Air and Space this Week

Item of the Week

THE P-47 THUNDERBOLT

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*Big, fast, tough, and heavily-gunned, the P-47 Thunderbolt was a terror at high altitude and devasting to ground targets. No foe could dive away from its guns. Its pilots racked up a strong record in aerial combat and ground operations; its only drawback was its relatively-short range. Its first test flight was on **May 6, 1941**, **83 years ago** this week. And don't skip the rather-interesting Coda to this story; it has a lot of unusual connections!*

U.S. AIRPLANE INDUSTRY IN THE 1930s

The nascent airplane manufacturing industry underwent a number of changes in the 1930s, driven by the growing need for better airplanes for both civilian and military use, and inhibited by the overall general economic conditions of the Depression. Companies formed, went broke, consolidated, got bought, etc. Two of the larger to develop in the 1920s were the companies of the Wright Brothers and Glenn Curtiss. They merged in 1929, and grew during the 1930s to hold more defense-related contracts than all by General Motors. Curtiss-Wright built the airplanes, and the Wright Aeronautical Corporation built engines.

Another example of the shaking out of the industry is that of North American Aviation, which started out as a holding company of a variety of aviation-related interests. Such companies were broken up by the Air Mail Act of 1934, so NAA began building aircraft while retaining Eastern Airlines, a change facilitated by General Motors acquiring a controlling interest in NAA the year before. NAA absorbed GM's General Aviation Manufacturing Corporation in the process. NAA is not part of this story, but they ended up building the T-6 Texan trainer, the B-25 medium bomber, and the P-51 Mustang in WWII.

War clouds were obviously building in the latter half of the 1930s, and the USAAF was trying to improve its aviation assets. The Navy needed planes that could defend their carriers and bases from attack, and planes that could project power at sea. Their go-to fighter plane at the time of Pearl Harbor was the Grumman F4F Wildcat. The Army needed strategic bombers and ground attack support, and the planes that could protect those assets from defensive aerial attack. Their go-to fighter at the start of the War was the Curtiss P-40 Warhawk.

The special needs of each of these missions dictated the need for a variety of specialized aircraft. A fighter aircraft needs speed, rate of climb, maneuverability, firepower, pilot/fuel tank protection, range, and durability. No one aircraft can have all of the above.

A naval interceptor would have to be able to operate from an aircraft carrier, climb rapidly to defend against attack, and have considerable firepower. A naval fighter would need the same, but to be able to maneuver effectively to take on enemy fighters. Range was less important.

Army fighters, on the other hand, would need sufficient range to be able to escort bombers on strategic bombing missions. Longer runways were available, too, so weight and rate of climb were less important.

The background of the designers and overall military philosophy was in play here, too. For example, the Japanese were more familiar with individual combat between highly-skilled opponents. Americans and Germans, on the other hand, had lots of experience with team sports, where each element of the team has a different sub-objective, hence, different skills for each. The designers of Japanese fighters like the Zero sacrificed pilot/fuel armor and durability for maneuverability, which cost them dearly. Their pilot training program was poorly-thought out, too; they produced the finest pilots but in tiny numbers that could not sustain much attrition without calamitous degrading of pilot competence.

A TALE OF TWO ALEXANDERS

Alexander de Seversky was born in Russia on June 7, 1894. His family had money and power, and one of the first airplanes in Russia. Young Alexander learned to fly it by the time he was 14, and would graduate from the Russian Naval Academy with a degree in aeronautical engineering in 1914, just in time for the start of WWI. He joined the Imperial Naval Air Service in 1915.

De Seversky's introduction to air combat was somewhat rough. He was shot down on his first sortie, losing his lower right leg. But he was a tough and dedicated fighter, and would fly 56 more combat missions, downing 13 German fighters in the process, which made him the top ace in the Russian Navy. He was decorated accordingly, and received a plum assignment as an attaché to the Russian Embassy in Washington in 1918. That was a lucky break; he escaped the Russian Revolution and met and became friends with General Billy Mitchell. The two saw eye-to-eye on the primacy of aerial bombing in both land and sea theaters.

De Seversky had an inventive mind, and made a number of contributions to aviation in the 1920s, including in aerial refueling and the first gyroscope-stabilized bombsight.

Alexander Kartvelishivili was born in Tbilisi, Georgia, on September 9, 1896. After completing his primary education there, he moved to France, where he studied aeronautical engineering. A flying accident ended his test piloting career early on, but he became a successful aircraft designer for Louis Blériot's aircraft company, where he worked from 1922-1927. He was then recruited by the American subsidiary of the Dutch Fokker company, so off to New York he went. He had been there three years when he met the other Alexander (Seversky, henceforth "AS"). Kartvelishivili (AK") quickly became the Chief Engineer at Seversky Aircraft.

The Alexes worked well together, coming up the first "modern" USAAC fighter (metal fuselage, low-set single wing, retractable landing gear, and a radial engine), the SEV-1XP. Their fighter, which would become the P-35, outperformed the Curtiss P-36 Hawk in the USAAC competition

held in 1936. Meanwhile, AK, who was much more innovative than AS, was working up two other designs, given the provisional names XP-44 and XP-47.

AS was a good designer but a lousy manager, and his company was losing money, lots of it, in spite of its success with the P-35. Things came to a head in 1939, when Curtiss' P-40 design was chosen over Sikorsky's AP-4. AS was forced to step down and the company was reorganized as the Republic Aviation Company in 1939, with AK remaining as the Chief Engineer. AS was already well-known to the public, so he began writing, lecturing, and advisor on aerial warfare, both tactical and strategic. This aspect of his career culminated with his book, "Victory Through Air Power," which became a best seller and was turned into a partially-animated movie with that same name by Walt Disney; you can find it on YouTube.

The USSAC liked the AP-4 enough to fund its further development. It became the P-43 Lancer, and most of the 273 that were built were sent to China, many to the Flying Tigers volunteer group. However, when General Chennault took over the Tigers he got rid of the Lancers, because they lacked armor for the pilot and a self-sealing fuel system. The other knock against the P-36 was its short range.

Alexander Kartvelishvili kept working during and after WWII. He started work on a jet fighter in 1944, a design that eventually became the F-84 Thunderjet. He led the Republic design team that created the F-105 Thunderchief, a super-sonic penetration aircraft capable of carrying a nuclear weapon at low altitude deep into Russia. The F-105 was used during the Viet Nam conflict to hit targets north of Hanoi.

The value of the P-47 as a heavily-armed ground attack platform was carried on in later times by the A-10 "Warthog," as shown by its official name, "Thunderbolt II."

HOW CAN WE BEST USE THIS ENGINE? PART 1

AK's initial design for the XP-47 was a light-weight fighter built around a 1150 hp Allison engine, with only two .50-caliber machine guns for armament. Information coming from the War prior to Pearl Harbor showed that such a design was no good at all. The USAAC came out with a new request for proposals that stipulated that the fighter they wanted had to:

- Have an airspeed of 400 MPH in level flight at 25,000 feet altitude
- Be armed with at least six, better eight, .50-caliber machine guns
- Have armor plating for the pilot
- Have self-sealing fuel tanks
- Be able to carry 315 gallons of fuel internally

The XP-47 had become the P-47A but was cancelled because it could not come close to meeting the new design requirements. One thing about the XP-47 would prove quite important, however; it had a turbo-supercharging system that gave the engine additional power at altitude, something that AK would incorporate in later designs. Instead of using the Allison engine, an in-line V-12 design, AK opted to use a more powerful (1600 HP) Wright radial engine; then he shifted to the huge Pratt & Whitney radial engine (1850 HP). The result was the XP-44

Rocket. It proved to be fast and could climb at 4000 feet/minute, but the P&W Double Wasp drank gas in huge gulps, so the only thing it would have been good for was base defense.

AK was called to DC to learn that the P-44 Rocket did not satisfactory. Undaunted, AK took the train back to RAC, and on the way, he worked out an entirely new design concept.

ASIDE: Engine Design. There were two basic aircraft engine designs used in WWII: in-line and radial. Each had serious advantages and disadvantages. The arrangement of pistons in an in-line engine allowed for a much trimmer engine profile, which allowed for a more streamlined cross-section with low drag. However, it required a liquid cooling system that had vulnerable piping and radiator, minor damage to any part of it would knock down the airplane. The pistons in a radial engine were arranged in a circle perpendicular to the line of flight, which produced a lot more drag, but required no liquid cooling; radial engines could take significant damage before they failed. Seeing over the nose of a radial engine was more difficult, which made planes with them less suited for carrier operations, the exception being the Corsair, which used the same P&W engine that AK put into the Rocket. NOTE: The interplay between the pistons and the crankshaft in a radial engine is better illustrated by a visualization rather than an explanation in words. One of my favorite exhibits at NASM was a cutaway of a real radial engine that could be spun with a hidden electric motor; a few seconds of watching it work gave most visitors an "aha" moment of understanding. There are several such visualizations available via YouTube; one example is here.

HOW CAN WE BEST USE THIS ENGINE? PART 2

During his train ride from DC, AK started with a clean slate mentally. He thought, "Why should we be trying to shoehorn a large radial engine into a small, maneuverable airframe, where we cannot fit the equipment we need to meet the USAAC's requirements? Why not go the other way, go BIG?" The engine is powerful enough to carry a huge load, especially with the earlier turbo-supercharging system already created for the XP-47! The result was the P-47B, very different from the A model. Its fuselage was more rotund than other fighters, due to the supercharger and its ducting, so much so that the P-47 would acquire the nickname, the "Jug." Two factors delayed its debut in combat. First, some time was necessary to make and test the B model, essentially a new airplane, and second, the range of the P-47 was shorter than other fighters, making it less universally usable. When the Allies captured bases in Sicily and southern Italy later in the War, the P-47 could escort bombers deep into Germany; before that, they could only reach targets in France or Holland from bases in England.

The P-47B was much larger and heavier than other fighters in WWII. It was plenty fast in level flight, but relatively slow in climbing, and it wasn't very good in a dogfight of maneuver. However, its 8 .50-caliber machine guns, four in each wing, packed a heavy punch, it was very tough and could still operate with battle damage, and it could out-dive any plane it ever faced, taking away an enemy pilot's favored escape route. Its durability and firepower made it an excellent platform for supporting ground operations. Later in the War, the capacity for the P-47

to carry rockets and (napalm) bombs wreaked havoc with defenses, especially when preventing reinforcements from reaching the D-Day beachheads.

TWO FAMOUS AIR GROUPS USE THE P-47

The 56th Fighter Group

The first P-47Bs were delivered to the USAAC in June, 1942. It had undergone extensive testing prior to that, and although it carried less fuel than specified, its 412 MPH speed at altitude impressed the Army, which quadrupled its original order, requiring a major expansion of its construction facilities in Farmington, NY. Later that year, an additional P-47 factory complex was built at Evansville, IN. The initial flight testing showed several design flaws, and the first test model crashed on August 8, 1942. The flaws were identified and corrected, and the USAAC ordered 171 P-47Bs and 602 P-47Cs.

Additional testing followed. On November 13, 1942, two pilots made a test dive from 30,000 feet. They nosed over and encountered an aerodynamic problem called "compressibility," where the airflow over parts of the aircraft reached the speed of sound, even though the plane itself stayed sub-sonic. Both pilots experienced extreme buffeting and their controls were immobilized until the thicker air a lower altitude slowed the diving planes. One other factor arose that required attention. The earliest B-models had a three-bladed propellor, inefficient given the enormous power of the P-47 engine. A four-bladed propellor was substituted, and the P-47 was ready for combat.

The 56th Fighter Group of the Eighth Air Force, stationed in Britain, was the first unit to receive the P-47B, on April 9, 1943. Its short range hampered its utility, but it showed promise as a high-altitude escort on shorter bombing missions. Four pilots were lost in low-level mock dogfights against Spitfires when they tried to turn with the Spits, half their size and weight, and stalled and crashed.

Pilots quickly learned that lesson well, and did not try to dogfight the more-nimble Bf-109s and FW-190s they faced. Rather, they adopted a hit-and-run approach, utilizing their high speed and diving ability to avoid effective return fire. The results were quite impressive. The 56th became known as the "Wolfpack," and two of its pilots, Francis Stanley Gabreski (34.5 victories, 28 of which were in WWII; he was also an Ace in Korea, flying the F-86) and Robert S. Johnson (27 victories) were numbers 3 and 5 on the list of the top American aces.

The Tuskegee Airmen

The Tuskegee Airmen were an all-Black unit trained at the Tuskegee Institute in Alabama. They faced severe institutional racism, but overcame it with outstanding leadership and flying skill, even though the aircraft they received were often older and/or combat-worn. The first fought with P-40s, but then converted to Thunderbolts, with which they had great success. Ultimately, they were equipped with P-51 Mustangs. They collectively proved they, too, had the "right stuff." I'm giving the Airmen short shrift here only because they were the subject of a previous Item of the Week, see here.

ITALY AND D-DAY

Recall that the earliest models of the P-47 had an inefficient three-blade propeller, and that performance was significantly improved by having four blades, not three. But that propeller was still not ideal in utilizing the engine's power effectively. Additional aerodynamic research showed that a propeller shaped more like a canoe paddle was much better at converting engine power to speed, and the new propellers were quickly made and sent to England at the start of 1944. P-47s so equipped had a significant increase in performance. The P-47 was still less maneuverable than pure fighter aircraft, but the increase in level flight and climbing speed proved important. The new paddle-blade props were quickly installed on the Corsair and on bombers.

Ground attack was not the initial mission of the P-47 in Europe, but its potential was recognized by Major Glenn Duncan of the 353rd Fighter Group, who found from experience that the Thunderbolt was dynamite as strafer and low-level bomber. He persuaded the brass to conduct an operational evaluation of the P-47 as a ground-attack platform in March, 1944. The results were so impressive that many P-47s would escort bombers into Germany and then return "on the deck" strafing targets of opportunity with great success.

P-47s played a very important role during the D-Day invasion, preventing the Germans from bringing up reinforcements and cutting bridges, blowing up locomotives, and destroying communications facilities all over northern France. Supply convoys were particularly vulnerable because the P-47s' eight .50-caliber machine guns could stop all but the heaviest tanks. Bombs carried by the P-47s could take care of anything that survived strafing. As the invasion progressed, flights of P-47s covered advancing Allied armored columns, guiding them with radio.

The Wehrmacht was in full retreat from the Normandy area within weeks of the invasion, and their columns of tanks, trucks, and other vehicles were utterly devastated by P-47s. The carnage at the Falaise Gap, a transportation bottleneck, was almost unbelievable.

FINAL TALLY

From here: "P-47s flew more than 546,000 combat sorties between March 1943 and August 1945, destroying 11,874 enemy aircraft, some 9,000 locomotives and about 6,000 armored vehicles and tanks. Only 0.7 per cent of the fighters of this type dispatched against the enemy were lost in combat. As a testament to the survivability of the P-47, it should be noted that the top ten aces who flew the P-47 returned home safely. Before the war was over, a total of 15,579 Thunderbolts were built, about two-thirds of which reached operational squadrons overseas."

CODA

I'm including the following as an Item bonus because it is a really amazing set of connections that only peripherally involves the P-47 and does not reflect well on some aspects of the WWII

military industrial complex. But it does connect the Curtiss-Wright corporation, its demise, then-Senator Harry Truman, playwright Arthur Miller, and Marilyn Monroe. Intrigued? Check out Stephan Wilkinson's March 13, 2024, piece entitled, "The Scandal that led to Harry S. Truman Becoming President and Marilyn Monroe Getting Married," at: https://www.historynet.com/curtiss-wright-scandal.

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Arthur Miller revitalized his career as playwright with *All My Sons*, which was built around the story of military engines being shipped from the factory despite management's knowledge they were faulty, thinly based on problems at Curtiss-Wright. For a synopsis of the play, see: https://www.sparknotes.com/drama/all-my-sons/summary.

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Bud Mahurin's Obituary: https://www.latimes.com/local/obituaries/la-me-bud-mahurin-20100514-story.html (Mahurin was an Ace with the 56th Fighter Group)

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