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Introduction

In 1942 the Allied powers faced the most serious challenge to their control of the seas encountered in the Second World War: the menace of the U-boat. Fast, well-armed, and long-ranged, Hitler's submarines attacked shipping throughout the North Atlantic, often within sight of America's coastal towns and cities.

Eventually, the combination of intelligence, land and sea-based air power, and surface vessel operations from both North American and British bases ended this threat, making possible the Allied build-up for the invasion of Europe in 1944.

This booklet, by A. Timothy Warnock of the Air Force Historical Research Agency, is one of a series tracing selected Army Air Forces activities in the Second World War. It describes the Army Air Forces' contribution to the Battle of the Atlantic from the American Theater. A subsequent booklet will examine the campaign in the eastern Atlantic and the Mediterranean.

Flying radar-equipped long-range patrol planes, AAF airmen demonstrated the value of land-based air power against naval threats. This success has been reaffirmed consistently since the Second World War, from Vietnam and crises such as the *Mayaguez* incident to operations in Desert Shield and Desert Storm. The Harpoon-armed B-52s of our present-day global Air Force are the heirs of a sea-control tradition dating to the AAF's A-29s and B-24s of the Second World War.

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The Battle Against the U-Boat in the American Theater

December 7, 1941–September 2, 1945

The political settlement ending World War I left a bitter legacy that poisoned international relations and led within twenty years to an even more devastating war. By the 1930s, totalitarian regimes in central Europe and Japan threatened their neighbors. In the Far East, Japan occupied Manchuria in 1931 and 1932, a first step in seeking the domination of China over the next dozen years. In Europe, Adolf Hitler assumed dictatorial power in Germany in 1933 and rebuilt that country's military forces. Between March 1938 and September 1939, Hitler annexed Austria, dismembered Czechoslovakia, and, with the acquiescence of the Soviet Union, invaded Poland on September 1, 1939. Having guaranteed the integrity of Poland's borders, Great Britain and France declared war against Germany on September 3. Between February and June 1940, Germany overran Denmark, Norway, the Netherlands, Belgium, and France, leaving only Great Britain to oppose Hitler's ambitions in western Europe.

As the world edged closer to another major conflict, the United States maintained a strong isolationist position in the international community. By 1939, however, President Franklin D. Roosevelt realized that the United States could not remain neutral indefinitely as the Axis Powers—Germany, Italy, and Japan—gradually escalated their aggression and violence. While the United States remained unwilling to wage war, President Roosevelt gave China in the Far East and Great Britain in Europe all the encouragement and support possible.

While providing aid to China and Great Britain, the United States began to build its war industry and rearm, thus preparing for entry into the war. President Roosevelt sought to make the United States an "arsenal for democracy." The Allies obtained armaments and supplies from United States manufacturers, at first on a "cash and carry" basis, later on credit under the Lend-Lease program.

By 1941, the German submarine offensive against Allied shipping in the Atlantic threatened to starve Great Britain. Like Japan, she was dependent on ocean-borne commerce to sustain her economy and defend herself. The British population depended on imports for a third of its food and for oil from North America and Venezuela to sustain its lifeblood, but German submarines in 1940 and 1941 were sinking

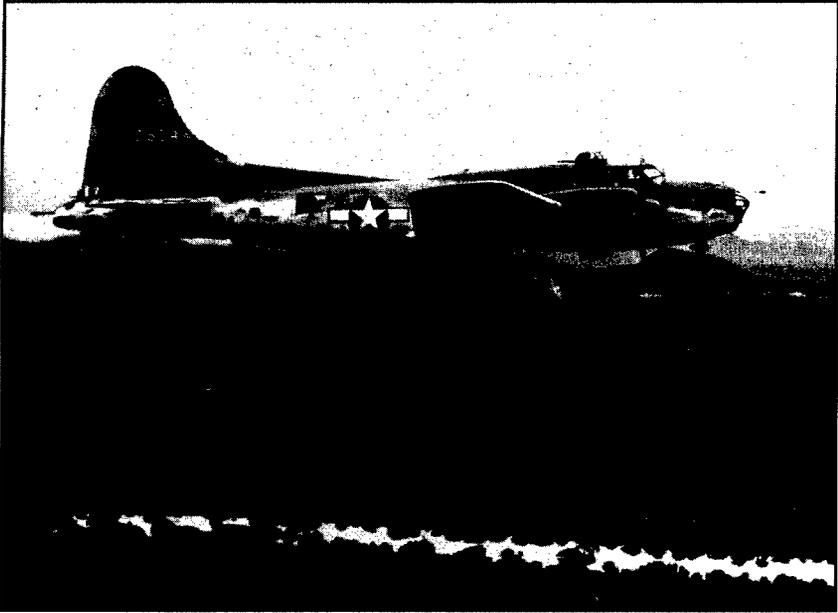
merchant ships and tankers faster than the British could replace them. Consequently, the United States gradually undertook a greater role in the campaign that British Prime Minister Winston Churchill named the Battle of the Atlantic. In September 1941, the U.S. Navy began to escort convoys in the western part of the North Atlantic. Within a month, a German submarine attacked a U.S. destroyer escorting a convoy near Iceland, leaving several sailors dead or wounded. On October 31, a German submarine sank a U.S. destroyer six hundred miles west of Ireland, killing 115 of the crew.

Despite this loss of life, events in the Far East rather than in Europe pushed the United States into World War II. By July 1941, Japanese forces had occupied French Indochina, and U.S. economic sanctions had cut off much of Japan's oil and other imported resources. In October, the Japanese government decided on war, even as it negotiated with the United States. Japanese military leaders hoped to strike a blow that would paralyze the U.S. fleet in Hawaii long enough to establish a defensive ring from Southeast Asia through the East Indies and eastward in the Pacific as far as Wake Island. This strategic plan would have provided Japan with unlimited access to the rich resources of Southeast Asia. As the opening stage of this plan, a Japanese aircraft-carrier task force attacked the American naval base at Pearl Harbor and nearby facilities in Hawaii on December 7, 1941.

The Role of The Army Air Forces in the Antisubmarine Campaign

The United States was not prepared for war. Though the Battle of the Atlantic had raged since September 1939, the United States lacked ships, aircraft, equipment, trained personnel, and a master plan to counter any serious submarine offensive. However, steps taken just before and shortly after the Pearl Harbor attack helped the U.S. Navy enhance its submarine defenses. The U.S. Coast Guard was transferred to the Navy in November 1941, and the next month President Roosevelt named Adm. Ernest J. King Commander in Chief, United States Fleet. In March, the admiral became Chief of Naval Operations as well, giving him the authority and means to direct the U.S. effort in the Battle of the Atlantic, particularly in the American Theater.

This theater included the North and South American continents, except Alaska and Greenland, and the waters about the continents to mid-Atlantic and mid-Pacific Oceans. After Pearl Harbor, the Navy organized its existing East Coast naval districts into sea frontiers, with the Eastern Sea Frontier extending from the Canadian border to northern Florida. The Gulf Sea Frontier encompassed the Gulf of Mexico as far south as the border between Mexico and Guatemala,



A Boeing B-17 Flying Fortress beginning an ocean patrol from its base in the Panama Canal Zone.

most of the Florida Coast, the northern half of the Bahamas, and the eastern half of Cuba. The Panama Sea Frontier covered the Pacific and Atlantic coasts of Central America and Colombia, and the Caribbean Sea Frontier included the rest of the Caribbean and the northeast coast of South America.

To provide adequate antisubmarine measures in this vast area, the Navy needed trained manpower and specialized surface vessels. As early as 1937, it started training personnel for convoy escort duty in surface vessels, but by 1941 had only a few qualified officers for this duty. Shortly before the United States entered the war, the Navy's General Board chose the Hamilton Class Coast Guard Cutter as the ideal antisubmarine ship. It proved to be an outstanding American escort vessel, but as late as October 1942 only five were on antisubmarine convoy patrol in the North Atlantic. The Navy also had too few destroyers for its needs, even with the use of World War I-era ships, and for the first few months of the war had to rely on smaller craft, including civilian yachts, for antisubmarine patrols.

The Navy's air arm in 1941-1942 was as inadequate as its antisubmarine surface fleet. Initially, the Navy had no escort carrier, a type that eventually was very effective against the German submarines. It also lacked aircraft capable of long-range (radius of 400-600 miles) or very-long-range (radius up to 1,000 miles) patrols over the ocean.

Pre-war plans called for the Army Air Forces (AAF) to support naval forces in case of an emergency. To supplement its meager antisubmarine forces, the Navy turned to the AAF, commanded by General Henry ("Hap") H. Arnold. AAF doctrine, however, emphasized strategic bombing, and the AAF had no equipment or trained personnel for the specialized job of patrolling against, detecting, and attacking submarines from the air.

The AAF's medium and long-range bombers, including the twin-engine Douglas B-18 Bolos and North American B-25 Mitchells and the four-engine Boeing B-17 Flying Fortresses and Consolidated-Vultee B-24 Liberators, were potentially capable of an antisubmarine role. These carried bombs rather than depth charges and lacked radar or other special submarine detection equipment. Also, like the Navy, the AAF had many demands for the few aircraft on hand. The shortage of aircraft equipped for antisubmarine war continued into mid-1943, with fighters and light bombers often used as antisubmarine aircraft.

Initially, the AAF leadership considered the AAF's role in antisubmarine war to be temporary, and the major thrust of its efforts remained strategic bombing. Thus the AAF somewhat reluctantly began flying antisubmarine missions in a two-front naval war waged off both the East and West Coasts of the United States.

Operations off the West Coast December 1941–February 1943

After the attack on Pearl Harbor, the greatest danger of submarine attack apparently was along the West Coast of the United States, but the Japanese submarine fleet never presented much of a threat. Japanese strategic policy limited submarines primarily to attacks on enemy naval forces, with merchant shipping being a purely secondary target. Even if naval policy had been different, in December 1941 Japan had only twenty submarines capable of traveling from Japan to the West Coast.

During December nine of these patrolled off the West Coast, attacking ten commercial vessels and sinking one merchant ship and three tankers. Then, between February and October 1942, four other Japanese submarines patrolled off the West Coast up to a month at a time. They sank seven ships, including a submarine, and on at least three occasions attacked installations ashore, inflicting little damage. No Japanese submarines operated off the West Coast again until late 1944, when one sank two more ships.

On November 28, 1941, the AAF ordered the Second and Fourth Air Forces, the two organizations that shared responsibility for West

Adversaries in the Battle of the Atlantic

Relative Sizes of USAAF Aircraft and German Submarines



Lockheed A-29



North American B-25



Douglas B-18



Consolidated B-24



Boeing B-17



German Type VII *

100'

* The Type VII U-Boats were the most numerous German submarines in the North Atlantic.

Coast air training and defense, to support the Navy in patrolling against submarines. Their commanders worked closely with Navy authorities to institute offshore patrols that avoided duplication of effort and still covered essential areas of coastal waters.

Lack of experience and different administrative and operational methods initially clouded liaison between the AAF and the Navy. The establishment of a joint information center in late December 1941 at San Francisco helped solve the liaison problems. Differing methods of patrol created some interservice tension. The Navy used a search pattern shaped like a fan, with every aircraft branching out from a central point on diverging courses, while the Army Air Forces flew a parallel track search pattern, with each aircraft on patrol flying parallel within sight of the aircraft on either side. The AAF pilots soon adopted the fan pattern in the interest of interservice cooperation and more efficient coverage of the patrol areas. The Navy flew patrols close to the shore, but the AAF antisubmarine missions ranged up to 600 miles offshore from Seattle, Washington, in the north all the way south to the coastline of Lower (Baja) California.

In December 1941, the AAF had only forty-five modern fighter aircraft—thirty-five medium bombers and ten long-range bombers—stationed on the West Coast. To meet the immediate need for more long-range aircraft, on December 8, the AAF created a temporary collection agency of aircrews and B-17s formerly bound for the Philippine Islands. This "Sierra Bombardment Group" participated in off-shore patrols until early January 1942 when the absence of an immediate threat became obvious and scheduled movements of aircraft to the Southwest Pacific could resume.

While the Sierra Bombardment Group provided short-term relief from personnel and aircraft shortages, it did not solve problems presented by untrained, inexperienced personnel and lack of submarine detection equipment. The available aircraft were not equipped with radar or other devices, and detection of enemy submarines depended solely on eyesight. The antisubmarine aircrews occasionally mistook whales and floating logs for Japanese submarines. They frequently reported and attacked enemy submarines, but rarely confirmed results. A B-25 crew of the 17th Bombardment Group (Medium), Second Air Force, bombed a submarine near the mouth of the Columbia River on December 24, 1941. They claimed it sank, but in fact no Japanese submarine was sunk off the West Coast during World War II.

In February 1943, the AAF ceased flying antisubmarine patrols off the West Coast. Japanese submarines had not appeared off the coast since October 1942, and Navy aircraft and surface vessel strength had grown sufficiently strong to handle any new threats.

Operations off the East Coast December 1941–June 1942

In complete contrast to the West Coast, German submarine forces posed a deadly threat to U.S., British, Canadian, and other Allied shipping off the East Coast of the United States. Because of British reliance on imports, Germany's leaders sought to destroy Allied shipping. Admiral Karl Doenitz, commander of Germany's submarine force, had formulated a strategy of attacking Allied shipping at weakly defended points to achieve the greatest destruction at the least cost. Furthermore, Germany had the submarine force to pursue Admiral Doenitz's strategy. It began 1942 with 91 operational submarines; at the peak of its strength a year later, it had 212. These submarines, sailing from bases in France, took about three weeks to reach American waters. Modified to carry an extra twenty tons of fuel, they could remain on patrol two to three weeks, and averaged forty-one days at sea. Admiral Doenitz managed to extend this time by refueling and resupplying the operational submarines from specially modified submarines. Called "milch cows," they carried enough fuel and supplies to resupply other boats and extend their time at sea to an average of sixty-two days with one refueling and eighty-one days with a second refueling. The first submarine "milch cow" deployed at sea in March 1942.

The sudden entry of the United States into World War II caught Admiral Doenitz by surprise, with no submarines immediately available to send to American waters. He allocated five long-distance submarines, all he could quickly make ready, to Operation DRUMBEAT, his code name for operations against shipping in U.S. coastal sea-lanes. These sailed from Lorient, France, between December 23 and 27, 1941. On January 11, 1942, some three hundred miles east of Cape Cod, the leading submarine, *U-123*, commanded by Captain Reinhard Hardegen, sank an Allied merchant ship, the first combat loss in the American Theater. Three days later, Captain Hardegen sank another ship just off the coast of Massachusetts.

Captain Hardegen and the rest of the German submariners used tactics that Admiral Doenitz had developed during the interwar years. Usually, the submarine would lie on the shallow continental shelf in as little as 30 meters (100 feet) of water during the day, then surface to attack at night. The submarine operated on the surface to obtain a favorable position, then hit the target with two to four torpedoes. If the ship did not immediately sink, the Germans sometimes gave the ship's crew time to abandon ship, then finished the vessel off with shells from the deck gun. As German submarine commanders realized the vulnerability of Allied merchant shipping and the inability of the U. S.

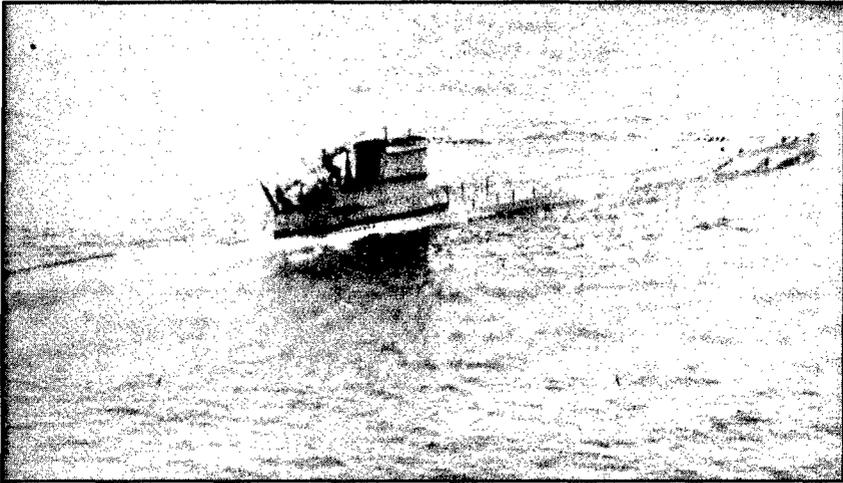
antisubmarine forces to respond or patrol, they sometimes attacked from the surface in the daytime.

Using these tactics, the Germans between mid-January 1942 and the end of June sank 171 ships off the East Coast, many of them tankers. For several months, the German submarine offensive gravely threatened the cargo carrying capability of the Allies. Not until the last quarter of 1942 did the United States build merchant ships rapidly enough to offset losses inflicted by the German submariners. During the first half of 1942, the Allies lost three million tons of shipping, mostly in American waters. The submarine attacks claimed about 5,000 lives, and the loss of irreplaceable cargoes grievously endangered Great Britain's ability to continue the war.

This perilous situation resulted in part from the tragic U.S. delay in taking such precautionary measures as controlling maritime traffic and organizing submarine defenses. German submarine captains arriving in American waters in the first half of 1942 found merchant ships following peacetime sea-lanes and sailing practices. The ships, sailing independently instead of in convoys, were silhouetted at night against the brightly lit coast, making the job of the enemy much easier. U.S. military leaders until May 1942 undertook little effective action to find and attack submarines whose positions were known through distress signals from torpedoed ships or to redirect merchant shipping away from waters where attacks had taken place. While no one reason can be cited for the delay in instituting defensive measures, the general state of American unpreparedness is perhaps the best explanation.

Early in the war the AAF and the Navy pooled their meager resources for antisubmarine patrols. In response to a Navy request, the AAF on December 8, 1941, directed the I Air Support Command and I Bomber Command to initiate patrols in the Eastern Sea Frontier. The I Air Support Command's observation and pursuit (fighter) aircraft patrolled out to 40 miles offshore from Portland, Maine, south to Wilmington, North Carolina, but usually had fewer than ten aircraft per day on patrol. The I Bomber Command relied on its medium B-25 and B-18 bombers to fly up to 300 miles offshore and its heavy B-17s to cover up to 600 miles out. On the average, however, until March 1942 this command had only three aircraft flying each day from Westover Field, Massachusetts, and three from Mitchel Field, New York, not nearly enough to patrol the Eastern Sea Frontier effectively.

The Army Air Forces obtained the assistance of the Civil Air Patrol (CAP) to augment I Bomber Command's efforts. Organized a week before the war began, the CAP consisted of civilian pilots willing to fly their own aircraft off the coast to look for submarines and to assist in the rescue of survivors. Receiving only aviation gasoline from the AAF, the CAP began patrolling on March 8, 1942, eventually establishing



Two crewmembers fire the anti-aircraft guns of a German submarine at the attacking AAF aircraft.

twenty-one stations from Bar Harbor, Maine, to Brownsville, Texas. With the help of the CAP, the I Bomber Command flew almost 8,000 hours in March, about as much as in January and February combined. The additional patrols forced German submarines to remain submerged except on the darkest nights.

As the number of patrols increased, the AAF overcame numerous deficiencies in its antisubmarine efforts. Originally, aircraft were unarmed or armed with bombs instead of depth charges. They could not fly at night and none had radar before March 1942. The aircrews lacked training in navigation, recognition of ships, and antisubmarine attack tactics. In December 1941, forced to rely on eyesight alone, they often reported incorrectly the sighting of surfaced and submerged submarines. On December 29 near Newport, Rhode Island, an AAF bomber dropped four bombs on a U.S. Navy destroyer that the aircrew had mistaken for a submarine. Fortunately, the bombs exploded harmlessly.

The United States sought the guidance of Great Britain, which had been waging antisubmarine war against Germany since 1939. As suggested by the British, the AAF and the Navy established a Joint Control and Information Center in New York City on December 31, 1941. The center tracked the movements of merchant shipping, plotted enemy contacts, and determined the locations of all surface and air antisubmarine patrols.

One British capability the Americans remained unable to exploit until mid-1943 was intelligence that virtually pinpointed the locations of enemy submarines. During the interwar period, Germany developed

a machine, called Enigma, to encipher the military codes used to transmit radio messages. Early in World War II the British, in cooperation with the French and Polish governments-in-exile, developed the means to break the German codes enciphered by the Enigma, with intelligence derived from the broken codes known as ULTRA. The British routed convoys around the locations of enemy submarine wolfpacks, using ULTRA information as well as intelligence derived from aerial reconnaissance, radio fingerprinting (identification of individual enemy radiomen by their distinctive method of sending messages), and radio direction-finding.

Shortly after the United States entered the war, Great Britain agreed to provide pertinent ULTRA intelligence to the U.S. military. However, on February 1, 1942, Germany replaced its original Enigma machines on the Atlantic U-boat net with a new, more complex machine employing more encrypting rotors, resulting in codes that the British could not decipher. Not until December 13, 1942, six weeks after the capture of German code books related to the new Enigma from a badly damaged enemy submarine, were the British able to again read the German U-boat code. (They soon discovered that the Germans had broken the Allied code directing convoy traffic, a discovery that resulted in a new British code in March 1943.) By August, the British and Americans were reading German messages almost as soon as they were intercepted, but for much of the time between January 1942 and October 1943, when the Army Air Forces participated extensively in the antisubmarine war, ULTRA intelligence was sporadic or non-existent.

To add to the intelligence woes of the Americans in 1942, the Navy initially failed to send the information it did receive from the British to the using commands. Consequently, the intelligence was not being used in operations against the enemy. Even if it were disseminated, intelligence data often lost its usefulness because it was not quickly communicated from Navy to Army organizations or down the chain of command in either service.

In large part, the intelligence lapse stemmed from the chaos and confusion that Army and Navy commands suffered in the first few months of the war. This confusion also led to faulty tactics that usually resulted in unsuccessful attacks on enemy submarines. Attacked submarines often escaped because the aerial and surface attacks were sporadic rather than sustained. Through inexperience, poor training, and lack of adequate forces, both Navy surface forces and AAF aircrews often failed to follow up initial antisubmarine attacks.

Once again the AAF and the Navy turned to the British for applied lessons in tactics. British tactics exploited the weaknesses of the submarine, which had to surface, usually at night, to recharge its batteries,

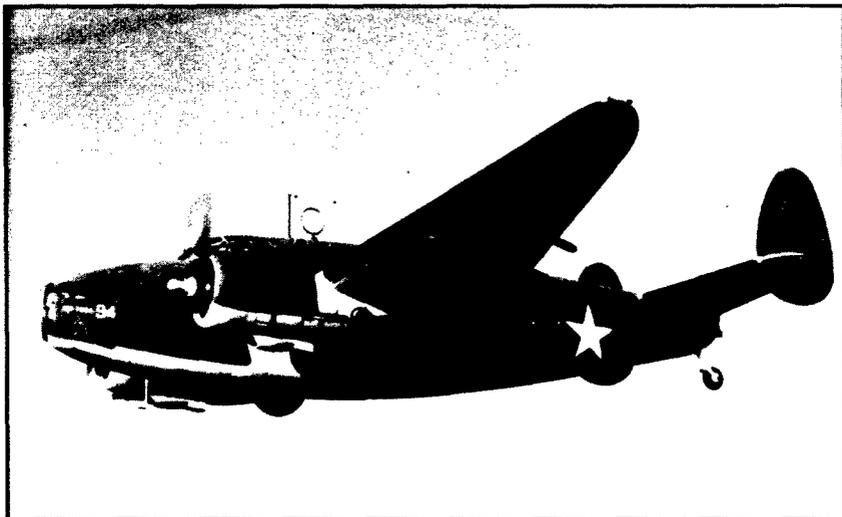
ventilate the boat, and permit crewmembers a chance to come topside. Constant aerial patrolling to as far as 600 miles out to sea restricted opportunities for submarines to operate on the surface. Until the first AAF aircraft received radar sets in March 1942, the submarines could surface and attack almost at will during dark nights or inclement weather, but the advent of night flights using radar to locate surfaced submarines added considerably to the value of the routine antisubmarine air patrol. By June 1942, I Bomber Command aircraft had vastly increased sightings of and attacks on German submarines.

As the British had learned, when an aircrew sighted an enemy submarine, it had to act quickly to achieve surprise. An attack later than fifteen to thirty-five seconds after the submarine submerged usually proved unsuccessful. By flying in clouds and attacking at an angle from fifteen to forty-five degrees, the pilot increased the chances of a hit or near-miss. The attack itself required the aircraft to fly as low as possible, preferably about fifty feet above the water, and to drop the depth bomb within twenty feet of the submarine's pressure hull. As the aircraft passed over the submarine, the aircrew would fire the machine guns in an attempt to damage it and suppress antiaircraft fire.

The first successful AAF aircraft attack on a German submarine, *U-701*, on July 7, 1942, incorporated these tactics. The official history of I Bomber Command records the attack from an A-29 piloted by Lt. Harry J. Kane of the 396th Bombardment Squadron.

Lt. Kane attacked by the bow. He was flying a routine patrol from Cherry Point, N.C. He sighted a submarine seven miles away. Since he was using cloud cover, he was able to approach it undetected, closing in on a course of zero degrees relative to the track of the submarine. He attacked from fifty feet at 220 miles per hour, releasing three MK XVII depth charges in train about twenty seconds after the target submerged. The submarine was still visible underwater as the bombs fell. The first hit short of the stern; the second, just abaft of the conning tower; the third, just forward of the conning tower. Fifteen seconds after the explosions, large quantities of air came to the surface, followed by seventeen members of the crew.

Accumulated experience—coupled with British coaching, improved radar, depth bombs, and other equipment—resulted in noticeably higher levels of success for AAF antisubmarine patrols during July, August, and September 1942. In the previous quarter, only seven of fifty-four attacks resulted in damage to submarines, but in the third quarter, eight of twenty-four attacks damaged submarines, not counting the one sunk on July 7.



A Lockheed A-29, the type of aircraft flown by the crew that made the first successful Army Air Forces attack on a German submarine in the American Theater.

By this time, the Americans owed a great deal to the British for sharing their antisubmarine experience. But in one area they appeared slow to assimilate British methods. Early in the Battle of the Atlantic, Great Britain had recognized the need for close cooperation between sea and air antisubmarine forces at higher as well as operational levels of command. But such cooperation at the higher levels of the AAF and the Navy was frequently elusive, partly because of historical rivalry. Between World Wars I and II, the two services had argued bitterly over the roles of their respective air arms, the Navy insisting on responsibility for all missions over the ocean and the Army insisting on controlling all long-range, land-based aircraft. The jurisdictional problem continued into the war and at times handicapped efforts to counter enemy submarine attacks in American waters.

Partially as a result of the jurisdictional dispute, multiple headquarters had overlapping responsibility for antisubmarine operations. Since its doctrine emphasized centralized operational control of aircraft, the AAF found this situation objectionable. To achieve centralization, General Arnold in March 1942 proposed to Admiral King the establishment within the AAF of an organization to conduct all air operations against submarines. The Navy did not accept this idea because it would give the Army a traditionally Navy mission and bring naval aircraft under Army control. Most AAF units involved in antisubmarine operations came under I Bomber Command, and, in

an effort to reduce organizational confusion, I Bomber Command was placed under the operational control of the Eastern Sea Frontier on March 26. Gradually, I Bomber Command reoriented the training of its flying personnel, obtained additional aircraft, and adapted its equipment to the antisubmarine mission. General Arnold, along with most other AAF leaders, believed that progress in bringing the AAF's antisubmarine resources and operations under one headquarters was largely offset by Navy policies. The Navy allocated the AAF antisubmarine squadrons to the sea sector commanders and would not ordinarily allow aircraft allocated to one sea sector or frontier to operate in another. Transfer of aircraft from one sea frontier to another to meet changing submarine threats proved difficult and usually too late.

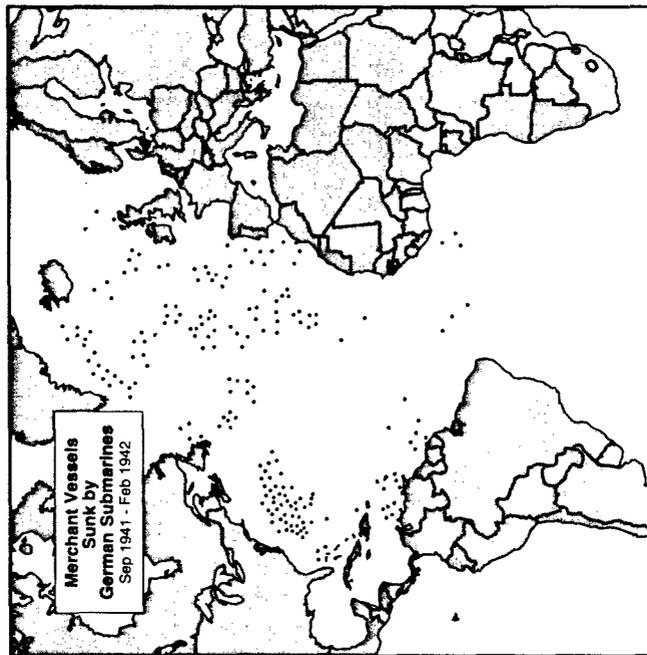
This significant difference in Navy and AAF doctrine aggravated disputes caused by interservice rivalry. The AAF perceived the Navy command structure as inflexible and its strategic concept as essentially defensive. The Navy confirmed these perceptions as it built up its forces until it could institute a coastal convoy system, one of the most important and effective defensive measures. The first convoy sailed from Hampton Roads, Virginia, southward bound, on May 14, 1942. Admiral King sought increased support from the AAF for convoy escort duties. The Army Air Forces preferred to concentrate on long-range over-water patrols, but until mid-1943, the AAF had to divert considerable aircraft to convoy escort duties, probably the best use of scarce resources.

The formation, equipping, and training of effective sea and air antisubmarine forces against the German offensive on the East Coast required time. The Navy, supported by the AAF, gradually progressed with various defensive measures and increasingly effective air patrols forced the Germans to greater caution in the waters of the Eastern Sea Frontier. By June 1942, German submariners had turned to the less dangerous waters of the Gulf of Mexico and the Caribbean Sea.

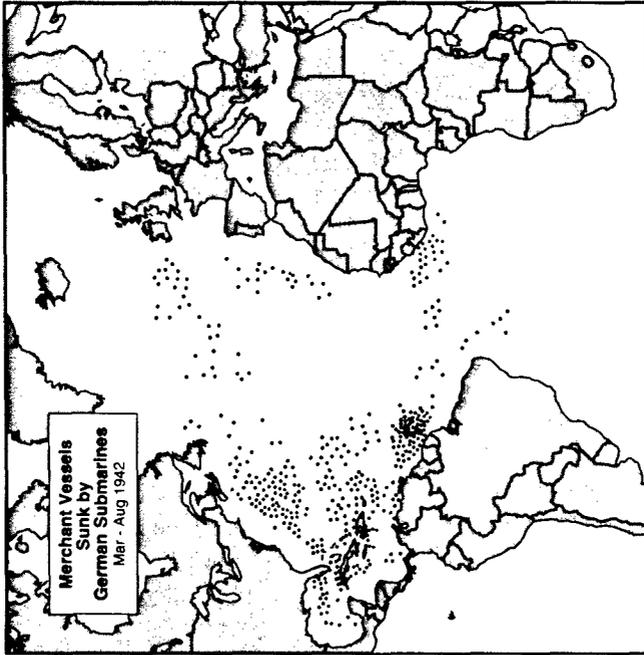
Operations in the Gulf of Mexico and the Caribbean Sea January–October 1942

Only five ships had been sunk in the Gulf Sea Frontier in the first four months of 1942, but in May 1942, submarines sank forty-one ships, totalling 219,867 gross tons, with 55 percent tanker tonnage. By July 1942, the enemy had sunk sixty-two ships in the Gulf. As many as four enemy submarines at a time prowled the Gulf of Mexico between May and August 1942, taking advantage of skimpy air patrols and the lack of a convoy system.

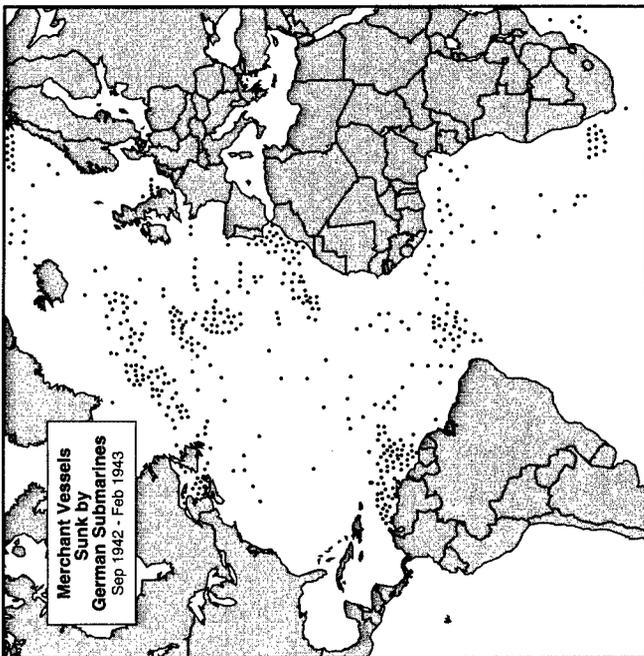
Impact of Antisubmarine Campaign on German Submarine Operations



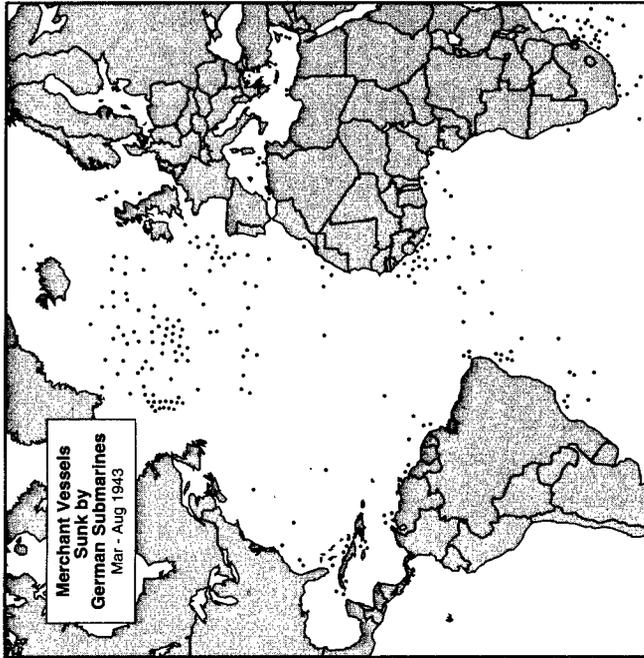
Prior to 1942, German U-boats primarily attacked shipping in the North Atlantic.



After the United States entered the war, the U-boats increasingly operated in American waters.



As submarine defenses improved, the U-boats sought safer areas, generally the convoy routes of the North and South Atlantic.

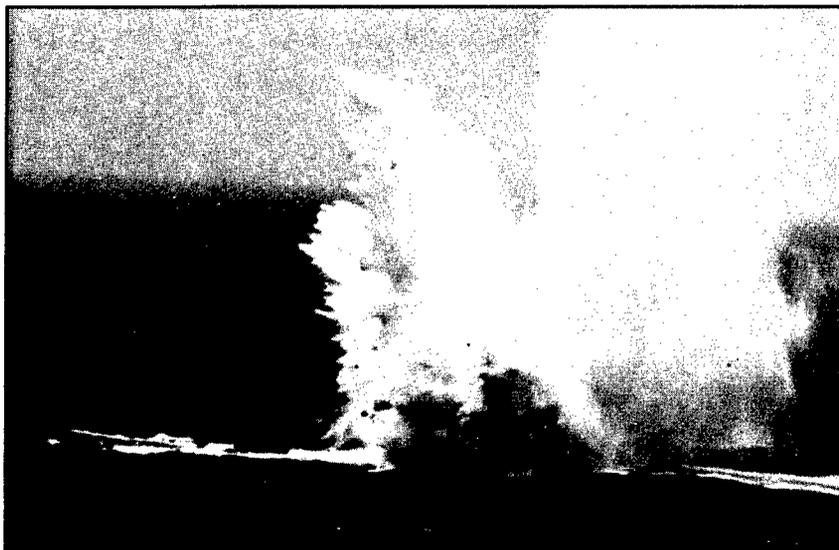


In the middle months of 1943, persistent air patrols helped diminish the U-boat threat.

The shift of the German submarine offensive to the Gulf overwhelmed the resources of the Navy and the AAF, which were barely adequate to defend against submarines in the Eastern Sea Frontier. The Navy had created the Gulf Sea Frontier in February 1942 with minimal surface and air forces, and the AAF had contributed only fourteen observation aircraft and two worn-out B-18s. To counter increased submarine attacks, the AAF, between May 8 and 10, sent a squadron of light bombers (A-29s) to Jacksonville, Florida, and six medium bombers (B-25s) to Miami and on May 20-21 sent a detachment of B-25s to Havana, Cuba, to patrol the Yucatan Channel. On May 26, the First Air Force created the Gulf Task Force and stationed it at Miami. This organization, which continued to operate until November 1942, cooperated with the Commander, Gulf Sea Frontier, to provide operational control of all AAF aircraft that flew antisubmarine patrols in the area. At the end of July 1942 the Navy instituted a convoy system in the Gulf of Mexico, and German submarines faced the same dangers they had off the East Coast. On September 4, 1942, the United States lost the last ship sunk by enemy action in the Gulf of Mexico, as Admiral Doenitz withdrew all submarines from the Gulf.

The devastation of German submarine attacks in the Caribbean Sea Frontier matched that in the Gulf Sea Frontier. Having dispatched a sizeable force to the U.S. East Coast, Admiral Doenitz fixed the opening of the Caribbean operation for the new moon period of February 1942. On the 16th, a German submarine sank two tankers off San Nicholas, Aruba, then moved into the harbor and shelled a refinery, inflicting little damage but killing four people. In February and March, the Germans operated six submarines in the Caribbean Sea, each patrolling for two to three weeks before returning to France. Then, in April, a second wave of submarines arrived in the area; some, refueled and replenished northeast of Bermuda by "milch cow" submarines, stayed up to six weeks. By July, the German submarines had sunk some 141 ships and sank another 173 ships in the Caribbean Sea Frontier and its approaches by September. Between February and September, the German submarines sank an average of one and a half ships each day, destroying over one million gross tons in the Caribbean and adjacent waters.

U.S. military leaders had been aware of possible threats in the Caribbean and the Gulf at the beginning of the war. The Army Air Forces, fearing an attack on the Panama Canal, in December 1941 transferred to the Canal Zone eighty additional fighter aircraft, nine heavy bombers, and four mobile radar sets. In February 1942, the Sixth Air Force assumed responsibility for the aerial defense of the Panama Canal. Major General Davenport Johnson, Commander of the



A depth bomb exploding near the stern of a U-boat caught on the surface sends spray high in the air.

Sixth Air Force, concentrated aerial patrols on the Pacific side in fear of a carrier-borne Japanese attack. Then in April 1942, when the German submarine threat became evident, the Sixth Air Force, cooperating with the Navy, instituted antisubmarine patrol flights as far east as Curaçao. Most flights were by tactical aircraft, such as Bell P-39 Airacobras and Northrup A-17s, which could fly only during daylight; lacking radar and trained observers, the pilots had little luck in spotting enemy submarines. On the other hand, Sixth Air Force aircraft occasionally attacked friendly ships and submarines, fortunately without damaging them.

The AAF in February 1942 organized a provisional force, later designated the Antilles Air Task Force. Scattered about the Caribbean in Trinidad, Curaçao, Aruba, St. Lucia, Surinam, British Guiana, Puerto Rico, St. Croix, and Antigua, it consisted of about forty B-18 medium bombers, seven Douglas A-20 Havoc light bombers, and several fighter aircraft. Although remaining substantially the same size through the year, the task force obtained radar-equipped aircraft, vastly increasing its antisubmarine capability. Prior to July the aircrews reported few sightings of or attacks on submarines, but in July and August attacked twenty. To supplement these efforts, the First Air Force sent six B-18s equipped with radar to the Caribbean Sea Frontier. This unit, shuffled from one island and commander to another from August to November 1942, accomplished little.

The Navy extended the convoy system to the Caribbean Sea Frontier, with the first convoy sailing on July 10, 1942, between Guantanamo, Cuba, and the Canal Zone. In reaction, Admiral Doenitz redeployed his submarines to the Trinidad area where targets were lucrative and relatively unprotected. In August, the submarines sank only one ship in the rest of the Caribbean while destroying ten near Trinidad. Because of the extensive Caribbean air patrols, the submarines attacked independently, continuing their success into September, sinking an additional twenty-nine ships totaling 143,000 tons.

The AAF stationed detachments of B-18s at Trinidad, Curaçao, Dutch Guiana, and British Guiana in June 1942; but these aircraft, lacking radar, could not stem the German efforts in the area during July and August. On August 17, to aid the Caribbean Sea Frontier, the AAF sent a detachment of B-18s equipped with microwave radar to Key West, Florida. The detachment, which always patrolled the Trinidad area, moved to other bases in the Caribbean and was based at Trinidad between September 22 and October 16, 1942.

Operations of the AAF Antisubmarine Command October 1942–August 1943

By October 1942, the AAF had been engaged in antisubmarine war for almost a year. During that time it had laid the basis for an effective organization and made plans for a larger antisubmarine force. To take advantage of these plans, the AAF on October 15, 1942, activated the Army Air Forces Antisubmarine Command (AAFAC) to replace I Bomber Command, which held most of the AAF's antisubmarine resources. I Bomber Command furnished the personnel, aircraft, and equipment for the new organization, which remained under Navy operational control. The AAFAC provided a greater unity of command of antisubmarine forces in the War Department, resulting in increased flexibility and more effective operations. The I Bomber Command had been handicapped in its efforts because its primary mission remained long-range bombardment. The antisubmarine task was secondary and presumably temporary. "Now," in the words of the official history of the Army Air Forces in World War II, "as an officially constituted antisubmarine unit, the AAFAC was able to attack its problems with undivided energy, free at least from any immediate uncertainty as to its mission." The reorganization extended to subordinate elements as well. By November 20, 1942, the AAFAC had organized the squadrons it had inherited from I Bomber Command into the 25th and 26th Antisubmarine Wings with headquarters at New York and Miami respectively.

In January 1943, the command had only nineteen squadrons and only twenty B-24s, the aircraft type most useful for long-range antisubmarine patrolling. The command grew rapidly until, by September 1943, there were twenty-five antisubmarine squadrons, most of which flew B-24s modified for antisubmarine war. At the end of 1942, most of these squadrons operated in the Gulf, Caribbean, and Eastern Sea Frontiers on endless patrols with few sightings and fewer attacks. The Navy continued to require the AAFAC to commit sizeable forces in these areas to counter what was a diminishing German threat—the five to ten submarines that Admiral Doenitz kept along the U.S. coast and in the Caribbean Sea. From September 1942 until mid-1944 these few submarines maintained pressure on the American antisubmarine forces. To counter the submarine threat in the Caribbean, the AAF Antisubmarine Command continued to fly patrols and escort coverage from Cuba. These operations, which had begun as early as June 1942, generally kept the German submariners from making successful attacks in the Caribbean Sea Frontier, although two ships were sunk there as late as July 1943.

The Germans found the hunting more profitable in the area of Trinidad until mid-year 1943. The AAFAC consequently based B-18s at Edinburgh Field, Trinidad, from early January until August 1943. In November and December 1942, German submarines sank eighteen ships. Increased aerial patrols paid off with no losses of friendly ships near Trinidad from January to July 1943. During this time, the AAF B-18s engaged mostly in convoy escort and coverage missions. In July–August, German submarines sank four merchant vessels. The AAF antisubmarine squadrons, flying both B-24s and B-18s, made six attacks and participated in two killer hunts to foil the enemy offensive in Trinidad waters.

In addition to the Trinidad area, the German submarines operated extensively in the South Atlantic Ocean in 1943, where merchant vessels sailed independently because there was no convoy system. The AAFAC sent a detachment of B-24 aircraft in May from Trinidad to Natal, Brazil, to patrol the South Atlantic sea-lanes at ranges beyond the reach of the Brazilian Air Force. The next month, the detachment moved to Ascension Island, added two more aircraft, and flew patrols over the South Atlantic Ocean until August 1943.

Although important, the AAFAC's operations from October 1942 in the Eastern Sea Frontier, the Gulf Sea Frontier, and the Caribbean Sea Frontier constituted only a small part of the war against the German submarines. In fact, by mid-summer 1942, the U.S. Navy's and the AAF's antisubmarine warfare efforts had forced Admiral Doenitz to withdraw most of his forces from these areas. The German submarines moved back to the North Atlantic to exploit

weaknesses in Allied antisubmarine efforts there. Consequently, the AAFAC turned to the reinforcement of the meager antisubmarine air forces in Newfoundland.

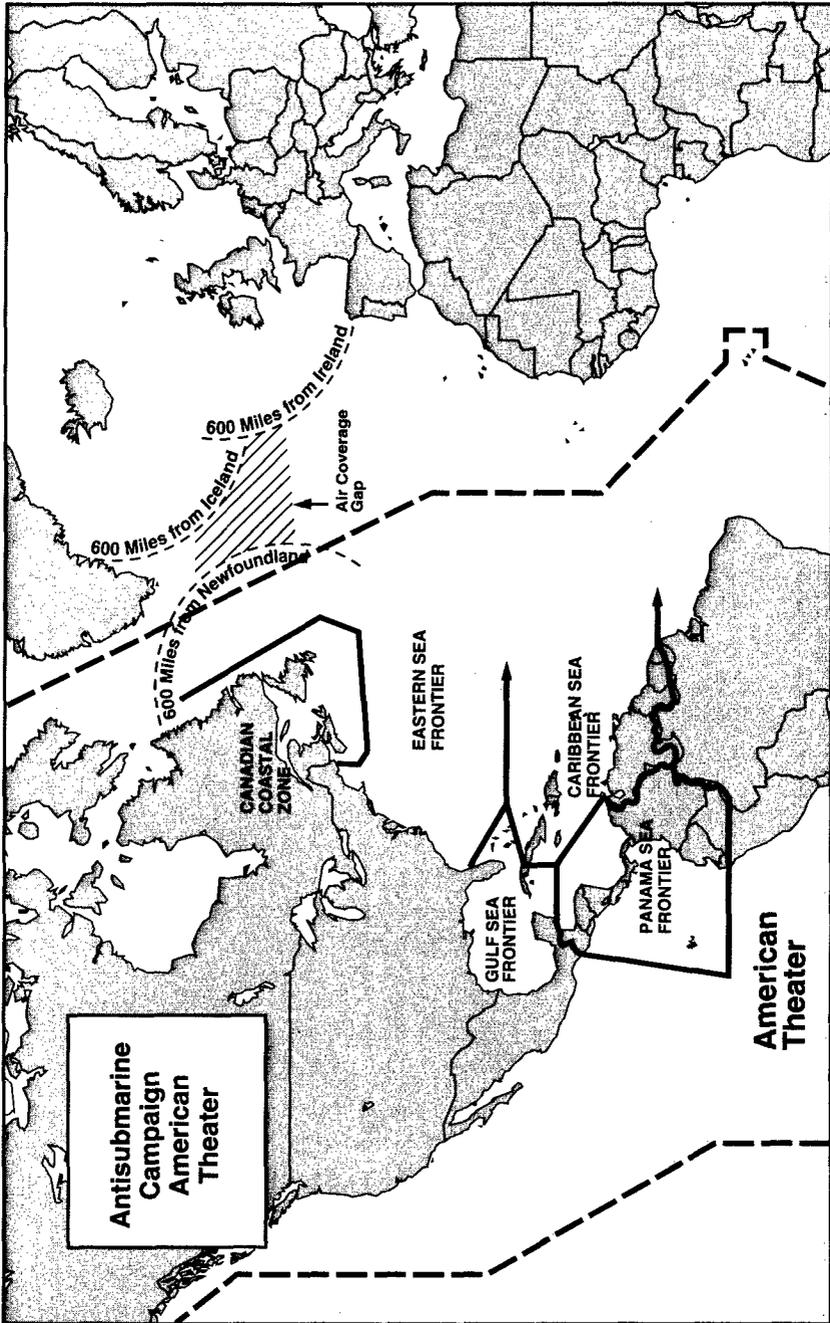
Operations from Newfoundland October 1941–July 1943

In October 1941, far to the north, an AAF detachment of four to six B-17s had begun antisubmarine patrols over the northwest Atlantic Ocean from Gander Lake, Newfoundland. The B-17s were armed with machine guns and bombs but carried no radar or depth charges. In July 1942, the 421st Bombardment Squadron, also flying B-17s and with a primary mission of long-range bombardment training, replaced the detachment. The squadron cooperated with Royal Canadian and U.S. Navy organizations in Newfoundland to carry on its secondary mission of antisubmarine war. Then, in the fall of 1942, the AAF Antisubmarine Command made antisubmarine patrol the squadron's primary mission, redesignating it the 20th Antisubmarine Squadron.

The 421st had replaced the B-17 detachment in Newfoundland even as the Germans increased submarine activity in the 500-mile gap between 25 and 45 degrees West longitude that the Allies could not cover with land-based aircraft. This gap in air coverage allowed the German submarine wolf packs to attack convoys without being spotted or attacked from the air. Admiral Doenitz organized the submarines in two screens running in a northwesterly direction at either end to catch the convoys as they sailed into the gap. The sea-lanes northeast of Newfoundland, marking the eastern edge of Allied air coverage, were especially dangerous.

The Allied convoys sailed under several other disadvantages from September 1942 until March 1943. Fuel shortages kept them close to the shortest track to and from Great Britain. Winter weather favored the submarines which often approached the convoys without being detected until too late. For most of 1942 the British could not decipher Enigma transmitted code, but the Germans could read the Allied convoy code. The Germans located and intercepted Allied convoys more frequently and successfully during this period than at any other time in the war.

Germany redeployed its submarines to the mid-Atlantic in June and July 1942, and the offensive became effective in July and August. By then, the enemy had eighty-six submarines in the North Atlantic, and approximately this number remained operational there until June 1943. In August and September 1942, the submarines located twenty-one of sixty-five convoys that sailed, attacked seven, and sank forty-three Allied ships.



During the Allied Conference in January 1943 at Casablanca, French Morocco, Great Britain and the United States agreed to deploy B-24 aircraft to patrol the mid-Atlantic gap. Modified B-24s, with a radius up to 1,000 miles, could fly day or night in all but the worst weather to detect and attack submarines. The British immediately began operating B-24s from bases in Ireland and Iceland to cover the eastern part of the gap, but the U.S. Navy did not send any aircraft to cover the western stretches of the mid-Atlantic. During February 1943 twenty-two ships totalling almost 200,000 tons were lost, mostly in the western gap. The next month in the Atlantic, the Allies lost thirty-eight ships of 750,000 tons and an escort in four convoys.

On March 18, a B-24 detachment of the 25th Antisubmarine Wing established a headquarters at St. John's, Newfoundland, and began antisubmarine patrols on April 3, 1943. By the end of the month the AAF Antisubmarine Command had three B-24 squadrons operating from St. John's and Gander Lake, Newfoundland. The squadrons engaged in convoy coverage and in broad offensive sweeps ahead of the convoys. In April and May they made twelve sightings of German submarines, which resulted in three attacks, but the B-24s did not sink a submarine.

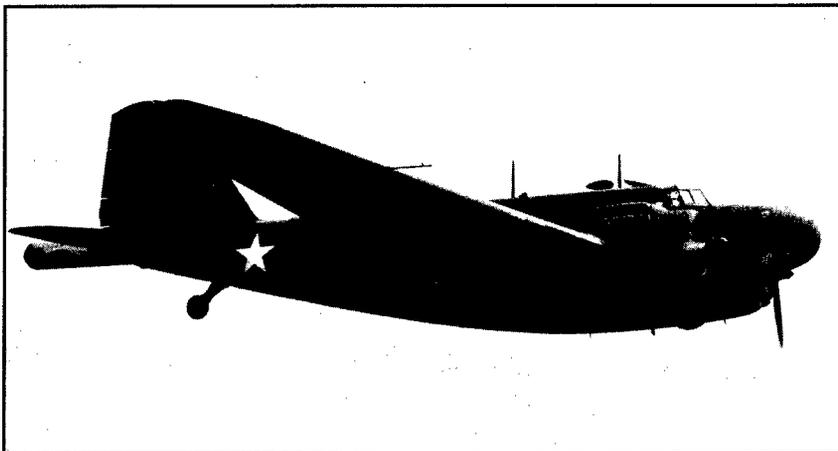
During April 1943, Allied long-range B-24 aircraft and escort carriers closed the mid-Atlantic gap in air coverage, effectively neutralizing the German submarine offensive. That month the Germans sank only three Allied merchant vessels while losing four submarines. In May Germany lost thirty-one submarines in the North Atlantic, and on May 26, Admiral Doenitz withdrew his boats from the North Atlantic, essentially conceding victory to the Allies in the Battle of the Atlantic. Almost 1,700 Allied ships crossed the ocean in June and July 1943 without a loss.

Development of Antisubmarine Equipment and Tactics

Admiral Doenitz recognized that improvements in Allied tactics and weapons had turned the tide of war against the German submarines. He noted in a memorandum dated June 1943:

The war at sea is at present characterized by a decrease in the victories of our Navy against enemy merchant shipping. The principal exponent of this type of warfare, the submarine, is limited in operational capacity by the ever-growing strength of the enemy's antisubmarine defenses and in particular by the enemy Air Force, using as yet unknown equipment and weapons.

The "unknown" equipment and weapons owed their existence at least in part to the 1st Sea-Search Attack Group which General Arnold



A pre-war Douglas B-18, when equipped with a magnetic anomaly detector boom and nose radar, was a formidable threat to U-boats.

established on June 17, 1942, at Langley Field, Virginia. The group engaged in the development of equipment and tactics best suited for aerial antisubmarine warfare. Among the devices that the group helped develop or test were the absolute altimeter, the magnetic anomaly detector (MAD), the radio sonic buoy, improved airborne depth charges, long-range navigation, and airborne microwave radar.

The absolute altimeter used a modified microwave radar to determine an aircraft's exact altitude to within ten feet. This altimeter, replacing the less accurate barometric instrument, permitted aircraft to fly safely as low as 50 feet. The low altitude attack substantially improved the chances of destroying the target. This device was standard equipment on AAF antisubmarine aircraft by 1943.

The magnetic anomaly detector operated by sensing a change in the magnetic field of the earth, an anomaly that could be produced by the steel hull of a submarine. Aircraft outfitted with this device would patrol in an area where a submarine had been spotted but had submerged. Combined with the use of a radio sonic buoy to listen for the sounds of a submarine, the MAD permitted an intensive search with a high probability of success.

Another important development was the use of LORAN (long-range aid to navigation). The aircraft received radio signals from three known points, allowing the navigator to pinpoint his location to within four miles at a range of 1,200 to 1,500 miles from transmitters. LORAN permitted efficient control of converging forces. LORAN coverage extended over the Eastern Sea Frontier, Gulf Sea Frontier, and most of the Caribbean Sea and North Atlantic Ocean.

The 1st Sea-Search Attack Group also helped develop an effective depth bomb with shallow fuse settings for about 25 feet. Eventually, the Americans and British developed a blunt depth bomb that sank slowly and exploded at the desired depth to destroy the submarine. This depth bomb became standard in early 1943.

Perhaps the most important task of the 1st Sea-Search Attack Group was to develop techniques for using Airborne Surface Vessel Detection (ASV) radar to find surfaced submarines. The radar that eventually went into production was ten-centimeter wave equipment, known as ASV-10. The British had developed a long-wave ASV radar and used it to find submarines in 1941-1942. As early as March 1942, the I Bomber Command had four B-18s outfitted with the long-wave radar sets, but the Germans outfitted their submarines with a long-wave radar detector that effectively countered the British radar. The United States quickly developed the microwave radar, which the Germans never effectively countered. The first microwave sets were hand-manufactured and delivered to the 1st Sea-Search Attack Group in June 1942. By February 1943, a skilled radar operator could identify surfaced submarines at more than 40 miles and even the conning tower of a boat running decks awash at 15 to 30 miles.

Radar sets were notoriously unreliable and difficult to maintain, and scientists assigned to the 1st Sea-Search Attack Group found much of their time consumed by seminars in the field on basic functions and maintenance of equipment. Consequently, the AAF established a unit in the group to train ground personnel in its proper maintenance.

Initially the ASV-10 radar sets were placed on B-18 medium bombers flying antisubmarine patrols. Some 90 B-18s carried the equipment by the end of June 1942, but the Allies needed the microwave radar on the B-24. Equipped with auxiliary fuel tanks, microwave radar, and a powerful search light, this very long-range bomber was ideal for extended antisubmarine patrols. The AAF outfitted its first two microwave radar-equipped B-24s in September 1942, and the 1st Sea-Search Attack Group acquired a squadron of B-24s in December.

Using the B-18s and B-24s assigned to it, the 1st Sea-Search Attack Group trained combat crews in the tactical employment of new equipment. In general, the Army Air Forces employed three broad types of antisubmarine operations: routine aerial patrol of waters in which an enemy threat might exist; air escort or coverage of convoys within range of land-based aircraft; and intensive patrol of an area in which one or more submarines had been spotted, an operation the AAF termed a "killer hunt" (in contrast to the Navy expression "hunter-killer"). At various times, each of these operational tactics had its place in the antisubmarine war.

Early in the war, the Army Air Forces usually used the aerial patrol to restrict and hamper enemy operations. Such flying required precise navigation and reliable communications, and the crew had to identify surface craft accurately to avoid attacks on friendly vessels. However, an aircrew on routine antisubmarine patrol could fly hundreds of hours without sighting a submarine. As most German submarines withdrew in the summer of 1942 from American waters, the routine patrols, with virtually no chance of spotting an enemy submarine, became the nemesis of the Army aircrews.

Aerial escort of convoys came close to being as resented as the routine patrols. The AAF considered these antisubmarine operations to be primarily defensive in character, but they were absolutely essential to prevent enemy submarines from attacking convoys. After the institution of the coastal convoy system on May 15, 1942, the Navy frequently called on the Army Air Forces to protect convoys, initially between Key West and the Chesapeake Bay, later in the Caribbean.

Although convoy duty was essential, the AAF preferred the offensively oriented killer hunt. This tactic most effectively used the newly developed sonic buoys, magnetic anomaly detectors, and microwave radar. A patrolling aircraft that spotted and unsuccessfully attacked a German submarine would radio its location to its home base. The information would be passed on to Navy authorities, who would dispatch a force of ships and aircraft to maintain contact with the submarine and attack it as the opportunity arose.

The killer hunt took large numbers of aircraft and surface vessels from normal convoy escort and patrols, and the Navy did not regularly employ it until mid-1943. The escort aircraft carriers used this tactic very effectively against German submarines, including the "milch cows." The escort carriers coupled with ULTRA allowed the Allies to attack not just defensively, as in convoy escort, or fortuitously, as in aerial patrol, but also actively by seeking out the enemy submarines. Between June and October the escort carriers, guided by ULTRA intelligence, located and destroyed nine of the ten refueling submarines operating in the Atlantic Ocean.

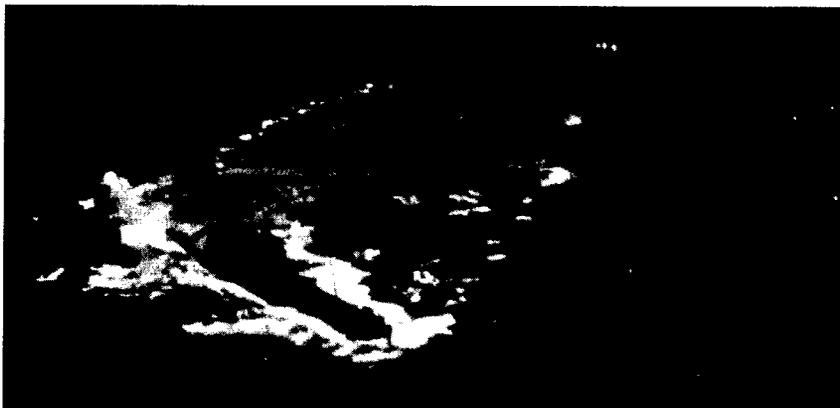
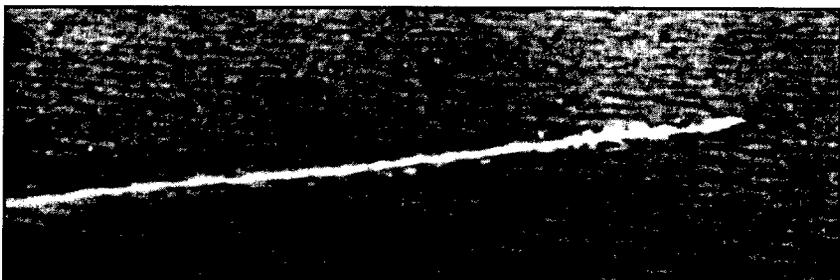
The first killer hunt to result in a destroyed submarine occurred much earlier in the Gulf Sea Frontier on June 10-13, 1942. A German submarine, *U-157*, sank a ship north of Cuba on the night of June 10. Within three hours, a radar-equipped B-18 out of Miami was patrolling in the vicinity and early on the 11th unsuccessfully attacked the surfaced submarine. Other AAF B-18s in the area contacted and attacked the submarine several times over the next two days. Meantime, five Navy ships out of Key West sailed to the area. Making sound contact with the submerged submarine on the 13th, the Navy crews sank it with depth charges.

Dissolution of the AAF Antisubmarine Command

The killer hunt involved close cooperation among the operational forces of the U.S. Army Air Forces and the U.S. Navy. Unfortunately, this cooperative attitude did not lessen interservice rivalry concerning organization, control, and use of land-based aircraft. The AAF deemed the Navy's continuing operational control of its aircraft an intolerable situation, especially since the Navy kept most of the Antisubmarine Command's aircraft on endless patrol off the East Coast. To meet the AAF's objections and achieve better control and coordination between the services, U.S. Army Chief of Staff, General George C. Marshall, proposed in April 1943 a centralized antisubmarine organization under the Joint Chiefs of Staff. Admiral King rejected this proposal but on May 20, 1943, established the Tenth Fleet, a Navy command with jurisdiction over all antisubmarine activities. Although the Tenth Fleet brought needed order to the American antisubmarine effort, Army leaders remained unhappy because the AAFAC remained under the Navy's operational control. Besides, in the opinion of General Arnold and the AAF leadership, the Navy appeared to be duplicating the AAF's efforts. By this time, the Navy was receiving large numbers of B-24s to use on antisubmarine patrols.

On July 9, 1943, after several meetings, the Army and the Navy agreed that the AAF would withdraw from antisubmarine operations. In accordance with this agreement, the AAF by October 6 turned over seventy-seven B-24s configured with antisubmarine equipment to the Navy in return for an equal number of unmodified B-24s from the Navy allocation. On August 31, the Army Air Forces redesignated the AAFAC as the I Bomber Command and assigned it to the First Air Force, redesignating the antisubmarine squadrons as heavy bombardment squadrons. The 25th and 26th Antisubmarine Wings were disbanded, but two antisubmarine groups overseas continued operations into October 1943 before being inactivated. Thus, the AAF ended its antisubmarine mission, mostly disdained in spite of its strategic significance as temporary and secondary to the AAF's responsibilities as a strategic bombing force.

German submarines sank fewer than twenty ships in the Atlantic Ocean between September 1943 and the end of the war. Still, the submarine threat tied down large Allied naval and air forces. Hitler recognized the Atlantic Ocean as his first line of defense in the West and the danger of the antisubmarine forces if they should be released to undertake other military tasks against Germany. Thus, the submarines operated until the end of World War II, even returning in small numbers from time to time to the Caribbean Sea or the East Coast of the United States.



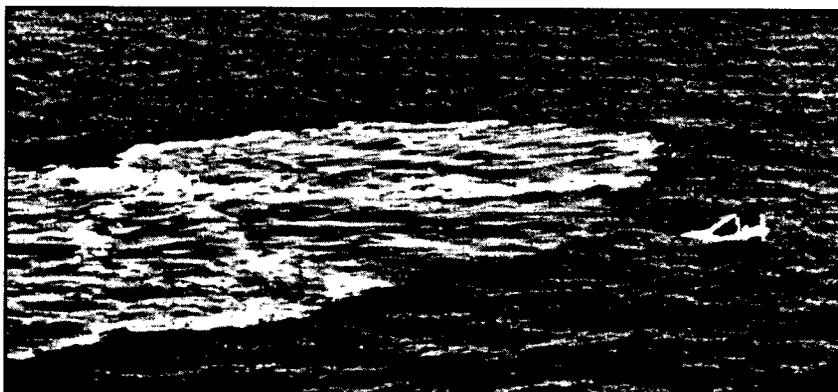
Death of a Submarine.

Top—the long white wake of a sub cruising on the surface.

Above—the submarine desperately attempts to evade an attack.

Right—exploding depth bombs straddle the submarine.

Below—after the attack, only debris and the bow show as the sub settles to the bottom.



AAF Contributions to the Antisubmarine War

Statistics underline the menace of the German submarine offensive. Submarines sank over 2,600 Allied ships, totaling about 15,000,000 tons. Germany built 1,162 submarines, of which 785 were sunk, 156 surrendered at the end of the war, and the rest scuttled or otherwise destroyed. German submarines operated between September 1939 and May 1945 not only in the North Atlantic and American waters but also in the South Atlantic, Caribbean Sea, Gulf of St. Lawrence, Mediterranean Sea, Indian Ocean, Kola Inlet in North Russia, as well as around the Cape of Good Hope and along the coasts of Australia and Brazil.

During the Battle of the Atlantic the Canadians and the British sank most of the German submarines destroyed in the American Theater. The U.S. Navy and the AAF cooperated with Canadian and British forces to stifle the German submarine offensive off the East Coast, in the Gulf of Mexico and the Caribbean Sea, and in the North Atlantic Ocean. Since the Japanese made relatively few submarine attacks off the West Coast, the AAF contributions there mostly amounted to reassuring the public and governmental officials that antisubmarine operations were in place to defend shipping and deter the enemy.

During the war, increasingly effective antisubmarine air patrols resulted from deployment of modified B-24s, development of various finding aids and other technological advances, and experience in the specialized tactics of hunting and attacking submarines. After the war, Admiral Doenitz cited the radar-equipped very long-range B-24 as a decisive factor in the defeat of the German submarines in the North Atlantic. The AAF and the U.S. Navy explored the best tactical combination of radar, depth bombs, and the magnetic anomaly detector in the aerial search for submarines. Working together at the tactical level, the two services conducted a successful offensive action against enemy submarines, helping to turn the tide of submarine war against the German submarine fleet within about eighteen months.

As part of the overall Allied antisubmarine effort, the Army Air Forces significantly affected the outcome of the campaign. In terms of the force available, the AAF increased its antisubmarine force from a few obsolete observation aircraft, medium bombers, and B-17s, all without radar, to 187 operational B-24s, 80 B-25s, 12 B-17s, and 7 Lockheed B-34 Venturas, most equipped with microwave radar and other detection equipment. These 286 aircraft were assigned to the Antisubmarine Command when, on August 24, 1943, the AAF withdrew from antisubmarine operations in the American Theater. In this theater, AAF aircraft flew over 135,000 operational combat hours on antisubmarine

patrols. Altogether, the Army Air Forces participated in ninety-six attacks on German submarines between December 7, 1941 and August 24, 1943. These statistics do not include the contribution of the AAFAC in the Antisubmarine Campaign, European-African-Middle Eastern Theater, nor of the Army Air Force's bombers which frequently attacked the German submarine bases and sometimes sank submarines anchored in their berths.

The AAF's antisubmarine campaign harassed the Germans to the point of ineffectiveness. Even the efforts of the small unarmed Civil Air Patrol aircraft in the shallow coastal waters contributed to this outcome. The German policy from the beginning of the war was to withdraw from areas that became too dangerous because of heavy aerial patrols. By May 1943, Germany had lost the strategic initiative in the Battle of the Atlantic. Aircraft had forced the enemy to submerge so frequently and stay down for such extended intervals that their targets escaped and U-boat activity became so handicapped that the returns barely justified the expense.

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