Demise Observation Capsule (DOC)
Development Status

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Demise Observation Capsule

“Providing a clear perspective on stage re-entry”

What DOC records:

- Images of upper stage
- Key disintegration events
- Trajectory
Goals

Breakup
- Document key disintegration events
- Stage, Payload and Instrument demise
- Complete health status

Trajectory
- Validation of re-entry models
- Understand re-entry physics
- Obtain data to ‘design for demise’
- Structural, aero-thermodynamic and material databases

Footprint
- Regulatory Compliance
- Reducing impact footprint
- Re-entry public safety
The Mission

DOC Mission Profile

- Launch & Ascent Phase
- Host Vehicle & DOC Capsule
- Separation from the Host Vehicle
- Communication Network Service
- Breakup Measurement data
- DOC Capsule
- Blackout
- Post Impact Phase
- Re-Entry Phase
- Descent Phase
- Wakeup Phase
- Host Vehicle Breakup

Launch Preparation & Integration Phase

Post Impact Phase
Qualification flight on VEGA AVUM in 2020 (TBC)
• Robust, optimized and modular design for a **multitude** of launch vehicles/stages: 3rd and 4th stage(s)
• **Rideshare** item: no impact on launcher payloads or operations
• **Safe & controlled** separation from the stage after its passivation
• On-board software design for **autonomous mission** performance & in-flight data transfer
• Flight-ready equipment: PFM + GSE:
  • Mass: <10kg
  • Diameter: ~350mm
• **Miniaturized electronics and sensors**
  • Versatile and extendable sensor suite
• Observation **cameras** on host vehicle and capsule
• **IRIDIUM Modem**
• **ITAR-free** equipment
## The Capsule – Sensor Package

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Model</th>
<th>Delivers</th>
<th>Range</th>
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<tbody>
<tr>
<td>GPS</td>
<td>NovaTel OEM615</td>
<td>Time</td>
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<tr>
<td></td>
<td></td>
<td>Position</td>
<td>&gt;7300 km ECEF</td>
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<tr>
<td></td>
<td></td>
<td>Velocity</td>
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<tr>
<td>IMU</td>
<td>ADIS16488</td>
<td>Acceleration</td>
<td>±18 g</td>
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<tr>
<td></td>
<td></td>
<td>Angular rate</td>
<td>&gt;±480°/s</td>
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<tr>
<td></td>
<td></td>
<td>Magnetometer</td>
<td>&gt;±0.18 mT</td>
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<tr>
<td>Camera (Onboard &amp; Host Vehicle I/F)</td>
<td>C1U NanoCam</td>
<td>Temperature</td>
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<tr>
<td>Thermocouples</td>
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<td>Accelerometers</td>
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<td>High acceleration</td>
<td>±200 g</td>
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<td>Pressure sensor</td>
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<tr>
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<td>MKS 905</td>
<td>Internal Pressure</td>
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EQM (EBB) Test Campaign (GOMSpace & CIRA)
Back-up Slides