

Cold Weather Testing in Alaska: 1940 - 1970



April 2012

Chapter 1.0 – Introduction

*Not all the outlying 'ramparts we watch' are tropical or semi-tropical. Alaska, mighty northwest territory, reaches far beyond the Arctic Circle. It presents many new and tricky problems for those charged with the Nation's defense, particularly airmen.*¹

1.0 Purpose of Study

In September of 2009, U.S. Army Garrison Fort Wainwright (USAG FWA) entered into a Programmatic Agreement with the Alaska State Historic Preservation Officer, the Advisory Council on Historic Preservation, the National Park Service, Tanana Yukon Historical Society, and the Fairbanks North Star Borough Historic Preservation Commission regarding Aviation Stationing at Fort Wainwright, Alaska. The agreement stipulated that USAG FWA would develop a historic context on military cold weather experimentation at Fort Wainwright. This document was developed in fulfillment of that stipulation.

Fort Wainwright was established as the Ladd Field Cold Weather Test Detachment in 1939. The original purpose of the Test Detachment was to ensure all Army planes and equipment could function in extreme cold down to - 60° F. While the installation has been given a number of new missions over the years, cold weather testing has continued to be a vital part of its development. Even after the headquarters of the Cold Weather Test Detachment was transferred to Eglin Air Force Base in 1947, cold weather testing continued to be a major component of the installation through the work of the Permafrost Division, later the Cold Regions and Research and Engineering Laboratory (CRREL), the 46th/72nd Reconnaissance Squadron, the Arctic Aeromedical Laboratory, Ice Island Research Stations, and the Cold War missions of the installation.

1.1 Previous Work

Previous research on cold weather testing was included in historic contexts on the World War II and Cold War history of the installation, and in the determination of eligibility for the CRREL Permafrost Tunnel.² These studies included information on many of the same topics that are covered in this report. However, these early studies focused on how cold weather testing was related to the WWII Ladd Field National Historic Landmark and the Ladd Air Force Base Cold War Historic District rather than the individual achievements of the organizations or detailed information on agencies. This report will focus on and expand the information provided in the previous reports.

Ladd Field was activated in 1940 as a cold weather experimental station. The Cold Weather Test Detachment stationed at Ladd Field made advances in cold weather aeronautics and personal gear development. After the start of World War II, the mission of the installation expanded to include the duties of the Alaska Air Command transit hub and also served as a transfer point for Lend-Lease aircraft.

¹ Henry, H. Arnold, General, *History of the 11th Army Air Force to V-J Day* (University of Alaska Anchorage Archives, Blue Collections, 1945).

² Kathy Price, *Northern Defenders: Cold War Context of Ladd Air Force Base, Fairbanks, AK 1947-1961* (Fort Collins, Colorado: Colorado State University: Center for the Environmental Management of Military Lands, 2001); Kathy Price, *The World War II Heritage of Ladd Field, Fairbanks, Alaska* (Fort Collins, Colorado: Colorado State University: Center for the Environmental Management of Military Lands, 2004); Mary Shanks and Julie Esdale, "Proposed Expansion of the Cold Regions Research and Engineering Laboratory Permafrost Tunnel, CRL-00008-1J, FWA," 2011.

At the height of the War, more than 5,000 U.S. military and civilian personnel and 300 Russian personnel were assigned to Ladd Field.

Following World War II, it became apparent that the Soviet Union had no intention of demobilizing and was, in fact, continuing to produce long distance bombers at an alarming rate. The U.S. and its allies grew increasingly concerned, particularly, about the virtually unprotected arctic front.³ Little was known about the geography of the arctic region at this time and some believed that it was possible the Soviets had established airbases on unknown polar land masses as close as 100 miles from the U.S.' territory of Alaska.⁴

In response, the U.S. developed a series of agencies and programs to expand its knowledge of the Arctic. Among them were the 46th/72nd Reconnaissance Squadron, Ice Island research stations, the Permafrost Division and CRREL, and the Arctic Aeromedical Laboratory.

1.3 Methods and Results

Major portions of this report were prepared in Fairbanks during the summer of 2011 using primary and secondary sources. Primary sources were used as much as possible, with secondary sources used to supplement when the original historic documentation was not available. Sources include: archival collections at the University of Alaska, Fairbanks, the 3rd Wing History Office at Joint Base Elmendorf-Richardson, and the University of Alaska, Anchorage, contemporary newspaper and magazine articles, the available military records stored at Fort Wainwright, as well as published histories, and cultural resources reports. Based on a thorough review of this material, major themes in cold weather testing were developed. This report places those themes within the context of the other missions of the installation.

Cold weather testing is the foundation of the history of Fort Wainwright and has significance at multiple levels—national, state, and local. The significance of the Cold Weather Test Detachment has already been recognized, but the significance of the other missions has not always been fully articulated. As such, this report will highlight the significance of those other cold weather testing missions.

³ Ken White, *World in Peril: The Origin, Mission & Scientific Finding of the 46th/72nd Reconnaissance Squadron* (Elkhart, Indiana: K.W. White and Associates, 1992), 4-5. The U.S., on the other hand, had demobilized rapidly, leaving a void of military power in the face of the increasing Soviet threat. It was generally believed at this time that the Soviets would attack via the shortest air route: over the little-explored polar ice cap and through a virtually undefended Alaska.

⁴ White, *World in Peril*, 5, 37-38. Although the U.S. Military knew that the Soviets had utilized the U.S. long-range B-29 aircraft design for their own Tupelov Tu-4 aircraft, they had sorely underestimated the Soviet strength at about 300 planes, rather than their actual 1,500 planes. On a one-way suicide mission, the Tupelov Tu-4 could travel 3,000 miles, placing major American west coast cities, such as San Francisco, in immediate danger of Soviet attack; if the Soviets were able to establish bases in arctic territories like Greenland, however, American cities along the entire eastern seaboard, including New York City and Washington D.C., could be threatened.

Chapter 2.0 — Cold Weather Test Detachment

*It would be impossible, obviously, to build enough heated hangars to house our General Headquarters Air Force if it should be required suddenly in Alaska, so we must learn how to operate planes left out in the open. That is no mean task.*⁵

2.0 The History of the Cold Weather Test Detachment

The early history of the Cold Weather Test Detachment (the detachment) has already been well documented by Kathy Price in *The World War II Heritage of Ladd Field, Fairbanks*.⁶ Thus, this chapter will include only a brief introduction on the history of the detachment, and information on some of the lesser known research completed by the detachment.

Activated in 1940, the mission of the detachment⁷ was to ensure that all military aircraft could function in the extreme arctic and sub-arctic conditions, down to temperatures of -60° Fahrenheit. During its first two years, the detachment managed to establish basic operational and maintenance requirements for aircraft in the Arctic, performed experiments on cold weather uniforms and rations, and began experimenting on solutions to arctic flying issues before the second year of testing was curtailed after the attack on Pearl Harbor. The detachment was re-established just in time for the third season of testing (1942-1943) and, during the fourth and fifth winters, conducted extensive testing with aeronautics manufacturers from around the country. Advancements made by the detachment were incorporated into wartime production, helping to establish new standards for aircraft design and development.

In addition to aircraft design, the detachment also worked on numerous other cold weather issues. Among the other experiments were developments in open air maintenance and, cold weather uniforms and rations, as well as special projects and work on experimental aircraft that were not part of the Army Air Corps' fleet. This chapter will briefly discuss some of these lesser known advancements including nose hangars, aircraft wing covers, cold weather uniforms, and the YR-4 "Arctic Jitterbug" helicopter.

2.1 Open Air Maintenance

One of the earliest advancements made by the Cold Weather Test Detachment was the construction of portable nose⁸ hangars. The detachment was activated prior to the completion of many of its

⁵ Henry, H. Arnold, General, *History of the 11th Army Air Force to V-J Day*. (University of Alaska Anchorage Archives, Blue Collections, 1945).

⁶ Kathy Price, *The World War II Heritage of Ladd Field, Fairbanks, Alaska* (Fort Collins, Colorado: Center for the Environmental Management of Military Lands, 2004).

⁷ The Army Air Corps was renamed the Army Air Force in June 1941, and the official title of the Cold Weather Test Detachment changed frequently during its life span. But for clarity, these are the terms that will be used throughout the chapter.

⁸ An aircraft nose is the forward end or projection, or the stem of an aircraft or its protective metal covering. Merriam-Webster Dictionary (2011), s. v. "nose."

facilities, including the hangar. The Army had supplied the fledgling airfield with standard design maintenance shelters; however, these shelters were small, constructed of lightweight material, and could only cover a single engine. While this made them ideal as portable shelters over the smaller single engine fighters, they were difficult to heat and inadequate for heating the much larger quad engine B-17s, which has four engines, two located on each wing. To solve these difficulties, the detachment designed and constructed two much larger nose hangars. As seen in the image below, these larger nose hangars were designed to cover a larger area including nose, or cockpit, and the two engines on either side, providing heat and allowing crews to perform maintenance on the aircraft.

The nose hangars had sturdy wooden frames covered with canvas, and one of the nose hangars was slightly larger than the other. Both nose hangars were insulated, one with spun glass and the other with felt sheets. The open side of the nose hangars was fitted with canvas curtains, each with drawstring openings around the nacelles⁹ that could be tightened to keep in warmth. The nose hangars and portable maintenance shelters were each fitted with wood stoves, kerosene heaters, and Airmix hot air units. The detachment reported that the nose hangars were effective and that “they provided comparatively warm, light, and roomy places for work and several engine changes as well as routine inspections.”¹⁰

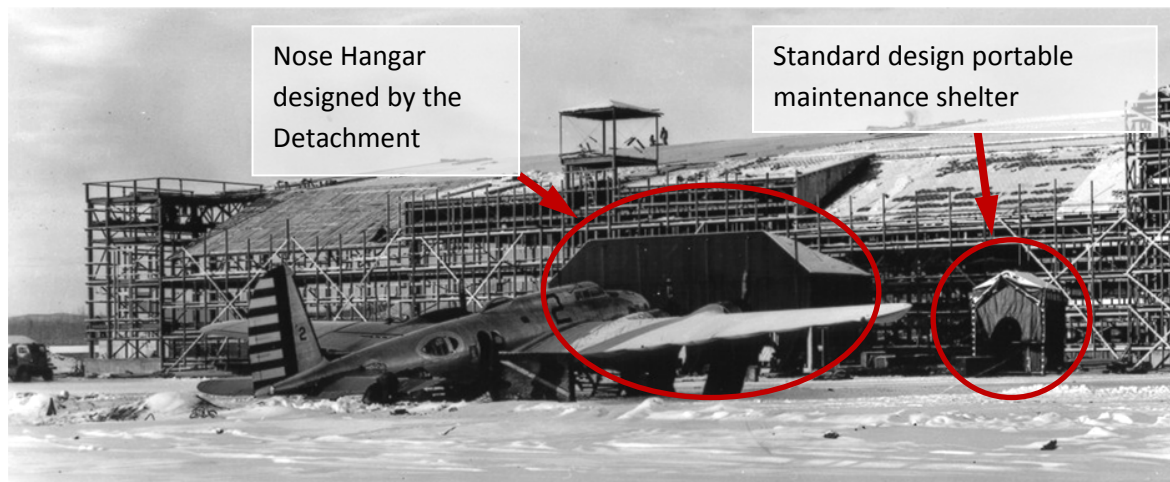


Figure 2-1: Photo of Hangar 1 under construction with nose hangar and portable maintenance shelter in the foreground, January 10, 1941.¹¹

In addition to the nose hangars, the detachment also developed a set of wing covers for all of the aircraft in the Army Air Corps' fleet. The detachment tested both lightweight, tightly woven cotton cloth and heavier weight canvas. It found that at extremely cold temperatures, the heavier canvas would

⁹ A nacelle is a streamlined, protective enclosure for an aircraft engine. Merriam-Webster Dictionary (2011) s.v. “nacelle.”

¹⁰ Lauer, B.C., *Official History: Ladd Field – Fairbanks, Alaska, Fall 1938- To – 31 January 1944* (Ladd Field, Alaska: Headquarters 1466th AAF Base Unit Alaska Division, Air Transport Command, 1944) 24.

¹¹ From the Ladd Field Collection, Office of the 11th Air Force 3rd Wing Historian at the Joint Base Elmendorf-Richardson.

become too stiff to remove easily. The lighter cotton cloth was sufficient to keep the frost off the wings and allowed for easier removal.¹²

2.2 Cold Weather Uniform Development

Numerous experiments in uniform design were completed during and after World War II by the detachment, many in partnership with other research organizations. One of the most unusual was the development of the electrically heated underwear, developed by General Electric and field tested by the detachment during the winter of 1940 - 1941. The electric underwear was designed to supplement the flight suits of pilots in cold weather conditions, but the testing process proved somewhat unorthodox. In order to test the underwear, the test pilot could not wear anything on top of it to ensure the results were from the suit and not other materials. As the unit historian noted at the time the Associated Press was reporting that “some Army people in distant Alaska were flying around in bombers wearing nothing but undies.”¹³

The underwear was designed as a two-piece suit with metal coils running through it. Felt shoes and felt and leather gloves were attached to heat the hands and feet. When plugged into the aircraft control system, the coils would heat and warm the pilot beneath a layer of insulating clothing. Maj. Dale Gaffney, the commander of the Cold Weather Test Detachment, personally participated in the initial testing and served as the test pilot. Maj. Gaffney wore the suit during a seven and half hour flight in a B-17, flying over 300 miles past the Arctic Circle. After all the testing was completed, the experimental heated underwear was deemed so successful, it was manufactured and used by pilots in both theaters, including long, high altitude bombing runs in Europe.

However, while the suit was exceptionally useful for pilots in the air, it was not practical for personnel on the ground. As a result, the detachment developed additional uniforms for land-based operations. The detachment worked with polar explorers, Native Alaskans, and local Fairbanks residents in developing the new uniforms. The earliest uniform developed by the detachment, called the DVG, was actually named after the unit’s commander, Dale V. Gaffney;



Figure 2-2: Major Dale V. Gaffney wearing the DVG uniform.¹⁴

¹² Lauer *Official History: Ladd Field*, 32-33.

¹³ *History of the Cold Weather Testing Detachment* (Ladd Field, Alaska: Headquarters 1466th AAF Base Unit Alaska Division, Air Transport Command, 1945) 14.

¹⁴ From the Kay Kennedy Aviation collection, 91-098-854, Archives and Manuscripts, Alaska and Polar Regions Department, University of Alaska Fairbanks.

the uniform consisted of parkas and boots made out of sheepskin.¹⁵ But while the DVGs worked for most of the unit, they were not warm enough for the airfield crews. Major Randal Accord, one of the test pilots for the detachment, remembered that they had looked at the Alaskan Native clothing but determined that it would not be functional for airfield personnel. “The ones that the Natives used, the Eskimos used were generally made out of clipped caribou skin. Now the socks they used on the mukluks was clipped caribou skin, the soles of mukluks was made out of sealskin or walrus. It’s amazing how light all of that is.”¹⁶ The largest difficulty they had to overcome was the ability to mass-produce a uniform. The Alaska Native garments could not be mass produced and could not be adapted to the Quartermaster system. Additionally, they were difficult to get into and hampered movement, frequently catching on flight controls.

Ultimately, the detachment developed a flight crew uniform consisting of a down-filled jump suit. The original version of the suit was covered in a light, cotton quilted cloth that was easy to tear. The heavier weight duck cloth improved the tearing issue but made the uniform more difficult to wear. Zippers were added to the front, legs and arms, and over all of the pockets to make them easier to put on. But as Major Accord recalled “the more zippers you have on a thing, the more heat loss you have. Well, they improved that a little bit by having a zipper and then they'd put a flap that you could snap over that. That helped a little bit, but every time you make something easier, you have to sacrifice something, seems like, particularly in the clothing business.”¹⁷ This final version of the suit was used by Airmen until the end of the war. The detachment also developed a range of lightweight cold weather uniforms for other divisions that could be adapted or layered, depending on the conditions.

2.3 The YR-4 – Experimental Helicopter

One of the lesser known projects the detachment was involved with was one of the Army’s first helicopters, the YR-4. Developed by Sikorsky Company, the YR-4 was the first helicopter ordered in bulk by the U.S. and its allies. In 1943, after the first series of tests at the Sikorsky factory, the Army ordered the helicopter disassembled and shipped to Ladd Field for cold weather testing.¹⁸ The purpose behind the testing was two-fold: one, to ensure that the YR-4 could be transported utilizing the U.S. existing fleet of aircraft, and two, that the helicopter could function in cold climates. The Army hoped to utilize the helicopter for emergency rescues missions, but its extremely limited range required that the helicopter be easily transportable.¹⁹

After arriving at Ladd Field, to much excitement and curiosity, the YR-4, nicknamed the “Arctic Jitterbug,” was quickly reassembled and readied for testing. The weather warmed to 20° above zero throughout the testing period and the helicopter performed well. Despite the warm temperatures, the detachment was still able to examine the helicopter and make recommendations for improved arctic

¹⁵ Interview, Bill Stoecker with Kathy Price, 30 April 2002, Fort Wainwright Oral History Collection.

¹⁶ Interview, Randall Acord with Kathy Price, 17 May 2002, Fort Wainwright Oral History Collection.

¹⁷ Acord, 2002.

¹⁸ H. F. Gregory, *Anything a Horse Can Do: the Story of the Helicopter* (New York, Reynal & Hitchcock, 1944) 201.

¹⁹ Gregory, 1944, 202.

performance.²⁰ Recommendations included cold climate weight oils, hydraulic fluids, and lubricants as well as a protective covering for the rotors when not in use to prevent frost build-up. The rotor coverings were designed from the same material the detachment had used for the wing covers previously developed. Additional tests were run to improve pilot comfort in the sparsely designed helicopter, but the advancements the detachment had made in cold weather clothing proved satisfactory. As a result of the tests, the Army determined that the helicopter would be suitable for emergency rescues missions, even in extreme cold climates.

2.4 Cold Weather Testing in the Post War Period

Cold weather testing continued at Ladd Field, even after the end of World War II. While many of the experienced pilots and mechanics were transferred back to the contiguous U.S. or discharged from service, others stayed behind to train new personnel.²¹ In 1947, a new fully climate controlled hangar was completed at Eglin Air Force Base in Florida, and the headquarters for cold weather testing was reassigned there. Over the next year, staff from the re-designated Ladd Air Force Base transferred to Eglin while a small complement of personnel remained and completed limited testing. There was a resurgence of cold weather testing after 1949, however, as the headquarters at Eglin found it difficult to reproduce some of the real world conditions experienced by airmen in the field. Cold weather testing at Ladd Field continued throughout the 1950s and even today, under the auspices of the Cold Regions Testing Center, still housed on Fort Wainwright's training lands.

²⁰ Gregory, *Anything a Horse Can Do*, 204.

²¹ Acord, 2002.

Chapter 3.0 – The 46th/72nd Aerial Reconnaissance Unit

*Photo reconnaissance . . . It is the one positive means by which we are able to study the enemy's back yard. Its relative importance cannot be over-rated – we must have it.*²²

3.0 The Establishment of the 46th/72nd Reconnaissance Squadron

On March 21, 1946, Army Air Force Commander General Carl A. Spaatz established the Strategic Air Command. It was assigned the critical task of evaluating any impending Soviet threat and ensuring that Army Air Force was prepared to retaliate in the event of an attack. In July 1946, Strategic Air Command's first operational unit, the 46th Reconnaissance Squadron (Very Long Range) Photographic, re-designated the 72nd Reconnaissance Squadron in October 1947 (46th/72nd Reconnaissance Squadron), was established at Ladd Field in order to accomplish these critical missions.²³



Figure 3-1: 46th/72nd Reconnaissance Squadron Patch.²⁴

The 46th/72nd Reconnaissance Squadron's primary missions consisted of "Project Nanook" and "Operation Floodlight." Under "Project Nanook" the squadron was tasked with exploring and documenting the Arctic and polar regions. "Operation Floodlight" was more specifically tasked with searching for and photographing new land masses in the polar regions. These two frequently overlapping missions directly contributed to early Cold War defense. They helped to determine whether

²² Farquhar, Roy J., "Northern Sentry, Polar Scout: Alaska's Role in Air Force Reconnaissance Efforts, 1946-1948." In Fern Chandonnet, ed., *Alaska at War 1941-1945*. (Anchorage, Alaska At War Committee, 1995), 184.

²³ Ken White, *World in Peril: The Origin, Mission & Scientific Finding of the 46th/72nd Reconnaissance Squadron* (Elkhart, Indiana: K.W. White and Associates, 1992), 5.

²⁴ From the 46th/72nd Reconnaissance Squadron Veterans Association collection, Photographic Archives of Air Force Historical Research Agency, at Maxwell Air Force Base.

the Soviets had established an Arctic base of operations and revealed any suitable uninhabited landmasses on which the U.S. could station its own military or research personnel.

The squadron's missions were of particular importance, because there was belief that the U.S. was significantly behind the Soviets in Arctic aviation and research. Early evidence indicated that the Soviets could already successfully navigate over the polar ice cap as early as June 1946. This belief was based in part on the knowledge that the Soviet Union had invested considerable time during the 1930s investigating the area.²⁵ If true, the U.S. was significantly behind in the race for control of the Arctic.²⁶

At the time, an upcoming United Nations agreement was being developed that would limit sovereignty in the polar region to the nations bordering the Arctic. The agreement would extend the longitudinal lines of the countries' eastern and western borders northward to the North Pole. Since the U.S. controlled only a small section of known Arctic territory (Alaska), such an agreement would greatly limit U.S.' activity in the northern regions. Thus, "Project Nanook" and "Operation Floodlight" were of critical importance, because they would allow the U.S. to claim any undiscovered Arctic land before the United Nations passed the agreement.²⁷

Within only a few short years, the 46th/72nd Reconnaissance Squadron completed all of these missions while performing more hazardous missions than any other peacetime squadron. By developing a new system of Arctic navigation, assessing the Soviet threat, and photographing and mapping the Arctic, the 46th/72nd contributed not only to the successful defense of the Arctic during the Cold War era, but also to the collection of invaluable scientific knowledge about the world's Arctic regions.²⁸

3.1 Cold War Reconnaissance

In order to navigate the polar region, the 46th/72nd Reconnaissance Squadron was supplied with a B-29 aircraft that was modified to increase its range and withstand subzero temperatures. The aircraft was modified for these reconnaissance missions, and all guns and turrets were removed and a larger fuel tank was installed in the bomb bay. Other major alterations included replacing propellers and vacuum gauges, installing a larger heated astrodome (which allowed better celestial navigation), and installing special windows to protect the aerial cameras mounted in the back of the aircraft.²⁹ B-29

²⁵ In the late 1930s, the Soviets established the first drifting station on pack ice near the North Pole. Called the North Pole 1 expedition, the first settlement consisted of four men camped on the island conducting research until the island drifted into the Greenland Sea. In 1941, the Soviet plane, N-169, made three landings on an ice pack north of Wrangel Island, each time conducting scientific experiments. After the war, the Soviets established six Arctic drifting stations, each active for about a year, and they made multiple ice pack landings to conduct short-term research. Bushnell, Vivian, ed. *Scientific Studies at Fletcher's Ice Island, T-3, 1952-1955. Vol. 1. Geophysical Research Papers No. 63.* (Cambridge, Geophysics Research Directorate, Air Force Cambridge Research Center, Air Research and Development Command, United States Air Force, 1959), 1.

²⁶ White, *World in Peril*, 11.

²⁷ Bushnell, *Scientific Studies at Fletcher's Ice Island*, 5.

²⁸ Fred John Wack, *The Secret Explorers: Saga of the 46th/72nd Reconnaissance Squadrons* (Turlock, California, Seeger's Publishing, 1992), forward, n. n. White, 1992, 11.

²⁹ White, *World in Peril*, 12-13.

aircraft with these modifications were re-designated as F-13 aircraft³⁰, and the first three completed F-13s arrived at Ladd Field ready for duty on July 19, 1946.³¹



Figure 3-2: One of the 46th/72nd Reconnaissance Squadron's F-13s in front of Birchwood Hangar 6 at Ladd Field³²

3.1.1 "Project Nanook"

The first operational flight of "Project Nanook," was on August 2, 1946. The mental and navigational challenges of arctic flying became apparent on this first flight. Due to the inadequate knowledge regarding arctic navigation, the navigator lost track of their location, and the crew grew increasingly concerned that they were flying away from base over the Pacific Ocean. Ultimately, they discovered that they were only fifty miles off course. This first flight made it clear that the mission to explore the Arctic would require the development, implementation, and testing of new navigational procedures. As a result of these dangers, the squadron commander flew with each crew on their initial flight over the polar cap in order to assess the equipment and each crew's decision-making processes under such dangerous conditions. The squadron commander also ensured that each crew was photographed prior to take-off so that they could be identified if the plane went down.³³

³⁰ At this time, aircraft were still designated using World War II naming conventions where, "B" stood for "bomber," "P" for "pursuit," and "F" for "foto (photo)."

³¹ Wack, *The Secret Explorers*, 3.

³² From the 46th/72nd Reconnaissance Squadron Veterans Association collection, Photographic Archives of Air Force Historical Research Agency, at Maxwell Air Force Base.

³³ White, *World in Peril*, 32.

These early flights ensured that one of the most important early goals of the 46th/72nd was to develop new navigational procedures for Arctic navigation, as magnetic navigation proved unreliable in such close proximity to the magnetic pole. While grid navigation had been theorized and tested briefly by the Allied powers during World War II, the 46th/72nd Reconnaissance Squadron was the first to apply this theory to practical, long-range flights. During the course of their early missions, which lasted an average of 20 hours and were conducted under complete radio silence, the 46th/72nd crews took thousands of readings, including directional compass headings, gyro headings, astro-compass readings, precession rates, celestial bearings, star-shots, and sun lines in order to compile data to be used for the standardization of grid navigation.³⁴ The 46th/72nd Reconnaissance Squadron quickly perfected this type of polar navigation, and on October 16, 1946, a 46th/72nd Reconnaissance Squadron crew completed the first scientifically verified flight over the North Pole.³⁵



Figure 3-3: Photo of one of the 46th/72nd Reconnaissance Squadron crews to fly over the North Pole³⁶

While the standardization of grid navigation was of great strategic value to the U.S., it was also applied to commercial travel, allowing airlines to travel shorter routes over the pole and save hundreds to thousands of flight miles. In addition to contributing to the standardization of grid navigation, all of these readings contributed directly to a better understanding of the magnetic properties of the earth, allowing squadron ground support to accurately identify and locate not just one magnetic pole, but three.³⁷

³⁴ "Top of the World: The National Geographic Society's New Map of Northlands." *National Geographic* (October 1949), 524.

³⁵ Wack, 1992, 11. Although aviators like Byrd and Balchen claimed flights over the North Pole in the decades prior to this flight, many of these flights were later contested as missing the geographic North Pole by tens to hundreds of miles. This was the first successful North Pole flight able to be proven through navigational equipment.

³⁶ From the 46th/72nd Reconnaissance Squadron Veterans Association collection, Photographic Archives of Air Force Historical Research Agency, at Maxwell Air Force Base.

³⁷ Wack, *The Secret Explorers*, 7-8.

3.1.2 “Operation Flood Light”

While collecting data to help both perfect polar flying and expand scientific knowledge of the polar regions, the 46th/72nd Reconnaissance Squadron also photographed the arctic landscape and searched for undiscovered landmasses under the polar ice. New missions to photograph different areas were routinely added, not only for the Strategic Air Command, but also for other government departments, such as the Geological Survey and Alaskan Department. Projects ranged from photographing the Alaskan coast to completing mosaic photographs of all Alaskan military bases. On October 14, 1946, while on a reconnaissance mission, a 46th/72nd Reconnaissance Squadron crew discovered through radar what they believed was an undiscovered landmass in the Arctic Ocean, approximately fourteen by seventeen miles, about 300 miles north of Point Barrow. When the crew flew over the location, they visually confirmed the target, which they called “Target X”, noting that there was no evidence of Soviet occupation and that the overlaying ice showed gravel and other evidence of land underneath the ice. Although this mass was later identified as an ice island (renamed T-1) rather than a landmass, the find was highly significant for future military and scientific research possibilities as research stations on Arctic ice islands.³⁸

While exploring the Arctic, the 46th/72nd Reconnaissance Squadron also played a key role in determining Soviet offensive capabilities. Although the reconnaissance missions largely allayed U.S. fears regarding Soviet presence in the Arctic, the 46th/72nd Reconnaissance Squadron continually monitored Soviet military advancement, particularly regarding nuclear capabilities. Crews of the 46th/72nd Reconnaissance Squadron would often fly over Soviet territory, not only scouting for military bases or stations, but also testing the radioactivity in the atmosphere. These flights were highly classified, even to the crew performing the mission, who often knew little more than that “at approximately three-hour intervals, the airplane would be depressurized and a new piece of filter paper inserted into the ‘bug catcher’ mounted on the top of the airplane.”³⁹ In actuality, these filter papers would record the radioactive “counts per minute,” with 50 counts per minute being within the range of an atom bomb test. In 1949, results of over 1,000 counts per minute from these tests indicated that the Soviets had successfully detonated their own nuclear bomb.⁴⁰

While the above missions contributed directly to national security and early Cold War reconnaissance, the American population knew little of their missions. The missions of the 46th/72nd Reconnaissance Squadron were portrayed to domestic and foreign audiences as strictly meteorological. In 1947, the squadron’s classified records were sent to the Strategic Air Command headquarters, and the military released enough information concerning the squadron’s scientific progress and polar flight prowess to help deter the Soviets from attempting to expand their power into the Arctic.⁴¹

³⁸ Bushnell, *Scientific Studies at Fletcher’s Ice Island*, 1. For additional information, see chapter 4.

³⁹ White, *World in Peril*, 40.

⁴⁰ White, *World in Peril*, 40.

⁴¹ For example, one *National Geographic* article concerning the 46th/72nd contribution to revised terrestrial maps of the Arctic credits the squadron with over 100 flights over the North Pole within a year, with over 5,000 flight hours and one million miles

3.2 Cold Weather Testing

Aside from these major Cold War missions, the 46th/72nd Reconnaissance Squadron also participated in a variety of additional military endeavors specific to their location at Ladd Field, one of the leading cold weather test sites for the U.S. military. Although the 46th/72nd Reconnaissance Squadron was designated “Top Secret” and held tenant status, it was nevertheless in constant communication with Ladd Field’s Cold Weather Test Detachment. The Cold Weather Test Detachment would often provide the squadron with special cold weather clothing and supplies, while the 46th/72nd Reconnaissance Squadron would provide feedback on the equipment, as well as participants for cold weather field tests.

Field tests were often held at Chandler Lake for up to a week at a time, using members of the 46th/72nd Reconnaissance Squadron. The Cold Weather Test Detachment also utilized the squadron for survival equipment tests at Blair Lake during the winter of 1946, as well as emergency field ration testing, field tests on Birch Hill, and in 1948 emergency flight survival kit field testing in Brooks Range.⁴² The testing efforts of the 46th/72nd Reconnaissance Squadron and the survival lessons they learned would ultimately prove critical not only for development and implementation of cold weather testing at Ladd Air Force Base following World War II, but also for the continued training of later arctic troops, as the 46th/72nd Reconnaissance Squadron crews trained other squadrons in arctic survival and polar aviation, including the 59th Weather Reconnaissance Squadron.

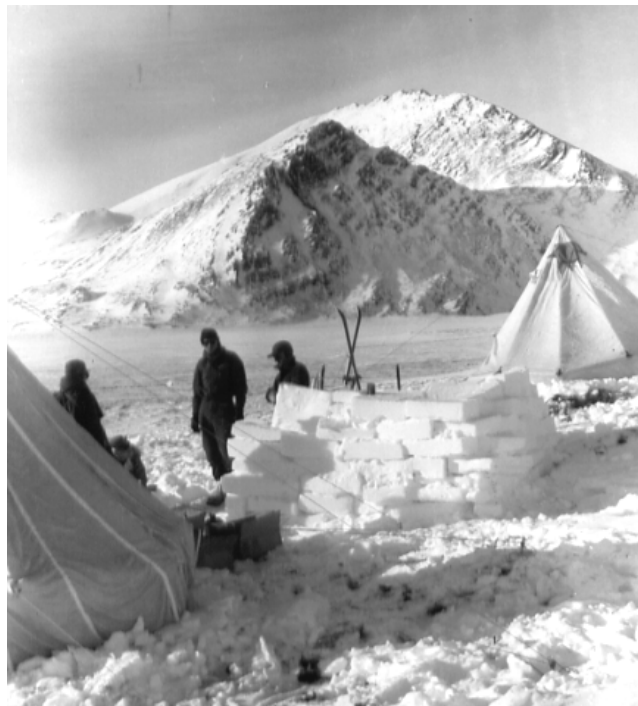


Figure 3-5: Arctic Survival Camp at Chandler Lake, Brooks Range.⁴³

covered. Additionally, it is emphasized that polar flights were “common place, [for] never a day passes without a polar flight by a weather-observation or training plane.” “Top of the World,” *National Geographic*, 524. White, *World in Peril*, 130.

⁴² Ladd Field History Officer, *Ladd Field History Reports*, (Ladd Field History Office, Ladd Field, Fairbanks, AK, 1946-1948).

⁴³ From the 46th/72nd Reconnaissance Squadron Veterans Association collection, Photographic Archives of Air Force Historical Research Agency, at Maxwell Air Force Base.

Other collaboration efforts between Cold Weather Test Detachment and the 46th/72nd Reconnaissance Squadron included missions at Moose Lake in Tanana Flats to test the use of radar-blocking material (which was ultimately proven to be unsuitable for the Arctic),⁴⁴ as well as flight testing glass windshields specifically designed to withstand extreme arctic environments, with electrical windshield de-icing. As a result of almost 200 hours of hazardous testing by a 46th/72nd Reconnaissance Squadron crew, the glass was determined to be both efficient and safe, and it is currently installed in all modern aircraft.⁴⁵ The 46th/72nd Reconnaissance Squadron even participated in the creation of a military survival training movie entitled “Land and Life on the Arctic Tundra,” which was shot in Nome in 1948 by a Hollywood film crew and went on to win the Venice Film Festival, Documentary Class in 1949.⁴⁶

3.3 Legacies of the 46th/72nd Reconnaissance Squadron

Bernt Balchen, World War II American-Norwegian pilot and commander of the 10th Search and Rescue at Ladd Field, recalls in his 1958 autobiography that, “It is the Soviet’s suspicion of our ability to strike back [in the Arctic], I think, that is the greatest single deterrent to attack today.”⁴⁷ This defensive ability, which helped keep the Soviets at bay throughout the Cold War, was greatly dependent upon arctic military training, knowledge of the landscape, and familiarity with Arctic navigation and would not have been possible without the early efforts of the 46th/72nd Reconnaissance Squadron. The advances in cold weather testing made by the 46th/72nd Reconnaissance Squadron were pivotal in developing and improving this defense. When “Project Nanook” was discontinued on October 13, 1947, its 94 officers and 408 enlisted men were transferred en masse. Downgraded from “Top Secret” to “Classified”, the 46th/72nd remained at Ladd Field until 1949 when it was transferred to Eielson and continued Cold War reconnaissance missions until 1955.⁴⁸

With the records of the squadron declassified in 1988, it is now possible to appreciate fully the contribution of these crews to both Alaskan and American defense. Having contributed more to the scientific and strategic knowledge of the polar territories than any other group or individual previously, these men established “top of the world” flight corridors, identified three magnetic poles, discovered and tracked multiple ice islands, and photographed thousands of miles of previously unexplored land. Moreover, the aerial photo maps produced by the squadron were utilized for years, contributing not only to defensive planning, but also to community planning, agricultural surveys, demographics, governmental studies, and oil deposit searches. As a result they indirectly influenced the future growth of social, commercial, and militaristic development in America’s last great arctic frontier.

⁴⁴ Wack, *The Secret Explorers*, 57.

⁴⁵ Wack, *The Secret Explorers*, 33.

⁴⁶ White, *World in Peril*, 173, 261-264.

⁴⁷ Glines, Carroll V., *Bernt Balchen, Polar Aviator* (Smithsonian Institution Press, Washington, D.C., 1999).

⁴⁸ Ladd Field History Officer, *Ladd Field History Reports*, (Ladd Field History Office, Ladd Field, Fairbanks, AK, 1949).

Chapter 4.0 – Ice Station Research

*The great center of the map is white, almost blank. Sketchily charted, its secrets for the most part still shrouded in ice and snow, the Arctic now assumes a new prominence in the eyes of the military planner. If we will adapt our technology to its demands, the Arctic offers us a new military frontier.*⁴⁹

4.0 Discovery of the Ice Islands

From 1946 to 1961, the U. S. Air Force engaged in observations of polar ice pack phenomena, which resulted in the support of manned ice stations. The stations were established to gain information on Arctic ice pack phenomena, serve as Arctic weather stations, and as experiments in establishing permanent forward operating bases on the ice islands.⁵⁰ While the U.S. had conducted some research into polar ice pack phenomena prior to and during World War II, the real push for additional research came afterward. The lack of information on the Arctic and any potential landmasses concerned U.S. military and strategic planners, because the Soviet Union had invested considerable time during the 1930s investigating the region.⁵¹ The upcoming United Nations' agreement limiting Arctic sovereignty gave the issue even greater urgency.⁵²

As discussed in the previous chapter, the 46th/72nd Reconnaissance Squadron had been tasked under “Project Nanook” to identify undiscovered land masses in the Arctic. On 14 August 1946, the unit made a discovery that they believed could be a new landmass, which they documented, photographed, and named “Target X”.⁵³ The discovery quickly moved up the chain of command:

A special courier relayed the picture to the Pentagon, where it aroused a blizzard of excitement. A hitherto unknown island, as large as Guam, situated in the Arctic Ocean? It could have an important bearing on American military strategy were war to come with

⁴⁹Fletcher, Joseph O., Lt. Colonel, *The Arctic: Challenge to the Air Force*. (Air Research and Development Command, Headquarters 1953), 1.

⁵⁰ Fletcher, Joseph O., Lt. Colonel, *Floating Ice Islands, Special Report No. 5* (Seattle, Headquarters, 58th Strategic Reconnaissance Squadron, Weather, 1951), 2. Schiller, Ronald, *Floating Air Bases of the Arctic* (Elmendorf Air Force Base, Alaska, Office of History, Alaskan Air Command, 1952), 1. Stinchfield, Phillip R. Captain, *Floating Ice Island Weather Station Project: Operations Report May-June 1951* (Elmendorf Air Force Base, Alaska, Arctic Weather Central Headquarters. 11th Weather Squadron, 1951), 1.

⁵¹ In the late 1930s, the Soviets established the first drifting station on pack ice near the North Pole. Called the North Pole 1 expedition, the first settlement consisted of four men camped on the island conducting research until the island drifted into the Greenland Sea. In 1941, the Soviet plane, N-169, made three landings on an ice pack north of Wrangel Island, each time conducting scientific experiments. After the war, the Soviets established six Arctic drifting stations, each active for about a year, and they made multiple ice pack landings to conduct short-term research. Bushnell, *Scientific Studies at Fletcher's Ice Island*, 1.

⁵² See Chapter 3.

⁵³ Fletcher, *Floating Ice Islands*, 1. Schiller *Floating Air Bases of the Arctic*, 1. Stinchfield, *Floating Ice Island Weather Station Projects*, 2.

Russia. The lid of secrecy was clamped down tightly, while high brass and big planes roared north to investigate.⁵⁴

Multiple attempts were made in the days that followed to relocate the island, but low visibility and difficulties charting the island's location meant that it was several days before a second confirmed contact was made. Once they had relocated the island, they were startled to find that not only had the island moved several miles east of its original position, but that it was actually a floating mound of freshwater ice in the middle of the Arctic Ocean.⁵⁵

Once it was determined that the ice island was not a landmass, the weather reconnaissance flights flown out of Ladd Air Force Base and Eielson Air Force Base were tasked with monitoring the ice island's location. Target X, later renamed T-1, was identified regularly by the weather reconnaissance units until 6 October 1949, after which it was lost for a year.⁵⁶ In 1950, attempts were initiated to identify more ice islands. The weather reconnaissance squadrons identified T-2 on 20 July 1950 and T-3 on 24 August 1950.⁵⁷

4.1 "Project Icicle"

A conference was held in December 1951, and it was decided that the Air Force would establish a temporary camp on one of the islands to explore the possibility of a more permanent base. Lt. Colonel Fletcher and Dr. Kaare Rodahl with the Arctic Aeromedical Laboratory were two of the project leaders on the expedition. T-3, later renamed Fletcher's Island after the leader of the early expedition, was chosen as the most desirable location, because it was both closest to the center of the Arctic Ocean and nearest to Alaska. T-3 was located approximately 800 miles from Point Barrow, at the limit of a C-47's range.⁵⁸

The expedition depended heavily on support from Ladd Air Force Base and the surrounding area. Supplies for the expedition were purchased from local outfitters in Fairbanks, as none of the standard issue clothing was sufficient for a polar expedition, and transportation to the site was provided by the 10th Rescue Squadron stationed at Ladd Air Force Base.⁵⁹ On 11 March 1952, the crew departed Ladd Field in route to Thule Air Force Base in Greenland from which the final approach would be made. While initial plans had called for using T-1 as a refueling point, it was unable to be relocated and a fuel cache was left for the expedition on the ice pack.⁶⁰ After arriving at T-3, it was determined that only the ski equipped C-47 could land safely. The remainder of the supplies were air dropped to the site.⁶¹

⁵⁴ Schiller, *Floating Air Bases of the Arctic*, 1.

⁵⁵ Fletcher, *Floating Ice Islands, Special Report*, 2-3. Schiller, *Floating Air Bases of the Arctic*, 1.

⁵⁶ Schiller, *Floating Air Bases of the Arctic*, 1.

⁵⁷ Fletcher, *Floating Ice Islands, Special Report*, 2. Schiller, *Floating Air Bases of the Arctic*, 2.

⁵⁸ Bushnell, *Scientific Studies at Fletcher's Ice Island*, 1. Rodahl, Kaare, *Report on the Initial Phase of Project Icicle* (Ladd Air Force Base, Alaska, Arctic Aeromedical Laboratory, 1952), 4. Stinchfield, *Floating Ice Island Weather Station Projects*, 4.

⁵⁹ Rodahl, *Report on the Initial Phase of Project Icicle*, 6-7.

⁶⁰ Rodahl, *Report on the Initial Phase of Project Icicle*, 8.

⁶¹ Rodahl, *Report on the Initial Phase of Project Icicle*, 13.

The initial camp was located near the edge of the island to give the scientists easy access to the ice pack. Although the first camp on T-3 was small, a single tent for three researchers and support staff, it quickly expanded as they realized it was possible to maintain a larger operation.⁶² By the end of April, the camp had expanded to include several additional staff, and support facilities. A small caterpillar tractor was transported and used to prepare a runway in 1952.⁶³ In 1953, the camp was taken over by the Northeast Air Command and more huts were added with more facilities. The camp remained essentially unchanged from 1953 until a new camp was established in 1957.⁶⁴



Figure 4-1: View of the 1952 camp showing single Jamesway hut and tents used for storage.⁶⁵

⁶² Bushnell, *Scientific Studies at Fletcher's Ice Island*, 5.

⁶³ The runway was considered critical by United States Air Force Command due to the desire to use larger aircraft on the island. Rodahl, *Report on the Initial Phase of Project Icicle*, 25.

⁶⁴ Bushnell, *Scientific Studies at Fletcher's Ice Island*, 6.

⁶⁵ From the Ice Island Research Station collection, Office of the 11th Air Force 3rd Wing Historian at the Joint Base Elmendorf-Richardson.

The design of the camp was determined by the need for unobstructed measurements and to limit potential fire hazards. The main building was a Jamesway hut, and it served most functions for the encampment during the winter of 1952-1953. It contained working, cooking, dining, recreation, sleeping, toileting, and storage areas. The extra supplies were often placed along the low walls in order to provide additional insulation. Mark III shelters were used for operations and sleeping during the winter of 1953-1954, at which point the Jamesway hut was then used only for storage.⁶⁶



Figure 4-2: Aerial of T-3 showing the camp.⁶⁷

Snow-block shelters were used for data collection and observation. Since data was collected through holes in the sea ice, which was generally thinner than the ice island, these snow-block shelters were placed at the edge of the ice island and projected out over the edge of the island onto the sea ice. Within the snow-block shelters, the thinner sea ice allowed the crew to dig a well and lower various nets, traps, dredges, corers, and hydrophones into the water. Unfortunately, the area on which these snow-block shelters were constructed was one of maximum ice-warping, and they had to be

⁶⁶ Mohr, John L. "Marine Biology on Fletcher's Island" in Vivian Bushnell, ed. *Scientific Studies at Fletcher's Ice Island, T-3, 1952-1955. Vol. 1. Geophysical Research Papers No. 63.* (Cambridge, Geophysics Research Directorate, Air Force Cambridge Research Center, Air Research and Development Command, United States Air Force, 1959), 86.

⁶⁷ From the Ice Island Research Station collection, Office of the 11th Air Force 3rd Wing Historian at the Joint Base Elmendorf-Richardson.

reconstructed repeatedly as successive wrecking occurred. Life rafts and extra rations were kept on location in case of an emergency, though never used.⁶⁸

T-3 was characterized by cold, wet summers during the melting season and extremely cold winters. The highest temperature recorded was 36° F, while the lowest was -60° F. Cloud observation confirmed what polar explorers had already commented upon: that the polar region sky was often covered in persistent, dark, low-overcast skies during the summer months. In winter, however, the sky was clearer.⁶⁹

Life on the ice islands was dangerous, and while flying conditions consisting of ceiling and visibility are relatively good, “flying operations themselves are difficult during much of the year. This is due mainly to the long periods of darkness in winter, accompanied by the lack of navigational aids, unsuitable landing surfaces, and various other factors.”⁷⁰ Holger “Jorgy” Jorgensen, a bush pilot, often flew fuel and supplies to the island. When he was later interviewed, he remembered a conversation he had with one of the scientist based on the island:

A few of the people among those who worked on T-3 have been friends of mine, and now and then, I’ve prodded them to tell me about life and work there. Oh, it got to be pretty routine, most of them said. Just your basic field camp in the Arctic, a little cramped, but we had labs and desks plus holes in the ice. You get up in the morning and it’s really just another day at the office. One of them, however, was a little more willing to share a candid view over coffee one day. It was off the edge of the earth, he said. Hundreds of miles from any other people. Radio was iffy, weather reports hopeless, even finding T-3’s location in the always moving ice depended more on stars than instruments. Darkness, cold, polar bears appearing unexpectedly (sic), and if fuel ran low or somebody got sick—well, we had reason to be a little tense, he said.

“I’d think you should be scared,” I said.

“Scared? Well, I guess some of the guys were scared now and then, you know, like when the island split right through camp or like that time when we were just about out of fuel and stuff and didn’t think the resupply flight was going to make it,”

But I persisted, “What about you? Were you scared?”

“Me, scared? Nah,” he said, picking up his coffee cup. “I was terrified.”⁷¹

⁶⁸ Mohr, “Marine Biology on Fletcher’s Island,” 88.

⁶⁹ Mohr, “Marine Biology on Fletcher’s Island,” 88.

⁷⁰ Bushnell, *Scientific Studies at Fletcher’s Ice Island*, 5.

⁷¹ Jorgensen, Holger, and Jean Lester, *Jorgy: The Life of Native Alaskan Bush Pilot and Airline Captain Holger “Jorgy” Jorgensen as told to Jean Lester* (Ester, AK: Ester Republic Press, 2007), 7.

There were many difficulties in supplying ice islands, as they were constantly moving and in operation when completely dark and frequently masked by low cover. That close to the magnetic North Pole, the compass became unreliable and radio communication could be fickle. The grid navigation system that had been developed by the 46th/72nd Reconnaissance Squadron aided navigation, but without a consistent coordinate for the island, locating it consistently was a challenge. Even if the pilot could locate the island, landing on the runway was difficult, for it was only a “short, crude strip scraped and stomped out of the snow, lit only crude firepots burning oil and scrap.”⁷² When asked how good the runway was on T-3, made by a Weasel pulling a drag across the snow and ice, Jorgy responded that it was “rough as a cob.”⁷³

4.2 End of Island Research

In an approach typical of the Cold War, and much of the military’s Cold Weather Research in Alaska, research on T-3 included both basic and applied science in a framework of partnership between military and contracted researchers. By sponsoring and supporting the station, the U.S. Air Force contributed to basic geophysical research as it tested military applications for its own purposes. Contributions to basic geophysics included studies in oceanography, arctic meteorology and the upper atmosphere, ice movement, solar radiation, gravity and magnetism, and ice island features and origins. The U.S. Air Force also gained experience in developing the islands as forward operating bases with weather stations, emergency landing facilities, and listening posts.

During the International Geophysical Year in 1961, when T-3 had drifted to Greenland, two other stations were established in the western Arctic as pack ice stations. Ice Station Alpha was occupied from 1957 – late 1958. When it began to break up, crews established a new station the following spring. Known as Ice Station Charlie, it lasted ten months before meeting the same fate. In 1961, the U.S. Air Force ended its sponsorship of ice station research, turning its remaining facilities at T-3 over to the Navy.

⁷² Jorgensen, *Jorgy*, 7

⁷³ Jorgensen, *Jorgy*, 7

Chapter 5.0 – Permafrost Research

*We had spent only a few hours in Alaska before it was evident that it was one thing to decide that national defense requires air bases up near the Arctic Circle, with air units stationed there, and quite another to accomplish these results.*⁷⁴

5.0 Origins of U.S. Army Corps of Engineers Permafrost Research

Permafrost has been of interest to the U.S. Army Corps of Engineers (USACE) since World War II when several wartime construction projects, including the Alaska Highway, CANOL pipeline, and construction of the Northwest Staging Route, were hampered by permafrost. The USACE's inexperience working with permafrost had caused major difficulties, damaged equipment, and turned many of the construction sites into swamps as the permafrost melted. In response to these issues, the USACE established two new agencies: the Frost Effects Labs in 1944, under the New England Division, and the Permafrost Division in 1945, under the St Paul Division.⁷⁵ While their missions varied slightly, they were both directed "to determine design methods and construction procedures to be used in the construction of airfields" in arctic and subarctic climates, and were specifically focused on construction methods for areas where permafrost was prevalent.⁷⁶

As the Cold War progressed and the "Arctic Front" concept⁷⁷ developed, interest in permafrost and its potential military applications expanded. Additional agencies including the Snow, Ice and Permafrost Research Establishment (SIPRE), and the Arctic Construction and Frost Effects Laboratory (ACFEL) were founded in the early 1950s. Ultimately, the separate divisions were reorganized and combined under the Cold Regions Research and Engineering Laboratory (CRREL) in 1961. In Alaska, the early work on permafrost was conducted by the USACE's Permafrost Division at the Fairbanks Permafrost Experimental Station and airbases around the territory. After the internal reorganization, the work was continued by CRREL.

5.1 Fairbanks Permafrost Experimental Station

Though officially based at the USACE's St. Paul office, the Permafrost Division quickly established a field office in Alaska, based at Ladd Field.⁷⁸ Officially titled a "Comprehensive Program for Investigation

⁷⁴ Henry, H. Arnold, General, *History of the 11th Army Air Force to V-J Day*. (University of Alaska Anchorage Archives, Blue Collections, 1945).

⁷⁵ Edmund A. Wright, *CRREL's First 25 Years, 1961-1986* (Hanover, New Hampshire: Cold Regions Research and Engineering Laboratory, 1986), 2. The USACE is divided into multiple regional offices based on geographic areas; the New England Division and the St. Paul Division are two of these offices.

⁷⁶ Wright, *CRREL's First 25 Years*, ii.

⁷⁷ See Chapter 1.

⁷⁸ USACE, St. Paul District *Comprehensive Report Investigation of Military Construction in Arctic and Subarctic Regions* (St. Paul, Minnesota: USACE, 1950), 5-6; Wright, *CRREL's First 25 Years*, 6. Though officially based at Ladd Field, space issues at the busy installation meant that the field office was temporarily housed at Northway Airfield from February – September 1945. While at Northway, the Permafrost Division studied the effects of permafrost on built facilities by taking ground temperature

of Airfield Construction in Arctic and Subarctic Regions,”⁷⁹ the work of the Permafrost Division Field Office was diverse. Early studies included observations of existing construction on airbases throughout Alaska, weather and climate studies done in conjunction with the Alaska Weather Service, and permafrost identification using aerial photography in cooperation with the University of Perdue and the 46th/72nd Reconnaissance Squadron.⁸⁰ One of the largest experiments was the establishment of the Fairbanks Permafrost Experimental Station.

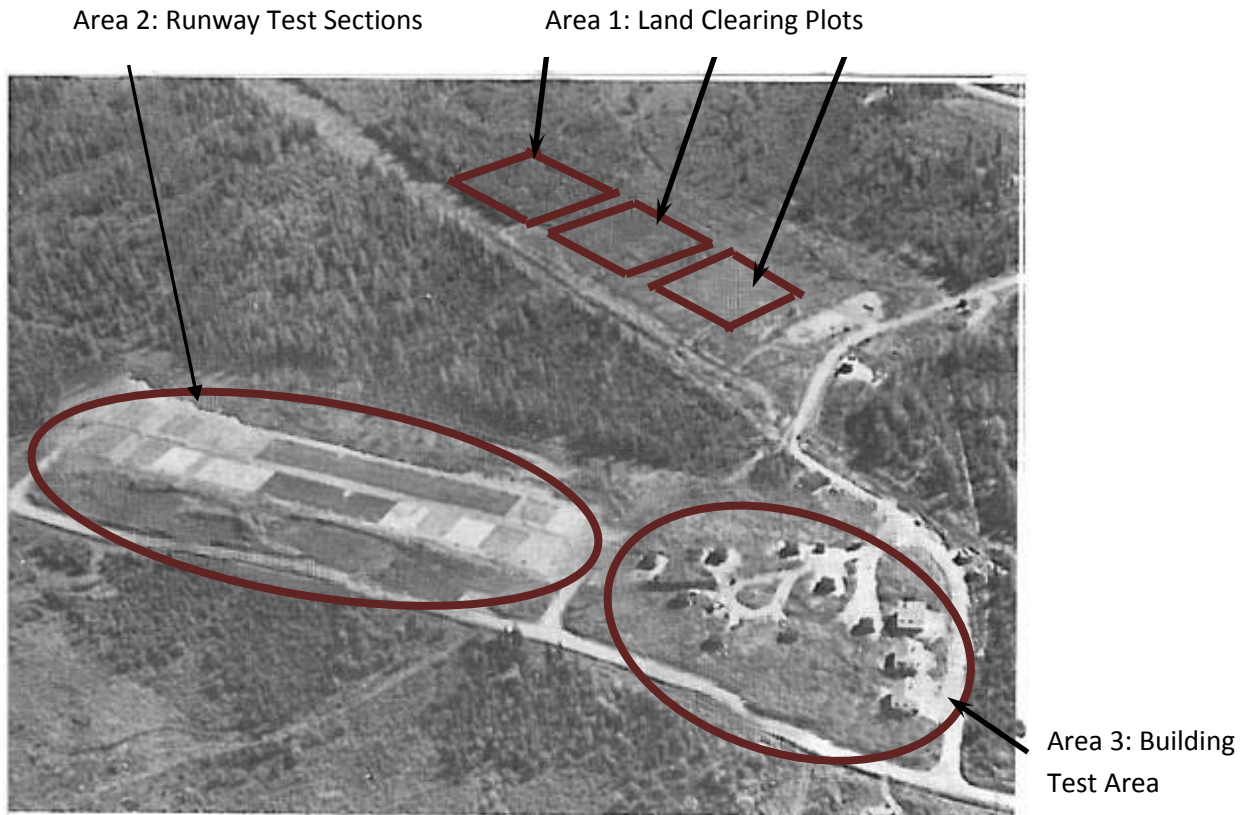


Figure 5-1: Aerial of Fairbanks Permafrost Experimental Station, circa 1948.⁸¹

The Fairbanks Permafrost Experimental Station was located three miles northeast of Fairbanks. The station provided “an opportunity to observe various types of structures erected on permafrost under conditions that would be known and recorded from the beginning to the conclusion of operations.”⁸² The station was constructed by the Ladd Field Engineer with assistance from the Alaska Field Office of

measurements, probing beneath runways and building foundations for permafrost depth, and looking a building settlement. The Division officially moved to Ladd Field in September of 1945. Work continued at Northway until 1948.

⁷⁹ Ladd Field History Officer, *Ladd Field History Report, Oct – Dec 1945* (Ladd Field History Office, Ladd Field, Fairbanks, AK, 1945), 25.

⁸⁰ USACE, St. Paul, *Comprehensive Report*, 12.

⁸¹ Margaret Cysewski, Karen Henry, Kevin Bjella, and Thomas Douglas, “Fairbanks Permafrost Experimental Station Historic Highlights” in *Ninth International Conference on Permafrost*, ed. Douglas L. Kane and Kenneth M. Hinkel (Fairbanks, University of Alaska Fairbanks, 2008).

the Permafrost Division from January 1946 through December 1947.⁸³ It was divided into three areas: Area 1, which studied the effects of site clearing on permafrost; Area 2, which focused on runway construction; and Area 3, which looked at building construction on permafrost.⁸⁴ Each area was monitored by a series of ground temperature sensors year-round and readings were taken to determine the amount of frost heave, the movement of the ground level in response to the melting and thawing actions of soils.⁸⁵

Investigations in Area 1 were focused on variations in permafrost depth and thawing due to climatological factors (i.e., sunlight, radiation, wind). The idea was to study the effects of ground clearing on permafrost melt and frost heave. Area 1 was subdivided into three sections (A, B, and C), each with varying levels of ground cover. Section A, was covered in undisturbed vegetation; in Section B, the vegetation had been thinned but not cleared; and Section C was completely cleared.⁸⁶

Area 2 consisted of twenty-six runway test sections, each fifty feet square. Each section was constructed with a different combination of surface material, base course, and insulation, which varied in both type and depth. Surface materials included in the study included asphalt, concrete, and gravel, while the insulation included both natural and artificial materials: P.C. Foamglas,⁸⁷ cell concrete, compacted spruce logs, compacted moss, and zonolite concrete. An additional variable was added by painting two portions of each test section white and black while leaving the third bare.⁸⁸

Area 3 was the largest of the three areas and took the longest to complete, with construction continuing through 1947.⁸⁹ Area 3 consisted of eleven buildings, three of which were designed and built specifically for the testing, called purpose-built facilities, and eight “Ready Stout Houses,” prefabricated temporary structures, that were moved to the site from Tanacross. As in Area 2, each of the buildings had a different combination of foundation and insulation to determine the best method for building on permafrost.⁹⁰

The Permafrost Division received mixed results from the early experiments, with Areas 1 and 2 showing less differentiation in the results than Area 3. In Area 1, it was determined that there was only a moderate difference in permafrost loss by thinning as opposed to clearing. In Area 2, none of the

⁸³ Ladd Field History Officer, *Ladd Field History Report, February 1946* (Ladd Field History Office, Ladd Field, Fairbanks, AK, 1945), 18.

⁸⁴ T. A. Douglas, M. Torre Jorgenson, M.Z. Tomanovsky, Y. Shur, and K. Yoshikawa, “Permafrost Dynamics at the Fairbanks Permafrost Experimental Station Near Fairbanks, Alaska” in *Ninth International Conference on Permafrost*, ed. Douglas L. Kane and Kenneth M. Hinkel (Fairbanks, University of Alaska Fairbanks, 2008), 373; Ladd Field History Officer, *History Report February 1946*, 18; USACE, St. Paul, *Comprehensive Report*, 15.

⁸⁵ Frost Heave is an upthrust of ground or pavement caused by freezing of moist soil — called also *frost heaving*. . Merriam-Webster Dictionary (2011), s.v. “frost heave.”

⁸⁶ USACE, St. Paul, *Comprehensive Report*, 39.

⁸⁷ P. C. Foamglas is a manufacturer’s brand name for foam glass, a black opaque cellular glass material that is made by firing crushed glass with powdered carbon and is used as a substitute for cork, balsa wood, or kapok in life preservers and as an insulating material. Merriam-Webster Dictionary (2011), s.v. “foam glass.”

⁸⁸ USACE St. Paul Division, *Comprehensive Report Investigation of military construction in arctic and subarctic regions 1945-1948*, Appendix III: Design and Construction Studies at Fairbanks Research Area (St. Paul, Minnesota: USACE, 1950), 8.

⁸⁹ Ladd Field History Officer, *Ladd Field History Report, July 1947*, (Ladd Field History Office, Ladd Field, Fairbanks, AK, 1947), 21.

⁹⁰ USACE, St. Paul, *Comprehensive Report, Appendix 3*, 13

foundations or insulation methods used provided significant change in permafrost depth.⁹¹ The greatest variation was found in Area 3, with large amounts of heave and depth of permafrost thaw beneath several of the buildings, one facility, built on piles, remained relatively stable. The results of these early studies were deemed successful but additional studies were planned. Work continued at the site until 1954 when all the test buildings in Area 3 were removed. Areas 1 and 2 were left in place and work has periodically been done on the site since the 1950s.⁹²



Figure 5-2: Photo of test buildings in Area 3, showing purpose-built facilities that also served as housing for researchers.⁹³

5.2 CRREL Permafrost Tunnel

After 1961, when the Permafrost Division, SIPRE, ACFEL, and the Frost Effects Lab were combined under CRREL, the USACE continued their original work but also began looking at potential military applications of permafrost. Previous research had primarily focused on issues of permafrost in relation to military construction in areas where permafrost predominated. Only one project had been conducted examining potential benefits of permafrost.⁹⁴ In Alaska, the most significant of these new studies was the construction of the CRREL Permafrost Tunnel, located approximately eight miles northeast of Fairbanks. While previous experiments in Greenland had addressed construction into permafrost from above, the CRREL was interested in expanding its studies into construction within permafrost and, in particular, permafrost that was more typical of Alaska.

⁹¹ Margaret Cysewski, et al., *Fairbanks Permafrost Experimental Station Historic Highlights*, 6. More recent studies have noted that a significantly greater amount of settlement has occurred in the sections of runways that were painted black, but a full analysis of the phenomena has yet to be completed.

⁹² James F. Haley, *Thawing Beneath Buildings Constructed on Permafrost Near Fairbanks, Alaska*, (Boston, Massachusetts, Arctic Construction and Frost Effects Laboratory, USACE, 1955), 4.

⁹³ Margaret Cysewski et al., *Fairbanks Permafrost Experimental Station Historic Highlights*.

⁹⁴ Camp Century, 1954 – 1966, was actually the first experimental facility constructed within permafrost. Constructed in Greenland in 1954, 140 miles northeast of the town on Thule, it was designed as an underground city for up to 100 people. Unlike the later permafrost tunnel, Camp Century was built by digging 21 “cut-and-cover” trenches. The trenches were excavated from above and then covered with corrugated steel arches and reburied. Camp Century was an a working outpost and had 30 prefabricated buildings within its tunnels, including research laboratories, dorms, a mess hall, dispensary, gym, barbershop, laundry, and nuclear reactor.

Camp Century, Greenland, active from 1954 to 1966, was the first facility constructed by the USACE into permafrost. Unlike the planned tunnel, however, Camp Century was dug from above and then reburied.⁹⁵ While much was learned from the experiments at Camp Century, permafrost in the U.S., and particularly Interior Alaska, presented different challenges.⁹⁶ The CRREL Permafrost Tunnel was the first project to excavate horizontally into permafrost, and the engineers had to address concerns with stability and the removal of material that had not occurred at other sites.

The CRREL Permafrost Tunnel is located at the eastern edge of the early 20th century mining operations in the Goldstream Valley. Referred to as Project 6.1, the purpose of the tunnel was to explore the military applications of permafrost and, specifically, the construction of emergency shelters or storage facilities in case of a nuclear act or Soviet invasion.⁹⁷

The adit⁹⁸ of the tunnel was dug into a bluff created during the overburden removal process of earlier mining activities. The tunnel was dug over the course of three winters, from 1963 to 1966, using an Alkirk Continuous Cycle miner and modified blasting techniques. Each technique left its mark on the tunnel in the form of the adit's walls, which are round where the miner was used and more uneven where blasting was necessary.⁹⁹ The miner worked by drilling two small pilot holes to guide the twin rotating cutting arms. The excavated material was pushed onto a conveyor and then loaded onto shuttles and driven out of the tunnel. Once it was completed in 1966, the adit measured 110-m long, and a ventilation shaft was dug at the easternmost end of the tunnel. A research facility and parking area were constructed on a gravel pad formed by flattening the tailings left from the mining operations.



Figure 5-3: Historic image showing the original tunnel portal, circa 1969.¹⁰⁰

⁹⁵ Wright, *CRREL's First 25 Years*, 18.

⁹⁶ Paul Sellmann, *Geology of the UAS CRREL Permafrost Tunnel, Fairbanks Alaska, Technical Report 199*, (Hanover, New Hampshire, Cold Regions Research and Engineering Laboratory, 1967), 1.

⁹⁷ T.D., Hamilton, J.L. Craig, and P.V. Sellmann, "The Fox permafrost tunnel: A late Quaternary geologic record in central Alaska," *Geological Society of America* 100(1988): 948; Sellmann, *Geology of USA CRREL Permafrost Tunnel*, 1; George K. Swinzow, *Permafrost Tunneling by a Continuous Mechanical Method, Technical Report 221*, (Hanover, New Hampshire, Cold Regions Research and Engineering Laboratory, 1970), 1.

⁹⁸ An adit is nearly horizontal passage from the surface in a mine. Merriam-Webster Dictionary (2011), s.v. "adit."

⁹⁹ Kevin Bjella, Thomas Tantillo, Jason Weale, and James Lever, *Evaluation of the CRREL Permafrost Tunnel*, (Hanover, New Hampshire, Cold Regions Research and Engineering Laboratory, 2008), 3; Sellmann, *Geology of USA CRREL Permafrost Tunnel*, 1; Swinzow, *Permafrost Tunneling*, 9.

¹⁰⁰ USACE, historical files, CRREL Permafrost Tunnel.

The tunnel portal was constructed as a separate phase. The intention was to provide additional support for the tunnel by constructing an arched steel structure that would serve as the interior skeleton of the tunnel, and a door that would be used to insulate the tunnel during the summer. The portal was created by inserting an insulated 5.4-meter corrugated steel culvert into the mouth of the tunnel and cutting it flush. A wooden structure was built to enclose the culvert (Figures 5-5). Inside the tunnel, the support structure consisted of nine welded I-beams forming steel arches, supported by cross-braces. A depression was cut just inside the entrance to trap cold air near the portal, and a shallow trench was dug for power and utility lines to assist with cooling and lighting the tunnel.¹⁰¹ After the portal and the first 5 meters of the support structure were completed, the scientists working on the project determined that the support structure was not needed as the permafrost was self-supporting.



Figure 5-4: Interior of tunnel with the adit on left and the winze¹⁰² on the right, 27 June 2011.¹⁰³

The CRREL Permafrost Tunnel was constructed as an experiment into military applications of permafrost. Project 6.1 was an experiment looking at utilizing permafrost as emergency shelters in response to Cold War concerns regarding nuclear war. The experiments in Greenland had shown that permafrost was capable of sustaining high velocity shocks. So the research on the CRREL tunnel was dedicated to determining whether permafrost could remain stable after exposure to sustained human activity and whether it would be cost effective to construct facilities in permafrost.¹⁰⁴ George Swinzow, one of the lead scientists on the team, concluded that “the permafrost tunnel offers a useful and comfortable personnel shelter. . . [t]he construction of large command posts, bulk fuel storage caves, and warehouse facilities in permafrost appears to be feasible and should be investigated.”¹⁰⁵ While

¹⁰¹ Swinzow, *Permafrost Tunneling*, 16-17.

¹⁰² Winze, a steeply sloped passage in a mine. Merriam-Webster Dictionary (2011), s. v. “Winze”

¹⁰³ Photo by author

¹⁰⁴ Swinzow, *Permafrost Tunneling*, 1.

¹⁰⁵ Swinzow, *Permafrost Tunneling*, 28.

further research into using permafrost tunnels for military applications was never conducted, the tunnel has been in continuous use for studying other aspects of permafrost. ¹⁰⁶

5-3 Permafrost Research Today

These early studies of permafrost laid the foundation for much of the work that has been done within the last few decades. The knowledge gained from the experiments at the Fairbanks Permafrost Experimental Station were incorporated into military and civilian construction manuals and is still used and updated by further research, in all military construction within permafrost areas today. The CRREL Permafrost Tunnel remains an active research site, and plans are being made to expand the tunnel complex within the coming years.

¹⁰⁶ The second major experiment in the legacy tunnel was the construction of the winze, an addition to the tunnel constructed over the winter of 1968 - 1969, by the Bureau of Mines. The winze was developed to research excavations methods for placer gold deposits located beneath permafrost. Other experiments conducted in the legacy tunnel include studies of ground ice structures; permafrost stability and sublimation studies; studies of paleontological remains and comparative studies conducted by the National Aeronautics and Space Agency (NASA) exploring permafrost applications for the Mars missions.

Chapter 6.0 – the Arctic Aeromedical Laboratory

*In any armed conflict in the foreseeable future such areas by virtue of their geographic location are destined to be the scene of much human activity . . . The Arctic Aeromedical Laboratory is performing a vital function for all of the Armed Services through its efforts to solve the severe environmental problems of men living and working in the Arctic.*¹⁰⁷

6.0 Foundation and Organization of the Arctic Aeromedical Laboratory

The Arctic Aeromedical Laboratory was initially founded on March 1, 1947, as the 1st Central Medical Establishment, under the School of Aviation Medicine at Randolph Air Force Base, Texas. It was quickly transferred to Ladd Air Force Base and re-designated the 1st Arctic Aeromedical Laboratory, later shortened to just the Arctic Aeromedical Laboratory.¹⁰⁸ Its purpose was “to solve the severe environmental problems of men living and working in the Arctic.”¹⁰⁹ In many respects, this was a continuation of the work of the Cold Weather Test Detachment with whom it was closely connected and dependent upon for aerial support.¹¹⁰ The Arctic Aeromedical Laboratory’s emphasis was on the physiological, biochemical, and psychological effects of extreme cold.

The Arctic Aeromedical Laboratory conducted medical research on human adaptation to the Arctic in all three fields of medical research (clinical, fundamental, and technological) with an emphasis, particularly in later years, on technical and fundamental research. The mission of the Arctic Aeromedical Laboratory, as defined by Air Force Regulation 80-21, was four-fold:

- 1) To conduct an in-house program of research, supplemented by research carried out under contract with various institutions throughout the country, principally universities, on arctic human factor problems.
- 2) To establish Air Force requirements for clothing, personal equipment, operating procedures, and training programs for use in the Arctic.
- 3) To evaluate, under arctic conditions, items of clothing and equipment developed in other Air Force laboratories.
- 4) To provide laboratory facilities, logistic support, and technical assistance to visiting research teams or field parties.¹¹¹

¹⁰⁷ Arctic Aeromedical Laboratory Unit Historian, *The Arctic Aeromedical Laboratory: History Mission, Environment*. (Fort Wainwright, Alaska, Arctic Aeromedical Laboratory, 1961), 1.

¹⁰⁸ Elmendorf Unit Historian, *Arctic Aeromedical Laboratory 1 March 1947 – 30 June 1967* (Elmendorf Air Force Base, Alaska, Office of the Unit Historian, unpublished), 2.

¹⁰⁹ Arctic Aeromedical Laboratory Unit Historian, 1961, 1.

¹¹⁰ Elmendorf Unit Historian report, Unpublished, 3.

¹¹¹ Arctic Aeromedical Laboratory Unit Historian, 1961, 2.

To accomplish these missions, the Arctic Aeromedical Laboratory was divided into five research departments: Environmental Medicine, Physiology, Biochemistry, Protective Equipment, and Psychology.¹¹² The Department of Environmental Medicine conducted research on the identification, treatment, and prevention of diseases of concern in the arctic environment, and on the relationships between human and arctic life.¹¹³ Human acclimatization to extreme cold, the effects of short-term exposure to extreme cold, and hypothermia were the province of the Department of Physiology.¹¹⁴ The Department of Biochemistry was dedicated to nutritional and biochemical agents with relation to arctic adaptation, including the biochemical cause and effect of exposure to extreme cold.¹¹⁵ The Department of Protective Equipment, sometimes referred to as “special projects,” was tasked with designing, developing, and testing personal and survival equipment; in the final years of the Arctic Aeromedical Laboratory, this was the primary focus of the organization.¹¹⁶ The fifth department, the Department of Psychology, was dedicated to the study of the psychological effects of life in the Arctic but also worked on methodologies for identifying personnel best suited for duty in the Alaskan theater.¹¹⁷

Over its twenty years of operation, the Arctic Aeromedical Laboratory completed and published over 600 experiments and technical reports, and sponsored several symposiums concerning arctic issues.¹¹⁸ The work of the Arctic Aeromedical Laboratory was exceptionally wide ranging. Studies were done on the flora and fauna of Alaska, including studies on the suitability, or lack thereof, of certain species to live in the Arctic.¹¹⁹ A number of studies focused on the issue of human acclimatization to the cold and included work with subjects from Alaskan Native villages, the local population of Fairbanks, and the Soldiers and Airmen stationed in Alaska.¹²⁰ Psychological testing on military personnel and local inhabitants was aimed at determining suitability for service in the Arctic and on ways that morale could be improved.¹²¹ Studies also included improving personal equipment and standards for emergency training regimens.¹²² Additionally, studies were done in cooperation with various universities and other federal agencies, including work with the National Aeronautic and Space Administration.¹²³ This chapter will briefly describe three studies testing emergency equipment for airmen, a morale study of the personnel assigned to Ladd Field, and a controversial thyroid study on Alaska Natives.

¹¹² Variations in the names and organization of the various departments occurred throughout the life of the Arctic Aeromedical Laboratory. For the purposes of this study, they have been simplified using the names identified in the 1961 unit history. A more complete discussion of the variations can be found in the report of the Elmendorf Unit Historian.

¹¹³ Arctic Aeromedical Laboratory Unit Historian, 1961, 6.

¹¹⁴ Arctic Aeromedical Laboratory Unit Historian, 1961, 9.

¹¹⁵ Arctic Aeromedical Laboratory Unit Historian, 1961, 12.

¹¹⁶ Arctic Aeromedical Laboratory Unit Historian, 1961, 14.

¹¹⁷ The Department of Psychology was discontinued after 1961 when the unit lost its psychologist. Arctic Aeromedical Laboratory Unit Historian, 1961, 17.

¹¹⁸ Elmendorf Unit Historian report, Unpublished, 40.

¹¹⁹ See TR-64-37, *Temperature Regulation in the Vampire Bat Desmodus Rotundus*; TR-57-16, *Emergency Food Value of Alaskan Wild Plants*; TR-65-15, *Physiological Observations on Subarctic Bears Under Winter Den Conditions*.

¹²⁰ See TR-57-33, *Napaskiak, An Eskimo Village in Western Alaska*; TR-57-84, *Comparative Sweat Rates of Eskimos and Caucasians Under Controlled Conditions*.

¹²¹ See TR-63-41, *Military Small Group performance Under Isolation and Stress*; TR-61-12, *Indoctrination Procedures for Personnel Assigned to Arctic Sites*.

¹²² See TR-63-1, *An Experimental Winter Flying Glove*; TR-63-12, *Accumulation of Static Electricity on Arctic Clothing*; TR-61-7, *Evaluation of Various Types of Boots in Cold Environments*.

¹²³ See TR-64-24, *Cold Test Evaluation of Some Components of the NASA Mercury Survival Kit*.

6.1 Emergency Survival Equipment

Emergency survival equipment and procedures were one of the main areas of focus for the Department of Protective Equipment, which tested everything from gloves, boots, and immersion suits to portable shelters or shelters that could be improvised by downed airmen in the field. In order to test this equipment, the Arctic Aeromedical Laboratory worked with both the Cold Weather Test Detachment and the Arctic Indoctrination School housed at Ladd Air Force Base.¹²⁴ Results from their tests were incorporated into the training regimen of military personnel stationed in, and equipment designed for, the Arctic. Three of the studies that were conducted by the Department of Protective Equipment included the development of a walk-around sleeping bag, using aircraft as emergency shelters, and the development of a pararescue medical kit.



Figure 6-1: Walk-around sleeping bag during field testing.¹²⁵

The walk-around sleeping bag was developed in 1959 as a proposed modification to the standard Quartermaster mountain sleeping bag. The idea was to eliminate the need for both a bulky sleeping bag and an arctic parka in the emergency kits for Airmen. Simple modifications to the standard issue sleeping bag, the addition of armholes, additional insulation, and dual directional zipper¹²⁶ would allow a single article to serve both purposes, with the added benefit of allowing the Airmen greater range of

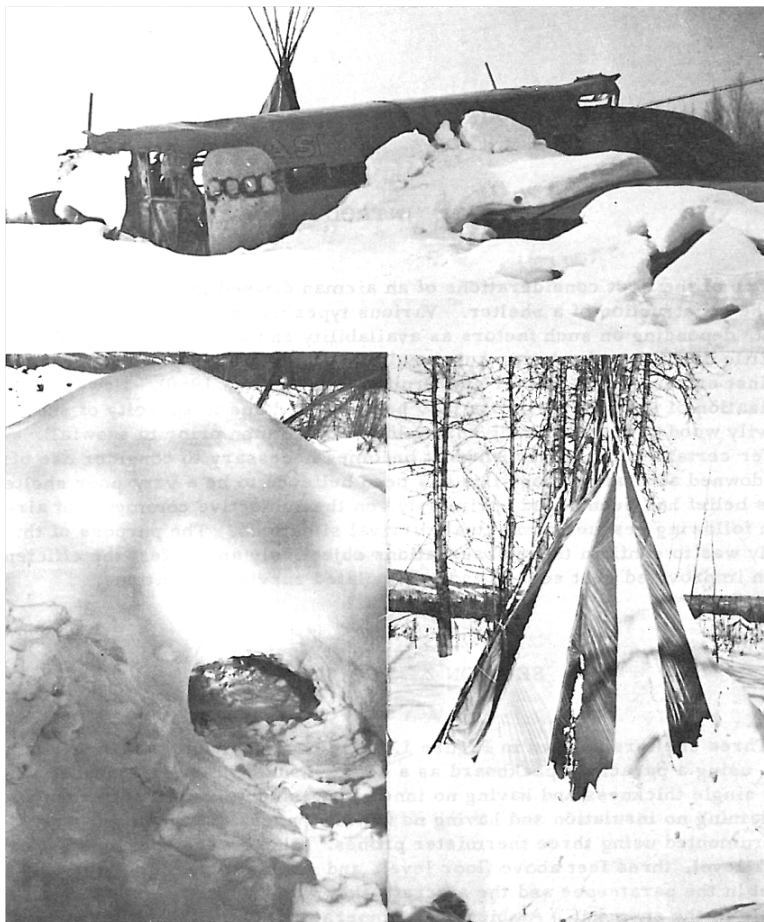
¹²⁴ Buskirk, Harvey A., *TR-59-4 Walk-Around Sleeping Bag* (Ladd Air Force Base, Alaska, Arctic Aeromedical Laboratory, 1959) 7.

¹²⁵ Buskirk, 1959, 10.

¹²⁶ Buskirk, 1959, 2.

motion without having to remove the bag and lose body heat.¹²⁷ The bag was tested by the Arctic Indoctrination School and was determined to be satisfactory. In fact, the Arctic Aeromedical Laboratory recommended that the bag be considered for use by the Army's ground personnel.¹²⁸ While a later study on a mass-produced version of the bag proved unsatisfactory, the locally altered version was used by personnel in the field.

Another experiment concerned using downed aircraft as emergency shelters. The use of airplanes as shelters had been discouraged because the lack of insulation caused many to believe they were unsuitable. The Arctic Indoctrination School taught Airmen to build snow huts and paratepees,¹²⁹ but these were not always feasible. Snow huts were only possible when there was enough snow on the ground to construct them, and the paratepee required long pieces of wood which might not be available, particularly at more northern latitudes where tundra and ice fields predominated.¹³⁰ The



study **Figure 6-2:** From top to lower right, fuselage of downed aircraft, snow hut, and paratepee.¹³¹

¹²⁷ Buskirk, 1959, 6-7.

¹²⁸ Buskirk, 1959, 7.

¹²⁹ Shelters constructed like "teepees" using parachutes and propped up on long sticks or pieces of timber.

¹³⁰ Barnett, Paul W., Lieutenant *TR-62-29 Consideration of Aircraft as Emergency Shelters* (Ladd Air Force Base, Alaska, Arctic Aeromedical Laboratory, 1959) 2

¹³¹ Barnett, 1959, 1.

compared the three shelters and determined that an un-insulated aircraft was not a suitable shelter unless a source of additional heat was available. The researchers discovered that Airmen could construct a small improvised stove using pieces of the downed plane's exhaust system. The stove would take approximately two hours to construct and required a set of pliers, a saw, screw driver and a hand drill. The Arctic Aeromedical Laboratory recommended that the Indoctrination School train Airmen in the construction of emergency stoves and ensure that a basic tool kit was located on all aircraft, but concluded that downed aircraft should be utilized only as a last resort.¹³²

A third project looked at developing a pararescue medical kit. Airmen had been using field improvised kits, but the Alaska Air Command requested that the Arctic Aeromedical Laboratory develop a standardized kit that could be incorporated into the existing jumping equipment.¹³³ The improved kit developed by the Arctic Aeromedical Laboratory included both emergency medical supplies



Figure 6-3: Pararescue medical kit, shown with snowshoes.¹³⁴

¹³² Barnett, 1959, 10.

¹³³ Millard, W. W., MSgt. and MSgt. J. R. Schumann, *TR-64-1 Pararescue Medical Kit* (Ladd Air Force Base, Alaska, Arctic Aeromedical Laboratory, 1964) 1.

¹³⁴ Millard and Schumann, 1964, 4.

(fluids, bandages, and splints) and other survival items, (an extra down-filled coat, flares, a radio).¹³⁵ The kit was attached to the front of the jumping harness and designed not to interfere with the auxiliary chute located on the chest.¹³⁶ The kit was designed to support attaching snowshoes if needed. The kit was field tested and incorporated into the standard equipment for paratroopers and rescue teams.¹³⁷

6.2 Morale Studies at Ladd Field

Unlike the field tests of survival equipment which had been previously carried out by the Cold Weather Test Detachment, the Arctic Aeromedical Laboratory was the first military organization to conduct psychological testing on personnel stationed in the Alaskan theater. One of the earliest tests was a morale study at Ladd Air Force Base in 1949. The study was conducted using a questionnaire given to 1,000 enlisted personnel: 300 entering the theater and 700 already stationed at Ladd Air Force Base.¹³⁸ The study looked at five main categories of personnel: based on age (greater or less than 21), marital status, reenlistment plans, personnel accompanied by their family, and personnel who exhibited psychosomatic complaints.¹³⁹ While the study did not presume that morale at Ladd Air Force Base was a concern, it tried to determine what factors might affect it.¹⁴⁰ The study considered a number of factors including: services (including recreational) provided to Airmen, personality factors, social and sexual adjustment (including marital status), involvement in recreation, and interaction with their unit.¹⁴¹ The study concluded that overall morale at Ladd Air Force Base was not a major concern, but that it tended to be of greater concern in the younger, unmarried personnel who had not adapted to military life. Morale was of particular concern among those men who had enlisted, at least in part, to utilize the GI Bill of Rights and further their education. While the researcher in charge of the study listed no official recommendations, he did note that increased transportation to recreational activities and additional housing for men who were married but unable to have their families accompany them could help to increase morale.¹⁴²

6.3 Physiological Studies and Controversy

One of the most controversial studies developed by the Arctic Aeromedical Laboratory studied at the effect of the thyroid in metabolic response to cold. The study was controversial because scientists working on the study failed to obtain informed consent from the study subjects. The study was conducted from 1955 to 1957, during which 102 Alaska Natives, from the villages of Wainwright, Anaktuvuk Pass, Fort Yukon, Arctic Village, and Point Hope, and nineteen military personnel were given Iodine-131, a radioactive isotope, in an attempt to study the role of the thyroid in metabolic response to

¹³⁵ Millard and Schumann, 1964, 1.

¹³⁶ Millard and Schumann, 1964, 3.

¹³⁷ Millard and Schumann, 1964, 5.

¹³⁸ Ernest L. McCollum, Captain, *Technical Report 18: Survey of Human Adjustment Problems in the Northern Latitudes: Morale Survey of Personnel Assigned to Ladd Air Force Base*. (Ladd Air Force Base, Alaska, Arctic Aeromedical Laboratory, 1951), 4.

¹³⁹ McCollum, 1951, 2.

¹⁴⁰ McCollum, 1951, 3.

¹⁴¹ McCollum, 1951, 5.

¹⁴² McCollum, 1951, 38-39.

extreme cold.¹⁴³ Ultimately, the Arctic Aeromedical Laboratory concluded that there was no correlation between the two.¹⁴⁴

In 1996, a report by the National Research Council examined the study and concluded that the Arctic Aeromedical Laboratory had violated its own procedures. The scientists involved in the project had not gained informed consent from the subjects, but had gone to the village elders and asked for volunteers. The report by the National Research Council concluded that language issues and cultural differences had contributed to the lack of informed consent, particularly as it was difficult to describe the concept of radiation in the subjects' native languages.¹⁴⁵ Individuals included in the study later related that they thought the scientists were doctors performing health checks and that they had assumed the pills were a medicinal treatment. As James Nageak, one of the study's subjects, stated, "I figured it was something that would make me healthier. If I'd known what was in those pills, I never would have taken them . . . Nobody would have."¹⁴⁶

After the National Research Council's report, doctors were hired to examine and, if necessary, treat the victims of the study, but found only one individual who had contracted thyroid cancer. They concluded that it was impossible to link the cancer directly to the study, given the statistical prevalence of the disease, but did state that the young age of the individual would have made him particularly susceptible as he had been a child during the time of the experiment.¹⁴⁷ The Air Force issued a formal apology to all of the surviving participants and paid seven million dollars in restitution.¹⁴⁸

6.4 Closure

Like many of the other organizations located at Ladd Field during WWII and the early Cold War, the Arctic Aeromedical Laboratory enjoyed a considerable amount of freedom from the typical chain of command. Until July of 1966, there were no restrictions placed on the experiments conducted by the Arctic Aeromedical Laboratory. It was allowed complete freedom within the confines of its mission. However, in the final years of the lab that changed, and the Arctic Aeromedical Laboratory was restricted to study Arctic biology and personal protective gear. While this still allowed a fair amount of freedom, it eliminated the Department of Psychology and affectively combined the Departments of Environmental Medicine, Biochemistry, and Physiology.¹⁴⁹ While the Arctic Aeromedical Laboratory continued its experiments for another year, on 17 May 1967, the lab was notified that it was being disbanded and its mission transferred to the Air Force School of Aerospace Medicine at Brooks Air Force Base. All field testing would be carried out on a project-by-project basis.¹⁵⁰ The Arctic Aeromedical

¹⁴³ Whitney, David, "Tests wronged Natives: Report urges feds to admit errors" *Anchorage Daily News*, 31 January 1996, 1.

¹⁴⁴ Chipman, Andrea "New Study blames feds for tests on Natives: 'Wrongs done' in '50s radiation experiments" *Fairbanks Daily News-Miner*, 31 January 1996, A-1.

¹⁴⁵ Whitney 1996, 1; Chipman 1996, A-1.

¹⁴⁶ The Associated Press, "Alaskans testify in Congressional hearing" *Daily News-Miner*, 13 March 1996, A-3, B-2.

¹⁴⁷ Phillips, Natalie, "Cancer found in experiment subject" *Anchorage Daily News*, 18 September 1996, B-1.

¹⁴⁸ The Associated Press, "Experiment victims paid: Air Forces apologies to Natives" *Anchorage Daily News*, 27 October 2000, A-1.

¹⁴⁹ Elmendorf Unit Historian, Unpublished, 39.

¹⁵⁰ Elmendorf Unit Historian, Unpublished, 44.

Laboratory was officially disbanded on 1 August 1967, and all facilities were transferred to the Army under the direction of Fort Wainwright.¹⁵¹

¹⁵¹ Elmendorf Unit Historian, Unpublished, 45.

Chapter 7.0 – Conclusion

Until recently we seemed resigned to writing off the Arctic as a region in which nature was so intractable that its use would forever be denied to ourselves and our enemies. But we had forgotten the versatility man acquired when he learned to fly. . . Should war come, we may do much of our fighting in the Arctic, and there it will be on nature's terms. Success will come to those who meet her terms with greatest resourcefulness and imagination. It will not be easy, but it can be done.¹⁵²

Cold weather testing was the foundation of Fort Wainwright and is interwoven throughout the history of the installation, from Ladd Field through today. Since the foundation of the Cold Weather Test Detachment in 1940, advances made in cold weather testing and operations have been incorporated into the day-to-day operations of the installation. The work of the Cold Weather Test Detachment was incorporated into aircraft design, and alterations were made on planes serving throughout the theaters of World War II. The advancements of the 46th/72nd Reconnaissance Squadron improved, not only military and civilian aviation in the Arctic, but assisted in the missions of numerous other units. The Permafrost Division's advances in building construction and design were incorporated directly into the construction of the installation and standards for construction on permafrost throughout the Army. While the work on the ice islands was less widely disseminated, it did contribute to the body of knowledge concerning the arctic environment. Finally, the work of the Arctic Aeromedical Laboratory, while at times controversial, was also vital in improving the health of soldiers serving in arctic environments.

The significance of these programs, specifically the Cold Weather Test Detachment, the 46th/72nd Reconnaissance Squadron, and the Arctic Aeromedical Laboratory, has already been partially recognized in relation to the Ladd Field National Historic Landmark (1985) and the Ladd Air Force Base Cold War Historic District (2001). More recently, the CRREL Permafrost Tunnel in Fox, Alaska, was also determined and eligible for the National Register of Historic Places. Complete determinations of eligibility for the other properties associated with these missions is beyond the scope of this project, but this context will serve as the basis for future determinations.

This compilation of cold weather testing at Fort Wainwright pulls together information on testing throughout World War II and the early Cold War period but is not comprehensive. Cold weather testing was conducted by almost every unit stationed at Ladd Air Force Base and early Fort Wainwright. Additional research on testing conducted later in the Cold War period and interviews with soldiers who served here during the Cold War period would enhance our understanding of day-to-day life on the installation and if and how Cold Weather Testing was integrated into their day-to-day missions.

The work begun by the Cold Weather Test Detachment, 46th/72nd Reconnaissance Squadron, the Permafrost Division, and the Arctic Aeromedical Laboratory has continued under organizations like

¹⁵² Fletcher, *The Arctic*, 2,4.

CRREL and the Cold Regions Test Center, and is integrated into the everyday operations of units stationed at Fort Wainwright. While each of the missions discussed in this report was carried out by different units and organizations, with unique and sometimes contradictory goals, ultimately they all worked together to achieve the larger goal of military readiness in the Arctic.

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