Rockwell B-1 Lancer

The fantastic looking, but troubled, B1 bomber, which is operated by the USAF, is now 33 years old but certainly doesn't look it.

The B-1, which was built by Rockwell International (now part of Boeing) is a supersonic variable-sweep wing, heavy bomber. It is commonly called the "Bone" (from "B-One") and is one of three strategic bombers in the U.S. Air Force fleet, the other two being the B-2 Spirit and the B-52 Stratofortress.

The B-1 was first envisioned in the 1960s as a platform that would combine the Mach 2 speed of the Convair B-58 Hustler with the range and payload of the B-52 and was meant to ultimately replace both bombers. After a long series of studies, Rockwell International won the design contest for what emerged as the B-1A. This version had a top speed of Mach 2.2 at high altitude and the capability of flying for long distances at Mach 0.85 at very low altitudes. The combination of the high cost of the aircraft, the introduction of the AGM-86 cruise missile that flew the same basic profile and early work on the stealth bomber all significantly affected the need for the B-1. This led to the program being cancelled in 1977, after the B-1A prototypes had been built.

The program was restarted in 1981, largely as an interim measure due to delays in the B-2 program, with the B-2 eventually reaching initial operational capability in 1997. This led to a redesign as the B-1B, which differed from the B-1A by having a lower top speed at high altitude of Mach 1.25, but improved low-altitude performance of Mach 0.96. The electronics were also extensively improved during the redesign and the airframe was improved to allow take-off with the maximum possible fuel and weapons load. The B-1B began deliveries in 1986 and formally entered service with Strategic Air Command (SAC) as a nuclear bomber in that same year. By 1988, all 100 aircraft had been delivered.

In the early 1990s, following the Gulf War and concurrent with the disestablishment of SAC and its reassignment to the newly formed Air Combat Command, the B-1B was converted to

conventional bombing use. It first served in combat during Operation Desert Fox in 1998 and again during the NATO action in Kosovo the following year. The B-1B has supported U.S. and NATO military forces in Afghanistan and Iraq. The Air Force had 66 B-1Bs in service as of September 2012. The B-1B is expected to continue to serve into the 2030s along with the B-52s, with the Northrop Grumman B-21 Raider to begin replacing the B-1B after 2025. The B-1s in inventory are planned to be retired by 2036 and the B-52 will stay a bit longer.

Although never intended for the low-level role, the B-52's flexibility allowed it to outlast its intended successor as the nature of the air war environment changed. The B-52's huge fuel load allowed it to operate at lower altitudes for longer times and the large airframe allowed the addition of improved radar jamming and deception suites to deal with radars. During the Vietnam War, the concept that all future wars would be nuclear was turned on its head and the "big belly" modifications increased the B-52's total bomb load to 60,000 pounds (27,000kg), turning it into a powerful tactical aircraft which could be used against ground troops along with strategic targets from high altitudes.

Although effective, the B-52 was not ideal for the low-level role. This led to a number of aircraft designs known as penetrators, which were tuned specifically for long-range low-altitude flight. The first of these designs to see operation was the supersonic F-111 fighter-bomber, which used variable-sweep wings for tactical missions.

The USAF needed a replacement and proposals were submitted by Boeing, General Dynamics and North American Rockwell in January 1970. In June 1970, North American Rockwell's design was selected and was awarded a development contract. The original program called for two test airframes, five flyable aircraft, and 40 engines. This was cut in 1971 to one ground and three flight test aircraft. The company changed its name to Rockwell International and named its aircraft

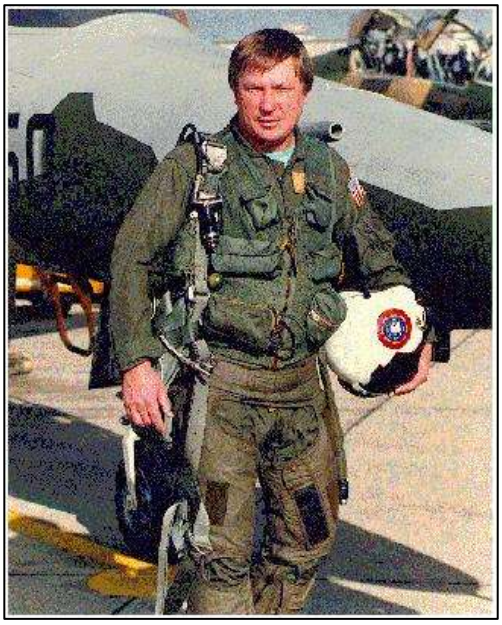
division North American Aircraft Operations in 1973. A fourth prototype, built to production standards, was ordered in the fiscal year 1976 budget. Plans called for 240 B-1As to be built, with initial operational capability set for 1979.

Rockwell's design featured a number of features common to 1960s U.S. designs. Like the F-111, among these was the use of a crew escape capsule that ejected as a unit during emergencies, to improve survivability in the case of an ejection at high speed. Additionally, the design featured large variable-sweep wings in order to provide both high lift during take-off and landing and low drag during a high-speed dash phase. With the wings set to their widest position the aircraft had considerably better lift and power than the B-52, allowing it to operate from a much wider variety of bases. Penetration of the Soviet Union's defences would take place at supersonic speed, crossing them as quickly as possible before entering into the less defended "heartland" where speeds could be reduced again. The large size and fuel capacity of the design would allow the "dash" portion of the flight to be relatively long.

In order to achieve the required Mach 2 performance at high altitudes the exhaust nozzles and air intake ramps were variable. Initially, it had been expected that a Mach 1.2 performance could be achieved at low altitude, which required that titanium be used in critical areas in the fuselage

and wing structure. The low altitude performance requirement was later lowered to Mach 0.85, reducing the amount of titanium and therefore cost. A pair of small vanes mounted near the nose are part of an active vibration damping system that smooths out the otherwise bumpy low-altitude ride. The first three B-1As featured the escape capsule that ejected the cockpit with all four crew members inside. The fourth B-1A was equipped with a conventional ejection seat for each crew member.

In 1970, the estimated unit cost was $40 million and by 1975, this figure had climbed to $70 million.



In 1976, Soviet pilot Viktor Belenko defected to Japan with his MiG-25 "Foxbat". During debriefing he described a new "super-Foxbat" (almost certainly referring to the MiG-31) that had look-down/shoot-down radar in order to attack cruise missiles. This would also make any low-level penetration aircraft "visible" and easy to attack. Given that the B-1's armament suite was similar to the B-52, and it now appeared no more likely to survive Soviet airspace than the B-52, the program was increasingly questioned. In particular, Senator William Proxmire continually derided the B-1 in public, arguing it was an outlandishly expensive dinosaur. During the 1976 federal election campaign, Jimmy Carter made it one of the Democratic Party's platforms, saying "The B-1 bomber is an example of a proposed system which should not be funded and would be wasteful of taxpayers' dollars."

When Carter took office in 1977 he ordered a review of the entire program. By this point the projected cost of the program had risen to over $100 million per aircraft, although this was lifetime cost over 20 years. He was informed of the relatively new work on stealth aircraft that had started in 1975 and he decided that this was a better avenue of approach than the B-1. Pentagon officials also stated that the AGM-86 Air Launched Cruise Missile (ALCM) launched from the existing B-52 fleet would give the USAF equal capability of penetrating Soviet airspace. With a range of 1,500 miles (2,400 km), the ALCM could be launched well outside the range of any Soviet defences and penetrate at low altitude like a bomber (with a much lower radar cross-section due to smaller size), and in much greater numbers at a lower cost. A small number of B-52s could launch hundreds of ALCMs, saturating the defence. A program to improve the B-52 and develop and deploy the ALCM would cost perhaps 20% of the price to deploy the planned 244 B-1As.

On 30 June 1977, Carter announced that the B-1A would be cancelled in favour of ICBMs, SLBMs, and a fleet of modernized B-52s armed with ALCMs. Carter called it "one of the most difficult decisions that I've made since I've been in office." No mention of the stealth work was made public with the program being top secret, but today it is known that in early 1978 he

authorized the Advanced Technology Bomber (ATB) project, which eventually led to the B-2 Spirit.

Domestically, the reaction to the cancellation was split along partisan lines. The US Department of Défense was surprised by the announcement; internal expectations were that the number of B-1s ordered would be reduced to around 150. Congressman Robert Dornan (R-CA) claimed, "They're breaking out the vodka and caviar in Moscow." In contrast, it appears the Soviets were more concerned by large numbers of ALCMs representing a much greater threat than a smaller number of B-1s. Soviet news agency TASS commented that "the implementation of these militaristic plans has seriously complicated efforts for the limitation of the strategic arms race." Western military leaders were generally happy with the decision. NATO commander Alexander Haig described the ALCM as an "attractive alternative" to the B-1. French General Georges Buis stated "The B-1 is a formidable weapon, but not terribly useful. For the price of one bomber, you can have 200 cruise missiles."

It was during this period that the Soviets started to assert themselves in several new theatres of action, in particular through Cuban proxies during the Angolan Civil War starting in 1975 and the Soviet invasion of Afghanistan in 1979. U.S. strategy to this point had been focused on containing Communism and preparation for war in Europe. The new Soviet actions revealed that the military lacked capability outside these narrow confines.

The U.S. Department of Défense responded by accelerating its Rapid Deployment Forces concept but suffered from major problems with airlift and sealift capability. In order to slow an enemy invasion of other countries, air power was critical; however the key Iran-Afghanistan border was outside the range of the U.S. Navy's carrier-based attack aircraft, leaving this role to the U.S. Air Force. Although the B-52 had the range to support on-demand global missions, its long runway requirements limited the forward basing possibilities. During the 1980 presidential campaign, Ronald Reagan campaigned heavily on the platform that Carter was weak on defence, citing the cancellation of the B-1 program as an example, a theme he continued using into the 1980s. During this time Carter's defence secretary, Harold Brown, announced the stealth bomber project, apparently implying that this was the reason for the B-1 cancellation.

On taking office, Reagan was faced with the same decision as Carter before, whether to continue with the B-1 for the short term, or to wait for the development of the ATB, a much more advanced aircraft. Studies suggested that the existing B-52 fleet with ALCM would remain a credible threat until 1985. It was predicted that 75% of the B-52 force would survive to attack its targets. After 1985, the introduction of the SA-10 missile, the MiG-31 interceptor and the first Soviet Airborne

Early Warning and Control (AWACS) systems would make the B-52 increasingly vulnerable. During 1981, funds were allocated to a new study for a bomber for the 1990s time-frame which led to developing the Long-Range Combat Aircraft (LRCA) project. The LRCA evaluated the B-1, F-111, and ATB as possible solutions; an emphasis was placed on multi-role capabilities, as opposed to purely strategic operations.

In 1981, it was believed the B-1 could be in operation before the ATB, covering the transitional period between the B-52's increasing vulnerability and the ATB's introduction. Reagan decided the best solution was to procure both the B-1 and ATB and on 2 October 1981 he announced that 100 B-1s were to be ordered to fill the LRCA role.

In January 1982, the U.S. Air Force awarded two contracts to Rockwell worth a combined $2.2 billion for the development and production of 100 new B-1 bombers. Numerous changes were made to the design to make it better suited to the now expected missions, resulting in the new B-1B. These changes included a reduction in maximum speed, which allowed the variable-aspect intake ramps to be replaced by simpler fixed geometry intake ramps in the newer design. This reduced the B-1B's radar signature or radar cross-section; this reduction was seen as a good trade off for the speed decrease. High subsonic speeds at low altitude became a focus area for the revised design and low-level speeds were increased from about Mach 0.85 to 0.92. The B-1B has a maximum speed of Mach 1.25 at higher altitudes.

The B-1B's maximum take-off weight was increased to 216,000 kg from the B-1A's 179,000 kg. The weight increase was to allow for take-off with a full internal fuel load and for external weapons to be carried. Rockwell engineers were able to reinforce critical areas and lighten non-critical areas of the airframe, so the increase in empty weight was minimal. To deal with the introduction of the MiG-31 equipped with the new Zaslon radar system, and other aircraft with look-down

capability (which reduced the B-1s low-flying advantage), the B-1B's electronic warfare suite was significantly upgraded.

Opposition to the plan was widespread within Congress. Critics pointed out that many of the original problems remained in both areas of performance and expense. In particular it seemed the B-52 fitted with electronics similar to the B-1B would be equally able to avoid interception, as the speed advantage of the B-1 was now minimal. It also appeared that the "interim" time frame served by the B-1B would be less than a decade, being rendered obsolete shortly after the introduction of a much more capable ATB design. The primary argument in favour of the B-1 was its large conventional weapon payload, and that its take-off performance allowed it to operate with a credible bomb load from a much wider variety of airfields. The USAF spread production subcontracts across many congressional districts, making the aircraft more popular on Capitol Hill.

B-1A #1 was disassembled and used for radar testing at the Rome Air Development Centre at the former Griffiss Air Force Base, New York. B-1As #2 and #4 were then modified to include B-1B systems. The first B-1B was completed and began flight testing in March 1983. The first production B-1B was rolled out on 4 September 1984 and first flew on 18 October 1984. The 100th and final B-1B was delivered on 2 May 1988; before the last B-1B was delivered, the USAF had determined that the aircraft was vulnerable to Soviet air defences.

The B-1 has a blended wing body configuration, with variable-sweep wing, four turbofan engines, triangular fin control surfaces and cruciform tail. The wings can sweep from 15 degrees to 67.5 degrees (full forward to full sweep). Forward-swept wing settings are used for take-off, landings and high-altitude maximum cruise. Aft-swept wing settings are used in high subsonic and supersonic flight. The B-1's variable-sweep wings and thrust-to-weight ratio provide it with improved take-off performance, allowing it to use shorter runways than previous bombers. The length of the aircraft presented a flexing problem due to air turbulence at low altitude. To alleviate this, Rockwell included small triangular fin control surfaces or vanes near the nose on the B-1. The B-1's Structural Mode Control System rotates the vanes automatically to counteract turbulence and smooth out the ride.

Unlike the B-1A, the B-1B cannot reach Mach 2+ speeds; its maximum speed is Mach 1.25 (about 1,530 km/h at altitude), but its low-level speed increased to Mach 0.92 (1,130 km/h). The speed of the current version of the aircraft is limited by the need to avoid damage to its structure and air intakes. To help lower its radar cross section (RCS), the B-1B uses serpentine air intake ducts and fixed intake ramps, which limit its speed compared to the B-1A. Vanes in the intake ducts serve to deflect and shield radar emissions from the highly reflective engine compressor blades. The B-1A's engine was modified slightly to produce the GE F101-102 for the B-1B, with an emphasis on durability, and increased efficiency. The nose gear cover door has controls for he

auxiliary power units (APUs), which allow for quick starts of the APUs upon order to scramble. That small shape hanging below the nose area is the Sniper XR pod.

In late 1990, engine fires in two Lancers led to a grounding of the fleet. The cause was traced back to problems in the first-stage fan and the aircraft were placed on "limited alert"; in other words, they were grounded unless a nuclear war broke out. Following inspections and repairs they were returned to duty beginning on 6 February 1991. By 1991, the B-1 had a fledgling conventional capability, forty of them able to drop the 500-pound (230 kg) Mk-82 General Purpose (GP) bomb, although mostly from low altitude. Despite being cleared for this role, the problems with the engines prevented their use in Operation Desert Storm during the Gulf War. B-1s were primarily reserved for strategic nuclear strike missions at this time, providing the role of airborne nuclear deterrent against the Soviet Union. The B-52 was more suited to the role of conventional warfare and it was used by coalition forces instead.

Originally designed strictly for nuclear war, the B-1's development as an effective conventional bomber was delayed. The collapse of the Soviet Union had brought the B-1's nuclear role into question, leading to President George H. W. Bush ordering a $3 billion conventional refit. After the inactivation of Strategic Air Command (SAC) and the establishment of the Air Combat Command (ACC) in 1992, the B-1 developed a greater conventional weapons capability. Part of this development was the start-up of the U.S. Air Force Weapons School B-1 Division. In 1994, two additional B-1 bomb wings were also created in the Air National Guard, with former fighter wings in the Kansas Air National Guard and the Georgia Air National Guard converting to the aircraft. By the mid-1990s, the B-1 could employ GP weapons as well as various CBUs. By the end of the 1990s, with the advent of the "Block D" upgrade, the B-1 boasted a full array of guided and unguided munitions.

The B-1B no longer carries nuclear weapons, its nuclear capability was disabled by 1995 with the removal of nuclear arming and fuzing hardware. Under provisions of the New START treaty with Russia, further conversions were performed. These included modification of aircraft hardpoints to prevent nuclear weapon pylons from being attached, removal of weapons bay wiring bundles for arming nuclear weapons, and destruction of nuclear weapon pylons. The conversion process was completed in 2011, and Russian officials inspect the aircraft every year to verify compliance.

The B-1 was first used in combat in support of operations in Iraq during Operation Desert Fox in December 1998, employing unguided GP weapons. B-1s have been subsequently used in Kosovo and, most notably, in Afghanistan and the 2003 invasion of Iraq. The B-1's role in Kosoco has been criticized as the aircraft was not used until after enemy defences had been suppressed by aircraft like the older B-52 it was intended to replace. At the height of the Iraq War, a B-1 was

continuously kept airborne to provide rapid precision bombardment upon important targets as intelligence identified them.

In November 1993, three B-1Bs set a long distance record for the aircraft, which demonstrated its ability to conduct extended mission lengths to strike anywhere in the world and return to base without any stops.

Of the 100 B-1Bs built, 93 remained in 2000 after losses in accidents.

With upgrades to keep the B-1 viable, the Air Force may keep it in service until approximately 2038 but despite upgrades, it has repair and cost issues, every flight hour needs 48.4 hours of maintenance. The fuel, repairs and other needs for a 12-hour mission cost $720,000 as of 2010. The $63,000 cost per flight hour is, however, less than the $72,000 for the B-52 and the $135,000 of the B-2.

A crusty old Army Sergeant Major found himself at a gala event hosted by a local liberal arts college. There was no shortage of extremely young idealistic ladies in attendance, one of whom approached the Sergeant Major for conversation. "Excuse me, Sergeant Major, but you seem to be a very serious man. Is something bothering you?" "Negative, ma'am. Just serious by nature." The young lady looked at his awards and decorations and said, "It looks like you have seen a lot of action" "Yes, ma'am, a lot of action." The young lady, tiring of trying to start up a conversation, said, "You know, you should lighten up. Relax and enjoy yourself." The Sergeant Major just stared at her in his serious manner. Finally the young lady said, "You know, I hope you don't take this the wrong way, but when is the last time you had sex? "1955, ma'am" "Well, there you are. No wonder you're so serious. You really need to chill out! I mean, no sex since 1955" She took his hand and led him to a private room where she proceeded to "relax" him. Afterwards, panting for breath, she leaned against his bare chest and said, "Wow, you sure didn't forget much since 1955." The Sergeant Major said, after glancing at his watch, "I hope not; it's only 2130 now."

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