

Astrium

First ELIXIR School

Ottobrunn

30th of May to 2nd of June 2010



All the space you need



■ **Astrium at work**

- Access to space
- A safer world
- Daily life benefits
- Our Earth
- Exploring the Universe
- Man in space

- **The company**
- **Organization**
- **Satellite Projects**

Astrium at work



Astrium is a global space industry leader, with world-class expertise and extensive prime contractorship experience across all sectors of the space business

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All the space you need | **ASTRIUM AT WORK**



Access to space

- Without launchers, no space activity would be possible

Astrium provides Europe with a full, flexible launch capability

- Ariane 5
- Soyuz
- Rockot
- Vega



A safer world

- Space systems have become key factors in defence and security systems. Astrium provides space-based defence systems, technologies and services

- Reconnaissance
- Secure communications systems
- Ballistic missiles
- Future space-based defence systems



Daily life benefits

- Space technology is very much a part of the fabric of our daily lives. Astrium offers its customers tailor-made solutions for every field of application

- Communications
- Navigation
- Geo-information
- Weather forecasting

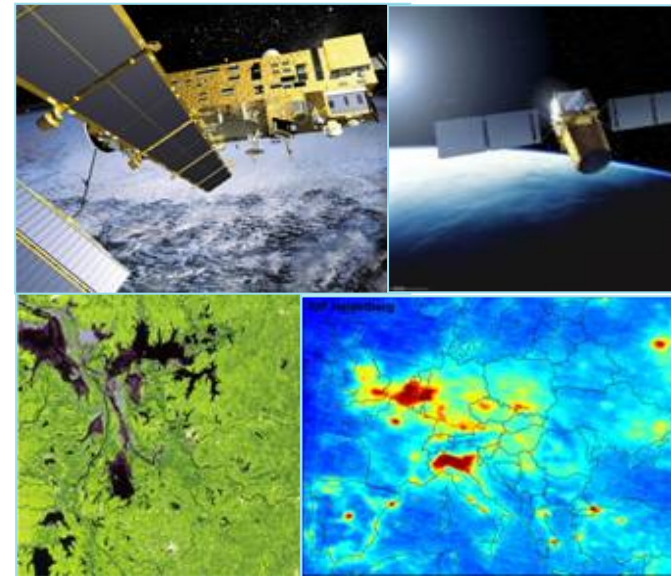


Our Earth

- Earth observation from space has truly revolutionised how we view our home planet

Astrium is an established leader in Earth observation satellite systems and a key partner in major ESA and national European space agency programmes

- Radar systems
- Optical systems



Exploring the Universe

- From his earliest days, Man has been fascinated by the stars above

Astrium's technology enables us to explore the solar system and the secrets of the Universe

- Earth & Sun
- Planetary missions
- The wider Universe



Man in space

- The International Space Station (ISS) is an uplifting example of international co-operation and ambition not only for advances in space technology and engineering, but also for all kinds of scientific research

Astrium is leading the European contribution to this project and was selected by ESA as prime contractor for major elements

- Columbus laboratory
- Automated Transfer Vehicle ATV
- Operation & utilisation



Astrium is passionate about space!

All the space you need | **ASTRIUM AT WORK**



■ Astrium at work

■ The company

- Basics
- Facts & figures
- Our sites
- Core activities

■ Organization

■ Satellite Projects

Astrium: part of EADS, a global leader in aerospace and defence

EADS



**Airbus
Airbus Military**



Eurocopter



Astrium



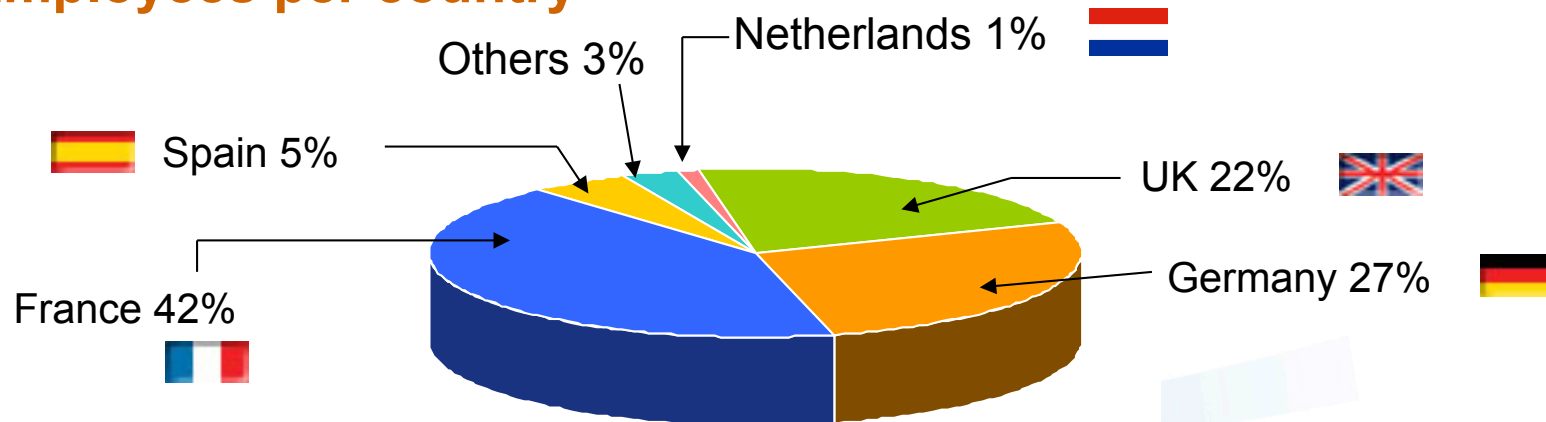
**Defence
& Security**

Facts & Figures 2009

Employees: 15,000
Sites: F, G, UK, S, NL
Turnover: €4.8 billion
Order backlog: €14.7 billion
CEO: François Auque



Employees per country



Astrium: the heritage and expertise of the leading European space nations



Additional locations

France

Limeil-Brévannes (Sodern)

Germany

Backnang (Tesat)

Potsdam (Infoterra)

UK

Colerne (Paradigm)

Corsham (Paradigm)

Farnborough (Infoterra)

Guildford (SSTL)

Hawthorn (Paradigm)

Leicester (Infoterra)

Newcastle (Infoterra)

Oakhanger (Paradigm)

Spain

Barcelona (Infoterra)

Saudi Arabia

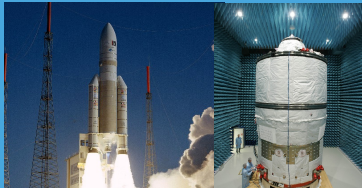
Riyadh (GPT)

Astrium is a global space industry leader, with unrivalled world class expertise

Astrium's activities are based in three key areas

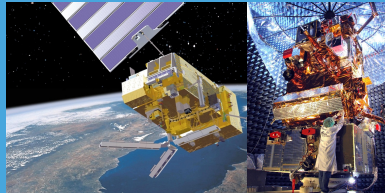
Astrium Space Transportation

The European prime contractor for civil and military space transportation and manned space activities



Astrium Satellites

A world leader in the design and manufacture of satellite systems



Astrium Services

At the forefront of satellite services in the secure communications, Earth observation and navigation fields



- **Astrium at work**

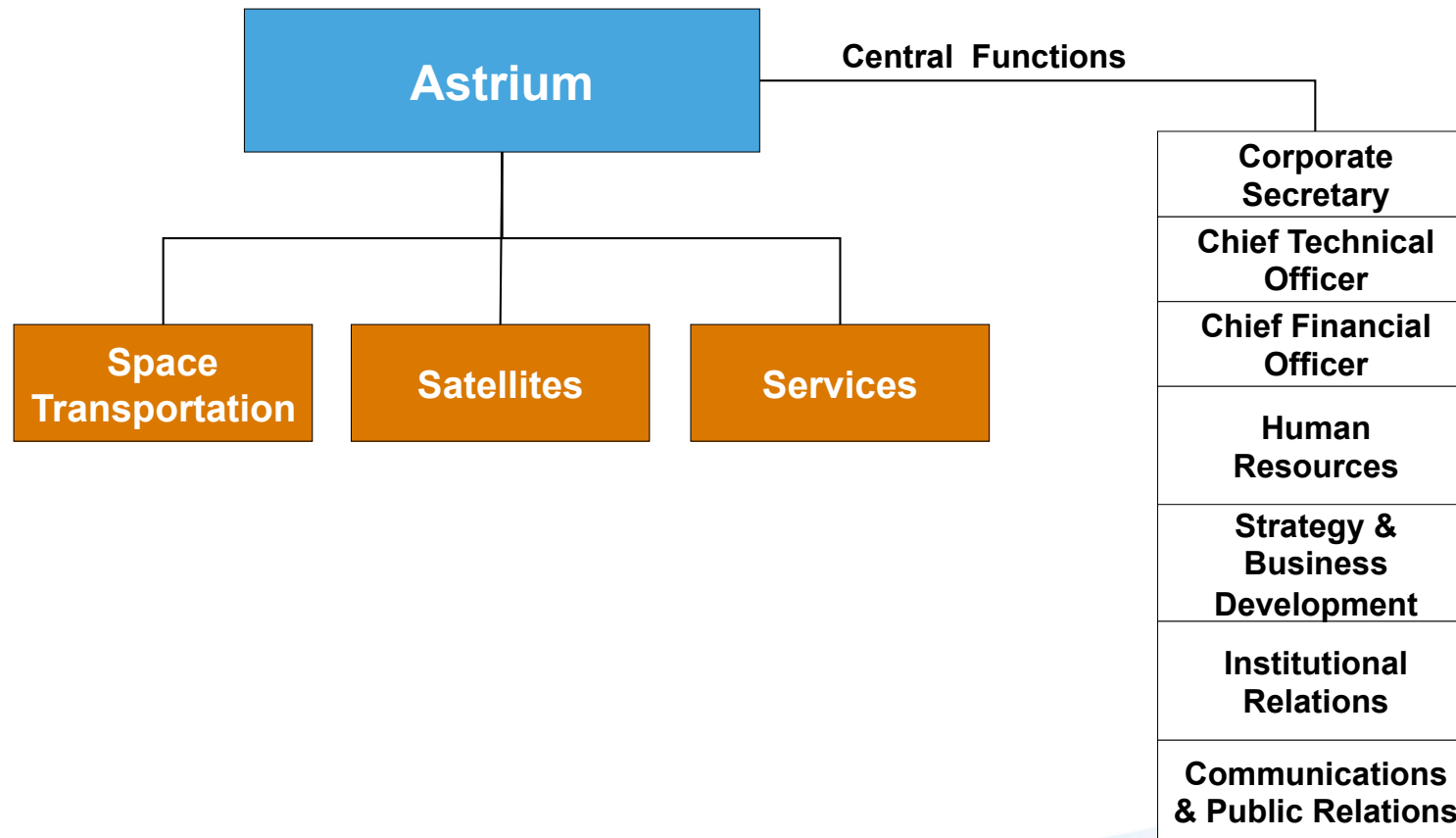
- **The company**

- **Organisation**

- Astrium Space Transportation
- Astrium Satellites
- Astrium Services

- **Satellite Projects**

Astrium: an integrated company



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Astrium Space Transportation

- The European prime contractor for space transportation, orbital infrastructure and manned space



CEO: Alain Charmeau

Business Divisions:

- Launchers
- Defence
- Orbital System & Space Exploration
- Propulsion & Equipment

Astrium Services

- A provider of satellite services in the secure communications, Earth observation and navigation fields



CEO: Eric Béranger

Business Divisions:

- Telecom Services
- Navigation Services
- Earth Observation Services
- Secure Satcom Systems

Astrium Satellites

- A world leader in the design and manufacture of satellite systems



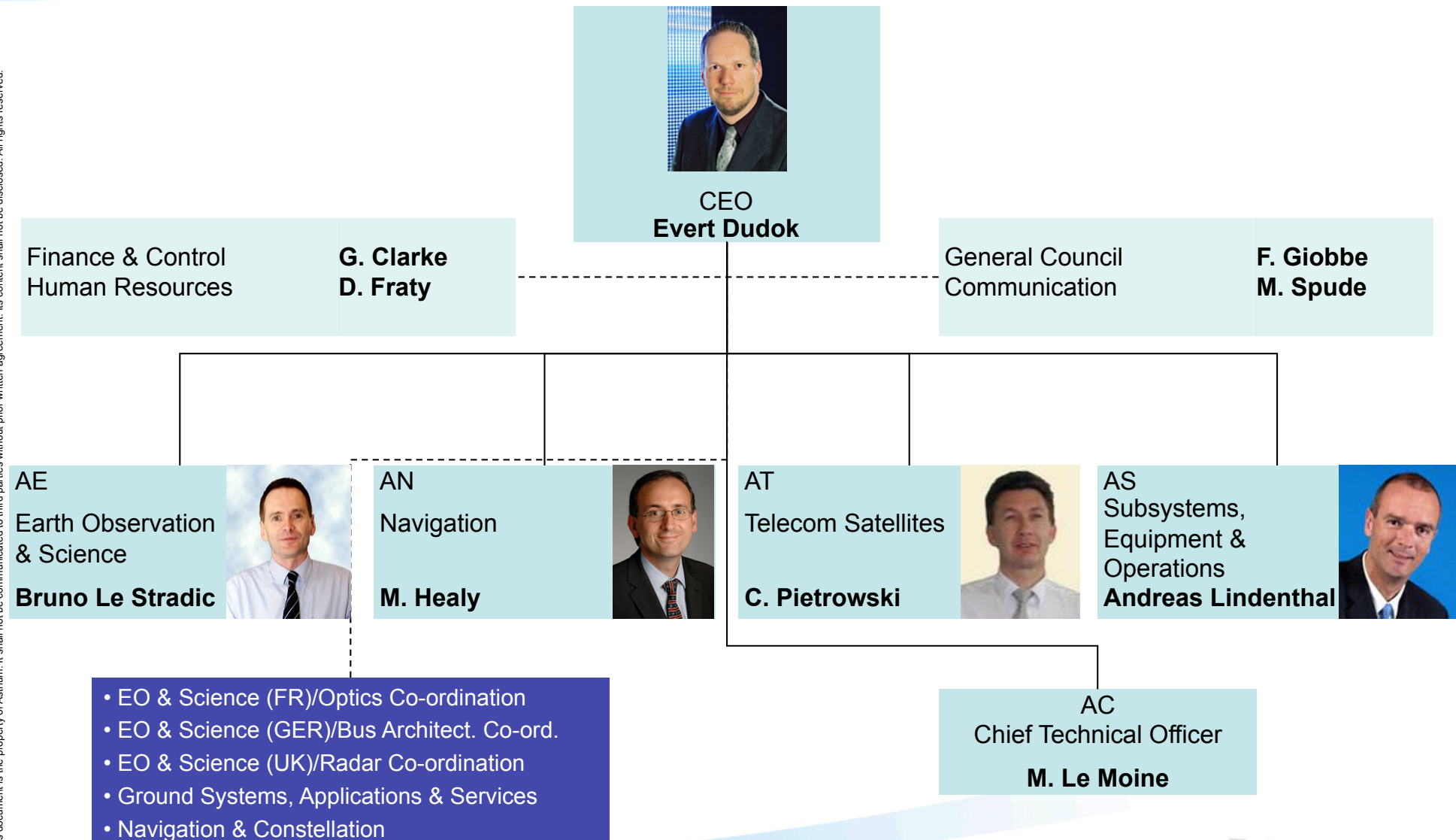
CEO: Evert Dudok

Business Divisions:

- Earth Observation & Science
- Navigation
- Subsystems, Equipment & Operations
- Telecom Satellites

Astrium Satellites Organisation

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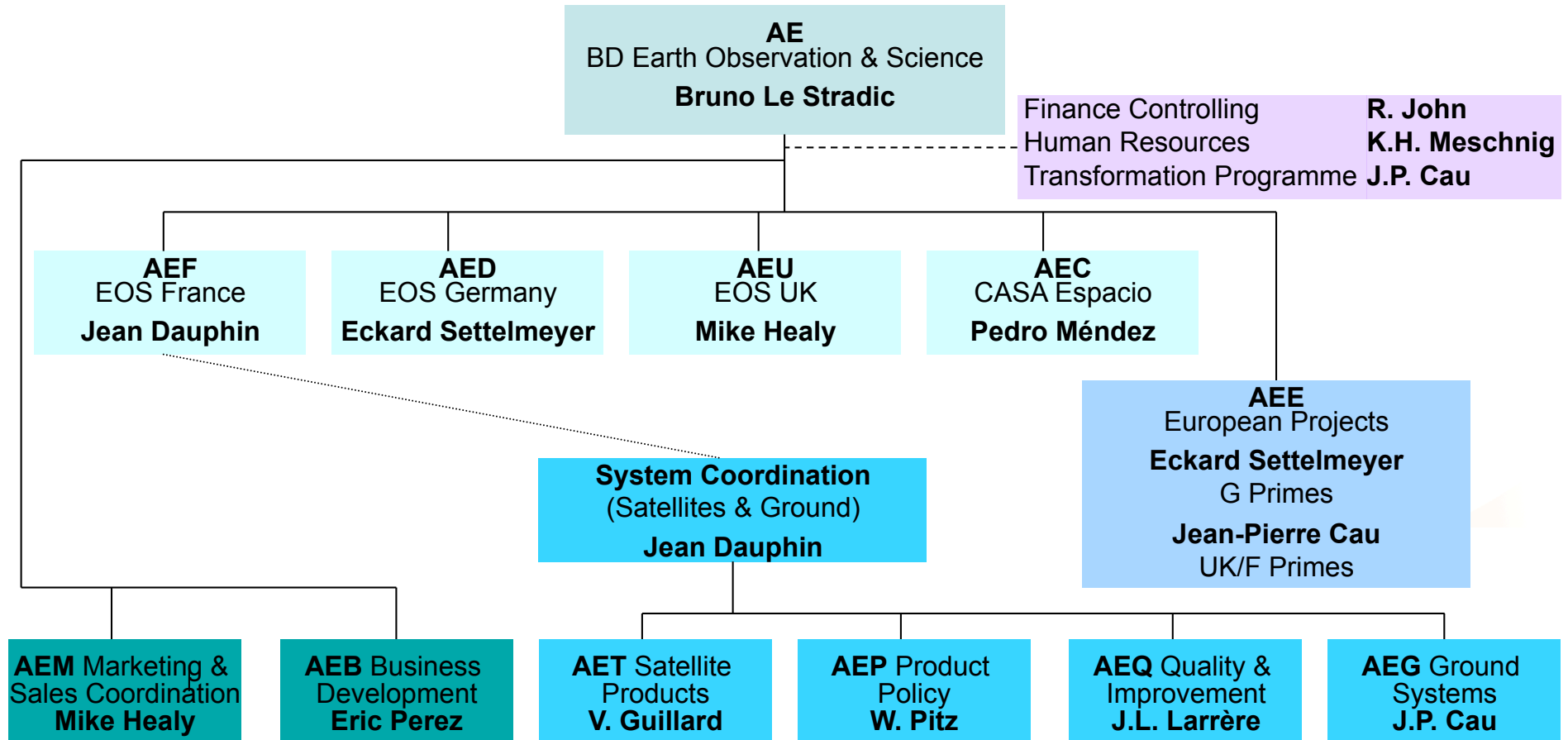


All the space you need



Astrium Satellites Organisation

AE – BD Earth Observation & Science



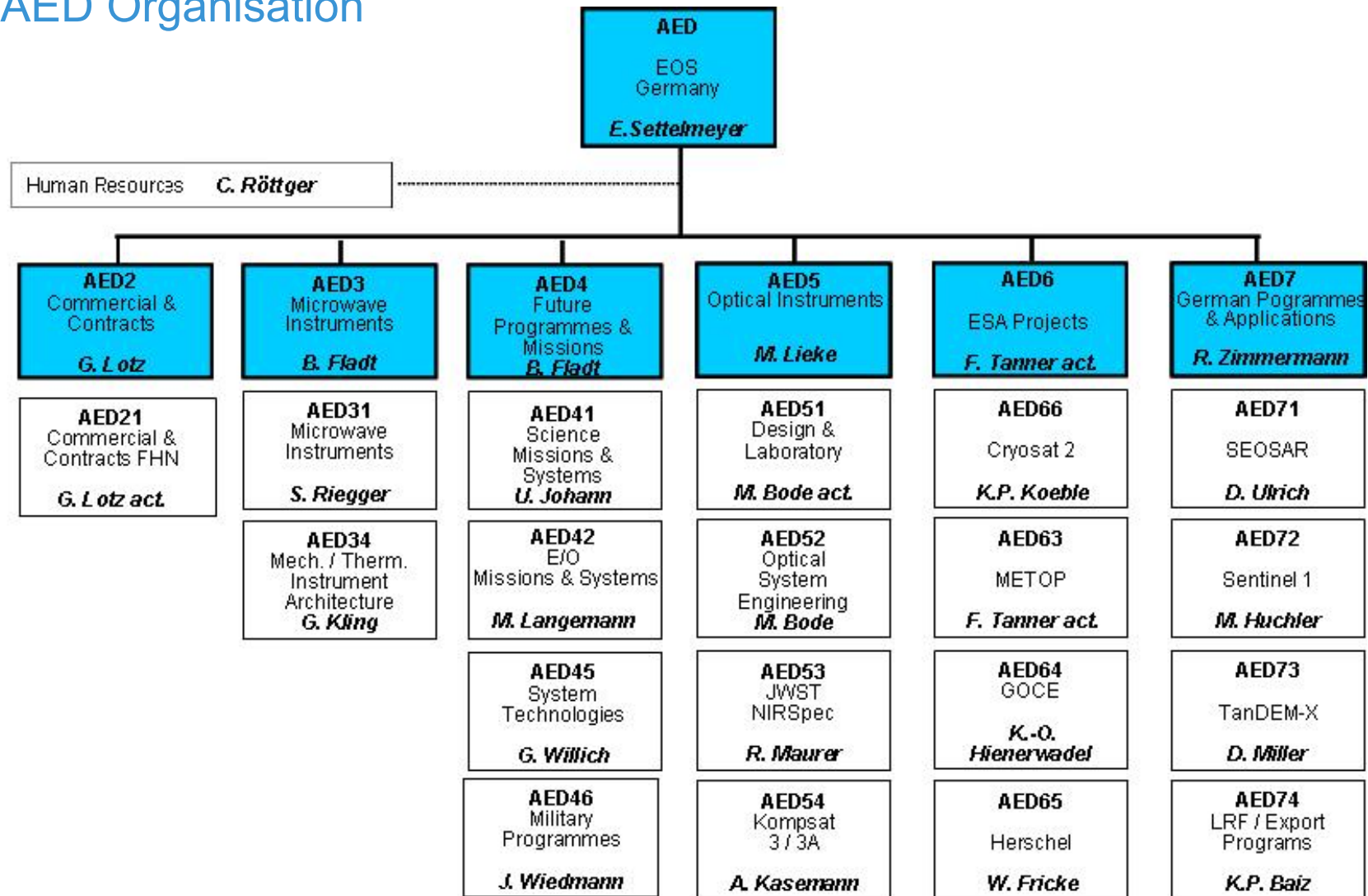
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All the space you need



Astrium Satellites Organisation

AED Organisation



- **Astrium at work**
- **The company**
- **Organisation**

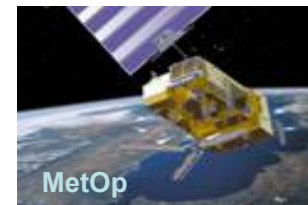
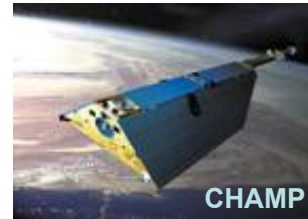
- **Satellite Projects**

- Operational Mission
- Current Satellite Projects

Satellite Projects at Astrium

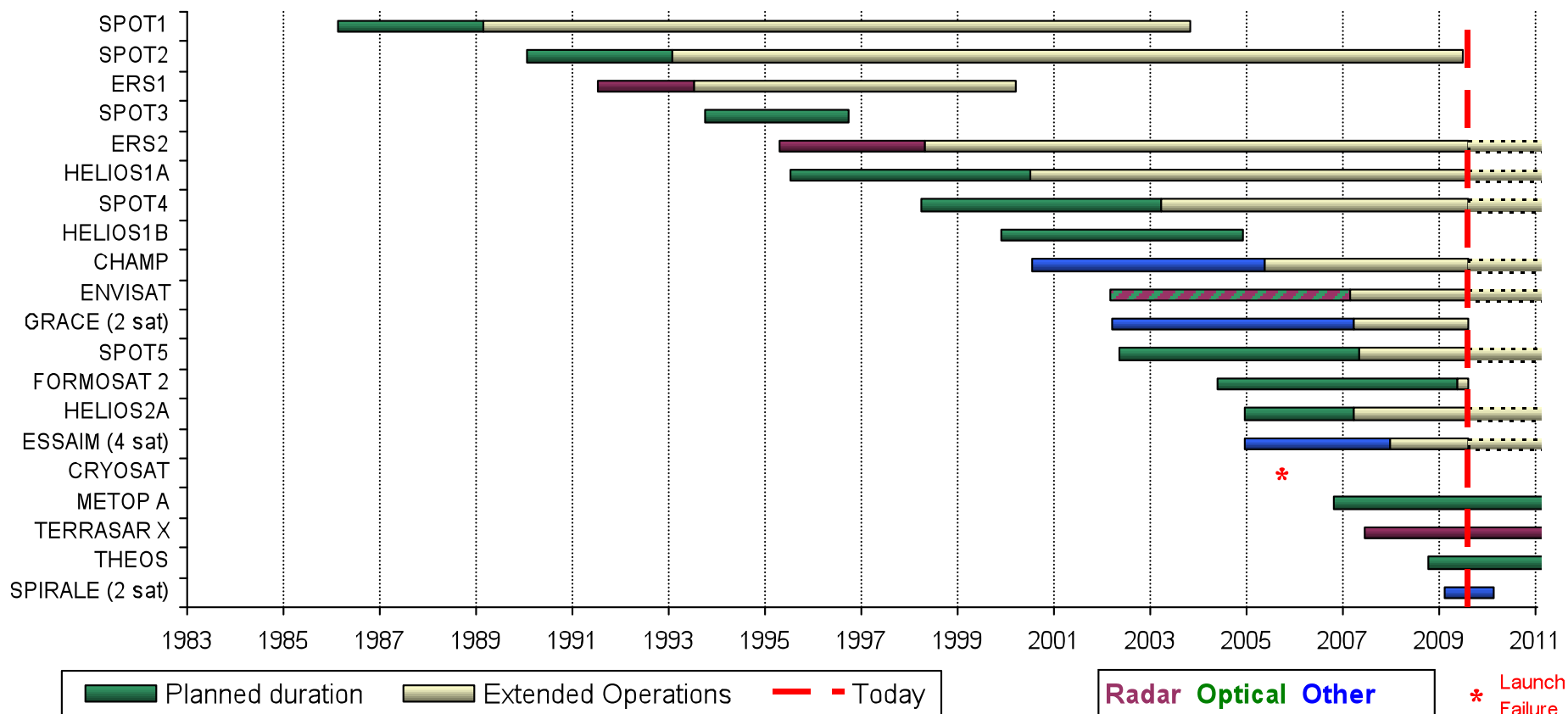
Operational Missions – Earth Observation

- ERS II
- Envisat
- Champ
- Grace
- MetOp-Payload Module
- TerraSAR-X
- GOCE



Satellite Projects

EOS in Orbit Status: Observation Satellites



Earth Observation Satellites - **162 years** accumulated in orbit

Prime contractor of 25 satellites

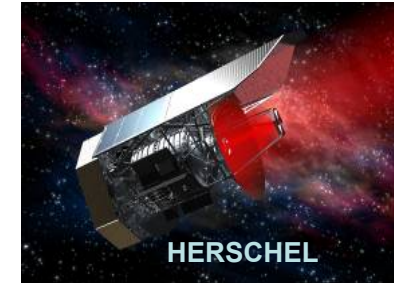
All the space you need



Satellite Projects at Astrium

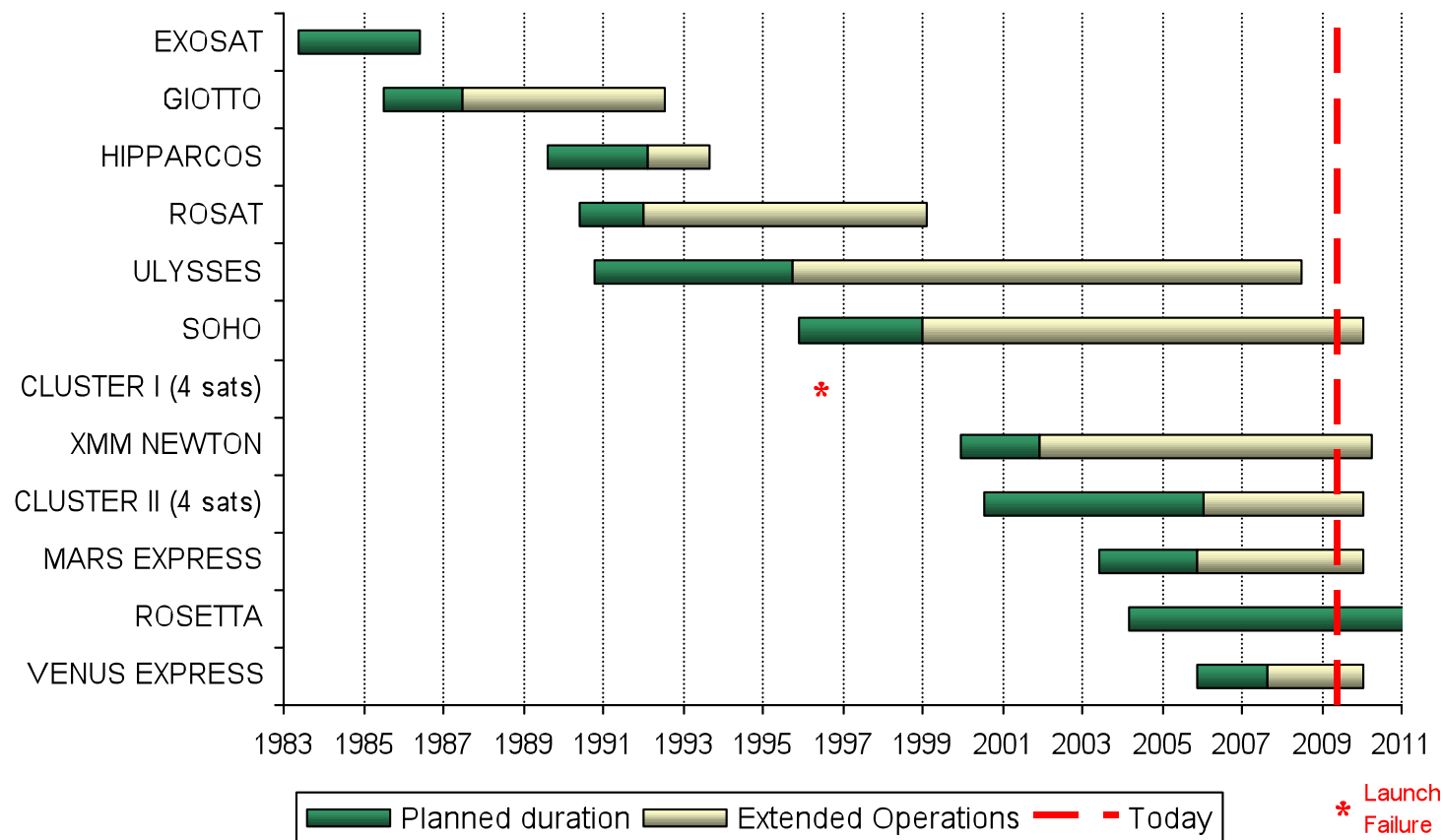
Operational Mission – Science:

- Ulysses
- Cluster
- Huygens
- Rosetta
- XMM
- Herschel



Satellite Projects

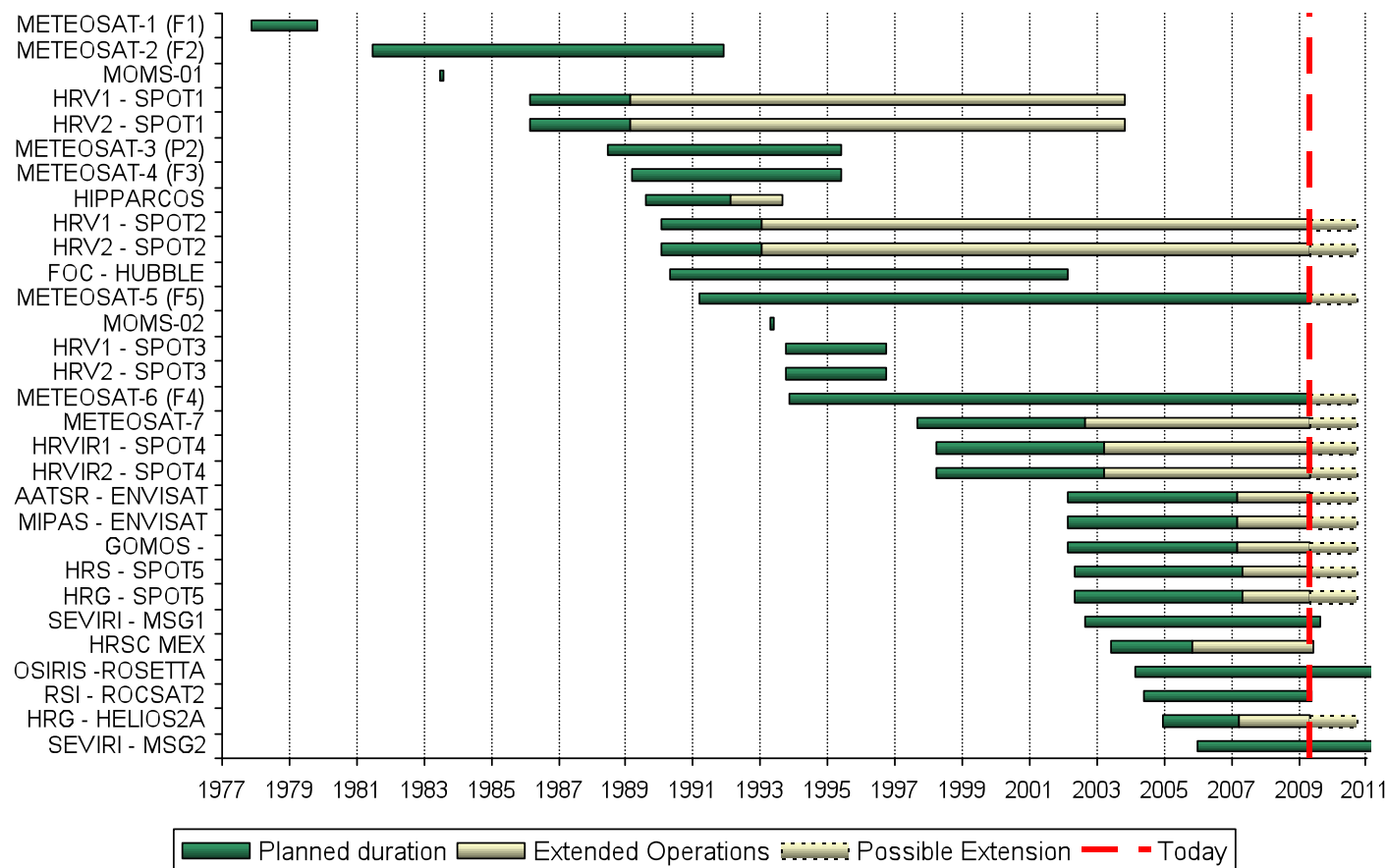
EOS in Orbit Status: Science Satellites



Science & Exploration Satellites – 87 years accumulated in orbit
Prime contractor of 18 satellites

Satellite Projects

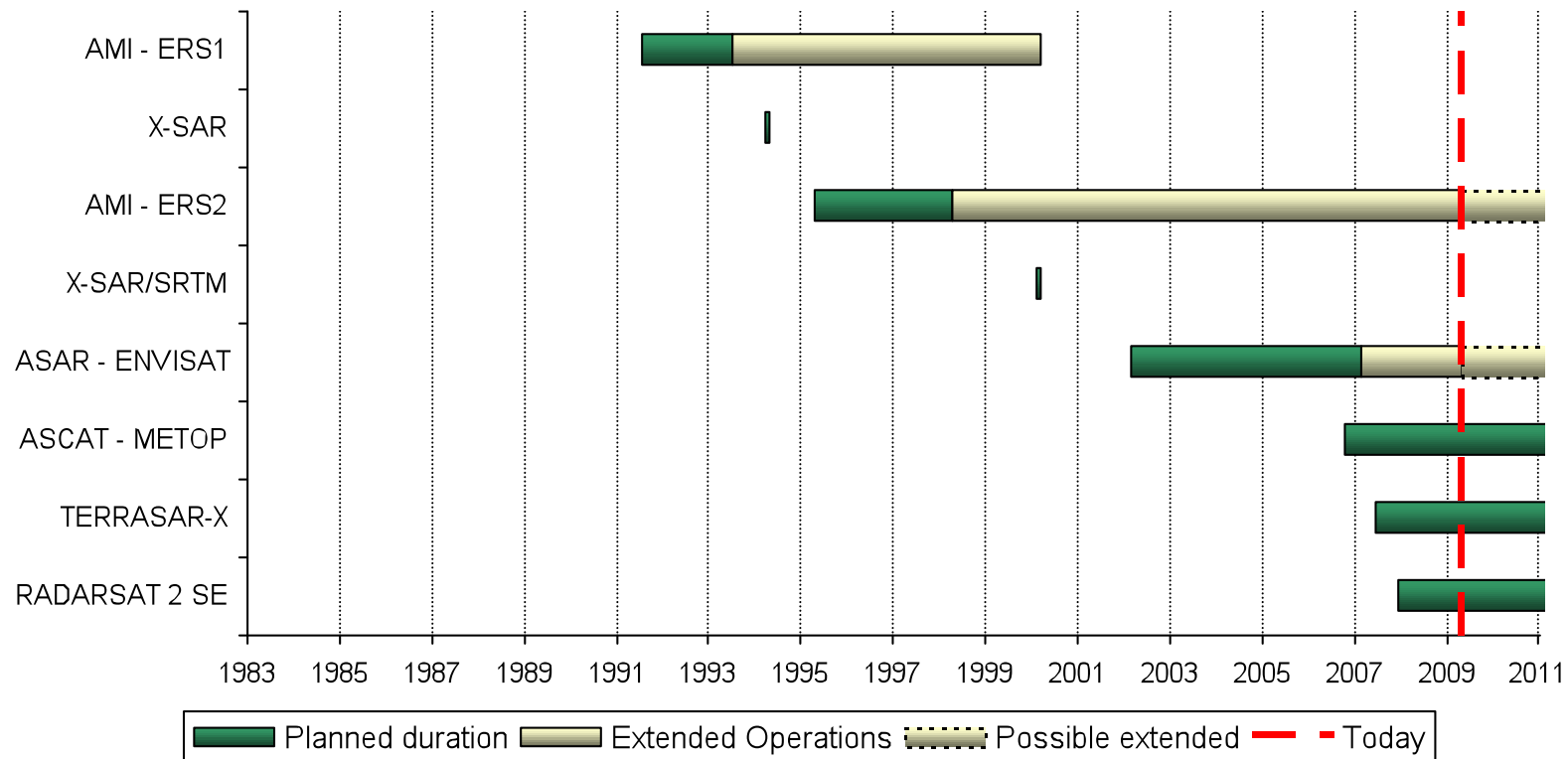
EOS in Orbit Status: Optical Instruments



Instrumentation – 276 years accumulated in orbit
Prime contractor of 30 instruments

Satellite Projects

EOS in Orbit Status: Radar Instruments



Radar Instrumentation – 38 years accumulated in orbit

- **Astrium at work**
- **The company**
- **Organisation**

- **Satellite Projects**

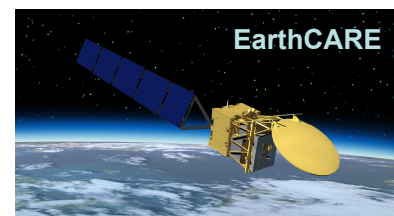
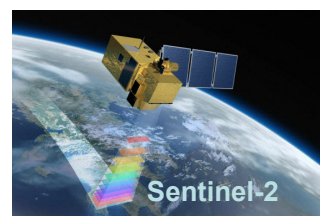
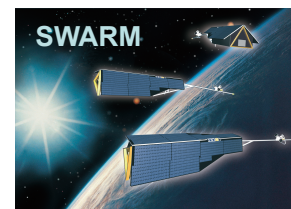
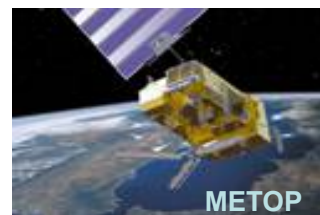
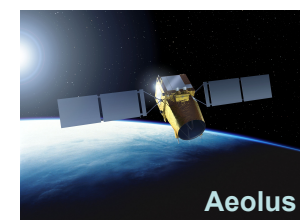
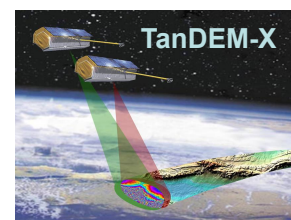
- Operational Mission
- **Current Satellite Projects**

Satellite Projects at Astrium

Current Satellite Projects Overview

■ Earth Observation:

- Cryosat 2
- TanDEM-X
- Aeolus
- MetOp
- SWARM
- MSG-2, -3, -4
- Sentinel-2
- EarthCARE

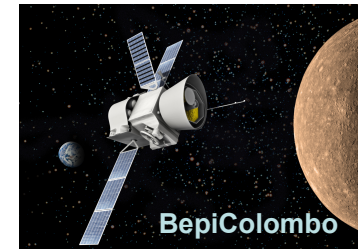


Satellite Projects at Astrium

Current Satellite Projects Overview

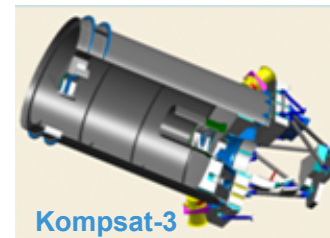
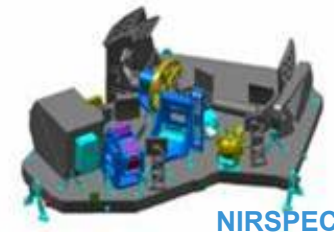
■ Science:

- LISA Pathfinder
- Gaia
- BepiColombo



■ Instruments:

- NIRspec
- LTP Instrument
- Kompsat 3, Kompsat 3A
- Sentinel-1 C-Band Radar

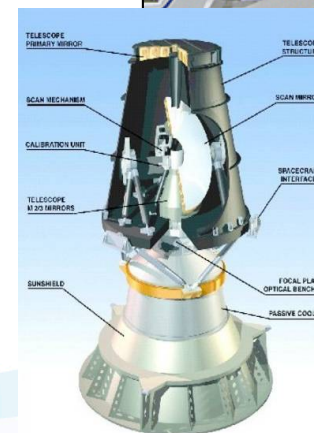


Current Satellite Projects – E/O

Meteorology: Meteosat Second Generation (MSG 1-4)

Mission:	Meteorology & climate observation from GEO; 4 satellites
Customer:	EUMETSAT via ESA contract (Alcatel Prime)
Launch:	2002, 2005, 2009, 2011 (Ariane V)
Mass:	Launch mass 2035 kg (MSG2)
Orbit:	Geostationary
Astrium Role:	AEF Instrument Prime, AED Propulsion, AOCS & Power System; Structure and Telescope of SEVIRI Instrument

Status:	
MSG 1+2:	in orbit
MSG 3:	in storage
MSG 4:	it is planned to enter storage in 2010



Current Satellite Projects – E/O

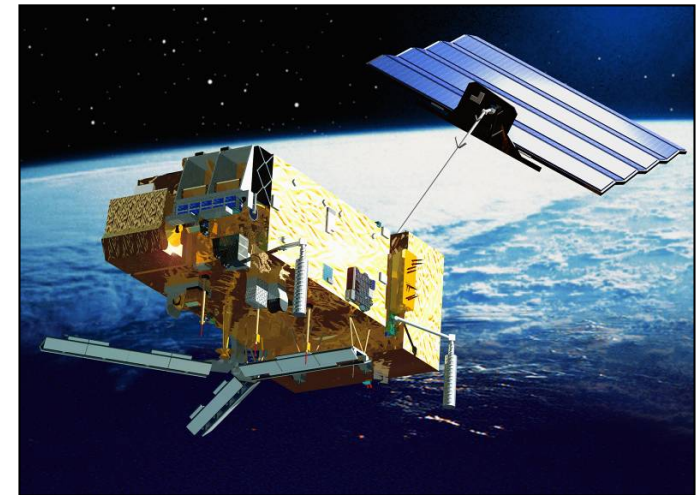
Meteorology: MetOp

Mission:	Meteorology & climate observation from polar orbit; measurement of ozone layer; 3 satellites
Customer:	SSST (EUMETSAT via ESA contract)
Launch:	Oct. 2006, 2010, 2015 (Soyuz)
Mass:	4.086 kg
Orbit:	820 km SSO, LTDN 10:30
Astrium Role:	AEF mission prime, AED PLM Prime, ASCAT, GRAS

Status:

Phase C/D (03/1998 – 08/2010)

PLM 1:	in storage / maintenance
PLM 2:	in orbit since 19.10.2006
PLM 3:	in storage / maintenance



Current Satellite Projects – E/O

Earth Explorer Opportunity Mission: Cryosat 2

Mission: Measurement of ocean & land ice thickness variations in polar regions.
Altitude resolution
2–5 cm, spatial resolution 280 m

Customer: ESA

Launch: 08.04.2010

Mass: 720 kg

Orbit: 720 km polar Orbit (no SSO, $i=92^\circ$)

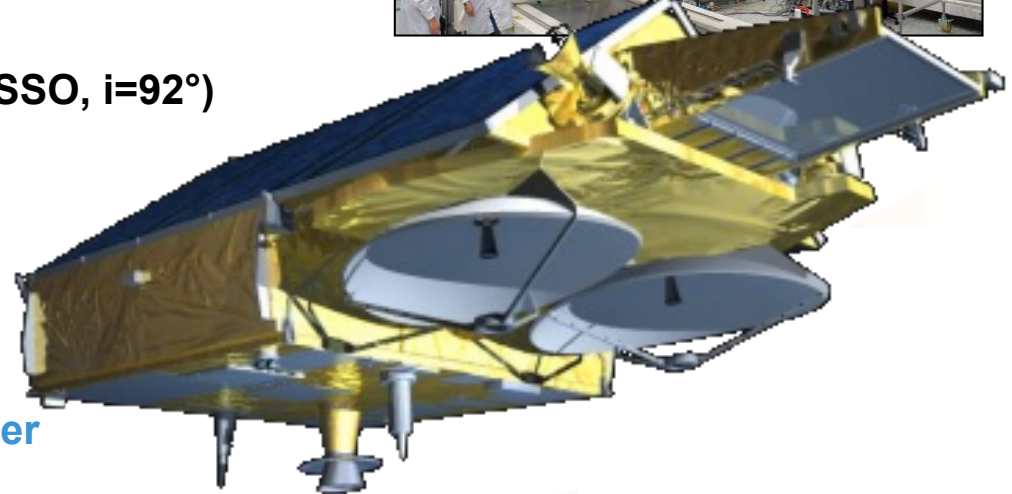
Astrium Role: AED Satellite Prime

Status:

Rebuilt of Cryosat after failure of launcher

Spacecraft in final check-out

FAR: 13.11.2009



Current Satellite Projects – E/O

Earth Explorer Opportunity Mission: SWARM

Mission: provide the best ever survey of the geomagnetic field and its temporal evolution, and gain new insights into improving our knowledge of the Earth's interior and climate.

Customer: ESA

Launch: early 2012

Mass: 500 kg

Orbit: 3 S/C;
single sat: 530 km;
pair sats: 450 km;
drifting polar orbit; $i=87,6^\circ$

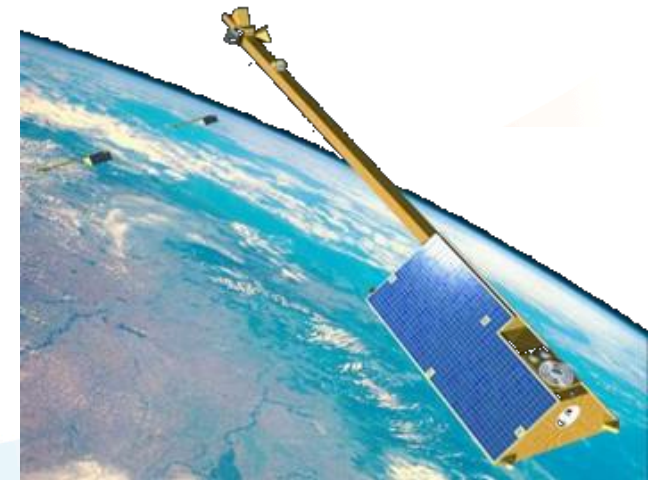
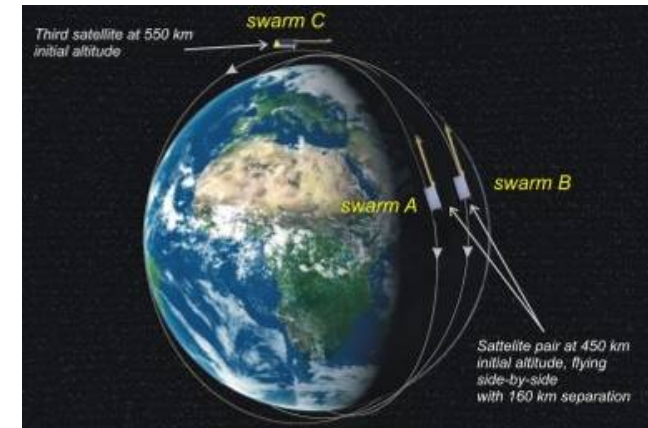
Astrium Role: AED Satellite Prime

Status:

Phase C/D

CDR successfully passed on April 2009

FM1 and FM2 integration on-going



Current Satellite Projects – E/O

Earth Explorer Core Mission: AEOLUS

Mission: The Earth Explorer Atmospheric Dynamics Mission (ADM-Aeolus) will provide global observations of wind profiles from space to improve the quality of weather forecasts, and to advance our understanding of atmospheric dynamics and climate processes

Customer: ESA

Launch: end 2011

Mass: 1200 kg

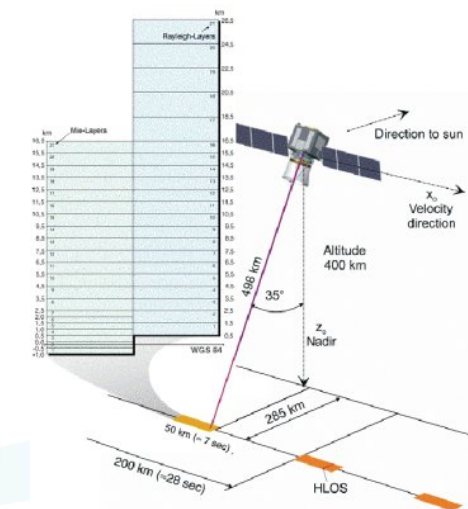
Orbit: 405 km, SSO, dawn-dusk

Astrium Role: AEU Mission Prime

AED Electrical Systems

Status:

Platform activities close to completion. Afterwards platform will be put into storage until availability of flight instrument.



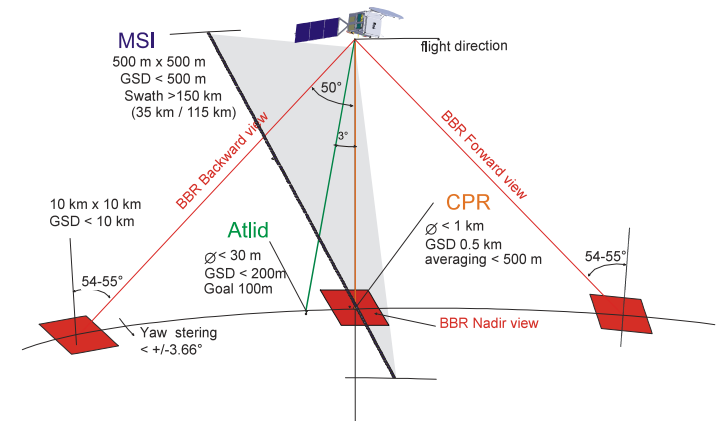
Current Satellite Projects – E/O

Earth Explorer Core Mission: EarthCARE

Mission: EarthCARE (Earth Clouds, Aerosols and Radiation Explorer) addresses the need for a better understanding of the interactions between clouds, aerosols and radiation. There are still large deficiencies in the representation of clouds, aerosols and radiative transfer in atmospheric models - the source of large uncertainties in predicting climate change.

Customer: ESA
Launch: 2014
Mass: 2000 kg
Orbit: 393 km SSO; LTDN 14:=0
Astrium Role: **AED Satellite Prime with AEU**
involved in platform elements

Status:
System PDR (End of Phase B) October 2009



Current Satellite Projects – E/O

GMES: Sentinel 1

Mission:

GMES C-Band SAR Operational Mission:
Monitoring of sea ice zones,
Surveillance of marine environment,
Mapping of land surfaces,
Mapping in support of humanitarian aid
and in crisis situations;
„high performance“ SAR mission compared
to ERS 1, ERS 2 and Envisat

Customer:

ESA/EU (Thales Alenia Space Italy Prime)

Launch:

2013 (Soyuz)

Mass:

2.300 kg

Orbit:

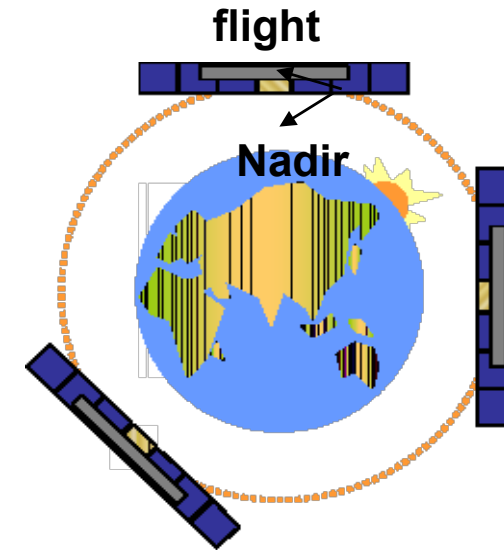
692 km, SS, dusk-dawn

Astrium Role:

**AED SAR Instrument Prime
AEU SAR Electronic**

Status:

SAR Instrument CDR April 2010



Current Satellite Projects – E/O

GMES: Sentinel 2

Mission: GMES superspectral Mission
Global land mission for mapping,
monitoring and security
Wide 290 km swath with high resolution
(10-60m),
13 VNIR/SWIR bands 0.4-2.4 μm
Landsat/SPOT type of mission
2 satellites in baseline

Customer: ESA/EU

Launch: 2013

Mass: ca. 1.100 kg

Orbit: ca. 800 km, SSO, LTDN 10:30

Astrium Role: **AED Satellite Prime**
AEF Instrument Prime



Status:
PDR in Nov 2008
Phase CD since 2009

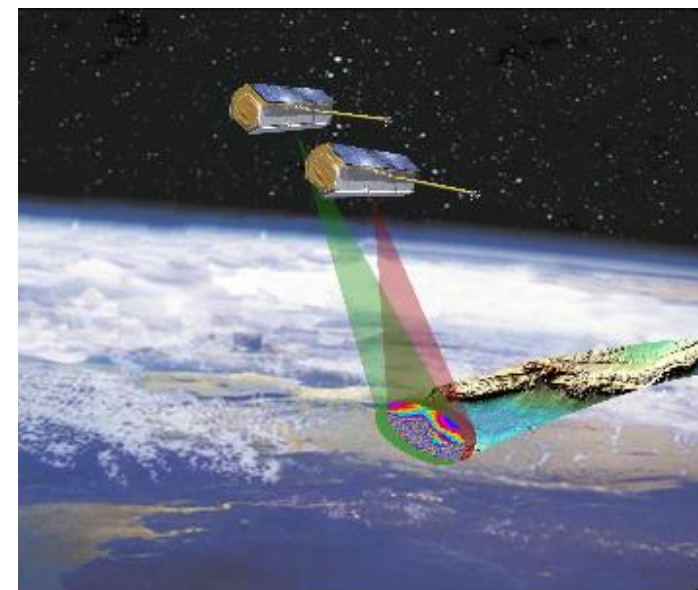
Current Satellite Projects – E/O

DLR: Tandem-X

Mission:	TanDEM-X is a rebuild of TerraSAR-X – both satellites will perform bistatic SAR interferometry while flying in a close tandem constellation – mission goal is to create a global Digital Elevation Model (DEM) of unprecedented accuracy
Customer:	DLR
Launch:	21.06.2010 (Dnepr)
Mass:	1.320 kg
Orbit:	514 km, SSO, dusk-dawn
Astrium Role:	AED Satellite Prime, Launch- & In-orbit commissioning service

Status:

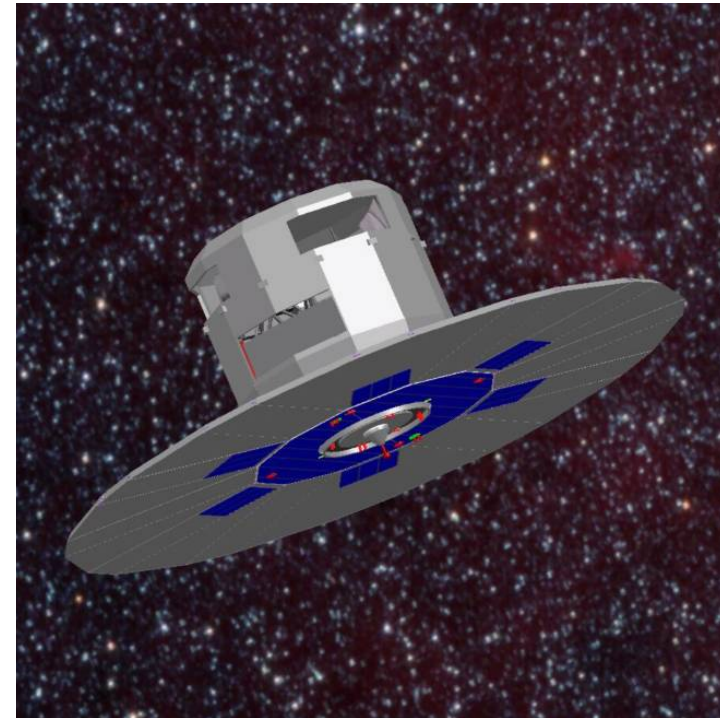
Environmental Tests / FAR successfully completed
Pre-Shipment Review on 25.03.2010



Current Satellite Projects – Science

GAIA

Mission:	Global space astrometry (map of our galaxy with more than 1000 million stars)
Customer:	ESA (AEF as Prime)
Launch:	June 2012 (Soyuz Fregat)
Mass:	1.940 kg
Orbit:	Lagrange Point 2 (Sun – Earth System)
Astrium Role:	AEF Prime & Payload & AIT AED Mechanical Package (incl. thermal & propulsion) AEU Electrical Package



Status:

- **Start of AIT Phase July 09**
- **CDR 15.06.2010**

Current Satellite Projects – Science

BepiColombo

Mission: BepiColombo will provide the most complete exploration yet of Mercury.
Two orbiters, one (MPO) will map the planet, the other (MMO) will investigate its magnetosphere.

(The MMO will be provided by JAXA)

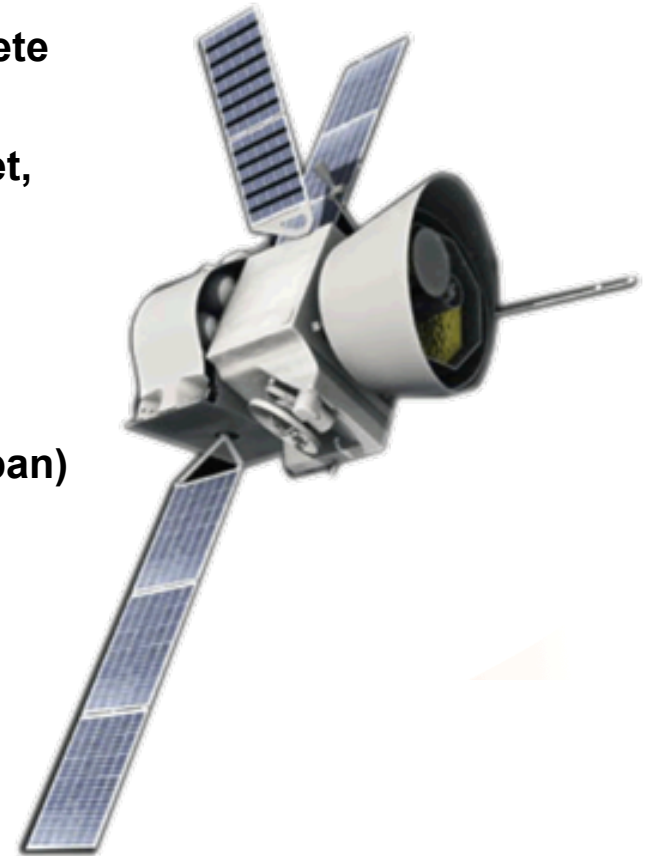
Customer: ESA
(first ESA mission in co-operation with Japan)

Launch: August 2014

Astrium Role: **AED Satellites Prime**
AEU Mechanical Propulsion Bus
AEF AOCS analyses & CSW

Status:

- Definition phase 2001 – 2005
- Start of Phase B2/C/D on Nov. 2006
- PDR successfully passed on 06/2009



Current Satellite Projects – Science

NIRSPEC (James Webb Telescope – JWST)

Mission: Study the origin and evolution of galaxies, stars and planetary systems Optimized for infrared observations (0.6 – 28 μm)

Customer: ESA / NASA

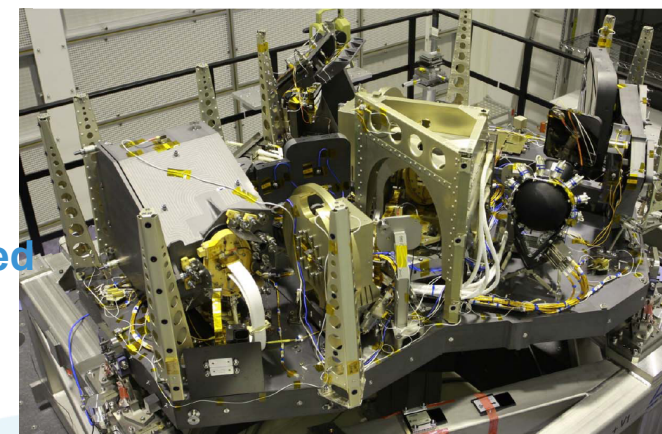
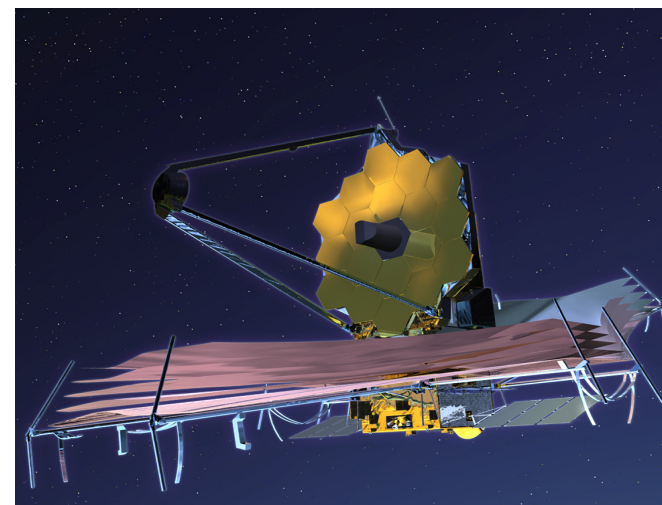
Launch: mid 2014

Orbit: L2

Astrum Role: AED Instrument Prime

Status:

- Instrument level and subsystem level CDR passed
- Instrument Development model completed and delivered
- FM integration ongoing
- Instrument delivery early 2011



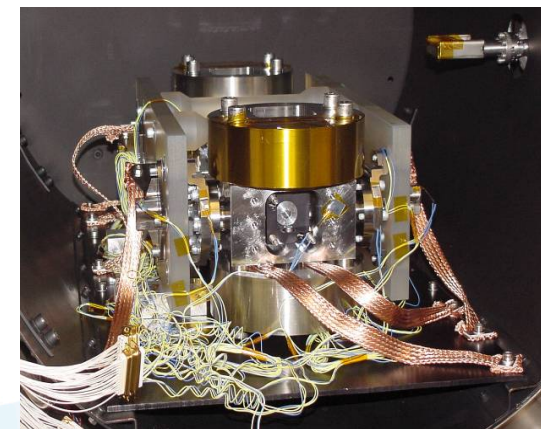
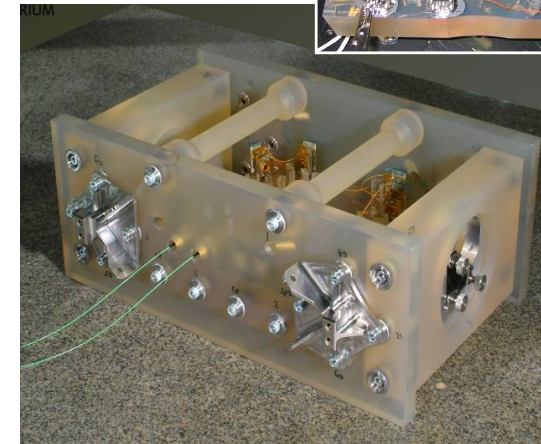
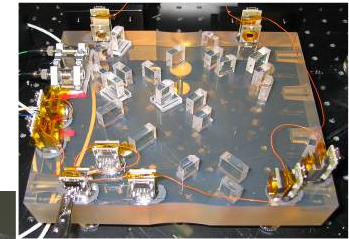
Current Satellite Projects – Science

LISA Pathfinder and LISA Technology Package

Mission: LISA Pathfinder
Customer: ESA / DLR
Launch: 2013
Orbit: Lagrange Point 1 (Sun – Earth System)
Astrium Role: AED Instrument (LTP) Prime
AED Instrument operations prime
(Drag-free Control)

Status:

- Implementation Phase
- FM integration started
- Instrument delivery to LPF in October 2011



Astrium provides all the space you need for science