APPENDIX 2

# A Summary of Patrol Aircraft Ordnance Equipment

THE AIRPLANE, THE SUBMARINE and the aircraft carrier were new technologies developed primarily in the first half of the twentieth century that changed the face of naval warfare. No change of similar major proportions had been experienced since the middle of the previous century, when steam, armor plate, breech-loading guns and torpedoes overturned the centuries-long dominance of wooden sailing ships. The development of ordnance for aircraft was part of the process that lead ultimately to the demise of the armored ship as the "Queen of Battle" and pitted patrol aviation against its principal adversary—the submarine.

This appendix was written to provide a brief overview of patrol aircraft ordnance equipment. It is by no means a definitive work on patrol aircraft ordnance equipment. This subject would require volumes to adequately chronicle the entire history and development of patrol aircraft ordnance equipment.

## Pre-World War I

THE FIRST AIRCRAFT PURCHASED by the Navy from Glenn Curtiss and the Wright Brothers were far too frail to do much more than get airborne with one or two people aboard. Nonetheless, the first intrepid Navy pilots were determined to find useful tasks for the fledging Naval Aviation. On 26 October 1912, Lieutenant John H. Towers began tests over Chesapeake Bay to determine the ability to spot submarines from the air. He concluded that they could be seen best from 800 feet only when the submarines were running a few feet below the surface. The waters of the bay were too muddy for a fair trial of the idea. A few months later, in January 1913 the test was repeated when the aviation section was on exercises with the fleet at Guantanamo Bay, Cuba. Lieutenant (jg) Patrick N.L. Bellinger reported that submarines could be seen clearly beneath the surface. The tests were largely ignored at that time, however, some of the senior officers admitted the value of aircraft as airborne observation posts when the pilots were able to help the battleships spot the fall of shot during gunnery exercises.

Naval Aviation's first true test under fire came on 6 May 1914. Lieutenant (jg) Bellinger's Curtiss AH-3 hydroaeroplane was hit by Mexican rifle fire while locating artillery targets during the operations at Veracruz, Mexico, the first marks of combat on a Navy plane. The AB-3 flying boat based on *Mississippi* (BB 23) was also used by the Aviation detachment during flight operations to spot mines around the fleet anchorage in Veracruz harbor. Once a mine was located, escort vessels fired upon the large horned mines until they detonated.

By 1916, improvements in the strength of airframes and development of more powerful engines enabled aircraft to finally hoist aloft a useful load. WWI at this point had been raging in Europe for nearly two years. By then, the Allied powers and Germany had both conducted bombing and strafing missions. On 28 July 1916, Lieutenant (jg) Victor D. Hersbster conducted the first Navy bombing tests at Indian Head Proving Grounds, Stumpneck, Md. This was the first time that bombs had been carried aboard U.S. Navy aircraft. In these early experiments, small bombs were carried in racks in the rear observer's cockpit. Each was released separately by hand over the side of the aircraft. Needless to say, it was an extremely hazardous way of unloading live bombs. So dangerous in fact, that on 8 November 1916, Lieutenants Clarence K. Bronson and Luther Welsh, were killed at Indian Head by the premature explosion of a bomb in their plane. This accident served to accelerate the development of bomb racks placed under the wings.

The art of artillery spotting was further refined from previous tests with the fleet at Guantanamo Bay, Cuba, when, on 5 August 1916, Lieutenant Patrick N. L. Bellinger spotted mortar fire for Army shore batteries at Fort Monroe, Va. Bellinger, flying the AH-10, signaled his spots with Very pistol flares.

## World War I

BOTH SIDES IN THE EUROPEAN conflict had used fixed and movable machine guns since the middle of

1915. However, there were no lightweight machine guns in the inventory of the U.S. Navy that could be carried by existing aircraft. This was particularly ironic since the Germans were using a machine gun invented by an American, Hiram Maxim, and the British were using a machine gun developed by another American, Lieutenant Colonel Isaac N. Lewis, U.S. Army Coast Artillery. Captain Charles DeForest Chandler, USA, commanding officer of the flying field at College Park, Md., fired a Lewis gun from a Wright Model B at an altitude of 250 feet on 7 June 1912. But it was not until 8 January 1917, that a French designed Benet-Mercie machine gun was fired from a Navy aircraft, the AH-10, while flying 200 feet over Pensacola, Fla.

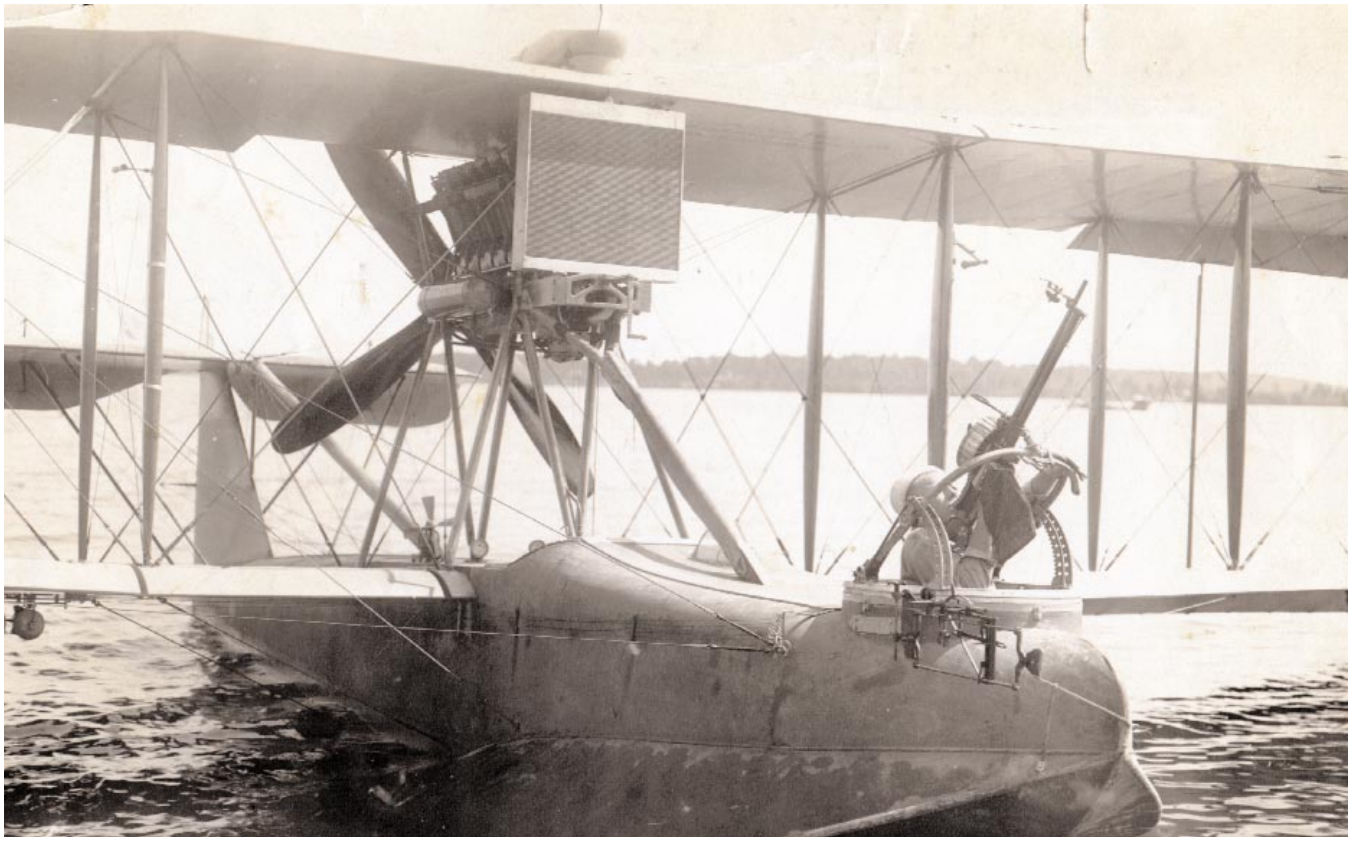
As the inevitability of U.S. entry into the war became more apparent, the Navy received the authorization needed to gear up for the conflict. War was declared on 6 April, but it wasn't until a month later on 5 May 1917, that a test was conducted with a Berthier machine gun synchronized to fire through the propeller of an aircraft. This test was conducted with a Curtiss R-3 while it was sitting on the beach and taxing on the bay. At the start of U.S. involvement in WWI there were no standard machine guns in use by the U.S. Navy. An Aviation Ordnance Section was established in the Bureau of Ordnance as part of the Gun Mount Section. This section became a fully autonomous organization by March 1918.

The British Lewis machine gun manufactured by Savage Arms, was the first to be selected as an aircraft gun. The first deliveries of the new weapons began to arrive in January 1918. They were a lightweight air-cooled machine gun having a 97-round pan magazine. During the same period, several other weapons were ordered for operational trials. One thousand Marlin aircraft guns were purchased but not delivered until July 1918. Upon receipt they were quickly put into service.

*The Lewis gun on a patrol boat.*

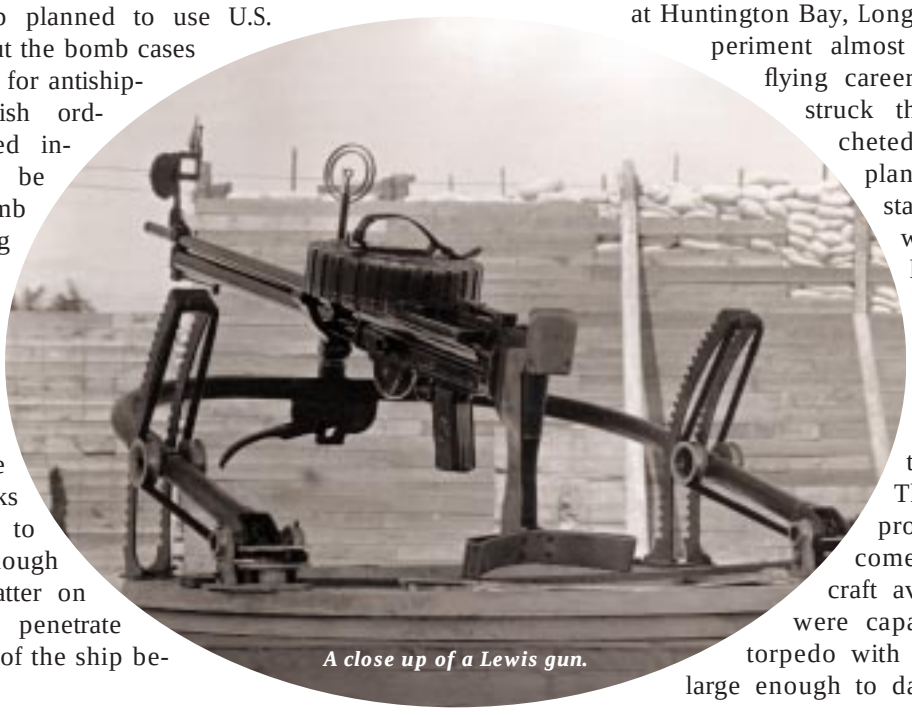
One of the oddest weapons ordered and actually used in operation by Navy patrol aircraft during the war was the Davis non-recoil gun. This strange looking tube-like weapon was open at both ends with the projectile recoil balanced by a rearward discharge of birdshot and vaseline. The weapon, an early version of the recoilless rifle, mounted a Lewis machine gun on top for aid in sighting. The device was designed specifically as an antisubmarine weapon with enough punch to penetrate the pressure hull of German U-boats. This weapon was designed for mounting in the bow of the flying boats. With all the struts and wires between the wings, the gunner, however, had to be very careful where the rear of the device was pointed before pulling the trigger.

Depth bombs were another antisubmarine weapon under development at the start of WWI. Effective antishipping demolition bombs were also under development. Three sizes became standard in the U.S. Navy: a 163-pound light case bomb, a 230 and a 270-pound bomb. The most common ordnance load for large patrol flying boats was two 230-pound bombs, one under each wing. U.S.



*The Lewis gun on a patrol boat.*

bombs were used by coastal patrol aircraft based in the continental United States, while units assigned abroad used English, French and Italian ordnance. Units assigned to British bases used 100, 230 and 520-pound bombs and units assigned to French bases used 52, 75 and 150-kilogram bombs. In March 1918 the Northern Bombing Group planned to use U.S. Army bombs, but the bomb cases proved too light for antishipping and British ordnance was used instead. To be effective, a bomb needed to be big enough to rupture the hull of a vessel with a near miss. Smaller bombs could be used to penetrate the armored decks but they had to have a thick enough case to not shatter on impact and to penetrate into the bowels of the ship before exploding.



***A close up of a Lewis gun.***

The U.S. Navy Bureau of Ordnance began experiments with torpedoes in 1914. While not a new weapon to the world's navies (it had been invented by Whitehead in 1880), it had not been carried aloft by aircraft. The first drop from an airplane took place on 14 August 1917, by Lieutenant Edward O. McDonnell at Huntington Bay, Long Island, N.Y. The experiment almost ended McDonnell's flying career when the torpedo struck the water and ricocheted, nearly striking the plane. After this shaky start, additional tests were conducted by lowering the torpedoes by cable. After trying both methods, it was decided that dropping in free flight still gave the best results. There were still other problems to be overcome. None of the aircraft available to the Navy were capable of delivering a torpedo with an explosive charge large enough to damage a modern ar-

mored warship. This fact retarded development of the aerial torpedo carrier until after WWI when more powerful engines and larger aircraft became available to make this form of attack feasible.

## Period Between the Wars, 1918–1941

TORPEDOES FINALLY CAME INTO their own during this period and were deemed by many the best antishipping weapon then available. One common refrain often heard during fleet exercises was "if you want to fill 'em with air, bomb 'em; if you want to fill 'em with water, torpedo 'em." On 27 September 1922, 18 PT aircraft using Mark VII, Model 1 "A" torpedoes, with dummy warheads, attacked the target *Arkansas* (BB 33). Analysis of the exercise emphasized the artificial nature of the exercise and prevented the practice from demonstrating the combat capability of either the surface or air units. However, the outstanding fact demonstrated was that torpedoes could be successfully launched from aircraft and be made to run straight.

There were a variety of torpedo types in stock by 1937 and all were used in the first two years of WWII. Some were designed for use by submarines, while others were for use by surface vessels and still other models were for aircraft use. The training constraints during the depression prevented the use of live warheads and the correction of any defects. One of the greatest shortcomings of American naval ordnance during the first year of WWII was the unreliability of the torpedo. Confidence in this key weapon was lost when torpedoes fired against enemy ships either failed to explode or ran amok when released.

Effective armor-piercing (AP) bombs were not developed by the U.S. Navy between the wars because near misses did not produce pressure-wave damage to surface ships equal to similar weight light-case bombs. The Navy and Army bombing tests in July 1921 had established that no matter how well the warship was compartmentalized, aircraft armed with 1,000 to 2,000-pound general purpose bombs could sink it with a near miss, a fact that Brigadier General Billy Mitchell delighted in pointing out to the public and Congress over the next decade. What he failed to point out, and the Navy failed to emphasize, was that the tests were conducted on stationary ships with no personnel on board to render any defense or damage control.

Machine guns had been significantly improved in both size and weight since the end of WWI. Most forward firing guns were now mounted within the forward fuselage to improve streamlining. The 30-caliber M2 air-cooled Browning was the standard weapon for Navy aircraft, with a cyclical rate of 1,100 rounds per minute, and a muzzle velocity of 2,600 to 2,740 feet per second. A heavier machine gun, the 50-caliber M2 air-cooled Browning had been developed for aircraft use. This weapon had a cyclical rate of 750 to 850 rounds per minute, and a muzzle velocity of 2,865 to 3,100 feet per second. The XPBM-1 Mariner seaplane in 1937 was the first Navy aircraft to mount single 50-caliber guns in turrets.

Depth bombs for antisubmarine operations were needed because ordinary bombs had little value for such operations since submarines could usually submerge in time to avoid being hit on the surface. The tactics required bombs with a high percentage of filler and hydrostatic fuzes that could be set to detonate the charge far enough below the surface to destroy a submerged submarine. The need for depth bombs was recognized by the Bureau of Ordnance, and designs were drawn up during the 1930s, but production of this new design weapon was not initiated. No such bombs existed when the United States first joined the war against the Axis. It was not until after the U.S. entered World War II that depth bombs were fully developed and produced.

Signaling and illumination devices had also been improved. Pilots no longer used the small Very pistol of WWI to signal. A larger pyrotechnic pistol with a much larger charge and multiple balls of various colors that provided a greater assortment of signals was used by pilots. Parachute flares, which could be launched by hand or dropped from bomb racks, produced 300,000 candle power that burned for approximately 3 minutes. As aircraft speeds increased, newer aircraft were equipped with flare chutes that were carried within the fuselage of the aircraft.

## World War II

THE ULTIMATE ANTISUBMARINE weapon used by Navy patrol aircraft in WWII was undoubtedly the depth bomb. Aircraft-type depth bombs had not been manufactured at the start of the Neutrality Patrol in 1940. The first types to become available were based on a 1930 design, the Mark 17, weighing 325 pounds, filled with TNT and having a hydrostatic fuse that could be set for different depth. The weapon was intended for low-release, and was not ready in quantity until the early spring of 1942. A second design, the Mark 29, became available in the summer of 1942, weighing 650 pounds. It also was a low-release weapon. Many patrol plane crews were justifiably cautious with this bomb, as it reached depth quickly when the fuse was set for a shallow depth and exploded, sending powerful shock waves over the departing aircraft. Bomb "skip" was another problem encountered with the early round-nose models. If the bomb was released to low it would strike the water and rebound into the air, often striking the aircraft.

*Aircraft depth bombs receive a fresh coat of paint from aviation ordnancemen, 80-G-K-15110.*

This problem was lessened in later designs by producing bombs with a flat nose. The power of the weapon was improved in 1942, when stable TNT was replaced by more powerful, but more sensitive TORPEX. This in turn was replaced by the less sensitive HBX making the weapon safer to handle.

Retrorockets were first successfully test fired on 3 July 1942. The retrorocket was fired backward from a speeding airplane to counter its forward speed. The rockets proved particularly effective when used with Magnetic Anomaly Detection (MAD) gear, which detected the submarine when directly above. VP-63 received the first service installation of this weapon in February 1943. On 24 April 1944, the squadron scored its first kill with retrorockets and MAD gear, sinking the *U-761* in the approaches to the Straits of Gibraltar.

Patrol aircraft used parachute stabilized acoustic homing torpedoes for the first time in the war when VPB-103 and VPB-110 were equipped with the Mark 24 torpedo (FIDO) in April and July of 1943. On 25 April 1945, VPB-110 sank the *U-1107* in the Bay of Biscay using the new weapon.

Mines dropped by patrol aircraft were another effective weapon developed during WWII. Three types of mines were dropped from Navy patrol aircraft during the war. The magnetic influence mine, Mark 12 Mod 1, was detonated by the magnetic properties of a passing vessel's metal hull. It was a copy of a German device washed up on a beach in England and was quickly reproduced and put into production in 1940. The dip-needle type, Mark 10 Mod 6, was a derivative of the magnetic mine, but with greater reliability. The subsonic acoustic mine (Mark 25 and 26), was activated by underwater low frequency sound waves, and was generally considered unsweepable. The pressure mine (Mark 25 and 26 variant), activated by changes in

water pressure caused by a passing ship, was also considered unsweepable. All mines were equipped with a stepper switch which determined how many ships could pass before the mine would detonate.

Navy patrol aircraft carried the smaller Mark 10 and 12 mines on wing mounts. The larger Mark 25 (2,000 pound) and Mark 26 (1000 pound) mines were carried in internal bomb bays. During WWII U.S. Navy patrol aircraft in the Pacific dropped 3 percent of all the mines used against the Japanese. The USAAF dropped the remaining 97 percent. The following are statistics of the mining campaign: over 2,000,000 tons of shipping sunk or damaged (25 percent of the pre-war Japanese merchant marine); a total of 21,389 aircraft mines laid during 4,700 aerial mining sorties; only 65 aircraft lost due to operational causes; key enemy bases were abandoned due to mining at Palau and Penang; and ports closed include Shanghai, Hong Kong, Takao, Bangkok, Singapore, Balikpapan, Surawaya, Kure, Sasebo and Hiroshima.

Rockets used by the U.S. Navy during the war were developed from the British 3.5 inch rocket in late 1942, with a 20-pound solid head and a 3.5 inch motor. These rockets weighed 55 pounds and were propelled by a powerful motor that traveled at 1,175 feet per second. They were effective to 60 feet underwater. This type of ordnance proved particularly effective in piercing the tough pressure hull of enemy submarines that conventional 50-caliber projectiles could not always penetrate. An improved rocket carried a 5 inch high-explosive head. By early December 1943, the first Mark 4 rocket launchers were being fitted to Navy PV-1 Ventura aircraft for use on ASW patrols. The new rockets saw their first combat use by Marine squadron VMTB-134 flying TBFs from Green Island against the Japanese at Rabaul on 15 February 1944. The effective range and penetration of this weapon was further improved in the 5-inch HVAR (High Velocity Aircraft Rocket, or "Holy Moses") series.

Machine guns used during WWII were basically the same models developed between the wars, with minor improvements in performance. The smaller 30-caliber guns were being replaced in the second year of war by the M2 50-caliber model. Stellite barrel linings reduced wear and improved the service life of these weapons. The design was upgraded to 1,200 rounds per minute by 1943 and redesignated M3. The PB4Y-2 Privateer patrol bomber used the new M3 guns exclusively, making it the most defensively armed and armored aircraft in the world at that time. Experiments were begun to find replacements for the 50-caliber M2 early in the war. The 60-caliber machine gun was one of the designs considered to replace the 50-caliber M2. Design work was based on the German Mauser 20-mm machine gun Model 151 of 1939 but development was not completed before the end of the war. However, a 20-mm design based on the Type 404 Hispano-Suiza was developed and installed in combat aircraft before the end of the war.

The U.S. did not design new armor piercing bombs until after the start of the war. The weapons capable of being carried by a new generation of aircraft included 1,000-pound and 1,600-pound bombs capable

*A close up of the port waist twin .50 caliber machine gun on a PB4Y, 80-G-K-14546.*

of penetrating 8 inches of armor. High altitude attacks, for which AP bombs were designed, were seldom undertaken by Navy aircrews since practical experience with the much-touted Norden bombsight had shown that high altitude drops against moving surface targets resulted in few hits. Most Navy AP bomb drops were by dive bombing aircraft that were able to provide the velocity necessary to penetrate armor. Demolition and semi-armor piercing (SAP) bombs were favored by patrol bomber crews due to the better blast effect at masthead heights. These bombs were literally skipped into the side of the ship from extremely low altitude. The down side to this tactic was estimating correct altitude to compensate for the shock wave from the blast effect. This was made somewhat safer by 1944 when fuses developed for these tactics became available.

Some of the more interesting pieces of ordnance used in the war were the glide bombs. The Navy began its first project with a device called the Pelican, tested by VPs 152 and 153 using the PV-1 Ventura twin-engine patrol bomber. The Pelican used a standard 500-pound bomb casing for the body and had a 10-foot wing span. It depended on radar painting by the mother aircraft to guide it to the target. On 12 October 1943, the Bureau of Ordnance established a production program for 3,000 Pelican guided missiles at a delivery rate of 300 a month. Unfortunately, tests in mid-1944 were failures resulting in cancellation of the project on 18 September 1944. A second glide bomb, called the Bat, used a 1,000-pound bomb case for its body and was similar in size and appearance to the Pelican, but had its own internal radar to paint the target. Being considerably larger than the earlier Pelican, the Bat required the services of the four-engine PB4Y-2 Privateer patrol bomber as a mother ship. On 6 February 1945, CNO directed VPB squadrons 109, 123 and 124, of Fleet Air Wing 2, be equipped to employ the SWOD (Special Weapons Ordnance Device) Mark 9 (Bat) glide bomb in combat. By the time the squadrons arrived in the South Pacific it was too late in the war to find large ship targets. Nonetheless, the weapon proved somewhat effective and sank a destroyer escort, several transports and damaged land targets. The Bat missile was the first fully automatic target-seeking missile used by any of the combatants during the war.

In tests conducted off Cape May, N.J., on 8 March 1945, another innovative device, a rocket powered Gorgon air-to-air missile was launched from a PBY-5A. Tests of the weapon proved somewhat inconclusive, but improvements on the missile continued after the war as developments in electronics refined the accuracy of the homing system. The Germans faced the same problems with their surface-to-air and air-to-air missile programs and fortunately were not able to solve the problem before the end of the war.

Problems with guidance systems early in the war led to the development of a hybrid drone bomb in 1944 designed specifically to destroy U-boat pens and V-1 sites in France. On 3 September 1944, Lieutenant Ralph Spalding, USN, of the Special Air Unit, FAW-7, flew a TORPEX-laden PB4Y-1 Liberator from an airfield at Feresfield, England, set the radio control and parachuted to the ground. Ensign James M. Simpson, controlling the drone's flight from a PV-1 Ventura, sought to hit submarine pens on Helgoland Island. Unfortunately, he lost view of the plane in a rain shower during the final alignment, hitting a barracks and industrial area on Dune Island instead. A second attempt to use this manned/radio-controlled weapon resulted in the death of Lieutenant Joseph P. Kennedy, Jr., USN, when the explosives aboard detonated prematurely.

## Post World War II to 1950

DESPITE NEW DEVELOPMENTS during WWII, the principal machine gun serving as the standard armament for all patrol aircraft at the end of the war was still the reliable, time-tested Browning 50-caliber. New weapons still under test during the war began to be issued for operational use in late 1945. The 20-mm gun developed from the Hispano-Suiza Model 404 in late 1941, designated AN-M2, had a cyclical rate of 750 rounds per minute and a muzzle velocity of 2,800 feet per second, providing much greater striking energy than the 50-caliber guns. All but the first few P2V-2 Neptunes in 1947 housed six of these guns in the nose with two more in the tail turret.

Navy progress in guided missiles benefited greatly from analysis of German projects at the end of the war. On 12 March 1946, CNO directed the continuance of Bat, Gorgon II-A and III-A testing programs begun in the final years of WWII. In May, VPs 104 and 115 were designated as the lead squadrons for the operational introduction of the Bat (SWOD 9). On 14 August 1946, CNO directed that the terminology SWOD and Pilotless Aircraft (P/A) be dropped in favor of the standardized term guided missiles. The first Naval Air Missile Test Center was established at Point Mugu, Calif., to conduct tests and evaluation of guided missiles and components. The proliferation of missile types under development by the services prompted the Army and Navy to adopt a standard system of designating guided missiles on 30 April 1947. The designations A (Air), S (Surface) and U (Underwater) were combined to indicate their function. Thus, a surface-to-air missile was designated SAM. Names assigned to the designations were as follows: ASMs would be named for birds of prey, AAMs for other winged creatures, SAMs for mythological terms and SSMs for astronomical terms or bodies.

On 8 May 1948, the Michelson Laboratory of the Naval Ordnance Test Station, China Lake, Calif., was established. The former testing facility became a research and development center for rocketry and guided missiles. A similar facility for rocketry was constructed on the East Coast with the establishment of the U.S. Naval Aeronautical Rocket Laboratory, Lake Denmark, N.J.

Development of conventional gravity bombs languished during the new atomic age. In September 1948, 12 P2V-3C Neptunes had most of their armament removed to enable the aircraft to carry a 9,700-pound 14-kiloton, Mark 1 atomic bomb. Some of these aircraft retained their tail turret. This model was designed for interim use onboard the Navy's Midway-class carriers. Subsequent models of the Neptune patrol aircraft, the primary patrol bomber in the Navy, lacked any defensive armament, retaining only the bomb bays and external wing mounts for offensive conventional armaments (GP bombs, rockets, etc.). Following the introduction of the early P2V-5s, the glazed nose fairing and MAD gear tail housing replaced the nose and tail gun positions on these aircraft.

## Korea, 1951–1953

AT THE BEGINNING OF THE Korean War the U.S. entered combat with the weapons used at the end of WWII. New developments were slow to enter operational use for patrol aviation. Patrol squadrons directly involved in the conflict flew the same PBM and PB4Y-2 aircraft that had entered service in 1944. Radar had improved, but the ordnance was essentially the same. One improved device used to great effect by patrol squadrons was pyrotechnical (flare) equipment. The date 12 June 1951 marked the first use of flares by patrol squadrons for night operations since WWII. Two P4Y-2s (PB4Y-2) of VP-772 were transferred from NAS Atsugi, Japan, to Pusan K-1, South Korea, to fly flare-dropping missions for Marine Corps night attack aircraft. In October 1951 patrol squadron VP-871 flew similar missions over Korea, earning the squadron its nickname, "Big Red," for the red night illumination flares they dropped for allied air and ground units. These night missions by patrol squadrons prevented the North Koreans and Chinese from overrunning Marine Corps positions during the war.

One important development in ordnance during this period was the acoustic torpedo. Although not used during the Korean Conflict, the Mark 34 parachute stabilized acoustic torpedo came into the patrol community inventory in 1951 after it was first tested by VP-57. It was a design developed from the original mark 24 (FIDO) first brought into service in 1943.

## Post Korean Period, 1954–1959

THE POST KOREAN WAR period can justifiably be called the real beginning of the guided missile age. As mentioned previously, the trend with patrol aircraft was to reduce or entirely eliminate the onboard defensive ordnance in exchange for offensive bomb or rocket payloads. On 3 April 1956, the Petrel, an air-to-surface guided missile designed for use against surface shipping, was put into its first operational use with on P2V-6Ms assigned to VP-24. On 22 November 1957, VP-834 from NAS Floyd Bennett Field, N.Y., fired the Petrel, becoming the first reserve patrol squadron to fire guided missiles as part of its regular training.

During the latter part of WWII operational use was made of acoustic torpedoes dropped from patrol aircraft in the war against the U-boats. The Korean War presented no enemy vessels against which to test the Mark 34 acoustic torpedo, since the primary antagonists, China and North Korea, were land powers with no significant naval forces. Development of torpedoes continued and in 1956 the Mark 44 Mod 1 torpedo was introduced for use by patrol aircraft. This lightweight, air-launched antisubmarine torpedo continued in service through the 1970s. Its range extended to 18,000 feet, with a depth limit of 985 feet.

On 1 December 1959 an era ended when the Bureau of Naval Weapons replaced the Bureau of Ordnance and Bureau of Aeronautics. The Bureau of Ordnance and Bureau of Aeronautics had been responsible for the development of aviation ordnance for almost four decades.

## Vietnam Conflict, 1959–1973

UNLIKE THE PREVIOUS CONFLICT in Korea, the Vietnam confrontation offered numerous opportunities for the testing of a new generation of airborne weaponry over an extended period of time. In July 1962, the first P-3A Orion became operational with VP-8 at NAS Patuxent River, Md. This land-based patrol aircraft was to become the principal airborne ASW platform of the Navy through the end of the twentieth century. VP-50 was the first to deploy with a full complement of Orions to NAF Cam Ranh Bay, RVN, on 1 May 1968. The offensive load of the aircraft consisted of mines (Mark 52 and 36), conventional or nuclear depth bombs and rockets or torpedoes that were carried in the forward fuselage bay and on wing racks. Sonobuoys and markers were carried in the aft fuselage. The Mark 46 Mod 1 air-launched torpedo began to enter service in 1966 as a replacement for the earlier Mark 44 Mod 1. The newer Mark 46 had a range of 36,000 feet, to a depth of 1,500 feet. New mines were also deployed. The Mark 52 weighed 2,000-

pounds, and the Mark 36 weighed in at 500-pounds. On 11 April 1972, the first Harpoon antiship missile was launched from 20,000 feet by a P-3A Orion assigned to the Point Mugu Missile Test Center. The AGM-84 Harpoon was designed to be launched from aircraft or ships at a standoff range against enemy ship targets. Delivery to fleet units began in 1977. The introduction of the new P-3B Orion in 1965 included a provision for the Bullpup ASM-N-7 (B), air-to-surface missiles with a liquid fuel propellant, first tested by VP-6 on deployment in August 1967. VP-1 fired the last Bullpup missile in July 1978, the same month that it was removed from the inventory.

## Post Vietnam, 1974–1990

THE POST VIETNAM PERIOD extending to the end of the Cold War saw continued development of the basic Orion airframe in use by all the Navy's patrol squadrons. In August 1977, the P-3C Update II was delivered to the Navy with the necessary control system for Harpoon missiles. On 7 June 1982, the Block 1B Harpoon missile with an improved radar-guidance system was delivered to the Navy. The Harpoon was programmed to be the Navy's basic antiship missile for the rest of the century. On 14 June 1988, VP-62 became the first reserve patrol squadron to fire the AGHM-84 Harpoon missile. The missile was launched from one of the squadron's new P-3C UIII Orion aircraft. Mine warfare was upgraded in the Orion with the introduction of the new Mark 53 mine, capable of operation from greater depths with more sensitivity. VP-4 was tasked with the operational testing of the new Mark 50 parachute stabilized acoustical torpedo in October 1988. This weapon has a range of 45,000 feet to a depth of 1,970 feet.

During the decade of the 1970s and 1980s the Rockeye cluster bombs and Zuni 5-inch rockets were added to the P-3's armament.

## The Last Decade of the Twentieth Century

THE GULF WAR AND THE NEW AGE of littoral warfare defined the last decade of the twentieth century. The fate of Navy patrol aviation came into question on 17 April 1990 when Lockheed formally delivered the last P-3 Orion to the U.S. Navy in a ceremony at Palmdale, Calif. The P-3 was scheduled to be replaced by the P-7A, LRAACA (Long-Range Air Antisubmarine Warfare Capable Aircraft), under a contract awarded by the Navy to Lockheed on 14 October 1988. On 20 July 1990, the Navy terminated the P-7A maritime patrol aircraft program with Lockheed for default. No replacement aircraft is planned for the foreseeable future. While electronic warfare updates have continued apace with the currently existing airframes still in service, only the Mark 50 Barracuda air-launched torpedo, which entered U.S. Service in 1990, has been added to the maritime patrol inventory. The Maverick missile was tested by VP-11 in 1993 as a replacement or potential alternative for the Harpoon at the end of the decade.

In 1998, the AGM-84E SLAM (Standoff land-attack missile) capability was installed in the AIP (Antisurface Improvement Program) version of the P-3C Update III and gave patrol crews a substantial littoral strike capability.