Satellites
Space Transportation
Services

SWARM

Swarm Satellite Structure

MAPPING THE EARTH'S MAGENTIC FIELD

The primary objective of the Swarm mission is to provide the best ever survey of the geomagnetic field and the first global representation of its variation on time scales from an hour to several years. Swarm will simultaneously obtain a space-time characterisation of both the internal field sources in the Earth and the ionospheric-magnetospheric current systems.

The primary research objectives assigned to the mission are:

- Studies of core dynamics, geo-dynamo processes, and core-mantle interaction
- Mapping of the lithosphere magnetisation and its geological interpretation
- Determination of the 3-D electrical conductivity of the mantle
- Investigation of electric current flowing in the magnetosphere and ionosphere

Swarm builds on the heritage of Champ, an Astrium designed satellite which was launched July 2000 and operated for 10 years. Astrium utilises in house knowledge on specific needs for satellite platform and instruments.

All the space you need

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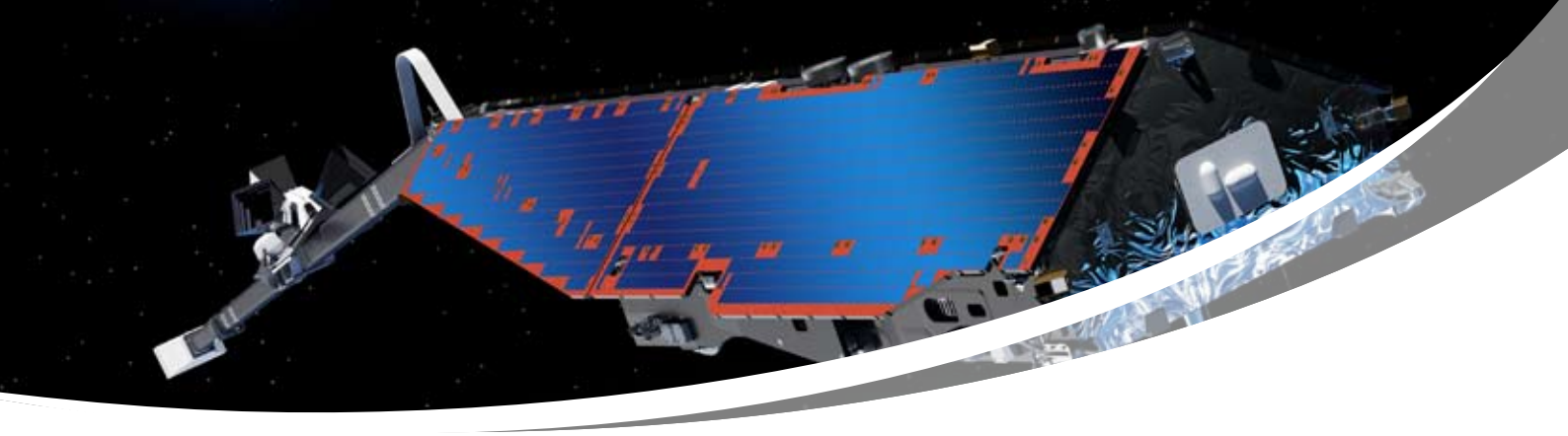

Customer	European Space Agency
Mission	Geomagnetic field measurement
Orbit	Polar Low Earth Orbit
Spacecraft	Swarm consists of 3 satellites in a constellation flying at altitudes between 490 and 300km
Payload	• ASM (Absolute Scalar Magnetometer) • VFM (Vector Field Magnetometer) • EFI (Electrical Field Instrument • ACC (Accelerometer) • LRR (Laser Retro Reflector) • Star Tracker System • GPS Receiver L1/L2
Features	• Magnetically clean spacecraft • Deployable boom (4m) • Ultra-stable optical bench • High ballistic coefficient • 6Mbit/s S-band downlink • L1/l2 GPSR • Earth oriented safe mode
Launch Mass	1500kg
Dimensions	Height = 1m, Width = 1.5m, Depth = 9m
Launch Date	2012
Mission Duration	4 years
Status	CDR passed
Astrium Responsibilities	• Prime contractor • Thermal/mechanical platform • System AIT/V • PCDU and Solar Array • Optical Bench Assembly • Mission analysis

Key Features:

The Swarm system design is based on Astrium's long standing experience in magnetically clean satellites, in missions including ISEE-B, Ulysses, Cluster and Champ. Swarm will allow the permanent monitoring of Earth's magnetic field from low earth orbit to continue.

The optical bench assembly houses a vector field magnetometer and three star cameras, to give a precise field measurement where the instrument position is known. The magnetometer and star cameras are separated by 0.5m to prevent the magnetic fields of the star cameras from interfering with the magnetometer, and they are connected by a stable carbon-fibre/ceramic structure. This optical bench is stable to one arc second, so accurate that it cannot be measured under gravity and must undergo additional testing and modelling to prove the assembly.

The three satellite constellation allows the magnetic field to be measured in several locations at the same time. To date, changes in measurements could be because the field varies over time. Swarm's multiple simultaneous measurements will reveal variations due to location alone.

The Swarm design allows the spacecraft to fly at low altitudes for extended periods with a low fuel demand due to a low ballistic coefficient. This is when the cross sectional area is small but the mass is large. The Swarm design needs a mass of 500kg, and unlike other spacecraft where mass is minimised as much as possible, the Swarm satellites must reach their target of 500kg or any difference will be made up by extra weight added.

Swarm Optical Bench

INDUSTRIAL TEAM

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GFZ
Xperion

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SciSys
IGG
Marotta

DTU

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Oerlikon
Clemessy
RUAG

TAS-I

VZLU

Critical Software

SSBV
Bradford Engineering

TECHNOLOGICA
GMV

Patria

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Boostec

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