Mechanical System - Structure
Large Deployable Antenna: programme status
Large Deployable Antenna: flight experiment
New activities in ARTES 5 2006 workplan
Activities carried forward from ARTES 5 2005 workplan
Large Deployable Antenna: programme status

The Large Deployable Antenna contract (15230/01/NL/JSH) was kicked off September 2001. The responsibilities of the work were established at that time as follows:
Large Deployable Antenna: programme status

**LDA Reference Mission Scenarios**

The advanced S-UMTS has been selected as the reference scenario for the Large Reflector Antenna. This scenario reports two typical communication links:

- **Multispot contoured beam** (broadcasting service)
- **Cellular scenario** (multicasting service)

**LDA – Mission Design Parameters**

- Reflectometer diameter [m] 12.0
- Focal length [m] 6.3
- Offset clearance [m] 3.0
- Feed diameter [m] 0.120
- Feed separation [m] 0.125
Large Deployable Antenna: programme status

The European subcontracts have been finalised successfully and mainly within schedule in the case of SENER and with slight delays in the cases of HTS and Magna. In all these cases the technical results were according to the expectations and in agreement with the requirements.

| Antenna Deployment Mechanism, ADB, HTS (CH) | Antenna Hold Down, AHD, Magna-Steyr (A) | Reflector Trimming Mechanism, RTM, SENER (E) |
Large Deployable Antenna: programme status

The LDR is completely manufactured and assembled, including its own hold-down and release systems in a 12 by 15 meter configuration. It can be deployed in a gravity environment by means of an advanced motorised gravity compensation rig. Three deployments have been done.
## Large Deployable Antenna: programme status

<table>
<thead>
<tr>
<th>Test</th>
<th>Configuration</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIM Products</td>
<td>Deployed</td>
<td>Performed.</td>
</tr>
<tr>
<td>Deployment 1</td>
<td>Stowed to deployed under 0-g suspension</td>
<td>Performed.</td>
</tr>
<tr>
<td>Deployment 2</td>
<td>Stowed to deployed under 0-g suspension</td>
<td>Performed.</td>
</tr>
<tr>
<td>Surface check</td>
<td>Deployed. 400 control points</td>
<td>Performed</td>
</tr>
<tr>
<td>Stiffness</td>
<td>Deployed</td>
<td>Performed</td>
</tr>
<tr>
<td>Deployment 3</td>
<td>Stowed to deployed under 0-g suspension</td>
<td>Performed</td>
</tr>
<tr>
<td>Surface measurement</td>
<td>Deployed. 400 control points</td>
<td>Performed</td>
</tr>
<tr>
<td>Sine Vibration</td>
<td>Stowed</td>
<td>Scheduled April 2006</td>
</tr>
<tr>
<td>Acoustic Vibration</td>
<td>Stowed</td>
<td>Scheduled April 2006</td>
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<tr>
<td>Random Vibration (TBC)</td>
<td>Stowed</td>
<td>Scheduled April 2006</td>
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<tr>
<td>Shock</td>
<td>Stowed</td>
<td>Scheduled April 2006</td>
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<tr>
<td>Deployment 4</td>
<td>Stowed to deployed under 0-g suspension</td>
<td>Scheduled May 2006</td>
</tr>
<tr>
<td>Detailed Surface measurement</td>
<td>Deployed. 3000 measurement points</td>
<td>Scheduled May 2006</td>
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<tr>
<td>Depressurisation</td>
<td>Stowed</td>
<td>Scheduled June 2006</td>
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<tr>
<td>Thermal vacuum with release</td>
<td>Stowed and initial release</td>
<td>Scheduled June 2006</td>
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<tr>
<td>Deployment 5</td>
<td>Stowed to deployed under 0-g suspension</td>
<td>Scheduled June 2006</td>
</tr>
<tr>
<td>PIM Products</td>
<td>Deployed</td>
<td>Scheduled June 2006</td>
</tr>
</tbody>
</table>
Large Deployable Antenna: programme status

The first PIM tests have been carried out showing full compliance with the requirements: better than $-140\ \text{dBm}$ at 5th order and better than $-150\ \text{dBm}$ at 7th order at full power. The chamber noise floor is below $-150\ \text{dBm}$.

LDR during PIM test in the RSC-Energia anechoic chamber
Large Deployable Antenna: programme status
View of reflector under 0-g portal during deployment 2 (courtesy of NPO-EGS, RSC-Energia and Alcatel Alenia)
Large Deployable Antenna: flight experiment

Flight Experiment feasibility study (completed):

Conclusions

**Cargo vehicle**: Modified Progress Cargo Ship

(ATV discarded due to package dimensions and EVA limitations)

**Accommodation**. Two options:

1. On Progress (baseline)
2. On the ISS (back-up)

**Experiments proposed**:

1. Deployment and reflector shape measurement (baseline)
2. Radiation diagram measurement via RF link (baseline)
3. PIM products in orbit (baseline)
4. SAR (back-up)
Large Deployable Antenna: flight experiment
Modified PROGRESS, with additional non pressurized Cargo Bay

The use of the non pressurized cargo Compartment allows a direct access of the LDA equipments to EVA without the transfer inside the ISS, hence could be compatible with the dish package of 2354 mm, that is the dish with a rim diameter of 12 meters.
# Large Deployable Antenna: flight experiment

<table>
<thead>
<tr>
<th>Event</th>
<th>Start Date</th>
<th>End Date</th>
<th>Duration</th>
<th>Description</th>
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<tr>
<td>Definition Phase: CCN9 of LDA contract</td>
<td>June 2006</td>
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<td>4 months</td>
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<tr>
<td>PROGRESS Cargo Ship MAIT + Cargo Implementation</td>
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<td>18 months</td>
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<td>Flight Experiment RF Payload MAIT</td>
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<td>16 months</td>
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<tr>
<td>Flight Experiment Arm (hinges and tubes) MAIT</td>
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<td>16 months</td>
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<td>Reflector Qualification (LDA contract)</td>
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<td>14 months</td>
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<tr>
<td>Reflector Adaptation &amp; Refurbishment</td>
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<td>6 months</td>
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<tr>
<td>Reflector Flight Acceptance</td>
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<td>6 months</td>
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<tr>
<td>Launch campaign KO</td>
<td>Dec. 2007</td>
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</tbody>
</table>
New activities in ARTES 5 2006 workplan

Advanced Attachment Configurations for Large Deployable Reflectors (4E.018) - 500 k€

Proc. Policy: C
Duration: 18 months
Priority: 2

Objective:
The objective is to design, manufacture and test a Breadboard Model of a side attachment Deployment Release and Pointing System suitable for large deployable mesh reflectors (9–25m aperture). Functionalities, kinematics and dynamic performances of the model shall be tested with an equivalent dummy reflector. The performances and limitations shall be compared to single boom central attachment concepts.
New activities in ARTES 5 2006 workplan

Inflatable Thermally Cured Mast (4E.019) - 200 k€ - Proc. Policy: C
Duration: 12 months
Intended issue: 1st quarter 2006
Priority: 1

Objective:
This activity is to design, manufacture and test in thermal vacuum a seven-meter inflatable mast.
Activities carried forward from ARTES 5 2005 workplan

European Reflector Mesh for Large (Deployable) Reflector Antennas (5B.025) – 500 kEuro –
Proc. Policy: DN (AAS (I))
Duration: 12 months
Priority: 2

Objective:
The objective is to develop and test representative samples of advanced reflector mesh material with improved performances (PIM performances, improved thermal-optical properties and in general more reliable performances over lifetime).
Activities carried forward from ARTES 5 2005 workplan

In-Flight Thermo-Elastic Stability Improvement of Carbon Reflectors (5B.026) – 800 kEuro –
Proc. Policy: C
Duration: 24 months
Priority: 2

Objective:
This activity is to study and demonstrate improvements of the thermo-elastic stability of antenna reflector surfaces. The study will identify a preferred concept, which will be verified by manufacturing and testing a reflector with a diameter greater than 2 meter.

Status: initiated AO/1-4990/06/NL/IA.
Deadline for submission of proposals: 13 April 2006
Further questions:

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