Bombers

British Bombers
Chinese Bombers
Russian Bombers
US Bombers

Avro Vulcan

Notes: The Vulcan is – well, a *huge* bomber. It is in the class of the American B-52 Stratofortress and the B-47 Stratojet. Vulcans began research in 1952, with first deliveries beginning in 1956. The Vulcan at first filled the British air leg of its Nuclear Triad; later, most were converted to tankers. The Vulcan is a delta-winged tailless design with an absolutely huge wing; this design was chosen to allow the original Vulcans to fly high over Eastern Europe and the Soviet Union, and otherwise have long legs. Of the V-Bombers, the Vulcan was the technically most advanced. The Vulcans are now retired, except for three (one B.1 and two B.2s), which are kept in flying condition for appearances in air shows. Many pilots feel that the Vulcan handles astonishing well for its size; Avro test pilot Roland Falk even underlined this by putting a prototype Vulcan into a slow barrel roll while overflying officials and test personnel. Reportedly, Falk was so low that he smashed all the skylight windows in the Avro assembly building (he was admonished sternly to avoid this kind of dangerous maneuver in the future). However, the Vulcan did receive its Certificate of Airworthiness less than a month afterwards, and Falk did another low-level barrel roll at the 1955 Farnborough Air Show.

It is interesting that in the early 1980s, Argentina approached Britain with an offer to buy a number of Vulcans, which were at that point retired from the RAF. Britain was suspicious of the Argentine offer, with the Foreign and Commonwealth Office of the MoD noting that the Vulcans could be very useful to the Argentines in an invasion of the Falklands. And notably, Argentina invaded the Falklands three months later. It is there that the Vulcans were employed in their only combat action.

The Australians also considered the Vulcan B.1A as an interim bomber until they could start receiving the TSR.2s, which at the time were still delayed and not yet cancelled. The Australians again considered the Vulcan on an interim basis until their version of the F-111C was ready.

It is also notable, that Vulcans took part in the 1960, 1961, and 1962 Operation Skyshield, exercises, where they simulated Russian bomber attacks against New York, Chicago and Washington. The results of Operation Skyshield exercises were classified until 1997, and it was then found that the Vulcans had easily slipped through American and Canadian air defenses and delivered their simulated payloads to their targets without a problem. This apparently also happened during the 1974 Giant Voice exercise, against supposedly greatly tightened and improved American and Canadian air defenses.

As their airframes aged, starting in the mid-1980s the tactical nuclear weapon delivery roles were given to the Tornado and Jaguar aircraft. Strategic nuclear delivery was given to Britain's boomers. The remaining Vulcans became museum pieces (except for the three examples kept in flying condition – see the B.2 below. Many ended up in US, Australian, and Canadian bombing ranges; some were apparently farmed out to special ops units to practice seizing enemy aircraft. A few others were kept for as long as a decade (in one case) to conduct various flight tests of engines and avionics. The Vulcan Restoration Trust raises money to keep more Vulcans in museum condition, and is responsible for the Vulcans still flying.

Vulcan B.1

The B.1, when first tested, required a large wing design; the original wing was more of a swept/delta wing. This proved to make the B.1 unstable, and the wings were enlarged to a full delta design with a curve in the mid-wing. The original B.1s were fitted with Rolls Royce Olympus 101 engines, four engines in total, with a power rating of 11,000 pounds of thrust each. 15 of these were so equipped, after which a few were re-engined to Olympus 102 engines, with 12,000 pounds of thrust each, this was done due to fluttering on the wingtips with the Olympus 101 engines. The B.1A was fitted with 13,500 pounds thrust Olympus 104s each; it also required smaller inlets. (These were the engines that were supposed to power the cancelled TSR.2.) B.1s had a bulged fairing at the rear of the fuselage; this carried a tail-warning radar with a 45-degree angle of sweep to either side of the midline, along with the aircraft's ECM/ECCM suite and the IR flares. The electronics required for the use of the Skybolt SRAM, though the actual capability to carry and fire Skybolts was not installed until the advent of the B.2. In addition, part of the avionics for the later Olympus 200 engines were installed into the wings, though again those engines were not installed until the B.2s made their appearance.

The designers would have preferred to stack the engines on either side on top of each other, but the wing was so thin that this proved impossible.

Despite modifications to the tail, wings, and engines, the Vulcan B.1 still tended to pitch upwards at high speed. An auto-mach trimmer feature was added to help tame this effect; nonetheless, the B.1 still tended to pitch up a bit and the control stick actually had to be continually corrected forward by the pilots. Before the auto-mach trimmer was installed, the Vulcan had a tendency to pitch up into a stall, then enter an uncontrollable dive at high speed that only the skill of the test pilots manage to avoid a crash. (The Vulcan had a fighter-type control stick instead of the control yoke more common on large aircraft.) Vulcans were painted anti-flash white to help with the flare from nuclear explosions, and the cockpit windows had thick panels to slide over the windows to prevent blinding the crew from the same; on a run up to a target, the Vulcans flew on instruments, and using bombing radar. (Bombing radar could also used to drop conventional weapons, but a computerized bombsight was the normal procedure for this eventuality. In any case, the only instance of combat conventional bombing was during Operation Black Buck during the Falklands War.

The B.1's primary weapons load was either conventional 450-kilogram bombs or nuclear free-fall bombs. Due to the size of the nuclear bombs of the time, the load of nuclear bombs which could be carried was much smaller than its conventional bomb load. (By the time smaller nuclear bombs were available, the Vulcan was out of the nuclear-bomb-delivery business.). The weapon system operator, behind and below the pilot, was able to conduct visual or radar bombing. The pilot and co-pilot were also able to conduct radar bombing (at degraded accuracy), and fire any missiles carried by the Vulcan. Beside him was the air electronics operator, controlling and tweaking the ECM/ECCM suite, as well having auxiliary radar screens and able to deploy things like chaff, flares, and even decoys on the rare occasions when they were carried. In between them and behind was the nav plotter (navigator). The Vulcan carried its fuel in 12 bag-type tanks; their capacities were spilt into four equal sections, each feeding one of the engines. If one bag was holed, no more than 10% of the fuel load of that bag would be lost. Cross-feed was possible between bag groups, in case an engine went out or for some reason was sucking more fuel than normal.

The original specification for the Vulcan called for a jettisonable crew capsule, which have ejected the entire flight deck in an emergency. Avro, however, was never able to make this work, and the capsule was replaced by conventional ejection seats. The B.1s (and later Vulcans) had ejection seats for the pilot and copilot, but the other three crewmen had fall-away hatches and simply fell out of the bottom of the aircraft. If passengers were carried, they had to manually get out of their seats and drop out of one of the hatchways vacated by the rest of the crew.

Due to its shape, the Vulcan has a measure of “accidental stealth,” even though in this era things like RCS and stealth were not even thought of when designing a warplane.

At 90% power or greater, the Vulcan would emit a howling noise, caused by the arrangement of the air intakes. Though not tactically important, it was one of the things that made the Vulcan popular at air shows.

The original B.1s were painted in all over glass antiflash white and with colored RAF roundels. Some were also left with a natural metal finish, with a black radome and colored RAF roundels. With the adoption of the low-level penetrator role (primarily applicable to the B.2, as the B.1s were never strengthened for low-level penetration), Later B.2s were painted dark sea gray with dark green stripes, and a gray bottom. This was later changed to a wrap-around camouflage finish which was more effective in the low-level penetration role.

The B.1 had a rather short refueling probe, mounted in the nose. This probe position made is difficult for the pilot of the Vulcan to conduct aerial refueling (One level more of difficulty when trying aerial refueling in a B.1). The B.2s had a longer refueling probe that ran alongside the cockpit and extended beyond the cockpit. This allowed the pilot to aim the refueling probe easier.

Vulcan B.2

The Vulcan B.2 began with a re-engining in 1960; early in the B.1s development, the Olympus 6 was actually the first engines installed in the B.1. These had high thrust, which would have enabled the B.1 to carry more ordnance; but introduced a wingtip flutter, which would have required a further redesign of the wings. The first B.2 had Olympus 200 engines, which were improved Olympus 6s. The Olympus 200, like the Olympus 6, had 16,000 pounds thrust each. These were quickly replaced with Olympus 201s, which allowed the B.2 to carry a heavier fuel load and ordnance load. Later, the Olympus 201s were upgraded to 202s, which had the same thrust, but increased reliability by including a rapid air starter and a redesigned oil separator breathing system. The B.2 also featured a larger wing, an improved electrical system, improved ECM/ECCM, and a tail-warning radar with a 60-degree sweep to either side. The B.2 retained the later versions of the B.1’s narrower air inlets, though the actual intake was deepened. The B.2s could accommodate one or two additional fuel tanks in its bomb bay, something that became useful in later tanker variants of the B.2. Radar updates included general updates to range, discrimination, and miniaturization of components, as well as the addition for TFR, should the B.2 be used for low-level “skiing.” In the late 1970s, the B.2 was also updated with the ability to carry smart bombs in the weapons bay (though smart missiles still had to be carried on the hardpoints).

Later B.2s were equipped with Olympus 301 engines which could develop 30,000 pounds thrust each, but in normal practice were derated to 18,500 pounds thrust to conserve fuel and wear on the engines. These engines were uprated back to 30,000 pounds thrust for Operation Black Buck, the Vulcan strikes on the Falklands. (See Below.) The B.2 (and the K.2) were equipped with an early fly-by-wire system; the electronics did not have the full control as on modern fly-by-wire aircraft, but the Vulcan was difficult to control if the electronic system went out.

In the early 1970s, the B.2s got a general airframe strengthening to make them strong enough for long low-altitude flights, as they were to be used in the low-level penetration role. The Vulcans did do their low-level work successfully, but because of the size and design of the Vulcan, speed was severely hampered at low altitude. At typical altitudes where the aircraft’s TFR would be used, speed was often reduced to as little as 560 kilometers per hour. Fighters in exercises often found them easy pickings; however a new paint scheme that Vulcans started to deploy proved quite effective at low level. After this, the Vulcan Pilots got very adept at slipping past fighter screens.

The B.2 was from the beginning designed to carry two American-made Skybolt nuclear-tipped standoff missiles; they were also still able to carry conventional or free-fall nuclear bombs in its bomb bay. The Skybolts were too big to fit in the Vulcan’s bomb bay, and they were carried on two hardpoints under the air inlets. Unfortunately, late in development, the Skybolt was cancelled by the US DoD, and the British had to scramble to find a replacement. British designers worked overtime and produced the Blue Steel, a weapon which actually lighter and carried a higher-yield 1.1-megaton warhead. (Conventional-warhead Blue Steels were not produced and in fact never designed.) These hardpoints became important during Operation Black Buck.

Vulcan B.3

The B.3 was a projected enhanced version of the B.2, upon which development would have been started in 1960. The wing would have been massively larger, and six hardpoints would have been available for use with Blue Steel missiles or other missiles with conventional or nuclear warheads. Fuel capacity would be increased, including bag-type tanks in a dorsal spine and larger wing tanks. The landing gear would have been strengthened to support the increased weight. The engines would have been Olympus 23s with a power rating of 23,500 pounds thrust each. The fuselage would have been 3.28 meters longer, allowing a larger crew compartment to be installed, including a reclining seat for a relief pilot, an additional weapons system/defensive systems operator, and a folding passenger seat if needed. The Vulcan B.3’s job would have been that of a patrol/armed reconnaissance aircraft, particular for maritime patrols; it would range the battlefield or ocean at medium altitude (above most of the light or medium land or shipborne SAMs of the time). The B.3 would also have benefitted from the rapid increase in electronic advancements, included better ECM/ECCM, IRCM, additional packet flares and chaff, and a larger corridor chaff pod. The larger wings would have allowed for additional fuel in the wings. The larger wings would have also allowed for six missiles on wing hardpoints, and though they were initially designed for Blue Steel nuclear missiles, they could also carry two ALCM or four SRAMs on each hardpoint or a variety of conventional PGM or ARM (depending on the size of the weapon, up to six munitions could be carried on each hardpoint). The B.3 never got out of the development stage before it was cancelled.

Vulcan B.3s would have a modified fighter radar and could also carry AAM on its hardpoints, up to three per hardpoint (at this time in history, the AAMs would be Sidewinders, Sparrows, Red Tops, Skyflashes, or other NATO missiles of similar function and time frame).

An interesting variant of the B.3 would have carried three Gnat fighters on modified hardpoints under the wings and fuselage. They modified hardpoints were not designed to allow the Gnats to return to the Vulcan, and they would have refueled from tankers and returned to base or the battle area after completing their initial nuclear-delivery mission. (This version is not statted here.) Another interesting variant would have had the B.3 with hardpoints filled with ARMs and essentially acting as a large, long-ranged Wild Weasel.

Vulcan K.2

The K.2 was a tanker based on a converted B.2, also known as a B(K).2 or B.K2 or B.2(K). Though there a couple of conversions which were done before the Falklands War, the War and the decision to use Vulcan B.2s suddenly emphasized the need for tankers, both to support the bombers for Operation Black Buck and aircraft at home. More conversions were than done at warp speed, and eventually six such conversions were done. (As it was, however, Victor tankers were used for the Black Buck missions.) The Vulcans were fitted with three drum-type tanks in the bomb bay containing 15005 liters each, and a Mk 17 HDU (Hose Drum Unit) in the tail, in the space where part of the ECM/ECCM was installed. The tail warning radar also had to be deleted. The K.2 had large white rectangles on the bottom of the fuselage, with narrow red stripes on the white ones along the center of the fuselage, to better allow refueling aircraft to line up with K.2; in addition, the tail cone had three bright lights on each side of the HDU. The K.2's HDU was capable or transferring fuel at the rate of 1900 or 4000 liters per minutes, depending upon the capabilities or needs of the receiving aircraft.

The K.2 did not enjoy a long service life with the RAF, as the Vulcan was being retired due to airframe age and the HDUs used were essentially what Avro had laying around and were no longer manufactured. Not even parts were being manufactured and when an HDU needed a part to replace something broken, the unit machine shop had to make a new one. There was a push to replace the ad hoc HDUs with new Mk 17 HDUs, but these were allocated to the VC-10 tanker program and none were allocated for Vulcan use. As the number of VC-10 tankers increased, tankers based on the Vulcan (and the other V-Bombers) were no longer needed. The K.2.used the same Olympus 301 engines as the B.2, but they were derated to 18,500 pounds thrust.

The K.2s were the last Vulcans to fly operationally, and this squadron was retired in March 1984.

Vulcan B.2 (MRR)

Nine Vulcan B.2s were converted for Maritime Radar Reconnaissance (MRR). (These were also known as the SR.2, for Strategic Reconnaissance, as they were often used in this role.) Some electronics that were not needed, were removed or replaced by other equipment, while other equipment was added in. The MRR was equipped with a sonobuoy dropper and more powerful radar set; in particular, the bombing radar was improved, as it faced down. A separate look-down radar set was installed, as well as SLAR and an steerable IR sensor under the nose. A MAD boom was fitted internally in the tailcone. They were also fitted with additional navigation gear and avionics appropriate to their role. The engines were the same as those on the B.2, though they were derated to 18,500 pounds thrust to conserve fuel and allow longer missions, Hardpoints were typically used for antishipping missiles (the MRR had four hardpoints under the intakes), Under each wing near the outside were mounted air sampling units, used for the MRR's secondary role as an air sampling aircraft. The MRR normally operated at high altitude, but would occasionally go to low altitude for closer inspection of shipping. The MRR had small sampling pods under each wing, both to detect and measure exhaust from ships and their supporting aircraft and to detect and sample nuclear explosions if necessary.

Operation Black Buck

Operation Black Buck was the operational name given to the Vulcan operations during the Falklands War. (I have seen in one source the Vulcans modified for Black Buck being designated "B.2 BB," but I doubt this is an official designation as it appears only in this one source.) The Vulcans staged from Ascension Island, as this island had the closet runway and base to the Falklands that could handle the Vulcans and their supporting tankers. Ascension was still 6900 kilometers from Britain and 6100 kilometers from the Falklands. Black Buck was basically what would later be called by President George W Bush as a "shock and awe" campaign; there were actually no strategic or tactical targets in the Falklands or on South Georgia Island would make Vulcan bombardment necessary, and though Brazil gave permission for the Vulcans to stage out of the airport at Rio de Janeiro, Margaret Thatcher didn't want to take the chance of widening the conflict to a general South American War. The Wideawake base on Ascension Island was actually a USAF base; the fact that the British aircraft were staging from an American base was not acknowledged until it appeared in the press several months later.

The long ranges made the Vulcan bombers completely dependent on the 23 Victor K.2 tankers available to the RAF (the Vulcan

K.2 not being modified from the B.2 at that point). Nine tankers were required to get one Vulcan to the Falklands, plus one alternate Vulcan, which would also carry our an alternate bombing mission if it did not need to take over for a defective Vulcan. Each tanker would refuel the Vulcans once, then turn back to Ascension Island. Next, another Victor would refuel the Vulcans and then be refueled by another Victor, and then go back to Ascension Island. And this would continue until the Victors used all their refueling fuel and had turned back to Ascension Island. If a Vulcan had to turn back, this aircraft would still have to refueled so it could make it back to Ascension Island. As the tankers arrived back at Ascension Island, they were refueled and their fuel tanks for refueling were replenished, and then they immediately took off to support the Vulcans as they returned from the Falklands. For the flight from the UK to Acension, unknown to the world until about two years after the Falklands War, the Vulcans and Victor tankers were actually refueled by American KC-135s staging out of the Canary Islands, and using British call-signs.

As stated above, the Vulcans' Olympus 301 engines, normally derated to 18,500 pounds thrust, were restored to 30,000 pounds thrust, allowing the Vulcan to carry a greater fuel load (drum-type tanks took up part of the bomb bay), and still carry a respectable load of 450-kilogram bombs, and keep up a decent speed on the run in to their targets. The Vulcans carried a reduced bomb load of 21 bombs for these missions.

Before the actual bombing runs, a Victor reconnaissance variant took a run over South Georgia Island and the Falklands, both in support of Operation Black Buck and on behalf of an SAS group which to recapture South Georgia Island. (Operation Paraquet is an interesting story in itself.) This Victor recon variant itself took a large amount of tanker support. A dangerous daylight photoreconnaissance run at high speed was also undertaken by a pair of Sea Harriers prior to the Black Buck strikes. Another such run was undertaken after each Vulcan strike. These Sea Harrier runs caused controversy in the Task Force as the Vulcan strikes were to conduct strikes that the Sea Harriers couldn't do much damage to or would be highly dangerous to the Sea Harriers.

The Vulcans' initial jobs, Black Buck 1-3, was to crater the runway at Port Stanley, which was being used by Argentine aircraft. It was also expected that parked aircraft near the runway and support facilities and antiaircraft guns and missiles near the runway might also be damaged or put out of commission. To minimize the utility of those AAA guns and SAMs, the Vulcans would bomb at night, preferably in bad weather, from low level (about 150-300 meters).

The Black Buck Vulcans were modified by the addition of a Carousel INS navigation system, additional ECM/IRCM pods carried on improvised underwing pylons, advanced IFF, and additional flare dischargers. In addition, the Black Buck 4-6 aircraft had modifications to its hardpoints, and additional avionics at the WSOs and pilot's position to allow the Vulcans to use the Shrike ARMs.

Black Buck 4,5, and 6 had two Vulcans carrying Shrike ARMs on the under-air-intake pylons. At the time, the British standard ARM was the Martel, which was long known to be inaccurate and inadequate for the Black Buck missions, which was to destroy the radar, SAM sites, and radar-directed AAA, which were still a problem at Port Stanley. The US gave the Shrikes, plus some spares, to the British "under the table", and this was not revealed until one of the Black Buck 6 bombers had a fuel-feed problem and got permission to divert their landing to Rio de Janeiro. The crew and aircraft were held for nine days, during which the fuel feed problem was fixed, but also Brazilian technicians gave the Vulcan a good examination – especially the one Shrike missile the Vulcan landed with, which was not expended in the strike on Port Stanley.

Black Buck 7's job was essentially in support of ground forces; the Vulcans bombed any remaining intact aircraft as well as the Argentine garrison.

Twilight 2000 Notes: Vulcans, including at least three B.1s, served in the RAF during the Twilight War. They were used mostly for conventional bombing, but did on occasion deliver tactical nuclear weapons, and were known for using what became known as the "one-two-melt" – the delivery of two tactical nukes to one target with less than a second between dropping them (usually the bombs were slowed by small parachutes to allow the Vulcans to gain distance from the nuclear explosions).

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
B.1 (Olympus 101 Engines)	$135,537,599	JP-A	32.55 tons	77.11 tons	5+2	48	Radar (300 km), Weather Radar (500 km), Bombing Radar (200 km), Tail Radar (100 km)	Shielded
B.1 (Olympus 102 Engines)	$145,536,128	JP-A	35.39 tons	77.11 tons	5+2	48	Radar (300 km), Weather Radar (500 km), Bombing Radar (200 km), Tail Radar (100 km)	Shielded
B.1A	$145,860,400	JP-A	37.26 tons	77.27 tons	5+2	48	Radar (300 km), Weather Radar (500 km), Bombing Radar (200 km), Tail Radar (100 km)	Shielded
B.2 (Early)	$191,301,330	JP-4	40.28 tons	78.22 tons	5+2	50	Radar (400 km), Weather Radar (600 km), Bombing Radar (300 km), Tail Radar (150 km)	Shielded
B.2 (Mid)	$196,609,035	JP-4	40.48 tons	77.79 tons	5+2	52	Radar (400 km), Weather Radar (600 km), Bombing Radar (300 km), Tail Radar (150 km)	Shielded
B.2 (Late)	$232,950,071	JP-4	41.19 tons	79.73 tons	5+1	54	Radar (400 km), Weather Radar (600 km), Bombing Radar (300 km), Tail Radar (150 km), TFR (40 km)	Shielded

B.2 (Black Buck)	$239,202,479	JP-4	51.83 tons	80.8 tons	5	56	Radar (400 km), Weather Radar (600 km), Bombing Radar (300 km), Tail Radar (150 km), TFR (40 km)	Shielded
B.3	$410,614,936	JP-4	46.03 tons	81.77 tons	5+1	58	Radar (400 km), Weather Radar (600 km), Bombing Radar (300 km), Tail Radar (150 km), TFR (40 km), SLAR (150 km), VAS (40 km)	Shielded
K.2	$233,285,450	JP-4	390 kg	82.39 tons	5+1	58	Radar (400 km), Weather Radar (600 km)	Shielded
B.2 (MRR)	$255,919,221	JP-4	1.2 tons	80.53 tons	5+1	58	Radar (400 km), Weather Radar (600 km), Tail Radar (150 km), SLAR (150 km), IRST (40 km), VAS (50 km)	Shielded

Vehicle	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap*	Fuel Cons	Ceiling	Armor
B.1 (Olympus 101 Engines)	1492	414 (94)	NA 18 4/3 40/30	42200	2727	17000	FF8 CF7 RF6 T5 W6
B.1 (Olympus 102 Engines)	1625	451 (87)	NA 20 4/3 40/30	42200	4066	17000	FF8 CF7 RF6 T5 W6
B.1A	1820	506 (87)	NA 22 4/3 40/30	42200	4574	17000	FF8 CF7 RF6 T5 W6
B.2 (Early)	2126	591 (87)	NA 27 4/3 40/30	44500	5421	18830	FF8 CF7 RF6 T5 W6
B.2 (Mid)	2138	594 (87)	NA 27 4/3 40/30	44500	5421	18830	FF8 CF7 RF6 T5 W6
B.2 (Late)	2601	722 (87)	NA 33 4/3 40/30	44500	6777	18830	FF8 CF7 RF6 T5 W6
B.2 (Black Buck)	3835	1065 (87)	NA 49 4/3 40/30	54500	10166	18830	FF8 CF7 RF6 T5 W6
B.3	2975	827 (82)	NA 38 4/3 40/30	54570	7964	18900	FF8 CF7 RF6 T5 W7
K.2	2331	648 (87)	NA 30 4/3 40/30	44500 + 45015	6269	18830	FF8 CF7 RF6 T5 W6
B.2 (MRR)	2575	715 (77)	NA 33 4/3 40/30	44500	6777	18830	FF8 CF7 RF6 T5 W6

Vehicle	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
B.1	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, LABS, Flare and Chaff Dispensers (60 Flares, 60 Chaff), Stealth 1	1900/1500m Hardened Runway	+1	Internal Weapons Bay, 2 Semi-Recessed Hardpoints	Normal Load 21x450 kg Gravity Bombs or two Blue Danube Nuclear Bombs or two Mk 5 Nuclear Bombs or four Red Beard Nuclear Bombs, two Blue Steel Nuclear SRAM Missiles on Hardpoints; Other

					Loadouts Possible
B.1A	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Inertial Navigation, Gyrocompass, Barometric Altimeter, LORAN-C, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, LABS, Flare and Chaff Dispensers (70 Flares, 70 Chaff), Stealth 1	1900/1500m Hardened Runway	+2	Internal Weapons Bay, 2 Semi-Recessed Hardpoints	Normal Load 21x450 kg Gravity Bombs or two Blue Danube Nuclear Bombs or two Mk 5 Nuclear Bombs or four Red Beard Nuclear Bombs, two Blue Steel Nuclear SRAM Missiles on Hardpoints; Other Loadouts Possible
B.2 (Early)	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Inertial Navigation, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, Flare and Chaff Dispensers (70 Flares, 70 Chaff), Stealth 1	1900/1500m Hardened Runway	+2	Internal Weapons Bay, 2 Semi-Recessed Hardpoints	Normal Load 32x450 kg Gravity Bombs or four Red Beard Nuclear Bombs, or one Yellow Sun Thermonuclear Bombs or six x WE.177B Retarded Nuclear Bombs, two Blue Steel Nuclear SRAM Missiles on Hardpoints; Other Loadouts Possible
B.2 (Mid)	IFF, RWR, Secure Radios (One 1000 km, One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Inertial Navigation, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 3, ECCM 3, Flare and Chaff Dispensers (80 Flares, 80 Chaff), Stealth 1, Laser Designator (20 km)	1900/1500m Hardened Runway	+2	Internal Weapons Bay, 2 Semi-Recessed Hardpoints	Normal Load 32x450 kg Gravity Bombs or LGBs, or four Red Beard Nuclear Bombs, or one Yellow Sun 2 Thermonuclear Bombs or six x WE.177B Retarded Nuclear Bombs, two Blue Steel Nuclear SRAM Missiles or PGM on Hardpoints;

					Other Loadouts Possible
B.2 (Late)	IFF, RWR, Secure Radios (One 1000 km, One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Inertial Navigation, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 3, ECCM 3, IRCM 1, Flare and Chaff Dispensers (80 Flares, 80 Chaff), Corridor Chaff Pod (100), Stealth 1, Laser Designator (30 km)	1900/1500m Hardened Runway	+3	Internal Weapons Bay, 2 Semi-Recessed Hardpoints	Normal Load 32x450 kg Gravity Bombs or LGBs, or four Red Beard Nuclear Bombs, or one Yellow Sun 2 Thermonuclear Bombs or six x WE.177B Retarded Nuclear Bombs, two Blue Steel Nuclear SRAM Missiles or PGM on Hardpoints; Other Loadouts Possible
B.2 (Black Buck)	Advanced IFF, RWR, RDF, Radar Direction Finder, Secure Radios (One 1000 km, One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Inertial Navigation, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 3, ECCM 3, IRCM 2, Flare and Chaff Dispensers (90 Flares, 90 Chaff), Corridor Chaff Pod (250), Stealth 1, Laser Designator (35 km)	1900/1500m Hardened Runway	+3	Internal Weapons Bay, 2 Semi-Recessed Hardpoints	21x450 kg Gravity Bombs (LGBs Possible, But Not Carried During Black Buck), 4x Shrike ARMs on Double Mounts on two Hardpoints (Only Used On Black Buck 4, 5, and 6 Missions). Other Loadouts Possible (But Not Used); Nuclear Weapons carry Possible (Again, Not Used During Black Buck); 10,000-Liter Fuel Tank carried in Bomb Bay
B.3	Advanced IFF, RWR, RDF, Radar Direction Finder, Secure Radios (One 1000 km, One 700 km, Two 300 km, One AM), Digital Computerized Bombsight, Transponder, Inertial Navigation, Gyrocompass, Barometric Altimeter, LORAN, TACAN, Radar	1900/1500m Hardened Runway	+3	Internal Weapons Bay, 6 Heavy Hardpoints Under Wings	Normal Load 32x450 kg Gravity Bombs or LGBs, or four Red Beard Nuclear

	Beam Riding, Radio Beacon Detection, ILS, ECM 3, ECCM 4, IRCM 2, Flare and Chaff Dispensers (100 Flares, 100 Chaff), Corridor Chaff Pod (250), Chaff Rockets (4) Stealth 1, Laser Designator (40 km), Multitarget (4)				Bombs, or six x WE.177B Retarded Nuclear Bombs, Blue Steel, Nuclear SRAM Missiles or ALCM or PGM or AAM on Hardpoints; Other Loadouts Possible
K.2	IFF, RWR, Secure Radios (One 1000 km, One 700 km, Two 300 km, One AM), Transponder, Inertial Navigation, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 1, ECCM 1, Flare and Chaff Dispensers (60 Flares, 60 Chaff), Stealth 1	1900/1500m Hardened Runway	Nil	3x15005-Liter Fuel Tanks in Internal Weapons Bay	3x15005-Liter Drum Fuel Tanks. HDU Mk 17 Unit
B.2 (MRR)	Advanced IFF, RWR, Secure Radios (One 1000 km, One 700 km, Two 300 km, One AM), Transponder, Inertial Navigation, Gyrocompass, Barometric Altimeter, LORAN-C, Radar Beam Riding, Radio Beacon Detection, RDF, Radar Direction Finder, ILS, ECM 2, ECCM 2, IRCM 1, MAD Array, Sonobuoys (50), F.95 Film Day/Night Camera, Flare and Chaff Dispensers (80 Flares, 80 Chaff), Laser Designator (40 km) Stealth 1	1900/1500m Hardened Runway	+3	Internal Weapons Bay, 4 Hardpoints, 2 Atmospheric Sensing Pods	Normal Load 21x450 kg Gravity Bombs or LGBs, Nuclear Weapons Carry Possible, SRAM or PGM on Hardpoints; Other Loadouts Possible

*Vulcan Bombers could carry up to three 10,000-liter drums of extra fuel in their bomb bays, and still carry a reduced load of bombs. (The Black Buck loadout included one of these drums.) The K.2, of course, cannot carry these drums, as their bomb bays are filled with much larger drums for refueling other aircraft. The B.2 MRR typically carried a full complement of three of these drums.

English Electric Canberra

Notes: The initial requirement for what became the Canberra was issued in 1944 for an aircraft to replace bomber versions of the Mosquito. The Air Ministry called for a medium bomber which had an ability to bomb from high altitude with a good level of accuracy. The RAF received the first Canberra in 1951. The RAF, at the Canberra's peak, had 900 Canberras; Australia also used 49 Canberras, and 403 modified forms designated B-57 Canberra were used by the US (and built by Martin in the US); other users include the Royal New Zealand Air Force and Indian Air Force. Later users of the Canberra include Argentina, Chile, Ecuador, Ethiopia, France, Pakistan, Rhodesia (current fate unknown), South Africa, Sweden, West Germany, Venezuela, and Peru. The Canberra has sometimes been described as appearing to look like a scaled-up Gloster Meteor.

English Electric deemed that the needed performance could be attained without the use of swept wings or tail. The basic design presented to the Air Ministry, had numerous problems and several redesigns had to be carried out before the Air Ministry would accept the Canberra. In addition, the Air Ministry seemed to have a great deal of difficulty deciding what featured they wanted in the future Canberra, also leading to several redesigns and tweaks. Some of these were the use of uprated Avon RA 3 engines instead of the lower-rated Nene engines; the Canberra's distinctive wingtip teardrop-shaped extra fuel tanks were added. Early fight testing revealed instances of buffeting in the rudder and elevator; after these were corrected, pilots remarked that the Canberra handled more like a fighter than a bomber.

The Martin B-57 Canberra will be covered in US Bombers.

RAF Canberras

The first production version, the Canberra B.2, had 132 orders from the Air Ministry, in bomber, reconnaissance, and training variants. As the advanced H2S Mk9 bombing radar meant for the B.2 was not ready for production when the B.2 was built, the B.2. had a glazed nose for a bombardier using an advanced version of the US Norden bombsight. When the Korean War broke out, the demand for B.2s increased, with 196 more produced by English Electric, 75 by Avro and Handley Page, and 60 by Shorts. The numbers of B.2s produced was greater than any other Canberra variant. Many of these were stationed in Europe (largely Germany), though many were also sent to the far east, based in Japan.

The B.2 used Rolls-Royce Avon RA 3 engines, one on each wing, developing 6500 pounds of thrust each. Each engine further drove a 6kW generator to power electrical avionics, as the engines did not provide enough power to electronics. At the rear were the two main fuel tanks; a further flexible-bag lace-supported fuel call was mounted in the forward fuselage, it's flexible shape allowing it to fit around the bomb bay and avionics. The B.2 had ejection seats for the pilot and navigator, but the bombardier up front in the glazed nose had to release a hatchway under him, allowing him to fall free from the aircraft, along with his seat, which then separated normally. The two bomb bays could carry a total of 4.5 tons, and in the B.2, this was limited to free-fall bombs. Underwing pylons could carry an additional 900 kilograms. Due to the limits of its range, and its inability to carry the nuclear bombs of the time, the B.2 Canberra was generally relegated to the role of tactical comber. The PR.3 photo-reconnaissance version of the B.2 was modified by the addition of a 36-centimeter fuselage plug, forward of the wing and behind of the cockpit, to house seven types of cameras. In addition, an additional fuel tank was mounted in the bomb bay to allow prolonged dash speeds. The PR.3 can carry stores on wing hardpoints, normally for ECM pods, though it is capable of armed reconnaissance. The Canberra T.4 trainer version of the B.2 differed primarily in being equipped with dual controls and duplication of flight instruments on both side of the cockpit, rather than having all of the navigation equipment.

The B.5 served as the prototype for the B.6, which differed primarily in having a solid nose along with the addition H2S Mk9 radar bombing equipment.; the bombardier remained at his station in the nose. The B.6 moved the main fuel tanks to the wings. A slight, 0.3-meter fuselage stretch, mainly in the forward bomb bay, gave the B.6 the ability to carry the more modern weapons available in its day (about 1953), along with the ability to carry one of smaller nuclear weapons also available at the time. The engines were replaced by Rolls-Royce Avon RA 7 engines, which had a thrust of 7490 pounds each. Some 106 were built for the RAF by English Electric, and Shorts and Harland both built 49 for the RAF. English Electric also built 12 for its first export customers.

The B.15 was an upgraded B.6, designed for low-level tactical strikes. The avionics were modernized and fittings for two cameras were also carried, though the cameras were rarely carried on operational missions. The B.15 was also equipped with LABS. The B.15 could use the AS.30 ASM, carried on wing pylons, though to the size of the AS.30's fins, only one hardpoint could be used when the Canberra was carrying AS.30s. The B.16 was a further upgraded B.15, different primarily in having slightly uprated engines, with 7510 pounds thrust; they were also easier to maintain.

An interdictor version of the B.6, designated the B(I).6, marked the beginning of the transition of the Canberra in the RAF to a more tactical, ground support role. In the B(I).6, the rear bomb bay was taken up with a pack of four HS-404 20mm autocannons. The front bomb bay could also be fitted out with a rotary launcher for 36 50mm Matra SNEB unguided rockets, which could be fired singly or in sets of three, six, 10, 20, or the full 36. The B(I).8 is a further modification of the B(I).6, with the forward fuselage redone to replace the side-by-side seating with a tandem arrangement, the canopy was also offset somewhat to the left. This also allowed the addition of new avionics (and also some which were replaced by more modern, somewhat miniaturized components. The B(I).6 and B(i).8 were still able to conduct the nuclear strike role using its forward bomb bay. In both cases, underwing weapons carriage was increased, with the B(I).6 and B(I).8 primarily having underwing pylons for rockets and bombs. Both had underwing carriage for 1.2 tons of stores. The B(I).8 operated primarily as a long-range interdictor, ranging far behind enemy lines, due to the larger fuel load it carried. Due to their ground support roles, the B(I).6 and B(I).8 were fitted with the LABS (Low-Altitude Bombing System) to increase accuracy of bombing or rocketing as altitudes of 500 meters or less. The LABS could also be used in conjunction with nuclear weapon delivery. The B(I).6 and B(I).8 also had a secondary role as interceptors, and for this role were equipped with air intercept radar, and could carry radar-homing missiles and heat-seeking missiles on their wing pylons. The B)I).8 also had the uprated engines of the B.16.

The B.6(RC), was a very different animal than the B.6. It was a specialist ELINT and EW version, with an enlarged nose for a more powerful forward-looking radar and a SLAR. The bomb bays were primarily filled with its ELINT gear, recorders for the ELINT gear, radar and radio direction finders, and large amounts of ECM gear; they also carried two specialist crewmembers to operate the ELINT/EW suite. The B.6(RC) was part reconnaissance aircraft and part electronic warfare aircraft. Only four were built and went into operation.

The PR.7 variant of the B.6 was another photoreconnaissance variant. The PR.7 had restored its rear fuselage tanks, as well as having the mid-aircraft flexible bag storage and the new wing tanks. It used the more powerful RA 7 engines of the B (I).8 and antilock brakes.

The PR.9 was a greatly-modified version of the PR.7, with the fuselage stretched by 27.72 meters, wingspan was increased by 1.22 meters to improve high-altitude operations, and Rolls-Royce Avon RA 27 engines, which put out 10,030 pounds thrust each. New types of cameras were installed, as well as a primitive form of SAR and look-down radar.

As late as 1957, Canberras stationed overseas (other than Europe) had not yet been modified to deliver nuclear ordnance.

The Canberra U.10 (later redesignated D.10) were B.2s converted to maneuvering target drones. 18 conversions were made. The U.14 (later D.14 were six B.2s converted for the same role for the Royal Navy. These versions will not be otherwise covered here.

T.17s were B.6(RC)s designed for training ELINT/EW crews. An additional seat was added for an instructor. Despite their training role, they are able to function as normal EW/ELINT aircraft, though they have updated components. Unlike most Canberra trainers, the PR.9s do not have dual controls, the crewmembers being trained were the EW/ELINT crewmen. The T.17 were T.19s converted back into conventional training aircraft.

Most T.x Canberras are training aircraft, and have dual controls. They do have functioning weapon bays and have hardpoints typical for Canberras of their time period, to allow the trainees to practice bombing and rocketing.

Four B.2s were sold to the US; these were used to develop the Martin B-57 Canberra, and Martin received a license to build further B-57s in the US. However, not all B-57s were built by Martin.

RAAF Canberras

After World War 2, the Royal Australian Air Force initiated Plan D, which called for a massive reorganization of the Air Force, including the replacement of propeller-driven aircraft by jets. The acquisition of the Canberra was one of the first jets acquired; the first Canberras they got were based on the B.2, (designated B.20) followed soon thereafter by the B.5 (designated the B.50). All of the Australian Canberras (48 in total) were built under license in Australia at the Government Aircraft Factories (GAF). One of the features the Australians requested was the capability for nuclear delivery, though the Australian Canberras never carried nuclear weapons and the Australians kept no nuclear weapons on their soil. Australian B.20s had additional fuel tanks in their wings, while B.50s retained their two rear fuel tanks. Australian Canberra B.2s and B.5s had a single BDAR film camera to the rear of their rear weapons bay.

Australian Canberras saw much combat use, including during the Malaysian Emergency (along with RZNAF and RAF Canberras), and in South Vietnam during the Vietnam War, where they deployed eight Canberras for the ground support role. While their USAF counterparts were usually armed with a pack of M3 .50-caliber or 20mm autocannons, Australian Canberras were not so equipped and were strictly low-level bombers or rocketing aircraft. In addition, Australian Canberras have been modified with the addition of an autopilot and enhanced navigation equipment, including allowing the use of radar beam navigation, TACAN, and the ability to home on a friendly radio or radar beam. They also had updated navigation equipment and bombing equipment, including bombing radar and the H2S Mk9 equipment. Australian Canberras assigned to Vietnam (or for that matter, US B-57s) could not drop napalm canisters from their weapons bays, but could carry them on their hardpoints.

As early as 1954, it was recognized that the Canberra was becoming obsolete. In particular, the Canberra did not have the range for targets in Indonesia, and it was judged that the Canberra would not fare well even against relatively aged aircraft like the MiG-17, Australia evaluated the (cancelled) BAC TSR.2, Dassault Mirage IV, F-4 Phantom II, and A-5 Vigilante, and even looked at the Vulcan and Victor, before settling on a modified version of the F-111C..Despite the procurement of the F-111, the Canberra remained in service until 1982. (Supposedly, if the RAAF had its way, it would have gone with the TSR.2, but the British seemed intent on cancelling the project.)

The Australians used a small number of PR.7 (designated PR.17s)., The PR.7s saw extensive use in the Malaysian Emergency and over Indonesia, due to its increased range.

RZNAF Canberras

New Zealander Canberras are B(i).8s modified by the addition of an autopilot and enhanced navigation including updated to allow radar beam navigation, TACAN, and the ability to home on a friendly radio or radar beam.

Indian Air Force Canberras

In 1972, the US sold the Indians a small number of Standard ARMs, later followed by Shrike ARMs. The sale also included an unknown number of the then-new Paveway I laser-guided bombs, along with laser designators. This undisclosed sale included avionics for use of the missiles and ECM pods; it was not publicly acknowledged until the Indians retired their Canberras in 2007. The Indians used B(I).5s (modified to B(I).6 standards), which were designated B(I).58s, and they bought 54 of them; six were modified for Wild Weasel duty, but used the same designation, The Wild Weasels were further modified with chaff and flare dispensers In Wild Weasels, the bombardier also functions as the EW officer, and has a downlinked TV viewer to spot the targets. He also operates the EW gear and the ARMs. The Indians also bought eight PR-57 photo reconnaissance versions, and six T.4 training variants. Indian Air Force Canberras had autopilots and updated navigation gear, as per the RAAF Canberras above.

South African Canberras

South African Canberras were B(I).8s, and were mostly used for armed reconnaissance.. with the gun pack and rocket pack in the weapons bays and rockets on the wing hardpoints., They were also modified with enhanced navigation gear and had an autopilot. Radios had an encryption/decryption system (essentially a more clumsy system of secure radios). Essentially, with different makes of avionics, they are the same as RZNAF Canberras.

Swedish Canberras

The Swedish bought two B.2s in 1960, and then had them modified to T.11 trainers. However, this was a ruse; in Sweden, the two Canberras were re-modified into EW/ELINT versions, similar to the B.6(RC), though with a more advanced ELINT suite. They were officially designated as would be a training aircraft, with the designation of Tp.52, and referred to as “testing” aircraft. These aircraft were used primarily to eavesdrop on Soviet, Polish, and East German radio and radar emissions. The modifications were not admitted to for ten years.

Twilight 2000 v1/v2/v2,2s: The Canberra was primarily used in the Twilight War by Britain for reconnaissance, though it was sometimes used for attack, and other countries also used it for bombing.

Twilight 2013: Few flying examples exist; most of these are employed In research (such as by NASA and the USGS).

Merc 2000:Some Merc organizations looking for a non-descript bomber or jump aircraft (the paratroopers being carried in the weapons bays) employ Canberras

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
B.2	$7,135,859	JP-A	5.44 tons	20.86 tons	3	41	None	Enclosed
PR.3	$15,285,386	JP-A	900 kg	21.26 tons	3	49	Cameras (7)	Enclosed

B.6	$9,844,437	JP-A	6.06 tons	20.86 tons	3	41	Radar (100 km), Radar Bombing (60 km)	Enclosed
B(I).6	$17,259,665	JP-A	1.2 tons	21.38 tons	3	43	Radar (100 km), Radar Bombing (60 km)	Enclosed
B(I).8	$17,333,201	JP-A	1.2 tons	22.45 tons	3	44	Radar (100 km), Radar Bombing (60 km)	Enclosed
B.15	$11,024,374	JP-A	6.06 tons	20.96 tons	3	42	Radar (120 km), Radar Bombing (70 km)	Enclosed
B.16	$11,024,928	JP-A	6.08 tons	20.96 tons	3	42	Radar (120 km), Radar Bombing (70 km)	Enclosed
B.5(RC)	$20,628,875	JP-A	1.2 tons	24.7 tons	5	51	Radar (150 km), SLAR (150 km)	Enclosed
PR.7	$25,459,710	JP-A	1.2 tons	27.33 tons	3	52	Radar (150 km), SLAR (150 km)	Enclosed
PR.9	$43,026,595	JP-A	1.2 tons	28.7 tons	3	55	Radar (165 km), SLAR (165 km), Passive IR (35 km)	Enclosed
T.17	$31,769,147	JP-A	1.2 tons	24.9 tons	6	56	Radar (165 km), SLAR (165 km), Passive IR (35 km)	Enclosed
B.20	$8,288,111	JP-A	5.44 tons	21.06 tons	3	42	Bombing Radar (60 km)	Enclosed
B.50	$10,351,937	JP-A	6.06 tons	21.06 tons	3	42	Radar (100 km), Radar Bombing (60 km)	Enclosed
B(I).58	$15,589,853	JP-A	6.06 tons	21.08 tons	3	43	Radar (100 km), Radar Bombing (60 km)	Enclosed
B(I).58 (Indian Wild Weasel)	$39,301,130	JP-A	4.86 tons	21.09 tons	3	52	Radar (165 km), SLAR (165 km), Passive IR (35 km)	Enclosed
Tp.52	$42,510,004	JP-A	1.2 tons	25 tons	5	53	Radar (165 km), SLAR (165 km), Passive IR (35 km)	Enclosed

Vehicle	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
B.2	1626	455 (87)	NA 19 6/4 60/40	10500	2642	15000	FF6 CF7 RF6 T5 W5
PR.3	1596	447 (87)	NA 19 6/4 60/40	15876	2642	18288	FF8 CF7 RF6 T5 W5
B.6	1869	524 (87)	NA 22 6/4 60/40	11500	3044	15000	FF8 CF7 RF6 T5 W5
B(I).6	1824	511 (87)	NA 22 6/4 60/40	11500	3044	15000	FF8 CF7 RF6 T5 W5
B(I).8	1742	488 (87)	NA 21 6/4 60/40	12570	3050	15000	FF8 CF7 RF6 T5 W5
B.15	1860	517 (87)	NA 22 6/4 60/40	11500	3044	15000	FF8 CF7 RF6 T5 W5
B.16	1864	518 (87)	NA 22 6/4 60/40	11500	3050	15000	FF8 CF7 RF6 T5 W5
B.5(RC)	1580	439 (87)	NA 19 6/4 60/40	11500	3044	15240	FF8 CF7 RF6 T5 W5
PR.7	1437	399 (87)	NA 17 6/4 60/40	18501	3050	15240	FF8 CF7 RF6 T5 W5
PR.9	1865	518 (77)	NA 22 5/4 50/40	19758	3050	17000	FF8 CF7 RF6 T5 W5
T.17	1574	437 (87)	NA 19 6/4 60/40	11500	3050	15240	FF8 CF7 RF6 T5 W5
B.20	1611	448 (87)	NA 19 6/4 60/40	11500	2642	15000	FF8 CF7 RF6 T5 W5
B.50	1852	514 (87)	NA 22 6/4 60/40	11500	3044	15000	FF8 CF7 RF6 T5 W5
B)I).58	1850	514 (87)	NA 22 6/4 60/40	11500	3044	15000	FF8 CF7 RF6 T5 W5
B(I).58	1849	514 (87)	NA 22 6/4 60/40	11500	3044	15000	FF8 CF7

(Indian Wild Weasel)							RF6 T5 W5
	1562	434 (87)	NA 19 6/4 60/40	11500	3044	15000	FF8 CF7 RF6 T5 W5
Tp.52	2568	435 (87)	NA 19 6/4 60/40	13500	3044	15500	FF8 CF7 RF6 T5 W5

Vehicle	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
B.2	IFF, Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Advanced Norden Bombsight, LORAN, Radar Beam Riding, Radio Beacon Detection	1020/805m Hardened Runway	+1	2xInternal Weapons Bay, 2 Hardpoints*	
PR.3	IFF, RWR, Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Cameras (Four Film Cameras, Three IR Cameras), Radio Beacon Detection (100 km), ECM 1	1020/805m Hardened Runway	Nil	2 Hardpoints*******	
B.6	IFF, RWR, Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Radar Bombsight, Cameras (Two Film Cameras), Radio Beacon Detection (100 km), LORAN	1020/805m Hardened Runway	+2	2xInternal Weapons Bay, 4 Hardpoints**	
B(I).6	IFF, RWR, Secure Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Radar Bombsight, Optic Gunsight, LABS, Cameras (Two Film Cameras), Radio Beacon Detection (100 km), LORAN, ECM 1	1020/805m Hardened Runway	+2	2xInternal Weapons Bay (One w/4x20mm Gun Pack, One with 36-round Matra Rocket Pod), 4 Hardpoints***	2880x20mm HS404, 36x50mm Matra Rockets.
B(I).8	IFF, RWR ,Secure Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Radar Bombsight, Optic Gunsight, LABS, Cameras (Two Film Cameras), Radio Beacon Detection (100 km), Radar Beam Riding Navigation, LORAN, ECM 1	1020/805m Hardened Runway	+2	2xInternal Weapons Bay (One w/4x20mm Gun Pack, One with 36-round Matra Rocket Pod), 4 Hardpoints***	2880x20mm HS404, 36x50mm Matra Rockets.
B.15	IFF, RWR, Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Radar Bombsight, Optic Gunsight, LABS, Cameras (Two Film Cameras), Radio Beacon Detection (100 km), Radar Beam Riding Navigation, LORAN, ECM 1, One Film Camera, One IR Camera	1020/805m Hardened Runway	+2	2 Weapon Bays, 4 Hardpoints****	
B.16	IFF, RWR, Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Radar Bombsight, Optic Gunsight, LABS, Cameras (Two Film Cameras), Radio Beacon Detection (100 km), Radar Beam Riding Navigation, LORAN, ECM 1, One Film Camera, One IR Camera	1020/805m Hardened Runway	+2	2 Weapon Bays, 4 Hardpoints*****	
B.5(RC)	IFF, RWR, Secure Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, RDF, Radar Direction Finder, Radio Beacon Detection (100 km), Radar Beam Riding Navigation, LORAN, ECM 2, ELINT 2, Two Film Cameras, Two IR Cameras	1020/805m Hardened Runway	+2	4 Hardpoints*****	
PR.7	IFF, RWR, Secure Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter,	1020/805m Hardened Runway	+2	4 Hardpoints*******	

PR.9	Cameras (Four Film Cameras, Three IR Cameras, One Radar Camera), Radio Beacon Detection Optic Gunsight, (100 km), ECM 2 IFF, RWR, Secure Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Cameras (Four Film Cameras, Two Panoramic Film Cameras, Two Panoramic IR Cameras, Primitive SAR (10 km), Three IR Cameras, Two Radar Cameras), Radio Beacon Detection, Optic Gunsight, (100 km), ECM 2	1020/805m Hardened Runway	+2	4 Hardpoints*******	
T.17	IFF, RWR, Secure Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, RDF, Radar Direction Finder, Radio Beacon Detection (100 km), Radar Beam Riding Navigation, LORAN, ECM 2, ELINT 2, Two Film Cameras, Two IR Cameras	1020/805m Hardened Runway	+2	4 Hardpoints*******	
B.20	IFF, Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Radar Bombsight, LORAN, TACAN, Radar Beam Riding, Radio Beacon Detection, Autopilot	1020/805m Hardened Runway	+2	2xInternal Weapons Bay, 2 Hardpoints*	
B.50	IFF, RWR, Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Radar Bombsight, LABS, Cameras (Two Film Cameras), Radio Beacon Detection (100 km), LORAN, TACAN, Autopilot	1020/805m Hardened Runway	+2	2xInternal Weapons Bay, 2 Hardpoints*	
B(I).58	IFF, RWR, Secure Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Radar Bombsight, Optic Gunsight, LABS, Cameras (Two Film Cameras), Radio Beacon Detection (100 km), LORAN, TACAN, ECM 1, Autopilot	1020/805m Hardened Runway	+2	2 Weapon Bays, 4 Hardpoints*****	
B(I).58 (Indian Wild Weasel)	IFF, RWR, Secure Radios (Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, Radar Bombsight, Optic Gunsight, LABS, Cameras (Two Film Cameras), Radio Beacon Detection (100 km), RDF, Radar Direction Finder, LORAN, TACAN, ECM 2, Flare Chaff (6/10), Laser Rangefinder/Designator, Autopilot	1020/805m Hardened Runway	+3	2 Weapon Bays, 4 Hardpoints*******	2 Standard ARMs or 4 Shrike ARMs
Tp.52	Advanced IFF, RWR, Secure Radios (Three 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, RDF, Radar Direction Finder, Radio Beacon Detection (100 km), Radar Beam Riding Navigation, LORAN, ECM 2, IRCM 1, ELINT 2, Two Film Cameras, Two IR Cameras, Flares/Chaff (6/6)	1020/805m Hardened Runway	+2	4 Hardpoints*****	

*Hardpoints may carry only 900 kilograms; weapons bays may carry then 4.54 tons if the hardpoints are filled.
**Hardpoints may carry 1200 kilograms; weapons bays may then carry 4.86 tons if the hardpoints are filled.
***Hardpoints may carry 1200 kilograms, If the forward weapons bay is not taken up with a rocket launcher, the bay may carry up to 3.03 tons of other ordnance.
****Though the B.15 can carry 1200 kg on its hardpoints; however, if it does so, the Canberra may carry only 4.86 tons in its weapon bays Though the B.15 has four hardpoints, the fins of the AS.30 are large enough that only two AS.30s may be carried.
*****Though the B.16 can carry 1200 kg on its hardpoints; however, if it does so, the Canberra may carry only 4.88 tons in its weapon bays Though the B.16 has four hardpoints, the fins of the AS.30 are large enough that only two AS.30s may be carried.
******The B.5(RC) can carry 1200 kg on its hardpoints

*******These aircraft can carry bombs and rockets on their hardpoints, and are capable of conducting armed reconnaissance. However, their hardpoints, when used, are normally taken up with ECM pods or chaff and flare pods. The PR.3 can carry 900 kg; the PR.7, PR.9, and T.17 may carry 1200 kg.

********The Indian Wild Weasels can carry ARMs on their hardpoints. Standard ARMs are too big and heavy to carry more than two on the hardpoints. Four Shikes, however, may be carried. ARMs may not be carried in the weapon bays (they normally carried HE bombs to "finish the job."). If ARMs are not carried (the Wild Weasel may carry 6.06 tons in its Weapon Bays).

Handley Page Victor

Along with the other V-Bombers, the Victor is heavily-linked with the United Kingdom's nuclear deterrent; though it did not use ICBMs, it had bombers and (later) boomers. Prototypes began to be tested in 1952, but almost immediately cracking around the bolt-holes holding the tailplane on was detected, including a crash during a full-speed low-altitude pass, killing the entire crew. This was remedied by adding a fourth bolt-hole to the tailplane, all of which were also strengthened. The tailplane also tended to flutter as top and near-top speeds; this was fixed by adding large ballast weights to the tail roots and tailplane roots. The escape position near the air intakes, which partially led to the loss of crew in the aforementioned crash, was moved away from the air intakes; the rear crewmembers were essentially pulled along a short tunnel, out of the aircraft. This was not an optimal solution from a crew injury standpoint, but was better than the rear crewmembers being sucked into the air intakes. The Victor was retired in 1993; by this point, almost all had been converted into tankers.

The Victor itself had a mostly conventional planform, with a bulged forward fuselage as the wing root forward and a crescent-shaped wing with a graceful curve. The wing not only provided the best wing shape for subsonic cruise, but enhanced low-level, landing, and takeoff characteristics. The four turbojets (later turbofans) were mounted close to the fuselage, with two on either side of the fuselage in the wing root. The tail is a high T-Tail, to clear the turbulence caused by the wing and engines.

Though the normal loadout for the Victor was a single or number of nuclear bombs, the Victor could also conduct standard bombing exercises, carrying 35 454-kilogram free-fall bombs, 70 227-kilogram free-fall bombs, or 52 340-kilogram bombs. It could also carry a number of specialist bombs or PGM in its bomb bay. However, the design strength of the Victor proved inadequate for low-level penetration flights, with cracking appearing in the wings and tail.

Original 1950 plans for the Victor had the entire nose ejecting as an escape pod in emergencies, but this was discarded before the first prototype was built.

Victor B.1

The original Victor (other than the prototypes) was the B.1, designed to handle the high-altitude, high-subsonic, nuclear-delivery role. It was powered by four 11,000 pound-thrust Armstrong Siddley ASSa.7 turbojets, and was equipped by a number of ECM and ECCM devices, and weather, long-range, and bombing radars, though no tail-warning radar. The original Victors also carried an optical analog bomb computing system, basically a greatly-improved Nordon bombsight of World War 2. The B.1 originally carried the 9.98-ton Blue Danube nuclear bomb as its only weapon, though this was later changed to the two of the smaller, more powerful Yellow Sun, then a set of three Mark 5 450-kilogram nuclear bombs or four smaller Red Beard tactical nuclear bombs. The Victor had a long aerial refueling probe above and between the front windows.

In 1956, test pilot Johnny Allam dove a Victor B.1 at high speed and accidentally broke the sound barrier at a speed of Mach 1.1. At the time, it was the largest aircraft to break the sound barrier.

The B.1A modifications, performed from 1956-1960, added a tail-warning radar, RWR, and additional ECM and ECCM capability. The nose was also lengthened, again to move the ejection position of the rear crewmembers; they were switched to downward ejection.

Victor B.2

The Victor B.2 was designed for a higher night altitude mission, and the engines were swapped out for Sapphire 9 turbofans, developing 14000 pounds thrust each and requiring larger air intakes.

However, the Sapphire 9 engine was cancelled, so the Phase 2A version was tried with two engine types: the original engines, which were quickly rejected, and Rolls-Royce Conway turbofans developing 17250 pounds thrust each. This required large intakes later called "elephant ear" intakes. These led to ram air intakes inside the intake path. These provided additional electrical power to systems. The ECM/ECCM suite was modernized, as were the chaff and flare dispensing system. It was this aircraft that became the B.2.

It should be noted that during testing of the Phase 2A aircraft, the first of the prototypes disintegrated at high altitude. It was many years later, on other Victors, that longitudinal cracks in the wings were discovered in several Victor B.2s, that were likely the cause of the disintegration of the prototype aircraft. This cracking would later lead to the early curtailment of the Victor's bombing mission.

Twenty-one B.2s were later modified into the B.2R standard. This entailed of a large-scale modification of the Victors, including the bomb bay, the section of the fuselage ahead of the bomb bay, and on into the rear nose of the aircraft. The engines were also replaced with Conway RCo.17 turbofans giving 20600 pounds thrust. These modifications were to allow the carriage of the large Blue Steel stand-off nuclear-tipped missile (a conventional version was contemplated, but never built). The warhead for the Blue Steel would be the Green Bamboo boosted fission warhead, or the Granite-series of thermonuclear warheads; however, later, these were replaced by Red Snow warheads, a version of the US W-28. The Blue Steel itself is a huge missile, 4 meters across its fins, 10.7 meters long, and with a diameter of 1.22 meters, and is similar in concept to the Hound Dog missiles carried for a time by American B-52 aircraft. It was essentially a rocket aircraft, with a range of 926 kilometers.

Blue Steel was eventually cancelled, in part due to the dangerous steps necessary to fuel the missile, the complicated process it took to arm the missile, and the difficulty with which arming the B.2R took. (In addition, during testing in the Australian Outback, fueling the missile could be done only in the pre-dawn coolness due to the hypergolic nature of the fuel in hotter weather.) That, and with the new deployment of the Polaris SLBM with Renown-class submarines, meant that the Blue Steel was no longer necessary from a strategic standpoint. Despite its significant limitations, Blue Steel was used on Victor (and Vulcan) aircraft from 1963-70.

The Blue Steel was fitted with an advanced (for the time) inertial navigation unit. The missile's inertial navigation unit was, in fact, more advanced than that of the B.2R's unit, and the B.2R could hook into the Blue Steel's INU during the time that the aircraft was carrying the Blue Steel, allowing a more precise arrival at the release point.

The B(SR).2 was a strategic reconnaissance version of the Victor; nine were built. The bomb bay was filled with a radar mapping system and a total of nine cameras photographing as different wavelengths, angles, and resolutions, as well as technicians to monitor this intelligence. One of the day cameras had a range of 600 kilometers. Atop the wing were sniffers to detect radioactive particles from nuclear tests. The B(SR).2 was also equipped with ELINT and other electronic reconnaissance gear, along with an enhanced ECM/ECCM suite. In an odd way for things to turn out, the B(SR).2s were replacing Valiants which had been modified for the same role, but had been retired due to metal fatigue; this is strange due to the Victors' history of surface cracking.

When the high-altitude nuclear penetration flights no longer made sense for the Victor (or many other large bombers in the world), the Victor was modified for the low-level penetration role and for low-level conventional bombing. Internal modifications were successful; however, it was discovered during training for this role that the Victors' very design, along with defects discovered earlier in the Victors' career, that it was not going to be able to operate as a low-level penetrator or bomber. The design, particularly the tail and wing roots, tended to develop cracks during low-level high-speed runs, the types that would be necessary is the fulfillment of its role. Though no aircraft were lost during these tests and training, it was obvious that it was only a matter of time, and the Victors were withdrawn from the low-level penetration and bombing role and never used for such again.

The Victor Tankers – the Conclusion of the Victors' Careers

The Valant fleet had to be withdrawn early due to metal fatigue; this included those that had been modified as tankers. This left the RAF with no strategic tanker aircraft. The B.1s and B.1As were deemed surplus aircraft by this point, so many of them were modified into tankers. It was somewhat a hurried affair at first, with B.1s and B.1As being converted to the B(K).1A standard being fitted with a hose system under each wing with a drogue attached to the hose, and a reel system attached to sponsons under the wings. Six such aircraft were converted. These aircraft became operational in August of 1965. While these aircraft were adequate for short-tern use, they could pass fuel at only a very limited speed, and were not suitable for refueling large aircraft such as the Vulcan (which was still on active bomber duty). It should be noted that the B(K).1A had a reduced volume of space in the bomb bay (most was taken up by a large cylindrical tank for refueling), and the B(K).1A could carry a reduced mount of bombs or PGM in the bomb bay, giving it a secondary role as a bomber.

The refueling problems were addressed in the next iteration of B.1 and B.1A-based tankers, the K.1 and K.1A. These versions (though the B.1 base aircraft were no longer brought up to B.1A standard first) had a three-hose system, with another hose under the fuselage near the tail. The wing refueling points retained the same fuel flow as the B(K).1A, but a high-speed hose and drogue was fitted under the fuselage just ahead of the tail bulge, with three times the fuel flow rate of the wing hoses.

24 B.2s were also modified into tankers, similar to the K.1 and K.1A, and designated K.2. Other than uprated specifications, they were similar to the K.1 and K.1A.

For the Black Buck missions (the Vulcan bombing missions against Port Stanley airport in the Falklands), the K.2s were modified to carry three day/night long range cameras in the former bombardier's position. These cameras were upgrades of those carried on the B(SR).2 and had a day/night high-resolution range of 800 kilometers. While they did some long-range reconnaissance of the Falklands during their refueling work with the Vulcans on the mission, their primary role of the cameras was to reconnoiter South Georgia Island. (They were also to conduct reconnaissance on Argentine airfields and harbors in the hypothetical raids based out of Rio De Janeiro, but it was elected not to conduct these raids to prevent a wider was in South America.) The K.2s retained the ability for aerial refueling and so relays of tankers could be set up. The K.2s also received new inertial navigation gear, as their normal navigation equipment was inadequate for navigation over the trackless Atlantic.

Vickers tankers were often fitted with JATO bottles on the rear sides to decrease the heavy Victor tanker's takeoff length. This decreases the takeoff run by 30%. The JATO bottles are expended shortly after the Victor gets into the air and fall off of their own accord shortly after they are expended.

The K.2s. were retired in 1993, replaced by Vickers VC-10 tankers.

Aircraft	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Victor B.1	$334,064,700	JP-A	32.95 tons	92.99 tons	5	105	Radar (300 km), Weather Radar (500 km), Bombing Radar (200 km)	Shielded
Victor B.1A	$367,811,400	JP-A	33.32 tons	94.49 tons	5	108	Radar (300 km), Weather Radar (500 km), Bombing Radar (200 km), Tail Radar (100 km)	Shielded
Victor B.2	$380,995,200	JP4	34.02	94.77	4	111	Radar (400 km), Weather Radar	Shielded

			tons	tons			(500 km), Bombing Radar (200 km), Tail Radar (150 km)	
Victor B.2R	$429,940,500	JP4	406 kg	102.47 tons	4	125	Radar (400 km), Weather Radar (500 km), Bombing Radar (200 km), Tail Radar (150 km)	Shielded
Victor B(SR).2	$444,370,600	JP4	681 kg	95.28 tons	8	115	Radar (400 km), Weather Radar (500 km), Tail Radar (150 km), SLAR (150 km), 3 Day Cameras (50 km), 3 Wide-Angle Day Cameras (50 km), 2 Night/IR Cameras (40 km), UV Camera (40 km), Radar Camera (30 km)	Shielded
Victor B(K).1A	$387,629,900	JP4	5.45 tons	111.92 tons	5	107	Radar (300 km), Weather Radar (500 km), Bombing Radar (200 km), Tail Radar (100 km)	Shielded
Victor K.1	$460,010,300	JP4	520 kg	143.46 tons	5	106	Radar (300 km), Weather Radar (500 km)	Shielded
Victor K.1A	$506,479,830	JP4	589 kg	144.96 tons	5	108	Radar (300 km), Weather Radar (500 km), Tail Radar (100 km)	
Victor K.2	$524,634,050	JP4	585 kg	145.24 tons	5	110	Radar (400 km), Weather Radar (500 km), Tail Radar (150 km)	Shielded
Victor K.2 (Black Buck)	$546,383,040	JP4	465 kg	145.34 tons	5	111	Radar (400 km), Weather Radar (500 km), Tail Radar (150 km), Two Day/Night Cameras (800 km), One Radar Camera (600 km)	Shielded

Aircraft	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
Victor B.1	1248	347 (145)	NA 68 7/5 70/50	36713	4492	17000	FF8 CF7 RF7 T6 W5
Victor B.1A	1228	341 (145)	NA 67 7/5 70/50	36713	4492	17000	FF8 CF7 RF7 T6 W5
Victor B.2	1901	528 (145)	NA 104 7/5 70/50	36713	7015	19000	FF8 CF7 RF7 T6 W5
Victor B.2R	2823	784 (145)	NA 154 7/5 70/50	36713	11356	19000	FF8 CF7 RF7 T6 W5
Victor B(SR).2	3034	943 (145)	NA 185 7/5 70/50	36713	11356	19000	FF8 CF7 RF7 T6 W5
Victor B(K).1A	1042	289 (145)	NA 57 7/5 70/50	36713+37854	4492	17000	FF8 CF7 RF7 T6 W5
Victor K.1	819	228 (145)	NA 45 7/5 70/50	36713+50472	4492	17000	FF8 CF7 RF7 T6 W5
Victor K.1A	811	225 (145)	NA 44 7/5 70/50	36713+50472	4492	17000	FF8 CF7 RF7 T6 W5
Victor K.2	2001	556 (145)	NA 109 7/5 70/50	36713+50472	7015	19000	FF8 CF7 RF7 T6 W5
Victor K.2 (Black Buck)	2001	556 (145)	NA 109 7/5 70/50	36713+50472	7015	19000	FF8 CF7 RF7 T6 W5

Aircraft	Combat Equipment	Minimum Landing/Takeoff	RF	Armament	Ammo

		Zone			
Victor B.2	IFF, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 1, ECCM 1, INS, Flare and Chaff Dispensers (40 Flares, 40 Chaff)	2400/1840m Hardened Runway	+1	Internal Bomb Bay	Various Nuclear Bomb(s), 35x454 kg or 52x340 kg or 70x227 kg Bombs
Victor B.1A	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, INS, Flare and Chaff Dispensers (40 Flares, 40 Chaff)	2400/1840m Hardened Runway	+1	Internal Bomb Bay	Various Nuclear Bomb(s), 35x454 kg or 52x340 kg or 70x227 kg Bombs
Victor B.2	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, IRCM 1, INS, Flare and Chaff Dispensers (50 Flares, 50 Chaff), One Chaff Rocket	2400/1840m Hardened Runway	+2	Internal Bomb Bay	Various Nuclear Bomb(s), 35x454 kg or 52x340 kg or 70x227 kg Bombs
Victor B.2R	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, IRCM 1, INS*, Flare and Chaff Dispensers (50 Flares, 50 Chaff)	2400/2200m Hardened Runway	+4	Internal Bomb Bay (Modified)	Blue Steel Standoff Missile**
Victor B(SR).2	Advanced IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 3, ECCM 3, IRCM 1, DJM, ELINT 3, Radar Detection 2, Radio Jamming 1, INS, Target ID, Flare and Chaff Dispensers (80 Flares, 60 Chaff), Corridor Chaff Pod, Chaff Rocket, Radiation Detector (800 km)	2400/2000m Hardened Runway	Nil	Nil	Nil
Victor B(K).1A	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, INS, Flare and Chaff Dispensers (40 Flares, 40 Chaff)	2400/2600m Hardened Runway	+2	Internal Bomb Bay	12x454 kg Bombs
Victor K.1	IFF, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 1, ECCM 1, INS, Flare and Chaff Dispensers (40 Flares, 40 Chaff), Two Hose/Drogue Reels	2400/2600m Hardened Runway	Nil	Nil	Nil
Victor K.1A	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, INS, Flare and Chaff Dispensers (40 Flares, 40 Chaff), Two Hose/Drogue Reels	2400/2600m Hardened Runway	Nil	Nil	Nil
Victor K.2	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, IRCM 1, INS, Flare and Chaff Dispensers (50 Flares, 50 Chaff), One Chaff	2400/2600m Hardened Runway	Nil	Nil	Nil

	Rocket, Three Hose/Drogue Reel Units				
Victor K.2 (Black Buck)	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, IRCM 1, INS, Flare and Chaff Dispensers (50 Flares, 50 Chaff), One Chaff Rocket, Three Hose/Drogue Reel Units	2400/2600m Hardened Runway	Nil	Nil	Nil

*While the Blue Steel missile is mated to the B.2R, the crew may use the missile's INS, which has a range of 125 km and eases the navigator's task of guiding the aircraft by one level.
**Preparing the Blue Steel and mating it to the B.2R takes a minimum of four hours. Mating the missile to the aircraft is a Difficult Mechanic task and requires a minimum of six persons. Fueling the missile is an Impossible Mechanic task. Arming the missile is an Easy ADM or Average Mechanic task. The cost of the Blue Steel is subsumed in the cost of the B.2R.

Vickers Valiant

What? No this isn't about the British tank – no, it's the British *bomber*. Yes – I know they have the same name and are both made by Vickers and are -- yes, they are BOTH Vickers Valiants – every so often, those nutty Defense Contractors like to play games and tricks on us…oh, anyway…

Notes: Though the Valiant was the first of the V-Bombers in service, it is often regarded as the "forgotten V-Bomber;" it had the shortest life in service due to design limitations, and even did not serve as a tanker or special aircraft for very long, as did the other V-Bombers. The design for the Valiant began in the late 1940s, in response to Specification B.35/46 for a nuclear-armed bomber jet-powered bomber. At the time, nuclear bombs were huge, and the aircraft which would become the Valiant could just barely carry one. The initial prototype flew in early 1949 (known then as the Vickers 660). Vickers initially proposed a six-engine bomber, but as jet engine technology rapidly increased, Vickers was able to reduce the number of engines to four, which were buried in the wings. (This aircraft appeared in prototype form in 1951.) LRIP began in 1953, with full production beginning in 1955.

The original Vickers 660 prototype essentially comprised what would be the operational aircraft except for certain electronics. It was powered by Rolls-Royce RS.3 Avon turbojets developing 6500 pounds thrust each. Meanwhile, the second prototype was referred to as the Vickers 667 and was intended to be They were initially to be powered by Armstrong Siddeley Sapphire turbojets, with 7500 pounds thrust each; however these were not available, and RS.7 Avons were used again, and these had the same power as the Sapphires. Upon the success of the prototypes, the aircraft was given the name Valiant. Some 108 Valiants were built, including the sole B.2.

One observer said the Valiant looked sort of like a DeHaviland Comet airliner; this may have kicked off a short-lived program to make a passenger-carrying variant of the Valiant, designated as the V.1000. The sole prototype was scrapped only a few months before its scheduled first flight, as BOAC was not interested in the V.1000. There are rumors that some of the features of the V.1000 later reappeared in the Vickers VC.10.

Valiant B.1

In 1951, the B.1 was given an initial production order of 25. In 1955, the first aircraft of this order was delivered to the RAF. It was declared the first of the V-Bomber force. The first five aircraft delivered to the RAF were not in a full operational mode; it was considered that the RAF may want to make additional refinements to the Valiant B.1, and they did, though by and large they were happy with the aircraft.

In addition to the Valiant's role as a nuclear bomber, the Victor was also to be used as a high-altitude and low-level bomber. In 1962, the role of the Valiant was changed to low-level flight due to the proliferation of SAMs; the SAMs would have a more difficult time to track and lock-on to Valiants traveling at high subsonic speed at low levels.

It should be noted that during the Anglo-French Suez intervention in 1956, Valiants staged out of Malta to bomb Egyptian targets. Their primary targets were Egyptian airfields, but though 856 tons were delivered, results were said to have been disappointing. This was said to be because all of the bombardiers on the mission were trained to use radar bombing exclusively, and not all of the Valiants were yet equipped with radar bombing equipment.

The Valiant initially was powered by Avon RA.3 engines developing 6500 pounds thrust, installed in fireproof pairs under each wing root. The intakes were at the front of each wing root, and were reminiscent of the later Victor V-Bomber. While the installation of the engines made it more possible that a fire in one engine would ignite the second engine in the pair, it made maintenance easier, so the risk was considered acceptable. The installation also increased the complexity of the main wing spar. The wings were a crescent shape which were used again on the later Victor. A short landing was made more possible by the installation of a drogue chute, and a rocket pack could be added to shorten the takeoff; these were intended for use when the Valiant was using shorter dispersal runways and highway sections, and the Valiant could take off with the rocket pack in less than 1220 meters and slow to a stop within 1800 meters. When more powerful engines were installed, the rocket packs were no longer considered necessary. Valiants were also given a water/methanol-injection system for the engines, increasing takeoff thrust by 1000 pounds thrust for three minutes.

The Victor was equipped with an early form of fly-by-wire surfaces actuation; the control surfaces and flaps were actuated by electric motors instead of hydraulic pressure. Though the first five aircraft had the Avon RA.3 engines, but further production aircraft were powered by Avon 201 turbojets developing 9500 pounds thrust each. In addition to powering the aircraft, the engines also gave power to the pressurization, ice protection and boots, and air conditioning and heating systems. Heaters were also installed in the air intakes to mitigate ice buildup, which was a continuing problem with the Valiant.

In addition, a strategic reconnaissance version entered service, as well as multipurpose version optimized for conventional bombing and tactical missile delivery, a conventional aerial reconnaissance version, an EW version, and a tanker. Several Valiants were used in tests of the Blue Steel Nuclear Missile, though the Valiant never carried the Blue Steel operationally. Valiants were also used to test some of the British nuclear bombs in the Australian Desert. The Valiants were thus the only of the V-Bombers to actually drop nuclear weapons.

The Valiant used a five-man crew, with the pilot and co-pilot facing forward, and the EW officer, navigator, and bombardier facing to the rear. The pilots had standard ejection seats; the rest of the crewmen were to bail out of an oval hatch in port side of the aircraft, one at a time. It was well known among aircrews and designers that the rear three crewmen would probably not be able to bail out successfully in an emergency situation.

The lower half of the nose contained the H2S radar in a glass fiber radome; in addition, a visual bombsight supplemented the radar bombsight. The avionics bay was not accessible from the cockpit; it could only be accessed on the ground via a normal catwalk after opening a narrow hatch in the rear of the nose section. Under the nose and cockpit was a SLAR installation. An ARI 5800 radar was contained in the rear. This gave the Valiant a frontal radar arc of 180 degrees, a tail radar arc of 60 degrees, and a weather radar arc of 120 degrees. Later, the glazed radome was replaced by a metal radome and a port in the underside of the nose used with a port for visual bombsighting.

Valiants could also carry large fuel tanks on their wings, with a capacity of 7500 liters each. They could be jettisoned, but are not actually meant to be drop tanks. There was an idea for carrying stand-off missiles on those hardpoints, but in the end this was never done. The huge tanks were a nod to the fact that the internal tankage of the Valiant was a bit small.

After less than a decade of faithful service, crystalline cracks began to appear in the wing spars of all Valiants except those few who were not subjected to low-level flying. All Valiants also showed fatigue in the wing spars, and specifically, the wing attachment points. The Valiants were then separated into three groups: Cat A -- no cracks and certified to continue low-level flights, Cat B -- a group which was to fly to a repair base, but deemed more easily repairable. Cat C Valiants would require major overhauls before becoming flyable again, including close inspection of the wings and tail and replacement of the wing spar. Cat C Valiants formed the largest members of the Valiant fleet. This was what was supposed to happen, and in 1964 was already beginning. (A stronger replacement wing spar which could be simply “slotted” in was devised in particular for this purpose.) However, there was a change in government in 1965, the new MoD minister decided that Cat B and Cat C aircraft were not worth the expense of repairing; Cat A aircraft would, however, remain flying (for a short time), but were subject to additional checks for cracks after each flight. For the most part, Cat B and C Valiants were scrapped, though some were moved to the Canadian Training Grounds for use in bombing and strafing practice. The last active-duty Valiant was retired in 1965. One Valiant, however, had its wing spar replaced and continued to fly as a test aircraft until 1968. One preserved Valiant (though not in flying condition) is kept at the Cold War Exhibit at RAF Museum Cosford; this is the only place in the world where all three V-Bombers can be seen together.

Unlike other V-Bombers, the Valiant never received an upgrade to a more capable Mark 2 model like the other V-Bombers; the B.2s mentioned above were never used as operational aircraft. In addition, original LRIP Valiants were not equipped for aerial refueling.

New Roles for Old Aircraft

Some of the Cat B aircraft, as well as the Cat A aircraft, were taken off bombing duty and given a number of alternate roles. By far, most Valiants were refitted as tankers, but some were outfitted for strategic reconnaissance, tactical reconnaissance, and electronic warfare,

The first modifications were designated B(PR).1s; 11 Cat B aircraft were modified for the photoreconnaissance role. For this purpose, the bombardier’s position received a new panel to control the cameras. The camera suite was in the bomb bay and consisted of two wide-angle BW cameras, one wide-angle color camera, two survey cameras, four high-resolution cameras, an IR camera, and a trainable BW camera which could zero in on a particular item of interest.

The B(PR)K.1 was sort of a jack of all trades; these were 14 Cat A aircraft which had a camera suite, room for a smaller amount of bombs, as well as a tank in the bomb bay for refueling other aircraft and a HDU unit to accomplish this. These carried two survey cameras, an IR camera and four high-resolution cameras.

The B(K).1 were bomber/tanker aircraft; they carried a large drum-type fuel tank in the bomb bay, along with room for a single rack of bombs. The fuel tank could be removed along with the HDU, allowing the Valiant to function as a standard bomber. A further 16 B(K).1s were ordered, but later cancelled before conversions could take place.

The B(EW).1 carried mostly electronic warfare equipment in the forward bomb bay. Two of the crewmembers (the bombardier and EW officer) manned the EW equipment; they had different instrument panels than normal. The B(EW).1 carried a large amount of additional electronic gear ranging from electronic listening and detection equipment to additional ECM, flares, and chaff.

Valiant B.2

I have included stats for a B.2 below as a “what-if.”

The first B.2. prototype flew in late 1953. The B.2. was originally intended as a Pathfinder aircraft for the main bomber force, and had an entirely gloss black paint scheme; it would drop flares as well as bombs ahead of the main bomber force, and had enhanced navigation equipment. (However, it was envisioned that a production B.2 force would function as bombers as well as Pathfinders.) In this role, the B.2 would fly at little more than 1500 meters at a speed of nearly 940 kmh. This made necessary the installation of a primitive form of TFR – nothing like what was in development for the future F-111, but able to allow the B.2 to fly as low as 500 meters at a reduced speed of 700 kmh. (One speed test had the B.2 flying at 1030 kmh at less than 1000 meters altitude for a few minutes.) The intended role as a bomber of night missions also led to the installation of night vision gear a tank crewman of the time would have given his eye teeth for.

The Valiant B.2 was powered by four Rolls Royce Conway turbojets, developing 10,000 pounds thrust each. The B.2 had a wider wingspan, allowing it to carry a pair of Blue Steel SRAMs as well as its standard wing fuel tanks; the B.2 was also to have inner hardpoints which allowed fuel tanks or Blue Steel missiles. The outer hardpoints could also carry a variety of alternate stores, from additional gravity bombs to extra fuel to chaff rockets or corridor chaff pods to some of the new generation of guided munitions.

Other changes included a longer fuselage, allowing for a larger bomb bay, one which could also carry two Blue Steel missiles if desired, more gravity bombs, or the new generation of TV-guided and radar-beam-riding bombs and missiles. On the whole, the entire airframe was strengthened, including internal components; internal fuel tanks were also changed to self-sealing fuel tanks. One change which had effects beyond what one would think was the main handing gear retracting into pods at the rear of the wing, giving room for the stronger wing spar, a slightly larger bomb bay and electronics bay, and a little more fuel in the wings. The wings were also lengthened, due to center-of-gravity needs more than anything else, but this also allowed for more fuel carriage.

The B.2 retained the Conway engines, and the gloss black paint scheme, for which it was known as the "Black Bomber." The B.2, though 17 were ordered, only one was built, and remained used as prototype, test, and experimentation aircraft, well into the 1960s.

One high-level member of the RAF noted that the production of the B.2 and its inevitable variants would have probably made the Victor and Vulcan redundant, as the B.2 would be able to fill all their roles. (Thus, there may have been some politics involved in the cancellation of the B.2, as Avro and DeHavilland would not have been happy with the loss of money that the approval of the B.2 might bring.) However, the main "problem" at the time was that the B.2 was optimized for the low-level penetration role, and at the time, only a few forward-looking people thought that a low-level penetrator would be necessary anytime in the foreseeable future.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
B.1 (LRIP Aircraft)	$109,041,283	JP-A	30.52 tons	63.5 tons	5	190	Radar (250 km), Weather Radar (400 km), Bombing Radar (100 km), Tail Radar (75 km), SLAR (75 km)	Shielded
B.1 (Production)	$145,536,128	JP-A	29.41 tons	64.52 tons	5	190	Radar (250 km), Weather Radar (400 km), Bombing Radar (100 km), Tail Radar (75 km), SLAR (75 km)	Shielded
B(PR).1	$672,098,056	JP-A	1.27 tons	64.71 tons	5	225	Radar (250 km), Weather Radar (400 km), Tail Radar (75 km), SLAR (75 km)	Shielded
B(PR)K.1	$327,494,660	JP-A	1.33 tons	76.43 tons**	5	275	Radar (250 km), Weather Radar (400 km), Bombing Radar (100 km), Tail Radar (75 km), SLAR (75 km)	Shielded
B(K).1	$255,919,221	JP-A	1.49 tons	78.93 tons**	5	295	Radar (250 km), Weather Radar (400 km), Bombing Radar (100 km), Tail Radar (75 km), SLAR (75 km)	Shielded
B(EW).1	$321,461,031	JP-A	1.26 tons	71.44 tons	5	308	Radar (250 km), Weather Radar (400 km), Tail Radar (75 km), SLAR (75 km), IRST (40 km), VAS (20 km)	Shielded
B.2	$290,650,603	JP-4	34.68 tons	66.68 tons	5	180	Radar (300 km), Weather Radar (400 km), Tail Radar (115 km), SLAR (120 km), IRST (40 km), VAS (20 km)	Shielded

Vehicle	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap*	Fuel Cons	Ceiling	Armor
B.1 (LRIP)	1078	300 (75)	NA 13 4/3 40/30	20400	2641	16000	FF7 CF6 RF6 T5 W4
B.1 (Production)	1539	427 (75)	NA 19 4/3 40/30	20400	3862	16000	FF7 CF6 RF6 T5 W4
B(PR).1	1534	426 (75)	NA 19 4/3 40/30	20400	3862	16000	FF7 CF6 RF6 T5 W4
B(PR)K.1	1304	362 (75)	NA 16 4/3 40/30	20400+7500	3862	16000	FF7 CF6 RF6 T5 W4
B(K).1	1263	351 (77)	NA 15 4/3 40/30	20400+10000	3862	16000	FF7 CF6

							RF6 T5 W4
B(EW).1	1393	387 (75)	NA 17 4/3 40/30	20400	3862	16000	FF7 CF6 RF6 T5 W4
B.2	1567	435 (70)	NA 19 4/3 40/30	24500	4065	19000	FF7 CF7 RF7 T6 W6

Vehicle	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
B.1 (LRIP)	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 1, ECCM 1, INS (75 km), Flare and Chaff Dispensers (40 Flares, 40 Chaff)	1800/1500m Hardened Runway	+1	Internal Weapons Bay, 2 Hardpoints (Wet Only)	Normal Load 21x450 kg Gravity Bombs or one Blue Danube Nuclear Bombs or two B28 Nuclear Bombs or two B43 Nuclear Bombs or one Yellow Sun Nuclear Bomb or one Red Beard Nuclear Bomb; Other Loadouts Possible
B.1 (Production)	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 1, ECCM 1, INS (75 km), Flare and Chaff Dispensers (40 Flares, 40 Chaff), TFR (20 km)	1800/1300m Hardened Runway	+1	Internal Weapons Bay, 2 Hardpoints (Wet Only)	Normal Load 21x450 kg Gravity Bombs or one Blue Danube Nuclear Bombs or two B28 Nuclear Bombs or two B43 Nuclear Bombs or one Yellow Sun Nuclear Bomb or one Red Beard Nuclear Bomb; Other Loadouts Possible
B(PR).1	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Inertial Navigation (75 km), Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2,	1800/1300m Hardened Runway	Nil	2 Hardpoints (Wet Only)	None

	ECCM 2, ELINT 2, Flare and Chaff Dispensers (40 Flares, 40 Chaff), Two Wide-Angle BW Cameras, One Wide-Angle Color Camera, Two Survey Cameras, Four High-Resolution Cameras, One IR camera, Trainable BW Camera				
B(PR)K.1	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Inertial Navigation (75 km), Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, Flare and Chaff Dispensers (40 Flares, 40 Chaff), Two Survey Cameras, Four High-Resolution Cameras, One IR Camera	1800/1300m Hardened Runway	+1	Internal Weapons Bay, 2 Hardpoints (Wet Only)	10x450 kg Gravity Bombs, Nuclear Weapons Carry Possible, Other Loadouts Possible;
B(K).1	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 1, ECCM 1, INS (75 km), Flare and Chaff Dispensers (40 Flares, 40 Chaff)	1800/1300m Hardened Runway	+1	Internal Weapons Bay, 2 Hardpoints (Wet Only)	10x450 kg Gravity Bombs, Nuclear Weapons Carry Possible, Other Loadouts Possible;
B(EW).1	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 3, ECCM 3, ELINT 3, INS (75 km), Flare and Chaff Dispensers (75 Flares, 75 Chaff), Chaff Rocket	1800/1300m Hardened Runway	Nil	2 Hardpoints (Wet Only)	None
B.2	IFF, RWR, Secure Radios (One 700 km, Two 300 km, One AM), Navigation Bombing Computer, Transponder, Gyrocompass, Barometric Altimeter, LORAN, Radar Beam Riding, Radio Beacon Detection, ILS, ECM 2, ECCM 2, INS (75 km), Flare and Chaff Dispensers (80 Flares, 80 Chaff), TFR (40 km)	1900/1500m Hardened Runway	+2	Internal Weapons Bay, 4 Hardpoints	Normal Load 40x450 kg Gravity Bombs or one Blue Danube Nuclear Bomb or two B28 Nuclear Bombs or two B43 Nuclear Bombs or two Yellow Sun Nuclear Bombs or two Red Beard Nuclear Bombs or two Blue Steel Missiles; Other Loadouts Possible

*The Valiant may carry one 6500-liter fuel tanks on each its wing hardpoints. (They were originally to have been also able to carry external weapons, but this idea was later dropped.)
**The Aircraft Weight figure is with all possible bomb-bay stores carried.

Xi'an H-20

Notes: The H-20 (alternatively the H-X, denoting the fact that only protypes have been built and it is in advanced field testing) is a subsonic stealth bomber. It is not expected to be in service until about 2025. The H-6 was developed in response to the USAF's B-2 and upcoming B-21, as well as a heavy bomber capable of stealth and having the range to range far away from their bases – different sources state this range variously at 8000km, 8050 km, and 12,000 km. The H-20 will also be capable of aerial refueling, and has ejection seats.

The H-20 is a flying-win design with flight computers to make more stable; the US DoD are pretty sure the H-20 was built using stolen intelligence from the US B-2 and B-21, but resembles the projected B-21 more than the B-2. . It's primary role is to attack US Carrier Task Forces, though bombing of Japan is also mentioned in it's possible targets. US intelligence is skeptical that the Chinese could essentially build a B-2 near-clone in such a short period of time, unless US manufacturers have spies in US manufacturing companies of the B-2, the DoD, and the Pentagon, as well as hackers who targeted the B-2.

The H-20 is likely powered by WS-10 engines (which, it should be noted, the Chinese have not yet been able to manufacture). The H-20 has an AESA radar as well as a terrain-following radar, both of which are like the B-2, whose radars are extremely difficult to detect when in use. The Chinese also used parts of the design features of the US X-47B stealth drone. (Indeed, the H-20 looks like an enlarged X-47B, with a combination of B-2 and B-21 features.) The stealth features mimic those of the B-2 and B-21 in stealth design. The H-20 is capable of using most air-to-ground munitions, from cruise missiles to antishipping missiles to conventional ASM and bombs (both guided and unguided), as well as nuclear weapons and nuclear-tipped missiles. The H-20 has a rotary launcher similar to that of the B-2. The crew consists of a Pilot, Co-Pilot, and a WSO/ECM Operator.

The H-20 is said to be not as stealthy as the B-2 or B-21, or the X-47B for that matter. The H-20 is essentially a long-range bomber in which the Chinese did not completely successfully copy the B-2, B-21, or X-47B.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$616,775,320	JP6 Equivalent	30.72 tons	114.48 tons	3	60	Radar (300km), Rear Radar (150km), 2nd Gen FLIR, LIDAR, TFR (300m)	Shielded

Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
2971	825 (60)	NA 166 5/3 50/30	104,726	30628	15250	HF5 CF5 FF4 T0 W7*

Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
All-Weather Flight, Flare/Chaff (50/40), ECM 2, IR, Stealth 5 IR Stealth 3, Deception Jamming (59 km), Laser Designator (20 km), Inertial Navigation, GPS, RWR, Secure Radios, Satcom Radio, Target ID,	1800/2200m Hardened Runway	+4	2 Bomb Bays	Nil

*The H-20 has no tail to target or become damaged.

Il-28 Beagle

Notes: Designed shortly after World War 2, the Beagle was built in huge numbers by Russia and China, with over 6000 built. They are a very basic sort of combat aircraft with a minimum of avionics, and today's fighter-bombers easily outperform it. The bomb bay may hold 2 tons of the total weapons load; the two wingtip hardpoints may only be used for special 335-liter drop tanks designed especially for it. The Beagle is not capable of aerial refueling. The tail gunner does not have an ejection seat.

Twilight 2000 Notes: By the Twilight War, only about 500 of this number remained in active service, primarily with Middle Eastern and African nations, and air forces such as those of Vietnam and Cuba.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$24,351,140	JP4/5	3 tons	21.2 tons	3	26	Radar (75 km)	Enclosed

Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
1004	451 (130)	NA 113 4/2 40/20	6780	2913	12300	FF6 CF6 RF6 T5 W5

Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
RWR	835/760m Hardened Runway	+1	2x23mm Autocannons (Front), 2x23mm Autocannons (Rear), Bomb Bay, 2 Hardpoints	750x23mm

Tu-16 Badger

Notes: There were at least 22 variants of this medium bomber built. In particular, the variants designed to carry specific large cruise missiles, such as the Tu-16K series, were no longer in use, because the primitive cruise missiles were replaced by later weapons that could be carried in conventional bomb bays. These models were either scrapped or modified into other versions. Other versions were made for conventional bombing, long-range search and rescue, long-range reconnaissance, electronic warfare, refueling, and UAV launching. Not all of these are detailed here; the Tu-16A is the standard bomber, the Tu-16RM-2 is for long-range reconnaissance, and the Tu-16Ye is an electronic intelligence (ELINT) aircraft, the Tu-16P is an electronic warfare aircraft (Wild Weasel). Besides Russia, the Badger is used by Iraq and China.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Tu-16A	$222,619,380	JP4/5	9 tons	75.8 tons	6	51	Radar, RLR	Shielded
Tu-16RM-2	$268,452,780	JP4/5	2.72 tons	74.19 tons	6	55	Radar, RLR	Shielded
Tu-16Ye	$281,544,800	JP4/5	1.5 tons	72.6 tons	6	57	Radar, RLR	Shielded
Tu-16P	$282,568,280	JP4/5	1 ton	72.6 tons	6	55	Radar, RLR	Shielded

Vehicle	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
Tu-16RM-2	1984	496 (120)	NA 124 5/3 50/30	43800	6720	12300	FF7 CF7 RF7 T6 W7
Others	1984	496 (120)	NA 124 5/3 50/30	42400	6720	12300	FF7 CF7 RF7 T6 W7

Vehicle	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
Tu-16A	All-Weather Flight, RWR, Flare/Chaff (80/80), ECM 2	1675/2045m Hardened Runway	+2	2x23mm Autocannons (Front, Rear, Belly, Dorsal), Bomb Bay	6000x23mm
Tu-16RM-2	All-Weather Flight, RWR, Flare/Chaff (80/80), ECM, Still Cameras (5; 20-120 km), Video Cameras (3, 10-120 km), Look-Down Radar, SAR (120 km)	1675/2045m Hardened Runway	+2	2x23mm Autocannons (Front, Rear, Belly, Dorsal), 2 Hardpoints	6000x23mm
Tu-16Ye	All-Weather Flight, RWR, Flare/Chaff (80/80), ECM 2, IRCM 1, Radar Detectors (100 km), Radio Detectors (100 km), ELINT 2, Recording Gear, Still Camera (50 km), Video Camera (30 km)	1675/2045m Hardened Runway	+2	2x23mm Autocannons (Front, Rear, Belly, Dorsal), 2 Hardpoints	6000x23mm
Tu-16P	All-Weather Flight, RWR, Flare/Chaff	1675/2045m	+2	2x23mm Autocannons	6000x23mm

	(100/90), ECM 3, IRCM 2, Deception Jamming (40 km), Chaff Rockets (20), Corridor Chaff Pods (2)	Hardened Runway	(Front, Rear, Belly, Dorsal), 2 Hardpoints

Tu-22 Blinder

Notes: This supersonic medium bomber was designed as a counter to the US B-58 Hustler, just coming into service at the time (1959). Few were in use by Russia during the Twilight War, most of them having replaced by the Backfire, but hundreds were in use by other countries, most notably by Iraq, and Libya, as well as a few by Syria. The variants depicted here are the Blinder-A bomber and the Blinder-C maritime armed reconnaissance aircraft; the Blinder-B is a variant specially-modified to carry the huge Kitchen cruise missile, the Blinder-D is a trainer, and the Blinder-E is a dedicated long-range reconnaissance aircraft.

Twilight 2000 Notes: Most Russian examples used during the Twilight War were reconnaissance models or tankers. Due to their poor maneuverability, they were easy pickings for enemy fighters and SAMs.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Blinder-A	$274,584,670	JP4/5	12 tons	84 tons	4	51	Radar, RLR	Shielded
Blinder-C	$483,036,080	JP4/5	4.5 tons	84.1 tons	4	53	Radar, RLR, MAD, Image Intensification	Shielded

Vehicle	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
Blinder-A	3002	750 (135)	NA 188 3/2 30/20	51480	10438	13300	FF7 CF8 RF7 T6 W6
Blinder-C	3002	750 (135)	NA 188 3/2 30/20	128705	10438	13300	FF7 CF8 RF7 T6 W6

Vehicle	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
Blinder-A	All-Weather Flight, Flare/Chaff (20/20), RWR	1445/1765m hardened Runway	+2	23mm Autocannon (R), Bomb Bay	1000x23mm
Blinder-C	All-Weather Flight, Flare/Chaff (20/20), RWR, Sonobuoys (100), Look-Down Radar, Deception Jamming (20 km), Inertial Navigation	1445/1765m hardened Runway	+3	23mm Autocannon (R), Bomb Bay	1000x23mm

Tu-22M Backfire

Notes: Mistakenly referred to by NATO sources as the Tu-26 for many years, the correct designation is Tu-22M, because the Backfire is in fact a highly-modified Tu-22 Blinder. The differences include the variable-geometry wings, engines of much higher power that are relocated to the fuselage, avionics that are vastly improved, and improved weapon delivery systems. There were several variants, including the standard bomber, cruise/antiship missile carrier, and long-range reconnaissance variant. The bomb bay may hold up to 14.5 tons in the Tu-22M1 and Tu-22M2, and 18 tons in the Tu-22M3.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Tu-22M1	$199,336,650	JP4/5	24 tons	125 tons	4	67	Radar, RLR	Shielded
Tu-22M2	$241,012,450	JP4/5	24 tons	126 tons	4	70	Radar, RLR, MAD	Shielded
Tu-22M3	$294,068,460	JP4/5	24 tons	130 tons	4	74	Radar, RLR, SLAR, Image Intensification	Shielded

Vehicle	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
Tu-22M1	3574	894	NA 223 5/3 50/30	87000	27680	13000	FF8 CF8 RF7 T6 W6
Tu-22M2	3874	969	NA 242 6/4 60/40	87000	29986	13000	FF8 CF8 RF7 T6 W6
Tu-22M3	3974	994	NA 248 6/4 60/40	90000	30555	13000	FF8 CF8 RF7 T6

	W6

Vehicle	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
Tu-22M1	All-Weather Flight, Flare/Chaff (30), RWR, ECM 2, Terrain Following Radar, Laser Designator, Auto Track	1445/1765m Hardened Runway	+2	2x23mm Autocannons (Rear), Bomb Bay, 6 Hardpoints	2000x23mm
Tu-22M2	All-Weather Flight, Flare/Chaff (30), RWR, ECM 2, Terrain Following Radar, Laser Designator, Auto Track, Chaff Rockets (8), IRCM 1, Inertial Navigation	1390/1700m Hardened Runway	+3	2x23mm Autocannons (Rear), Bomb Bay, 6 Hardpoints	2000x23mm
Tu-22M3	All-Weather Flight, Flare/Chaff (30), RWR, ECM 2, Terrain Following Radar, Laser Designator, Auto Track, Chaff Rockets (8), IRCM 1, Inertial Navigation, Deception Jamming, Secure Radios, Look-Down Radar, Target ID	1325/1620m Hardened Runway	+4	2x23mm Autocannons (Rear), Bomb Bay, 6 Hardpoints	2000x23mm

Tu-160 Blackjack

Notes: This Russian heavy bomber is similar in appearance to the US B-1B Lancer, but is much larger and is a less-efficient design, requiring more fuel. Though designed in the late 1970s, the first flight did not take place until 1981. They were generally equipped with the best avionics the Russians could offer at the time.

Twilight 2000 Notes: In the Twilight War, they were used as low-level penetration bombers ion long-range missions in a similar manner to the B-1B (they were even seen over the Continental US on some occasions).

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$364,079,720	JF	40 tons	275 tons	4	75	Radar, RLR, SLAR, Image Intensification	Shielded

Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
4416	1104 (120)	NA 276 4/2 40/20	196045	53031	15500	FF89 CF9 RF8 T7 W7

Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
All-Weather Flight, Flare/Chaff (50), Chaff Rockets (10), Stealth 1, ECM 3, IRCM 3, Deception Jamming, Active Jamming, Terrain-Following Radar, Track While Scan, Inertial Navigation, RWR, Secure Radios, Target ID, Look-Down Radar	1730/2115m Hardened Runway	+4	2 Bomb Bays	None

B-1 Lancer

Notes: The Lancer was originally conceived of in its B-1A guise in the early 1960s. The high, fast-flying XB-70 Valkyrie was defeated before any flew into enemy territory – by rapidly-improving Russian SEAD and aircraft like the MiG-25 interceptor. Nevertheless, the Air Force felt that there was a need for the fast bomber, but perhaps in the low-fast penetrator role. Several such studies were carried out on paper in the 1960s and 1970s, with McNamara and the DoD fighting the proposals the entire way. (They felt that the FB-111A and the B-52, together, could fulfill the high-altitude penetrator and low-altitude penetrator requirement.) Finally, Nixon's new DoD Chief Melvin Laird broke the deadlock and directed that the last study, AMSA (Advanced Manned Strategic Aircraft) be developed fully into a modern bomber. RFPs were solicited starting in 1969, the first B-1As were built in 1971, and first flight went off in 1974. IOC took place in 1979, with 240 originally ordered. It was eventually intended that the B-1A would replace the B-52, B-58, and FB-111A. The B-1 is known to its pilots as the Bone (B-one).

B-1A

The B-1A had the planform of a slim, blended wing-body design with swing wings for good operation at low, medium, and high speeds and automatic wing sweep. The fuselage flared to the rear, and the tail incorporated slab all-moving tailplanes. There were no ailerons; the B-1A used a combination of wing slotted flaps and slats for such a purpose. Leading-edge slats improved maneuverability, particularly at low altitude.

The engines were GE F101-100 afterburning turbofans, arranged in pairs on either side of the fuselage at the wing roots. They were positioned as close as possible to the center of the aircraft line to provide stability if one or more engines failed, and the air intake were complicated and variable to properly feed air into the engines at both low-altitude low-Mach flight and high-altitude high-Mach flight. The engines were, however, far enough apart to allow retraction of the main landing gear. The three bomb bays were in the center of the aircraft and the center of the center bomb bay was at the center of gravity of the aircraft. (Bet you can't say that three times fast!)

The blended wing-body had an ancillary effect – a measure of stealth. The high tailplane which was above the wings when they were fully swept contributed to this. The B-52 looked like a house on radar. The B-1A looked like a fighter about the size of an F-15 or F-4 on radar. The leading edges were made of titanium; this not only dealt with heat as high speeds, but it just a very bit radar-absorbent.

Eight internal fuel tanks were carried; four in the wings, and the rest in the fuselage. This allowed a copious amount of fuel carriage and thus excellent range at low and high altitude.

Each bomb bay was normally meant to carry a rotary launcher for a variety of weapons from SRAM missiles to ALCMs to a massive amount of 750 or 1000-pound gravity bombs. In practice, the B-1A was stuck in the nuclear triad role, set up and loaded and only to carry standoff nuclear weapons. The B-1A carried no defensive armament (despite the wargame *Airwar* having it armed with a tail Vulcan cannon stinger). It did carry a large amount of ECM, ECCM, chaff, flares, IRCM, and even corridor chaff dispensers and chaff rockets. Tied to this was a large amount of computing power for the time (it was basically the same computing setup as the Space Shuttle, though with different crew instruments and software, of course.) Radar and navigation were state of the art for the time, including a Doppler Radar to better detect movement at range and a Doppler altimeter for assistance in low-altitude TFR flight, The B-1A essentially had radar coverage almost around the entire aircraft, missing only the 180-240-degree area on each side.

The B-1A had four crewmembers – pilot, copilot, offensive WSO and defensive WSO. In an emergency, the entire crew capsule separated from the aircraft and stabilized by a set of spoilers, descended on three parachutes. The capsule then served as a crew survival shelter, and was fully able to float in water.

Though there were originally 240 ordered, President Carter cancelled the B-1A in 1977. Carter did, however, allow testing of existing airframes to continue. However, only eight B-1As had been built by this time.

In 1984, one B-1A was essentially internally outfitted as a B-1B, though externally and airframe-wise it remained a B-1A. Though Reagan had re-authorized the B-1, this began the road to the B-1B.

B-1B Lancer

Though President Reagan reinstated the B-1 program, the B-1 that was to be developed was a low-altitude penetrator that was very different from the B-1A. The engines were to be less-fuel-hungry than those of the B-1A, Avionics and software and computers were upgraded and given the task of low-altitude penetration, while still being able to conduct the occasional high-altitude bombing mission.

Perhaps the biggest change was the engines, intakes and fairings. The intakes in particular were drastically simplified, and made without the variable geometry that to a great deal that made high-Mach travel possible. Though the GE F101-GE-102 turbofans made low altitude penetration speed increase from Mach 0.86 to 0.92 (or Mach 1.2 at altitude). The simplified air intakes could be redesigned as a result that the B-1B's RCS decreased somewhat.

The internal fuel carriage increased with two tanks in the wings, one in the wing sweep carriage box, and four others in the main fuselage. In addition, the bomb bays could carry a 75,708-liter cylindrical fuel tank if necessary for long-range missions; rumors state that in the beginning of the Afghanistan and Iraq Wars, When the B-1Bs were required to fly from their bases in the US to their targets, B-1B's were carrying up to two of these. Of course, the B-1B (and B-1A, for that matter) can be air-refueled, with the receptacle being just in front of the windshield.

The B-1B has a complex avionics and weapon delivery suite known as OAS (Offensive Avionics System). This is complimented by another integrated system, the DAS (Defensive Avionics System). The OAS allows accurate munitions release and delivery, regardless of aircraft speed and attitude up or down. The system allows changes of target or angle of approach to the target, making changes in the munitions delivery data automatically. Though gravity and free-fall munitions may be delivered accurately without any laser or optical assistance, the B-1B also has the assistance of a laser designator and a laser boresight capability. However, the primary assistance for aiming freefall and gravity munitions is bombing radar. Notably, this radar system is separate from the TFR system, though it uses the same antenna.

The radar system, in fact, uses the same antenna for all radar emissions, though some minor systems have their own emitters, and the radios and ECM/ECCM/IRCM have their own emitters as well. The radar can emit in 11 ways – Ground Mapping Mode, High-Res Ground Mapping mode, Velocity Update Mode, TFR, Terrain Avoidance Mode, Precision Position Update, High-Altitude Calibration, Rendezvous Beacon Mode, Standard Rendezvous Mode and Weather Detection Mode. The different modes may change in microseconds, and in practice are continuous in all modes.

TFR includes terrain avoidance scans to the front and side, in addition to photo scans of the upcoming terrain in a 60-degree sweep. The pilots may choose from a variety of TFR modes, from 610 meters to as low as 60 meters; pilots often call them a Soft Ride, Bumpy Ride, and Hard Ride. The OAS automatically adjusts to whatever TFR mode the B-1B is in.

The B-1B originally used an INS system, but upgrades in the early 2000s gave an ever-improving GPS capability. The B-1B also has a velocity sensor, a gyro-stabilization system, a radar altimeter, and a system for dead reckoning (if all else fails).There is a plethora of radios ranging from satellite radios to several UHF, HF, and VHF radios; essentially, the B-1B can talk to whoever it needs to. One of the UHF antennas also gives off the IFF signal. Upgrades in the early 2000s gave it the ability to use GPS-guided ordnance, including 750-pound, 1000-pound, and 2000-pound JDAMs. Like the B-52 and B-2, it can carry many of such bombs, individually targeting them, potentially surgically taking out up to 84 targets or breaking the back of an armored advance,

The DAS, of course, controls the defensive systems, from ECM/ECCM/IRCM, chaff and flares, and chaff rockets. (The B-1A's corridor chaff dispensers were deleted.) The DAS also includes Active Jamming and Deception Jamming capabilities. The DAS controls the radar in the rear tailcone as well.

Recent upgrades have given the B-1B Link 16 capability, essentially an aerial version of a BMS that also interfaces with ground units and intelligence from a variety of sources.

It has been rumored that some of the external skin has been replaced by carbon fiber and/or RAM, as well as treated with RAM paint. This is the version I have statted below.

Despite these changes, the basic airframe of the B-1B was identical to the B-1A (with a change in paint scheme). However, the structure was strengthened and the landing gear beefed up, allowing the B-1B a significantly-higher takeoff weight, and landing weight if necessary. The bomb bays were lengthened by nearly a meter, with one being relocated in wing fuselage section and the other two being forward in the fuselage, and the two forward weapon bays could be connected to carry very large ordnance. There are four crewmen; with the pilot and copilot having a fighter-type stick and HOTAS throttle. Unlike the B-1A, the Offensive and Defensive WSOs have a small window to their sides. Unlike the escape capsule of the B-1A, the crew of the B-1B have ejection seats with standard aircrew bailout bags and equipment.

The B-1B can carry external weapons pylons on the lower fuselage sides, each able to carry two weapons, Eight other single-weapon pylons could be carried on hardpoints on the fuselage, allowing a total of 13 external weapons to be carried later. (See the B-1R in the next section for more on these hardpoints.) In fact, this external weapons carriage severely degrades performance and increases RCS dramatically, and in practice have been rarely used. Today, it is believed that external weapons carriage has been removed from the B-1B, including deleting from the computer and software, though interestingly the hardpoints do remain. (Under SALT/START, a B-1B may carry no more than twelve nuclear weapons externally at a time.)

An interesting note is that the B-1B has the radar and software to employ AIM-120 AMRAAMs, though it has yet to do so operationally.

B-1R Lancer – the "Aerial Battleship"

The B-1R was conceived in the early 2000s as a partner to the F-22A or as an aircraft able to quickly break up large formations of enemy aircraft. Though it is an upgrade of the B-1B, it has more in common with the B-1A, able to reach Mach 2.2 and having vastly more powerful Pratt & Whitney F119 engines (the same as those on the F-22 Raptor) -- and fuel-hungry engines; the estimated range of the B-1R is about 20% less than that of a B-1B, even with a full load of fuel. Though the planform is basically the same as the B-1B, the inlets and engines give it away immediately – if that doesn't, the Y-shaped tail will – a tail shape that further increases the stealth profile of the B-1R (not by a full step however – it gives the radar and his missiles an additional -2), and somewhat increases its maneuverability. The radar has an additional mode, which is at the cost of some other modes – an AESA air-to-air fire control radar developed from that of the F-22 and F-15S (and rumors also say the Israeli version of the F-15). This is, however, at the cost of some radar modes like Ground Mapping and High-Res Ground Mapping and High-Altitude Calibration modes. The B-1R does not carry chaff rockets. It does have, however, several new air-to-air attack modes.. Some conceptions give the R-1R the ability, one it has fired all its externally-carried missiles, to jettison its MERs and use a rotary launcher in each bomb bay, each able to carry eight missiles. Some conceptions also have the B-1R able to carry AIM-9X Sidewinder missiles or AGM-122 Sidearm ARMs. Some conceptual designs also call for the carriage capability of the HARM ARM as well. I have included these in the stats below. Note that the normal missile loadout for the B-1R is the AIM-120 AMRAAM, and the most common version associated with the B-1R is and AIM-120D; however, the B-1R is able to use any version of the AIM-120 (or the Sidewinder, for that matter).The B-1R is able to lock onto 24 targets per phase, and is able to ripple-launch 12 missiles at twelve different targets the following phase (or if the offensive WSO wishes, later phases, as long as the B-1R maintains its lock-ons).Note that the B-1R's missiles and attack radar is operated by the Offensive WSO.

So far, the B-1R exists only in computers, computer simulations, and aircraft simulators.

Twilight 2000 Notes: These aircraft excelled at the low-level deep penetration raids for which they were designed, and were responsible for a lot of damage to targets ranging from Europe to the Middle East to Southeast Asia, as well as flying missions over the North American continent. However, the gradual loss of suitable airfields and support facilities, the reduction in available jet fuel, and combat losses meant that its use decreased steadily in the later stages of the Twilight War; though some 40 Lancers survived the Twilight War, it is believed that the last B-1B mission was flown in mid-1999.

Aircraft	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
B-1A	$192,386,263	JP5	34.02 tons	179.169 tons	4	51	Radar (250 km), SLAR (100 km), RLR (80 km), SAR (20 km), FLIR (100 km), Image Intensification (60 km)	Shielded
B-1B	$237,790,077	JP5	34.02 tons	216.37 tons	4	61	Radar (300 km), SLAR (150 km), RLR (100 km), SAR (50 km), FLIR (100 km), LIDAR (120 km), Image Intensification (60 km), VAS (50 km)	Shielded
B-1R	$181,074,470	JP5	34.02 tons	208.4 tons	4	59	Radar (300 km), SLAR (150 km), RLR (100 km), SAR (50 km), FLIR (100 km), LIDAR (150 km), Image Intensification (60 km), VAS (65 km)	Shielded

Aircraft	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
B-1A	1331	370/646 (130)	NA 87/152 6/4 60/40	112635	9252	18898	FF5 CF6 RF4 T6 W4
B-1B	956	265/550 (130)	NA 62/151 5/3 50/30	112635	7936	18288	FF7 CF8 RF7 T6 W6
B-1R	3979 (1276)	1105/2293 (130)	NA 900/1867 5/3 50/30	112635	9524	19564	FF7 CF8 RF7 T6 W6

Aircraft	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
B-1A	All-Weather Flight, Flare/Chaff Dispensers (75/75), Chaff Rockets (10), Corridor Chaff Pods (4) ECM 2, IRCM 2, Deception Jamming (60 km), Active Jamming, Stealth 1, IR Stealth 1, TFR (40 km), Track While Scan, Laser Designator (40 km), INS, IFF, RWR, Secure Radios, Look-Down Radar	3000/2300m Hardened Runway	+3	3 Bomb Bays	None
B-1B	All-Weather Flight, Flare/Chaff Dispensers (75/75), Chaff Rockets (10), ECM 3, IRCM 3, IR Suppression, Deception Jamming (75 km), Active Jamming, Stealth 2, IR Stealth 1, TFR (40 km), Track While Scan, Laser Designator (75 km), INS, GPS,IFF, RWR, Secure Radios, Satcom Radio, Target ID, Look-Down Radar, Multitarget (6)*	1800/2200m Hardened Runway	+4	3 Bomb Bays, 14 Hardpoints**	None
B-1R	All-Weather Flight, Flare/Chaff Dispensers (75/75), Chaff Rockets (10), ECM 3, IRCM 3, IR Suppression, Deception Jamming (75 km), Active Jamming, Stealth 2, IR Stealth 1, TFR (40 km),, INS, GPS, Advanced IFF, RWR, Secure Radios, Satcom Radio, Target ID, Look-Down Radar, Multitarget (12), Auto Track, Track While Scan,	1800/2200m Hardened Runway	+5	3 Bomb Bays, 3 Hardpoints/MERs (24 Attachment Points)***	Up to 48 AMRAAMs or Sidewinders or Sidearms or HARMs (or combination)****

	HUD Interface, IR Uncage, Supercruise

*Though the B-1B can carry AMRAAMs and the Multitarget ability can apply to them, the Multitarget capability normally applies to the number of guided munitions that the B-1B can launch at once.
**Though the B-1B can carry 14 low-capacity hardpoints around the aircraft, this is almost never done, as it reduces the speed by 10% and increases fuel consumption by 10%, and partially spoils the B-1Bs stealth profile (Stealth profile degrades by one step).
***While the B-1R is carrying it's external hardpoints, it suffers the same effects as the B-1B when it is using its external hardpoints.
****The B-1R could carry conventional free-fall and guided munitions in its weapon bays or fuel tanks, but though the fuel tanks are possible (to increase range), carriage of air-to-ground munitions is unlikely (but of course, mission-dependent).

B-2 Spirit

Research on this aircraft began in the mid 1970s, but its existence was not confirmed until the late 1990s (except for President' Carter's slip of the tongue in 1978). You see, in 1978, President Carter secretly authorized the development of a low-observable full-sized bomber, and invited Lockheed, Boeing, and Northrop to compete on the project, called the ATB Program (Advanced Technology Bomber). Northrop had a leg up, having had developed in its past the low-observable XB-35 and YB-49 flying wing bombers. These designs had a natural stealth profile to them, having buried engines, small canopies, only the barest amount of a tailcone (more to improve stability than anything else), and very small multiple vertical stabilizers, more fins than anything else, and again more for stability than anything else. (This was waaaaay before fly-by-wire technology…) Carter thought that the ATB could replace the escalating-cost B-1A, and the B-52 which he felt was increasingly obsolete. (Boy, was he wrong on all counts!)

The Northrop ATB was given the code name Senior Ice while the Lockheed proposal became Senior Peg. (Boeing had teamed with Northrop and Vought earlier in the process.)

Northrop's design was a barbed-arrowhead design which was essentially a flying wing design with no fins, fairings, projections, only the barest of blisters for antennas and emitters – many of the antennas and blisters could even be retracted into the aircraft in a process that later on, B-2A crews would call "stealthing up." You would be hard put (if the guards would let you near a B-2A) to find a surface that does not bounce radar off at a wrong angle to reflect properly. Most of the upper and lower surfaces are smoothly blended into each other, yet designed to also reflect incoming radar and guidance signals into off angles. Most of the B-2A is covered in a special elastic material which enforces its smoothness, and on top of this is the still-classified RAM material and RAM paint.

In 2005, Jack Northrop, then in his 90s and long a proponent of the flying wing, was shown a model of the soon-to-go-into-production B-2A Spirit. He broke down crying. He died within a year.

The chaff used by the B-2 is similar to that used by the Eurofighter; it actively broadcasts jamming signals, and functions one level better in effectiveness than normal chaff.

The centerbody contains the cockpit, some of the avionics in front and below the cockpit, a large avionics bay, and the weapons bay. (There is also a small, flat space behind the cockpit about big enough the one of the crewmen to lay out flat; most crews put a full length lawn chair or a cot there so on long missions they can switch off and rest. There is also a chemical toilet which suctions waste like you might find inside a passenger airline. There are only two crewmen; the pilot is usually designated the Aircraft Commander and flies the aircraft, performs the duties of a Defensive WSO, and in general keeps track of the stealth profile and the defensive avionics. The second crewman is designated the Mission Commander, and takes care of offensive operations as well as avionics such as the radar and radios. The B-2A has satellite radio and essentially enough radios to talk to anyone friendly on or above the battlefield or ships out at sea. It should be noted that much of the avionics operate on voice command, and some operate automatically.

The design of the B-2A was dictated by the need for stealth and the need for a high subsonic speed. Thus, the barbed arrowpoint/boomerang shape, complete with nose point. The wings are swept back and have a jagged rear edge that send detection beams off at angles and give the design maximum controllability. It should be noted that without the B-2A's avionics, it would probably crash the second it left the runway; the B-2A is almost completely unstable in flight without computer assistance. Intakes and exhausts are angular; even when control surfaces actuate, they are shaped and angled such that they are still stealthy. The B-2A has such a large wing that flaps are not needed. Though there is a set of control surfaces above the wings for yaw control, it is believed that the engines can be used to create differential thrust for additional yaw control, as the direction of greatest instability on the B-2A is the yaw axis.

Though the B-2A looks to casual inspection like it has only two engines, it in fact has four, GE F118-GE-11 non-afterburning turbofans. The engine is based on the F101-X, which itself is based on the F-100 that originally powered the F-16 and F-15, The F-100-X was eventually developed into the engines that powered the B-1A. The engines are buried far enough inside the intakes that the compressor blades cannot be seen by any sort of radar or guidance emission. The intakes are buried and the inlets covered with special S-shaped sections inside curved wedge shapes to confuse radar and reflect it as all sorts of odd angles; In early wind tunnel tests, it was found that the shapes of the inletsw led to a loss of power due to the inlets and intakes being unable to feed the engines enough air at low speeds. Therefore, at low speed, the B-2A's wings on either outer side of the intakes open auxiliary scoops to properly feed the engines. The engines were designed to run relatively cool, and the exhausts were likewise buried in the aircraft and let out to special (and still classified, but are supposedly based on a large improvement on the Space Shuttle's heat shield tiles). The engines are in barely-rising nacelles blended into the wing on either side of the crew compartment and weapons bay, which was itself low and blended smoothly into the rest of the structure. At the end of the aircraft, known as the beavertail, there are further moveable surfaces which help dampen the heat from the exhausts.

The wings are basically full of fuel, the central body, as stated, has the cockpit, avionics, and two bomb bays. These weapon bays generally carry rotary launchers carrying heavy JDAMs, ALCMs, JASSMs, LRASMs, and other such ordnance. The rotary launchers normally carry eight weapons per bay, but one or both bays may be reconfigured to carry a marked increase in smaller JDAMs or gravity bombs.

As stated, the B-2A has two crewmen. They are seated on ejection seats. There is a jumpseat behind and between the crewmembers for visitors , trainers, or evaluators, but in most cases, this is kept in the stowed position, and it is almost never used on a combat mission. The B-2A is capable of midair refueling, through a receptacle behind the cockpit on the upper fuselage; the receptacle rotates smoothly when not in use, leaving a smooth surface that blends into the rest of the aircraft.

Though it may seem that putting radar on a stealth aircraft would negate its stealth, the B-2A has an AESA radar which already has a low probably of being seen, and also has additional LPI (Low Probably of Intercept) features. Much of the radar system is classified, but it can function as a weather radar, and also has the tasks of detection, classification, identification, and location of any hostile threats (or non-hostile targets). The radar, like the F-22 and F-35, receives inputs from several locations on the aircraft, and essentially has 360-degree coverage around and even *through* the aircraft.

The Block 20 version of the B-2A appeared ion 1996. The primary difference is a strengthening of the airframe, landing gear, and weapon racks and rotating racks that allow it to operate at a higher weight. The INS navigation was also replaced with a GPS receiver (though the vanilla B-2A has partial GPS capability in order to drop JDAMs and some other GPS-guided ordnance). The Block 20 B-2A is also equipped with Link-16, which is essentially a BMS for aircraft which interfaces with ground BMSs like Blue Force Tracker.

The Block 30 is, so far, the definitive version of the B-2A. Essentially, all the RAM coating and paint was removed and replaced with even more efficacious materials. The TFR system allows the B-2A to follow terrain at an altitude as low as 60 meters – essentially giving it the ability of the B-1B, F-111F, or FB-111A. The Block 30 B-2A is integrated with the AFMSS (Air Force Mission Support System, which makes the aircraft extremely flexible in approaching, egressing, choosing, and changing targets based on the needs of higher headquarters, target prosecution, or evasion needs. It also allows the Block 30 B-2A to interacts with the sensors of UAVs within range, and receive pictorial data from satellites.

By the end of 2000, all B-2As had been upgraded to the Block 30 standard. In 2012, development began on what will become Block 40, with improvements primarily centering in the radar and radio systems, as well as some other avionics and equipment. The exact update list is still unspecified.

There are currently 21 B-2As; there were originally to be 50 B-2A's built, each one named *Spirit of [name of one of the US States]* However, the entire DoD chain of command, as well as the President, Vice President, the Congress, the Senate, several white House, Congressional, and Senatorial staffers…collectively gagged on the price on *one* B-2A, let alone 50; the RL price of a B-2A is rumored to be about $2 Billion. *Each*. The Acquisition program was cut before the halfway point, with 21 being built. In early 2008, the B-2A *Spirit of Kansas* crashed on takeoff from Guam; ofservers reported the aircraft had seemingly spontaneously caught fire, damaging the avionics and causing the *Spirit of Kansas* to roll sharply to starboard. The crewmembers ejected safely and are reportedly still flying B-2As. The cause of the crash was corruption of the air data system; somehow, moisture got introduced into the avionics while some parts of the avionics were being calibrated. The *Spirit of Kansas*, unfortunately, was essentially a total loss and no replacement B-2A was authorized.

Unfortunately, due to its design, the B-2 is not an agile aircraft, nor is it a fast aircraft, though it *is* fuel efficient.

Twilight 2000 Notes: This aircraft's existence was still only a rumor until just after the start of the Twilight War, when an NBC news camera crew shot some footage at Diego Garcia and caught the first public sight of the strange-looking aircraft, which the President later confirmed was the rumored "Stealth Bomber." These aircraft were used to penetrate heavy defenses all over the globe. Some 32 B-2As were built before the beginning of hostilities; most of these were upgraded to Block 20, but 12 were built to Block 30 standards.

Aircraft	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
B-2A Block 10	$833,549,931	JP5	22.68 tons	170.1 tons	2	49	AESA LPI Radar (300 km), AESA LPI SLAR (150 km), AESA LPI RLR (100 km), FLIR (100 km), LIDAR (120 km), Image Intensification (60 km), SAR (50 km)	Shielded
B-2A Block 20	$834.224,913	JP5	23.46 tons	177.11 tons	2	50	AESA LPI Radar (300 km), AESA LPI SLAR (150 km), AESA LPI RLR (100 km), FLIR (100 km), LIDAR (120 km), Image Intensification (60 km), SAR (50 km)	Shielded
B-2A Block 30	$902,609,453	JP5	23.46 tons	177.11 tons	2	54	AESA LPI Radar (300 km), AESA LPI SLAR (150 km), AESA LPI RLR (100 km), FLIR (100 km), LIDAR (120 km), Image Intensification (60 km), SAR (50	Shielded

	km)

Aircraft	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor*
B-2A Block 10	1582	434 (140)	NA 109 6/4 60/40	81646	7755	18288	FF6 RF6 RF6 T0 W6
B-2A Block 20	1521	417 (140)	NA 105 6/4 60/40	81646	8078	18288	FF6 RF6 RF6 T0 W6
B-2A Block 30	1521	417 (140)	NA 105 6/4 60/40	81646	8078	18288	FF6 RF6 RF6 T0 W6

Aircraft	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
B-2A Block 10	All-Weather Flight, Flare/Chaff Dispensers (60/80), Chaff rockets (4), ECM 2, IRCM 4, Stealth 3, IR Stealth 3, IR Suppression, Deception Jamming (75 km), Active Jamming, TFR (50 km), Track While Scan, Laser Designator (75 km), INS, GPS, RWR, Secure Radios, Satcom Radio, Target ID, Look-Down Radar, EW Suite, HUD Interface, Advanced IFF	1600/2000m Hardened Runway	+5	2 Bomb Bays	None
B-2A Block 20	All-Weather Flight, Flare/Chaff Dispensers (60/80), Chaff rockets (4), ECM 2, IRCM 4, Stealth 3, IR Stealth 3, IR Suppression, Deception Jamming (75 km), Active Jamming, TFR (50 km), Track While Scan, Laser Designator (75 km), INS, GPS, RWR, Secure Radios, Satcom Radio, Target ID, Look-Down Radar, EW Suite, HUD Interface, Advanced IFF, Link 16, Multitarget (4)	1600/2000m Hardened Runway	+5	2 Bomb Bays	None
B-2A Block 30	All-Weather Flight, Flare/Chaff Dispensers (60/80), Chaff rockets (4), ECM 2, IRCM 4, Stealth 4, IR Stealth 3, IR Suppression, Deception Jamming (75 km), Active Jamming, TFR (50 km), Track While Scan, Laser Designator (75 km), INS, GPS, RWR, Secure Radios, Satcom Radio, Target ID, Look-Down Radar, EW Suite, HUD Interface, Advanced IFF, Link 16, Multitarget (6), UAV Interaction	1600/2000m Hardened Runway	+5	2 Bomb Bays	None

*The B-2 has no tail or vertical stabilizer surfaces. Any tail hits are considered misses.

Boeing B-52 Stratofortress

Notes: Known affectionately to its crews as the BUFF (Big Ugly Fat Fellow, or Big Ugly Fat Fucker), the B-52's design goes back to the late 1940s, when plans for a heavy, turboprop-powered intercontinental bomber were drawn up. The engines were quickly replaced with what were then 8 of the most powerful jet engines available, the wings got swept and the fuselage sleeker, and in the intervening years, the design has been steadily upgraded with a stronger frame and skin, ever-more powerful electronics and bomb-delivery equipment, rebuilds to allow the carriage of heavier and more versatile weapons, and an upgraded rear gun position. Over the years, it was supposed to be replaced by a variety of newer bombers, including the B-58 Hustler, the XB-70 Valkyrie, and the B-1 Lancer, but it has outlasted any aircraft ever built. One misconception is that the B-52 is merely an enlarged B-47; this is far from the truth as the design work for the B-52 began before the design work for the B-47. That the B-52 bears any resemblance to the B-47 is coincidental. Some of the different iterations of the B-52 are so different that they could almost be regarded as separate aircraft, especially the different versions of the B-52H. Currently, the Air Force plans to keep the B-52 in service until at least 2020 and possibly as long as 2040; some of the present crop of B-52 crews are the children and even grandchildren of the original B-52 aircrew.

BUFF Prototypes – the XB-52 and YB-52

After years of failed design work on a piston, turbofan, and underpowered turbojet, the first true B-52, the XB-52, went into testing. One was built; its job was to wring out any problems with the upcoming B-52. The design had been lengthened from the original drawing board design by 4.26 meters, and huge above-wing spoilers were added to add to maneuverability and slow landing speeds. Pairs of huge flaps replaced the earlier conceptual flaperons. The wings were hugely thick at the roots, tapering to less than 0.6 meters at the tips. Some experience was gained from the B-47 program; the wings are swept at 35 degrees, the engines were podded, and the double bicycle landing gear with wingtip stick gear were used. The XB-52 used a bubble canopy, similar to that of the B-47 (though larger). The landing gear could be pivoted 20 degrees in either direction, making crosswind landings possible despite the size of the XB-52. Further braking was accomplished by a 13.4-meter wide parachute carried in the rear of the aircraft under the horizontal stabilizer.

The XB-52 was powered by eight Pratt & Whitney YJ57-P-3 turbojets, delivering 8700 pounds of thrust each, for a total of 26,100 pounds of thrust. Defensive armament consisted of four M-2HB machineguns mounted in a manned tail, with the tail gunner sitting above the gun turret. The turret could fire upwards 20 degrees, almost straight downwards, and about 45 degrees to either side. If the crew had to escape the aircraft, the tail gunner's compartment would be jettisoned by explosive bolts so the tail gunner could jump out. The bomb bay was located in the center of the aircraft between the wheel bogeys; provisions were made for both conventional and nuclear bombs. The standard crew was five: the pilot and copilot sat under the bubble canopy, the bombardier and defensive weapons (ECM) operator sat further back and downwards from the canopy, and the tail gunner was in the rear. The front had one more seat – the tail gunner took off in this seat, and before the XB-52 reached altitude, he would climb back to the tail gunner's position and lock himself in while the rest of the aircraft other than the cockpit were depressurized.

The XB-52 flew once, then was returned to Edwards for extensive ground experimentation and modifications. It would not fly again until after the YB-52s flew, using lessons learned from the XB-52.

The second prototype, the YB-52, was a service test model. It incorporated changes in response to the XB-52 flight and ground experimentation. Perhaps the biggest change in the YB-52 was the use of a shorter vertical stabilizer, a feature which would not appear again until the B-52G.

Early BUFFs – B-52A-C

The first production model was the B-52A, which first flew in 1954. Three B-52As were built, and used for advanced service testing, though they were also fully capable of carrying out missions. They however never saw squadron service. The nose of the B-52A was completely changed – instead of the bubble canopy, the B-52A had the side-by-side seating and nose we all know and love now. The crew accommodation of the B-52A was changed to six – pilot, copilot, tail gunner, radar navigator/bombardier, defensive systems operator, and navigator. The pilot and copilot sat in the top deck of the B-52A, while everyone else except the tail gunner sat in a lower deck behind the cockpit which later got tagged with names such as "the pit," the hole," and "the black hole;" the deck was dark and cramped. A seventh seat was a folding seat behind and between the pilot and copilot for an instructor pilot. The pilot and copilot had ejection seats; the four members of the crew on the lower deck simply fell out of the floor of the B-52. If an IP was present, he had to leave his seat, put on a parachute, then jump out of one of the spaces on the lower deck left by the escaping lower deck crew.

At first, the bombing system was not finished; a temporary system was installed until the actual MA-6A bombing/navigation system was ready. The B-52A was not only capable of aerial refueling, it carried, under the outer wings a pair of 3785-liter drop tanks.

The first 10 B-52Bs were to have been B-52As, but technical improvements based on the B-52As test program were incorporated into the new aircraft. The B-52B was the first version to see squadron service, and first flight was in 1955. 50 B-52Bs were originally to have been delivered as bombers; however, only 23 B-52B bombers were actually delivered. The remaining 27 were outfitted as RB-52B long-range reconnaissance aircraft. The B-52B used an A-3A fire control system for the tail gunner, but some later were retrofitted with the more advanced MD-5 system, which incorporated short-range tail radar. The RB-52 could still perform a bombing mission; a small portion of the bomb bay could still carry bombs, and the special wing MERs could carry weapons. All B-52Bs used the MA-6A bombing/navigation system. The B-52Bs were powered by J57-P-1W turbojets, each with a rating of 11,400 pounds of thrust.

A notable achievement (for the time) was a flight by three B-52Bs on a nonstop trip around the world, aided by aerial refueling. This flight took 45 hours 19 minutes for the 39,148-kilometer trip.

The RB-52B had an interesting internal setup: in the bomb bay was a two-man pressurized capsule who, depending on the mission, carried out photographic reconnaissance, radar reconnaissance, ELINT, or one of those activities and the use and launching of ECM or drones such as the Quail, which was designed to look on radar like a B-52.

Two RB-52Bs were later modified into X-15 launch aircraft. The other B-52Bs and RB-52Bs were modified to the B-52C standard in 1957-58.

The B-52C first flew in 1956; it was essentially an improved B-52B which had the capability to carry the RB-52Bs bomb bay pod (though the "R" designation was not used, as the mounting was not permanent). 35 total were produced. Internal fuel capacity was increased, and the size of the drop tanks was increased to 11,356 liters (though the smaller tanks of the B-52A and B could still be mounted). The B-52C was the first B-52 to carry the "SAC" paint scheme – largely natural metal with the underside of the aircraft painted in a reflective antiradiation white paint. This paint was classified – and it led to questions about why the underside of the B-52C was white. For the most part, these questions were never answered until the paint scheme was declassified, and ironically, the questions stopped and the paint scheme was rarely questioned. Power was again increased by use of the J57-P-19W, which had a rating of 11,750 pounds thrust.

An interesting feature present on all B-52s is a small water heater, generally for heating coffee and tea. Like all B-52s, the B-52A had antiflash curtains to pull across the windshield to protect the pilot's and copilot's eyes from nuclear flashblindness. The aircraft had to be flown on IFR when the curtains are deployed.

Large-Scale Production Begins: The B-52D, B-52E, and B-52F

The service entry in 1956 of the B-52D marks the B-52 as part of the triad of nuclear delivery systems that was the foundation of defense and offensive combat power for the US Air Force. The B-52D, B-52E, and B-52F were also capable of carrying out conventional bombing missions. Some 170 B-52Ds were built. The B-52D was essentially the B-52C without the capability to carry the special pod in its bomb bay. The B-52D got another power upgrade by the use of J57-P-29W turbojets, each developing 12,100 pounds of thrust. Production was extended to Boeing's plant in Wichita, Kansas, as in the Seattle plant, much of production was dedicated to the KC-135. The fire control system for the tail gunner was the A-3A or the MD-9, a later version of the MD-5. The bombing/navigation system remained the MA-6A. The Doppler radar system was updated from the AN/APN-108 to the AN/APN-89A, and a form of Terrain-Following Radar (TFR) was added.

The B-52E appeared in 1957, with 100 built. The E Model was very similar to the B-52D, with a more advanced bombing/navigation system, electrical system, and more advanced ECM and ECCM. The B-52E was capable of carrying the AGM-28 Hound Dog cruise missile, a small unmanned aircraft with inertial guidance and a thermonuclear warhead. Two could be carried, one each on hard points on the inner wing. Some B-52Es were used to test low-altitude penetration of enemy defenses, an activity at which they were largely successful.

The B-52F was the last B-52 to be manufactured in Seattle (though some modification work was carried out in Seattle). Squadron service began in 1958, and 44 were built. The biggest change was that the B-52F had self-starting engines; no external power cart was required. The self-starting module was carried on the port side of each port engine nacelle. Power was further increased by use of the J57-P-43W engine, with a thrust of 13,750 pounds thrust each. The B-52F suffered from a problem with leaky fuel lines, presenting a possible fire hazard; though this was not the first instance of this problem, it was the biggest. When operations over Vietnam started, the B-52Fs had their ECM and ECCM upgraded. A Loran homing navigation device was also added. The upgraded electronics limited the bomb load. The guns equipping earlier models of the B-52 were traded for M-3s, doubling their rate of fire.

One modification applied only to B-52Ds was the "Big Belly" refit, which increased the capacity of the bomb bay dramatically. This was a direct result of requirements for missions over the Hanoi-Haiphong area and Route Pack Six. Along with the Big Belly refit was the retrofitting of more advanced ECM/ECCM capability and an increase in chaff and flare carriage. It should be noted that the Big Belly refit did not actually change load-carrying capacity, it simply rearranged storage in the B-52, allowing it to carry more iron bombs for saturation bombing missions. It allowed up to 107 500-pound bombs, plus another 24 on the wing MERs. Other modifications made to Vietnam-bound B-52Ds included the Rivet Rambler ECM fit, which included an improved RWR, a radar receiver which could be left on to warn the crew, SLAR. Three more radar jamming modules (to cover the large amount of equipment the Russians were giving the North Vietnamese), and high-capacity flare and chaff dispensers were installed.

The B-52D was the model most used in the Vietnam War; rumors are that the actor James Stuart, an Air Force Reserve officer and qualified heavy bomber pilot, flew one mission against a VC stronghold in Cambodia. B-52 strikes in Vietnam were popularly known, especially to the ground troops, as Arc Light missions. Missions in Route Pack Six were called Linebacker missions. A result of B-52D (and E and F) operations is that they had to undertake an in-theater IRAN (Inspect and Repair as Necessary) upgrade.

First of the Last: The B-52G

The B-52G had perhaps the most marked change in appearance of all the B-52 series – the shorter vertical stabilizer like that used on the YB-52. Boeing's data indicated that the large vertical stabilizer of earlier models was not only unnecessary from a design and aerodynamic standpoint, but shortening the tail saved thousands of kilograms of weight and also reduced the RCS by a bit. Internally, there were also large changes – most notably the elimination of the rubber bladder-type tanks, with hollow tanks taking their place, allowing for a big increase in fuel capacity. The wing tanks in particular were joined, forming what Boeing and the Air Force called a "wet wing." However, the size of the external drop tanks was greatly reduced in response to the increase in fuel capacity; they now were physically smaller and held only 2650 liters each. Unlike earlier such tanks, these were attached permanently and are a part of the B-52G's (and H's) fuel load. The loss of weight in the tail led to an increase in possible takeoff weight. On the inner wings, the B-52G could carry huge multiple ejector racks, able to carry twenty-four 500-pound or 750-pounds bombs or eighteen 1000-pound bombs. Another type of rack could be installed on those wing hardpoints, allowing the B-52G to carry a pair of Hound Dogs. The B-52G was also to have carried the GAM-87A Skybolt medium-range attack missile, but the Skybolt program was cancelled during the B-52G's development. Instead of the Skybolt, four ADM-20 Quail decoys were carried in the bomb bay in addition to the B-52G's weapons load. These decoys used a preprogrammed flight path and had an RCS similar to the B-52.

Another large change to the B-52G was the elimination of the tail gunner's position. The former tail gunner was brought up to the lower deck of the B-52G, and he became the defensive weapons operator (generally an NCO Staff Sergeant, Technical Sergeant, or Master Sergeant). He was still responsible for the defense of the aircraft, and could launch chaff, flares, and chaff rockets, or the Quail (when so equipped). His primary job, however, was the firing of the tail guns by remote control; he had a wide-angle CCTV viewer with a reticle that varied by range, and the tail radar was more powerful and could also help direct the guns. The gunner could also leave aiming the guns to the AGS-15 fire control system, meaning that he only had to drop the trigger on enemy aircraft. He faced the rear, and had an upward-firing ejection seat.

The B-52G introduced TERCOM to the B-52, to go with the new low-level penetration role of the B-52. This allowed the B-52G to be safely flown as low at 200 feet, in a soft or hard ride flight configuration.

Like the B-52H, the B-52G was used over North Vietnam, South Vietnam, Cambodia, and Laos, with mixed results. Though the Vietnamese were justifiably afraid of the havoc they could bring down, they were suited more for urban and industrial targets than bombing of the Ho Chi Minh trail and other such tactical targets. In addition, the air defenses of the Hanoi-Haiphong area were much thicker than the designers of the B-52 ever thought about, and the B-52G and B-52H took heavy losses, especially during the Linebacker II bombing campaign.

B-52Gs (and Hs) dispensed with the wing ailerons, using spoilers and the tail to do the job formerly dome with ailerons.

The tail of the B-52G was increased by about a meter, and used for some of the new electronic systems and flare and chaff dispensers.

The B-52G is the B-52 variant featured in HBO's *By Dawn's Early Light.* Last combat use for the B-52G was during Desert Storm, though eight B-52Gs remained in service until 1995.

The "Last" Version: The B-52H

The B-52H was intended to be the last version of the B-52 to fly before it was to be replaced by more advanced bombers such as the XB-70 and later the B-1. It was also intended to be primarily a nuclear weapons carrier, and that it's primary armament would be the Skybolt missile with thermonuclear warheads. This would keep the B-52H, for the most part, from having to penetrate enemy air defenses while still being able to attack the target. The B-52H would still carry four Quails in its bomb bay. However, with the demise of the Skybolt program, the B-52H carried paired Hound Dog missiles, and free-fall nuclear weapons in its bomb bay. 102 were built; only 80 remain in service, with some being destroyed at AMARC as a part of the START treaty while others are preserved at AMARC as a source of spare parts. Some of these 80 B-52s are still in use over Afghanistan.

The B-52H had the same shortened tail as the B-52G; however, the tail armament was changed to the more effective M-61 Vulcan Gatling Gun. The engines were changed to more fuel efficient and higher-rated Pratt & Whitney TF33-P-3 turbofans, rated at 17,000 pounds of thrust each. This engine was a highly-modified J57, turning it into a turbofan. A power cart was again necessary, as the engines required a pneumatic blast to start. These engines have larger air intakes than the J57-powered aircraft and incorporate bypass air outlets that make the engine nacelle look very different from earlier models.

The B-52G introduced the rotary launchers that later could equip all B-52Gs and Hs. These were modular in nature, and could be removed to increase conventional bomb carrying capability. Two of these rotary launchers could fit into a B-52s bomb bay.

The B-52H had increased ECM and ECCM capability, as well as increased-capacity flare and chaff dispensers and the ability to carry 10 chaff rockets in its bomb bay. These systems were collectively referred to as the Phase VI Countermeasures Suite. A takaway from the earlier CCV program (see below) was a modification of the control surfaces and a small flight computer which gave the B-52H greater agility than its earlier cousins.

B-52H: Later Iterations

The B-52H has been the recipient of repeated and heavy modifications; some modifications programs should rightfully earned the B-52H a higher letter designation, despite the fact that this was never done.

The first such heavy modification was done to 281 B-52Gs and Hs. These modified B-52s began service in 1972. This involved the installation of a rotary-type launcher in for forward bomb bay, designed to carry eight of the then-new SRAM short-Range Attack Missiles, which could carry a nuclear or conventional warhead. Six further SRAMs could be carried on the wing hardpoints on an MER designed for this purpose. The B-52Gs and Hs could still carry four Quails in its bomb bay, but in late 1972, the Quails on the B-52H were replaced by the AGM-69A SCAD (Subsonic Cruise Armed Decoy Missile). Six of these were carried on a rotary launcher in the rear bomb bay; the SCAD was not only a decoy, but could be programmed to, at any point in its flight, to attack a target using a conventional warhead, using either flight programming or using an integral antiradar capability.

Next, the B-52H sprouted an ever-increasing amount of antennas, both faired and short, but free-standing. All over the aircraft are antennas for use with the B-52Hs extensive communications suite, including a two secure VLF radios, a pair of extreme-long range secure radios, and a medium-range secure link primarily to communicate with other B-52s and escorts in the same strike package, as well as tanker aircraft. Fairings on either side of the nose held advanced (for the time) ECM, ECCM, and Deception Jamming transmitters. Above the radome is a further fairing; this carries a AN/ALT-28 "noise generator," used for hard jamming of enemy air defenses by filling their scopes with static and false targets. A further fairing on the each side, with a small air intake in front of it, allows the B-52Hs air conditioning and heating to function even without the engines being on. (This is something anyone who has sat on a large aircraft on the ground can appreciate.) The mechanism also provided cooling for the ECM equipment. The lower fairings on both sides could be steered within its housing to get a better jamming effect. The AN/ASQ-38 bombing/navigation system was replaced with the up-to-date (at the time) AN/ASQ-176 Offensive Avionics System (OAS). The OAS gave the B-52H true radar bombing capability and greatly increased radar and bombing accuracy. Also added with the OAS was a FLIR. This is referred below as the B-52H-1.

The OAS (Block II) was necessary for the next upgrade: the carriage of the AGM-86B ALCM, also carried on the B-52Hs rotary launchers, and carryable on the wing hardpoints. Twelve ALCMs could be carried in the bomb bay, and another six on each wing MER. The electronics necessary for operation and aiming of the ALCM were also added, as well as allowing the bombardier to program a flight path, including various turns and other maneuvers. (Some B-52Gs also received this modification.) B-52s carrying cruise missiles are fitted with wing root extensions at the front of the wing to allow the Russians to tell whether we have too many B-52s with potential nuclear weapons to comply with treaty obligations (as we did, at the beginning of the modification program). All B-52H bomb bays now had a pair of rotary launchers, which could deliver nuclear weapons, conventional munitions, and most of the tactical missiles in the USAF inventory. This is referred to below as the B-52H-2.

The next modification was relatively small: the addition of the AN/AVQ-22 Electro-Optical Viewing System. This was a long-range sight that could be swiveled 45 degrees to either side, 15 degrees upward, and 45 degrees downward. It also provided long-range LLTV. This sight not only allows the B-52H to identify enemy aircraft at beyond visual range, is allows the crew their first look at a target, again from long range. In 1982, the wing hardpoints of the B-52H (and G) were modified to carry six Harpoon missiles, giving the B-52 an antishipping capability. The crewmembers on the lower deck were given CCTV monitors to allow them a view outside (these were later replaced flat panels). The OAS Block II was improved and modified into the Flight Management System, which combined the navigation functions with the Stores Management Overlay (SMO); the SMO facilitated the use of several different types of weapons by merely loading the software for use of a particular weapon into memory. The SMO function of the FMS would see continual upgrades over the years as new weapons were added to the B-52H's repertoire – and continues to be upgraded. This is referred to below as the B-52-3.

In the mid-1980s, ECM capability and strength was further increased by new equipment in the belly of the B-52H forward of the bomb bay; this resulted in a "farm" of eight blade-type antennas underneath the B-52H. An IRCM device was also installed, providing more protection against heat-seeking missiles and providing false targets for aircraft with IR seekers. A datalink device was used, with the antenna atop the rear fuselage; this gave the B-52H a direct link not only with each other, but with AWACS aircraft and ground radars. The addition of another extreme long-range secure radio allowed contact with ground units. GPS was added to the FMS in the late 1980s. The OAS Block II was modified into the Block III, which included the AN/APQ-166 Strategic Radar, which had increased range, had a planar-array radar. The longer-ranged AN/AAQ-23 FLIR replaced the AN/AAQ-6. The AN/AVQ-22 EOVS was replaced by the longer-ranged, more flexible, and more reliable AN/AVQ-37. Another, more general upgrade was done to switch to systems that had more availability of spare parts. These collective modifications are referred to the B-53H-4.

In October of 1991, the tail gun of the B-52H was deemed unnecessary and was removed. This meant that the gunner and his station were removed and the remaining functions of the Offensive Systems Operator were folded into a redesigned Offensive/Defensive Systems Operator station; the use of more advanced computers also allowed this integration to take place without unduly increasing the O/DSO's workload. Though at first the guns remained on the aircraft and were operated by the O/DSO, they were finally totally removed by 1994. Interestingly, the tail gunner's seat, reticle gunsight, and AN/ASG-21 defensive fire control system remained in the tail, though the area was covered over by a bolt-on fairing. In addition, the tail radar was increased in ability into a full search and tracking radar.

The mid-1990s also saw communications upgrades for the B-52H. The AN/ARC-210(V) VHF/UHF replaced the old VHF/UHF radio, and provided the B-52H with secure, long-range communications. It could be used in LOS or SATCOM modes, and unified the shorter-range communications with other aircraft as well as air-to-ground communications. The radio set also had a commercial Have Quick I set for communications with civilian aircraft, and a Have Quick II module which gave the set a strong antijamming capability as well as an interface with the SINCGARS radios used by ground units and military helicopters. It was capable of multiple simultaneous communications, and could be used in manual mode to talk to ships and submarines.

Another addition was a receive-only radio called the AN/ARR-85(V), letting the aircraft listen to VLF and LF transmissions. This was meant primarily for the B-52H to be able to receive attack orders even in heavily ionized atmospheric conditions like those during a general nuclear exchange. The AN/ARR-85(V) was operated by the navigator, who would then print out the orders and give them to the bombardier. Computers and software developed from commercial counterparts, called Falcon View and Combat Track II, were added; this included three laptop computers which controlled the entire communications and ECM setup. The computer system made the entire communications, ECM/ECCM, and attack profile much more agile. The Combat Track II also included a fold-up LCD which functioned as sort of an additional HUD. The collective developments in the past three paragraphs are called below the B-52H-5.

In 2000, the B-52H began to receive the Avionics Mid-life Improvement (AMI), which essentially brought the bombing and navigation systems into the 21st century. AMI replaced the avionics computer and data transfer unit, which under OAS had severe limitations, with full digital capability and supporting advanced data entry such as a trackball for targeting, a digital mapping unit, and modernized the base computer language. A problem with the B-52H's navigation capability over the poles was fixed. The AMI was a bit slow in implementation and the AMI was not fully operational until 2006.

After AMI, the Combat Network Communication Technology (CONECT) replaced all the old, monochrome TV monitors with full-color LCD monitors. A client/server architecture replaced previous communications technology with other aircraft, ground units, and AWACS aircraft. The Link-16 Tactical Datalink (TDL) with Windows Mail allowed higher commands to give the crew of the BUFF the ability to change targets or weapons use as needed. It also gave the B-52H a wideband wireless internet and data connection ability. This upgrade occurred in 2007. A removable Litening II targeting pod allowed the B-52H to use virtually all smart weapons in the USAF inventory. This upgrade included the modification of the bombardier's panel into the Advanced Guided Weapon Control Panel (AGWCP). The Litening Pod was itself upgraded several times to improve resolution, range, coordinates for GPS-guided weapons, and the ability to automatically transfer the BUFF's weapons complement and targeting information to ground units. The AGWCP software also transmitted coordinates to ground units in both latitude and longitude and in the grid coordinates used by ground units. Part of the AGWCP included a joystick which resembled that of a gamer's flight-type joystick. The AN/AAQ-28A(V)3 Litening AT/ISR allowed the B-52H to transmit pictures from the weapons' receivers to a properly-equipped ground unit or AWACS aircraft (or back to the AWACS). The two paragraphs above are referred to below as B-52H-6.

In general, virtually all BUFFs received structural strengthening and improvements throughout their lifetimes. This is particularly true of the B-52G and H; while the aircraft were older in most cases than their aircrews, many structural components and skin had been replaced several times. Modifications were legion, including the replacement of whole systems, electronic and electrical. Most B-52Hs are well beyond the original 5000 hours projected for their airframes at the time of their construction.

As for the designations I am using – B-52H-1 through -6 – **these are not official designations,** merely designations to easily delineate them.

Special BUFFs

One B-52A went on to serve into the late 2000s; it was modified into the NB-52A configuration and used to launch research aircraft such as the X-15, lifting body aircraft, and the X-37, as well as various scale models of actual aircraft in a pre-prototype testing phase.

The NB-52A was getting really long in the tooth by 2001. It's supposed replacement was a B-52H, which was heavily-modified for it's role (but not given an NB designation). However, NASA contracted such use to Scaled Composites and its White Knight research aircraft, and the modified B-52H was retired in 2006, having never flown a research mission.

The NB-52E was a part of a larger research program into Controlled Configuration Vehicles (CCVs). CCVs sport extra aerodynamic surfaces in addition to modifications designed to deliberately cause the aircraft to be unstable and capable of maneuvers that a stock aircraft cannot do. (The B-52E is largely unable to perform most air combat maneuvers.) Special computers allow the unstable to be flown by continually adjusting aerodynamic surfaces, sometimes as much as 20 such corrections per second. The NB-52E was largely differentiated by it's bright-colored test paint scheme canards just behind and below the cockpit, and vertical fin under the nose. Special modifications were designed to reduce the structural bending and control surface flutter which could happen to a B-52 in severe air turbulence. The flight computer array was linked to sensors literally everywhere in the aircraft. Gyroscopes and accelerometers detected abrupt or unexpected movements of the aircraft and caused the flight computers to jigger the control surfaces, or the canards and nose fin. The system, computers, and canards and fin were collectively called the Ride Control System. In some places, the skin was replaced with anti-radar paint or actual anti-radar materials. Testing started in 1973, but the configuration was never included in actual production B-52s. Though the NB-52E had a bomb bay largely containing instrumentation, I have included a "combat example" below for interest and comparison. I have given this the designation of "YB-52H", **but let me stress that this is not a real designation.**

Another NB-52E was used to test the B-52 while powered by four Pratt & Whitney JT9D turbofans, also employed on the Boeing 747. This was done primarily in an effort to come up with a configuration that required less maintenance and less fuel, and produced 43,500 pounds of thrust apiece. Ultimately, the costs of re-equipping the entire B-52 fleet got in the way, along with the costs and time to train ground crews on the new engines, train the pilots to proficiency with the new engines, etc, etc, etc. I have decided to add a "combat version" below. Another NB-52E was used to test a fly-by-wire system, which later reappeared on the B-52H. As above, I have given this the **non-real designation** of "YB-52J." This re-engined B-52 is, however, showing every sign of becoming the real B-52J.

Twilight 2000 Notes: By the Twilight War, the only official service variant was the B-52H, with a fully modern electronic warfare suite and modernized attack center able to conduct both low-level penetration missions and high-altitude bombing with anything from conventional iron bombs to air-launched cruise missiles. In the Twilight War, they are perhaps best known for the bombing of the Krefeld Salient, where, despite staggering losses, they were able to break the back of the Russian invasion of Germany; and the carpet bombing of Baghdad and the surrounding area, practically reducing the Iraqi capital to total ruins along with most of the Republican Guard in a single 22-hour campaign of non-stop bombing.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
B-52A	$177,497,303	JP5	19.2 tons	187.5 tons	6+1	166	Weather Radar (200 km), Radar (200 km), Bombing Radar (40 km)	Shielded
B-52B	$186,844.635	JP5	20.57 tons	200.89 tons	6+1	176	Weather Radar (200 km), Radar (200 km), Tail Radar (50 km), Bombing Radar (40 km)	Shielded
RB-52B	$1,265,960,000	JP5	2.57 tons	200.44 tons	8+1	186	Weather Radar (200 km), Radar (300 km), Tail Radar (50 km), Bombing/Mapping Radar (50 km)	Shielded
B-52C	$187,226,535	JP5	20.57 tons	200.89 tons	6+1	176	Weather Radar (200 km), Radar (200 km(, Tail Radar (60 km), Bombing Radar (50 km)	Shielded
B-52D	$166,228,788	JP5	20.57 tons	200.89 tons	6+1	180	Weather Radar (220 km), Radar (220 km), Tail Radar (65 km), Bombing Radar (55 km)	Shielded
B-52D (Big Belly)	$182,851,667	JP5	26.79 tons	207.11 tons	6+1	186	Weather Radar (220 km), Radar (220 km), Tail Radar (65 km(, Bombing Radar (55 km)	Shielded
B-52E	$232,960,809	JP5	19.2 tons	200.89 tons	6+1	181	Weather Radar (240 km), Radar (240 km), Tail Radar (75 km), Bombing Radar (60 km), Doppler Radar (40 km)	Shielded
B-52F	$286,089,129	JP5	22.32 tons	217.68 tons	6+1	124	Weather Radar (275 km), Radar (275 km), Tail Radar (86 km), Bombing Radar (66 km),	Shielded

							Doppler Radar (45 km), Loran (299 km)	
B-52G	$211,325.360	JP5	22.32 tons	217.68 tons	6+1	124	Weather Radar (303 km), Radar (303 km), Tail Radar (95 km), Bombing Radar (75 km), Doppler Radar (58 km), Loran (299 km)	Shielded
B-52H	$247,281,408	JP5	22.32 tons	217.68 tons	6+1	125	Weather Radar (336 km), Radar (336 km), Tail Radar (105 km), Bombing Radar (83 km), Doppler Radar (64 km), Loran (299 km), Advanced FLIR (80 km)	Shielded
B-52H-1	$231,749,000	JP6	22.32 tons	217.68 tons	6+1	130	Weather Radar (336 km), Radar (336 km), Tail Radar (105 km), Bombing Radar (83 km), Doppler Radar (64 km), Loran (299 km), Advanced FLIR (80 km)	Shielded
B-52H-2	$292,749,000	JP6	22.32 tons	217.68 tons	6+1	132	Weather Radar (336 km), Radar (336 km), Tail Radar (105 km), Bombing Radar (83 km), Doppler Radar (64 km), Loran (299 km), Advanced FLIR (80 km)	Shielded
B-52H-3	$492,189,088	JP6	22.32 tons	217.68 tons	6+1	135	Weather Radar (336 km), Radar (336 km), Tail Radar (105 km), Bombing Radar (83 km), Doppler Radar (64 km), Loran (299 km), Advanced FLIR (80 km)	Shielded
B-52H-4	$448,399,872	JP6	22.32 tons	217.68 tons	6+1	136	Weather Radar (336 km), Radar (336 km), Tail Radar (105 km), Bombing Radar (83 km), Doppler Radar (64 km), Loran (299 km), Advanced FLIR (80 km)	Shielded
B-52H-5	$457,750,528	JP6	22.32 tons	216.02 tons	5+1	138	Weather Radar (336 km), Radar (336 km), Tail Radar (105 km), Bombing Radar (83 km), Doppler Radar (64 km), Loran (299 km), Advanced FLIR (80 km)	Shielded
B-52H-6	$683,145,600	JP6	22.32 tons	216.02 tons	5+1	140	Weather Radar (336 km), Radar (336 km), Tail Radar (105 km), Bombing Radar (83 km), Doppler Radar (64 km), Loran (299 km), Advanced FLIR (80 km)	Shielded
YB-52H	$798,529,728	JP-6	20.09 tons	221.41 tons	6+1	153	Weather Radar (370 km), Radar (370 km), Tail Radar (60 km), Bombing Radar, (92 km). Doppler Radar (71 km), Loran (329 km), Advanced FLIR (88 km)	Shielded
YB-52J	$683,187,264	JP-6	22.32 tons	211.73 tons	6+1	140	Weather Radar (409 km), Radar (409 km), Tail Radar (66 km), Bombing Radar (102 km), Doppler Radar (79	Shielded

		km), Loran (361 km), Advanced FLIR (97 km)

Vehicle	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
B-52A	1960	914 (169)	NA 122 4/2 60/50	134761	7316	15420	FF7 CF7 RF7 T6 W8
B-52B	1838	857 (169)	NA 114 4/2 60/50	134761	9857	14417	FF7 CF7 RF7 T6 W8
RB-52B	1838	857 (169)	NA 114 4/2 60/50	134761	9857	14417	FF7 CF7 RF7 T6 W8
B-52C	1894	942 (169)	NA 125 4/2 60/50	135139	9857	13960	FF7 CF7 RF7 T6 W8
B-52D	1894	942 (169)	NA 125 4/2 60/50	135139	9857	13960	FF8 CF7 RF7 T6 W8
B-52D (Big Belly)	1879	934 (169)	NA 124 4/2 60/50	135139	9936	13960	FF8 CF7 RF7 T6 W8
B-52E	1894	942 (169)	NA 125 4/2 60/50	135139	9857	14082	FF8 CF7 RF7 T6 W8
B-52F	1894	942 (169)	NA 130 4/2 60/50	157295	9857	14234	FF8 CF7 RF7 T6 W8
B-52G	1974	982 (169)	NA 135 4/2 60/50	181853	10277	14326	FF8 CF7 RF7 T7 W8
B-52H/B-52H-1	1992	920 (170)	NA 127 5/2 70/40	1133481	12291	14539	FF8 CF7 RF7 T7 W8
B-52H-2/3/4	2070	1992 (160)	NA 175 5/2 70/40	1133481	12291	14539	FF8 CF8 RF7 T7 W8
B-52H-5/6	2091	2012 (155)	NA 177 5/2 70/40	1133481	11062	14539	FF8 CF8 RF7 T7 W8
YB-52H	2039	1962 (140)	NA 173 6/4 80/35	1133481	11339	14539	FF8 CF8 RF7 T7 W8
YB-52J	2099	2020 (160)	NA 178 5/2 70/40	1133481	10620	15993	FF8 CF8 RF7 T7 W8

Vehicle	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
B-52A	All Weather Flight, Flare/Chaff Dispensers (35 Each), RWR, ECM 3), ECCM 3, Magnetic Compass, Gyrocompass, Secure Radios	2200/2600m Hardened Runway	+1 (Bombing) or +2 (Tail Guns)	4xM-2HB, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	600x.50

B-52B	All Weather Flight, Flare/Chaff Dispensers (35 Each), RWR, ECM 3, ECCM 3, Magnetic Compass, Gyrocompass, Secure Radios	2200/2600m Hardened Runway	+1 (Bombing) or +2 (Tail Guns)	4xM-2HB, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	600x.50
RB-52B	All Weather Flight, Flare/Chaff Dispensers (40 Each), RWR, ECM 5, ECCM 5, Magnetic Compass, Gyrocompass, Secure Radios, ELINT 2	2200/2600m Hardened Runway	+1 (Bombing) or +2 (Tail Guns)	4xM-2HB, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	600x.50
B-52C	All Weather Flight, Flare/Chaff Dispensers (40 Each), RWR, ECM 3, ECCM 3, Magnetic Compass, Gyrocompass, Secure Radios	2200/2600m Hardened Runway	+1 (Bombing) or +2 (Tail Guns)	4xM-2HB, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	600x.50
B-52D	All Weather Flight, Flare/Chaff Dispensers (48 Chaff, 56 Flares), RWR, ECM 3, ECCM 5, Magnetic Compass, Gyrocompass, Secure Radios, TFR	2200/2600m Hardened Runway	+1 (Bombing) or +2 (Tail Guns)	4xM-2HB, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	600x.50
B-52E	All Weather Flight, Flare/Chaff Dispensers (48 Chaff, 56 Flares), RWR, ECM 5, ECCM 5, Magnetic Compass, Gyrocompass, Secure Radios, TFR	2200/2600m Hardened Runway	+2 (Both)	4xM-2HB, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	600x.50
B-52F	All Weather Flight, Flare/Chaff Dispensers (48 Chaff, 56 Flares), RWR, ECM 5, ECCM 5, Magnetic Compass, Gyrocompass, Secure Radios, TFR	2200/2600m Hardened Runway	+3 (Bombing) or +2 (Tail Guns)	4xM-3, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	600x.50
B-52G	All Weather Flight, Flare/Chaff Dispensers (60 Chaff, 58 Flares), RWR, ECM 5, ECCM 5 Active Jamming, Magnetic Compass, Gyrocompass, Secure Radios, TFR	2200/2600m Hardened Runway	+3 (Bombing) or +3 (Tail Gun)	20mm M-61 Vulcan, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	1242x20mm
B-52H	All Weather Flight, Flare/Chaff Dispensers (75 Chaff, 90 Flares), 10 Chaff Rockets, RWR, ECM 5, ECCM 5, IRCM 3, ELINT 2, Magnetic Compass, Gyrocompass, Secure Radios, TFR	2200/2600m Hardened Runway	+3 (Bombing) or +3 (Tail Gun)	20mm M-61 Vulcan, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	1242x20mm
B-52H	All Weather Flight, Flare/Chaff Dispensers (75 Chaff, 100 Flares), 10 Chaff Rockets, RWR, ECM 5, ECCM 5, TRCM 3, ELINT 2, Magnetic Compass, Gyrocompass, Secure Radios, VLF/LR Radios Secure Radios, TFR, Inertial Navigation, GPS	2200/2600m Hardened Runway	+3 (Bombing) or +3 (Tail Gun)	20mm M-61 Vulcan, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	1242x20mm
B-52H-1/2/3/4	All Weather Flight, Flare/Chaff Dispensers (75 Chaff, 100 Flares), 10 Chaff Rockets, RWR, ECM 5, ECCM 5 ,IRCM 3, ELINT 2, Magnetic Compass, Gyrocompass, Secure Radios, TFR, Inertial Navigation, GPS	2200/2600m Hardened Runway	+3 (Bombing) or +3 (Tail Gun)	20mm M-61 Vulcan, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	1242x20mm
B-52H-5/6	All Weather Flight, Flare/Chaff Dispensers (75 Chaff, 159 Flares), 10 Chaff Rockets, RWR, ECM 5, ECCM,5 IRCM 3, ELINT 2, Magnetic Compass, Gyrocompass, Secure Radios, VLF/LR Radios Secure Radios, TFR, VAS, Inertial Navigation, GPS	2200/2600m Hardened Runway	+3 (Bombing) or +3 (Tail Gun)	2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	Nil
YB-52J	All Weather Flight, Flare/Chaff Dispensers (75 Chaff, 159 Flares), 10 Chaff Rockets, RWR, Stealth 1, ECM 5, ECCM 5, IRCM 4, ELINT 3, Magnetic Compass, Gyrocompass, Secure Radios, VLF/LR Radios Secure Radios, TFR, VAS, Inertial	2000/2400m Hardened Runway	+3 (Bombing) or +3 (Tail Gun)	20mm M-61 Vulcan, 2xExtra Large Hardpoints, 2 Wet Hardpoints, Double Bomb Bay	1242x20mm

	Navigation, GPS

F-111 Aardvark

Notes: Despite the designation, this is not a fighter, but is in fact a medium bomber. It has variable geometry (swing) wings, which change the sweep angle automatically according to speed. The aircraft has four hardpoints and an internal bomb bay. In the F-111E, this normally carries up to 1.8 tons of weapons, or a 20mm Vulcan pod with 2084 rounds of ammunition; in the F-111F, this bay carries the Pave Tack pod, but the Pave Tack pod may be removed and internal weapons carried instead. If internal weapons only are carried, the weapons do not count when determining agility or turning. The F-111 uses an escape pod instead of ejection seats; the entire cockpit is ejected in an aerodynamic shell, and lowered on a parachute. This pod floats. The F-111 is capable of in-flight refueling and nuclear weapons delivery. In addition to the USAF, the Aardvark is used by Australia.

Early F-111s

The F-111A was the first model. It was designed under the TFX (Tactical Fighter Experimental) program. At first, it was meant to be a long-range defensive fighter, and was to carry two Phoenix missiles in its bomb bay allow with two Sidewinder missiles, and four Sparrow (later AIM-120) missiles in its inner wing hardpoints.

The F-111 had a checkered history, suffering several mysterious crashes during its first deployments to the Vietnam War. It was one of the first operational aircraft to use a variable-geometry ("swing") wing, allowing good performance at high and low speeds and a comparatively short takeoff and landing run. Compared to later Aardvarks, the F-111A was a relatively primitive aircraft, with unsophisticated ECM systems, bombsights that were heavily slaved to the radar (if performing radar or level bombing only, RF is +2), and the swing wing was not automatic. The original 11 had conventional ejection seats; on all others, the entire cockpit capsule was blasted out of aircraft, supposedly to increase crew safety. However, landing in the crew capsule usually resulted in severe injuries to the crew; this was partially ameliorated by the use of one large parachute instead of three smaller ones (which usually resulted in the three chutes streamering around each other in tests).

The F-111B was to be a naval interceptor version of this aircraft, but this version was cancelled. The F-111B had the same basic structure as the F-111A, but the side-by-seating was a concession to the Navy, as was the escape crew capsule. The nose was 2.6 meters shorter than the F-111A, necessitating a smaller, less capable radar to be mounted. In the end, however, the Navy decided that the F-111B was a lost cause and began preliminary work on what would become the F-14 Tomcat. I have done no stats below for the F-111B.

The RF-111A was supposed to be a tactical reconnaissance version of the RF-111; a prototype was built, but the project was not carried further. The RF-111A did not have the ability to carry weapons and had no fire control software, though its wing hardpoints were envisioned to carry one or two extra fuel tanks per wing. In its bomb bay, the RF-111A would carry several film, TV, and infrared cameras, as well as a primitive digital suite that could transmit grainy pictures back to base. The RF-111A had a radar boresight mode, used to focus a single camera on a target, and a long-range laser rangefinder, used to keep the camera suite on target. Imagery obtained good results; imagery from the digital system was even better than expected, However, the USAF baled because, while General Dynamics assured the Air Force that conversions would only take a few hours and could be done in the field, in fact conversions took several days and needed considerable technical support to accomplish. The RF-111A, had it worked out, would have been an excellent reconnaissance platform because it supported complex electronics, was a stable reconnaissance platform, and could absorb damage while maintaining the ability to take stable pictures. It was also fairly light next to most F-111s and was therefore a fast variant. Therefore, I have included a version of the RF-111A below as a "what-if."

In 1969, the RAF and British MoD, in the wake of the TSR.2 debacle (and it *was* a fiasco – almost on scale with the Avro Arrow fiasco in Canada), still felt the need for a light, nuclear-capable, tactical bomber. They thus looked to the US, and the then-new F-111A. (And the F-111A for that time would have been a step down from TSR.2 – someday, I'm going to have to put the TSR.2 in the Best Aircraft That Never Were section…) Anyway, the RAF and MoD, already haven taken twin body-blows from the costs of the defunct TSR.2 program, were than shocked again by the potential costs of training, conversion, and maintenance of the F-111A, and pulled the plug, eventually deciding to go with the Blackburn Buccaneer for the nuclear low-altitude penetration role. The British version would have been essentially the same as the F-111A, except for its nomenclature, which would have been the F-111K.

Australian F-111Cs

The F-111C is the Australian Air Force version; it is an F-111A with the longer wings of the FB-111A, more hardpoints, a reinforced undercarriage, and upgraded radar, bomb delivery systems, and ECM. It also has some of the electrical system of the F-111B, which was felt by the RAAF to be more robust. The F-111C was to replace the RAAF's antiquated Canberra bombers. The F-11C was equipped with a forward-looking attack radar, which could also be used as a weather radar, used for navigation, air-to-ground delivery of ASMs and as a bombing radar. It had a multimode radar, and could in fact perform all these functions at once. Theoretically, the F-111C's radar could also be used in the air-to-air mode (for use with a Vulcan cannon or air-to-air missiles), but the Australians never used their F-111Cs in that way.

Four unmodified F-111As were also bought by the RAAF and equipped as RF-111Cs. They have cameras, IR Cameras, and early digital reconnaissance equipment in its bomb bay. The bay also has a small bubble which contains a TV system that keeps the reconnaissance equipment lined upon the targets. Some of the radar modifications of the F-111C were also added.

Originally the F-111C's were to keep in the inventory until 2020, but upgrade and maintenance costs led the Australians to return the F-111Cs and RF-111Cs to Palmdale. California, where they were made, and now they are kept in working order as the Boneyard.

The Australians got unnamed vehicles, aircraft, and other concessions for the return of essentially well-kept and modified F-111s.

F-111D/E

In the late 1960s, soon after the development of the F-111A, the USAF and DoD decided to “max up” the F-111A. They did this by replacing the engines with a pair of Pratt & Whitney TF30P-9 engines, a nearly 30% in power. In addition, the F-111D has special Triple Plow 2 intakes, which prevent the compressor stalls at low speed all too frequent on F-111As The Mark II electronics suite revolved around 7 items – INS patched to the attack and bombing radar, an IBM computer system to master all the aircraft’s functions (though the F-111D was *not* a fly by wire aircraft), an integrated display set (an early version of a glass cockpit), a Doppler radar to sharpen the other radar and INS systems, and stores management, and a forward-looking/TFT radar with MTI. In addition, the F-111D could use radar-homing AAMs, though they were almost never carried.

This was all good, but the scale of improvements took a great deal of time and rebuilding. The F-111D did not fly until 1970, then was put on hold after an F-111A crash. It was not until late 1971 before the first examples were sent to an Air Force unit for testing, and IOC wasn’t declared until late 1972. Then, seemingly just to rain on the parade, the F-11D was crippled by software problems during most of 1972. The F-11D was not considered operationally ready until early 1974. It was not until then that the F-11D’s problems were finally ironed out for good (for the most part; there were still some “ghosts in the machine” that were not chased down for a few months). The F-111D Fleet remained at their home base at Cannon AFB until the early 2000s.

Meanwhile, the DoD was getting impatient with how long the F-111D was taking in development and how long its software was taking ti iron out. So the DoD commissioned the F-111E, a simplified version of the F-111D. (It should be noted that the Air Force did not want the F-111E, feeling it was simply a “dumbed-down” version of the F-111D that they really wanted. It should be further noted that the F-111E’s development also slipped, though not as much as the F-111D, due to F-111A accidents.) The F-111E has the same engines as the F-111D, but paired with simplified air intakes that did not eliminate all of the low-speed compressor stalls. The F-111E threw out nearly all of the F-111D’s avionics and software suite, substituting a radar system based on a lower-power radar which was used for navigation, the TFR suite, ASM and bombing targeting, It did not have a master computer to monitor and correct the avionics and weapons suite. It did have an air to air mode, though again it was almost never used. The F-111E suffered heavily from losses in Vietnam and accidents, and the entire fleet was grounded (though lifted in in 1970).

The first prototype of the F-111E was loaned to NASA for tests in support of the Integrated Propulsion Support System. This was sort of a fly-by-wire system that controlled the changes in weight caused by changes in win sweep, contents of the bomb bay, and fuel state. The first such flight was carried out in mid-1975, the last in early 1976. The modified F-111E was returned to it’s normal configuration. Later, it was used as a chase plane for the then-new B-1A bomber (the B-1 hadn’t been given the name Lancer yet).

F-111F

TAC (Tactical Air Command) ordered a “plus version of the F-111D in 1970, and the entire F-111F wing was declared operational by late 1972. (At that point, the final bombing halt had been declared, but the F-111F would later see action in the first and second bombings of Libya and in Desert Storm. (The Dale Brown story *Chains of Command* has the protagonist on a mission to Baghdad in Desert Storm in a modified F-111F with a nuclear weapon; he refuses to obey orders to nuke Baghdad and gets in a lot of trouble thereafter…) No F-111Fs were lost in Desert Storm and only one in the Libyan strikes despite being engaged several times by aircraft and SAMs, a testament to their combat effectiveness. The F-111Fs were particularly impressive during Desert Storm, due to their ability to deliver precision-guided ordnance under all weather conditions. They were also the only aircraft able to deliver the hastily-devised GBU-28 5000-pound “Bunker Busters.”

The first 30 F-111Fs were engined with the same TF30P-9 engines of the F-111D; this was done because the F-111F’s TF30P-100s were not ready when the first prototypes and LRIP models were rolled out and the Air force wanted to get the bugs worked out of the new avionics and to start training new crews. The prototypes and LRIPs were later re-engined with the more powerful (and reliable) TF30P-100s. One other mechanical component that was improved was the main landing gear, which which in previous models did collapse on occasion. The F-111F carried a simpler (ie, more modernized) avionics suite that did the avionics suite on the F-111D about two steps better. The avionics centered around the Mark IIB avionics suite, which included a navigational and digital weapons computer which was borrowed from the FB-111A (also being developed at the time). The attack reticule used a reticule which could be widened out to 2.5 miles, made possible by the attack computer’s 0.2-second pulse-width capacity.

The F-111F has the standard F-111 weapons bay, which can carry air-to-air missiles, bombs or ASMs, or a Vulcan cannon. It should be also noted that the F-111F has the ability to carry almost any type of air-to-air missile on its wing pylons or in it’s bomb bay (it can, for example, theoretically carry four AMRAMMs or Sparrows in its bomb bay if the Pave Tack is not carried), in practice neither AAMs or the Vulcan cannon has been carried on any operational mission. However, the F-111F normally carried in the bay the Pave Tack Pod, which gave the F-111F a long-range laser designator and FLIR-capability. The FLIR and laser designator are boresighted to a rotating TV receiver which allows the F-111F to record the bombing and essentially do its own BDAR. (This is why in some videos of the F-111Fs bombing Libyan airfields, the picture suddenly flips upside down.) The FLIR and TV views are also shown on the WSO’s monitors, so they can get an instant idea of how well they did in their bombing run and whether they might have to go around again.

FB-111A

OK, let’s go back to the F-111A. Yes, all the way back there. (It wasn’t really a big difference in time, anyway.) The Air Force thought, “We need an interim replacement for the B-52 and B-58 until the B-1A is available, and why don’t we modify some of the impending F-111As to fulfill the role? We don't have to keep them forever, anyway… (And if only the Air Force know how soon the FB-111A would be retired and how long the B-52 would stick around!) Some DoD officials, including Robert McNamara, thought the aircraft should have been designated the BF-111A, but the Air Force was against that.

The Air Force wanted 263 FB-111As, but Robert McNamara cut that order to 126, plus a few examples for training, testing, and development. McNamara cited the rising costs of the FB-111A program. From inception to last deliveries, the FB-111A program went from 1965-1971.

General Dynamics took the F-111A and lengthened the fuselage by a meter to accommodate a larger bomb bay., then they took the longer wings that the F-111B was supposed to have; when they were in their fully forward position, the FB-111A had a wingspan over two meters wider. Due to the extra hardpoints and larger bomb bay, internal fuel load was not as large, but the new engines and air intakes made the FB-111A more fuel-efficient. .The engines were replaced by more powerful TF30P-7 engines, and to keep them properly fed with air, used the new Triple Plow II air intakes that would later be used on the F-111E and F. It had stronger landing gear for the heavier weight in aircraft in weapons, It was equipped with the Mark IIB avionics suite which was planned for the F-111F, except with the displays (which were in of themselves advanced for the time) of the F-111D. (It did not have the Pave Tack pod, it having not been developed yet, but the FB-111A *did* have a decent laser designator and night vision, as well as a beacon-following capability and a photo-recorder.)

Though the FB-111A could carry a host of weapon types in its enlarged bomb bay and four wing pylons, but its primary offensive weapon was to be the AGM-69A SRAM, which would later make appearances on the B-52 and B-1. (More on the SRAM in US ASMs, if it's not there already…if it *is* there, it's probably wrong considering the research I've done lately on it.)

When the B-1B Lancer came into service and took the FB-111A's role as a long-range penetration bomber, the FB-111As became redundant. Their ability to carry nuclear weapons was removed and deleted from their software, and they took the tactical deep-penetration strike role. At this point, they were redesignated F-111Gs. A Have Quick UHF radio was installed, able to communicate with ground units and ships in the littoral combat zone.

F-111Gs has their capability to carry SRAMs and nuclear weapons removed (including from their software). A conventional weapons carriage and release system was re-installed, allowing gravity-bomb and AAM use. Unlike almost all F-111s, the F-111Gs were known to have carried their Vulcan cannon on some strike missions during Desert Storm. In 1994, the RAAF bought 16 F-111Gs, but they returned them to the US about the same time as their F-111Cs; like the F-111Cs, they were originally supposed to stay on with the RAAF until 2020 and be further modified in that time, but were taken out of service in the late-1990s for the same reasons.

However…

In 1979, the B-1B Lancer was still not ready for action. In response, the General Dynamics proposed a lengthened, upgraded, up-engined version of the FB-111A, using versions of the same engines that would have been used on the B-1A. Heavily upgraded, it had a larger fuel capacity to provide fuel to the new fuel-hungry engines and provide a bit extra range. The FB-111B was to provide nuclear alert role, with four SRAMs in the bomb bay and four SRAMs under each wing. The avionics were to be sort of an amalgamation of the FB-111A and F-111G, along with upgraded attack computers and software and better radar and night vision/VAS, along with some new gadgets.

In 1980, however, other General Dynamics executives thought they could take the low-level penetration mission away from Rockwell outright. They essentially started working to build an upgraded FB-111A, then started getting ideas from the technicians working on the FB-111B, then took the idea even further. And created (on paper and in large-scale models, anyway), the FB-111H.

Personally, I think the FB-111H would have been an awesome version of the F-111 series to have had in service. It was similar in idea to the FB-111B, but extended even longer, with a bomb bay greatly increased in size (big enough for 12 SRAM missiles, for example). It would have had six hardpoints which could carry a variety of weapons or tanks – for example six SRAMs or twelve ALCMs, and the wings could sweep with all hardpoints occupied. It was also to have an enhanced conventional strike capability, with all hardpoints being able to pivot with the wings. The avionics were based on those of the FB-111A and F-111G, but, as Walt Disney would say, "plussed." The fire control, navigation, and main computers were state-of-the-art (for the late 1970s-early 1980s). The FB-111H used the same engines as the B-1B and that the FB-111B would have used. Almost everything avionics-related was new or state-of-the-art. Internal fuel capacity was increased. The new bomb bay could no longer mount a Vulcan cannon, but this was thought of as unimportant since F-111-series aircraft almost never carried one operationally.

I personally think the FB-111H would have been able to carve out a decent niche complementing the B-1B; there are a lot of missions that don't require a heavy bomber, but where a medium bomber would fit just right, and you need something more than a fighter-bomber. The stats below, however, are highly conceptualized and may be nothing like a real FB-111H would have been.

EF-111A Raven

The EF-111A Raven will be covered in US Special Aircraft.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
F-111A	$45,204,982	JP5	13.61 tons	28.8 tons	2	32	Radar (150 km), Bombing Radar (90 km)	Shielded
RF-111A	$89,795,989	JP5	9 tons	24 tons	2	34	Radar (150 km), FLIR (90 km), VAS (45 km), 3xFilm Camera (60	Shielded

							km), Digital Camera (40 km)	
F-111C	$95,553,400	JP5	13.82 tons	28.9 tons	2	34	Radar (150 km), FLIR (90 km), VAS (45 km), 3xFilm Camera (60 km), Digital Camera (40 km)	Shielded
RF-111C	$91,494,960	JP5	11 tons	24 tons	2	34	Radar (150 km), FLIR (90 km), VAS (45 km)	Shielded
F-111D	$141,676,350	JP5	13.33 tons	30 tons	2	33	Radar (185 km) Bombing Radar (110 km)	Shielded
F-111E	$118,063,625	JP5	13.78 tons	28.8 tons	2	32	Radar (158 km), Bombing Radar (95 km)	Shielded
F-111F	$161,622,212	JP5	14.23 tons	32.57 tons	2	36	Radar (205 km), Bombing Radar (120 km), (With Pave Tack) FLIR (40 km), 3rd Gen Image Intensification (40 km), VAS (40 km)	Shielded
FB-111A	$214,494,777	JP5	17.73 tons	37.96 tons	2	40	Radar (225 km), Bombing Radar (135 km), FLIR (45 km), VAS (45 km), Photo Recorder (20 km)	Shielded
F-111G	$214,494,777	JP5	17.73 tons	33.43 tons	2	41	Radar (225 km), Bombing Radar (135 km), FLIR (45 km), VAS (45 km), Photo Recorder (20 km)	Shielded
FB-111B	$292,165,344	JP5	18.8 tons	35.44 tons	2	41	Radar (250 km), Bombing Radar (150 km), FLIR (50 km), VAS (50 km), Photo Recorder (22 km)	Shielded
FB-111H	$313,401,044	JP5	19.19 tons	35.71 tons	2	43	Radar (280 km), Bombing Radar (170 km), FLIR (50 km), VAS (50 km), Photo Recorder (25 km)	Shielded

Vehicle	Tr Mov	Com Mov	Mnvr/Acc Agl/Turn	Fuel Cap	Fuel Cons	Ceiling	Armor
F-111A	2899/3343	806/1232 (105)	NA 201/308 5/3 50/35	19090	3649	17679	FF5 CF6 RF6 T5 W6
RF-111A	3842/4430	1067/1227 (105)	NA 231/266 5/3 50/35	19090	5413	17679	FF5 CF6 RF6 T5 W6
F-111C	2892/3321	803/1222 (100)	NA 200/305 5/3 50/30	19090	3771	17679	FF5 CF6 RF6 T5 W7
RF-111C	3842/4430	1067/1227 (105)	NA 231/266 5/3 50/35	19090	5413	17679	FF5 CF6 RF6 T5 W7
F-111D	2778/3190	772/1175 (105)	NA 185/282 5/3 50/35	19060	3271	17679	FF5 CF6 RF6 T5 W6
F-111E	2892/3321	803/1222 (105)	NA 200/305 5/3 50/35	19090	3271	17679	FF5 CF6 RF6 T5 W6
F-111F	2580/3695	717/1098 (105)	NA 179/274 5/3 50/35	19089	3622	17267	FF5 CF6 RF6 T5 W6
FB-111A	2292/3283	637/976 (100)	NA 159/244 5/3 50/30	18964	3407	15320	FF6 CF6 RF6 T5 W7
F-111G	2598/3271	722/1033 (100)	NA 228/326 5/3 50/30	18964	3407	15320	FF6 CF6 RF6 T5 W7
FB-111B	3401/4825	945/1191 (100)	NA 228/285 5/3 50/30	20292	4741	18000	FF6 CF7 RF6 T5 W7

FB-111H	3376/4790	938/1183 (100)	NA	226/283 50/30	5/3	20900	4741	18000	FF6 CF7 RF6 T5 W7

Vehicle	Combat Equipment	Minimum Landing/Takeoff Zone	RF	Armament	Ammo
F-111A	All Weather Flight, Flare/Chaff (50/50), Advanced RWR, ECM 2 ECCM 1, TFR (40 km), INS, Secure Radios	1400/1105m Hardened Runway	+2	20mm Vulcan (Optional), 6 Hardpoints, Internal Bomb Bay	(Optional) 2084x20mmM61
RF-111A	All Weather Flight, Flare/Chaff (50/50), Advanced RWR, ECM 2, ECCM 1, TFR (40 km), INS, Secure Radios, Radar Boresight, HUD Interface	1400/1105m Hardened Runway	Nil	6 Hardpoints	Nil
F-111C	All Weather Flight, Flare/Chaff (55/55), Advanced RWR, ECM 2, ECCM 1, IRCM 1, TFR (40 km), INS, Secure Radios, Radar Boresight	1400/1105m Hardened Runway	+3	20mm Vulcan (Optional), 8 Hardpoints, Internal Bomb Bay	(Optional) 2084x20mmM61
RF-111C	All Weather Flight, Flare/Chaff (55/55), Advanced RWR, ECM 2, ECCM 1, IRCM 1, TFR (40 km), INS, Secure Radios, Radar Boresight, HUD Interface	1400/1105m Hardened Runway	Nil	8 Hardpoints	Nil
F-111D	All Weather Flight, Flare/Chaff (60/60), Advanced RWR, ECM 2, ECCM 2, IRCM 1, TFR (44 km), INS, Secure Radios, HUD Interface, Track While Scan, Auto Track	1400/1105m Hardened Runway	+3	20mm Vulcan (Optional), 6 Hardpoints, Internal Bomb Bay	(Optional) 2084x20mmM61
F-111E	All Weather Flight, Flare/Chaff (50/50), Advanced RWR, ECM 2, ECCM 1, TFR (44 km), INS, Secure Radios, HUD Interface, Track While Scan	1400/1105m Hardened Runway	+2	20mm Vulcan (Optional), 6 Hardpoints, Internal Bomb Bay	(Optional) 2084x20mmM61
F-111F	All Weather Flight, Flare/Chaff (60/60), Advanced RWR, ECM 3, ECCM 2, IRCM 2, TFR (44 km), INS, Secure Radios, HUD Interface, Track While Scan, Auto Track, Target ID, (With Pave Tack) Laser Designator (40 km)	1400/1105m Hardened Runway	+3, (With Pave Tack) +4	20mm Vulcan (Optional), 6 Hardpoints, Internal Bomb Bay (Except with Pave Tack)	(Optional) 2084x20mmM61
FB-111A	All Weather Flight, Flare/Chaff (70/70), Chaff Rocket (1), Advanced RWR, ECM 3, ECCM 3, IRCM 2, TFR (50 km), INS, Secure Radios, HUD Interface, Track While Scan, Auto Track, Laser Designator (40 km)	1400/1105m Hardened Runway	+3	20mm Vulcan (Optional), 8 Hardpoints, Internal Bomb Bay	(Optional) 2084x20mmM61
F-111G	All Weather Flight, Flare/Chaff (70/70), Chaff Rocket (1), Advanced RWR, ECM 3, ECCM 3, IRCM 2, TFR (50 km), INS, Secure Radios, HUD Interface, Track While Scan, Auto Track, Laser Designator (40 km), Radar Boresight	1400/1105m Hardened Runway	+3	20mm Vulcan (Optional), 8 Hardpoints, Internal Bomb Bay	(Optional) 2084x20mmM61
FB-111B	All Weather Flight, Flare/Chaff (80/80), Chaff Rocket (1), Advanced RWR, ECM 3, ECCM 3, IRCM 2, TFR (55 km), INS, Secure Radios, HUD Interface, Track While Scan, Auto Track, Laser Designator (40 km), Radar Boresight	1400/1105m Hardened Runway	+3	20mm Vulcan (Optional), 8 Hardpoints, Internal Bomb Bay	(Optional) 2084x20mmM61
FB-111H	All Weather Flight, Flare/Chaff (80/80), Chaff Rocket (1), Advanced RWR, ECM 3, ECCM 3, IRCM 3, TFR (55 km), Radio Jamming 1,	1400/1105m Hardened Runway	+3	6 Hardpoints, Internal Bomb Bay	Nil

INS, Secure Radios, HUD Interface, Track While Scan, Auto Track, Laser Designator (50 km), Radar Boresight