

“Air-breathing” rocket engine

Sabre is an experimental air-breathing rocket engine, designed to power a craft from standstill on a runway to hypersonic flight at over Mach 5 (6,300km/h), before switching over to rocket mode to reach Mach 25



Concept space plane

Sabre: Synergetic Air Breathing Rocket Engine

Air-breathing mode: Burns liquid hydrogen in atmospheric oxygen

Rocket mode: Uses on-board liquid oxygen

Heat is generated by compression of air in engine's intake. Concorde's engines dealt with temperatures of about 160°C at Mach 2 (2,140km/h)

1 Air intake: Air must be slowed to subsonic speed. At Mach 5.14 temperature of air can reach 1,000°C

3 Compressor: Helium turbine, which uses heat absorbed by pre-cooler, compresses air to 150 bar (153kg/cm²)

2 Pre-cooler: Air is chilled from 1,000°C to -120°C by super-cold, liquid helium pumped through thin-walled pipes

Excess air

4 Rocket engines Compressed air and liquid hydrogen ignited in combustion chambers, producing thrust

Ramjets Excess air and hydrogen burn to provide additional thrust

5 Rocket mode: Air intake is closed and compressor stops. Liquid oxygen used

16,800 pipes made of **Inconel 718** alloy. Wall thickness of 40 microns

