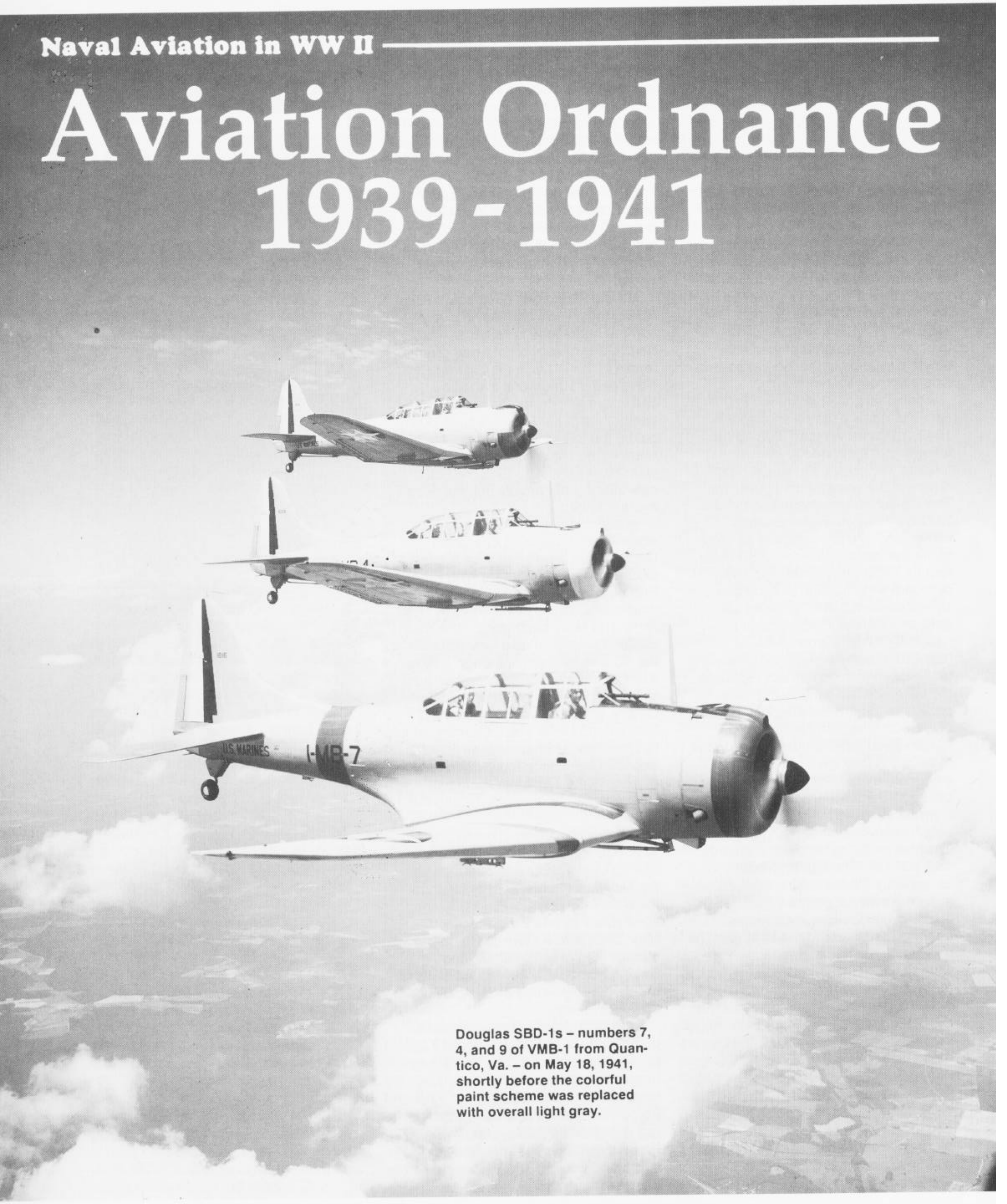
Naval Aviation in WW II

Aviation Ordnance 1939-1941



Douglas SBD-1s – numbers 7, 4, and 9 of VMB-1 from Quantico, Va. – on May 18, 1941, shortly before the colorful paint scheme was replaced with overall light gray.

By John M. Elliott

With memories of the First World War fresh in mind, the United States entered a period of isolationism that was to last until the Japanese attack on Pearl Harbor. The general feeling was that with a large ocean between the U.S. and Europe, or the Far East, we were invulnerable to attack and would not become involved in another foreign war. There was to be no further intervention in the affairs in Europe. The primary mission of the military was the defense of this country. However, there were several countries within the Western Hemisphere in which we did position troops and conduct military operations in the name of establishing a responsible government and ensuring political relations throughout the hemisphere in keeping with our national interests.

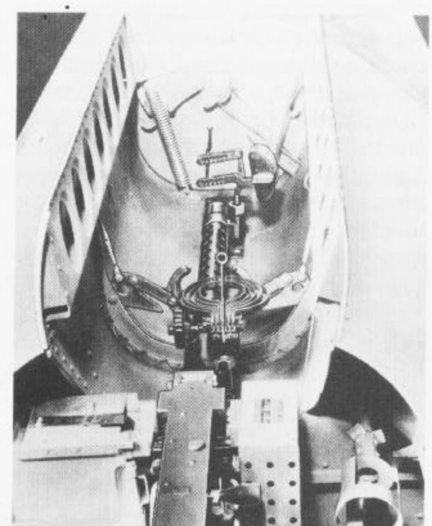
Perhaps part of the false sense of security and adequacy of our military was based on the operation of these troops. Against the rebel factions of these underdeveloped countries, the weapons being used by our troops were more sophisticated and sufficient for the immediate task at hand. Little consideration seems to have been given to the advances in armaments being made in Europe. In no other field was this lack of appreciation for new technology more apparent than in aviation.

Naval Aviation entered WW II with the weapons that had been in existence at the end of the last war. Armor-piercing, demolition, antipersonnel and depth bombs, long-delay and hydrostatic fuzes, in addition to normal contact types, had been developed during WW I. Aircraft machine guns of .50 caliber, as well as lead computing sights for free gunnery, were all in place. The U.S. Navy had pioneered in the delivery of aerial torpedoes and specialized aircraft for their delivery. What then had been accomplished in the intervening 20 years?

Although studies had been made of aircraft armor for many years, it was impracticable to install it in naval aircraft until 1940. Prior to that time, aircraft performance was not able to support the additional weight of armor. But aircraft performance had improved to a point where the consideration of armor was feasible, and experience in the European war indicated it to be a necessity.

By March 1940, the protection of pilots was accepted as the maximum that could be afforded due to the weight of the armor. Complete protection of all vital components of the aircraft was not considered practicable. The installation of armor in naval aircraft was ordered in 1941. By the time we entered WW II, armor was being installed by the contractors in all combat aircraft being delivered. At this time, the armor was only designed to provide protection against .30-caliber weapons, although the requirement for protection against .50-caliber armor-piercing ammunition had been established in April 1939.

One of the anticipated most significant weapons and the most crushing disappointment was the aerial torpedo. A torpedo attack against a ship, with the resulting heavy underwater explosion, could have devastating results. Unfortunately, as we entered WW II, we possessed a torpedo which was most likely the worst in any navy.



SBD-1 original single .30-caliber free gun installation. Note 100-round magazine on gun and holder for six more.

In order to get the torpedo in the water in one piece with a reasonable expectation that it would function properly, it was necessary to release it from a height of less than 100 feet and a speed under 90 knots. Like its counterpart used by submarines and surface ships, that did not necessarily mean that it would run true to the target. The biggest problem, though, was if it did arrive at the target after these restrictions, it might not explode. It was not until well into the war that these problems were solved to a reasonable extent, and by that time the aerial delivery of torpedoes was seldom used. How could these problems not have been realized during the intervening years?

The problem of poor control in all U.S. torpedoes was well known. The disaster of malfunctioning exploder mechanisms was not as well known, and to a great extent this was a matter of economy. Torpedoes were expensive weapons. To conserve money, torpedoes expended during training contained a dummy warhead. At the completion of the torpedo's run to the target, it would bob to the surface due to the buoyancy of an air flask, so it could be retrieved and used again. The expenditure of live warheads was not large enough to adequately expose the deficiencies in their operation.

It was recognized that the airplane was a means of delivering ordnance to the target. In 1937, the Douglas TBD *Devastator* was the best torpedo bomber known, but time and technology passed it by. No matter what aircraft was used, the one major flaw was in the delivery technique. The long, low, slow, steady course necessary to set up the delivery made the aircraft a sitting duck to every gun that could be brought to bear. The only really successful torpedo attacks by aircraft during the war were made against ships not expecting an attack or ones that were softened up for this last blow.

While all the various types of aerial bombs had been developed by the end of WW I, those used by the Navy were strictly U.S. Navy designs. During the days prior to the Army/Navy Standard (AN Standard) program, Navy bombs would not fit on Army aircraft and vice versa. The fuzes for these bombs developed by the Bureau of Ordnance were complex and expensive, due to the stringent safety precautions imposed. Some Army fuzes were fully armed as the bomb fell free of the aircraft and a spring-loaded "jump out" pin was ejected. This concept was completely unacceptable in Naval Aviation operating off a carrier. Using an Army-type fuze, a bomb accidentally dropped upon takeoff would be fully armed when it entered the water and could explode as the carrier sailed over it. Navy fuzes, on the other hand, required several hundred feet of free air travel to become armed. During the travel, the explosive train within the fuze was aligned with the firing pin to arm the fuze. This concept was adopted in the AN Standard nose fuze but not in the family of tail fuzes necessary for the various size bombs.

Depth bombs for use against submarines were another problem. These bombs had a transverse fuze operated by water pressure. It was necessary that the depth at which the bomb was to explode be set in the fuze prior to the bomb being hung on the aircraft. Adjusting this depth setting due to an operational change was a slow and time-consuming task. The five bolts that secured the fuze head to the bomb had to be removed and the exploder mechanism withdrawn from the transverse fuze well and disassembled. Depth was set by a combination of springs of various colors that indicated their strength. By using the appropriate springs, depth settings from 25 to 150 feet, in steps of 25 feet, could be set into the fuze. Then this all had to be reassembled, ensuring a watertight seal around the head of the fuze and side of the bomb.

As we entered WW II, tail hydrostatic fuzes were being introduced which could be set by turning a depth-setting knob on the side of the fuze. Once airborne, though, there was no way in which the depth setting could be changed on any of the fuzes. During the latter part of the war, depth bombs with contact nose fuzes were employed against caves for their blast effect, which was much greater than general purpose bombs of the same weight.

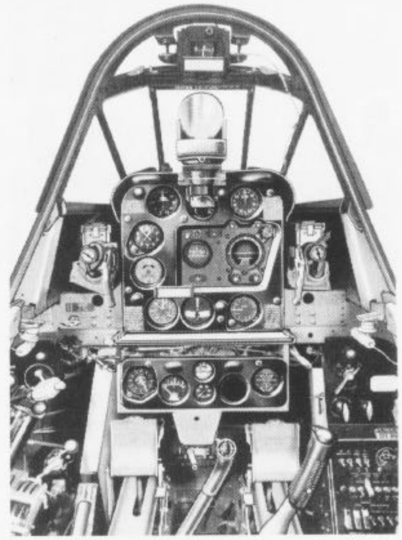
At the beginning of the war, AN Standard bombs – which could be used by the Army, Navy, and British – were coming into use. Many of the old individual service types were in the magazines and caused compatibility problems. Where there was a similar type in both services, a standard design was adopted. The Navy retained its 1,000 and 1,600-pound armor-piercing bombs with Navy tail fuzes for use against capital ships and other heavily reinforced targets. Both of these could be carried by the SBD *Dauntless* dive-bomber.

The introduction of a heavily armored aircraft by the Germans during the closing days of WW I made the rifle-caliber machine gun obsolete as an aerial weapon. The United States was among the first to realize this change. General John J. Pershing, Commander in Chief of the American Expeditionary Force, was among the first to see that the lightweight rifle-caliber bullets would be ineffective against armored aircraft. He immediately directed that development be started on a machine gun having a bore of at least one-half inch.

By the late 1920s, the Browning .30-caliber machine gun was developed into a successful weapon capable of firing 1,000 rounds per minute. Then, practically all machine gun development ceased in this country. This was partly due to a lack of funds but even more a result of the peaceful lethargy that settled over this country after the war. After all, who was going to penetrate our ocean barriers?

A large caliber machine gun was considered to be a weapon for special objectives, such as balloons and other targets to be engaged at altitudes below 20,000 feet, while the rifle-caliber gun would be used by high-flying aircraft against similar aircraft. Development was slow and .50-caliber guns were used only experimentally until 1937.

The normal gun installation during the years between the wars consisted of one or two .30-caliber guns firing forward and one of the same type gun firing aft. To illustrate the lack of appreciation for gun power, the TBD-1 was delivered in 1937 with a single .30-caliber forward-firing gun. Some defense while slowly flying down the gun barrels of a battleship!



SBD-6 pilot's instrument panel with Mk 8 illuminated gun sight and Browning .50-caliber machine guns installed. Chart board between two sections of instrument panel is partly withdrawn. Note the gun charging handles and canvas pouch tied around the lower rear of the guns to absorb oil and prevent it from dripping on the pilot's leg.

With the introduction of the F3F-3 in 1938, .50-caliber guns began to be installed, but they were all mounted on the forward fuselage and had to be synchronized to fire between the blades of the revolving propeller. In many cases, the early use of .50-caliber guns resulted in a mixed battery of one .50 and one .30-caliber gun.

It was not until the introduction of the Brewster F2A-1 *Buffalo* in the spring of 1940 that free-firing .50-caliber machine guns were installed in the wings of U.S. Navy fighter aircraft. Even then, the armament consisted of a pair of synchronized .30s in the cowl and a .50-caliber gun in each wing. In August 1940, with the delivery of the first Grumman F4F-3 *Wildcat*, the Navy finally received an aircraft with two .50-caliber guns in each wing. The idea of synchronized guns was hard to give up. The SBD, which was delivered in 1940 with two .50-caliber guns, continued to have this installation until production terminated in 1944. Even the Grumman TBF-1 *Avenger* entered service in 1942 with a synchronized .50-caliber gun.

A synchronized gun installation had many problems both in maintenance and operation. Ammunition had to be manufactured with closer tolerances than for use in other machine guns or rifles. While the settings varied from aircraft to aircraft, the disadvantages and problems with the installation were similar. Basically, the gun would fire while a selected propeller blade was in line with the gun bore. By the time the projectile reached the plane of the rotating propeller, the blade had moved out of the way.

This was a major operational problem. The pilot had to ensure that the engine was turning fast enough for the blade to be out of the way, but not too fast or the next blade would be struck. All of this careful timing was controlled by a rather simple mechanical system. An engine-driven cam, through a cam follower, imparted a pull on a wire which snaked its way up to the gun. This then pulled a slide which in turn moved an arm into the gun to release the firing pin. Because of these mechanical actions, wearing of parts, and the possibility of adjustments changing, it was necessary to check every gun prior to each day's operation.

From the above, it can be seen that the gun was really a single-shot weapon rather than a machine gun. The system had to wait until the gun had fired, extracted and ejected the spent cartridge case, fed a new round into the chamber, and was locked ready to fire. Then, when the correct propeller blade came by, the gun would receive a pulse to shoot another round. This presented another operational problem to a pilot in combat who would like to fire as many rounds as possible while having his guns bear on the target. Attempts to make it possible for the gun to fire on any blade rather than just one were less than successful. The slight increase in gun-firing rate and the possibility of accidentally hitting a blade did not justify trying to adjust the system so that the gun could fire on any blade of a three-blade propeller. This practice was discontinued.

In those aircraft with a second crew member as a radio-gunner, the installation was not much improved from that of the rear-seat gunner in a DH-4 in France during WW I. True, the Lewis gun, with its 97-round ammunition drum, had been replaced by a Browning with a 100-round magazine. While this did increase the rate of fire by approximately 300 rounds a minute, the operation of the guns was still strictly by manpower. Instead of having to squat to fire overhead, the gunner could now lower his adjustable seat. But to do so, he had to let go of his gun with one hand to release the seat.

There had been twin Lewis gun installations, but we entered WW II without a twin-gun installation in any of the two and three-seat aircraft. This was not to be improved upon until just prior to the Battle of Midway in June 1942. Antiquated as this system may have been, rear-seat gunners were able to shoot down the much heralded Japanese *Zero*.

Gun sights hadn't progressed much, either. The rear-seat gunner was still equipped with a ring and post sight as had been his counterpart in WW I. The difference was changes in the rings to accommodate the higher speeds. Pilots had progressed to a telescope sight for both bombing and gunnery. While this did give an enlarged view of the target, which was nice for bombing, it reduced his overall vision during

TBD-1 0358 of VN-5D8, Corry Field, Pensacola, Fla., Spring 1939.

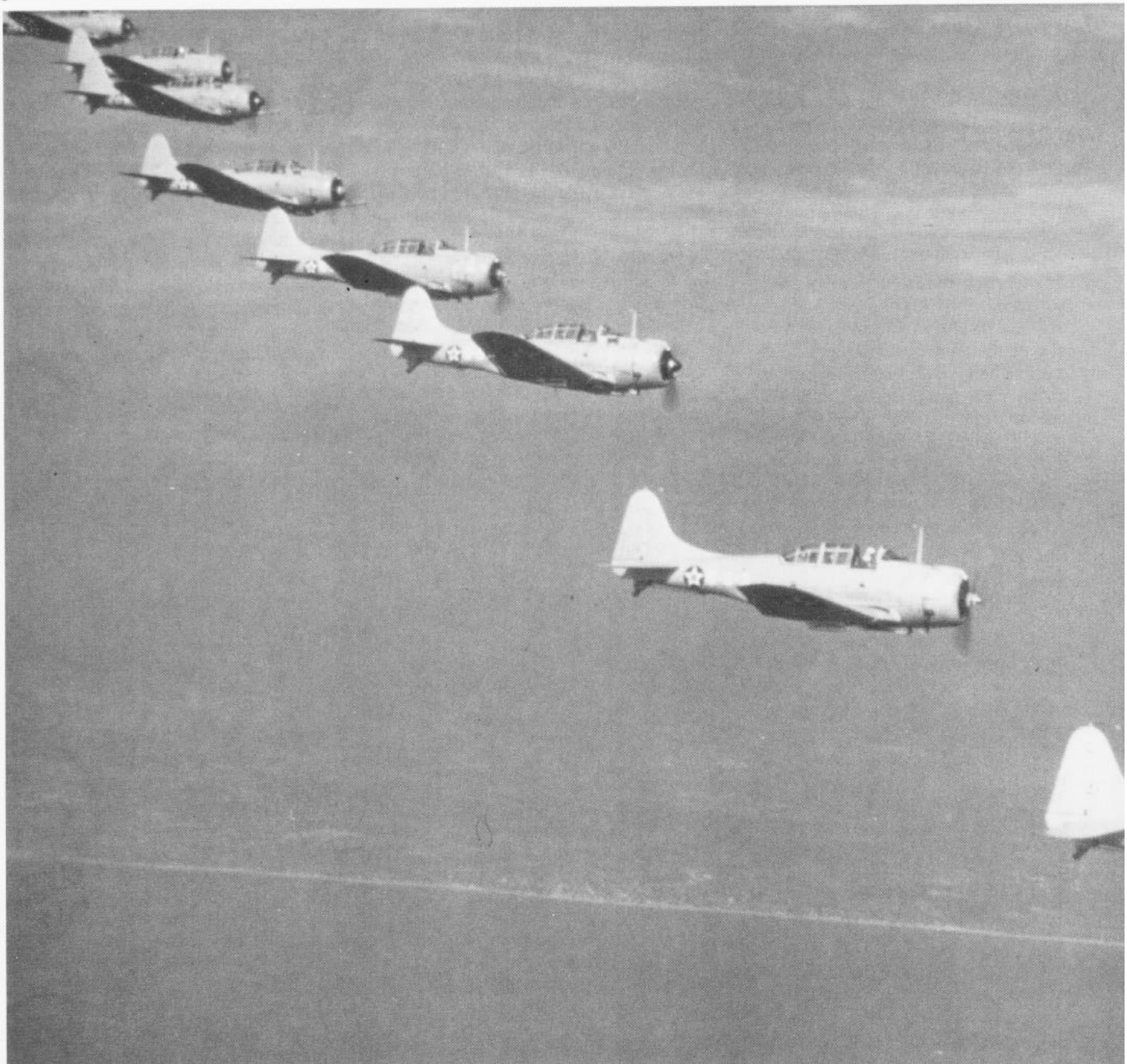
gunnery while he had one eye glued to the scope. Just to be on the safe side in the event the telescope lens became fouled, auxiliary ring and post sights were attached to the barrel of the telescope. Optical illuminated gun sights were not to be a reality until just prior to the attack on Pearl Harbor.

The dropping of bombs, as well as arming their fuzes, was done mechanically. It was not until just before the Battle of Midway that an electrical bomb release system was installed in the dive-bombers, and even then the mechanical system was retained as a back-up until the end of the war.

Prior to WW II, the use of aircraft parachute flares to provide illumination for night attack, reconnaissance, night rescue, and emergency landings figured heavily in training. In the course of the war, however, they were seldom used. Smoke screens had been of great importance in training exercises. While the SBD continued to be equipped for this, the capability was not used.

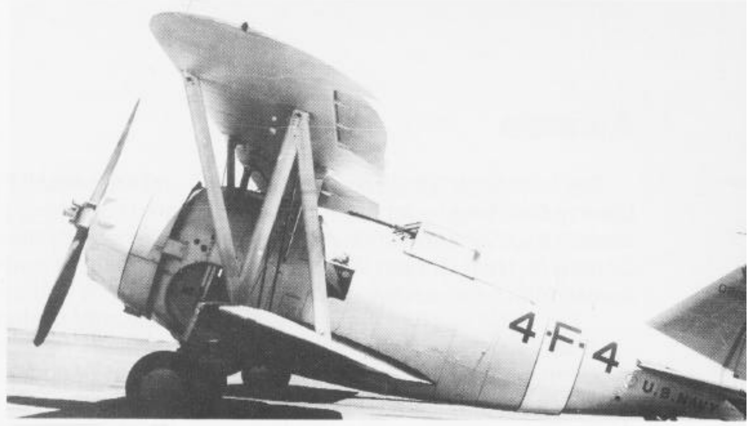
During the late 1930s, rudimentary work was being accomplished on what would evolve into guided missiles. At this time, it meant the remote control of an entire aircraft which would be flown into the target. Such a system was actually developed and tried in the Solomons in 1944.

Rockets on aircraft had been used



against Zeppelins during WW I, but the idea was not tried again until after 1943. Napalm bombs and VT (variable time) fuzes were still to be developed during the war. U.S. Naval Aviation was to enter WW II with basically the weapons it had 20 years earlier. ■

Mr. Elliott was assistant historian in the Naval Aviation History Office until his retirement in 1990.



Grumman F3F-1. Section leader, second section VF-4, denoted by the insignia fuselage band and full white cowl.

50 Years Ago — WW II

July 1: The first landing, takeoff, and catapult launching from an escort carrier were made aboard USS *Long Island*.

July 1: Patrol Wing, Support Force, was redesignated and established as Patrol Wing 7 at Argentia, Newfoundland.

July 7: The First Marine Aircraft Wing was organized at Quantico, Va. It was the first of its type in the Marine Corps and the first of five wings organized during the war period.

July 8: Patrol Wing 8 was established at Norfolk, Va.

July 12: Naval Air Station, Quonset Point, R.I., established.

July 15: United States Naval Air Station, Argentia, Newfoundland, established.

July 29: The Secretary of the Navy approved the installation of a Radar Plot aboard carriers as "the brain of the organization" protecting the fleet from air attack. The first installation was planned for the island structure of *Hornet* (CV-8).

August 10: The Second Marine Aircraft Wing was activated at San Diego, Calif.

A flight of SBD-2s in 1941.