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AESTUS ENGINE

PROPULSION SOLUTIONS FOR LAUNCHERS

- POWERS THE ARIANE 5 ES UPPER STAGE
- ORBITAL INSERTION OF HEAVY PAYLOADS INTO LEO, SSO AND GTO*
- PRESSURE-FED ENGINE CONSUMING UP TO 10 METRIC TONS OF BIPROPELLANT MMH/N204**
- PROVEN DESIGN AND FLEXIBILITY WITH MULTIPLE RE-IGNITION CAPABILITY TO PLACE 21-METRIC TON ATV INTO LEO
- OPERATIONAL AS OF 1997 (ARIANE FLIGHT 502) TO JULY 2018 (ARIANE FLIGHT 244)

* LEO: LOW-EARTH ORBIT
SSO: SUN-SYNCHRONOUS ORBIT
GTO: GEOSTATIONARY TRANSFER ORBIT

** MMH/N204:
MONOMETHYLHYDRAZINE/
DINITROGEN TETROXIDE

AESTUS ENGINE
SPACE PROPULSION

Aestus development history

- 1988–1995: Development at the Ottobrunn Space Propulsion Centre in Germany
- 1999–2002: Performance improvement program involving propellant mixture ratio adjustment
- 2003–2007: Re-ignition qualification program demonstrated with the first ATV launch (9 March 2008)
- 2009–2015: Specific delta qualification for ES Galileo missions including production restart

MAIN CHARACTERISTICS	
Propellants	N_2O_4\ MMH
Specific impulse vacuum	324 s
Thrust vacuum	29.6 kN
Propellant mass flow rate	9.3 kg/s
Mixture ratio (TC)	1.9
Engine feed pressure	17.7 bar
Combustion chamber pressure	11 bar
Nozzle area ratio	84
Nozzle exit diameter	1.31 m
Overall engine length	2.2 m
Thrust chamber mass	111 kg
Nominal single firing	1100 s
Power	43,700 kW 59,400 hp
Re-ignition capability	Multiple

MAJOR SUB-ASSEMBLIES

- Injector with coaxial injection elements for mixing propellants
- Combustion chamber regeneratively cooled by MMH fuel
- Nozzle extension, radiatively cooled
- Propellant valves for fuel and oxidiser, pneumatically operated by pilot valves
- Gimbal joint mounted at the top of the injector dome allowing for pitch and yaw control

The Aestus engine powers the Ariane 5 ES version bipropellant upper stage for insertion of payloads into LEO, SSO and GTO.

With its proven flexibility and multiple re-ignition capabilities, the Aestus engine enables a considerable range of mission specific profiles for the Ariane 5 launcher: for example, delivering the 21 ton International Space Station freighter ATV (to LEO orbit), the comet-chaser Rosetta probe (on a hyperbolic trajectory) or a total of 12 Galileo navigation satellites (to MEO orbit) over 3 different Ariane 5ES missions.

Such specific missions requiring upper stage re-ignition capability are taken over by the Ariane 6 which will cover also Galileo missions.

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