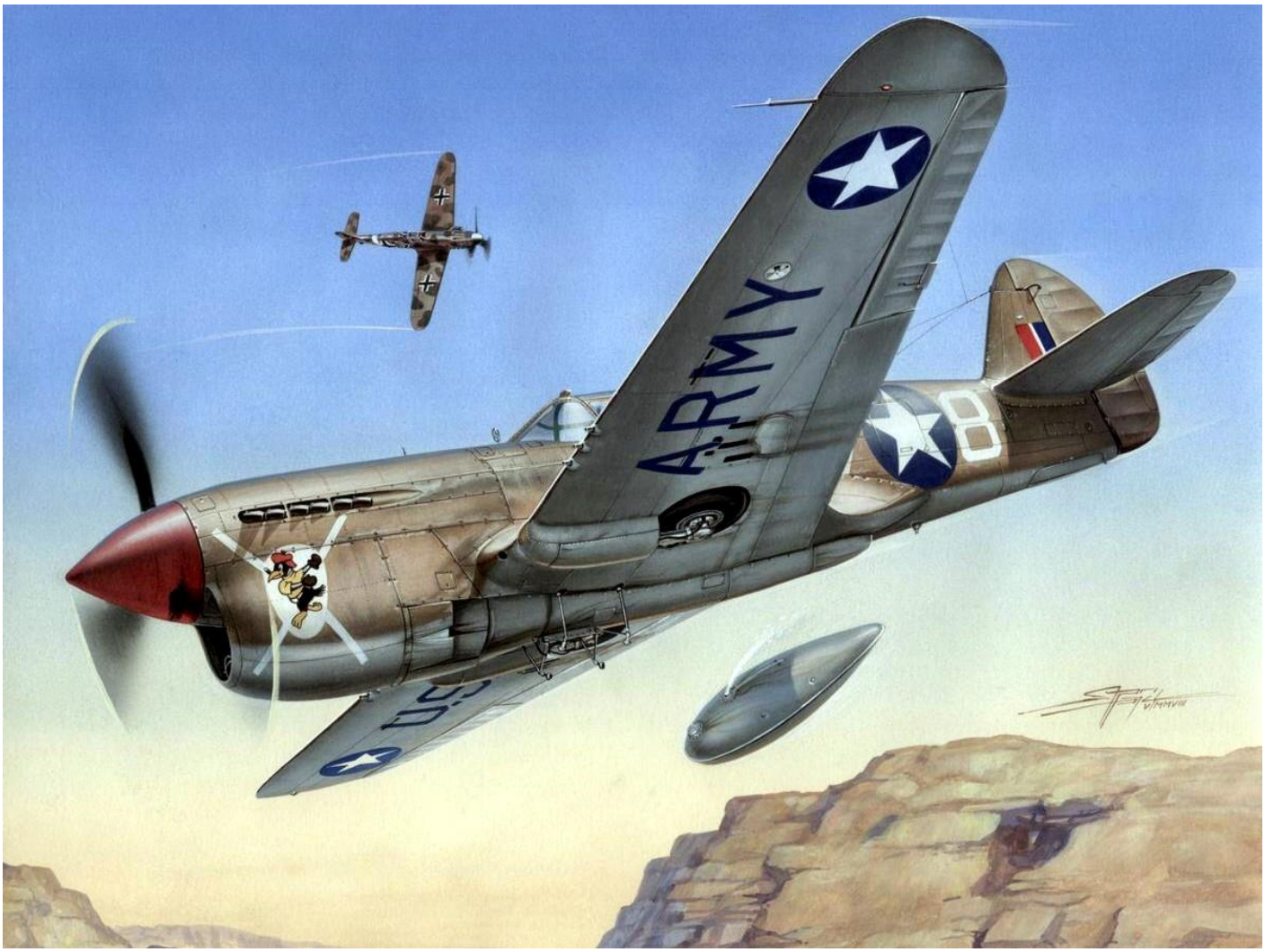
Curtiss P-40 Warhawk



I) Introduction

Le **Curtiss P-40 Warhawk** fut le troisième avion de chasse des États-Unis par la production, il était le dernier développement de la série des chasseurs Curtiss Hawk, et vola pour la première fois en 1938. Il traîne une réputation d'avoir été un avion de chasse dépassé et surclassé par ses adversaires, ce qui provoqua même une enquête après la Seconde Guerre mondiale, visant à déterminer pourquoi il avait été maintenu envers et malgré tout en production. Il semble plutôt avec le recul que ses pilotes eurent à combattre dans des conditions difficiles qui ne permirent pas à l'avion de briller comme certains modèles postérieurs. Il eut une importance certaine dans les opérations du milieu de la Seconde Guerre mondiale, pour la simple raison que :

- le P-39 Airacobra, son concurrent le plus direct, déçut cruellement les espoirs mis en lui ;
- le P-47 Thunderbolt ne fut disponible, et en petit nombre pour commencer (partagé de plus entre l'Europe, la Méditerranée et le Pacifique!) qu'au printemps 1943 et qu'il montra vite qu'en chasseur pur il laissait à désirer ;
- le P-51 Mustang ne fut pas disponible comme chasseur avant décembre 1943 (il l'était en petit nombre depuis le printemps pour la reconnaissance et l'appui en tant que F-6 et A-36).

Tout cela fit que le P-40 resta donc par la force des choses jusqu'à l'automne 1943 le seul chasseur valable et disponible en grand nombre de l'aviation américaine (qui ne l'engagea jamais sur le front d'Europe du Nord, alors qu'elle fit un essai catastrophique avec le P-39).
Bien que peu performant en altitude, du fait de son moteur, il servit très honorablement pendant la plus grande partie du conflit, grâce à son faible coût, sa grande facilité de maintenance et sa grande robustesse. Pour les Britanniques et les autres nations du Commonwealth, il fut connu successivement comme **Tomahawk**, puis **Kittyhawk**.

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Il reste célèbre pour avoir été l'avion des Tigres volants de la future 14th USAAF engagés en Chine et il fut aussi l'appareil de nombreux as de plusieurs pays. Les derniers exemplaires à servir dans une force aérienne furent brésiliens, ils ne furent mis à la retraite qu'en 1958.

II) Conception

1) La genèse

Le Curtiss P-36 Hawk ou Curtiss Hawk Model 75, avait connu peu de succès du fait de ces performances décevantes. Réalisant que son moteur en étoile est au bout de son développement, l'idée vient chez Curtiss, d'y adapter un moteur en ligne, le Allison V-1710. Bien que pas plus puissant, ce moteur a l'avantage d'avoir une section frontale plus faible et permet donc par gain aérodynamique, une augmentation notable de la vitesse de pointe. Un premier essai, est réalisé avec la version turbocompressée du Allison, monté sur un fuselage dont le poste de pilotage a été reculé très en arrière, le XP-37, il sera suivi de treize exemplaires de présérie YP-37, mais le manque de fiabilité des turbocompresseurs condamne vite le projet.
L'ingénieur Donovan Berlin, demande alors la permission à l'USAAC, de monter un Allison V-1710-19, un moteur V12 à refroidissement liquide de 1150 ch avec un compresseur mécanique à simple étage, dans le 10ème P-36A (numéro de série 38-10), le prototype ainsi réalisé, vola pour la première fois le 14 octobre 1938. L'avant du fuselage est redessiné entièrement, l'entrée d'air du carburateur est sur le dessus du capot moteur et un radiateur d'huile en dessous. Le radiateur pour le liquide de refroidissement, est placé lui sous le fuselage au niveau du bord d'attaque des ailes. Par contre contrairement au XP-37, le poste de pilotage est gardé dans la même position. L'armement est de deux mitrailleuses de 12,7 mm synchronisées, sur le capot moteur, ce qui est la norme pour les chasseurs américains de cette époque et de 6 lance-bombes de 20 livres sous les ailes.

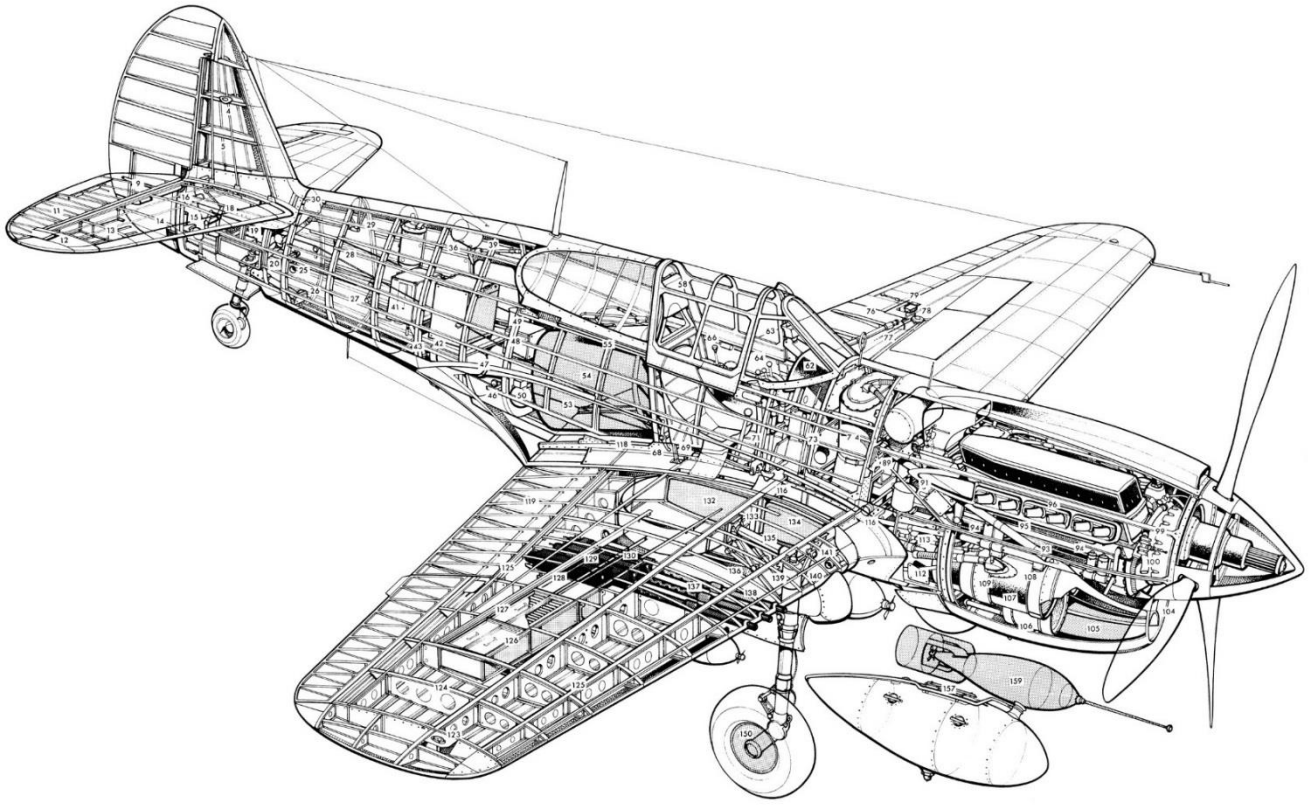
Les débuts sont assez décevants, l'avion n'arrivant pas à dépasser 483 km/h et, après quelques tâtonnements, on crée finalement un ensemble sous le nez comprenant un radiateur pour l'huile et deux pour le mélange d'éthylène glycol de refroidissement.

De plus, les deux pipes d'échappement latérales sont remplacées par six indépendantes de chaque côté ; le système d'obturation du train d'atterrissage, hérité du P-36, est remplacé par deux volets plus aérodynamiques. Suite à ces modifications, les performances augmentent et le XP-40 atteint 550 km/h, ce qui le rend plus rapide que le Hurricane mais moins que le Spitfire et le Bf 109, il a cependant un rayon d'action largement supérieur à ces trois avions avec 976 km, soit près du double (caractéristique habituelle des avions américains).

2) Les premières séries

Une compétition, dite *US Army Pursuit Contest*, est lancée le 25 janvier 1939, par l'USAAC, elle oppose le XP-40 au Bell XP-39, au Lockheed XP-38, aux XP-41 et XP-43 de Republic et aux XP-37 et XP-42 de Curtiss. Bien que moins performant en altitude que les avions dotés de turbocompresseurs, il fut considéré le plus acceptable par l'USAAC, du fait de son coût et de sa cellule déjà éprouvée. Il présentait surtout l'avantage non négligeable de pouvoir être produit en masse un an avant ses concurrents. L'USAAC, encore influencée par des doctrines privilégiant des chasseurs de basse altitude, pour soutenir les troupes au sol, en commanda 524 exemplaires, le 26 avril, sous la désignation de **P-40 Warhawk**.

Le premier exemplaire de série vole le 4 avril 1940, il diffère du prototype par le montage de deux mitrailleuses supplémentaires d'un calibre de 7,62 mm dans les ailes et l'adoption du Alison V-1710-33 développant 1040 ch. En mai, l'Armée de l'air française, à la recherche de chasseurs, passe commande de 140 Curtiss Hawk 81A1, la version d'exportation, qui se distinguait du P-40 américain par son instrumentation en système métrique, ses quatre mitrailleuses d'aile FN-Browning en calibre 7,5 mm et les manettes de gaz inversées à la mode française. La commande américaine est différée après 200 exemplaires pour accélérer la livraison de ces machines, mais elles ne seront pas prêtes avant l'armistice de juin 1940, le premier volant seulement le 6 juin. La RAF britannique décide alors de reprendre ces avions sous la désignation de **Tomahawk I** et le premier arrive en Angleterre en septembre, les mitrailleuses sont remplacées par des Browning de 7,7 mm, mais beaucoup, du fait de la précipitation, sont encore équipés d'instruments métriques et des marquages en français.



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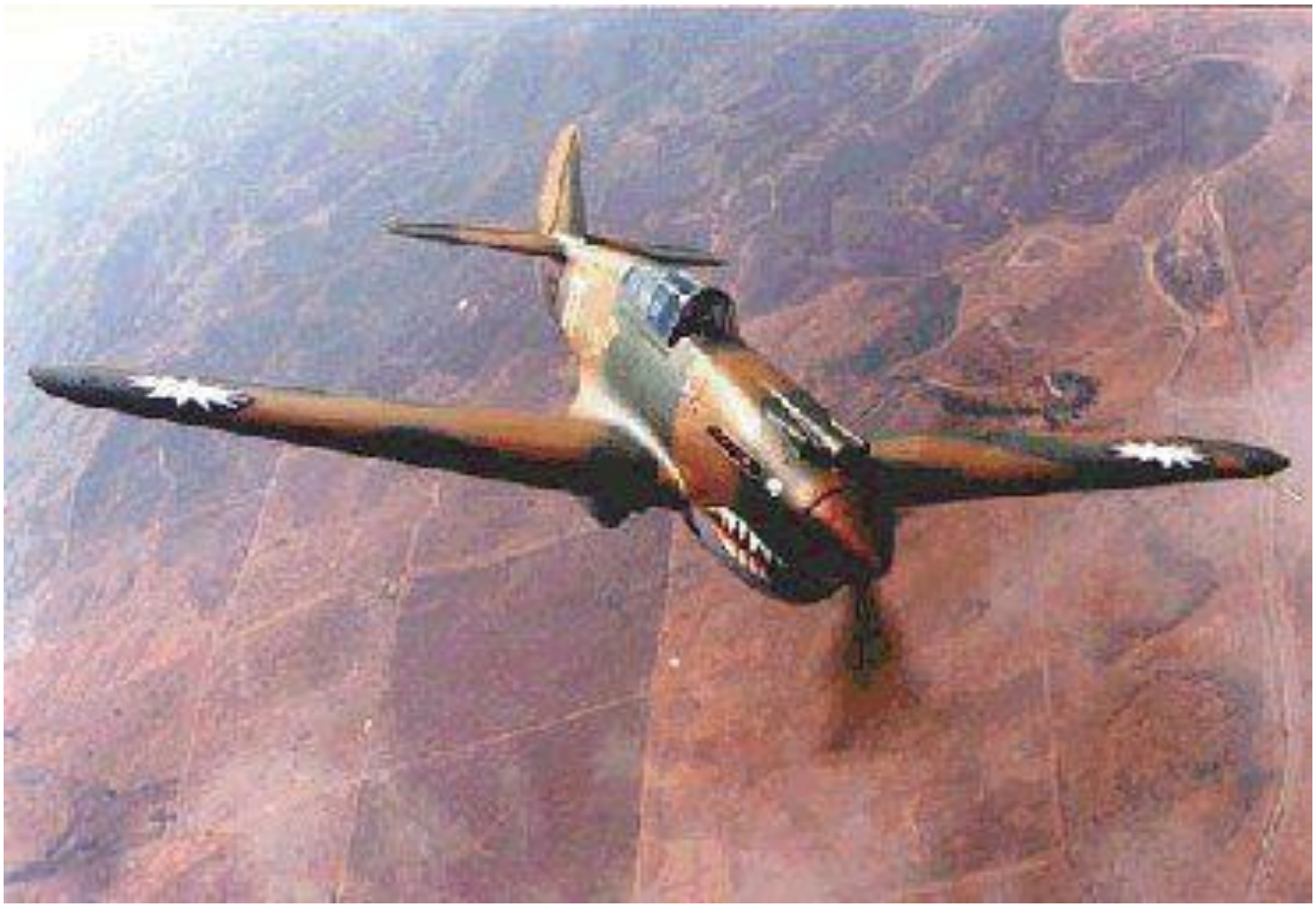
Le 13 mars 1941, suite aux premières expériences de combat, apparaît le premier P-40B, dont l'armement est renforcé par deux mitrailleuses de 7,62 mm et les réservoirs sont rendus auto-obturants par l'adjonction d'une bâche autour de leurs parois. L'USAAC en commande 131 en septembre 1940 pour reprendre la livraison des 324 exemplaires restants sur son contrat initial. Les britanniques, eux, commandent 110 exemplaires d'un dérivé, le **Tomahawk IIA**, avec des mitrailleuses de 7,7 mm, des blindages pour le pilote et une radio d'origine nationale.

Parallèlement, le 10 avril, le premier P-40C prend l'air lui aussi, il est pourvu d'un tout nouveau système d'alimentation en carburant avec des nouveaux réservoirs d'une capacité de 134 gallons, à obturation interne. Il introduit aussi l'usage du réservoir largable de 52 gallons, et de la nouvelle radio SCR-247N qui remplace la SCR-283. L'USAAC voit sa commande initiale complétée avec ce modèle, tandis que la RAF en commande 930. Ces modifications, imposées pour rendre le P-40 apte au combat, sont cependant très coûteuses sur la masse au combat de l'avion (une augmentation de près de 11%), et donc ses performances, ainsi le P-40C sera le moins rapide de la série, avec 583 km/h, cependant la robustesse de l'avion est louée par ses pilotes, en particulier, lors des attaques au sol sur le théâtre africain.



3) La première refonte

Pour remédier à la chute des performances, l'avion est alors entièrement revu pour le montage d'un moteur V-1710-39 de 1150 chevaux doté d'un meilleur compresseur, il avait été proposé le 10 juin, sur le chasseur expérimental XP-46, mais l'USAAC préférait le voir adapté sur une cellule déjà existante. L'avant est redessiné plus court, ce qui va devenir la caractéristique des modèles ultérieurs de P-40. En fait tout l'avion est repensé, si bien que Curtiss lui affecte une nouvelle désignation d'usine, **Hawk Model 87**. Le fuselage est aminci, avec une longueur qui diminue de six pouces.

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Le train d'atterrissage est raccourci lui aussi et le radiateur est avancé et prend encore plus d'ampleur pour refroidir le nouveau moteur. L'armement de nez disparaît, et on installe alors deux mitrailleuses de 12,7 mm dans chaque aile, avec des nouveaux chargeurs hydrauliques. Deux emplacements pour un canon de 20 mm sont même prévus mais ils ne seront en fait jamais utilisés. La France et le Royaume-Uni passent commande dès juin 1940, alors que l'avion est encore sur les planches à dessin. La commande française est annulée après la défaite de ce pays, mais les Anglais se portent acquéreurs de 560 exemplaires, l'USAAF, elle, attendra septembre pour suivre.

L'avion commence à être produit en mai 1941, mais après seulement 582 exemplaires produits, la production bascule sur les modèles Model 87-B2 (P-40E) et 87-A4 (Kittyhawk IA), suite à une demande de l'USAAF datée du 18 février 1941, d'augmenter l'armement à six mitrailleuses de 12,7 mm. Ce modèle va être acquis par l'USAAF à 2320 exemplaires, dont 1500 P-40E-1, destinés au prêt-bail pour le Royaume-Uni.

4) Les versions à moteurs Merlin

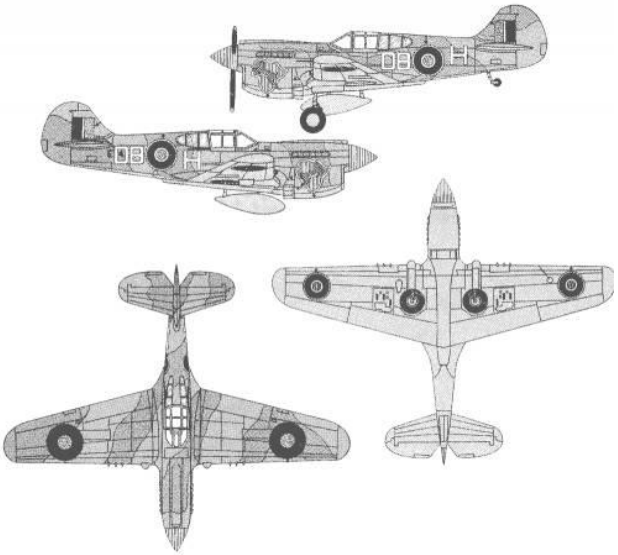
Pour améliorer encore plus les performances, en particulier en altitude, un P-40D est motorisé par un Rolls Royce Merlin XXVIII. Il prend l'air le 30 juin 1941 et se distingue par l'absence de prise d'air de carburateur sur le capot moteur. En septembre 1941, la production est lancée, motorisée par la copie sous licence du Merlin, le Packard V-1650-1. Après 699 exemplaires, le système dit des blocs de production entre en vigueur, avec la sous-série, P-40F-5-CU, qui présente un fuselage allongé de 66 centimètres, pour compenser l'influence du couple sur la stabilité longitudinale. Suivent les P-40F-10-CU, P-40F-15-CU et P-40F-20-CU, caractérisées respectivement par des volets de refroidissement à commandes manuelles au lieu d'électriques, des équipements d'hiver et un nouvel équipement d'oxygène pour le pilote. Le P-40F n°41-13602, affecté à des tests pour le placement des radiateurs, fut nommé officieusement, XP-40F. Parallèlement, on produit le modèle 87-B3 (P-40L), dont la masse à vide a été réduite, par la diminution d'équipements internes, elle y gagna son surnom de « Gipsy Rose Lee » (nom d'une stripteaseuse de l'époque). Malgré le gain de poids, la vitesse n'est augmentée que de 6 km/h.

Par la suite, beaucoup de P-40F et L, de l'USAAF, furent reconvertis en P-40R1 et R2, par le montage d'un Allison V-1710-81, afin de servir d'avion d'instruction avancé. Certaines sources américaines, parlent de 600 ou de 300, en se basant sur les numéros de série, 70 conversions de F en R1 et 53 de L en R2, sont à peu près certaines. Une version P, dérivée de la cellule du P-40N sera prévue en 1943, avec 1500 exemplaires, mais les Packards, sont trop peu nombreux et le Mustang, absorbe maintenant le gros de la production, la commande est donc annulée.

III) La version chinoise et les grandes séries

Alors que le P-40E est sur les chaînes de production, le 28 octobre 1941, L'USAAF, passe commande de 600 P-40K, équipé du puissant Allison V-1710-73 de 1325 ch, qu'elle compte attribuer à la Chine nationaliste, dans le cadre d'un prêt-bail. Il est prévu aussi que ce soit la dernière grande série de P-40, qui doit céder la placer au futur Curtiss P-60, mais lorsque les avions commencent à sortir de l'usine en août 1942, le projet du P-60 souffre de difficultés et de retards, et la commande est alors augmentée à 1300 avions, qui sont produits à côté des versions à moteur Packard. Le 24 août 1942, un nouveau contrat, est signé, toujours pour le prêt-bail, sur 600 exemplaires d'un nouvelle version tirée du K, mais avec un moteur V-1710-18. Il se distingue de son prédécesseur par l'adjonction deux petites prises de refroidissement en avant des échappements, il commencera à être livré à partir de novembre 1942, la plupart allant aux forces aériennes du Commonwealth.

Au début de 1943, les performances de l'avion sont encore à la traîne par rapport, aux P-51 Mustangs et P-47 Thunderbolts. Curtiss entame alors un travail en profondeur pour alléger la structure, la visibilité vers l'arrière est améliorée en augmentant la taille des vitrages arrières. De cette étude, devait déboucher deux versions, la N et la P, la deuxième pourvue d'un Packard, doit être bientôt abandonnée, faute de moteurs disponibles. Par contre, le **P-40N**, va connaître plusieurs contrats successifs, qui feront de lui le P-40 le plus produit, avec 5219 exemplaires. Un premier lots de 400 P-40N-1-CU, sort à partir de mars 1943, grâce à l'emploi d'aluminium, de roues plus légères, la suppression de deux mitrailleuses et la réduction de la capacité en carburant à 462 litres, il ne pèse que 2720 kilogrammes à vide et donc malgré l'emploi du même moteur est bien plus performant. Il est le plus rapide de tous les P-40, avec une vitesse de pointe de 608 km/h.



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Le bloc P-40N-5-CU améliore encore la visibilité avec une verrière sans montant, mais il réintroduit l'armement à six mitrailleuses, à la demande des pilotes, et des points d'emport de charges portant la capacité en charge externe à 680 kg. Par la suite le volume des réservoir est aussi augmenté, et les performances recommencent à baisser. En 1944, deux derniers contrats de livraison de P-40, sont signés, le 14 février pour 500 P-40N-30-CU et 500 N-35-CU, et le 30 juin pour 1000 N-40-CU. Par la suite ce dernier contrat est réduit à 220 avions, et le dernier exemplaires quitte les chaînes, le 30 novembre, il est le 13739e P-40 construit. La tentative de Curtiss, de relancer une nouvelle fois son avion en le dotant d'une verrière en goutte d'eau, échoue car dorénavant les modèles plus modernes et performants, comme le North American P-51 Mustang, sont disponibles en nombre suffisant, tout développement sur le P-40 cesse alors.
Notons en conclusion que Curtiss, qui avait été le plus important constructeur aéronautique américain de sa création à 1941, fit faillite peu après la fin de la guerre malgré l'importance des commandes du P-40, du SB2C Helldiver (le plus construit des bombardiers en piqué) et du C-46 Commando (dont toutes les caractéristiques l'emportaient sur celles de son rival C-47/DC-3). La première place fut prise par Boeing, une toute petite marque avant le B-17 (pourtant lui aussi théoriquement inférieur au B-24 de Consolidated)...

IV) Variantes

- **XP-37** Prototype avec moteur Allison V-1710 et turbocompresseur General Electric.
- **YP-37** présérie avec moteur Allison V-1710 et turbocompresseur General Electric, 13 exemplaires.
- **XP-40** (désignation usine : Curtiss Hawk Model 75P), prototype avec moteur Allison V-1710 et compresseur mécanique.

- **P-40** (désignation usine : Curtiss Hawk Model 81) première variante produite, 2 mitrailleuses de 12,7 mm sur le capot et deux de 7,62 dans les ailes, 199 exemplaires, à partir de juin 1940.
- **Tomahawk I** (désignation usine : Curtiss Hawk Model 81A1) version d'exportation du P-40 à l'origine une commande française, reprise par la RAF, 140 exemplaires, à partir de juin 1940.
- **P-40A** la désignation a été porté par un P-40 converti pour la reconnaissance photographique (numéro de série 40-326) en mars 1942.
- **P-40B** (désignation usine : Curtiss Model Hawk 81B) 4 mitrailleuses de 7,62 dans les ailes, 131 exemplaires, à partir de mars 1941.
- **Tomahawk IIA** (désignation usine: Curtiss Hawk Model 81A2) version d'exportation du B pour la RAF, 4 mitrailleuses de 7,7 dans les ailes, blindage, réservoirs auto-obturants par l'extérieur et une radio britannique, 110 exemplaires.
- **P-40C** réservoirs auto-obturants, 193 exemplaires, à partir de avril 1941..
- **Tomahawk IIB** (désignation usine : Curtiss Hawk Model 81A3) version d'exportation du C pour la RAF, 4 mitrailleuses de 7,7 mm, réservoirs auto-obturants par l'intérieur, radio américaine, 930 exemplaires.
- **P-40D**(désignation usine : Curtiss Hawk Model 87A1) 4 mitrailleuses de 12,7 mm dans les ailes, moteur V-1710-39 de 1150 ch, fuselage légèrement plus étroit, verrière revue, prise d'air de refroidissement agrandie, 22 exemplaires, à partir de mai 1941.
- **Kittyhawk I** désignation britannique du Model 87A1, 564 exemplaires.
- **P-40E** (désignation usine : Curtiss Hawk Model 87B2) six mitrailleuses de 12,7 mm dans les ailes, 820 exemplaires, à partir de septembre 1941.
- **P-40E1** ou **Kittyhawk IA**(désignation usine: Curtiss Hawk Model 87A4), version destiné à la RAF dans le cadre du Prêt-bail, 1500 exemplaires.
- **P-40F** (désignation usine : Curtiss Hawk Model 87D) version avec un Packard V-1650-1 (Rolls Royce Merlin produit sous licence), pas de prise d'air de carburateur sur le capot, 1311 exemplaires, à partir de décembre 1941.
  - P-40F-5-CU fuselage rallongé
  - P-40F-10-CU commandes de volets de radiateur manuelles.
  - P-40F-15-CU équipé pour les conditions hivernales.
  - P-40F-20-CU nouveau système d'oxygène pour le pilote.
- **P-40G** (désignation usine : Curtiss Hawk Model 81AG) désignation attribuée à 44 P-40, équipés d'ailes de Tomahawk IIA.
- **P-40J** projet d'une version turbocompressée du E.
- **P-40K** moteur Allison V-1710-73, 1 300 exemplaires à partir de août 1942.
  - P-40K-1-CU identique aux E, sauf le moteur
  - P-40K-5-CU valve rotative pour le refroidissement
  - P-40K-10-CU fuselage long du P-40F-5-CU.
  - P-40K-15-CU idem, plus équipement hivernal.
- **P-40L** version allégée dérivée du F, souvent 4 mitrailleuses, surnommé « Gypsy Rose Lee » en l'honneur d'une stripteaseuse, 720 exemplaires à partir de août 1942.
  - P-40L-1-CU même armement et réservoirs que le F.
  - P-40L-5-CU armement réduit à quatre mitrailleuses, réservoirs avant d'aile retirés
  - P-40L-10-CU trim d'ailerons à commandes électrique, commandes moteur modifiées
  - P-40L-15-CU filtre à air du carburateur amélioré, révision des feux de navigation.
  - P-40L-20-CU changement sur la radio et le circuit électrique, grenade incendiaire pour l'autodestruction.

- **P-40M** ou **Kittyhawk III** P-40K avec Allison V-1710-81 de 1 200 ch, deux petites entrées d'air au niveau des pipes de l'échappement, 600 exemplaires, 264 à la RAF, 168 à l'Australie, 34 à la Nouvelle-Zélande et 19 au Brésil.
  - P-40M-1-CU ailerons renforcés
  - P-40M-5-CU filtre à air du carburateur et ailerons améliorés.
  - P-40M-10-CU signalisation du train d'atterrissage amélioré, changement sur le système d'alimentation en carburant.
- **P-40N** fuselage arrière agrandi pour compenser le couple des derniers Allison, structure et train allégés, les derniers construits auront un Allison V-1710-115 de 1 360 ch, 5 219 exemplaires produits à partir de 1943, la Grande-Bretagne en reçu 586, sous le nom de **Kittyhawk IV**, mais les 130 premiers furent cédé à l'Union soviétique. L'Australie en perçu 468, la Nouvelle-Zélande 172, le Canada 36 et le Brésil 41.
  - P-40N-1-CU (mars 1943) 122 gallons de carburant interne, 6000 livres à vide, quatre mitrailleuses.
  - P-40N-5-CU nouvelle verrière sans montants, armement rétabli à six mitrailleuses.
  - P-40N-6-CU modification de terrain du précédent avec des caméra pour la reconnaissance.
  - P-40N-10-CU préparé pour les conditions hivernales, quatre mitrailleuses.
  - P-40N-15-CU capacité des réservoirs d'aile augmentée, six mitrailleuses, batterie déplacé devant le coupe-feu, nouveaux phares d'atterrissage.
  - P-40N-20-CU moteur V-1710-99, un V-1710-81 avec contrôle automatique.
  - P-40N-25-CU réservoirs non métalliques, instruments du tableau révisés
  - P-40N-26-CU modification de terrain du précédent avec des caméra pour la reconnaissance.
  - RP-40N-26-CU trois exemplaires P-40N-25-CU, convertis en biplaces d'entraînement.
  - P-40N-30-CU (14 février 1944, 500 exemplaires) identique au N-25, à part le système électrique.
  - P-40N-31-CU trente et un N-30, convertis en biplaces d'entraînement.
  - P-40N-35-CU (14 février 1944, 500 exemplaires) amélioration des systèmes de lubrification, électrique, radio et équipement ADF.
  - P-40N-40-CU (30 juin 1944, 1 000 exemplaires commandés, réduit à 220) moteur V-1710-115 de 1 360 ch, ailerons entièrement métalliques, pas d'hélice à contrôle automatique.
  - XP-40N désignation d'un P-40N converti avec une verrière goutte d'eau.

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- **P-40P** version identique au N, mais pourvu d'un Packard V-1650-1, 1 500 prévus, annulés par suite du manque de moteurs.
- **P-40Q1** P-40K converti en 1943 par le montage d'un V-1710-121 et une hélice quadripale, radiateurs déplacés à l'emplanture des ailes, 1 prototype construit.
- **P-40Q2** P-40N modifié, hélice quadripale, verrière goutte d'eau, radiateur d'huile à l'emplanture des ailes, 1 prototype construit.
- **P-40Q3** similaire au Q2, mais avec des ailes de corde inférieure et une verrière légèrement différente, 1 prototype construit.
- **P-40R1**conversion de P-40F en avion d'entraînement avec un moteur Allison V-1710-81, au moins 70 réalisés.
- **P-40R2** conversion de P-40L en avion d'entraînement avec un moteur Allison V-1710-81, au moins 53 réalisés.
- **RP-40** désignation des P-40 à partir du 22 octobre 1942
- **RP-40G** désignation des P-40G à partir du 22 octobre 1942

V) Engagements

1) Aux USA

Les premiers P-40 furent admis dans l'USAAC, au sein du 8e Pursuit Group (groupe d'interception), basé sur l'aérodrome de Langley, en Virginie. Le 20e à Hamilton en Californie et le 31e à Selfridge dans le Michigan suivirent peu après. Le premier déploiement extérieur se fit au sein du 37e et du 16e, basé à Panama, puis le 36e à Porto Rico et les 15e et 18e à Hawaii. Durant 1941, les P-40B et C, complètent les formations et en équipent de nouvelles comme le 24e, basé au Philippines. Le P-40E commence à entrer en service, entre autres au sein du 24e et du 35e qui faute de pouvoir atteindre les Philippines, sera déployé à Java.

L'attaque japonaise, va surprendre les 15e, 18e, 20e, 24e Pursuit Group sur leurs terrains respectifs. À Hawaii, lors de l'attaque sur Pearl Harbor, seul sept appareils, dont quatre du 47e Pursuit Squadron, basés à Haleiwa Field, parviennent à prendre l'air et attaquer les japonais. Ils revendiqueront cinq victoires, dont quatre pour le seul George S. Welch. Les autres avions seront mitraillés sur leurs terrains de *Wheeler Field* et de *Bellows Field* et trois abattus au décollage. À la fin de la journée, des 99 P-40B et des 60 P-40C présents, seuls 25 sont en état de vol. Le scénario est assez similaire pour le 24e Pursuit Group, sur le terrain de *Clark Field* aux Philippines, les 107 P-40B, présents ne sont plus que 22 après quatre jours de combat, 26 étant détruits au sol, dès le 8 décembre. Le lieutenant Boyd D. Wagner sur son P-40E, réussira quand même à abattre quatre Nakajima Ki.27 du 50e Sentai, le 12, il en ajoutera un autre le 16.

Par la suite, la plupart des P-40 de l'USAAF, serviront plutôt à l'entraînement avancé, mais quelques unités opérant sur des fronts dits « secondaires » continueront à utiliser le P-40 au combat. Parmi elles, deux unités du MTO, sont particulièrement connues, le 325e groupe de chasse « Checkertail Clan » (12th USAAF puis 15th USAAF, qui obtint 130 victoires aériennes d'avril à octobre 1943 et le 57e groupe de chasse (12th USAAF) qui opéra sur P-40 jusqu'au début 1944. Ce dernier obtint 140 victoires, et eu la chance de participer à l'interception d'un convoi de Junkers Ju 52, le 18 avril 1943, suite au décodage des codes secrets allemands de la machine Enigma. À cette occasion, au moins soixante dix avions allemands furent abattus, contre six à sept alliés. Un autre groupe de chasse célèbre sur P-40, fut le 23e (14th USAAF), qui succéda aux Tigres volants en Chine, et qui opéra sur cet avion jusqu'à la fin de la guerre avec un très bon rapport victoires/pertes.

2) Forces aériennes du Commonwealth

La RAF reçoit ses premiers Tomahawk I, en septembre 1940. L'avion est rapidement considéré comme impropre au combat, du fait du manque de blindages et de réservoirs auto-obturants, mais vu l'urgence de la situation, en pleine bataille d'Angleterre, les appareils sont malgré tout versés, provisoirement, au sein des unités de combat mais ne seront pas engagés. La menace écartée, l'avion est alors rendu à des tâches d'entraînement avancé. Les Britanniques commandent par la suite 110 Tomahawk IIA, puis ils achètent 930 Tomahawk IIB, livrés en quatre lots.

https://www.techno-science.net/glossaire-definition/Curtiss-P-40-Warhawk.html

Avec l'entrée en guerre de l'Union soviétique, le gouvernement britannique, décide lui de fournir 23 Tomahawk IIA et 195 Tomahawk IIB, à la fois directement à partir des USA et en puisant dans sa réserve constituée en Angleterre en prévision d'un éventuel débarquement allemand. 6 IIB, sont aussi fournis à la Royal Egyptian Air Force et un certain nombre du même modèle à la Turquie pour favoriser sa neutralité. 100 Tomahawk IIB, constitueront les premiers avions des Tigres volants, en Chine. De plus, un Tomahawk IIA, est affecté au Canada, pour l'entraînement, et 31 B furent perdus en mer lors de leur transit.

Avec l'arrivée des Tomahawk II, le nombre d'unités qui emploient le chasseur américain augmente, les escadrilles 2, 26, 73, 112, 136, 168, 239, 241, 250, 403, 414, 430 et 616 de la RAF emploient alors l'avion. Les forces des autres pays du Commonwealth, commencent aussi à utiliser l'avion: la Royal Australian Air Force au sein de ses 3e et 450e escadrilles et la South African Air Force, dans ses 2e et 4e. La plupart de ces unités étaient déployées en Égypte et au Moyen-Orient. La première utilisation au combat, eut lieu, lors de la révolte irakienne, du 2 mai 1941, le 250e squadron fournissant, 2 Tomahawk d'escorte aux bombardiers attaquant la base aérienne de Palmyre, où sont parqués les avions allemands qui ont transités par le Liban. L'engagement suivant eut lieu, lors de la campagne contre le Liban vichyste, pendant laquelle, le 3e squadron sud-africain, détruit un et endommage 3 Dewoitine D.520, le 8 juin, puis deux Ju-88, opérant de la Crète, le 12 juin. L'intervention de cette escadrille donna l'avantage à la RAF sur ce front, tant par la supériorité en combat aérien du P-40 sur le D-520 français que par son emploi dans les mitraillages au sol, que les chasseurs français ne pratiquaient pas. Pendant ce temps, le 250e squadron en Égypte, s'adjuge un avion de reconnaissance italien, et au cours de l'été il est renforcé par le squadron 112, qui perçoit des Tomahawk II, pour remplacer ses Gloster Gladiator perdus en Crète. C'est cette unité qui aura l'idée de peindre les premières gueules de requin sur l'avion, décoration qui sera reprise plus tard par les Tigres volants.

Au combat, le Tomahawk II se révèle supérieur au Messerschmitt Bf 109 de son temps lors des combats à basse altitude, mais au-dessus de 5000 mètres, son compresseur le pénalise trop. Mais sur le front africain, il est de plus opposé surtout à des Fiat CR.42 Falco et Fiat G.50 Freccia nettement inférieurs, si bien que certains pilotes, comme Neville Duke, obtiennent de jolis palmarès. L'Australien, Clive Caldwell par exemple, obtient 15 victoires et demie sur l'avion et il en ajoutera 5 sur Kittyhawk.

Les 564 Kittyhawk I, commandés dès mai 1940, seront livrés à partir de mai 1941. Ce sont les derniers P-40 achetés par les Britanniques, 96 seront affectés à la Royal Canadian Air Force, mais finalement 72 de ceux-ci seront livrés à la Turquie, pour garantir sa neutralité. Les modèles suivants seront *prêtés* en vertu de la loi de prêt-bail, à savoir :

- 1500 Kittyhawk IA, dont 163 allèrent à la RAAF, 133 à la RNZAF, et 11 à la RCAF.
- 150 Kittyhawk II (P-40F), dont 10 furent rendus à l'USAAF en Afrique du Nord, 7 servirent aux FAFL au sein du II/5 *La Fayette*, 100 furent transférés à l'Union soviétique et 7 perdus en mer lors de la livraison.
- 100 Kittyhawk II (P-40L)
- 192 Kittyhawk III (P-40K), dont 42 pour la RAAF, 22 pour la RNZAF et 9 pour la RCAF.
- 160 Kittyhawk III (P-40L).
- 264 Kittyhawk III (P-40M) pour la RAF, 168 pour la RAAF et 34 pour la RNZAF.
- 586 Kittyhawk IV (P-40N) qui servirent dans les squadrons 112, 250 et 450 de la RAF.
- 468 Kittyhawk IV (P-40N) qui servirent dans les squadrons 75, 78 et 80 de la RAAF.
- 172 Kittyhawk IV (P-40N) pour la RNZAF.
- 35 Kittyhawk IV (P-40N) pour la RCAF.

Unités australiennes ayant utilisé le P-40 : les 3e, 75e, 76e, 77e, 78e, 80e, 82e, 84e, 86e, 120e (Indes orientales) et 450e escadrilles de chasse.

Unités neo-zélandaises ayant utilisé le P-40: les 14e, 15e, 16e, 17e, 18e, 19e et 20e escadrilles de chasse.

3) La France

Transfert officiel de 12 Curtiss P-40F Warhawk de l'USAAF au Groupe de Chasse II-5 le 9 janvier 1943 à Casablanca.

Le GC II/5 (futur La Fayette, basé à Médiouna près de Casablanca, au Maroc), dont les H75 avaient été détruits lors du débarquement anglo-saxon du 8 novembre 1942 (Opération TORCH, AFN), fut rééquipé sur P-40F Warhawk en AFN dès le 25 novembre 1942 grâce à l'intervention d'un vétéran américain de 14-18 qui avait servi dans l'escadrille du même nom. En avril 1944, les P-40F furent remplacés par des P-47D Thunderbolt.

4) L'American Volunteer Group (AVG)

5) En Union soviétique

livraisons à l'Union soviétique (total 2097) :

- 16 P-40G livrés en octobre 1941, plus 1 en 1943
- 23 Tomahawk IIA
- 195 Tomahawk IIB
- 100 P-40F
- 1758 P-40N ?

VI) Autres caractéristiques

Le P-40 était vraiment un avion peu coûteux si on se réfère aux coûts moyens des différents chasseurs de l'USAAF :

- Lockheed P-38 Lightning : 126 234 dollars
- Republic P-47 Thunderbolt : 114 377 dollars
- Seversky P-43 Lancer : 85 694 dollars
- Bell P-39 Airacobra : 71 965 dollars
- North American P-51 Mustang: 64 872 dollars
- Curtiss P-40 : 54 675 dollars

Coûts des différents modèles de P-40 :

- P-40: 51 538 dollars (dont cellule 24 889, moteur 17 126, hélice 3 425, électronique 1 360)
- P-40E: 59 618 dollars (dont cellule 27 482, moteur 16 885, hélice 2 481, électronique 3 160)
- P-40N: 52 869 dollars (dont cellule 27 189, moteur 10 702, hélice 3 110, électronique 7 154)

Version anglaise wikipédia

The **Curtiss P-40 Warhawk** is an American single-engined, single-seat, all-metal fighter and ground-attack aircraft that first flew in 1938. The P-40 design was a modification of the previous Curtiss P-36 Hawk which reduced development time and enabled a rapid entry into production and operational service. The Warhawk was used by most Allied powers during World War II, and remained in frontline service until the end of the war. It was the third most-produced American fighter of World War II, after the P-51 and P-47; by November 1944, when production of the P-40 ceased, 13,738 had been built,[3] all at Curtiss-Wright Corporation's main production facilities in Buffalo, New York. P-40 Warhawk was the name the United States Army Air Corps gave the plane, and after June 1941, the USAAF adopted the name for all models, making it the official name in the U.S. for all P-40s. The British Commonwealth and Soviet air forces used the name **Tomahawk** for models equivalent to the original P-40, P-40B, and P-40C, and the name **Kittyhawk** for models equivalent to the P-40D and all later variants. P-40s first saw combat with the British Commonwealth squadrons of the Desert Air Force in the Middle East and North African campaigns, during June 1941.[4][5] No. 112 Squadron Royal Air Force, was among the first to operate Tomahawks in North Africa and the unit was the first Allied military aviation unit to feature the "shark mouth" logo,[6][7] copying similar markings on some Luftwaffe Messerschmitt Bf 110 twin-engine fighters.[6] [N 1] The P-40's liquid-cooled, supercharged Allison V-1710 V-12 engine's lack of a two-speed supercharger made it inferior to Luftwaffe fighters such as the Messerschmitt Bf 109 or the Focke-Wulf Fw 190 in high-altitude combat and it was rarely used in operations in Northwest Europe. However, between 1941 and 1944, the P-40 played a critical role with Allied air forces in three major theaters: North Africa, the Southwest Pacific, and China. It also had a significant role in the Middle East, Southeast Asia, Eastern Europe, Alaska and Italy. The P-40's performance at high altitudes was not as important in those theaters, where it served as an air superiority fighter, bomber escort and fighter-bomber. Although it gained a postwar reputation as a mediocre design, suitable only for close air support, more recent research including scrutiny of the records of Allied squadrons indicates that this was not the case; the P-40 performed surprisingly well as an air superiority fighter, at times suffering severe losses, but also inflicting a very heavy toll on enemy aircraft.[9] Based on war-time victory claims, over 200 Allied fighter pilots – from the UK, Australia, New Zealand, Canada, South Africa, the US and the Soviet Union – became aces flying the P-40. These included at least 20 double aces, mostly over North Africa, China, Burma and India, the South West Pacific and Eastern Europe.[10] The P-40 offered the additional advantages of low cost and durability, which kept it in production as a ground-attack aircraft long after it was obsolescent as a fighter.

Design and development

Origins

Curtiss XP-40 "11" used for test purposes by the Materiel Division of the U.S. Army Air Corps

On 14 October 1938, Curtiss test pilot Edward Elliott flew the prototype XP-40 on its first flight in Buffalo.[11] The XP-40 was the 10th production Curtiss P-36 Hawk,[12] with its Pratt & Whitney R-1830 Twin Wasp 14-cylinder air-cooled radial engine replaced at the direction of Chief Engineer Don R. Berlin by a liquid-cooled, supercharged Allison V-1710 V-12 engine. The first prototype placed the glycol coolant radiator in an underbelly position on the fighter, just aft of the wing's trailing edge.[13] USAAC Fighter Projects Officer Lieutenant Benjamin S. Kelsey flew this prototype some 300 miles in 57 minutes, approximately 315 miles per hour (507 km/h). Hiding his disappointment, he told reporters that future versions would likely go 100 miles per hour (160 km/h) faster.[14] Kelsey was interested in the Allison engine because it was sturdy and dependable, and it had a smooth, predictable power curve. The V-12 engine offered as much power as a radial engine but had a smaller frontal area and allowed a more streamlined cowl than an aircraft with a radial engine, promising a theoretical 5% increase in top speed.[15] Curtiss engineers worked to improve the XP-40's speed by moving the radiator forward in steps. Seeing little gain, Kelsey ordered the aircraft to be evaluated in a NACA wind tunnel to identify solutions for better aerodynamic qualities. From 28 March to 11 April 1939, the prototype was studied by NACA.[16] Based on the data obtained, Curtiss moved the glycol coolant radiator forward to the chin; its new air scoop also accommodated the oil cooler air intake. Other improvements to the landing gear doors and the exhaust manifold combined to give performance that was satisfactory to the USAAC.[13] Without beneficial tail winds, Kelsey flew the XP-40 from Wright Field back to Curtiss's plant in Buffalo at an average speed of 354 mph (570 km/h).[N 2] Further tests in December 1939 proved the fighter could reach 366 mph (589 km/h).[18] An unusual production feature was a special truck rig to speed delivery at the main Curtiss plant in Buffalo, New York. The rig moved the newly built P-40s in two main components, the main wing and the fuselage, the eight miles from the plant to the airport where the two units were mated for flight and delivery.[19]

Performance characteristics

A three-quarter view of a P-40B, X-804 (s/n 39-184) in flight. This aircraft served with an advanced training unit at Luke Field, Arizona.

The P-40 was conceived as a pursuit aircraft and was agile at low and medium altitudes but suffered from a lack of power at higher altitudes. At medium and high speeds it was one of the tightest-turning early monoplane designs of the war,[20] and it could out turn most opponents it faced in North Africa and the Russian Front. In the Pacific Theater it was out-turned at lower speeds by the lightweight fighters A6M Zero and Nakajima Ki-43 "Oscar". The American Volunteer Group Commander Claire Chennault advised against prolonged dog-fighting with the Japanese fighters due to speed reduction favoring the Japanese.[21] Allison's V-1710 engines produced 1,040 hp (780 kW) at sea level and 14,000 ft (4,300 m). This was not powerful compared with contemporary fighters, and the early P-40 variants' top speeds were only average. The single-stage, single-speed supercharger meant that the P-40 was a poor high-altitude fighter. Later versions, with 1,200 hp (890 kW) Allisons or more powerful 1,400 hp Packard Merlin engines were more capable. Climb performance was fair to poor, depending on the subtype.[9] Dive acceleration was good and dive speed was excellent.[9] The highest-scoring P-40 ace, Clive Caldwell (RAAF), who claimed 22 of his 28½ kills in the type, said that the P-40 had "almost no vices", although "it was a little difficult to control in terminal velocity".[22] The P-40 had one of the fastest maximum dive speeds of any fighter of the early war period, and good high-speed handling.

Evidence of the P-40's durability: in 1944 F/O T. R. Jacklin (*pictured*) flew this No. 75 Squadron RAAF P-40N-5 more than 200 mi (322 km) after the loss of the port aileron and 25% of its wing area, due to a mid-air collision with another P-40N-5.[23] [N 3]

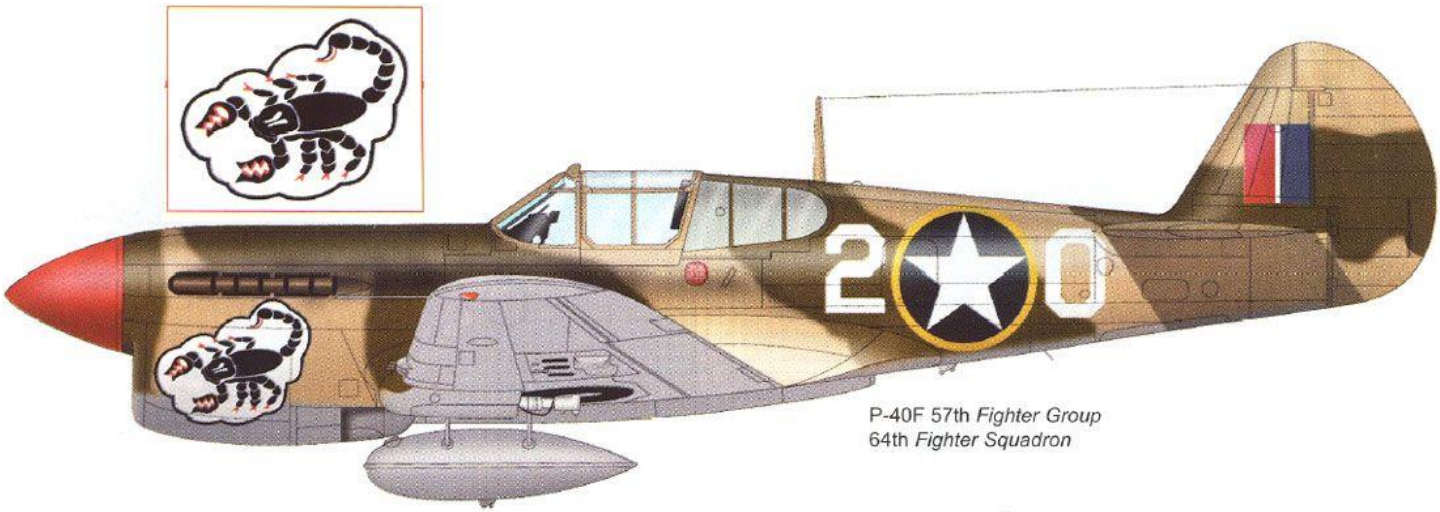
The P-40 tolerated harsh conditions and a variety of climates. Its semi-modular design was easy to maintain in the field. It lacked innovations such as boosted ailerons or automatic leading edge slats, but its strong structure included a five-spar wing, which enabled P-40s to pull high-G turns and survive some midair collisions. Intentional ramming attacks against enemy aircraft were occasionally recorded as victories by the Desert Air Force and Soviet Air Forces.[24] Caldwell said P-40s "would take a tremendous amount of punishment, violent aerobatics as well as enemy action".[25] Operational range was good by early war standards and was almost double that of the Supermarine Spitfire or Messerschmitt Bf 109, although inferior to the Mitsubishi A6M Zero, Nakajima Ki-43 and Lockheed P-38 Lightning. Caldwell found the P-40C Tomahawk's armament of two .50-inch (13 mm) Browning AN/M2 "light-barrel" dorsal nose-mount synchronized machine guns and two .303-inch (7.7 mm) Browning machine guns in each wing to be inadequate.[25] This was improved with the P-40D (Kittyhawk I) which abandoned the synchronized gun mounts and instead had two .50-inch (13 mm) guns in each wing, although Caldwell still preferred the earlier Tomahawk in other respects. The D had armor around the engine and the cockpit, which enabled it to withstand considerable damage. This allowed Allied pilots in Asia and the Pacific to attack Japanese fighters head on, rather than try to out-turn and out-climb their opponents. Late-model P-40s were well armored. Visibility was adequate, although hampered by a complex windscreen frame, and completely blocked to the rear in early models by a raised turtledeck. Poor ground visibility and relatively narrow landing gear track caused many losses on the ground.[9] Curtiss tested a follow-on design, the Curtiss XP-46, but it offered little improvement over newer P-40 models and was cancelled.[26]

Operational history

In April 1939, the U.S. Army Air Corps, having witnessed the new, sleek, high-speed, in-line-engined fighters of the European air forces, placed the largest fighter order it had ever made for 524 P-40s.

French Air Force

An early order came from the French *Armée de l'Air*, which was already operating P-36s. The *Armée de l'Air* ordered 100 (later the order was increased to 230) as the **Hawk 81A-1** but the French were defeated before the aircraft had left the factory and the aircraft were diverted to British and Commonwealth service (as the Tomahawk I), in some cases complete with metric flight instruments. In late 1942, as French forces in North Africa split from the Vichy government to side with the Allies, U.S. forces transferred P-40Fs from 33rd FG to *GC II/5*, a squadron that was historically associated with the Lafayette Escadrille. GC II/5 used its P-40Fs and Ls in combat in Tunisia and later for patrol duty off the Mediterranean coast until mid-1944, when they were replaced by Republic P-47D Thunderbolts.



British Commonwealth

Deployment

Armourers working on a Tomahawk Mk.II from No. 3 Squadron RAAF in North Africa, 23 December 1941

In all, 18 Royal Air Force (RAF) squadrons, four Royal Canadian Air Force (RCAF), three South African Air Force (SAAF) and two Royal Australian Air Force (RAAF) squadrons serving with RAF formations, used P-40s.[27][28] The first units to convert were Hawker Hurricane squadrons of the Desert Air Force (DAF), in early 1941. The first Tomahawks delivered came without armor, bulletproof windscreens or self-sealing fuel tanks, which were installed in subsequent shipments. Pilots used to British fighters sometimes found it difficult to adapt to the P-40's rear-folding landing gear, which was more prone to collapse than the lateral-folding landing gear of the Hurricane or Supermarine Spitfire. In contrast to the "three-point landing" commonly employed with British types, P-40 pilots were obliged to use a "wheels landing": a longer, low angle approach that touched down on the main wheels first. Testing showed the aircraft did not have the performance needed for use in Northwest Europe at high-altitude, due to the service ceiling limitation. Spitfires used in the theater operated at heights around 30,000 ft (9,100 m), while the P-40's Allison engine, with its single-stage, low altitude rated supercharger, worked best at 15,000 ft (4,600 m) or lower. When the Tomahawk was used by Allied units based in the UK from February 1941, this limitation relegated the Tomahawk to low-level reconnaissance with RAF Army Cooperation Command and only No. 403 Squadron RCAF was used in the fighter role for a mere 29 sorties, before being replaced by Spitfires. Air Ministry deemed the P-40 unsuitable for the theater. UK P-40 squadrons from mid-1942 re-equipped with aircraft such as Mustangs

A Kittyhawk Mk III of No. 112 Squadron RAF, taxiing at Medenine, Tunisia, in 1943. The ground crewman on the wing is directing the pilot, whose forward view is hindered by the aircraft's nose.

The Tomahawk was superseded in North Africa by the more powerful Kittyhawk ("D"-mark onwards) types from early 1942, though some Tomahawks remained in service until 1943. Kittyhawks included many improvements and were the DAF's air superiority fighter for the critical first few months of 1942, until "tropicalised" Spitfires were available. DAF units received nearly 330 Packard V-1650 Merlin-powered P-40Fs, called Kittyhawk IIs, most of which went to the USAAF and the majority of the 700 "lightweight" L models, also powered by the Packard Merlin, in which the armament was reduced to four .50 in (12.7 mm) Brownings (Kittyhawk IIA). The DAF also received some 21 of the later P-40K and the majority of the 600 P-40Ms built; these were known as Kittyhawk IIIs. The "lightweight" P-40Ns (Kittyhawk IV) arrived from early 1943 and were used mostly as fighter-bombers.[N 4] From July 1942 until mid-1943, elements of the U.S. 57th Fighter Group (57th FG) were attached to DAF P-40 units. The British government also donated 23 P-40s to the Soviet Union.

Combat performance

Tomahawks and Kittyhawks bore the brunt of *Luftwaffe* and *Regia Aeronautica* fighter attacks during the North African campaign. The P-40s were considered superior to the Hurricane, which they replaced as the primary fighter of the Desert Air Force.[9] I would evade being shot at accurately by pulling so much g-force...that you could feel the blood leaving the head and coming down over your eyes... And you would fly like that for as long as you could, knowing that if anyone was trying to get on your tail they were going through the same bleary vision that you had and you might get away... I had deliberately decided that any deficiency the Kittyhawk had was offset by aggression. And I'd done a little bit of boxing – I beat much better opponents simply by going for [them]. And I decided to use that in the air. And it paid off.

—*Nicky Barr, 3 Sqn RAAF*[30]

The P-40 initially proved quite effective against Axis aircraft and contributed to a slight shift of advantage in the Allies' favor. The gradual replacement of Hurricanes by the Tomahawks and Kittyhawks led to the *Luftwaffe* accelerating retirement of the Bf 109E and introducing the newer Bf 109F; these were to be flown by the veteran pilots of elite *Luftwaffe* units, such as *Jagdgeschwader 27* (JG27), in North Africa.[31] The P-40 was generally considered roughly equal or slightly superior to the Bf 109 at low altitude but inferior at high altitude, particularly against the Bf 109F.[32] Most air combat in North Africa took place well below 16,000 ft (4,900 m), negating much of the Bf 109's superiority. The P-40 usually had an advantage over the Bf 109 in turning, dive speed and structural strength, was roughly equal in firepower but was slightly inferior in speed and outclassed in rate of climb and operational ceiling.[9][31]

The P-40 was generally superior to early Italian fighter types, such as the Fiat G.50 Freccia and the Macchi C.200. Its performance against the Macchi C.202 *Folgore* elicited varying opinions. Some observers consider the Macchi C.202 superior.[33] Caldwell, who scored victories against them in his P-40, felt that the *Folgore* was superior to the P-40 and the Bf 109 except that its armament of only two or four machine guns was inadequate.[34] Other observers considered the two equally matched or favored the *Folgore* in aerobatic performance, such as turning radius. The aviation historian Walter J. Boyne wrote that over Africa, the P-40 and the *Folgore* were "equivalent".[35][36][37] Against its lack of high-altitude performance, the P-40 was considered to be a stable gun platform and its rugged construction meant that it was able to operate from rough front line airstrips with a good rate of serviceability.[38] The earliest victory claims by P-40 pilots include Vichy French aircraft, during the 1941 Syria-Lebanon campaign, against Dewoitine D.520s, a type often considered to be the best French fighter of the war.[4] The P-40 was deadly against Axis bombers in the theater, as well as against the Bf 110 twin-engine fighter. In June 1941, Caldwell, of 250 Squadron in Egypt, flying as flying Officer (F/O) Jack Hamlyn's wingman, recorded in his log book that he was involved in the first air combat victory for the P-40. This was a CANT Z.1007 bomber on 6 June.[4] The claim was not officially recognized, as the crash of the CANT was not witnessed.

The first official victory occurred on 8 June, when Hamlyn and Flight Sergeant (Flt Sgt) Tom Paxton destroyed a CANT Z.1007 from *211ª Squadriglia* of the *Regia Aeronautica*, over Alexandria.[5] Several days later, the Tomahawk was in action over Syria with No. 3 Squadron RAAF, which claimed 19 aerial victories over Vichy French aircraft during June and July 1941, for the loss of one P-40 (and one lost to ground fire).[39]

North Africa, c. 1943. A P-40 "Kittybomber" of No. 450 Squadron RAAF, loaded with six 250 lb (110 kg) bombs.

Some DAF units initially failed to use the P-40's strengths or used outdated defensive tactics such as the Lufbery circle. The superior climb rate of the Bf 109 enabled fast, swooping attacks, neutralizing the advantages offered by conventional defensive tactics. Various new formations were tried by Tomahawk units from 1941 to 1942, including "fluid pairs" (similar to the German *rotte*); the Thach Weave (one or two "weavers") at the back of a squadron in formation and whole squadrons bobbing and weaving in loose formations.[40] Werner Schröer, who was credited with destroying 114 Allied aircraft in only 197 combat missions, referred to the latter formation as "bunches of grapes", because he found them so easy to pick off.[40] The leading German *expert* in North Africa, Hans-Joachim Marseille, claimed as many as 101 P-40s during his career.[41] From 26 May 1942, Kittyhawk units operated primarily as fighter-bomber units, giving rise to the nickname "Kittybomber".[42] As a result of this change in role and because DAF P-40 squadrons were frequently used in bomber escort and close air support missions, they suffered relatively high losses; many Desert Air Force P-40 pilots were caught flying low and slow by marauding Bf 109s. Caldwell believed that Operational Training Units did not properly prepare pilots for air combat in the P-40 and as a commander, stressed the importance of training novice pilots properly.[44]

Competent pilots who took advantage of the P-40's strengths were effective against the best of the *Luftwaffe* and *Regia Aeronautica*.[9][45] In August 1941, Caldwell was attacked by two Bf 109s, one of them piloted by German ace Werner Schröer. Although Caldwell was wounded three times and his Tomahawk was hit by more than 100 7.92 mm (0.312 in) bullets and five 20 mm cannon shells, Caldwell shot down Schröer's wingman and returned to base. Some sources also claim that in December 1941, Caldwell killed a prominent German *Experte*, Erbo von Kageneck (69 kills), while flying a P-40.[N 5] Caldwell's victories in North Africa included 10 Bf 109s and two Macchi C.202s.[47] Billy Drake of 112 Squadron was the leading British P-40 ace with 13 victories.[45] James "Stocky" Edwards (RCAF), who achieved 12 kills in the P-40 in North Africa, shot down German ace Otto Schulz (51 kills) while flying a Kittyhawk with No. 260 Squadron RAF.[45] Caldwell, Drake, Edwards and Nicky Barr were among at least a dozen pilots who achieved ace status twice over while flying the P-40.[45][48] A total of 46 British Commonwealth pilots became aces in P-40s, including seven double aces.[45]

P-40 Warhawk
Tomahawk / Kittyhawk

A restored P-40M Warhawk landing at Season Premier Airshow, in Shuttleworth, UK

The **Curtiss P-40 Warhawk** is an American single-engined, single-seat, all-metal fighter and ground-attack aircraft that first flew in 1938. The P-40 design was a modification of the previous Curtiss P-36 Hawk which reduced development time and enabled a rapid entry into production and operational service. The Warhawk was used by most Allied powers during World War II, and remained in frontline service until the end of the war. It was the third most-produced American fighter of World War II, after the P-51 and P-47; by November 1944, when production of the P-40 ceased, 13,738 had been built,[3] all at Curtiss-Wright Corporation's main production facilities in Buffalo, New York. P-40 Warhawk was the name the United States Army Air Corps gave the plane, and after June 1941, the USAAF adopted the name for all models, making it the official name in the U.S. for all P-40s. The British Commonwealth and Soviet air forces used the name **Tomahawk** for models equivalent to the original P-40, P-40B, and P-40C, and the name **Kittyhawk** for models equivalent to the P-40D and all later variants. P-40s first saw combat with the British Commonwealth squadrons of the Desert Air Force in the Middle East and North African campaigns, during June 1941.[4][5] No. 112 Squadron Royal Air Force, was among the first to operate Tomahawks in North Africa and the unit was the first Allied military aviation unit to feature the "shark mouth" logo,[6][7] copying similar markings on some Luftwaffe Messerschmitt Bf 110 twin-engine fighters.[6] [N 1]

The P-40's liquid-cooled, supercharged Allison V-1710 V-12 engine's lack of a two-speed supercharger made it inferior to Luftwaffe fighters such as the Messerschmitt Bf 109 or the Focke-Wulf Fw 190 in high-altitude combat and it was rarely used in operations in Northwest Europe. However, between 1941 and 1944, the P-40 played a critical role with Allied air forces in three major theaters: North Africa, the Southwest Pacific, and China. It also had a significant role in the Middle East, Southeast Asia, Eastern Europe, Alaska and Italy. The P-40's performance at high altitudes was not as important in those theaters, where it served as an air superiority fighter, bomber escort and fighter-bomber. Although it gained a postwar reputation as a mediocre design, suitable only for close air support, more recent research including scrutiny of the records of Allied squadrons indicates that this was not the case; the P-40 performed surprisingly well as an air superiority fighter, at times suffering severe losses, but also inflicting a very heavy toll on enemy aircraft.[9] Based on war-time victory claims, over 200 Allied fighter pilots – from the UK, Australia, New Zealand, Canada, South Africa, the US and the Soviet Union – became aces flying the P-40. These included at least 20 double aces, mostly over North Africa, China, Burma and India, the South West Pacific and Eastern Europe.[10] The P-40 offered the additional advantages of low cost and durability, which kept it in production as a ground-attack aircraft long after it was obsolescent as a fighter.

Design and development

Origins

Curtiss XP-40 "11" used for test purposes by the Materiel Division of the U.S. Army Air Corps

On 14 October 1938, Curtiss test pilot Edward Elliott flew the prototype XP-40 on its first flight in Buffalo.[11] The XP-40 was the 10th production Curtiss P-36 Hawk,[12] with its Pratt & Whitney R-1830 Twin Wasp 14-cylinder air-cooled radial engine replaced at the direction of Chief Engineer Don R. Berlin by a liquid-cooled, supercharged Allison V-1710 V-12 engine. The first prototype placed the glycol coolant radiator in an underbelly position on the fighter, just aft of the wing's trailing edge.[13] USAAC Fighter Projects Officer Lieutenant Benjamin S. Kelsey flew this prototype some 300 miles in 57 minutes, approximately 315 miles per hour (507 km/h). Hiding his disappointment, he told reporters that future versions would likely go 100 miles per hour (160 km/h) faster.[14] Kelsey was interested in the Allison engine because it was sturdy and dependable, and it had a smooth, predictable power curve. The V-12 engine offered as much power as a radial engine but had a smaller frontal area and allowed a more streamlined cowl than an aircraft with a radial engine, promising a theoretical 5% increase in top speed.[15] Curtiss engineers worked to improve the XP-40's speed by moving the radiator forward in steps. Seeing little gain, Kelsey ordered the aircraft to be evaluated in a NACA wind tunnel to identify solutions for better aerodynamic qualities. From 28 March to 11 April 1939, the prototype was studied by NACA.[16] Based on the data obtained, Curtiss moved the glycol coolant radiator forward to the chin; its new air scoop also accommodated the oil cooler air intake. Other improvements to the landing gear doors and the exhaust manifold combined to give performance that was satisfactory to the USAAC.[13] Without beneficial tail winds, Kelsey flew the XP-40 from Wright Field back to Curtiss's plant in Buffalo at an average speed of 354 mph (570 km/h).[N 2] Further tests in December 1939 proved the fighter could reach 366 mph (589 km/h).[18] An unusual production feature was a special truck rig to speed delivery at the main Curtiss plant in Buffalo, New York. The rig moved the newly built P-40s in two main components, the main wing and the fuselage, the eight miles from the plant to the airport where the two units were mated for flight and delivery.[19]

Performance characteristics

A three-quarter view of a P-40B, X-804 (s/n 39-184) in flight. This aircraft served with an advanced training unit at Luke Field, Arizona.

The P-40 was conceived as a pursuit aircraft and was agile at low and medium altitudes but suffered from a lack of power at higher altitudes. At medium and high speeds it was one of the tightest-turning early monoplane designs of the war,[20] and it could out turn most opponents it faced in North Africa and the Russian Front. In the Pacific Theater it was out-turned at lower speeds by the lightweight fighters A6M Zero and Nakajima Ki-43 "Oscar". The American Volunteer Group Commander Claire Chennault advised against prolonged dog-fighting with the Japanese fighters due to speed reduction favoring the Japanese.[21] Allison's V-1710 engines produced 1,040 hp (780 kW) at sea level and 14,000 ft (4,300 m). This was not powerful compared with contemporary fighters, and the early P-40 variants' top speeds were only average. The single-stage, single-speed supercharger meant that the P-40 was a poor high-altitude fighter. Later versions, with 1,200 hp (890 kW) Allisons or more powerful 1,400 hp Packard Merlin engines were more capable. Climb performance was fair to poor, depending on the subtype.[9] Dive acceleration was good and dive speed was excellent.[9] The highest-scoring P-40 ace, Clive Caldwell (RAAF), who claimed 22 of his 28½ kills in the type, said that the P-40 had "almost no vices", although "it was a little difficult to control in terminal velocity".[22] The P-40 had one of the fastest maximum dive speeds of any fighter of the early war period, and good high-speed handling.

Evidence of the P-40's durability: in 1944 F/O T. R. Jacklin (*pictured*) flew this No. 75 Squadron RAAF P-40N-5 more than 200 mi (322 km) after the loss of the port aileron and 25% of its wing area, due to a mid-air collision with another P-40N-5.[23] [N 3]

The P-40 tolerated harsh conditions and a variety of climates. Its semi-modular design was easy to maintain in the field. It lacked innovations such as boosted ailerons or automatic leading edge slats, but its strong structure included a five-spar wing, which enabled P-40s to pull high-G turns and survive some midair collisions. Intentional ramming attacks against enemy aircraft were occasionally recorded as victories by the Desert Air Force and Soviet Air Forces.[24] Caldwell said P-40s "would take a tremendous amount of punishment, violent aerobatics as well as enemy action".[25] Operational range was good by early war standards and was almost double that of the Supermarine Spitfire or Messerschmitt Bf 109, although inferior to the Mitsubishi A6M Zero, Nakajima Ki-43 and Lockheed P-38 Lightning. Caldwell found the P-40C Tomahawk's armament of two .50-inch (13 mm) Browning AN/M2 "light-barrel" dorsal nose-mount synchronized machine guns and two .303-inch (7.7 mm) Browning machine guns in each wing to be inadequate.[25] This was improved with the P-40D (Kittyhawk I) which abandoned the synchronized gun mounts and instead had two .50-inch (13 mm) guns in each wing, although Caldwell still preferred the earlier Tomahawk in other respects. The D had armor around the engine and the cockpit, which enabled it to withstand considerable damage. This allowed Allied pilots in Asia and the Pacific to attack Japanese fighters head on, rather than try to out-turn and out-climb their opponents. Late-model P-40s were well armored. Visibility was adequate, although hampered by a complex windscreen frame, and completely blocked to the rear in early models by a raised turtledeck. Poor ground visibility and relatively narrow landing gear track caused many losses on the ground.[9] Curtiss tested a follow-on design, the Curtiss XP-46, but it offered little improvement over newer P-40 models and was cancelled.[26]

Operational history

In April 1939, the U.S. Army Air Corps, having witnessed the new, sleek, high-speed, in-line-engined fighters of the European air forces, placed the largest fighter order it had ever made for 524 P-40s.

French Air Force

An early order came from the French *Armée de l'Air*, which was already operating P-36s. The *Armée de l'Air* ordered 100 (later the order was increased to 230) as the **Hawk 81A-1** but the French were defeated before the aircraft had left the factory and the aircraft were diverted to British and Commonwealth service (as the Tomahawk I), in some cases complete with metric flight instruments. In late 1942, as French forces in North Africa split from the Vichy government to side with the Allies, U.S. forces transferred P-40Fs from 33rd FG to *GC II/5*, a squadron that was historically associated with the Lafayette Escadrille. GC II/5 used its P-40Fs and Ls in combat in Tunisia and later for patrol duty off the Mediterranean coast until mid-1944, when they were replaced by Republic P-47D Thunderbolts.

British Commonwealth
Deployment

Armourers working on a Tomahawk Mk.II from No. 3 Squadron RAAF in North Africa, 23 December 1941

In all, 18 Royal Air Force (RAF) squadrons, four Royal Canadian Air Force (RCAF), three South African Air Force (SAAF) and two Royal Australian Air Force (RAAF) squadrons serving with RAF formations, used P-40s.[27][28] The first units to convert were Hawker Hurricane squadrons of the Desert Air Force (DAF), in early 1941. The first Tomahawks delivered came without armor, bulletproof windscreens or self-sealing fuel tanks, which were installed in subsequent shipments. Pilots used to British fighters sometimes found it difficult to adapt to the P-40's rear-folding landing gear, which was more prone to collapse than the lateral-folding landing gear of the Hurricane or Supermarine Spitfire. In contrast to the "three-point landing" commonly employed with British types, P-40 pilots were obliged to use a "wheels landing": a longer, low angle approach that touched down on the main wheels first. Testing showed the aircraft did not have the performance needed for use in Northwest Europe at high-altitude, due to the service ceiling limitation. Spitfires used in the theater operated at heights around 30,000 ft (9,100 m), while the P-40's Allison engine, with its single-stage, low altitude rated supercharger, worked best at 15,000 ft (4,600 m) or lower. When the Tomahawk was used by Allied units based in the UK from February 1941, this limitation relegated the Tomahawk to low-level reconnaissance with RAF Army Cooperation Command and only No. 403 Squadron RCAF was used in the fighter role for a mere 29 sorties, before being replaced by Spitfires. Air Ministry deemed the P-40 unsuitable for the theater. UK P-40 squadrons from mid-1942 re-equipped with aircraft such as Mustangs

A Kittyhawk Mk III of No. 112 Squadron RAF, taxiing at Medenine, Tunisia, in 1943. The ground crewman on the wing is directing the pilot, whose forward view is hindered by the aircraft's nose.

The Tomahawk was superseded in North Africa by the more powerful Kittyhawk ("D"-mark onwards) types from early 1942, though some Tomahawks remained in service until 1943. Kittyhawks included many improvements and were the DAF's air superiority fighter for the critical first few months of 1942, until "tropicalised" Spitfires were available. DAF units received nearly 330 Packard V-1650 Merlin-powered P-40Fs, called Kittyhawk IIs, most of which went to the USAAF and the majority of the 700 "lightweight" L models, also powered by the Packard Merlin, in which the armament was reduced to four .50 in (12.7 mm) Brownings (Kittyhawk IIA). The DAF also received some 21 of the later P-40K and the majority of the 600 P-40Ms built; these were known as Kittyhawk IIIs. The "lightweight" P-40Ns (Kittyhawk IV) arrived from early 1943 and were used mostly as fighter-bombers.[N 4] From July 1942 until mid-1943, elements of the U.S. 57th Fighter Group (57th FG) were attached to DAF P-40 units. The British government also donated 23 P-40s to the Soviet Union.

Combat performance

Tomahawks and Kittyhawks bore the brunt of *Luftwaffe* and *Regia Aeronautica* fighter attacks during the North African campaign. The P-40s were considered superior to the Hurricane, which they replaced as the primary fighter of the Desert Air Force.[9] I would evade being shot at accurately by pulling so much g-force...that you could feel the blood leaving the head and coming down over your eyes... And you would fly like that for as long as you could, knowing that if anyone was trying to get on your tail they were going through the same bleary vision that you had and you might get away... I had deliberately decided that any deficiency the Kittyhawk had was offset by aggression. And I'd done a little bit of boxing – I beat much better opponents simply by going for [them]. And I decided to use that in the air. And it paid off.

—*Nicky Barr, 3 Sqn RAAF*[30]

The P-40 initially proved quite effective against Axis aircraft and contributed to a slight shift of advantage in the Allies' favor. The gradual replacement of Hurricanes by the Tomahawks and Kittyhawks led to the *Luftwaffe* accelerating retirement of the Bf 109E and introducing the newer Bf 109F; these were to be flown by the veteran pilots of elite *Luftwaffe* units, such as *Jagdgeschwader 27* (JG27), in North Africa.[31] The P-40 was generally considered roughly equal or slightly superior to the Bf 109 at low altitude but inferior at high altitude, particularly against the Bf 109F.[32] Most air combat in North Africa took place well below 16,000 ft (4,900 m), negating much of the Bf 109's superiority. The P-40 usually had an advantage over the Bf 109 in turning, dive speed and structural strength, was roughly equal in firepower but was slightly inferior in speed and outclassed in rate of climb and operational ceiling.[9][31]

The P-40 was generally superior to early Italian fighter types, such as the Fiat G.50 Freccia and the Macchi C.200. Its performance against the Macchi C.202 *Folgore* elicited varying opinions. Some observers consider the Macchi C.202 superior.[33] Caldwell, who scored victories against them in his P-40, felt that the *Folgore* was superior to the P-40 and the Bf 109 except that its armament of only two or four machine guns was inadequate.[34] Other observers considered the two equally matched or favored the *Folgore* in aerobatic performance, such as turning radius. The aviation historian Walter J. Boyne wrote that over Africa, the P-40 and the *Folgore* were "equivalent".[35][36][37] Against its lack of high-altitude performance, the P-40 was considered to be a stable gun platform and its rugged construction meant that it was able to operate from rough front line airstrips with a good rate of serviceability.[38] The earliest victory claims by P-40 pilots include Vichy French aircraft, during the 1941 Syria-Lebanon campaign, against Dewoitine D.520s, a type often considered to be the best French fighter of the war.[4] The P-40 was deadly against Axis bombers in the theater, as well as against the Bf 110 twin-engine fighter. In June 1941, Caldwell, of 250 Squadron in Egypt, flying as flying Officer (F/O) Jack Hamlyn's wingman, recorded in his log book that he was involved in the first air combat victory for the P-40. This was a CANT Z.1007 bomber on 6 June.[4] The claim was not officially recognized, as the crash of the CANT was not witnessed. The first official victory occurred on 8 June, when Hamlyn and Flight Sergeant (Flt Sgt) Tom Paxton destroyed a CANT Z.1007 from *211ª Squadriglia* of the *Regia Aeronautica*, over Alexandria.[5] Several days later, the Tomahawk was in action over Syria with No. 3 Squadron RAAF, which claimed 19 aerial victories over Vichy French aircraft during June and July 1941, for the loss of one P-40 (and one lost to ground fire).[39]

North Africa, c. 1943. A P-40 "Kittybomber" of No. 450 Squadron RAAF, loaded with six 250 lb (110 kg) bombs.

Some DAF units initially failed to use the P-40's strengths or used outdated defensive tactics such as the Lufbery circle. The superior climb rate of the Bf 109 enabled fast, swooping attacks, neutralizing the advantages offered by conventional defensive tactics. Various new formations were tried by Tomahawk units from 1941 to 1942, including "fluid pairs" (similar to the German *rotte*); the Thach Weave (one or two "weavers") at the back of a squadron in formation and whole squadrons bobbing and weaving in loose formations.[40] Werner Schröer, who was credited with destroying 114 Allied aircraft in only 197 combat missions, referred to the latter formation as "bunches of grapes", because he found them so easy to pick off.[40] The leading German *expert* in North Africa, Hans-Joachim Marseille, claimed as many as 101 P-40s during his career.[41] From 26 May 1942, Kittyhawk units operated primarily as fighter-bomber units, giving rise to the nickname "Kittybomber".[42] As a result of this change in role and because DAF P-40 squadrons were frequently used in bomber escort and close air support missions, they suffered relatively high losses; many Desert Air Force P-40 pilots were caught flying low and slow by marauding Bf 109s. Caldwell believed that Operational Training Units did not properly prepare pilots for air combat in the P-40 and as a commander, stressed the importance of training novice pilots properly.[44] Competent pilots who took advantage of the P-40's strengths were effective against the best of the *Luftwaffe* and *Regia Aeronautica*.[9][45] In August 1941, Caldwell was attacked by two Bf 109s, one of them piloted by German ace Werner Schröer. Although Caldwell was wounded three times and his Tomahawk was hit by more than 100 7.92 mm (0.312 in) bullets and five 20 mm cannon shells, Caldwell shot down Schröer's wingman and returned to base.

Some sources also claim that in December 1941, Caldwell killed a prominent German *Experte*, Erbo von Kageneck (69 kills), while flying a P-40.[N 5] Caldwell's victories in North Africa included 10 Bf 109s and two Macchi C.202s.[47] Billy Drake of 112 Squadron was the leading British P-40 ace with 13 victories.[45] James "Stocky" Edwards (RCAF), who achieved 12 kills in the P-40 in North Africa, shot down German ace Otto Schulz (51 kills) while flying a Kittyhawk with No. 260 Squadron RAF.[45] Caldwell, Drake, Edwards and Nicky Barr were among at least a dozen pilots who achieved ace status twice over while flying the P-40.[45][48] A total of 46 British Commonwealth pilots became aces in P-40s, including seven double aces.[45]

Chinese Air Force
Flying Tigers (American Volunteer Group)

3rd Squadron Hell's Angels, Flying Tigers over China, photographed in 1942 by AVG pilot Robert T. Smith. [N 6]

The Flying Tigers, known officially as the 1st American Volunteer Group (AVG), were a unit of the Chinese Air Force, recruited from U.S. Navy, Marines and Army aviators. Chennault received crated Model Bs which his airmen assembled in Burma at the end of 1941, adding self-sealing fuel tanks and a second pair of wing guns, such that the aircraft became a hybrid of B and C models.[50] These were not well-liked by their pilots: they lacked drop tanks for extra range, and there were no bomb racks on the wings.

Chennault considered the liquid-cooled engine vulnerable in combat because a single bullet through the coolant system would cause the engine to overheat in minutes. The Tomahawks also had no radios, so the AVG improvised by installing a fragile radio transceiver, the RCA-7-H, which had been built for a Piper Cub. Because the plane had a single-stage low-altitude supercharger,[51] its effective ceiling was about 25,000 feet (7,600 m). The most critical problem was the lack of spare parts; the only source was from damaged aircraft. The planes were viewed as cast-offs that no one else wanted, dangerous and difficult to fly. But the pilots did appreciate some of the planes' features. There were two heavy sheets of steel behind the pilot's head and back that offered solid protection, and overall the planes were ruggedly constructed.[52] Compared to opposing Japanese fighters, the P-40B's strengths were that it was sturdy, well armed, faster in a dive and possessed an excellent rate of roll. While the P-40s could not match the maneuverability of the Japanese Army air arm's Nakajima Ki-27s and Ki-43s, nor the much more famous Zero naval fighter in slow, turning dogfights, at higher speeds the P-40s were more than a match. AVG leader Claire Chennault trained his pilots to use the P-40's particular performance advantages.[53] The P-40 had a higher dive speed than any Japanese fighter aircraft of the early war years, for example, and could exploit so-called "boom-and-zoom" tactics. The AVG was highly successful, and its feats were widely publicized by an active cadre of international journalists to boost sagging public morale at home. According to its official records, in just 6+½ months, the Flying Tigers destroyed 297 enemy aircraft for the loss of just four of its own in air-to-air combat. In the spring of 1942, the AVG received a small number of Model E's. Each came equipped with a radio, six .50-caliber machine guns, and auxiliary bomb racks that could hold 35-lb fragmentation bombs. Chennault's armorer added bomb racks for 570-lb Russian bombs, which the Chinese had in abundance. These planes were used in the battle of the Salween River Gorge in late May 1942, which kept the Japanese from entering China from Burma and threatening Kunming. Spare parts, however, remained in short supply. "Scores of new planes...were now in India, and there they stayed—in case the Japanese decided to invade... the AVG was lucky to get a few tires and spark plugs with which to carry on its daily war."[54]

4th Air Group

China received 27 P-40E models in early 1943. These were assigned to squadrons of the 4th Air Group.[55]

United States Army Air Forces

P-40K 42–10256 in Aleutian "Tiger" markings.

P-40B G-CDWH at Duxford 2011. It is the only airworthy P-40B in the world and the only survivor from the Pearl Harbor attack.[56]

Junichi Sasai and a captured P-40B in the Dutch East Indies, 1942

https://www.techno-science.net/glossaire-definition/Curtiss-P-40-Warhawk.html

A total of 15 USAAF pursuit/fighter groups (FG), along with other pursuit/fighter squadrons and a few tactical reconnaissance (TR) units, operated the P-40 during 1941–45.[48][57][58] As was also the case with the Bell P-39 Airacobra, many USAAF officers considered the P-40 exceptional but it was gradually replaced by the Lockheed P-38 Lightning, the Republic P-47 Thunderbolt and the North American P-51 Mustang. The bulk of the fighter operations by the USAAF in 1942–43 were borne by the P-40 and the P-39. In the Pacific, these two fighters, along with the U.S. Navy Grumman F4F Wildcat, contributed more than any other U.S. types to breaking Japanese air power during this critical period.

Pacific theaters

By mid-1943, the USAAF was superseding the P-40F (pictured); the two nearest aircraft, "White 116" and "White 111" were flown by the aces 1Lt Henry E. Matson and 1Lt Jack Bade, 44th FS, at the time part of AirSols, on Guadalcanal

The P-40 was the main USAAF fighter aircraft in the South West Pacific and Pacific Ocean theaters during 1941–42. At Pearl Harbor[59] and in the Philippines,[60] USAAF P-40 squadrons suffered crippling losses on the ground and in the air to Japanese fighters such as the A6M Zero and Ki-43 Hayabusa respectively. During the attack on Pearl Harbor, most of the USAAF fighters were P-40Bs, the majority of which were destroyed. However, a few P-40s managed to get in the air and shoot down several Japanese aircraft, most notably by George Welch and Kenneth Taylor. In the Dutch East Indies campaign, the 17th Pursuit Squadron (Provisional), formed from USAAF pilots evacuated from the Philippines, claimed 49 Japanese aircraft destroyed, for the loss of 17 P-40s[58][60]

The seaplane tender USS *Langley* was sunk by Japanese airplanes while delivering P-40s to Tjilatjap, Java.[61] In the Solomon Islands and New Guinea Campaigns and the air defence of Australia, improved tactics and training allowed the USAAF to better use the strengths of the P-40. Due to aircraft fatigue, scarcity of spare parts and replacement problems, the US Fifth Air Force and Royal Australian Air Force created a joint P-40 management and replacement pool on 30 July 1942 and many P-40s went back and forth between the air forces.[62] The 49th Fighter Group was in action in the Pacific from the beginning of the war. Robert M. DeHaven scored 10 kills (of 14 overall) in the P-40 with the 49th FG. He compared the P-40 favorably with the P-38:

"If you flew wisely, the P-40 was a very capable aircraft. [It] could outturn a P-38, a fact that some pilots didn't realize when they made the transition between the two aircraft. [...] The real problem with it was lack of range. As we pushed the Japanese back, P-40 pilots were slowly left out of the war. So when I moved to P-38s, an excellent aircraft, I did not [believe] that the P-40 was an inferior fighter, but because I knew the P-38 would allow us to reach the enemy. I was a fighter pilot and that was what I was supposed to do."[63]

The 8th, 15th, 18th, 24th, 49th, 343rd and 347th PGs/FGs, flew P-40s in the Pacific theaters between 1941 and 1945, with most units converting to P-38s from 1943 to 1944. In 1945, the 71st Reconnaissance Group employed them as armed forward air controllers during ground operations in the Philippines, until it received delivery of P-51s.[58] They claimed 655 aerial victories. Contrary to conventional wisdom, with sufficient altitude, the P-40 could turn with the A6M and other Japanese fighters, using a combination of a nose-down vertical turn with a bank turn, a technique known as a low yo-yo. Robert DeHaven describes how this tactic was used in the 49th Fighter group: [Y]ou could fight a Jap on even terms, but you had to make him fight your way. He could outturn you at slow speed. You could outturn him at high speed. When you got into a turning fight with him, you dropped your nose down so you kept your airspeed up, you could outturn him. At low speed he could outroll you because of those big ailerons ... on the Zero. If your speed was up over 275, you could outroll [a Zero]. His big ailerons didn't have the strength to make high speed rolls... You could push things, too. Because ... [i]f you decided to go home, you could go home. He couldn't because you could outrun him. [...] That left you in control of the fight.

China Burma India Theater

USAAF and Chinese P-40 pilots performed well in this theater against many Japanese types such as the Ki-43, Nakajima Ki-44 "Tojo" and the Zero. The P-40 remained in use in the China Burma India Theater (CBI) until 1944 and was reportedly preferred over the P-51 Mustang by some US pilots flying in China. The American Volunteer Group (Flying Tigers) was integrated into the USAAF as the 23rd Fighter Group in June 1942. The unit continued to fly newer model P-40s until the end of the war, achieving a high kill-to-loss ratio.[48][64] In the Battle of the Salween River Gorge of May 1942 the AVG used the P-40E model equipped with wing racks that could carry six 35-pound fragmentation bombs and Chennault's armorer developed belly racks to carry Russian 570-pound bombs, which the Chinese had in large quantity.[65] Units arriving in the CBI after the AVG in the 10th and 14th Air Forces continued to perform well with the P-40, claiming 973 kills in the theater, or 64.8 percent of all enemy aircraft shot down. Aviation historian Carl Molesworth stated that "...the P-40 simply dominated the skies over Burma and China. They were able to establish air superiority over free China, northern Burma and the Assam valley of India in 1942, and they never relinquished it."[66] The 3rd, 5th, 51st and 80th FGs, along with the 10th TRS, operated the P-40 in the CBI.[N 7] CBI P-40 pilots used the aircraft very effectively as a fighter-bomber. The 80th Fighter Group in particular used its so-called *B-40* (P-40s carrying 1,000-pound high-explosive bombs) to destroy bridges and kill bridge repair crews, sometimes demolishing their target with one bomb.[67] At least 40 U.S. pilots reached ace status while flying the P-40 in the CBI.

Europe and Mediterranean theaters

Top to Bottom: P-40L, P-40F, and P-40K Warhawk

On 14 August 1942, the first confirmed victory by a USAAF unit over a German aircraft in World War II was achieved by a P-40C pilot. 2nd Lt Joseph D. Shaffer, of the 33rd Fighter Squadron, intercepted a Focke-Wulf Fw 200C-3 maritime patrol aircraft that overflew his base at Reykjavík, Iceland. Shaffer damaged the Fw 200, which was finished off by a P-38F. Warhawks were used extensively in the Mediterranean and Middle East theatre of World War II by USAAF units, including the 33rd, 57th, 58th, 79th, 324th and 325th Fighter Groups.[57] While the P-40 suffered heavy losses in the MTO, many USAAF P-40 units achieved high kill-to-loss ratios against Axis aircraft; the 324th FG scored better than a 2:1 ratio in the MTO.[68] In all, 23 U.S. pilots became aces in the MTO on the P-40, most of them during the first half of 1943.[57] P-40 pilots from the 57th FG were the first USAAF fliers to see action in the MTO, while attached to Desert Air Force Kittyhawk squadrons, from July 1942. The 57th was also the main unit involved in the "Palm Sunday Massacre", on 18 April 1943. Decoded Ultra signals revealed a plan for a large formation of Junkers Ju 52 transports to cross the Mediterranean, escorted by German and Italian fighters. Between 1630 and 1830 hours, all wings of the group were engaged in an intensive effort against the enemy air transports. Of the four Kittyhawk wings, three had left the patrol area before a convoy of a 100+ enemy transports were sighted by 57th FG, which tallied 74 aircraft destroyed. The group was last in the area, and intercepted the Ju 52s escorted by large numbers of Bf 109s, Bf 110s and Macchi C.202s. The group claimed 58 Ju 52s, 14 Bf 109s and two Bf 110s destroyed, with several probables and damaged. Between 20 and 40 of the Axis aircraft landed on the beaches around Cap Bon to avoid being shot down; six Allied fighters were lost, five of them P-40s.

On 22 April, in Operation Flax, a similar force of P-40s attacked a formation of 14 Messerschmitt Me 323 *Gigant* ("Giant") six-engine transports, covered by seven Bf 109s from II./JG 27. All the transports were shot down, for a loss of three P-40s. The 57th FG was equipped with the Curtiss fighter until early 1944, during which time they were credited with at least 140 air-to-air kills.[69] On 23 February 1943, during Operation Torch, the pilots of the 58th FG flew 75 P-40Ls off the aircraft carrier USS *Ranger* to the newly captured Vichy French airfield, Cazas, near Casablanca, in French Morocco. The aircraft supplied the 33rd FG and the pilots were reassigned.[70] The 325th FG (known as the "Checkertail Clan") flew P-40s in the MTO and was credited with at least 133 air-to-air kills from April–October 1943, of which 95 were Bf 109s and 26 were Macchi C.202s, for the loss of 17 P-40s in combat.[57][71] The 325th FG historian Carol Cathcart wrote: on 30 July, 20 P-40s of the 317th [Fighter Squadron] ... took off on a fighter sweep ... over Sardinia. As they turned to fly south over the west part of the island, they were attacked near Sassari... The attacking force consisted of 25 to 30 Bf 109s and Macchi C.202s... In the brief, intense battle that occurred ... [the 317th claimed] 21 enemy aircraft.

—*Cathcart*[72]

Cathcart wrote that Lt. Robert Sederberg assisted a comrade being attacked by five Bf 109s, destroyed at least one German aircraft, and may have shot down as many as five. Sederberg was shot down and became a prisoner of war.[72] A famous African-American unit, the 99th FS, better known as the "Tuskegee Airmen" or "Redtails", flew P-40s in stateside training and for their initial eight months in the MTO. On 9 June 1943, they became the first African-American fighter pilots to engage enemy aircraft, over Pantelleria, Italy. A single Focke-Wulf Fw 190 was reported damaged by Lieutenant Willie Ashley Jr. On 2 July the squadron claimed its first verified kill; a Fw 190 destroyed by Captain Charles Hall. The 99th continued to score with P-40s until February 1944, when they were assigned P-39s and P-51 Mustangs.[73][74] The much-lightened P-40L was most heavily used in the MTO, primarily by U.S. pilots. Many US pilots stripped down their P-40s even further to improve performance, often removing two or more of the wing guns from the P-40F/L.

Royal Australian Air Force

P-40E-1 piloted by the ace Keith "Bluey" Truscott, commander of No. 76 Squadron RAAF, taxis along Marston Matting at Milne Bay, New Guinea in September 1942

P-40N-15 "Black Magic", No. 78 Squadron RAAF F/L Denis Baker scored the RAAF's last aerial victory over New Guinea in this fighter on 10 June 1944. It was later flown by W/O Len Waters. Note the dark blue tip on the tailfin used to identify 78 Squadron.

The Kittyhawk was the main fighter used by the RAAF in World War II, in greater numbers than the Spitfire. Two RAAF squadrons serving with the Desert Air Force, No. 3 and No. 450 Squadrons, were the first Australian units to be assigned P-40s. Other RAAF pilots served with RAF or SAAF P-40 squadrons in the theater. Many RAAF pilots achieved high scores in the P-40. At least five reached "double ace" status: Clive Caldwell, Nicky Barr, John Waddy, Bob Whittle (11 kills each) and Bobby Gibbes (10 kills) in the Middle East, North African and/or New Guinea campaigns. In all, 18 RAAF pilots became aces while flying P-40s.[45] Nicky Barr, like many Australian pilots, considered the P-40 a reliable mount: "The Kittyhawk became, to me, a friend. It was quite capable of getting you out of trouble more often than not. It was a real warhorse."[75] At the same time as the heaviest fighting in North Africa, the Pacific War was also in its early stages, and RAAF units in Australia were completely lacking in suitable fighter aircraft. Spitfire production was being absorbed by the war in Europe; P-38s were trialled, but were difficult to obtain; Mustangs had not yet reached squadrons anywhere, and Australia's tiny and inexperienced aircraft industry was geared towards larger aircraft. USAAF P-40s and their pilots originally intended for the U.S. Far East Air Force in the Philippines, but diverted to Australia as a result of Japanese naval activity were the first suitable fighter aircraft to arrive in substantial numbers. By mid-1942, the RAAF was able to obtain some USAAF replacement shipments. RAAF Kittyhawks played a crucial role in the South West Pacific theater. They fought on the front line as fighters during the critical early years of the Pacific War, and the durability and bomb-carrying abilities (1,000 lb/454 kg) of the P-40 also made it ideal for the ground attack role. During the Battle of Port Moresby RAAF 75 destroyed or damaged some 33 Japanese aircraft of various types. With another 30 probables.[76] General Henry H. Arnold said of No 75 squadron: "Victory in the entire air war against Japan can be traced back to the actions which took place from that dusty strip at Port Moresby in early 1942."[77] For example, 75, and 76 Squadrons played a critical role during the Battle of Milne Bay,[78][79] fending off Japanese aircraft and providing effective close air support for the Australian infantry, negating the initial Japanese advantage in light tanks and sea power. The Kittyhawks fired "nearly 200,000 rounds of half-inch ammunition" during the course of the battle.[80]

The RAAF units that most used Kittyhawks in the South West Pacific were 75, 76, 77, 78, 80, 82, 84 and 86 Squadrons. These squadrons saw action mostly in the New Guinea

and Borneo campaigns. Late in 1945, RAAF fighter squadrons in the South West Pacific began converting to P-51Ds. However, Kittyhawks were in use with the RAAF until the end of the war, in Borneo. In all, the RAAF acquired 841 Kittyhawks (not counting the British-ordered examples used in North Africa), including 163 P-40E, 42 P-40K, 90 P-40 M and 553 P-40N models.[81] In addition, the RAAF ordered 67 Kittyhawks for use by No. 120 (Netherlands East Indies) Squadron (a joint Australian-Dutch unit in the South West Pacific). The P-40 was retired by the RAAF in 1947.

Royal Canadian Air Force

118 Sqn RCAF Kittyhawk pilots take a group picture on Sea Island in 1943.

A total of 13 Royal Canadian Air Force units operated the P-40 in the North West European or Alaskan theaters. In mid-May 1940, Canadian and US officers watched comparative tests of a XP-40 and a Spitfire, at RCAF Uplands, Ottawa. While the Spitfire was considered to have performed better, it was not available for use in Canada and the P-40 was ordered to meet home air defense requirements. In all, eight Home War Establishment Squadrons were equipped with the Kittyhawk: 72 Kittyhawk I, 12 Kittyhawk Ia, 15 Kittyhawk III and 35 Kittyhawk IV aircraft, for a total of 134 aircraft. These aircraft were mostly diverted from RAF Lend-Lease orders for service in Canada. The P-40 Kittyhawks were obtained in lieu of 144 P-39 Airacobras originally allocated to Canada but reassigned to the RAF. However, before any home units received the P-40, three RCAF Article XV squadrons operated Tomahawk aircraft from bases in the United Kingdom. No. 403 Squadron RCAF, a fighter unit, used the Tomahawk Mk II briefly before converting to Spitfires. Two Army Co-operation (close air support) squadrons: 400 and 414 Sqns trained with Tomahawks, before converting to Mustang Mk. I aircraft and a fighter/reconnaissance role. Of these, only No. 400 Squadron used Tomahawks operationally, conducting a number of armed sweeps over France in the late 1941. RCAF pilots also flew Tomahawks or Kittyhawks with other British Commonwealth units based in North Africa, the Mediterranean, South East Asia and (in at least one case) the South West Pacific.[N 8] In 1942, the Imperial Japanese Navy occupied two islands, Attu and Kiska, in the Aleutians, off Alaska. RCAF home defense P-40 squadrons saw combat over the Aleutians, assisting the USAAF.

The RCAF initially sent 111 Squadron, flying the Kittyhawk I, to the US base on Adak island. During the drawn-out campaign, 12 Canadian Kittyhawks operated on a rotational basis from a new, more advanced base on Amchitka,75 mi (121 km) southeast of Kiska. 14 and 111 Sqns took "turn-about" at the base. During a major attack on Japanese positions at Kiska on 25 September 1942, Squadron Leader Ken Boomer shot down a Nakajima A6M2-N ("Rufe") seaplane. The RCAF also purchased 12 P-40Ks directly from the USAAF while in the Aleutians. After the Japanese threat diminished, these two RCAF squadrons returned to Canada and eventually transferred to England without their Kittyhawks. In January 1943, a further Article XV unit, 430 Squadron was formed at RAF Hartford Bridge, England and trained on obsolete Tomahawk IIA.[82][83] The squadron converted to the Mustang I before commencing operations in mid-1943. In early 1945 pilots from No. 133 Squadron RCAF, operating the P-40N out of RCAF Patricia Bay, (Victoria, British Columbia), intercepted and destroyed two Japanese balloon-bombs,[83] which were designed to cause wildfires on the North American mainland. On 21 February, Pilot Officer E. E. Maxwell shot down a balloon, which landed on Sumas Mountain in Washington State. On 10 March, Pilot Officer J. 0. Patten destroyed a balloon near Saltspring Island, British Columbia. The last interception took place on 20 April 1945 when Pilot Officer P.V. Brodeur from 135 Squadron out of Abbotsford, British Columbia shot down a balloon over Vedder Mountain.[

Royal New Zealand Air Force

F/O Geoff Fisken in front of his P-40, *Wairarapa Wildcat* (*NZ3072/19*)

Some Royal New Zealand Air Force (RNZAF) pilots and New Zealanders in other air forces flew British P-40s while serving with DAF squadrons in North Africa and Italy, including the ace Jerry Westenra.

A total of 301 P-40s were allocated to the RNZAF under Lend-Lease, for use in the Pacific Theater, although four of these were lost in transit. The aircraft equipped 14 Squadron, 15 Squadron, 16 Squadron, 17 Squadron, 18 Squadron, 19 Squadron and 20 Squadron.

RNZAF P-40 squadrons were successful in air combat against the Japanese between 1942 and 1944. Their pilots claimed 100 aerial victories in P-40s, whilst losing 20 aircraft in combat[N 9][85] Geoff Fisken, the highest scoring British Commonwealth ace in the Pacific, flew P-40s with 15 Squadron, although half of his victories were claimed with the Brewster Buffalo. The overwhelming majority of RNZAF P-40 victories were scored against Japanese fighters, mostly Zeroes. Other victories included Aichi D3A "Val" dive bombers. The only confirmed twin engine claim, a Ki-21 "Sally" (misidentified as a G4M "Betty") fell to Fisken in July 1943.[85] From late 1943 and 1944, RNZAF P-40s were increasingly used against ground targets, including the innovative use of naval depth charges as improvised high-capacity bombs. The last front line RNZAF P-40s were replaced by Vought F4U Corsairs in 1944. The P-40s were relegated to use as advanced pilot trainers.[86][87][88] The remaining RNZAF P-40s, excluding the 20 shot down and 154 written off, were mostly scrapped at Rukuhia in 1948.

Soviet Union

Assembly of *Tomahawks* for Russia, somewhere in Iran, 1943

The Soviet *Voyenno-Vozdushnye Sily* (VVS; "Military Air Forces") and *Morskaya Aviatsiya* (MA; "Naval Air Service") also referred to P-40s as "Tomahawks" and "Kittyhawks". In fact, the Curtiss P-40 Tomahawk / Kittyhawk was the first Allied fighter supplied to the USSR under the Lend-Lease agreement.[89] The USSR received 247 P-40B/Cs (equivalent to the Tomahawk IIA/B in RAF service) and 2,178 P-40E, -K, -L, and -N models between 1941 and 1944.[24] The Tomahawks were shipped from Great Britain and directly from the US, many of them arriving incomplete, lacking machine guns and even the lower half of the engine cowling. In late September 1941, the first 48 P-40s were assembled and checked in the USSR.[90][91] Test flights showed some manufacturing defects: generator and oil pump gears and generator shafts failed repeatedly, which led to emergency landings. The test report indicated that the Tomahawk was inferior to Soviet "M-105P-powered production fighters in speed and rate of climb. However, it had good short field performance, horizontal maneuverability, range, and endurance."[92] Nevertheless, Tomahawks and Kittyhawks were used against the Germans. The 126th Fighter Aviation Regiment (IAP), fighting on the Western and Kalinin Fronts, were the first unit to receive the P-40. The regiment entered action on 12 October 1941. By 15 November 1941, the regiment had shot down 17 German aircraft. However, Lt (SG) Smirnov noted that the P-40 armament was sufficient for strafing enemy lines but rather ineffective in aerial combat. Another pilot, Stephan Ridny (a Hero of the Soviet Union), remarked that he had to shoot half the ammunition at 50–100 meters (165–340 ft) to shoot down an enemy aircraft.[92]

Hawk 81A-3/Tomahawk IIb *AK255*, at the U.S. National Museum of Naval Aviation, is shown in the colors of the Flying Tigers, but never actually served with them; it began life with the RAF and was later transferred to the Soviet Union

In January 1942, some 198 aircraft sorties were flown (334 flying hours) and 11 aerial engagements were conducted, in which five Bf 109s, one Ju 88, and one He 111 were downed. These statistics reveal a surprising fact: it turns out that the Tomahawk was fully capable of successful air combat with a Bf 109. The reports of pilots about the circumstances of the engagements confirm this fact. On 18 January 1942, Lieutenants S. V. Levin and I. P. Levsha (in pair) fought an engagement with seven Bf 109s and shot down two of them without loss. On 22 January, a flight of three aircraft led by Lieutenant E. E. Lozov engaged 13 enemy aircraft and shot down two Bf 109Es, again without loss. Altogether, in January, two Tomahawks were lost; one downed by German anti-aircraft artillery and one lost to Messerschmitts.[24] The Soviets stripped down their P-40s significantly for combat, in many cases removing the wing guns altogether in P-40B/C types, for example. Soviet Air Force reports state that they liked the range and fuel capacity of the P-40, which were superior to most of the Soviet fighters, though they still preferred the P-39. Soviet pilot Nikolai G. Golodnikov recalled: "The cockpit was vast and high. At first it felt unpleasant to sit waist-high in glass, as the edge of the fuselage was almost at waist level. But the bullet-proof glass and armored seat were strong and visibility was good. The radio was also good. It was powerful, reliable, but only on HF (high frequency). The American radios did not have hand microphones but throat microphones. These were good throat mikes: small, light and comfortable."[93] The biggest complaint of some Soviet airmen was its poor climb rate and problems with maintenance, especially with burning out the engines. VVS pilots usually flew the P-40 at War Emergency Power settings while in combat, which brought acceleration and speed performance closer to that of their German rivals, but could burn out engines in a matter of weeks.[24] Tires and batteries also failed. The fluid in the engine's radiators often froze, cracking their cores, which made the Allison engine unsuitable for operations during harsh winter conditions. During the winter of 1941, the 126th Fighter Aviation Regiment suffered from cracked radiators on 38 occasions. Often, entire regiments were reduced to a single flyable aircraft because no replacement parts were available.[94] They also had difficulty with the more demanding requirements for fuel and oil quality of the Allison engines. A fair number of burned-out P-40s were re-engined with Soviet Klimov M-105 engines, but these performed relatively poorly and were relegated to rear area use.[24] Actually, the P-40 could engage all Messerschmitts on equal terms, almost to the end of 1943. If you take into consideration all the characteristics of the P-40, then the Tomahawk was equal to the Bf 109F and the Kittyhawk was slightly better. Its speed and vertical and horizontal manoeuvre were good and fully competitive with enemy aircraft. Acceleration rate was a bit low, but when you got used to the engine, it was OK. We considered the P-40 a decent fighter plane.[95]

—N. G. Golodnikov, 2nd Guards Fighter Regiment (GIAP), Northern Aviation Fleet (VVS SF)[96]

The P-40 saw the most front line use in Soviet hands in 1942 and early 1943. Deliveries over the Alaska-Siberia ALSIB ferry route began in October 1942. It was used in the northern sectors and played a significant role in the defense of Leningrad. The most numerically important types were P-40B/C, P-40E and P-40K/M. By the time the better P-40F and N types became available, production of superior Soviet fighters had increased sufficiently so that the P-40 was replaced in most Soviet Air Force units by the Lavochkin La-5 and various later Yakovlev types. In spring 1943, Lt D.I. Koval of the 45th IAP gained ace status on the North Caucasian front, shooting down six German aircraft flying a P-40. Some Soviet P-40 squadrons had good combat records. Some Soviet pilots became aces on the P-40, though not as many as on the P-39 Airacobra, the most numerous Lend-Lease fighter used by the Soviet Union.[24] However, Soviet commanders thought the Kittyhawk significantly outclassed the Hurricane, although it was "not in the same league as the Yak-1".[95][97]

Japan

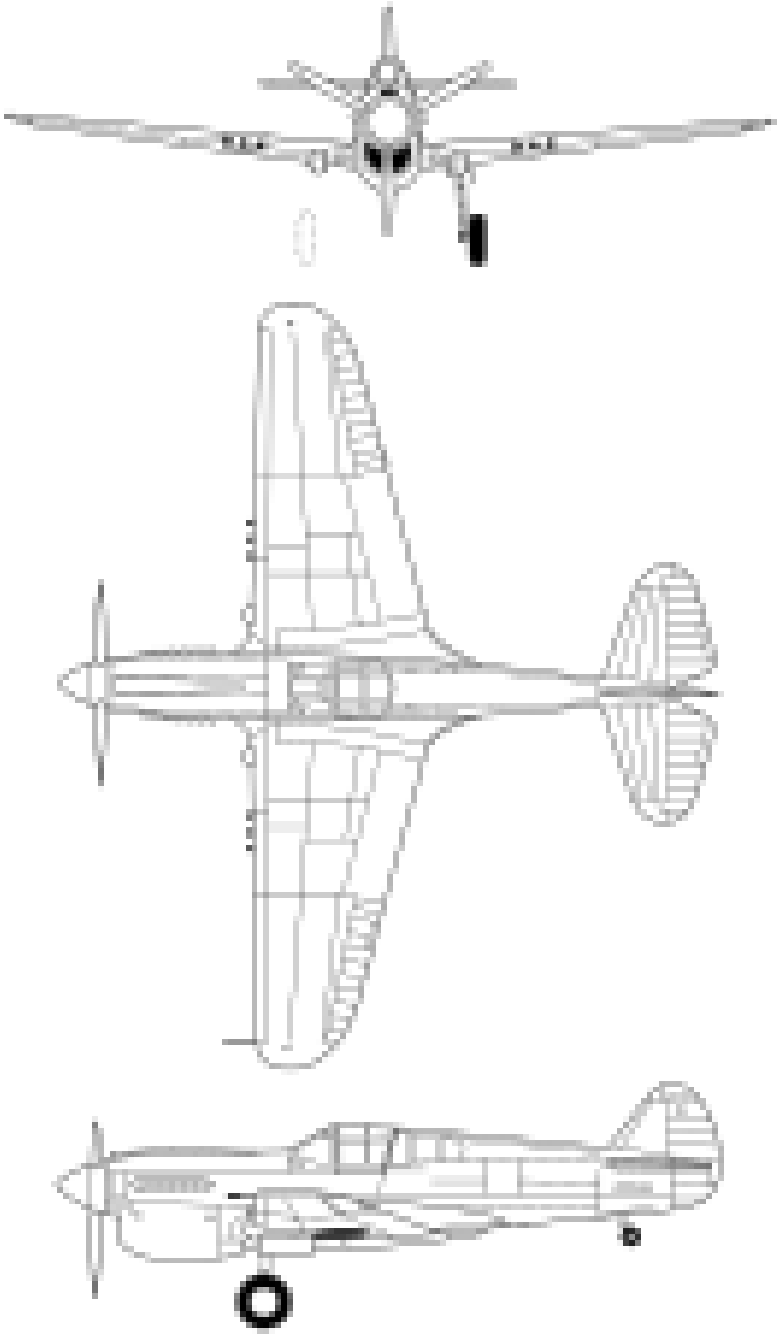
The Japanese Army captured some P-40s and later operated a number in Burma. The Japanese appear to have had as many as 10 flyable P-40Es.[98] For a brief period in 1943, a few of them were used operationally by 2 *Hiko Chutai*, 50 *Hiko Sentai* (2nd Air Squadron, 50th Air Regiment) in the defense of Rangoon. Testimony of this is given by Yasuhiko Kuroe, a member of the 64 *Hiko Sentai*. In his memoirs, he says one Japanese-operated P-40 was shot down in error by a friendly Mitsubishi Ki-21 "Sally" over Rangoon.

Other nations

P-40 Warhawk at Campo Dos Afonsos

The P-40 was used by over two dozen countries during and after the war. The P-40 was used by Brazil, Egypt, Finland and Turkey. The last P-40s in military service, used by the Brazilian Air Force (FAB), were retired in 1954. In the air war over Finland, several Soviet P-40s were shot down or had to crash-land due to other reasons. The Finns, short of good aircraft, collected these and managed to repair one P-40M, P-40M-10-CU 43–5925, *white 23*, which received Finnish Air Force serial number KH-51 (KH denoting "Kittyhawk", as the British designation of this type was Kittyhawk III). This aircraft was attached to an operational squadron HLeLv 32 of the Finnish Air Force, but lack of spares kept it on the ground, with the exception of a few evaluation flights. Several P-40Ns were used by the Royal Netherlands East Indies Army Air Force with No. 120 (Netherlands East Indies) Squadron RAAF against the Japanese before being used during the fighting in Indonesia until February 1949.[99]

Specifications (P-40E)



P-40E

General characteristics

- **Crew:** One
- **Length:** 31 ft 8.5 in (9.665 m)
- **Wingspan:** 37 ft 3.5 in (11.367 m)
- **Height:** 10 ft 8 in (3.25 m)
- **Wing area:** 236 sq ft (21.9 m^2)
- **Airfoil:** root: NACA2215; tip :NACA2209
- **Empty weight:** 5,922 lb (2,686 kg)

https://www.techno-science.net/glossaire-definition/Curtiss-P-40-Warhawk.html

- **Gross weight:** 8,515 lb (3,862 kg)
- **Powerplant:** 1 × Allison V-1710-39 V-12 liquid-cooled piston engine, 1,240 hp (920 kW)
- **Propellers:** 3-bladed Curtiss-Wright electric constant-speed propeller

Performance

- **Maximum speed:** 334 mph (538 km/h, 290 kn) at 15,000 ft (4,600 m)
- **Cruise speed:** 308 mph (496 km/h, 268 kn)
- **Range:** 716 mi (1,152 km, 622 nmi) at 70% power
- **Service ceiling:** 29,100 ft (8,900 m)
- **Time to altitude:** 15,000 ft (4,600 m) in 6 minutes 15 seconds
- **Wing loading:** 35.1 lb/sq ft (171 kg/m^2)
- **Power/mass:** 0.14 hp/lb (0.23 kW/kg)

Armament

- **Guns:** 6 × 0.5 in (12.7 mm) M2 Browning machine guns in the wings
- **Bombs:** 250 to 1,000 lb (110 to 450 kg) bombs to a total of 2,000 lb (910 kg) on hardpoints under the fuselage and two underwing

Source : https://en.wikipedia.org/wiki/Curtiss_P-40_Warhawk