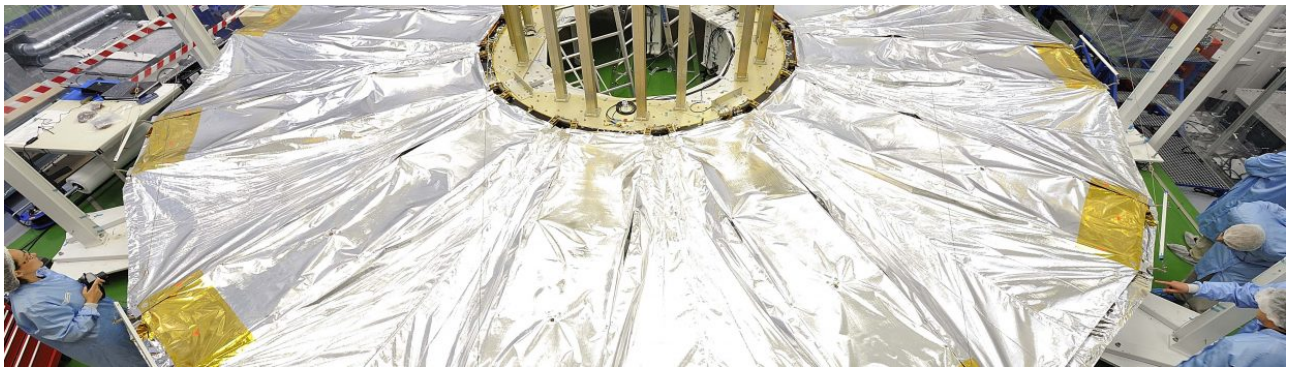
XSpace

# GAIA deployable sunshield



SENER XSPACE / XINNOVATION IN SPACE / GERMANY

| | | |
|---|---|---|
| *GAIA DEPLOYABLE SUN-SHIELD* | **Cliente: ASTRIUM / ESA** | **Fecha inicio: enero del 2006** |
| | **País: Germany** | **Fecha fin: enero del 2010** |

The GAIA Deployment Sunshield Assembly (DSA), provides a stable and continuous shadow environment to the SVM and PLM of the satellite. The DSA is composed by 12 rectangular petals joined by 12 triangular sectors to form an almost circular plane around the base of the spacecraft. The difference of temperature between the sunside layer and the shadowside layer is around 150º C.

In working configuration the DSA is a flat circle of about 10.200 mm diameter. Due to the geometrical constrains of the rocket fairing, for launch purposes the sunshield has to be folded into a dodecagonal prism configuration around the thermal tent, to fit into the fairing diameter of 3.800 mm.

Each petal is formed by a structural frame (H shaped) composed by CFRP tubes joined by metallic fittings bonded to the tubes.

The thermal function of the DSA is achieved by two layers of thermal foils: sun side foil and shadow side foil designed to meet the thermal requirements. These foils are kept in place by special tensioning devices which maintain the thermal insulation in a controlled manner once the item is deployed.

©Sener - Sener Group 2025

In the centre of the H shape's intermediate tube the fitting through which the frame is fixed to the S/C through the Hold down and release mechanism.

The structural frames are hinged at the base (two hinges per frame), attached to a ring assembled over the base of the SVM. The hinges perform the deployment function by means of loaded springs. The 12 frames are joined at the hinges axis via flexible couplings, composing a single shaft loop in order to achieve a synchronous deployment when the deployment is triggered.

The deployment is controlled actively by two DSA actuators. Each of these actuators are based in an actuator and a Four-Bar Linkage Mechanism that brakes or provides actuating torque to ensure the 90 degree deployment of the DSA. In order to control the actuators, a motor driving electronic system per actuator is required to apply the electrical inputs to the motor windings to run proper steps. These electronics apply required inputs to the actuators by means of a specific actuator harness.

Actualmente es el parasol más grande puesto en órbita y sólo será superado por el sucesor del Hubble después de que Gaia haya terminado su vida útil. Anteriormente la sonda WMAP de la NASA había desplegado un parasol de 3 m de diámetro aproximadamente. Por ello el parasol de Gaia se puede considerar un hito importante dentro de los grandes sistemas desplegables para satélites.

- Characteristics:
- The sunshield provides thermal insulation from solar radiation of several orders of magnitude. Of a total of 1400 W/m2 of solar radiation, only 5 W/$m^2$ reaches the telescope with a uniformity of 20 milliwatts/$m^2$.
- The total weight, including the electronics, is 125 kg, and it consumes less than 20 W in the course of the 4 minutes of deployment.
- The sunshield»s structure secures solar panels, as well as the thermal protection, delivering great dimensional stability with deformations of less than 0.05% in a temperature range of 150°.
- Besides their insulating capacity, the thermal protections, arranged in two layers of multi-layer insulation (MLI), include novel fixation systems. Their design permits in-orbit deployment, from undeployed to deployed configuration, in a unique design that allows their volume to be compacted by a factor of 12.
- The mechanisms include a combination of well-tested elements, such as Sener»s actuator, with other newly design elements, such as the flexible connectors that synchronize deployment, the thermal protection tensors that reduce deployment resistance, or the actuator»s coupling mechanism, which determines the motoring profile throughout deployment.

©Sener - Sener Group 2025