The AMEDD Historian

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Chief's Corner

Welcome to the latest installment of the *AMEDD Historian*. This issue focuses on aviation medicine. From the first days of Army flight programs, many aspects are covered. We also have various articles about other topics.

Primarily written by the staff of the AMEDD Center of History & Heritage (ACHH), we welcome new author LTC Robert J. Schultz and Linda Bine. Please read through our current issue and let us know your thoughts. We would like to hear your comments and are always seeking new articles for publication. If you are at Fort Sam Houston please stop by the AMEDD Museum and see the new exhibit on Army Medicine during World War I.

In addition to this publication, please visit our websites with attached social media feeds:

History: http://history.amedd.army.mil/

The AMEDD Regiment: http://ameddregiment.amedd.army.mil/

The AMEDD Museum: http://ameddmuseum.amedd.army.mil/index.html

These websites are great resources for AMEDD history—people, campaigns, units, medical advances, and more.

Nolan A. (Andy) Watson
Acting Chief, ACHH

Army Aviation Medicine

Sanders Marble, Senior Historian, ACHH

Aviation medicine is a historic and continuing mission for the AMEDD. Since 1949, when the US Air Force Medical Service was established, most people have lost sight of the AMEDD's continuing work. Aviation medicine is a mix of environmental medicine, preventive medicine, and occupational health.

The Army bought its first airplane in 1908, but medical screening for potential aviators did not start until 1912. The key criteria were good vision, good hearing, and good equilibrium. With very few aviators (partly because few passed the tight physical exam), there was little urgency. In October 1916 a board was appointed to improve the guidelines for aviator examinations, but it would not report until May 1917. By then the Army was busily expanding for WWI.

WWII flight surgeon badge

During WWI, the AMEDD drew on the experience the British and French had in aviation medicine; their war had started in 1914, and they had selected tens of thousands of pilots. The US established 35 examination stations for would-be pilots, focusing on ophthalmology, ears/nose/throat problems, neurology, and the cardiovascular fitness. After learning from the British that most crashes were due to flier error,

selection was made a high priority, but the British also advised that pilots grew 'stale' or tired. US flight surgeons (the title was adopted in WWI) were advised to ground pilots for the pilot's own protection. The AMEDD also started research and development work in WWI with a Medical Research Board at the Mineola NY air station. Two of their main research efforts were on oxygen deprivation and the effects of rapid three-dimensional motion.

After WWI, the Army Air Service grew into the Army Air Corps. Congress provided more money for aviation, and the Army allocated more manpower. Early research included the effect of exhaust fumes on flight personnel, reflecting the open cockpits, but as aircraft changed the range of medical questions expanded quickly as aircraft performance put new stresses on aircrew bodies. With airplanes flying higher and further, new clothing and safety equipment was needed, plus there were military-specific things like dive-bombing that put extreme stresses on the body. (This led to a 1941 film, *Dive Bomber*, with Errol Flynn as the flight surgeon. Unfortunately for the AMEDD, the film was set in the Navy.)

Today's Flight Surgeon Badge

The Medical Research Laboratory and School of Flight Surgeons were merged into a School of Aviation Medicine, which left Long Island for sunnier Brooks Field (San Antonio, Texas) and then Randolph Field on the other side of San Antonio. Flight surgeons were required to become pilots; this would both better acquaint them with the stresses of flying and ensure that pilots knew their flight surgeons were also pilots. In 1941 the Navy set up their own School of Aviation Medicine, initially with Army instructors, so Errol Flynn's character should have had AMEDD instructors, but Hollywood glossed over that.

The increasing influence of the Air Corps led to administrative questions for aviation medicine. Did aviation medicine belong to the Air Corps or to the Medical Department? There were arguments on both sides, no doubt complicated by some flight surgeons wanting the increased autonomy of being separated from The Surgeon General. The arguments would be temporarily settled by establishment of the United States Army Air Forces in June, 1941; The Air Surgeon would be the equal of The Surgeon General. Flight surgeons were still Army officers, but the Air Corps and USAAF were headed towards being a separate service, so there was little transfer of personnel even though they were all theoretically AMEDD. (The Air Force was eventually established in 1947, and the Air Force Medical Service in 1949.)

The Master Flight Surgeon Badge

With the Army Air Forces an Army responsibility, research continued during WWII. Increasing altitude led to development of new oxygen masks and studies about altitude frostbite and how to prevent it, including different versions of heated flight suits. Gravity suits were developed to keep blood from flowing away from the head in tight, fast turns and dives. Body armor was developed to protect flight personnel. Late in the war jet propulsion led to new concerns about high speed and high acceleration.

When the Air Force Medical Service was established, the School of Aviation Medicine became the USAF School of Aviation Medicine, and there were no Army students because the Army had lost essentially all flying missions. However, helicopters grew in importance during the Korean War, and Army doctors were sent through the Air Force school. As helicopters grew increasingly useful, in 1963 the Army started its own course, run by Continental Army Command, a predecessor of Training and Doctrine Command, with the AMEDD setting the syllabus. In 1984 that became the US Army School of Aviation Medicine. In 1962 an Aeromedical Research Unit was created, pushed along by Col. Spurgeon Neel, MC.

Research continues, looking at both aircrew and more recently at the patients that medevac helicopter transport. Aircrew are exposed to the loud and vibrating helicopters far longer than passengers are, and studies have looked at aircrew fatigue, hearing loss, and lower-back pain, and how special equipment (especially flight helmets) can mitigate problems. Eyesight is also a major research area, with questions about eyewear, night-vision goggles, contact lenses, and more recently refractive eye surgery. Other research has looked at special considerations for medevac patients, how anesthesia effects on patients differ due to altitude, and validating the working of medical equipment in helicopters.

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Major General Spurgeon Hart Neel, Jr. – Army Aerospace Medicine and Aeromedical Evacuation Pioneer

Lewis Barger, ACHH

Few people serving in the Army Medical Department have exerted the same kind of career-long influence as Major General Spurgeon Neel, Jr. Neel, who joined the Army during World War II, commanding a divisional medical company and earning a purple heart, two bronze stars, and a combat medic badge, left the Army shortly after the war ended. A few months later he decided to re-join, and although he considered switching to the newly separate Air Force, he stayed in the Army.

An incident during his World War II experience would plant a seed of interest in the capabilities of Army aviation. His company was supporting operations at a bridgehead over the Rhine River. Soldiers wounded on the far side could not be evacuated because the urgent need to move combat forces forward limited the bridges to one-way traffic. An aircraft that could land and take off from unimproved terrain in order to carry casualties to ambulances on the other side of the river would solve Neel's problem, but no aircraft were available to him.

During World War II Army Air Forces used helicopters to evacuate casualties in Burma and the Philippines, but the small number of vehicles available and the helicopters' limited capabilities only hinted at their role in Korea and later conflicts. Neel attended an air transportation (fixed wing) course in 1948, but his first direct experience with helicopters came when he served as chairman of a board evaluating an early Kaman design to determine whether or not helicopters would make suitable platforms for patient evacuation. In 1949 he was assigned to be division surgeon for the 82d Airborne Division. In 1947, YR-13 (later H-13 Sioux) hel-

icopters were sent to Fort Bragg for consideration by Army Field Forces Board No. 1 and for testing and evaluation by the 82d Airborne Division which continued during Neel's tenure as division surgeon. At this time he began developing concepts for employing helicopters as ambulances in combat. Following this, Neel attended and was the first Army student to graduate from the Air Force's Basic Aviation Medicine course at Randolph Air Force Base, Texas.

In 1952 Neel was assigned briefly as Chief of the Field Medical Service Branch at the Medical Field Service School, MFSS. Using lessons learned from Korea, he developed doctrine and organizational documents for helicopter ambulance detachments that would serve as the basis for later authorization documents. In the process he became an ardent advocate for the Medical Department's control of the air evacuation mission. He also recommended that Medical Corps officers be trained not only to support ground operations, but also receive training in the unique physiological effects of the aerial environment so that they could adequately support Army aviators. The MFSS' primary course in military medicine began including 46 hours of classes on aviation medicine and select graduates of the military medicine advanced course received another 46 hours of instruction at Randolph Air Force Base followed by two weeks applying their newly learned skills at the Army Aviation School at Fort Sill, OK.

In June 1953, Neel deployed to Korea as the war there was coming to a close, first serving in the Eighth Army Surgeon's office, then taking command of the 30th Medical Group. Synthesizing his experience evaluating helicopter support as a Division Surgeon, information from the Aviation Medicine course, and the evolving doctrine being developed in the schoolhouse, Neel created a provisional air ambulance company and used it as a test bed for developing standard operating procedures, and in 1954 published "Medical Considerations in Helicopter Evacuation" in the *U.S. Armed Forces Medical Journal*. In his article, Neel addressed the advantages of air evacuation beyond the obvious element of speed, noting that it also allowed transport directly to a facility best suited to treat a severely injured casualty, rather than through the steps of the ground evacuation chain. It also allowed the Medical Department to concentrate surgical specialists rather than having to piecemeal them out to hospitals spread along the front line. Neel also anticipated the value of aerial evacuation in emerging doctrine as the Army was moving away from massed formations of troops to greater dispersion of smaller units on a potentially nuclear battlefield. While in Korea, Neel also established the Eighth Army Aviation Medicine Program which would later serve as a template for Army Aviation Medicine and also was the first Army officer to receive the military occupational specialty of 3160, Aviation Medical Officer.

Neel returned to the United States where he was assigned as the first Medical Corps officer to serve as the Chief of Aviation Section (later the Aviation Branch) at the Office of The Surgeon General. He spearheaded several proposals that would solidify flight medicine as a specialty in the AMEDD. In 1955 The Surgeon General established a requirement for aviation medical officers to be placed on non-crewmember flying status, and Neel was the first medical officer placed on flight status. In 1957 his design for the Aviation Medical Officer Badge was approved and he was the first to be awarded the badge. He then moved to establish an Aviation Medicine Board to certify medical corps officers in the specialty. He also continued to contribute to the body of knowledge, penning three articles on aviation medicine while heading the Aviation Section.

It was also during this time when Neel participated as the medical representative on the board selecting a new Army helicopter. The Army had established requirements in 1952 for a helicopter that would serve as a helicopter ambulance, for instrument training, and in the general utility role. Neel ensured that the aircraft the Army would ultimately accept, the Bell XH-40, met the AMEDD criteria for use as a helicopter ambulance. The XH-40 had the capability to carry two litters, a medical attendant, and 100 pounds of additional baggage. When the Army completed its tests and authorized limited initial production in 1958 the helicopter was redesignated the HU-1A, eventually becoming the ubiquitous UH-1 series of military helicopters.

In 1957 Neel became the first Army medical officer to attend the Air Force's Advanced Aviation Medicine training program. As part of this program, he attended the Harvard School of Public Health from which he received a Master's in Public Health, cum laude, and producing two more monographs on the application of aviation medicine to soldiers. He continued his training in the Air Force School of Aerospace Medicine at Brooks Air Force Base in San Antonio, conducting research on the medical effects of helicopter evacuation and writing a history of the developments in helicopter evacuation during the preceding decade. His thesis was written as a model for a course in Military Survival Medicine, and was subsequently published in *Military Medicine*.

At the conclusion of his schooling Neel was selected to command the hospital at Fort Rucker where he also served as Command Surgeon for the US Army Aviation Center and School. His accomplishments during this period were numerous and significant, and as a result, in 1962, he was awarded the Army Aviation Association of America's John H. McClellan Award for Outstanding Contributions to Army Aviation Safety. Neel was specifically cited for establishing of an advanced aviation medicine training program at Fort Rucker (affiliated with the USAF school at Brooks AFB) and establishing the US Army Aeromedical Research Laboratory. Additionally, Neel established and served as the first director of the Department of Aeromedical Education and Training in the Aviation School, helped coordinate the design for a new hospital at Fort Rucker incorporating aviation medicine facilities, and served as a medical representative to the Howze Board. The last, more formally known as the Tactical Mobility Requirements Board, established the principles for Army airmobile operations which were tested by the 11th Air Assault Division (Test), which Neel also helped evaluate and ensured that an organic aerial evacuation platoon was included in the division's medical battalion. The 11th formed the nucleus for the reactivated 1st Cavalry Division (Airmobile) which put the principles of airmobility into practice in Vietnam.

During his tour at Fort Rucker, Neel also continued to write, although in his role as Command Surgeon his 'Memos from the Flight Surgeon' in *Army Aviation Digest* were aimed towards providing medical information to non-medical aviators that would equip them for safe operation of Army aircraft. Between November 1960 and April 1962 Neel penned seven articles on the topics of cold injury, stimulants, night vision, fatigue, heat injury, hyperventilation, and aviation medicine's contributions to flying safety. Cognizant that there would still be some accidents, he worked with Fort Rucker's air ambulance section, FLAT-IRON, to improve their crash response procedures. Neel also collaborated with Major Roland Shamburek, MC, to produce two longer pieces on the history of Army Aviation Medicine and Medical Evacuation as part of an ongoing series of articles, "The

MG Neel as a colonel in the early 1960s when he was Commander, US Army Hospital Fort Rucker.

Army Aviation Story."

Neel's next operational assignment would be to Vietnam, but first he spent another year in schooling, this time at the Industrial College of the Armed Forces where he wrote his thesis on managing the Department of Defense Blood Program. This evidently was not enough to keep him occupied, as he simultaneously earned a Master of Science degree in Business Administration from George Washington University at the same time. Following completion of these two courses Neel deployed to Vietnam as Command Surgeon for the Military Assistance Command, Vietnam; the senior medical advisor to General William Westmoreland. He arrived when the US was shifting its policy from advising the Army of the Republic of Vietnam to direct combat. Neel was faced with developing a medical support plan for a rapidly growing combat force and increasing numbers of casualties. He moved to add more air ambulance units to the force structure and set up an office of the Far East Joint Medical Regulating Office in Saigon. With those two pieces in place, he clarified procedures for regulating the evacuation of US military, Allied Forces, South Vietnamese military, and civilians inside Vietnam and, as appropriate, to hospitals outside the combat zone. In recognition of his contributions, the Association of Military Surgeons of the United States awarded him the Major Gary P. Wratten Award for outstanding accomplishment in field military medicine.

Neel returned to the US in 1966 and was assigned as the Director of Plans, Supply, and Operations in the Office of The Surgeon General. In addition to these duties, he took the opportunity to consider the lessons from his first tour in Vietnam and advocate for the advantages of aeromedical evacuation not only in wartime but for civilian trauma response. He published "Army Aeromedical Evacuation Procedures in Vietnam; Implications for Rural America" in the *Journal of the American Medical Association* in 1968 and also lectured on the topic in small, local gatherings and national level assemblies of medical professionals. In his article he noted that mortality for wounded soldiers admitted to medical facilities in Vietnam was only 2.3%. Helicopter ambulances were not the only reason Neel noted for this success; he also listed consistently available whole blood, skilled medical personnel, well-equipped medical facilities, and making the most of the available medical assets through effective management, but helicopters topped his list and were the subject of the remainder of the article. In particular, he singled out the crash rescue procedures developed by FLATIRON as a potential model for improving civilian trauma evacuation.

In 1970 the Department of Defense began a cooperative program with the Department of Transportation and the Department of Health, Education, and Welfare known as Military Assistance to Safety and Traffic (MAST) which made military air ambulances at (initially) five locations available to respond to civilian medical emergencies, particularly highway accidents, in an attempt to reduce the more than 55,000 traffic fatalities that were occurring annually in the United States. Initial trials were promising enough to merit the program's expansion. MAST would provide support in underserved areas of the United States for decades, but as civilian air ambulance companies began providing service, the MAST program was reduced. Neel's vision for revolutionizing trauma response had been realized, though, not only in the United States but around the world.

In 1968 Neel returned to Vietnam to command the 44th Medical Brigade. His earlier initiatives were well established. Operational tempo had increased substantially, but the medical force structure was in place and the 44th had recently been reorganized so that it was no longer subordinate to the 1st Logistics Command and now reported directly to Headquarters, US Army, Republic of Vietnam, with the brigade commander dual-hatted as the USARV Surgeon. After six months in command, Neel redeployed to become Deputy Surgeon General.

As Deputy Surgeon General, Neel had many duties, including leading a review of the organization of Army medicine worldwide that resulted in the 1973 reorganization of the AMEDD and establishment of

Health Services Command. Despite this, he continued to write extensively. He prepared his most extensive contribution during this period, a substantial volume in the 'Vietnam Studies' series published by the US Army Center of Military History. *Medical Support of the U.S. Army in Vietnam, 1965-1970* described in detail the organization and evolution of medical support to the Army in Vietnam during the years when US ground forces were most actively engaged in combat. He also continued to prepare shorter pieces, including a chapter on "Medical Aspects of Survival and Rescue" for the 2nd edition of *Aerospace Medicine*. In 1973 he was selected to serve as the first commander of Health Services Command, shepherding that organization through its first four years. Neel retired in 1977 and passed away in 2003.

Over the course of thirty-four years Major General Neel was enormously influential in the fields of Army aviation medicine and aeromedical evacuation. A prolific writer, Neel's contributions recorded history, shaped opinions, and informed colleagues. His entry into aviation medicine coincided with the separation of the Air Force from the Army, providing opportunity for him to grow into the specialty as it was becoming a specialized area of medicine in its own right. He influenced the future of aviation medicine by establishing an aviation medicine training program at Fort Rucker. Similarly, his career paralleled the growth in capability of the helicopter, and he was fortuitously stationed in locations where he could impact the Army's development of doctrine, organization for support, and specifications for future airframes. The last is best exemplified by the Army's selection of the UH-1 Iroquois, the "Huey," which became an iconic symbol of Army medical evacuation and the Vietnam War. Fittingly, Neel Plaza at the AMEDD Center & School, named in honor of General Neel, has as its centerpiece a UH-1 painted to represent a MEDEVAC helicopter ambulance. The Army Medical Department Museum Foundation presents the Spurgeon Neel Annual Award each year for writing about the history, legacy, and traditions of the Army Medical Department.

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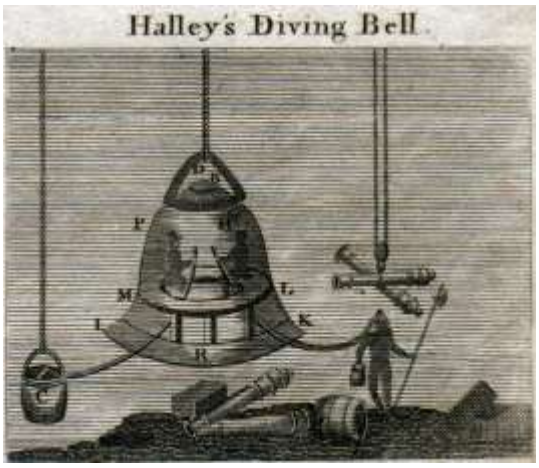
The Evolution of Hyperbaric Medicine and the Hyperbaric Chamber

LTC Robert J Schultz

The Military Health System recently opened a new Undersea and Hyperbaric Medicine Clinic at Fort Sam Houston. It is staffed by Air Force personnel, is overseen by Brooke Army Medical Center, and treats patients from all services. Let's look back at the history of hyperbaric medicine and how an Undersea and Hyperbaric Medicine Clinic became completely staffed by Air Force personnel.

Hyperbaric Oxygen Therapy (HBOT) is defined as a treatment in which a patient intermittently breathes 100% oxygen while the treatment chamber is pressurized to greater than sea level (1 atmosphere absolute). The concept of hyperbaric medicine was practically an inadvertent outcome related to the development of the diving bell. Described by Aristotle in the 4th Century BCE, the diving bell was developed to allow divers to remain underwater for greater periods of time due to the presence of air within the bell space. The concept of the bell was used for many activities, such as salvaging wreckage, retrieving sunken treasure and general underwater exploration. Use of the diving bell continued with limited success until late in the 1600s when Edmund Halley (of Halley's Coment) advanced the technology by enhancing air replenishment techniques that eventually enabled divers to remain underwater for periods greater than 1 hour. Further attempts to enhance the diving process led to the discovery of the best known medical problem associated with it: decompression sickness. During deep-sea diving, inert gas breathed at relatively high pressure dissolves and accumulates in body tissues. As the diver returns to the surface, the gas may form bubbles that interfere with normal physiological processes. Blood circulation, for example, can be disrupted by bubbles that clog small blood vessels causing pain when those bubbles attempt to expand within the closed spaces of joints – a condition called decompression sickness or "The Bends."



Early diving bell.
Courtesy History of Diving Museum,
www.divingmuseum.org

Eventually, physicians discovered they could counter decompression sickness by hyperbaric recompression but they also claimed other benefits utilizing HBOT as well. During the late 1600s, the British physician Henshaw constructed an airtight room called a "Domicillium" that he claimed cured multiple ailments, inclusive of almost all afflictions of the lungs. However, there are no documented accounts proving Henshaw's claims. After almost two centuries without any HBOT developments, trials reportedly stated that HBOT treatment could cure nervous disorders and therefore, the first two chambers appeared in North America: Ontario, Canada and New York City in 1860 and 1861, respectively. During that same period, the French surgeon Fontaine developed a mobile hyperbaric treatment facility that was believed to aid in patient treatment regarding hernia reductions, asthma, chronic bronchitis, emphysema and anemia. Within a 3-month period, twenty-seven operations were performed and HBOT popularity grew to the point where chambers were present in almost all major European cities. Proof was still thin, but patients were eager for relief.

In North America, the concept of hyperbaric treatment to remedy disease and bodily afflictions continued to progress. In 1927, Dr. Orval J. Cunningham, an anesthesiologist at the University of Kansas, reported treatment success with syphilis, hypertension, and cancer reasoning that positive outcomes resulted from the anaerobic (living in the absence of air) infections that played a significant role in all such diseases. Based on his achievements and discoveries, one patient was so grateful that in 1928, he invested one million dollars to fund a "steel ball" hyperbaric chamber and hospital. Engineered by Alois Hauser, this one-of-a-kind facility had no luxury spared in its design and construction. The climate-controlled 900-ton, five-story, sixty-five foot diameter superstructure was able to accommodate forty patients at a time and interior amenities included group dining and recreational areas. After nearly a year of hard labor by the Melbourne Construction Company, the facility opened on 1 December 1928. At the time, it was the only functioning hyperbaric chamber in the world.

Cunningham's facility.

Left—outside view

Right—inside a recreation room.

Courtesy Morgan Choffin, "The Cunningham Sanitarium," *Cleveland Historical*, accessed August 21, 2017, https://clevelandhistorical.org/items/show/378 and Cleveland State University

As publicity increased surrounding Cunningham's treatments, the American Medical Association requested documented proof regarding his HBOT treatments. Never producing the requested documentation or describing his procedures in medical literature (coupled with a depressed economy), the Steel Ball facility was shut down a mere five years after its opening and Cunningham was forced to sell the facility. Eventually, the facility was dismantled, scrapped, and sold based on weight for a mere $25,000. Shortly after the sale of Cunningham's facility, the United States military began using HBOT for divers and pilots suffering from cramps and altitude sickness. In 1939, the United States Navy successfully treated decompression sickness with HBOT, which was considered a breakthrough at the time based on their previous trials/results with compressed air therapy. The Navy continued to expand upon HBOT especially for the treatment of decompression sickness, resulting in the Navy being made the DOD lead agent in the use of Hyperbaric Oxygen. However, in 1974, the United States Air Force began a Clinical Hyperbaric Medicine Program at Brooks Air Force base that expanded beyond dive related injuries alone. The program initially focused primarily on osteoradionecrosis, bone death of the jaw following radiation for head or neck cancer. Due to the expanded program, the Air Force was named the DoD lead agent for Clinical Hyperbaric Medicine in 1984. Soon thereafter, the program expanded to address thirteen conditions, mainly centered on blood gas imbalances, crush injuries, slow wound healing, intracranial abscess, thermal and radiation burns, and healing of skin flaps/grafts.

Unfortunately, there are treatment risks. Often mild and reversible, the side effects can be severe and life threatening. In general, if pressures do not exceed 43.5 pounds per square inch and the length of treatment is less than 120 minutes, HBOT treatment is safe. Although the popularity and use of HBOT continues to grow within the military, this treatment modality has remained a remedy familiar to only a limited number of people. To meet the needs of this growing patient population and adhere to credentialing requirements, the program was moved from Brooks Air Force Base to Wilford Hall Medical Center (WHMC) at Lackland Air

Force Base, both located in San Antonio, Texas. Over the next 30 years, Base Realignment and Closure (BRAC) coupled with slow facility construction progress and the downsizing of WHMC from a Medical Center to a Medical Clinic (losing inpatient capability), a full tertiary care center was required to maintain credentialing. Thus the decision was made to construct a new 13,281 square foot clinic at Brooke Army Medical Center, Joint Base San Antonio (Fort Sam Houston) as part of the integrated Army/Air Force San Antonio Military Health System (SAMHS). This new project consists of a direct addition to BAMC, with six individual patient evaluation/assessment rooms, a multi-chamber that can accommodate up to six patients, a single patient chamber, as well as staff and administrative space. For future use and potential expansion, the facility has been enabled to accommodate another six patient multi-chamber if mission dictates. Additionally, the new facility provides benefits that were previously in jeopardy such as the provision of a Graduate Medical Education (GME) program.



BAMC hyperbaric addition. Left—facility exterior. Center—individual evaluation room. Right—interior of multi-chamber. Photos courtesy of the author.

Having the facility at SAMMC is a logical move for both patients and staff. SAMMC is the DOD's only inpatient platform providing a full-spectrum burn center and Level 1 Trauma Center; San Antonio had the largest patient population to support GME and research.

In summary, the future for HBOT is promising. What was a relatively unknown treatment modality continues to prove beneficial for a myriad of illnesses, injuries and complications. HBOT continues to provide treatment breakthroughs that only seem to increase over time. For the military, one of the more important potential uses that remain in trials and research is the potential use to remedy brain injuries. With the varying levels of Traumatic Brain Injury (TBI – categorized as mild, moderate, severe or penetrating), these injuries remain as some of the top injuries/concerns for personnel redeploying from wartime operations. Prior to 2008, the use of HBOT as a treatment modality for brain injuries (mild TBI and Persistent Post-Concussion Syndrome in particular) had been periodically tested. However, progress and results have not yielded the promising outcomes desired, and research continues. Anecdotally, performance recovery with HBOT continues to be a newsworthy topic. As recent as 2016, high-profile athletes such as Hines Ward of the Pittsburgh Steelers and Joe Namath claim that the HBOT they received extended their playing careers and prevented brain damage. Obviously, finding the right combination for "just right" continues to be a work in progress, but the new facility and staff at BAMC may soon lead to those sought after clinical outcomes.

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Testing human acceleration and deceleration limits were part of aviation medicine. Col. John P. Stapp served in the Army Medical Corps 1944-49, and continued in the Air Force until retirement. He rode rocket-propelled test sleds to find the body's limit for acceleration, personally exceeding 46 gravities.
Image courtesy National Library of Medicine

Malcolm C. Grow: Pioneer in Aviation Medicine

George M. Watson, Jr., Ph.D

Malcolm C. Grow rose to major general in the American military service and is justly remembered today for his insistence on a superior medical service for the newly independent American air arm. In July 1949 he became the first Surgeon General of the United States Air Force.

Malcolm Grow was born in Philadelphia, Pennsylvania, on November 19, 1887. He graduated from Jefferson Medical College in Philadelphia in 1909 with a specialty in internal medicine. He served the Russian cause as a doctor in World War I from September 1915 to May 1917, first as a civilian and later with a Russian military commission. He functioned initially as a surgeon at the czarist retreat of Tsarskoye Selo when that place became a medical center. Once commissioned, he joined an army corps in the field. Grow's compassion for the rank and file and his level of standards for American military -aviation medicine took much from his experiences with troops at this stage of his life.

On a visit to Washington, DC in August 1915, he met Dr. Edward Egbert, Chief Surgeon of the American Red Cross hospital at Kiev who was home on a brief leave from Russia. Dr. Egbert described the Russian Army's dire need for doctors. Grow was fascinated and, seeing an opportunity to enhance his surgical skills, left his comfortable Philadelphia practice for the Russian front.

A month later he was in Russia with Egbert, seeking to join the Imperial Russian Army. He was introduced to Dr. Vicker, the Russian chief surgeon at the Hussars Hospital at Tsarskoe- Selo. The American arranged to relieve Vicker temporarily and immediately went to work as a surgeon. Grow was astonished at the capacity of the Russian soldier for pain. They "would grip the hand of one of the kindly nurses until the muscles in their arms stood out like knots, and the sister would wince with pain from the pressure, but never a word of complaint...."

Grow met Col. Kalpaschnecoff, commander of the 1st Siberian Army Corps, called the "Ironside Corps" because of its battlefield accomplishments. Kalpaschnecoff, a former attaché in Washington who spoke fluent English, warned Grow about the danger of front-line duty: his surgeon had been recently killed by German shells. But Grow persisted, and the colonel, who desperately needed a surgeon, cut through bureaucratic formality to secure him a Russian Army commission as a captain. Grow's elation dampened when he learned that he would be required to remain through ''unknown perils" until he might be "relieved of duty at the pleasure of the Army Command or until the end of the war."

If action was what Grow wanted, he soon got it. He endured constant shelling and knew first-hand the trials and terrors of trench warfare. During the winter of 1915--1916, Grow recorded the mundane, the technological innovations, and the heart-stopping experiences of the war. He rode in a captured automobile belonging to Prince Frederick of Germany, son of the Kaiser. He briefly chatted with Czar Nicholas II. Against orders, he flew with a Russian captain on a reconnaissance exercise in a captured German aircraft, and dropped a bomb over German lines. Just short of friendly territory, the craft's engine quit without warning; he and his pilot barely made it back to their own lines. Grow realized quickly the importance of aircraft in this war, especially in intelligence -gathering. His pilot had identified two new German batteries and a German reserve regiment reoccupying a dugout village. But with only few of its own observation aircraft facing a German establishment with many, the Russian host "was a blind army," Grow noted, "unable to tell what the enemy was doing while they were aware of every move we made."

Grow and his assistants worked stoically under appalling battlefield conditions. He did not like having batteries located just two hundred feet behind the medical dressing stations, themselves only 1,500 feet from the front line trenches. But, "in this war military matters came first; the care of the wounded was a secondary consideration." He concluded that the Russian soldier was not properly equipped to protect himself from the biting cold climate, but as he noted, the soldiers did not complain. Grow himself was wounded and temporarily deafened when running to a bomb shelter.

Grow left for the US in January 1917 to intercede at home for medical supply and ambulances for Russia, never gauging the level of discontent brewing under the Romanov regime. Grow returned to Russia in July

1917 on a mission for the American Red Cross, and could see the effects of the first, social democratic, revolution. The attitude and appearance of the Russian common soldier had turned. Officers were being discharged by soldier committees, and the remaining generals were powerless to enforce discipline. Malcolm Grow never lost his respect and admiration for the Russian soldier, whose simple and uncomplaining demeanor drove the American doctor through his military career to forge a better lot for enlisted fighting men.

For Grow, the war after he left Russia was anticlimactic and peacetime even duller by comparison. He was surgeon to coast artillery, machinegun, and infantry units, and a sanitary inspector. The enchantment of flight continued to beckon. Still intrigued with his Russian flying experience, in 1921 CPT Grow applied unsuccessfully for admission to the School of Aviation Medicine at Brooks Field, Texas. For the next seven years, he served in various capacities in Washington and Alaska. On one fateful hunting excursion his rifle accidentally misfired, grievously wounding a woman in his party. Grow rushed her back to camp and into surgery and saved the life of Winifred "Freddy" Rogers, who became his wife in June 1930.

Grow was not a member of the elite group that dominated the Army General Hospital system. In 1927, Grow had advanced only to the position of post surgeon at Fort Lewis, WA, but, as with so many things in the Army, a single piece of paper stuck in the system now changed his life. In 1928 Malcolm Grow was finally accepted into the School of Aviation Medicine. Within three months he graduated and was certified as an aviation medical examiner. From that point, he was identified with the research and development problems of aviation medicine and technology. In August 1928 he became the base surgeon at the Fairfield Air Depot, Ohio. He remained there for several more years, near the center of the Army Air Corps' experimental activities at nearby Wright and Patterson Fields.

By the early 1930s, engineers and pilots realized that flight equipment failed to meet requirements for sustaining man in flight. Test pilots at Wright Field, Ohio, turned to Grow for advice on coping with physiological problems caused by carbon monoxide fumes, bulky flying clothing, and the cold that assailed them especially in open cockpits in mid-winter. Other flight surgeons such as 1LT Harry G. Armstrong were tackling the design of new flight clothing. In 1932 Grow flew with test pilots and submitted some of the earliest American technical reports on flight clothing and equipment. He was eventually provided a desk in the Equipment Branch, Engineering Division, at Wright Field, and divided his time between that office and his regular duties at Patterson Field. Among his first projects was a study on the maximum amounts of carbon monoxide allowable in the cockpit of experimental aircraft. His findings, the first of their kind, were published in 1934.

The same year, LTC Henry H. "Hap" Arnold tapped Grow as flight surgeon for the "Alaskan Flight." Arnold led twelve Martin B-10 bombers to Alaska to publicize the capability of bombers as coastal defense weapons. The flight enhanced the reputation of the Air Corps, and Grow cemented a friendship with Arnold, later Chief of the Air Corps.

Grow long realized the need for professional exchanges among physicians, physiologists, and engineers on the effects of flight on the human body and psyche. With others, he saw the need for a medical aviation laboratory in which these specialists could cooperate among themselves. His next assignment afforded him the opportunity to enhance his cause. In October 1934, he became assistant chief of the medical service division in the Office of the Chief of the Air Corps. The following March, he became chief of the division, re-

porting to the Chief of the Air Corps, MG Oscar Westover. In this position, he defended funding for his laboratory. He saw his vision materialize with the establishment of the Aero Medical Laboratory at Wright Field, Ohio, in 1935 under his colleague, 1LT Harry G. Armstrong. Under Armstrong, the laboratory became the major aeromedical research and development center in the US.

Amid growing international tensions, Grow was part of a slowly expanding and increasingly capable air force within the Army. He participated in a flight from the US to Panama in 1936 that again showed the reach of American forces. While the flight was routine, it provided Grow another "hands on" experience as co-pilot for one of the bombers. In October 1938, he was assigned as flight surgeon at Langley Field, Virginia, until May 1940, when he became surgeon at MacDill Field, FL. The following January he became the surgeon of the Third Air Force at Drew Field, FL, the headquarters of one of the principal stateside numbered air forces during World War II.

During the summer of 1940 as the Battle of Britain raged, Grow and Armstrong worked closely with the British medical staff, including the chief medical officer of the Royal Air Force. They learned about the medical problems confronting the British and were kept abreast of the latest developments in German aviation physiology and medicine.

In 1941, Grow started to put his ideas about flight medicine on paper for large numbers of aviators then being trained in an expanding Air Corps. That year he and Armstrong published *Fit to Fly: A Medical Handbook for Flyers,* which dealt with specific problems of aviation medicine. The authors coined two terms that found a place in medical annals: *aeroneurosis,* or emotional stress that affected aviators' gastrointestinal tracts, and *aero otitis media* (or *barotrauma otitis media),* a traumatic inflammation of the middle ear common among aviators caused by variations in air pressure. Grow saw the need for preventive medicine for flyers to detect strain before a flyer became fatigued and on the verge of a breakdown. His prescription was simple enough--the flyer should divorce himself periodically from things pertaining to flying. He called for rest and recreation centers where flyers could enjoy golf, swimming, tennis and other social activities.

After a brief assignment to the Office of the Chief of the Air Corps from February to June 1942, Malcolm Grow became directly involved in the European war effort as surgeon of the Eighth Air Force. Drawing upon his Wright--Patterson experience during the 1930s, Grow believed there should be some "hands on" unit near the action to test medical innovations for flyers. Grow and his deputy (Armstrong, now a colonel) recognized that the physical and mental problems of combat air crews required solution and believed that a new type of medical organization was needed. He convinced the British government to make available large estates as rest centers for American airmen. More than forty such homes, complete with staffs, accommodated 1,200 enlisted men and officers. The aviators wore civilian clothes and could do much as they pleased, including sports activities and visits to nearby pubs. In addition, Grow trained his flight surgeons to notice brooding, withdrawal from companions, insomnia, unusual airsickness, combativeness, and startle reactions as early warning signs of breakdown. Grow's preventive medicine theories produced results; during the first year of the war, not one flyer returned to the United States from the Eighth Air Force suffering from psychiatric breakdown.

Grow also spearheaded improvements in body armor. Recalling that over 50 percent of the casualties he saw in Russia resulted from low velocity shell fragments, Grow ordered a survey of Eighth Air Force wounds. He found that 65 percent were also caused by nearly spent missiles. Knowing that aviators did not have to run across stretches of "no--man's land" as he had done, Grow speculated that some type of light armor might offer protection. He contracted with a British firm, the Wilkinson Sword Company, for a 22--pound armored suit that withstood a .45 caliber round fired at point blank range. Grow concluded it would also stop flak and successfully tested the handmade suit on a B-17 crew. Soon the "flak suit," as it was called, was mass produced by both the British and the Americans.

Grow's and Armstrong's wartime experience convinced them that the American military was unaware of the nature and extent of physiological and medical problems of modern combat aviation. The effects of anoxia, frostbite, blackout, and aeroembolism from sustained aerial operations had not been consistently observed. They suggested that an aviation medical research and teaching unit be established, staffed with

carefully selected medical experts in aviation medicine, physiology, and psychiatry. General Grow and Colonel Armstrong established the 8th Air Force Provisional Medical Field Service School on July 30, 1942, as a deployable field unit. In November 1943, it was redesignated as the 8th Air Force Central Medical Establishment, and in August 1944, the 1st Central Medical Establishment (CME), located at High Wycombe, England.

Under Grow's direction, the CME considered many problem areas including air--sea rescue and ditching, anoxia, psychological problems, and frostbite. With British collateral research, the CME was able to isolate wind blast, defective electrical equipment, lack of equipment, and personnel failure as the four major causes of the frostbite problem. Wind blast was solved by enclosing waist windows with Plexiglas in heavy bombardment aircraft. Newer and more reliable electrically heated suits and gloves were introduced and, through CME efforts, British production of electrically heated suits helped ameliorate an immediate shortage. Besides the rest and recreation, the CME psychiatry department found that fixed combat tours were essential to high aircrew morale. Under Grow's guidance, the CME contributed to the elimination of ditching casualties, through intensive training programs, improvement in air--sea rescue equipment, and establishment of standardized ditching procedures for the various types of 8th Air Force operational aircraft.

The 1st Central Medical Establishment yielded the immediate response to practical combat flying problems Grow had hoped for. Its analysts provided continuity of applied research for 8th Air Force throughout World War II. Its pioneering work served as a primary conduit for transmitting the most recent aviation medical and physiological information to the US from the U.S. Air Forces in Europe, the Royal Air Force, and the Luftwaffe. In short, Grow and Armstrong's organization helped shape policy for the entire US Army Air Forces Medical Service.

During the closing days of the war in Germany, Grow participated in Operation *Paperclip,* which rounded up German scientists of all specialties. He concentrated on aviation medicine experts and collected pertinent documents and equipment relating to their work. Eventually some of these medical experts were persuaded to come to the US to work at various locations including the Aero Medical Laboratory at Wright Field and the US Air Force School of Aviation Medicine at Randolph Field, Texas. The more prominent of their works were eventually published in a two-volume work entitled *German Aviation Medicine in World War II.* Grow received the Legion of Merit in July 1943 for developing body armor, and received the Distinguished Service Medal in 1944 for his work as surgeon for the 8th Air Force.

Grow arrived on the island of Guam in August 1945 as surgeon of the US Strategic and Tactical Air Forces. One month later, he returned to the US to become Acting Air Surgeon, pending the retirement of Maj. Gen. (Dr.) David N. W. Grant.

From then, Grow continued distinguished service but his focus was on organizational structure and autonomy rather than directly on aviation medicine. On July 1, 1949, he became the first Surgeon General of the United States Air Force. He held that position for only five months, retiring on November 30, 1949 after more than 31 years of service in the Army and Air Force. He had served in two World Wars, and in uniform of both Russia and the US, and he had been instrumental in the emergence of Air Force medicine as a distinct organizational and professional entity.

After his retirement, Grow remained a force in military medicine. For several years he maintained a desk in the Office of the Surgeon General USAF and acted as a consultant to his successor, Harry G. Armstrong. In 1955 he provided technical assistance for the movie, "On the Threshold of Space," a film produced at Eglin Air Force Base dealing with "Aeromedics," a new term linking the study of air and medicine as essential elements for future space travel. Malcolm Grow passed away in October 1960. Many of his ideas about helping the common soldier, and later the airman, were shaped on the Russian Front in World War I.

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New Donations

New to the AMEDD Museum

The AMEDD Museum has been offered several exciting donations recently, including a group of DUSTOFF pilot uniforms from CW5 Tom Goff. Goff began his Army service during the Vietnam War. During his service he participated in deployments in Vietnam, Desert Shield/Storm and the Global War on Terror. Although initially a commissioned officer, he transferred to a warrant so that he could keep flying.

Retired Army nurse Colonel Jennifer Bedick has offered two of her white polyester pantsuits and a hospital duty dress, all from 1984. COL Bedick entered the Army as enlisted, serving a year as a 68 Delta before acquiring a nursing degree and continuing her career as an Army nurse. She served a total of 33 years before retiring in 2017. Additionally COL Bedick has offered the Museum a World War I field operating case complete with instruments.

Additionally Mr. Howard Miller has offered artifacts from two generations of his family. His great-great-aunt, Elizabeth Zook, from Pennsylvania, worked as an Army nurse under Dorothea Dix during the Civil War. Miss Zook, who died of disease while serving as a nurse, kept a photograph album. The album contains not only family photographs but photographs of some of her patients. Mr. Miller's grandmother, Mary Chase, served as an Army nurse during World War I with the American Expeditionary Forces. She saved her blue wool "outdoor" uniform, her trunk, and a purse that is filled with documents from her service.

New to the ACHH Research Collection

Mr. Edward Sargent donated a collection of WWI letters and newspaper clipping belonging to Private Alonzo "Lonnie" E. Reed. Private Reed served with Medical Detachment, 61st R.T.C. during World War I.

Helen May Cornell's family donated her partial photo album. Ms. Cornell graduated from the Robert Green Hospital in 1940 and later joined the US Army Nurse Corps in 1941.

An assortment of 35mm slides belonging to Major Jake Jakoby were donated to the ACHH Research Collection through the ANC Historian. They document Jakoby's overseas tours to Korea, Vietnam, Japan, and Berlin between the 1950s and 1960s.

Books:

John R. Bollard. *From storm to freedom: America's long war with Iraq.* 2016.
William K. Emerson. *U.S. Army soldiers and their chevrons: an illustrated catalog and history from the Revolutionary War to present.* 2013.
------. *Chevrons, illustrated history and catalog of U.S. Army insignia.* 1983.
W. Douglas Fisher and Joann H. Buckley. *African American doctors of World War I: the lives of 104 volunteers.* 2016.
Charles H. Harris III and Louis R. Sadler. *The great call-up: The guard, the border, and the Mexican revolution.* 2015.
Mark Harrison. *The medical war: British military medicine in the First World War.* 2010.
Lukasz Kamienski. *Shooting up: A short history of drugs and war.* 2016.
Paul A. Kennedy. *Battlefield surgeon: Life and death on the front lines of World War II.* 2016.
John M. Kinder. *Paying with their bodies: American war and the problem of the disabled veteran.* 2016.
John E. Lesch. *The first miracle drugs: How the sulfa drugs transformed medicine.* 2006.
Erik. Sabiton. *Dustoff 7-3: Saving lives under fire in Afghanistan.* 2015.

The effects of altitude on patients being flown was part of aviation medicine. It had different parameters when aircraft were not pressurized and did not typically fly above 5,000-7,500 feet, as in WWII. Flight nurses were specially trained to monitor patients for altitude effects

A Physician's First-Hand Account of the 59th Evacuation Hospital 1942-1945: 15,000 Miles, 8,295 Surgical Cases, 250 Letters Home

By René Bine, Jr., MD and Linda Bine

On April 11, 1942, René Bine Jr., MD – a 26-year-old resident physician and newly minted Army lieutenant – wrote the first of what would become more than 250 letters to his parents back home in San Francisco. The letters were filled with colorful, personal accounts of his experiences and those of his colleagues. With the salutation, "Dear Folkies," Dr. Bine's letters were addressed to his mother, Alma, and his father, René Sr., who was also a physician.

Dr. Bine.
All images courtesy the author.

On August 15, 1945, a month before Dr. Bine left Paris to return home to San Francisco, he wrote that he was sending the carbons of his letters home under separate cover. He added the following comment, "I may some day clip out portions to make a consecutive story, who knows?" Unfortunately, when Dr. Bine passed away in 1985, after 40 years as an internist and cardiologist in private practice in San Francisco, he had been too busy caring for his patients to put together his story. So, as his daughter, I have done it for him. I am posting these excerpts 75 years to the day after he wrote them and adding photographs at www.dearfolksies.com.

Here is his account from the unit's first dry run with setting up a mobile hospital on June 28, 1942 at Ft. Ord CA.

Tuesday was the big day! Everybody had an early lunch and it was planned that we would all move out by trucks at 12:15 P.M. to the area selected for our hospital site, about 3 to 4 miles back of the main garrison. The 1st Medical Regiment had gone out earlier in the A.M. and were supposed to have Battalion Aid Stations, Collecting and Clearing Stations, and were supposed to ship us patients, the first to arrive at about 1:30 P.M.

Things were a little slow in starting, so Mattie [Carleton Mathewson MD], Ed Welles and I went out in advance of the others in a jeep. On the way out to the selected site, we were stopped by a sentry on the road, who told us we couldn't go in that area as one of the Artillery units was firing there. Mattie finally talked the sentry into letting us through to a certain point where we could get in touch with the Range Officer, as we had definitely been assigned that area for the two days.

When we got to the site out tents were to be pitched on, we found the Artillery had a telephone exchange set up right on the spot. We got in touch with the Range Officer and straightened things out. As it happened, the Range Officer was a friend of Ed's from high school. Ed and I set up what equipment we had brought out ourselves and then waited. The rest of our trucks had some difficulty getting through the same sentries until Mattie and the Range Officer went back and cleared up the details. As a consequence of the delay, however, our tents were not set up at the scheduled time. Our tent was the first one up, but even at that, Ed and I had to handle about six patients out in front of the tent before it was up, as the 1st Medics' ambulances started coming.

At the beginning, things in our tent functioned fairly

smoothly, then suddenly we had 8 ambulances at our front door and we had one side of the tent full of ambulatory patients and the other side full of litter patients and the ambulances were still pulling up outside.

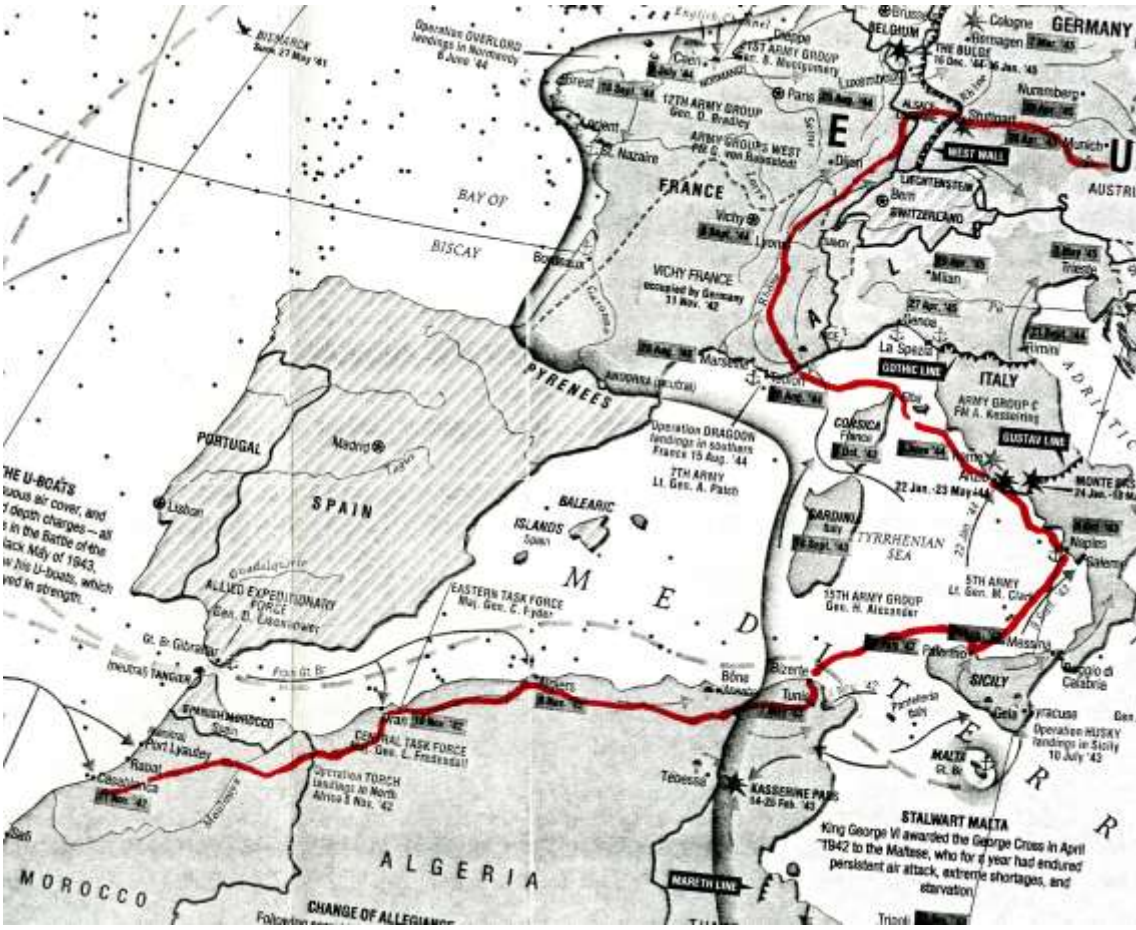
What happened was that, since the 1st Medics had been functioning since 8 A.M. themselves, they had a Clearing Station that was full of patients and another Clearing Station that was getting patients at a normal rate. Consequently, when they got word that we were set up and ready to operate, they completely evacuated the one Clearing Station to us so that they could more elsewhere, and thus the deluge we received.

The ambulatory patients were stringing out the front door when Col. [Oral B.] Bolibaugh arrived in our tent, and Ed and I breathed a sigh of relief when he gave us permission to split the personnel of the tent and move the ambulatory section of the Receiving Tent into the tent next door, which was only partly being used. Ed took charge of the Ambulatory section and I ran the Litter section. From the time we separated until the time the whole exercise was over we were never again bogged down and were able to operate pretty well.

We did, however, make note of many, many features that we knew would have to be remedied if we were to actually handle sick patients. In these so-called "dry-runs" all we have been really doing, of course, is the paperwork that is connected with all the procedures. Naturally, in time of actual combat, our paperwork has to be a minimum and the actual handling of patients the most important thing.

In the 3 hours of operation we ran approximately 130 patients through our tents. Of course, that number was not evacuated through our Evacuation Tent until about an hour or two after that.

Our tents were set up under trees, trees that made pretty good camouflage. The only difficulty was that setting them up so that they were camouflaged, they were too close together and I know that I for one was always tripping over the tent pegs, trying to go between some of the tents that were especially close together. How the litter bearers managed to get around from tent to tent, with their patients, is still a mystery to me and the others.



Dr. Philip Westdahl, another member of the 59th Evac Hospital, created this map showing the unit's route.

The first wave of patients ended at about 5:15 P.M. We all ate in two shifts and then waited around for more patients. The first patients had to be used over again, consequently there was a lag between the time we evacuated them out our back door until the time they started coming through from the 1st Medics again. Consequently, we didn't start getting the second batch until 8 P.M. The only lights we had in the tents were kerosene lamps and a few shaded flashlites, but they worked out fairly well. No lights were used between the tents and yet the litter bearers got around very well. Our last patients were through our tent at 3 A.M. and then we had some ham and cheese sandwiches and hot

chocolate, then turned in at around 3:45 A.M.

There had been 15 of the nurses with us on this maneuver and they left by truck and came back to their barracks at 3 A.M., sleeping till noon, while the rest of us were up again at 6:45 A.M., had breakfast in the field, stayed around while the men packed up our equipment, took down the tents, policed the area, and finally left the camp site at about 10 A.M. We got back, took showers, had lunch, and then all collapsed for a couple of hours more sleep.

At the end of 1942, Dr. Bine would begin sending dispatches from Casablanca, Morocco – where the 59th Evacuation Hospital, under Colonel Bolibaugh, first set up its tents for real. Over the next three years, as a member of this unit, he sent letters home from Sicily, Italy, France and Germany, the 59th Evac was among the first to enter Dachau to care for the concentration camp survivors.

On August 18, 1944, Dr. Bine wrote from the South of France.

I'm sitting in our tent in a dustless field, between two small vineyards containing rather luscious red and green grapes. The owner of our present area, and very happy to have us here, is a French physician who has been enjoying himself making rounds in our wards and in surgery most of the day.

I am anesthetist for our surgical team attached to this other Evac. We have realized the glaring differences between ours and this outfit -- which incidentally was the first Evac. Hospital set up and taking patients in Southern France -- beating the others by 24 hours. They have a great deal less equipment than we do, and have a Colonel who is not regular Army, and who considers himself and staff primarily as doctors rather than Army puppets.

Clint Green, Bill Kioski & Chuck Davis – Drying out on D-Day in Southern France

Our landing here turned out to be, instead of a grim and determined ordeal, a tiring but swell experience. In fact, on looking back it was really lots of fun. (Perhaps that's a bad viewpoint to take for, one could, and probably will, use such experiences for dramatic and hair-raising cocktail material when one finally gets home.)

We awoke a couple of hours before dawn on the big day and what we could see in the fog was an amazing site -- all kinds of ships -- every description from tremendous to tiny. It wasn't long before the big boys let loose -- what a racket!!

The whole operation was a masterpiece of organization. Things went off in much better fashion than any previous invasion.

We were on land ourselves in no time -- but a few hours after the first men. How close seems appalling when we think back about it. We got off our big ship and onto a smaller one, musette bag, gas mask, medical kit, and sleeping bag (with extra clothes) on our backs!! We were landed about 50 feet off shore and waded up to our necks from the boat to the sandy shores. Roy [Cohn, M.D.] *and I then went back for the two bloomin' anesthesia machines (50 lbs each) -- luckily they were in crates and we were able to float them in. Roy and I think we deserve some sort of extra medal for packing those darn things all the way like that. The gang we're attached to should have arranged for bringing them.*

After we were on solid ground (having plunked into holes in the sand in the water on the way in) we were a funny looking bunch, pants sagging below the knees where they had beaucoup water ballooning them out as they went into our boots. Our boots are waterproof alright, but that doesn't do any good when water goes above the belt and then down that way into the boots.

We hiked a ways in our salty, soggy stuff and then stopped while someone tried to locate where we were supposed to go to meet the main body of the hospital gang (only the "attached group" was with us). While waiting we disrobed and tried to dry our stuff out in some Frenchman's backyard. While so doing, standing in our undies (along with a very nice Lt. Colonel we had met on the ship) along came a couple of generals and it made quite a picture -- our saluting them while almost au-naturel along the side of the road. It was really funny.

We continued tramping up and down the road, as the M.P.s didn't seem to know exactly where the ar-

ea was, and actually we had gone by it before a sign was put on the road to show the turn off to the area. So, for a day we camped on the side of a hill very recently vacated by the Germans. We got some nice wicker furniture from one of their command posts, found some Frenchmen with some good "vin rouge," and made ourselves fairly comfortable. In fact, imagine playing bridge on a French hillside, drinking wine, on the evening of D-Day! That's what we did all right.

Later that year, Dr. Bine recounts doing surgery with a colleague who later became a world-renowned pioneer in cardiovascular surgery, Dr. Frank Gerbode. On October 15, 1944, Dr. Gerbode was doing neurosurgery in France with Dr. Bine.

Last night we really caught the tough babies. A bad time was had by all. It's really amazing what bullets and shell-fragments can do to the human body -- it's amazing and terrible, but it is also amazing what the human body can stand. Some of the men with the worst looking and most extensive wounds seem to perk up and feel fine in very little time after the operations. One case that Gerbode and I did some days ago, a French boy, had several scalp wounds and three wounds that went into the skull. His prognosis is definitely not good, yet he keeps asking for wine, beer and food and more food. He is now getting double or more portions of food at each meal (despite his complete left hemiplegia that includes the left part of his face) and he eats at least 12 pieces of bread per day between meals. He's only an 18 year-old kid whose family has long since been killed by the Germans.

On May 10, 1945, Colonel Bolibaugh was assigned as Camp Surgeon to the recently liberated Dachau Concentration Camp. On May 16, 1945, Dr. Bine summarized their first several days on site.

Their biggest problem is the typhus and the delousing of everyone and everything. When they first went down there the death rate daily was tremendous and now it has been cut down greatly, but is still mighty high. They've really got a job on their hands. I haven't been down there as yet, but probably shall to one of these days. They say that it was horrible the first few days -- and I shall be glad not to have seen it as it was.

As he predicted, he did go "down to Dachau" as the Officer in Charge of the Convalescent Hospital. On June 11, 1945 he wrote:

If one takes the time, as one frequently does, one can hear any number of stories about Dachau and other similar places throughout Germany and Poland. Even with the small amount of German that I know, I've listened to tales from Poles, Russians and Yugoslavs, and they all jibe -- i.e. the experiences of one prisoner were almost the same as another.

We have one kid who had been used in the freezing experiments and he was one of two that survived out of about 2,000 on which the experiment was tried -- and that right here in Munich. He had actually been frozen in ice seven different times, and had to be chopped out of his ice-block each time. He's just a kid about 13 or 14. One would expect to find various neurological changes in him, but though he has an unsteady gait and odd posture, his reflexes are all normal.

We had another little guy, 16 years old, who has been in concentration camps since the age of 12, who has sort of made himself our mascot. Whenever we park the little Opel in front of the building and leave it for a few minutes, we come back and find him sitting peacefully inside. He loves to ride around with us in it and hates to get out when we have to leave the confines of the camp to come to our quarters. He told us of the march from Buchenwald to Dachau when the American Armies approached Buchenwald. Thousands made that march in five days -- some 280 km. Of course, there were thousands who started out on that march who never got here.

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Protective Clothing for Aviators

Charles Franson, AMEDD Museum

The unique risks involved in military aviation create a need for specialized protective clothing and equipment for flight crews. The risk of engine fires and combat-related fires dictate fire retardant clothing. In the late 1950s and early 1960s, the only options were one-piece cotton coveralls, either an International Orange flight suit (which lost its flame-retardant ability after 14 wash cycles) or the gray K2B flight suit, that could be specially treated with a Borax solution as a field expedient, and which needed to be re-treated after each washing. The many synthetics, such as nylon, melted quickly during a fire, causing catastrophic burns to the wearer.

In the early 1960s, the US Navy had developed a flight suit made from Nomex, a DuPont polyamide fiber, which had superior fire resistance, and did not require special treatments. In 1965, the Army conducted trials with a modified version of the Navy suit, with a double layer of fabric on the back for better fire protection. The new suits were approved for field trials in March of 1966.

Field trials by the 12th and 17th Aviation Groups in the summer of 1966 resulted in a recommendation for Army-wide adoption. This adoption was halted, however, by an adverse report in January of 1967 from US Army Vietnam which complained that the suit was hot, produced skin irritation and itching, had a tendency to turn brown with extensive sun exposure, and had an offensive odor when wet. DuPont responded with an improved weave and modifications to the formula, and resubmitted samples for further trials.

The improved Nomex was made into both one-piece coveralls and two-piece shirt and trousers sets, which were issued in March 1967. Both types were tried in single- and double-layer configurations. On 13 June, 1967, the Army settled on a two-piece, single layer shirt and trousers of 4.4 oz. Nomex for general issue. The uniform consisted of a shirt with zip front, flapped, buttoned breast pockets and a zippered sleeve pocket and sleeves which closed with velcro. The trousers had extra pockets on the thigh and lower leg, and the cuffs closed with velcro. The cuffs of both shirt and pants were meant to be worn closed and the shirt tucked in for maximum protection from fire. The Army also stressed the avoidance of nylon clothing (t-shirts, socks etc.), as these contributed to disfiguring or fatal burns as the nylon melted and adhered to skin.

Lt Bolko Zimmer's Nomex shirt with Vietnam made unit patches on the pockets.

The AMEDD Museum collection has two Vietnam aviator uniforms that show this evolution in aviation medicine. A set of K2B cotton coveralls were worn by 1Lt Thomas Chiminello, who served in Vietnam with the 57th Medical Detachment (Helicopter Ambulance). Chiminello, the son of an Army colonel, died on October 29, 1967 while on a DUSTOFF mission. The second set of aviator's clothing from Vietnam was worn by then LT Bolko Zimmer, who received his orders for Vietnam upon graduation from Fort Rucker, AL. Zimmer served in Vietnam in 1971 and wore the Nomex shirt and trousers adopted in 1967. He was initially assigned to the 54th Medical Detachment and later served with the 236th Medical Detachment based out of Da Nang.

Flight crews were also issued special footgear. The tropical or "jungle" boots issued for Vietnam had uppers made from nylon. In order to mitigate fire-induced traumatic amputations or disabling burns to the feet and ankles, aviators wore leather boots.

Aircrews were also provided with a helmet for protection of the head from trauma resulting from crashes and projectiles. Initially, crews wore the fiberglass APH5 helmet. Demands for increased protection resulted in a new helmet made from laminated ballistic nylon bound in a resin. The new helmet, which included a tinted face shield, was standardized as the AFH1 ("crash ballistic flying helmet, nylon outer shell") in November 1965. The new AFH1 helmet provided a significant improvement in protection against head injuries from impact, as well as flying projectiles. The AFH1 remained standard issue until 1969, when it was superseded by the SPH4 helmet, which was made of molded epoxy resin. This shell featured improved ear cups and was significantly lighter. Slow manufacture of this improved helmet however delayed full replacement until 1972.

Lt Bolko Zimmer in his Nomex shirt and trousers, pistol belt, leather boots and Red Cross marked AFH1 flying helmet.
Zimmer was in a unit flying helicopters painted white as an experiment. See newsletter number 4, autumn 2013.

In March 2018 the ACHH will be helping the AMEDD Museum Foundation and the Society for the History of Navy Medicine run a conference on medicine and WWI. Presentations on all facets of medicine and healthcare related to the war are welcome, to include: historical understandings of military medicine as practiced by all participants and in all geographic regions; consideration of the repercussions of the war on the practice of medicine; medicine in various campaigns; effects on the home fronts; postwar medical issues; mental health issues; the pandemic influenza; and related topics. Presentations should be 30 minutes long, and two-paper panels are welcome. Contact us if you're interested!

Writing for *The AMEDD Historian*

We are seeking contributions! We believe variety is the way to attract a variety of audiences, so we can use:

- Photos of historical interest, with an explanatory caption
- Photos of artifacts, with an explanation
- Documents (either scanned or transcribed), with an explanation to provide context
- Articles of varying length (500 word minimum), with sources listed if not footnotes/endnotes
- Book reviews and news of books about AMEDD history

Material can be submitted to **usarmy.jbsa.medcom.mbx.hq-medcom-office-of-medical-history@mail.mil**
Please contact us about technical specifications.

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