

VULCAIN 2 NOZZLE



The Vulcain 2 is the upgraded version of the main engine for the Ariane 5, which develops more thrust and allows for higher Isp. Volvo Aero is responsible for the upgrade of the nozzle, which is based on a new cooling concept.

The main technical challenge for our nozzle team was to keep a low surface mass density while reinforcing the hot tube wall (1 000 K) and the lower, even hotter, film-cooled wall (1 350 K).

The area ratio of the Vulcain 2 nozzle has been extended, from 45:1 to 58.3:1.

CHARACTERISTICS OF THE VULCAIN 2 NOZZLE

Operational reference points

	Vulcain	Vulcain 2
Chamber pressure	110	117 bar
CC mixture ratio	6.25:1	7.2:1
Propellant flow rate	271	320 kg/s
Dump mass flow	3.0	3.0 kg/s
TEG* mass flow	N/A	10.3 kg/s
TEG temperature (LOX)	N/A	721 K
TEG temperature (LH2)	N/A	567 K

Overall dimensions

Length	1.8	2.17 m
Inlet diameter	0.59	0.59 m
Outlet diameter	1.76	2.094 m
Inlet area ratio	5:1	4.6:1
Outlet area ratio	45:1	58.3:1
TEG injection area ratio	N/A	32:1

*Turbine Exhaust Gas



Close-up of the inlet through which Turbine Exhaust Gas (TEG) supersonic film is fed to cool the metal skirt.

Supersonic film cooling

The new nozzle is considerably larger than its predecessor and uses world-first technology for supersonic film cooling. Two layers (reinjecting turbopump exhaust and dumped hydrogen) ensure highly efficient cooling of the lower part of the nozzle. The upper part is made up of a spiraling tube wall.

Volvo Aero responsibility

Volvo Aero Corporation is responsible for the development and production of the nozzle and the LH2 and LOX turbines for the Vulcain 2 engine. Nozzle development is being carried out in cooperation with Snecma and EADS Space Transportation.

The Swedish National Space Board is financing Volvo Aero's part of the program.

Similar assignments

- Development and manufacture of the Vulcain nozzle for the Ariane 5.
- Manufacture of the Viking 4, 5 and 6 thrust chambers for the Ariane 4.

Volvo Aero Corporation

Volvo Aero develops and manufactures components for aircraft and rocket engines with a high technology content in cooperation with the world's leading producers. Service and maintenance are an important part of our operations. The company offers an extensive range of products, including

sales of spare parts for aircraft engines and aircraft, sales and leasing of aircraft engines and aircraft, and overhaul and repair of aircraft engines. Volvo Aero also develops and services gasturbines for propulsion and power generation.

VOLVO AERO

www.volvoaero.com

Space Programs and Marketing · SE-461 81 Trollhättan, Sweden
Tel. +46 520 94 000 · Fax +46 520 985 50