

B-2 at 30: Improving with Age

Whiteman AFB, Mo., to Libya is 10,000 miles round trip. In 2016, two B-2s flew this overwater route, eliminating the need for overflight permissions.



Primary Function

The Air Force's B-2 Spirit is the only stealth bomber in the world, an unprecedented combination of long-range, heavy payload, and stealth on a single platform.

Aircraft Design

Its low-observable flying wing design combines stealth with aerodynamic efficiency, and includes two spacious weapons bays capable of carrying

60,000 lbs.

First Flight

July 17, 1989.

This star logo featuring five B-2 silhouettes was used at the plane's rollout in 1989.



Prime Contractor

Northrop Grumman

Number Built 21

Inventory 20

Delivered

December 1993-December 1997. (Test-aircraft redelivered combat capable, July 2000)

IOC

April 1997, Whiteman AFB, Mo.

Active Variant

B-2A.

Aircraft Location

Edwards AFB, Calif.; Whiteman AFB, Mo.

Operator

AFGSC, AFMC, ANG (associate)

Engines 4

General Electric F118-GE-100 turbofans, each 17,300 lb. thrust

Accommodation



Two pilots, on ACES II zero/zero ejection seats.

Max takeoff Weight
336,500 lb.

Ceiling
50,000 ft.

Performance



Maximum speed
Mach 0.8

(550 knots, 630 mph, 1,010 kilometers per hour) at 40,000 feet altitude

Cruise speed
Mach 0.77

(487 knots, 560 mph, 900 km/h) at 40,000 feet altitude

Range
6,000

nautical miles (10,000 with one refueling); Service ceiling: 50,000 feet (15,200 meters)

Maneuvering

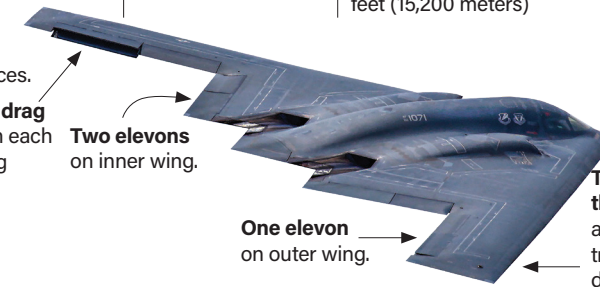
Four pairs of control surfaces.

One split drag rudder on each outer wing

Two elevons on inner wing.

One elevon on outer wing.

The leading edges of the wings are angled at 33 degrees and the trailing edge has a double-W shape.



Radar Cross Section

The radar cross section (RCS) is a key measure of strength. A target's RCS depends on its physical shape, materials, antennae, and other sensors. Onboard sensors can play as much of a role in determining RCS as materials and design.



Recognition

Collier Award Recipient, May 1992—Air Force/Northrop Grumman-led contractor team wins the Collier Trophy, aerospace's most prestigious award for the design, development, production, and flight testing of the B-2 Spirit.

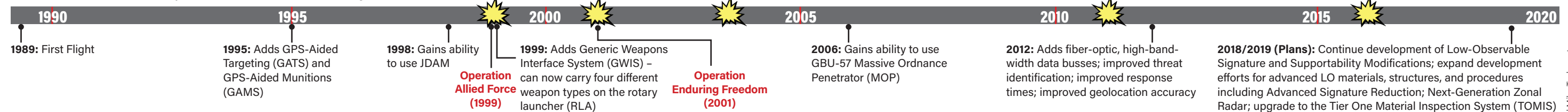
Esoterica

- 1.9 million lines of code
- Cot on board (with only two seats, pilots can stow a cot for resting during long flights)

- B-2 carries more guided weapons than any other platform (80x GBU-38)
- Only about 700 people have flown in a B-2; everyone who has is assigned a unique "Spirit number"

Upgrades

The original B-2s have benefited from significant enhancements since the planes were first introduced. All aircraft today meet the Block 30 standard, featuring AESA radars and Link 16.



Ongoing Upgrades Include:

- Defensive Management System Modernization (DMSM) to improve survivability in contested environments, primarily by locating and identifying enemy radars.
- Adaptable Communications Suite (ACS) providing beyond-line-of-sight communications to enable time-sensitive mission updates and in-flight retasking.

- Low-Observable Signature and Supportability Modifications (LOSSM) to improve the B-2's stealth signature and reduce the amount of maintenance its stealth materials require.
- Radar-Aided Targeting System (RATS) that uses the B-2's radar to provide precision weapon targeting in GPS-denied environments.
- JASSM-ER integration to enable B-2s to carry 16 of the extended-range variant of the AGM-158 Joint Air-to-Surface Standoff Missile (JASSM).

Potential future upgrades could include:

- Ability to carry both smart bomb rack and rotary launcher to maximize loadout flexibility.
- Airspeed and altitude hold autopilot functionality to reduce crew fatigue.
- Integration of hypersonic weapons on a more survivable launch platform.

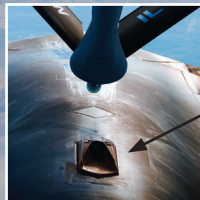
- Integration of anti-ship weapons such as the Long-Range Anti-Ship Missile, something the influential think tank CSBA has called for as a means of countering the Chinese Navy.



A KC-46 refuels a B-2 in April over Edwards AFB, Calif. It was the first time the two aircraft types linked up.

Photos: Christian Turner/USAF; Pfc. Jason Northcutt/US Army

Refueling



Fueling receptacle rotates to open and closed position.

Historic Details

Operation Allied Force (1999)

- First combat mission—March 24, 1999.
- First sustained bombing campaign launched from continental United States.
- Two B-2s flew more than 31 hours from Whiteman AFB, Mo., to attack multiple targets in Kosovo.
- Though flying less than 1 percent of total missions, B-2s destroyed 33 percent of all targets in conflict's first eight weeks.

Operation Enduring Freedom (2001).

- Longest flight—44 hours, October 7-8, 2001—longest air combat mission in history.
- *Spirit of America* and five other B-2s were first to enter Afghan airspace following the 9/11 attacks on New York and Washington, D.C.
- After dropping ordnance, the planes made a 45-minute pit stop with engines still running for crew and service change, then flew home 30+ hours to Missouri. Total flight time, including the pit stop, was about 75 consecutive hours.

Operation Iraqi Freedom (2003)

- 6 B-2s struck critical regime infrastructure on night 1 (3 from Whiteman AFB, 3 from Diego Garcia).
- B-2s dropped 1.5 million pounds of ordnance on 600 targets in 49 sorties over 10 days.
- B-2s achieved 85 percent mission capable rate (higher than B-1 or B-52).

Operation Odyssey Dawn (2011)

- 3 B-2s launch from Whiteman AFB; one turns back, but two strike and destroy 45 hardened aircraft shelters near Sirte, Qaddafi's hometown.
- Flew overwater route via Mediterranean, eliminating need for overflight/diplomatic permissions.
- Total mission is 25 hours, with two refuelings in each direction.

Operation Odyssey Lightning (2016)

- 2 B-2s launch from Whiteman AFB and drop 108 500-lb GBU-28 JDAMs on ISIS mobile targets in Libya.
- 34-hour mission is supported by 15 KC-135 and KC-10 tankers.

Armaments

Nuclear



16 B61-7, B61-12



16 B83



8 B61-11 bombs (on rotary launchers)

Conventional



80 Mk 62 500-lb sea mines



80 Mk 82 500-lb bombs



80 GBU-38 JDAMs



16 GBU-31 JDAMs



16 Mk 84 (2,000-lb) bombs



16 AGM-154 JSOWs



16 AGM-158 JASSMs



8 GBU-28 LGBs



2 GBU-57 Massive Ordnance Penetrators



B-2 is the only aircraft that can deliver these weapons.



Photo: SrA. Joel P. Frester

80 GBU-38 guided ammunitions inside one bay door of a B-2 before Libya mission.

Accidents



Photo: FAA

2008: *Spirit of Kansas* crashes shortly after takeoff at Andersen AFB, Guam. Both pilots eject safely, before the aircraft is destroyed. Investigators later blame moisture from heavy rains for maintenance crews improperly calibrating air-data sensors.



Photo: Staff Sgt. Alexandra Boutte

2010: *Spirit of Washington* suffers a catastrophic engine fire in Guam, severely damaging the aircraft and all four engines. With only 20 B-2 aircraft in the inventory, however, the Air Force returns the jet to service four years later.