LAUNCH VEHICLE PROPULSION

VULCAIN®2

Snecma
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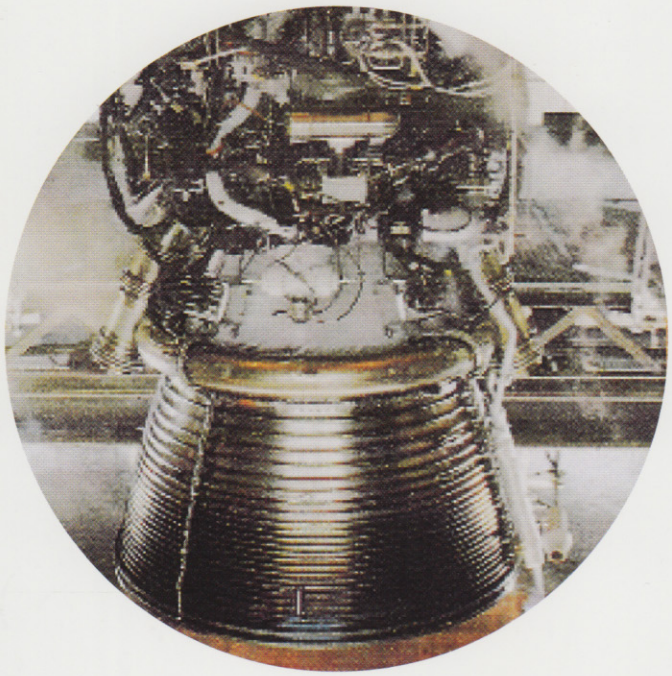
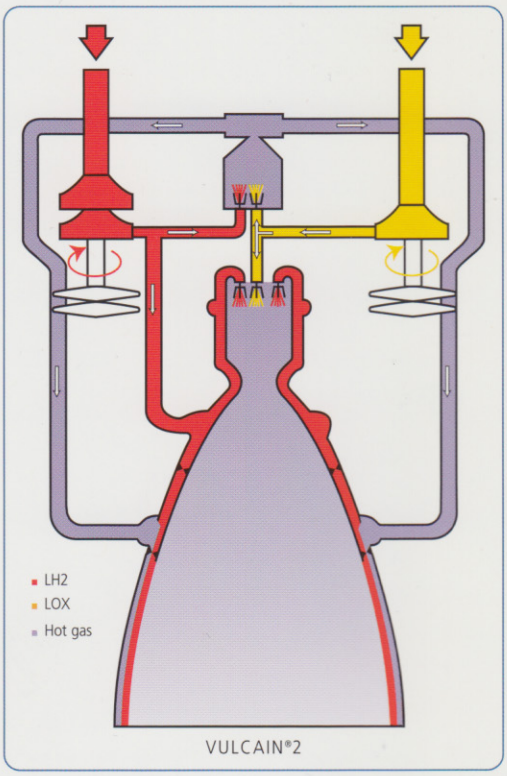
VULCAIN®2





VULCAIN®2

The Vulcain®2 cryogenic rocket engine is derived from the Vulcain® engine powering the main stage of Ariane 5. It was developed within the scope of the Ariane 5 Evolution program, launched in 1995 to enhance the launcher's performance. On the heavier-lift Ariane 5 ECA, the Vulcain®2 engine increases payload capacity into geostationary transfer orbit by 1,150 kg, compared with the original Vulcain® engine. Snecma is prime contractor for the Vulcain®2, leading a team of European companies including Techspace Aero, a fellow member of the SAFRAN group, EADS ST GmbH, Avio and Volvo Aero Corporation.

The main improvements to Vulcain®2 include:

- 10% increase in propellant load, plus an increase in the liquid oxygen/hydrogen ratio from 5.2 to 6.1.
- Thrust increase from 1,145 kN to 1,340 kN.
- Increase in specific impulse due to a redesigned nozzle, allowing for turbine exhaust gases to be reinjected in the nozzle.
- The 5.1-MW two-stage liquid oxygen turbopump and the combustion chamber were totally redesigned. However, the 14-MW liquid hydrogen turbopump was only slightly modified in relation to the original Vulcain®1 engine.

Program status

The first mission flown by the Vulcain®2 in December 2002 showed the need for changes to the nozzle exit cone. It was mechanically and thermally strengthened, and the cooling system was improved.

By the time of the qualification flight of Ariane 5 ECA on February 12, 2005, a complete success, the Vulcain®2 engine had logged 175 firing tests totaling 75,000 seconds, or 140 times the engine operating time during a standard mission.

Characteristics

Vacuum thrust	1,340 kN
Specific impulse	431 seconds
Combustion pressure	115 bar (about 1,670 psi)
Expansion ratio	59
Propellants	LOX – LH2
Propellant flowrate	320 kg/sec
Mixture ratio	6.1
Turbopump speed	LOX: 12,300 rpm – LH2: 35,800 rpm
Turbine power	LOX: 5 MW – LH2: 14 MW
Height	3.45 meters
Nozzle exit diameter	2.1 meters
Engine weight	2,100 kg

Snecma - Communications Department - May, 2005

Snecma
10, allée du Brévent - CE1420 Coucouronnes
91019 Evry Cedex - France
Tel: 33 (0)1 69 87 09 00 - Fax: 33 (0)1 69 87 09 02
www.snecma.com

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