I3D PROJECT GROUP

FLIGHT MANUAL
B-1B Lancer

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The folks at I³D would like to personally thank you downloading our first freeware aircraft, Boeing's B-1B Lancer, also known as the "Bone". We would also like to express a big "Thanks" to the USAF pilot(s) that provided input.

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Before you begin

Please read this document thoroughly before taking flight as there is some very important information.

Although we pride ourselves in giving you the best immersive experience for simulated flight in FS by using *authentic* aircraft data (Flight test performance and aero) from reliable sources and as well as feedback from the pilots that fly them; our B-1B was only designed basically by the latter. Due to the needed high security clearances and classification of the B-1B, we couldn't get as much data as we would have liked. So in conclusion, the flight dynamics are based more so *feel* rather than hard data. But you can be assured that when the B-1B sources gave the "OK", that's how the B-1B *flies*. The flight dynamics are essentially *unfinished* as far as our flight dynamics programmer is concerned; perhaps in the future we will release updated B-1B flight dynamics once more data arrives or is found. Currently, the B-1B's flight dynamics possess estimated aero data and the engine is unfinished. The SMS FBW system is not modeled.

Same can be said with our 2D and VC cockpits. We weren't able to obtain enough information. But, thankfully in the FS World you can add and remove gauges at your heart's desire. The VC cockpit doesn't contain an abundance of animated gauges but you would like to add them in, and then by all means go for it.

The B-1B will give you a *slight* preview of what is to come in our payware products. This manual for instance doesn't contain our performance charts. Our payware products are more thorough and extensive with a touch of some *Ingenious, Innovative, and Immaculate* work.

Requirements

Due to the high detail presented in our B-1B model and your computer system, you might get a reduction in frame rate. You will need a video card that supports textures bigger than 512 x 512. If you do get a lower frame rate then you may want to lower some of your graphic settings. The B-1B was tested on Windows XP and Windows 9x in FS 2002.

How to use this Manual

The easiest way to use this manual is by two ways: the scroll method or use the bookmarks.

The scroll method is what you typical do when you view a web page or any document in which you can either use the Page UP/DOWN keys, the wheel on the mouse, click on the wheel mouse and move the mouse, or use the scroll bar on the right.

The bookmarks method is a feature in Adobe Acrobat's Reader in which there is a pane on the left side and you can either select the thumbnails or bookmarks. If you don't see this pane, just move your mouse over to the left side of the window and drag the pane towards the right.

How the thumbnails work, it just shows you all the pages that were created in the document. And by bringing your mouse pointer to a page icon and clicking on the icon, the page will be shown in the right pane. So in essence, it is a direct page linking too. Whereas the bookmarks, lists the sections of the manual and will direct you to the proper section you are seeking that will locate it accordingly in the right pane.

Installation

This procedure is very easy, just click on the executable and follow the directions in the installation routine. Just remember to point to the root directory of your FS installation.

De-installation

To remove the B-1B from your computer either go to your Add/Remove Programs applet in your control panel or use the shortcut provided during the installation.

Aircraft

Description: The B-1B aircraft, designed and manufactured by Rockwell International, is a long-range supersonic bomber with the capability of high-speed flight at low-level altitude.

The aircraft has a blended wing-body concept with variable-sweep wings, a single vertical stabilizer with a three-section (upper, intermediate, and lower) rudder, and horizontal stabilators which operate independently to provide pitch and roll control. The variable-sweep (15 to 67.5 degrees) wing is equipped with slats, spoilers (which also function as speed brakes), and flaps which provide the aircraft with a highly versatile operating envelope. Structural mode control vanes mounted on each side of the forward fuselage are part of the Structural Mode Control System (SMCS) which reduces structural bending oscillations in the longitudinal and lateral axes.

The aircraft is powered by four General Electric (F-101-GE-102) dual-rotor afterburning turbofan engines in the 30,000-pound thrust class. The engines are mounted in twin nacelles below the wing near the left and right wing pivot points. Four Accessory Drive Gearboxes (ADGs), each shaft-driven by a corresponding engine, are mounted in separate compartments forward of the engines. ADGs 2 and 4 may also be driven by the Auxiliary Power Unit (APU) on their respective side (there are two APUs, one mounted in each twin nacelle). The ADGs drive the hydraulic pumps on all four engines and the aircraft generators on engines 1,2, and 4. There is no generator associated with engine 3.

The crew compartment provides for a basic complement of four crewmembers. There are provisions for seating an instructor pilot between and slightly aft of the pilot and copilot station, and for an avionics instructor between and slightly aft of the Offensive Systems Officer (OSO) and Defensive Systems Officer (DSO) stations. Individual ejection seats are provided for primary crewmembers and bottom bailout is provided for the instructors. Avionics equipment is located in the forward avionics compartment, wing glove avionics compartments, wheel well avionics compartments, central avionics compartment, and aft avionics compartment. Stores may be carried in three bays, two forward of the wing carry-through and one aft of the main landing gear wheel well.

History and Features: The first B-1B was delivered to the Air Force at Dyess Air Force Base, Texas, in June 1985, with initial operational capability on Oct. 1, 1986. The final B-1B was delivered May 2, 1988.

The swing-wing design and turbofan engines of the B1B not only provide greater range and high speed at low levels but they also enhance the bomber's survivability. Wing sweep at the full-forward position allows a short takeoff roll and a fast base-escape profile for airfields under attack. Once airborne, the wings are positioned for maximum cruise distance or high-speed penetration.

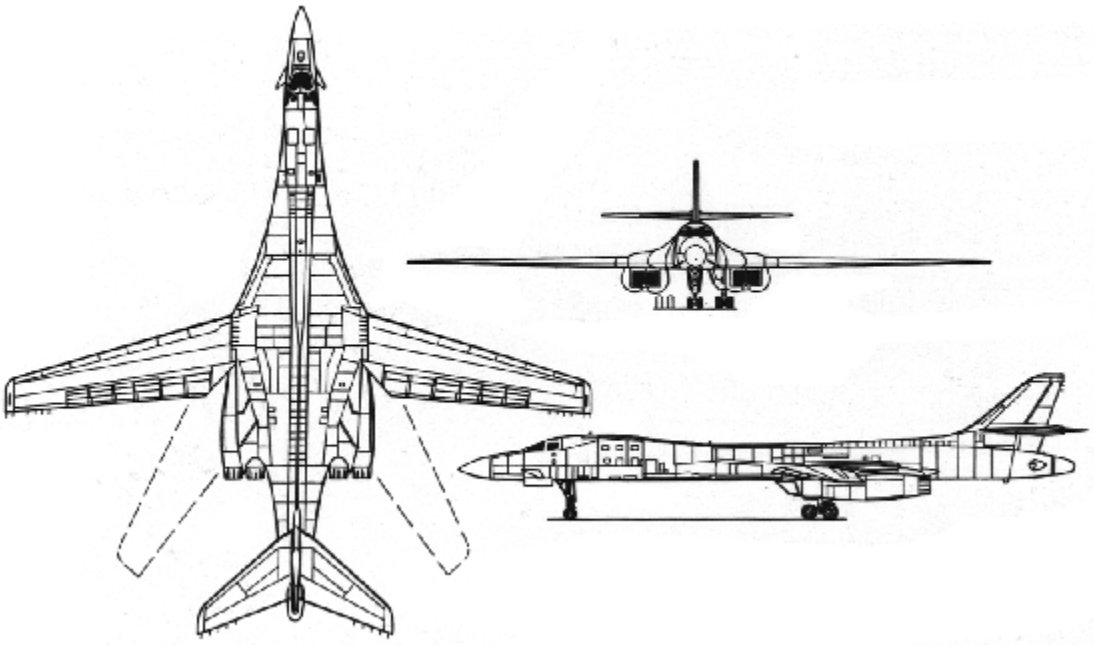
The B-1B uses radar and inertial navigation equipment enabling aircrews to globally navigate, update mission profiles and target coordinates in-flight and precision bomb without the need for ground-based navigation aids. Included in the B-1B offensive avionics are modular electronics that allow maintenance personnel to precisely identify technical difficulties and replace avionics components in a fast, efficient manner on the ground.

The B1B has an AN/ALQ 161A defensive avionics system, which is a comprehensive electronic counter-measures package that detects and counters enemy radar threats including missiles attacking from the rear. It defends the aircraft by applying the appropriate counter-measures,

such as electronic jamming or dispensing expendable chaff and flares. Similar to the offensive avionics, the defensive suite has a re-programmable design that allows in-flight changes to be made to counter new or changing threats.

Numerous sustainment and upgrade modifications are ongoing or under study for the B-1B aircraft. Large portions of these modifications that are designed to increase the combat capability are known as the conventional mission upgrade program. This three-phase program will increase the lethality, survivability and supportability of the B-1B fleet. Phase I of the program added the capability to release cluster bomb unit weapons. Phases II and III will further upgrade the B-1B capability, to include the ability to deliver joint direct attack munitions and standoff weapons, and greatly improve its electronic counter-measures capability.

Specifications:



Primary Function:	Long-range, multi-role, heavy bomber
Builder:	Rockwell International, North American Aircraft, Boeing
Operations Air Frame and Integration:	Offensive avionics, Boeing Military Airplane; defensive avionics, AIL Division
Power Plant:	Four General Electric F-101-GE-102 turbofan engine with afterburner
Thrust:	30,000-plus pounds (13,500-plus kilograms) with afterburner, per engine
Length:	146 feet (44.5 meters)
Wingspan:	137 feet (41.8 meters) extended forward, 79 feet (24.1 meters) swept aft
Height:	34 feet (10.4 meters)
Weight:	Empty, approximately 190,000 pounds (86,183 kilograms)

Maximum Takeoff Weight:	477,000 pounds (214,650 kilograms)
Fuel:	188000 lbs approx.
Crew:	Four (aircraft commander, pilot, offensive systems officer and defensive systems officer)

Operational Limitations

Variable Geometry Wings: Each wing sweep position is limited by a certain speed and the pilot must be aware of the each wing position's speed limit is or there will be structural damage to the aircraft.

During a climb, if the speed lessens, increase the wing sweep position and adjust the wing sweep position accordingly to hold the climb speed. If in cruise mode and you want to increase your cruise speed but the aircraft will no longer accelerate in MIL power, increase the wing sweep.

There are total of ten positions modeled.

Full Flaps: During landing, the variable geometry wings are fully forward with the full flaps (TEF) and slats (LEF) this happens when you depress the F8 key. **Maximum Speed 225 KIAS**

Half Flaps: Depress the F6 key once. The LEF will still be deployed. This setting is used for take offs. **Maximum Speed 240 KIAS**

LEF: This setting has the LEF deployed while the TEF are fully retracted. Depress the F6 key once. **Maximum Speed 280 KIAS (same for landing gear)**

The next time you depress the F6 key, you'll be at 15° sweep with a *clean* wing and the remaining key depresses will increase the wing sweep angle. For main cruise flight and climbing the wings are typically at 20° so the F6 key needs to be depressed again.

Depressing the F5 key will automatically fully sweep the wings aft to 67.5°.

To lessen the wing sweep angle or to move the wings forward, depress the F7 key for each angle as the wings will reverse in sequence.

Wing Sweep Position (Degrees)	Maximum Speed (KTAS)
15	325
20	400
40	440
50	450
55	477
63	500
67.5	520

Cg Limitations: Before any flight, the pilot must set the proper amount of fuel in the front center tank to be used as weight ballast since the aircraft has majority of its weight aft. The rule of thumb is to have at least 40% (50% optimum) of the front center tank more than the rear center tank.

Climbing: During an Autopilot climb the aircraft's nose will oscillate if the vertical speed is set too high. The remedy is to *lower* this setting.

Excessive pitch when over 30º pitch could cause a departure depending on the altitude, speed and Angle of Attack (AOA) and should be avoided or the aircraft will stall and depart.

Diving: When performing excessive dive pitch angles of more than 30º it should be cautioned as the AOA available is less in what you find in the smaller and lighter combat aircraft. Recovery distances are *doubled*.

Rolls: The maximum recommended Angle of Bank (AOB) is 60º.

Extreme caution should be exhibited when a roll is being attempted at 15º wing sweep as there will be a rapid loss of altitude which could be followed by adverse yaw with nose down moment. A departure could soon follow. It is not recommended to do complete 360º rolls at low altitudes.*

*In real life, the B-1B isn't permitted to do a full 360º roll. We have implemented in there so you can have some enjoyment flying the aircraft.

Sideslip/Spins: Sideslip is evident with up to 10º if prolonged followed by rolling the aircraft Spins have not yet been incorporated.

Spoilers: There are spoilers that not only aid lateral maneuvering to also act as a speed brake. Unfortunately, the auto spoilers are not working in the flight model build.

Flight Characteristics

Primary Flight Controls: As stated in the Aircraft section (page 6), the Lancer is an aircraft with supersonic capability with spectacular range but due to its large size and weight, however, it does not maneuver like smaller and lighter combat aircraft.

The four F101-GE-102 engines' total thrust with afterburning at Sea Level does not posses enough power to give the Lancer a thrust to weight (T:W) of 1:1.

The SMS controls the load factor in which the maximum load factor (G) is limited to 2-3G. (The flight dynamics, depending on the weight, you can reach 3.6G at high speeds).

The horizontal tail controls pitch and roll. The spoilers on the wings also aid in roll. Rudder input is responsive for an aircraft of this size.

Variable Geometry Wings: The wings are manually controlled and the swept angles are from 15° to 67.5°. The variable geometry wings at 15° aids in landing, climb and cruising setting them to 67.5° gives better maneuverability and acceleration at high speeds.

Center of Gravity: The aircraft has majority of its weight aft due the placement of the engine nacelles and the wing sweep mechanism. The front fuel tank of the aircraft is used as a weight ballast to counter the weight of the rear to balance the aircraft. If fuel tank quantity is equal in all six tanks, the aircraft will have a tendency to have a nose up moment in which trim must be used to level the aircraft. The aircraft burns the rear center first before touching the front tank.

Check the *Operational Limitations* section for the ratio of the front tank to the rear.

Aero Center: With variable geometry wings, the Lancer's center lift moves depending on the wing sweep angle. Fully swept forward, the aero center is at its most forward location and as the wings is swept back, the aero center moves aft.

Pitch Control: Control input in pitch is somewhat sluggish at maximum deflection while small inputs can give a very responsive aircraft. At maximum pitch deflection, the aircraft will have delayed reaction. Pitch input lessens at 9 degrees of AOA (Angle of Attack) and there is no AOA gauge in the cockpit.

The horizontal tail is somewhat responsive at speeds less than 130 KIAS.

The Lancer flight profile has a nose up attitude with the variable wings fully forward and trim must be used. This nose up attitude is exaggerated more when either the front tank is empty or is equal to the center tank. As the fuel is burn from the rear center tank the nose up moment lessens. The aircraft is very responsive with nose down moment at all speeds.

Roll Control: The Lancer's roll performance is slow due its engine placement and its wingspan. Roll performance can be enhanced with some yaw input. The Lancer does not roll on center like a small F-16 combat aircraft exhibits as it rolls off center. With the variable geometry wings set at fully forward the deviation from center is great and as the wings are swept in (increasing sweep angle) this deviation lessens. The roll performance is faster with the variable geometry wings fully aft.

As the aircraft completes its roll or AOB maneuver, the aircraft will sway back into the opposite direction (adverse yaw) as the weight settles with nose down moment.

The aircraft lacks ailerons and uses the spoilers on each wing as well as the horizontal tails to aid in roll maneuvering.

Yaw Control: Rudder input response is average with some sideslip. With prolonged rudder input, the yaw condition will start to roll the aircraft in the same the direction of yaw.

Departures: Performance high speed climbs in which the pitch is more then 30º can cause a stall followed by a departure as the speed bleeds rapidly. Pitch authority is greatly reduced and the aircraft will start to descend aft first and then the nose will fall. As the speed increases, the pitch authority is still reduced as high AOA has been achieved.

Rolls performed with the variable geometry wings at 15 can cause a great loss of altitude with nose down moment. The aircraft will exhibit some adverse yaw. The pilot must unload the aircraft as it descends and then slow pull the stick aft to recover.

When the aircraft is in a dive, care must be taken in that the pilot must not pull to heavily on the stick since at higher AOA, the pitch input lessens. Dives performed at high speed needs at least twice the distance for the aircraft to recover when compared to the smaller and lighter combat aircraft.

Take off: All take offs are completed with the variable geometry wings set at the 15º with the flaps at half. During rotate, maintain 8º of pitch and hold this attitude until the planned altitude has been reached.

Landing: On approaches, try to maintain 2º of pitch. The aircraft has a very heavy feel on approach. The engines do not possess any reverse thrust and to aid in slowing down use the spoilers.

Performance

Flight test: Feb.28, 2003

Rotate/Take off Speeds:

210000 GW (16933 lbs FUEL): ……R[1] 119 KIAS / Take off: 134 KIAS
280000 GW (88411 lbs FUEL): ……R[1] 140 KIAS / Take off: 159 KIAS
390000 GW (188088 lbs FUEL): ……..R[1] 168 KIAS / Take off: 183 KIAS*

*Maximum weight modeled: 381508 lbs

Climb:

After take off, climb to 4000' and accelerate to 360 KIAS using afterburner/reheat. Once 360 KIAS has been reached, sweep the wings to 20°. Adjust the throttle and wing sweep to maintain 360 KIAS. **

**The engine modeling is not completed.

Cruise:

B-1B Lancer with 50% Fuel wing sweep at 20°

Altitude	Maximum Endurance	Optimum Cruise
15000'	283 KIAS	303 KIAS
20000'	280 KIAS	297 KIAS
25000'	274 KIAS	293 KIAS
30000'	267 KIAS	279 KIAS

Adjust wing sweep accordingly to maintain speed. Partial throttle settings of the engine have not been adjusted.

Landing:

210000 GW (16933 lbs FUEL): ……145 KIAS FULL FLAPS
380000 GW (188088 lbs FUEL): ……..195 KIAS FULL FLAPS

Speed:

Top Speed: Sea level Mach 0.92; at high Altitude Mach 1.2x

Support

If you have any problems, we prefer you to visit our Support section on our website (http://www.mnm-fs.com/) or you can visit our forums, which is linked there as well.

Be sure to check the website for updates.

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