

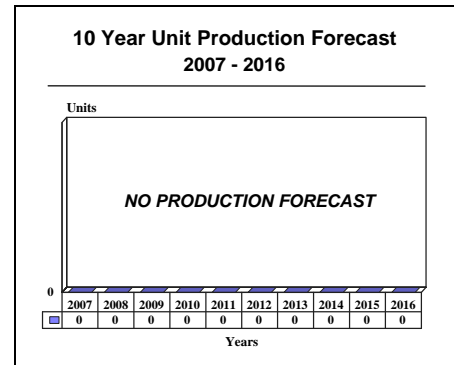
# ARCHIVED REPORT

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## Northrop Grumman B-2 Stealth Bomber - Archived 01/2008

### Outlook

- All 21 planned B-2s have been delivered
- No further production is forecast
- Northrop Grumman may propose an improved B-2 version for USAF long-range strike requirement



### Orientation

**Description.** Four-engine, long-range, strategic nuclear and conventional strike/attack aircraft.

**Sponsor.** U.S. Air Force Aeronautical Systems Center, Wright-Patterson AFB, Ohio, USA.

**Status.** Production was completed in November 1997.

**Total Produced.** Northrop Grumman produced 21 B-2s. The B-2 entered service with USAF in December 1993.

**Application.** Long-range multirole bomber capable of penetration at high and low altitudes.

**Price Range.** Unit cost was approximately \$1.157 billion in FY98 U.S. dollars.

### Contractors

#### Prime

<b>Northrop Grumman Integrated Systems</b>	<a href="http://www.is.northropgrumman.com">http://www.is.northropgrumman.com</a> , One Northrop Grumman Ave, El Segundo, CA 90245 United States, Tel: + 1 (310) 332-1000, Prime
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#### Subcontractor

<b>GE - Aviation</b>	<a href="http://www.geae.com">http://www.geae.com</a> , 1 Neumann Way, Cincinnati, OH 45215-6301 United States, Tel: + 1 (513) 243-2000, Fax: + 1 (513) 786-1568 (F118-GE-100 Turbofan)
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## Northrop Grumman B-2 Stealth Bomber

B-2A

Source: Northrop Grumman

## Technical Data

**Design Features.** Flying wing airframe constructed mostly of composite materials. Aluminum and titanium materials are used in limited amounts in the airframe structure. The bulbous cockpit contains wide, wrap-around windscreens and is integrated into the wing structure with conformal skins. Twin, low-profile engine nacelles have scalloped, forward-tilted leading

edges. The inlets proceed aft and downward, with air flowing to each of four GE F118 turbofans. The engines are buried in the body on each side of the bomb bay sections. Landing gear is tricycle type, with four wheels on each main body and twin wheels on the nose unit.

	<u>Metric</u>	<u>U.S.</u>
<b>Dimensions</b>		
Length	20.90 m	69.0 ft
Height	5.10 m	17.0 ft
Wingspan	52.12 m	172.0 ft
<b>Weight</b>		
T-O weight (typical)	152,635 kg	336,500 lb
Payload	18,144 kg	40,000 lb
<b>Performance</b>		
Ceiling	15,152 m	50,000 ft
Unrefueled range (approximate)	11,112 km	6,000 nm
<b>Propulsion</b>		
B-2A (4)	General Electric F118-GE-100 non-afterburning, twin-spool turbofan engines rated 77.0 kN (17,300 lbst) each.	

## Northrop Grumman B-2 Stealth Bomber

**Seating**

Side-by-side seating for pilot and mission commander. Provisions for a third crew member.

**Armament**

Various conventional or nuclear weapons.

## Program Review

**Background.** During the U.S. presidential election campaign of 1980, President Jimmy Carter announced the existence of a new aircraft program to develop the Advanced Technology Bomber, which later became known as the B-2. Full-scale development of the B-2 began in 1981. In January 1988, the U.S. Air Force announced the award of a \$2.0 billion low-rate initial production contract to Northrop Corp in support of the B-2. In 1994, Northrop acquired Grumman, and renamed itself Northrop Grumman Corp.

Northrop Grumman's Military Aircraft Systems Division, El Segundo, California, was the prime contractor for the aircraft and was responsible for overall system design integration. Sections of the aircraft were manufactured by Boeing in Seattle, Washington, and by Northrop Grumman in Dallas, Texas. These sections were then shipped to Palmdale, California, for final assembly by Northrop Grumman.

The Air Force originally planned to acquire 132 operational B-2s. In April 1990, following a major aircraft review, the B-2 quantity was reduced to 75. In January 1992, President George H.W. Bush announced that the total number of B-2s to be acquired would be further reduced to 20.

**Design Details.** The B-2 was designed to be a long-range, multirole bomber capable of penetration at both high and low altitudes. It was intended to defeat projected Soviet air defenses well into the 21st century. Northrop Grumman designed and manufactured the B-2 using a three-dimensional computing capability that combined computer-aided design and computer-aided manufacturing techniques.

Northrop Grumman went directly from the electronic database to the manufacture of production tooling, thus avoiding the manufacture of prototype tooling. The precision required by the low observable design of the B-2 made the accuracy of production tooling mandatory for the first B-2.

The design of the B-2 includes low observable technologies, such as special shaping and radar-absorbing materials, which are intended to reduce the radar cross-section of the aircraft.

The B-2 is powered by four General Electric F118 turbofan engines. Tricycle landing gear are employed on the aircraft.

**Range.** In July 1989, USAF General Bernard Randolph, commander of the Air Force Systems Command, said that, with one air refueling and operating from just four bases, the B-2 could cover any point on the world's land mass on a nonstop radius mission carrying a full conventional payload.

**Contractor Team.** Besides Boeing and GE, B-2 subcontractors included the following firms: AAI Corp; Adage Inc; Adams-Russell Company Inc; AlliedSignal Inc; Amoco Performance Products; Amdahl Federal Service Corp; Applied Consulting & Tech Service; Arkwin Industries Inc; Associate N/C Programming; B&H Associates; B&M Associates; Batelle Columbus; BDM Corp; Belcan Services; Burns & Roe Pacific Engineers; Butler Service Group; Condor Systems Inc; Consultants & Designers Inc; Continental Microwave & Tool Company; Contract Services; Defense Technologies Inc; Deloitte, Haskins & Sells; Digital Equipment Corp; Eastman Kodak; Eldec Corp; Electrodynamics Inc; Electromagnetic Devices; Ensign Bickford Company; Ernst & Whitney; Evolving Technology; Ewing Technical Design Inc; Explosive Technology Inc; Facilities Systems Engineering; and Fairchild Communications & Electronics Company.

Others included: Fenwal Inc; Frequency West; GEC Astronics Corp; General Devices Inc; General Dynamics Corp; Gould Defense Systems; Gull Inc; H.L. Yoh; Hamilton Standard; Hazeltine; Hercules Inc; Hi Tec; Honeywell Inc; Hughes Aircraft Company; IBM; Inconen Corp; Interglobal Technical Services; ITT Gilfillan; Jaycor; Kaman Avidyne; Kaman Instrumentation; Kaman Sciences Corp; Kaymar; Kearfott; Keco Industries Inc; Kirk-Mayer Inc; Kom Wave Corp; Lighting Technologies; Lockheed Martin Corp; Logicon; Los Alamos Technical Associates Inc; Mantech International Corp; Mantech Support Technologies Inc; Mantecs; McKenna, Conner & Cuneo; Micro Lab; Microdynamics Inc; Microwave Associates Inc; Microwave Development Labs; Microwave Engineering Corp; Miltope Company; Mini

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Systems; Mini-Systems Associates; Moog Inc; Multax Systems; N/C Services; Narda Microwave Inc; Nelson, Coulson & Associates Inc; and Norman Engineering Company.

Further subcontractors included: OEA Inc; Parker Hannifin; PDA Engineering; PDS-Tech Services; Pollack & Son; Raychem Corp; Raytheon Company; Resdel Engineering Corp; RHO Company Inc; Rockwell International Corp; Rosemount Inc; Sanders; Science & Engineering Associates Inc; Scipar Inc; Servicon Systems Inc; Simmonds Precision; Smiths Industries; Spectragraphic Corp; Standard Manufacturing Company; Stonehouse Group; Storage Tech Corp; Sundstrand; Superior Design Company Inc; Superior Manufacturing Company; TAD Technical Services; Tech Resources Inc; Tech Systems Corp; Teledyne Electronics; Teledyne McCormick; Texas Instruments; Transportable Technology Inc; TRW; Unisys Corp; United Technologies Corp; UTS Engineering & Consultants; Vanite Industries; Varian; VERAC Inc; Versatech; VTC Service Corp; Wang Laboratories Inc; Watkins-Johnson Company; Whittaker Corp; and Xerox.

**Planned Fleet.** Northrop Grumman delivered the 21st and final B-2 to the Air Force in November 1997. USAF plans called for a fleet of 21 operational B-2s. In 1996, President Clinton decided to add one operational aircraft to the Air Force's then-planned fleet of 20 operational B-2s.

The initial development aircraft (AV-1) was subsequently converted into an operational aircraft. In May 1997, USAF awarded a \$493 million contract to Northrop Grumman for this conversion. The modification involved replacement of the landing gear, installation of a new avionics suite, and modifications to the aircraft structure, fuel system, and weapons bay doors.

Prior to the decision, the Air Force had planned to procure a fleet of 20 operational B-2s. However, a total of 21 would still actually have been built. This total included six developmental aircraft and 15 production aircraft, with five of the six developmental aircraft being reworked, refurbished, and delivered for Air Force operations. Now, all six developmental aircraft have been converted into operational aircraft.

The 21 B-2s were delivered in three different configurations, each with increasing capabilities. Only the final two aircraft were delivered in the full Block 30 configuration, which includes full precision-guided munitions capability, full low observable performance, fully operational defensive and offensive avionics, additional operating modes for the synthetic aperture radar, and a more sophisticated mission planning system. All 19 of the earlier B-2s have since been modified to the Block 30 configuration.

## Funding

	U.S. FUNDING							
	FY04	FY04	FY05	FY05	FY06	FY06	FY07	FY07
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>(Req)</u>	<u>(Req)</u>
B-2 Mods	-	120.2	-	93.9	-	58.3	-	191.3
B-2 RDT&E (PE#0604240F)	-	171.3	-	263.6	-	294.9	-	224.2

All \$ are in millions.

## Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1980	Advanced Technology Bomber program announced
	1981	Full-scale development begun
Nov	1988	Rollout of first B-2
Jul	1989	Initial flight
Apr	1997	B-2 achieves Initial Operational Capability
Nov	1997	Delivery to USAF of 21st B-2

Northrop Grumman B-2 Stealth Bomber

Worldwide Distribution/Inventories

U.S. Air Force 21

Forecast Rationale

Though limited support has appeared from time to time in the U.S. Congress for resuming B-2 production, these efforts have never been successful. The USAF B-2 fleet remains at 21 aircraft.

The Air Force intends to field a new long-range strike platform by 2018. This new bomber would complement the service's existing fleet of B-2, B-1, and B-52 bombers. Northrop Grumman, Boeing, and Lockheed Martin are engaged in exploring possible concepts for the USAF long-range strike requirement. All three companies believe that a subsonic bomber is the most realistic solution.

If the Air Force does opt for a subsonic design, Northrop Grumman may propose an improved version of the B-2 for the program. The company, however, is also studying supersonic concepts as possible alternatives should the Air Force decide to go in another direction.

Northrop Grumman intends to use the B-2 as a testbed to evaluate and demonstrate technologies for the USAF long-range strike effort. These would primarily include improved systems and survivability features. The technologies could provide upgrades for the Air Force's existing B-2 fleet as well.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Aircraft	(Engine)	thru 06	High Confidence Level				Good Confidence Level				Speculative		Total 07-16	
			07	08	09	10	11	12	13	14	15	16		
NORTHROP GRUMMAN														
B-2	F118-GE-100	21	0	0	0	0	0	0	0	0	0	0	0	0
Total Production		21	0	0	0	0	0	0	0	0	0	0	0	0