Naval Aviation–A Century of Evolution

For a brief glimpse of the role that technology has played in Naval Aviation's development during the 20th century,* NANews *turned to two of our most trusted sources: Roy Grossnick, Head of the Aviation History Branch of the Naval Historical Center, and Hal Andrews, our technical advisor. In the following pages, Mr. Grossnick highlights a few key technological advances, and Mr. Andrews describes the little-recognized role of the people who made those technologies reality.

JO1 Joshua M. Hudson

By Roy Grossnick

During the 20th century, technological advancements have played a greater role in dictating military strategy than ever before, particularly the development of the flying machine. The evolution of Naval Aviation operations is a result of improved technology bringing about new equipment, strategies and missions.

I believe the first significant technical product in Naval Aviation was the long-distance flying boat developed during WW I. It allowed the Navy to marry an

Behind the Scenes of New Technology

Tom Wildenberg

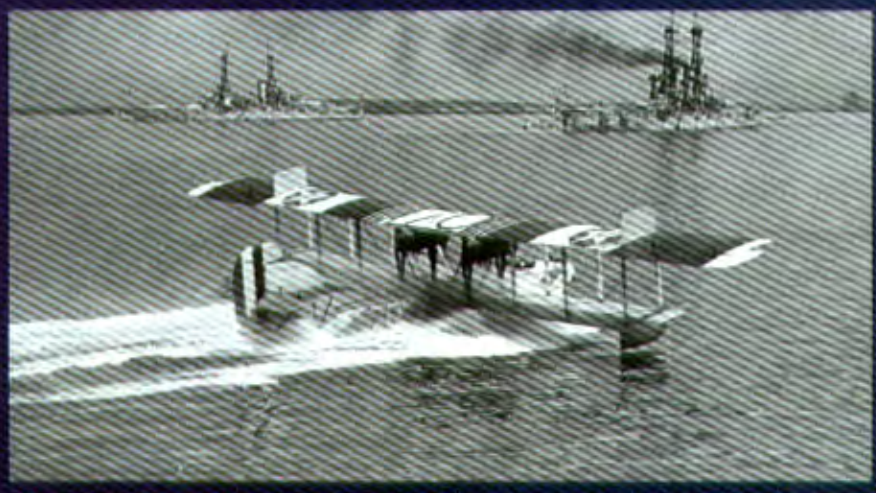
By Hal Andrews

I have had a technical association with Naval Aviation for the last 55 of its 88 years, and in that time I have observed that pilot, aircrew and airplane noteworthy events have regularly received wide attention, while the people behind the scenes generally have not. These stalwarts comprise large numbers of Navy and Marine Corps uniformed personnel and civil service, industry and technical specialists. Together with some more technically oriented Naval Aviators, these people have kept Naval Aviation at the forefront of advancing aeronautical technology.

aviation machine with fleet operations in order to expand the capability of sea power. In essence, it was the initial and major means of taking air power to sea.

In WW I the flying boat operated from bases in England, France, Italy, Ireland and the United States. It flew coastal and long-range patrols, searching for enemy submarines as well as providing convoy coverage and search and rescue support. Shortly after the end of the war the NC-4 flying boat made the first transatlantic flight. The success of the long-range flying boat provided Naval Aviation with the footing necessary to continue technological development in the coming decades.

The 1920s brought impressive progress that advanced carrier aviation, such as the development of aircraft equipped with oleo struts and folding wings to enhance operating capability aboard carriers, as well as refinements to arresting gear designs. But perhaps the most important innovation was the radial air-cooled engine. This design provided the type of power plant needed for an aircraft to operate successfully aboard an aircraft carrier with more efficiency, reliability and less maintenance than its predecessor, the liquid-cooled engine.



The F-5L was one of the long-range flying boats developed during WW I, shown here operating with fleet battleships, circa 1920.

By the end of the first decade of the 20th century, the U.S. Army was exploring use of aeroplanes, but operating them from the Navy's ships required further innovation. As Glenn Curtiss experimented with "hydroaeroplanes," his invitation for a Navy officer to be trained was accepted in early 1911. Lieutenant T. G. Ellyson actively participated in further development of the first seaplanes, including the first two purchased by the Navy, which he piloted on their Navy acceptance tests. He became the first of a handful of trained naval pilots at the Navy's first "operating base" on Greenbury Point, Annapolis, Md.

Jerome C. Hunsaker

The subsequent flying activities of early Naval Aviators have regularly been recognized. Less noticed are the nonflight activities of two naval constructors (similar to today's engineering duty officers) who became major figures during Naval Aviation's first two decades. Holden C. "Dick" Richardson was a hands-on engineering officer, also trained as a Naval Aviator, and Jerome C. Hunsaker was trained at the Massachusetts Institute of Technology (MIT). Both became leaders as aircraft evolved in the years leading up to U.S. entry into WW I. Richardson initiated work in seaplane hydrodynamics and catapults at the Washington Navy Yard where wind tunnel and engine test facilities were added to the towing tank already there for ship hull testing. Hunsaker created and led the Navy's first aircraft engineering and acquisition management organization after creating the first aeronautical course at MIT. Both played major roles in the Navy's outstanding WW I performance by Navy crews flying U.S.- designed and built flying boats in antisubmarine warfare (ASW) combat against German submarines. Many of these aircraft were products of the Naval Aircraft Factory, Philadelphia, Pa., which was built from scratch and producing aircraft a year after the United States entered the war.

Hunsaker and his mixed military and civilian engineering and management staff carried over into the Navy's new Bureau of Aeronautics (BUAER) in 1921. As flight testing with quantitative results became more important in the mid-1920s, two individuals became BUAER leaders for the next quarter century. Walter S. Diehl was brought onto Hunsaker's staff as an ensign

The SBD *Dauntless* played a leading role in the decisive battles of Coral Sea and Midway. First assigned to an operational squadron in 1938, the *Dauntless* flew in combat throughout the war.

This development was a pivotal factor in enhancing carrier aviation's evolution during the 1920s.

Technical developments in the 1930s were largely refinements of aircraft equipment and components. Radios were improved and reduced in size. Bombing sights were made more accurate. Aircraft were equipped with supercharged power plants and controllable-pitch propellers. Efficient retractable landing gear, better structural design and improved aircraft configurations, such as the switch from biplanes to monoplanes, resulted in enhanced aerodynamics. These changes contributed to more dependable equipment, improved aircraft performance and new methods of tactical employment. The Douglas SBD *Dauntless* epitomized the improvements in aircraft during the 1930s. This successful monoplane dive-bomber went on to prove its worth during WW II, particularly during the Battle of Midway when it successfully sank four Japanese carriers.

Four great technological developments came out of WW II that continue to play an important role. Airborne radar, missiles, jet engines and the helicopter are major components of Naval Aviation operations today, and will continue to be in the future.

during WW I, and Edward W. Rounds was a WW I Naval Aviator who became a BUAER civil service engineer and, as a reservist, a test pilot at NAS Anacostia, D.C. Together they established procedures that evolved into the Navy standard for flight testing new aircraft designs, with contractor testing followed by a separate Navy evaluation. (This procedure continued through the 1980s when modern digital data technology enabled the creation of integrated Navy/contractor flight test teams.) The 1920s also saw air races, carriers and their aircraft, and record-breaking patrol flying boats receive widespread attention. At the same time, both officers and civilian personnel in BUAER's propulsion group were instrumental in continuing advances of the air-cooled radial engine for both civilian and military applications.

By Pearl Harbor, Navy aircraft, like others, had reached an airframe plateau, but radar systems were progressing in both technology and service use in a manner paralleling that of computers today. To meet the need for trained technicians for ship, shore and aircraft radar systems, the Navy created a formal training program. After qualifying for the 10-month program, roughly one quarter of the selectees spent the final six months becoming proficient in maintaining and operating all the widely used airborne radar and related advanced radar systems at Naval Air Technical Training Center Ward Island, Corpus Christi, Texas. About 10,000 were rated as aviation radio technicians and sent to ship and shore assignments by V-J Day—myself among them.

Walter S. Diehl

The airborne early warning (AEW) system is one essential current carrier-based system directly traceable to WW II radar developments. The Cadillac AEW system entered the fleet in 1945 as a high-powered radar carried by a modified TBM *Avenger* and linked by a radio relay to the carrier's combat information center (CIC). The product of a typical cooperative venture among several Navy organizations led by MIT's Radiation Laboratory, its development was expedited to defeat the late-war kamikaze threat. Due to this experience at the end of the war the Navy installed the airborne components and a full CIC in modified WW II Army B-17 bombers to create an Airborne Early Warning and Command Center called Cadillac II. This concept is alive and well today in the E-2C *Hawkeye*.

BUAER's electronics engineers, working with other Navy organizations such as the Naval Research Laboratory and the

When *Enterprise* was commissioned in 1961, it was the ultimate development in carrier technology of that era, leading the way for today's nuclear carrier fleet.

carrier class specifically designed to operate jet aircraft. The *Forrestal* class culminated in the development of the nuclear-powered carrier *Enterprise* (CVN 65), from which the Navy's nuclear fleet of aircraft carriers evolved.

Technological progress has kept Naval Aviation in the vanguard of the nation's ability to project its power and influence throughout the world. And the innovators and equipment operators who continue to make Naval Aviation the best it can be are the main players in the success story.

The 1950s and 1960s saw a revolution in carrier developments that enabled a quantum leap in platform capabilities for the forthcoming tactical aircraft evolution. Advancements such as the angled deck, steam catapults and mirror landing system were incorporated in a new super-

Ted Carlson

Naval Air Development Center, also pushed the technology for other airborne applications, including all-weather intercept radar/fire control and ASW systems. In addition, with the change in aircraft weapons from guns to missiles, development and test facilities at China Lake,

The airborne early warning system in today's E-2C *Hawkeye*, above, can trace its lineage back to the PB-1W, above left, a modified Army B-17G carrying the Cadillac II system and to the TBM-3W, left, which carried the Cadillac AEW system.

Calif., were established as key elements in weapon development and technology.

As the jet and supersonic era took over in the 1950s and 1960s, aeronautical systems became more complex. BUAER merged with the Bureau of Ordnance to better integrate all Navy aircraft and weapon systems management under the new Bureau of Naval Weapons in 1959. The continuing leadership of rotating Navy and Marine officers as they reached higher ranks and senior civilians—such as George Spangenberg, *de facto* if not official Chief Engineer—maintained the new bureau's effectiveness through the abolishment of the Navy's bureau system in 1966. These individuals and their staffs brought the traditional technical approach to the newly established Naval Air Systems Command.

Even today, the ever-increasing need to deal effectively and affordably with integrated systems has not changed the basic need for technical military and civilian personnel to work together to provide the fleet with aircraft and support systems in accomplishing the Navy's mission. It's still the people behind the scenes who ensure that Naval Aviation maintains its position at the forefront of the advancing state of the art.