

**PROFILE
PUBLICATIONS**

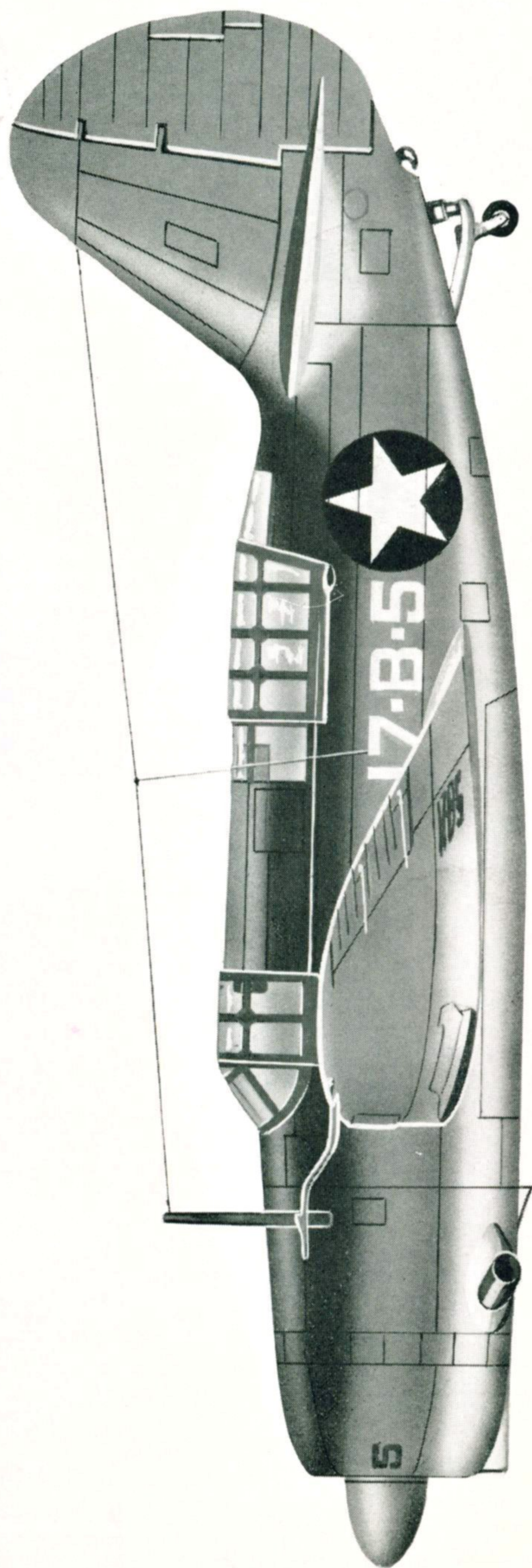
The
Curtiss
SB2C-1
Helldiver

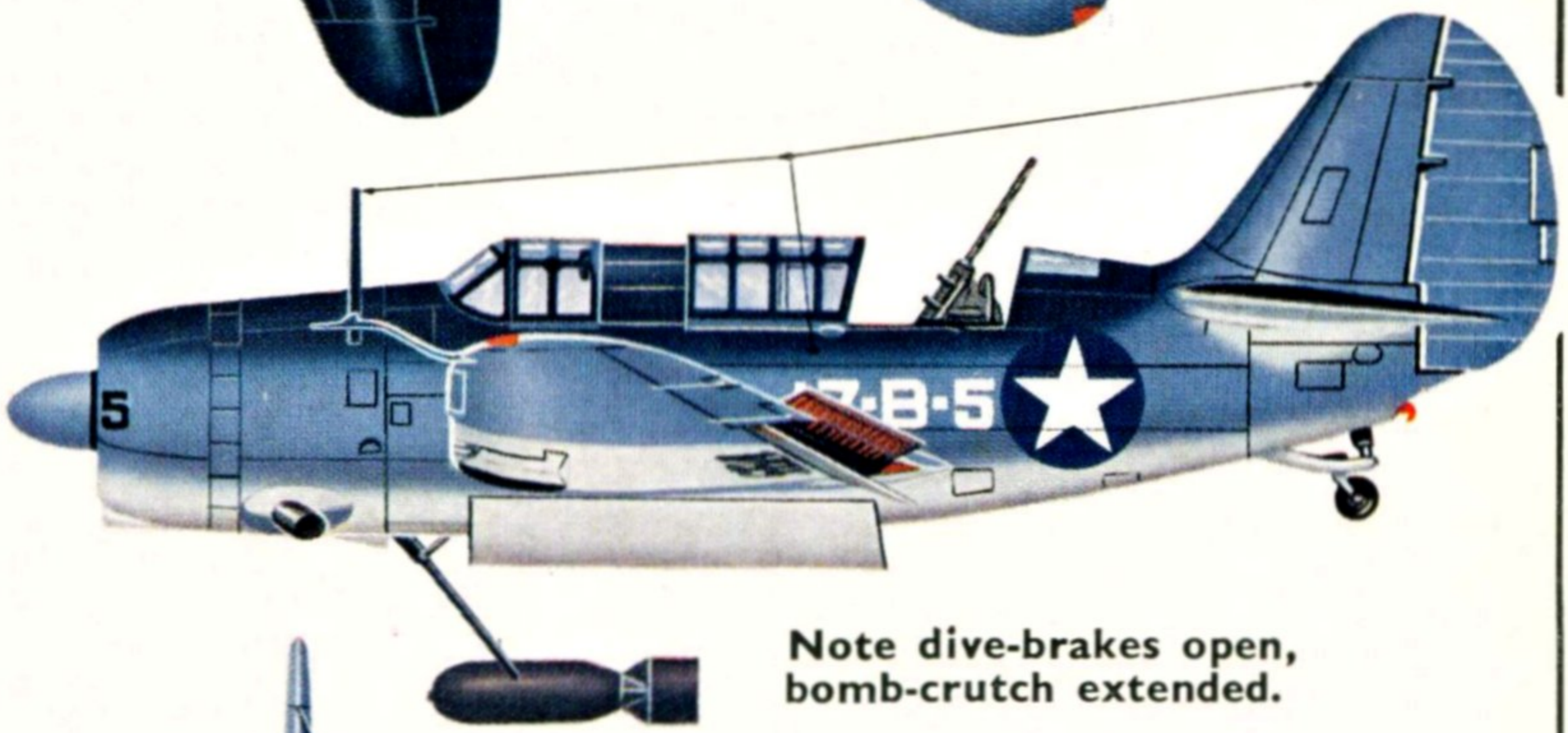
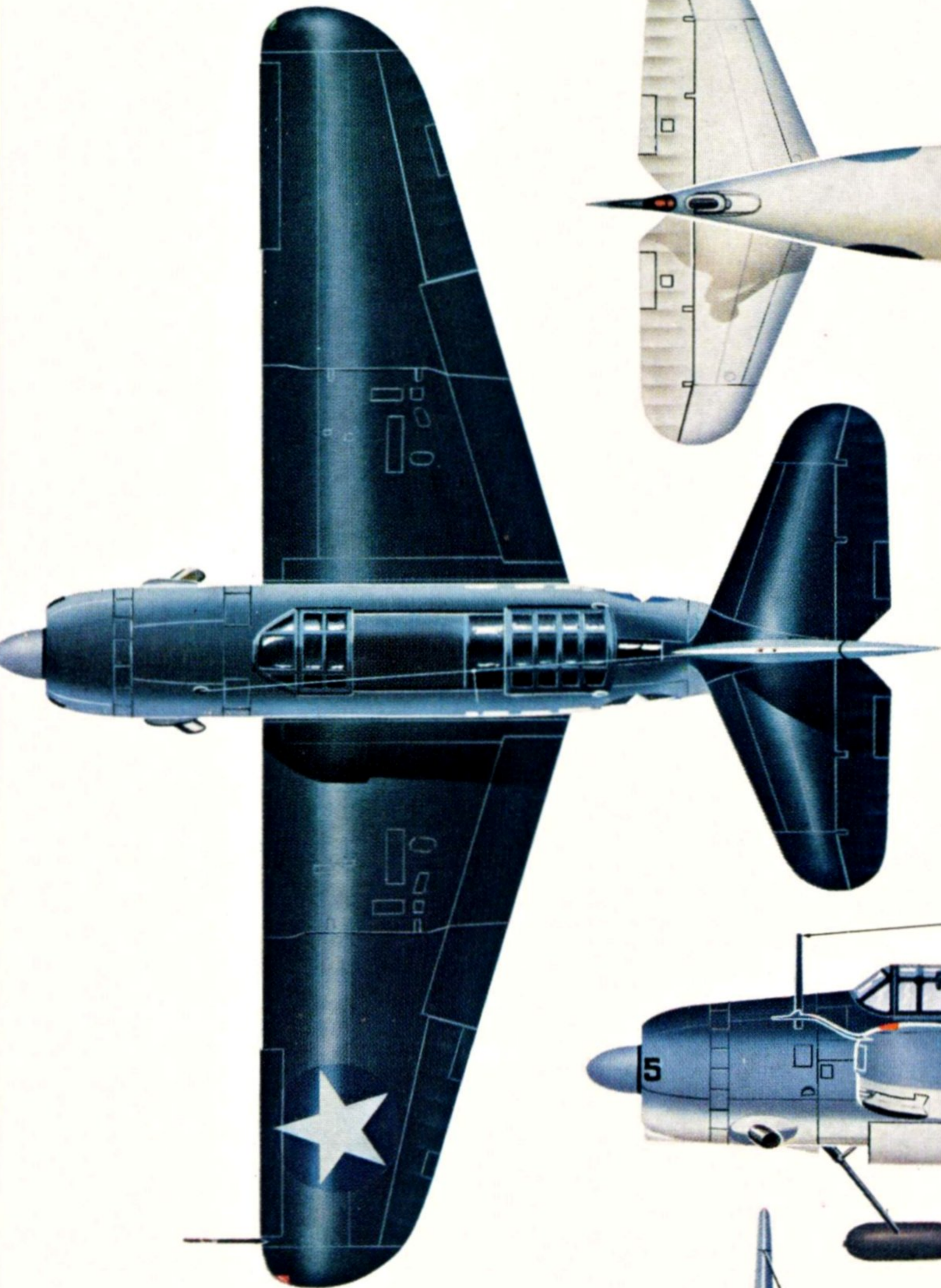
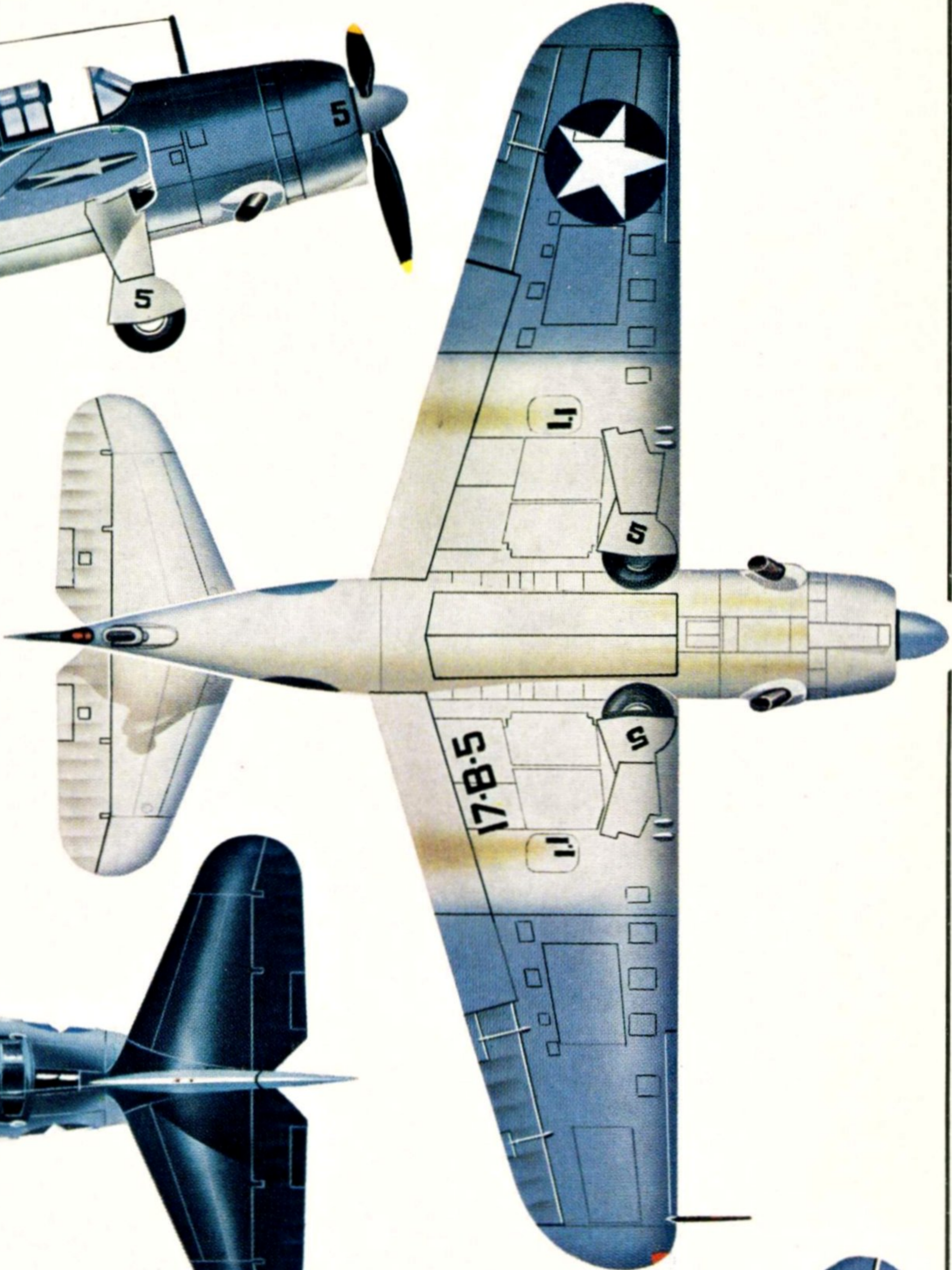
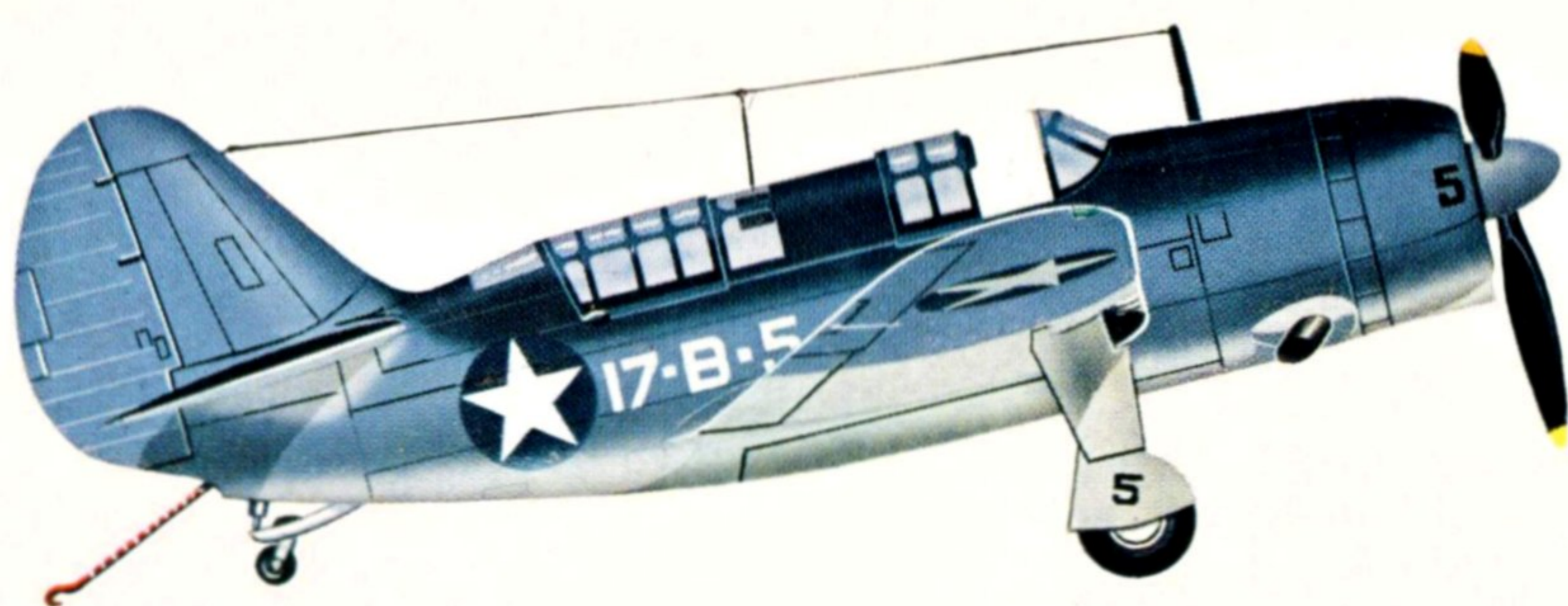
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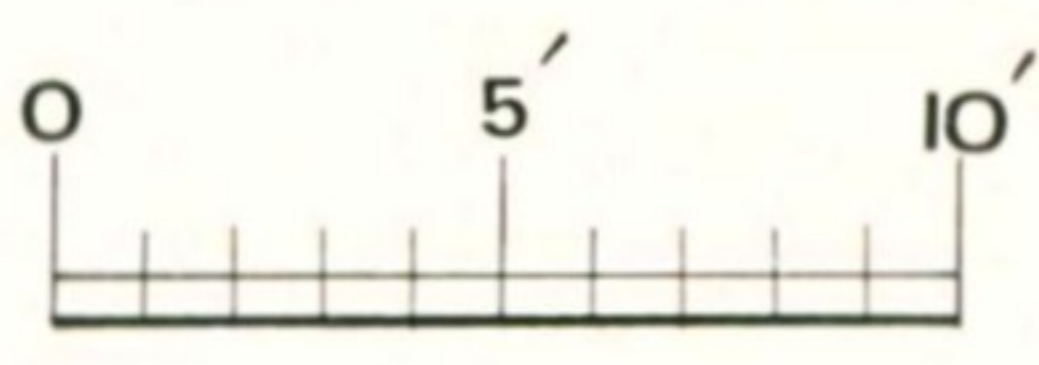
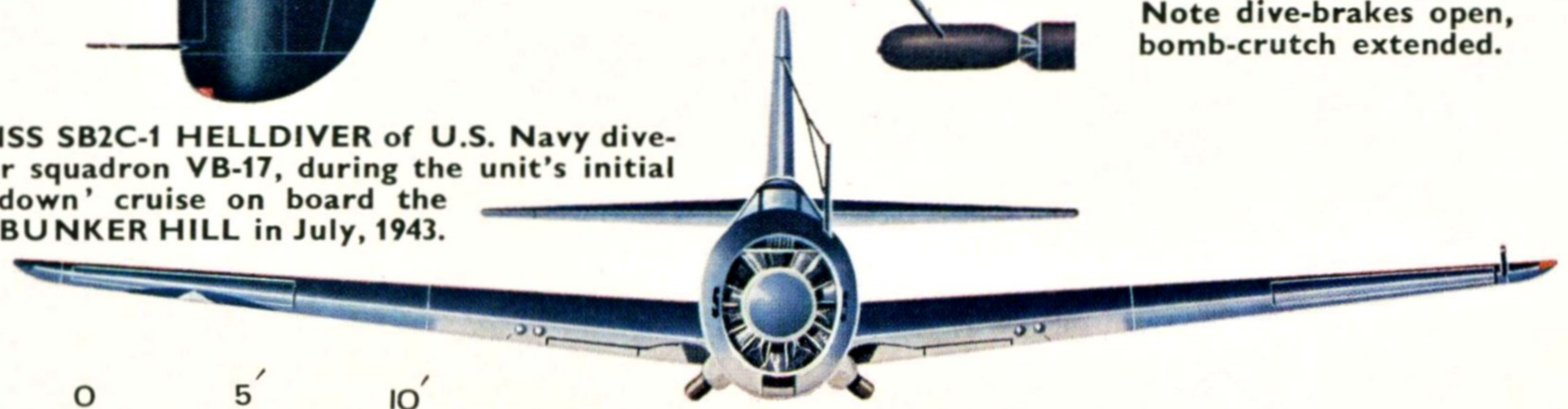
UNITED KINGDOM TWO SHILLINGS

UNITED STATES AND CANADA 50 CENTS





CURTISS SB2C-1 HELLDIVER of U.S. Navy dive-bomber squadron VB-17, during the unit's initial 'shakedown' cruise on board the U.S.S. BUNKER HILL in July, 1943.



The SB2C-1 first saw combat with VB-17 on the U.S.S. Bunker Hill, in a raid on Rabaul on 11th November, 1943. A group of the Bunker Hill Helldivers are seen here on another mission, in January 1944. Note underwing bombs mounted on nearest aircraft; also modified twin .30 calibre rear armament in place of the .50 calibre mounting originally fitted.

(Photo: U.S.N./National Archives)

Summing up the air action in the Battle of the Philippine Sea, 19-20th June, 1944, the eminent naval historian, Samuel Eliot Morison has written, "... the new Helldiver (SB2C) was outshone by the two remaining squadrons of Dauntless dive bombers (SBD). Unfortunately, nothing could be done about it since the production lines

were rolling with Helldivers: here the Dauntless fought her last battle." This was the first major Pacific action in which SB2C's equipped the majority of the dive bomber squadrons in the participating carrier air groups.

Only three months prior to this action, the Truman Committee published its aircraft report on the basis of testimony taken the previous year. Particular attention was directed to the Curtiss-Wright Corporation and the fact that no combat-usable SB2C-1 dive bombers had yet been delivered to the Navy. Production of its Army equivalent was no better, and furthermore, dive bombers by then were considered of little use for Army Air Force action.

It remains for later versions of the Helldiver to fully live up to the Curtiss-Wright ads. which the Truman Committee so thoroughly condemned. But the story of the SB2C-1 series is not all black; in the final analysis it is the story of overcoming almost insurmountable obstacles under conditions that changed drastically with the fast-paced events of the period.

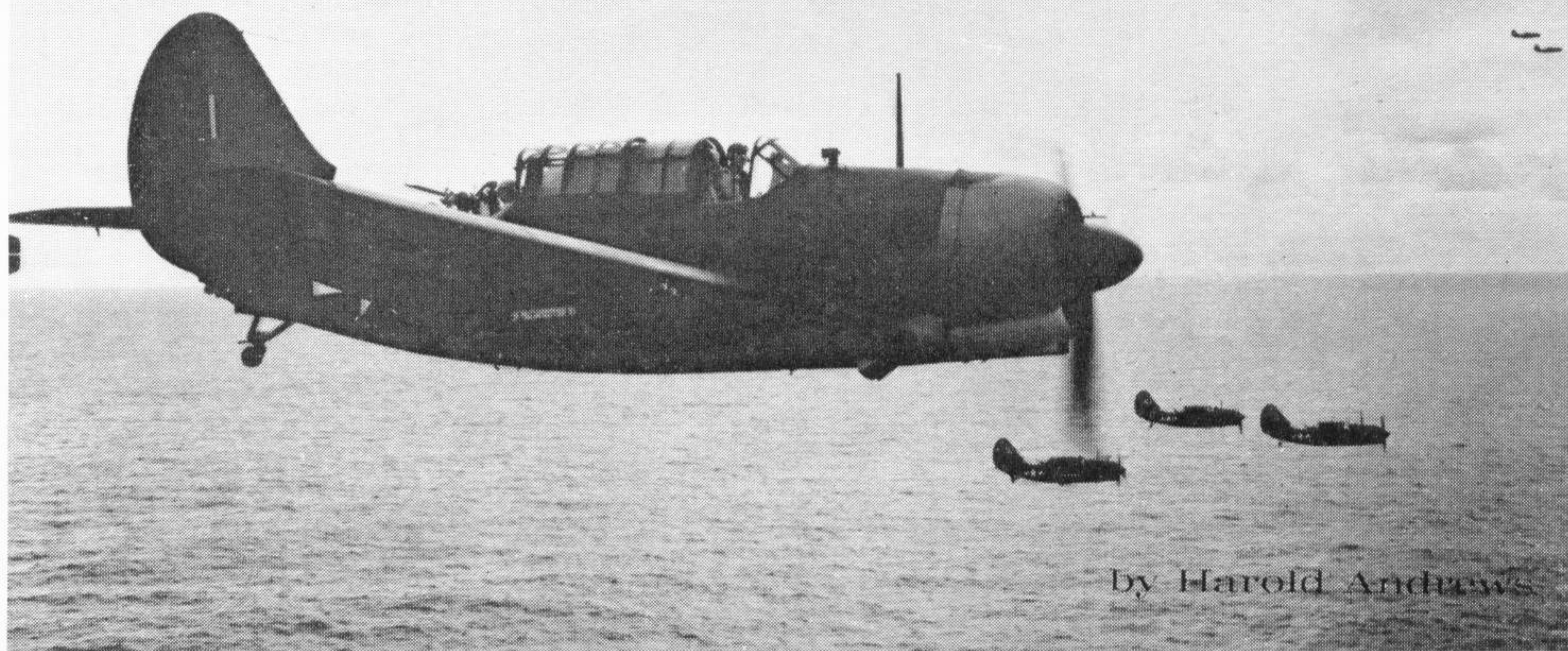
THE XSB2C-1

The story of the SB2C began early in 1938 when the U.S. Navy's Bureau of Aeronautics prepared the requirements for a new scout/dive bomber aircraft. Factors considered included the new air-cooled radial engines then under development, fitting a maximum number of airplanes on the carrier decks, and the desire for increased speed, range, armament and bomb carrying capability. De-icing equipment, folding monoplane wings, retractable landing gear and provisions for armour installation were all considered necessary in the design. Fleet reaction was that folding wings were undesirable and that fixed landing gear was preferred, but they more than agreed with the need for heavier armament. Bureau engineers and officers studied these reactions and decided to go ahead as planned. Among other features considered desirable was that two of these aircraft could be handled on a 40 by 48 foot elevator with at least one foot clearance all around.

In response to the August 1938 invitations to submit entries for the design competition, six companies submitted a range of designs by the December closing date. Only the Curtiss and Brewster designs proposed to use the new larger radial engines, specifically the 1700 h.p. Wright R-2600, and even the best of their designs only met minimum requirements. In addition, certain changes were considered necessary. With the condition that these changes be made, Brewster and Curtiss were selected to build XSB2A-1 and XSB2C-1 prototypes respectively, notification being made in January 1939.

Design of these two aircraft was similar in many respects: folding wings mounted far enough up on the fuselage to permit bomb carriage in an internal bomb bay,

The Curtiss SB2C-1 Helldiver

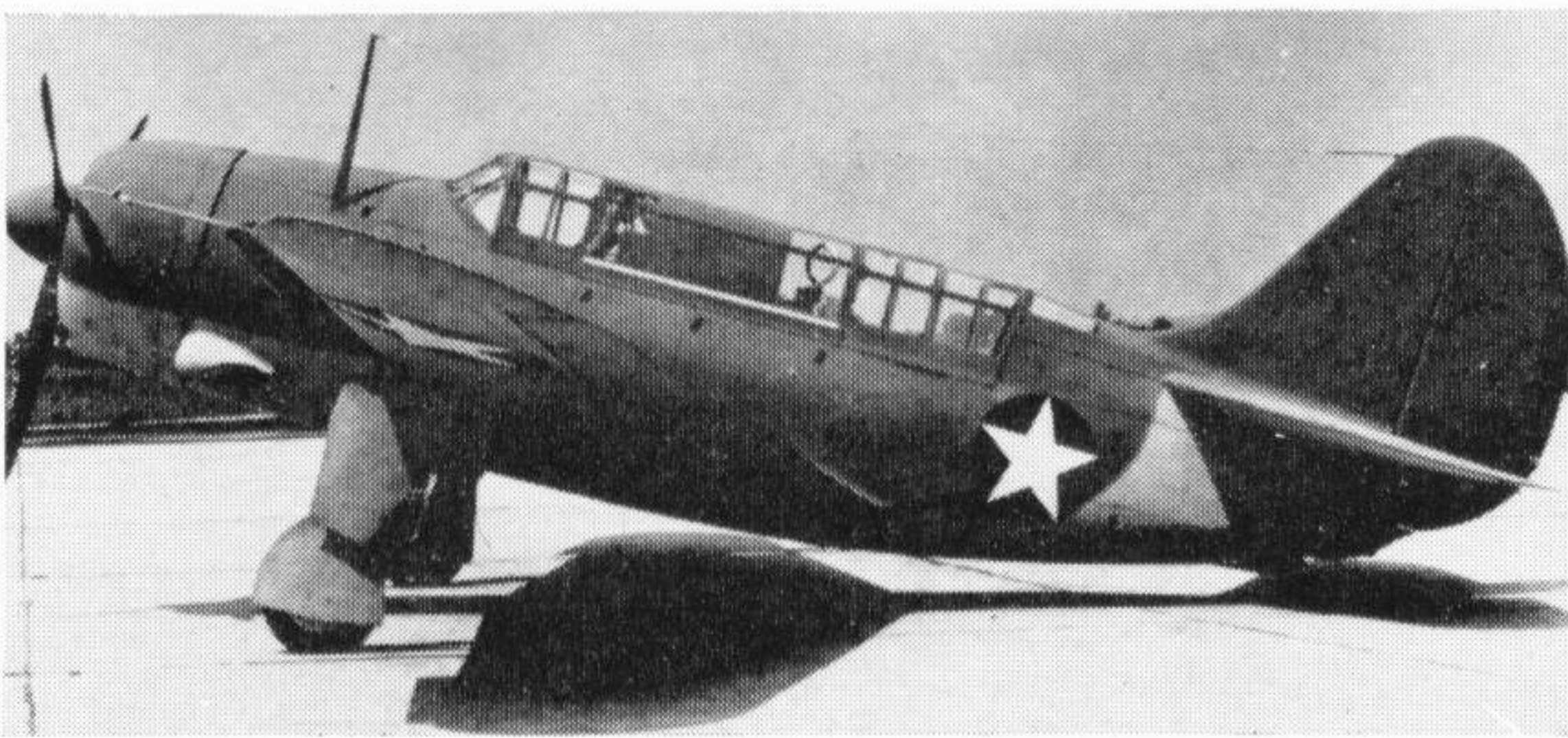


By Harold Andrews

inward retracting main landing gear, cleanly cowled engines, split trailing edge dive flaps, and all metal construction except for fabric covered control surfaces. Curtiss' Design 84 went further toward meeting the "two airplanes on the elevator" requirement and was almost a stubby airplane. Its typical Curtiss planform shapes were carried over from the P-40 and other Curtiss designs and the aft fuselage arrangement was derived from the SBC series.

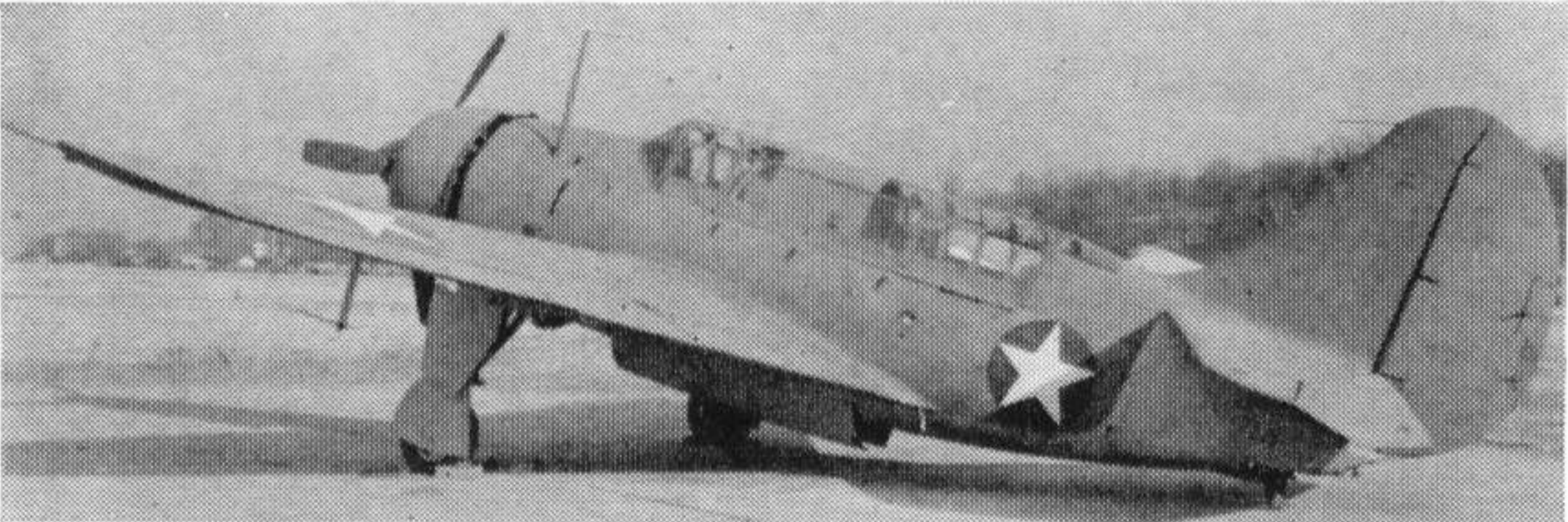
Events of the design period were not unlike those for any new aircraft design. As the design developed in detail, problems arose and had to be solved, and BuAer was also to find some changes necessary in its planning. Excessive weight was a major problem throughout the design period, as was the aft gun installation. Curtiss engineers, under Project Engineer Raymond Blaylock, had the design well under way when the contract was finally signed in May 1939. In addition to XSB2C-1 BuNo 1758, the contract called for the usual static tests, design data and flight demonstration tests. Mock up inspection took place in late May with the principal changes recommended for, and subsequently made in, the armament installation: deletion of the alternate provisions for .50 forward firing fuselage guns in place of the regular installation of two .30's, and major redesign of the power driven flexible gun installation. Two subsequent mockups of the rear gun installation were required before the design was considered acceptable in February 1940.

In July a major design setback was encountered. Wind tunnel and experimental full scale flight testing showed that the wing maximum lift coefficient would be lower than had been estimated, giving an excessively high stall speed. After considering alternate solutions (extending the leading edge slats to full span, drooping the ailerons, and increasing wing area), the latter action was taken, with an increase from 385 to 422 square feet. The penalty in top speed was accepted and the entire wing redesigned. Dive brakes were also investigated thoroughly since the brake-open dive speed was higher than desired. Conclusive action was not taken, except to provide variable opening angles of the split diving and landing flaps for flight evaluation. Magnesium alloy was used for many items to save weight, but most of this had to be replaced with aluminium alloys before the airplane was ready for flight. Several large forgings were designed for the wing carry-through area as another weight saving measure, along with reductions in size of some structural members. Redesign of the cannon installation in each wing to accommodate a different type .20 mm. cannon, delay in engine qualification and delivery, and incorporation of changes made necessary by failures in static testing further delayed the prototype programme.



The first SB2C-1, BuNo.00001 at Port Columbus on 2nd July 1942, during the initial flight programme. Used for contract demonstration flights it was, like the XSB2C-1, lost due to structural failure during dive demonstration tests.

(Photo: U.S.N./National Archives)



Radio and electrical tests were conducted on 00007 at Anocostia. Photographed on 14th December, 1942, the aircraft is seen here with ASB radar and ABD IFF installed. (Photo: U.S. Navy)

On 18th December, 1940, Curtiss test pilot Lloyd Childs took the XSB2C-1 up for its first flight at the Curtiss Buffalo, New York plant. Flight testing continued through December and January. A large number of problems in stability and control characteristics, particularly in lack of stability at aft centre of gravity location were uncovered, as well as engine cooling difficulties and various (and typical) hardware items. On 9th February, 1941, the engine cut out in the approach and the XSB2C-1 crashed among large piles of frozen dirt in a construction area short of the runway. The fuselage broke in two just aft of the wing and the entire aircraft was damaged extensively, the pilot surviving.

By early May the airplane was rebuilt and flight testing resumed on 6th May. On the 10th flight, the left landing gear collapsed outward on landing and the airplane ground looped to a stop with a minimum of damage. Before the end of May the XSB2C-1 was back in the air. With the impetus of immense orders for production SB2C-1's, flight testing and development proceeded at a fast pace during June and July, averaging nearly a flight a day. During this time engine operation, engine and oil cooling, performance, and stability and control were tested, improved where necessary and retested, under a wide variety of flight conditions. Jet exhaust were evaluated

to improve speed, without any significant improvement. A series of changes were made to the horizontal and vertical tail and tested to improve stability and control. Several changes to the cowling and cowl flaps were tested to improve engine cooling.

During August of 1941, the airplane was laid up for installation of a one foot longer engine mount to move the centre of gravity forward, to improve stability. When flying resumed in September, propeller stress investigations were conducted, followed by installation of a newly-built tail assembly based on the latest and most satisfactory version tested prior to that time. With additional testing and several less significant changes, the airplane was considered ready for preliminary demonstration manoeuvres. These began with air manoeuvres and spins in late October with dives beginning in November. On 12th November, the XSB2C-1 was ferried to Port Columbus where dive tests continued. Dives proceeded through various conditions, mostly with speed brakes open, gradually building up to high speeds and higher "g" pullouts. There were some indications of tail buffeting and minor damage was repaired. On 21st December, test pilot Baron T. Hulse pushed over into a zero lift dive at 22,000 feet, intending to approach maximum "g" conditions in a pullout at speeds approaching terminal velocity. As the airplane started its pullout, the right wing and tail failed; the pilot baled out safely. The SB2C programme was left without a flight test airplane; and with a major problem to be solved since the cause of the crash could not be determined immediately.

SB2C-1 DEVELOPMENT

Negotiations began in the summer of 1940 and in November, still prior to the first flight of the XSB2C-1, Curtiss-Wright and the Navy reached agreement on a production order for 370 SB2C-1's. The following month a production contract for the Brewster SB2A-1 was signed—as well as one for Grumman's new TBF-1 torpedo-bomber, two prototypes of which had been ordered several months after the two scout-bombers, and which also had not yet flown. These were the first major contracts for carrier combat types under the expanding 1940 Defense Programme.

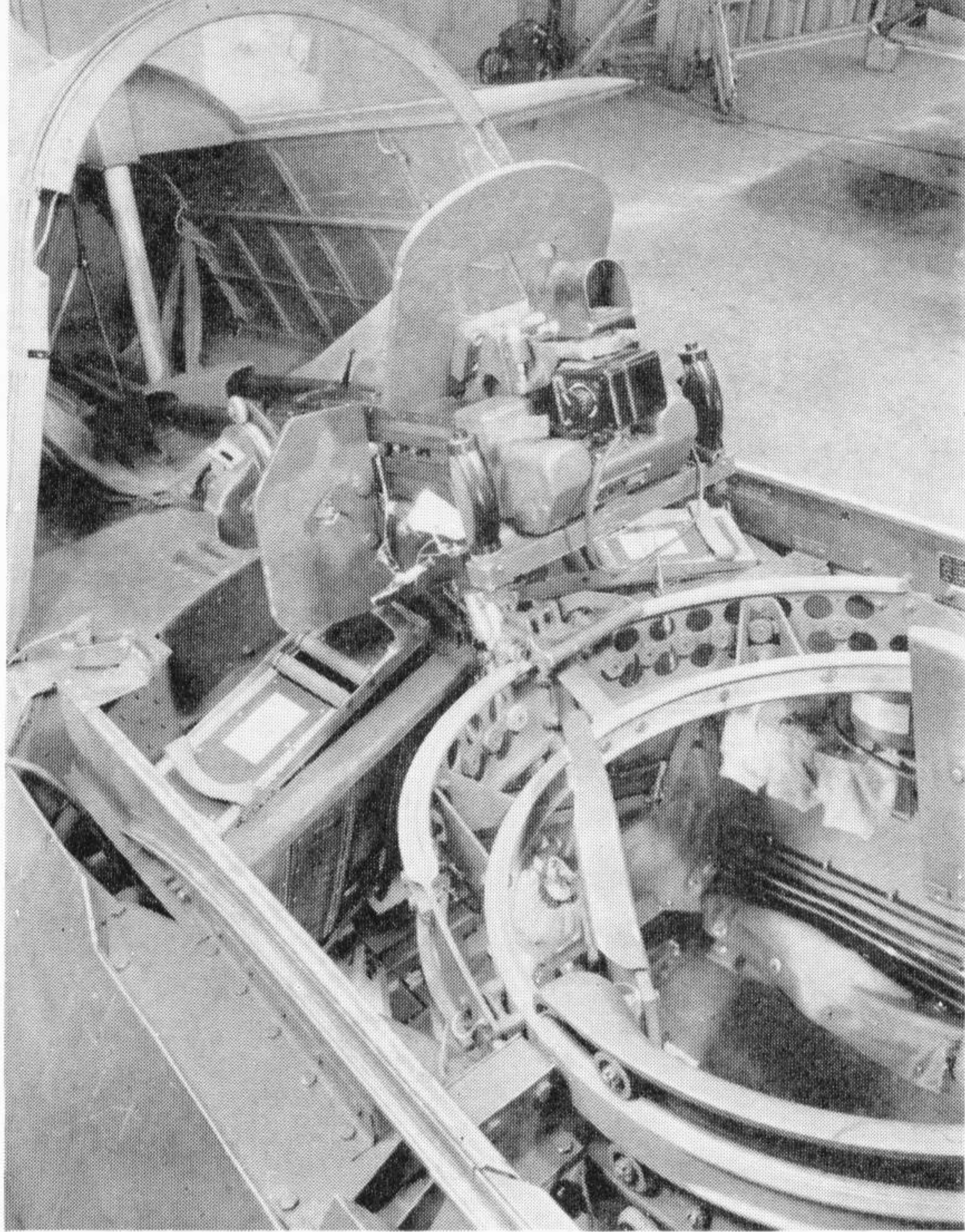
The SB2C-1 schedule called for completion of the first airplane in December 1941 and a production rate of 85 per month beginning in April 1942. The production model was to be extensively redesigned to use techniques and components suitable for large volume production in place of the typical aeronautical practices of the time which were based on small orders, largely "hand-built". Extensive use was to be made of forgings, particularly large ones, and die castings. While initial production might be delayed by this approach, Curtiss and the Navy felt that it would rapidly build up to be like P-40 production—at that time the nearest approach to mass production of a

combat aircraft in the United States. In addition, other changes were to be made such as the use of .50 wing guns rather than 20 mm. cannons, since the latter would not be available in production quantities to meet SB2C-1 schedules. Curtiss engineers recognized that they would have to check out all aspects of the airplane, using the XSB2C-1, to make



BuNo 00018 shown in flight, shortly after issue to VS-9 at NAS Norfolk, Virginia in November 1942. The company-painted number is visible on the fin; note also retracted tail wheel and ASB Yagi antennae under the wings.

(Photo: U.S.N./National Archives)



Details of the twin mounting for two .30 calibre guns, which provided the Helldiver with tail and beam protection.

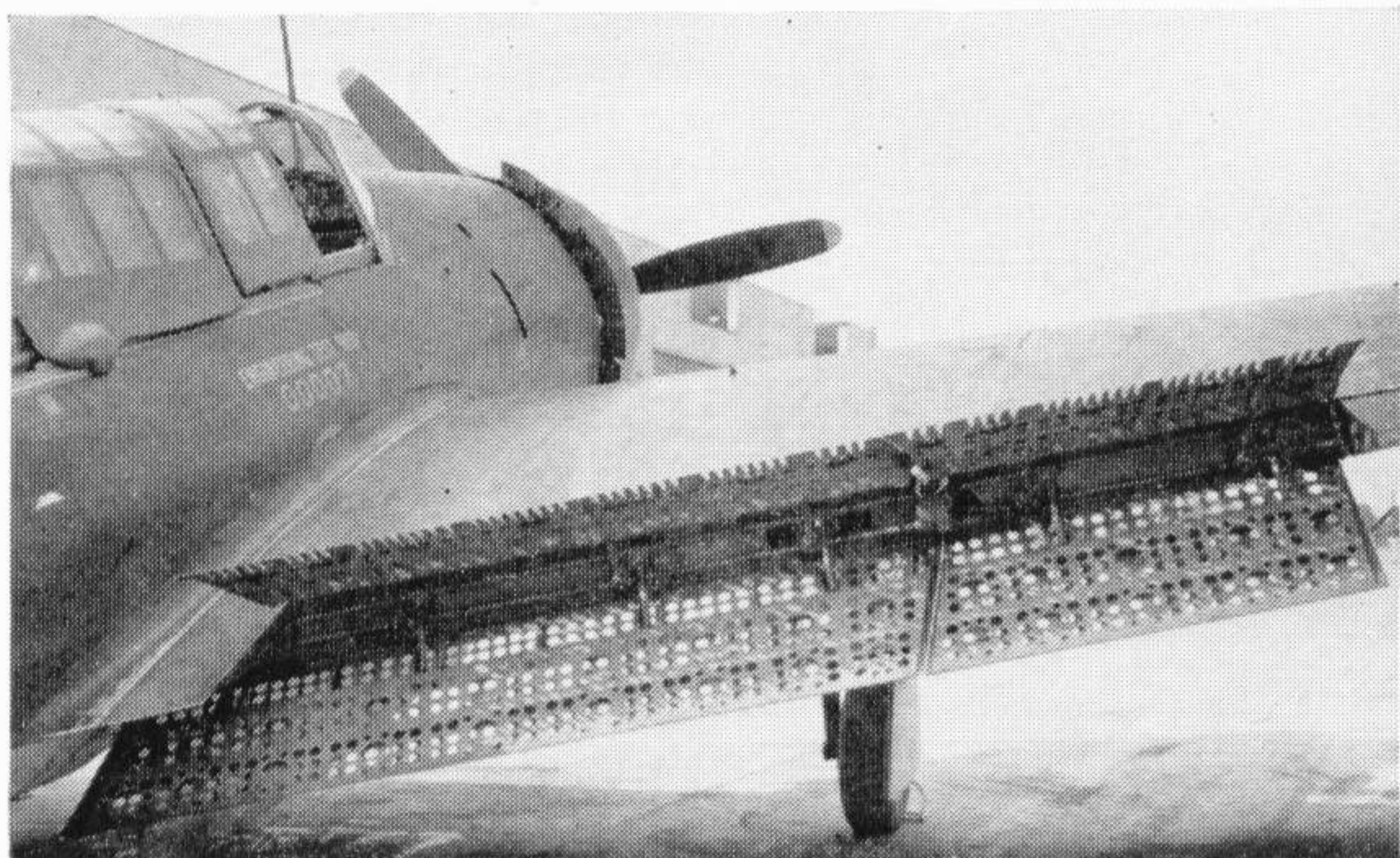
(Photo: U.S. Navy)

the planned production scheme effective since changes would result in far greater production delays than would be experienced with the normal aircraft industry methods.

Before the SB2C-1 contract was two months old, the Navy had increased its total quantity on order to 578. In the late winter of 1941, production of the SB2C-1 was scheduled for the Columbus, Ohio plant. There the SB2C-1's would be produced alongside S03C's, concentrating Curtiss-Wright's Airplane Division production for the Navy in one location. The Columbus plant (now used by North American Aviation) was one of several aircraft plants being built by the Government to support the expanded Defense Programme.

As the early months of 1941 went by, the programme progressed, but not without problems. The problems of the XSB2C-1 flight testing have already been related and meeting production schedules depended on successfully demonstrating a satisfactory X prototype, or at least solving all of its problems for the production design. In addition to the flight test problems, failures occurred in static testing of both wing and fuselage under the X contract. Improvements were incorporated in the production design including increasing the wing-mounted

Left: Final appearance of the perforated dive flaps, as installed on 00007 when she became a Curtiss engineering test aircraft. (Photo: Curtiss-Wright via U.S.N.) Right: Torpedo installation was extensively tested on the SB2C-1, but never used in service. This view shows 00013 with bomb bay doors removed and replaced by torpedo fairing panel; the aft portion folded up to clear the torpedo fins, and folded down to complete the fairing surface after the torpedo was dropped. (Photo: U.S. Navy)

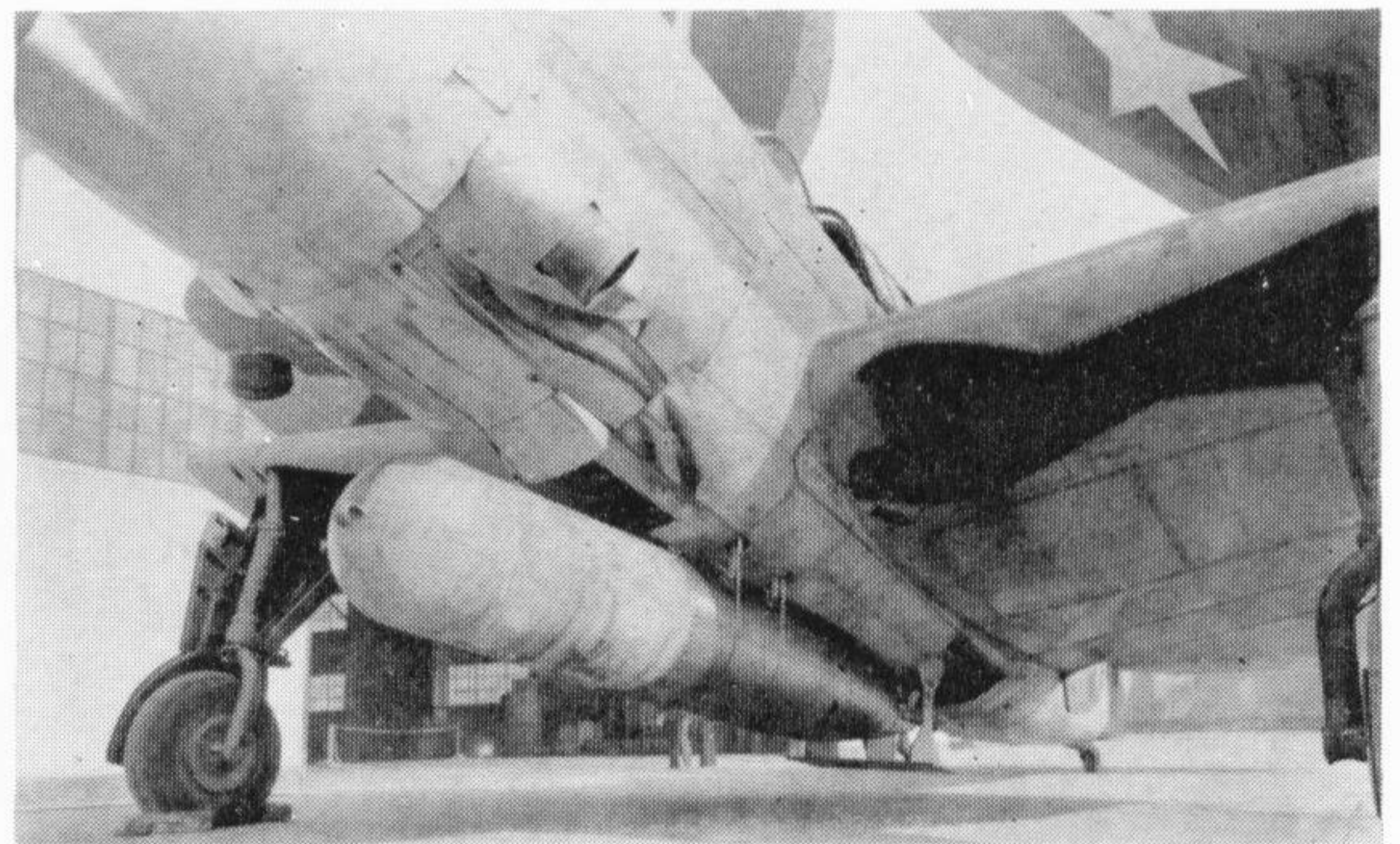


guns from one to two .50's in each wing and adding leakproof wing fuel tanks and cockpit and turret armour. By June it was evident that delivery of the first production airplane would be delayed at least until February 1942. An overweight condition of some 300 pounds was also anticipated. During the Summer and Autumn both the overweight and delivery delays increased. While the training programme for the production workers at Columbus moved ahead satisfactorily, continual redesign of the SB2C-1 on the basis of flight test results, and the job of tooling up a whole new plant proved to be far beyond what had been envisioned at the outset.

On 1st October, along with other Navy combat aircraft, the SB2C-1 received a name: Helldiver, a name long associated with Curtiss dive bombers. In November, the engineering group for the SB2C was shifted to the new Columbus plant.

Pearl Harbour, 7th December, 1941, placed a new sense of urgency on the SB2C programme. Then came the crash of the XSB2C-1. The first four SB2C-1's were assigned special priority. Their construction was to be expedited on a hand built basis so that flight testing and trials could get underway. Subcontracting was initiated to increase production, and the large forgings were redesigned to reduce the need for the overcommitted heavy presses. In the Spring, Curtiss-Wright was informed that 3,000 additional SB2C's would be ordered for the Navy, the contract change being signed in June. Meanwhile radar (ASB), IFF (ABD/ABK) and new radio (ATC and ARB) installations were designed and mocked up for approval. In May 1,000 Helldivers were ordered as SBW's from Canadian Car and Foundry, Fort William, Ontario through War Supplies Ltd., representing the Canadian government. Four hundred and fifty of these were allocated to the Royal Navy. All drawings for production of these aircraft were supplied by Curtiss.

The first SB2C-1, 00001, was rolled out in June and prepared for first flight. Other than its new camouflage paint, and a slightly taller vertical tail, it showed little change in appearance from the XSB2C-1 just before it crashed, in spite of its major redesign for production. First flight was on 30th June 1942. During July, flight testing was extensive and results were reported as generally satisfactory in terms of engine cooling, performance, and stability and control (except for weak longitudinal stability). Preliminary demonstration manoeuvres brought about some control system changes, and dive tests began. During August 00002 joined the flight programme for stability and control testing, being transferred to Anacostia in September for performance, engine cooling, and stability and control testing. Changes were developed and installed to correct problems that were uncovered during these tests. In October 00002 went to NAF Philadelphia for arrested landing and catapult tests, while 00004 went to the Aircraft Armament Unit at Norfolk, Virginia for gunfiring and bombing tests. 00003 was modified to have hydraulic cylinders operating the flaps directly instead of their being operated through

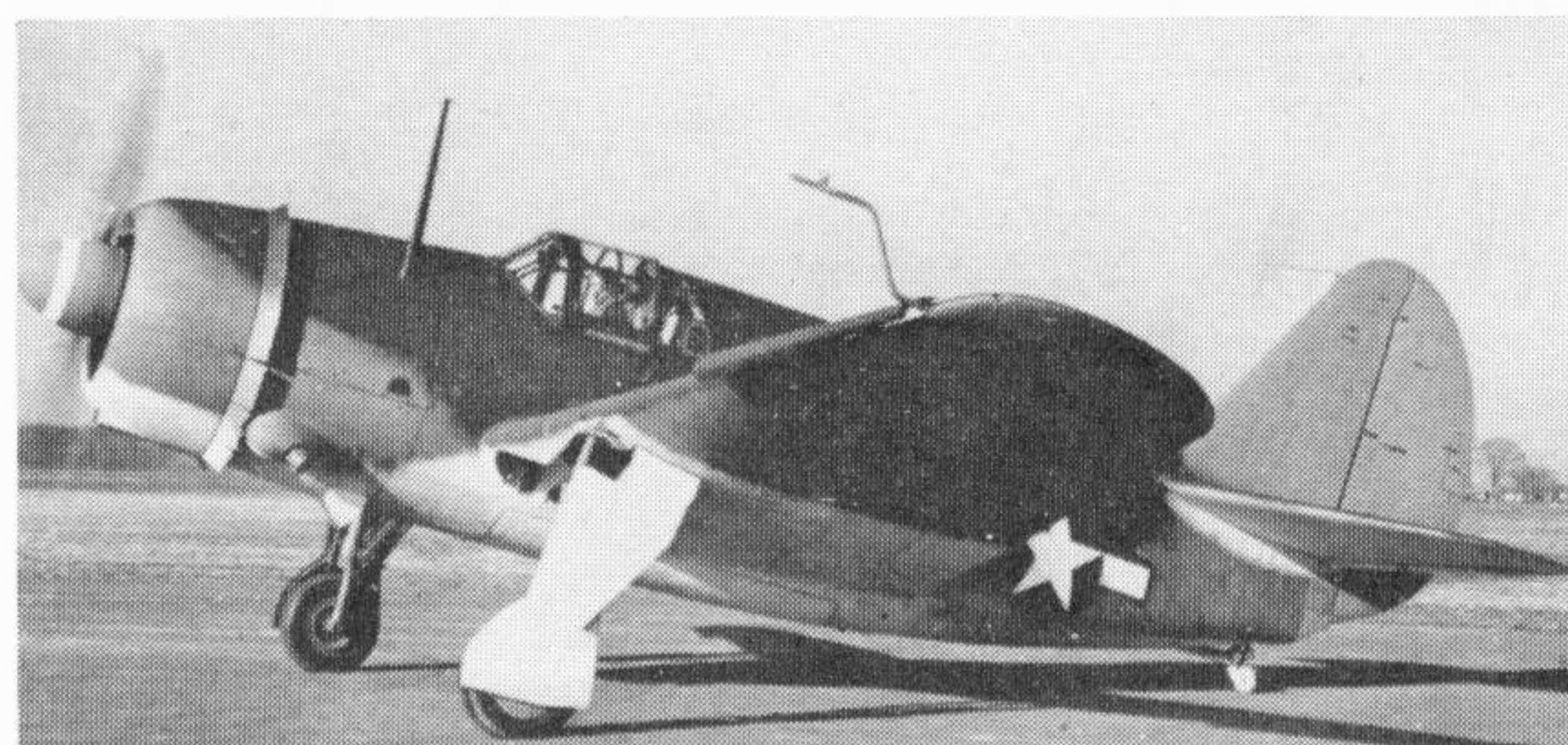
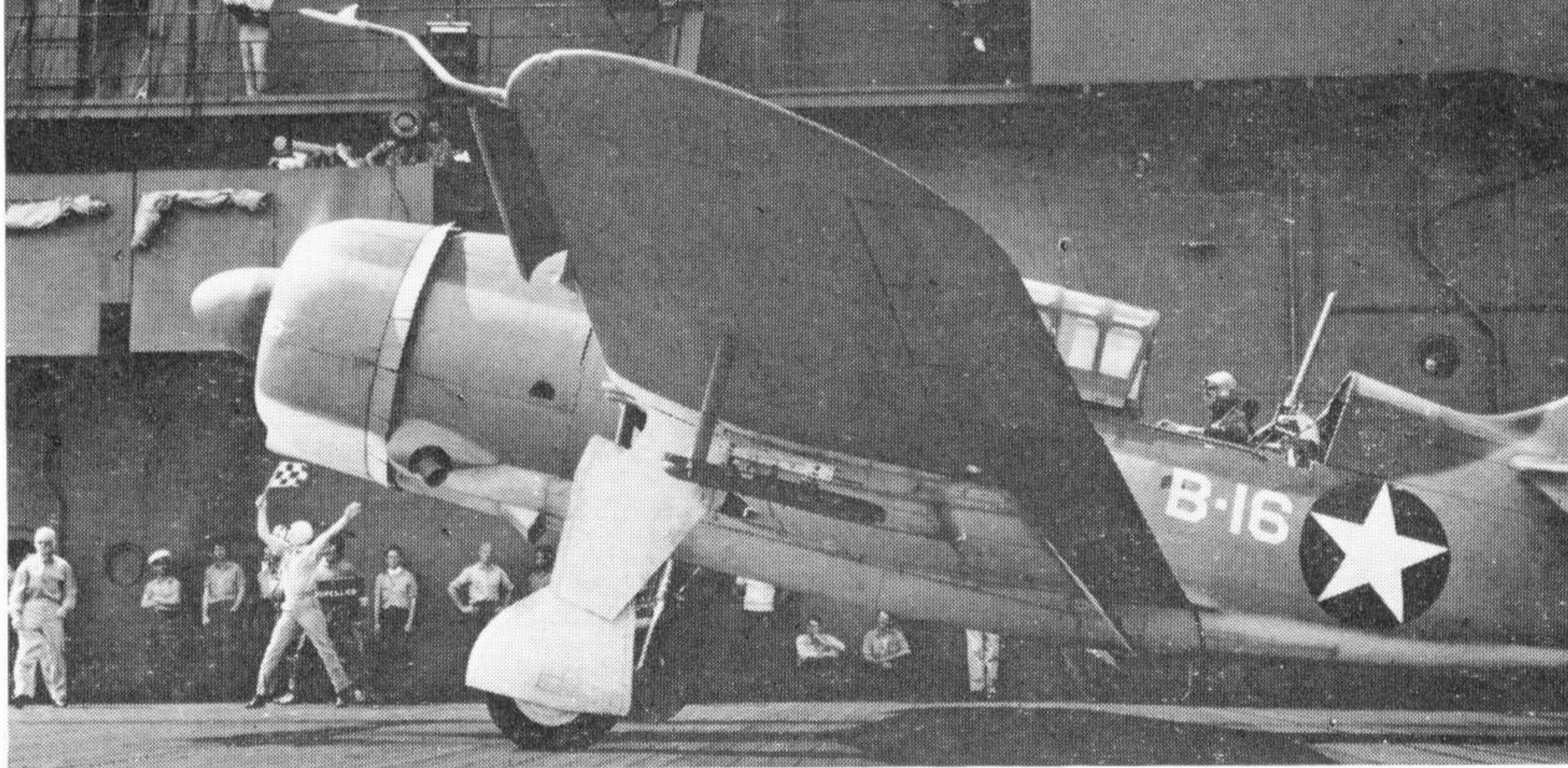


An SB2C-1 prepares to launch from the deck of the U.S.S. Yorktown during carrier qualification trials. As a result of this programme, Captain J. J. Clark of the Yorktown recommended cancellation of the SB2C series.

(Photo: U.S.N./National Archives)

mechanical drive from a fuselage mounted hydraulic motor. This feature, which gave much faster acting flaps, was scheduled for the 201st airplane, along with a new type of 20 mm. cannon, one of which was to replace the two .50's in each wing. 00006 went to Wright Field for Army tests in anticipation of their A-25A's, 00007 with complete radio/radar installation to NAS Anacostia, D.C. for radio/electrical tests, and 00008 to Norfolk for accelerated service tests. While these test programmes got underway, the next four airplanes were assigned to various training functions. In November, 00013, which had been modified for torpedo carrying, was flown to NAS Quonset Point, Rhode Island for torpedo launching tests and a month later, 00014 went to Langley Field, Virginia for flight and full scale tunnel tests. As these tests proceeded, various unsatisfactory conditions and problems were uncovered, but the SB2C-1 was considered to be in quite good shape considering that the XSB2C-1 had never undergone Navy trials. The main recurring complaint was the longitudinal instability, although this was not considered a critical condition. The arresting and catapulting tests led to changes to increase the strength of the fuselage fuel tank and its supports and of the tailwheel support structure, along with many lesser items. Armament tests showed the .50 wing gun installation to be satisfactory with minor changes, but the .50 turret was unacceptable due to poor tracking, sight vibration and other problems. Bomb loading and bomb release results were generally satisfactory. Accelerated service trials with 00008 revealed many discrepancies, most of them attributed to the high power settings used in these tests and to poor workmanship. The torpedo installation was also developed into a workable condition—though the SB2C-1's were never used for torpedo missions in service.

The NACA Langley tests had a two-fold purpose. While drag evaluation was of interest, these tests and accompanying flight tests were also directed toward investigating the flight characteristics of the SB2C in high speed dives. The latter programme stemmed from the loss of the XSB2C-1 and dive problems with other contemporary combat aircraft. It included static tests of re-designed surfaces at Curtiss as well as the NACA flight programme. As part of the NACA drag tests, installation of a twin .50 Emerson aft turret was evaluated. In January the demonstration dives of 00001 brought home the need for the high speed research more clearly when the first SB2C-1, like the XSB2C-1, failed structurally in a dive pull-out.

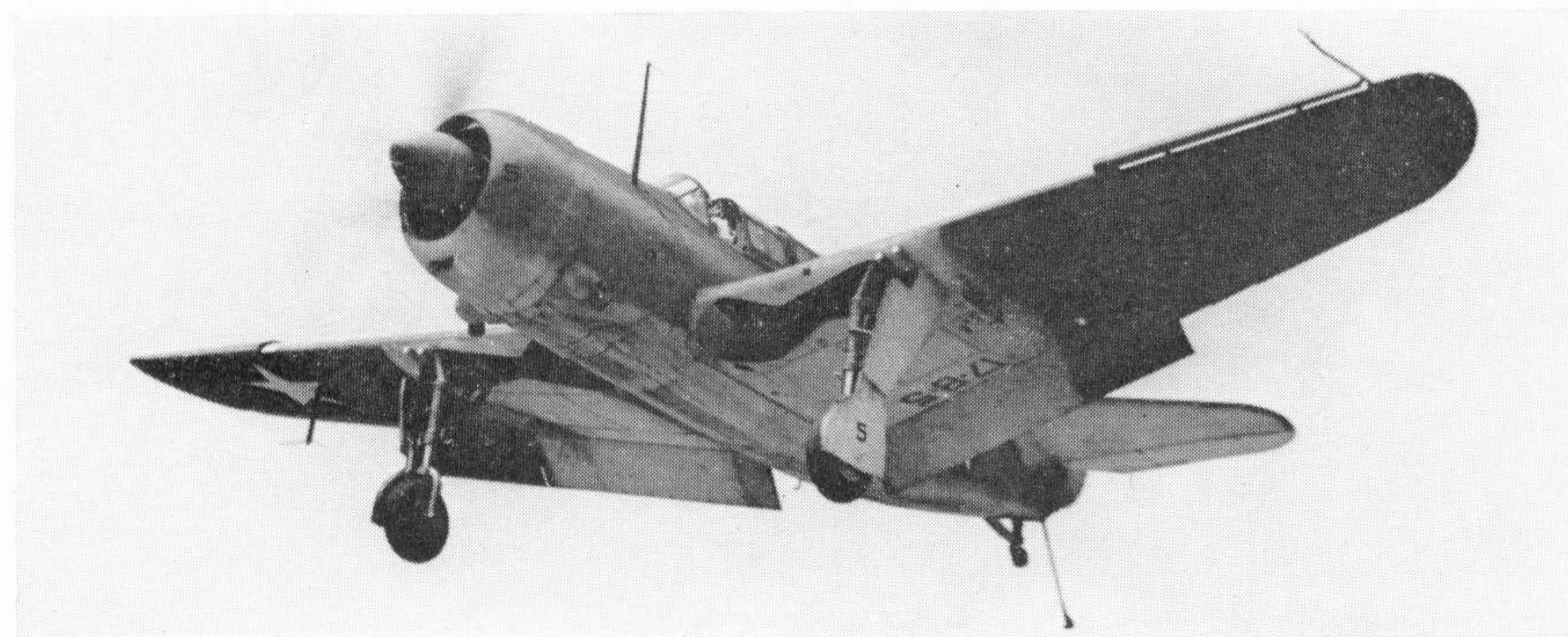


This view shows to good effect the three-shade camouflage finish of the Helldiver, including the non-specular white undersurfaces. (Photo: U.S.N. via Ward)

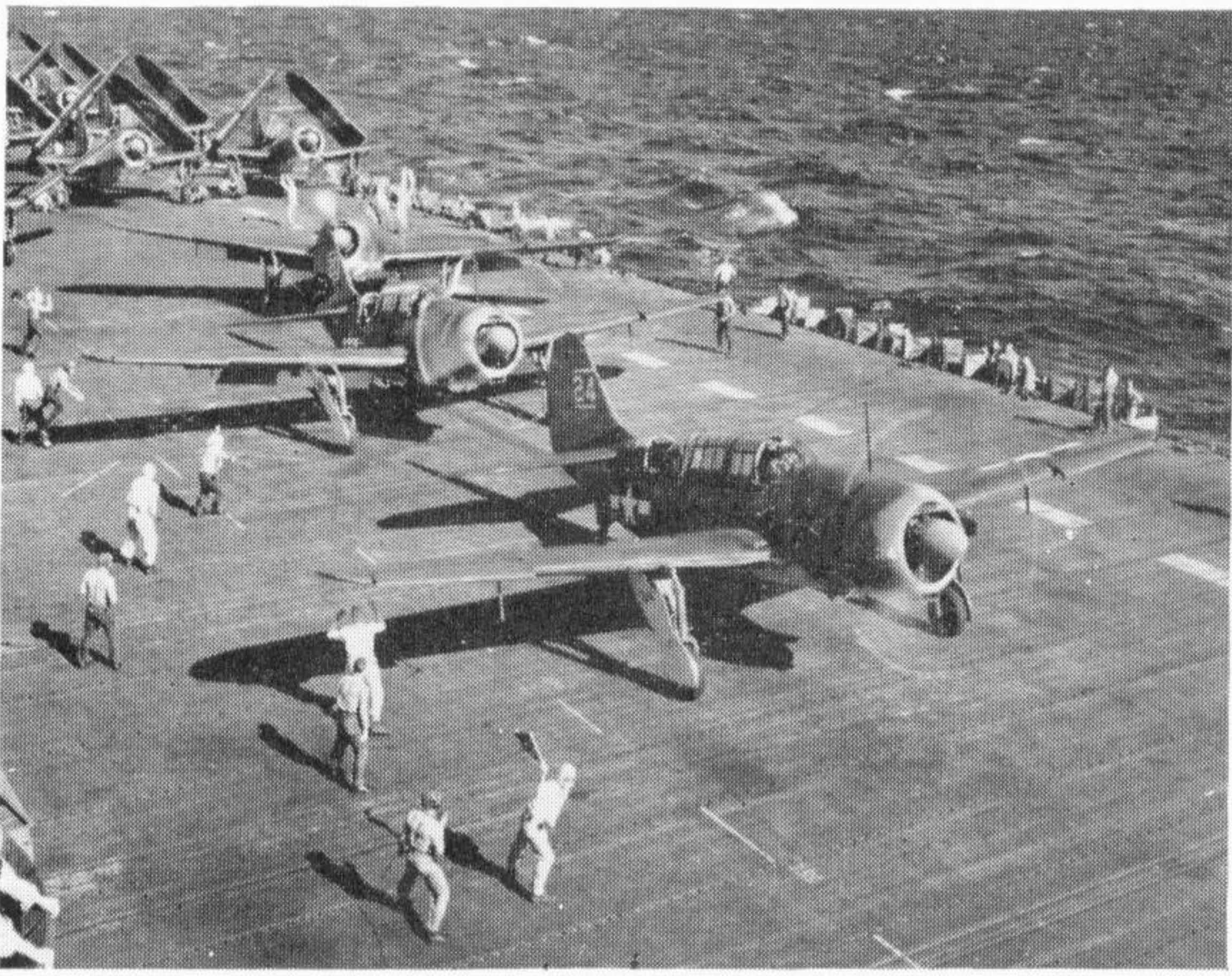
This time the test pilot was not as fortunate as Hulse had been. Efforts were intensified and led to what became the final major engineering effort on the SB2C-1: an intensive programme to determine the cause of these crashes, fix the airplane, and demonstrate safely the required dives and pull-outs. Using two highly instrumented SB2C-1's for flight test, Curtiss-Wright Research Laboratory in Buffalo undertook the final flight investigation, checking both flutter and air loads, beginning in November 1943. When completed, compressibility effects were found to be the cause. Dive demonstrations, modified to call out only zero lift, dive-brakes-open dives were completed using the air loads research airplane 00140 in the later summer of 1944, after which the Curtiss pilots conducted similar demonstrations on the SBW-1 and SBF-1. The last was the Fairchild of Canada-built SB2C-1, the contract for which had been signed in December of 1942. The SB2C-1 series aircraft operated throughout their service life restricted against clean high speed dives.

EARLY SERVICE

December 1942 saw the first SB2C-1's delivered to a fleet squadron: to VS-9, one of the squadrons of Air Group 9 which would go aboard the *Essex* (CV-9). VB-9 also began to receive SB2C-1's. With an early deployment date for the *Essex*, it soon became apparent that the new Helldivers were developing too many faults, both in design and workmanship, to permit completion of the necessary operational training on schedule. Their planes were shifted to VB-17 and the *Yorktown's* Air Group 10



Striking study of an SB2C-1 of VB-17 approaching the deck of the Bunker Hill during Air Group 17's shakedown cruise in July 1943. This aircraft is the subject of the five-aspect painting on p.2 of this Profile. (Photo: U.S.N./National Archives)



By the time of the Battle of the Philippine Sea in June 1944, the SB2C-1C's of VB-8 had replaced VB-17 on the Bunker Hill. This was the first major action in which the majority of the participating dive-bomber squadrons were equipped with the Helldiver. This view shows a mission lining up for take-off from Bunker Hill. (Photo: U.S.N./National Archives)

also began to receive Helldivers. The large and increasing number of problems led to a modification programme (Mod. I) at Curtiss to bring the first 200 airplanes up to a combat ready condition. These changes resulted from both service and flight testing failures.

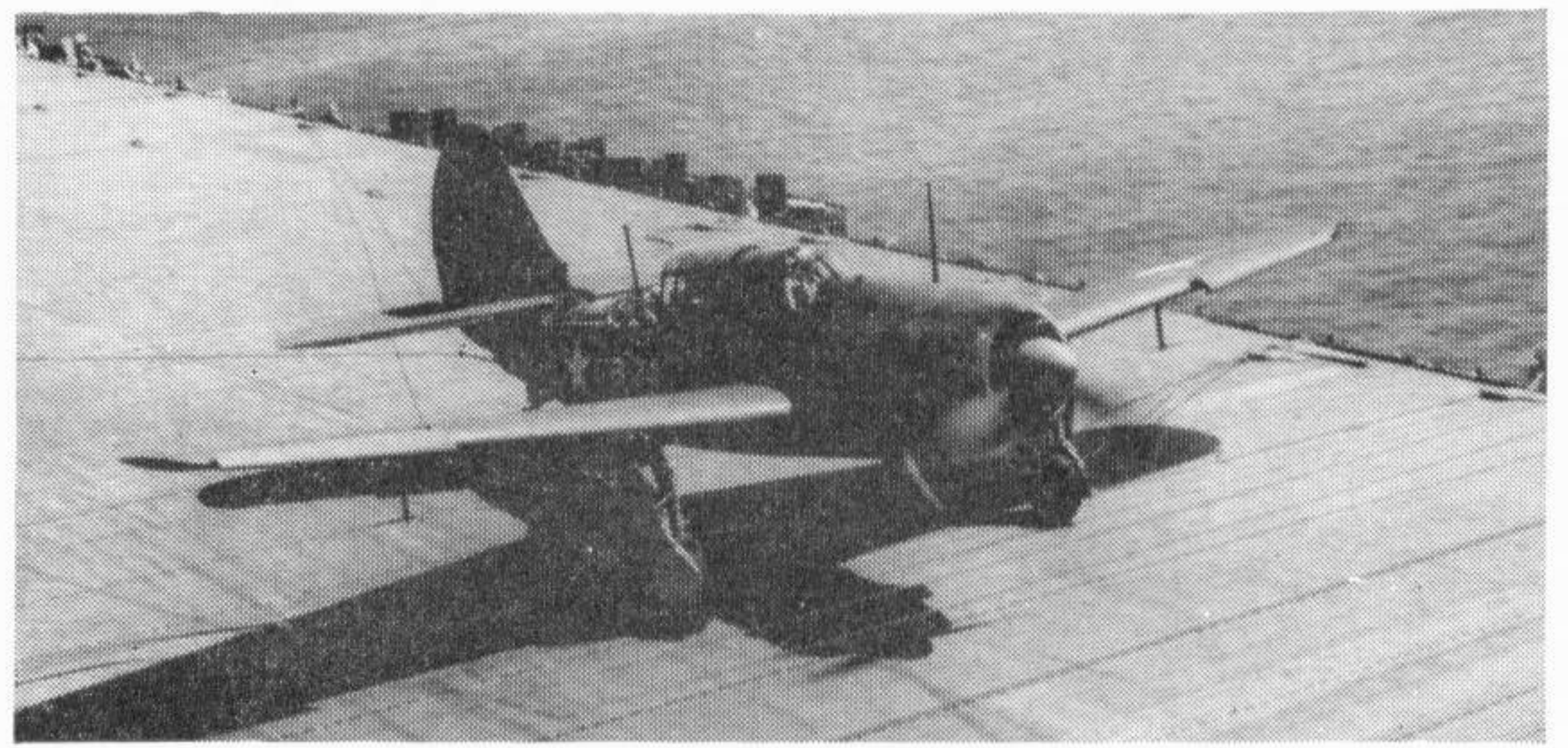
Initial carrier qualifications were conducted resulting in various failures, including unsatisfactory tail hook operation, tailwheel collapses and other structural problems. Only VB-17's initial period on board the *Santee* (ACV-29) in April gave encouraging results. The additional failures led to the Mod. II programme at Norfolk and in May the SB2C's of VB-6 and VB-4 embarked on *Yorktown* for her shakedown cruise. The results were sufficiently bad for the *Yorktown* skipper, Capt. J. J. Clark to recommend that contract cancellation be considered. VB-6 and VB-4 were then issued SBD's to meet their combat schedule.

A Mod. III programme was set up at Curtiss/Columbus and other plants to incorporate the major changes deemed necessary. This included deletion of the .50 turret and substitution of twin .30's for the rear gunner; the installation was similar to one originally installed in 00005 as the XSB2C-2. Extensive structural strengthening was incorporated, along with such changes as a bobweight in the longitudinal control system to give higher forces in dive recoveries, a non-retractable tailwheel, and self sealing fuselage fuel tank in place of the vapour diluting system.

VB-17 went aboard the *Bunker Hill* in July with their airplanes in the Mod. II status, and while many problems were encountered, corrections for most of them were already in the Mod. III programme. The squadron was subsequently re-equipped with 36 aircraft from the Mod. III programme, and the *Bunker Hill* headed for San Diego and west.

Curtiss-Wright had meanwhile begun to turn out the 20 mm. wing gun/hydraulic flap airplanes which were later redesignated SB2C-1C's. Like the SB2C-1's, these went directly from the production line to the modification line to reach the squadrons in service condition. In August the first SBF-1 and SBW-1 were rolled out, both in the SB2C-1C configuration.

Other squadrons, including VB-8 scheduled for the *Intrepid*, began to receive SB2C-1's. As these squadrons trained, some additional problems were encountered such as the hook bounce which plagued VB-14 and VB-15 on their carrier qualifications. The hydraulic system also continued to present maintenance headaches. But the major problems seemed to be over. In early November the 601st SB2C was rolled out, the first to come off the line "fully modified".



17-B-34 picks up a "late wire"; note lowered turtleback. Another photograph taken during VB-17's shakedown cruise. (Photo: U.S.N./National Archives)

COMBAT OPERATIONS

On 21st October 1943, the *Bunker Hill*, with Air Group 17 on board, departed Pearl Harbour en route to Espiritu Santo Island. VB-17 was finally on its way to war with its SB2C-1's. After a short stop at the huge Second Channel naval base on Espiritu Santo, *Bunker Hill* and the rest of Task Group 50.3, including the carriers *Essex* and *Independence*, were underway for a strike on the Japanese base at Rabaul. Launching some 160 miles southeast of Rabaul on 11th November, Air Group Seventeen's strike force included 23 SB2C-1's of VB-17, led by the squadron skipper LCDR J. E. Vose, along with Hellcats and Avengers.

As the strike force approached Rabaul they were met by a large group of defending Zeros. Through the determined fighter attacks and the flak from Japanese anti-aircraft fire, the planes of the three air groups pressed their attack against the warships in the harbour. With many hits observed on the ships below, and with minimum losses, the air groups jubilantly headed back for the carriers to be readied for a second strike. The planes were rearmed and refuelled and the second strike was being launched in the early afternoon when the Japanese struck back. The fighters were already in the air and, between their aggressive defence and the task group's anti-aircraft fire, the ships of the task group escaped almost undamaged.

The Japanese air group was nearly annihilated. Lost were all of its "Kate" torpedo bombers and almost all of its "Val" dive bombers. Since the carrier decks were crowded with armed and fueled aircraft, just one bomb hit could have significantly changed these results! The second strike at Rabaul was cancelled and the task group retired. While the damage to the Japanese fleet ships was later found to be considerably less than reported, the immediate evaluation of the strike was that it had been an outstanding success. Certainly in the air, the U.S. Navy's accomplishments were clear; only a small number of U.S. carrier aircraft were lost while the Japanese land-based squadrons suffered heavily. The SB2C-1 came through its baptism of fire successfully—VB-17 pilots and gunners acquitted themselves well in their dive bombing attacks and

Note fixed tail wheel of this SB2C-1 of VB-8, operating in the Norfolk, Virginia area in December 1943.

(Photo: U.S.N./National Archives)



in air action against both the defending fighters over Rabaul and, joining the task group's fighters, against the Japanese counter attack.

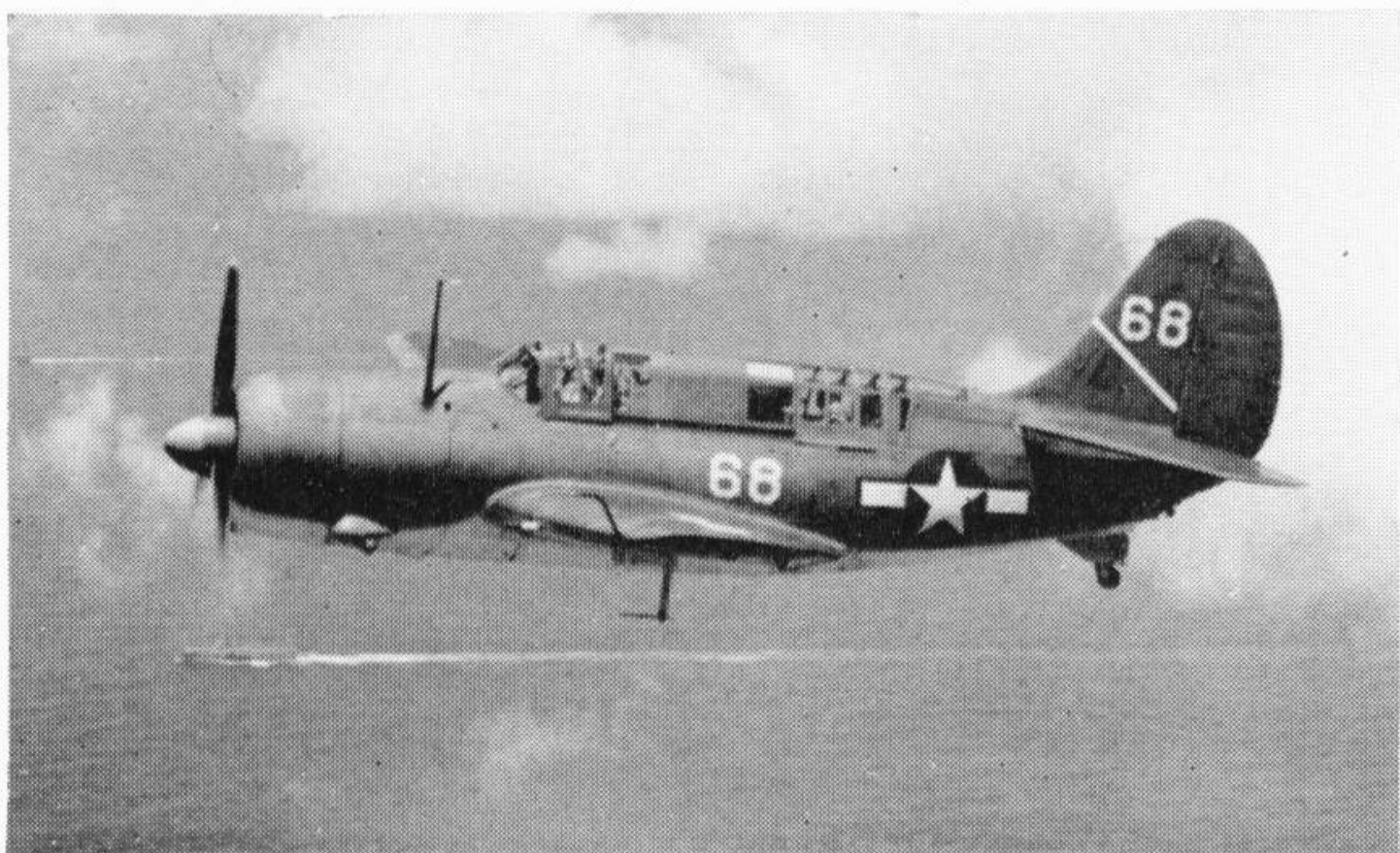
On Christmas Day of 1943, 27 of VB-17's SB2C-1's were launched with the rest of the air group in pre-dawn darkness for a raid on shipping in Kavieng harbour, New Ireland. There was little in the way of ship targets to be bombed, but on New Year's Day a cruiser convoy heading for Truk was spotted and a strike launched. Again Zeros put up a determined defence over the convoy and anti-aircraft fire was intense. Air Groups 17 and 30 (the latter from the *Monterey*) pressed home their attack, and reported extensive damage to the ships of the convoy. (Actually, only minor damage was suffered by the Japanese ships).

By late January, VB-17, now commanded by LCDR G. P. Norman, was part of the air power of Task Group 58.3, under RADM Frederick C. Sherman, which conducted strikes against Kwajalein Island and Eniwetok Atoll during the attacks on the Marshall Islands from 29th January until 3rd February. While few Japanese planes were encountered, anti-aircraft fire was intense. No SB2C's were lost in action, but three were lost in operational accidents. After a short break for replenishment, Task Force 58 mounted one of the most successful U.S. carrier strikes of the war—on the major Japanese base at Truk in the Caroline Islands, 17-18th February, 1944. Again, VB-17's SB2C's were part of the action, though in this raid they were to see no air to air combat, for the Hellcats of the Task Force were sent in to destroy the Japanese fighter defences before the systematic bombing and torpedo attacks began. The strike virtually eliminated Truk as a major Japanese Navy base in the Pacific. Only five days later VB-17 again saw action as part of Task Group 58.3 in major strikes against Tinian and Rota in the Marianas over which no American or Allied planes had flown since early in the war. VB-17 suffered no losses in this strike. This was its last major action before completing its successful combat tour and returning to the States aboard the *Essex* in early March.

While VB-17 was taking the SB2C-1 into action, other squadrons continued their operational training. Many of the major problems of the early SB2C's were corrected, and with favourable reports from initial action, opinion of the Helldiver improved. On the East coast, VB-8 continued training with SB2C-1's and other squadrons with -1's and -1C's. On the West coast, VB-20 had been among the first to receive SB2C-1's (at San Diego's North Island) beginning in the fall of 1943. By spring SB2C-1C equipped squadrons were ready for the Pacific action and began to replace the SBD equipped squadrons as air groups were returned for rest and reforming.

By spring, too, the -1C had been replaced on the production line with the higher powered SB2C-3, with the Canadian Helldiver lines following suit. Some of the twenty-six SBW-1B's for the Royal Navy were used to form No. 1820 Squadron at NAS Squantum, Massachusetts on 1st April 1944 and later sailed to England.

A veteran SB2C-1 from one of the groups which took part in the Philippine Sea actions flies over the task force on the 23rd June—after the battle was over. Note the early-style counter-shaded colour-scheme. (Photo: U.S.N./National Archives)



Carrier Air Group 2 operated from the Hornet (CV-12) during the action of June 1944. Here, VB-2's SB2C-1C's share the flight deck with Hellcats and Avengers.

(Photo: U.S.N./National Archives)

However, the squadron was disbanded in December without seeing action.

The "2C's", as they were commonly called, going to Pacific combat, were all SB2C-1C's; VB-17 was the only squadron to take the original -1 model into combat. The squadrons operated with from 32-40 SB2C's while on board ship. In May the growing U.S. carrier forces, including the SB2C-equipped bomber squadrons as part of the new air groups on board, participated in raids on Wake and Marcus Islands. The combat experience and training were considered secondary objectives on these missions, in preparation for the forthcoming assault on the Marianas. Beginning 11th June, the tempo of air operations picked up with almost continuous action by the carrier air groups during the following week. Initial strikes on Saipan preceded the landings there. VB-15's "2C's" operating from the *Essex* were also participants in a devastating attack against a convoy leaving Saipan.

BATTLE OF THE PHILIPPINE SEA

Co-ordinated strikes by the air groups were flown against Iwo Jima, Chichi Jima and Pagan before the Task Force rendezvoused on the 18th to meet the Japanese fleet. On the carrier decks were five SB2C and two SBD squadrons. The following day the Japanese launched their first carrier aircraft attack on the ships of Task Force 58 to begin the Battle of the Philippine Sea. Helldiver participation on the first day was devoted to bombing strikes against Orote Field, Guam to limit its assistance to the Japanese carrier air groups.

On the second day of the battle, the "2C's" were major participants in one of the most famous actions of the Pacific War. Locating the Japanese fleet in mid-afternoon at maximum range for an air strike, Admiral Marc Mitscher ordered the launch, knowing that recovery would be after dark, and that fuel exhaustion would further compound the problem. The "2C's" were launched with full bomb bay tanks to give the needed range. The attack on the Japanese fleet just before sundown was short; the defending fighters and anti-aircraft accounted for 20 of the 216 attacking aircraft. In spite of the lack of time for a co-ordinated attack, the Japanese carrier *Hiyo* and two fleet oilers were sunk and other ships, including the carrier *Zuikaku*, suffered extensive damage. More than half of the Japanese carrier aircraft which had survived the previous two days of battle were also shot down.

The Americans headed "home". As they departed, two SB2C's from VB-8 were shot down when jumped by Zeros, but the Hellcats soon eliminated this threat to the



SB2C-1C of VB-15 loses its engine in a barrier crash on the Essex (CV-9) after returning from a mission in the Philippine Sea battles.
(Photo: U.S.N./National Archives)

retiring force. The worst was yet to come. All the pilots had to stretch their fuel as much as possible. Aircraft with combat damage causing loss of fuel couldn't hope to get back to the carriers. One of VB-14's SB2C's ditched half-way back. The crew was later rescued, as was a VB-8 pilot, and his crewman, after throttling down to conserve fuel and flying into the water.

As the first planes approached the carriers, Admiral Mitscher gave his famous order to turn on all the lights in the Task Force. Confusion reigned as pilots tried to find any deck available on which to land. Many were forced to ditch: one group of "2C's" ditched together just prior to fuel exhaustion. When the score was counted, four SB2C's were among the 18 aircraft lost in combat and 39 joined 14 Hellcats, 4 SBD's and 23 Avengers lost in deck crashes or ditchings. However, most of the pilots and crewmen were rescued subsequently. The Japanese fleet had suffered a far greater loss in ships, aircraft and aircrews.

With the Battle over, the "2C's" had not done as badly in comparison to the SBD's as Morison's evaluation would suggest, until the final night recovery when 39 of the 47 returning Helldivers were lost. The "2C's" had generally delivered half again the bomb load per airplane that the SBD's carried and loss rates, to enemy anti-aircraft and enemy fighters combined, were quite comparable. Certainly it would remain for later action—and later models—to prove that the Helldiver was as much of an improvement over the Dauntless as was desired or expected.

The SB2C-1C equipped air groups continued with Task Force 58 through the summer of 1944, though the new air groups entering action introduced SB2C-3's with considerably improved performance. SB2C-1C equipped VB-8, which had replaced VB-17 on the *Bunker Hill*, received SBW-1's and SBF-1's as replacements for some of the SB2C-1C's which it lost. VB-20 had started training with the -1C, but flew -3's when they and the rest of Air Group 20 entered combat from the *Enterprise* in August. When *Essex's* VB-15 completed its combat tour in November, it could claim 2 Japanese aircraft shot down in combat. It had flown with Task Force 58 through the entire Marianas campaign including direct support of ground forces on Guam. With the *Essex*, it joined Task Force 38 in action against Palau, Mindanao, Manila Bay and other targets in the Philippines and Formosa from late August until mid-November. At that time VB-15 could proudly point to a record of no aircraft shot down in combat.

In the Battle for Leyte Gulf, 23-26th October, VB-15 was the only bomber squadron still flying SB2C-1C's; the

remaining air groups were by then equipped with the -3 version of the "Beast", as the SB2C had come to be known. With the rest of Mitscher's Air Groups, VB-15 helped destroy much of what remained of the Japanese Fleet.

From this time on, almost all of the remaining -1C's, SBW's and SBF's, like the -1's were used in the operational training rôle, training the continuing stream of naval aviators on their way to carrier combat. Some served Marine VMSB squadrons before they shifted to later models. As production lines spewed out more and more of the latest SB2C-4's in early 1945, the -1 series was gradually replaced in their training job by the -3's, just as they previously had been in the fleet. Most were scrapped beginning in early 1945. A few survived longer for special uses, such as BuNo 01150 which was modified for radio controlled dive tests by the Naval Air Modification Unit at Johnsville, Pennsylvania and tested by them and by the NACA at Langley Field.

XSB2C-2

During 1940, development of several aircraft as land or sea based Marine expeditionary aircraft was studied by BuAer. One of the types of interest was the SB2C. In January BuAer decided to proceed with a project to convert the XSB2C-1 into a seaplane prototype after it completed Navy trials, with Edo building the floats. The converted XSB2C-1 would serve as a prototype for production SB2C-2's. By the time of Pearl Harbour Curtiss-Wright was informed that 294 of the SB2C-1's under contract would be produced as SB2C-2's, and Edo was given a letter of intent for production floats. After the crash of the XSB2C-1, the float programme was transferred to the fifth SB2C-1, immediately following the four priority test airplanes. BuNo 00005 was fitted with the floats at Columbus, accepted as an SB2C-1 and ferried to NAS Anacostia where the floats were installed and tests conducted. Following generally satisfactory results, though take off distance was excessive, rough water tests were conducted successfully in Hampton Roads on 9th March 1943, operating at fairly low weights. Following this a prototype twin .30 free rear gun installation, adapted from the SBD, which replaced the SB2C-1 turret was evaluated, and with some changes recommended for the SB2C's until a reliable power-driven .50 turret became available. With the delays in the overall SB2C programme, and the passing of the need for seaplane expeditionary types, the production SB2C-2's were finally cancelled on 14th April, 1944.

A25A/SB2C-1A

The last of the SB2C-1 series to appear were the A-25A's for the Army. As combat airplanes they were destined to be stillborn.

Their story begins with the phenomenal success of German dive bombing in support of the German Army advances across Europe. Based on this success, the U.S. Army became interested in dive bombing as a separate method of ground attack from the low level strafing and bombing practiced by Army Attack Squadrons. With the expansion of the Army Air Corps in 1940, procurement of dive bombers was added to the planning and the Army

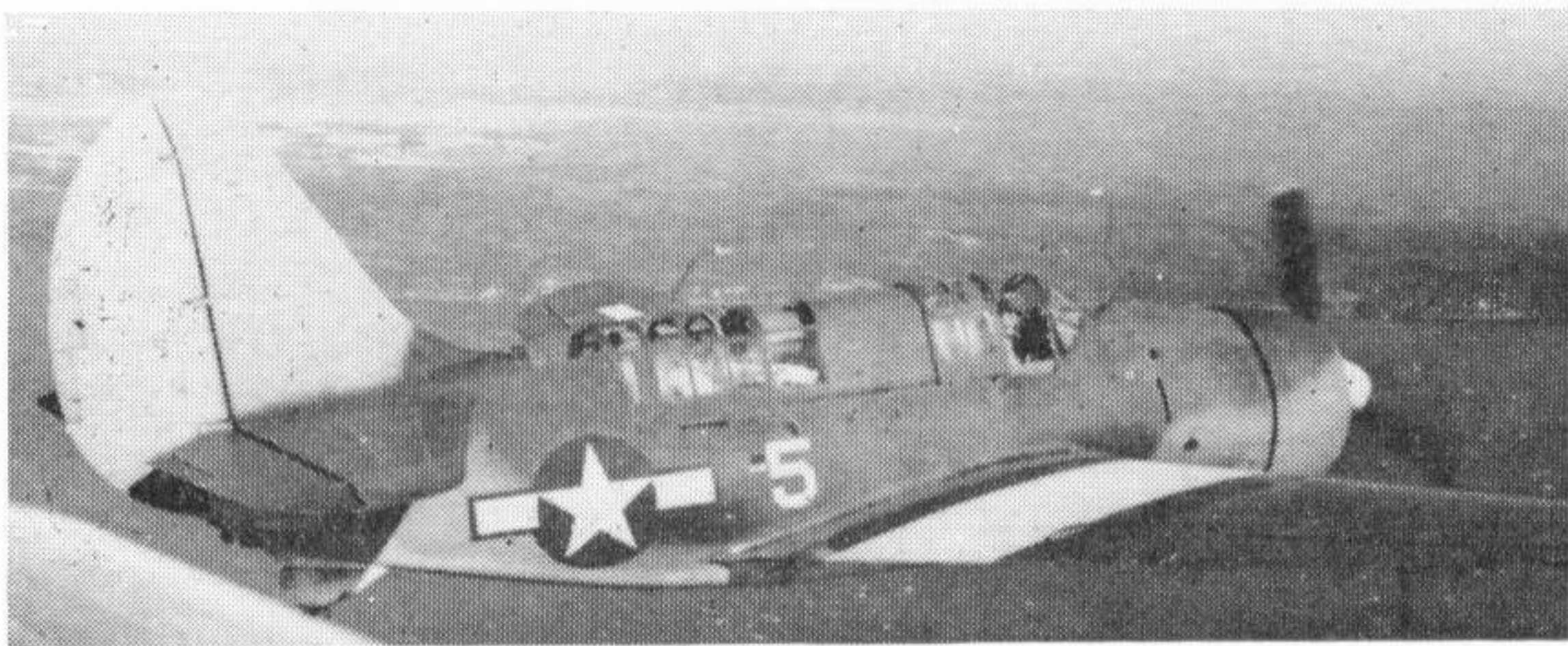
SB2C-1C's of an operational training unit based at Fort Lauderdale, Florida in the spring of 1944.

(Photo: U.S.N./National Archives)





A classic view of an SB2C-1 releasing a 1,000 lb. bomb with the displacement gear. (Photo: U.S.N./National Archives)



Whidbey Island, Washington was one West Coast base for operational training of SB2C pilots. This training SB2C-1, with wing inboard section painted white, is seen over Puget Sound in August 1944. (Photo: U.S.N./National Archives)

turned to the Navy's SBD and SB2C to fill this mission. In late 1940 agreement was reached for the Navy to procure approximately 100 SB2C type dive bombers from Curtiss under the recently signed Navy contract. Referred to as SB2C-1A for procurement and designated A-25A by the Army, these were to be standardized as much as possible with Navy production. An order for 100 was added to the Navy contract on 31st December 1940. By the end of 1941 much larger quantities of A-25A's were being considered and the Navy felt that all the production capacity at Curtiss-Wright's Columbus Plant was required to meet its needs. The Army Air Materiel Command therefore directed that the St. Louis Plant of Curtiss-Wright be turned over to production of A-25A's. By spring, procurement of 3,000 more A-25A's had been initiated, to be built in St. Louis. From here on, the problems of co-ordinating engineering and manufacturing between two plants, which was not particularly eased by the fact that both were divisions of the same company, was added to the problems of co-ordinating Army and Navy requirements. The A-25A became the model S84 within the Curtiss organization, and soon had its own series of drawings to account for different engineering and shop practices between the plants. The A-25A was to have larger main wheels, larger pneumatic tail wheel, Army radio and additional forward and underside armour plate. Redesign for the needed larger wheel well was done for both models to maintain standardization. Major subcontractors and suppliers for the Navy production were retained for the A-25A in order to enhance standardization.

On 29th September 1942, almost exactly three months after the initial flight of the first production SB2C-1, the first A-25A Shrike was flown. It included the folding wings and the wing slats of the SB2C-1. Production and testing proceeded more slowly than the Columbus programme. By March, 1943, the final A-25A of the first block of ten had been rolled out—it was the last with folding wings. By this time action was well underway to transfer the A-25A programme to an Army contract since the attempts to maintain standardization were holding up both programmes. The transition added further to delays in A-25A production due to problems with inspection authority, government furnished equipment and sub-contracts.

By the time production was well underway, the Army

had reached two conclusions: (1) the A-25A was its best dive bomber and (2) the Army had no use for dive bombers.

Thus the A-25A's were delivered to various second-line activities to serve training, target towing and other needs. By the end of 1943 they were redesignated RA-25A to denote their non-combat status. They also traded their assigned popular name, Shrike, for the Navy's Helldiver, the only item of increased standardization since the beginning of the programme!

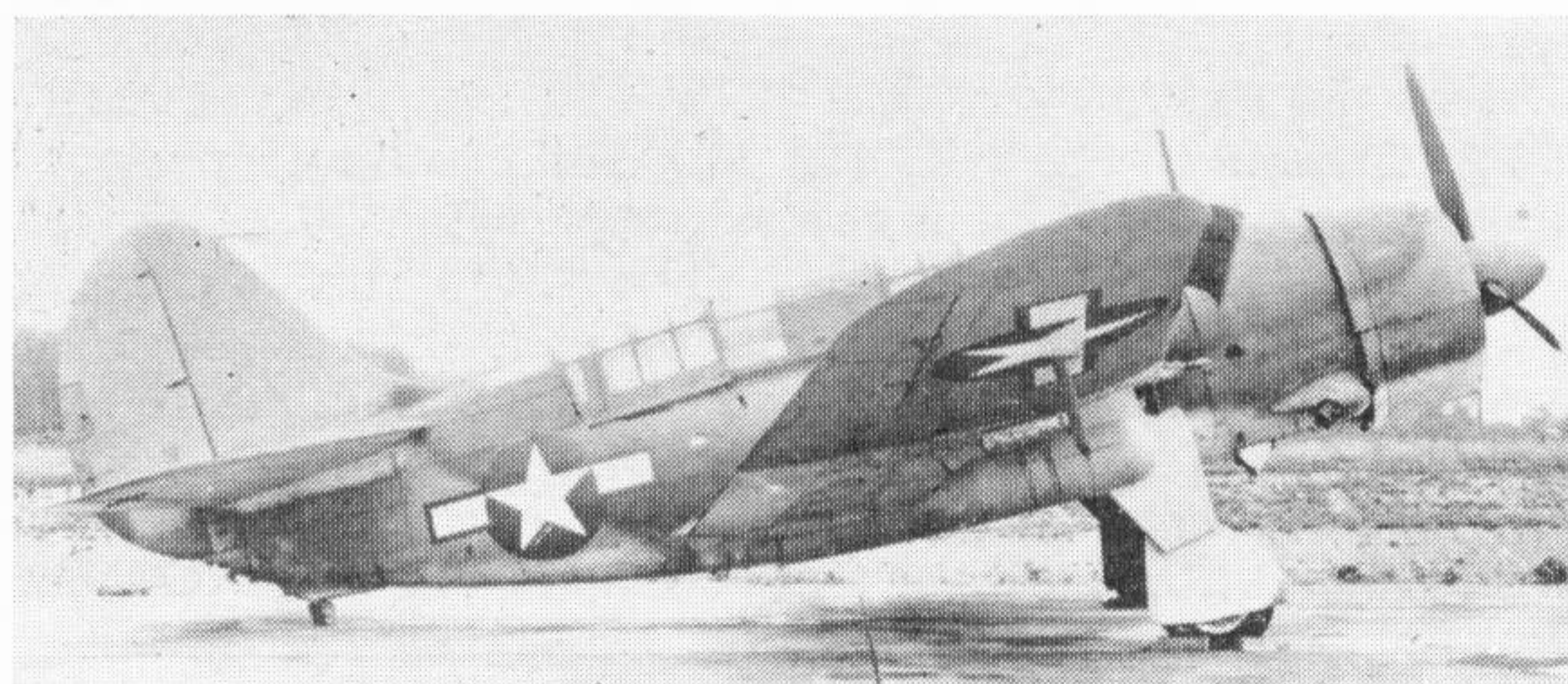
Early in the A-25A programme, 150 airplanes had been allocated for the Royal Australian Air Force to help meet their critical need for combat types. However, with the programme delays and the R.A.A.F.'s decision that dive bombers were no longer needed, 140 of these were considered surplus to R.A.A.F. needs and were never delivered.

With production of RA-25A's reaching a peak, and no further requirement for the type, the programme took another turn. 410 airplanes, including the 140 intended for the R.A.A.F. and the last 268 off the line were to be transferred to the Navy for use as land based divebombers by the Marines, with the line closing down when 900 had been built. By this time many changes had been incorporated in the RA-25A design to meet Army requirements, including elimination of the wing slats and changes to the control surfaces.

Following a configuration review for the Marine Corps, a programme was set up to send the transferred airplanes through modification centres operated by NAF Roosevelt Field, New York, Consolidated-Vultee, Allentown, Pennsylvania and Delta Airlines. There service changes were incorporated along with the planned modifications and the SB2C-1A's were issued to Marine VMSB squadrons for operational training. Additional service changes were found necessary after delivery and these were incorporated by the squadrons. By the end of 1944 when all SB2C-1A's had been modified and delivered, transfer to the Navy's Operational Training Command and to other uses began. The Marine/Navy SB2C-1A's were destined also for a non combatant role, and both Army and Marine/Navy land based Helldivers were declared surplus at an early date.

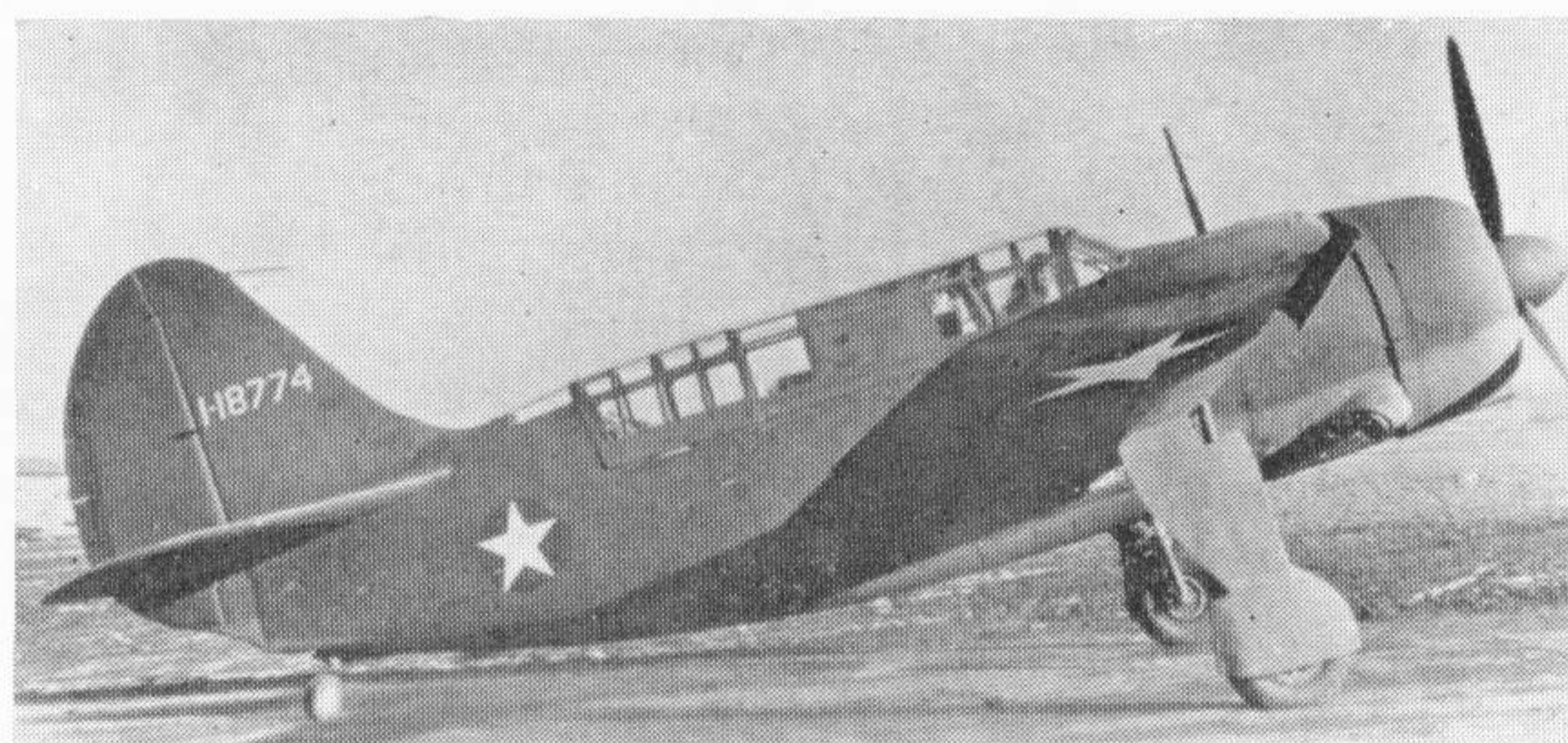
© Harold Andrews, 1966.

The assistance of those who provided information and photos for this Profile is gratefully acknowledged; especially A. O. Van Wyen and L. M. Pearson of the U.S. Navy, L. S. Casey of the National Air Museum, and the staff of Naval Aviation News.

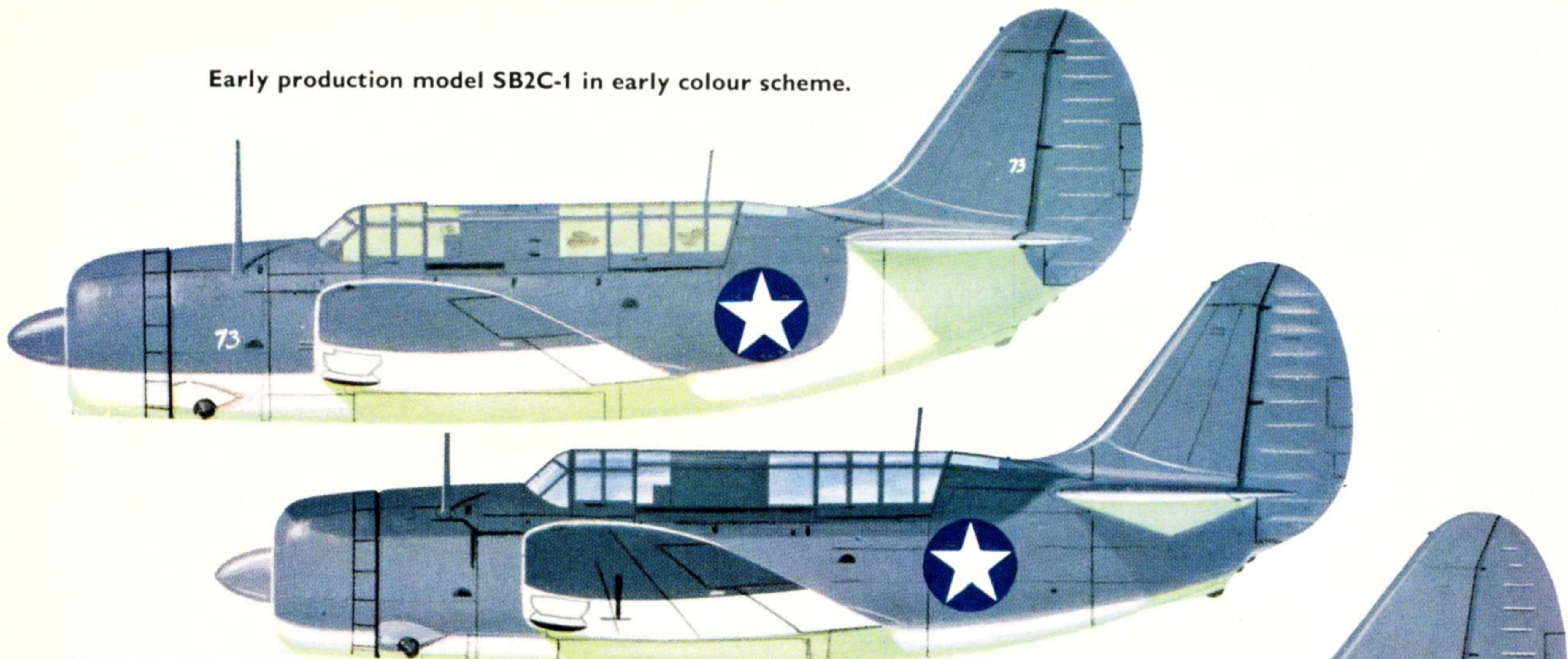


Top: SB2C-1C at Patuxent River in summer of 1944, with ASH (APS-4) radar installation on right wing bomb rack: centre, the first A-25A Shrike at St. Louis in late 1942. Note open wing slats; these later locked closed and installation removed: bottom, an RA-25A photographed at Miami in November 1943 in unusual paint scheme, with the name "Gray Ghost" on nose.

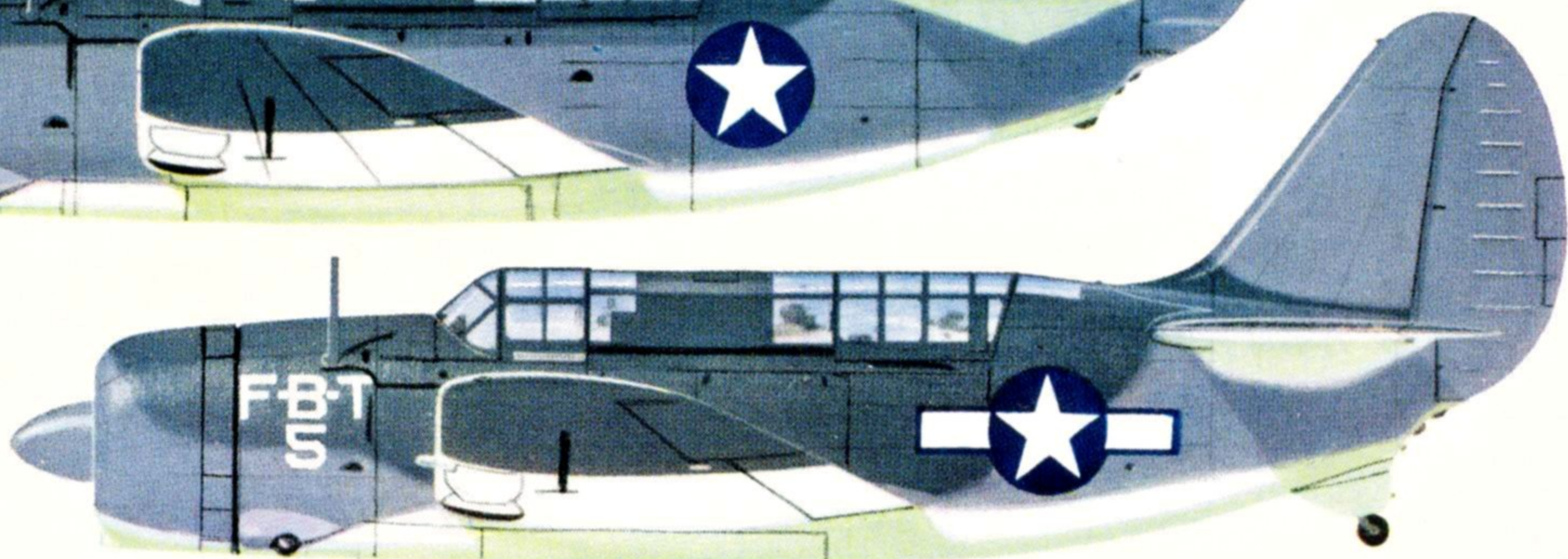
(Photos: top, U.S. Navy; bottom, U.S. Air Force)



Early production model SB2C-1 in early colour scheme.



SB2C-1 in early counter-shaded scheme.

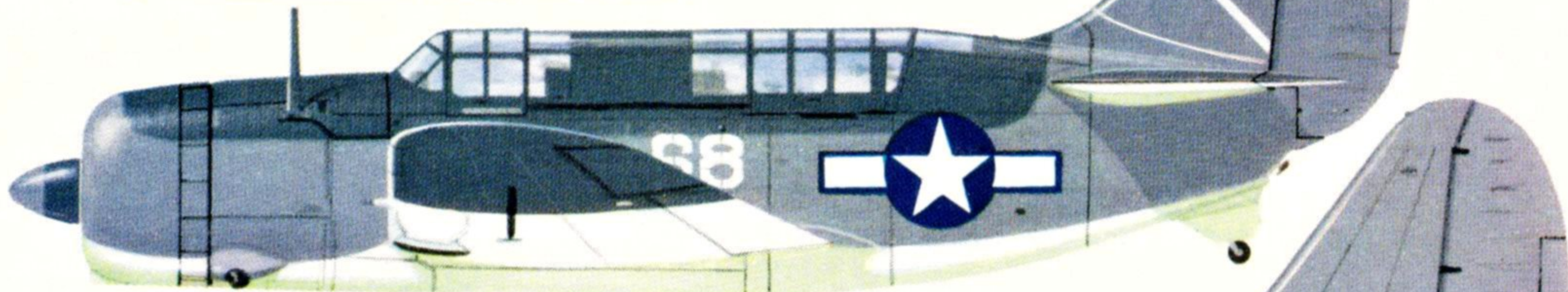


SB2C-1C of training unit, Fort Lauderdale, Florida, April 1944.

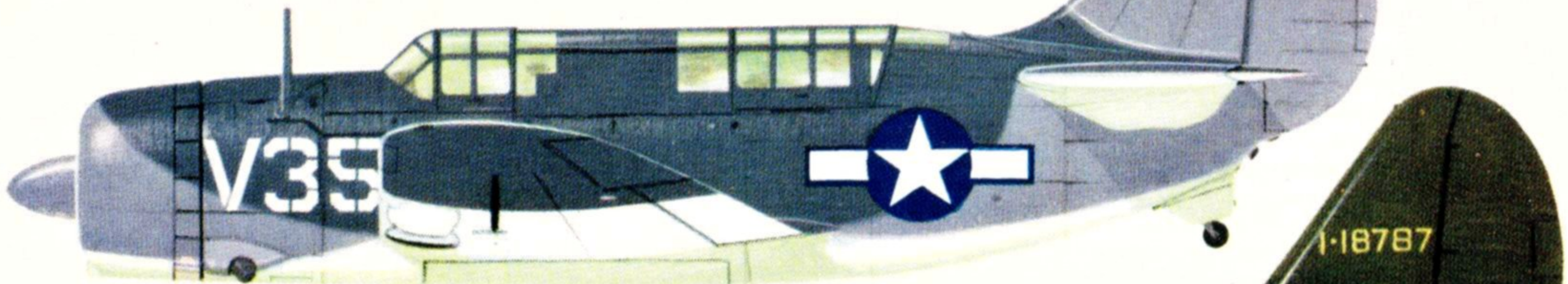
SB2C-1C during training period, Hawaii, May 1944.



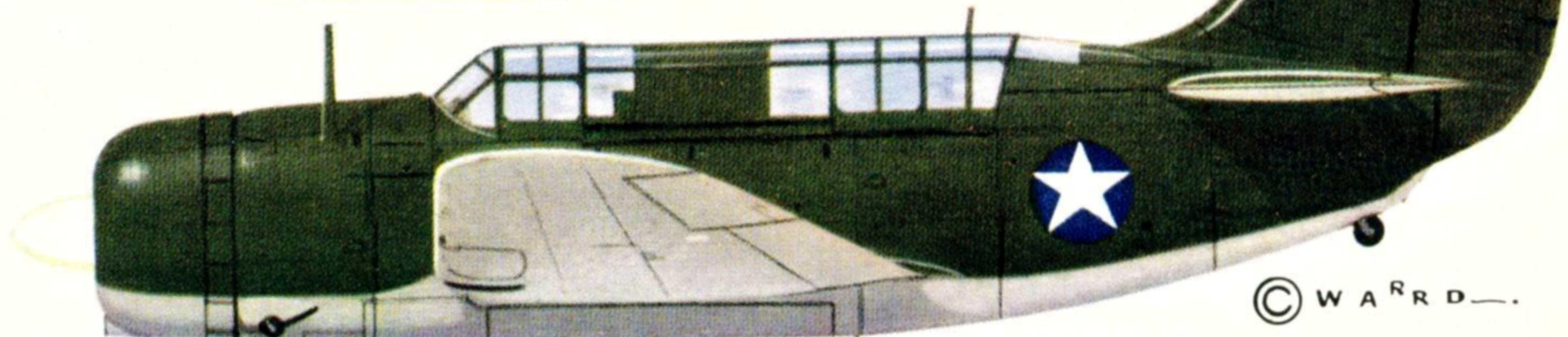
SB2C-1 from one of the five Air Groups which saw action during the Battle of the Philippine Sea.

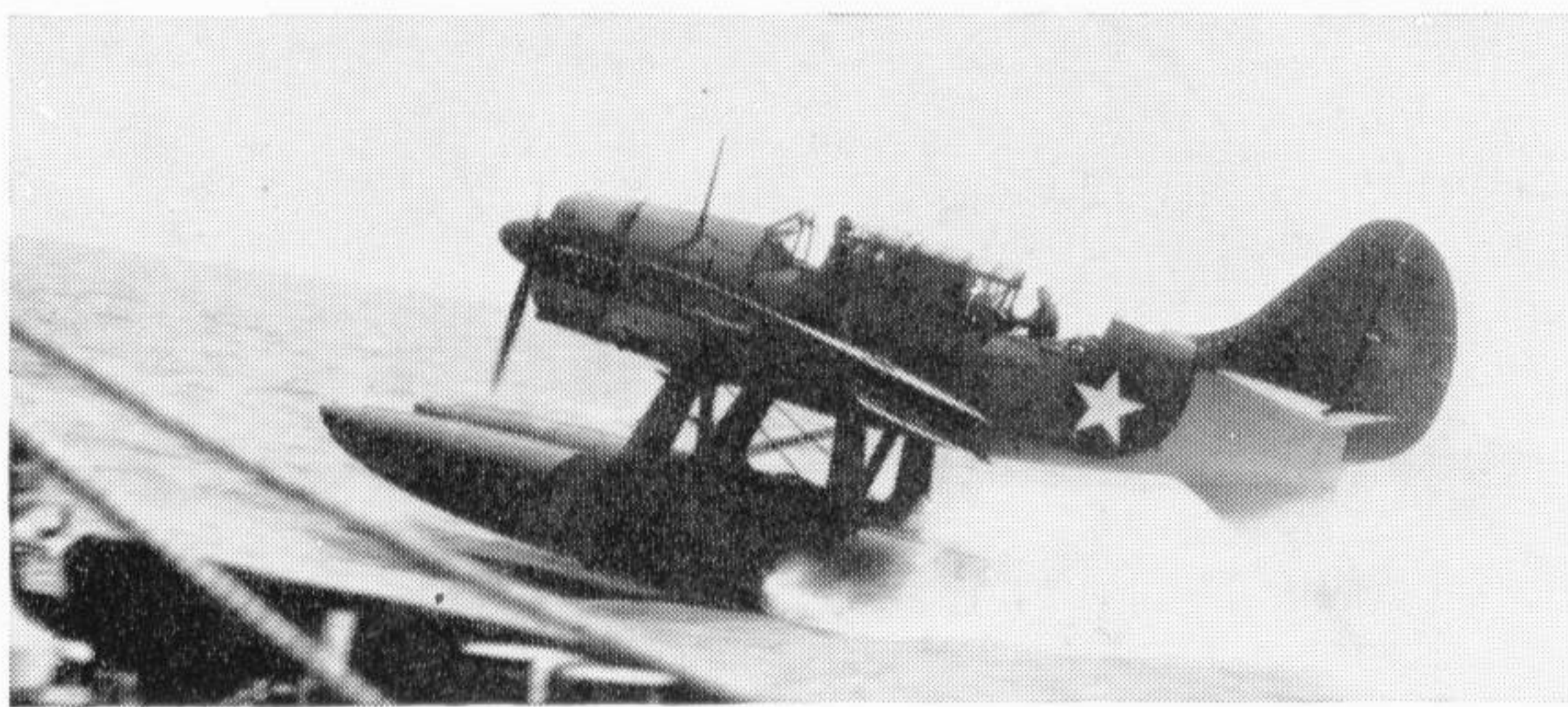


SB2C-1 of VB-20, December 1943.

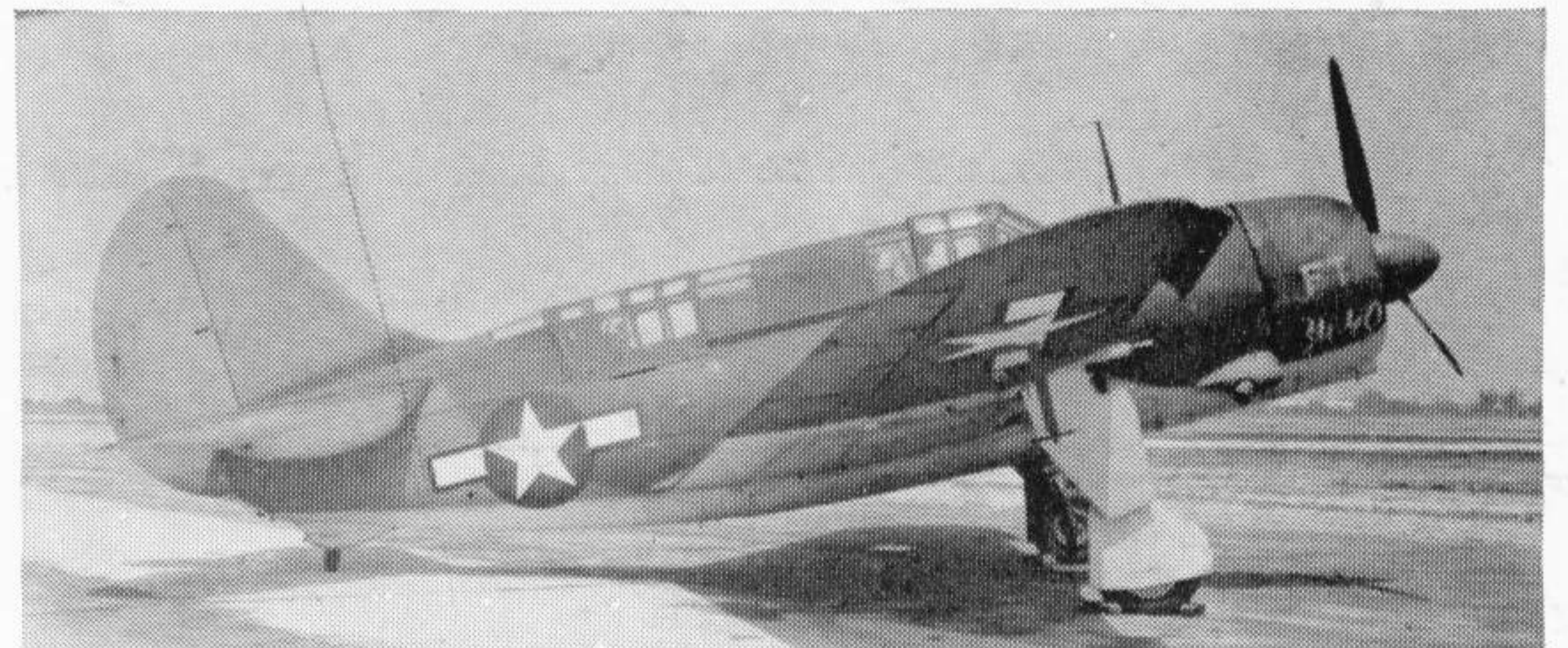


A-25A of U.S.A.A.F., standard Olive Drab and Grey scheme.

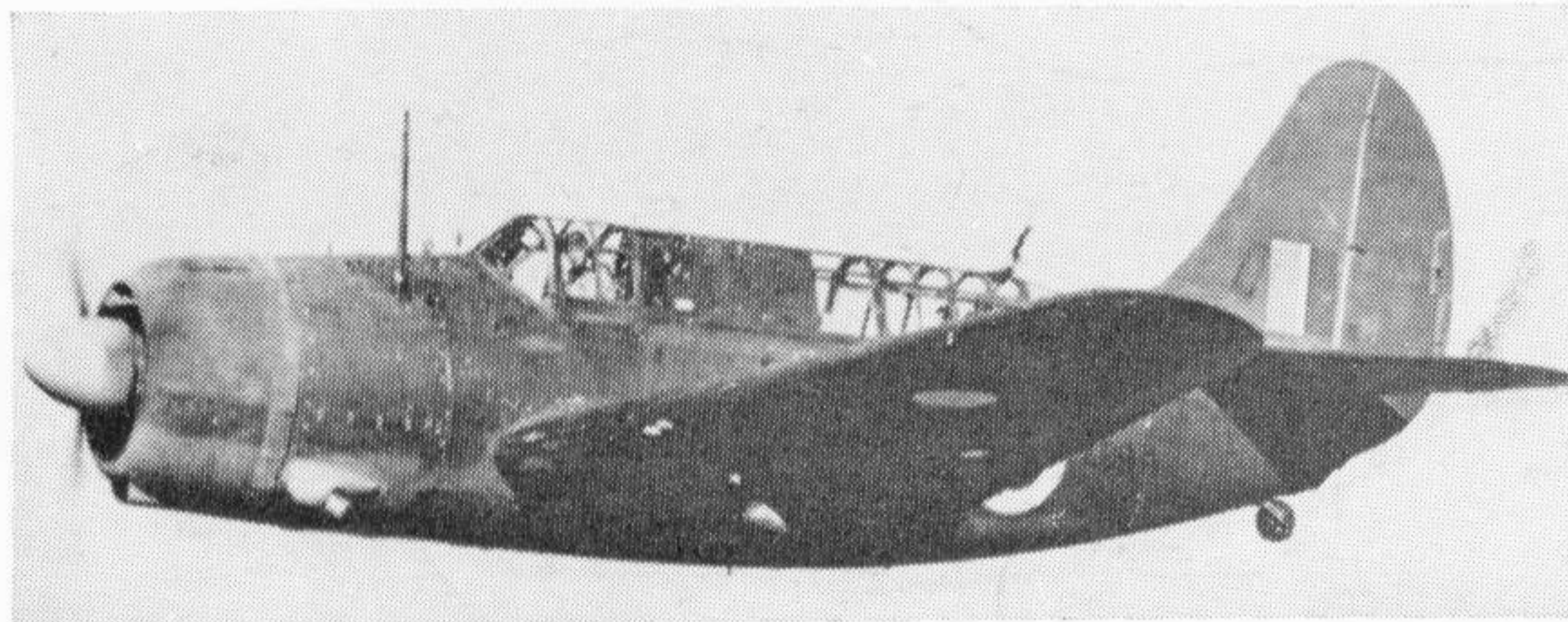




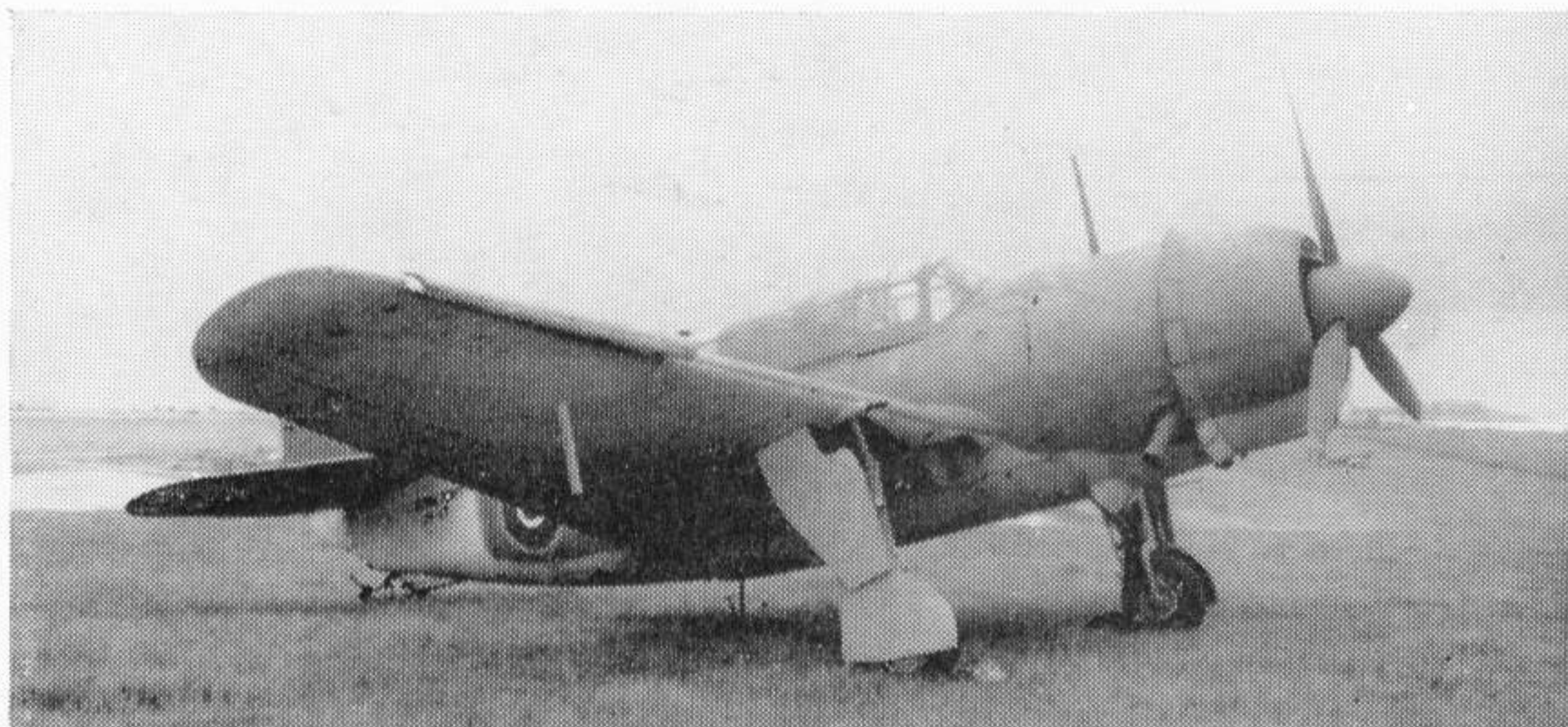
Rough water tests on the XSB2C-2 in Hampton Roads, Virginia were conducted in March 1943 by pilots from NAS Norfolk, Virginia. This shot shows the aircraft immediately after touching down. (Photo: U.S. Navy)



The Fairchild-built SBF-1 during Board of Inspection Trials; BuNo 31640 at Patuxent River in May 1944, showing typical SB2C-1C features and colour scheme. (Photo: U.S. Navy)



One of ten A-25's actually delivered to the Royal Australian Air Force, A69-4 was U.S.A.A.F. 42-79686. Shown here during test flights, it carried R.A.A.F. fin flash and roundels on standard U.S.A.A.F. finish. (Photo: R.A.A.F. Official)



Production by Canadian Car and Foundry was to include a large batch of Helldivers for the Royal Navy. Only 26 SBW-1B's were actually delivered; this machine, JW117, was flown in trials by the Aircraft and Armament Experimental Establishment. (Photo: Crown Copyright via Malcolm Passingham)

SPECIFICATION SB2C-1 Helldiver

General: Span (spread) 49.72 ft. (folded) 22.54 ft. Length 36.67 ft. Height (tail wheel on ground, prop. blade vertical), 14.75 ft.; (wings folded) 16.83 ft.

Wing: Area, 422 sq. ft. Root chord 12 ft. Tip chord (theoretical at tip) 5.17 ft. Incidence (root), 1.5°; Twist, 2°; dihedral, 6°. Root section, NACA 23017; tip section, 23009. Split flaps, upper and lower, area 52.2 sq. ft. Max. deflection, landing 0° up, 60° down: dive 45° up, 45° down. Leading edge slat, extended with landing gear, 29.4° span inboard from end of rounded tip. Frise ailerons with balance and trim tabs, total area aft of hinge 13.7 sq. ft. each.

Horizontal Tail: Span 19.04 ft. Area 107.4 sq. ft. Elevator area, incl. trim tab, 37.88 sq. ft. Stabilizer incidence 3°.

Vertical Tail: Area 45.7 sq. ft. Rudder area, incl. trim tab, 22.2 sq. ft. Fin offset 1.5° leading edge left.

Engine: Wright R-2600-8. Military and take-off power: 1,700 h.p./2,600 r.p.m./sea level to 3,000 ft.; 1,450 h.p./2,500 r.p.m./7,800 ft. to 12,000 ft. Normal power: 1,500 h.p./2,400 r.p.m./sea level to 5,800 ft.; 1,350 h.p./2,400 r.p.m./8,900 ft. to 13,000 ft.

Curtiss electric constant speed propeller, three blade, 12 ft. diameter.

Tank Capacities: Fuel, internal, fuselage 110 U.S. gal., wing 2x105 U.S. gal.; bomb bay, jettisonable, 130 U.S. gal. External, wing 2x58 U.S. gal. Oil, 25 U.S. gal.

Weights (SB2C-1C): Empty; 10,114 lbs. Gross, dive bomber, full internal fuel, one 1,000 lb. bomb in bay; 14,760 lbs. Gross, bomber, two external tanks, two 1,000 lb. bombs in bay; 16,607 lbs. Gross, scout, max. fuel; 15,419 lbs.

Weights (RA-25A, SB2C-1A): Empty: 10,363 lbs. Gross, dive bomber, full internal fuel, one 1,000 lb. bomb in bay; 15,076 lbs. Gross, bomber, two 500 lb. bombs on wing racks, two 1,000 lb. in bay; 17,162 lbs.

SB2C-1 SERIES PRODUCTION

Model	Order Date	Deliveries	Quantity	Service	Serials
XSB2C-1	15/5/39	18/12/40(1)	1	U.S.N.	BuNo 1748
SB2C-1	19/11/40	Sept. '42-Aug. '43	200	U.S.N.	BuNo 00001-00200(2)
SB2C-1C	19/11/40	Aug. '43-March '44	778	U.S.N.	BuNo 00201-00370 01008-01208 18192-18598(3)
XSB2C-2	March 1941(4)	28/10/42(5)	(1)	U.S.N.	(BuNo 00005)
A-25A	31/12/40	Dec. '42-March '44	900	A.A.F.(6)	41-18774-41-18873 42-79663-42-80462
SBW-1	23/5/42	Sept. '43-March '44	40	U.S.N.	BuNo 21192-21231
SBW-1B (Helldiver I)	23/5/42	Sept. '43-Feb. '44	26	R.N.	JW100-JW125 (BuNo 60010-60035)
SBF-1	31/12/42	Oct. '43-June '44	50	U.S.N.	BuNo 31636-31685

Notes:

- (1) First flight date.
- (2) In addition to 00005 which is shown as converted to XSB2C-2, 00008 was returned to Columbus and converted to the XSBC-3 with R-2600-20 engine after accelerated service tests.
- (3) Some records indicate 18306 converted to XSB2C-5; this now known to be inaccurate. XSB2C-5 was an SB2C-4, 65286.
- (4) Date of letter of intent to provide for conversion of XSB2C-1 as landplane or seaplane type.
- (5) Following crash of XSB2C-1, contract amended to provide for conversion of one SB2C-1 to XSB2C-2 convertible land plane/seaplane. This is date of completion of float installation at NAS Anacostia.
- (6) From A25A programme, ten a/c out of 150 allocated were furnished to R.A.A.F. (remainder A69-11 to A69-150) and 410 delivered to U.S.N. as SB2C-1A, and modified for U.S.M.C. land service.

Squadron Use

Commencing March 1943 (VB-17/VB-7), the following U.S.N. squadrons were equipped with SB2C-1's for varying periods. VB-14, -15, and -18 relinquished their early model Helldivers in November 1944, being the last squadrons to do so. VB-1, -2, -3, -4, -6, -7, -8, -9, -11, -13, -14, -15, -17, -18, -19, -20, -80, -81, -82, -83, -85, -86, -87, -99, -100. VD-2 (Photographic Squadron 2) had between one and six SB2C-1's or -1C's from January 1944.

U.S. Marines

VMSB-334 and -342 were issued one machine November 1943; not retained. VMSB-132, -144, -234, -344, -454, -464, -474, -484 had from 21 to 30 machines (SB2C-1A's), received between May and July 1944. The first three became VMTB squadrons and the fourth was disbanded, in the autumn of 1944. VMSB-454 became a VMTB squadron at the same period. The last three units were replacement training squadrons at MCAS El Toro, California. VMSB-933 had -1C aircraft from November 1944.