DISPELLING THE COLD BUGABOO: A HISTORY OF THE ARCTIC AEROMEDICAL LABORATORY, 1947-1967



"During the Cold War, science was the most potent weapon in the American arsenal, and scientists served as warriors in the battle against communism." – Anchorage Daily News, May 9, 1993 In 1947, the United States Air Force (USAF) created the Arctic Aeromedical Laboratory (AAL). Its mission was to provide military forces with adequate equipment and knowledge to survive and succeed in the Arctic. The AAL consisted of not only military personnel, but also civilian researchers dedicated to expanding the scientific understanding of the Arctic.





Given seemingly free rein, AAL scientists conducted any research they deemed pertinent to their mission. Their projects ranged from the peculiar with the Walk-Around Sleeping Bag to the practical with various studies on Alaskan flora and fauna. Some found their experiments controversial, specifically their 1955-1957 thyroid study, in which the AAL gave participants iodine-131, a medical tracer that emits radiation. More routine projects included simulated survival scenarios to evaluate equipment and investigate new Arctic regions. They even facilitated ration trials and hunger tests on a consistent basis to improve the diets and nutrition of those serving in the Arctic.

The AAL collaborated with government agencies, private research centers, and universities to ensure the quantity and quality of its work. Annual symposiums and continuous publications made its findings and experiments available for scholarly research and public consumption. Local and national newspapers reported on the AAL's guide "How to Live at 35 Below" and noted how the AAL pulled the "fangs from arctic winter." Scholars and academics cited many of its studies and expanded upon its research.

For a relatively small military operation in the interior of Alaska, the AAL garnered well-deserved respect and recognition for its contribution to arctic research and military preparedness in cold weather environments. Its work, even today, remains relevant as researchers continue to utilize AAL findings while conducting their own arctic studies.

NTRODUCTION

"Our first task in training men for the Arctic service is to dispel the cold bugaboo, show them that they need not freeze or even suffer from the cold if they follow instructions and use their equipment and their heads." – Colonel Jack Bollerud

By the time the AAL closed its doors in 1967, it had significantly improved the military's capability to wage war in the Arctic by providing military personnel with the skills, knowledge, and equipment needed to survive and excel. However, the AAL's multitude of military unit reassignments and internal reorganizations, as well as facility issues characterized much of its early years and hampered its initial attempts at 'dispelling the cold bugaboo.' Moreover, a shortage of qualified staff limited the AAL's efficacy throughout its 20 years of service.

The mission of the Arctic Aeromedical Laboratory as outlined in Air Force Regulation 80-21 is fourfold:

(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 factors problems. The Labor at or y's budget is divided very nearly equally between the in-house and contract programs.

(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.

Reassignments and Reorganizations

In March 1947, the United States Air Force (USAF) created the 1st Central Medical Establishment at the School of Aviation Medicine at Randolph Air Force Base, Texas. The USAF soon renamed the outfit the Arctic Aeromedical Laboratory and moved the AAL to Ladd Air Force Base, Alaska. Concurrently, the USAF detached the AAL from the School of Aviation Medicine and reassigned it to the Alaskan Air Command. At Ladd Air Force Base, the USAF commissioned the AAL with the task "to solve the severe environmental problems of men living and working in the Arctic."



ENVIRONMENTAL PROTECTION June 1964 ORGANIZATION

Initially, the AAL contained four sections: Administrative, Research, Flight, and Special Projects. The Administrative Section handled daily office agendas, supplies, and managed the unit's motor vehicles. The Flight Section operated and maintained the lab's assigned aircraft. The Special Projects Section tested and evaluated experimental survival equipment and clothing. The AAL divided its Research Section into four departments: Biology, Physiology, Biochemistry, and Psychology. The Biology Department focused its research on arctic flora and fauna. The Biochemistry Department evaluated rations and nutritional needs. The Physiology Department concentrated on human

<u>1947-1949</u>



ARCTIC AEROMEDICAL LABORATORY TIMELINE

1947 MARCH

United States Air Force initiates the Arctic Aeromedical Laboratory as the 1st Central Medical Establishment under the School of Aviation Medicine at Randolph Air Force Base, Texas.

1947 MARCH

Colonel Jack Bollerud named the first commander of the Arctic Aeromedical Laboratory

1948

Arctic Aeromedical Laboratory is detached from the School of Aviation Medicine and reassigned to the Alaskan Air Command.

adaptations and physical responses to the cold. The Psychology Department investigated the psychological effects of living and working in the Arctic. Along with the Special Projects Section, the Research Section conducted work in all three fields of medical research: clinical, fundamental, and technological. However, this organizational structure proved temporary.

Throughout the 1950s, the AAL went through several organizational reconfigurations before adopting its final structure in 1964. The first significant change occurred in April 1951 when the AAL added the Arctic Aviation Medicine Section. This addition initiated the AAL's new concern for preventive medicine. In 1955, the Arctic Aviation Medicine Section merged with the Biology Department. The AAL named this amalgamation the Environmental Medicine Department and assigned it supplementary research duties that included new inquiries into the field of environmental sanitation. In 1957, the AAL decided to prioritize the research of the Environmental Medicine Department giving it divisional status with three sections: Preventive Medicine, Protective Equipment, and Prototype Fabrication. Simultaneously, the AAL created another division, the Bioscience Division, which was comprised of the original departments of Biochemistry, Physiology, and Psychology. In the early 1960s, the AAL employed a five department system to conduct its research that included Environmental Medicine, Physiology, Biochemistry, Protective Equipment, and Psychology.

1949

Arctic Aeromedical Laboratory conducts morale study at Ladd Air Force Base. Questionnaire given to 1,000 enlisted personnel (300 new to Ladd and 700 already stationed).



It took 17 years, but the AAL finally settled on a permanent organizational structure in June 1964. The AAL decided on two divisions: Support and Research. The Support Division supervised the Administrative, Financial, Management, and Material Branches. The Research Division oversaw the Biochemistry, Physiology, Arctic Medicine, and Environmental Protection Branches. The Biochemistry and Physiology Branches' research and objective remained relatively the same throughout the entire organizational shuffle. The Arctic Medicine and the Environmental Protection Branches split the duties of the previous Environmental Medicine Department. Arctic Medicine concentrated on similar experiments and studies as its predecessor, the Arctic Aviation Medicine Section. Environmental Protection developed, tested, and evaluated cold weather clothing and survival equipment. The AAL disbanded its Psychology Department when it failed to acquire a psychologist to lead the department's research.

Issues with Facilities and Personnel

Prior to the AAL's founding, the Cold Weather Testing Detachment (CWTD) at Ladd Air Force Base handled the responsibilities of assessing and adapting USAF equipment and aircraft to handle the Arctic environment. Even though Ladd Air Force Base housed the CWTD, AAL personnel found the base lacking in appropriate facilities and a sufficient number of skilled and knowledgeable enlistees able to perform the tasks required of the AAL.

The AAL's issues with facility space and personnel hindered research during its early years. AAL staff often commented on the problems of insufficient laboratories and field testing space. Major M.L. Buffenbarger, the AAL's unit historian in the early 1950s, illustrated this point in his 1952 spring report. He stated, "the laboratory work of the Arctic Aeromedical Laboratory is done in two semi-permanent type buildings which have been converted into laboratories...One of these has served fairly well as an animal house and field house for animal physiology studies, and the other for preventive medicine field work. However, neither of these two buildings is adequate as a research laboratory." Personnel shortages exacerbated the AAL's facility problems. In part, the impetus for most of the organizational restructuring resulted from a shortage of necessary medical staff to conduct certain studies and experiments. Through facility expansion and a combination of innovative means, the AAL overcame the inadequacy of its laboratories and staff.

At its inception, the AAL utilized a prefabricated warehouse and a Quonset hut as additional warehouse space and storage. However, slowly, but surely, the AAL began acquiring temporary and permanent structures. The AAL first obtained two pyramidal tents and used them for storage though the inability to control the interior temperature limited their usefulness. This minimized what supplies and equipment the AAL could store on site.

The problem of supply storage presented an additional obstacle that reinforced the need to upgrade and expand its facility space. Project

1950-1951



1950 WINTER

Arctic Aeromedical Laboratory facilitates survival study. Simulation consisting of 14 men living in tents on a ration of two candy bars per day at temperatures of -20 and -30°F. The study shutdown early due to a blizzard and required the 10th Rescue Squadron to evacuate the test subjects.

1950 DECEMBER

Lieutenant Colonel Andres I. Karstens named the second commander of the Arctic Aeromedical Laboratory.

1951

United States Air Force transfers the technical supervision of the Arctic Aeromedical Laboratory from the Surgeon General to the Deputy Chief of Staff for Development.

1951 APRIL Arctic Aeromedical Laboratory creates

delays occurred often because the AAL required gear and supplies not readily available on base. According to the unit historian, during the winter months the whole process of ordering and receiving supplies took an average of 40 days. Winter not only hindered the logistics of resources, but also affected water supply and electricity. The potential for the pipes to freeze was a constant concern and the main building even lost heat for 11 days at one point. The challenges of winter often reminded AAL staff that their current buildings were inadequate.

The USAF and Congress started seriously addressing the AAL's facility problems during the 1950s with electrical and heating repairs and the construction of new buildings. The AAL also received four fabricated shacks for the Biology Department to utilize as storage space. Then in 1951, Congress approved funding for the construction of permanent buildings, but progress moved slowly as construction did not begin until 1954.

On February 15, 1955, the AAL relocated to its new facilities that included "three modern buildings and a small flammable storage building," a move that provided 24,800 square feet of space. The main building, known as Building 4070, contained "two floors of laboratories and one occupied by a technical library, conference room, publication and graphic arts facilities, and administrative offices." The other two buildings housed "a material warehouse and office, a colony of small animals, and a small woodworking, sheet metal and fabric shop for the construction of research equipment and prototypes of clothing and shelters."

1951 OCTOBER

the Arctic Aviation Medicine Section.

Design for new Arctic Aeromedical Laboratory facilities completed.

The AAL retained its original Quonset hut due to its coveted location near the Chena River and soon identified it as the "River Laboratory." Its location and relative isolation from other buildings on the base made the River Laboratory an ideal staging area for field tests. The AAL also utilized the River Laboratory as its "center for work on larger mammals and native animals." When necessary, the AAL converted it into temporary housing for visiting researchers. During this period, the AAL established two semi-permanent field laboratories at Anaktuvuk Pass near the Brooks Range and Cleary Summit, a hilltop approximately 25 miles north of Fairbanks. In the fall of 1956, the AAL constructed and maintained another remote camp at Agak Lake about 30 miles west of the camp at Anaktuvuk Pass. Such field laboratories and remote camps offered researchers adequate spaces to conduct tests and evaluations of survival techniques, clothing, and equipment, as well as to conduct studies and experiments on the climate and terrain. Researchers also utilized these field laboratories to study the diets and habits of Alaska Natives in the area.

In the 1960s, the AAL continued to expand its facilities at Ladd Airfield and throughout the state of Alaska with temporary and permanent remote sites. At Ladd Field, the AAL acquired the old veterinarian buildings on base and referred to these buildings as the "Bridge Laboratory" due to their proximity to Trainor Bridge. The development of remote sites enabled the AAL to provide comprehensive field testing. With the addition of a facility near Valdez, the AAL was able to test experimental exposure suits in the ocean and compare equipment in wet and dry environments.

In 1964, the AAL finished constructing its high altitude cold weather research facility on Mt. Wrangell. The Mt. Wrangell camp allowed AAL staff to expand its dry-cold testing capabilities from the previous 4-month limit to a potential 12-month operation. Throughout the 1960s, the AAL established various temporary, semi-permanent, and permanent sites throughout Alaska. In essence, as one unit historian noted, "the entire state of Alaska and to a lesser extent the Arctic Basin itself may be considered extensions of the laboratory."

Even with the new facilities, however, one AAL senior physicist in the early 1960s noted again the problem of quality staff. He argued that "the incapacity of the scientist at the lab to make precise measurements" limited the AAL's potential. He added, "In their field they were at least adequate but the lab neither had the facilities nor the expertise to support the biologically and chemically oriented researchers there who were primarily field oriented experimentalists." This concern for adequate personnel as well as staff shortages seemed consistent and prevalent throughout AAL's history. In order to alleviate the problems of staff shortages or underqualified staff, the AAL evolved from an exclusively military operation to a hybrid civilian/ military research center.

In 1948, the AAL had an authorized strength of "nine officers and twenty-four enlisted personnel, with no civilians" and initially filled all positions. However, according to a unit historian, the "skills authorized were not commensurate with either the degree of training or the skills required." Thus, the AAL initially operated

with enlistees whose skills and knowledge were insufficient to accomplish necessary duties and obligations. The AAL's difficulty in maintaining the appropriate and necessary amount of qualified medical officers compounded this problem. Both the lack of qualified enlistees and the shortage of medical officers proved problematic to conduct basic experiments and studies. In 1948 alone, the AAL suspended or terminated almost 50 percent of its projects due to either personnel or equipment limitations.

To resolve personnel matters and to continue to produce quality scientific research in pursuit of its mission, the AAL supported visiting research teams during its nascent years. It then proceeded to contract independent scientists and initiate civilian authorizations as years progressed. Early visiting researchers came from several government agencies and universities including the Surgeon General, Aeromedical Lab, Army Chemical Center, U.S. Public Health Service, Department of Agriculture, University of Washington, Cornell University, Harvard University, and the University of Wisconsin. The number of visiting research teams steadily decreased throughout the years, but the AAL still contracted out many experiments to universities and independent researchers. During 1953, the AAL approved 11 new projects with four contracted to University of Alaska, three contracted to universities from the contiguous United States, and four assigned to AAL personnel.

Although civilian authorizations reached its peak in the mid-1950s, civilian authority and presence characterized much of the AAL until its





1954

Arctic Aeromedical Laboratory's Dr. Fred Milan assists in Denali rescue of George Argus.

1954

Arctic explorer C.A.K. Innes-Taylor leads Arctic Aeromedical Laboratory personnel on 15-day survival exercise.

1954

Dr. Kaare Rodahl selected as Director of Research, the highest civilian position authorized at the Arctic Aeromedical Laboratory.

1955-1957

conducts controversial study on Native and 19 military personnel receive lodine-131 (radioactive isotope and medical tracer) throughout the course of the study.

Arctic Aeromedical Laboratory Commanders

Colonel Jack Bollerud

• 1 March 1947 - 1 December 1950

Lieutenant Colonel Andres I. Karstens

Major Henry G. Wise, Jr.

• 1 June 1955 - 31 August 1955

Colonel Howard Currie

Colonel Joseph M. Quashnock

Colonel John D. Fulton

• 1 June 1961-27 June 1962

Major James A. Sproul, Jr.

• 28 June 1962 - 15 July 1963

Lieutenant Colonel Fritz M.G. Holmstrom

• 16 July 1963 - June 1965

Major Paul A. Albert

• June 1965 - 9 July 1965

Colonel Evan R. Goltra, Jr.

- 10 July 1965-30 June 1967
- Arctic Aeromedical Laboratory the role of the thyroid in metabolic response to extreme cold. 102 Alaska

1955 JUNE

Major Henry G. Wise, Jr. named the third commander of the Arctic Aeromedical Laboratory.

disbandment in 1967. In 1954, the USAF authorized the highest civilian position, GS-15 Director of Research. The AAL selected Dr. Kaare Rodahl, a distinguished and world renowned scholar and explorer, as its first Director of Research. In December 1955, the AAL reached its highest level of civilian authorizations with 30 civilian employees. This number slowly decreased to 25 in 1959 and then to 20 by 1967. Civilian personnel supervised and conducted the majority of the AAL's research. Additionally, civilians commanded many of the research sections.

According to AAL personnel, by utilizing civilians, visiting research teams, and contracting out projects the AAL got "the top men in their fields." Nevertheless, this approach had its own flaws and limitations. In 1957, the unit historian noted that many "civilian scientists are very reluctant to move to Fairbanks." Reservations about moving to Fairbanks included the long and harsh winters, cost of living, and lack of reasonable housing accommodations. The AAL attempted to circumvent this problem by allowing qualified individuals to conduct research at their own universities or laboratories. As one AAL staff member stated, "sometimes they work here, sometimes at their schools. But we get what we want." Regardless of the early and continuing limitations with facilities and personnel, one scholar has argued that by the time the AAL dissolved it "was the most important site for research on Arctic acclimatization."

Closing Down Shop

In the mid-1960s, the AAL witnessed its mission downsized and its program discontinued. Although the AAL dealt with annual budget cuts throughout its history, the USAF started a concerted effort to study the feasibility of having other military units and government agencies conduct the research of the AAL. The USAF believed it could reduce the cost of AAL's research by performing them on a task force basis, meaning studies and equipment should be conducted and developed only when needed. One unit historian noted that the AAL "began the fight for existence" in 1962. Their efforts included concentrating on "high priority projects" and AAL leadership traveling to "discuss and defend" projects at the Aerospace Medical Division Headquarters. In its final year, the AAL focused its research on Arctic biology and personal protective gear as funding continued to decrease.

In May 1967, the USAF informed the AAL that it planned to disband the research facility and officially deactivated the AAL in August 1967. The USAF gave the Air Force School of Aerospace Medicine at Brooks Air Force Base, Texas, the responsibility of task force projects and equipment development related to the Arctic after the AAL shut down. The USAF then transferred AAL's facilities over to the Army who then occupied Ladd Field under the name Fort Wainwright. The closing of the Arctic Aeromedical Laboratory saved the USAF approximately \$467,000 and released "14 military and 12 civilian manpower slots."

Understanding the roles and different inquires of the various research departments, sections, and branches proves difficult when trying to piece together each one with its predecessor and successor throughout the many organizational changes that took place during the AAL's 20-year span. In order to maintain consistency and navigate their operations more easily, the research departments, sections, and branches are presented as the unit historian illustrated them in the 1961 AAL report, "The Arctic Aeromedical Laboratory: Its History, Mission, Environment." At that time, the AAL consisted of five research departments: Environmental Medicine, Physiology, Biochemistry, Protective

Although not a member of the original four departments, the Department of Environmental Medicine emerged as arguably the most important in the late 1950s before the AAL decided to split its duties into two separate research departments following the final 1964 organization restructuring. Primarily, the Department of Environmental Medicine conducted "studies concerning the etiology, pathology, treatment, prognosis, and prevention of diseases" military personnel may encounter in the Arctic.

1955-1957



1955 FEBRUARY

Construction completed on the Arctic Aeromedical Laboratory's new, permanent buildings at Ladd Field.

1955 SEPTEMBER Colonel Howard Currie named

the fourth commander of the Arctic Aeromedical Laboratory.

1956

Arctic Aeromedical Laboratory establishes field research camp at Agak Lake.

Equipment, and Psychology.

1956

Arctic Aeromedical Laboratory establishes the Environmental Medicine Department to investigate preventive medicine, environmental sanitation, diseases of flora and fauna, and special weapons defense in the Arctic.

Department of Environmental Medicine

One major focus of research for Environmental Medicine developed from one of its predecessors, the original Biology Department. The biological interrelationships between flora and fauna and humans led to numerous experiments and studies. This included investigations into 10,000-yearold microorganisms frozen in core samples of permafrost and glacier ice. The department's staff hoped their research on ancient microorganisms would lead to "new and different antibiotics which could be utilized in controlling current day infectious disease." Due to the uniqueness of the Arctic's environment, which differed drastically from the temperate zone of much of the contiguous United States, they also studied contemporary arctic microorganisms for use in biological and radiological warfare.

Other pertinent areas of research included water purification, sewage disposal, and frostbite. Each area demonstrates the difficulties of life in the Arctic. Due to the scarcity of water and the

EPARTMENTS S EARC T

1957

Arctic Aeromedical Laboratory personnel Dr. Richard C. Hubley dies from prolonged cold exposure, studying McCall Glacier at Brooks Range camp.

persistent cold weather, water purification and sewage disposal posed legitimate obstacles for the AAL to overcome. Environmental Medicine developed new methods of water purification to treat water hardness and decrease the levels of iron as conventional treatments and practices for water purification proved expensive and inadequate. The department made progress in sewage disposal via an innovative means of incinerating human waste without odor. The concern with frostbite transcended departmental research with every research department seemingly studying the varying facets of this injury. Environmental Medicine not only focused on effective means of treatment, but also the "exact mechanism and nature of injury."

Department of Physiology

The Department of Physiology focused its attention on how the human body adapts to the cold environment of the Arctic. Its staff directed studies and experiments to understand cold acclimatization, short-term effects of cold, and hypothermia. For a time, the department utilized three main subdivisions with each subdivision specializing in one topic.

The first subdivision, and the largest, concerned itself with understanding the process of acclimatization to the cold. Experiments delved into the "effects of prolonged or chronic cold exposure which induce in the basic physiology of the individual a permanent or semi-permanent change." Much of the research developed from the fact that many animals, when exposed to long

periods of cold, acclimated to the cold via various physiological adaptations such as the cessation of shivering in dogs or the growth of thicker hair on horses. Animal research supported the theory that humans adapted in a similar fashion. However, such a hypothesis proved difficult to verify as it would have meant "the exposure of nude men to the potentially dangerous temperatures which can be employed for weeks at a time with animals."

To circumvent this problem, the Department of Physiology investigated human societies that have grown accustomed to living in cold environments. Scientists traveled to various Alaska Native villages to conduct metabolic, dietary, and cultural studies as part of a larger goal "to study all groups of people in the world who are habitually exposed to extreme cold." Additionally, researchers with the Department of Physiology explored the possibility of race as a factor for cold acclimatization via close observations of Alaska Natives and African Americans in either controlled cold rooms or "precisely defined natural environments." Race as a potential determinant for cold acclimatization occupied an integral point of enquiry in some of the department's studies.

The other two subdivisions concentrated on the short-term effects of cold exposure and hypothermia. The short-term effects of cold exposure were of particular interest to AAL researchers since the temperature on base could drop to negative -40°F during winter months. Researchers looked into the effects of acute cold exposure with respect to respiratory heat loss, cardiovascular training among military personnel in regards to hiking and running, and the

importance of whole body insulation versus hand and foot exposure. The Department of Physiology also facilitated long-term studies on "the nervous mechanism for the control of shivering." These tests even included investigating drugs used to control the shaking caused by Parkinson's disease as a possible solution to cease cold-induced shivering.

The subdivision on hypothermia explored the treatment for moderate or mild hypothermia and the cardiac implications of profound or deep hypothermia. Primarily, the AAL's focus on hypothermia was to overcome the fundamental problem of rewarming individuals. AAL scientists recognized the dangers of rewarming individuals suffering from mild and severe hypothermia when performed incorrectly. The process could potentially be painful and sometimes fatal. The AAL sought to provide military personnel with the best practices for hypothermia prevention and treatment, especially in arctic survival situations.

Department of Biochemistry

In a broad sense, the Department of Biochemistry investigated nutrition in the Arctic, "the biochemical mechanism of adaptation to cold," and "the biochemical basis for the harmful effects of cold." Biochemistry also supported the other departments as an ancillary, performing chemical tests and determinations, the finding of a factor or factors that affect the outcome of a study. However, its main mission was the "development and evaluation or improvement of rations for use in the Arctic, including survival rations, and the investigation of all lines of biochemical evidence which will help to explain how men and animals are

<u>1958-1961</u>



1958 AUGUST

Colonel Joseph M. Quashnock named the fifth commander of the Arctic Aeromedical Laboratory.

1959

Arctic Aeromedical Laboratory develops Walk-Around Sleeping Bag to eliminate need for both parka and sleeping bag.

1960s

Arctic Aeromedical Laboratory hosts annual conference at the Geophysical Institute at University of Alaska Fairbanks.

1961

Project SARAH (Search and Rescue Homing) produces new electronic locater to assist the Alaskan Air Command in search and rescue missions.

affected by cold, fatigue, semistarvation, and other stresses likely to be encountered in the Arctic."

Throughout the AAL's history, the Department of Biochemistry's staff conducted numerous studies and survival simulations with other departments to determine optimal survival rations for the Arctic. They aimed for a survival ration minimum in both bulk and weight, but which provided enough vital calories and nutrition. Through these studies, however, they found rations secondary for an individual's survival. Shelter and clothing for warmth proved more pertinent to survival than food, especially given the limited space provided on most aircraft for survival kits. As a result, AAL scientists conducted hunger survival simulations to understand best practices for refeeding after prolong periods of starvation and created a minimalist ration pack with the ideal balance of fluids, fats, and proteins for survival. Such simulations also led to the discovery that humans physiologically adapt to atypical diets. AAL scientists found that "when men are first given a high fat, high protein, carbohydratefree ration, considerable metabolic disturbance results," but after a few days, humans adjust and their "metabolism returns to normal."

Department of Protective Equipment

The Department of Protective Equipment went through several changes during the AAL's history. Initially known as the Special Projects section it solely tested and evaluated experimental survival equipment and clothing. During the late 1950s, the AAL relegated the department to a subdivision in

> 1961 \$96,000 committed to construction of cold weather testing facility.

the Environmental Medicine Department. Soon after, the AAL designated it as the Department of Protective Equipment, and, although evaluating survival equipment and clothing remained its primary concern, the AAL assigned the department secondary and tertiary duties as well. These obligations included the development of prototypes, dissemination of information to independent researchers and the public through sponsored conferences, and studying and evaluating the curriculum of the Arctic Survival Training School. From 1964 until 1967, the AAL renamed the department the Environmental Protection Branch and reduced its role to developing and evaluating of winter survival clothing and equipment and assessing procedures for survival in the Arctic.

The department performed several functions in pursuit of its primary objective. Its staff consistently tested and evaluated clothing and equipment produced either in house or developed from an outside agency and sent to the AAL for field testing. Protective Environment's researchers applied scientific methods and principles in order to ensure objective conclusions on the quality of the product. The department utilized facilities at Ladd Field Air Force Base and remote AAL sites to conduct all tests in "the natural, out-of-doors environment." Occasionally, the department recommended various clothing and equipment suitable for public purchase, including several types of boots, headgear, and exposure suits. Other successful prototypes included the Walk-Around Sleeping Bag that served as both a parka and a sleeping bag, a survival kit that molded specifically to its assigned aircraft, and various life rafts and survival shelters.

The department's conferences brought together Operations Officers, Flight Surgeons, Personal Equipment personnel, and Survival Training instructors as a means to foster collaboration within the field of applied science. Conferences addressed a variety of topics. One in particular discussed winter survival clothing from head to toe. Another analyzed survival equipment and kits assigned to aircraft. The conferences afforded multiple parties the opportunity to review and discuss best practices for survival gear and techniques.

Lastly, the Department of Protective Equipment supported the Arctic Survival Training School, a program designed to train airmen how to survive winter conditions. According to lead instructor Master Sergeant John R. Schumann, the school simulated "what an air crew is up against when stranded in the Arctic with minimal equipment." Protective Equipment personnel accompanied the Arctic Survival Training School on simulated survival treks to evaluate and provide recommendations to improve the curriculum. Their observations not only benefitted the Arctic Survival Training School, but also helped Protective Equipment staff as these treks also served as field tests for their survival equipment and clothing.

Department of Psychology

The Department of Psychology investigated the psychological problems and effects of living and working in the Arctic. Its research provided valuable information on individual's mental abilities to adapt to life in the Arctic as well as recommended solutions to improve working and living conditions. However, the AAL discontinued the Department of Psychology when it failed to find a permanent psychologist following its organizational restructuring in 1964.

Within the first four years, particular interest focused on the morale of the troops stationed in Fairbanks and the Arctic in general. In 1949, researchers facilitated an extensive questionnaire given to 1,000 enlisted personnel. Staff did not assume morale was an issue at Ladd Field; rather, they designed the study to gauge factors that may cause morale to decrease among those stationed in the Arctic. The study found that difficulties in morale related more to the transition to military life than life in the Arctic. These types of questionnaires continued into the 1950s. Although researchers found morale to be sufficiently high among military personnel, they did make recommendations based on the responses of enlistees, namely more housing for their families and additional recreational facilities. Most of the department's research and studies served to increase efficiency and confidence during training and operational procedures.

After the AAL disbanded the department, it contracted out psychological studies deemed vital. Most of these studies concentrated on the effects of the cold on mental performance, the psychological impact of isolation in remote areas, psychological effects of long-range flight missions, and the "psychophysiological problems encountered in handling missiles in a cold environment." The development of the Nike Hercules program in Alaska facilitated the need for studies on the psychophysiological problems of handling missiles. The Nike Hercules program was a system of defense

1961



1961

Arctic Aeromedical Laboratory acquires old Base Veterinarian buildings. Buildings given the nickname "Bridge Laboratory" due to their location near the Trainor Bridge.

1961

Arctic Aeromedical Laboratory publishes unit history, "The Arctic Aeromedical Laboratory: Its History, Mission, Environment."

1961 JANUARY

Ladd Air Force Base transferred to the Army and designated Fort Jonathan Wainwright. Air Force maintains authority over the Arctic Aeromedical Laboratory and its facilities at Fort Wainwright.

1961 JUNE Colonel John D. Fulton named Aeromedical Laboratory.

against Soviet Union aggression. Each site consisted of ground-based anti-aircraft missiles designed to counter ballistic attacks. Soldiers stationed at Nike sites were constantly at a state of readiness while isolated at their posts for days or even weeks at a time. Thus, the military had an invested interest in understanding the psychophysiological effects of handling missiles.



energy expenditure during winter survival exercise.

the sixth commander of the Arctic

1961 NOVEMBER

Arctic Aeromedical Laboratory reassigned to the Air Force Systems Command and newly formed Aerospace Medical Division.

The AAL produced quality research that served to empower and enable soldiers to adapt and succeed in the Arctic. Furthermore, its work increased the scientific understanding of the region and afforded independent scholars and academics opportunities to conduct their research in unique arctic areas. However, not every experiment proved ethical in pursuit of the AAL's mission. At a conference during the 1990s, government officials, public health experts, and academics revisited the AAL's 1955-1957 study on the role of the thyroid in cold acclimatization. Their initial conversations illustrated a need to investigate the experiment more fully. The federal inquiry that followed discovered, not only ethical issues with the study, but also revealed much anxiety and mistrust among Alaska Natives for the United States government

The purpose of the AAL's study was to determine the significance of the thyroid in cold acclimatization. For its experiment, the AAL enlisted 102 Alaska Natives from five villages and 19 white military volunteers. Researchers recruited Alaska Native test subjects through village elders or leaders, whom they contacted about the experiment. Village elders or leaders recommended volunteers to the AAL. Language presented a barrier for Alaska Native recruitment, as not all volunteers may have understood the details of the study nor had the concept of radiation described to them, as the term is not readily translatable into many Alaska Native languages. Problems with language and communication, and the misunderstandings that would have resulted, laid the groundwork for revisiting the nature of study in the 1990s.

AAL scientist had test subjects ingest capsules of iodine-131, a medical tracer and an isotope that emits radiation, in order to measure the thyroid in various arctic conditions. AAL researchers wanted to determine the role of the thyroid, if any, in cold acclimatization through a comparative study of Alaska Natives and white soldiers. Over the course of the study, AAL staff distributed 200 doses of iodine-131 to 121 participants. Iodine-131 worked as a tracer through urinary excretion. AAL scientists measured and compared amounts of the tracer discharged through urination to decide if the thyroid functioned differently in whites and Alaska Natives during the winter season. Their study consisted of six tests over a two-year period. The AAL researchers concluded from their study that the thyroid did not play a significant role in cold acclimatization.

In 1993, public officials and experts participated in the Arctic Contamination Conference held in Anchorage, Alaska, to discuss "problems relating to the post-World War II era of human occupation of the Arctic." The conference concentrated its attention on the "radiation and chemical experimentation and contamination of the Arctic." With the end of the Cold War twoyears earlier, American policy makers wanted to review government-sponsored radiation studies to determine if their purpose was necessary and if they had any detrimental effects. During the conference, discussions about the AAL's study on the role of thyroid in connection to cold acclimatization led to inquiries about the ethics and purpose behind such an experiment.

As a result, Congress soon requested the National Research Council (NRC) and Institute of Medicine (IOM) to appoint a committee to review the AAL's thyroid study. The NRC and IOM formed the Committee for Evaluation of Air Force 1950s Health Testing in Alaska Using Radioactive Iodine to investigate the study. The committee wanted to determine whether the AAL had followed accepted guidelines of the 1950s for using human subjects during medical experiments. Specifically, it wanted to examine the procedures the AAL utilized to inform participants about the immediate and longterm risks. Senator Frank Murkowski, who helped initiate the process of inquiry, asserted, "It may turn out that this is a case where there were no human risks" but "nobody should be treated like a human guinea pig."

<u> 1962-1964</u>



1962 JUNE

in regards to their Cold War experiments.

Major James A. Sproul, Jr. named the seventh commander of the Arctic Aeromedical Laboratory.

1962 JULY

Arctic Aeromedical Laboratory simulates survival trek from Anaktuvuk Pass to Beaufort Sea to test the F-102 Aircraft Survival Kit.

1963 JULY

Lieutenant Colonel Fritz M.G. Holmstrom named the eighth commander of the Arctic Aeromedical Laboratory.

1964

Arctic Aeromedical Laboratory settles on final organizational structure and discontinues its Psychology Department due to inability to secure a qualified psychologist.

In response to the initial reports about the study illustrating Alaska Native anxiety towards government officials, Will Mayo, of the Tanana Chiefs Conference, argued, "All these things are suddenly being revealed and some of them, they're so weird that you just wonder what's next. Today it's, 'we fed your people radioactive pills.' What's the next wonderful revelation going to be?" Bob Aghook, who participated in the study, confirmed early concerns about the ethics behind the thyroid test. Aghook stated, "They never said anything about iodine back then. All I knew was they studied what we eat. I never knew what the pill was when they gave it to me."

The committee set about its mission in the summer of 1994 and began acquiring formal documents and names of individuals connected with the study. Committee member Dr. Baines and a NRC study director visited two rural Alaska villages to interview native participants in the experiment. They spoke with 16 individuals about their experiences. To hear the opinions and stories of other test participants, the committee mailed questionnaires. Due to a limited timeframe and budget, this task proved difficult and minimized the efficacy of the venture, but it still exposed much about the relationship between Alaska Natives and the federal government.

The committee members also held a two-day public forum to provide information and openly discuss the nature of the experiment. The forum offered

1964

Arctic Aeromedical Laboratory establishes station at an elevation of 13,800 feet on Mount Wrangell.

many individuals the opportunity to present and share their memories or knowledge about the study. Speakers included Alaska Native study participants; a white military participant; AAL staff and researchers; director of the study, Dr. Kaare Rodahl via telephone; a medical historian; several public health officials and physicians; and representatives of state, local, and tribal governmental agencies. Although the speakers and public spoke primarily about the AAL and the thyroid study, the public forum highlighted other concerns as well.

The committee's investigation and sponsored public forum brought to the surface the cultural distrust and misunderstanding that had permeated, but remained silent, throughout Alaska for decades. The committee noted several common themes that included fear, anger, and confusion about this study and other medical experiments of the time. According to the committee, many Alaska Natives believed that "Native people seemed healthier long ago and that health difficulties seemed linked with the rapid and sometimes dramatic changes caused by increasing domination of Western culture that began in the 1940s." The idea that United States government officials often betrayed or misled Alaska Natives was a consensus among the speakers. As a journalist from the Anchorage Daily News observed, Alaska Natives demanded, "and rightly so, a dialogue with science in which communication flows two ways and both parties are respected." In essence, the public forum offered

Alaska Natives an opportunity to have their voice and grievances heard.

The committee concluded that "aspects of the AAL study, especially the informed consent process, were flawed even by 1950s standards and thus the Alaska Natives who participated...were wronged." However, the committee refused to assign blame and argued that any effects from iodine-131 were more benign than malignant. Committee members provided recommendations for reconciliation that included the United States Air Force contacting every participant and apologizing for the unethical nature of the study. They also suggested that if Congress passes legislation to "redress any wrongs or harms done to human subjects of government radiation research where informed consent was not obtained...Congress should consider including the subjects of the AAL thyroid function study."

Although the committee faulted the AAL for failure to communicate the details of the study effectively with the participants, many individuals found its opinion on the effects of radiation disheartening and concerning. George Ahmaogak, Sr., mayor of the North Slope Borough, lamented, "They say radiation didn't do any harm, but then they admit iodine-131 isn't used anymore because it sends a lot of radiation to the thyroid gland." In response to the findings, the North Slope Borough filed a \$428 million claim against the USAF and other federal agencies on behalf of the Alaska Native participants. The North Slope Borough's decision to file a claim stemmed from the fears of villagers concerning the correlation between radiation and cancer. These fears were exacerbated when Dr. James Ruttenber of the University of Colorado's School of Medicine, who, along with Dr. K.C. Kaltenborn of Anchorage, conducted physicals and blood tests on 43 villagers near Wainwright and Anaktuvuk Pass and diagnosed one of the study's participants with thyroid cancer. Though Dr. Ruttenber cautioned, "To say it was caused by the iodine is tough," he still argued, "It is reasonable to conclude the iodine caused the cancer, but we could never prove that."

In October 2000, the *Anchorage Daily News* announced that the United States government and the North Slope Borough had reached a settlement. USAF officials met with Alaska Native participants of the thyroid study and North Slope Borough residents at the Iñupiat Heritage Center in Barrow, Alaska to issue a formal apology. Participants of the study received \$67,000 each in restitution. Todd Sherwood, borough attorney, felt that "people who participated in the experiment were satisfied with the settlement" and that the event at the Iñupiat Heritage Center served as a "time to come together."

<u>1964-1966</u>



1964

Arctic Aeromedical Laboratory designs new pararescue medical kit. Medical kit includes medical and survival supplies (fluids, bandages, splints, extra downfilled coat, flares, radio, etc.).

1965 JUNE

Major Paul A. Albert named the ninth commander of the Arctic Aeromedical Laboratory.

1965 JULY

Colonel Evan R. Goltra, Jr. named the tenth and last commander of the Arctic Aeromedical Laboratory.

1966 MARCH Captain Ray McDo

Captain Ray McDonald survives plane crash and 50 hours in -45°F because of a rescue pack designed by the Arctic Aeromedical Laboratory.



1966 JULY

United States Air Force limits Arctic Aeromedical Laboratory to studies on Arctic biology and personal protective gear.

Technical Note 57-6: Testing an Incinerator Toilet for Ground Use, April 1957

Throughout the 1950s, the AAL attempted to resolve the problem of human waste at remote sites. Such topics posed an issue because of the scarcity of water and because the climate and terrain made burial a difficult task. At the time of study, AAL and military personnel utilized the "honey-bucket system." They collected human waste in 55-gallon drums and stored the drums in a heated room. When able, they transported the full drums some distance away from sites and dumped them. As AAL researchers stated in their report "this is not a great system medically or aesthetically, a new system is desired."

The Tokheim Company initially designed the oil-fired toilet for the Aero Medical Laboratory at Wright-Patterson Air Force Base in Dayton, Ohio. The first unit arrived at Ladd Field in December 1954 and AAL personnel quickly installed it at the River Laboratory for field testing. The AAL researchers initially used a mixture of canned dog food and water to test the toilet several times a day until eventually testing the unit with actual human waste when the laboratory's restroom became out of order on a few occasions. The first unit, it was determined, had several issues including leaks in the exhaust system and it splashed moisture when flushed. The AAL sent the unit back to Tokheim Company with recommendations. The second unit developed mechanical problems within the first few days of installation. AAL staff exacerbated these issues when they attempted to

fix the toilet themselves. The AAL received a third unit in February 1955. In August that year, a minor explosion occurred and the AAL returned the unit. AAL researchers concluded that all three units proved unsatisfactory for remote site usage.

Technical Note 57-16: Emergency Food Value of Alaskan Wild Plants, July 1957

The AAL produced as much research as possible to aid military personnel in survival situations. Although field testing of equipment and clothing occupied much time and resources, examinations into flora and fauna proved just as vital. Throughout the 1950s, AAL staff investigated Alaskan wild plants for their nutritional benefits and availability in the Arctic and interior of Alaska. They condensed their research and disseminated information on 16 plants they determined most prevalent and pertinent for survival. This made it easier for an individual participating in a survival course to absorb and retain the information for practical use during an actual survival situation.

The AAL researchers concluded that 150 wild plants offered "some promise as emergency food sources." As a caveat, they noted that the extreme seasonal temperature variability limited the availability and abundance of such food sources "for short periods of time in favorable seasons and localities." AAL personnel determined that a majority of Alaskan wild plants provided caloric content similar to most garden vegetables. Albeit, they considered few as high-energy plants and determined that individuals needed to eat most in large quantities. In its 1957 technical note, the AAL reported on the 16 most important wild plants for survival. These included roots and underground stems, greens, and berries. The report provided military personnel with maps, illustrations, brief descriptions, and how to collect, prepare, and eat the wild plants.

Technical Report 59-4: Walk-Around Sleeping Bag, April 1959

In order to reduce the weight and size of an airmen's emergency kit, the AAL personnel converted the standard issued sleeping bag into a hybrid parka/ sleeping bag. They named their hybrid the Walk-Around Sleeping Bag. Modifications included arm openings with cuffs that the user could tighten with drawstrings; a bottom that could be pulled up and tied around the waist to free the legs; the addition of two double pull zippers to replace the single zipper, thereby allowing the wearer to open the sleeping bag from the bottom and the top as well as from the inside or the outside. Individuals wore the Walk-Around Sleeping Bag as a parka during hikes and exercise in order to limit cold exposure and to retain body heat. After the Arctic Indoctrination School field tested the Walk-Around Sleeping Bag and deemed it satisfactory, the AAL recommended it for the Army's ground personnel.

The AAL evaluated a new design of the Walk-Around Sleeping Bag in 1967. In contrast to the previous one, this particular model proved unsatisfactory. The new design had several deficiencies. The model did not fit larger, taller soldiers, nor did it maintain an individual's body heat well enough. AAL researchers found this

1967-2000



1967 MARCH

Arctic Aeromedical Laboratory conducts seven-day experiment designed to aid the development of new survival rations.

1967 MAY

United States Air Force delivers Arctic Aeromedical Laboratory its notice for disbandment.

1967 AUGUST

Arctic Aeromedical Laboratory officially disbanded. All buildings transferred to the Army at Fort Wainwright.

1993

Conference held on the Cold War legacy in the Arctic. Discussions on 1950s thyroid study led to Congress requesting the National Research Council to appoint a committee (the Committee on Evaluation of 1950s Air Force Human Health Testing in Alaska Using Radioactive lodine) to investigate purpose and methodology of AAL's thyroid metabolic study.



Soldier field testing the 1957 version of the Walk-Around Sleeping Bag.

2000

United States Air Force issues formal apology to the participants of the 1955-1957 thyroid study. Each participant receives \$67,000 in restitution.





model did perform adequately during survival tasks such as "fuel gathering, fire making, cooking, snow igloo building, weapon firing and flare operation." However, they found that to perform most of these tasks, individuals needed "to pull the bag up above the knees" which "resulted in a marked cooling of the trunk." This limited the effectiveness and purpose of the Walk-Around Sleeping Bag.

Technical Report 61-8: An Evaluation of an Electronic Location Marker (SARAH) for Arctic Use, May 1961

Prior to the development of the Search and Rescue and Homing (SARAH) location marker, locating downed airmen proved difficult in most areas of the world. The Arctic exacerbated this problem, since finding downed airmen needed to occur quickly. Through various studies and simulated survival treks, the AAL recognized that the cold and coldrelated injuries presented the primary obstacle for survival. The survival clothing and equipment issued to military personnel proved adequate, but only for a limited period of time, maybe several days. Locating airmen efficiently and promptly was key for their survival.

AAL scientists believed the technology existed for an effective electronic location device, but acknowledged "no satisfactory solutions have appeared at operational levels." Deficiencies of previous devices included limited power, excessive size, sensitivity to shock, and consistent malfunctioning during adverse weather conditions and extreme temperatures. Prior to the SARAH, AAL researchers deemed all other transmitters "highly undesirable" for arctic search and rescue.

The AAL tasked its physicist, Glenn Stanley, to develop an adequate radio locator beacon for the Arctic. Stanley decided to reexamine the original SARAH that the United States had invented, but discarded. He also assessed the British SARAH model for use in the Arctic. The British model, essentially an updated version of the older American SARAH, had success in Europe, and, at the time, at least 15 countries used it as their sole device for search and rescue missions. Stanley believed only two deficiencies prevented the British SARAH from being an effective search and rescue tool in the Arctic: the battery pack and the antennae.

Stanley's modifications to the antennae enabled greater quality and range to work sufficiently across the diverse and mountainous terrain of Alaska. He also improved upon the cold weather batteries that the United States Air Force had designed. Stanley's version of the SARAH proved adequate with a "range of about 150 nautical miles 'line-of-sight' from high altitude" and could "pinpoint the location of the downed aircraft to within a few degrees of the correct latitude and longitude." The AAL estimated that a B-57 could perform a successful search of an area roughly one third the size of Alaska over the course of a four-hour flight. Moreover, the SARAH search equipment was adaptable enough for mounting on a variety of aircraft.

Technical Report 61-26: Human Physiological Response to Extremity and Body Cooling, October 1961.

The AAL spent considerable time and effort understanding how the human body reacts to cold exposure. Many of its experiments explored the relationship between whole body insulation and exposure of the hands and feet. This particular study examined the "response of the extremities as opposed to the rest of the body when subjected to a cold environment." The AAL wanted to quantify the tolerance of the appendages to the cold as well as determine importance of extremity protection versus insulation of the whole body.



Search and Rescue and Homing (SARAH) receiver and direct current to direct current converter.



e first experimental outfit, or minimal tfit, for the "Human 'siological Response Extremity and Body Cooling" study.



The second experimental outfit for the "Human Physiological Response to Extremity and Body Cooling" study.





elin tomporaturo duri posure to the cold.

Special Suit Might Save Lives

An anti-exposure flying suit of waterproof material porous enough to allow body vapors to escape is under test at Fort

escape is under test at Fort Wainwright. The Air Force Arctic Aero-medical Lab is testing the suit as a device that might cut fa-talities in aircraft accidents. A three-year study of fatalities successful ejections has shown drowning or exposure to cold water to be the second leading cause of deaths. To obtain realistic estimates of survival time for pilots in cold water, the environmental Protection Branch of the Arc-tic Aeromedical Laboratory, Fr. Wainwright has carried out tests on anti-exposure suits. Voluncer subjects were dump-ed into the icy waters of the Chena River and into a tem-perature controlled tank in the laboratory. From measurements of body temperatures taken dur-

nperatures taken dur-Turn to SUIT Page 6

ANTI-EXPOSURE SUIT READY FOR TEST MSgt. John Schumann adjusts Maj. Paul Albert's outfit

c Aeromedical Laboratory personnel testing new an exposure suit. *Yukon Sentinel*, March 11, 1966. Arctic Aeron

To accomplish this goal, AAL staff placed five test subjects in a cold chamber at 0°F. Each subject wore three different outfits. One of the outfits was simply the military-issued winter underwear, which the AAL referred to as the minimal outfit for the study. AAL scientists used skin and rectal temperatures of participants wearing this outfit as the control for the experiment. The second outfit included the military-issued winter underwear along with insulated protection for the subjects' hands and feet. The third outfit was a sleeping bag that covered the individual's entire body, including their head, but it exposed their hands and feet.

AAL researchers asserted in their report that "extremity protection in cold environments is of primary importance." They concluded that coverage of the hands and feet appeared more pertinent to one's tolerance than whole body insulation in cold environments. Researchers found the skin temperature of the test subjects reached 40°F in about eight minutes with the minimal and sleeping bag outfits. While wearing the minimal attire with their extremities protected with insulation, individuals' skin temperature took about 83 minutes to reach 40°F. They inferred that shivering keeps the trunk of the body warm enough to tolerate low temperatures, but shivering is not sufficient to keep hands and feet warm. In essence, tolerance of the cold requires the hands and feet to have adequate protection and insulation.

Technical Note 62-15: Simulated Survival Trek from the Confluence of the Anaktuvuk and Colville Rivers to the Arctic Coast, January 1963

In order to test survival techniques, clothing, equipment, and rations, the AAL facilitated simulated survival treks and exercises. In July 1962, the AAL conducted such a trek from the confluence of the Anaktuvuk and Colville Rivers to the Arctic coast. The purpose of this particular simulated

survival trek was "to provide field experience in this area and to determine the merits and deficiencies of the F-102 Aircraft Survival Kit." The AAL limited Captain James H. Veghte and Staff Sergeant Robert C. Dudley to the components of an F-102 summer survival kit and instructed them to hike alongside the Colville until they reached the Arctic coast. Master Sergeant Freeman E. White acted as an observer and carried supplemental medical and food supplies in case of an emergency.

According to their daily log, the two weeks proved difficult due to terrain, weather, and the limited rations of the survival kit. For the first few days, a mixture of rain and snow made life miserable with one spent "shivering uncontrollably," forcing the two men to "call on considerable willpower to make camp." By day four, due to the depletion of the survival kit's rations, Veghte and Dudley began supplementing their diets with ground squirrels that were prevalent in the area. The second week offered some alleviation as the weather improved and Veghte and Dudley switched to rafting the river as means of travel. On the last day, the crew utilized a SARAH transmitter and a helicopter transported them to Eielson Air Force Base.

Veghte, Dudley, and White concluded their survival trek with several observations and recommendations to aid individuals in arctic survival situations specific to that area and to improve the F-102 survival kit. With regard to water and food sources, they found that the Colville River provided clean water up until reaching the coast. Ground squirrels proved a plentiful and adequate dietary supplement. Additionally, gill nets placed in select locations provided fish as another dietary complement to the survival kit's rations. The crew found hiking difficult and almost infeasible in the region and suggested rafting as the means of travel, if possible. Recommendations for the survival kit included replacing the heavy winter socks with

APPENDIX A		
SURVIVAL KIT FOR	F-102 AIRCRAFT	
ITEM	STOCK NUMBER	FIREWELL SUMMER
Bag, Sleeping, MC-1	8465-559-2529	1
Candle, Plumber's Wax	6260-299-5689	1
Compass, Lensatic Wrist	6605-223-7064	1
File, Flat, 6"	5110-234-6532	1
Headnet, Mosquito	8415-269-0492	1
Knife, Pocket, 4 Blade	7340-162-2205	1
(leenex (24 tissues)	8540-213-6384	1 pk
Gloves, Nylon, Size Large	8415-269-0500	l pr
Gloves, Flying Cotton K-1	8415-261-7014	1 pr
Socks, Wool, Winter, Size 12	8840-153-6717	1 pr
Food Packet, Survival, Arctic (SA)3	8970-163-8869	2
Nire, Snare Brass	9525-596-3498	20 ft.
Box, Match, W.P.	8465-265-4925	3
Raft, Pneu. MB 4	4220-541-0872	1
Mirror, Signal MK3	6350-299-6197	1
Manual, Survival	AFM 64-5	1
lipstick (Chapstick)	8510-161-6205	1
Kit, Fishing Survival	7810-273-9596	1
Tablet, Water Purification Halazone, Bottle	6850-250-2620	1
<pre>Iet, Gill 15' x 3-1/2'</pre>	4240-300-2138	1

Content list of the survival kit for the F-102 aircraft.



next to a pen for size comparison.



Arctic Aeromedical Laboratory scientists determining the rate of heat loss through an exposure suit and life raft.

cushion sole socks, increasing the rations, providing salt for the wild game needed to supplement the kit's rations, and including lightweight raingear.

Technical Note 63-3: Evaluation of Pocket Pen Flare, February 1963

The SARAH electronic location marker proved a viable tool to increase the chances of locating downed airmen and became a fixture in the Alaskan Air Command survival kit. However, the AAL wanted to supplement the SARAH in case of instances where the contents of the survival kit were lost. The AAL decided to evaluate the pocket pen flare, purchased from J.S. Enterprise, as a possible complement.

AAL researchers tested the pocket pen flare through a variety of different scenarios while conducting an eight-day simulated survival exercise 35 miles east of Galena Air Force Station, Alaska. Prior to the field test, they cold-treated the flares in an environmental chamber at -70°F and immersed some flares "in both fresh and salt water for periods of half hour to 15 hours." The first three days, the temperatures dropped between -36°F and -40°F, providing AAL staff with typical winter arctic conditions. On their initial attempts, 40 out of 42 flares fired, including the flares soaked in fresh and salt water.

A H-21 helicopter crew from the Base Air Rescue Detachment was providing air cover for the simulated survival exercise occurring concurrently and was unaware of the AAL's flare experiment. The pilot and copilot stated, "They were not expecting any flares and were not looking in the direction of the firing but had no difficulty spotting them." Additionally, the AAL provided the Arctic Survival Training School with the pocket pen flare for use during survival exercises. The helicopter pilots and the instructors' favorable comments about the pocket pen flare provided qualitative support for the product's use. The AAL recommended that the United States Air Force issue the pocket pen flare to all Alaska Air Command crew members. The AAL suggested airmen carry the flare pistol in the left upper arm pocket of the MA-1 jacket with the flares packed in a strong plastic container small enough to fit in the outer pocket.

Technical Documentary Report 63-24: Effects of Partial Cold Water Immersion on Man in the Arctic, June 1963

Frostbite and hypothermia were arguably the two most important cold-related injuries the AAL sought to minimize. It conducted many experiments and sponsored academic symposiums to understand both conditions and to develop prevention and treatment techniques. One study explored the hazardousness of partial submersion into cold water and the approximate time for frostbite to occur following such an immersion.

The test required subjects to immerse their right leg into the Chena River during the winter season. Subject's left leg represented the control. The ambient temperature ranged between -2°F and -45°F with water temperature settling around 32°F for all immersions. After immersion, subjects remained outside resting. Every two minutes, AAL researchers took skin and rectal temperatures of the subjects with the experiment ending once the skin temperature reached 40°F.

AAL scientists found that cold water immersion reduced the effect of cold exposure on the toe and foot temperatures. They surmised that water must "act as a medium for transferring the warmer heat of the foot to the normally colder toes." For the matter of frostbite, they found that an individual at rest after partial immersion has approximately 30 minutes before frostbite develops.



Arctic Aeromedical Laboratory researcher preparing to fire the pocket pen flare gun.

For 20 years, the AAL pursued its mission "to solve the environmental problems of men living and working in the Arctic." To this end, the AAL facilitated and published over 600 experiments and technical reports as well as hosted numerous symposiums and conferences on a variety of scientific topics. The AAL expanded the military's understanding of the Arctic and presented practical solutions for humans to live adequately in its harsh climate and terrain. Research on the flora and fauna as well as explorations into the Arctic brought to light lesser known ecosystems and revealed uncharted areas. The AAL's development of cold weather equipment and clothing undoubtedly made life more bearable for those living in cold environments and saved numerous lives.

However, the AAL's history is more nuanced. The AAL's controversial thyroid study and the perpetuation of scientific racism are intertwined with its legacy. Acknowledging this aspect of the AAL's past does not diminish its achievements and accomplishments, but serves to contextualize its role in the expansion of western culture into the Alaskan frontier.

Solider field testing an experimental insulated survival shelter

Locations of the Arctic Aeromedical Laboratory's Research Facilities and Remote Sites



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Environmental

Colorado State University

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MILITARY LANDS

The Cultural Resources Management Program supports the Army's mission by inventorying and managing cultural resources in a manner that complies with federal law, minimizes impacts on the mission, supports sustainability of resources and infrastructure, and provides sound stewardship of properties eligible for the National Register of Historic Places.

The Cultural Resources Management Office is located within the Environmental Division, Building 3023. Copies of our publications, additional information on the history of Fort Wainwright, and historic photos of the installation are available upon request. Business hours are Monday through Friday 7:30 am-4:30 pm.

Directorate of Public Works ATTN: IMFW-PWE (Cultural Resources Manager) 1046 Marks Road, Fort Wainwright, Alaska 99703-4500 (907) 361-3002

Text by Steven Nickollof

Cultural Resources Management at Fort Wainwright

