

United States aircraft losses in Antarctica

PETER J. ANDERSON
*Office of Polar Programs
National Science Foundation*

Much of the success of the U.S. program of exploration and scientific investigation in Antarctica since World War II is attributable to the mobility provided by aviation. The use of fixed wing airplanes and helicopters enables explorers and scientists to expand their horizons while compressing the time required to investigate new areas and to get to existing stations, especially inland.

While aviation contributes to the success of the U.S. effort in Antarctica, this contribution has not been without significant losses. Since the beginning of *Operation Highjump*, in 1946, 40 U.S. scientists and support personnel have died in Antarctica; 29 of them died in aircraft accidents. In all, 20 helicopters and 30 fixed wing airplanes have been destroyed while flying in support of U.S. antarctic programs. This paper reports in detail the U.S. aircraft losses during operations in Antarctica from 1946 to the end of the *Deep Freeze 73* summer season in March 1973.

In the 28 years between the end of World War II and 1973, the United States sent 22 expeditions to Antarctica: U.S. Navy Antarctic Developments Project (*Operation Highjump*), 1946-1947; Second U.S. Navy Developments Project (*Operation Windmill*), 1947-1948; the U.S. Navy Antarctic Expedition (USS *Atka*), 1954-1955; the U.S. Air Force Electronics Test Unit, 1957-1958; and 18 *Operation Deep Freeze* expeditions, from 1955 to 1973.¹ The *Deep Freeze* expeditions were conducted by the Department of Defense to provide logistics support for the U.S. Antarctic Research Program, which is managed and funded by the National Science Foundation.

Each of these expeditions used aircraft. These ranged from the small, single-engine DeHavilland UC-1 Otter to the huge, four-engine Douglas C-133. Each expedition except *Operation Deep Freeze 68* experienced airplane or helicopter losses.

Mr. Anderson was technical editor at the Washington, D.C., office of *Operation Deep Freeze*, from 1970 to 1972, and assistant information officer, Office of Polar Programs, during 1972-1973.

¹ Additionally, one privately financed expedition from the United States, the Ronne Antarctic Research Expedition, operated in the Antarctic Peninsula during 1947-1948. Led by Commander (later Captain) Finn Ronne, USNR, the expedition was based on Stonington Island and consisted of 30 men and 2 women, one ship, and three airplanes on loan from the Office of Research and Development, U.S. Army Air Forces (Bertrand, 1971).

The early days

Aircraft were used in Antarctica by U.S. nationals prior to 1946. On November 16, 1928, Carl Ben Eielson, pilot, and an Australian, Sir Hubert Wilkins, observer, made the first airplane flight in Antarctica.² Their two Lockheed Vegas were based on Deception Island and were used to explore the Antarctic Peninsula (Grierson, 1964).

Between 1928 and 1941, seven aircraft-supported expeditions were sent to Antarctica by the United States: two Richard E. Byrd expeditions, four Lincoln Ellsworth expeditions, and the U.S. Antarctic Service Expedition, led by Byrd.

The First Byrd Antarctic Expedition, from 1928 to 1930, had three airplanes: a Ford trimotor, *Floyd Bennett* (NX 4542); a Fairchild folding wing monoplane, *Stars and Stripes* (NX 8006); and a Fokker Super Universal monoplane, *Virginia* (NC 4453), which was abandoned after wind gusts up to 150 miles-per-hour blew it away from a frozen lake in the Rockefeller Mountains east of Little America on March 14, 1929 (Byrd, 1930). The Second Byrd Antarctic Expedition, from 1933 to 1935, brought four airplanes to Little America II: a Curtiss-Wright Condor twin-engine biplane equipped with skis and floats, *William Horlick* (NR 12384); a Pilgrim single-engine monoplane, *Miss American Airways* (NC 74N); a single-engine Fokker F-14 monoplane, *Blue Blade* (NC 331N); and a Kellett autogyro, *Pep Boy's Snowman!* (NR 2615), the first rotary wing airplane to be used in polar regions (Byrd, 1935). The Fokker crashed on March 13, 1934, and the Kellett autogyro crashed on September 28, 1934, both at Little America. The Ford and Fairchild airplanes from the 1928 to 1930 expedition were recovered and returned to the United States in 1935, along with the second expedition's Condor and Pilgrim (Bertrand, 1971). The Condor was damaged while loading on a ship for the return voyage and scrapped upon its return to the United States (Matthews, 1967).

Lincoln Ellsworth made three successive attempts in the southern hemisphere summers of 1933-1934, 1934-

² The first person to be airborne in Antarctica was Captain Robert F. Scott, on February 4, 1902, in the tethered balloon, *Eva*, which was supplied by the British War Office. The same day, Ernest Shackleton went aloft and took the first aerial photographs at an altitude of about 800 feet (Scott, 1905).



Douglas LC-117Ds from Operation Highjump to the early 1960s, were the principal airplanes used in U.S. antarctic expeditions. They were replaced by LC-130s.

U.S. Navy

1935, and 1935-1936, to fly across Antarctica in a Northrop Gamma all-metal, cantilever, low wing monoplane, *Polar Star* (NR 12269). On the first attempt, in January 1934, *Polar Star* was damaged when sea ice broke up in the Bay of Whales. The plane needed factory repairs. The second attempt was unsuccessful when engine damage and bad weather delayed the flight until the summer season had passed. On the third attempt, Ellsworth and Herbert Hollick-Kenyon, pilot, successfully flew from Dundee Island to within 16 miles of Little America II before the airplane's fuel ran out. Between November 23 and December 5, 1935, the pair flew 2,200 miles, 1,200 miles of which was over previously unexplored territory. Four stops were made enroute (Bertrand, 1971).³

Ellsworth returned to Antarctica in 1938-1939 with two airplanes: an all-metal Northrop Delta monoplane (NC 14267) and a smaller Aeronca two-seat scouting plane (NR n/a). Both were equipped with wheels, skis, and pontoons. The expedition ended when a man was seriously injured, and was forced to sail for Tasmania, where hospital care was available (Bertrand, 1971).

The last of the U.S. pre-World War II expeditions, and the first official expedition since the 19th century Wilkes expedition, was the U.S. Antarctic Service Expedition, from 1939 to 1941, led by Byrd and strongly supported and followed by President Franklin D. Roosevelt (Bertrand, 1971). Four airplanes were used by the expedition: a Barkley-Grow T8P-1 two-engine seaplane (NC 18470) was carried on the USS *Bear* for ice recon-

naissance; two Curtiss-Wright Condor (U.S. Navy R4C-1) twin-engine biplanes, one (Buero 9584)⁴ for West Base (Little America III) and the other (Buero 9585) for East Base (Stonington Island); and one single-engine Beechcraft D.17A biplane (NC 20778) stationed at West Base. The Little America III Condor was abandoned in January 1941 after an engine burned while the airplane was being used to resupply a trail party at 78°30'S. 157°30'W. The Stonington Island Condor was abandoned on Watson Island (then known as Mikkelsen Island), after being used to evacuate East Base in March 1941 (Matthews, 1967). The deteriorating international situation in 1941 caused an early withdrawal of the U.S. Antarctic Service Expedition (Bertrand, 1971).

U.S. Navy Antarctic Developments Project

Operation Highjump (1946-1947) remains the largest expedition ever sent to Antarctica by any nation. It consisted of 4,700 men, 19 airplanes, 7 helicopters, and 13 ships. The aircraft included six Martin PBM-5 Mariner seaplanes, six Douglas R4D transport planes equipped with skis and wheels, seven Sikorsky helicopters, two Grumman J2F-6 amphibians (built by Columbia Aircraft Corporation) two Curtiss SOC seaplanes, two Convair OY observation planes, and one Noorduy JA-1 Norseman skiplane. The expedition's objectives were to: train personnel and test equipment under antarctic conditions;

³ The feat was not repeated until January 1956 when a P2V-2N from Navy Air Development Squadron Six (vx-6) flew from McMurdo Sound to the Weddell Sea and returned.

⁴ U.S. Naval aircraft are assigned Bureau of Aeronautics numbers, abbreviated Buero or, more recently, Buno. U.S. Army and Air Force aircraft are assigned serial numbers, abbreviated SN.

consolidate and extend the basis for U.S. claims in Antarctica, should claims ever be made; investigate problems in the selection of base sites and in their establishment, maintenance, and use; develop techniques for the establishment, maintenance, and use of air operations facilities on ice; extend the knowledge of hydrography, geography, geology, meteorology, and electromagnetic propagation in Antarctica; supplement the Navy's *Operation Nanook* in the Arctic in 1946.

The expedition accomplished most of its objectives. Icebreakers, used for the first time in Antarctica, were especially successful. Some 1.5 million square miles of the continent were seen, almost half for the first time, and about 15,000 aerial trimetrogon photographs were taken. Aircraft, fitted with skis and wheels, flew to a continental station from an aircraft carrier. Weather observations, which increased the knowledge of antarctic weather processes, were sufficient for twice-daily weather maps. About 70,000 aerial reconnaissance photographs were taken during 64 flights. At least 18 new mountain ranges were discovered and two ice-free areas near the Indian Ocean coast were photographed.

Several pieces of World War II military equipment were successfully adapted for use in exploration: the destroyer USS *Brownson* (DD-868) used its radar-equipped fire control director as a range finder and obtained elevation angles of peaks while doing offshore mapping; a magnetic airborne submarine detector was used as an airborne magnetometer for geological observations; and radar operators on the long range airplanes, after becoming more proficient in reading their radar scopes, were able to guide the planes to landings during poor visibility (Bertrand, 1971).

Four of the 26 aircraft assigned by the U.S. Navy to *Highjump* were lost—three during antarctic operations, and one while the expedition was returning to the United States. Also, the six R4Ds were abandoned at Little America and later went out to sea when the ice shelf calved.

The first loss was a PBM-5 Martin Mariner (Buno 59098). The seaplane departed its tender, USS *Pine Island* (AV-12), at 66°30'S. 98°00'W. on December 30, 1946, for photographic reconnaissance over the continent.

During the flight south the weather began to deteriorate. After 3 hours of flight the plane was in sight of the continent, but by then the ceiling was down to 1,000 to 500 feet with the sky completely overcast. Visibility was less than 2 miles. The PBM-5 entered a whiteout and shortly thereafter *Pine Island* lost radio contact.

As the PBM-5 reached the coast, under poor conditions, Lieutenant(jg) William H. Kearns, Jr., the copilot, took control of the airplane from the pilot, Lieutenant(jg) Ralph Paul LeBlanc, and climbed to 1,000 feet. The plane was sluggish due to icing, and the altimeters registered inconsistently. Ahead, the crew saw land rising into the overcast. Kearns decided to turn back and made

a shallow left turn. There was a crunching sound and a sharp jolt as the plane's hull scraped the surface. The plane bounced into the air. Kearns pulled more to the left and increased power to full throttle, but in an instant the plane exploded and crashed at 71°23'S. 98°45'W. on Thurston Island. Everyone but LeBlanc was thrown clear. Kearns, in spite of a broken arm, managed to rescue the semiconscious LeBlanc from the burning PBM. Killed in the crash were Ensign Maxwell A. Lopez, navigator, and Petty Officer Wendell K. Hendersin, radio operator. Two hours after the crash Petty Officer Frederick Williams, engineer, also died. Survivors other than LeBlanc and Kearns were Petty Officer Owen McCaety, photographer, Petty Officer William Warr, mechanic, Petty Officer James Robbins, radio operator, and Captain Henry H. Caldwell, captain of the *Pine Island*, an observer on the flight. The dead were buried at the crash site.

When the Mariner became overdue, search or rescue was impossible because of the weather. The first search flight could not be launched until the evening of January 5, 1947. It returned a few hours later when weather closed in to the south. The same happened on the following 4 days.

Searching for better weather, Captain George Dufek, commander of the eastern group of *Operation Highjump*, ordered *Pine Island* westward to 67°S. 104°W. On January 11 a flight was launched and the survivors were spotted while the search plane was returning to the ship. A message was dropped to the survivors informing them that open water was 10 miles to the north. When the survivors signaled they could walk that far, the search crew dropped flags to mark the way, and then returned to the ship to refuel.

The third PBM aboard *Pine Island*, a spare assembled after the crash, had been launched when the wreckage was first sighted. It flew to Thurston Island and landed in the open water. Two men went ashore, broke through the waist-deep snow to the survivors, and helped them to the coast. Fog closed in after they reached the rescue plane, and it was 8 hours before they could take off for *Pine Island*. On January 12 the survivors finally reached the ship (Bertrand, 1971).

An investigation concluded that unfavorable weather conditions and the pilots' inexperience at polar flying were to blame for the crash (U.S. Navy Task Force 68, 1947).

After recovering the survivors of the PBM crash and transferring all but Captain Caldwell to the destroyer USS *Brownson* for return to the United States, *Pine Island* was scheduled to continue eastward along the Eights Coast. At the request of Rear Admiral Richard E. Byrd, officer in charge of the expedition, the ship was delayed to photograph the coastline from Thurston Island westward to Mount Siple. On the afternoon of January 19, 1947, while at 68°10'S. 105°32'W., *Pine Island* launched an H03S-1 helicopter (Buno 57996) to



Pontoon-equipped Bell HTL helicopters were issued to U.S. Navy and U.S. Coast Guard icebreakers.

U.S. Navy

search for a place at the edge of the pack ice from which to launch the planes. Captain Dufek was on board as the observer. While the mission was in progress the weather worsened. During final approach to the ship, severe icing occurred on the main rotor blades and the helicopter began to settle rapidly. The helicopter landed in the water to avoid crashing into the ship. Captain Dufek and the pilot escaped unhurt; but without floats, the helicopter was lost (Bertrand, 1971).

Three days later, on January 22, 1947, a second helicopter was lost. An H03S-1 (Buno 57997) was aboard the aircraft carrier USS *Philippine Sea* for delivery to Little America. During the voyage the helicopter was used for ice reconnaissance. On take off for such a mission, the H03S-1 hit a downdraft after clearing the flight deck and crashed into the water at 59°33'S. 155°24'W. The crew was picked up at once (U.S. Navy Task Force 68, 1947).

The fourth and last aircraft lost during *Operation Highjump* was the spare Martin PBM-5 Mariner carried on the sea plane tender USS *Currituck* (AV-7). The final flights of the season took place on March 1, 1947, and, after recovering the two PBMs, *Currituck* steamed north toward Sidney, Australia. During a severe storm on March 9, the spare PBM (Buno n/a) broke loose and damaged another PBM (Buno 59143) when *Currituck* took a 28° roll to the right. When the ship rolled 32° to the left, the spare PBM went over the side (U.S. Navy Task Force 68, 1947).

U.S. Navy Second Antarctic Developments Project

*Operation Windmill*⁵ (1947-1948) was the third U.S. expedition to explore the coast of Wilkes Land (Bertrand, 1971). Carried out by Task Force 39 of the U.S. Pacific Fleet, it consisted of two icebreakers: USS *Burton Island* with one Sikorsky H03S-1 and one Bell HTL-1 helicopter, and USS *Edisto* with one H03S-1 and one Grumman J2F-6 amphibian airplane.

The expedition was ordered to further the objectives of *Operation Highjump* in training personnel and testing equipment, and to reaffirm U.S. interests in the region, check the installations and equipment left at Little America, and make detailed investigations of the coast inshore of the ice pack from the Ross Sea eastward to Bungee Lakes. Electromagnetic propagation conditions were to be investigated and information on geographic, hydrographic, oceanographic, geologic, and meteorologic conditions was to be collected.

The commonly accepted purpose of the expedition—to establish ground control for the extensive *Highjump* aerial photography—was included in the tentative concept of operations only.

⁵ *Windmill* was an unofficial nickname, coined by the news media, because of the expedition's use of helicopters (Bertrand, 1971).

The Task Force operated in the pack ice for 69 days in areas that, for the most part, were unsounded and inadequately charted for approximately half of the circumference of Antarctica. The expedition was the first to transit the ice pack to the continent in the vicinity of the Knox Coast and successfully exited the pack ice north-east of the Bay of Whales. Seventeen geodetic positions were established, and limited triangulation nets were laid out. Oceanographic observations were taken, fathometers provided continuous soundings, and ice positions and types were plotted. Additionally, field work in biology and geology was conducted, and meteorological observations were made (Bertrand, 1971).

The helicopters were used for ice reconnaissance and for landing shore parties for exploration and ground control. The amphibian was used for aerial photography and ice reconnaissance.

Both Sikorsky helicopters were damaged when the frames supporting the floats were broken on landing. The HTL-1 (Buno n/a) was destroyed on January 13, 1948, when it crashed while trying to land in a whiteout at Bunger Hills (65°21'S, 110°13'E.). No one was injured, and the ground control work continued after the helicopter crew returned to *Burton Island* (U.S. Navy Task Force 39, 1948).

U.S. Navy Antarctic Expedition

On December 1, 1954, the U.S. Navy icebreaker USS *Atka* sailed from Boston to Antarctica. *Atka's* mission was to conduct a reconnaissance of Antarctica in support of future defense requirements as well as scientific requirements created by the planned International Geophysical Year (IGY). *Atka's* crew was to establish ground control points for mapping, survey existing camps to determine whether they could be used during the IGY, and collect geological samples and weather and oceanographic data (USS *Atka*, 1955). Commander Glen Jacobsen, USN, was commanding officer of *Atka*.

Three Bell HTL-5 helicopters were assigned from Helicopter Unit Two (HU-2) under the command of Lieutenant Homer W. McCaw, Jr., USNR. The helicopters were used to assist in ship navigation, to carry men and material from ship to shore, for aerial photographic and visual surveys of potential station locations, and for training missions.

One helicopter (Buno n/a) was lost during ship-to-shore operations at Kainan Bay on January 22, 1955. Lieutenant(jg) John P. Moore took off from the ice shelf in a whiteout to return to the ship. He became disoriented, lost direction, and flew into the ice at full power. He died later that day from injuries sustained in the crash (USS *Atka*, 1955).

Operation Deep Freeze I (1955-1956)⁶

The Department of Defense supported the U.S. national program in Antarctica during the International Geophysical Year. Because most of the supplies would be delivered by sea, and because of the Navy's long association with the exploration of Antarctica, the Navy was given the main responsibility for logistics support but was authorized to call on the other services for support not available within the Navy (U.S. Navy Task Force 43, 1955).

The Navy created Task Force 43 within the U.S. Atlantic Fleet on February 1, 1955, to "implement the planned program in the Antarctic by conducting operations during the period 1954 to 1959 and subsequent thereto as directed." Operations included supplying logistics support for the International Geophysical Year effort, conducting mapping operations, including aerial photography for mapping, establishing permanent stations, and conducting scientific investigations (U.S. Navy Task Force 43, 1955).

The first year's operation was primarily for construction of two bases: Little America V and Naval Air Facility McMurdo (U.S. Navy Task Force 43, 1956a). The Navy also created a flying squadron to support antarctic operations. Air Development Squadron Six (vx-6) was formed at Naval Air Station Patuxent River, Maryland, on January 17, 1955. Its mission was to conduct operations in support of the Department of Defense responsibilities in connection with the United States Antarctic Program (Air Development Squadron Six, 1955).

Fifteen aircraft ultimately were assigned to vx-6 for use during *Deep Freeze I*: two wheeled R5D-3 Sky-master transports, two ski and wheel-equipped P2V-2N Neptune patrol bombers, two ski and wheel-equipped R4D-5/6 Dakota transports, two triphibian UF-1 Albatrosses, four ski and wheel-equipped UC-1 Otters, and three wheeled H04S-3 helicopters.

The R4D Dakotas and UF-1 Albatrosses were the only aircraft that did not reach Antarctica; they remained in New Zealand after trying to reach the continent. The Otters were new to the Navy: one had just been delivered from the DeHavilland factory in Canada; three were borrowed, and later purchased, from the Royal Canadian Air Force. The other aircraft had previous tours of service with the U.S. Navy.

Flying operations during *Deep Freeze I* in support of the IGY resulted in the loss of five aircraft. None of the

⁶ The original nickname assigned by the Navy to the Task Force 43 operation was *Project Longhaul*, indicative of the long logistics "pipeline" between the United States and Antarctica. Before operations began, the name was changed to *Operation Deepfreeze*. When the Amana Corporation notified the Navy of a copyright infringement, the name was changed further (about October 1956) to *Operation Deep Freeze*.

losses, however, occurred while accomplishing the primary aviation objectives of the season: nine long, exploratory flights from McMurdo Sound over the continent.

The first loss was a Sikorsky HO4S-3 helicopter (Buno 138519) which crashed in Port Lyttelton, New Zealand, on December 14, 1955. The helicopter had been unloaded from the USNS *Greenville Victory* (TAK-237), which had carried it from the United States to New Zealand, and Lieutenant Commander Glen Lathrop took off from the pier at Lyttelton to fly it to Royal New Zealand Air Force Station Wigram for servicing. The helicopter crashed on take off when the tail rotor control failed. Lathrop was not injured but the helicopter, destined for use by vx-6 at Naval Air Facility McMurdo, was destroyed (Air Development Squadron Six, 1956).

The second loss was a DeHavilland UC-1 Otter (Buno 142424), the one delivered to the Navy from the Toronto factory. This Otter arrived in the McMurdo Sound area via USS *Glacier* (AGB-4). It was used for several days to search for a suitable base site in the McMurdo Sound area. The Hut Point Peninsula and Winter Quarters Bay area eventually was selected.

On December 22, 1955, the Otter crashed on take off at about 77°15'S. 166°E., near Cape Bird, Ross Island. There were no fatalities but one passenger—Commander George R. Olliver—suffered a broken leg. Also aboard were Commander William M. Hawkes, pilot; Lieutenant Eric W. Weiland, copilot; and AD1 Edward Crandall, plane captain.

In a letter to the commanding officer of vx-6, Hawkes reported that he noticed something wrong with the controls on take off. They felt "spongy" and could not be moved forward of the neutral position. About 50 feet after take off, the Otter's skis brushed the snow and the airplane hit hard but flat. Both main ski struts were forced into the fuselage to such an extent that the

airplane was a strike⁷ (Hawkes, 1956). Removable parts were salvaged and the airplane floated out to sea on ice and it presumably sank.

The three other losses during *Deep Freeze I* were interrelated and occurred between February 3 and 10, 1956. Two of the losses resulted from search efforts after the first plane disappeared.

The sequence began on February 3 when a UC-1 Otter (Buno 144260) with a three-person crew—Lieutenant Commander Glen H. Lathrop, Jr., pilot, Lieutenant Paul A. Streich, copilot, and AD2 John H. Floyd, Jr., plane captain—was sent from Little America V to Mile 381, Army Navy Trail, to pick up a four-person traverse party (CD1 Roland Levesque, SVC George Moss, CD1 Alvah George Edwards, and PH2 Chester M. Stevens, Jr.) and return them to Little America V. About 2 hours after take off from the Marie Byrd Land pick up, the Otter started icing while flying at 3,000 to 4,000 feet. After 10 or 15 minutes, the ice continued to grow on the propeller and the airplane flew into the summit of a snow covered mountain on Edward VII Peninsula at 77°32'S. 154° 10'W. The impact of the crash was slight, and no one was injured (Air Development Squadron Six, 1956). Little America V received an SOS from the Otter, but the location of the crash and the number of survivors was not known.

The missing Otter plus one HO4S-3 helicopter had been the only aircraft at Little America V. To conduct the search, Rear Admiral George Dufek, the Task Force commander, ordered other Otters from McMurdo to Little America. On two successive attempts one was

⁷ A strike occurs when an aircraft is sufficiently damaged to be removed from the Navy inventory. An administrative strike occurs when an aircraft is retired.



DeHavilland UC-1 Otters supported traverses and short range logistics missions from 1956 to 1966.

U.S. Navy

forced back by weather. Finally an Otter was loaded on the USS *Glacier* to be delivered to Little America.

A P2V-2N (Buno 122466) Neptune, which had already returned to Naval Air Station Patuxent River, Maryland, was ordered back to Antarctica for the search. It took off with a parachutist on board who was to assist the survivors if a rescue plane could not land at the crash site. Enroute both engines failed in flight and it crashed in a remote jungle swamp in Venezuela (09°37' N. 62°15'W.) on February 8, 1956. The hull ruptured and both wings came off. The eight men on board were rescued by Venezuelan authorities, and electronic and special equipment was salvaged (U.S. Navy Task Force 43, 1956a).

On February 10, 1956, *Glacier* arrived at Little America V to deliver the Otter (Buno 144259) for the search flights. During offloading, a cable broke and the UC-1 plunged to the ice shelf and landed on its right wing and main landing gear. The fall damaged the wing extensively and fractured the fuselage. The airplane was judged a strike (Air Development Squadron Six, 1956).

The crash site was finally located on February 9 by another Otter flying from Little America V. A helicopter was sent out to recover the survivors, who had abandoned the wreck and walked 40 of the 110 miles back to Little America V.

The experience convinced Task Force officials of the need for a pararescue team, staffed by specially trained volunteers who could parachute to a crash site and assist the survivors until they were returned to base (Air Development Squadron Six, 1963). In October 1956 the chief of naval operations authorized the formation of the team, which still exists.

In June 1956, shortly after vx-6 returned to Naval Air Station Patuxent River, Maryland, the squadron was relocated to Naval Air Station Quonset Point, Rhode Island.

Operation Deep Freeze II (1956-1957)

During *Deep Freeze II*, Task Force 43 continued support of the two bases established in the previous season, and constructed new stations on the Knox Coast, on the Weddell Sea coast, in the Cape Adare area, at the South Pole, and in Marie Byrd Land. Also, an auxiliary facility was established near Beardmore Glacier to support air operations to the South Pole. The aircraft available to vx-6 were: four R4D Dakota transports, three P2V-7 Neptune patrol planes, one P2V-2 Neptune patrol plane, two R5D-3 Skymaster transports, ten UC-1 Otter utility planes, and three HO4S-3 helicopters.

The two UR-1L triphibians that did not reach Antarctica in *Deep Freeze I* were transferred from the squadron before deployment. Additionally, the U.S. Air Force supplied eight C-124 Cargomaster transports, which flew 50 tons of critically needed cargo and 50

passengers from New Zealand to McMurdo, and then airdropped about 500 tons of construction material and supplies at the South Pole and about 265 tons of drummed petroleum, oil, and lubricants at the Byrd Station site (U.S. Navy Task Force 43, 1956b).

The summer season began on October 16, 1956, when an R5D-3 flew from Christchurch to McMurdo. When the R5D-3 landed on the sea ice runway of McMurdo Sound, the signal was given for the other long range planes to proceed from New Zealand. After the planes had passed the point of safe return (PSR), a severe storm enveloped the McMurdo area. Since they had insufficient fuel to return to New Zealand, they were committed to flying into the storm and landing at McMurdo (U.S. Navy Task Force 43, 1957).

The first plane to arrive, on October 18, 1956, was a P2V-2N Neptune (Buno 122465) with Lieutenant David W. Carey, USNR, as pilot. Carey made a ground controlled approach from 12,000 feet to 300 feet in altitude and then elected to make a visual landing. With the landing gear down the plane began to turn to the right. The nose of the plane fell and the Neptune struck the snow on the nose and right wing. The plane was completely demolished. Carey, AD1 Marion O. Marze, the plane captain, and AT1 Charles S. Miller, a radioman, were killed. Captain Rayburn A. Hudman, USMC, leader of the pararescue team and a survivor of the Venezuela crash, died a few hours later (Air Development Squadron Six, 1957).

Four others on the plane were injured: Ensign Kenneth D. MacAlpine, USNR, copilot; Staff Sergeant Robert C. Spann, USMC, navigator; AD2 Clifford C. Allsup, USN, second mechanic; and AT2 Richard E. Lewis, USN, radioman.

While the dead and injured were being removed from the crash, the remaining airplanes arrived safely from New Zealand. The storm continued until October 25, preventing vx-6 operations into the interior.

Air Force C-124C Globemasters began flying to McMurdo on October 20, 1956. The third C-124C, which arrived on October 21, landed nose wheel first. When the propeller pitch was reversed, the nose wheel strut buckled and the airplane skidded to a halt, causing three propellers to strike the ice. The airplane was towed off the runway to the parking area.

Maintenance crews first thought the airplane a loss, but closer inspection led to a decision to repair it. A 16-man repair team was sent from the Air Force Air Materiel Command and the Douglas Aircraft Company to Christchurch on November 26 along with two plane-loads of parts and repair equipment.

On November 29 the repair team arrived at McMurdo on board a C-124C (SN 52-1015). It landed some 80 feet short of the runway, hit the snow bank at the end of the runway with its left main landing gear, and then landed on the ice runway, left landing gear making contact first. The left gear failed and collapsed, the nose

wheel blew out and the plane skidded to a halt as fire enveloped the entire forward section of the Globemaster. The pilot, Captain Warren J. Fair, escaped through a cockpit window using a rope to slide to the ground. He broke a leg as he slipped to the ground, and several members of the repair team sustained rope burns. The airplane was destroyed but most of the repair parts and equipment were saved (Anthony, 1960).

Four more losses were sustained during *Deep Freeze II*: two in the summer season and two during the winter. Near Ellsworth Station on December 31, 1956, a Bell HTL-5 helicopter (Buno n/a) assigned to USS *Staten Island* from detachment 31, Helicopter Utility Squadron One, was destroyed when the engine failed on take off and the helicopter crashed on the flight deck. A USS *Glacier* HO4S-3 helicopter (Buno 138595) from detachment 69, Helicopter Utility Squadron Two, crashed into the Ross Sea when its engine failed on January 19, 1957. Lieutenant Commander Charles Costanza, pilot, and Lieutenant(jg) John W. Erlewine, co-pilot, barely escaped from the helicopter, which quickly filled with water and sank (USS *Glacier*, 1957).

A third helicopter was lost on July 12, 1957. A vx-6 HO4S-3 (Buno 138580) was returning to McMurdo after participating in a routine pilot proficiency flight. It crashed short of McMurdo when its windshield frosted and visibility worsened from ice crystals in the air. Several men in the HO4S-3 and some firefighters were injured when the helicopter burned. AD2 Nelson R. Cole, USN, died from burns.

Finally, a UC-1 Otter (Buno 142426) was destroyed on August 31, 1957, at Little America V. The airplane had been tied down with double lines, but 80 mile per hour winds opened the tiedown rings and blew the airplane away.

Operation Deep Freeze III (1957-1958)

The first two *Deep Freeze* seasons were primarily devoted to station construction and initial stocking of supplies and equipment. *Deep Freeze III* was principally a resupply effort (U.S. Navy Task Force 43, 1958).

Aviation support was provided by 26 aircraft assigned to Air Development Squadron Six (vx-6) and eight C-124s from the U.S. Air Force 53rd Troop Carrier Squadron. Also, two helicopters were assigned to each icebreaker.

After the six aviation losses during the 1956-1957 season, *Deep Freeze III* was a welcome relief. Only one helicopter was destroyed.

Two helicopters from detachment 30, Helicopter Utility Squadron One (HU-1), were assigned to USS *Atka*: one HUL-1 (Buno 143144) and one HO4S-3 (138498). On December 1, 1957, the HUL-1 crashed on take off from the flight deck and caught fire. Ensign Sam Walling, the pilot, and two passengers quickly escaped but

the helicopter was destroyed. Flights were suspended until the wreckage was pushed over the side and the flight deck repaired (USS *Atka*, 1958).

Two days later *Atka's* second helicopter, the HO4S-3 crashed on the Ross Ice Shelf while enroute to Little America V with a load of passengers. There were no injuries, but the helicopter was out of commission for the remainder of the season. To permit *Atka* to complete her assignments, a helicopter from vx-6 was sent aboard (USS *Atka*, 1958).

U.S. Air Force Electronics Test Unit (1957-1958)

During *Deep Freeze III* a U.S. Air Force Electronics Test Unit was sent from Bolling Air Force Base, Washington, D. C., to Ellsworth Station, Antarctica, to test a Raydist electronic positioning system by surveying and photographing about 100,000 square miles within a 400-mile radius of Ellsworth Station. Commanded by Major James W. Lassister, the unit also supported field parties with its two ski-equipped C-47 airplanes (SNs 51134 and 59554) (U.S. Air Force Electronics Test Unit, 1957).

The unit left Bolling Air Force Base on October 1, 1957, and deployed to Ushuaia, Argentina. On October 16 it left Ushuaia and flew to Robert Island in the South Shetland Islands, where it refuelled from a fuel cache established by the Chilean Navy. Severe weather kept the unit on Robert Island until November 21, when it departed for Antarctica. The unit landed at Dolleman Island to wait for a storm to pass. Lassister and nine men reached Ellsworth Station on November 22; the second airplane, with Captain David W. Roderick and three men, reached Ellsworth Station on December 6.

The mapping project was completed by mid January and Lassister and his men left Antarctica on board *ARA General San Martin*, an Argentine icebreaker. The planes later were recovered and returned to the U.S. Air Force (U.S. Air Force Electronics Test Unit, 1958).

Operation Deep Freeze IV (1958-1959)

When the International Geophysical Year program in Antarctica was first conceived, *Deep Freeze IV* was to mark the termination of the program, a period for closing bases and returning scientific and support personnel to the United States. Instead, the research program was continued indefinitely, and *Deep Freeze IV* was concerned with resupply and consolidation. Wilkes and Ellsworth stations were transferred to Australia and Argentina, respectively, and Little America V was closed. Continuing to operate were McMurdo, Byrd, and Amundsen-Scott South Pole stations, and the joint U.S.-N.Z. station at Cape Hallett. The seasonal camps, such as Little Rockford and Beardmore Glacier, would be

activated as needed (U.S. Navy Task Force 43, 1959).

Aviation support again was provided by Air Development Squadron Six (25 aircraft of seven types) and the U.S. Air Force (ten C-124s from the 52nd Troop Carrier Squadron). The four icebreakers were assigned two helicopters each.

Five aircraft were lost in *Deep Freeze IV* accidents that killed eight men. In three of the accidents there were only minor injuries. The first accident, by a P2V-7N modified patrol bomber (Buno 140434), occurred on August 11, 1958, during an acceptance flight at Ontario, California, when a ski malfunctioned. The Neptune had been overhauled prior to deployment. There were no injuries but the plane was destroyed. Since the deployment to Antarctica was near and a replacement airplane was not available, this loss was not made up (Air Development Squadron Six, 1959).

On October 15, 1958, a U.S. Air Force C-124C Globemaster (SN 52-1017), 52nd Troop Carrier Squadron, departed Harewood Airport in Christchurch for Williams Field. It carried nine crewmembers, four Air Force passengers, general cargo, and provisions and mail to be parachuted to Hallett Station. While descending to the airdrop altitude near Hallett, the C-124C crashed into a hill near Cape Roget.

A major search was ordered when the Globemaster failed to reach McMurdo. The first contact with the survivors was when a second C-124C received a mayday message while enroute to McMurdo. The message reported six dead, seven survivors, and the approximate location. A P2V-7N failed to locate the survivors during an initial aerial search. An Otter and a helicopter were sent from McMurdo to Hallett Station and two

weasels from Hallett were sent toward the crash site. The helicopter, piloted by Lieutenant Commander E. A. Potter, was the first to reach the stricken airplane. It made two trips to Hallett to evacuate the survivors (Air Development Squadron Six, 1959a). Recovered later were the dead: Technical Sergeant Iman A. Fendley, Technical Sergeant Nathaniel Wallace, Staff Sergeant Leonard M. Pitkevitch, A1C Richard J. DeAngelo, A2C Robert L. Burnette, and A2C Kelly Slone.

An investigation blamed an error in navigation caused by poor to inaccurate maps and the reception of false radar returns (52nd Troop Carrier Squadron, 1958).

Two UC-1 Otters were lost during the summer season. The first (Buno 142427) initially was reported as an aircraft accident but later was classified as a ground accident. The Otter was supporting a scientific party taking observations on the Ross Ice Shelf on October 22, 1958. It made a landing, the scientists took their observations, and the Otter taxied to another site for more observations. During the taxiing the fuselage cracked. Although able to return to McMurdo, the airplane was not repaired and was struck from the Navy roster (Air Development Squadron Six, 1958).

The second Otter (Buno 144673) crashed after taking off from the Marble Point dirt runway. Lieutenant Harvey E. Gardner, pilot, and Lieutenant(jg) Lawrence J. Farrell, copilot, were on a logistics support mission from the Williams Air Facility at McMurdo to the Marble Point camp of the Naval Construction Battalion Reconnaissance Unit. After unloading, the Otter took off for the return flight to Williams Air Facility. As Lieutenant Gardner made a very steep left turn toward a glacier, the left wing hit a small knoll, and the airplane cart-



UH-2A Sprite helicopters, used for ice reconnaissance and for personnel and light cargo transport, were assigned to icebreakers in Antarctica.



The U.S. Air Force introduced ski-equipped C-130As to antarctic service in 1960. Two fuel bladders are in the foreground.

U.S. Navy

wheeled and crashed. Both Gardner and Farrell were killed (Air Development Squadron Six, 1959b). Investigators were unable to determine the cause of the crash. The usual turn on take off was to the right, away from the glacier (CNAL, 1959).

The final aircraft lost in *Deep Freeze IV* was a Sikorsky HRS-3 helicopter (Buno 144257) which was assigned to USS *Glacier* as part of Detachment 69, Helicopter Utility Squadron Two (HU-2). On February 12, 1959, Lieutenant Commander Ross W. Russell took the HRS-3 on a test flight after an engine change. About 3 minutes into the flight, the engine failed and the helicopter autorotated to make a crash landing on rough ice about 2,000 yards from the ship. The tail broke off on landing and the rotor blades smashed on the ice. The helicopter and engine could not be salvaged because of the inaccessibility of the crash site and pressing operational commitments. *Glacier* was attempting to free the beset M/V *Polarhav* in the Weddell Sea when the crash occurred (USS *Glacier*, 1959).

Operation Deep Freeze 60 (1959-1960)

With the evolution of the antarctic program from an IGY program to a continuing research and logistics program, the designation of the annual expedition was changed from Roman to Arabic numerals to reflect the current fiscal year. The Task Force 43 mission for *Deep Freeze 60* was primarily resupply. Aviation resources consisted of Air Development Squadron Six (21 aircraft of seven types), 9th Troop Carrier Squadron (ten C-124 Globemasters and two C-54 Rescuemasters), 61st

Troop Carrier Squadron (seven ski-equipped and one wheeled C-130 Hercules), and the eight helicopters assigned to the four icebreakers (U.S. Navy Task Force 43, 1960). The introduction of Air Force C-130s, Project Iceflow, presaged the revolution in logistics provided by turbine powered aircraft, both heavy transports and helicopters.

Two airplane losses occurred during the summer season, both R4D Dakotas assigned to Air Development Squadron Six. An R4D-5 (Buno 17163) crashed on September 15, 1959, while making a landing at Hallett Station. After the touchdown on the ice at Cape Hallett the starboard main landing gear collapsed. The airplane was declared a strike because it was not economical to repair in view of its age (Air Development Squadron Six, 1960a).

On Christmas Eve 1959, an R4D-8 (Buno 17154) crashed while attempting a landing in a whiteout at Byrd Station. Lieutenant Garland M. Reganar was on final approach when the Dakota stalled and the right wing dropped. Although Reganar applied power and used his rudder to compensate, the right wing hit the surface and broke. There were no injuries, but the airplane was destroyed (Air Development Squadron Six, 1960b).

Operation Deep Freeze 61 (1960-1961)

Task Force 43 attention this year was devoted to improving stations, living conditions, communications, weather forecasting, and operational safety, as well as

resupply (U.S. Navy Task Force 43, 1961). *Deep Freeze 61* also was the first field season conducted under the Antarctic Treaty.

Air Development Squadron Six again provided the bulk of aviation support (21 aircraft of eight types), supplemented by the U.S. Air Force 9th Troop Carrier Squadron (ten C-124s and two C-54s), and the U.S. Navy Helicopter Utility Squadrons One (HU-1) and Four (HU-4) which provided eight helicopters for the four icebreakers. VX-6 used its C-130BL Hercules transports for the first time—three in general logistics operations and one as a test bed. The latter C-130BL was flown by a composite crew of Navy, Air Force, and Lockheed personnel (Air Development Squadron Six, 1961).

Two aircraft were lost during *Deep Freeze 61*, although neither was assigned to Air Development Squadron Six. On October 31, 1960, a Lockheed wv-2 (Buno 126513) crashed and was destroyed while landing at McMurdo Station. Also known as an EC-121K, the wv-2 was a specially configured Super Constellation used in Project Magnet, an airborne survey of the earth's magnetic properties. At about 0630 hours, the wv-2 landed hard about 100 yards short of the runway, bounced into the air as the pilot tried to recover, and landed again about 50 yards short of the runway. The left main landing gear collapsed and the plane veered into the snowbank on the side of the runway tearing off the wing and breaking the fuselage behind the wings. Only two of the 23 men on board were seriously injured. At the time of the crash the copilot was flying while the aircraft commander was occupied with a landing gear warning light (Commander, Task Force 43, 1960).

The second aircraft loss of *Deep Freeze 61* was a Sikorsky HRS-3 helicopter assigned to detachment 12, Helicopter Utility Squadron One (HU-1), on board the USS *Staten Island* (AGB-5). The HRS-3 (Buno 130162) was flying off the Eights Coast on February 15, 1961, when its engine caught fire and exploded. The helicopter crashed at 72°30'S, 91°43'W. Neither the pilot, Lieutenant(jg) Jack C. Thorp, nor the copilot, Lieutenant(jg) Richard N. Franks, was injured. Due to the location of the crashed helicopter in a heavily crevassed area, and the adverse weather, the HRS-3 was declared a strike (USS *Staten Island*, 1961).

Operation Deep Freeze 62 (1961-1962)

Improvements in the logistics situation begun in *Deep Freeze 61* continued in *Deep Freeze 62*. A new Byrd Station was occupied, communications were improved by introducing single side band high frequency radios, and the PM-3A nuclear power plant was completed at McMurdo Station (U.S. Navy Task Force 43, 1962).

Aviation support was again provided by Air Development Squadron Six (22 aircraft of seven types), the U.S. Air Force 9th Troop Carrier Squadron (nine C-124C Globemasters and two SC-54 Rescuemasters), and the Navy Helicopter Utility Squadrons One (HU-1) and Four (HU-4). Introduced in *Deep Freeze 62* was a U.S. Army detachment of Bell UH-1B helicopters that supported topographic mapping projects by airlifting engineers to mountain peaks unattainable by other kinds of helicopters, thereby saving months of climbing (Air Development Squadron Six, 1962).

Sikorsky HUS-1 (LH-34D) Seahorse helicopters were used by VX-6 for short range logistics, personnel, and science support flights in the McMurdo Sound-dry valleys area. Many, including this one, were equipped with aerial cameras mounted above right cargo doors.



U.S. Navy

Two airplanes were destroyed in *Deep Freeze 62*. A Lockheed P2V-7LP Neptune, a former patrol bomber modified with two jet engines and a metal bomb bay fuel tank, crashed at Wilkes Station on November 9, 1961. The Neptune (Buno 140439) had arrived at Wilkes from Mirny Station after completing a magnetometer mission that originated at McMurdo Station. While taking off from the skiway at Wilkes Station the Neptune caught fire and crashed. Of the nine men on board only four survived. Killed were Dr. Edward C. Thiel, a geophysicist from the University of Wisconsin, Lieutenant Commander William D. Counts, copilot, Lieutenant(jg) Romauld P. Compton, navigator, AMH1 William W. Chastain, metalsmith, and ADR2 James L. Gray, flight engineer.

An investigation of the accident reported the cause as a collision with the ground shortly after take off following an intense, uncontrollable inflight fire that developed in the landing gear-bomb bay fuel tank area (Air Development Squadron Six, 1962). Also, the Neptune was subjected to stress at or exceeding the design limits of the airplane during its take off from an extremely rough skiway.

Three days later, on November 12, 1961, a Douglas R4D-8L Dakota (Buno 17219) was damaged beyond repair while landing in the Sentinel Mountains. The

pilot reported that he experienced a rough landing on the open field. During the rollout the left landing gear collapsed resulting in substantial damage to the airplane. Because of the crash location and the absence of repair facilities, the Dakota was declared not salvageable (Air Development Squadron Six, 1962).

Operation Deep Freeze 63 (1962-1963)⁷

The summer season of *Deep Freeze 63* was marked by the establishment of Eights Station at the base of the Antarctic (then Palmer) Peninsula, almost 1,400 miles from McMurdo, and by a site survey by USS *Staten Island* for the proposed Palmer Station on the Peninsula (U.S. Navy Task Force 43, 1963a). As research expanded

⁷ In 1962 the Department of Defense ordered all services to adopt a uniform system of aircraft designation, that used by the U.S. Air Force. This resulted in the following changes in designation of Navy aircraft used in Antarctica: R4D-5 to LC-47H, R4D-6 to LC-47J, R4D-8 to LC-117D, C-130BL to LC-130F, P2V-7N to LP-2J, R5D-3 to C-54Q, R7V-1P to C-121J, UC-1 Otter to U-1B, HRS-3 to CH-19E, HUS-1L to LH-34D, HUL-1 to UH-13P, HTL-7 to TH-13N, and HU2K-1 to UH-2B (Swanborough and Bowers, 1968).



U.S. Army UH-1B helicopters, noted for their agility, supported topographic mapping programs by airlifting people and equipment to lofty peaks.

U.S. Navy

deeper into the continent and farther from McMurdo Station, the Task Force found that it was harder to provide support with the resources available. This difficulty was reported to the Chief of Naval Operations with an emphatic request for more C-130 airplanes (Reedy, 1963).

Aviation support was again provided by Air Development Squadron Six (24 aircraft of eight types), the U.S. Army (three UH-1B helicopters), four U.S. Navy helicopter detachments on board four icebreakers (eight helicopters of three types), and the U.S. Air Force 9th Troop Carrier Squadron (nine C-124C and two sc-54 airplanes).

Four aircraft, all assigned to vx-6, were lost in *Deep Freeze 63*: two LH-34D helicopters, one LC-47H, and one LC-117D. The LC-117D (Buno 17188) was lost on November 22, 1962, when the ski landing gear collapsed during a landing at the Sentinel Range camp of a geological traverse party. The airplane was a strike because of the extent of damage and the remoteness of the crash site (Air Development Squadron Six, 1963). Also lost the same day was an LH-34D helicopter (Buno 145719), which crashed on landing in Wright Valley.

The LC-47H (Buno 50777) was lost on November 25, 1962, while making a jet assisted take off (JATO) at Davis Glacier. A JATO canister was released accidentally before it stopped firing and hit a propeller. The LC-47H lost an engine and crashed (Air Development Squadron Six, 1963).

The final loss of the season occurred on December 23, 1962, when an LH-34D (Buno 144658) was preparing to take off from the McMurdo helicopter pad. The engine oversped and exploded, and the helicopter burned (U.S. Navy Task Force 43, 1963a).

Operation Deep Freeze 64 (1963-1964)

During *Deep Freeze 64*, Task Force 43 supplied and supported existing U.S. stations, transported scientific and support personnel to and from Antarctica, and planned construction of the new Palmer Station on Anvers Island (U.S. Navy Task Force 43, 1963b). This was to be done within a budget 24 percent less than in the previous season. The budget reduction forced retirement of the two remaining LP-2J Neptunes and set back the construction of Palmer Station by a year (U.S. Navy Task Force 43, 1964).

Aviation resources again were provided by Air Development Squadron Six (22 aircraft of eight types), the U.S. Army (three UH-1B Iroquois helicopters), four detachments from Helicopter Utility Squadrons One and Four (eight helicopters of three types), and the U.S. Air Force (three C-130Es from the 1608th Air Transport Wing, Charleston Air Force Base, South Carolina) (U.S. Navy Task Force 43, 1964).

One aircraft was lost in *Deep Freeze 64*: a CH-19E

(Buno 144255) on November 28, 1963. Assigned to USS *Atka* (AGB-3) as part of detachment 87, Helicopter Utility Squadron Four, the helicopter crashed in a white-out about 4 miles from McMurdo. Both crewmembers were injured and the helicopter was destroyed: the engine was torn from the mounts, the tail was broken in two places, and the main rotor and transmission were twisted. *Atka*, at the time of the crash, was clearing the McMurdo shipping channel with *Burton Island* and *Glacier* (U.S. Navy Task Force 43, 1963c).

Operation Deep Freeze 65 (1964-1965)

Task Force 43 continued its scientific support and station maintenance missions during *Deep Freeze 65*. Additionally, it built Palmer Station on Anvers Island and provided airdrops for the first part of a 4-year traverse from the South Pole toward Roi Baudouin Station (U.S. Navy Task Force 43, 1965).

Aviation resources consisted of Air Development Squadron Six (22 aircraft of seven types), the U.S. Army helicopter detachment (three UH-1B helicopters), three detachments from Helicopter Utility Squadrons One and Four (six helicopters of two types) for the icebreakers, and Air Force C-130Es and C-124s for flights between New Zealand and McMurdo Station (U.S. Navy Task Force 43, 1965).

Four airplanes were lost during *Deep Freeze 65*, plus one LH-34D (Buno 150220) that was declared a loss but later recovered when LC-47 tail wheel skis were placed under the landing gear and sailors from USS *Staten Island* pulled it 3 miles to the ship. It was later repaired and returned to service. The first loss, an LC-47H (Buno 12407), occurred on October 22, 1964, when the airplane was flying in support of a UH-1B geodetic survey team on Lillie Glacier. While taking off with JATO assistance, one JATO canister was inadvertently fired while being jettisoned. The JATO canister struck the left propeller, knocked the engine off, and forced the left ski into a vertical position. The airplane crashed and was a total loss (U.S. Navy Task Force 43, 1965).

On November 8, 1964, one of the Army UH-1B helicopters (SN 62-12544) crashed while attempting a landing near the summit of a 13,800-foot peak at 71°45'S. 169°45'E. in the Admiralty Mountains of Victoria Land, about 38 nautical miles from Hallett Station. There were no injuries but the helicopter was destroyed. The one-engine helicopter lacked sufficient power for a controlled landing at the high altitude.

A UH-13P helicopter (Buno 143146) assigned to detachment 43, Helicopter Utility Squadron One, on USS *Staten Island*, crashed on December 5, 1964, while attempting an emergency landing. The helicopter caught fire when the main rotor blade struck the tail assembly during the hard landing, and the UH-13P was destroyed. The fourth airplane loss of the season occurred on Janu-



U.S. Air Force C-124 Cargomasters brought U.S. Army UH-1B helicopters from Fort Custer, Virginia, to Williams Field, McMurdo Station. C-124s also airdropped construction materials and supplies for Byrd and South Pole stations.

U.S. Navy

ary 12, 1965, at Camp Ohio in the Horlick Mountains. An LC-47J (Buno 50778) was on its landing rollout on the skiway when one of the main skis struck a high but unobserved sastrugi. The ski turned vertical and struck the propeller, tearing off the engine and twisting the fuselage (U.S. Navy Task Force 43, 1965).

Operation Deep Freeze 66 (1965-1966)

During *Deep Freeze 66*, in addition to routine resupply and maintenance activities, the Task Force built Plateau Station (79°14'48"S. 40°30'E.) and the very low frequency longwire antenna substation in Marie Byrd Land, and supported the second year of the South Pole-Queen Maud Land Traverse. Also, a new runway was built on the ice shelf at Williams Field.

Air Development Squadron Six (21 aircraft of six types) again provided much of the aviation support, supplemented by three UH-1B helicopters from the U.S. Army Aviation Detachment and three C-130Es from the 1501st Air Transport Wing, U.S. Air Force. The four icebreakers again received eight helicopters from the two helicopter squadrons.

Three airplanes were lost during the summer season, all LC-47s. The remaining UC-1 Otters were retired after a final flight on January 16, 1966.

On October 6, 1965, an LC-47H (Buno 17239) crashed on the Ross Ice Shelf about 3 miles from Williams Field while taking off after a practice open field landing. The airplane received strike damage when an improperly rigged ski cable slipped and the front of one ski dug into the snow (U.S. Navy Task Force 43, 1966).

A second LC-47H (Buno 17107) was lost on December 5, 1965, when a main mount collapsed on landing in

the Horlick Mountains. The investigation board decided the cause was material failure; the mount was not strong enough to withstand the pressure from the sastrugi in the landing area (U.S. Navy Task Force 43, 1966).

After these two losses, and considering the LC-47/117 losses of previous seasons, the commanders of the Task Force and vx-6 decided to limit LC-47/117 landings to established runways/skiways and to open-snow areas where safe landings could be expected. This reevaluation of LC-47/117 use resulted in an expansion of the role of LC-130s (U.S. Navy Task Force 43, 1966).

The third aircraft accident involved an LC-47J (Buno 50832) that crashed while in a landing approach at Mile 60 (78°51'S. 159°28'W.) on the Army-Navy Trail on the Ross Ice Shelf on February 2, 1966. The airplane stalled while about 200 feet above the surface. The right wing dropped, the pilot corrected and the left wing dropped. The plane hit the snow surface while nearly inverted. The wings broke off and the fuselage broke in two places before the plane caught fire and the JATO canisters on board exploded (U.S. Navy Task Force 43, 1966).

All six men on the plane were killed: Lieutenant Harold M. Morris, aircraft commander; Lieutenant William D. Fordell, copilot; Lieutenant Commander Ronald Rosenthal, navigator AT1 Richard S. Simmons, radioman; ADJ3 Charles C. Kelley, plane captain; and ADR3 Wayne M. Shattuck, plane captain (trainee) (Air Development Squadron Six, 1966).

Operation Deep Freeze 67 (1966-1967)

Task Force 43 continued its mission of station resupply and support of the research program in Antarctica during *Deep Freeze 67* (U.S. Navy Task Force 43,

1967). Aviation support again was provided by Air Development Squadron Six (15 aircraft of 5 types), a U.S. Army helicopter detachment with three UH-1D helicopters, three Navy and one Coast Guard helicopter detachments (eight helicopters) on four icebreakers, and a Military Airlift Command task unit of two C-130Es. Also, a C-141 Starlifter made one flight between New Zealand and McMurdo Station. This was the first pure jet aircraft operation in Antarctica and proved the feasibility of C-141 flights (U.S. Navy Task Force 43, 1967).

There were two helicopter crashes during *Deep Freeze 67*, one Army and one from the USCGC (former USS) *Glacier* (WAGB-4). The Bell UH-1D (SN 65-9741) from the U.S. Army Aviation Detachment, Antarctic Support, crashed in a whiteout on November 5, 1966, at Marie Byrd Land Camp 1 (77°S. 144°W.). Major B. R. Hawkins, detachment commander and pilot, and a crew of five had made an aerial check of a marooned topographic party. The topographic team was safe, but weather prevented landing. The UH-1D returned to its camp and was preparing to land in heavy turbulence when the weather deteriorated to whiteout conditions. The pilot lost visual reference, and the helicopter landed hard. None of the men on board were injured, but the helicopter was severely damaged and abandoned. Radios and special equipment were salvaged and returned to the United States.

On January 22, 1967, a UH-13P (Buno 143135) assigned to *Glacier* from detachment 55, Helicopter Utility Squadron One (HU-1), crashed on a glacier tongue at 71°21'30"S. 169°3'48"E. while supporting a seal counting mission from Coulman Island to Edisto Inlet.

The helicopter was making a precautionary approach to the glacier tongue after a sudden loss of power. The pilot, Lieutenant Commander Allan B. Callison, reported a loss of surface definition in a near whiteout and landed on the nose of the helicopter. The UH-13P rolled end over end and Callison, still strapped in his seat, was thrown through the canopy on the first roll. He was not injured seriously, but the helicopter was destroyed.

Operation Deep Freeze 68 (1967-1968)

Logistic support continued to occupy the various units of Task Force 43. Aviation resources were provided by Air Development Squadron Six (14 aircraft of five types), the U.S. Army Aviation Detachment (three UH-1D helicopters), the U.S. Air Force (Christchurch-McMurdo turn around flights by C-124 and C-130E transports), four detachments from Helicopter Support Squadrons Four (HU-4) and Five (HU-5) assigned to the icebreakers, and the Royal New Zealand Air Force (one C-130H for three New Zealand-McMurdo round trip flights).

Deep Freeze 68 was the second accident-free season of air operations for vx-6 and was the first year to be free of aviation accidents for all units supporting the U.S. Antarctic Research Program (U.S. Navy Task Force 43, 1968).

One airplane, however, was classified a strike during the summer season. An LC-117D (Buno 99853) was being hoisted aboard USNS *Private John R. Towle* at McMurdo on January 12, 1968, for shipment to the



C-141 Starlifters, flown by the U.S. Air Force, began deploying people and priority cargo to Antarctica during *Deep Freeze 67*. These wheeled airplanes, still used in U.S. antarctic programs, land on ice runways at McMurdo Station.

U.S. Navy



This Douglas C-133 from Dover Air Force Base, Delaware, is the largest airplane to land in Antarctica. On October 21, 1970, it delivered three UH-1D helicopters to McMurdo Station.

U.S. Navy

United States and retirement. A sling cable separated, and the LC-117D fell 25 feet to the quay. Two other LC-117Ds (Buno 17092 and 12441) were administratively struck during the summer and delivered to Davis-Monthan Air Force Base for storage in the desert (Air Development Squadron Six, 1968).

Operation Deep Freeze 69 (1968-1969)

The Task Force 43 logistic support mission remained unchanged during *Deep Freeze 69*. Aviation support was provided by Air Development Squadron Six (12 aircraft of four types), the U.S. Army Aviation Detachment (three UH-1D helicopters), the U.S. Air Force 438th Military Airlift Wing (eight C-141 round trip flights), helicopter detachments from Helicopter Support Squadrons Four (HU-4) and Five (HU-5) (eight UH-2B helicopters), and Royal New Zealand Air Force Number 40 Squadron (three flights by a C-130H) (U.S. Navy Task Force 43, 1969). On January 1, 1969, Air Development Squadron Six (vx-6) was redesignated Antarctic Development Squadron Six (vxE-6). This was the last season for U.S. Army helicopter support. The three UH-1D helicopters were transferred to vxE-6 during 1969.

There were no aircraft accidents during *Deep Freeze 69*, the third consecutive year for vxE-6. One LC-47H (Buno 17221), which had been used only in New Zealand since 1966, was retired in April 1969 and donated to the Ferrymead Museum of Science and Technology, Christchurch. It is now on permanent display.

Operation Deep Freeze 70 (1969-1970)

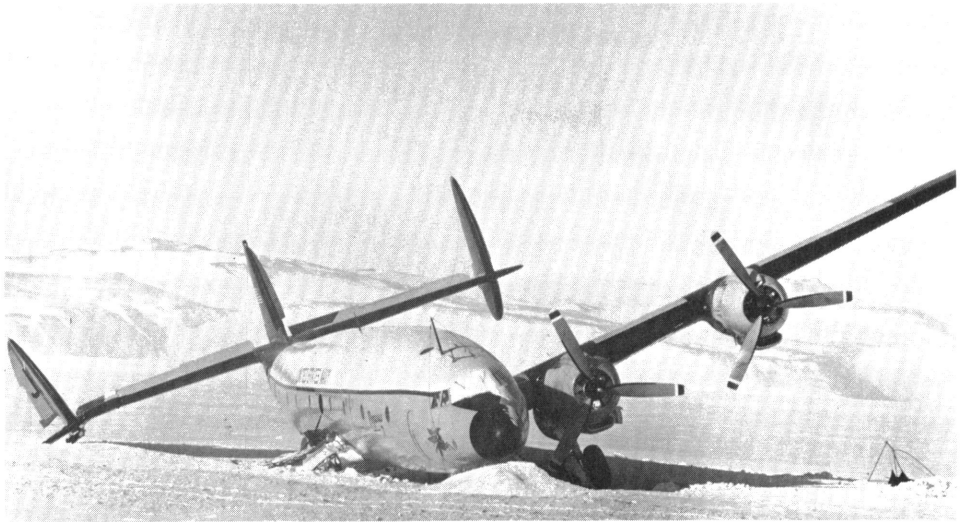
Resupply and station maintenance remained the primary logistics function of Task Force 43 during *Deep Freeze 70*. A new summer station—Siple—was established in Ellsworth Land, and new fuel storage tanks were built at McMurdo Station. Aviation support was provided by Antarctic Development Squadron Six (15 aircraft of four types), U.S. Coast Guard helicopter detachments on three icebreakers (six HH-52A helicopters), units of the 21st Air Force (16 C-141 New Zealand-McMurdo Station flights), and the Royal New Zealand Air Force Number 40 Squadron (three C-130H flights to McMurdo) (U.S. Navy Task Force 43, 1970).

The accident-free record of vxE-6 since February 1966 ended on November 19, 1969, when an LH-34D helicopter (Buno 150220) crashed at 77°34'S, 162°54'E., about 57 nautical miles west of McMurdo Station. During a level flight with eight men on board the engine failed and the pilot, Lieutenant Commander James F. Brandau, landed the helicopter by autorotation. The LH-34D landed on the side of a slope near Mt. McLennan, slid down and caught fire. Two of the men on board were killed: Thomas E. Berg, a scientist from the University of Wisconsin, and Jeremy Sykes, a television cameraman from New Zealand. The helicopter was destroyed (U.S. Navy Task Force 43, 1970).

Operation Deep Freeze 71 (1970-1971)

During *Deep Freeze 71* Task Force 43 units continued to provide logistic support to the U.S. Antarctic Research Program. A major construction effort began for

On the 1970-1971 summer season's opening day this C-121J Super Constellation crashed near McMurdo Station. No one was injured but the airplane was damaged beyond repair.



U.S. Navy

a new station at the South Pole. In October 1970, the President reaffirmed U.S. national interests in Antarctica and directed the National Science Foundation to assume management and budgetary responsibilities for the scientific and support efforts in Antarctica.

Aviation resources consisted of Antarctic Development Squadron Six (15 aircraft of four types), units of 21st Air Force (flights by C-141s, a C-133, and chartered commercial airliners), the U.S. Coast Guard (two HH-52A helicopters on each of the three icebreakers), and the Royal New Zealand Air Force Number 40

Squadron (three flights to McMurdo by a C-130H) (U.S. Navy Task Force 43, 1971).

Three aircraft were lost during *Deep Freeze 71*, but there were no deaths or serious injuries. On the first day of the summer season, October 8, 1970, a C-121J (Buno 131644) was destroyed while landing at Williams Field. The Super Constellation with 68 passengers and a crew of 12 was the seventh plane to leave New Zealand for Antarctica. About 30 minutes before arrival at Williams Field the weather deteriorated to zero visibility in blowing snow. The pilot had to land

Sikorsky HH-52A helicopters are assigned to today's icebreakers operating in Antarctica. They are used for ice reconnaissance, for personnel and cargo transport, and for scientific support flights.



U.S. Navy



U.S. Navy

Air Development Squadron Six (VXE-6) began using Bell UH-1N twin turbine powered helicopters in 1971. This one landed on a remote peak to support a U.S. Geological Survey mapping team.



U.S. Navy

This LC-130 was destroyed by fire after it taxied over a 5½-foot snowbank at McMurdo Station on February 15, 1971. No one was injured.

because there was no alternate field and the airplane was low on fuel. He made five radar controlled approaches that were unsuccessful. On the sixth attempt he was able to land, but the C-121J veered off the right side of the runway and was severely damaged. The 80 men on board arrived at McMurdo Station about 4 hours after the crash, delayed by the intense storm (U.S. Navy Task Force 43, 1971).

On January 9, 1971, a U.S. Coast Guard HH-52A helicopter (CG 1404) crashed on the east slope of Mount Erebus while enroute to Cape Bird from McMurdo. The helicopter lost power in flight and was damaged when it landed. The four crew and passengers were not injured. The helicopter was abandoned because of its location (U.S. Navy Task Force 43, 1971).

The third plane lost during *Deep Freeze 71* was an LC-130F Hercules (Buno 148318) on February 15, 1971. The Hercules was taxiing on the skiway at Williams Field for a flight to Christchurch. It taxied around the Ground Controlled Approach building in poor visibility, and the left main ski went over a 5½-foot snow-bank. The right wing hit the ground and broke between the two engines. A fire, fed by fuel and fanned by high winds, destroyed the airplane (Antarctic Development Squadron Six, 1971).

Operation Deep Freeze 72 (1971-1972)

During *Deep Freeze 72* Task Force 43 units began construction of the geodesic dome to house the new South Pole Station and continued the resupply, station maintenance, and support of scientific activities. Aerial support was provided by Antarctic Development Squadron Six (10 aircraft of two types), Coast Guard helicopter detachments on board three icebreakers (six HH-52A helicopters deployed to three icebreakers), units of

21st Air Force (C-141s and commercial charters), and Number 40 Squadron, Royal New Zealand Air Force (five flights by three C-130Hs) (U.S. Navy Task Force 43, 1972).

One airplane, an LC-130F (Buno 148321), was lost on December 4, 1971. The Hercules had landed in the open field at 68°20'S, 137°20'E. to resupply a French traverse team participating in the International Antarctic Glaciological Project. After unloading, the plane made a JATO take off to return to McMurdo Station, a distance of about 750 nautical miles. At about 50 feet in altitude two JATO bottles separated from the left side of the fuselage and struck the left inboard engine and propeller. The propeller and gear box were torn off, and the left outboard propeller was damaged by flying debris.

The pilot reduced power immediately and landed the plane in a left wing down and yaw condition which caused severe damage on impact. The 10 men on board were not injured and lived in survival shelters for 80 hours until the weather improved enough to allow a rescue plane to land.

Operation Deep Freeze 73 (1972-1973)

Task Force 43 was reorganized prior to *Deep Freeze 73*. The Admiral's staff in Washington, D.C., was eliminated, and many of the positions were integrated with Antarctic Support Activities, which then assumed the title U.S. Naval Support Force, Antarctica. Siple Station was converted to a year-round station and operated by a four-person civilian team. Otherwise, the Task Force continued its support role in Antarctica. Aviation support was provided by Antarctic Development Squadron Six (three LC-130's and six UH-1N's), the U.S. Coast Guard (six HH-52A helicopters on three icebreakers), 438th Military Airlift Wing (43 C-141 missions from



On January 29, 1973, this Lockheed LC-130R crashed while landing at South Pole Station.

U.S. Navy

New Zealand to Antarctica and C-141 and commercial flights between the U.S. and N.Z.), Number 40 Squadron of the Royal New Zealand Air Force (ten C-130H round-trip flights), and for the first time, Number 30 Squadron of the Royal Air Force (20 round-trip flights by two C-130s) (U.S. Navy Task Force 43, 1973).

One airplane was lost during Operation *Deep Freeze* 73. On January 28, 1973, an LC-130R (Buno 155917) crashed while making a ground controlled approach landing at Amundsen-Scott South Pole Station after a routine flight from Williams Field with two passengers and a load of mixed cargo.

In the final moments of the approach, the pilot was waved off. The plane was already sinking to the skiway and unable to regain altitude. The fuselage hit the skiway, the wing tips struck the snow, and the wings, engines, landing gear, and tail section disintegrated (Antarctic Development Squadron Six, 1973a).

There were no injuries to the nine crewmembers and two passengers on board but the airplane was destroyed. The cargo survived the crash without damage with the exception of one 500-gallon bladder of motor gasoline. This was thrown from the plane by the impact of the crash and burned. Much of the credit for the lack of injury was attributed to the thoroughness of the loadmaster, ABJ2 David V. Hazzard, who had secured the 20,000 pounds of cargo, mail, and gasoline so securely that most of it did not move (*Antarctic Journal of the U.S.*, 1973).

Antarctic Development Squadron Six (VXE-6) ended

its deployment to Antarctica with the lowest aircraft inventory in its history: two fixed-wing transports and six helicopters, four of which were in Antarctica. The other two helicopters had remained at the squadron's homeport, Naval Air Station Quonset Point, Rhode Island.

References

- Bertrand, Kenneth J. 1971. *Americans in Antarctica 1775-1948*. New York, American Geographical Society. 554 p.
 Byrd, Richard E. 1930. *Little America*. New York, G. P. Putnam's Sons. 422 p.
 Byrd, Richard E. 1935. *Discovery*. New York, G. P. Putnam's Sons. 405 p.

Research for this paper was conducted primarily at the Center for Polar Archives, a division of the General Services Administration's National Archives and Records Service, Washington, D.C. [For a discussion of the holdings of the Center for Polar Archives, see Alison Wilson, "The Center for Polar Archives, Washington, D.C." *Polar Record*, 16(103): 541-552.] Most information was contained in Records Group 313, "Records of the U.S. Naval Operating Forces," some 230 feet of documentation. Other information was made available by the Aviation History Division and by the Aviation Programs Division, Office of the Deputy Chief of Naval Operations for Air Warfare.

Aircraft losses by season in the U.S. antarctic program, 1946-1973.

Expedition	Airplanes lost	Helicopters lost	Total aircraft lost
<i>Highjump</i>	2	2	4
<i>Windmill</i>	0	1	1
<i>Atka</i>	0	1	1
<i>Deep Freeze I</i>	4	1	5
<i>Deep Freeze II</i>	3	3	6
<i>Deep Freeze III</i>	0	1	1
Electronics Test Unit	0	0	0
<i>Deep Freeze IV</i>	4	1	5
<i>Deep Freeze 60</i>	2	0	2
<i>Deep Freeze 61</i>	1	1	2
<i>Deep Freeze 62</i>	2	0	2
<i>Deep Freeze 63</i>	2	2	4
<i>Deep Freeze 64</i>	0	1	1
<i>Deep Freeze 65</i>	2	2	4
<i>Deep Freeze 66</i>	3	0	3
<i>Deep Freeze 67</i>	0	2	2
<i>Deep Freeze 68</i>	1	0	0
<i>Deep Freeze 69</i>	0	0	0
<i>Deep Freeze 70</i>	0	1	1
<i>Deep Freeze 71</i>	2	1	3
<i>Deep Freeze 72</i>	1	0	1
<i>Deep Freeze 73</i>	1	0	1
TOTAL	30	20	50

- Grierson, John. 1964. *Challenge to the Poles*. Hamden, Conn. Archon Books. 695 p.
- Matthews, William R. 1967. Curtiss Condor II. *Journal of the American Aviation Historical Society*. 12(1): 3-27.
- Scott, Robert F. 1905. *The Voyage of the Discovery*. Vol. 1. London, Smith, Elder, and Co. 556 p.
- Swanborough, Gordon, and Peter M. Bowers. 1968. *United States Navy Aircraft Since 1911*. New York, Funk and Wagnall's. 518 p.

The following primary sources are contained in Records Group 313, "Records of Naval Operating Forces," Center for Polar Archives, U.S. National Archives and Records Service, Washington, D.C.

- Air Development Squadron Six. 1955. *Squadron Log*. Entry for 10:41 a.m., January 17, 1955.
- Air Development Squadron Six. 1956. *Report of Operation Deep Freeze I*.
- Air Development Squadron Six. 1957. *Report of Operation Deep Freeze II*.
- Air Development Squadron Six. 1958. *Aircraft Accident Report 3-58*, UC-1, Buno 142427, 22 October 1958.
- Air Development Squadron Six. 1959a. *Report of Operation Deep Freeze IV*.
- Air Development Squadron Six. 1959b. *Aircraft Accident Report 1-59*, UC-1, Buno 144673, 4 January 1959.
- Air Development Squadron Six. 1960a. *Report of Operation Deep Freeze 60*.
- Air Development Squadron Six. 1960b. *Aircraft Accident Report 3-59*, R4D-8, Buno 17154, 24 December 1959.
- Air Development Squadron Six. 1961. *Report of Operation Deep Freeze 61*.
- Air Development Squadron Six. 1962. *Report of Operation Deep Freeze 62*.
- Air Development Squadron Six. 1963. *Report of Operation Deep Freeze 63*.
- Air Development Squadron Six. 1966. *Aircraft accident report 1-66A*, LC-47J, Buno 50832, 2 February 1966.
- Air Development Squadron Six. 1968. *Report of Operation Deep Freeze 68*.
- Antarctic Development Squadron Six. 1969. *Report of Operation Deep Freeze 69*.
- Antarctic Development Squadron Six. 1971. *Report of Operation Deep Freeze 71*.
- Antarctic Development Squadron Six. 1973a. Supplementary message report number one of major aircraft accident, electrical message 290254Z, January 1973.
- Antarctic Journal of the United States*. Field activities in December and January. VIII (2): 45-55.
- Anthony, Alexander E., Jr. 1966. *The Air Force in Antarctica—The First Decade, 1947-1957*.
- CNAL (Commander, Naval Air Force, Atlantic Fleet). 1959. Fourth endorsement to Air Development Squadron Six *Aircraft Accident Report 1-59*.
- Commander, Task Force 43. 1960. Letter to the senior member, Aircraft Accident Board, Antarctic Support Activities.
- 52d Troop Carrier Squadron. 1958. Preliminary accident report to Donaldson AFB, S.C.
- Hawkes, William M. 1956. Letter to commanding officer, Air Development Squadron Six (vx-6), subject: report of accident to aircraft.
- Reedy, J. R. 1963. Letter to chief of naval operations forwarding the *Report of Operation Deep Freeze 63*, serial W-531, July 9, 1963. U.S. Naval Support Force, Antarctica.
- U.S. Air Force Electronics Test Unit. 1957. *Operations Plan*. Services and Support Group (Provisional), Headquarters Command, USAF.
- U.S. Air Force Electronics Test Unit. 1958. Report of U.S. Air Force Electronics Test Unit, Services and Support Group (Provisional), Headquarters Command, USAF.
- U.S. Navy Task Force 39. 1948. *Report of Operations, Second Antarctic Development [sic] Project, 1947-1948*.
- U.S. Navy Task Force 43. 1955. *Operation Plan 1-55, Deep Freeze I*.
- U.S. Navy Task Force 43. 1956a. *Report of Deep Freeze I*.
- U.S. Navy Task Force 43. 1956b. *Operation Plan 1-56, Deep Freeze II*.
- U.S. Navy Task Force 43. 1957. *Report of Operation Deep Freeze II*.
- U.S. Navy Task Force 43. 1958. *Report of Operation Deep Freeze III*.
- U.S. Navy Task Force 43. 1959. *Report of Operation Deep Freeze IV*.
- U.S. Navy Task Force 43. 1960. *Report of Operation Deep Freeze 60*.
- U.S. Navy Task Force 43. 1961. *Report of Operation Deep Freeze 61*.
- U.S. Navy Task Force 43. 1962. *Report of Operation Deep Freeze 62*.
- U.S. Navy Task Force 43. 1963a. *Report of Operation Deep Freeze 63*.
- U.S. Navy Task Force 43. 1963b. *Operation Order 1-63, Deep Freeze 64*.
- U.S. Navy Task Force 43. 1963c. Daily situation report, 30 November 1963, number 70. Electrical message 300442Z.
- U.S. Navy Task Force 43. 1964. *Report of Operation Deep Freeze 64*.
- U.S. Navy Task Force 43. 1965. *Report of Operation Deep Freeze 65*.
- U.S. Navy Task Force 43. 1966. *Report of Operation Deep Freeze 66*.
- U.S. Navy Task Force 43. 1967. *Report of Operation Deep Freeze 67*.
- U.S. Navy Task Force 43. 1968. *Report of Operation Deep Freeze 68*.
- U.S. Navy Task Force 43. 1969. *Report of Operation Deep Freeze 69*.
- U.S. Navy Task Force 43. 1970. *Report of Operation Deep Freeze 70*.
- U.S. Navy Task Force 43. 1971. *Report of Operation Deep Freeze 71*.
- U.S. Navy Task Force 43. 1972. *Report of Operation Deep Freeze 72*.
- U.S. Navy Task Force 43. 1973. *Report of Operation Deep Freeze 73*.
- U.S. Navy Task Force 68. 1947. *Report of Operation Highjump, U.S. Navy Antarctic Developments Project*.
- USS *Atka* (AGB-3). 1955. *Report of U.S. Navy Antarctic Expedition, 1954-1955*.
- USS *Atka* (AGB-3). 1958. *Report of Operation Deep Freeze III*.
- USS *Glacier* (AGB-4). 1957. *Report of Antarctic Expedition, Operation Deep Freeze II*.
- USS *Glacier*. 1959. *Report of Operation Deep Freeze IV*.
- USS *Staten Island*. 1961. *Report of Operation Deep Freeze 61*.