



(Walter M. Jefferies, Jr. Coll.)

## The Early Curtiss P-40s

By ERIC H. HART

The Curtiss P-40 was the production model of the successful XP-40. With its design initiated in March 1937, the XP-40 was ordered under Contract No. AC-10136 on 30 July 1937 and carried Spec. No. 98-605-1. Although the U. S. Army Air Corps called for delivery by February 1938, the XP-40 was not flown until October of that year. This prototype was one answer to the Army's request for a pursuit powered by the Allison V-1710, which was the only liquid-cooled engine under development that had any hope of gaining military orders. Curtiss had tried one idea, based on the airframe of the new P-36, soon to enter production. This was the XP-37 which utilized the Allison with a turbo-supercharger in a highly-modified fuselage. Another suggestion, and the one that was accepted, was a simple engine change on a standard P-36, thereby saving design time and expense. Other manufacturers, notably Bell and Lockheed, also trying for a contract, had to design the airframe first and, besides, were including turbos on the Allison. This was still frowned on by Washington as the role of pursuit aviation was not envisioned to entail any type of high-altitude operations.

Even as the XP-37 entered its test flight period, from which only an order for 13 YP-37s resulted, work was started on the XP-40. Production of the P-36A had just begun, so it was the tenth article to leave the factory (AAC serial 38-10) that was selected to carry the V-1710. The basic structure remained unchanged but for the engine installation and modifications to accommodate the cooling system components. A large radiator was placed on the belly of the plane, just aft of the wing's trailing edge. The Allison V-1710-19 was housed in a streamlined nose which added almost three feet to the original length. Engine exhaust was provided by a series of small slits ending in a flaired exit on each side of the nose. A small circular oil cooler inlet was mounted below and behind the propeller spinner while the carburetor air intake was a small square

affair just ahead of the cockpit. The gun barrels of the single .30-cal. and single .50-cal. nose guns were enclosed in large fairings.

This aircraft, although performing well, proved disappointing in regard to speed as the maximum was only 299 mph, which was no improvement on that of the P-36A it was meant to replace in squadron service. A prime cause of this was the hurried installation of the engine. The various air inlets did not offer too smooth an airflow surface and their different positions increased drag even more. The XP-40 was returned to the factory for revisions.

The first major change was the relocation of the engine coolant radiator from beneath the rear fuselage to a point under the nose where it was combined with the oil cooler. This cleaned up the fuselage, and the exhaust outlets were modified. Further test flights, however, dictated more changes. Included were greatly simplified gun barrel fairings, individual exhaust stacks and the removal of the cumbersome fairing plates on the landing gear. Due to these improvements, the maximum speed climbed to 342 mph and the general performance was enhanced.

The production model differed little externally from this final form of the XP-40. Only the type of tail wheel cover and slight alterations in the transparent areas aft of the cockpit distinguished the two. Flush-headed rivets replaced the brazier-head type in order to reduce profile drag, while the armament was standardized at two .50-cal. M-2 Browning electrically controlled guns, with 200 rounds per gun, synchronized to fire through the propeller. There was also provision for mounting a .30-cal. Browning free-firing gun, with 500 r.p.g., in each wing panel, although these were not installed at the factory. The fittings that had enabled the P-36A's and the XP-40 to carry six 20-lb. bombs were eliminated in production models.

Five hundred twenty-four were ordered on 26 April

1939 under Contract No. AC-12414 for \$12,872,898, which was, at that time, the largest peacetime order ever placed by the Air Corps. With Spec. No. 98-610-2A, the P-40 began leaving the assembly line in May 1940. It was to be the first pursuit to carry the Army's new olive drab and gray camouflage paint, but the first three (s/n 39-156, -157, -158) left the factory in their natural Alclad finish. In an unusual move, the contract did not provide for any YP-40s as was normally the case, and these three were used for service testing.

The basic fuselage, wing and tail structure was still that of the parent P-36, which enabled Curtiss to deliver on the contract so quickly. The fuselage was monocoque construction built in an upper and a lower half and joined along the profile centerline. It was built up on a framework of bulkheads joined by longitudinal stringers and covered by Alclad aluminum alloy sheet riveted to the framework. These two halves hastened production time, the lower being trundled under the upper and the completed shell moving on along the line.

The wing was divided into four sections, two main panels and two wing tips. The main panels were joined at the plan centerline of the fuselage by heavy bolt angles, bolts and nuts. Wing tips were secured by screws which could be removed for inspection and assembly. The lower portion of the bolt angle was removed to provide accommodation for the large removable fuel tanks that were supported inside the wing by conventional padded straps. Construction was a multi-spar intercostal design with the main spars built up of a single sheet web punched for lightening holes capped by riveted channels that constituted a light "I" beam. Ribs were stamped aluminum sheet, flanged and with cut-out lightening holes. Added strength was given by beads and riveted stiffeners.

High speed airfoils were used (N.A.C.A. 2215 at root and 2209 at tip) and comprised an aluminum Alclad sheet covering over extruded section stiffeners laid laterally. Cutouts were provided in the skin for landing gear wheel wells, fuel tanks, machine gun and cartridge boxes, inspection plates and covered hand-holes. Split-flaps extended between the ailerons and were flat sheet riveted to half-ribs, hinged at their leading edge. Ailerons were all-metal construction, fabric covered and fitted with small trim tabs. They were statically and dynamically balanced through the use of lead weights bolted into the over-hanging leading edge forward of the hinge centerline. The fuselage was lowered onto the wing and bolted into place through the bolt angles attached to the wing. The wing to fuselage joint was covered with large sheet fairing strips riveted to contour ribs that extended from the fuselage bulkheads.

This wing, due to its lack of a center-section, later gave the RAF a headache in the Middle East on their Tomahawk IIB's. Because of the P-40's aversion to three-point power-off landings, RAF pilots flying the type for the first time caused ground-loop damage to many a wing tip before they became familiar with the proper method, i.e., two-point power-on touch downs and allowing the tail to settle slowly. While most fighters in use could be repaired by changing a tip and, at times, an aileron, the Curtiss' dug in tip caused damage to the main wing panel, and these could not be changed in the field due to the absence of a center section. A completely new wing was required and this was a major Maintenance Unit job. Many Tomahawks were seen in Egypt needing this type of repair at a time when the Desert Air Force was crying for aircraft. ①

The vertical and horizontal stabilizers were all-metal, built up on a structure of spars and ribs reinforced with stiffeners, the whole being covered with riveted aluminum alloy sheet. The rudder and elevators were of similar construction covered with fabric. The latter each had small trim tabs that could be controlled in flight.



*The original Curtiss XP-40, 38-10 as it appeared during initial testing at Wright Field in October 1938. (Author)*



*The XP-40 after modification placing the engine coolant radiator under the nose and adding new exhaust outlets. (Author)*



*After second modification the XP-40 took this final form with landing gear fairing plates removed and cleaned up nose. (Author)*



*One of the first three P-40s of the production order which, in alclad finish, were used for service testing. (Author)*

The landing gear was of the conventional type, consisting of two main forward wheels and one tail wheel. The main wheels were supported on cantilever air-oil shock absorber legs. Retraction moved these legs rearward and a pair of right-angle bevel gear plates rotated the leg through 90 degrees to cause the wheels to lie flat inside the cutouts in the wing undersurface. Two small plates closed over the leg forward portion to reduce drag. In order to place the gear centerline as far forward as possible, two small perispheric housings projected forward of the wing leading edge and covered the gear support plate and fitting. The tail wheel was fully retractable and covered in flight by two clam-shell doors.

The engine was an Allison V-1710-33 (C-15), 12-cylinder, liquid-cooled Vee with a single-speed internal supercharger. This unit had a maximum normal rating of 840 hp at 2600 RPM at sea level, 960 hp at 2600 RPM at 12,000 feet, and 1090 hp at 3000 RPM at 15,000 feet. The maximum normal at 12,000 feet was used for cruising while the maximum permissible power for takeoff was 1090 hp at 3000 RPM at 42.9 inches of mercury manifold pressure.

The eleven foot diameter propeller was a three-bladed all-metal electrically-controlled Curtiss design of constant speed control. It was gear-driven by the engine through a reduction gearing of 2:1.

The down-draft type carburetor's air was taken from a point just aft of the propeller, between the fairings for the nose guns, and led aft through a duct down to the engine. This air could be heated if necessary.

The oil tank was mounted aft of the cockpit above the baggage compartment. The oil cooler was below the engine in the radiator cluster. Two other radiators cooled the engine coolant (ethylene-glycol) with each accommodating an individual cylinder bank system. A small header tank containing 2.5 gallons let in more fluid as it evaporated or leaked off. This entire cooling system was automatic. The radiator cluster was fully enclosed in a large streamlined housing beneath the fuselage which opened at the forward end into a large air-scoop. The aft end was fitted with hydraulically controlled cowl flaps that regulated the pressure drop across the radiators, thus insuring adequate, even cooling throughout the full range of operating speeds and temperatures.

The fuel system consisted of three tanks, two below and one in the fuselage aft of the pilot's head-rest. The main tank in the wing held 61.25 U.S. gallons while the reserve held 40.5. The fuselage tank held 57.5 with the expansion tank above it holding 1.76 U.S. gallons. None of these were of the self-sealing type. A large fairing assembly covered the tank pumps and lines below the fuselage, thereby giving the P-40 its odd under-slung appearance.

Operating mechanisms were all hydraulically controlled. The fluid reservoir was below the oil tank. The electrical system was supplied by a 12-volt battery below the baggage compartment. Complete radio and oxygen equipment were provided.

Cockpit accommodations included a flare pistol with six flares, a life preserver fitted to the back of the seat, which was adjustable, and complete engine and navigation instruments. There was no armor plate protection for the pilot and the windscreen was not hardened. Pilot, as well as fuel tank, protection was not incorporated due to the fact that the Air Corps still felt that these items had not proven their worth sufficiently to compensate for the added weight and expense.

The baggage compartment carried the engine starter crank, first-aid kit and a small bag of tools. One hundred twenty-five pounds of cargo could be carried. Provision was also made for plugging in electrically-heated equipment, flying suit and helmet.

This, then, was the Curtiss P-40 for the Army. The aircraft remained basically the same through the many changes of designation that still lay ahead in the

spring of 1940. Minor changes were indicated by a model letter change as the Block Number idea was still in the future. Externally, it never varied. Internally, the modifications and additions made to the aircraft brought it up to full combat standards but, because the same engine was retained, performance suffered.

One wonders, then, why the power was not increased to compensate. This was possible because the Allison V-1710-121, of 1425 hp, used later in the XP-40Q was nothing more than an improved "C". The answer to the question lies with the decision of the Joint Aircraft Committee which was formed by the U. S. Government on 21 August 1940.

As early as 11 January 1940, France had asked the Air Corps for 25 P-40s. But it was not until an executive order of 25 March authorized the release of U. S. aircraft types to foreign governments as soon as superior models became available to the Navy and Army that a positive French order could be honored. A total of 140 examples of a modified export model were contracted. This version, known on company records as the Curtiss Model H81-A-1, was altered internally to conform to French standards. These modifications included metric-calibrated instruments, a throttle that operated in the reverse direction to that of the American version, a seat suitable for the Lemercler back parachute, a Baille-Lemaire gunsight, Radio-Industrie-537 radio equipment and provision for four wing-mounted 7.5mm FN-Browning machine guns that were to be installed in France.

About this time, the Air Corps, after studying European combat reports, finally realized the importance of armor plate, hardened windcreens and protected fuel tanks, as well as the need for more guns. In April 1940, the Army agreed to defer delivery of 324 P-40s for two reasons. One was to allow Curtiss to expedite the manufacture of the H81-A-1s. The other was to give engineers time to incorporate those changes now considered so necessary into the basic design.

The Model H81-A-1, however, never saw service with the French. That country surrendered before the first was completed. With remarkable speed, the British Purchasing Board took over all French contracts placed with U. S. aircraft concerns just hours before the Treasury Department froze French assets in the country. Thus, these pursuits became the property of the RAF.

Shortly after this, problems began to crop up. Although the P-40 and H81-A-1 were basically the same, there were many detail differences, and both the Army and the RAF began constantly changing specifications, independently of each other. The result, of course, was a headache for Curtiss and a low rate of delivery. The Joint Aircraft Committee, with one of its duties being the standardization of the planes and armament being produced in American plants for both governments, met at the Buffalo plant of Curtiss in September 1940. The meeting lasted two days and resulted in an agreement to standardize the model and freeze the design for a period of six months. An almost immediate jump in production was the rewarding result.

Although 200 P-40s were delivered (one as a P-40G), not all of them entered squadron service with the Air Corps. One was supplied to the Pratt & Whitney Division of United Aircraft where it was used as a test-bed for the 1200 hp R-1830 Twin Wasp 14-cylinder two-row air-cooled radial. This engine was housed in a specially-designed close cowling and was found to give the aircraft a better performance than that of the Allison-powered models in production.

Another, ordered under the same contract, but with Spec. No. 98-610-3, was the one modified and delivered in July 1940 as the P-40G. This model's full description is still confused. Most references mention only one such version, 39-221 (which was to be sent to Russia in August 1943). Lately, however, material in hand seems to point to at least 44 more.

In addition, the P-40G has been described as modified to carry operational armor, self-sealing fuel tanks



*P-40 of the 8th Pursuit Group, 35th PS, in 1940. (F. Quick)*



*31st Pursuit Group P-40 at Selfridge Field, 1941. (Author)*



*P-40 number 97 of the 54th Pursuit Group. (USAF 24706AC)*



*P-40B at the factory on 25 February 1941. (Jefferies Coll.)*



*A P-40C ready for delivery during 1941. (George Gosney)*

and P-40E-type wings with six .50-cal. guns. The matter of the wings is moot because, while the P-40G was accepted in 1940, the P-40E did not enter the picture until an order from the Army on 18 February 1941 increased the armament of the P-40D from four to six wing guns. According to an official Air Corps document (2), the P-40G was identical to the P-40 except for a change in armament, fuel capacity and certain modifications to accommodate "Tomahawk" wings.

Another matter is the P-40A. This designation was not officially used by the Air Corps, but one is reported to have existed. A P-40 (40-326) was converted into a photo reconnaissance plane in March 1942 and was designated P-40A.

This brings up the RP-40s, supposedly converted into reconnaissance fighters. Actually, all P-40, P-40B, P-40C and P-40D models were given an "R" prefix in early 1943. This denoted "Restricted Use." In January 1945, the first two became ZRP-40 and ZRP-40B as they were considered obsolete.

The first of the 131 P-40B's began to be delivered to the Air Corps in February 1941, under Contract No. AC-15802, with Spec. No. 98-610-5A. Changes included two plates of armor, a small one forward of the pilot under the cockpit cowl and a large one aft of the seat running the height of the fuselage; the factory-mounting of the two .30-cal. wing guns; an increase in capacity for the nose guns to 380 r.p.g.; a hardened windscreen and externally self-sealing fuel tanks. These modifications brought the Curtiss up to a combat-worthy standard, but increased the weight and adversely affected performance.

The RAF ordered 110 examples of this model as the Tomahawk IIA or H81-A-2. The export version differed in having four .303-cal. wing guns, British radio and oxygen equipment.

Ordered to Spec. No. 98-610-11, Contract No. AC-15802, were 193 P-40C's, and these began to arrive at Air Corps' fields in March 1941. This model was identical externally to the P-40B. Internal changes included a new fuel system with a larger capacity, internally self-sealing fuel tanks, a change in radio from SCR-283 to SCR-247N, and four wing-mounted .30-cal. Browning guns with 490 r.p.g. In addition, fittings were installed that enabled this model to carry a 52-gallon belly tank.

Due again to the increase in weight that these modifications entailed, the P-40C's performance was the lowest of the series for the Army.

A grand total of 930 of this version were built for the RAF as the Tomahawk IIB or H81-A-3. These differed in having four .303-cal. wing guns. American radio and oxygen equipment was used in place of the British type in the IIA. Further field modifications, applied to IIB's used operationally by the RAF in the Middle East, included the fitting of filters to the carburetor air intake, the installation of British radio and oxygen equipment, and the removal of the .50-cal. nose guns. These were replaced by a pair of .303-cal. guns, making a total of six .303s to ease the problem of supplying the right type of ammunition. The U. S. Army was not too



*P-40C of 18th Pursuit Group over Hawaii, 1941. (R. D. Neal)*

anxious to have scarce .50-cal. rounds exported.

Of the total of 1180 Tomahawks (I, IIA, IIB), many were supplied to Allied or Neutral powers as the war spread and newer aircraft became available. Due to Russia's tremendous loss in aircraft in the opening weeks of the German invasion, the RAF agreed to supply Tomahawks as long as they were replaced by improved versions of the Curtiss fighter. The initial batch sent from England numbered 24 Tomahawk IIA's (AH 936, 952, 965 to 971, 974 to 985, 987, 989, 990). Later, 146 IIB's were shipped. The last 49 IIB's built (AN 469 to 517) were sent directly from the U. S. to the Russian Air Force.

Six IIB's (AK 254, 434, 440, 448, 470, 561) were released to Egypt as well as several from the AN 218/517 group. Others from this group were given to Turkey in November 1941, including AN 281. Thirty-six IIB's from the AK 100/570 group (including AK 466, 467, 468, 471, 472, 473) and 64 from the AM 370/519 group were released from the contracts and sold to China by Curtiss even before they emerged from the factory. Thirty-one IIB's (AK 210 to 224, 226 to 241) were lost at sea.

#### BRIEF OPERATIONAL RECORDS

##### USAAF

The first of the 200 P-40s that began to be delivered to the Air Corps in May 1940 were, after successful completion of service testing with the first three articles, issued to the 8th Pursuit Group at Langley Field, Virginia, in September. They replaced an aging mixture of Consolidated PB-2A's, Curtiss P-36A's and Curtiss YP-37's. The 8th became the first unit to be fully equipped with the type. On the West Coast, the 20th Pursuit Group was also fully equipped with P-40 aircraft.

In November, the 8th Group moved to Mitchel Field, New York. With the 8th, the P-40 began to receive a reputation as a "hot" plane, due mostly to exaggerated accounts of its flight and landing characteristics. It also was called the "American counterpart of Britain's Spitfire and Hurricane, Germany's Messerschmitt." ③

The 31st Pursuit Group also equipped with the P-40 but soon, due to its lack of defense, coupled with the promise of rapid delivery of the more combat-worthy P-40B and P-40C, it was relegated to the training role.

This was especially true after the many new pursuit groups were formed by the Air Corps on 15 January 1941. They were passed from unit to unit and used in various roles. At least one (40-305) ended its days as an airframe for sheet metal repair instruction.

The P-40B, soon after delivery began, became the first of the type to be sent to Air Corps stations overseas. On 20 April 1941, a consignment was flown off the Navy aircraft carrier that had brought it from the West Coast to the Hawaiian Islands. By the end of the month, 55 P-40B's had been delivered for the 15th and 18th Pursuit Groups at Wheeler Field. A total of 87 were on strength by 7 December 1941.

Although problems were encountered with these new planes, including rusting of the main bearings, 50 of them, comprising two full squadrons, were reported by Lt Gen. Walter C. Short, Hawaiian Department Commander, as being ready for dispatch by carrier to Wake and Midway Islands on 28 November. The Navy, however, pointed out that the P-40B's would be frozen to these bases because of their inability to land back on the ships, and so they were never sent.

The Japanese attack on Pearl Harbor and adjacent facilities destroyed 62 P-40B's and damaged the remaining 25. This carnage was due to the Hawaiian Department's assessment of the warning of possible hostilities with Japan, sent by Washington on 27 November, as meaning that Gen. Short's gravest concern was an outbreak of sabotage by the Islands' large population of Japanese heritage. In attempting to comply as fully as possible without any interruption of the training that was such an important part of the 14th Pursuit Wing's duties, the General ordered all planes not slated for use to be emptied of guns and fuel, lined up on the ramps and to have armed sentries placed around them. This cut down any possibility of sabotage, and he radioed his new dispositions to the War Department. He received no reply and so thought his decision to be adequate and correct.

The P-40B's were a strafers' paradise that Sunday morning and soon became burning junk. Providentially, the smoke from their fires effectively covered a group of P-36A's nearby, saving them from a similar fate. Those that had been damaged were hastily repaired in the next few days and flew constant patrols thereafter. Heavy usage and an increasing number of accidents caused by pilot fatigue soon finished them.

Thirty-one other P-40B's had been sent in crates by freighter to the Philippine Islands in April 1941.



*Deckload of P-40C's of the 8th Pursuit Group on board the USS Wasp in the Atlantic, July 1941. In background are eight North American O-47 observation aircraft. (National Archives 80-G-64700)*

*P-40C of the 33rd Pursuit Squadron, 8th Group, taking off from the deck of the USS Wasp. It was one of 30 P-40s of the Squadron being transferred to Iceland. (National Archives 80-G-64700)*



Arriving in June, they were assembled at the Air Depot and issued to the 20th Pursuit Squadron at Clark Field the following month. The first modern fighters to see service in the islands, they were a welcome sight to men already aware of the Japanese threat.

Problems soon presented themselves that seriously threatened the serviceability of these planes. All kinds of tools were in extremely short supply for even the most simple repair or maintenance. The worst problem, however, was the lack of spare engines or spare parts of any kind. Hobbling their combat capabilities was the acute shortage of .50-cal. ammunition, which held down target practice; the 20-mile range limit of their radios; and the lack of oxygen for their systems that limited the service ceiling to the individual pilot's altitude ability.

The absence of spare parts was the result of a very short-sighted viewpoint on the part of the Air Corps. Curtiss had been ordered to build only complete aircraft and not to bother with spares. This caused trouble at all places the P-40 entered service, but especially overseas, thousands of miles from the factory. Because of this, on 7 December, the 20th Pursuit Squadron had 18 P-40B's in commission, but reserve aircraft have never been mentioned. In all probability, there were none, as damaged planes could have been the only source of spares to keep the rest flying.

Entering combat on 8 December over Clark Field, only three planes of the 20th could get off the ground before bombers and fighters hit the rest. Lt J. Moore, the squadron leader, followed by Lts Keator and Gilmore, mixed with nine Zeros. Keator got the first one while Moore destroyed two more.

Some P-40C's followed the B's to foreign stations. On 25 July 1941, the 33rd Pursuit Squadron, 8th Group, saw its 30 P-40C's loaded on board the Navy aircraft carrier "Wasp" at Norfolk, Virginia. From there, they were shipped to Iceland as part of the air component of U. S. Army forces that took over protection of the island and nearby shipping routes from the British.

Twelve P-40C's had reached Hawaii by 7 December and 10 of them were destroyed in the attack. The most famous interception of the day was performed by two flown by Lts G. Welch and K. Taylor, pilots with the 47th Pursuit Squadron, 15th Group, based at Haleiwa. In two sorties each, they shot down six Japanese planes before Taylor was wounded near the close of the raid.

Other P-40C's served their time with most of the old

and new Stateside pursuit groups and with pursuit groups in Panama and the Caribbean area. They were in use as late as 1944 as fighter trainers.

#### ROYAL AIR FORCE

The 140 H81-A-1s were shipped in crates to England where the first was listed as on strength by the RAF the week of 14 September 1940. Designated Tomahawk I (4), the empty gun bays in the wings were fitted with four .303-cal. Brownings, but nothing could be done with their French appointments. The type's lack of armor and other protection, plus its poor performance above 15,000 feet, ruined any chance it had of entering Fighter Command. These shortcomings were ascertained during tactical trials held at Duxford by the Air Fighting Development Unit, the duties of which were to develop air fighter tactics and make operational evaluations of new combat aircraft. Held in reserve, they were finally issued to a few reconnaissance and Army co-operation squadrons, the first being No. 2. Soon, however, they were removed from service and used for airframe instruction.

The 86 Tomahawk IIA's remaining in England after the first shipment to Russia were also issued to reconnaissance squadrons and other units as trainers.

The Tomahawk IIB's sent to England filled the same roles as those of the I's and IIA's. Several fighter squadrons used them as trainers before being issued Spitfires or Hurricanes. At times, Tomahawks spotted for the coastal guns at Dover during bombardments of the French coast. In April 1942, seven (AK 312, 523, AN 303, 325, 329, 334, 460) were at No. 53 R.S.U. As late as February 1944, No. 1682 (B) D.T.F., flying IIB's, began operating from Enstone airfield.

Combat operations by the Tomahawk IIB in the RAF were in the Middle East. Early in 1941, British air units in the area were spread thinly from Greece to Ethiopia and from Egypt far into Libya. Trouble was also brewing in Iran, Iraq and Syria. Few fighter planes were available for the squadrons then deployed. New units were arriving, but their equipment with aircraft was in doubt. The Gloster Gladiator had finally been replaced in front line service by the Hurricane I, but this plane, modified for desert operations, lost enough of its performance to make the task of finding another type a matter of some urgency. Spitfires and the newer Hurricanes II's could not then be spared from home



*Unidentified Curtiss Model H81-A with odd camouflage finish.*

defenses. The only ready answer was to send the Curtiss.

Beginning in March, up to October, 1941, 205 were sent into the Middle East from England. They were sent by ship to Takoradi, Gold Coast, assembled there and then flown in stages across the continent to the Sudan, and from there north to Egypt. In addition, 89 arrived directly from the U. S. by sea. This total of 294 Tomahawks was all that ever saw service in the Mediterranean area, except for seven that arrived early in 1942.

As the Curtiss fighters began to be unloaded at Takoradi, difficulties arose. First of all, these aircraft were entirely new to the technical staff entrusted with their erection and testing. Spares, of course, were non-existent. Tool kits had not arrived. Slowly overcoming these problems, they had to be modified for operations as explained above. A trickle became a steady flow east and north to the fighting.

The first unit to fly the Curtiss was No. 250 "Sudan" Squadron that had been reformed early in the year from "B" flight of No. 112. Sent to Takoradi to pick up their aircraft, the pilots had trouble learning to fly the Tomahawks as there were no pilots' manuals or instructions of any kind available. Also, the Curtiss was the first modern monoplane pursuit many of them had flown, their previous mount having been the Gladiator.

Learning from their mistakes, the men of No. 250 discovered the plane's aversion to 3-point landings. The lack of A.B.C. (Automatic Boost Control--long standard on British types and first employed in the Warhawk's Allison-powered series on the P-40K) caused many a pilot to burn up the engine on takeoff until he learned to compensate by throttle action. If the aircraft was put into a dive, and the throttle was not closed, the engine produced ratings never even thought of by Allison! The engine had a tendency to overheat, and full power could not be achieved for takeoff and climb. In the air, the 11B was found to yaw considerably, especially during changes of speed. Much stick and rudder action was necessary to stay straight in a dive or climb. Slight irritation was brought on by the position of the insulators on the aerial which were often taken for enemy planes out of the corner of the eye.

The Tomahawk 11B's of No. 250 Squadron entered service in the Middle East in May 1941. First combat sortie came on 14 May when two Curtiss' escorted Blenheims of No. 84 Squadron, RAF, in a raid on German aircraft in Syria.

No. 3 Squadron, RAAF, converted to Tomahawks in May 1941 and, although they suffered the same troubles as No. 250 in their training, this unit went on to prove the plane's worth in combat during the Syrian campaign. 11B's were issued to No. 2 Squadron, SAAF, on 7 June. By 11 November, there were five fighter squadrons, of a total of 17 in Air Headquarters, Western Desert, equipped with the Curtiss. These were: No. 2 and 4, SAAF; No. 3, RAAF; No. 112 and 250, RAF.

Throughout the desert actions of 1941, the Tomahawks encountered the various enemy fighters in combat. Al-



*RAF Tomahawk 11A, model H81-A-2, is serial number AH 973.*

though outclassed by the Messerschmitt Bf 109, it was far from being useless in the fighting. The records compiled by Neville Duke and Clive Caldwell, as well as those others now forgotten, attest to this.

The Bf 109F that had been introduced into the theater had been used mostly in fast raids of two or three planes that were hard to counter. RAF squadrons had been flying a typical fighter sweep with all planes staying on course with the exception of two "Weavers" to the rear. These the 109F's found easy to attack and destroy with their hit-and-run tactics. Tomahawk squadrons soon began weaving the entire formation, and this seemed to keep the Germans in check.

However, as the British offensive called "Crusader" began, the 109F's adopted RAF tactics and initiated full-squadron fighter sweeps to clear the air for their bombers. A clash for fighter superiority was inevitable.

During the morning of 22 November, No. 3 Squadron, RAAF, escorted Blenheims in a raid near Bir el Gubi. Fifteen 109F's attacked and the battle became a contest between the speed of the Germans and the horizontal maneuverability of the Tomahawks. Two Messerschmitts were shot down while three 11B's were lost. That same afternoon, southeast of El Adem, No. 3 and No. 112 Squadron, RAF, (the unit that originated the design of a mouth on the Curtiss as a squadron insignia) clashed with 20 109F's. The enemy had the advantage of speed, climb and ceiling but, after some wary sparring, the two forces fell into defensive circles. Individuals broke out to attack if an opportunity came up, but neither side could break the other. The approach of darkness finally caused the action to be broken off. One German and seven 11B's were shot down.

Although the figures of losses seemed to make this a one-sided victory for the enemy, the RAF squadrons had not broken and had held their own with the result that the Germans never challenged for superiority again. They fell back to raider tactics with small numbers of planes, thereby allowing the British bombers to continue their missions unmolested.

Due for replacement late in 1941 by the Kittyhawk I (H87-A-2), Tomahawks continued on in the fighter squadrons until relieved. An idea of the morale of Curtiss pilots is seen by their reaction to the arrival of the first Spitfires in the desert. The men thought they flew too high to be of any use and, in order to see some combat, should come down to the 11B's operating level! However, by 27 October 1942 at El Alamein, only No. 5 Squadron, SAAF, was still using the old Tomahawk as a fighter.

Phased out of the fighter squadrons, many 11B's served on as trainers in Egypt, but combat operations were continued in another role. February of 1942 saw the tactical reconnaissance squadrons of the Desert Air Force still flying old Hurricane I's. One flight in both No. 40 Squadron, SAAF, and No. 208 Squadron, RAF, was issued Tomahawks and the greater speed of this plane was a big factor in keeping up the morale of the recon-

pilots. The arrangement of one Hurricane I or IIA to perform the actual reconnaissance accompanied by a Tomahawk IIB to counter enemy fighters allowed the squadrons to fulfill their missions through 1942 and into the series of battles at El Alamein.

A.V.G.

The record of those Tomahawk IIB's sold to China and flown by the "Flying Tigers" is too well known to bear repeating here. However, some rare notes are included.

When the idea of buying American planes and hiring American pilots to fly them was first proposed by Chiang Kai-shek in 1940, Chennault was not too enthusiastic. The surplus U. S. aircraft were being sent to Europe and there seemed to be no good fighters available. He did not favor the P-40 because of its liquid-cooled engine. It also seemed too slow and heavy to counter the maneuverable Nakajima Ki-27s and Mitsubishi A6Ms.

On arriving in the U. S., he found planes hard to find. But, with the increase in production at Curtiss caused by the Joint Aircraft Committee and the help of company vice-president Burdette Wright, he was able to buy 100 IIB's after they were released from the contract by the British. These aircraft cost China \$8,900,000.

Trouble arose over obtaining guns, ammunition, armor plate and accessories. Some were delivered with .303-cal. wing guns while others had .30-cal. guns. Service radios could not be had so the A.V.G. ended up with commercial sport-plane radios not suited for combat operations.

During training in Burma, pilots had trouble with the plane's landing characteristics. The narrow landing gear gave trouble on hard earth runways. Multi-engined pilots especially had trouble in conversion. Rumors made the plane a killer due to erratic flying tendencies, high landing speed and an inferior power plant. Later, after war began and the A.V.G. saw the RAF cut to ribbons over Rangoon, they refused a British offer to trade Hurricanes for P-40s.

Chennault summed up the case of the Curtiss when he wrote of the battle for Rangoon (23 December 1941 to 29 February 1942):

"Whatever its later shortcomings, the Curtiss-Wright P-40 was an excellent fighter for the battles over Rangoon, all of which were fought below 20,000 feet. At those altitudes the P-40 was better than a Hurricane and at its best against the Japanese Army Nates and Navy Model Zeros. The two .50-cal. machine guns gave the P-40 a heavy, fast-firing gun that neither the British nor Japs could match. Pilot armor saved many a P-40 pilot's life, and the heavy rugged construction, though a disadvantage in maneuverability, was certainly an advantage in field maintenance and putting damaged planes back into battle. P-40s could be repaired after damage that would have made a Japanese plane a total loss.

"...I had never favored liquid-cooled engines for combat planes but the Allison engines in our P-40s certainly did more than the manufacturer claimed for them."

FOOTNOTES: (1) R.A.F. Flying Review, Vol. XVIII, No. 3, (Dec. 1962); letter from E. N. Woodward.

(2) "Army Airplane Characteristics", (TSEST-A-2), 1 April 1946, William Englehardt, Design Branch, Air Materiel Command.

(3) Popular Science, June 1941.

(4) All P-40s in the AAF were designated "Warhawk."

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| SPECIFICATIONS   | P-40                           | P-40B                          | P-40C                          | TOMAHAWK II                    | P-40G                          |
|------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| WING SPAN        | 37' 3 $\frac{1}{2}$ "          | 37' 3 $\frac{1}{2}$ "          | 37' 3 $\frac{1}{2}$ "          | 37' 3 $\frac{1}{2}$ "          | 37' 3 $\frac{1}{2}$ "          |
| LENGTH           | 31' 8 $\frac{1}{2}$ "          | 31' 8 $\frac{1}{2}$ "          | 31' 8 $\frac{1}{2}$ "          | 31' 8 $\frac{1}{2}$ "          | 31' 8 $\frac{1}{2}$ "          |
| OVERALL HEIGHT   | 12' 4"                         | 12' 4"                         | 12' 4"                         | 12' 4"                         | 12' 4"                         |
| TREAD WIDTH      | 8' 2"                          | 8' 2"                          | 8' 2"                          | 8' 2"                          | 8' 2"                          |
| WING AREA        | 236 sq ft                      | 236 sq ft                      | 236 sq ft                      | 236 sq ft                      | 236 sq ft                      |
| EMPTY WEIGHT     | 5,376 lbs                      | 5,590 lbs                      | 5,812 lbs                      |                                | 5,674 lbs                      |
| GROSS WEIGHT     | 6,787 lbs                      | 7,325 lbs                      | 7,549 lbs                      |                                | 6,787 lbs                      |
| MAX GROSS WEIGHT | 7,215 lbs                      | 7,600 lbs                      | 8,058 lbs                      |                                | 7,215 lbs                      |
| POWER LOADING    | 7.06                           | 7.40                           | 7.85                           |                                | 7.06                           |
| WING LOADING     | 28.75                          | 32.65                          | 34.75                          |                                | 28.75                          |
| MAXIMUM SPEED    | 357 mph @ 15,000<br>(6835 lbs) | 352 mph @ 15,000<br>(6835 lbs) | 345 mph @ 15,000<br>(7327 lbs) | 331 mph @ 15,000<br>(7646 lbs) | 357 mph @ 15,000<br>(6835 lbs) |
| CRUISING SPEED   | 277 mph @<br>(6835 lbs)        | 280 mph @<br>(6835 lbs)        | 270 mph @<br>(7327 lbs)        | 270 mph @                      | 277 mph @<br>(6835 lbs)        |
| LANDING SPEED    | 80 mph                         | 80 mph                         | 86 mph                         | 86 mph                         | 80 mph                         |
| RATE OF CLIMB    | 3080 ft per min                | 2860 ft per min                | 2690 ft per min                | 1960 ft per min                | 3080 ft per min                |
| SERVICE CEILING  | 32,750 ft<br>(6835 lbs)        | 32,400 feet<br>(6835 lbs)      | 29,500 feet<br>(7327 lbs)      | 31,400 feet<br>(7646 lbs)      | 32,750 feet<br>(6835 lbs)      |
| ABSOLUTE CEILING | 33,800 feet                    | 33,800 feet                    | 30,500 feet                    | 32,300 feet                    | 33,800 feet                    |
| NORMAL RANGE/mph | 950 mi. @ 250 mph              | 940 mi. @ 280 mph              | 800 mi. @ 280 mph              | 665 mi. @ 234 mph              | 750 mi. @ 250 mph              |
| alt./gals/weight | 10,000'/180/7215               | 15,000'/160/7600               | 15,000'/160/7645               | 20,000'/ /7646                 | 10,000'/148/7535               |

| Model | Qty. | Serial Numbers  | P-40B        | 31  | 41-13297/13327 | Tomahawk IIB | 471 | AK 100 to 570                  |
|-------|------|-----------------|--------------|-----|----------------|--------------|-----|--------------------------------|
| P-40  | 134  | 39-156 to -289  | P-40C        | 193 | 41-13328/13520 | Tomahawk IIB | 150 | AM 370 to 519                  |
| P-40  | 66   | 40-292 to -357  | Tomahawk I   | 140 | AH 741 to 880  | Tomahawk IIB | 300 | AN 218 to 517                  |
| P-40B | 100  | 41-5202 to 5304 | Tomahawk IIA | 110 | AH 881 to 990  | Tomahawk ?   | 2   | BK 852 to 853*                 |
|       |      |                 | Tomahawk IIB | 9   | AH 991 to 999  |              |     | *Reported to be ex-A.V.G. a/c. |