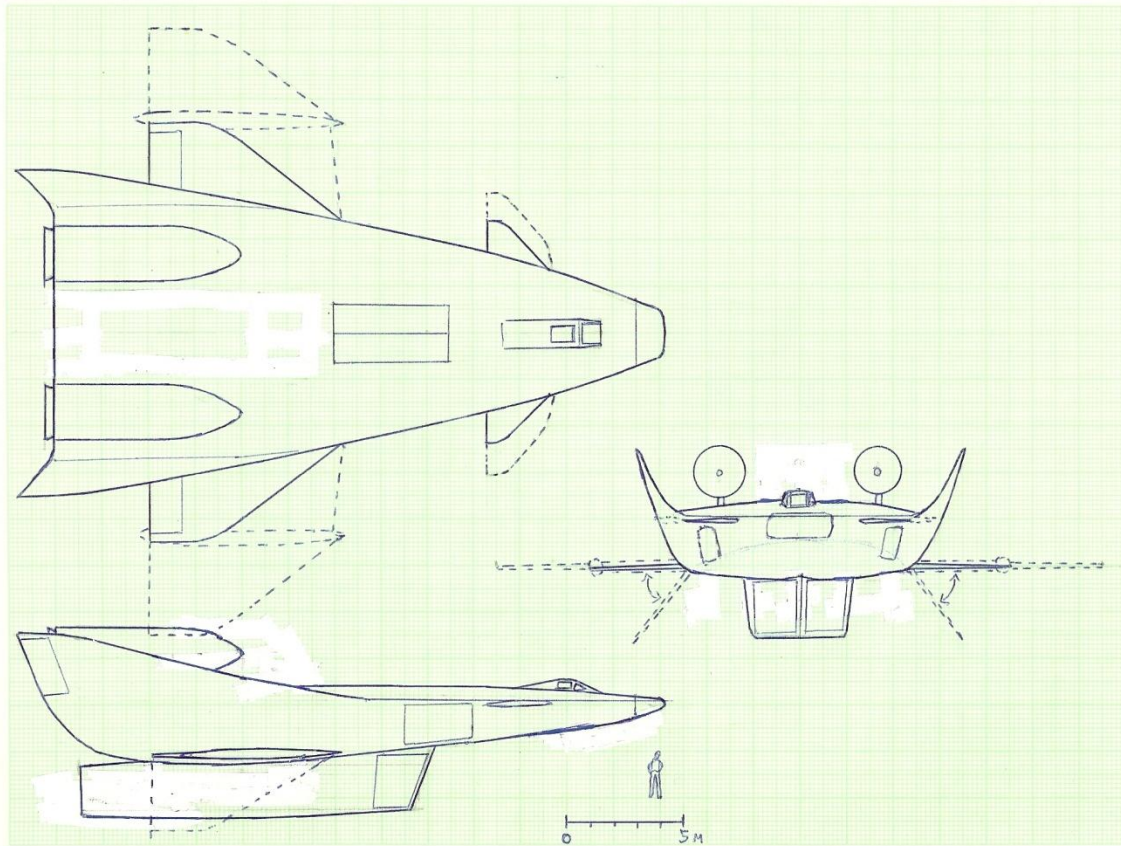


Lockheed-Aerojet SP-10A STARBLAZER



Characteristics :

- Crew : 2 (Pilot, Observer/Mission Specialist).
- Length : 27.8 m.
- Span : 18 m / 14 m (wingtips down) / 26 m (telescopic wings extended).
- Height : 8.2 m.
- Weights : 32,000 kg (empty, operational) / 201,974 kg (full fuel, no SRBs) / 254,974 kg (full fuel, two SRBs).
- Wing area : 36 m² (wings telescoped in) / 92 m².
- Wing loading : 434.8 kg/m² (wings extended for landing, mass of 40,000 kg, all rocket fuel burned and SRBs jettisoned).
- **Engines :**
 - **Two Aerojet LR-87-5 RT** liquid bipropellant main rocket motors. Thrust each of 111,842 kg st (vacuum) / 97,536 kg st (S.L.). ISP of 297 seconds (vacuum) / 259 seconds (S.L.). Oxidizer : N₂O₄ (71,616 kg / 49,528 L). Fuel : Aerozine-50 (37,270 kg / 39,243 L). Burn time : 71 seconds. Engine mass : 739 kg (each). Each

engine has two nozzles and are restartable and throtttable in flight. Both fuel and oxidizer can be stored aboard for long periods.

- **Two Aerojet AJ10-118K** liquid bipropellant orbital rocket motors. Thrust each of 4,435 kg st (vacuum). ISP of 321 seconds (vacuum). Oxidizer : N₂O₄ (8,700 kg / 6,000 L). Fuel : Aerozine-50 (4,550 kg / 5,061 L). Burn time : 478 seconds. Engine mass : 98 kg (each). Can be restarted multiple times in flight, are fully throtttable. Both fuel and oxidizer can be stored aboard for long periods.
- **Two Aerojet AJ10-118K** liquid bipropellant orbital retro-rocket motors. Thrust each of 4,435 kg st (vacuum). ISP of 321 seconds (vacuum). Oxidizer : N₂O₄ (10,920 kg / 7,531 L). Fuel : Aerozine-50 (5,712 kg / 6,346 L). Burn time : 600 seconds. Engine mass : 98 kg (each). Can be restarted multiple times in flight, are fully throtttable. Both fuel and oxidizer can be stored aboard for long periods.
- **Two Thiokol CASTOR 120S** solid rocket booster motors, hooked to dorsal pylons and ejected once burned out. Thrust each of 168,000 kg st (vacuum). ISP of 280 seconds (vacuum) / 229 seconds (S.L.). Burn time : 40 seconds. Engine mass : 27,000 kg (each, loaded). Length of 5 m and diameter of 2.4 m.
- **Two Pratt & Whitney R-80** ramjet atmospheric booster engines in ventral keel pod, with thermal covers for air intakes and exhaust nozzles during atmosphere reentry and off mode. Thrust each of 82,000 kg st at high altitude and Mach 3+. Oxidizer : ambient air. Fuel : RP-1 refined kerozene (20,000 kg / 24,691 L). Burn time : 30 seconds at full thrust.
- **Two Pratt & Whitney TF-58R** turbofan-ramjets atmospheric engines. Thrust each of 12,000 kg st (turbofan only, dry) / 20,000 kg st (ramjet at Mach 3+). Air intakes and exhaust nozzles covered with thermal panels during atmosphere reentry and off mode. Oxidizer : ambient air. Fuel : RP-1 refined kerozene (10,000 kg / 12,345 L).
- **16 banks of liquid monopropellant vernier attitude control motors.** Fuel : MMH (5,000 kg / 5,682 L). Positioned around the lifting body to provide full 3D attitude control in vacuum.
- Cabin/cockpit : Canopy made of multilayered titanium/ceramic/thermal glass, with circulation of cooling air between layers during reentry. Cabin is 5 m long, 2.5 m wide and 1.9 m high. Contains pilot's ejection seat and flying station, observer's ejection seat and control station, one zero-G

toilet, two spacesuit support stands, kitchenette with convection oven and refrigerator, reserves of food and water, spare clothes and hygiene items and reserves of air. Crewmembers sleep in sleeping bags hooked to the ceiling.

- Airlock : behind cabin and connected to it and to the payload bay by airtight hatches. Exit hatch on top. Personnel lift integrated to floor of airlock, lowers down to ground level when not in flight.
- Payload bay : behind airlock and connected to it by an airtight hatch. Bay is 5 m long, 2.4 m wide and 2.4 m high. Can accommodate up to 3,000 kg of various payloads. Once in space, the top payload bay doors open and act as a radiator and a solar energy panel.
- Wings : outer sections are made of heat-resistant graphite composites and are designed for supersonic/hypersonic flight. Inner, telescopic sections are thick, straight wings for subsonic flight and landings.
- Canard surfaces : telescopic, with outer supersonic surface and inner (telescoped) section for subsonic flight.
- Fuselage : Lifting body fuselage, provides most of the lift at high supersonic and hypersonic speeds. Ramjet keel also creates a shockwave at hypersonic speeds that augments the lift from the fuselage shape.
- Construction : Stainless steel honeycomb panels surfaces on titanium structural frame, covered over the belly and forward edges with bolted on panels of heat ablative materials. Heat ablative panels made easy and quick to change after a mission in orbit.
- **Sensors/electronics :**
 - One high resolution camera (down view, lens covered by protective cover that opens in orbit).
 - Three medium resolution cameras (down view, oblique left view, oblique right view, lens covered by protective covers).
 - One high definition surface mapping radar.
 - One optical telescope (down view) for observer to help align cameras.
 - Air search radar (in heat-resistant radome in nose).
 - Radar altimeter.
 - Inertial navigation system linked to cockpit map display unit.
 - Heads-up display linked with frontal view e/o camera pack (FLIR + LLLTV).
 - Four other e/o camera packs giving night view of frontal arc, front-down view and down-vertical view.
 - Radar signal analysis receiver system.

- Encrypted datalink for secure orbit-to-ground communications.
- Four clear comms radios (2 UHF, 1 VHF, 1 HF).
- TACAN receiver.
- IFF transponder.
- VOR and ILS navigation and landing aids systems.

Mission sequence :

- The SP-10 spaceplane is lifted to high altitude (20,000 m) by a C-1000 special heavy lift aircraft.
- At Mach 0.9 and 20,000 m of altitude, the SP-10 is dropped by the C-1000 and ignites its two solid rocket booster motors, breaks through the sound barrier while climbing.
- At Mach 2+, both the R-80 ramjet engines and the TF-58R (ramjet part only) ignite just before burnout and jettisoning of the SRBs, continue the acceleration to Mach 5 and the climb to 30,000+ m.
- At Mach 5 and 30,000+ m, the LR-87-5 RT main rocket engines light up, while the ramjet engines and TF-58Rs shut down and cover their intakes and exhausts. The main rocket engines burn for up to 71 seconds, or until Low Earth Orbit velocity is achieved, then shuts down.
- The SP-10 coasts in LEO while calculating its trajectory and further boost sequences needed to regularize its orbit.
- The two orbital rocket motors light up at pre-calculated times and durations in order to regularize and refine the spaceplane's orbit and be in optimum position to start its space mission.
- Free flight in orbit around the Earth while the mission is accomplished (either launch/retrieval of a satellite, or a strategic reconnaissance mapping mission). Autonomy in orbit for the crew is up to six days.
- At end of mission, firing up of the retro rockets and reentry in the atmosphere.
- Hypersonic gliding while lowering through the upper atmosphere and losing speed.
- Ignition of the TF-58R turbofan-ramjet engines once at low supersonic speeds and piloted, powered flight back to base or pre-designated landing site. Deployment of telescopic wings once at low subsonic speeds.