

### Deutsche Orbitale Servicing Mission - Phase B Client

The DEOS mission has been initiated by the German Aerospace Center DLR in order to demonstrate

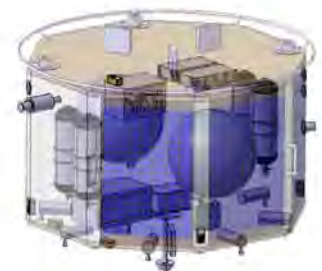
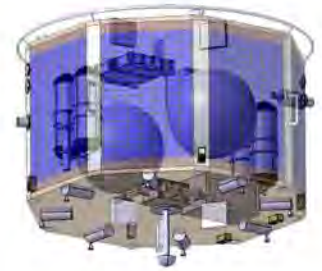
- the rendezvous with and the berthing of a non-cooperative, tumbling satellite by means of a robotic manipulator system accommodated on a servicing satellite
- the docking of a cooperative spacecraft via a dedicated docking device
- the performance of servicing tasks while in the coupled configuration
- the execution of a controlled de-orbiting / re-entry of the two spacecraft in a coupled configuration at the end of the mission

As part of the DEOS Phase B German industrial team, SpaceTech signed responsible for the design and development of the Client spacecraft.

The Client is designed to execute different attitude maneuvers in accordance with the specific mission needs, including different spinning and tumbling modes to simulate a non-cooperative, out-of-service satellite as well as three axes stabilized modes to allow the active docking by the Servicer satellite. In order to allow the grapple via the Servicer manipulator arm system, the Client spacecraft is equipped with a grapple ring and a set of grapple fixtures.

Orbit maneuvers of the coupled configuration fixed by the Servicer manipulator arm, including the final controlled re-entry into the Earth's atmosphere, are actively executed by the Client spacecraft using the on-board hydrazine propellant system.

The Client consists of a satellite platform and the on-orbit servicing payload. The platform is entirely one failure tolerant with a high degree of on-board automatism. A high capacity battery support the simulation of an out-of-control satellite in an attitude with low power input from the seven power panels that are allocated on the circumference of the satellite. All on-board resources are designed and sized to support the operation of the on-orbit servicing payload, i.e. the passive part of the docking / berthing mechanism, the on-orbit servicing elements, a camera system and a refueling demonstration system.



Client satellite accommodation concept

Physical Properties				
Dimensions	Length: 1852 mm / Width: 1852 mm / Height: 1540 mm (including UDBM/grapple ring)			
Mass	Dry: 323,7 kg	Cold Gas: 12.6 kg	Hydrazine: 137,6 kg	Total: 473,9 kg
Thermal Control				
Type	Passive system using thermistors / heaters and on-board thermal control application software			
Power System Characteristics				
Power Bus Type	Unregulated 28 V (26 ~ 33.6 V)	S/A Regulator	Sequential Shunt Regulator	
Avg. Satellite Power	114 ~ 239 W (sun-to-orbit angle dependent)			
S/A Cells	GaAs Triple Junction arranged on 7 circumferential solar array panels with 7 strings of 20 cells each			
Battery	Lithium-Ion	Name Plate Capacity	2 x 24 Ah	
Attitude & Orbit Control				
Type	Modes in accordance with demonstration program: <ul style="list-style-type: none"> <li>• Three axes stabilized LVLH</li> <li>• Spin stabilized (spin axis &amp; speed settable)</li> <li>• Free drifting (inactive AC)</li> <li>• Tumbling (tumbling axis &amp; nutation angle settable)</li> </ul>			
Sensors	Coarse Earth/Sun Sensor, Magnetometer, Gyroscope, GPS Receiver			
Actuators	Magnetorquer (3-axes), Hydrazine Propulsion (De-orbit), Cold Gas Propulsion (Nominal AOC)			
RF Communication (S-Band)				
Uplink	BPSK / 256 kbps; Omni-directional	Downlink	BPSK / 256 kbps; 1 W RF Power; Omni-directional	
Payloads				
<ul style="list-style-type: none"> <li>• Holding devices (handles, grapple ring) supporting the grapple by the Servicer manipulator grapple mechanism</li> <li>• Passive part of the unified docking and berthing mechanism (UDBM) including LED light pattern for active support of the docking by the Servicer satellite</li> </ul>				

The DEOS Client Phase B has been performed on behalf of the Agency of the German Aerospace Center funded by the Federal Ministry of Economy and Technology, funding code 50 RA 0922.