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Active Descent System

The Active Descent System (ADS) is intended to provide the required impulse to ensure that the Rosetta Lander will descent towards the nucleus of comet 67P/Churyumov-Gerasimenko in 2014. To accomplish the ADS, strategic industrial teaming was formed with Bleuler-Baumer Mechanik in Switzerland.

This autonomous propulsion system is designed to provide extreme performance and control within amazingly small envelope dimensions. The complete system has a total mass (including propellant) of 3.52 kg. Its envelope dimensions are limited to 236 x 340 x 105 mm for the complete system. With these very demanding mass and envelope requirements, the system –especially the tank- design required special care and has lead to a complete new development for all parts and components. For example for the thruster valves and pressure transducers, part of the housings were integrated into the system structure. Electronics for all parts and components are integrated into a single e-box centralised within the ADS system.

The ADS consists of a high tensile strength aluminium alloy tank with integrated non-return and vent valves. The different parts in the system are the following:
- 3 Litre Tank
- 2 Bradford Pressure Transducers
- 1 Sensitive Accelerometer (sensitivity 62.5V/g; range ± 40mg)
- 2 Parallel Thruster Valves, both redundant
- Tank opener with 2 wax Actuators

This model shows the location and orientation of the Active Descent System tank and nozzle on the top surface of the Rosetta Lander.

Performance Characteristics

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Propellant	GN_2
Thrust	17.6 N
Operating pressure	175 bar
Proof pressure	1.5 x MEOP
Burst pressure	2.5 x MEOP
Internal leakage	$< 10^{-6}$ scc/s GHe
External leakage	$< 10^{-6}$ scc/s GHe
Specific impulse	77.6 s (+20 °C)
Total impulse capacity	183 Ns
Operational temperature range	-55 … +70 °C

Main Elements and Industrial Teaming

The following main elements are present in the Active Descent System:
- Accelerometer (Kistler US), specially modified to sustain the demanding radiation environment.
- Bradford Pressure Transducers.
- Wax-actuated tank opener (Bleuler-Baumer).
- Parallel and series-redundant latch valve (thruster valve).
- Large degree of system integration for all driver / controller / conditioning electronics.
- Iso-tensoid propellant tank (Bleuler-Baumer).

Descent Control Approach

Dedicated radiation-hardened FPGA-based electronics with embedded control law has been developed to minise the impact velocity during the Lander's descent to the cometary surface. The FPGA core software can be modified in-flight, hence currently an exercise has been initiated to improve the descent profile/smoothness based on the latest astronomical observational data, and which will be uploaded during the course of 2007. The electronic set has high level of commonality with the MUPUS experiment also flying on Rosetta.
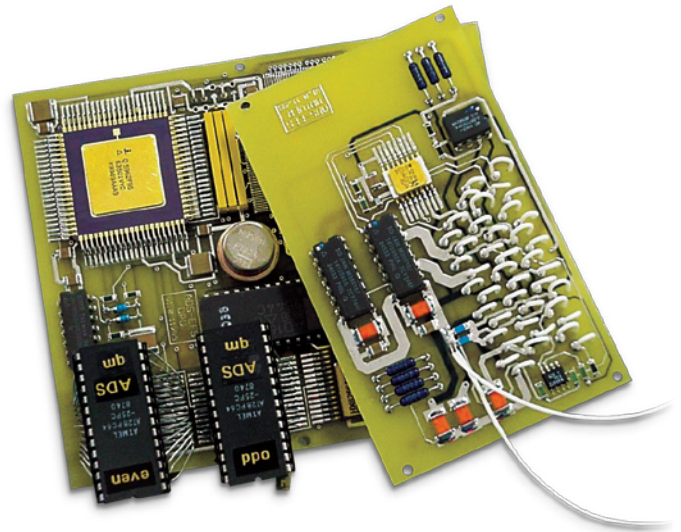
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