

White Paper 25-02



B-52 Stratofortress Modernization

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The Boeing Company of Seattle, Washington won the contract for the new bomber on 5 June 1946. The prototype YB-52 Stratofortress took to the skies for the first time on 15 April 1952, followed by the XB-52 on 2 October. With the first operational bomber delivery of RB-52B 52-8711 to the 93rd Bomb Wing at Castle AFB, CA on 29 June 1955, the B-52 instantly became the backbone of the USAF Strategic Bomber Force. Boeing spent additional time on structural design and testing as they expected their new bomber would fly well into the 1970s.

The initial contract to Boeing in February 1951 originally specified 13 B-52A's, models which differed from the prototypes with a revised cockpit design with side-by-side seating, a fuselage stretch and updated J57-P-9W engines using water-injection for additional boost power on takeoff but was changed on 9 June 1952 to include only 3 B-52As, with the remainder to be delivered as B-52B's. Another seven aircraft were added to the contract at this time. As it turned out, all 17 of these aircraft were completed as RB-52B's

Further B-52B's were ordered in September of 1952 and formally signed on 15 April 1953 calling for an additional 43 RB-52B's. In April 1954, the contract was amended and the number of RB-52Bs was cut to 33, with the remaining ten machines to be completed as B-52Cs. As it turned out, only ten of these aircraft were built as RB-52Bs, with the rest being delivered as bombers.

For the dual role RB-52B reconnaissance/bomber, the aircraft could be fitted with optical cameras, electronic intelligence (ELINT) sensors, or different surveillance radars. Two additional crew stations were added for sensor system operators. Of the 50 B-52B's ordered, the USAF

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acquired 27 of the RB-52B variants before dropping the reconnaissance role, with the final 13 aircraft completed at B-52B models, and 10 becoming B-52C models.

Moving rapidly, the B-52B was quickly surpassed by the B-52C model, of which 35 examples were built. The B-52C upgrades included updated J57-P-19W or J57-P-29W engines, a much-improved MD-9 fire control system, the AN/ASB-15 bombing/navigation system and underwing tanks capable of carrying 3,000 gallons of fuel rather than the previous 1,000 gallons. Flight of the first C model took place in March 1956.

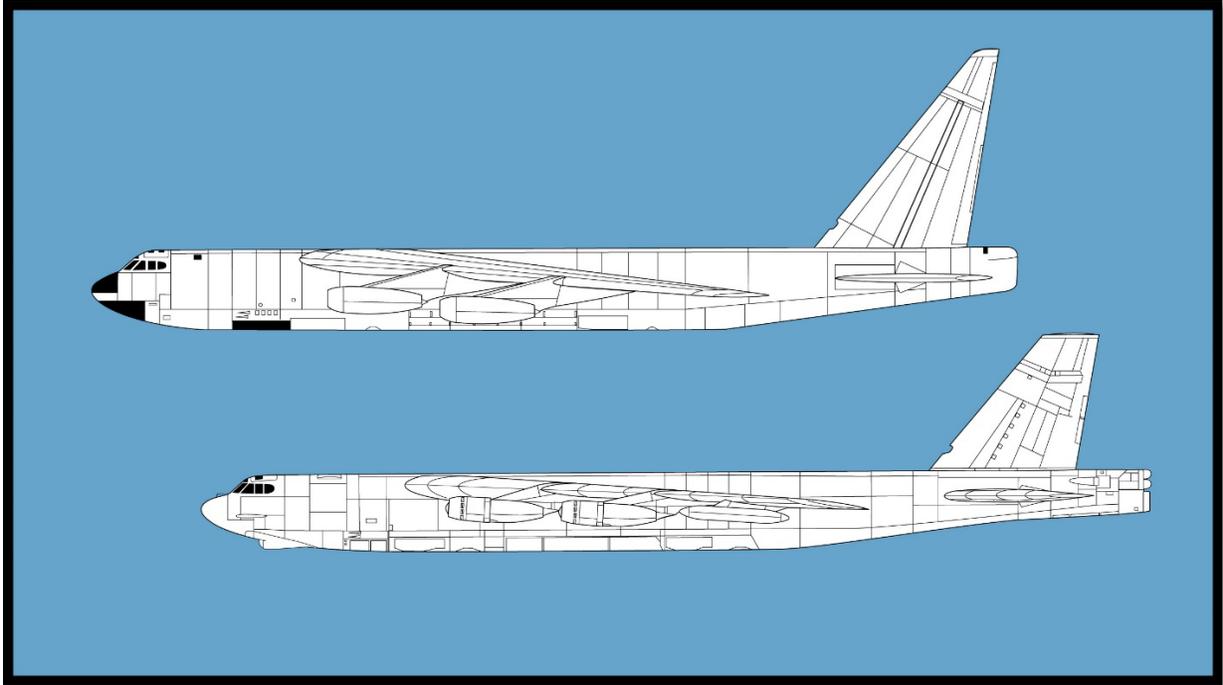
Prior to delivering the first operational C-model, Boeing was already flying the upgraded B-52D in May 1956. Larger production numbers of the B-52D required Boeing to open a second production facility in Wichita, Kansas. While the B-52D utilized the same engines and fire control systems, later structural modifications allowed the bomber to operate at low level altitudes. Additional modifications included the 'Big Belly' upgrade that increased the conventional ordnance capacity from 27 500-pound bombs to 84 500-pound bombs. Through the Pacer Plank life extension program (1972 to 1977) replacing many of the skin panels making the aircraft more aerodynamic and resistant to cracks, B-52Ds remained in service for nearly 30 years, with the last one retired in October 1983.



B-52 Stratofortress assembly line at Boeing's Wichita facility.

Following the B-52D was the upgraded B-52E of which 100 were built in Seattle and Wichita. At a production cost of \$1.4 million (\$16,071,000 in FY25 dollars), the E models included the capability to use the AGM-68 Hound Dog missile and GAM-72 Quail decoy. Making its first flight on 17 October 1957, the B-52E was the least expensive of the series and were retired from service by 1970.

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Primary external differences between the B-52B (top) and B-52H (bottom) included a revised nose shape with additional nose mounted sensors, TF33 turbofan engines replacing earlier J57 turbojets, a revised aft fuselage, and shortened vertical stabilizer.

The B-52H incorporated all the same improvements as the B-52G, the exceptions being newer, more fuel efficient TF33 turbofan engines and a new M61A-1 Vulcan 20mm rotary cannon tail turret. To keep the platform relevant, the B-52H has been through continuous upgrades and modification programs to extend the service life. One of the first was the addition of Advanced Capability Radar system with terrain-following capabilities. The 1970's brought an upgrade to the Electronic Countermeasures (ECM) package as well as an upgraded bombing-navigation system.

Later modifications included the AN/ASC-19 Air Force Satellite communications (AFSATCOM) equipment in 1979, this was replaced in mid-1980's with the introduction of the *Navstar* Global Positioning System (GPS). Additional electronics upgrades continued through the 1980's and 1990's. More recent upgrades to the Stratofortress fleet include the Combat Network Communications Technology (CONNECT) modifications beginning in 2011. The CONNECT program integrates an upgraded communications system and new mission management computers and displays.

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The added nose sensors and turbofan engines show up well in this front view of a B-52H.

By 2015, the Air Force realized that to keep the bombers operational they would require additional modernization efforts. Multiple upgrade programs were initiated that should keep the aircraft flying until the 2050's with some predictions being the 2060's. The Operation Test and Evaluation Plan for the Radar Modernization Program (RMP) was approved in April 2021. This program will replace the aging radar systems with a newer Active Electronically Scanned Radar (AESA) system. Current estimates have the upgraded aircraft reaching Initial Operational Capability (IOC) in FY 2028.

The second significant upgrade is the Commercial Engine Replacement Program (CERP), an effort to replace the aging Pratt & Whitney TF33 engines with a modern, reliable, fuel-efficient, off-the-shelf design. The Air Force chose to perform a 1 for 1 engine swap, rather than modify the aircraft to make use of modern larger turbofans used on most airliners to simplify and expedite the modification process. Initiated in 2015, with the Material Development Decision coming in 2018 and the contract award to Rolls Royce for their F130 turbojet engines in September 2021, the program has been beset with engineering issues and cost overruns. Current projects have the new B-52J variant beginning flight testing in FY 2029 to FY 2030, IOT&E testing the following year with a Full Rate Production decision in FY 2032.

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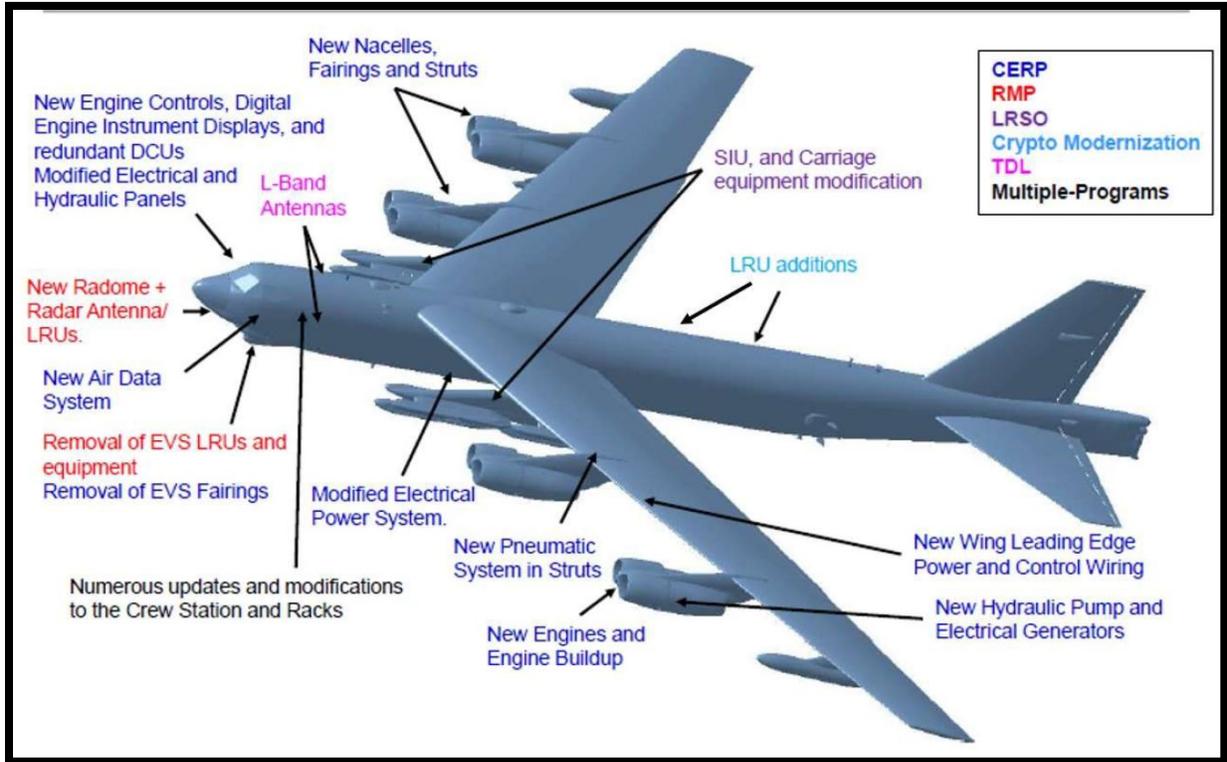


Illustration highlighting many of the modifications and upgrades to the latest variant of the Stratofortress family, the B-52J.

In summary, it took the Boeing Company 6 years from contract award to first flight of the YB-52 prototype, and an additional 3 years to deliver the first operational bomber. From the first flight of the first production variant B-52A, to the delivery of the final B-52H took only 8 years. In that time, Boeing constructed 742 aircraft (not including the 2 prototypes) in two production facilities in 8 distinct variants, B-52A thru B-52H. Current estimates show the Radar Modification Program will require 7 years before IOC, and the B-52 CERP re-engine program will have run 14 years from the initial Development Decision to Full Rate Production Decision, with no definitive estimate for IOC on the upgraded B-52J.

If current estimates for retirement are predicted to be near 2060, this will make the youngest B-52 airframe approximately 98 years old when phased out. Using age as the only factor, this would be equivalent to using a Wright Model B flyer (first flight in 1910) during Operation Enduring Freedom in 2008.

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