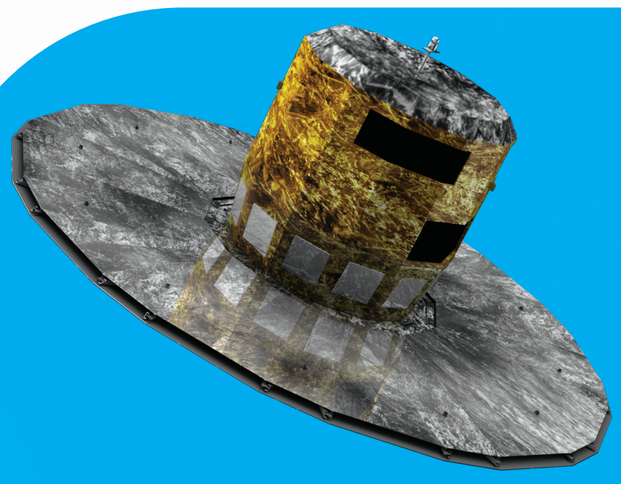


Credit: ESA - C. Carreau

Gaia Mission Overview

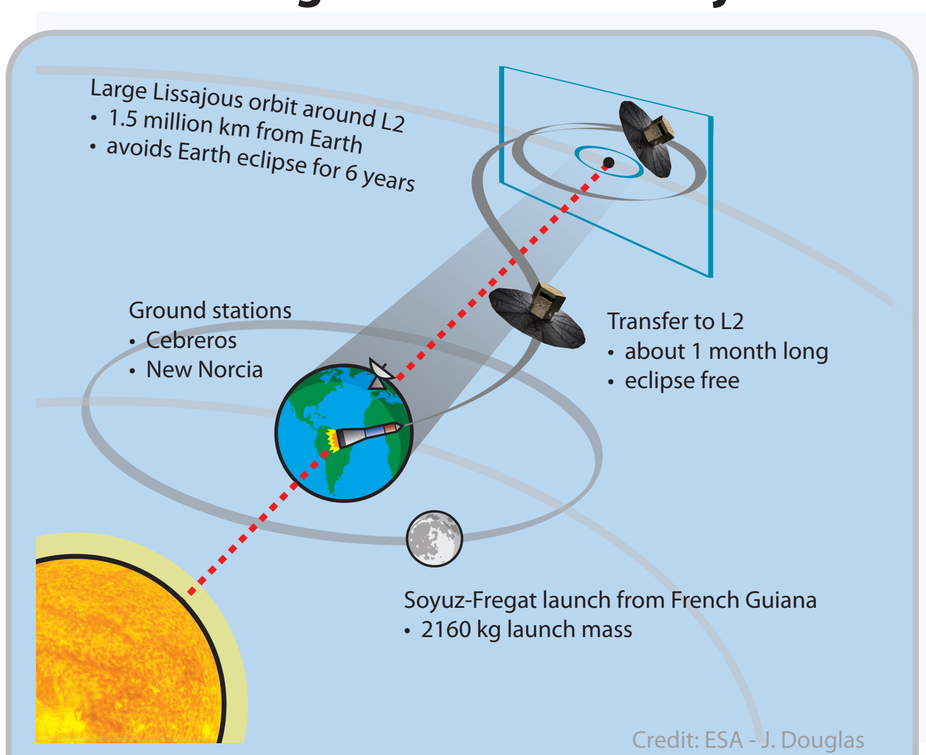
Gaia is a pioneering ESA astronomy mission set to revolutionise our view of the Galaxy with a precise and detailed stereoscopic survey of the billion brightest celestial objects.

High-accuracy astrometry will allow Gaia to exactly **pinpoint the position of a star** and to measure its movement across the sky, whilst spectroscopic measurements will allow the radial velocity to be determined. Gaia will also gather photometric data, measuring the brightness of a star in a few dozen colours. This array of data will reveal a **moving, three-dimensional Milky Way map** of unprecedented scope and precision, as well as providing profiles of the physical properties of each star, including luminosity, surface gravity, temperature and elemental composition.

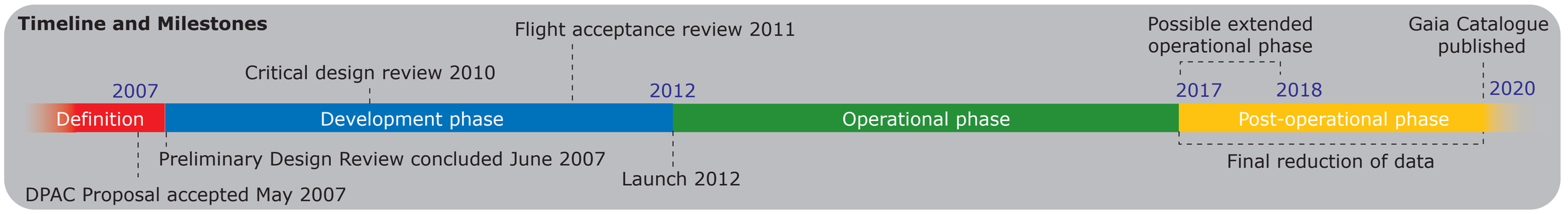
Selected as an ESA Cornerstone mission in 2000, Gaia is currently set to launch in early 2012. Gaia continues a European tradition for pioneering astrometry, building on expertise generated by the first space-based astrometry mission, **Hipparcos**.

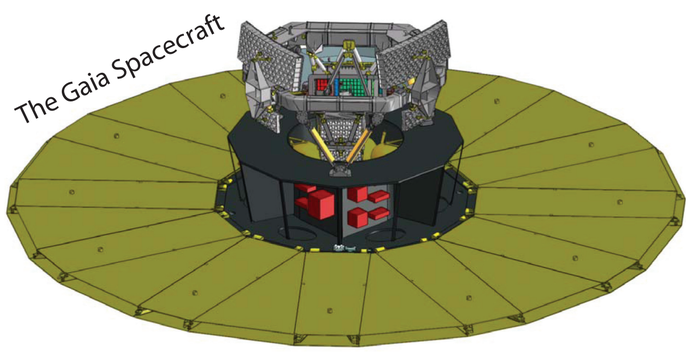
By surveying **all celestial bodies down to the very faint magnitude 20**, Gaia will take in a representative fraction of the Milky Way's population, providing scientists with the data to tackle unanswered questions about our home galaxy, potentially revealing its formation history, current state and future evolution. This catch-all survey will naturally include stars in short-lived phases of stellar evolution, and numerous binary and multiple stars, as well as several thousand brown dwarfs and extra-solar planets. Gaia will also map out our immediate neighbourhood in great detail, detecting hundreds of thousands of minor Solar System bodies. Beyond the Milky Way, Gaia will observe extra-galactic objects like supernovae and quasars, and resolve many distant galaxies.

Advanced processing and analysis will translate Gaia's raw data into the mission's final product: the **Gaia Catalogue**, an extensive galactic census, rich in scientific content. The unprecedented accuracy and unbiased nature of this full-sky survey will prove valuable, even revolutionary, to a huge range of scientific disciplines besides galaxy studies; Gaia's wealth of data will eventually inform and invigorate scientific areas as diverse as stellar life cycles, dark matter distribution and general relativity. As a complete sky survey without pre-programmed targets, the **discovery potential** of Gaia is also profound.

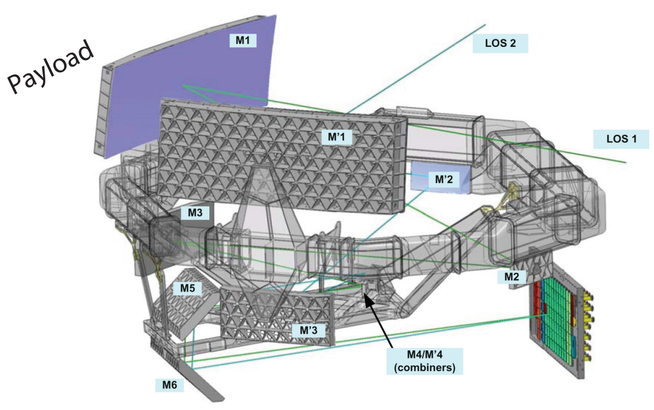


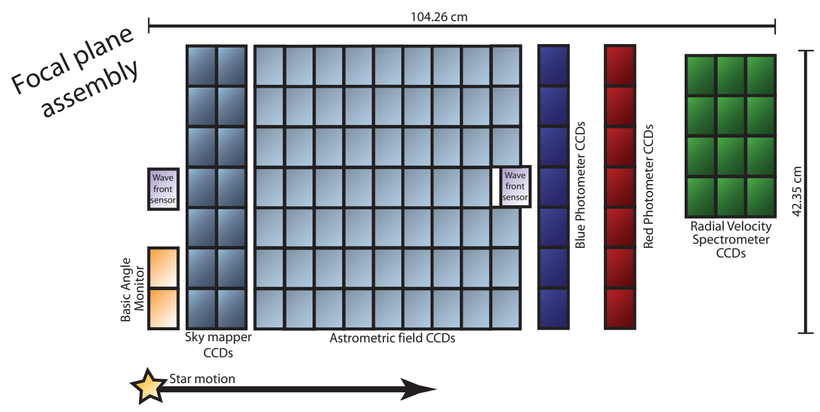
Following launch in early 2012, the Gaia spacecraft will travel 1.5 million kilometres from Earth, away from the Sun, to take up an orbit around the second Lagrange point L2, a position of (unstable) gravitational equilibrium in the Sun-Earth-Moon system. Shaded from the light of the Sun, Moon and Earth by a large deployable shield, the satellite will revolve slowly, with one full revolution every six hours, thereby scanning great circles across the sky.





Credit (spacecraft and payload images): EADS Astrium





Credit (FPA image): ESA - A. Short

Spacecraft and Instruments

Gaia's payload features **two telescopes** sharing a **common focal plane**, each looking out through an aperture in the payload housing and separated by a highly stable basic angle. Light from a celestial object enters the arrangement through one of the two apertures, striking the large primary mirror opposite (M1 and M'1 in the payload illustration). The light is then reflected by a series of mirrors along a total focal length of 35 m, with the two light paths meeting at the M4/M'4 beam combiner before finally reaching the shared focal plane.

At the focal plane is a large mosaic of sophisticated, custom-built charge coupled devices (CCDs), light detectors of essentially the same kind as found in a digital camera. Containing 106 CCDs, the focal plane assembly comprises a total of nearly one billion pixels (a 'gigapixel'), compared to the few million of a typical digital camera. This focal plane is shared by the astrometric, photometric and spectroscopic instruments.

As the spacecraft slowly rotates, the light from the celestial object (that is, the image of the object) passes across the focal plane. In this way, Gaia steadily **scans the whole sky** as the satellite spins and gradually precesses, with each part being observed around 70 times in the course of the operational lifetime.

Gaia's astrometric measurements are made using the **global astrometry** concept successfully demonstrated by Hipparcos. Having two different lines of sight allows Gaia to measure the relative separations of the thousands of stars simultaneously present in the combined fields of view. These wide-angle measurements build up a rigid network of relative star positions, contributing to Gaia's exceptional accuracy.

Data Processing

The nature of the Gaia mission leads to the acquisition of an enormous quantity of **complex, extremely precise data**, representing the multiple observations of a billion diverse objects by a 'double vision' instrument that is spinning and precessing. The Gaia data challenge - processing raw satellite telemetry into valuable science products - is therefore a huge task in terms of expertise, effort and dedicated computing power.

A large pan-European team of expert scientists and software developers known as **DPAC** (Data Processing and Analysis Consortium) is responsible for the processing of Gaia's data with the final objective of producing the Gaia Catalogue. Drawing its membership from 23 countries, the consortium brings together skills and expertise from across the continent, reflecting the international nature and cooperative spirit of ESA itself.

EADS Astrium

In May 2006, European satellite system specialist EADS Astrium signed a contract with ESA to develop and build the Gaia satellite. The cutting-edge technology employed in the Gaia spacecraft and instruments draws on Astrium's considerable expertise, particularly with silicon carbide telescopes, as used on the Herschel Space Observatory. Moreover, as the makers of Gaia's predecessor, Hipparcos, EADS Astrium bring much valuable experience to the project.

For more information or to download this poster:
www.rssd.esa.int/Gaia

Gaia: Surveying the Galaxy