Aircraft Navigation in the Aleutian Air War: World War II Civil Aeronautics Authority Radio Navigation Ranges in the Aleutian Islands, Alaska

The Eve of War

In 1939, the world marched toward war. German panzer divisions blazed through Poland, touching off the blitzkrieg assault on Europe. Japan's forces occupied China and were preparing for territorial expansion throughout the Pacific. Soviet troops advanced across the Finnish border, meeting stiff resistance as they attempted to overwhelm their smaller neighbor. Meanwhile, in North America, the Civil Aeronautics Authority (CAA) had recently completed surveying the territory of Alaska and was constructing a series of air navigation stations across its vast wilderness. These aids to aircraft navigation, called radio ranges, were to prove crucial in the approaching war in the Aleutians.

Commercial aviation had come to Alaska the decade before and had quickly become indispensable to the territory, although there was little support infrastructure for the early territorial aviators. Accurate maps were scarce and navigation aids nonexistent. In these conditions, pilots navigated by instinct, memory, and local knowledge, visually following geographic features. In 1938, Congress established the CAA, which was focused on developing aviation infrastructure and regulating the nation's airways. The agency immediately began surveying Alaska, selecting locations for airfields and navigation stations.

The British and French declaration of war on Germany in 1939 and rising tensions with Japan caused an increased urgency in the buildup of U.S. defenses. With Brigadier General William Mitchell's proclamation that "he who holds Alaska will hold the world," the territory's strategic importance in the impending conflict was clear. In 1940, the CAA partnered with the War Department to rapidly complete construction of air navigation facilities across the remainder of Alaska and upgrade air facilities for military use.

Japan's attack on Pearl Harbor on December 7, 1941, pulled the U.S. into World War II. Six months later on June 2 and 3, 1942, Japanese aircraft bombed Dutch Harbor, touching off the Aleutian Campaign. Due to the vast distances between islands and armies, air power became the key to holding the Aleutians. The radio navigation ranges built by the CAA proved pivotal in the Aleutian air war. Because of the tremendous advances brought about by instrument flying and radio navigation aids, planes that used to be grounded by weather could operate under all conditions. The CAA radio ranges played a critical role in the U.S. victory in the Aleutian Islands, a victory which set the stage for the remainder of the war in the Pacific and the United States' triumph in World War II.

Left: WW II Imperial Japanese Naval Parade (www.militaryhistoryonline.com)
Right: 1920's Biplane, Fairbanks, Alaska (University of Alaska Museum of the North)

German Troops Invade Poland, September 1, 1939 (www.britannica.com)

Soviet Union Troop Parade, Red Square, Moscow, 1941 (www.tvzveda.ru)

Early Aviation in Alaska

In 1913, just 10 years after Wilbur and Orville Wright's successful flight attempt in 1903, a flight in Fairbanks marked the birth of aviation in Alaska. From the outset, it was apparent that the airplane would play a prominent role in Alaska's vast, road-less expanse. Flights by early pioneers, such as Carl "Ben" Eielson's 1922 mail flight between Fairbanks and McGrath and Noel Wien's 1923 passenger flights between Anchorage and Fairbanks, signaled the beginning of commercial aviation in the territory. By 1931, six full-time commercial aviation companies were operating in the territory, with more planes and pilots on their way. The airplane had come to the territory to stay.

While aviation rapidly expanded across Alaska, supporting infrastructure was missing. Without available airstrips, navigation aids, and even useful maps, navigation was entirely by visual reference, with pilots following rivers, lakes, and mountains to find their way in the air. Other landforms, such as sandbars, mudflats, lakes, and snow-covered tundra served as landing strips. These challenges, along with the lack of readily available pilot training, contributed to a mounting accident rate, which accompanied the growth of aviation in Alaska. In the 1930s, more than one third of the aircraft in Alaska were demolished in major wrecks.

Although a map showing 67 landing strips appeared in the 1931 Annual Report of the Governor of Alaska to the Secretary of the Interior, navigation aids were lacking. Radio equipment, weather data, repair facilities, and accommodations were scarce. Airfields were typically level stretches of cleared, unpaved ground. Repair services were usually only available from a railroad or mine shop. Anchorage, Fairbanks, McCarthy, Nome, Seward, Tanana, and Valdez were the only facilities that might have radio equipment, basic weather instruments, or facilities for simple repairs. Navigation aids were primitive and available only in the immediate area of larger airfields. Most fields were marked in a very basic way, usually by an "L" or an "X" of white, painted boards at each corner of the strip. In the early 1930s, Fairbanks was the only airfield that had both a weather station and revolving navigation beacon light. Despite these rough and primitive conditions, aviation continued to proliferate in Alaska's vast, road-less expanses. The territory's airways would soon gain the attention of a newly formed federal aviation agency, the CAA.

U.S. Mail Plane, Alaska, 1920's (University of Alaska Fairbanks Archives)

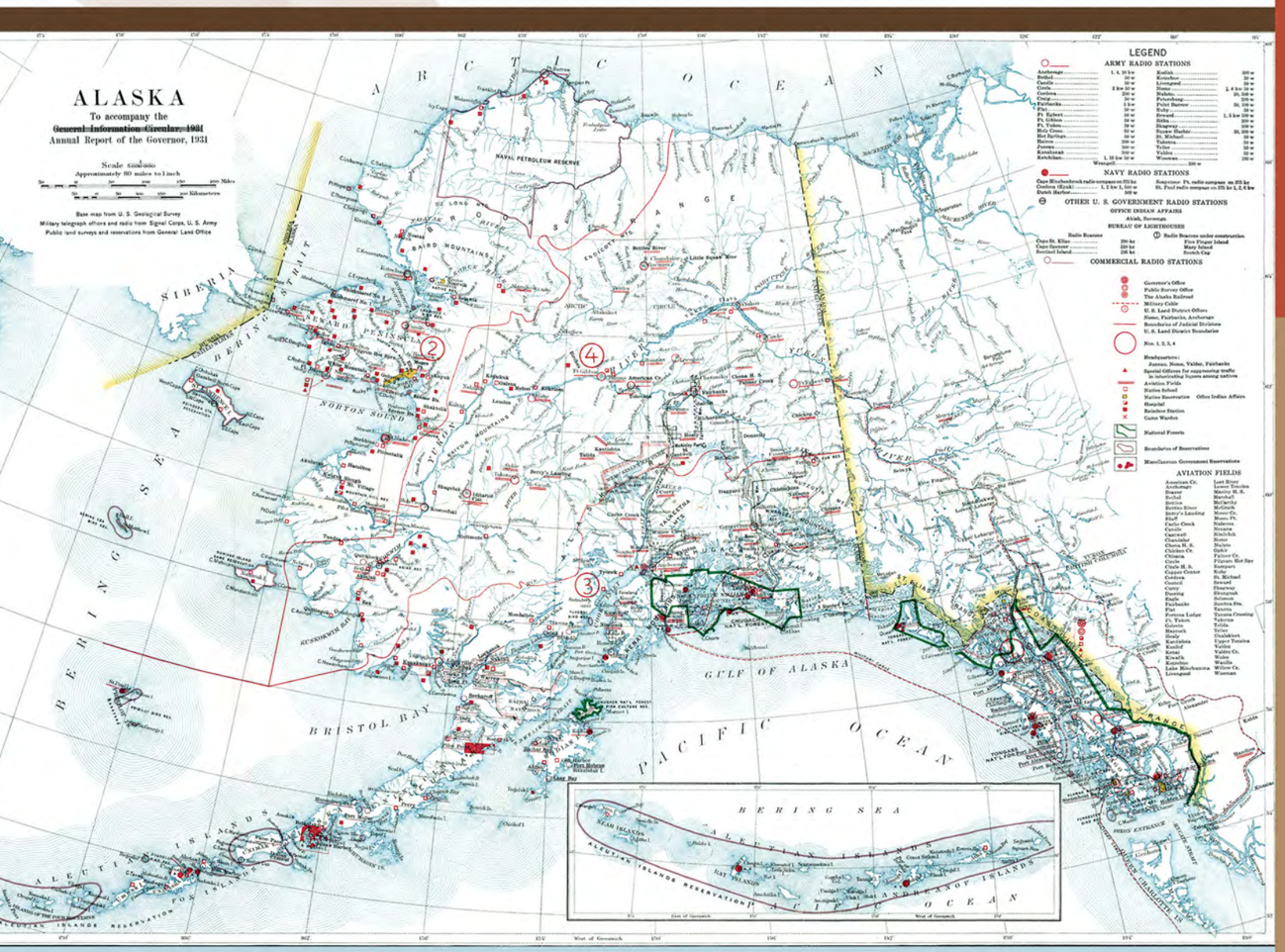
Biplane Taking Off From Fairbanks, 1920's (University of Fairbanks Archives)

Biplane wreck, Interior, Alaska, 1920's (University of Fairbanks Archives)

The Birth of the CAA

In 1938, Congress passed the Civil Aeronautics Act, which established the CAA, whose purpose was developing navigational aids, monitoring the nation's airways, and promoting safe practices. Upon its formation, the CAA immediately began surveying the territory to select airport and navigation sites to be developed as part of an Alaskan airport and air route network.

Development planned in 1938 consisted of five primary airports, 13 secondary airports, 68 emergency airports, seven seaplane facilities, and 17 radio navigation ranges. A year later, however, the project grew, and the CAA began plans for an additional 60 primary airports. When Congress appropriated funds for the CAA to build a national system of airports, Alaska received $48 million. By the war's end 228 airfields had been built or upgraded by the CAA in the territory, along with nearly 100 radio navigation ranges, communications, and weather stations.



Map Accompanying 1931 Governor of Alaska's Report to Secretary of Interior showing airstrips (red double lines) (www.dggs.alaska.gov)

The Territory at War

Preparations

During the 1930s, the U.S. War Department saw Alaska as a critical lynchpin in the "strategic triangle" that included Hawaii and Panama. Construction of a seaplane base at Sitka began in 1937. The Army began construction of Ladd Field near Fairbanks in 1939 and stationed the first Air Corps detachment there in 1940. A Naval Air Station and Naval Operating Base were established at Kodiak in 1941 along with an Army Garrison named Fort Greely. At Dutch Harbor, the Naval Operating Base and Army Fort Mears became operational in September 1941. More forts, bases, and outposts were soon finished throughout the territory along with aviation infrastructure including airfields, communications sites, and navigation aids.

While the military constructed installations in Alaska for defense, the CAA continued building airfields and establishing navigation aids for civil aviation. As part of war preparations, in 1939, the Army requested that the CAA design Alaska's air infrastructure to meet military aircraft needs. Eleven existing airports were selected for upgrades for military use, and 56 radio navigation ranges were planned. By February 1940, the CAA and military agreed to coordinate their construction programs. Later that year, with the growing certainty that war was coming, the CAA formally partnered with the War Department and private contractor Morrison-Knudsen to accelerate development of Alaska's aviation infrastructure. Work commenced at a frantic pace. By the end of 1942, there were 193 operational airfields in Alaska and a small, but growing network of radio navigation ranges.

U.S. World War II Alaska Propaganda Poster. Note the "mousetrap" highlights the importance of the Army-Navy-Civilian partnership in territorial defense (University of Alaska Museum of the North Archives)

CAA Radio Range Three Miles Southwest of Elmendorf Field 1939, one of the first navigation aids built by the CAA in the territory (University of Alaska Museum of the North Archives)

World War II Alaska Territorial Guard Poster (University of Alaska Museum of the North Archives)

The Opening Salvos

In response to the attack on Pearl Harbor, the U.S. declared war on Japan. With the outbreak of war in the Pacific, the fortification of Alaska became an urgent national priority. The War Department immediately began construction of Fort Glenn Army Airfield on Umnak Island. Troops and planes arrived early in 1942, and Fort Glenn became home to fighters and bombers of the 11th Air Force. Navy Fleet Air Wing 4 patrol aircraft flew out of Fort Glenn and Dutch Harbor. At Cold Bay, a CAA airfield built in 1941 was upgraded by the military to become Fort Randall Army Airfield, housing fighter and bomber aircraft and up to 13,000 soldiers. After Pearl Harbor, the military in Alaska went on high alert. Intelligence indicated an imminent Japanese attack. The CAA advised all civil pilots in Alaska that all planes flying over coastal military installations would be fired upon without warning. The civilian population, primarily indigenous Aleuts, of the Aleutian Islands were evacuated by the military from their ancestral lands on many islands in the Aleutians. Work began on the Alaska Highway, which was needed to provide critical military supplies to the territory. The U.S. began providing the Soviet Union with planes as part of the Lend-Lease program, which entailed flying the aircraft from the lower 48 to Alaska's Ladd Field, and then transferring to Soviet airmen who would pilot the aircraft across to Siberia and on to Soviet bases in Russia. Marvin R. Marston enlisted and armed Alaska's Native population, creating Alaska's Territorial Guard, a 2,000-person strong reserve force tasked with defending Alaska's most strategically important points.

Japanese Bombs Explode at Pearl Harbor, December 7, 1941 (www.history.com)

The Aleutian Campaign

In June 1942, six months after Pearl Harbor, the Japanese fleet targeted the Aleutian Islands. On June 3 and 4, 1942, Japanese bombers from two aircraft carriers launched bombing raids on Dutch Harbor. On June 6, Japanese ground forces invaded Kiska Island. On June 7, they landed on Attu. For the first time in modern history, foreign forces occupied U.S. soil. The Aleutian Campaign had begun.

With opposing forces separated by miles of ocean and islands, the Aleutian Campaign was fought primarily as an air war. The Army Air Corps' 11th Air Force and the Navy's Fleet Air Wing 4 were the units tasked with defending the Aleutian skies. Army fighters and bombers flew from Fort Glenn, Cold Bay, and later Adak, Amchitka, and Shemya in continuous missions against Japanese positions at Kiska and Attu. Navy Patrol Bomber (PBY) Catalina aircraft flew patrols over the vast, gray North Pacific in search of the Japanese fleet or were armed with bombs, torpedoes, or depth charges to attack enemy vessels.

In Fall 1942, the Army pushed west across the island chain and established airfields at Adak and Amchitka Islands, stationing aircraft within close striking distance of Japanese forces on Attu and Kiska. Throughout the winter of 1942-1943, the 11th Air Force bombed Kiska and Attu in a nearly continuous campaign known as the "Kiska Blitz." Bombing sorties launched whenever possible, although flights were handicapped, delayed, or cancelled by the almost constant fog and foul weather hovering over the islands.

On May 11, 1943, Army troops made an amphibious landing on Attu and began retaking the island. After 2 weeks of relentless combat, suffering heavy casualties, the Japanese were pushed back to Chichagof Harbor. After a last stand of savage hand-to-hand combat, nearly all of the Japanese were killed, and Attu was effectively recaptured. On August 15, 1943, U.S. troops made an amphibious landing at Kiska to find the island uninhabited. The Japanese troops had secretly evacuated under the cover of fog, and the island was declared secure. The Japanese forces had been driven from Alaska. While this is considered the end of the Aleutian Campaign, U.S. forces continued to fortify the islands. New airfields were established at Attu and Shemya, and additional aircraft were deployed. These bases were used to launch air raids against the Japanese Kuril Islands, the first land-based bombing missions of the war against Japanese home islands. The initial raid was launched in July 1943. By the end of the war, over 1,500 sorties were flown from Attu and Shemya against Japanese positions in the Kurils.

11th Air Force B-24 Liberators and a B-25 Mitchell from Fort Glenn over the Aleutians, 1942 (www.pioneerairmuseum.org)

Ships and oil tanks burn after Japanese attack on Dutch Harbor, June 4, 1942 (www.ww2db.com)

Troops of the Japanese Special Naval Landing Force raising the Japanese naval ensign on Kiska Island, Aleutian Islands, June 6, 1942 (www.ww2db.com)

Aleutian Air Bases

General Strategy

While there were some indications that the Japanese attack of Dutch Harbor was a diversion to draw U.S. forces away from Midway, the Japanese occupation of Kiska and Attu could provide a steppingstone to attack the U.S. mainland, or provide protection for the eastern extension of the Japanese empire. Driving the enemy from the Aleutians was critical. At the outset, strategists recognized the importance of air power in the campaign. American strategy in the Aleutians focused on establishing infrastructure that would support the air war against the Japanese.

Navy Fleet Air Wing 4 PV-1 Ventura over the Aleutians, 1943 (Library of Congress, www.loc.gov)

Navy Fleet Air Wing 4 OS-2U Kingfisher, Attu, 1943 (www.history.navy.mil)

World War II U.S. Aleutian air bases and radio navigation ranges

Kodiak Naval Operating Base and Fort Greely Harbor Defense

Construction of Kodiak Naval Operating Base and harbor defenses at Fort Greely began in 1939. At the time of the Japanese attack on Pearl Harbor, it was operational and served as the principal advance base in Alaska and the North Pacific. The base included a naval air station with two runways and additional facilities for seaplanes. Navy Fleet Air Wing 4 aircraft, such as PBY Catalinas, used the base to launch patrols of the North Pacific and Bering Sea. In 1941, the Army added a third airstrip suitable for use by Army bombers, and the base became the 11th Air Force's headquarters. Kodiak served as the headquarters of the Alaska Defense Command and joint operations center until 1943. During the early phases of the war, Kodiak was the planning center for Alaska military operations and a key logistics point for aircraft deploying in defense of the Aleutians.

Cold Bay Navy Airfield and Fort Randall Army Airfield

Construction on the secret Fort Randall Army Airfield at Cold Bay began in December 1941 in the wake of the Pearl Harbor attack. McGrath was the original planned location of the airfield. By the time supplies arrived in December, however, the ground at McGrath had frozen, and the location was moved to Cold Bay. Disguised as civilian employees of the "Blair Fish Packing Company," Naval Construction Battalions known as Seabees commissioned the Cold Bay Naval Airfield on July 14, 1942. Army engineers completed a permanent airfield by March of 1943. War planes of the 11th Air Force were stationed there until moving to Umnak when the facilities at Fort Glenn were completed. The airfield at Cold Bay remained in operation throughout the war, serving as a transit point for planes, troops, and supplies deployed to the Aleutians.

Kodiak Naval Operating Base, WWII (FAA Archives)

Cold Bay Fort Randall Army Airfield, WWII (FAA Archives)

Dutch Harbor Naval Operating Base and Fort Mears

In 1912, the U.S. Navy permanently established a military presence in the Aleutians by constructing radio stations at Dutch Harbor and nearby Unalga Island. Dutch Harbor played a key strategic role in the Aleutians due to its deep-water port. In 1940, construction of the Dutch Harbor Naval Operating Base and Army Fort Mears began. While Dutch Harbor provided excellent anchorage for Navy ships, level land suitable for runway construction was scarce. The Naval Air Station was therefore initially designed as a port for seaplanes and PBY Catalinas. To accommodate land-based aircraft, the Navy first established a short strip equipped with a catapult and arresting gear, similar to an aircraft carrier. Later, a regular, yet somewhat short, runway for fighter aircraft was carved out of rock at the foot of Mount Ballyhoo. The Army mission at Fort Mears was defense of the harbor's Naval facilities. When the Japanese attacked, the Naval Operating Base was nearly complete, along with coastal defense installations and other facilities around Unalaska Bay. After the Japanese air raids, the military anticipated an enemy landing before winter. In response, the Army installed a series of defensive points on surrounding ridges and mountaintops, dubbing it the "Iron Ring." By Fall 1942, however, the fear of invasion diminished and new bases were established on islands farther west in the chain. Dutch Harbor continued as a critical center of support and logistics for both Navy and Army air operations throughout the campaign.

Umnak Fort Glenn Army Air Base and Otter Point Naval Air Facility

Following the attack on Pearl Harbor, U.S. leadership authorized a top-secret airfield on Umnak Island. Army engineers and Navy Seabees deployed to Umnak dressed in civilian clothes for secrecy. Supplies were labelled "Blair Fishing Packing Company." Crews worked in three shifts, 24 hours a day, laying the runways and constructing support facilities. Work on Fort Glenn began in January 1942, and the first runway—5,000 feet long and made of pierced steel planking called Marston matting—was completed 4 months later. During the first Japanese raids, 11th Air Force fighters were in place for defense of Dutch Harbor. On June 3, 1942, P-40 Warhawks from Fort Glenn surprised the Japanese attacking Dutch Harbor, destroying two enemy observation planes and crippling two more. On June 4, they shot down five Japanese aircraft, with the loss of two of their own. In 1942, Fort Glenn was the westernmost American airfield and main staging and bomb-loading base for the Kiska Blitz. Construction continued throughout Summer 1942 as planes roared overhead on combat missions. By July, three additional runways were completed along with the Naval Air Facility at nearby Otter Point. The 11th Air Force maintained its advanced command post at Fort Glenn from July until October, when it moved to the new airfield completed at Adak farther west. Fort Glenn eventually had facilities for 10,579 officers and enlisted men, and housed fighters, medium and heavy bombers, and transport and reconnaissance aircraft. As U.S. forces pushed west across the Aleutians and airfields were completed closer to the invading Japanese, combat sorties from Fort Glenn were downgraded. The installation, however, continued to provide important logistics, transport, and aircraft support through the end of the war.

Adak Army Air Base and Naval Operating Base

With the Japanese invasion of Kiska and Attu, the U.S. needed airfields in the western Aleutians within striking distance of the enemy. Bombers from Fort Glenn could reach Kiska, but shorter-range fighters could not escort them. The Adak Army Airbase and Naval Operating Base were built at a breakneck pace. Kuluk Bay on Adak's northwest shore provided one of the best deep-water anchorages in the western Aleutians. While the island's rugged terrain offered few areas suitable for an airfield, a tidal flat on the bay was drained and filled to construct operational runways. The initial U.S. troops landed in a raging storm on August 30, 1942, and Army engineers began runway construction 2 days later. Fighter-escorted bombers launched the first raid against Kiska 2 weeks later on September 14. Strict radio silence was maintained at all times, and the Japanese were unaware of the base's existence until a month later when it was spotted by a scout plane. The 11th Air Force moved its operational headquarters to Adak in October 1942, along with the bulk of its fighters and bombers. Air raids against Kiska and Attu were constant, launching whenever weather allowed. Navy Seabees followed the Army engineers, constructing first a naval air station for two Fleet Air Wing 4 squadrons of PBY Catalinas on search and patrol missions. By Summer 1943, Navy facilities had grown so extensively that a Naval Operating Base was established, the westernmost Navy base of the campaign.

Amchitka Army Air Base

Weather in the western Aleutians was particularly challenging. The mission to exert maximum pressure on the Japanese invasion force was constantly hindered by storms, fog, and wind. Because of these conditions, the decision was made to construct a new airfield on Amchitka Island, only 65 miles from the Japanese positions on Kiska. The first American forces on the island made an unopposed landing at Constantine Harbor on January 12, 1943. Three days later, nearly 2,100 troops disembarked only to be met by violent storms. The first night on shore, a howling gale smashed many of the landing boats and ran a troop transport aground. The second day, a blizzard hammered the island with snow, sleet, and biting winds that lasted for 2 weeks. In the face of these conditions, Army engineers immediately began construction on the airfield, struggling to lay down Marston matting and break ground for support facilities. When the blizzard cleared, a scout plane spotted the U.S. positions and the Japanese began bombing. Despite the brutal weather and continual Japanese bombing attacks, one runway sufficient for fighters was completed in February 1943. American aircraft were now within 65 miles of enemy positions on Kiska and 250 miles from Attu. From then on, Amchitka was the center of combat air operation in the Aleutian Campaign. Adak became a secondary air base used for repairing aircraft and forwarding shipments of bombs and air supplies to Amchitka.

Dutch Harbor Naval Operating Base, WWII (Alaska State Library Historical Collections)

(Top) P-40's of the 11th Air Force at Fort Glenn Army Airfield, 1942 (www.pioneerairmuseum.org)
(Bottom) Fort Glenn Army Airfield, WWII (FAA Archives)

(Top) U.S. Army engineers dredging tidal flat to create runway at Adak, September, 1943 (www.ww2db.com photo)
(Bottom) Adak Army Airfield, WWII (FAA archives)

Amchitka Army Airfield, WWII (FAA archives)

Shemya Army Air Base

In Spring 1943, American forces continued to push west along the island chain. On May 28, 1943, the same day as the defeat of the final Japanese forces on Attu, American scouts landed at Shemya Island, 35 miles to the east. The following day, engineers arrived and began constructing a base. The primary objective was an airfield specifically designed for B-29 Superfortress long-range bombers to launch raids on northern Japan. Shemya was uniquely suited because the island's flat topography enabled long runways required by heavy bombers. By late summer, a 10,000-foot runway for heavy bombers had been completed, along with additional runways for fighters. The first bombers, B-24 Liberators, landed in August. The airbase would become home to 11th Air Force P-38 and P-40 fighters, as well as B-24 and B-25 bombers. Navy Fleet Air Wing 4 assigned one squadron of PB4Y-2s, which were single-tail versions of the twin-tail B-24. Many administrative and cargo aircraft, such as the C-47 "Gooney Bird" also flew in and out of Shemya during the war.

Once the Japanese had been driven from the Aleutians, the establishment of the Shemya Army Air Base placed the 11th Air Force within striking distance of the Japanese Kuril Islands, 750 miles to the southwest. The Japanese had established a sizable defense complex on the northernmost Kurils, mainly on Paramushiro, the largest island in the chain. Serving as the headquarters for the Japanese Navy Fifth Fleet, it also supported three airfields and Japanese Army staging areas. The first bombing raids against the Kuril Islands launched from Shemya and the newly established field at Attu's Alexai Point on July 10, 1943, marking the first direct assault against Japanese home territory since General Doolittle's raid over Tokyo more than a year earlier. The Shemya Air Base was used to launch bombing raids against the Japanese Kurils for the remainder of the war.

Shemya Army Airfield, WWII (FAA Archives)

Attu Alexai Point Army Air Base and Casco Navy Airfield

Construction on the airfield at Attu began while the battle for the island raged. In the midst of heavy fighting on May 12, 1943—a day after American forces landed on the island—the site of Alexai Point was chosen for an airfield. Engineers began construction on May 28. The pierced-steel plank runway was completed by early June, as American troops continued mop-up combat. The first landing at Alexai Point Airfield was made by an 11th Air Force C-47 arriving on June 8 to deliver fighter crews and evacuate wounded soldiers. Shortly after, P-40 Warhawks arrived to provide air cover. Medium bombers soon followed as additional runways were completed. On July 11, 1943, Navy Seabees began construction on a runway at Casco Field. The Navy airfield became operational on October 1 with the completion of the 6,000-foot pierced steel plank north-south runway. Like Shemya, aircraft at Attu were in reach of Japanese home forces in the Kuril Islands. The first raid against the Kurils involved B-25 bombers from Attu. In August, specially designed Very-Long-Range (VLR) P-38 fighters were sent to Alexai Point to provide escort for the bombing missions. Attu served as a base of operations against Japan for the rest of the war. By the war's end, Army B-25 Mitchells from Attu and B-24 Liberators from Shemya flew 935 sorties over enemy forces in the Kurils, dropping a total of 659 tons of bombs. The Navy also flew 692 sorties from Attu and dropped 245 tons of bombs on the Kurils using PBY Catalinas, PV-1 Venturas, and PV-2 Harpoons.

Attu Casco Navy Airfield, WW II (FAA Archives)

Attu Base Construction, July 1943 (www.ww2db.com)

The Fog of War: Weather and Aviation in the Aleutians

Weather was the primary enemy in the Aleutian Campaign. Constant fog, heavy cloud cover, rain, snow, and gale-force winds are the norm. Clear, sunny days are rare. Clouds cover the islands most of the year, with cold, drizzling, persistent rains in the summer and snow and sleet sweeping the islands in the winter. Winds are constant, frequently blowing for days at a time. Hurricane-force gales of 100 knots or more are not uncommon. The islands are one of the only places in the world where winds and heavy fog occur at the same time. Air navigation in these conditions during the war was a daunting, deadly affair. Relying on visual landmarks and compass and airspeed calculations, pilots would regularly get lost, circling in search of familiar terrain until they ran out of fuel and disappeared, or miraculously found their way to an airfield. The weather's impact on aviation forces was dramatic. By war's end, the 11th Air Force would lose 35 aircraft in combat and another 150 to weather incidents, the highest American combat-to-operations loss ratio of the war. From the outset, it became apparent that the weather would play a decisive role in the theater. Learning to operate in these conditions would be one of the keys to victory.

PBY Catalina blown from the runway, Aleutians Islands, 1943 (Alaska State Library Historical Collections)

World War II Aircraft Navigation

As aircraft use grew leading up to the war, accurate, reliable navigation systems lagged behind. Before 1933, military instruction in navigation was given only as a brief part of pilot training. Though some specialized instruction was provided in combat units, the small number of long-range aircraft in the Air Corps required only a few specialized navigators. Even in 1939, Air Corps plans called for only about 500 officers to be trained as navigators. It was assumed that individual training of navigators would be conducted in specialized schools, but no such programs were operational until 1941. Complicating the situation, there was no standard system for aircraft navigation. Medium bombers typically used dead reckoning—which involved charting a given course, noting the required directional bearings, and calculating the airplane headings and airspeed necessary to fly the charted course. Long-distance heavy bombers relied on celestial navigation. Furthermore, different techniques were used in different theaters. Dead reckoning was used for American daylight bombing in Europe, while celestial navigation was preferred in the vast expanses of the Pacific. The incessant cloud coverage, however, hindered celestial navigation in the Aleutians. Dead reckoning was susceptible to cross winds and slight errors in calculation over long distances that caused pilots to become lost over the vast gray, icy seas of the North Pacific.

World War II B-17 Navigator "Dead Reckoning" (www.airandspace.si.edu)

Navy PBY Catalina on the runway in blizzard, Adak, 1943 (www.ww2db.com)

Extracting a Navy PBY Catalina sunk in icy waters, Aleutians Islands, 1943 (Alaska State Library Historical Collections)

Navy Fleet Air Wing 4 PV-1s over the Aleutians, 1943 (University of Alaska Archives)

Army Air Corps 11th Air Force P-38 over the Aleutians, 1943 (Time & Life Pictures/Getty Images)

“Flying the Beam”: Four-Course Radio Navigation

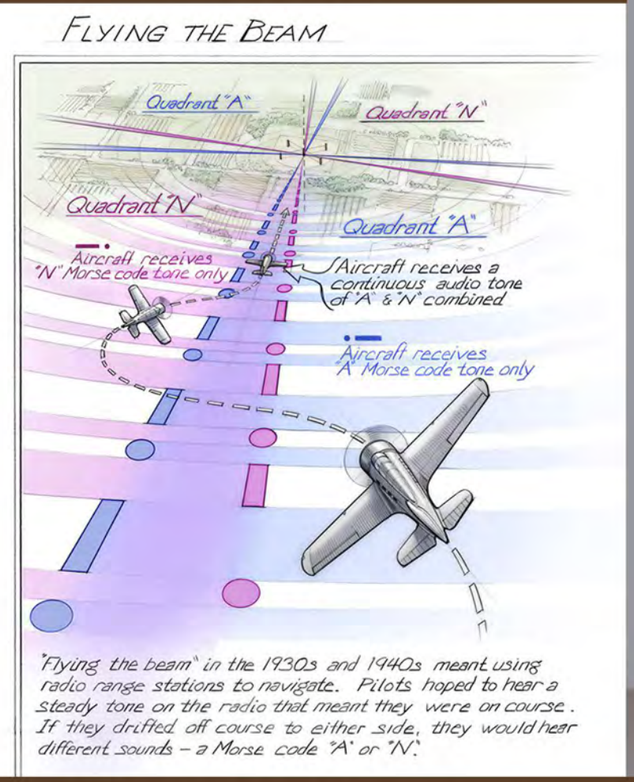
Radio navigation was the solution. The four-course radio navigation range system relied on a network of towers, which broadcast directional radio signals that defined specific routes. Aircraft equipped with special receivers could follow the radio beams even when pilots were shrouded in low-to-no visibility conditions. This became the U.S. military’s primary navigation system for instrument flying through the end of World War II.

The system used a network of strategically located radio transmission stations, known as ranges. One of two types of antenna systems were used at the ranges – either the loop-type antenna array called a Medium Range Loop (MRL) range, or the 5-tower antenna array known as the Simultaneous Broadcast Range, Adcock (SBRA) range. The MRL range employed two large vertical loop antennas, strung from seven 40-foot masts or towers, the loops intersecting each other at right angles. The SBRA range had a vertical antenna array that consisted of four 130-foot-tall antenna towers erected on the corners of a 425-foot by 425-foot square. Both types of ranges worked the same, emitting directional signals, which could be heard by pilots or navigators in their headsets. The Morse code for the letter “A” (dot-dash) was broadcast along one opposing quadrant pair, while the Morse code for the letter “N” (dash-dot) was broadcast along the other quadrant pair. The intersections between the quadrants where the “A” and “N” signals were of equal intensity defined four course lines from the station along four compass directions. The area where they overlapped and provided a directional signal was known as the “beam.” The letters “A” and “N” were used because their Morse code signals were opposite, a “dot-dash” for A and a “dash-dot” for N. The resulting effect when both were heard simultaneously was a constant tone. When aircraft were centered on the airway, the “beam,” the two opposite Morse-code signals— “A” and “N”—merged into a steady, unbroken tone heard by the pilot or navigator. If aircraft drifted off course to one side, the Morse code letter “A” could be faintly heard. The greater the drift, the stronger the “A” Morse code signal. Straying to the opposite side produced the “N” Morse code signal. To correct, the pilot would initiate a series of turns until the steady tone of the beam was heard, and the aircraft would regain its bearing.

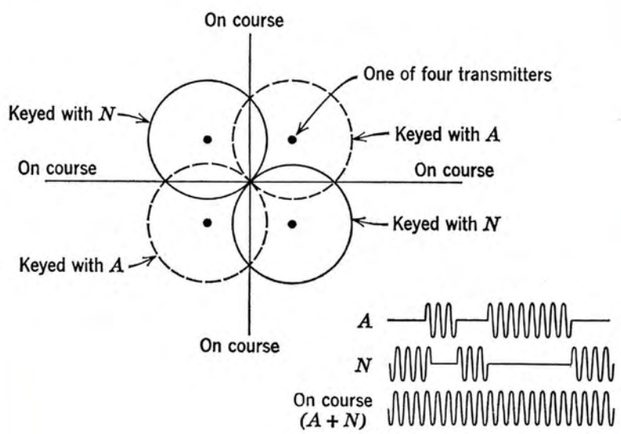
The CAA ranges in the Aleutians and most of Alaska also had a fifth central tower for voice communication and broadcasting weather and route information, as well as a horizontal antenna known as a “Z” marker. “Z” markers broadcast Morse code for the letter “Z” directly above. When aircrew heard the dash-dash dot-dot code for “Z,” it confirmed their location at the station.

Ranges were ideally located 150 to 250 miles apart. Aircraft would fly the radio “beam” from one station for up to 100 miles, at which point they could receive the beam from the next navigation range along their route. Radio ranges at the destination airfield would be used as the endpoint navigation beacon. Pilots typically carried air charts that depicted navigation range locations, radio beam direction, “A” and “N” quadrants, and airfield-specific approach information.

How pilots followed the radio range beams (www.timeandnavigation.si.edu figure)



Generalized antenna and radio transmission used in the radio navigation ranges (www.radiomuseum.org figure)



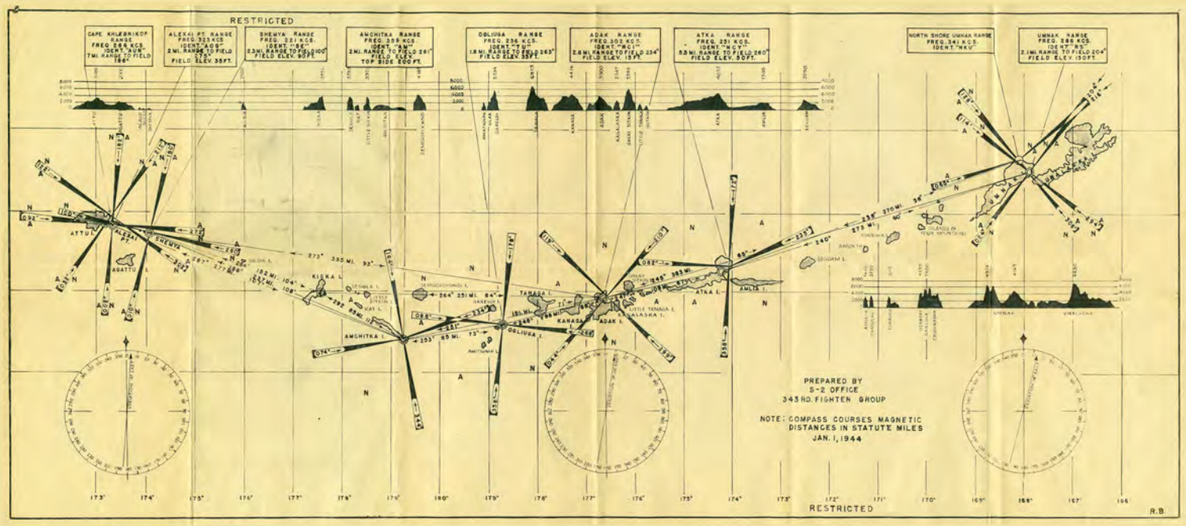
World War II Radio Navigation Ranges of the Aleutian Islands

At the outbreak of war, the CAA had established radio navigation ranges in interior and south-central Alaska. The network was far from complete, however. There was a gap of 575 miles with no radio ranges along the airway connecting Alaska to the “Lower 48,” and no radio ranges had yet been established in the Aleutians. As defense of the Aleutians became a vital concern, end-point radio navigation ranges were constructed at military airfields at Kodiak, Cold Bay, Dutch Harbor and Umnak Island, and the first en-route radio navigation ranges were established in the eastern Aleutians. Ranges were placed strategically, with overlapping or connecting radio beams that would provide courses to navigate along the island chain from airfield to airfield, with turns at strategic points to initiate patrols over the North Pacific or Bering Sea, or back to the Alaska mainland.

After the recapture of Kiska, Major General Davenport Johnson took over command of the 11th Air Force. A pioneer from the early days of the Army Air Forces, Johnson was quick to adopt and employ new technologies. One of his first acts was the establishment of the 11th Air Force Instrument Flying School and promotion of an intensive training program in radio navigation flying. He also accelerated the CAA’s development of radio ranges in the Aleutians. The CAA and its civilian contractors continued constructing navigation ranges in the Aleutians throughout the war, erecting towers and radio ranges on remote islands, while war planes battled overhead and bombs rained on the Japanese.

> “All radio ranges in the Aleutians area will be operated continuously except that ranges West of Atka will be shut down during hours of darkness. These ranges, however, will be available instantly upon properly authenticated request. Any range may be shut down upon orders of the Regional Fighter Controller if definite indication exists of an air attack.” -U.S. Army Air Corps Aleutians Islands Notice to Airmen, 3 September 1943 (Anchorage Museum Collections B2006.x.001)

U.S. Army 11th Air Force, 343rd Fighter Group S-2 Radio Beam Aeronautical Chart, Western Aleutians, January 1, 1944 (Anchorage Museum Collections B2006.x.001)



Range Construction

Radio range construction was a cooperative effort between the CAA, U.S. Army Corps of Engineers, Navy Seabees, and private contractor Morrison-Knudsen, a civil engineering company based in Boise, Idaho, that built airfields and bases throughout the Pacific. Conditions at these remote sites proved extremely difficult. Construction crews faced hardships such as severe weather, gale-force winds, unstable soil, the absence of accurate topographic maps and charts, lack of reliable communication, logistical delays, and shortages of supplies and building materials. Despite these hardships, within a year of the Japanese attack on Dutch Harbor, radio ranges were in operation throughout the Aleutians as far west as Adak and Amchitka.

Construction plans followed a standard design with similar configurations for all sites. The antenna tower array was either an MRL loop-type antenna, or the SBRA 5-tower layout. A horizontal “Z” marker was placed within the array, its location dictated by topography or suitable location. Operational facilities typically included a structure for generators that provided power to the station and a building for radio and radar equipment. At remote sites, support facilities for operations personnel were single-story houses that also served as mess halls and recreation facilities. Early designs called for stick-built, lumber-framed structures. As hostilities ensued, to accelerate rapid construction, CAA planners adopted standardized, prefabricated wall and roof modules. Design elements necessary for Alaskan conditions, such as insulation, were added during construction. Site layout was modified as necessary to accommodate existing terrain.

The Ranges

Radio ranges were established relative to air bases. Each airfield had an end-point navigation radio range to control destination and approach. In-route navigation ranges were established as outlying stations. Distance between ranges was the chief factor in selecting locations. The first ranges were established in the eastern Aleutians as outlying facilities to the Kodiak Air Station, Cold Bay’s Fort Randall, Dutch Harbor, and Umnak’s Fort Glenn. As U.S. forces pushed west, radio navigation ranges were established at Adak, Atka, Ogliuga, Amchitka, Shemya, and Attu. With the completion of the ranges in the western Aleutians, U.S. pilots had continuous radio beams that provided instrument navigation along the entire Aleutian chain and beyond.

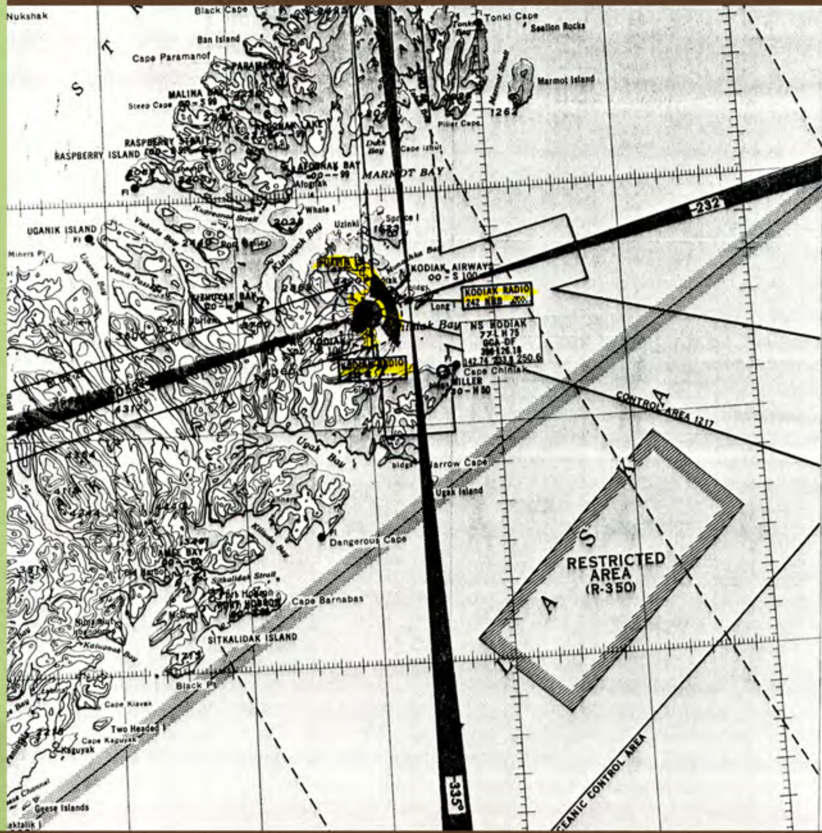
Woody Island

The first radio range used for navigation by Aleutian-bound aircraft from Kodiak was at Woody Island, 6.5 miles to the west of the airfield. Established in 1940, the range provided continuous navigation beams to and from Kodiak. The range at Woody Island broadcast beams with bearings toward the station at 37°, 130°, 223°, and 310°. The island was home to a number of naval facilities, amenities, and barracks to house up to 200 personnel. The station remained in operation until the 1960s.

Sand Point

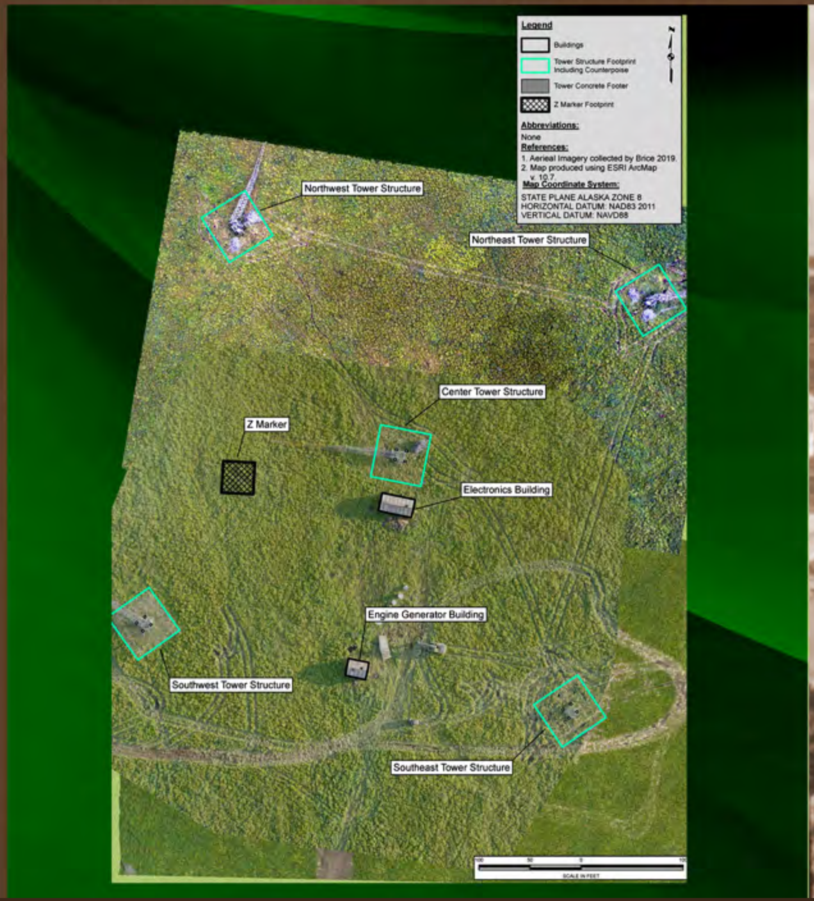
West of Chirikof, pilots relied on beams from the Sand Point radio navigation range and weather station, commissioned on September 22, 1943. The range operated continuously, broadcasting weather data and beams toward the station at magnetic bearings of 67°, 151°, 247°, and 331°. The range was operated by Navy personnel who were housed at the adjacent naval auxiliary field. The range was decommissioned on April 25, 1945. The radio range at Cold Bay was directly west of Sand Point, and to the southwest was the range at Caton Island in the Sanak archipelago.

Woody Island Radio Range Beam Bearings, 1957 U.S. Air Force Aeronautical Chart (FAA Archives)



U.S. Troops unloading supplies, Attu, May 1943 (University of Alaska Fairbanks Archives)

Umnak North Shore/Ashishik Point radio range 2019 drone imagery showing typical SBRA 5-tower radio range layout (BES figure)



Sand Point Naval Air Station with radio range tower array in background, May 1945 (FAA Archives)

Woody Island radio range, 1960 (FAA Archives)

Chirikof Island

To establish an airway southwest from Kodiak to the Aleutians, a navigation facility was commissioned 170 miles away on the north end of Chirikof Island in December 1942. The station included a radio range, radar beacon, and a weather observation station operated by 11 Navy enlisted men and one officer living in difficult, isolated conditions. The range operated continuously with identifier "NCF," broadcasting weather information and radio beams with bearings toward the station at 37°, 130°, 223°, and 310°. Six wood-frame structures sheltered personnel and equipment—an electronics operations/communications building, a power building with two generators, two storage buildings, and two quarters buildings. The facility was decommissioned following the war and abandoned in 1946.

"The 1945 Report on Conditions at Radio Range and Weather Station, Chirikof Island, Alaska from a survey by Lieutenant G.W. Shoe and D.C. Hutchins, paints a grim picture of life at this remote post in the storm-swept North Pacific:

"In the immediate vicinity of the station, sand is constantly being shifted and blown away by wind and rain. It is frequently necessary to fill in erosive areas around buildings to protect their foundations. Erosion and washouts are taking place very rapidly in the vicinity of the towers… Continuous operation and use without maintenance leaves the buildings needing complete renovation… Broken water pipes, caused by freezing, has resulted in much make-shift pipe fitting… In dry weather is it possible the station would be without water… At present, there is sewage welling up a distance of 150 feet from the living quarter buildings… There are no accommodations for servicing or repairing equipment on the station. Minor repairs and greasing are the only measures possible for equipment upkeep. Breakdowns have been numerous and have resulted in frequent complete disorganization of normal operations… Living conditions at this station may be summarily classified as deplorable… All furnishings and equipment are inadequate, of improper type and dilapidated. Such defects as follow make living on this station very miserable: The cooking range is worn out; the heating surface has to be operated manually; when generators go out they have no water, lights or heat; broken doors and windows make clean quarters impossible; broken-down washing machine, plus no laundry room, makes cleaning clothes very difficult; all household furniture is held together with wire or cord. These are only a few of the many difficulties experienced by personnel trying to operate this station."

Chirikof Island Radio Navigation Range
February 25, 1946 (FAA archives)

Chirikof Island Radio Navigation Range remains
April 19, 2017 (BES photo)

Caton Island (Sanak)

The radio navigation range at Caton Island, otherwise known as the Sanak radio range due to its location in the Sanak archipelago 100 miles southwest of Sand Point, was commissioned in January 1943. This remote station was operated by 10 Navy enlisted men under the command of one officer. The radio range, antenna tower array, radar beacon, weather observation, and support facilities were distributed among two areas connected by a road and power transmission line. The tower array and wooden structures that housed personnel and equipment were located in a high-wind area on the crest of a hill. With the identifier "NKK," the range broadcast continuous weather information and radio beams with bearings toward the station at 37°, 130°, 223°, and 310°. The range was decommissioned and abandoned at the end of the war.

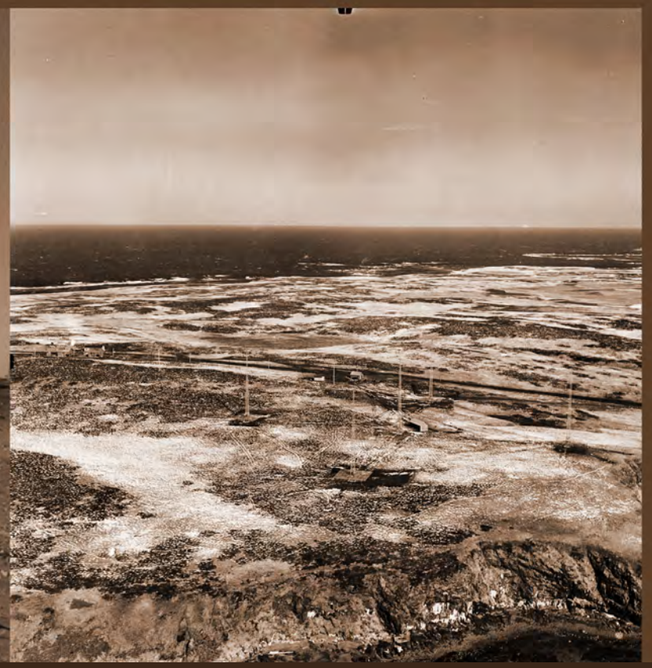
"The War Diary – U.S. Naval Operating Base Dutch Harbor, Alaska and its Satellite Stations – Compiled for the period 10 September 1941 through 31 December 1945 on file at the National Archives reports:

"Life at this small station is very routine. They endure many bad windstorms which at times blow down their power lines and antennas – in one case moving a building three feet off its foundation. As an example of the weather: during September 1944, a Y-87 reported that it was on the rocks in Peterson Bay and in need of help. Sanak Station kept proper activities informed of the situation but was unable to dispatch its barge because of the weather. The next day the wind having abated to 25 knots, Sanak's barge departed for Peterson Bay and took care of the situation.

…With poor mail service and limited recreational facilities the morale of the men is very high…

The everyday routine of life is occasionally broken by holiday. On Thanksgiving two frozen turkeys were dropped from a plane and the men had a sumptuous Thanksgiving dinner. A few days before Christmas a tree was brought in from Dutch Harbor and was installed and decorated in the crew's quarters. On the 24th of the month there were no Christmas packages other than those sent by the Red Cross. On Christmas day the dinner was enjoyed by all personnel. During the meal a small fishing boat pulled into the harbor with Christmas gifts from home making their Christmas Day complete."

Caton Radio Navigation Range,
March 22, 1944 (FAA Archives)

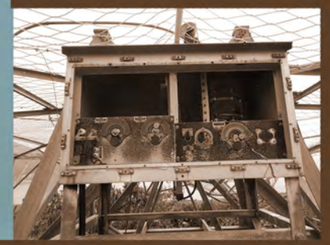


Caton Radio Navigation Range,
September 4, 2018 (BES photo)

Dutch Harbor - Hog Island

Located in Unalaska Bay, roughly 1 mile west of the airfield, the Hog Island radio range provided navigation signals to Dutch Harbor. Construction began in 1940, and the range was completed at the same time as the airfield. Broadcast with identifier "SY," the beams radiated from the range at cardinal directions of 0°, 90°, 180°, and 270°. The range was connected by cable to the air traffic control tower at the Dutch Harbor Airfield and could be controlled remotely by tower operators. The north beam of the Hog Island range and the west beam of Unalga range intersected 15 miles at sea, the north beam of Hog Island range giving a bearing for approach into Dutch Harbor. Operation of the site was transferred back to the CAA on May 1, 1945. For the next 5 years, the CAA maintained and operated the range until it was decommissioned and abandoned in 1950.

1. Hog Island radio navigation range overview, March 6, 1947 (FAA archives)
2. Hog Island radio range tower tuning panel, August 20, 2018 (BES photo)
3. Hog Island radio range "Z" marker, August 20, 2018 (BES photo)



Hog Island radio range tower and electronics building, March 6, 1947 (FAA archives)

Hog Island radio range tower and electronics building, August 20, 2018 (BES photo)

Unalga

Navy records show that a radio facility established in 1912 for ship navigation was upgraded for use as an aircraft radio range at Unalga, 150 miles west of Cold Bay and 20 miles east of Dutch Harbor. The War Diary – U.S. Naval Operating Base Dutch Harbor, Alaska and its Satellite Stations – Compiled for the period 10 September 1941 through 31 December 1945, on file at the National Archives, reports that the Unalga range began operating on October 14, 1942. The U.S. Army Air Corps Aleutians Islands Notice to Airmen 3 September 1943 states that the Unalga radio range was flight checked and operated continuously, broadcasting navigation beams at magnetic bearings of 09°, 99°, 189°, and 279°. According to the War Diaries, the station was manned by four radio operators, a medic and a cook.

> "Originally there were two Quonset huts at the range station, being 500 feet apart. One was used for equipment and the other for equipment and living quarters. This latter hut had complete plumbing but no water. Water had to be carried for all purposes. Having to carry water for a distance of 800 feet, many times through a blinding snowstorm, it was regarded as very precious." - "Unalga Naval Radio Range Station", p. 408 in War Diary - U.S. Naval Operating Base Dutch Harbor, Alaska and its Satellite Stations - Compiled for the period 10 September 1941 through 31 December 1945 (National Archives Identifier 4697018).

Hog Island radio range "Z" marker, March 6, 1947 (FAA archives)

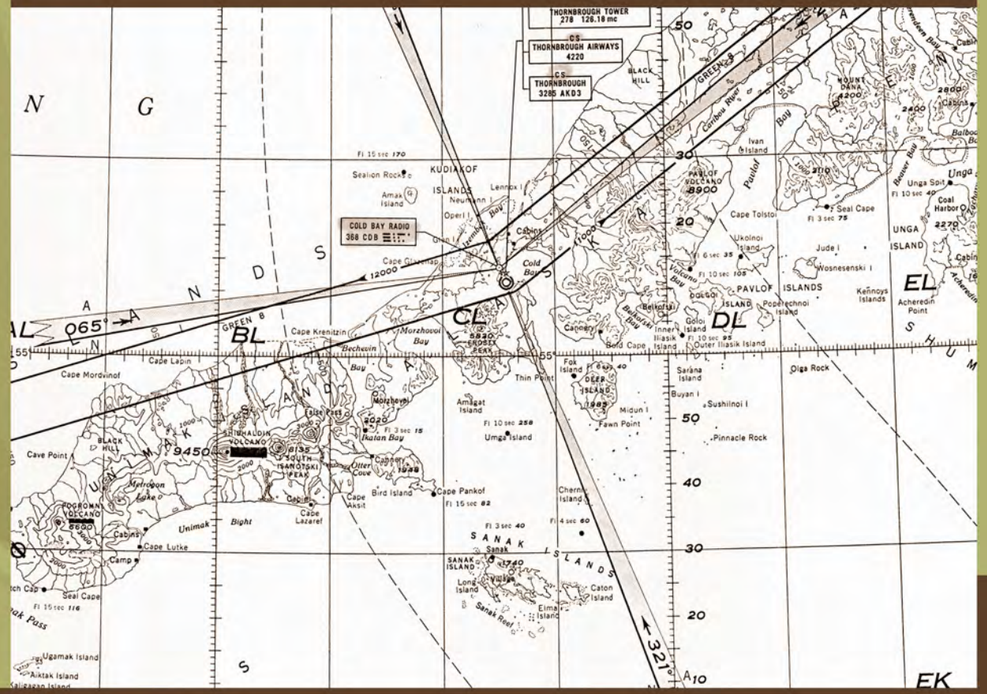
Unalga Island, WWII (FAA Archives)

Hog Island radio navigation range aerial overview, March 6, 1947 (FAA archives)

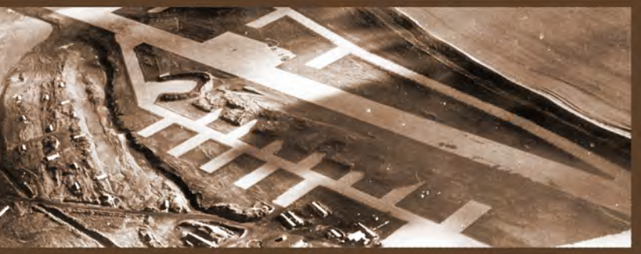
Cold Bay

Roughly 55 miles north of Caton and 90 miles west of Sand Point, a radio navigation range was established at Cold Bay at the same time as the Army airfield. Broadcasting with identifier “DI,” radio beams provided magnetic bearings toward the station at 65°, 141°, 214°, and 321°. The range was located 3 miles north of the airfield.

Cold Bay radio range beam bearings, 1943 Army Air Force aeronautical chart revised 1951 by U.S. Air Force (FAA Archives)



Atka emergency airfield and radio navigation range, WWII (FAA Archives)



Atka

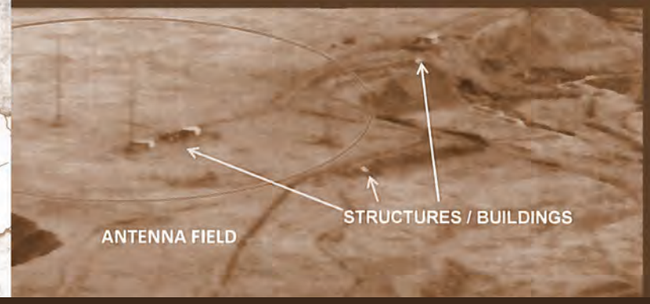
The 270 miles between Fort Glenn and the radio range to the southwest on Atka Island was the longest distance between Aleutian air war navigation stations. The Atka range was located on Cape Kudugnak, roughly 5 miles east of the Army airfield at Nazan Bay. Atka was also established as a naval air facility from November 1942 until September 1943 when it was decommissioned, leaving only a Navy weather detachment. The weather detachment worked Atka with Army personnel who operated the airfield until the end of the war. The range operated during daylight hours with identifier “NCY.” Radio bearings toward the station were set at magnetic headings of 82°, 172°, 235°, and 352°.

Atka radio beam navigation chart, 1947 (FAA Archives)

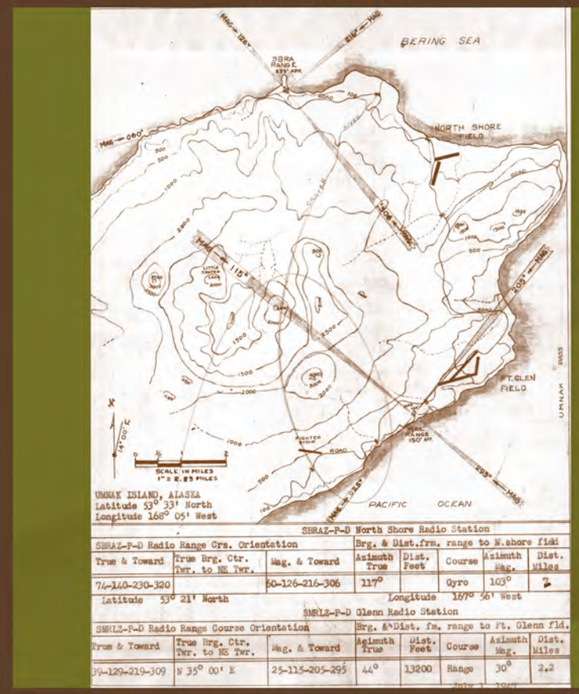
Umnak Island - Otter Point and Ashishik Point

Two radio navigation ranges were established on opposite sides of Umnak Island for aircraft from Fort Glenn. The first was commissioned at Otter Point on the island’s south side at the same time as Fort Glenn’s first airfield. The range stood 2 miles northwest of the airfield. With identifier “RS,” it broadcast continuous radio beams with magnetic bearings toward the station at 24°, 114°, 204°, and 294°. The Otter Point range was in operation at the time of the Dutch Harbor bombing. At Ashishik Point, on the northern coast of Umnak, the North Shore range was commissioned on August 22, 1943. The range was connected to Fort Glenn by road and staffed by Army Signal Corps personnel. The range operated continuously with identification of “NKU,” broadcasting weather information and radio beams with bearings toward the station at 60°, 126°, 250°, and 306°. The North Shore range was abandoned in 1950.

1. North Shore/Ashishik Point radio range radio range, August 20, 2018 (BES photo)
2. North Shore/Ashishik Point Electronics Building, August 20, 2018 (BES photo)
3. North Shore/Ashishik Point radio range 1953 (from U.S. Army Geospatial Center & USACE 2014, Historical Photographic Analysis, Fort Glenn, Umnak Island, Alaska)



Umnak Island radio beam navigation chart showing Otter Point and North Shore/Ashishik Point radio beams, 1947 (FAA Archives)

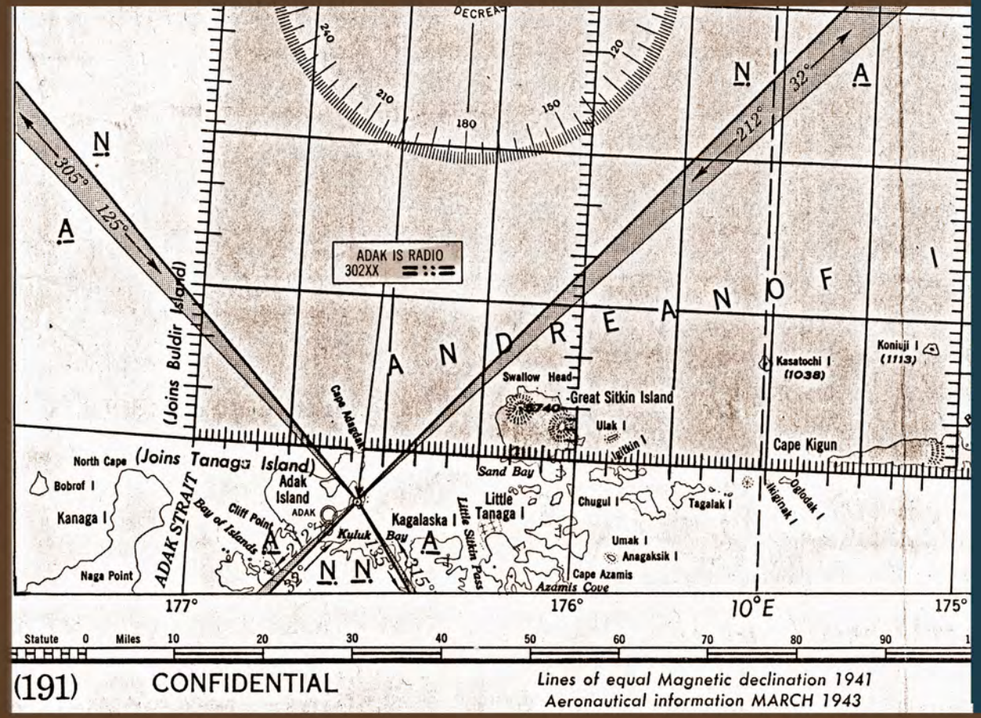


Otter Point radio beam bearings, 1943 Army Air Force aeronautical chart (FAA Archives)

Adak

When the Army airfield was built on Adak Island 109 miles to the southwest of Atka, a radio range facility was also constructed. Army Signal Corps personnel operated the range, which was 3 miles northeast of the airfield. Navigation beams were broadcast in daylight hours with the identifier "NCI," providing course bearings toward Adak at 44°, 119°, 210°, and 299°. Until the creation of the base at Amchitka, this was the farthest west range in the chain used by aircrews in the early days of the Kiska Blitz. During the winter of 1942-1943, this range and the base at Adak were the center of aerial combat operations against Attu and Kiska.

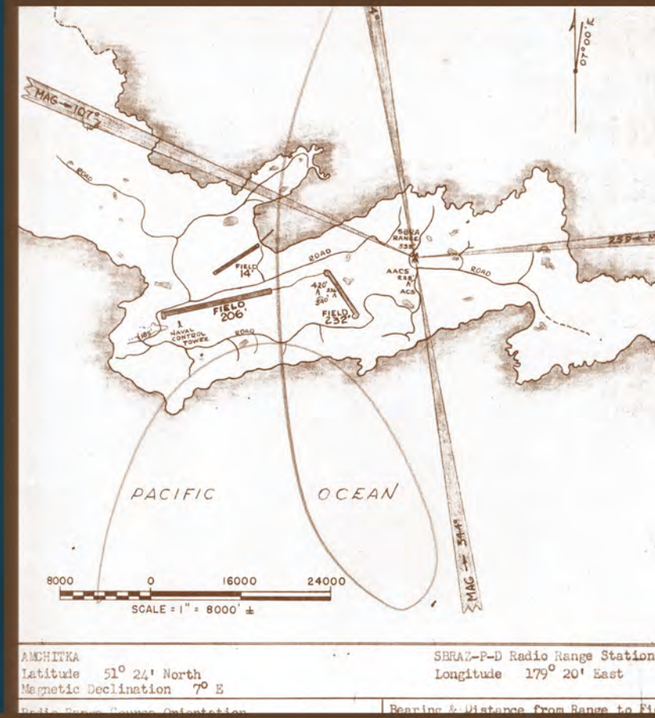
Adak radio range beam bearings, 1943 Army Air Force aeronautical chart (FAA Archives)



Amchitka

Amchitka Army Airfield also had a radio range operated by Army personnel, located 2 miles to the east of the bomber runway. With an identifier of "AM," it broadcast during daylight hours, with bearings toward the station at 74°, 164°, 254°, and 344°. The range was constructed at the same time as the airfield. As Amchitka became the center of the air war, the range provided navigation for raids against Kiska and Attu. Later, the range provided signals for transports and supplies headed to Shemya and Attu. After the war, the range was operated as part of an Army communications station maintained on the island until it was finally abandoned in 1950.

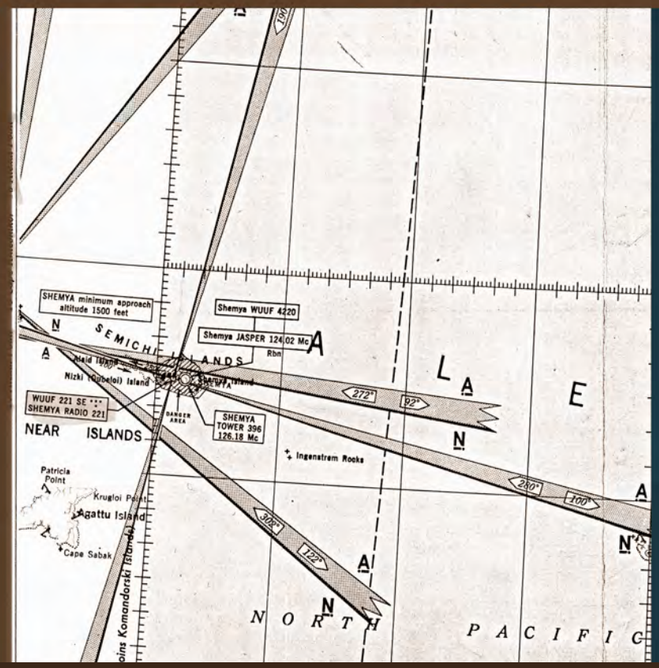
Amchitka radio beam navigation chart, 1947 (FAA Archives)



Ogliuga

Located roughly halfway between Adak, 96 miles to the east, and Amchitka, 85 miles to the west, the radio range on Ogliuga Island provided navigation for pilots in the western reaches of the chain. The radio facility was reportedly next to an emergency runway on the northwest end of the island. A 343rd Fighter Group Aeronautical Chart dated January 1, 1944, and the September 1, 1943, U.S. Army Air Corps Notice to Airmen report that it broadcast bearings toward the station at 88°, 178°, 268°, and 358° during daylight hours with identifier "TU."

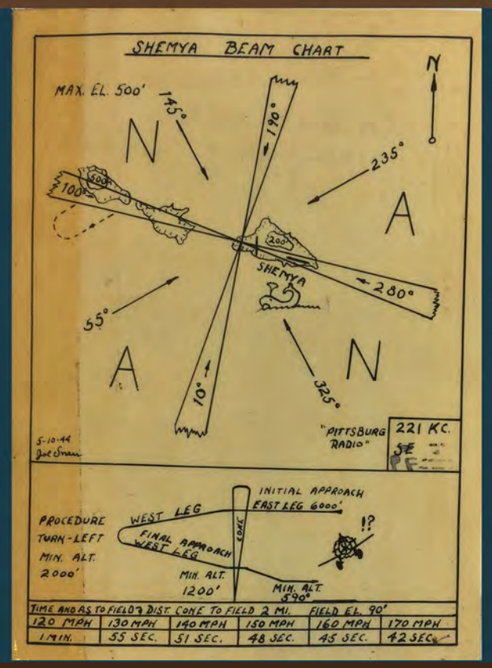
Shemya radio range beam bearings, 1943
Army Air Force aeronautical chart (FAA Archives)



Shemya

As American forces were mopping up the last Japanese resistance on Attu, work on the airfield and radio range at Shemya was underway. Approximately 237 miles of open ocean separated the Shemya range and the facility at Amchitka to the east. The range was strategically placed 2.5 miles west of the airfield to provide navigation beams for sorties launched against Japanese positions on islands to the west and southwest. It operated during daylight hours, broadcasting with the identifier "SE" and bearings toward the station at 10°, 100°, 190°, and 280°. The range provided crucial navigation for raids against Attu and long-distance bombing missions against the Kuril Islands. It remained in operation after the war, providing military and civil navigation for aircraft flying the "Great Circle Route" to Asia until it was decommissioned in the early 1960s.

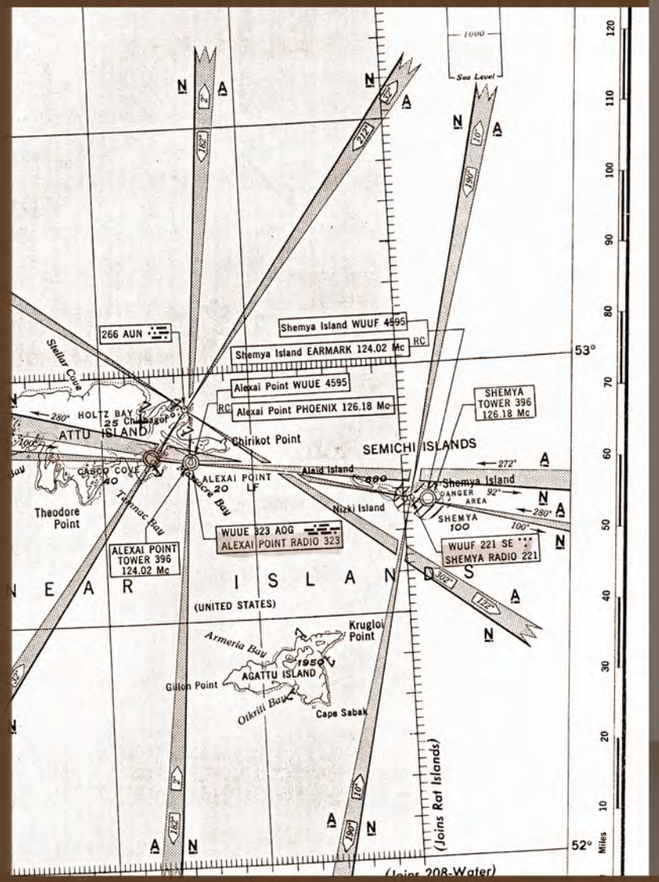
Shemya radio beam navigation card, May 10, 1944 (Anchorage Museum Collections B2006.x.001)



Attu

After Japanese forces were driven from the island, three ranges were established at Attu, 35 miles west of Shemya. The first of these was completed at the same time as the first runway in Summer 1943. It was operated by Army personnel and used by aircraft flying in and out of the Alexai Point Airfield. The tower array was located 1,900 feet west of the airfield's east-west runway. Broadcast during daylight hours with the identifier "AOG," the range provided courses toward the field at 02°, 92°, 182°, and 272°. Attu's second range, at Khlebnikof Point on the north shore of the island, was in use by September 1943. With identifier "AUN," the Khlebnikof range broadcast beams toward the station at 32°, 122°, 212°, and 302°. These are the two ranges depicted on the radio beam chart from January 1, 1944, by the 11th Air Force's 343rd Fighter Group stationed in the western Aleutians. Laminated radio beam navigation cards made on February 9, 1944, for pilots of the 344th Fighter Squadron, stationed on Attu, show three ranges on the island. Hand-colored navigation cards of the 343rd Fighter Group from June 10, 1944, show the same. The third range was commissioned in January 1944, on the west side of Massacre Bay, 2 miles south of the Casco Naval Air Station. This was the only radio range west of Umnak staffed by Navy personnel. The Casco range broadcast with identifier "ALM" and bearings toward the station at 61°, 173°, 277°, and 353°. The three ranges at Attu were the westernmost radio ranges in the Aleutians and the final stations in the network of navigation ranges along the chain. Fighters and medium bombers from Attu used the ranges for navigation during Kuril raids for the remainder of the war. Establishment of the second and third radio navigation ranges on the island during the Kuril bombing missions of late 1943 and 1944, at a time when U.S. forces in the western Aleutians were being drawn down, is a testament to their navigational importance to the Kuril air campaign.

Attu Alexai Point and Cape Khlebnikov radio range beam bearings, 1943 Army Air Force aeronautical chart (FAA Archives)



Strategic Value of the Ranges

Radio ranges in the Aleutians provided crucial navigation points for air raids against the Japanese during the Kiska Blitz. After enemy forces were driven from the Aleutians, the ranges were critical for navigation during long-range bombing missions against the Japanese Kuril Islands. These operations against the Kurils convinced the Japanese that their northern flank was in constant danger of attack. During the pivotal moments of the Pacific theatre, the Japanese were forced to keep much-needed aircraft and forces in the Kurils as defense against possible attack from the north. Through the Kuril bombing campaign, the smaller U.S. force in the Aleutians was able to tie down a larger Japanese defensive force, diverting resources Japan could have employed at other battles in the Pacific.

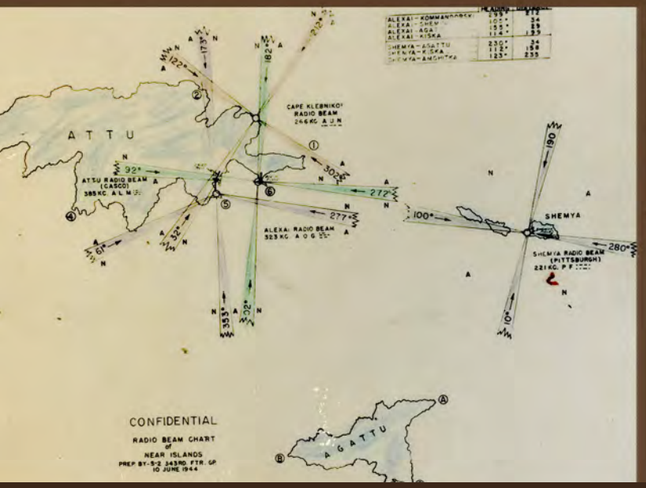
Although a Long-Range Aid to Navigation (LORAN) A station was established by the Army in the western Aleutians by 1944, radio ranges remained the primary means of navigation for U.S. aircraft. Early LORAN A was plagued by inaccuracies and was used primarily for ship navigation during the war. Radio ranges continued as the primary means of aircraft navigation in the Aleutians and Alaska throughout the 1950s, until eventually being replaced by Very High Frequency Omnidirectional Range (VOR) and second-generation LORAN technology. The final radio range in Alaska stopped broadcasting in the late 1960s.

The real nature of the Aleutian airways and their value to the U.S. was demonstrated on September 3, 1945, when a C-54 piloted by Major General G.E. Cain filed a flight plan at Atsugi Airdrome near Tokyo, Japan. After a 12-hour trip to Adak, he refueled and departed for Seattle, landing in Washington D.C. after 31 hours of flying, with the first motion pictures of the Japanese surrender. The pilot used radio ranges for navigation while making this first traverse of the "Great Circle Route" across the Pacific. Later in Fall 1945, several non-stop flights from Japan to Washington were made along this same route using radio ranges as navigation aids.

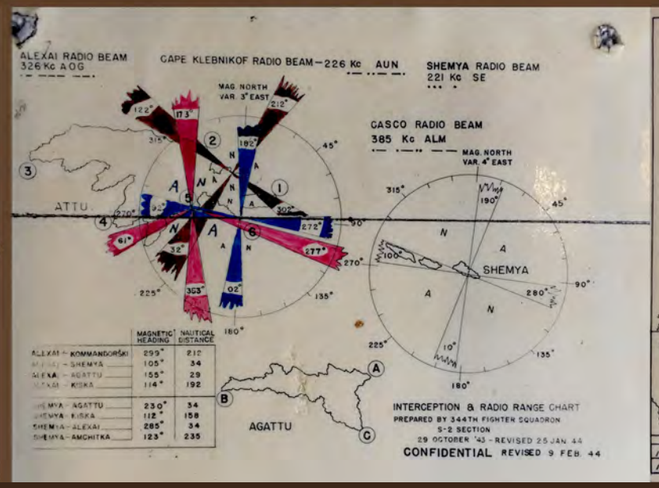
Radio navigation ranges, and the brave men who built and operated them on lonely, storm-swept islands in the Aleutians, made this possible.

> As the last official intelligence report of the 11th Air Force sums up:
>
> "The Aleutian Islands, on the Great Circle Route from North America to the Orient, may not have fulfilled their hope of becoming the 'Northern Highway to Victory', but they certainly are destined to be the aerial highway to peace." – Combat Air Forces of World War II (Army of the United States), p. 59

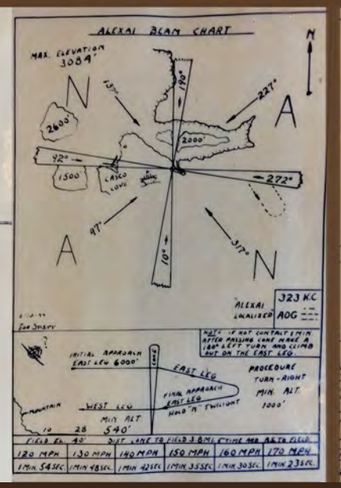
Attu radio beam navigation card, 343rd Fighter Group, June 10, 1944 (Anchorage Museum Collections B2006.x.001)



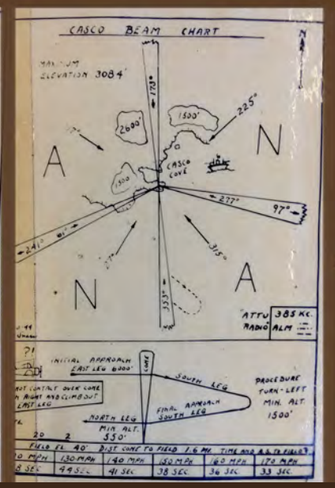
Attu radio beam navigation card, 344rd Fighter Squadron, February 9, 1944 (Anchorage Museum Collections B2006.x.001)



Alexai Point radio beam navigation card, May 10, 1944 (Anchorage Museum Collections B2006.x.001)



Casco Field radio beam navigation card, May 10, 1944 (Anchorage Museum Collections B2006.x.001)



P-40 Warhawks of the 18th Fighter Squadron escorting B-24 Liberators of the 21st Bombardment Squadron over the Western Aleutian Islands, July,1943 (www.ww2db.com)

When Ranges Fail

Although radio ranges were a dramatic improvement in aircraft navigation, they still had well-known drawbacks. They only provided four course directions per station. Radio transmissions were sensitive to atmospheric and other types of interference and would fluctuate depending on weather conditions, vegetation, or snow cover near the station. Under some conditions, the signals from the "A" quadrant would "skip" into the "N" quadrant, or vice versa, causing a false "virtual course" away from any real course line. Thunderstorms and other atmospheric disturbances would create electromagnetic interference to disrupt the range signals and produce crackling static in pilots' headsets. Navigation required pilots to listen for hours to an annoying monotonous beep or a faint stream of Morse codes, often embedded in background static. And like all technology, systems components were prone to failure.

On March 17, 1945, a Navy PV-1 piloted by Lieutenant A.F. Moorehead ditched off the coast of Kodiak. The plane's radio range receiver had failed, causing the craft to become lost in the fog and run out of fuel. Lieutenant Moorhead's statement of the incident, found in *The History of the Naval Air Station, Kodiak, Alaska 1941-1945*, a confidential Department of the Navy report produced in 1945, demonstrates the difficulties encountered with radio navigation systems failure.

> "We passed Chirikof with about 300 ft., visibility half mile to a mile. We went between Chirikof and Nagai Rocks and headed approximately 037 on the beam. Continuing on the heading after we lost Chirikof for about 10 minutes, we then switched to the Kodiak range. It should have taken 35 minutes from Chirikof to the intersection of the Kodiak south leg. We turned on the Kodiak range because the Chirikof range wasn't acting properly as we couldn't pick up the Chirikof beam. Still on 037, we turned on the Kodiak range and picked up a weak "A" signal with a very strong background about 15 minutes earlier than we should have. In other words, as soon as we turned on Kodiak, we were very close to the beam and we shouldn't have been. The identification signals at Kodiak were O.K. except for being slow… As soon as we turned on the Kodiak beam, we turned to 360 degrees approximately to get the beam. The weak "A" persisted so we increased heading 10 degrees at a time, picking up the beam and then back to "A". We increased to 090 degrees and hit the "N" for about one minute. We decreased heading to 330 degrees for five minutes to re-cross beam, but were unable to find the beam although we decreased heading to 270 degrees." – Lt. A.F. Moorehead, in Department of the Navy. 1945. History of Kodiak Naval Air Station, Kodiak, Alaska 1941-1945.

Wrecked Navy PBY Catalina, Aleutian Islands, WWII (Alaska State Library Historical Collections)

Abandonment & Reuse

After the war, most of the Aleutian radio ranges were decommissioned by 1950, at which point they met various fates. Some were repurposed and reused. Many were simply abandoned. At Chirikof, in 1949, all serviceable radio range equipment was removed from the facility and transported to Bettles for reinstallation to aid navigation on the air route to the Arctic Coast. The salvaged equipment, which amounted to several tons, was transported via barge from Chirikof to Kodiak, then air-shipped to the CAA station at Bettles. At Caton, which was abandoned in place, local residents John Olsen and his family, and later Sanak locals, salvaged material from the range station to construct structures and habitations used for hunting, fishing, and cattle ranching on the island. At Hog Island, local residents or a subsequent landowner repurposed one of the range structures to serve as a shop and the other as a cabin. One of the range structures on the north shore of Umnak at Ashishik Point was remodeled as a cabin by post-war cattle ranchers. The other was used to butcher cattle and reindeer. The Federal Aviation Administration (FAA), the successor organization to the CAA, has embarked on a program of cleaning up contaminants such as petroleum and lead and removing hazardous infrastructure left at the sites after the war's end. The FAA is performing clean-up efforts with an emphasis on preserving important historical aspects of the radio ranges and their role in World War II.

Collapsed structure built in the 1970's from salvaged CAA range materials, Caton Island, June 21, 2019 (BES Photo)

> "In the work of dismantling I do not feel frame buildings should be deliberately destroyed, as much material is wasted. Abandoned material could be left standing for future needs or given to the natives of the island." – War Diary – U.S. Naval Operating Base Dutch Harbor, Alaska and its Satellite Stations – Compiled for the period 10 September 1941 through 31 December 1945. p. 401.

(Top) Structure built in the late 1960's from salvaged CAA range materials, Caton Island, June 21, 2019 (BES Photo) (Bottom) Hog Island range structure re-used as a shop, August 20, 2018 (BES photo)

Umnak North Shore/Ashishik Point radio range structure re-used as a cabin, August 16, 2019 (BES photo)

Historic Preservation of World War II Aleutian Air War Infrastructure

World War II was a conflict that affected every corner of the globe and shaped the world we live in today. The CAA radio navigation ranges and sites detailed in this booklet illuminate Alaska's role in this important event. These traces of our past are protected under state and federal preservation laws. The purpose of these regulations is to remind us of our shared history and to provide the means by which future generations will learn about and understand the experiences of those who came before.

In the Aleutians, most of the sites mentioned in this booklet have been determined eligible for listing on the National Register of Historic Places. Adak Army Base and Naval Air Station, Fort Glenn Cape Field, Dutch Harbor Naval Operating Base and Fort Mears, the Attu Battlefield and U.S. Army and Navy airfields, and the Japanese Occupation Site at Kiska are all registered as National Historic Landmarks. Other World War II sites in the Aleutians are individually eligible for the National Register. The radio ranges detailed in this booklet are managed as cultural resources under the auspices of the Programmatic Agreement between the Federal Aviation Administration and the Alaska State Historical Officer Regarding the Demolition and Decommissioning of FAA Stations in Alaska.

This booklet, intended to further educate the people of Alaska, the nation, and the world about World War II, is the result of a cooperative effort among the FAA, the Alaska State Historic Preservation Officer, the Pauloff Harbor Tribe, and the U.S. Fish and Wildlife Service. Special thanks are due to the staff of the Anchorage Museum Atwood Resource Center and the Pioneer Air Museum for their gracious hospitality and assistance. Funding for this study was provided by the FAA.

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BY:

Brice
ENVIRONMENTAL

Brice Environmental Services Corporation
3800 Centerpoint Drive, Suite 400
Anchorage, Alaska 99503

AND:

The Federal Aviation Administration
222 W. 7th Avenue, Box 14
Anchorage, Alaska 99513

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Front Cover Photos and Graphic Captions:

(Left) CAA Radio Navigation Range, Hog Island, 1943 (FAA Archives)

(Right) U.S. Navy PBY Catalina on Patrol Over the Aleutian Islands, WWII (Alaska State Library Historical Collections)

(Center) Emblems of the CAA, 11th Air Force, and Navy Fleet Air Wing 4

CAA Radio Range Tower, Chirikof Island, April 19, 2017 (BES photo)

CAA Radio Range Tower, Chirikof Island, April 19, 2017 (BES photo)

CAA Radio Navigation Range, Ashishik Point, Umnak Island, August 20, 2018 (BES photo)