEZE. For the first step of this new responsibility, the Air Force led the planning, development, and execution of DEEP FREEZE 1998-99.[358]

---

*The two organizations implemented a slightly reworded agreement on 1 April 1999.

**Navy supply and fuel ships, as well as Coast Guard ice cutters, and Army logisticians continued to have important roles, but the Air Force took over all military airlift operations. The National Science Foundation also used contractors to fly smaller missions in Antarctica, primarily with Otter ski-equipped aircraft and helicopters.

For the second straight year, the 62d Airlift Wing led the strategic airlift portion of DEEP FREEZE 1998-99. Lieutenant Colonel John I. Pray, Jr., the 62d Operations Group Deputy Commander, led a small group of 26 personnel (including 3 aircrew members from the 446 AW, the 62 AW's Reserve associate wing) and 1 C-141B aircraft to Christchurch on 18 August 1998. Weather conditions at the Pegasus Site runway and aircraft maintenance problems caused several delays, and they did not complete the winter fly in (WINFLY) program until 5 September. In fact, a fuel leak on the second mission, on 22 August, forced the 14 crewmembers and 7 passengers to evacuate the aircraft upon its immediate return to Christchurch. A second C-141B arrived on 23 August in an attempt to keep the mission schedule from falling behind. On 26 August, a crease in the fuel line caused the second aircraft to become non-mission capable as well. On the 27th, two fuels maintenance specialists arrived and had both aircraft fully operational by the 28th. The next day, the aircraft that arrived first at Christchurch began its trip back to the US, while the second aircraft finished the schedule.[359]

Much like the WINFLY program, the DEEP FREEZE main season missions experienced numerous delays and cancellations because of weather and maintenance problems. Right from the beginning, the first scheduled Christchurch-McMurdo Sound shuttle mission, on 29 September, was canceled for excessive winds at McMurdo Sound. This rescheduled mission subsequently turned around--"boomeranged"--at the point of safe return (PSR) on 30 September and 1 October, and was again canceled on 2 October, before finally completing its mission on 3 October. This situation remained fairly consistent throughout October. Colonel Pray, the Mission Commander, instituted a new policy in which weather personnel provided surface forecast definitions using a probability system associated with the good, fair, and poor categories defined by the operations order. He also requested a waiver from Fifteenth Air Force to continue flights beyond the PSR in the event a forecast surface condition was above the poor status. By 20 October, weather had caused a total of 17 mission cancellations and 10 air aborts at or before the PSR (Photo 84). It quickly became obvious the shuttle missions would not be completed on schedule by 4 November.[360]

Fortunately, the 60th Air Mobility Wing (AMW) C-5 successfully completed its scheduled three missions in early October. With the mission so far behind schedule, the NSF reluctantly requested an additional C-141 special assignment airlift mission to assist in finishing the project. However, once they learned that a C-5 with an ice-qualified aircrew was in Richmond, Australia, they changed the request to the C-5, and the AMC Tanker Airlift Control Center (TACC) approved the C-5 mission request. The C-5 flew the final missions (each carrying three C-141-equivalent loads) on 8 and 9 November, completing the schedule only five days behind the original planned closure date.[361]

Despite the Air Force taking over at the end of DEEP FREEZE 1997-98, the Navy's VXE-6 Squadron supported one more year of LC-130 operations--this time in the augmenter role. With this support, the 109 AW launched the season's first LC-130 Antarctic mission on schedule, even though the unit arrived at McMurdo Sound five days behind schedule. With only one exception, the season went well for the 109 AW, with the wing reaching a new

Photo 84: Passengers travel aboard a C-141B bound for McMurdo Sound Station, Antarctica, during DEEP FREEZE 1998-99. Antarctic weather caused frequent problems during that season. (Photo from National Science Foundation)

Antarctic unit record of 380 missions completed. Planners expected this record to fall quickly after the VXE-6 Squadron inactivated at the end of the season.[362]

The one exception occurred on 16 November 1998 when an LC-130 experienced a mishap at the Upstream D location, a remote site on the West Antarctic Ice Sheet. As the aircraft was taxiing, the right, then left, skis sunk into a hidden crevasse. The crew quickly shut down the aircraft and evacuated it. An NSF-contracted Twin Otter subsequently evacuated the crew and passengers from the location. When the bad weather let up, a repair and investigation team went to recover the aircraft. They dug out the aircraft and replaced one engine and its propeller. On 4 January, an aircrew flew the LC-130 to McMurdo Sound and, on the 7th, to Christchurch, where the deployed members of the 109 AW performed most of their major repair work (Photo 85).[363]

The 62 AW sent a small deployment--46 personnel under the command of Lieutenant Colonel Steve Kernstock--at the end of DEEP FREEZE 1998-99 to support the redeployment of scientists, engineers, and others before the Antarctic winter closed down operations. This was the first time C-141s, using the Pegasus Site runway, participated in the redeployment, also known as the reverse WINFLY. In previous years, the LC-130s, augmented by

Photo 85: A 109th Airlift Wing LC-130H and a 452d Air Mobility Wing C-141 on the ramp at Christchurch, New Zealand.

C-130s from New Zealand and other nations, flew all of these redeployment missions. The C-141's larger passenger capacity greatly reduced the stress on the C-130 mission. Between 26 January and 21 February 1999, the 62 AW and 446 AW aircrews flew 11 C-141 reverse WINFLY missions.[364]

One of the critical reasons by which planners had always justified the midwinter airdrop program was "preparation for an emergency." Just such an emergency prompted an Ice Drop mission in 1999. The 47-year-old doctor, Jerri Nielsen, at the South Pole--the only doctor at the Station--found a lump in her breast at the height of the winter season. Using e-mail, Dr. Nielsen conferred with some of America's best cancer specialist through the South Pole's satellite communications link. Because of the extreme cold temperatures, using an LC-130 mission to take supplies to the South Pole or remove her from the site was completely out of the question before October. Instead, the NSF and AMC elected to conduct a C-141 airdrop mission to get drugs, diagnostic equipment, chemotherapy equipment, video-conferencing gear, and an ultrasound scanner to her. AMC assigned the airlift mission to the 62 AW and the supporting air refueling mission to the 60 AMW.[365]

The mission, under the command of Colonel Pray, consisted of 22 aircrew members drawn from the 62 AW and 446 AW.* Colonel Pray selected as many experienced crewmembers as possible from previous Ice Drop missions; however, since the last one occurred in 1995, there were only a few still available. At the same time, Mr. Sam Feola, Director of Logistics for Antarctic Support Associates (ASA), coordinated the acquisition and delivery of the medical equipment to McChord Air Force Base, Washington. The NSF purchased all the equipment, which was delivered to Denver, Colorado, on 5 July 1999, but Federal Express could not get it to McChord Air Force Base until noon the following day. Instead, ASA contracted space on a United Airlines flight to the Seattle-Tacoma Airport--and on to McChord Air Force Base via a rental van early on the morning of 6 July. As soon as it arrived, aerial port specialists packaged the cargo into five bundles for shipment. The C-141B left McChord Air Force Base on 8 July, and a KC-135 from Hickam Air Force Base, Hawaii, provided air-to-air refueling so the C-141 could fly straight through to Christchurch. Likewise, the KC-10 left Travis Air Force Base, California, on the same day, but had to return because of a fuel pressure sensor problem. Maintainers quickly corrected the problem, and the KC-10 departed Travis Air Force Base again. Both aircraft arrived at Christchurch on 9 July.[366]

On 10 July 1999, aerial porters at Christchurch prepared a bundle of fresh fruit and vegetables ("freshies") and mail** to drop along with the equipment, while aircrew members received a mission orientation briefing and rehearsed the execution sequence, and maintainers winterized the C-141B. Colonel Pray also reviewed the operational risk factors involved in the mission, including the fact that the Pegasus Site could serve as an alternate runway. This would provide for the safety of the aircrew, but the extended exposure to

*The total airlift deployment consisted of 49 people, counting the aerial port specialists, maintainers, and other non-aircrew members.

**In the bundle with the freshies, they placed a dozen roses as a symbol of encouragement, cheer, and goodwill for Dr. Nielsen.

the cold would probably prove detrimental to the aircraft. The aircraft launched on the morning of 11 July. Approximately 450 miles from the South Pole, the KC-10 provided the airlifter with 75,000 pounds of fuel. The C-141 aircrew, with Lieutenant Colonel Gregory Pyke as the aircraft commander, found the typical "C" pattern of smudge pots outlining the drop zone laid out on a 3,000-foot section of the South Pole's summer skiway. On the first pass, crewmembers in the back of the aircraft rolled two bundles out the troop doors, and on the second pass, they pushed out the remaining four bundles. Sadly, the parachute on the bundle containing the ultrasound scanner failed to deploy, and the scanner was destroyed when it hit the ice. Fortunately, no other medical equipment or medications were damaged in the drop.[367]

Photo 86: The first C-17A Globemaster III to land at McMurdo Sound, Antarctica, rolls down the runway on 15 October 1999. The flight occurred as a validation test for future C-17 Antarctic missions. (Photo from National Science Foundation)

By all accounts, the aircrew and aircraft performed flawlessly. The Air Force received very favorable international press. Various media outlets conducted interviews with several members of the crew and support personnel. The Columbia Broadcasting Corporation had a film crew on the KC-10. The aircrew members received an Air Medal, and support personnel received Achievement Medals. They also received a personal thank you from

Secretary of the Air Force F. Whitten Peters and from General Charles T. Robertson, Jr., Commander of AMC and US Transportation Command.[368]

Members of the 62 AW returned in August 1999 for the WINFLY program. During the deployment to Christchurch, the C-141B developed several maintenance problems, including only intermittent high frequency radio operations and a broken auxiliary power unit. Despite these concerns, the aircrew still managed to accomplish its grid navigation training on the way to New Zealand. Once there, maintainers quickly fixed the aircraft. The C-141B only flew four WINFLY missions this year, delivering 220 passengers and 93,300 pounds of cargo to McMurdo Sound's Pegasus Site runway. Additionally, 30 passengers and 25,000 pounds of cargo made the return trip to New Zealand.[369]

Colonel Steve Kernstock served as the mission commander for the WINFLY and for the main season airlift, which started on 30 September 1999. Weather again caused several delays and mission cancellations, particularly in the early part of the main season. Severe maintenance problems on the C-141s also caused several delays. Despite these weather and maintenance delays, aircrews completed the main season schedule on 14 November, only a few days behind schedule.[370]

On 15 October 1999, the 62 AW landed the first C-17A Globemaster III, tail number 98-0054, on the sea ice runway at McMurdo Sound (Photo 86). This flight occurred as a validation test for future C-17 Antarctic missions. In addition to a cargo of mail and freshies, the aircraft carried a powerful telescope destined for the South Pole. The mission included a much larger than normal crew (16 total) to take advantage of the training opportunity. Among the crewmembers was Chief Master Sergeant Stephen Spotts, a C-141 loadmaster with nine Antarctic flights to his credit. Chief Spotts said of the flight, "After being on the C-141 for 22 years, I'm no C-17 elitist, but that was the easiest trip to the ice I've ever made. The C-17 has a lot of advantages. You're looking at the future."[371] While on the ice, the crew assessed the aircraft's hydraulic systems, onboard computers, cargo winch, and engines. The C-17 offered three times the cargo capacity of the C-141, but fewer passenger spaces. Another 62 AW aircrew flew a second C-17 mission to McMurdo Sound on 11 November. These two flights proved the C-17's ability to perform the mission once all the C-141s retired.[372]

On the way back to McChord, the aircrew that made the first C-17 flight performed the solemn duty of returning the body of an Air Force officer who died in a motorcycle accident in New Zealand. Major Bryan S. Avery, a C-141 pilot, and his wife, Deborah, were spending a few days on leave in New Zealand when the accident occurred on 12 October. Major Avery died in the hospital on 15 October. The C-17 took the casket to Hickam Air Force Base where a C-141 carried it to Travis Air Force Base en route to Avery's hometown of Louisville, Kentucky, for burial.[373]

The 109 AW's advance team arrived early and successfully conducted its first LC-130 of the season ahead of schedule. This proved especially important as Dr. Nielsen was still waiting to leave the South Pole. To accomplish this, the 109 AW intended to fly down there at the earliest possible opportunity.

For the ANG Detachment 13's leadership, this situation presented a similar coordination situation to a previous year's early mission. On 12 August 1998, ANG Detachment 13 requested the Royal New Zealand Air Force (RNZAF) fly a C-130 aeromedical evacuation mission to McMurdo Sound after a civilian employee--Mr. Gerry Ness, an ASA Senior Site Manager at McMurdo Sound--had an appendicitis attack. It would have taken too long to get a 109 AW LC-130 from New York to New Zealand for the mission. Within seven hours after the incident, a RNZAF C-130, with Squadron Leader Tony Davies as the aircraft commander, was on its way to Antarctica and safely returned Ness to New Zealand soon afterwards. Thanks to the Pegasus Site runway, this was one of McMurdo Sound's earliest landings.[374]

Ever since the 11 July 1999 airdrop, Dr. Nielsen had been on a strict regimen of self-treatment, but she continued to become weaker and suffered from the side effects associated with chemotherapy and the cancer drugs. For the LC-130 to operate at the South Pole safely, it required a ground temperature of at least minus 58 degrees Fahrenheit. Anything lower would crystallize the fuel, starve the engines, and freeze the hydraulic systems. As October approached, the 109 AW made no special preparations for the rescue mission, although it remained a high-priority, high-profile mission. Instead, planners continued to use the guidelines that governed all phases of LC-130 operations. They initially set 25 October 1999 as the ten tative target date for the mission, but temperatures began to improve in early October, so they advanced the date, sending two LC-130s and three flight crews to Christchurch, leaving Schenectady, New York, on 7 October and arriving on the 11th. One of these aircraft forward-deployed to McMurdo Sound on 13 October and waited for the South Pole's weather to reach minimums.[375]

Finally, forecasters called for the weather to reach minimums, though just barely, on 16 October 1999. The aircraft commander, Major George R. McAllister, launched the LC-130 from McMurdo Sound for the emergency evacuation mission. McAllister, who had been flying missions to the South Pole for 11 years, later called the mission, "one of the most dangerous landings I've ever made, what with the wind, cold, and awful visibility."[376] The LC-130 was on the ground at the South Pole for only 22 minutes. The aircraft's door was open for only five, and the engines remained running. Most of the time was spent taxiing to and from the compound. Dr. Nielsen was waiting in a warm-up hut next to the flightline, and when the aircraft arrived, she was rushed aboard. Major McAllister taxied the plane slower than usual to prevent the skis from kicking up a storm of ice crystals. Once back in Christchurch, Dr. Nielsen declined an Air Force offer for military aircraft transportation back to the United States and took a commercial airliner instead. This aeromedical evacuation signified the earliest-ever aircraft flight to the South Pole.[377]

After that aeromedical mission, the LC-130 aircrews conducted a highly successful season, although they experienced a few weather and maintenance problems. One of the most significant was a mission on 1 November 1999 from Christchurch to McMurdo Sound. On this particular mission, with good weather forecasts, the LC-130 continued past the PSR. Antarctic weather often proved itself unpredictable, and whiteout conditions

settled over McMurdo Sound shortly before the aircraft arrived. That aircraft diverted to Terra Nova Bay, an Italian ice runway. Another LC-130 in the air, this one to the South Pole, found similar conditions there. Major John Degraaf, the aircraft commander, circled the Amundsen-Scott Station for about an hour waiting to see if the weather would break. When it didn't, they attempted to return to McMurdo Sound, but found it still under whiteout conditions. This aircrew finally diverted to the Siple Dome Station, even though that station had not yet been opened for the season, and spent two nights there waiting for the weather to break. This incident demonstrated yet again the challenges presented by the harsh Antarctic environment.[378]

As with most years, ANG Detachment 13 and the NSF also hosted a number of distinguished visitors. Among them, President William Clinton visited Christchurch and the new Antarctic Center on 15 September 1999. Secretary Peters went to Christchurch and Antarctica from 28 January to 3 February 2000. General Robertson reviewed the locations and operations in Christchurch, McMurdo Sound, and the South Pole from 6 to 12 February 2000. While there, General Robertson discussed several key issues with Colonel Saburro, including the overlapping responsibilities between AMC and ANG Detachment 13, and the always delicate issues of mission ownership, funding, and resources. General Robertson vowed to continue working such issues.[379]

For the reverse WINFLY, the 62 AW sent two C-141s to assist the LC-130s in redeploying out of Antarctica the scientists and support personnel not staying the winter. These C-141s flew 10 missions to the Pegasus Site runway. Of these, four were delayed for weather, and two turned around at the PSR because weather had dropped below minimums (these missions were rescheduled later). Another mission diverted back to the Pegasus Site because of a gear malfunction. After its repair, it proceeded to Christchurch. These redeployment missions focused on moving passengers north, with only token cargo loads moved to Antarctica.[380]

During their tour of DEEP FREEZE operations, both Secretary Peters and General Robertson asked the same question, "Why is Operation DEEP FREEZE not an AEF (Air and Space Expeditionary Force)?" The Air Force had begun its new AEF concept several years before, but had not yet applied it to the Antarctic mission. These high-level inquisitors initiated an effort by AMC to bring the operation in line with the AEF concept.[381] Under the AEF, the Air Force activated provisional units, easily identifiable with the term "expeditionary" in the title, to perform a mission, task, or operation of a limited or temporary nature. Thus, once the Air Force decided to apply this to DEEP FREEZE, beginning with the 2000-2001 season, AMC activated an air expeditionary group and two expeditionary airlift squadrons (see Appendix J) from the end of September until the beginning of March each season. This approach established the provisional units responsible for the command and control of the operation and aligned them with the way the Air Force handled various other limited-duration missions, tasks, and operations. Besides aligning this mission with the command and control the Air Force used, it also provided a way to recognize the principal units and individuals involved. Personnel deploying in support of DEEP

FREEZE now received AEF "credit" for that deployment. This deployment credit, in turn, more accurately reflected the individual's involvement in real-world operations occurring across the globe.[382]

The 62 AW sent 1 C-141B and 40 personnel* to support WINFLY 2000. Between 21 and 28 August, this C-141 flew four missions, transporting 210 passengers and nearly 100,000 pounds of cargo to McMurdo Sound's Pegasus Site runway. The deployed team took two aircrews. This allowed them to fly back-to-back missions on 27 and 28 August and recover from a two-day weather delay in the mission. The wing also kept one aircraft on standby at McChord Air Force Base in case the primary was unusable for any length of time.[383]

For the 2000-01 main season, the 62 AW sent 2 C-141Bs and 1 C-17 and 58 personnel to maintain, load, and operate the aircraft. Although two validation test missions by the C-17 were accomplished in the 1999 main season, in this first complete year of C-17 operations, the aircraft flew five shuttle missions, moving 281 passengers and over 187 tons of cargo between Christchurch and McMurdo Sound. Once again, weather and maintenance caused several delays and mission cancellations, but the operation was effectively completed between 3 October and 20 November. The NSF later requested two additional missions, and a C-141 returned to accomplish those missions on 8 and 9 December.[384]

For the LC-130 operations, weather played a significant role, causing the cancellation of 68 missions, out of 138 planned for the first half of the season. Weather improved steadily over the season, and by the second half of the season, the 109 AW's LC-130 aircrews completed 98 percent of the planned missions. The large number of canceled missions did not surprise the LC-130 planners. They were well aware of the Antarctic weather's impact on the mission and typically scheduled approximately 20 percent more missions than required. In fact, the 109 AW completed 459 missions, even though the tasked in-theater missions were 457. These included a number of aeromedical evacuation missions. At least three went to the Russian base at Vostok. Two in December removed individuals suffering from high-altitude illness, and the third, also in December, took place to remove a contractor for "inappropriate behavior." In January, a Norwegian citizen was hurt on the other side of the continent. A German aircraft airlifted this individual to the South Pole on 26 January, and an LC-130 bringing fuel to the South Pole on the 27th returned him to McMurdo Sound. A second LC-130 at McMurdo Sound transported the patient to Christchurch.[385]

The success of the 109 AW in accomplishing the DEEP FREEZE 2000-01 mission made a distinct impact on the National Science Foundation's leadership. So much that Dr. Karl A. Erb, Director of the NSF's Office of Polar Programs, commented, "I am enormously impressed by the efforts of the 109th Airlift Wing to meet the USAP [US Antarctic Program] requirements in the face of very adverse weather this year." In any

*As was typical of the deployment, most of the personnel came from the 62 AW or its Reserve associate wing (446 AW), but several people came from other organizations, including Fifteenth Air Force and the 615th Air Mobility Support Group. In preparation for moving the mission over to the Air Force Reserve, the 452 AMW, March Air Reserve Base, CA, also send two observers as part of this count.

one season, approximately 20 to 30 percent of the LC-130 missions supported "deep field" sites with unimproved landing locations.* With little or no skiway preparation, these sites presented inherent dangers for the remote science parties and the airlift support operations.** Because of their remote locations, many of them also tended to experience worse, or at least more unpredictable, weather problems. The other 70 to 80 percent of the missions supported major, multi-year camps with improved skiways and at least a minimal support infrastructure, including fuel storage and basic accommodations.[386]

Because of the poor weather and the limited flying duration constraints of the C-130 and LC-130 aircraft, planners sought a location for an emergency divert airfield. For example, in January 1998, a RNZAF, wheeled C-130 was forced to land at McMurdo Sound in whiteout conditions that occurred after it passed the PSR. Additionally, in the last few years, a number of LC-130s were forced to divert to other scientific stations during flights from Christchurch. Typically, the PSR for a wheeled C-130 was 3.5 hours before reaching McMurdo Sound and 4.0 hours for the LC-130. AMC supported an alternate ice runway as well. Although it was much more critical to the ANG mission, it would also provide an emergency airfield for the larger airlift aircraft. In December 1999, the ANG Detachment 13 and NSF selected the Odell Glacier, approximately 110 nautical miles northeast of McMurdo Sound, between the Wyandot Ridge and Allan Nantak Mountain range, as a possible location for an alternate ice runway. Planners thought the strong glacier winds between the elevated areas would keep an alternate divert airfield in this location virtually maintenance-free. Work began in 2000, but took more effort than expected--more snow had accumulated in the area than predicted. By 18 January 2001, engineers suspended the construction because they were uncovering foot-high humps of ice. The lead engineer, George Blaisdell, recommended returning to the original LC-130 emergency landing site, another skiway not far from McMurdo Sound. After visiting the Odell Glacier location, Colonel Verle L. Johnston, Jr., 109 AW Vice Commander, agreed to stop construction during this season, but recommended study of the site continue.[387]

Although planners intended to have the Odell Glacier divert airfield open in time, the reverse WINFLY started on 31 January 2001 without it. As a precursor to taking over the entire C-141 mission, the 452 AMW, March Air Reserve Base, California, sent 1 C-141C (tail number 66-0136) (Photo 87) and 53 personnel. The 62 and 446 AWs sent six people to provide training. This C-141 flew a total of 11 missions, moving 1,150 passengers and over 234,000 pounds of cargo. The trip back to Christchurch for two of these C-141 missions included aeromedical evacuations. The first, on 2 February, flew a Navy cargo handler at McMurdo with appendicitis. The second, on 5 February, returned a member of the RNZAF.[388]

The relatively small number of C-17s available worldwide on a daily basis for all types of operational missions was the fundamental reason for transferring the strategic airlift

*The LC-130s supported some of these locations with airdrop missions, mostly fuel. Statistics for these airdrop missions were generally not tracked separately from airlift missions.

**See discussion on page 157 on the mishap at the Upstream D location.

Photo 87: The view from a small porthole on a C-141C of the 452d Air Mobility Wing bound for McMurdo Sound Station, Antarctica. (Photo from National Science Foundation)

mission to the Air Force Reserve Command. Using C-17s for DEEP FREEZE strategic airlift requirements would have committed two Globemaster IIIs to Antarctic operations for the equivalent of four months. This would have been counterproductive because the highly reliable C-17 supported more airlift customers than any other AMC aircraft. Additionally, the NSF did not pay for crew swap-out missions or for PSR turnaround sorties, making it far more efficient to use the dwindling number of C-141s than the few available C-17s until the Air Force completed the C-141 retirement and received more C-17s into its inventory. The 452 AMW volunteered for the mission, providing AMC agreed to fund a few more positions to cover the additional workload. The wing participated in DEEP FREEZE 2000-01 as a transitional step and to certify its initial cadre. At the same time, the 62 AW agreed to continue flying a limited number of C-17 missions in support of DEEP FREEZE to increase its own aircraft transition expertise and to prepare for the eventual return of the primary strategic airlift mission (Photo 88).[389]

Another critical change occurred for DEEP FREEZE 2001-02. General Robertson, Commander of US Transportation Command, activated Support Forces Antarctica (SFA) in September 2001. SFA, with Colonel Joel R. Maynard serving as Commander for both SFA and ANG Detachment 13, was established as a Functional Component Command (FCC) for Operation DEEP FREEZE. As the "combatant command" for the operation, US Transportation Command established the FCC to

Photo 88: A C-17 takes off from the annual sea ice runway near McMurdo Sound Station, Antarctica, in October 2005. (Photo from National Science Foundation)

oversee this operational mission that was of a relatively brief duration. Under this new structure, Colonel Maynard retained overall command of DEEP FREEZE, but now through the SFA, rather than the ANG Detachment 13. This FCC activation would divide command responsibility when Colonel Maynard left in 2003.[390]

For the WINFLY portion, the 452 AMW deployed, in mid-August 2001, two C-141C aircraft and nearly all of the personnel required to accomplish the tasking. The 62 AW sent a few members to augment and provide some additional training. Weather, maintenance, and ice-qualification experience hampered the shuttle mission. Two missions "boomeranged" at the PSR because of weather conditions at McMurdo Sound, and a couple of others were weather-canceled before launching from Christchurch. With a minimum number of aircrew members ice-qualified, unit planners could not schedule back-to-back missions to regain the schedule. After one aircraft broke, the deployed maintainers found it difficult to get spare parts in a timely manner. Fortunately, the unit had sent two aircraft, so the broken aircraft had minimum overall impact on the schedule. By 30 August, they had completed 9 missions, moving 1,012 passengers and 230,780 pounds of cargo between Christchurch and McMurdo Sound.[391]

Photo 89: Passengers and cargo aboard a C-17A bound for McMurdo Sound Station, Antarctica, in August 2003. (Photo from National Science Foundation)

The terrorist attacks in the United States on 11 September 2001 prompted a response from Americans all over the world, including those at Christchurch. Immediately after the terrorist strikes, ANG Detachment 13 went to a minimum manning status and secured all of its facilities. Detachment members also canceled all unnecessary travel. While there was no indication of a specific threat in New Zealand, they reviewed security measures, proposed moving all operations to secured premises, and temporarily suspended all aircraft and facility tours. Planners also recognized the fact that C-17s may not be available for the 2001-02 season, and that the C-141s, while available at the beginning of the mission, may not be able to support the entire season. With the US's decision to invade Afghanistan, many New Zealanders held a "National Day of Action Anti-War Campaign" on 1 December 2001. This included demonstrations and speeches outside the Christchurch airport and other US Antarctic Program facilities. Although such demonstrations and the worldwide threat of terrorism continued, no serious incidents had occurred at Christchurch by the end of the DEEP FREEZE 2005-06 season.[392]

Photo 90: Engine and brake heaters keep aircraft parts from freezing while a C-141C is unloaded on the Ross Ice Shelf during DEEP FREEZE 2001-02.

Despite these concerns, the 452 AMW planned two C-141s for the mission, and the 109 AW sent six LC-130 aircraft. Debate about using the C-17 during the season, however, quickly arose. Finally, General Robertson directed the 62 AW to provide one C-17 to fly six of the seven planned C-17 main-season missions (Photo 89) and one mission during the redeployment phase. Regardless of the increased demand on airlift in the aftermath of the terrorist attacks, General Robertson made this decision at the request of the NSF, in order to prevent a delay in the construction of the new complex at the Amundsen-Scott South Pole Station. The C-17 missions were required to carry outsize cargo from Christchurch to McMurdo Sound. The C-141Cs flew 11 main season Christchurch to McMurdo Sound shuttle missions and 13 reverse WINFLY missions (Photo 90).[393]

For the next couple of years, planners expected the requirement for LC-130 operations (Photo 91) to continue to remain significantly high as the South Pole construction project continued. Since 1999, when the ANG became the only LC-130 airlift provider, planners had pushed the LC-130s very hard (see Table 7). Planners realized that the expected increase in missions requested by NSF in the 2001-02 season could likely exceed the LC-130s capability. Another significant factor that planners took into consideration was that the Odell Glacier emergency divert field became operational on 2 December 2001. With these factors in mind, AMC planners agreed to send 2 active-duty wheeled C-130H aircraft

and 53 personnel to accomplish the Christchurch to McMurdo Sound shuttle missions in December and early January, thus freeing up all 6 LC-130s to complete the intracontinental missions.[394]

TABLE 7

LC-130 PROGRAM AIRLIFT (1988-2002)

Season	Cargo (lbs)	Season	Cargo (lbs)
88/89	7.1 million	95/96	9.6 million
89/90	5.9 million	96/97	9.7 million
90/91	7.5 million	97/98	11.4 million
91/92	8.3 million	98/99	13.7 million
92/93	8.4 million	99/00	10.9 million*
93/94	10.3 million	00/01	11.1 million*
94/95	9.6 million	01/02	9.8 million*

NOTES: *Air National Guard was the sole LC-130 airlift provider beginning with 1999. Prior seasons included both US Navy and Air National Guard totals. For the 2001/02 season, active-duty C-130s of the 463d Airlift Group provided some tasking relief by transporting 205,232 pounds of cargo between Christchurch and McMurdo Sound.

SOURCES: Slides, 109 AW Operations Staff, "109th Airlift Wing, Christchurch Operations," Jan 02; Paper, Col Joel R. Maynard, DEEP FREEZE Commander, [DEEP FREEZE 01-02 review], ca Mar 02.

For the promised C-130H aircraft and personnel, AMC selected the 463d Airlift Group at Little Rock Air Force Base, Arkansas, because they flew C-130H-3s whose advanced engines and avionics systems matched those used by the 109 AW's LC-130H-3s. Prior to the deployment, maintainers prepared the aircraft by changing out the hydraulics with a synthetic fluid, adding new power cables designed for use with the more powerful C-141 winches needed in the harsh climate, and updating it with a new satellite communications system, which required the installation of 30 feet of new antenna cables. While maintainers prepared the aircraft, aircrews studied cold-weather operating procedures, including arctic survival, satellite communications, and polar grid navigation. Once at Christchurch, aircrews flew two training missions to get all four aircrews ice-qualified. Thus, the first wheeled C-130H (tail number 92-0553) mission, with Captain Robert L. Fletcher as the aircraft commander, landed on 10 December 2001. Because a strong low-pressure system elevated winds and created whiteout conditions from 12 to 18 December, the first operational mission occurred on the 19th.[395]

Photo 91: SSgt Jim Touchette, 109th Airlift Wing, refuels an LC-130H at Williams Field, Antarctica, in February 2003.

By the time the C-130Hs flew the last mission on 18 January 2002, they had completed 11 of 17 scheduled missions. They also experienced 5 weather aborts at or near the PSR and 14 weather cancellations, but no diverts to Odell Glacier. While the C-130H effort definitely contributed to the operation, planners decided the overall gain did not justify the effort, because of the poor weather conditions in December and January and a misunderstanding in operational requirements between the unit and NSF. It was not attempted again in the immediate future. Still, it added one more layer to the airlift experience.[396] As the deployed squadron commander, Major Jared P. Curtis, remarked:

> We had to virtually forget our tactical airdrop "roots." Instead of dropping 155mm howitzers for the 82d Airborne Division, we transported scientists studying ozone layer depletion and Weddell seals. We hauled fresh fruit and vegetables, or "freshies," for the 1,200 people working at McMurdo. And we literally hauled the mail--tons of it. Transporting cargo isn't new for us, but flying over 2,000 miles to the most inhospitable environment on earth is new. Despite the challenges, we thoroughly enjoyed this mission. If asked to do it again, I would gladly accept, and I'm sure many in the 463d would join me.[397]

By DEEP FREEZE 2002-03 and 2003-04, the airlifters had settled into the routine, with a few adjustments each season. Despite the continued high demand on airlift, AMC provided C-17 support for both Operation DEEP FREEZE seasons. This was not just to support the mission's requirements, but also in recognition of the C-141's impending retirement and the fact that the C-17 aircrews, therefore, needed to stay proficient in Antarctic operations. Both a C-141 and a C-17 supported the 2002 WINFLY program.* By 2003, the C-17 took over sole responsibility for that portion of the mission. During both years, the Air Force Reserve Command wing at Wright-Patterson Air Force Base, Ohio, the 445 AW, scheduled to have the last C-141s in the Air Force inventory, augmented the 452 AMW. This augmentation increased until the reverse WINFLY of 2004 when the 445 AW took over the mission with augmentation from the 452 AMW (Photo 92).[398]

As expected, the continued construction of the South Pole Station placed a large demand on the 109 AW's LC-130 deployments. In the 2003-04 season alone, the LC-130s flew 495 missions, transporting over 12.7 million pounds of cargo and more than 2,800 passengers. Two hundred of those missions directly supported the construction effort. Weather, in large part, contributed to this success since it significantly improved in 2003-04. The weather

Photo 92: A 445th Airlift Wing C-141C sets on the Pegasus Site runway while it is loaded with personnel and cargo returning to Christchurch, New Zealand, during the redeployment phase in 2004. (Photo from the National Science Foundation)

*The C-141 was not mission capable for de-icing and engine problems from its arrival on 19 August until replacement parts reached Christchurch on 22 August. [Slides, AMC TACC, "Daily Operations Summary," 22 Aug 02.]

affected only 10 percent of the LC-130 missions, as opposed to the 20 percent or so affected in the previous year. Likewise, maintenance problems held the potential of affecting the mission (Photo 93). However, the 109 AW's maintainers and loadmasters kept such factors from becoming a serious hindrance. As was typical for the 109 AW's Antarctic support, the wing continued to keep 115 to 120 personnel deployed to Christchurch and Antarctica at any one time throughout the season. Generally, these personnel rotated about every 14 to 45 days.[399]

Photo 93: A 109th Airlift Wing ski-equipped LC-130H taxies past a fire engine on the ice runway at McMurdo Sound's [Antarctica] Pegasus Site runway after aborting a takeoff because of low oil pressure in the number 2 engine on 10 February 2003.

EPILOGUE

TWO CONSTANTS, CHANGE AND WEATHER

The National Science Foundation (NSF) continued to purchase C-141, C-17, and any future C-5 missions through the special assignment airlift mission (SAAM) program. The NSF purchased these missions at the prescribed non-Department of Defense governmental user rate. The LC-130 Antarctica missions were not considered SAAMs because the NSF provided direct funding to the 109th Airlift Wing (AW). Planners recognized this unique situation early in the process and wrote in the Memorandum of Agreement between the Department of Defense and the National Science Foundation, "A civilian organization exercising funding control over operational military units is a departure from normal military command procedures and requires an exceptional amount of understanding and flexibility by all parties involved." Thus, command and control of assigned and deployed military units remained within military channels.[400]

In addition to paying for the military's support, the NSF also relied heavily on contractors for much of the support for the airlift and the US Antarctic Program. The NSF also worked various support agreements with the Royal New Zealand Air Force (RNZAF); the Christchurch, New Zealand, airport authority; and others. This mixture of cooperation created some unusual circumstances for US Air Force planners, maintainers, and aircrews. For example, it was not uncommon to find RNZAF personnel loading US Air Force aircraft using commercial airport or contractor equipment. Likewise, the only US Air Force military person involved in offloading a C-141 or C-17 at McMurdo Sound, Antarctica, was often the aircraft's loadmaster.[401]

By the start of DEEP FREEZE 2004-05, the US Air Force maintained two very small year-round liaison organizations at Christchurch. Air National Guard (ANG) Detachment 13 consisted of eight members. The detachment's primary function was to prepare for and then orchestrate each season's airlift operation. The detachment was also responsible for base-level support and managing, with the support of contractors, some of the equipment left between seasons. According to Lieutenant Colonel Timothy S. Penn, the detachment's last commander, the key to the detachment's success was based on the personal relationships members of the detachment made throughout the year with New Zealand and NSF authorities. Air Mobility Command (AMC) also maintained a small operating location at Christchurch, consisting of one senior non-commissioned officer who managed two New Zealand and two US civilians, at Christchurch's Harewood International Airport. While this small unit supported DEEP FREEZE, its primary function focused on supporting all AMC aircraft transiting the airport.[402]

Photo 94: A C-17 appears above the pink-hued Royal Society Range as it approaches the Pegasus Site runway on 23 August 2004 as part of the DEEP FREEZE 2004-05 winter fly in program. (Photo from the National Science Foundation)

DEEP FREEZE 2004-05 was also to become the last with US Transportation Command as the executive agent. The impetus of this transfer started with the Department of Defense's release of its Unified Command Plan in April 2002. This plan placed Antarctica under the US Pacific Command's area of responsibility. The planners initially left the US Transportation Command as the executive agent for Operation DEEP FREEZE, but later recognized that the starting point, Christchurch, New Zealand, was already within US Pacific Command's area and that the geographic command had responsibility for most of the oceans surrounding Antarctica. Previously, Antarctica was not under any specific command since the Department of Defense considered it a "non-militarized" area according to the treaty. This plan did not change that treaty status, only the peacetime operation's oversight responsibilities.[403]

Thus, DEEP FREEZE 2004-05 occurred much the same as the previous few years. One C-17 from the 62 AW, McChord Air Force Base, Washington, deployed for the winter fly in (WINFLY) program. Using the Pegasus Site runway, this C-17 delivered fresh foods and supplies to those who had wintered over at McMurdo Sound Station and engineers to prepare the sea ice runway for the main season (Photo 94). During the main season, October to November, the 62 AW sent two C-17s and the 445 AW, Wright-Patterson Air Force Base, Ohio, sent two C-141Cs. With the completion of the main season, the aircraft

were released to perform other missions. Both wings subsequently sent one aircraft each for the redeployment (reverse WINFLY) phase.[404]

This season marked the end of the C-141's contribution to Operation DEEP FREEZE's mission. On 14 November 1966, a C-141 became the first jet to land on the Antarctic continent. Moreover, C-141s had consistently participated in the mission since 1968. With the C-141's imminent retirement, the C-17 picked up the mission. The final C-141 DEEP FREEZE mission occurred as tail number 66-0152 departed the Pegasus Site runway on 4 February 2005 (Photo 95).[405]

Photo 95: The last C-141 to resupply the National Science Foundation's US Antarctic Program flies over a US Coast Guard ice-breaker ship as it departs the Ross Ice Shelf on 4 February 2005. (Photo from the National Science Foundation)

The seven deployed 109 AW LC-130s operated well throughout the season. One developed engine problems during its deployment from Stratton Air National Guard Base, New York, and remained at Travis Air Force Base, California, until a C-5 brought in spare parts, including a new propeller. On 28 November 2004, an LC-130 in Antarctica lost a jet-assisted take-off bottle when departing McMurdo Sound. Fortunately, the bottle had not ignited, and no injuries or damage to the aircraft or runway occurred. Deployed maintainers from the 109 AW, with approximately 7 to 10 percent augmentation from other active-duty, Air National Guard, and Air Force Reserve Command C-130 units, maintained a 95 percent mission effectiveness rate for the last 4 years. Overall, maintainers found keeping the aircraft busy helped mission capability. Otherwise, the cold weather tended to gel fuels, thicken oils and lubricants, make wiring and seals brittle, and crack windows. Mission

requirements ensured that an LC-130--unless broken or trapped by weather--did not remain on the ice long. Construction material and fuel for the South Pole Station continued to represent the bulk of the LC-130s' cargo weight (Photo 96).[406]

In addition to the resupply missions to the South Pole and approximately 14 other locations throughout Antarctica, the LC-130s flew two media flights. The first, on 17 November 2004, took media representatives from several countries to the South Pole on a flight to mark the 75th anniversary of Admiral Byrd's 1929 journey. The second, on 28 December, took Russian media representatives to a Russian "Deep Field" scientific site. Additionally, an LC-130 flew an aeromedical evacuation mission to the South Pole on 17 January. Airlift planners then diverted a second mission, originally scheduled as an intracontinental resupply run, to carry the patient to Christchurch from McMurdo Sound on the same day.[407]

Photo 96: Maj Mark Doll, a pilot with the New York Air National Guard, looks out the window of an LC-130 while flying from McMurdo Sound, Antarctica, to the Amundsen-Scott South Pole Station on 17 November 2004. (Photo from the National Science Foundation)

Not surprisingly, weather played a large role in the 2004-05 season. Right after the initial main season strategic airlift mission, McMurdo Sound temporarily closed the ice

Photo 97: An aircrew of the 109th Airlift Wing gazes upon an endless sea of ice while flying an LC-130 over Antarctica in 2005. (Photo from the National Science Foundation)

runway on 5 October to evaluate the ice strength after an unusually warm period. Specialists at McMurdo Sound assessed and repaired the runway on the 6th and 7th. Airlift operations resumed on the 8th, but heavy winds and whiteout conditions at McMurdo Sound halted operations on the 10th for another 24 hours. The LC-130s also experienced a higher-than-normal number of weather cancellations and diverts. Weather impacted over 20 percent of the scheduled missions. In January alone, the weather accounted for 41 mission cancellations. Still, the 109 AW met the NSF's annual requirement by season's end.[408]

With the conclusion of DEEP FREEZE 2004-05, operational responsibility transferred to the US Pacific Command. Additionally, planners took another step to further align DEEP FREEZE with the rest of the military by establishing the Support Forces Antarctica (SFA) as a Joint Task Force (JTF). JTF-SFA was aligned under the Pacific Air Force's (PACAF) George C. Kenney Warfighting Headquarters (Provisional), Hickam Air Force Base, Hawaii, which gained primary responsibility for the mission's execution. The US Transportation Command no longer served as the supported command, but took on its more traditional role of supporting the theater. AMC, ANG, and the Air Force Reserve Command (albeit in a smaller capacity than previously) sent aircraft, aircrews, maintainers, and support personnel to fill out the requirements of the JTF and the Air and Space Expeditionary Force units activated by PACAF (Photo 97).[409]

As part of this change in 2005-2006, Pacific Air Forces appointed a general officer, Lieutenant General David A. Deptula, as the Commander of the JTF and Colonel Ronald J. Smith as his deputy and Commander of the 500th Air Expeditionary Group. Both General Deptula and Colonel Smith were assigned to the Kenney Headquarters. (General Deptula also served as the PACAF Vice Commander.) The commanders for the expeditionary airlift squadrons came from the wings providing the majority of the aircraft and personnel. Lieutenant Colonel James A. McGann, from McChord Air Force Base, commanded the 304th Expeditionary Airlift Squadron and the C-17 portion of the mission. Colonel Tony German, from the 109 AW, commanded the 139th Expeditionary Airlift Squadron and the LC-130 portion of the mission.[410]

While the command structure changed substantially, little else about the operation actually did. During the last six weeks of DEEP FREEZE 2004-05, PACAF sent a team to Christchurch and McMurdo Sound to learn about the operation. Using this training as the baseline, PACAF drew heavily from experienced personnel--as just one example, Colonel Smith was a prior LC-130 pilot who had been involved with the Antarctic mission since 1997. One of the biggest changes involved the coordination process. The JTF-SFA reported through the US Pacific Command as the theater commander, but still had to include coordination with the US Transportation Command and AMC as the major force providers. This new unit also had to work with the NSF and its contractors, ensuring they understood the requirements of those organizations and the needs of the airlift forces. For instance, the sea ice runway was no longer usable at the end of the 2004-05 season. The contractor, Raytheon Polar Services, worked with the JTF-SFA and AMC representatives to select a new sea ice runway construction location (Photo 98).[411]

Despite the new location, warmer-than-normal temperatures again affected the sea ice runway in early October 2005. By 4 October, Colonel Smith requested the ice runway's integrity and uniformity be reassessed. Already by that time, engineers measured the ice thickness at the approach end of the runway at only 65 inches* and closed the first 1,500 feet of the runway. During the reassessment period, they also took the prudent measure of limiting landing and takeoff weight to 490,000 pounds. After measuring the ice, planners closed one of the three aircraft parking spots because of the minimal ice thickness. Despite these restrictions, the C-17s effectively maintained the flying schedule, flying the last main-season mission on 15 November.[412]

Although the area around McMurdo Sound was experiencing a relatively moderate summer, the South Pole remained below minimum temperatures (minus 50 degrees Celsius) until 21 October 2005. The airlifters also had to deal with several periods of excessively strong winds and whiteout conditions. Only one serious incident occurred during the season. On 30 December, a fuel spill occurred during an LC-130 refueling on McMurdo Sound's skiway. Upwards of 1,000 gallons of AN-8 jet fuel spilled, dousing several ground crewmembers. Fortunately, no serious injuries occurred, but the incident was critical because of Antarctica's sensitive environment.[413]

*Planners considered 71 inches as the minimum required for safe runway operations.

Photo 98: A C-17 and five LC-130s set on the annual sea ice runway at McMurdo Sound, Antarctica, in October 2005. The Royal Society Range mountains can be seen in the background. (Photo from National Science Foundation)

Despite these concerns, DEEP FREEZE 2005-06 became one of the most successful seasons in its 50 years. The deployed units set records with the most LC-130 missions on the continent (466), cargo moved to and from the South Pole (12.2 million pounds), C-17 Globemaster III missions (51), and cargo (3.04 million pounds) and passengers (4,739) moved by C-17 in a season.[414] In an article for the Hickam Air Force Base newspaper, Technical Sergeant Mark Munsey, 15 AW Public Affairs Office, conveyed the perspective of Dave Bresnahan, NSF representative at the McMurdo Sound Station, in describing the results of the command structure change:

> "The transition was seamless," he said. "There has not been one sign of mission degradation since Kenney Headquarters took over." And due to the Antarctic's location and limiting factors, that mission is cumbersome, he said. "Long-range capabilities here are absolutely essential here," he said. "No other country's airlift capability can touch ours."[415]

The Air Force has attempted various operational concepts and command structures to accomplish this 50-plus-year air mobility mission. Operations started with C-124 airlift and airdrop missions and eventually transitioned to an all-jet intercontinental force--on occasion supported by air refueling aircraft--and ski-equipped intracontinental aircraft. The Tactical Air Command operated the very first missions, and the Pacific Air Forces

managed the latest. No matter what was required, the people involved ensured it was accomplished. Despite the harsh environment, the Antarctic mission remained a popular one, rarely hurting for volunteers.* For a few, it may have been the chance to visit some place new and different. For those who returned multiple times, it was most likely the unique operational challenges that drew them.

Although speaking of one specific season, the words written by Colonel Roland J. Barnick, 63d Troop Carrier Wing Commander, in the foreword to the Air Force's Operation DEEP FREEZE 63 final report, apply equally well to the entire operation:

> The record of accomplishments on this DEEP FREEZE mission will endure as a constant reminder of the efficiency and world-wide capability of the Military Air Transport Service [substitute Military Airlift Command or Air Mobility Command as appropriate to time period discussed]. This mission has been one of the greatest peacetime tests of equipment and human endurance. It has exemplified the spirit of co-operation and support existing between the various military services [and civilian organizations] when efforts are combined toward a common goal.[416]

Fifty years of DEEP FREEZE airlift operations may prove the operation is reaching its zenith, or maybe its halfway point, or perhaps it's just a beginning. One thing is certain--Operation DEEP FREEZE will by no means reach a plateau where every participant can say it was "strictly routine." Operational changes and the volatile weather will see to that. No matter what happens next to this mission, it provided a unique and significant experience for those involved. More to the point, it amply illustrates the ability of Air Force people and equipment to meet one of the service's distinctive capabilities, that of rapid global mobility.

*For the first few years after taking over DEEP FREEZE, the 109 AW experienced some difficulty in recruiting enough personnel to fill the new positions associated with the mission increase. The unit, however, became quite efficient at highlighting its involvement in the Antarctic operation.

ENDNOTES

[1]As quoted in, Study, Anne M. Bazzell, 834 ALD History Office, "Antarctica: Down to the Ice," p. 4, Jul 81--omission occurred in original source.

[2]Rpt, Henry M. Dater, Staff Historian, US Antarctic Projects Officer, "Aviation in the Antarctic," Jul 59.

[3]Both quotes: *The Antarctic Treaty*, Washington DC, 1 Dec 59.

[4]Rpt, Henry M. Dater, Staff Historian, US Antarctic Projects Officer, "Aviation in the Antarctic," Jul 59; Website, US Naval Historical Center, "Dictionary of American Naval Fighting Ships," 4 Feb 04.

[5]Rear Admiral George J. Dufek, *Operation Deepfreeze*, New York: Harcourt, Brace and Company, pp. 41-49, 1957.

[6]Website, US Naval Historical Center, "The Personnel of Task Force 43," 20 May 03.

[7]Rear Admiral George J. Dufek, *Operation Deepfreeze*, New York: Harcourt, Brace and Company, pp.80-86, 1957.

[8]*Ibid*, pp. 86-88.

[9]Rpt, Task Force 43, "Command Task Force 43 Narrative, DEEP FREEZE I Summary of Operations," ca 1956, located on Website, US Naval Historical Center, "DEEP FREEZE I, Summary of Operations, 1955-56," 30 Jul 03.

[10]Rear Admiral George J. Dufek, *Operation Deepfreeze*, New York: Harcourt, Brace and Company, pp. 111-126, 1957.

[11]Rpt, Task Force 43, "Command Task Force 43 Narrative, DEEP FREEZE I Summary of Operations," ca 1956, located on Website, US Naval Historical Center, "DEEP FREEZE I, Summary of Operations, 1955-56," 30 Jul 03.

[12]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[13]Rear Admiral George J. Dufek, *Operation Deepfreeze*, New York: Harcourt, Brace and Company, pp. 165-166, 1957.

[14]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[15]Rpt, 63 TCW History Office, "Chronological History of Major Operations and Accomplishments of the 63d Troop Carrier Group (H), 63d Troop Carrier Wing (H), Military Air Transport Service," 20 Jun 59; Bio, USAF, "Maj Gen Chester E. McCarty," Sep 63, updated Apr 99.

[16]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[17]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," p. 2, ca 1963.

[18]Hist, 63 TCW, Jul-Dec 56, (K-WG-63-HI, IRIS 451245) n.d.

[19]Rear Admiral George J. Dufek, *Operation Deepfreeze*, New York: Harcourt, Brace and Company, pp. 186-187, 1957.

[20]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," p. 3, ca 1963.

[21]*Ibid*.

[22]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[23]Hist, 63 TCW, Jul-Dec 56, (K-WG-63-HI, IRIS 451245) n.d.

[24]As quoted in, Hist, 63 TCW, Jul-Dec 56, p. 51, (K-WG-63-HI, IRIS 451245) n.d.

[25]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66; Article, Cmdr (Ret.) James Edgar Waldron, "Flight of the Puckered Penguins," Chapter 9, Apr 1996, located on Website, University of Canterbury New Zealand, "Gateway Antarctica," ca Oct 2005.

[26]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[27]Article, Cmdr (Ret.) James Edgar Waldron, "Flight of the Puckered Penguins," Chapter 10, Apr 1996, located on Website, University of Canterbury New Zealand, "Gateway Antarctica," ca Oct 2005.

[28]Rear Admiral George J. Dufek, *Operation Deepfreeze*, New York: Harcourt, Brace and Company, p. 201, 1957.

[29]*Ibid*, pp. 193-204.

[30]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963.

[31]As quoted in, Hist 63 TCW, Jan-Jun 57, p. 89, (K-WG-63-HI, IRIS 451246) n.d.

[32]*Ibid*.

[33]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[34]Rpt, Henry M. Dater, Staff Historian, US Antarctic Projects Officer, "Aviation in the Antarctic," Jul 59.

[35]Hist, 63 TCW, Jan-Jun 57, (K-WG-63-HI, IRIS 451246) n.d.

[36]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963; Rpt, Henry M. Dater, Staff Historian, US Antarctic Projects Officer, "Aviation in the Antarctic," Jul 59; Hist, 63 TCW, Jan-Jun 57, (K-WG-63-HI, IRIS 451246) n.d.

[37]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," p. 135, (K490.04-1, IRIS 00508382) Sep 66.

[38]Hist, 63 TCW, Jan-Jun 58, n.d. The history contains several news clipping articles discussing the trees and the light-hearted controversy, including *Time Magazine* and the *New York Times*. The *Christchurch Press* article, "Pine Trees at McMurdo, Markers for End of Runways," provided both quotes.

[39]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963.

[40]Hist, 63 TCW, Jul-Dec 57, n.d.

[41]Hist, MATS, Jul-Dec 57, 31 Jul 58; Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963.

[42]Hist, 63 TCW, Jul-Dec 57, p. 50, n.d. Note: The vast majority of airdrops supported the South Pole and Marie Byrd Station. Of the 724 ton total airdrop, aircrews dropped 15 tons at Beardmore Base.

[43]Hist, 63 TCW, Jul-Dec 57, n.d.

[44]Hist, MATS, Jul-Dec 57, 31 Jul 58.

[45]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[46]Hist, 63 TCW, Jul-Dec 57, n.d.; Hist, 63 TCW, Jan-Jun 58, n.d.

[47]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[48]Hist, 63 TCW, Jul-Dec 57, n.d.

[49]Hist, MATS, Jan-Jun 58, 30 Jun 59.

[50]Hist, MATS, Jul-Dec 58, 20 Oct 59.

[51]Rpt, Lt Col Cicero J. Ellen, USAF Task Force Commander, "Operation DEEP FREEZE Phase IV," n.d.

[52]*Ibid*; Hist, MATS, Jul-Dec 58, 20 Oct 59.

[53]Article, Rear Admiral George J. Dufek, USN, "What We've Accomplished in Antarctica," *The National Geographic Magazine*, Vol. CXVI, No 4, p. 534, Oct 59.

[54]Hist, MATS, Jul-Dec 58, p. 148, 20 Oct 59.

[55]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963.

[56]Article, Rear Admiral George J. Dufek, USN, "What We've Accomplished in Antarctica," *The National Geographic Magazine*, Vol. CXVI, No 4, Oct 59.

[57]Operation Plan No. 1-59, Commander Task Force 43 (CNSFA), "Operation DEEP FREEZE 60," 17 Jul 59.

[58]Rpt, Henry M. Dater, Staff Historian, US Antarctic Projects Officer, "Aviation in the Antarctic," Jul 59.

[59]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963.

[60]Hist, 63 TCW, Jan-Jun 59, n.d.; Rpt, 64 TCW Commander, "Report of Survey Flight-Phase V, Operation DEEP FREEZE, 12-24 April 1959," 29 Apr 59.

[61]Hist, MATS, Jan-Dec 59, Feb 61.

[62]Rpt, Lt Col Dewey R. Bridges, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE Sixty," n.d.

[63]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963.

[64]Hist, MATS, Jan-Dec 59, p. 138, Feb 61.

[65]*Ibid*; Article, Col Frank H. Wilcox, MATS Chief of Safety, "Deepfreeze V," *The MATS Flyer*, Jan 60.

[66]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," p.12, ca 1963.

[67]*Ibid*.

[68]Hist, 63 TCW, Jul-Dec 56, (K-WG-63-HI, IRIS 451245) n.d.; Pamphlet, 9 TCS, "New Zealand Information Pamphlet, Operation DEEP FREEZE Phase V, 1959," n.d.; Pamphlet, 834 ALD, "DEEP FREEZE 83 Augmentee Brochure," 29 Nov 82.

[69]Rear Admiral George J. Dufek, *Operation Deepfreeze*, New York: Harcourt, Brace and Company, p. 81, 1957.

[70]Hist, 62 TCW, Jul-Dec 56, (K-WG-63-HI, IRIS 451245) n.d.

[71]Pamphlet, 9 TCS, "New Zealand Information Pamphlet, Operation DEEP FREEZE Phase V, 1959," n.d.

[72]*Ibid*; Rpt, Lt Col Cicero J. Ellen, USAF Task Force Commander, "Operation DEEP FREEZE Phase IV," n.d.; Msg, OL D, 61 MASW to 438 MAW *et al.*, "DEEP FREEZE '72," 310020Z Aug 71; Pamphlet, 834 ALD, "DEEP FREEZE 83 Augmentee Brochure," 29 Nov 82; Pamphlet, 109 AW, "109th Airlift Wing Antarctic Deployment Guide," 20 Oct 97; Article, Warren Head, "Long Mission for the US Navy," *Antarctica Magazine*, Mar 98.

[73]Rpt, Lt Col Cicero J. Ellen, USAF Task Force Commander, "Operation DEEP FREEZE Phase IV," n.d.

[74]*Ibid*; Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66; Pamphlet, 834 ALD, "DEEP FREEZE 83 Augmentee Brochure," 29 Nov 82.

[75]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[76]Memo, Lt Col Cicero J. Ellen, Commander Air Force Task Unit, to Maj Gen Frederic E. Glantzberg, MATS Vice Commander, "DEEP FREEZE Housing and Transportation," 29 Nov 58; Pamphlet, 109 AW, "109th Airlift Wing Antarctic Deployment Guide," 20 Oct 97.

[77]Memo, Maj Gen Frederic E. Glantzberg, MATS Vice Commander, to Lt Gen William H. Tunner, MATS Commander, "Living Conditions at McMurdo Base," 2 Dec 58.

[78]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[79]Memo, Maj Gen Frederic E. Glantzberg, MATS Vice Commander, to Lt Gen William H. Tunner, MATS Commander, "Living Conditions at McMurdo Base," 2 Dec 58.

[80]Article, Col Frank H. Wilcox, MATS Chief of Safety, "Deepfreeze V," *The MATS Flyer*, Jan 60.

[81]Hist, 63 TCW, Jan-Jun 57, (K-WG-63-HI, IRIS 451246) n.d.

[82]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[83]As quoted in, Hist, 63 TCW, Jan-Jun 57, p. 89, (K-WG-63-HI, IRIS 451246) n.d.

[84]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

[85]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66; Memo, Maj Benjamin T. Griffin, Jr., MATS Chief, Public Information Division, to Maj Gen Frederic E. Glantzberg, MATS Vice Commander, "Activity Report of Information Services Officer on Visitation to Antarctica and New Zealand," 26 Nov 58; Rpt, 1Lt Leonard M. Kacher, MATS DEEP FREEZE 63 Information Officer, "Operation DEEP FREEZE 63, Final Information Activity Report," 2 Jan 63.

[86]Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66; Memo, Maj Gen Frederic E. Glantzberg, MATS Vice Commander, to Lt Gen William H. Tunner, MATS Commander, "Living Conditions at McMurdo Base," 2 Dec 58.

[87]Rpt, Lt Col Wilbert Turk, 61 TCS Commander, "Mission Report, Operation Ice Flow," (K-WG-314-SU-OP, IRIS 455426) 15 Mar 60.

[88]News Release, Lockheed-Georgia Division, [first C-130D landing at South Pole], Jan 60.

[89]Hist, 314 TCW, Jan-Jun 60, (K-WG-314-HI, IRIS 455372) n.d.; Hist, 63 TCW, Jan-Jun 60, n.d.

[90]Rpt, Lt Col Wilbert Turk, 61 TCS Commander, "Mission Report, Operation Ice Flow," (K-WG-314-SU-OP, IRIS 455426) 15 Mar 60.

[91]*Ibid*.

[92]Hist, 314 TCW, Jan-Jun 60, (K-WG-314-HI, IRIS 455372) n.d.

[93]Msg, CNSFA to USAF Task Unit, [message of appreciation], 121109Z Feb 60, appended to Hist, 314 TCW, Jan-Jun 60, (K-WG-314-HI, IRIS 455372) n.d.

[94]Msg, Air Development Squadron Six to Chief Naval Information, [arrival of C-130BL], 220922Z Sep 60; Bulletin, U.S. Antarctic Project Officer, "Supplement," ca 1963; News Release, Lockheed-Georgia Division, [first C-130D landing at South Pole], Jan 60.

[95]Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE Sixty One," n.d.; Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 1962," 25 Jan 62; Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 63," n.d.

[96]Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE Sixty One," n.d.; Msg, USAF Task Unit to Commander Eastern Transport Air Force, [Christchurch activity and additional deployment], 292328Z Sep 60; Msg, USAF Task Unit to Secretary of the Air Force Office of Information, [communications restored], 210335Z Nov 60.

[97]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963; Msg, USAF Task Unit to Secretary of the Air Force Office of Information, [MATS in Antarctic], 201246Z Oct 60.

[98]As quoted in, Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," p.15, ca 1963.

[99]Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE Sixty One," n.d.

[100]Hist, 1501 ATW, Jul-Dec 60, n.d.; News Release, MATS Public Information Office, "MATS to Move Snowmilling Machines to Antarctica," 19 Sep 60; Msg, USAF Task Unit to Secretary of the Air Force Office of Information, [C-133s in Christchurch], 162307Z Oct 60.

[101]Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE Sixty One," p. B-5-6, n.d.

[102]*Ibid*; Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 1962," 25 Jan 62.

[103]Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 1962," 25 Jan 62; Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963.

[104]Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 1962," p. 5, 25 Jan 62.

[105]Rpt, Lt Col Foy B Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 1962," 25 Jan 62; News Release, MATS Public Information Office, "MATS Aircraft Make Longest Antarctic Flight," 30 Nov 61.

[106]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963.

[107]Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 63," n.d.

[108]*Ibid*; Fact Sheet, Martin AEC-USN, "Nuclear Power Plant…PM-3A, First for the Antarctic Continent," ca 1962.

[109]Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 63," n.d.

[110]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," ca 1963; Article, "Aussies Praise C-124 Airdrops in Operation DEEP FREEZE '63," *McGuire Airtides*, 23 Nov 62, included in Rpt, 1Lt Leonard M. Kacher, MATS DEEP FREEZE 63 Information Officer, "Operation DEEP FREEZE 63, Final Information Activity Report," 2 Jan 63.

[111]Article, [film stars], *The Christchurch Star*, 30 Nov 62; Article, "Penguins for U.S. Zoo," *The Press*, 1 Dec 62; Article, William Swing, "Penguin Expedition Nets Zoo 46 Birds," *The Oregonian*, 3 Dec 62, all included in Rpt, 1Lt Leonard M. Kacher, MATS DEEP FREEZE 63 Information Officer, "Operation DEEP FREEZE 63, Final Information Activity Report," 2 Jan 63.

[112]Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 63," n.d.; Article, "First MATS C-135 Lands in New Zealand," 1 Nov 62, , included in Rpt, 1Lt Leonard M. Kacher, MATS DEEP FREEZE 63 Information Officer, "Operation DEEP FREEZE 63, Final Information Activity Report," 2 Jan 63.

[113]Memo, Maj D.M. Altman, 1608 ATW Chief of Administration, to EASTAF, "Survey Report, Operation DEEP FREEZE FY 63," 26 Dec 62.

[114]Rpt, 63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation DEEP FREEZE.')," p. 24, ca 1963.

[115]Article, Terry MacGrath, "Farewell to the Globemaster," *New Zealand Truth*, 11 Dec 62, included in Rpt, 1Lt Leonard M. Kacher, MATS DEEP FREEZE 63 Information Officer, "Operation DEEP FREEZE 63, Final Information Activity Report," 2 Jan 63.

[116]Article, "Ashburton Man Builds Model Globemaster," *The Christchurch Star*, 14 Nov 62, included in Rpt, 1Lt Leonard M. Kacher, MATS DEEP FREEZE 63 Information Officer, "Operation DEEP FREEZE 63, Final Information Activity Report," 2 Jan 63.

[117]Foreword to Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 63," n.d.

[118]Ltr, Lt Col Russell C. Clarke, 76 ATS Commander, to Maj Gen William P. Fisher, Eastern Transport Air Force, "Airdrop Versus Ski Delivery, DEEP FREEZE FY 64," ca 31 Dec 62.

[119]Rpt, Lt Col Russell C. Clarke, USAF Task Force Commander, "Final Report: DEEP FREEZE 64," n.d.

[120]*Ibid*; Hist, 1608 ATW, Jan-Jun 63, n.d.

[121]Ltr, Capt Zack L. Stockett, Air Rescue Service/PFARS to Air Rescue Service Commander, "Final Report; ARS Element Operation DEEP FREEZE 63," 20 Dec 62; Rpt, Lt Col Russell C. Clarke, USAF Task Force Commander, "Final Report: DEEP FREEZE 64," n.d.

[122]Rpt, Lt Col Russell C. Clarke, USAF Task Force Commander, "Final Report: DEEP FREEZE 64," n.d.

[123]Hist, 1608 ATW, Jul-Dec 63, n.d.

[124]*Ibid*; Rpt, Lt Col Russell C. Clarke, USAF Task Force Commander, "Final Report: DEEP FREEZE 64," n.d.; Article, JOCM Leo Loftus, USN, "DEEP FREEZE: The Air Force in Antarctica," *The Airman*, Jul 65.

[125]Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 65," n.d.; Ltr, Lt Col Robert D. Coffee, 86 ATS Ops Officer, "Summary of DEEP FREEZE 65 Planning Conference," 13 Jul 64; Hist, MATS, Jul 64-Jun 65, Feb 66.

[126]Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 65," n.d.

[127]News Release, MATS Public Information Division, "MATS Commander First Four Star on Antarctica," 11 Dec 64.

[128]Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 65," n.d.; News Release, MATS Public Information Division, "MATS Begins Eighth Season in DEEP FREEZE Operation," 12 Oct 64; News Release, 1501 ATW Information Office, "Release No. 1244," 11 Dec 64.

[129]Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 65," n.d.; Article, A2C Joe Queenan, "Crews Prepare for 'DEEP FREEZE' at Survival School near Eielson," *Air Force Times*, 3 Jun 64.

[130]News Release, MATS Public Information Division, "Loftus Glacier Named for Headquarters MATS Navyman," 22 Dec 64; Article, JOCM Leo Loftus, USN, "DEEP FREEZE: The Air Force in Antarctica," *The Airman*, Jul 65.

[131]Hist, MAC, Jul 65-Jun 66, Mar 67.

[132]Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 66," n.d.

[133]*Ibid*; News Release, 1501 ATW Public Information Office, "First to the 'Ice'," 29 Oct 65.

[134]Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 66," p. 9, n.d.

[135]*Ibid*.

[136]Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation DEEP FREEZE 67," n.d.; Article, Eugene K. Stallard, "For Moffett Unit, DEEP FREEZE Plans Ready," *Standard Register Leader*, 2 Aug 66.

[137]Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation DEEP FREEZE 67," n.d.

[138]*Ibid*; Hist, MAC, Jul-Dec 66, Mar 68.

[139]Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation DEEP FREEZE 67," p. B-V-1, n.d.

[140]*Ibid*; Hist, MAC, Jul-Dec 66, Mar 68; Msg, Twenty-Second Air Force to MAC, [submission for weekly SECDEF report], 231637Z Nov 66; News Release, Lockheed-Georgia Newbureau, "First Jet on Ice -- 1966 Highlight for C-141," ca 15 Nov 66.

[141]Hist, 21 AF, Jul-Dec 67, Mar 69; Hist, 438 MAW, Jul-Dec 67, Nov 68.

[142]Hist, 21 AF, Jul 72-Jun 73, 30 Aug 73; Hist, MAC, Jul 74-Dec 75, 15 Jul 76; News Release, MAC Directorate of Information, "MAC Participates in Operation DEEP FREEZE '75," 17 Oct 74.

[143]Rpt, CAPT Alfred N. Fowler, CNSFA, "Report of Operation DEEP FREEZE 73," 25 Jun 73.

[144]Brochure, 834 ALD, "DEEP FREEZE 82 Aircrew Flimsy," 1 Oct 81.

[145]Welcome Guide, Task Force 43, "Operation DEEP FREEZE, United States Navy," ca 1967.

[146]*Ibid.*

[147]Brochure, 834 ALD, "DEEP FREEZE Aircrew Flimsy," p. 3, 2 Dec 83.

[148]*Ibid*.

[149]Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 65," n.d.; Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 66," p. 9, n.d.; Brochure, 834 ALD, "DEEP FREEZE Aircrew Flimsy," 2 Dec 83; Msg, MAC to OL D, 61 MSW, Christchurch, "Weather and Weather Impacts for Operation DEEP FREEZE," 151825Z Oct 71.

[150]Brochure, 834 ALD, "DEEP FREEZE Aircrew Flimsy," 2 Dec 83.

[151]*Ibid*; Hist, 834 ALD, Jan-Dec 82, 28 Aug 83.

[152]Article, Lt Col Leland W. Conner, 834 ALD Assistant Director of Operations, "Filling the Antarctic Square," *Airlift*, Summer 86.

[153]Ltr, Lt Col Robert C. Huf, Mission Commander, to 21 AF, "Summary of 438 MAW Support in Operation DEEP FREEZE 69," 20 Nov 68.

[154]Brochure, 834 ALD, "DEEP FREEZE Aircrew Flimsy," 2 Dec 83; Hist, 834 ALD, Jan-Dec 82, 28 Aug 83.

[155]Article, Bruce D. Nordwall, "Aviation on Ice Unlocks Antarctica," *Aviation Week & Space Technology*, p. 72, 25 May 98.

[156]*Ibid*; Brochure, 834 ALD, "DEEP FREEZE Aircrew Flimsy," 2 Dec 83; Hist, 834 ALD, Jan-Dec 82, 28 Aug 83; Article, Edward J. Belz, "MAC's Role in DEEP FREEZE," *Air University Review*, 1972.

[157]Brochure, 834 ALD, "DEEP FREEZE Aircrew Flimsy," 2 Dec 83; Hist, 834 ALD, Jan-Dec 82, 28 Aug 83.

[158]Ltr, Lt Col Robert C. Huf, Mission Commander, to 21 AF, "Summary of 438 MAW Support in Operation DEEP FREEZE 69," 20 Nov 68.

[159]Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 65," n.d.; Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 66," p. 9, n.d.

[160] Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: DEEP FREEZE 66," n.d.; Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation DEEP FREEZE 67," n.d.; Hist, 60 AMW, Jul-Dec 96, 25 Apr 97; Article, Jerry W. Huffman, National Science Foundation, "Williams Field: The History of an Icy Aerodrome," *Antarctic Journal of the United States*, Jun 83; Pamphlet, NSF, "United States Antarctic Program Participant Guide, 2004-2006 Edition," ca Jan 04.

[161]As quoted in, Article, "16 McGuire Starlifters Support DEEP FREEZE 72 in Antarctica," *McGuire Airtides*, 1 Oct 71--omission occurred in original source.

[162]Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation DEEP FREEZE 67," n.d.

[163]Ltr, Lt Col Robert C. Huf, Mission Commander, to 21 AF, "Summary of 438 MAW Support in Operation DEEP FREEZE 69," 20 Nov 68.

[164]Brochure, 834 ALD, "DEEP FREEZE Aircrew Flimsy," 2 Dec 83; Hist, 834 ALD, Jan-Dec 82, 28 Aug 83; Article, Lt Col Leland W. Conner, 834 ALD Assistant Director of Operations, "Filling the Antarctic Square," *Airlift*, Summer 86.

[165]Ltr, Lt Col Robert D. Coffee, 86 ATS Ops Officer, "Summary of DEEP FREEZE 65 Planning Conference," 13 Jul 64; Hist, 60 AMW, Jul-Dec 96, 25 Apr 97.

[166]Article, Bruce D. Nordwall, "Aviation on Ice Unlocks Antarctica," *Aviation Week & Space Technology*, 25 May 98; Study, Anne M. Bazzell, 834 ALD History Office, "Antarctica: Down to the Ice," Jul 81.

[167]Ltr, Lt Col William W. Hewitt, USAF Mission Commander, to 438 MAW Deputy Commander for Operations, "DEEP FREEZE 72," 11 Nov 71.

[168]Hist, MAC, Jul 68-Jun 69, Sep 70.

[169]Ltr, Lt Col Robert C. Huf, Mission Commander, to 21 AF, "Summary of 438 MAW Support in Operation DEEP FREEZE 69," 20 Nov 68.

[170]Hist, 438 MAW, Jul 68-Jun 69, Oct 69; Hist, 21 AF, Jul 68-Jun 69, Sep 70.

[171]Ltr, Lt Col Buford E. Stovall, Mission Commander, to Col Wayne G. Duckett, 438 MOG Commander, "Summary of 438 MAW Support-'Operation DEEP FREEZE 70'," 26 Nov 69.

[172]*Ibid.*

[173]Hist, 21 AF, Jul 69-Jun 70, May 71.

[174]Ltr, Lt Col Joseph F. McKone, USAF Mission Commander, to 438 MAW Deputy Commander for Operations, "Final Report-Operation DEEP FREEZE 71," 30 Nov 70.

[175]*Ibid*; Article, "McGuire Team Returns from Deep Fr-r-reeze," *McGuire Airtides*, 20 Nov 70.

[176]Hist, MAC, Jul 70-Jun 71, 15 Mar 72; Hist, 436 MAW, Jan-Dec 70, 15 May 71; News Release, MAC Public Information Division, "DEEP FREEZE," ca Oct 70.

[177]Ltr, Lt Col William W. Hewitt, USAF Mission Commander, to 438 MAW Deputy Commander for Operations, "Summary of 'DEEP FREEZE 72'," 11 Nov 72; Ltr, Col Gerald C. Weir, 21 AF Director of Aircrew Standardization, to 438 MAW Aircrew Standardization and Evaluation, "DEEP FREEZE-72," ca 1 May 71; Hist, 438 MAW, Oct-Dec 71, Mar 72.

[178]Ltr, Lt Col William W. Hewitt, USAF Mission Commander, to 438 MAW Deputy Commander for Operations, "Summary of 'DEEP FREEZE 72'," 11 Nov 72; Hist, 438 MAW, Oct-Dec 71, Mar 72; Hist, 438 MAW, Jan-Jun 72, Sep 72.

[179]Article, Maj Robert P. Everett, Editor, "Journey to the Ice," *Airman*, p. 25, Mar 72.

[180]Msg, Twenty-Second Air Force Command Post to MAC Command Post, "MAC Acft Limitation (DEEP FREEZE) Request," 162210Z Oct 71; Msg, OL D 6 MASWG to Twenty-Second Air Force Command Post, "MAC Acft Parking Limitation (DEEP FREEZE)," 170045Z Oct 71.

[181]Ltr, Lt Col William W. Hewitt, USAF Mission Commander, to 438 MAW Deputy Commander for Operations, "Summary of 'DEEP FREEZE 72'," p. 4, 11 Nov 72.

[182]*Ibid*.

[183]Rpt, CAPT Alfred N. Fowler, CNSFA, "Report of Operation DEEP FREEZE 73," 25 Jun 73.

[184]*Ibid*; Hist, 63 MAW, Oct-Dec 72, n.d.

[185]Handwritten Note, SECAF to 53 MAS Crew, 10 Dec 72.

[186]Rpt, TSgt Stanley J. Morris, 438 MAW Operations Analysis, "438DOXA Activity Report, Operation Deepfreeze 74," Dec 73; Operations Order 08-30-0109, 438 MAW, [DEEP FREEZE 74], 30 Aug 73.

[187]Hist, MAC, Jul 73-Jun 74, 30 Jun 75; Operations Order 08-30-0109, 438 MAW, [DEEP FREEZE 74], 30 Aug 73; Article, SSgt Gene Evans, "First Starlifter Wings to Pole [*sic*.]," *McGuire Airtides,* 19 Oct 73.

[188]Paper, Maj O'Brien, 60 MAW Operations Plans, "Operation DEEP FREEZE," 26 Sep 74; Msg, Twenty-Second Air Force Operations to 60 MAW Operations, "Support of DEEP FREEZE 75," 062200Z Sep 74; Hist, 60 MAW, Oct-Dec 74, n.d.

[189]Article, SSgt Michael L. Ward, 60 MAW Information Office, "Operation DEEP FREEZE 75, from Travis to Antarctica," *The Tailwind*, 15 Nov 74.

[190]Hist, MAC, Jul 74-Dec 75, 15 Jul 76.

[191]Paper, Twenty-Second Air Force Pacific Airlift Center, "Operation DEEP FREEZE," 20 Oct 77.

[192]Hist, 60 MAW, Oct-Dec 75, 15 Mar 76; Hist, MAC, Jan-Dec 76, Nov 77.

[193]Rpt, 60 MAW Combat Support, "Historical Report, 1 Oct-31 Dec 75," ca Jan 76; Rpt, CNSFA, "Minutes of DEEP FREEZE 70 MAC Airlift Planning Conference," 26 Jun 69; Brochure, 438 MAW, "DEEP FREEZE 73," n.d.

[194]Hist, 60 MAW, Oct-Dec 75, 15 Mar 76; Rpt, 602 OMS Commander, "Quarterly Historical Report (Oct-Dec 75)," 14 Jan 76; Article, Patrick Nolan, "DEEP FREEZE Exodus: Penguins Fly First Class," *The Tailwind*, 21 Nov 75.

[195]Article, J. D. Murphy, 349 MAW, "DEEP FREEZE '78," *The Air Force Reservist*, Mar 78.

[196]Hist, MAC, Jan-Dec 76, Nov 77; Hist, MAC, Jan-Dec 77, 27 Jul 78; Hist, 60 MAW, Oct-Dec 76, 15 Mar 77.

[197]Memo, Col Morris T. Warner, Jr., 60 MAW Deputy Commander for Operations, to Col Donald W. Bennett, 60 MAW Commander, "DEEP FREEZE Penguin Flight," 26 Nov 76; Hist, 60 MAW, Oct-Dec 76, 15 Mar 77.

[198]Paper, Twenty-Second Air Force Pacific Airlift Center, "Operation DEEP FREEZE," 20 Oct 77.

[199]Hist, MAC, Jan-Dec 77, 27 Jul 78; Hist, MAC, Jan-Dec 78, 15 Oct 79; Hist, 60 AMW, Oct-Dec 77, 2 May 78.

[200]Hist, 60 AMW, Oct-Dec 77, 2 May 78; Paper, Twenty-Second Air Force Pacific Airlift Center, "Operation DEEP FREEZE," 20 Oct 77; Hist, MAC, Jan-Dec 77, 27 Jul 78.

[201]Hist, MAC, Jan-Dec 78, 15 Oct 79; Hist, MAC, Jan-Dec 79, 22 Dec 80; Hist, 60 MAW, Oct-Dec 78, 25 Jun 79.

[202]Hist, 60 MAW, Oct-Dec 78, p. 19, 25 Jun 79.

[203]*Ibid*; Msg, CNSFA to MAC, "Starlifter Support," 200337Z Dec 78; Hist, 7 MAS, Oct-Dec 78, n.d.

[204]Hist, MAC, Jan-Dec 79, 22 Dec 80; Hist, MAC, Jan-Dec 80, 4 Mar 82; Msg, OL D 61 MASW to MAC, "DEEP FREEZE Ops Sum as of 14/1000Z Dec 79," 150025Z Dec 79; Hist, 60 MAW, Oct-Dec 79, 30 Apr 80.

[205]Ltr, Lt Col Frank B. Wells, 710 MAS Commander, to 349 MAW Commander, "Nomination for MAC Safety Award for Excellence in Airmanship," 28 Jan 80; Msg, OL D 61 MASW to Pacific Airlift Center Logistics, "Initial Assesment [*sic*.] of Damage on C-141, 650249," 310145 Oct 79.

[206]Ltr, Lt Col Frank B. Wells, 710 MAS Commander, to 349 MAW Commander, "Nomination for MAC Safety Award for Excellence in Airmanship," 28 Jan 80.

[207]Ltr, Lt Col Gerard G. Vaughan, Chief MAC Special Airlift Branch, to MAC Director of Operations, "Trip Report DEEP FREEZE SAAM 2901," 18 Dec 79; Hist, 60 MAW, Oct-Dec 79, 30 Apr 80; Pamphlet, National Science Foundation, "Flight to the South Pole, The New Age of Antarctic Exploration and Research," Washington DC: 1979.

[208]Ltr, Lt Col Gerard G. Vaughan, Chief MAC Special Airlift Branch, to MAC Director of Operations, "Trip Report DEEP FREEZE SAAM 2901," 18 Dec 79; Hist, 60 MAW, Oct-Dec 79, 30 Apr 80; Article, "Deadly Excursion," *The MAC Flyer*, Jan 81.

[209]Paper, SSgt Goetz, 61 MASW Maintenance, "DEEP FREEZE," 25 Oct 79; Hist, 60 MAW, Oct-Dec 79, 30 Apr 80.

[210]Hist, 60 MAW, Oct-Dec 79, 30 Apr 80; Hist, 834 AD, Jul-Dec 79, 1 Sep 80.

[211]Staff Summary, John F. Shea, MAC Plans, to MAC Command Section, "TAM Move to Hickam," 7 Dec 77; Paper, MAC Plans, "Pacific Reorganization," 27 Jun 78; Staff Summary, MAC Plans to MAC Command Section, "Reorganization of 322 ALD/ 834 ALD," 4 Dec 80.

[212]Study, Anne M. Bazzell, 834 ALD History Office, "Antarctica: Down to the Ice," Jul 81.

[213]Hist, 834 ALD, Jul-Dec 79, 1 Sep 80; Hist, 63 MAW, Jul-Sep 79, n.d.

[214]Hist, 63 MAW, Jul-Sep 79, n.d.

[215]Msg, Navy Det McMurdo Antarctica to OL D 61 MASW *et al*., "Airdrop McMurdo Station Antarctica-14 July," 140338Z Jul 79.

[216]Hist, 834 ALD, Jul-Dec 80, 15 Jun 81; Hist, 63 MAW, Jul-Sep 80, n.d.

[217]Msg, Navy Det McMurdo Antarctica to OL D 619 MASS *et al*., "Airdrop McMurdo Station Antarctica," 2903387Z Jul 80.

[218]Hist, 63 MAW, Jul-Sep 79, n.d.; Hist, 63 MAW, Jul-Sep 80, n.d.

[219]Article, Arnold J. Mann, "McMurdo Airdrop," *Air Force Magazine*, p. 84, Jan 90.

[220]*Ibid*; Hist, 63 MAW, Apr-Jun 81, ca Sep 81; Hist, 62 MAW, Apr-Jun 83.

[221]Intvw, Clayton H. Snedeker, 63 MAW Historian, with Lt Col James M. Galyen, 14 AS Commander, 14 Jul 82.

[222]Hist, MAC, Jan-Dec 80, 4 Mar 82; Hist, MAC, Jan-Dec 81, 31 Jan 83; Hist, 60 MAW, 22 Jul-31 Dec 80, 3 Mar 82.

[223]As quoted in, Study, Anne M. Bazzell, 834 ALD History Office, "Antarctica: Down to the Ice," p. 16, Jul 81.

[224]Extract from Pacific Airlift Center Logs, 6-11 Oct 80; Msg, OL D 619 MASS to Twenty-Second Air Force *et al*., "DEEP FREEZE Recovery Acft 40632," 112130Z Oct 80.

[225]Msg, OL D 619 MASS to Twenty-Second Air Force *et al*., "DEEP FREEZE Recovery Acft 40632," 112130Z Oct 80; Msg, OL D 619 MASS to 834 ALD Operations Plans, "Manpower DEEP FREEZE 81," 092245Z Oct 80.

[226]Study, Anne M. Bazzell, 834 ALD History Office, "Antarctica: Down to the Ice," Jul 81; Memo, Col Daniel I. Hejde, 619 MASS Commander, to Twenty-Second Air Force Director of Operations, "Guidelines for Operation DEEP FREEZE," 3 Mar 81.

[227]Hist, 60 MAW, 21 Jul-31 Dec 80, 3 Mar 82.

[228]Paper, Col Alton P. H. Brewer, Jr., MAC Director of Airlift Operations, "Mid-Winter Parachute Drop--Antarctica (Update for Gen Baginiski)," 11 Jun 81; Hist, 63 MAW, Apr-Jun 81, ca Sep 81; Hist, 22 BW, Apr-Jun 81, 18 Sep 81.

[229]Hist, 63 MAW, Apr-Jun 81, p. 23, ca Sep 81.

[230]*Ibid*; Paper, Col Alton P. H. Brewer, Jr., MAC Director of Airlift Operations, "Mid-Winter Parachute Drop--Antarctica (Update for Gen Baginiski)," 11 Jun 81.

[231]Hist, 60 MAW, Jul 81-Dec 82, ca Jan 84; Hist, MAC, Jan-Dec 81, 31 Jan 83.

[232]Hist, 834 ALD, Jul-Dec 81, 9 Jul 82; Ltr, Maj Joseph C. Reichal, 834 ALD Chief of Safety, to 845 ALD Commander, "Operation DEEP FREEZE '82 Trip Report," 23 Oct 81.

[233]Ltr, Maj Joseph C. Reichal, 834 ALD Chief of Safety, to 845 ALD Commander, "Operation DEEP FREEZE '82 Trip Report," 23 Oct 81.

[234]Msg, MAC Deputy Chief of Staff for Operations to Twenty-Second Air Force Director of Operations, "DEEP FREEZE Support," 141441Z Dec 81.

[235]Hist, 63 MAW, Apr-Jun 82, ca Sep 82; Pamphlet, SAC History Office, *Seventy Years of Strategic Air Refueling, 1918-1988, A Chronology*, May 90.

[236]Intvw, Clayton H. Snedeker, 63 MAW Historian, with Lt Col James M. Galyen, 14 MAS Commander, 14 Jul 82.

[237]*Ibid.*

[238]Intvw, Clayton H. Snedeker, 63 MAW Historian, with Lt Col James M. Galyen, 14 MAS Commander, 14 Jul 82.

[239]Hist, 834 ALD, Jan-Dec 82, 28 Nov 83; Hist, MAC, Jan-Dec 82, 31 Oct 83; Article, National Science Foundation, "Emergency Medical Evacuation from McMurdo Sound," *Antarctic Journal of the United States*, Dec 82.

[240]Intvw, Anne M. Bazzell, 834 ALD Historian, with Capt William H. Dudley, Det 2 619 MASS Commander, 1 Dec 82; Hist, 834 ALD, Jan-Dec 82, 28 Nov 83.

[241]Hist, 834 ALD, Jan-Dec 82, 28 Nov 83.

[242]*Ibid*; Hist, MAC, Jan-Dec 82, 31 Oct 83.

[243]Hist, MAC, Jan-Dec 83, 29 Aug 84; Hist, 62 MAW, Apr-Jun 83, 30 Sep 83.

[244]Hist, 62 MAW, p. 18, Apr-Jun 83, 30 Sep 83.

[245]*Ibid.*

[246]Hist, MAC, Jan-Dec 83, 29 Aug 84; Hist, 62 MAW, Apr-Jun 83, 30 Sep 83.

[247]Hist, 60 MAW, Jan-Dec 83, 1 Jun 84; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE," 20 Apr 84.

[248]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE," 20 Apr 84; Ltr, Maj William H. Dudley, Commander, Det 2 619 MASS, to 834 ALD Commander, "DEEP FREEZE 84 After Action Report," 2 Jan 84.

[249]Hist, 834 ALD, Jan-Dec 83, 31 Jul 84.

[250]Hist, 62 MAW, Apr-Jun 84, 30 Sep 84; Msg, Lt Gen Robert F. Coverdale, MAC Vice Commander in Chief, to Twenty-Second Air Force Commander *et al*., "Antarctic Midwinter Airdrop," 031635Z Jul 84; Ltr, Lt Gen James E. Light, Jr., 15 AF Commander, to 22 ARW Commander, "South Pole Midwinter Airdrop," 16 Jul 84.

[251]Hist, 62 MAW, Apr-Jun 84, 30 Sep 84; Article, Arnold J. Mann, "McMurdo Airdrop," *Air Force Magazine*, Jan 90.

[252]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 85," 4 Feb 85; Hist, 834 ALD, Jan-Dec 84, 31 Jul 85.

[253]See note above.

[254]Hist, 834 ALD, Jan-Dec 86, (K-DIV-834-HI, IRIS 01086352) 5 Jan 88.

[255]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 85," 4 Feb 85; Hist, 619 MASS, Oct-Dec 84, n.d.; Msg, CNSFA to Det 2, 619 MASS, "Ice Runway Thickness," 060330Z Nov 84.

[256]Msg, CNSFA to MAC Director of Operations, "Request for Waiver to Conduct Scientific Research," 020007Z Oct 84; Msg, MAC Operations Staff, to CNSFA, "Approval of Waiver-Scientific Research," 102223Z Oct 84; Hist, 834 ALD, Jan-Dec 84, 31 Jul 85.

[257]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 85," 4 Feb 85; Hist, 834 ALD, Jan-Dec 84, 31 Jul 85.

[258]Hist, 62 MAW, Apr-Jun 85, 30 Sep 85.

[259]Msg, NSFA to Commander Third Fleet *et al*., "1985 Antarctica Mid-Winter Airdrop," 260630Z Jun 85.

[260]*Ibid*.

[261]Hist, 60 MAW, Jan-Dec 85, (K318.7-60, IRIS 01078134) 3 Mar 83; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "DEEP FREEZE Report," 21 Jan 86.

[262]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "DEEP FREEZE Report," 21 Jan 86.

[263]Hist, 834 ALD, Jan-Dec 86, (K-DIV-834-HI, IRIS 01086352), 5 Jan 88.

[264]Hist, 63 MAW, Jan-Jun 86, (K318.7-62, IRIS 01081544) 31 Jul 87.

[265]Msg, South Pole Station to CNSFA *et al*., "Air Drop Mission," 230208Z Jun 86.

[266]Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 87," 31 Dec 86; Ltr, Lt Col John S. Beattie, Det 2 619 MASS Commander, to 834 ALD Assistant Director of Operations, "DEEP FREEZE After Action Report," 12 Dec 86.

[267]Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 87," 31 Dec 86.

[268]*Ibi*; Ltr, Lt Col John S. Beattie, Det 2 619 MASS Commander, to 834 ALD Assistant Director of Operations, "DEEP FREEZE After Action Report," 12 Dec 86.

[269]Intvw, Clayton H. Snedeker, 63 MAW Historian, with Major Charles E. Fitzpatrick III, 63 MAW Combat Tactics and Techniques, ca 17 Jun 87.

[270]*Ibid*; Hist, 834 ALD, Jan-Dec 87, (K-DIV-834-HI, IRIS 01088318) 29 Jul 88.

[271]Msg, NSF Polar to CNSFA, "Mid-Winter Airdrop of Data Buoys," 272130Z Apr 87; Paper, University of Washington Polar Science Center, "Ross Sea Drifting Ice Buoys, 1987," n.d.; Intvw, Clayton H. Snedeker, 63 MAW Historian, with Major Charles E. Fitzpatrick III, 63 MAW Combat Tactics and Techniques, ca 17 Jun 87.

[272]Hist, 60 MAW, Jan-Dec 87, 23 Aug 88; Hist, 834 ALD, Jan-Dec 87, (K-DIV-834-HI, IRIS 01088318) 29 Jul 88.

[273]Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 88," 23 Dec 87; Hist, 834 ALD, Jan-Dec 87, (K-DIV-834-HI, IRIS 01088318) 29 Jul 88.

[274]Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 88," 23 Dec 87.

[275]Hist, 60 MAW, Jan-Dec 87, 23 Aug 88; Hist, 834 ALD, Jan-Dec 87, (K-DIV-834-HI, IRIS 01088318) 29 Jul 88.

[276]Hist, 63 MAW, Jan-Jun 88, 17 Feb 89.

[277]*Ibid*; Hist, 834 ALD, Jan-Dec 88, (K-DIV-834-HI, IRIS 01099411) 5 Jul 89.

[278]Ltr, Lt Col Patrick M. Boyle, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 89," ca Dec 88; Hist, 60 MAW, Jul-Dec 88, (K318.7-60, IRIS 01094407) 18 Jul 89.

[279]Article, 1352 Audio Visual Squadron, "Penguin Airlift," ca Nov 88; Ltr, Lt Col Patrick M. Boyle, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 89," ca Dec 88; Article, American Polar Society, "Antarctic Conservation Act of 1978," *The Polar Times*, Jun 79.

[280]Article, 1352 Audio Visual Squadron, "'Big Bang' Research," ca Nov 88; Ltr, Lt Col Patrick M. Boyle, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 89," ca Dec 88.

[281]Paper, Twenty-Second Air Force Pacific Airlift Center, "Operation DEEP FREEZE," 20 Oct 77; Article, SSgt Herman J. Kokojan, "Antarctic Summer," *Airman*, Apr 75; Ltr, Lt Col Patrick M. Boyle, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 89," ca Dec 88.

[282]Hist, 834 ALD, Jan-Dec 89, (K-DIV-834-HI, IRIS 01099414) 6 Jul 90.

283 Hist, 62 MAW, Jan-Jun 89, 31 Oct 89; Article, Arnold J. Mann, "McMurdo Airdrop," *Air Force Magazine*, Jan 90.

[284]Article, Arnold J. Mann, "McMurdo Airdrop," *Air Force Magazine*, p. 86, Jan 90.

[285]Hist, 60 MAW, Jul-Dec 89, (K318.7-60, IRIS 0887939) n.d.; Ltr, Lt Col William H. Krechowski, 834 ALD Assistant Director of Operations, to 834 ALD Commander *et al.*, "MAC Mission Commander Report-DEEP FREEZE 90," 5 Jan 90; Msg, CNSFA to MAC Commander *et al.*, "USAF Support of Operation DEEP FREEZE 89/90," 272237Z Nov 89.

[286]Hist, 834 ALD, Jan-Dec 89, (K-DIV-834-HI, IRIS 01099414) 6 Jul 90; Memo, Lt Col William H. Krechowski, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations, "DEEP FREEZE 90 Update," 27 Oct 89; Hist, 62 MAW, Jul-Dec 89, 31 May 90; E-mail, CMSgt Stephen Spotts, 62 AW C-141 Loadmaster, to John W. Leland, AMC Historian, 'Operations in Antarctica," 1 Apr 98.

[287]Hist, MAC, Jan-Dec 89, 12 Jan 90; Ltr, MAC Standardization and Evaluation to MAC Deputy Commander for Operations, "C-5 to McMurdo, Antarctica," 28 Apr 89.

[288]Hist, 60 MAW, Jul-Dec 89, (K318.7-60, IRIS 0887939) n.d.; Msg, 60 MAW Operations Plans to 834 ALD Operations Plans, "DEEP FREEZE 89 OPORD," 272215Z Jun 89; Article, National Science Foundation, "Historic Flight Triples Transport Capability of Opening Flights to McMurdo Station," *Antarctic Journal of the United States*, Dec 89.

[289]As quoted in, Hist, 60 MAW, Jul-Dec 89, p. 41, (K318.7-60, IRIS 0887939) n.d.

[290]Hist, 60 MAW, Jul-Dec 89, (K318.7-60, IRIS 0887939) n.d.; Paper, Lt Col Gregory L. Hergesell, 20 AS Director of Operations, "Operation DEEP FREEZE," 23 Oct 96.

[291]Article, Gary Leiser, "Down to the Ice," US Air Force Museum's *The Friends Journal*, Winter 92; Hist, 834 ALD, Jan-Dec 89, (K-DIV-834-HI, IRIS 01099414) 6 Jul 90.

[292]Hist, 834 ALD, Jan-Dec 90, (K-DIV-834-HI, IRIS 0887902) 20 Dec 91; Hist, Twenty-Second Air Force, Jan-Dec 90, 31 Jul 91; Msg, CNSFA to MAC Deputy Commander for Operations *et al.*, "Antarctic Midwinter Airdrop," 111107Z Jun 90.

[293]Msg, NSFA Det McMurdo to NSF *et al.*, "Mid-Winter Airdrop 1990," 090440Z Jun 90.

[294]Hist, 834 ALD, Jan-Dec 83, 31 Jul 84.

[295]Paper, 61 MASW, "Operating Location Established at Christchurch," 5 Aug 80; Special Order, MAC, G-66, 29 Mar 67; Special Order, MAC, G-77, 11 Apr 67; Special Order, MAC, G-226, 4 Aug 70.

[296]Paper, 61 MASW, "Operating Location Established at Christchurch," 5 Aug 80; Hist, MAC, Jan-Dec 78, 15 Oct 79; Hist, MAC, Jan-Dec 79, 22 Dec 80; Hist, 834 ALD, Jan-Dec 82, 28 Aug 83.

[297]Rpt, CNSFA, "Minutes of DEEP FREEZE 70 MAC Airlift Planning Conference," 26 Jun 69; Draft Msg, 21 AF Director of Operations to 436 MAW Operations Staff *et al.*, "MAC Support of Operation DEEP FREEZE 70," 26 Sep 69; Ltr, Col Gilbert R. Smith Jr., 438 MAW Vice Commander, to 18 MAS *et al.*, 438 MAW Operations Order Number 10-20-1185," 21 Oct 69; Hist, 60 MAW, Jul-Dec 96, 6 Apr 97.

[298]Intvw, SSgt Gary E. Johnston, 60 AMW Historian, with Lt Col Brock W. Eshleman, 20 AS Assistant Director of Operations, 10 Dec 96, as quoted in, Hist, 60 AMW, Jul-Dec 96, 6 Apr 97.

[299]Ltr, Maj William H. Dudley, Det 2, 619 MASS Commander, to 834 ALD Director of Operations *et al*., "DEEP FREEZE 84 After Action Report," 2 Jan 84.

[300]*Ibid*; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 85," 4 Feb 85.

[301]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 85," 4 Feb 85.

[302]Staff Summary, Col Evertt G. Odgers, AMC Comptroller, "Follow-up to DEEP FREEZE Briefing," 7 Apr 95; Staff Summary, Maj Gen James F. Hinkel, AMC Director of Operations, "Recouping Expenses for Operation DEEP FREEZE from the National Science Foundation," 8 Jun 95; E-mail, CMSgt Stephen Spotts, 62 AW C-141 Loadmaster, to John W. Leland, AMC Historian, 'Operations in Antarctica," 1 Apr 98.

[303]Hist, 60 MAW, Jan-Dec 86, 23 Feb 88.

[304]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE," 20 Apr 84; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "DEEP FREEZE Report," 21 Jan 86.

[305]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "DEEP FREEZE Report," 21 Jan 86; Article, Casey Anderson, "Air Force on Course for Major Reorganization," *Air Force Times*, 18 Feb 91.

[306]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 85," 4 Feb 85; Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 88," 23 Dec 87; Hist, 60 MAW, Jan-Dec 87, 23 Aug 88.

[307]Ltr, Col Thomas D. Pilsch, 60 MAW Commander, to 834 ALD Commander, "Operation DEEP FREEZE 88," 18 Dec 87.

[308]Ltr, Lt Col Patrick M. Boyle, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE 89," ca Dec 88.

[309]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "DEEP FREEZE Report," 21 Jan 86; Ltr, Maj Joseph C. Reichal, 834 ALD Chief of Safety, to 845 ALD Commander, "Operation DEEP FREEZE '82 Trip Report," 23 Oct 81.

[310]Ltr, Lt Col Richard C. Bailey, 834 ALD Chief of Safety, to 834 ALD Director of Operations, "DEEP FREEZE '87 After-Action Report," 10 Dec 86; Ltr, Lt Col Patrick M. Henry, Mission Commander Operation DEEP FREEZE 87, to 834 ALD Commander, "ADO Comments on SE-After Action Report, 10 Dec 86," 12 Dec 86.

[311]Memo, Lt Gen Bruce L. Fister, 15 AF Commander, to Gen Robert L. Rutherford, AMC Commander, "Operation DEEP FREEZE," 5 Apr 95.

[312]*Ibid*; Msg, Lt Gen Charles T. Robertson, Jr., 15 AF Commander, to Gen Walter Kross, AMC Commander, "Antarctic Operations Update," 151941Z Jul 97.

[313]Hist, 834 ALD, Jan-Dec 86, (K-DIV-834-HI, IRIS 01086352) 5 Jan 88.

[314]Hist, 834 ALD, Jan-Dec 87, (K-DIV-834-HI, IRIS 01088318) 29 Jul 88; Demonstration Handout, "Stop the Starlifter National Demonstration," ca Oct 88.

[315]Hist, 834 ALD, Jan-Dec 87, (K-DIV-834-HI, IRIS 01088318) 29 Jul 88.

[316]Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-DEEP FREEZE," 20 Apr 84; Article, Robert Reinhold, "Drugs Are an Issue at the South Pole," *The New York Times*, 27 Nov 81, reprinted in American Polar Society, *The Polar Times*, Dec 81.

[317]Ltr, Col William B. Caldwell, 834 ALD Director of Logistics, to 834 ALD Commander, "Commander's Update," 14 Oct 88; Paper, Capt Artis, 834 ALD Logistics Plans, "Landing Fees at Christchurch New Zealand," 17 Jan 89.

[318]White Paper, Department of the Air Force, "Air Force Restructure," Sep 91.

[319]Pamphlet, 18 AF TACC, "TACC Welcome Brochure," 1 Feb 06; Hist, Twenty-Second Air Force, Jan-Dec 92, 29 Jun 93.

[320]Ltr, Maj William H. Dudley, Det 2, 619 MASS Commander, to 834 ALD Director of Operations *et al*., "DEEP FREEZE 84 After Action Report," 2 Jan 84; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "DEEP FREEZE Report," 21 Jan 86.

[321]Paper, unattributed, "Snow Runways in Antarctica," ca Jan 91; Hist, 834 ALD, Jan 91-Apr 92, (K-DIV-834-HI, IRIS 0887905) 30 Sep 92.

[322]Paper, Lt Col W. H. Krechowski, 834 ALD Assistant Director of Operations, "'Blue-Ice' Runway," 24 Oct 90; Hist, Twenty-Second Air Force, Jan-Dec 90, 31 Jul 91; Hist, 834 ALD, Jan-Dec 90, (K-DIV-834-HI, IRIS 0887902) 20 Dec 91; Paper, Lt Col Clyde Minish, MAC Aircrew Standardization and Evaluation, "C-141 Flights to Pegasus Blue Ice Site, Antarctica," ca 21 Jun 90; Article, Josh Landis, "The Tail of the Plane," *The Antarctic Sun*, 2 Jan 00.

[323]Hist, 834 ALD, Jan-Dec 90, (K-DIV-834-HI, IRIS 0887902) 20 Dec 91.

[324]Hist, Twenty-Second Air Force, Jan-Dec 90, 31 Jul 91; Article, Gary Leiser, "Down to the Ice," US Air Force Museum's *The Friends Journal*, Winter 92.

[325]Msg, CNSFA to MAC Operations Staff *et al.*, "C-141 Evaluation of Pegasus Site Ice Runway in Antarctica," 040603Z Nov 90; Msg, CNSFA to NSF *et al.*, "Operation DEEP FREEZE-Pegasus Site Runway SITREP," 092143Z Dec 90; Msg, CNSFA to 834 ALD Director of Operations *et al.*, "USAF MAC Pegasus Site Observers," 062113Z Jan 91.

[326]Hist, 63 MAW, Jan-Jun 91, (K318.7-62, IRIS 0887956) Dec 91.

[327]Hist, 834 ALD, Jan 91-Apr 92, (K-DIV-834-HI, IRIS 0887905) 30 Sep 92; Hist, 60 MAW, Jan 90-Oct 91, 22 Jun 93; Hist, 63 MAW, Jul-Dec 91, (K318.7-63, IRIS 0887959) 1 May 92; Paper, Maj John Theuerkauf, MAC Operations Staff, "National Science Foundation Support in Antarctica," 27 Sep 91.

[328]Hist, 834 ALD, Jan 91-Apr 92, (K-DIV-834-HI, IRIS 0887905) 30 Sep 92; Ltr, Lt Col William H. Krechowski, 834 ALD Assistant Director of Operations, to Lt Col Clyde Minish, MAC Aircrew Standardization and Evaluation, "Blue Ice Runway," 26 Jun 91; Msg, CNSFA to NSFA *et al.*, "Pegasus Site Blue Ice Runway Test in Antarctica," 112333Z Dec 91; Msg, CNSFA to NSFA *et al.*, "Pegasus Site Blue Ice Runway Test in Antarctica," 050113Z Jan 92.

[329]Hist, 63 AW, Jan-Jun 92, 2 Nov 92; Hist, Twenty-Second Air Force, Jan-Dec 92, 29 Jun 93; Hist, 62 AW, Jan 94-Jun 95, 1 Nov 95.

[330]Memo, Lt Col George E. Meggers, Twenty-Second Air Force Chief of Aircrew Standardization and Evaluation, to Twenty-Second Air Force Director of Operations *et al.*, "Mission Commander's Report-DEEP FREEZE 93," 7 Dec 92; Hist, Twenty-Second Air Force, Jan-Dec 92, 29 Jun 93.

[331]Ltr, Lt Col Jeff Cain, 4 AS Commander, to 62 OG Commander *et al.*, "Trip Report for Midwinter Airdrop 93," 15 Jun 93; Hist, Twenty-Second Air Force, Jan-Jun 93, 14 Dec 93.

[332]Hist, 15 AF, Jul 93-Dec 94, 15 Jul 95; Msg, CNSFA to AMC TACC *et al.*, "Bravo Zulu," 040200Z Dec 93.

[333]See note above; Article, AMC/PA, "Blue Ice," *AMC Global Reach*, Apr 94.

[334]As quoted in, Article, AMC/PA, "Blue Ice," *AMC Global Reach*, Apr 94.

[335]Hist, 62 AW, Jan 94-Jun 95, 1 Nov 95; Hist, 15 AF, Jul 93-Dec 94; Msg, 15 AF Commander to AMC Vice Commander, "Midwinter Airdrop," 111646Z Jul 94.

[336]Memo, Capt John M. Wiprud, 62 MDS Flight Surgeon, to 62 MDS Commander *et al*., "After Action Report-Mid Winter Air Drop to Antarctica Jun 1994," 23 Aug 94.

[337]Msg, 15 AF, Commander to AMC Vice Commander, "Midwinter Airdrop," 111646Z Jul 94.

[338]Rpt, Lt Col Russell J. Frasz, 20 AS Director of Operations, "Operation DEEP FREEZE 95 After Action Report," 25 Nov 94; Hist, 15 AF, Jul 93-Dec 94.

[339]See note above; Staff Summary, Maj Gen Walter S. Hogle, AMC Director of Plans, "Operation DEEP FREEZE," 23 Dec 96.

[340]Paper, Maj Phil Bossert, AMC Plans, "Operation DEEP FREEZE," 20 Nov 96; Hist, 62 AW, Jan 94-Jun 95, 1 Nov 95; Hist, 446 AW, Jan-Dec 95, (K-WG-446-HI, IRIS 01121913) 31 Jul 96; Rpts, Lt Col David R. Smith, Ice Drop 95 Commander, "Mission Commander's Report," 6-16 Jun 95; Article, "U.S. Cancels Supply Drops for Antarctic Personnel," *Christchurch The Press*, 6 Mar 96.

[341]Memo, Lt Col Gregory L. Hergesell, 20 AS Director of Operations, to 15 AF Director of Operations, "After Action Report, Operation DEEP FREEZE 96," 1 Dec 95; Hist, 60 AMW, Jul-Dec 95, 10 Apr 96.

[342]Memo, Lt Col Gregory L. Hergesell, 20 AS Director of Operations, to 15 AF Director of Operations, "After Action Report, Operation DEEP FREEZE 96," 1 Dec 95; Paper, Lt Col Gregory L. Hergesell, 20 AS Director of Operations, "Operation DEEP FREEZE," 23 Oct 96.

[343]Staff Summary, Maj Gen Walter S. Hogle, AMC Director of Plans, "Operation DEEP FREEZE," 23 Dec 96; Paper, Maj Phil Bossert, AMC Plans, "Operation DEEP FREEZE," 20 Nov 96; Report, Col Ron Smith, 500 AEG Commander, "Operation DEEP FREEZE 2005-06 SITREP," 281700Z Feb 06.

[344]Hist, ANG, Jan 95-Dec 97, 5 Sep 98; Article, Lt Walter F. Wintsch, "Brrr! New York ANG's 109th TAG Trains in the 'Frozen' Continent," *On Guard*, Mar-Apr 88; Article, TSgt Michael T. Smith, "The DEEP FREEZE," *Air Force Magazine*, Aug 01; Hist, 109 AW, Jan-Dec 96, (K169.011-109(AW), IRIS 01134180) 4 Aug 00.

[345]Hist, ANG, Jan 95-Dec 97, 5 Sep 98; Hist, 109 AW, Jan-Dec 96, (K169.011-109(AW), IRIS 01134180) 4 Aug 00; Intvw Notes, Charles J. Gross, ANG Historian, with Lt Col Mark Kalber, National Guard Bureau, 2 Apr 98.

[346]Hist, ANG, Jan 95-Dec 97, 5 Sep 98; Hist, 109 AW, Jan-Dec 96, (K169.011-109(AW), IRIS 01134180) 4 Aug 00; Article, Bruce D. Nordwall, "Aviation on Ice Unlocks Antarctica," *Aviation Week & Space Technology*, 25 May 98; Article, TSgt Michael T. Smith, "The DEEP FREEZE,"

Air Force Magazine, Aug 01; Release, Gov. George E. Pataki, NY, "Governor Pataki Announces Expansion at Air National Guard Base," 5 Feb 96.

[347]Paper, MSgt Bill Heineman, AMC Operations Staff, "Operation DEEP FREEZE," 20 Aug 96; Hist, AMC, Jan-Dec 97, n.d.

[348]Hist, AMC, Jan-Dec 97, n.d.; Hist, 60 AMW, Jul-Dec 96, 25 Apr 97; Staff Summary, Maj Gen Walter S. Hogle, Jr., AMC Director of Plans, "AMC Message PPlan 97-06, Operation DEEP FREEZE Mission Transfer from Travis AFB CA to McChord AFB WA," 28 Jan 97; Hist, 60 AMW, Jan-Jun 97, n.d.

[349]Memo, Lt Col Brock W. Eshleman, 20 AS Director of Operations, to 15 AF Director of Operations, "After-Action Report, Operation DEEP FREEZE 97," 16 Dec 96.

[350]Hist, 109 AW, Jan-Dec 96, (K169.011-109(AW), IRIS 01134180) 4 Aug 00; Hist, 109 AW, Jan-Dec 97, (K169.011-109(AW), IRIS 01132049) 3 Oct 99.

[351]Hist, 109 AW, Jan-Dec 97, (K169.011-109(AW), IRIS 01132049) 3 Oct 99; Article, "Historic Radio Broadcasts Focus National Radio, TV an Internet Attention on 109th," *Transport Topics*, Feb 97.

[352]Article, Maj Jim Hunt, "109th Makes Historic Flight," *Transport Topics*, Mar 97; Article, Maj Ed Vaughan, "About the Explorers," *Transport Topics*, Mar 97.

[353]Article, Maj Jim Hunt, "109th Makes Historic Flight," *Transport Topics*, p. 16, Mar 97.

[354]Hist, 62 AW, Jan-Dec 97, 29 Jul 98.

[355]Hist, 109 AW, Jan-Dec 97, (K169.011-109(AW), IRIS 01132049) 3 Oct 99; Hist, 109 AW, Jan-Dec 98, (K169.011-109(AW), IRIS 01134732) 7 Jan 01; Memo, Col Richard M. Saburro, DEEP FREEZE Commander, to Air National Guard *et al.*, "Operation DEEP FREEZE End of Season Report," 15 Aug 98.

[356]Hist, 109 AW, Jan-Dec 98, (K169.011-109(AW), IRIS 01134732) 7 Jan 01.

[357]MOA, Department of Defense and National Science Foundation, "Operational and Logistics Support of the National Science Foundation's Polar Programs," 1 Apr 98; Briefing, Maj Claude Poitras, AMC Operations Staff, "Operation DEEP FREEZE," 4 Nov 99.

[358]See note above; Special Order, ANG, GS-98-10, 25 Mar 98; Slides, ANG Det 13, "ANG Detachment 13 Mission Statement," Oct 99.

[359]Hist, 62 AW, Jul-Dec 98, 13 Jul 99.

[360]Rpt, Lt Col John Pray, 62 OG/CV, "62d Airlift Wing, End of Season Report," ca 15 Nov 98.

[361]Hist, 62 AW, Jul-Dec 98, 13 Jul 99; Rpt, Lt Col John Pray, 62 OG/CV, "62d Airlift Wing, End of Season Report," ca 15 Nov 98.

[362]Rpt, Col Richard M. Saburro, DEEP FREEZE Commander, "Operation DEEP FREEZE Consolidated Department of Defense End of Season Report, 1998-1999 Season," 15 Aug 99; Hist, 109 AW, Jan-Dec 98, (K169.011-109(AW), IRIS 01134732) 7 Jan 01.

[363]Ltr, Col Marion G. Pritchard, NYANG Commander, to Members and Their Families, "Here and On the Ice," 19 Nov 98; Rpt, Col Richard Saburro, Commander Operation DEEP FREEZE,

"Minutes, Recovery Team Meeting," 27 Nov 98; News Release, NSF, "Ski-Equipped Cargo Aircraft, Repaired at Remote Antarctic Site, Returns Safely," 5 Jan 99.

[364]Rpt, Lt Col Steve Kernstock, Mission Commander, "Redeployment [WINFLY] SITREP 05 (Final)," 212200Z Feb 99.

[365]Hist, AMC, Jan-Dec 99, n.d.; Hist, 62 AW, Jan-Dec 99, 25 Jun 00.

[366]Hist, 62 AW, Jan-Dec 99, 25 Jun 00; E-mail, Sam Feola, ASA Director of Logistics, to Alexandra Brown, *et al.*, "South Pole Airdrop Status as of COB 31 July 99 [*sic*.]," 2 Jul 99; Rpt, Lt Col John Pray, Mission Commander, "SPole Airdrop SITREP 001," 091300Z Jul 99.

[367]Hist, AMC, Jan-Dec 99, n.d.; E-mail, Sam Feola, ASA Director of Logistics, to Lt Col John Pray, 62 OG Deputy Commander, *et al.*, "South Pole Airdrop Status as of COB 30 June 99," 1 Jul 99; Paper, ANG Det 13, "South Pole Mid-Winter Airdrop," ca 12 Jul 99.

[368]Hist, AMC, Jan-Dec 99, n.d.; Hist, 62 AW, Jan-Dec 99, 25 Jun 00; E-mail, Peter J. West, NSF Office of Legislative and Public Affairs, to Col Richard M. Saburro, DEEP FREEZE Commander, *et al.*, "NSF Statement on S. Pole Medical," 18 Jun 99.

[369]Hist, 62 AW, Jan-Dec 99, 25 Jun 00.

[370]*Ibid*; Rpt, Col Richard M. Saburro, DEEP FREEZE Commander, "Operation DEEP FREEZE Consolidated Department of Defense End of Season Report, 1999-2000 Season," 5 May 00.

[371]Article, MSgt T. P. Barela, 62 AW Public Affairs, "McChord C-17 Makes Historic Flight to 'The Ice'," *Northwest Airlift*, 22 Oct 99.

[372]*Ibid*; Hist, AMC, Jan-Dec 99, n.d.

[373]Hist, ANG Det 13, Mar 99-Feb 00, 26 Aug 02; Hist, AMC, Jan-Dec 99, n.d.

[374]Rpt, ANG Det 13, "Chronology of Events, Gerry Ness, ASA Site Manager at McMurdo," 12 Aug 98; Article, Mathew Dearnaley, "Americans Thank Ice-Dash Crew," *New Zealand Herald*, 18 Aug 98.

[375]Hist, AMC, Jan-Dec 99, n.d.

[376]Article, "Prisoner at Earth's End," *People Magazine*, p. 132, 1 Nov 99.

[377]Hist, AMC, Jan-Dec 99, n.d.; Hist, ANG Det 13, Mar 99-Feb 00, 26 Aug 02; Rpt, Col Richard M. Saburro, DEEP FREEZE Commander, "Operation DEEP FREEZE Consolidated Department of Defense End of Season Report, 1999-2000 Season," 5 May 00.

[378]Rpt, Col Richard M. Saburro, DEEP FREEZE Commander, "Operation DEEP FREEZE Consolidated Department of Defense End of Season Report, 1999-2000 Season," 5 May 00; Article, John Landis, "Flight in White, Weather Sends LC-130 on Marathon Trip," *The Antarctic Sun*, 7 Nov 99.

[379]Hist, ANG Det 13, Mar 99-Feb 00, 26 Aug 02; Ltr, Gen Charles T. Robertson, Jr., USTRANSCOM Commander, to Col Richard Saburro, Operation DEEP FREEZE Commander, [visit], 28 Mar 00.

[380]Rpt, Col Richard M. Saburro, DEEP FREEZE Commander, "Operation DEEP FREEZE Consolidated Department of Defense End of Season Report, 1999-2000 Season," 5 May 00; Hist, 62 AW, Jan-Dec 00, 6 Jan 02.

[381]Memo, Col Max H. Della Pia, 109 AW Commander, to HQ NY ANG *et al.*, "ODF Becoming Part of an AEF," 15 Nov 00.

[382]Staff Summary w/mult atch, Maj Gen Roger A. Brady, AMC Director of Operations, "Operation DEEP FREEZE in the AEF," 31 Oct 00; Memo, Col Max H. Della Pia, 109 AW Commander, to HQ NY ANG *et al.*, "ODF Becoming Part of an AEF," 15 Nov 00; Special Order, AMC, GAXP-18, 28 Sep 00; Msg, Lt Gen Ronald C. Marcotte, AMC Vice Commander, to USAF Plans, "Operation DEEP FREEZE in AEF," 012349Z Nov 00; Msg, Chairman JCS to AMC Commander, "Approval to Include 109 AW DEEP FREEZE Missions in AEF Schedules," 271800Z Dec 00.

[383]Rpt, Col Joel R. Maynard, DEEP FREEZE Commander, "Operation DEEP FREEZE Consolidated Department of Defense End of Season Report, 2000-2001 Season," 26 Aug 02; Hist, 62 AW, Jan-Dec 00, 6 Jan 02.

[384]Rpt, Col Joel R. Maynard, DEEP FREEZE Commander, "Operation DEEP FREEZE Consolidated Department of Defense End of Season Report, 2000-2001 Season," 26 Aug 02.

[385]*Ibid*; Hist, ANG Det 13, Mar 00-Feb 01, 27 Aug 02; MFR, SMSgt Steven L. Stearns, ANG Staff Historian, "Det 13, Christchurch, New Zealand [report of visit and notes from four interviews]," 30 Sep 00.

[386]Ltr, Dr. Karl A. Erb, NSF Office of Polar Programs Director, to Gen Charles T. Robertson, Jr., USTRANSCOM Commander, [appreciation and planning factors], 29 Jan 01; Slides, 109 AW Operations Staff, "109th Airlift Wing, Christchurch Operations," Jan 02.

[387]Intvw Notes, SSgt Lyn A. Fry, 215 EIS Historian, with Lt Col Dan Dunbar, 22 Aug 01; Paper, Maj Claude Poitras, AMC Operations Staff, "Alternate Airfield on the Antarctic Continent," 23 Feb 00; Rpt, Col Verle L. Johnston, Jr., 109 AW Vice Commander, "O'Dell Glacier Site Survey," 12 Feb 01.

[388]Rpt, Col Joel R. Maynard, DEEP FREEZE Commander, "Operation DEEP FREEZE Consolidated Department of Defense End of Season Report, 2000-2001 Season," 26 Aug 02; Hist, 62 AW, Jan-Dec 01, 4 Nov 03.

[389]Msg, Maj Gen George N. Williams, AMC Director of Operations, to AFRC Director of Operations, "Operation DEEP FREEZE C-141 Phaseout," 091006Z Mar 00; Paper, Maj Janeczko, AMC Aircrew Standardization and Evaluation, "Operation DEEP FREEZE Transition to AFRC," 30 Mar 01; Hist, AMC, Jan-Dec 01, n.d.

[390]Memo, Gen Charles T. Robertson, Jr., USTRANSCOM Commander, to USTRANSCOM Operations *et al.*, "Activation of Support Forces Antarctica," 11 Sep 01; Draft Memo, USTRANSCOM Commander, "Activation of Support Forces Antarctica," ca Au 01; Staff Summary, Col James W. Swanson, USTRANSCOM Chief Counsel, "Support Forces Antarctica," ca Aug 01; Special Order, USTRANSCOM, G-98, 21 Sep 01; Intvw Notes, Ellery Wallwork, AMC Staff Historian, with Lt Col Timothy S. Penn, former ANG Det 13 Commander, and TSgt Drew LaPointe, former member of ANG Det 13, 24 Mar 06.

[391]Hist, 62 AW, Jan-Dec 01, 4 Nov 03.

[392]Draft Hist, ANG Det 13, Mar 01-Feb 02, n.d.; E-mail, MSgt Stephen D. Oertel, ANG Det 13 Security Coordinator, to All Members of ANG Det 13, "Scheduled Protest Reminder," 30 Nov 01.

[393]Hist, AMC, Jan-Dec 01, n.d.; Slides, Col Joel Maynard, DEEP FREEZE Commander, "Operation DEEP FREEZE, 2001/2002 Antarctic Season Overview," Aug 01.

[394]Slides, 109 AW Operations Staff, "109th Airlift Wing, Christchurch Operations," Jan 02; Draft Hist, ANG Det 13, Mar 01-Feb 02, n.d.; Paper, Col Joel R. Maynard, DEEP FREEZE Commander, [DEEP FREEZE 01-02 review], ca Mar 02; Hist, AMC, Jan-Dec 01, n.d.

[395]Hist, AMC, Jan-Dec 01, n.d.; Rpt, Maj Pat Curtis and Capt JJ Hunt, 50 EAS, "Devils Down Under," n.d.; Briefing, Maj Jared P. Curtis, 50 EAS Commander, "50 EAS After Action Report, Operation DEEP FREEZE, 10 Dec 01-20 Jan 02, Mission Commander's Assessment," Feb 02.

[396]Briefing, Maj Jared P. Curtis, 50 EAS Commander, "50 EAS After Action Report, Operation DEEP FREEZE, 10 Dec 01-20 Jan 02, Mission Commander's Assessment," Feb 02; Rpts, Maj Jared P. Curtis , 50 EAS Commander, "Polar Situation Reports-Operation DEEP FREEZE," 11 Dec 01-20 Jan 02; Hist, 463 AG, Jul-Dec 01, 17 May 02.

[397]E-mail, Maj Jared P. Curtis, 463 OSS Operations Staff, to SrA Mark Chandler, 463 AG Historian, "ODF Quotes," 18 Apr 02.

[398]Rpt, AMC TACC Airlift Operations, "SAAM Project History Report," Jan 02-Feb 03; E-mail, Lt Col Daniel Dunbar, AMC Airlift Operations Staff, to Kathy A. Skipper, AMC Historian, "Annual History," 3 Mar 04; Hist, Jan-Dec 03, 10 Sep 04.

[399]E-mail, Lt Col Daniel Dunbar, AMC Airlift Operations Staff, to Kathy A. Skipper, AMC Historian, "Annual History," 3 Mar 04; Hist, Jan-Dec 03, 10 Sep 04; Slides, 109 AW Operations Staff, "109th Airlift Wing, Christchurch Operations," Jan 02; Article, MSgt Chuck Roberts, "Operation DEEP FREEZE, Airmen Aid Researchers in Thawing Secrets of the Universe," *Airman*, Apr 05.

[400]MOA, Department of Defense and National Science Foundation, "Operational and Logistics Support of the National Science Foundation's Polar Programs," 1 Apr 99; see also, Plan, USTRANSCOM SFA, "Operation DEEP FREEZE Concept of Operations," Sep 04.

[401]Hist, AMC, Jan-Dec 01, n.d.; Intvw Notes, Ellery Wallwork, AMC Staff Historian, with Lt Col Timothy S. Penn, former ANG Det 13 Commander, and TSgt Drew LaPointe, former member of ANG Det 13, 24 Mar 06.

[402]Intvw Notes, Ellery Wallwork, AMC Staff Historian, with Lt Col Timothy S. Penn, former ANG Det 13 Commander, and TSgt Drew LaPointe, former member of ANG Det 13, 24 Mar 06; MFR, SMSgt Steven L. Stearns, ANG Staff Historian, "Det 13, Christchurch, New Zealand [report of visit and notes from four interviews]," 30 Sep 00; Special Order, AMC, GAXP-5, 18 Oct 01.

[403]Msg, Secretary of Defense Public Affairs Office to multiple addresses, "Public Affairs Guidance-Unified Command Plan 02," 171700Z Apr 02; Intvw Notes, Charles J. Gross, ANG Historian, with Lt Col Mark Kalber, National Guard Bureau, 2 Apr 98; Plan, USTRANSCOM SFA, "Operation DEEP FREEZE Concept of Operations," Sep 04.

[404]Hist, AMC, Jan-Dec 04, 31 Aug 05; Slides, Col Tye Beasley, DEEP FREEZE Commander, "Operation DEEP FREEZE SITREP," 13 Feb 05; Article, MSgt Chuck Roberts, "Operation DEEP FREEZE, Airmen Aid Researchers in Thawing Secrets of the Universe," *Airman*, Apr 05.

[405]Slides, Col Tye Beasley, DEEP FREEZE Commander, "Operation DEEP FREEZE SITREP," 13 Feb 05; Article, TSgt Joe Zucarro, "'Frigid' Chapter Closes for C-141," AMC News Service,

23 Feb 05; Article, Marlowe Churchill, "March AFB Hopes to Keep Operation DEEP FREEZE," *Riverside Press-Enterprise*, 6 Apr 04.

[406]Hist, AMC, Jan-Dec 04, 31 Aug 05; Spreadsheet, Col Tye Beasley, DEEP FREEZE Commander, "LC-130 Continental Airlift-DEEP FREEZE 2004-2005," 20 Feb 05.

[407]Spreadsheet, Col Tye Beasley, DEEP FREEZE Commander, "LC-130 Continental Airlift-DEEP FREEZE 2004-2005," 20 Feb 05.

[408]Hist, AMC, Jan-Dec 04, 31 Aug 05; Spreadsheet, Col Tye Beasley, DEEP FREEZE Commander, "LC-130 Continental Airlift-DEEP FREEZE 2004-2005," 20 Feb 05; Rpt, Col Tye Beasley, DEEP FREEZE Commander, "DEEP FREEZE Redeployment 05 SITREP," 13 Feb 05.

[409]Paper, Lt Col McNamara, PACAF Operations Staff, "PACAF SmartBook: Operation DEEP FREEZE," 24 Jun 04; Paper, Mark Voorhis, AMC Public Affairs, "AMC and Operation DEEP FREEZE," 29 Dec 05; Msg, USPACOM to PACAF Director of Operations *et al.*, [execution order], 140222Z May 05; Slides, JTF-SFA, "Operation DEEP FREEZE Update," 7 Jul 05.

[410]Rpt, Col Ron Smith, 500 AEG Commander, "Operation DEEP FREEZE 2005-06 SITREP," 20 Oct 05; Special Order, PACAF, GS-06-010, 10 Nov 05; Article, Juliana Gittler, "On the Last Continent," *Stars and Stripes*, 4 Jan 06.

[411]Intvw Notes, Ellery Wallwork, AMC Staff Historian, with Lt Col Timothy S. Penn, former ANG Det 13 Commander, and TSgt Drew LaPointe, former member of ANG Det 13, 24 Mar 06; Slides, JTF-SFA, "Operation DEEP FREEZE Update," 7 Jul 05; Msg, USPACOM to PACAF Director of Operations *et al.*, [execution order], 140222Z May 05; Article, Juliana Gittler, "On the Last Continent," *Stars and Stripes*, 4 Jan 06.

[412]Rpts, Col Ron Smith, 500 AEG Commander, "Operation DEEP FREEZE 05-06 SITREP," 4 Oct, 9 Oct, 11 Oct, and 27 Oct 05.

[413]Rpts, Col Ron Smith, 500 AEG Commander, "Operation DEEP FREEZE 05-06 SITREP," 4 Oct, 23 Oct, and 25 Oct 05; Rpt, AF Directorate of Operations and Training, "Air Force Operations Summary," 3 Jan 06.

[414]E-mail, Col Ron Smith, 500 AEG Commander, to Ellery Wallwork, AMC Staff Historian, "Season Numbers," 3 Mar 06; Article, Gregg K. Kakesako, "Operation DEEP FREEZE," *Honolulu Star-Bulletin*, 12 Mar 06.

[415]Article, TSgt Mark Munsey, 15 AW Public Affairs, "'On Ice' Kenney HQ Moves Mission to Antarctica," *Hickam Kukini*, 25 Nov 05.

[416]Foreword to Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation DEEP FREEZE 63," n.d.

APPENDIX A

US AIR FORCE AIRLIFT CHRONOLOGY
OPERATION DEEP FREEZE (1956-2006)

Phase of Operation	Deployment Dates	Unit and Aircraft	Operation Dates	Redeployment Dates
Deep Freeze II	4 Sep 56- 23 Oct 56	63 TCW/ 8 C-124	20 Oct 56- 23 Feb 57	24 Feb 57- ca 15 Mar 57
Deep Freeze III	7 Sep 57- ca 30 Sep 57	63 TCW/ 8 C-124	3 Oct 57- 5 Dec 57	4 Dec 57- 29 Dec 57
Deep Freeze IV	12 Sep 58- 3 Oct 58	63 TCW/ 10 C-124	2 Oct 58- 13 Nov 58	ca 13 Nov 58- ca 28 Nov 58
Deep Freeze 60	7 Sep 59- ca 1 Oct 59	63 TCW/ 10 C-124	3 Oct 59- 12 Nov 59	ca 13 Nov 59- 3 Dec 59
Deep Freeze 60 (Operation Ice Flow)	7 Jan 60- 23 Jan 60	314 TCW/ 7 C-130D 1 C-130A	25 Jan 60- 5 Feb 60	7 Feb 60- 3 Mar 60
Deep Freeze 61	18 Sep 60- 6 Oct 60	63 TCW/ 7 C-124	2 Oct 60- 30 Nov 60	ca Dec 60
Deep Freeze 61 (augmentation)	ca 30 Oct 60- 5 Nov 60	63 TCW/ 3 C-124	5 Nov 60- 30 Nov 60	ca Dec 60
Deep Freeze 62	9 Sep 61- ca 3 Oct 61	63 TCW/ 9 C-124	5 Oct 61- 1 Dec 61	mid-Nov 61- ca Dec 61
Deep Freeze 63	7 Sep 62- ca 5 Oct 62	63 TCW/ 9 C-124	7 Oct 62- 10 Dec 62	ca Dec 62
Deep Freeze 64	23 Sep 63- 12 Oct 63	1608 ATW/* 3 C-130E	14 Oct 63- 16 Dec 63	16 Dec 63- 20 Dec 63
Deep Freeze 65	7 Sep 64- 10 Oct 64	1501 ATW/ 3 C-130E	18 Oct 64- 17 Dec 64	17 Dec 64- 20 Dec 64
Deep Freeze 66	19 Sep 65- 28 Oct 65	1501 ATW/ 3 C-130E	1 Nov 65- 4 Dec 65	29 Nov 65- 7 Dec 65
Deep Freeze 67	9 Oct 66- 21 Oct 66	NATWP/ 2 C-130E	23 Oct 66- 6 Dec 66	4 Nov 66- 20 Dec 66
Deep Freeze 67 (C-141 trial)	ca 8 Nov 66	60 MAW/ 1 C-141A	11 Nov 66- 14 Nov 66	ca 15 Nov 66
Deep Freeze 68	18 Oct 67-	438 MAW/ 2 C-130E	24 Oct 67- 29 Oct 67	ca Nov 67
Deep Freeze 69	24 Oct 68- 26 Oct 68	438 MAW/ 2 C-141A	29 Oct 68- 9 Nov 68	10 Nov 68- 15 Nov 68

*The 1608th Air Transport Wing deployed a fourth C-130E to Christchurch from 22 October to 2 November.

Phase of Operation	Deployment Dates	Unit and Aircraft	Operation Dates	Redeployment Dates
Deep Freeze 70	14 Oct 69- 29 Oct 69	438 MAW/ 2 C-141A	6 Nov 69- 17 Nov 69	18 Nov 69- 20 Nov 69
Deep Freeze 71	15 Oct 70- 26 Oct 70	438 MAW/ 2 C-141A	28 Oct 70- 10 Nov 70	12 Nov 70- 13 Nov 70
Deep Freeze 72	1 Oct 71- ca 9 Oct 71	438 MAW/ 2 C-141A*	10 Oct 71- ca 10 Jan 72	ca 12 Jan 72- ca 14 Jan 72
Deep Freeze 73	3 Oct 72- ca 5 Oct 72	438 MAW/ 3 C-141A	6 Oct 72- 30 Dec 72	ca 31 Dec 72- ca 3 Jan 73
Deep Freeze 74	28 Sep 73- ca 8 Oct 73	438 MAW/ 2 C-141A	9 Oct 73- 17 Dec 73	ca 18 Dec 73- ca 20 Dec 73
Deep Freeze 75	13 Sep 74- ca 6 Oct 74	60 MAW/ 2 C-141A	8 Oct 74- 19 Dec 74	ca 20 Dec 74- ca 22 Dec 74
Deep Freeze 76	ca 6 Oct 75- ca 8 Oct 75	60 MAW/ 3 C-141A	10 Oct 75- 17 Dec 75	ca 18 Dec 75- ca 20 Dec 75
Deep Freeze 77	ca 30 Sep 76- ca 1 Oct 76	60 MAW/ 3 C-141A	2 Oct 76- 16 Dec 76	ca 17 Dec 76- ca 19 Dec 76
Deep Freeze 78	ca 1 Oct 77- 3 Oct 77	60 MAW/ 2 C-141A	5 Oct 77- 15 Dec 77	ca 16 Dec 77- ca 18 Dec 77
Deep Freeze 79	ca 1 Oct 78- 3 Oct 78	60 MAW/ C-141A	5 Oct 78- 18 Dec 78	20 Dec 78- 21 Dec 78
Ice Drop 79		63 MAW/ 1 C-141A**	14 Jul 79	
Deep Freeze 80	1 Oct 79- 4 Oct 79	60 MAW/ 2 C-141A	ca 5 Oct 79- 12 Dec 79	14 Dec 79- 22 Jan 80***
Ice Drop 80		63 MAW/ 1 C-141A	28 Jul 80	
Deep Freeze 81	3 Oct 80- 4 Oct 80	60 MAW/ 3 C-141A/B	6 Oct 80- 18 Nov 80	ca 20 Nov 80- 22 Nov 80
Ice Drop 81	19 Jun 81	63 MAW/ 1 C-141B	22 Jun 81	25 Jun 81

*Beginning with DEEP FREEZE 72, a change in the operational concept occurred. Aircraft and crews flying from the US stayed at Christchurch and flew two to four shuttle missions to McMurdo Sound before returning to the US. Total scheduled aircraft and crews for DEEP FREEZE 72 equaled 14, with one to three remaining at Christchurch at any one time. DEEP FREEZE 72 to DEEP FREEZE 90 aircraft total refers to maximum scheduled at Christchurch at one time; deployment, operations, and redeployment dates refer to deployment of command element and support personnel.

**The number of aircraft involved in DEEP FREEZE 79 and 80 was unknown, but believed to be six to seven total with two or three at Christchurch at any one time--this assumption would be consistent with the number of aircraft involved during the previous seven years.

***The Mobility Airlift Command Task Force Christchurch remained in place until 22 January 1980.

Phase of Operation	Deployment Dates	Unit and Aircraft	Operation Dates	Redeployment Dates
Deep Freeze 82	1 Oct 81- 2 Oct 81	60 MAW/ 2 C-141B	5 Oct 81- 8 Dec 81	10 Dec 81- 18 Dec 81
Ice Drop 82	19 Jun 82	63 MAW/ 1 C-141B	22 Jun 82	ca 24 Jun 82
Deep Freeze 83	29 Sep 82- ca 1 Oct 82	60 MAW/ 1 C-141B	4 Oct 82*- 14 Dec 82	ca 16 Dec 82- ca 18 Dec 82
Ice Drop 83	11 Jun 83- 16 Jun 83**	62 MAW/ 1 C-141B	21 Jun 83- 24 Jun 83	25 Jun 83
Deep Freeze 84	28 Sep 83- ca 30 Sep 83	60 MAW/*** 1 C-141B	2 Oct 83- 15 Dec 83	ca 17 Dec 83- ca 19 Dec 83
Ice Drop 84		62 MAW/ 1 C-141B	21 Jun 84 23 Jun 84	
Deep Freeze 85	27 Sep 84- 29 Sep 84	60 MAW/ 2 C-141B	2 Oct 84- 12 Nov 84	ca 13 Nov 84- ca 15 Nov 84
Ice Drop 85		62 MAW/ 1 C-141B	23 Jun 85- 25 Jun 85	
Deep Freeze 86	26 Sep 85- ca 28 Sep 85	60 MAW/ 1 C-141B	1 Oct 85- ca 5 Nov 85	ca 8 Nov 85- 10 Nov 85
Ice Drop 86	13 Jun 86	62 MAW/ 1 C-141B	21 Jun 86- 23 Jun 86	ca 25 Jun 86
Deep Freeze 87	24 Sep 86- 27 Sep 86	60 MAW/ 2 C-141B	ca 30 Sep 86- ca 17 Nov 86	19 Nov 86- ca 21 Nov 86
Ice Drop 87	29 May 87- 2 Jun 87	63 MAW/ 1 C-141B	10 Jun 87- 13 Jun 87	14 Jun 87- 15 Jun 87
Deep Freeze 88	25 Sep 87- 27 Sep 87	60 MAW/ 2 C-141B	1 Oct 87- 19 Nov 87	ca 21 Nov 87- 23 Nov 87
Ice Drop 88	16 Jun 88- ca 21 Jun 88	63 MAW/ 1 C-141B	28 Jun 88- 30 Jun 88	2 Jul 88- 4 Jul 88
Deep Freeze 89	28 Sep 88- ca 30 Sep 88	60 MAW/ 2 C-141B	4 Oct 88- 17 Nov 88	ca 19 Nov 88- ca 21 Nov 88
Ice Drop 89		62 MAW/ 1 C-141B	18 Jun 89- 21 Jun 89	

*An aircrew of the 445th Military Airlift Wing (Air Force Reserve wing at Norton Air Force Base, California) flew an emergency air evacuation mission to McMurdo Sound on 28 September, thus beginning the operation early.

**The aircrew flew channel missions in Australia before proceeding to Christchurch.

***A 63d Military Airlift Wing C-141B also flew one shuttle mission on 13 October. (Statistical information included in Appendix B.)

Phase of Operation	Deployment Dates	Unit and Aircraft	Operation Dates	Redeployment Dates
Deep Freeze 90	27 Sep 89- ca 29 Sep 89	60 MAW/ 2 C-141B	3 Oct 89- 23 Nov 89	ca 25 Nov 89- ca 27 Nov 89
Deep Freeze 90 (C-5 trial)	29 Sep 89	60 MAW/ 1 C-5A	4 Oct 89- 6 Oct 89	ca 8 Oct 89
Deep Freeze 90 (airdrop)	28 Oct 89	62 MAW/ 1 C-141B	1 Nov 89	ca 3 Nov 89
Ice Drop 90	30 May 90- 2 Jun 90	62 MAW/ 1 C-141B	7 Jun 90- 9 Jun 90	11 Jun 90- ca 12 Jun 90
Deep Freeze 91	26 Sep 90- ca 30 Sep 90	60 MAW/ 3 C-141B 1 C-5	2 Oct 90- 8 Nov 90	10 Nov 90- ca 12 Nov 90
Ice Drop 91		63 MAW/ 1 C-141B	25 Jun 91- 27 Jun 91	
Deep Freeze 92		60 MAW/ C-141B C-5	26 Sep 91- 29 Nov 91	
Deep Freeze 92 (airdrop)		62/63 MAW/ 4 C-141B*	24 Oct 91- 26 Nov 91	
Ice Drop 92	6 Jun 92- 8 Jun 92	63 AW/ 1 C-141B	13 Jun 92- 15 Jun 92	ca 17 Jun 92- ca 18 Jun 92
Deep Freeze 93		60 AW/ 1 C-141B 1 C-5	26 Sep 92- 18 Nov 92	
Deep Freeze 93 (airdrop)		63 AW/ 1 C-141B	1 Oct 92- 22 Oct 92	
Ice Drop 93		62 AW/ 1 C-141B	6 Jun 93- 8 Jun 93	
Deep Freeze 94	28 Sep 93- 29 Sep 93	60 AW/ 5 C-141	1 Oct 93- 9 Nov 93	10 Nov 93- 14 Nov 93
Ice Drop 94		62 AW/ 1 C-141B	11 Jun 94- 24 Jun 94	
Deep Freeze 95	28 Sep 94- ca 1 Oct 94	60 AMW/ 2 C-141B 1 C-5	4 Oct 94- 14 Nov 94	ca 16 Nov 94- 18 Nov 94
Ice Drop 95	ca 4 Jun 95- 6 Jun 95	62 AW/ 1 C-141B**	14 Jun 95- 16 Jun 95	ca 18 Jun 95- ca 20 Jun 95

*Supported a few of the season's Christchurch-McMurdo Sound shuttle missions as well.

**The aircrew included three members of the 446 AW, the 62 AW's Reserve associate wing at McChord Air Force Base, Washington.

Phase of Operation	Deployment Dates	Unit and Aircraft	Operation Dates	Redeployment Dates
Deep Freeze 96		60 AMW/ 2 C-141B 1 C-5	3 Oct 95- 9 Nov 95	
WINFLY 1996	15 Aug 96- 18 Aug 96	60 AMW/ 1 C-141B*	20 Aug 96- 24 Aug 96	ca 26 Aug 96- ca 28 Aug 96
Deep Freeze 97	26 Sep 96- 1 Oct 96	60 AMW/ 2 C-141B 1 C-5	2 Oct 96- 8 Nov 96	ca 10 Nov 96- 12 Nov 96
Deep Freeze 97 (LC-130)**	ca Nov 96	109 AW/ 2 LC-130H	ca Nov 96- ca Feb 96	ca Feb 96
Reverse WINFLY 1997		60 AMW/ 1 C-141B	2 Mar 97	
WINFLY 1997	16 Aug 97- ca 18 Aug 97	62 AW/ 1 C-141B	21 Aug 97- 27 Aug 97	ca 28 Aug 97- 30 Aug 97
Deep Freeze 1997-98		62 AW/ 2 C-141B 60 AMW/ 1 C-5	1 Oct 97- 15 Nov 97	
Deep Freeze 1997-98 (LC-130)	15 Sep 97- ca 17 Sep 97	109 AW/ 5 LC-130H	19 Sep 97- ca 20 Feb 97	ca 22 Feb 97- ca 24 Feb 97
WINFLY 1998	ca 16 Aug 98- 18 Aug 98	62 AW/ 2 C-141B	20 Aug 98- 5 Sep 98	6 Sep 98- ca 8 Sep 98
Deep Freeze 1998-99	28 Sep 98- ca 30 Sep 98	62 AW/ 3 C-141B 60 AMW/ 1 C-5	30 Sep 98- 9 Nov 98	11 Nov 98- ca 13 Nov 98
Deep Freeze 1998-99 (LC-130)	19 Sep 98- ca 21 Sep 98	109 AW/ 5 LC-130H	28 Oct 98- 6 Mar 99	ca 8 Mar 99- ca 10 Mar 99
Reverse WINFLY 1999		62 AW/ 1 C-141B	26 Jan 99- 21 Feb 99	
Ice Drop 99 (medical)	8 Jul 99- 9 Jul 99	62 AW/ 1 C-141B	11 Jul 99	ca 13 Jul 99- 15 Jul 99
WINFLY 1999	18 Aug 99- 19 Aug 99	62 AW/ 1 C-141B	20 Aug 99- 27 Aug 99	28 Aug 99- ca 29 Aug 99

*An unspecified number of personnel and/or aircraft from the 62 AW joined the 60 and 349 AMWs.

**Although 109 AW LC-130 missions began as early as 1988, they were augmenting the US Navy's portion of the mission. Thus, dates and figures remained virtually indistinguishable between what the Navy and the 109 AW completed prior to DEEP FREEZE 97.

Phase of Operation	Deployment Dates	Unit and Aircraft	Operation Dates	Redeployment Dates
Deep Freeze 1999-00	ca 24 Sep 99- 26 Sep 99	62 AW/ 2 C-141B 60 AMW/ 1 C-5	30 Sep 99- 14 Nov 99	16 Nov 99- ca 18 Nov 99
Deep Freeze 1999-00 (C-17 trial)	ca 11 Oct 99- 13 Oct 99	62 AW/ 1 C-17A	15 Oct 99	17 Oct 99- ca 19 Oct 99
Deep Freeze 1999-00 (C-17 second trial)	ca 8 Nov 99- 10 Nov 99	62 AW/ 1 C-17A	11 Nov 99	ca 13 Nov 99- ca 15 Nov 99
Deep Freeze 1999-00 (LC-130)	7 Oct 99- 22 Oct 99	109 AW/ 5 LC-130	13 Oct 99- 25 Feb 00	early Mar 00
Reverse WINFLY 2000	26 Jan 00- ca 28 Jan 00	62 AW/ 2 C-141B	1 Feb 00 25 Feb 00	26 Feb 00- 28 Feb 00
WINFLY 2000		62 AW/ 1 C-141B	21 Aug 00- 28 Aug 00	
Deep Freeze 2000-01	23 Sep 00- 26 Sep 00	62 AW/ 2 C-141B 1 C-17A	3 Oct 00- 20 Nov 00*	21 Nov 00- 22 Nov 00
Deep Freeze 2000-01 (LC-130)	12 Oct 00- 18 Oct 00	109 AW/ 6 LC-130	21 Oct 00- 24 Feb 01	19 Feb 01- ca 3 Mar 01
Reverse WINFLY 2001	24 Jan 01- 26 Jan 01	452 AMW/ 1 C-141C	31 Jan 01- 22 Feb 01	24 Feb 01- 25 Feb 01
WINFLY 2001	16 Aug 01- 18 Aug 01	452 AMW/ 2 C-141C	19 Aug 01- 30 Aug 01	ca 1 Sep 01 ca 2 Sep 01
Deep Freeze 2001-02	27 Sep 01- 30 Sep 01	452 AMW/ 2 C-141C 62 AW/1 C-17A	ca 30 Sep 01- ca Nov 01	
Deep Freeze 2001-02 (LC-130)		109 AW/ 6 LC-130	ca Oct 01- ca Feb 02	
Deep Freeze 2001-02 (C-130H)	4 Dec 01- 6 Dec 01	463 AG/ 2 C-130H	10 Dec 01- 18 Jan 01	22 Jan 01- 26 Jan 01
Reverse WINFLY 2002		452 AMW/ 1 C-141C 62 AW/ 1 C-17A	29 Jan 02- ca 20 Feb 02	

*At the request of the National Science Foundation, a C-141 returned in early December and completed two add-on missions on 8 and 9 December. Statistics included in Appendix B.

Phase of Operation	Deployment Dates	Unit and Aircraft	Operation Dates	Redeployment Dates
WINFLY 2002		452 AMW/ 1 C-141C 62 AW/1 C-17A	19 Aug 02- ca 30 Aug 02	
Deep Freeze 2002-03		452 AMW/ 1 C-141C 62 AW/ 1 C-17A	30 Sep 02- 16 Nov 02*	
Deep Freeze 2002-03 (LC-130)		109 AW/ 6 LC-130	ca Oct 02- 15 Feb 03	
Reverse WINFLY 2003		452 AMW/ 2 C-141C	ca Jan 03- ca 1 Mar 03	
WINFLY 2003		62 AW/ 1 C-17A	Aug 03	
Deep Freeze 2003-04		452 AMW/ 445 AW/ 2 C-141C 62 AW/ 1 C-17A	30 Sep 03- 16 Nov 03	
Deep Freeze 2003-04 (LC-130)		109 AW/ 6 LC-130	ca 22 Oct 03- 23 Feb 04	
Reverse WINFLY 2004		445 AW/ 2 C-141C	10 Jan 04- 23 Feb 04	
WINFLY 2004		62 AW/ 1 C-17A	20 Aug 04- 26 Aug 04	
Deep Freeze 2004-05		445 AW/ 2 C-141C 62 AW/2 C-17A	4 Oct 04- 10 Nov 04	
Deep Freeze 2004-05 (LC-130)		109 AW/ 7 LC-130	Oct 04 17 Feb 05	
Reverse WINFLY 2005		445 AW/ 1 C-141C 62 AW/ 1 C-17A	5 Jan 05- 14 Feb 05	
WINFLY 2005		62 AW/ 1 C-17A	20 Aug 05- 27 Aug 05	

*One C-141 mission occurred in December. The special assignment airlift mission moved 97 passengers and 29 tons from March Air Reserve Base, California, to McMurdo Sound.

Phase of Operation	Deployment Dates	Unit and Aircraft	Operation Dates	Redeployment Dates
Deep Freeze 2005-06		62 AW/ 1 C-17A	4 Oct 05- 15 Nov 05	
Deep Freeze 2005-06 (LC-130)	12 Oct 05- 16 Oct 05	109 AW/ 7 LC-130	17 Oct 05- 28 Feb 06	
Reverse WINFLY 2006		62 AW/ 1 C-17	ca Jan 06- 28 Feb 06	2 Mar 06- ca 4 Mar 06

ABBREVIATIONS: AG: Airlift Group; AMW: Air Mobility Wing; ATW: Air Transport Wing; AW: Airlift Wing; MAW: Military Airlift Wing; NATWP: Naval Air Transport Wing, Pacific; TCW: Troop Carrier Wing; WINFLY: winter fly in.

SOURCES: Hist, 63 TCW, Jan-Jun 57, (K-WG-63-HI, IRIS 451246) n.d.; Hist, 63 TCW, Jul-Dec 57, n.d.; Hist, MATS, Jul-Dec 58, 20 Oct 59; Rpt, Lt Col Cicero J. Ellen, USAF Task Force Commander, "Operation Deep Freeze Phase IV," n.d.; Rpt, Lt Col Dewey R. Bridges, USAF Task Force Commander, "Final Report: Operation Deep Freeze Sixty," n.d.; Rpt, Lt Col Wilbert Turk, 61 TCS Commander, "Mission Report, Operation Ice Flow," (K-WG-314-SU-OP, IRIS 455426) 15 Mar 60; Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze Sixty One," n.d.; Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze 1962," 25 Jan 62; Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze 63," n.d.; Rpt, Lt Col Russell C. Clarke, USAF Task Force Commander, "Final Report: Deep Freeze 64," n.d.; Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: Deep Freeze 65," n.d.; Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: Deep Freeze 66," n.d.; Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation Deep Freeze 67," n.d.; Hist, MAC, Jul-Dec 66, Mar 68; Hist, 21 AF, Jul-Dec 67, Mar 69; Ltr, Lt Col Robert C. Huf, Mission Commander, to 21 AF, "Summary of 438 MAW Support in Operation Deep Freeze 69," 29 Nov 68; Ltr, Lt Col Buford E. Stovall, Mission Commander, to Col Wayne G. Duckett, 438 MOG Commander, "Summary of 438 MAW Support-'Operation Deep Freeze 70'," 26 Nov 69; Ltr, Lt Col Joseph F. McKone, USAF Mission Commander, to 438 MAW Deputy Commander for Operations, "Final Report-Operation Deep Freeze FY 71," 30 Nov 70; Ltr, Lt Col William W. Hewitt, USAF Mission Commander, to 438 MAW Deputy Commander for Operations, "Summary of 'Deep Freeze 72'," 11 Nov 72; Ltr, Col Gerald C. Weir, 21 AF Director of Aircrew Standardization, to 438 MAW Aircrew Standardization and Evaluation, "Deep Freeze-72," ca 1 May 71; Hist, 438 MAW, Oct-Dec 72, 31 Mar 73; Hist, 438 MAW, Oct-Dec 73, 31 Mar 74; Hist, 60 MAW, Oct-Dec 74, n.d.; Hist, 60 MAW, Oct-Dec 75, 15 Mar 76; Hist, 60 MAW, Oct-Dec 76, 15 Mar 77; Hist, 60 MAW, Oct-Dec 77, 2 May 78; Hist, 60 MAW, Oct-Dec 78, 25 Jun 79; Hist, 834 ALD, Jul-Dec 79, 1 Sep 80; Hist, 60 MAW, Oct-Dec 79, 30 Apr 80; Ltr, MAC Airlift

Management Division to MAC Director of Operations, "Deep Freeze 80 Deployment Missions," 13 Sep 79; Hist, 60 MAW, 22 Jul-31 Dec 80, 3 Mar 82; Hist, 834 ALD, Jul-Dec 80, 15 Jun 81; Hist, 63 MAW, Apr-Jun 81, ca Sep 81; Hist, 60 MAW, Jul 81-Dec 82, ca Jan 84; Intvw, Clayton H. Snedeker, 63 MAW Historian, with Lt Col James M. Galyen, 14 MAS Commander, 14 Jul 82; Hist, 834 ALD, Jan-Dec 82, 28 Nov 83; Hist, 62 MAW, Apr-Jun 83, 30 Sep 83; Hist, 834 ALD, Jan-Dec 83, 31 Jul 84; Hist, MAC, Jan-Dec 83, 29 Aug 84; Hist, 62 MAW, Apr-Jun 84, 30 Sep 84; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations et al, "Mission Commander's Report-Deep Freeze 85," 4 Feb 85; Hist, 62 MAW, Apr-Jun 85, 30 Sep 85; Hist, 60 MAW, Jan-Dec 85, (K318.7-60, IRIS 01078134) 3 Mar 87; Hist, 834 ALD, Jan-Dec 86, (K-DIV-834-HI, IRIS 01086352) 5 Jan 88; Hist, 63 MAW, Jan-Jun 86, (K318.7-62, IRIS 01081544) 31 Jul 87; Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations et al, "Mission Commander's Report-Deep Freeze 87," 31 Dec 86; Intvw, Clayton H. Snedeker, 63 MAW Historian, with Maj Charles E. Fitzpatrick III, 63 MAW Combat Tactics and Techniques, ca 17 Jun 87; Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations et al, "Mission Commander's Report-Deep Freeze 88," 23 Dec 87; Hist, 63 MAW, Jan-Jun 88, 17 Feb 89; Ltr, Lt Col Patrick M. Boyle, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations et al, "Mission Commander's Report-Deep Freeze 89," ca Dec 88; Hist, 62 MAW, Jan-Jun 89, 31 Oct 89; Hist, 60 MAW, Jul-Dec 89, (K318.7-60, IRIS 0887939) n.d.; Ltr, Lt Col William H. Krechowski, 834 ALD Assistant Director of Operaions, to 834 ALD Commander et al, "MAC Mission Commander's Report-Deep Freeze 90," 5 Jan 90; Msg, NSFA Det McMurdo, to NSF et al, "Mid-Winter Airdrop 1990," 090440Z Jun 90; Hist, 22 AF, Jan-Dec 90, 31 Jul 91; Hist, 63 MAW, Jan-Jun 91, (K318.7-62, IRIS 0887956) Dec 91; Paper, Maj John Theuerkauf, MAC Operations Staff, "National Science Foundation Support in Antarctica," 27 Sep 91; Hist, 834 ALD, Jan 91-Apr 92, (K-DIV-834-HI, IRIS 0887905) 30 Sep 92; Hist, 63 AW, Jan-Jun 92, 2 Nov 92; Hist, 22 AF, Jan-Dec 92, 29 Jun 93; Hist, 63 AW, Jul-Dec 92, 27 Apr 93; Ltr, Lt Col Jeff Cain, 4 AS Commander, to 62 OG Commander et al, "Trip Report for Midwinter Airdrop 93," 15 Jun 93; Hist, 15 AF, Jul 93-Dec 94, 15 Jul 95; Hist, 62 AW, Jan 94-Jun 95, 1 Nov 95; Rpts, Lt Col David R. Smith, Ice Drop 95 Commander, "Mission Commander's Report," 6-16 Jun 95; Rpt, Lt Col Russell J. Frasz, 20 AS Director of Operations, "Operation Deep Freeze 95 After Action Report," 25 Nov 94; Hist, 446 AW, Jan-Dec 95, (K-WG-446-HI, IRIS 01121813) 31 Jul 96; Memo, Lt Col Gregory L. Hergesell, 20 AS Director of Operations, to 15 AF Director of Operations, "After Action Report, Operation Deep Freeze 96," 1 Dec 95; Hist, 60 AMW, Jul-Dec 96, 25 Apr 97; Hist, AMC, Jan-Dec 97, n.d.; Memo, Lt Col Brock W. Eshleman, 20 AS Director of Operations, to 15 AF Director of Operations, "After-Action Report,Operation Deep Freeze 97,"16 Dec 96; Hist, 109 AW, Jan-Dec 96, (K169.011-109(AW), IRIS 01134180) 4 Aug 00; Hist, 60 AMW, Jan-Jun 97, n.d.; Hist, 62 AW, Jan-Dec 97, 29 Jul 98; Hist, 109 AW, Jan-Dec 98, (K169.011-109(AW), IRIS 01134732) 7 Jan 01; Hist, 62 AW, Jul-Dec 98, 13 Jul 99; Rpt, Col Richard M. Saburro, Deep Freeze Commander, "Operation Deep Freeze Consolidated

Department of Defense End of Season Report, 1998-1999 Season," 15 Aug 99; Rpt, Lt Col Steve Kernstock, Mission Commander, "Redeployment [WINFLY] SITREP 05 (Final)," 212200Z Feb 99; Hist, 62 AW, Jan-Dec 99, 25 Jun 00; Rpt, Col Richard M. Saburro, Deep Freeze Commander, "Operation Deep Freeze Consolidated Department of Defense End of Season Report, 1999-2000 Season," 5 May 00; Hist, 62 AW, Jan-Dec 00, 6 Jan 02; Rpt, Col Joel R. Maynard, Deep Freeze Commander, "Operation Deep Freeze Consolidated Department of Defense End of Season Report, 2000-2001 Season," 26 Aug 02; Hist, 62 AW, Jan-Dec 01, 4 Nov 03; Paper, Col Joel R. Maynard, Deep Freeze Commander, [Deep Freeze 01-02 review], ca Mar 02; Slides, Col Joel Maynard, Deep Freeze Commander, "Operation Deep Freeze, 2001/2002 Antarctic Season Overview," Aug 01; Briefing, Maj Pat Curtis, 50 AS Commander, "50 EAS After Action Report, Operation Deep Freeze, 10 Dec 01- 20 Jan 02, Mission Commander's Assessment," Feb 02; Rpt, AMC TACC Airlift Operations, "SAAM Project History Report," Jan 02-Feb 03; E-mail, Lt Col Daniel Dunbar, AMC Airlift Operations Staff, to Kathy A. Skipper, AMC Historian, "Annual History," 3 Mar 04; Hist, AMC, Jan-Dec 04, 31 Aug 05; Paper, Col Ron Smith, 500 AEG Commander, "Strategic Airlift-Deep Freeze 2005-2006," ca 20 Nov 05; Rpts, Col Ron Smith, 500 AEG Commander, "Operation Deep Freeze 05-06 SITREP," 14 and 20 Oct 05 and 28 Feb 06.

APPENDIX B

US AIR FORCE AIRLIFT STATISTICS
OPERATION DEEP FREEZE (1956-2006)

Phase/Aircraft	Missions	Pax	Cargo (tons)
Deep Freeze II (1956-57)			
C-124 airlift	65	732	393.0
C-124 airdrop	84	1	881.3
Deep Freeze III (1957-58)			
C-124 airlift	59	401	250.0
C-124 airdrop	55		724.0
Deep Freeze IV (1958-59)			
C-124 airlift	37	161	403.6
C-124 airdrop	63		891.0
Deep Freeze 60 (1959-60)			
C-124 airlift	57	703	596.3
C-124 airdrop	99		1,467.8
C-130D airlift	58		406.9
Deep Freeze 61 (1960-61)			
C-124 airlift	84		881.0
C-124 airdrop	68		1,090.7*
Deep Freeze 62 (1961-62)			
C-124 airlift	68	1,036	849.6
C-124 airdrop	49		858.1*
Deep Freeze 63 (1962-63)			
C-124 airlift	58	865	785.8
C-124 airdrop	95		1,536.0*
Deep Freeze 64 (1963-64)			
C-130 airlift	41	1,294	504.1
C-124 airlift	2		19.0
Deep Freeze 65 (1964-65)			
C-130 airlift	36	1,067	403.7
Deep Freeze 66 (1965-66)			
C-130 airlift	16**	465	243.8
Deep Freeze 67 (1966-67)			
C-130 airlift	19	271	280.2
C-141 airlift	1	28	12.9

*Gross weight dropped.

**Includes a special mission to Hickam Air Force Base, Hawaii, levied by Task Force 43 to pick up cargo.

Phase/Aircraft	Missions	Pax	Cargo (tons)
Deep Freeze 68 (1967-68)			
C-130 airlift	6	11	42.0
C-124 airlift	1	2	9.5
Deep Freeze 69 (1968-69)			
C-141 airlift	8	240	174.2
Deep Freeze 70 (1969-70)			
C-141 airlift	15	150	275.0
Deep Freeze 71 (1970-71)			
C-141 airlift	12	324	239.2
Deep Freeze 72 (1971-72)			
C-141 airlift	38	1,766	608.0
Deep Freeze 73 (1972-73)			
C-141 airlift	43	2,058	705.9
Deep Freeze 74 (1973-74)			
C-141 airlift	30	1,720	479.2
Deep Freeze 75 (1974-75)			
C-141 airlift	26	1,518	438.4
Deep Freeze 76 (1975-76)			
C-141 airlift	25	711	384.5
Deep Freeze 77 (1976-77)			
C-141 airlift	30	1,024	607.7
Deep Freeze 78 (1977-78)			
C-141 airlift	35	983	682.2
Deep Freeze 79 (1978-79)			
C-141 airlift	36	1,300	950.0
C-141 airdrop (ID)*	1		4.6
Deep Freeze 80 (1979-80)			
C-141 airlift	25	1,301	686.2
C-141 airdrop (ID)	1		5.2
Deep Freeze 81 (1980-81)			
C-141 airlift	17	1,154	407.4
C-141 airdrop (ID)	1		8.5
Deep Freeze 82 (1981-82)			
C-141 airlift	26	1,334	694.9
C-141 airdrop (ID)	1		12.5

*The midwinter airdrop program was technically not part of Operation DEEP FREEZE. However, this program complemented the operation and ultimately served the same end user. For that reason, it remained closely associated with the DEEP FREEZE mission.

Phase/Aircraft	Missions	Pax	Cargo (tons)
Deep Freeze 83 (1982-83)			
C-141 airlift	19	1,348	522.3
C-141 airdrop (ID)	2		40.5
Deep Freeze 84 (1983-84)			
C-141 airlift	17	1,249	417.0
C-141 airdrop (ID)	2		30
Deep Freeze 85 (1984-85)			
C-141 airlift	17	951	393.6
C-141 airdrop (ID)	2		51.8
Deep Freeze 86 (1985-86)			
C-141 airlift	18	1,134	379.4
C-141 airdrop (ID)	2		44.3
Deep Freeze 87 (1986-87)			
C-141 airlift	23	1,401	658.0
C-141 airdrop (ID)	2		36.4
Deep Freeze 88 (1987-88)			
C-141 airlift	26	1,618	737.4
C-141 airdrop (ID)	2		40.4
Deep Freeze 89 (1988-89)			
C-141 airlift	23	1,543	593.3
C-141 airdrop (ID)	2		34.1
Deep Freeze 90 (1989-90)			
C-141 airlift	22	1,443	680.7
C-5 airlift	2	145	167.5
C-141 airdrop (DF)*	1		16.8
C-141 airdrop (ID)	2		41.9
Deep Freeze 91 (1990-91)			
C-141 airlift	18	1,602	750.0**
C-5 airlift	3		
C-141 airdrop (DF)	1		22.5
C-141 airdrop (ID)	2		39.0
Deep Freeze 92 (1991-92)			
C-141 airlift	30		1,500.0***
C-5 airlift	7		
C-141 airdrop (DF)	10		
C-141 airdrop (ID)	2		28.4

*DEEP FREEZE 90 included the first official C-141 DEEP FREEZE airdrop. Previous C-141 airdrops were for the midwinter airdrop program.

**Pax and cargo are total for C-141 and C-5 shuttle missions.

***Cargo figure includes all Military Airlift Command DEEP FREEZE sorties. Passenger figure was not available.

Phase/Aircraft	Missions	Pax	Cargo (tons)
Deep Freeze 93 (1992-93)			
C-141 airlift	18	1,127	586.0*
C-5 airlift	3		
C-141 airdrop (DF)	2		0**
C-141 airdrop (ID)	2		39.0
Deep Freeze 94 (1993-94)			
C-141 airlift	21	1,419	643.0
C-141 airdrop (ID)	2		39.0
Deep Freeze 95 (1994-95)			
C-141 airlift	14	1,234	425.4
C-5 airlift	2	251	225.6
C-141 airdrop (ID)	2		27.7
Deep Freeze 96 (1995-96)			
C-141 airlift	15	1,292	287.8
C-5 airlift	2	229	166.1
Deep Freeze 97 (1996-97)			
C-141 WINFLY airlift	3	160	25.0
C-141 airlift	16	1,840	403.7*
C-5 airlift	2		
C-141 Reverse WINFLY	1	100	
Deep Freeze 1997-98			
C-141 airlift	23	1,478	519.5***
C-5 airlift	2		
LC-130 airlift****	153	1,645	1,356.8
Deep Freeze 1998-99			
C-141 WINFLY airlift	8	232	91.2
C-141 airlift	11	1,030	321.9
C-5 airlift	5	381	332.8
C-141 Reverse WINFLY	11	1,605	200.0
LC-130 airlift	380	3,245	3,028.9

*Pax and cargo are total for C-141 and C-5 shuttle missions.

**Both mission air aborted at the point of safe return: the first because of weather and blowing snow at McMurdo Sound and the second because of a communications blackout.

***Pax and cargo are total for C-141 and C-5 shuttle missions.

****LC-130 airlift for this and all remaining seasons included occasional airdrop missions, most fuel to remote locations. These were not tracked separately from airlift missions. For LC-130 cargo stats for the 1988-89 to 2001-02 seasons, see Table 7 of this report.

Phase/Aircraft	Missions	Pax	Cargo (tons)
Deep Freeze 1999-00			
C-141 airdrop (ID)	1		App. 1.1
C-141 WINFLY airlift	4	250	59.2
C-141 airlift	21	1,354	423.2
C-5 airlift	2	202	141.0
C-17 airlift	2	19	42.3
C-141 Reverse WINFLY	10	1,187	248.0
LC-130 airlift	462	3,798	4,983.4
Deep Freeze 2000-01			
C-141 WINFLY airlift	4	253	61.5
C-141 airlift	23	1,425	450.1
C-17 airlift	5	281	187.4
C-141 Reverse WINFLY	11	1,150	276.9
LC-130 airlift	459	3,866	4,975.3
Deep Freeze 2001-02			
C-141 airlift	33*	1,559	770.8
C-17 airlift	7**	89	333.0
C-130H airlift	11	603	111.9
LC-130 airlift	365	2,109	4,903.0
Deep Freeze 2002-03			
C-141 WINFLY airlift	4	197	75.0
C-17 WINFLY airlift	1	105	57.0
C-141 airlift	23	1,538	394.0
C-17 airlift	9	180	279.0
C-141 Reverse WINFLY	2	194	35.7
LC-130 airlift	428	2,607	5,116.0
Deep Freeze 2003-04			
C-17 WINFLY airlift	3	364	73.4
C-141 airlift	41	3,448	828.6***
C-17 airlift	12	544	504.0
C-141 Reverse WINFLY	8		
LC-130 airlift	497	2,852	5,952.9

*C-141 totals include WINFLY (9 missions), main season (11 missions), and reverse WINFLY (13 missions).

**C-17 totals include main season (6 missions) and reverse WINFLY (1 mission).

***Includes all C-141 cargo and passenger totals for main season and reverse WINFLY.

Phase/Aircraft	Missions	Pax	Cargo (tons)
Deep Freeze 2004-05			
C-17 WINFLY airlift	4	437	102.2
C-17 airlift	21	4,271	1,800.0*
C-141 airlift	14		
C-17 Reverse WINFLY	7		
C-141 Reverse WINFLY	11		
LC-130 airlift	479	2,706	5,500.0
Deep Freeze 2005-06			
C-17 WINFLY airlift	4	496	103.2
C-17 airlift	23	1,611	835.1
C-17 Reverse WINFLY	24	2,693	581.7
LC-130 airlift	542	2,491	7,164.3

NOTES AND ABBREVIATIONS: This table does not include deployment/redeployment of mission aircraft, US-to-Christchurch deployment support missions, or other mission types (such as weather reconnaissance flights). Airdrops for 1956-63 refer only to net weight for supplies and equipment dropped (unless otherwise noted). Tare weight for pallets, packing materials, and parachutes were in addition to net tonnage. For example, there was approximately 84 tons of tare weight for Operation DEEP FREEZE IV drops, making the gross weight 975.0 tons. DF: DEEP FREEZE; ID: Ice Drop; WINFLY: winter fly in.

SOURCES: Hist, 63 TCW/HO, Jan-Jun 57,(K-WG-63-HI, IRIS 451246) n.d.; Rpt, 63 TCW/HO, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation Deep Freeze.')," ca 1963; Hist, 63 TCW/HO, Jan-Jun 58, n.d.; Rpt, Lt Col Cicero J. Ellen, USAF Task Force Commander, "Operation Deep Freeze Phase IV," n.d.; Rpt, Lt Col Dewey R. Bridges, USAF Task Force Commander, "Final Report: Operation Deep Freeze Sixty," n.d.; Rpt, Lt Col Wilbert Turk, 61 TCS Commander, "Mission Report, Operation Ice Flow," (K-WG-314-SU-OP, IRIS 455426) 15 Mar 60; Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze Sixty One," n.d.; Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze 1962," 25 Jan 62; Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze 63," n.d.; Rpt, Lt Col Russell C. Clarke, USAF Task Force Commander, "Final Report: Deep Freeze 64," n.d.; Hist, 1608 ATW, Jul-Dec 63, n.d.; Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: Deep Freeze 65," n.d.; Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: Deep Freeze 66," n.d.;

*Includes all C-17 and C-141 cargo and passenger totals for main season and reverse WINFLY.

Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation Deep Freeze 67," n.d.; Hist, 21 AF, Jul-Dec 67, Mar 69; Hist, 438 MAW, Jul-Dec 67, Nov 68; Ltr, Lt Col Robert C. Huf, Mission Commander, to 21 AF, "Summary of 438 MAW Support in Operation Deep Freeze 69," 29 Nov 68; Hist, 21 AF, Jul 69-Jun 70, May 71; Ltr, Lt Col Joseph F. McKone, USAF Mission Commander, to 438 MAW Deputy Commander for Operations, "Final Report-Operation Deep Freeze FY 71," 30 Nov 70; Hist, MAC, Jul 71-Jun 72, 30 Jun 73; Rpt, CAPT Alfred N. Fowler, CNSFA, "Report of Operation Deep Freeze 73," 25 Jun 73; Rpt, TSgt Stanley J. Morris, 438 MAW Operations Analysis, "438DOXA Activity Report, Operation Deepfreeze 74," Dec 73; Ltr, Capt John H. Crownover, 60 MAW Deep Freeze 75 Project Officer, [results], 15 Jan 75; Rpt, 60 MAW Current Operations, "Historical Report, 1 October-31 December 1975," ca Jan 76; Hist, 60 MAW, Oct-Dec 76, 15 Mar 77; Hist, 60 MAW, Oct-Dec 77, 2 May 78; Msg, CNSFA to MAC, "Starlifter Support," 200337Z Dec 78; Hist, 63 MAW, Jul-Sep 79, n.d.; Msg, OLD 61 MASW to MAC, "Deep Freeze Ops Sum as of 14/1000Z Dec 79," 150025Z Dec 79; Hist, 834 ALD, Jul-Dec 80, 15 Jun 81; Msg, OL D 619 MASS to MAC *et al*., "Deep Freeze Ops Sum as of 181400Z Nov 80," 180811Z Nov 80; Hist, MAC, Jan-Dec 81, 31 Jan 83; Msg, OL D 619 MASS to MAC *et al*.,"Deep Freeze Ops Sum as of 081400Z Dec 81," 080655Z Dec 81; Hist, 834 ALD, Jan-Dec 82, 28 Nov 83; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-Deep Freeze," 20 Apr 84; Hist, 62 MAW, Apr-Jun 84, 30 Sep 84; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-Deep Freeze 85," 4 Feb 85; Hist, 62 MAW, Apr-Jun 85, 30 Sep 85; Hist, 60 MAW, Jan-Dec 85, (K318.7-60, IRIS 01078134) 3 Mar 87; Hist, 834 ALD, Jan-Dec 86, (K-DIV-834-HI, IRIS 01086352) 5 Jan 88; Hist, 63 MAW, Jan-Jun 86, (K318.7-62, IRIS 01081544) 31 Jul 87; Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-Deep Freeze 87," 31 Dec 86; Msg, NSFA to CNSFA, "1987 Antarctica Mid Winter Airdrop," 150457Z Jun 87; Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations, "Mission Commander's Report-Deep Freeze 88," 23 Dec 87; Hist, 63 MAW, Jan-Jun 88, 17 Feb 89; Ltr, Lt Col Patrick M. Boyle, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-Deep Freeze 89," ca Dec 88; Hist, 62 MAW, Jan-Jun 89, 31 Oct 89; Ltr, Lt Col William H. Krechowski, 834 ALD Assistant Director of Operations, to 834 ALD Commander *et al.*, "MAC Mission Commander's Report-Deep Freeze 90," 5 Jan 90; Hist, 834 ALD, Jan-Dec 89, (K-DIV-834-HI, IRIS 01099414) 6 Jul 90; Hist, 62 MAW, Jul-Dec 89, 31 May 90; Msg, CNSFA to MAC Deputy Commander for Operations *et al.*, "Antarctica Midwinter Airdrop," 111107Z Jun 90; Hist, 22 AF, Jan-Dec 90, 31 Jul 91; Hist, 63 MAW, Jan-Jun 91, (K318.7-62, IRIS 0887956) Dec 91; Msg, CNSFA to MAC Operations Staff *et al.*, "MAC C-5/C-141 Support to Operation Deep Freeze 91-92," 112223Z Dec 91; Hist, 834 ALD, Jan 91-Apr 92, (K-DIV-834-HI, IRIS 0887905) 30 Sep 92; Hist, 63 AW, Jan-Jun 92, 2 Nov 92; Ltr, Lt Col Jeff Cain, 4 AS Commander, to 62 OG Commander *et al.*,

"Trip Report for Midwinter Airdrop 93," 15 Jun 93; Memo, Lt Col George E. Meggers, 22 AF Chief of Aircrew Standardization and Evaluation, to 22 AF Director of Operations *et al.*, "Mission Commander's Report-Deep Freeze 93," 7 Dec 92; Hist, 22 AF, Jan-Jun 93, 14 Dec 93; Hist, 15 AF, Jul 93-Dec 94, 15 Jul 95; Hist, 62 AW, Jan 94-Jun 95, 1 Nov 95; Rpt, Lt Col Russell J. Frasz, 20 AS Director of Operations, "Operation Deep Freeze 95 After Action Report," 25 Nov 94; Rpts, Lt Col David R. Smith, Ice Drop 95 Commander, "Mission Commander's Report," 6-16 Jun 95; Hist, AMC, Jan-Dec 97, n.d.; Memo, Lt Col Gregory L. Hergesell, 20 AS Director of Operations, to 15 AF Director of Operations, "After Action Report, Operation Deep Freeze 96," 1 Dec 95; Memo, Lt Col Brock W. Eshleman, 20 AS Director of Operations, to 15 AF Director of Operations, "After-Action Report, Operation Deep Freeze 97," 16 Dec 96; Hist, 60 AMW, Jan-Jun 97, n.d.; Hist, 62 AW, Jan-Dec 97, 28 Jul 98; Rpt, Lt Col Ray Phillips, Mission Commander, "Deep Freeze SITREP 18," ca 8 Nov 97; Memo, Col Richard M. Saburro, Deep Freeze Commander, to Air National Guard *et al.*, "Operation Deep Freeze End of Season Report," 15 Aug 98; Hist, 62 AW, Jul-Dec 98, 13 Jul 99; Rpt, Col Richard M. Saburro, Deep Freeze Commander, "Operation Deep Freeze Consolidated Department of Defense End of Season Report, 1998-1999 Season," 15 Aug 99; Rpt, Lt Col Steve Kernstock, Mission Commander, "Redeployment [WINFLY] SITREP 05 (Final)," 212200Z Feb 99; Hist, AMC, Jan-Dec 99, n.d.; Hist, 62 AW, Jan-Dec 99, 25 Jun 00; Rpt, Col Richard M. Saburro, Deep Freeze Commander, "Operation Deep Freeze Consolidated Department of Defense End of Season Report, 1999-2000 Season," 5 May 00; Hist, 62 AW, Jan-Dec 00, 6 Jan 02; Rpt, Col Joel R. Maynard, Deep Freeze Commander, "Operation Deep Freeze Consolidated Department of Defense End of Season Report, 2000-2001 Season," 26 Aug 02; Hist, 62 AW, Jan-Dec 01, 4 Nov 03; Paper, Col Joel R. Maynard, Deep Freeze Commander, [Deep Freeze 01-02 review], ca Mar 02; Briefing, Maj Pat Curtis, 50 AS Commander, "50 EAS After Action Report, Operation Deep Freeze, 10 Dec 01-20 Jan 02, Mission Commander's Assessment," Feb 02; Rpts, AMC TACC Airlift Operations, "SAAM Project History Report," Jan-Feb 02; E-mail, Peg Nigra, USTRANSCOM Resource Center, to Ellery Wallwork, AMC Staff Historian, "Deep Freeze," 31 Mar 06; E-mail, Lt Col Daniel Dunbar, AMC Airlift Operations Staff, to Kathy A. Skipper, AMC Historian, "Annual History," 3 Mar 04; Slides, Col Tye Beasley, Deep Freeze Commander, "Operation Deep Freeze SITREP," 13 Feb 05; Hist, AMC, Jan-Dec 04, 31 Aug 05; E-mail, Col Ron Smith, 500 AEG Commander, to Ellery Wallwork, AMC Staff Historian, "Season Numbers," 3 Mar 06; Paper, Col Ron Smith, 500 AEG Commander, "Strategic Airlift-Deep Freeze 2005-2006," ca 20 Nov 05; Paper, Col Ron Smith, 500 AEG Commander, [LC-130 stats for Deep Freeze 2005-06], ca Mar 06; Spreadsheets, 139 AS Director of Operations, [Operation Deep Freeze LC-130 stats 2001 to 2006], 16 Mar 06.

APPENDIX C

US AIR FORCE AIR REFUELING CHRONOLOGY
OPERATION DEEP FREEZE (1981-1999)

Phase of Operation	Unit	Aircraft	Operation Date	Fuel Offload (Pounds)
Midwinter Airdrop 1981	22 BW	3 KC-135	22 Jun 81	50,500
Midwinter Airdrop 1982		1 KC-10	22 Jun 82	67,400
Midwinter Airdrop 1983	22 BW	1 KC-10	21-24 Jun 83	
Midwinter Airdrop 1984	22 ARW	1 KC-10	21-23 Jun 84	75,000*
Deep Freeze 85	22 ARW	1 KC-10	2 Oct 84	
Midwinter Airdrop 1985	22 ARW	1 KC-10	23-25 Jun 85	
Deep Freeze 86	22 ARW	1 KC-10	1-ca. 7 Oct 85	
Midwinter Airdrop 1986	22 ARW**	1 KC-10	21-23 Jun 86	100,000***
Deep Freeze 87	22 ARW	1 KC-10		
Midwinter Airdrop 1987	22 ARW	1 KC-10	10-13 Jun 87	181,000****
Midwinter Airdrop 1988	22 ARW	2 KC-10	28-30 Jun 88	207,000
Midwinter Airdrop 1989	22 ARW	1 KC-10	19-21 Jun 89	
Deep Freeze 90		1 KC-10	4-6 Oct 89*****	
Midwinter Airdrop 1990	22 ARW	1 KC-10	7-9 Jun 90	12,800
Midwinter Airdrop 1991	22 ARW	1 KC-10	25-27 Jun 91	
Midwinter Airdrop 1992	22 ARW	1 KC-10	13-15 Jun 92	125,000******
Midwinter Airdrop 1993	22 ARW	1 KC-10	6-8 Jun 93	200,000
Midwinter Airdrop 1994		1 KC-10	Jun 94	
Midwinter Airdrop 1995	60 AMW	1 KC-10	Jun 95	
Ice Drop 1999	60 AMW	1 KC-10	11 Jul 99	75,000

*Scheduled.

**Crew provided by 452 ARW, the 22 ARW's Reserve associate wing. May have been the case for Midwinter Airdrop 1985 and others.

***First mission (McMurdo Sound and South Pole airdrops) only.

****Approximately.

*****This KC-10 refueled the first C-5 en route to Christchurch as part of the deployment. It then refueled the C-5 during its two missions to McMurdo Sound.

******First mission (McMurdo Sound and South Pole airdrops) only.

ABBREVIATIONS: AMW: Air Mobility Wing; ARW: Air Refueling Wing; BW: Bombardment Wing.

SOURCES: Hist, 22 BW, Apr-Jun 81, 18 Sep 81; Hist, 63 MAW, Apr-Jun 81, ca Sep 81; Pamphlet, SAC History Office, *Seventy Years of Strategic Air Refueling, 1918-1988, A Chronology*, May 90; Hist, 22 ARW, Apr-Jun 83, n.d.; Hist, 22 ARW, Apr-Jun 84, 1 Oct 84; Hist, MAC, Jan-Dec 83, 29 Aug 84; Msg, Lt Gen Robert F. Coverdale, MAC Vice Commander in Chief, to 22 AF Commander et al, "Antarctic Midwinter Airdrop," 031635Z Jul 84; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations et al, "Mission Commander's Report-Deep Freeze 85," 4 Feb 85; Hist, 62 MAW, Apr-Jun 85, 30 Sep 85; Hist, 22 ARW, Oct-Dec 85, 1 Mar 86; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations et al, "Deep Freeze Report," 21 Jan 86; Hist, 834 ALD, Jan-Dec 86, (K-DIV-834-HI, IRIS 01086352) 5 Jan 88; Hist, 60 MAW, Jan-Dec 86, 23 Feb 88; Hist, 452 ARW, Jan-Jun 86, n.d.; Ltr, Maj Charles E. Fitzpatrick, 63 MAW Combat Tactics and Techniques, to 63 MAW Director of Operations, "Mid-Winter Airdrop," 14 May 87; Hist, 63 MAW, Jan-Jun 88, 17 Feb 89; Hist, 62 MAW, Jan-Jun 89, 31 Oct 89; Hist, MAC, Jan-Dec 89, 12 Jun 90; Hist, 22 ARW, Jan-Jun 90, 30 Oct 90; Hist, 22 ARW, Jan-Jun 91, 1 Nov 91; Hist, 22 ARW, Jan-Jun 92, n.d.; Hist, 63 AW, Jan-Jun 92, 2 Nov 92; Hist, 22 ARW, Jan-Dec 93, 22 Nov 94; Hist, 22 AF, Jan-Jun 93, 14 Dec 93; Hist, 15 AF, Jul 93-Dec 94, 15 Jul 95; Hist, 60 AMW, Jan-Jun 95, 13 Oct 95; Hist, AMC, Jan-Dec 99.

APPENDIX D

FIRST US AIR FORCE AIRCRAFT IN ANTARCTIC OPERATION DEEP FREEZE (1956-2002)

Phase of Operation	Aircraft/ Tail Number	Aircraft Commander	Unit	Date
Deep Freeze II	C-124 51-0207	Col Horace A. Croswell	63 TCW	21 Oct 56
Deep Freeze II (airdrop)	C-124 52-1015	Capt Wally Malone	63 TCW	26 Oct 56
Deep Freeze 60 (Operation Ice Flow)	C-130D 57-0488		314 TCW	23 Jan 60
Deep Freeze 64	C-130E 62-1814	Lt Col Russell C. Clarke	1608 ATW	14 Oct 63
Deep Freeze 67	C-141A 65-0229	Capt Howard Geddes	60 MAW	14 Nov 66
Deep Freeze 71	C-133 56-1610		436 MAW	21 Oct 70
Midwinter Airdrop 1979	C-141A	Lt Col James M. Galyen	63 MAW	14 Jul 79
Deep Freeze 81	C-141B 65-0259	Capt Roger Purcell	60 MAW	12 Oct 80
Midwinter Airdrop 1981	C-141B 66-0128	Lt Col James M. Galyen	63 MAW	22 Jun 81
Midwinter Airdrop 1981	KC-135*		22 BW	22 Jun 81
Midwinter Airdrop 1982	KC-10			22 Jun 82
Deep Freeze 88	LC-13H		109 TAG	Jan 88
Deep Freeze 90	C-5B 87-0042	Lt Col Oakly L. Risser	60 MAW	4 Oct 89
Deep Freeze 90 (airdrop)	C-141B 64-0245	Maj William A. Burt	62 MAW	1 Nov 89

*In the case of the air refueling aircraft, table refers to first used in conjunction with Antarctic operations/first time over Antarctica.

Phase of Operation	Aircraft/ Tail Number	Aircraft Commander	Unit	Date
Deep Freeze 1999-00	C-17A 98-0054	Maj David E. Pollmiller	62 AW	15 Oct 99
Deep Freeze 2000-01	C-141C 66-0136		452 AMW	31 Jan 01
Deep Freeze 2001-02	C-130H 92-0553	Capt Robert L. Fletcher	463 AG	10 Dec 01

ABBREVIATIONS: AG: Airlift Group; AMW: Air Mobility Wing; ATW: Air Transport Wing; AW: Airlift Wing; BW: Bombardment Wing; MAW: Military Airlift Wing; TAG: Tactical Airlift Group; TCW: Troop Carrier Wing.

SOURCES: Hist, 63 TCW, Jul-Dec 56, (K-WG-63-HI, IRIS 451245) n.d.; Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66; Hist, 314 TCW, Jan-Jun 60, (K-WG-314-HI, IRIS 455372) n.d.; Hist, 1608 ATW, Jan-Jun 63, n.d.; Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation Deep Freeze 67," n.d.; Hist, 436 MAW, Jan-Dec 70, 15 May 71; Hist, 63 MAW, Jul-Sep 79, n.d.; Study, Anne M. Bazzell, 834 ALD History Office, "Antarctica: Down to the Ice," Jul 81; Hist, 63 MAW, Apr-Jun 81, ca Sep 81; Hist, 22 BW, Apr-Jun 81, 18 Sep 81; Pamphlet, SAC History Office, *Seventy Years of Strategic Air Refueling, 1918-1988, A Chronology*, May 90; Briefing, Maj Claude Poitras, AMC Airlift Operations Staff, "Operation Deep Freeze," 4 Nov 99; Hist, 60 MAW, Jul-Dec 89, (K318.7-60, IRIS 0887939) n.d.; Hist, 834 ALD, Jan-Dec 89, (K-DIV-834-HI, IRIS 01099414) 6 Jul 90; Hist, 63 MAW, Jul-Dec 89, 31 May 90; Hist, 62 AW, Jan-Dec 99, 25 Jun 00; Rpt, Col Joel R. Maynard, Deep Freeze Commander, "Operation Deep Freeze Consolidated Department of Defense End of Season Report, 2000-2001 Season," 26 Aug 02; Hist, 463 AG, Jul-Dec 01, 17 May 02.

APPENDIX E

US AIR FORCE ANTARCTIC ANIMAL AIRLIFT CHRONOLOGY OPERATION DEEP FREEZE (1957-1988)

Phase of Operation	Date	Unit and Aircraft	Animals	Destination
Deep Freeze III	12-15 Nov 57	63 TCW C-124	36 Adelie 30 Emperor	Johns Hopkins University/ Portland OR/ San Diego CA
Deep Freeze 63	30 Nov-1 Dec 62	63 TCW C-124	23 Adelie 23 Emperor*	Portland OR
Deep Freeze 66	4-6 Nov 65	NATWP C-130E	44 Adelie 3 Emperor	LaGuardia Field NY
Deep Freeze 69	28 Nov 68	438 MAW C-141	48 Adelie 30 Emperor 30 Skua gulls 4 seal pups	San Diego CA/ Grand Forks ND/ Scott AFB IL/ Andrews AFB MD
Deep Freeze 76	24 Nov 75	60 MAW C-141	100 penguins	Miramar CA
Deep Freeze 77	24 Nov 76	60 MAW C-141	100 Adelie 40 Emperor	North Island CA
Deep Freeze 78	ca 24 Nov 77	60 MAW C-141	140 penguins	Point Magu CA
Deep Freeze 89	16-17 Nov 88	60 MAW C-141	4 Emperor chicks	North Island CA

NOTES AND ABBREVIATIONS: Adelie and Emperor are types of penguins. AFB: Air Force Base; MAW: Military Airlift Wing; NATWP: Naval Air Transport Wing, Pacific; TCW: Troop Carrier Wing.

SOURCES: Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica-The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66; Rpt, 1Lt Leonard M. Kacher, MATS Deep Freeze 63 Information Officer, "Operation Deep Freeze 63, Final Information Activity Report," 2 Jan 63; Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation Deep Freeze 67," n.d.; Hist, 438 MAW, Jul 68-Jun 69,

*The flight also included a number of New Zealand natives, including 30 hedgehogs, 13 magpies, 14 opossums, and 1 rook.

Oct 69; Hist, 60 MAW, Oct-Dec 75, 15 Mar 76; Memo, Col Morris T. Warner, Jr., 60 MAW Deputy Commander for Operations, to Col Donald W. Bennett, 60 MAW Commander, "Deep Freeze Penguin Flight," 26 Nov 76; Hist, 60 AMW, Oct-Dec 77, 2 May 78; Paper, 22 AF Pacific Airlift Center, "Operation Deep Freeze," 20 Oct 77; Article, 1352 Audio Visual Squadron, "Penguin Airlift," ca Nov 88; Ltr, Lt Col Patrick M. Boyle, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations *et al*., "Mission Commander's Report-Deep Freeze 89," ca Dec 88.

APPENDIX F

US AIR FORCE DEPLOYED PERSONNEL STATISTICS OPERATION DEEP FREEZE (1956-1987)

	Officer	Enlisted	Civilian	Total
Deep Freeze II (1956-57)				Approx 300
Deep Freeze III (1957-58)				286
Deep Freeze IV (1958-59)				Approx 300
Deep Freeze 60 (1959-60)	67	306	2	375
Deep Freeze 60 (Ice Flow)				131
Deep Freeze 61 (1960-61)*	65	342	1	408
Deep Freeze 62 (1961-62)	62	336		398
Deep Freeze 63 (1962-63)	60	343		403
Deep Freeze 64 (1963-64)	33	134		167
Deep Freeze 65 (1964-65)	36	126		162
Deep Freeze 66 (1965-66)	29	100		129**
Deep Freeze 67 (1966-67)	23	70		93***
Deep Freeze 68 (1967-68)				59****
Deep Freeze 69 (1968-69)	12	15		27****
Deep Freeze 70 (1969-70)				30****
Deep Freeze 71 (1970-71)	16	30		46
Deep Freeze 72 (1971-72)				36****
Deep Freeze 73 (1972-73)				
Deep Freeze 74 (1973-74)	1	16		17

*Includes augmentation for four aircrews and 52 support personnel.

**Includes 11 Navy personnel (5 officer, 6 enlisted) from the Military Air Transport Service's Naval Air Transport Wing, Pacific (NATWP).

***Comprised of personnel from the NATWP. Includes five Air Force enlisted personnel (four communications specialists and one veterinary technician). Does not include seven Air Force personnel permanently assigned at Christchurch or six Air Force C-141 observers.

****Includes only those assigned to the 438th Military Airlift Wing and not any augmentation from other units. Beginning with DEEP FREEZE 73, only the Airlift Control Element team deployed. Aircrews rotated through with the aircraft and were not counted against the "deployed" personnel.

	Officer	Enlisted	Civilan	Total
Deep Freeze 75 (1974-75)				24*
Deep Freeze 76 (1975-76)	2	21		23
Deep Freeze 77 (1976-77)	2	21		23
Deep Freeze 78 (1977-78)	2	24		26
Deep Freeze 79 (1978-79)**				42***
Deep Freeze 80 (1979-80)				41
Deep Freeze 81 (1980-81)				11****
Deep Freeze 82 (1981-82)				
Deep Freeze 83 (1982-83)				
Deep Freeze 84 (1983-84)	1	7		8*****
Deep Freeze 85 (1984-85)	2	14		16
Deep Freeze 86 (1985-86)	2	11		13
Deep Freeze 87 (1986-87)	2	11		13
Deep Freeze 88 (1987-88)				******

*In order to maximize the training opportunity, the 60th Military Airlift Wing sent three Airlift Control Element teams during DEEP FREEZE 75. Each team consisted of approximately 24 members.

**Table does not include midwinter airdrops (1979-1996) since the operating location at Christchurch and the Royal New Zealand Air Force provided nearly all the support for the C-141 augmented aircrew.

***This included seven individuals from the 60th Military Airlift Wing forming an Airlift Control Element team and 35 logistics and maintenance personnel from various units (primarily 60th Military Airlift Wing and 61st Military Airlift Support Wing).

****Includes only 60th Mobility Airlift Wing maintenance and supply augmentation. With aircrews rotating through the operation and not counted, the overall "deployed" number remained fairly low and subsequent reporting on the numbers became sporadic.

*****This was for the second phase of the operation which was an unspecified reduction from the first part. Only three missions were scheduled for December.

******Documentation reporting the number of deployed personnel became very erratic after this point. Therefore, this report stopped tracking it after 1987.

SOURCES: Hist, 63 TCW, Jan-Jun 57, (K-WG-63-HI, IRIS 451256) n.d.; Hist, 63 TCW, Jul-Dec 57, n.d.; Rpt, Lt Col Cicero J. Ellen, USAF Task Force Commander, "Operation Deep Freeze Phase IV," n.d.; Rpt, Lt Col Dewey R. Bridges, USAF Task Force Commander, "Final Report: Operation Deep Freeze Sixty," n.d.; Rpt, Lt Col Wilbert Turk, 61 TCS Commander, "Mission Report, Operation Ice Flow," (K-WG-314-SU-OP, IRIS 455426) 15 Mar 60; Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze Sixty One," n.d.; Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze 1962," 25 Jan 62; Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze 63," n.d.; Rpt, Lt Col Russell C. Clarke, USAF Task Force Commander, "Final Report: Deep Freeze 64," n.d.; Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: Deep Freeze 65," n.d.; Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: Deep Freeze 66," n.d.; Rpt, LCDR Frank A. Achille, Task Unit Commander, "Report of Operation Deep Freeze 67," n.d.; Hist, 438 MAW, Jul-Dec 67, Nov 68; Article, "McGuire AFB 'Deep Freeze' Team," *McGuire Airtides*, 13 Dec 68; Hist, 21 AF, Jul 69-Jun 70, May 71; Ltr, Lt Col Joseph F. McKone, USAF Mission Commander, to 438 MAW Deputy Commander for Operations, "Final Report-Operation Deep Freeze FY 71," 30 Nov 70; Hist, 438 MAW, Oct-Dec 71, Mar 72; Rpt, TSgt Stanley J. Morris, 438 MAW Operations Analysis, "438DOXA Activity Report, Operation Deepfreeze 74," Dec 73; Article, SSgt Michael L. Ward, 60 MAW Information Office, "Operation Deep Freeze 1975, from Travis to Antarctica," *The Tailwind*, 15 Nov 74; Rpt, 60 MAW Combat Support, "Historical Report, 1 Oct-31 Dec 75," ca Jan 76; Paper, 22 AF Pacific Airlift Center, "Operation Deep Freeze," 20 Oct 77; Hist, 61 MASW, Oct-Dec 78, 22 Mar 79; Paper, SSgt Goetz, 61 MASW Maintenance, "Deep Freeze," 25 Oct 79; Hist, 60 MAW, 22 Jul-31 Dec 80, 3 Mar 82; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations, "Mission Commander's Report-Deep Freeze," 20 Apr 84; Paper, Maj Young, 834 ALD Operations Staff, "Operation Deep Freeze," 5 Nov 84; [see also Operations Order 03-86 (FOUO), 834 ALD Operations Staff, "Operation Deep Freeze," 24 Jul 85]; Ltr, Lt Col Leland W. C. Conner, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations, "Deep Freeze Report," 21 Jan 86; Ltr, Lt Col John S. Beattie, Det 2 619 MASS Commander, to 834 ALD Assistant Director of Operations, "Deep Freeze After Action Report," 12 Dec 86; Ltr, Lt Col Patrick M. Henry, 834 ALD Assistant Director of Operations, to 834 ALD Director of Operations et al, "Mission Commander's Report-Deep Freeze 88," 23 Dec 87.

APPENDIX G

US AIR FORCE DEPLOYMENT COMMANDERS OPERATION DEEP FREEZE (1956-2006)

SEASON	COMMANDER
Deep Freeze II (1956-57)	Col Horace A. Crosswell
Deep Freeze III (1957-58)	Col William G. Forwood
Deep Freeze IV (1958-59)	Lt Col Cicero J. Ellen
Deep Freeze 60 (1959-60)	Lt Col Dewey R. Bridges
Deep Freeze 60 (Ice Flow)	Lt Col Wilbert Turk
Deep Freeze 61 (1960-61)	Lt Col Foy B. Frost
Deep Freeze 62 (1961-62)	Lt Col Foy B. Frost
Deep Freeze 63 (1962-63)	Lt Col Foy B. Frost
Deep Freeze 64 (1963-64)	Lt Col Russell C. Clarke
Deep Freeze 65 (1964-65)	Lt Col Robert D. Coffee
Deep Freeze 66 (1965-66)	Lt Col Robert D. Coffee
Deep Freeze 67 (1966-67)	LCDR Frank A. Achille*
Deep Freeze 68 (1967-68)	Lt Col Ervin F. Bork**
Deep Freeze 69 (1968-69)	Lt Col Robert C. Huf
Deep Freeze 70 (1969-70)	Lt Col Buford E. Stovall
Deep Freeze 71 (1970-71)	Lt Col Joseph F. McKone
Deep Freeze 72 (1971-72)	Lt Col William W. Hewitt
Deep Freeze 73 (1972-73)	Lt Col Charles L. McKenzie
Deep Freeze 74 (1973-74)	Maj George Schleehauf
Deep Freeze 75 (1974-75)	Lt Col Troy M. Brown
Deep Freeze 76 (1975-76)	Lt Col Troy M. Brown
Deep Freeze 77 (1976-77)	Lt Col Phillip A. Cooke***
Deep Freeze 78 (1977-78)	Lt Col Phillip A. Cooke
Deep Freeze 79 (1978-79)	Maj Robert J. Byrne****
Deep Freeze 80 (1979-80)	Lt Col Robert J. Byrne
Deep Freeze 81 (1980-81)	Lt Col Robert J. Byrne

*A Navy unit assigned to the Military Airlift Command led the airlift effort for DEEP FREEZE 67.

**Colonel Bork was the Commander of the 29th Military Airlift Squadron of the 438th Military Airlift Wing and may not have been the Air Force Mission Commander.

***Colonel Cooke was the senior controller for the 60th Mobility Airlift Wing's Combat Support Section and may not have been the Air Force Mission Commander.

****The permanent operating location at Christchurch took over mission command. See Appendix E.

SEASON	COMMANDER
Deep Freeze 82 (1981-82)	Lt Col D. Erickson*
Deep Freeze 83 (1982-83)	Lt Col D. Erickson
Deep Freeze 84 (1983-84)	Lt Col Leland W. C. Conner
Deep Freeze 85 (1984-85)	Lt Col Leland W. C. Conner
Deep Freeze 86 (1985-86)	Lt Col Leland W. C. Conner
Deep Freeze 87 (1986-87)	Lt Col Patrick M. Henry
Deep Freeze 88 (1987-88)	Lt Col Patrick M. Henry
Deep Freeze 89 (1988-89)	Lt Col Patrick M. Boyle
Deep Freeze 90 (1989-90)	Lt Col William H. Krechowski
Deep Freeze 91 (1990-91)	Lt Col William H. Krechowski
Deep Freeze 92 (1991-92)	Lt Col William H. Krechowski
Deep Freeze 93 (1992-93)	Lt Col George E. Meggers**
Deep Freeze 94 (1993-94)	Lt Col George E. Meggers***
Deep Freeze 95 (1994-95)	Lt Col Russell J. Frasz****
Deep Freeze 96 (1995-96)	Lt Col Gregory L. Hergesell
Deep Freeze 97 (1996-97)	Lt Col Brock W. Eshleman
Deep Freeze 1997-98	Lt Col Raymond R. Phillips
Deep Freeze 1998-99	Lt Col John I. Pray, Jr.
Deep Freeze 1998-99 (Reverse WINFLY)	Lt Col Steve Kernstock
Deep Freeze 1999-00	Lt Col Steve Kernstock
Deep Freeze 2000-01	Lt Col Frederick P. DeMarco
Deep Freeze 2001-02 (201 AEG)*****	Col David B. Walker
Deep Freeze 2001-02 (C-130H)	Maj Jared P. Curtis
Deep Freeze 2002-03 (201 AEG)	Col Verle L. Johnston, Jr.
Deep Freeze 2003-04 (500 AEG)	Col Brian R. Spencer
Deep Freeze 2004-05 (500 AEG)	Col Dean Nelson
Deep Freeze 2005-06 (500 AEG)	Col Ronald J. Smith

*The 834th Airlift Division appointed Colonel Erickson, the division's Assistant Director of Operations, as the USAF Mission Commander. Capt William H. Dudley, commander/chief of the operating location at Christchurch, served as the Deputy.

**With the inactivation of the 834th Airlift Division, Twenty-Second Air Force took over mission command responsibilities.

***Fifteenth Air Force took over the mission from the inactivating Twenty-Second Air Force. Colonel Meggers served the same function in 15 AF as he had in 22 AF the previous year.

****The wing providing the aircraft took over mission command responsibilities.

*****With the establishment of the air and space expeditionary force concept, the AEG commander served as the operation's Commander of Air Force Forces.

Operation DEEP FREEZE Commander
(After Air Force took over)

SEASON	COMMANDER
Deep Freeze 1997-98	Col Richard M. Saburro
Deep Freeze 1998-99 (Det 13 ANG)	Col Richard M. Saburro
Deep Freeze 1999-00 (Det 13 ANG)	Col Richard M. Saburro
Deep Freeze 2000-01 (Det 13 ANG)	Col Joel R. Maynard
Deep Freeze 2001-02 (SFA)	Col Joel R. Maynard
Deep Freeze 2002-03 (SFA)	Col Joel R. Maynard
Deep Freeze 2003-04 (SFA)	Col Tye Beasley
Deep Freeze 2004-05 (SFA)	Col Tye Beasley
Deep Freeze 2005-06 (500 AETF)	Lt Gen David A. Deptula*

NOTE AND ABBREVIATIONS: For the years when the Air Force flew multiple phases (WINFLY, main season, and/or reverse WINFLY), the same mission commander served for each phase, unless otherwise noted. AEG: Air Expeditionary Group; AETF: Air Expeditionary Task Force; ANG: Air National Guard; Det: detachment; SFA: Support Forces Antarctica; WINFLY: winter fly in.

*Colonel Smith, as his deputy commander, worked the majority of the issues in New Zealand and Antarctica.

APPENDIX H

MIDWINTER AIRDROP MISSION COMMANDERS (1979-1999)

YEAR	COMMANDER
1979	Lt Col James M. Galyen
1980	Lt Col James M. Galyen
1981	Lt Col James M. Galyen
1982	Lt Col James M. Galyen
1983	Maj John A. Kent, Jr.
1984	Lt Col Jerry L. McKimmey
1985	Lt Col Jerry L. McKimmey
1986	Lt Col Jerry L. McKimmey
1987	Maj Charles E. Fitzpatrick III
1988	Maj Larry Curtis
1989	Maj William A. Burt
1990	Lt Col Robert Rogers
1991	Lt Col Vane Hugo III
1992	unknown*
1993	Lt Col Jeff Cain
1994	Lt Col David R. Smith
1995	Lt Col David R. Smith
1999 (medical drop)	Lt Col John I. Pray, Jr.

*This was most likely Colonel Hugo again, but none of the available documents specifically named the mission commander for that year.

APPENDIX I

PERMANENTLY ASSIGNED AIR FORCE DETACHMENTS OR OPERATING LOCATIONS AT CHRISTCHURCH, NEW ZEALAND (1959-2006)

Date	Designation	Action	Special Order
1 Mar 59	Det 1, 63 SUPS	Organized	MATS, #15, 19 Feb 59
21 Jan 63	Det 1, 63 SUPS	Discontinued	MATS, G-3, 3 Jan 63
21 Jan 63	Det 1, 1608 SUPS	Designated and Organized	MATS, G-3, 3 Jan 63
1 Jan 64	Det 1, 1608 SUPS	Discontinued	MATS, G-110, 9 Sep 63
1 Jan 64	Det 1, 1501 ATW	Designated and Organized	MATS, G-110, 9 Sep 63
8 Jan 66	Det 1, 1501 ATW	Discontinued	MATS, G-186, 17 Dec 65
8 Jan 66	Det 1, 60 MAW	Designated and Organized	MATS, G-186, 17 Dec 65
8 Apr 67	Det 1, 60 MAW	Discontinued	MAC, G-66, 29 Mar 67
8 Apr 67	OL 5, 61 MASW (Deep Freeze)	Designated and Established	MAC, G-66, 29 Mar 67
8 Apr 67	OL 5, 61 MASW (En Route Support)	Previous order amended	MAC, G-77, 11 Apr 67
1 Sep 70	OL D, 61 MASW	Redesignated	MAC, G-226, 4 Aug 70
1 Apr 80	OL D, 61 MASW	Inactivated	MAC, G-53, 26 Feb 80
1 Apr 80	OL D, 619 MASS	Designated and Activated	MAC, G-53, 26 Feb 80
1 Mar 82	OL D, 619 MASS	Inactivated	MAC, G-528, 23 Dec 81
1 Mar 82	Det 2, 619 MASS	Designated and Activated	MAC, G-528, 23 Dec 81
1 Jun 92	Det 2, 619 ALSG	Renamed	MAC, GA-54, 22 May 92
1 Jul 94	Det 2, 619 ALSG	Inactivated	AMC, GAXP-20, 27 May 94
1 Jul 94	Det 2, 615 AMSG	Activated	MAC, GAXP-20, 27 May 94

Date	Designation	Action	Special Order
1 Jul 95	Det 2, 615 AMSG	Inactivated	AMC, GAXP-11, 25 Apr 95
1 Jul 95	OL A, 615 AMSG	Activated	AMC, GAXP-11, 25 Apr 95
1 Apr 98	Air National Guard Det 13	Activated	ANG, GS-98-10, 25 Mar 98
1 Oct 99	OL A, 615 AMSG	Inactivated	AMC, GAXP-28, 17 Sep 99
1 Oct 99	OL A, Det 1, 635 AMSS	Activated	AMC, GAXP-28, 17 Sep 99
15 Mar 01	OL A, Det 1, 735 AMS	Renamed	AMC, GAXP-9, 28 Feb 01
1 Nov 01	OL A, Det 1, 735 AMS	Inactivated	AMC, GAXP-5, 18 Oct 01
1 Nov 01	OL E, 715 AMOG	Activated	AMC, GAXP-5, 18 Oct 01
7 Jan 05	Air National Guard Det 13	Inactivated	*
15 Jan 06	OL E, 715 AMOG	Inactivated	AMC, GAA5-8, 12 Jan 06
15 Jan 06	OL B, 735 AMS	Designated and Activated	AMC, GAA5-8, 12 Jan 06

NOTES AND ABBREVIATIONS: Most of these changes occurred as a result in parent unit changes. The major exception was establishing OL 5 of the 61 MASW. This change moved the operating location to a parent unit assigned at Hickam AFB HI. ALSG: Airlift Support Group; AMC: Air Mobility Command; AMOG: Air Mobility Operations Group; AMS: Air Mobility Squadron; AMSS: Air Mobility Support Squadron; ANG: Air National Guard; ATW: Air Transport Wing; Det: detachment; MAC: Military Airlift Command; MASS: Military Airlift Support Squadron; MASW: Military Airlift Support Wing; MATS: Military Air Transport Service; MAW: Military Airlift Wing; OL: operating location; SUPS: Supply Squadron.

SOURCES: Authority for all unit actions is addressed by special orders (listed with each action).

---

*Special order not available. Date may have been date ceremony held and not actual date of inactivation. Intvw Notes, Ellery Wallwork, AMC Staff Historian, with Lt Col Timothy S. Penn, former ANG Det 13 Commander, and TSgt Drew LaPointe, former member of ANG Det 13, 24 Mar 06.

APPENDIX J

AIR AND SPACE EXPEDITIONARY FORCE UNITS (2000-2005)

Date	Designation	Action	Special Order
28 Sep 00-1 Mar 01	201 AEG-Deep Freeze (Christchurch)	Activated	AMC, GAXP-18, 28 Sep 00
28 Sep 00-1 Mar 01	62 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-18, 28 Sep 00
28 Sep 00-1 Mar 01	109 EAS-Deep Freeze (McMurdo)	Activated	AMC, GAXP-18, 28 Sep 00
28 Sep 00-1 Mar 01	Det 1, 109 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-18, 28 Sep 00
30 Sep 01-1 Mar 02	201 AEG-Deep Freeze (Christchurch)	Activated	AMC, GAXP-23, 21 Sep 01
30 Sep 01-1 Mar 02	50 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-23, 21 Sep 01
30 Sep 01-1 Mar 02	109 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-23, 21 Sep 01
30 Sep 01-1 Mar 02	Det 1, 109 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-23, 21 Sep 01
30 Sep 01-1 Mar 02	452 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-23, 21 Sep 01
19 Aug 02-1 Mar 03	201 AEG-Deep Freeze (Christchurch)	Activated	AMC, GAXP-44, 20 Aug 02
19 Aug 02-1 Mar 03	109 EAS-Deep Freeze (McMurdo)	Activated	AMC, GAXP-44, 20 Aug 02
19 Aug 02-1 Mar 03	Det 1, 109 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-44, 20 Aug 02
19 Aug 02-1 Mar 03	452 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-44, 20 Aug 02
15 Aug 03-1 Mar 04	500 AEG-Deep Freeze (Christchurch)	Activated	AMC, GAXP-28, 15 Aug 03; GAXP-29, 18 Aug 03
15 Aug 03-1 Mar 04	139 EAS-Deep Freeze (McMurdo)	Activated	AMC, GAXP-28, 15 Aug 03

Date	Designation	Action	Special Order
15 Aug 03-1 Mar 04	Det 1, 139 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-28, 15 Aug 03
15 Aug 03-1 Mar 04	304 EAS-Deep Freeze (Christchurch)	Activated	AMC, GAXP-28, 15 Aug 03; GAXP-29, 18 Aug 03
15 Aug 04-28 Feb 05	500 AEG (Christchurch)	Activated	AMC, GAXP-33, 28 Sep 04
15 Aug 04-28 Feb 05	139 EAS (McMurdo)	Activated	AMC, GAXP-33, 28 Sep 04
15 Aug 04-28 Feb 05	Det 1, 139 EAS (Christchurch)	Activated	AMC, GAXP-33, 28 Sep 04
15 Aug 04-28 Feb 05	304 EAS (Christchurch)	Activated	AMC, GAXP-33, 28 Sep 04
29 Jul 05	500 AETF-Deep Freeze (Hickam)	Activated	PACAF, GS-06-010, 10 Nov 05
29 Jul 05	500 AEG-Deep Freeze (Christchurch)	Activated	PACAF, GS-06-010, 10 Nov 05
29 Jul 05	139 EAS-Deep Freeze (McMurdo)	Activated	PACAF, GS-06-010, 10 Nov 05
29 Jul 05	304 EAS-Deep Freeze (Christchurch)	Activated	PACAF, GS-06-010, 10 Nov 05
29 Jul 05	Det 1, 139 EAS-Deep Freeze (Christchurch)	Activated	PACAF, GS-06-010, 10 Nov 05

NOTES: The Air Force implemented the Air and Space Expeditionary Force system in an attempt to ensure home units received appropriate credit for the various campaigns and operations they supported. AEF: Air and Space Expeditionary Force; AEG: Air Expeditionary Group; AETF: Air and Space Expeditionary Task Force; AMC: Air Mobility Command; Det: Detachment; EAS: Expeditionary Airlift Squadron; PACAF: Pacific Air Forces.

SOURCES: Authority for all unit actions is addressed by special orders (listed with each action).

APPENDIX K

PRIMARY AIRCRAFT CHARACTERISTICS

C-124A Globemaster II

Length: 127.1 ft
Height: 48.6 ft

Wing Span: 174.1 ft

Max Cargo: 65,144 lb

Range: 1,830 nm
(w/40,800 lbs of cargo)

Standard Crew: 5 (pilot, co-pilot, flight engineer, navigator, radio operator)

C-124C Globemaster II

Length: 130.0 ft
Height: 48.6 ft

Wing Span: 174.1 ft

Max Cargo: 76,486 lb

Range: 1,875 nm
(w/42,100 lbs of cargo)

Standard Crew: 5 (pilot, co-pilot, flight engineer, navigator, radio operator)

C-130E Hercules

Length: 97.8 ft
Height: 38.5 ft

Wing Span: 132.6 ft

Max Cargo: 45,000 lb

Range: 2,7080 nm
(w/35,134 lbs of cargo)

Standard Crew: 5 (pilot, co-pilot, flight engineer, navigator, loadmaster)

C-130H Hercules

Length: 98.8 ft
Height: 38.4 ft

Wing Span: 132.6 ft

Max Cargo: 45,000 lb

Range: 2,666 nm
(w/35,133 lbs of cargo)

Standard Crew: 5 (pilot, co-pilot, flight engineer, navigator, loadmaster)

C-141A Starlifter

Length: 145.01 ft
Height: 39.3 ft

Wing Span: 160.7 ft

Max Cargo: 66,088 lb

Range: 5,500 nm
(w/31,148 lbs of cargo)

Standard Crew: 5 (pilot, co-pilot, flight engineer, loadmaster, navigator)

C-141B/C Starlifter

Length: 168.3 ft
Height: 39.3 ft

Wing Span: 160.7 ft

Max Cargo: 68,725 lb

Range: unlimited w/air refueling

Standard Crew: 5 (pilot, co-pilot, 2 flight engineers, loadmaster [navigator added for airdrops])

KC-135E Stratotanker

Length: 136.3 ft
Height: 41.7 ft

Wing Span: 130.8 ft

Max Transfer Fuel Load: 200,000 lb

Range: 1,300 nm
(w/150,000 lbs of transfer fuel)

Standard Crew: 4 (pilot, co-pilot, navigator, boom operator)

KC-10A Extender

Length: 181.6 ft
Height: 58.1 ft

Wing Span: 165.4 ft

Max Fuel Load: 356,000 lb
(in theory could transfer all)

Range: 3,800 nm
(w/170,000 lbs of cargo)

Standard Crew: 4 (pilot, co-pilot, flight engineer, boom operator)

C-5A/B Galaxy

Length: 247.8 ft
Height: 65.1 ft

Wing Span: 222.7 ft

Max Cargo: 270,000 lb

Range: 7,300 nm
(empty)

Standard Crew: 7 (pilot, co-pilot, 2 flight engineers, 3 loadmasters)

C-17A Globemaster III

Length: 174 ft
Height: 55 ft 1 in

Wing Span: 169 ft 10 in

Max Cargo: 170,900 lb

Range: 2,400 nm
(w/160,000 lbs. of cargo)

Standard Crew: 3 (pilot, co-pilot, loadmaster)

NOTE: Range varies with payload, fuel load, winds, and various other factors.

SOURCES: Guide, Deputy for Engineering, Aeronautical Systems Division, Air Force Systems Command, "USAF Standard Aircraft/Missile Characteristics," Vol. II (Brown Book), Oct 70; Fact Sheet, AMC/PA, "C-141 Starlifter," Oct 05; Fact Sheet, AMC/PA, "KC-135 Stratotanker," Oct 05; Fact Sheet, AMC/PA, "KC-10 Extender," Oct 05; Fact Sheet, AMC/PA, "C-5 Galaxy," Oct 05; Fact Sheet, AMC/PA, "C-17 Globemaster III," Oct 05.

APPENDIX L

A BRIEF HISTORY OF WILLIAMS FIELD MCMURDO SOUND, ANTARCTICA

The US Navy selected the original site for the airfield during the austral summer of 1954-1955 when the *USS Atka* visited Antarctica to locate sites in support of the International Geophysical Year (IGY). The bay ice proved solid enough to support cargo airlift operations and provided a level location for an airfield to support inland sites. Construction at the site began the next year. Since planners expected the site to be abandoned at the end of the IGY, engineers constructed the airfield 2.5 miles south of McMurdo Sound Station (located on the rocky hillside of Ross Island) on the 30-foot-thick sea ice, without consideration of long-term operations. The installation was originally designated US Air Operations Facility (AIROPFAC).

The airfield was located atop the Ross Ice Shelf. Fed by fresh-water glaciers, the shelf averaged 700 meters thick along the rocky coast and thinned rapidly to the north. The Ross Ice Shelf moves toward the sea at a rate of approximately two meters per week during the warmer months. This area, however, did not naturally break off into the sea. Navy engineers constructed the new runway by pushing up snow berms with bulldozers. The berms created a new obstacle on the ice to catch drifting snow--worsened by the fact that most runways align with the prevailing winds, but storm winds usually come from different directions. Had operations ceased by 1959 as expected, this would likely not have caused any problems.

Air operations began in December 1957. During the next two summers, engineers worked to expand the runway to make a 6,000-foot skiway and 4,000-foot runway. With this expansion, the field became known as a Naval Air Facility (NAF). The NAF was then named after Richard T. Williams, a naval construction equipment driver who lost his life on the Ross Ice Shelf when the bulldozer he was operating fell through the ice.

By the summer of 1961-1962, the snow berms along the runway were over 20 feet high and tapered out up to 200 feet on each side. This weight depressed the surrounding ice and produced deep and dangerous cracks. By 1962, Navy personnel moved the entire operation five miles from the edge of the snow berm barrier. The part of the ice shelf containing the original runway did break off and float away, but not before the Air Force used it again the following season. In October 1962, Navy engineers constructed Williams Field II directly south of Ross Island. They removed four to five feet of snow and smoothed out the ice, which had pressure ridges that buckled up to two-feet high. The engineers then flooded the runway with seawater to produce a smooth surface. They also produced a skiway parallel to the ice runway.

In an effort to improve operations, Navy engineers established a temporary camp made of Jamesway huts. They also adapted a US Marine-developed fuel-tank system to provide aviation fuel. The Marines used the 3,000-gallon tanks as removable fuel bladders in C-130s to provide air refueling for fighter aircraft. By adapting the tank system and connecting the bladders, Williams Field now had a fuel depot.

By 1964-1965, the snow berm reached 30 feet in height, and severe longitudinal cracks developed on the runway. Engineers briefly closed the runway twice that summer to effect repairs. In February 1965, over a three-day period, Navy personnel disassembled and moved the buildings further up the ice shelf. The camp was saved, but the runway was considered a complete loss.

A new runway, Williams Field III, was constructed during 1965-1966, approximately three miles south of Pram Point. The main complex consisted of skiways with an ice runway aligned with the primary skiway to simplify landing and navigational aid installations. Additionally, engineers installed a hose pipeline to simplify delivery of petroleum products from McMurdo Sound's tanks to the runway's storage bladders. In order to support US Air Force C-141 operations, engineers constructed another runway on the permanent ice shelf. This one, known as "Outer Williams Field," was about 7 miles southeast of McMurdo Sound* and was 10,000 feet in length. Williams Field was now a huge facility. "The landing surfaces exceeded the combined size of Washington's Dulles and Baltimore's Friendship airports. The manpower to construct the annual ice runways and to keep up the two permanent skiways was considerable."**

The Outer Williams Field sat on a thick portion of the ice shelf and was relatively snow free. However, maintenance was even more intense because the sun melted small pools in the clear ice surface. By the end of the 1970-1971 season, the Navy closed Outer Williams Field. About this same time, engineers were monitoring a large crack near the main runway and skiways. By the end of the 1974-1975 season, the fissure was only 50 yards from the approach end of the primary skiway. Navy engineers decided to move the runway in two stages.

Construction of a new skiway and runways began in the latter part of the 1975-1977 summer, about 5,000 feet from the ice shelf edge. The engineers then moved the camp, and operations at Williams Field IV got fully underway. In all of this movement and construction, Navy engineers learned a lot of lessons. Perhaps the most important was what to do with the excess snow. While a berm was still useful, the vast majority of the snow removed was blown across the ice shelf, instead of pushing it into piles along the runway. In 1980, the Navy turned over most of the runway construction and maintenance to Antarctic Services Inc., a National Science Foundation contractor.***

---

*Surface vehicle distance was actually closer to 14 miles.

**Article, Jerry W. Huffman, National Science Foundation, "Williams Field: The History of an Icy Aerodrome," *Antarctic Journal of the United States*, p. 4, Jun 83.

***In 1990, the National Science Foundation began contracting runway maintenance with the Antarctic Support Associates contracting firm and in 2001, with the Raytheon Polar Services Company.

Although discussions continued regarding finding a location for a land-based runway, the cost for such a project would be exceedingly large (about $200 million in 1972 dollars). Still, the ice shelf movement continued to present concerns (photo 99). By the 1982-1983 season, Antarctic Services Inc. employees completed the berm and road to a new site, approximately three miles from the last one. Construction of the new ice runways and skiways, as well as the relocation of facilities, occurred during 1983-1984. Williams Field V opened for air operations during the 1984-1985 season.

The next step consisted of the development of a "blue ice" runway. Planners considered this a more permanent runway as it was constructed further up the freshwater glacier away from the sea ice and the edge of the ice shelf. Additionally, this ice runway tended to hold up better than the traditional ice runway because of its thickness and location. Its principal drawback was its distance from the McMurdo Sound Station, significantly further than the traditional sea ice runway and the skiway. The Navy named the blue ice runway Pegasus, after a C-121 Super Constellation which crashed near the location on 8 October 1970.* Although first scheduled for testing in 1990, difficulties in constructing the blue ice runway kept it from opening permanently until 1994, and a lack of funding meant it did not see regular use until 1996. Engineers subsequently found that a layer of white ice, constructed by using 100-ton pneumatic tire rollers to compact a thin snow cover, protected the blue ice runway from deterioration caused by the warmer temperatures and high sun angles of the summer months. In 2002, the Air Force certified the Pegasus Runway with the white ice layer as capable of supporting C-5, C-17, and C-141 operations.

Since the construction of the Pegasus Site, three runways have served McMurdo Sound Station (photo 100), but each served a particular purpose or was used during a specific time of year. Furthermore, by the late 1990s, each runway became known under a different name. Williams Field came to refer only to the snow-compacted skiway which continued to support LC-130 and other ski-equipped aircraft in August of each year for the winter flight program and throughout the Antarctic summer months. Williams Field consisted of two runways (10,000 feet by 250 feet and 8,000 feet by 250 feet) with precision approach radar (PAR) and tactical air navigation (TACAN) systems. The annual sea ice runway, referred to only as "sea ice runway," carried on its traditional role of supporting large wheeled airlift aircraft from late September to mid December. This runway was 10,000 feet by 300 feet and was supported by approach lighting, a control tower, and PAR and TACAN systems. The large wheeled aircraft used the Pegasus Site in August and January to February, primarily supporting the winter fly in and late-season redeployment of scientists, contractors, and other technicians. The blue ice runway could also be used in the winter if required. The Pegasus Site was approximately eight miles from McMurdo Sound Station--about an hour's drive. It was a 10,000 feet by 300 feet on an approximately 200-foot ice pack. Pegasus had its own TACAN and received support from the Williams Field PAR.

*Despite a horrific crash that spread parts of the aircraft over several hundred yards, all 80 passengers and crew walked away. The whiteout conditions responsible for the crash also delayed rescue crews by an hour.

PRIMARY SOURCE: Majority adapted from Article, Jerry W. Huffman, National Science Foundation, "Williams Field: The History of an Icy Aerodrome," *Antarctic Journal of the United States*, Jun 83.

OTHER SOURCES: Rpt, Lt Col Foy B. Frost, USAF Task Force Commander, "Final Report: Operation Deep Freeze 63," n.d.; Rpt, Lt Col Robert D. Coffee, USAF Task Force Commander, "Final Report: Deep Freeze 66," n.d.; Hist, 834 ALD, Jan-Dec 86, (K-DIV-834-HI, IRIS 01086352) 5 Jan 88; Hist, 60 AMW, Jul-Dec 96, 25 Apr 97; Memo, Jane Dionne, NSF Office of Polar Programs Acting Environmental Officer, to NSF Director of Office of Polar Programs *et al*., "Environmental Action Memorandum (Construction of Williams Field Replacement Berthing in McMurdo Station/Decommissioning of Building 192)," 19 Aug 93; Article, Josh Landis, "The Tail of the Plane," *The Antarctic Sun,* 2 Jan 00; Press Release, NSF Office of Legislative and Public Affairs, "Runway Project Clears the Way for Improved Antarctic Airlift," 20 Feb 02; Pamphlet, NSF, "United States Antarctic Program Participant Guide, 2004-2006 Edition," ca. Jan 04; Paper, unattributed, "Snow Runways in Antarctica," ca Jan 91; Rpt, George L. Blaisdell, CRREL, "Report for All Season Pegasus Project," Jan 01; Briefing, Maj Claude Poitras, AMC Airlift Operations Staff, "Operation Deep Freeze," 4 Nov 99.

GAZETTEER

Amundsen-Scott Station, South Geographic Pole, Antarctica

Station dedicated 23 January 1957

Latitude: 90°00' South

Elevation: 9,840 feet

Annual mean temperature: -48.9°C
Annual mean wind velocity: 12.5 knots

Beardmore Glacier Station, Liv Glacier, Antarctica

Station completed circa 29 October 1956

Latitude: 84°56' South
Longitude: 165°30' West

Elevation: 6,000 feet

Cape Hallett Station, Moubray Bay, Antarctica

Station dedicated 9 January 1957

Latitude: 72°18' South
Longitude: 170°18' East

Elevation: 15 feet

Annual mean temperature: -15.3°C
Annual mean wind velocity: 8.1 knots

Harewood Aerodrome, Christchurch, New Zealand

Station constructed in 1937

Latitude: 43°29' South
Longitude: 172°32' East

Elevation: 123 feet

Aerodrome reference temperature (January): 22.4°C

Little America V, Kainan Bay, Antarctica

Station dedicated 4 January 1956

Latitude: 78°16' South
Longitude: 163°28' West

Elevation: 43 feet

Annual mean temperature: -23.5°C
Annual mean wind velocity: 15.3 knots

Marie Byrd Station, Marie Byrd Land, Antarctica

Station dedicated 1 January 1957

Latitude: 79°59' South
Longitude: 120°01' West

Elevation: 4,969 feet

Annual mean temperature: -28.0°C
Annual mean wind velocity: 15.9 knots

McMurdo Sound Station, Ross Island, Antarctica
(Williams Field)

Station dedicated 16 February 1956

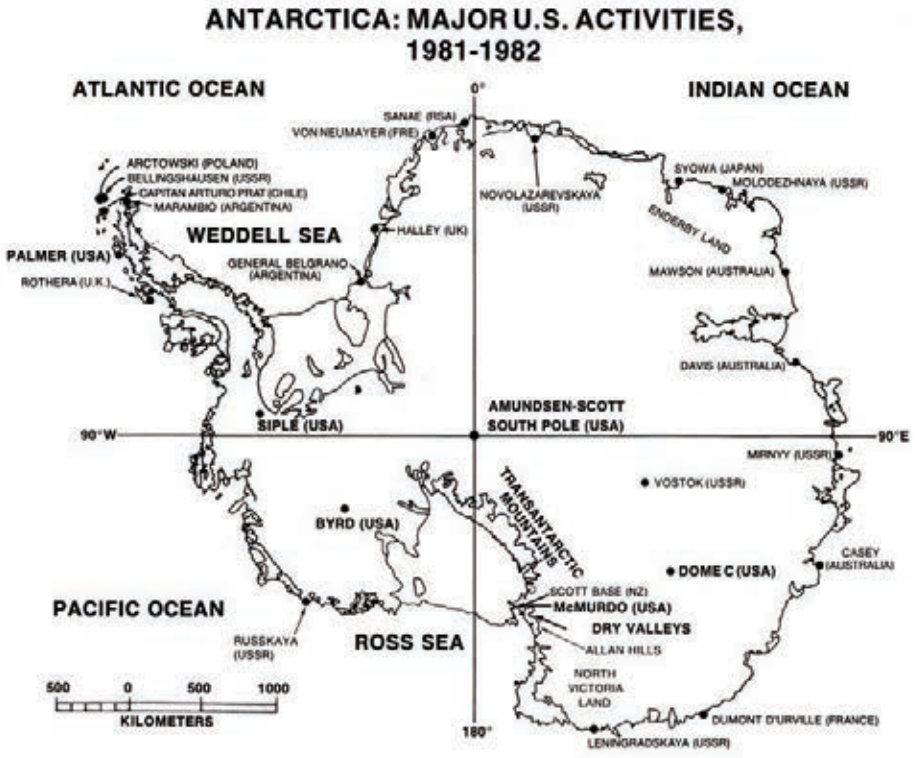
Latitude: 77°51' South
Longitude: 166°37' East

Elevation: 95 feet

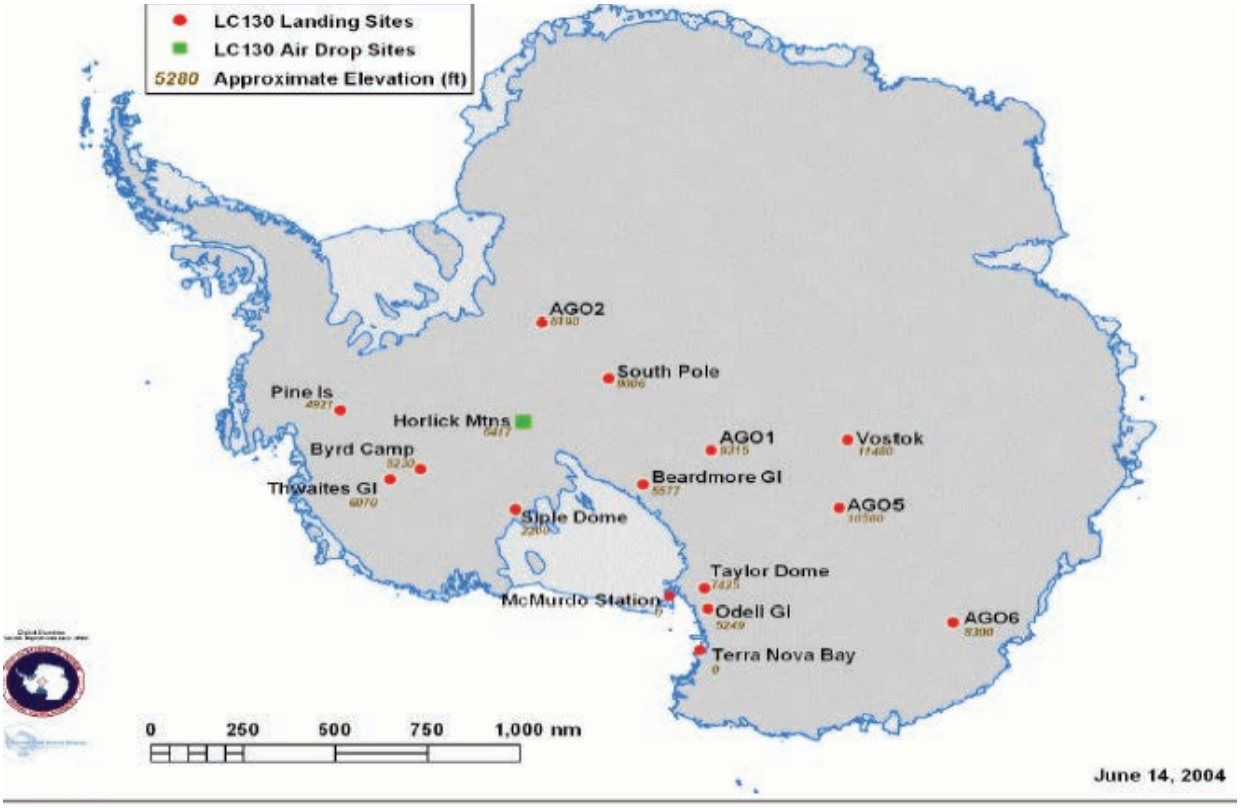
Annual mean temperature: -17.5°C
Annual mean wind velocity: 11.6 knots

SOURCES: Bulletin, U.S. Antarctic Project Officer, "Supplement," ca. 1963; Plan, United States National Committee for the International Geophysical Year, "Antarctic Program," Apr 56; Website, Airports-Worldwide, "Christchurch International Airport," 2005; Rpt, Capt Alexander E. Anthony, Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," Sep 66 (K490.04-1, IRIS 00508382); Mean temperature and wind velocity for Little America V extrapolated from Rpt, Herfried C. Hoinkes, University of Innsbruck, Austria, "Radiation Budget at Little America V, 1957," ca 1962.

MAP 2



MAP 3
ANTARCTIC SITES: As of 2004



2004 – 2005 LC-130 Landing and Airdrop Sites

Location	Latitude	Longitude	3-Letter Designator	Alpha Code
Beardmore Glacier	84.00S	164.50E	BDM	Y
Byrd Surface Camp	80.01S	119.57W	NBY	T
Horlick Mountains	85.38S	121.00W	HLK	L
Long Duration Balloon	TBD	TBD	LDB	B
McMurdo Station	77.85S	166.67E	ZCM	M
Odell Glacier	76.66S	159.95E	ODL	D
Pine Island	77.50S	95.93E	PNE	N
Siple Dome	81.66S	149.02W	SDM	S
South Pole Station	90.00S	139.27E	NPX	P
Taylor Dome	77.79S	158.79E	TDM	E
Terra Nova Bay	74.69S	164.12E	TNB	I
Thwaites Glacier	78.50S	118.50W	THW	G
Vostok	78.47S	106.82E	VOS	V

SOURCE: Pamphlet, NSF US Antarctic Program, "2004-2005 Antarctic Air Operations Planning Summary," ca Jun 04.

GAZETTEER ADDENDUM
(HOME STATION LIST)

US Pacific Command	Hickam Air Force Base, Hawaii
US Transportation Command	Scott Air Force Base, Illinois
Air Mobility Command	Scott Air Force Base, Illinois
Military Air Transport Service, redesignated Military Airlift Command	Scott Air Force Base, Illinois
Pacific Air Forces	Hickam Air Force Base, Hawaii
Strategic Air Command	Offutt Air Force Base, Nebraska
Tactical Air Command	Langley Air Force Base, Virginia
Eighteenth Air Force (1951-1957)	Donaldson Air Force Base, South Carolina
Eighteenth Air Force (2003-)	Scott Air Force Base, Illinois
Fifteenth Air Force	Travis Air Force Base, California
Twenty-First Air Force	McGuire Air Force Base, New Jersey
Twenty-Second Air Force	Travis Air Force Base, California
George C. Kenney Warfighting Headquarters (Provisional)	Hickam Air Force Base, Hawaii
Tanker Airlift Control Center	Scott Air Force Base, Illinois
834th Airlift Division	Hickam Air Force Base, Hawaii
Naval Air Transport Wing, Pacific	Moffett Field Naval Air Station, California
22d Bombardment Wing, redesignated 22d Air Refueling Wing	March Air Force Base, California

60th Military Airlift Wing, redesignated 60th Air Mobility Wing	Travis Air Force Base, California
61st Military Airlift Support Wing	Hickam Air Force Base, Hawaii
62d Military Airlift Wing, redesignated 62d Airlift Wing	McChord Air Force Base, Washington
63d Troop Carrier Wing	Donaldson Air Force Base, South Carolina
63d Military Airlift Wing, redesignated 63d Airlift Wing	Norton Air Force Base, California
109th Airlift Wing	Stratton Air National Guard Base, New York
314th Troop Carrier Wing	Sewart Air Force Base, Tennessee
349th Military Airlift Wing	Travis Air Force Base, California
436th Military Airlift Wing, redesignated 436th Airlift Wing	Dover Air Force Base, Delaware
438th Military Airlift Wing	McGuire Air Force Base, New Jersey
445th Military Airlift Wing (Associate)	Norton Air Force Base, California
445th Airlift Wing	Wright-Patterson Air Force Base, Ohio
452d Air Mobility Wing	March Air Reserve Base, California
463d Airlift Group	Little Rock Air Force Base, Arkansas
1501st Air Transport Wing	Travis Air Force Base, California
1608th Air Transport Wing	Charleston Air Force Base, South Carolina
Air Development Squadron Six	Quonset Point Naval Air Station, Rhode Island
Antarctic Development Squadron Six*	Point Mugu Naval Air Station, California

*Actual redesignation was 1969, whereas the move occurred ca 1974.

ACRONYM LIST

A

AEF	Air and Space Expeditionary Force
AEG	Air Expeditionary Group
AETF	Air and Space Expeditionary Task Force
AF	Air Force
AFB	Air Force Base
AFHRA	Air Force Historical Research Agency
AG	Airlift Group
AIROPFAC	US Air Operations Facility
ALCE	Airlift Control Element
ALD	Airlift Division
ALSG	Airlift Support Group
AMC	Air Mobility Command
AMOG	Air Mobility Operations Group
AMS	Air Mobility Squadron
AMSS	Air Mobility Support Squadron
AMW	Air Mobility Wing
ANG	Air National Guard
ANGB	Air National Guard Base
ANZUS	Australia, New Zealand, and United States
APS	Aerial Port Squadron
ARW	Air Refueling Wing
ASA	Antarctic Support Associates
ATW	Air Transport Wing
AW	Airlift Wing
AWLS	all weather landing system

B

BTU	British Thermal Unit
BW	Bombardment Wing

C

CDS	container delivery system
CNSFA	Commander, Naval Support Force, Antarctica
CVR	center vertical restraint

D

Det	detachment
DEW	Distant Early Warning

E

EAS	Expeditionary Airlift Squadron

F

F	Fahrenheit
FCC	Functional Component Command
FSRT	firm scheduled return time

G

GCA	ground controlled approach
GDSS	Global Decision Support System
GTPU	gas turbine power unit

H

HQ	Headquarters

I

IGY	International Geophysical Year
IRIS	inferential retrieval and indexing system

J

JA/ATT	Joint Airborne/Air Transportability Training
JATO	jet-assisted take-off
JTF	Joint Task Force

M

MAC	Military Airlift Command
MARS	Military Affiliate Radio System

MASS	Military Airlift Support Squadron
MASW	Military Airlift Support Wing
MATS	Military Air Transport Service
MAW	Military Airlift Wing

N

NAF	Naval Air Facility
NAS	Naval Air Station
NATWP	Naval Air Transport Wing, Pacific
nm	nautical mile
NSF	National Science Foundation
NSFA	Naval Support Force, Antarctica

O

OL	operating location

P

PACAF	Pacific Air Forces
PACE	Pacific Airlift Center
PAR	precision approach radar
PAX	passengers
PSR	point of safe return

R

RNZAF	Royal New Zealand Air Force

S

SAAM	special assignment airlift mission
SAC	Strategic Air Command
SATCOM	satellite communications
SFA	Support Forces Antarctica
SSB	single side-band
SUPS	Supply Squadron

T

TACAN	tactical air navigation
TACC	Tanker Airlift Control Center
TCS	Troop Carrier Squadron
TCW	Troop Carrier Wing
TALCE	tanker airlift control element

U

UHF	ultra-high frequency
USAF	United States Air Force
USAP	United States Antarctic Program

V

VXE-6	Air/Antarctic Development Squadron Six

W

WINFLY	winter fly in

SELECTED BIBLIOGRAPHY

BOOKS

Dufek, Rear Admiral George J., *Operation Deepfreeze*, New York: Harcourt, Brace and Company, 1957.

Klotz, Frank G., *America on the Ice: Antarctic Policy Issues*, Fort McNair, Washington DC: National Defense University Press, 1990.

National Science Foundation, *Flight to the South Pole, The New Age of Antarctic Exploration and Research*, Washington DC: 1979.

STUDIES/MONOGRAPHS

63 TCW History Office, "Seven Antarctic Years (Historical Resume of the Performance of the 63d Troop Carrier Wing in 'Operation Deep Freeze.')," ca 1963.

Anthony, Capt Alexander E., Jr., 18 AF, "The Air Force in Antarctica--The First Decade, 1947-1957," (K490.04-1, IRIS 00508382) Sep 66.

Bazzell, Anne M., 834 ALD History Office, "Antarctica: Down to the Ice," Jul 81.

Dater, Henry M., Staff Historian, US Antarctic Projects Officer, "Aviation in the Antarctic," Jul 59.

ARTICLES

Belz, Edward J., "MAC's Role in Deep Freeze," *Air University Review*, 1972.

Conner, Lt Col Leland W., 834 ALD Assistant Director of Operations, "Filling the Antarctic Square," *Airlift*, Summer 86.

Dufek, Rear Admiral George J., USN, "What We've Accomplished in Antarctica," *The National Geographic Magazine*, Vol. CXVI, No 4, Oct 59.

Huffman, Jerry W., National Science Foundation, "Williams Field: The History of an Icy Aerodrome," *Antarctic Journal of the United States*, Jun 83.

Kerr, 1Lt Peter, "Deep Freeze: Air Force Supplies Antarctica Mission," *Airman*, Feb 98.

Kokojan, SSgt Herman J., "Antarctic Summer," *Airman*, Apr 75.

Leiser, Gary, "Down to the Ice," US Air Force Museum's *The Friends Journal*, Winter 92.

Loftus, JOCM Leo, USN, "Deep Freeze: The Air Force in Antarctica," *The Airman*, Jul 65.

Mann, Arnold J., "McMurdo Airdrop," *Air Force Magazine*, Jan 90.

Nordwall, Bruce D., "Aviation on Ice Unlocks Antarctica," *Aviation Week & Space Technology*, 25 May 98.

"Prisoner at Earth's End," *People Magazine*, 1 Nov 99.

Roberts, MSgt Chuck, "Operation Deep Freeze, Airmen Aid Researchers in Thawing Secrets of the Universe," *Airman*, Apr 05.

Wilcox, Col Frank H., MATS Chief of Safety, "Deepfreeze V," *The MATS Flyer*, Jan 60.

AFTER-ACTION REPORTS
(presented chronologically)*

Task Force 43, "Command Task Force 43 Narrative, Deep Freeze I Summary of Operations," ca 1956.

Ellen, Lt Col Cicero J., USAF Task Force Commander, "Operation Deep Freeze Phase IV," n.d.

Bridges, Lt Col Dewey R., USAF Task Force Commander, "Final Report: Operation Deep Freeze Sixty," n.d.

Turk, Lt Col Wilbert, 61 TCS Commander, "Mission Report, Operation Ice Flow," (K-WG-314-SU-OP, IRIS 455426) 15 Mar 60.

Frost, Lt Col Foy B, USAF Task Force Commander, "Final Report: Operation Deep Freeze Sixty One," n.d.

*Not a comprehensive list. Other after-action reports undoubtedly exist.

Frost, Lt Col Foy B, USAF Task Force Commander, "Final Report: Operation Deep Freeze 1962," 25 Jan 62.

Frost, Lt Col Foy B, USAF Task Force Commander, "Final Report: Operation Deep Freeze 63," n.d.

Clarke, Lt Col Russell C., USAF Task Force Commander, "Final Report: Deep Freeze 64," n.d.

Coffee, Lt Col Robert D., USAF Task Force Commander, "Final Report: Deep Freeze 65," n.d.

Coffee, Lt Col Robert D., USAF Task Force Commander, "Final Report: Deep Freeze 66," n.d.

Achille, LCDR Frank A., Task Unit Commander, "Report of Operation Deep Freeze 67," n.d.

Huf, Lt Col Robert C., Mission Commander, "Summary of 438 MAW Support in Operation Deep Freeze 69," 20 Nov 68.

Stovall, Lt Col Buford E., Mission Commander, "Summary of 438 MAW Support-Operation Deep Freeze 70," 26 Nov 69.

McKone, Lt Col Joseph F., USAF Mission Commander "Final Report-Operation Deep Freeze 71," 30 Nov 70.

Hewitt, Lt Col William W., USAF Mission Commander, "Deep Freeze 72," 11 Nov 71.

Conner, Lt Col Leland W. C., 834 ALD Assistant Director of Operations, "Mission Commander's Report-Deep Freeze," 20 Apr 84.

Dudley, Maj William H., Commander, Det 2 619 MASS, "Deep Freeze 84 After Action Report," 2 Jan 84.

Conner, Lt Col Leland W. C., 834 ALD Assistant Director of Operations, "Mission Commander's Report-Deep Freeze 85," 4 Feb 85.

Conner, Lt Col Leland W. C., 834 ALD Assistant Director of Operations, "Deep Freeze Report," 21 Jan 86.

Henry, Lt Col Patrick M., 834 ALD Assistant Director of Operations, "Mission Commander's Report-Deep Freeze 87," 31 Dec 86.

Beattie, Lt Col John S., Det 2 619 MASS Commander, "Deep Freeze After Action Report," 12 Dec 86.

Henry, Lt Col Patrick M., 834 ALD Assistant Director of Operations, "Mission Commander's Report-Deep Freeze 88," 23 Dec 87.

Boyle, Lt Col Patrick M., 834 ALD Assistant Director of Operations, "Mission Commander's Report-Deep Freeze 89," ca Dec 88.

Krechowski, Lt Col William H., 834 ALD Assistant Director of Operations, "MAC Mission Commander Report-Deep Freeze 90," 5 Jan 90.

Meggers, Lt Col George E., 22 AF Chief of Aircrew Standardization and Evaluation, "Mission Commander's Report-Deep Freeze 93," 7 Dec 92.

Frasz, Lt Col Russell J., 20 AS Director of Operations, "Operation Deep Freeze 95 After Action Report," 25 Nov 94.

Hergesell, Lt Col Gregory L., 20 AS Director of Operations, "After Action Report, Operation Deep Freeze 96," 1 Dec 95.

Eshleman, Lt Col Brock W., 20 AS Director of Operations, "After-Action Report, Operation Deep Freeze 97," 16 Dec 96.

Saburro, Col Richard M., Deep Freeze Commander, "Operation Deep Freeze End of Season Report," 15 Aug 98.

Saburro, Col Richard M., Deep Freeze Commander, "Operation Deep Freeze Consolidated Department of Defense End of Season Report, 1988-1999 Season," 15 Aug 99.

Saburro, Col Richard M., Deep Freeze Commander, "Operation Deep Freeze Consolidated Department of Defense End of Season Report, 1999-2000 Season," 5 May 00.

Maynard, Col Joel R., Deep Freeze Commander, "Operation Deep Freeze Consolidated Department of Defense End of Season Report, 2000-2001 Season," 26 Aug 02.

139 AS Director of Operations, [spreadsheets for Operation Deep Freeze LC-130 stats 2001 to 2006], 16 Mar 06.

INTERVIEWS

Dudley, Capt William H., Det 2 619 MASS Commander, 1 Dec 82.

Dunbar, Lt Col Daniel J., ANG Detachment 13 Operations Officer, 22 Aug 01 (two sets of notes from interview only).

Eshleman, Lt Col Brock W., 20 AS Assistant Director of Operations, 10 Dec 96.

Fitzpatrick, Major Charles E. III, 63 MAW Combat Tactics and Techniques, ca 17 Jun 87.

Galyen, Lt Col James M., 14 MAS Commander, 14 Jul 82.

Kalber, Lt Col Mark, National Guard Bureau, 2 Apr 98 (notes from interview only).

Penn, Lt Col Timothy S., former ANG Det 13 Commander, and LaPointe, TSgt Drew, former member ANG Det 13, 24 Mar 06 (notes from interview only).

WEBSITES

US Antarctic Program.

Antarctic Sun, US Antarctic Program.

US Naval Historical Center.

Waldron, Cmdr (Ret.) James Edgar, "Flight of the Puckered Penguins," Apr 96, located on Website, University of Canterbury New Zealand, "Gateway Antarctica," ca Oct 05.

OTHER

Memo for Record, SMSgt Steven L. Stearns, ANG Staff Historian, "Det 13, Christchurch, New Zealand [report of visit and notes from four interviews]," 30 Sep 00.

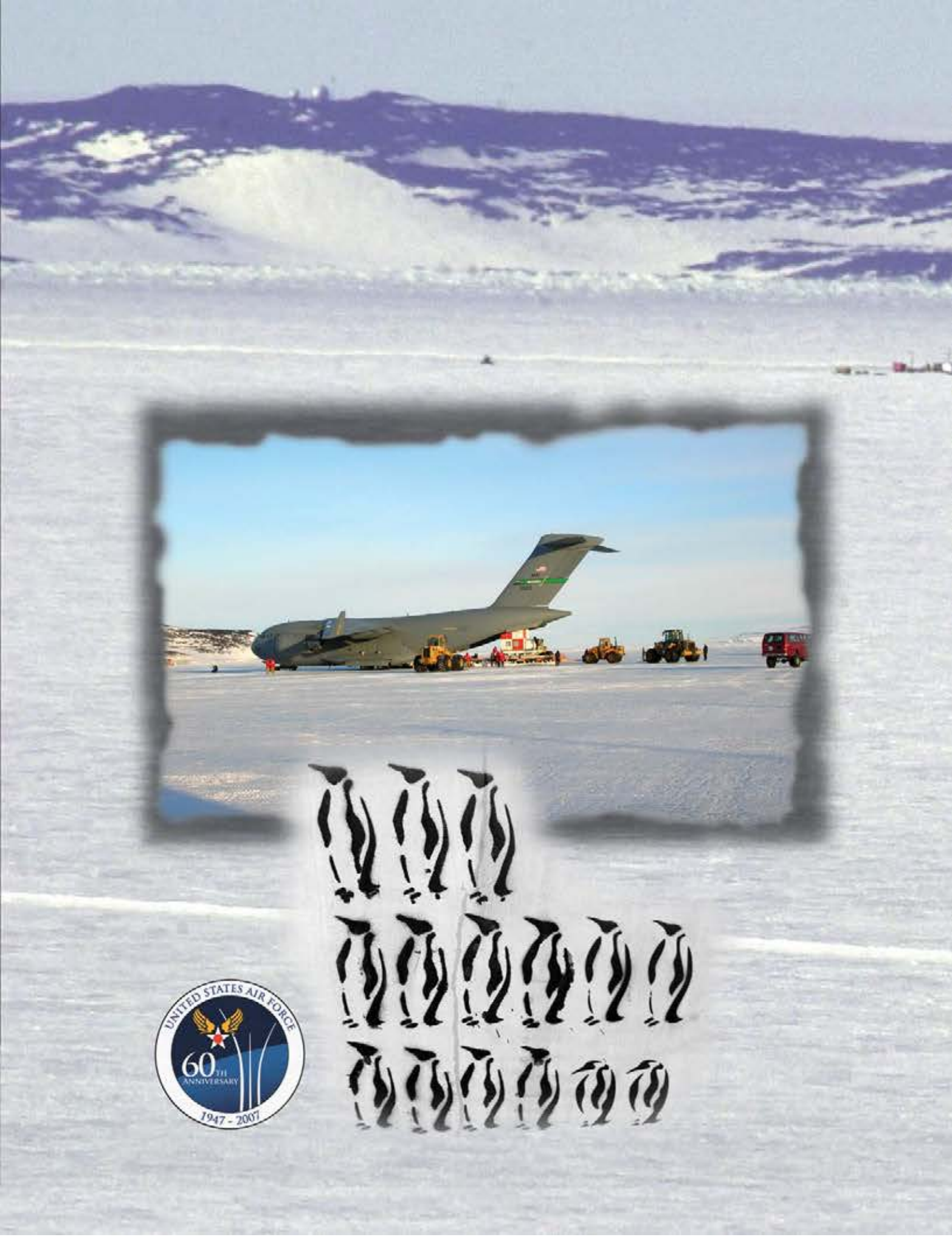
Pamphlet, NSF, "United States Antarctic Program Participant Guide, 2004-2006 Edition," ca Jan 04.

Photo 100: McMurdo Sound Station, Antarctica, as seen from a C-17A Globemaster III in November 2004. The research station sets on Ross Island with the annual sea ice clearly visible at the bottom of the photograph. (Photo from National Science Foundation)

Back Cover

Photo 101: Personnel unload a new microwave landing system from a C-17 parked on the annual sea ice runway near McMurdo Sound Station, Ross Island, Antarctica in 2005. (Photo from National Science Foundation)

Photo 102: Members of the 452d Air Mobility Wing, March Air Reserve Base, California, stenciled mission accomplishment penguins on the nose of the C-141C Starlifters in DEEP FREEZE 2001-02. Each penguin with its beak raised represents a completed resupply shuttle mission flown from Christchurch, New Zealand, to McMurdo Sound Station at Ross Island, Antarctica. The penguins with their heads turned down are referred to as a "boomerang" and represent the missions that aborted because of weather, maintenance, or communications problems.


UNITED STATES AIR FORCE
60TH ANNIVERSARY
1947 - 2007