Since its start in 2005 two flight models of an S-Band version in aluminum and composite fiber reinforced plastics (CFRP) have been built. The first stage of the LISA project was completed in 2007 with a successful End-to-End Verification of the antenna system through transmitting data via Artemis to the ESA ground station in Redu and receiving a mirrored signal again routed via Artemis. All necessary spaceflight qualification tests have been completed with a consistent RF performance.

After completing a precursor study for the further development of a Ka-Band version, the second stage of the project called LISA MS started in early 2008. Current goal is to provide a complete Ka-Band antenna, including the pointing mechanism, ready to be space-qualified in early 2010. Special focus during the development is the application of new production methods (e.g. direct-laser sintering).

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The goal of the LISA (Light-weight intersatellite antenna) project is to develop technologies for a novel intersatellite link antenna system that is highly compact, lightweight and mechanically steerable to cover a maximum area of the sphere around the spacecraft.

In S-Band all targeted goals (e.g. gain, VSWR, side lobes) for the RF performance have been reached. In the current phase a Ka-Band version of the antenna is developed to obtain higher data rates and to research the usage of new production techniques including rapid prototyping methods.

The second key element of the antenna system is the mechanical pointing mechanism that connects the antenna module to the spacecraft bus. It enables a maximal rotation of the antenna around two perpendicular axes with a minimal launch envelope in its stored position through its connection at the side of the rectangular shaped antenna.

The project LISA provides a small and compact solution for communication links between geostationary (GEO) and low earth orbits (LEO) spacecrafts. The mechanical pointing device can point quickly to other satellites (GEO or LEO) or ground stations on the earth. Through the small physical size and mass of the antenna system, the effects on the satellite during the tracking will be kept to a minimum.

Satellites with a high amount of data generated by the payload (e.g. on earth observing satellites) equipped with the LISA antenna system will be able to maintain a communication link to a ground station via a GEO data relay satellite. This communication architecture will enhance the link time to a ground station drastically and allow greater volumes of data to be transferred to the earth surface. Additionally, the times without a direct communication link can be reduced which will lead to faster response times (e.g. for commanding).

One other scenario that needs an uninterrupted communication link is on-orbit servicing (e.g. DEOS) where the continuous broadcasting of video and sensor data is essential to successfully dock a servicer-spacecraft with an old spacecraft to be refueled.

<table>
<thead>
<tr>
<th>Scope</th>
<th>Applications</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>The goal of the LISA (Light-weight intersatellite antenna) project is to develop technologies for a novel intersatellite link antenna system that is highly compact, lightweight and mechanically steerable to cover a maximum area of the sphere around the spacecraft.</td>
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</tbody>
</table>

**Applications**

<table>
<thead>
<tr>
<th>S-Band</th>
<th>Ka-Band</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antenna type</strong></td>
<td>Horn-array</td>
</tr>
<tr>
<td><strong>Number of Horns</strong></td>
<td>4x4 array</td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>Aluminium/CFRP</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>AL: 5.568g, CFRP: 4.872g</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>400x400x70 mm</td>
</tr>
<tr>
<td><strong>Frequencies</strong></td>
<td>2.076-2.255 MHz</td>
</tr>
<tr>
<td><strong>Polarisation</strong></td>
<td>LHC</td>
</tr>
<tr>
<td><strong>Gain</strong></td>
<td>18.1 dBi</td>
</tr>
<tr>
<td><strong>1st side lobe</strong></td>
<td>-13 dB</td>
</tr>
<tr>
<td><strong>Cross-Pol.</strong></td>
<td>-18 dB</td>
</tr>
<tr>
<td><strong>VSWR</strong></td>
<td>1.3</td>
</tr>
</tbody>
</table>

LISA aluminum flight model (left), LISA (Ka-Band) EM modeling (right)