Swept-Wing Wonder, Part II

In Flight Usa

Scott Schwartz

The Boeing XB-47; note the "bicycle" landing gear arrangement. How the aircraft wound up with this landing gear set-up will be covered in the next Aviation Ancestry article in the August issue of In Flight USA. (Photo courtesy of the U.S. Air Force)

Moving the engines to the top of the fuselage did little to resolve the drag problems, which in reality, were caused by the Model 432's straight wings. The high-speed potential of the jet engines simply could not be realized with the use of straight wings.

Although the advantages of swept wings were known to many, these advantages were theoretical. Theoretical, that is, until George Schairer's letter reached Boeing.

Why do swept wings allow greater flight speeds? Because the air flowing over the top of a straight wing reaches supersonic speeds way before the rest of the aircraft; flying the aircraft faster will cause the air to separate from the top of the wing. This separation – which is known as "drag-rise"– destroys lift and eventually leads to a stall. On the other hand, the air flowing over a swept wing does so at a lower speed – therefore delaying drag-rise, and therefore providing lift at greater aircraft speeds.

Within a week of the arrival of Schairer's letter, Boeing engineers began experimenting with various sweep angles in the wind tunnel. Ultimately, it was determined that 35 degrees was the angle that would prevent drag-rise at the speeds generated by the Model 432's engines.

The reader should be aware that swept wings were not an entirely new concept at the time that Boeing was conducting its tests. Prior to World War One, a few aircraft designers utilized swept wings in order to resolve center-of-gravity problems. Curtiss-Wright even flew a swept-wing, piston-engine, experimental aircraft during World War Two. And, of course, Boeing was not the only company with access to the German data. Bell and North American both produced swept experimental aircraft (in Bell's case, the aircraft was a swept-wing version of the P-63, which was known as the L-39. It was used to test the low-speed stall characteristics of high-speed, swept-wing aircraft, and it too, utilized a 35-degree sweep-angle), and the North American F-86 flew more than two months before the XB-47 did. Using swept wings on an aircraft as large as the B-47, however, is what set it apart from the others.

To be sure, the idea of using swept wings was not going to be an easy sell to the Air Force, nor to some at Boeing. Nonetheless, work on the aircraft was permitted to continue, and this resulted in a design known as "Model 448" that was shown to the Army Air Forces in September of 1945.

With its thin, swept wings and empennage, the Model 448 was an ultra-modern design in 1945. With its two TG-180 jet engines buried in the top of the fuselage, it looked like a swept-wing version of the Model 432. Because Boeing wanted to increase its chances of winning the jet-bomber competition, two more engines were added to the design. Mounted below the tail, at the rear of the fuselage, the additional engines were in response to the engineers figuring that two more engines would be needed for the bomber to meet range and speed requirements.

Bombers occasionally get shot at, and their engines sometimes sustain battle damage. The Model 448's engines were all located on or in the fuselage. Damage to the engines could have led to major damage to the fuselage. Consequently, the Air Force rejected the Model 448 and insisted that all four engines be moved to the "normal" position…under the aircraft's wings.

Naturally, Boeing engineers worried that the aerodynamic gains offered by the thin, swept wings would be negated by placing the six jet engines on the wings. Boeing solved this problem by encasing the engine's in streamlined "pods," which were hung from thin pylons under each wing. Placing the engine pods, low and forward of the wings resulted in the drag being reduced to where it was with the engines mounted on/in the fuselage. So, the new aircraft was to have six TG-180 engines. The two additional engines were mounted under the wing-tips (one engine under each wing-tip), and the pods, containing two engines each, were mounted roughly a third of the wing span away from the fuselage. This latest incarnation of the XB-47 was referred to by Boeing as the "Model 450."

At this point, the XB-47 was starting to look like…a B-47. But there was still a major hurdle to be overcome. The Model 450's wings were very thin, which was necessary in order to keep drag to a minimum. The problem was that this didn't allow much room for the retracted landing gear, unless the wings were "bulged" in order to accommodate the retracted main gear (in a tricycle-gear arrangement).