

# Kapitel 4: Projektpraxis

## Episode 2: Projektbeispiele in der Raumfahrt

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## Übersicht der Lerneinheit

Episode 1: Besonderheiten von Projekten in der Raumfahrt

**Episode 2: Projektbeispiele in der Raumfahrt**

Episode 3: Diskussion

## Lernziele der Episode 2

### **Lernziel 1:**

Sie können erläutern, woraus sich der Bedarf für Projekte in der Raumfahrt ergibt.

### **Lernziel 2:**

Sie können Beispiele für Projekte zum Transport von Gütern in den Weltraum erläutern.

### **Lernziel 3:**

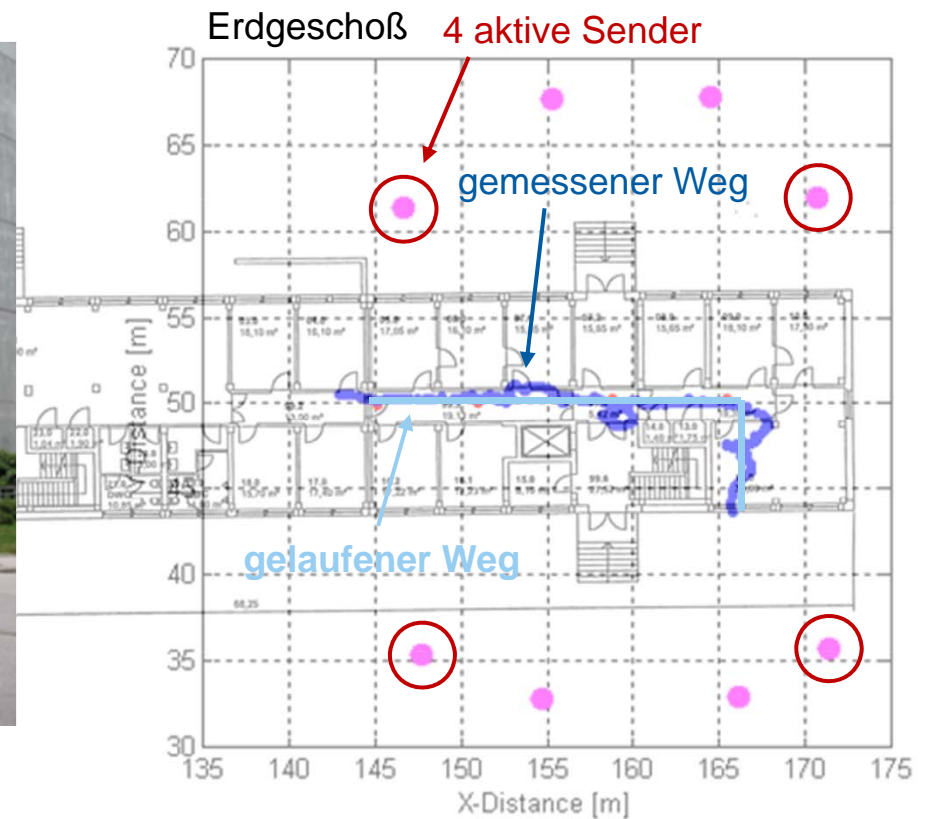
Sie kennen Projektebeispiele für die bemannte Raumfahrt.

## Overview – Need of Projects

- Navigation
- Communication
  - Civil
  - Military
- Earth Observation
  - Science
  - Commercial
  - Weather
- Science
- Space Transportation
- Manned Space

## Navigation (indoor)

- Measurements in complex concrete construction with coated windows
- Distance transmitter - buildings on several hundred meters increasable



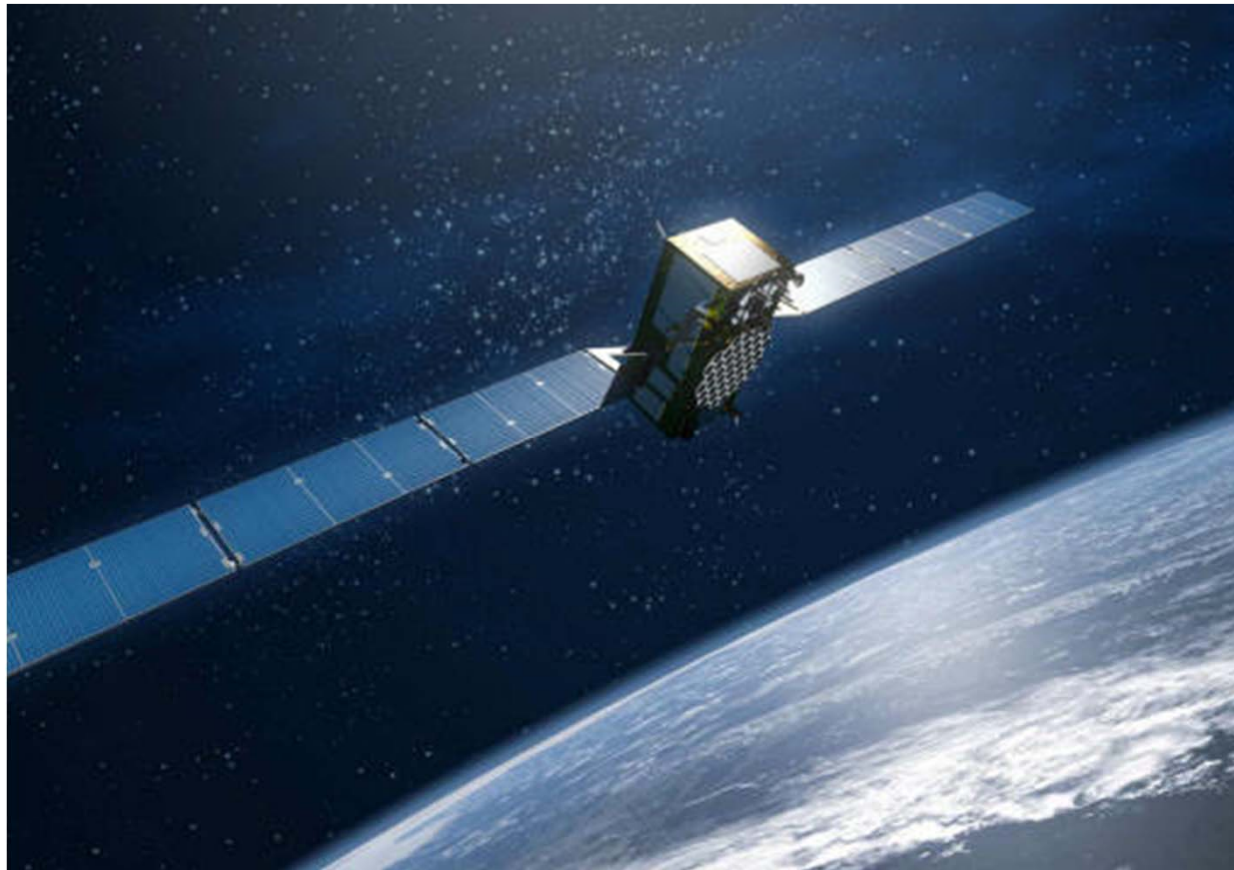
# Navigation

The activity of navigating - of lat. navigare (lead a ship), consists of the following subranges:

- Determine the geographical position by localization
- Compute the optimal way to the goal and
- Lead the vehicle to this goal, thus above all a holding of the optimal course, possibly with consideration of the leeway.

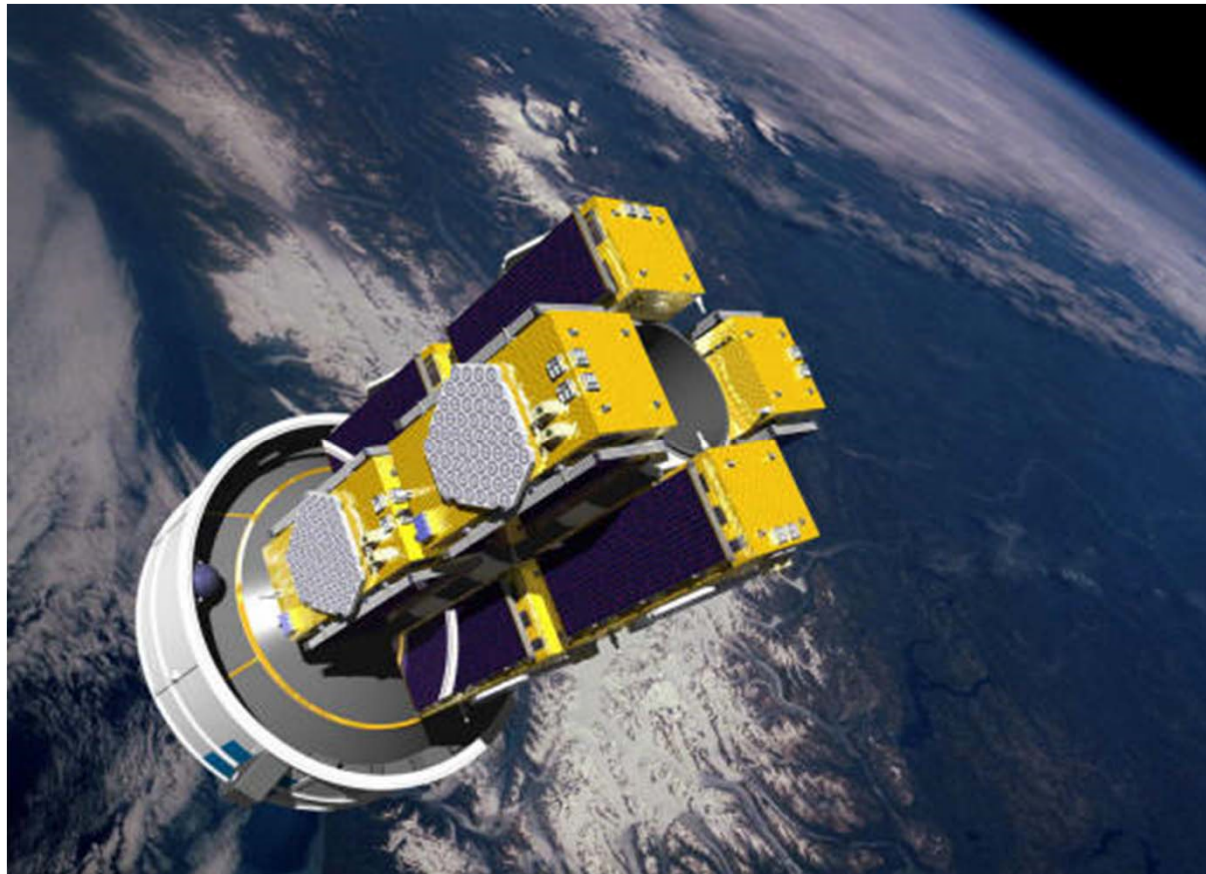
Quelle: <http://de.wikipedia.org/wiki/Navigation>

# Galileo



Navigation

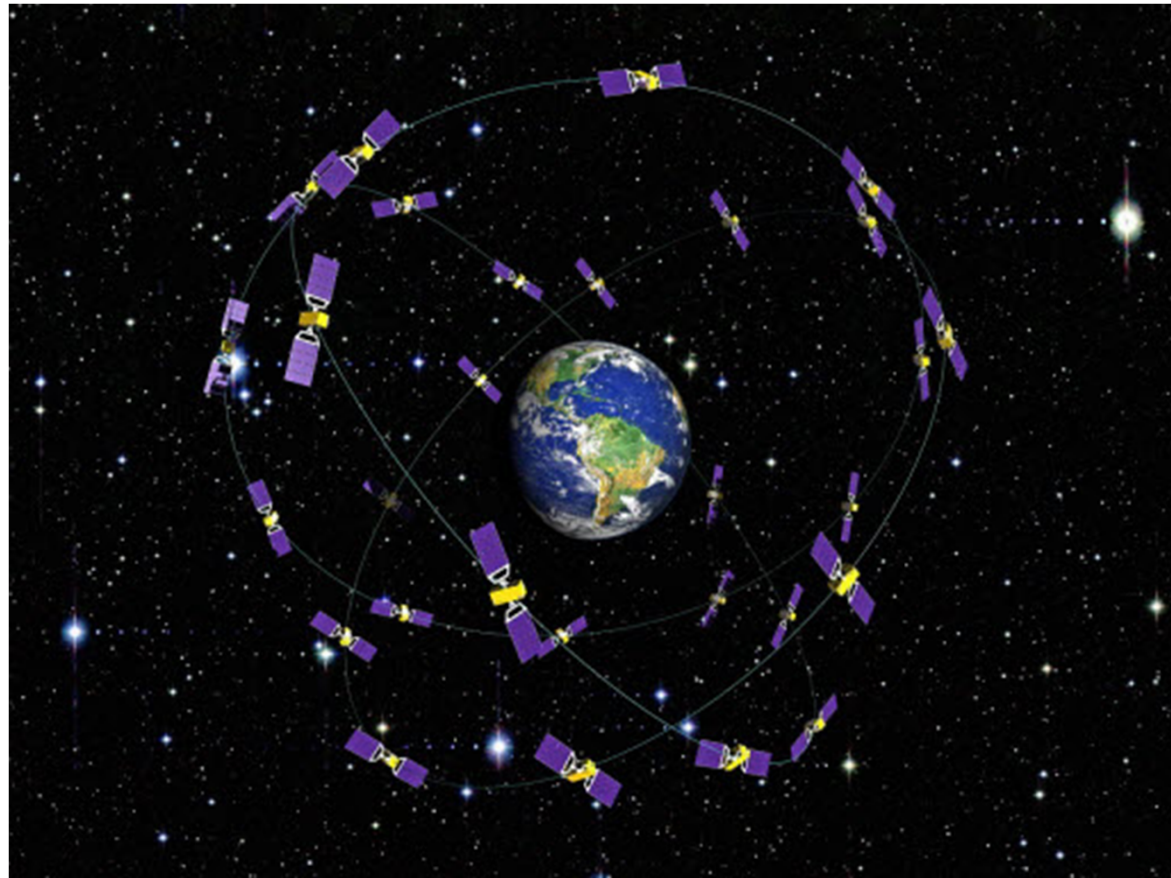
# Galileo



Navigation



# Galileo



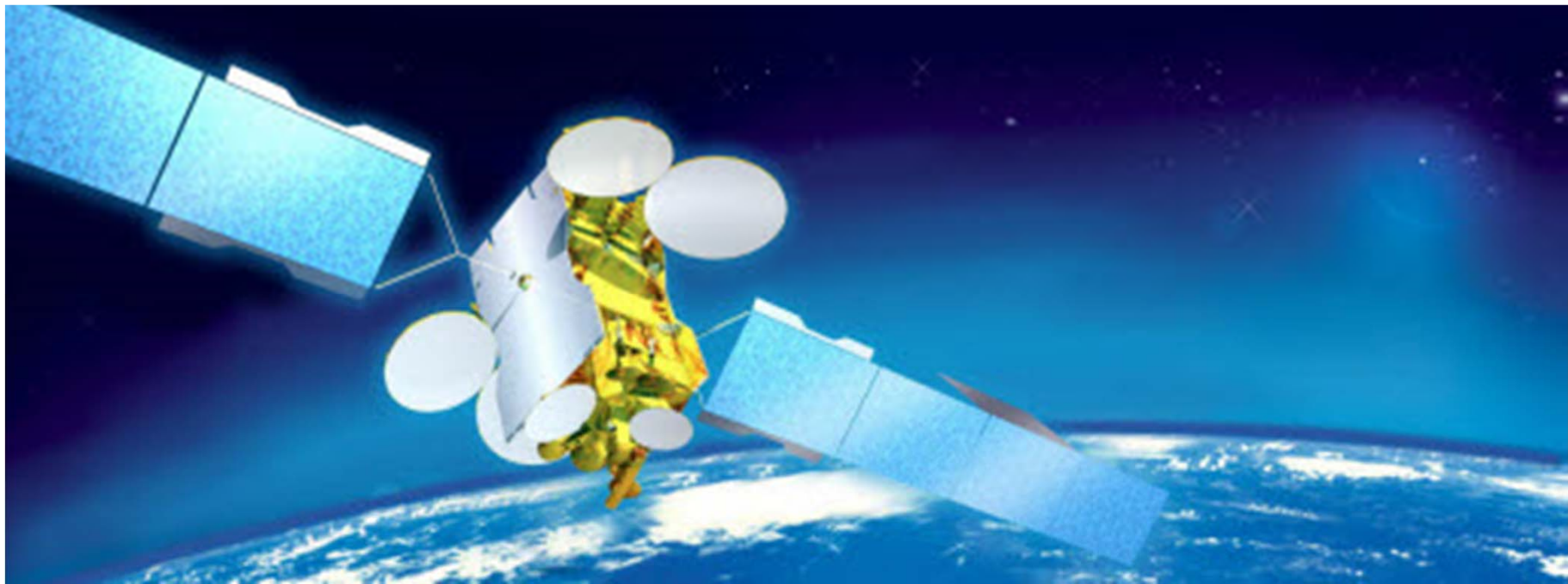
Navigation

## ASTRA 3B



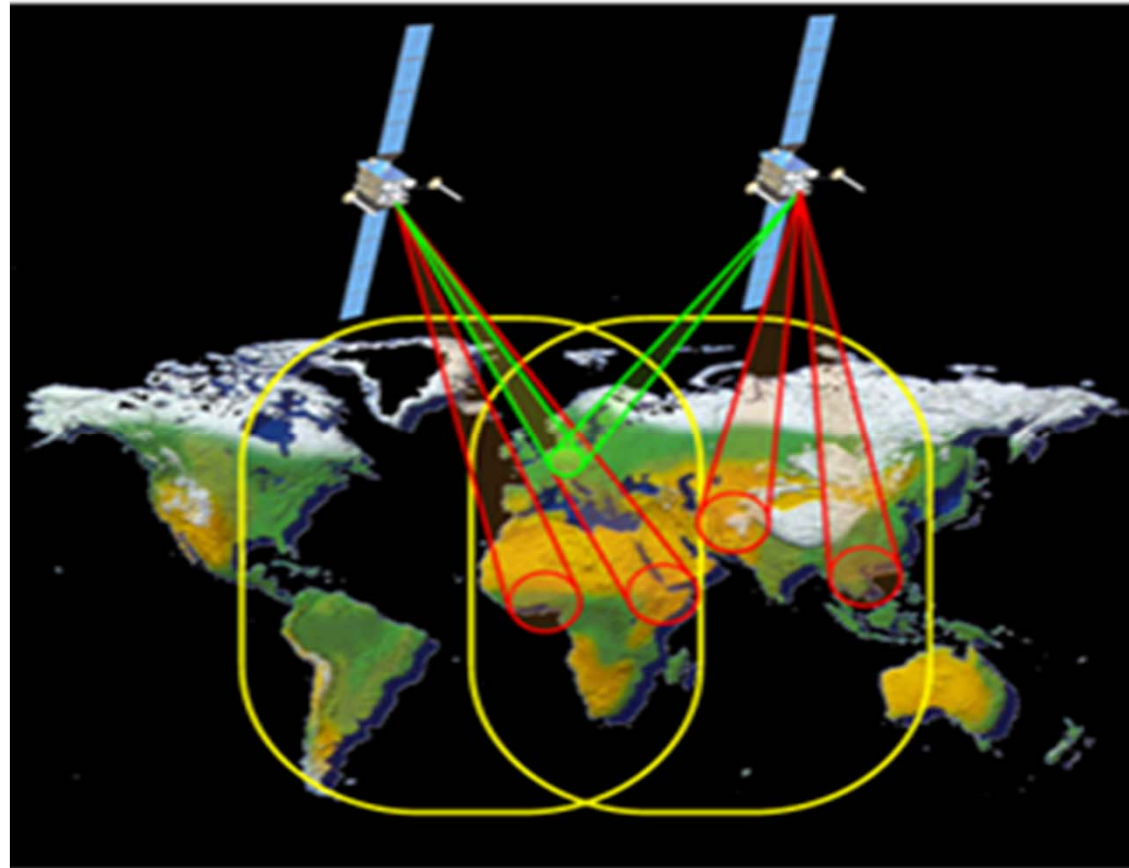
Communication (civil)

# ASTRA 3B



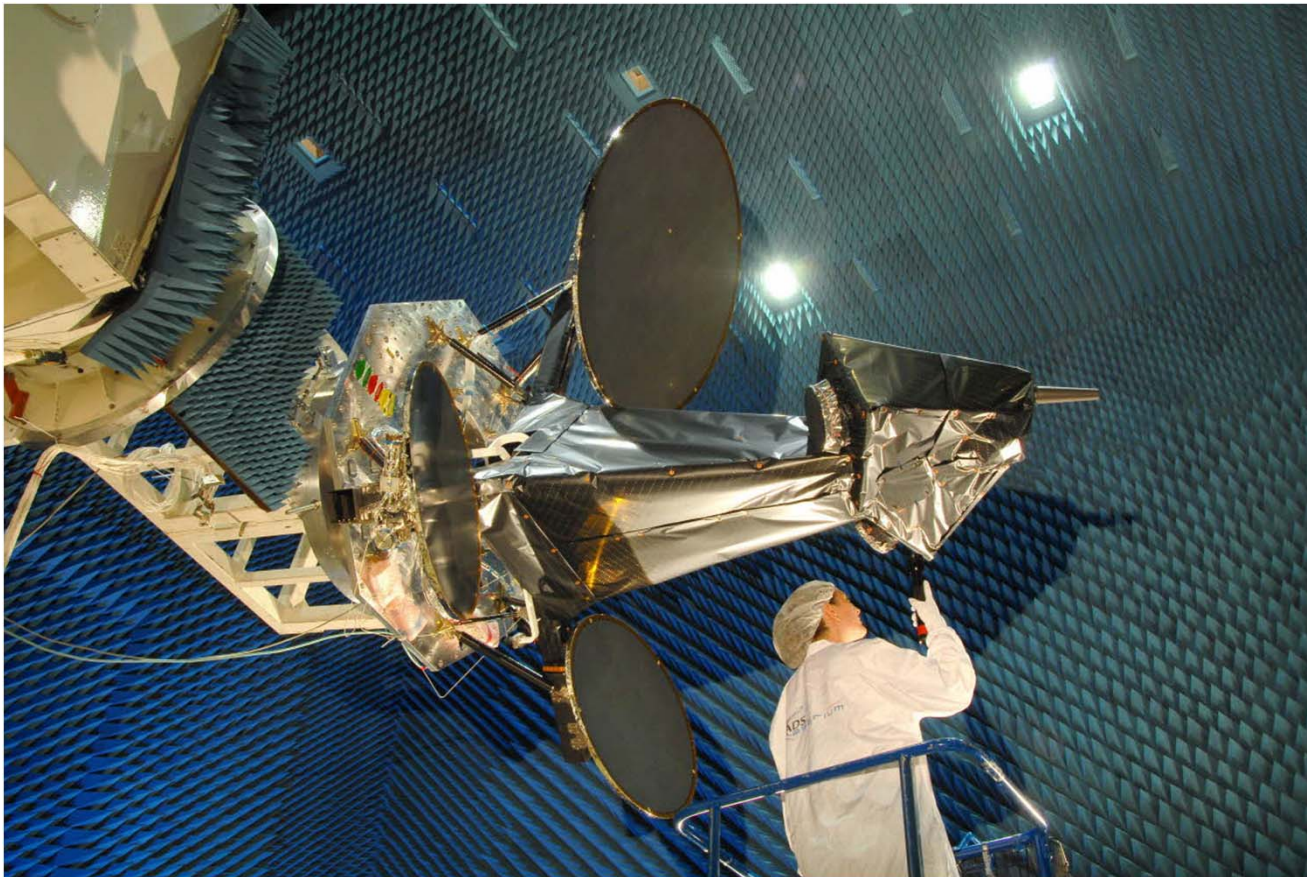
Communication (civil)

# SATCOMBw



Communication (military)

# SATCOMBw



Communication (military)

# SATCOMBw



Communication (military)

## Science Satellites



Encountering of Gulf and Labrador current before the American coast

Earth Observation

## Science Satellites

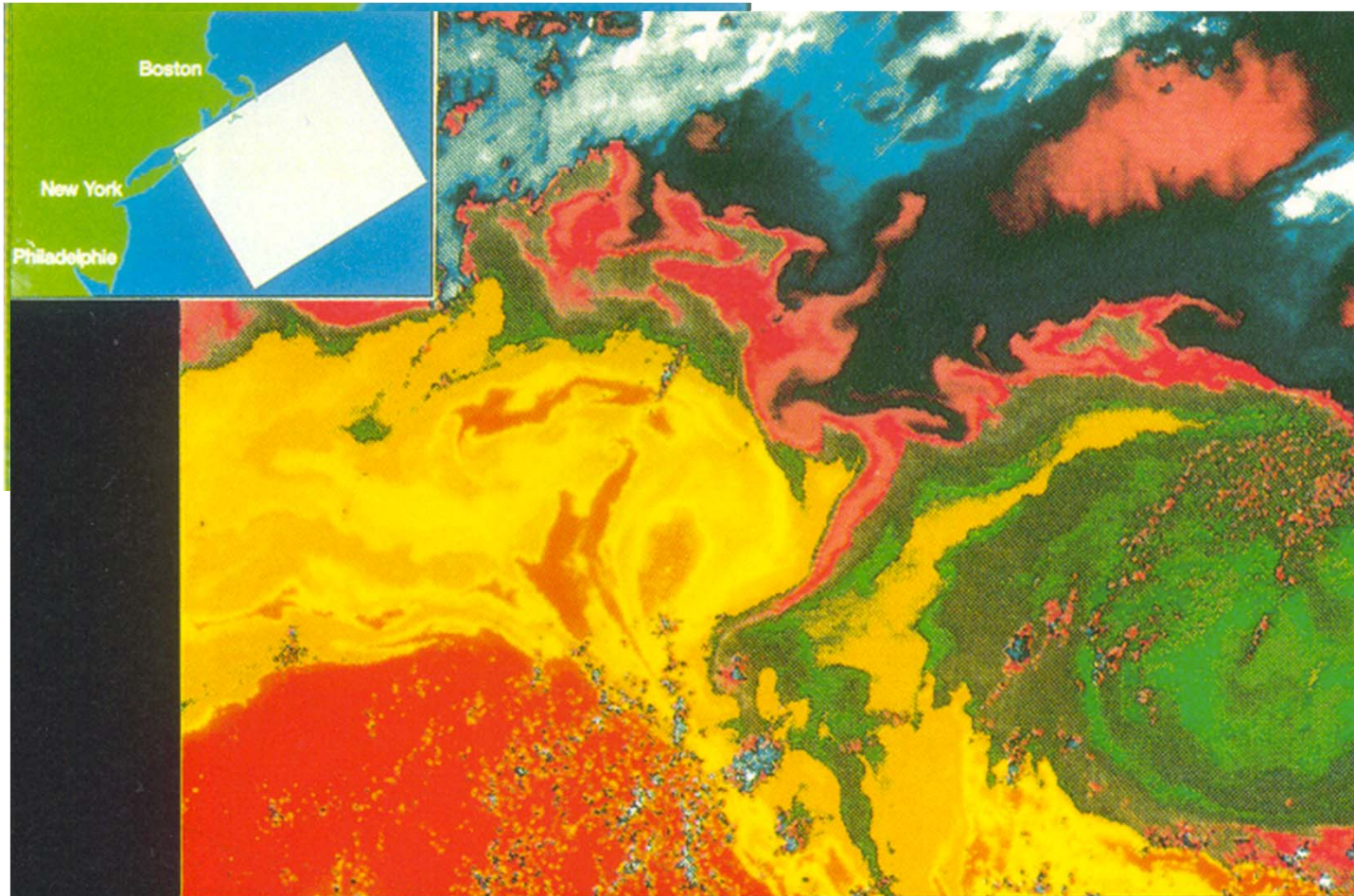


Encountering of Gulf and Labrador current before the American coast

Earth Observation



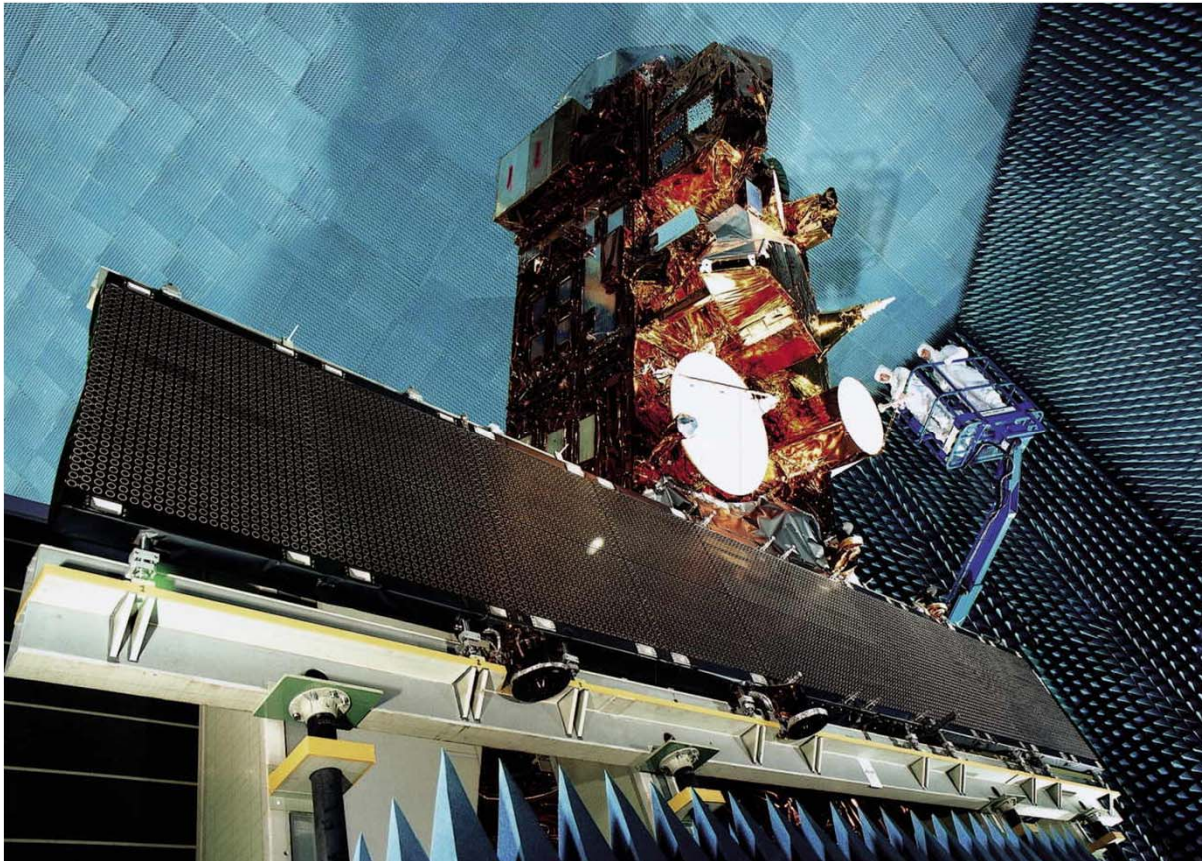
## Science Satellites



Encountering of Gulf and Labrador current before the American coast

Earth Observation

# ENVISAT



Earth Observation: Science Satellites

# ENVISAT



Earth Observation: Science Satellites

# ENVISAT



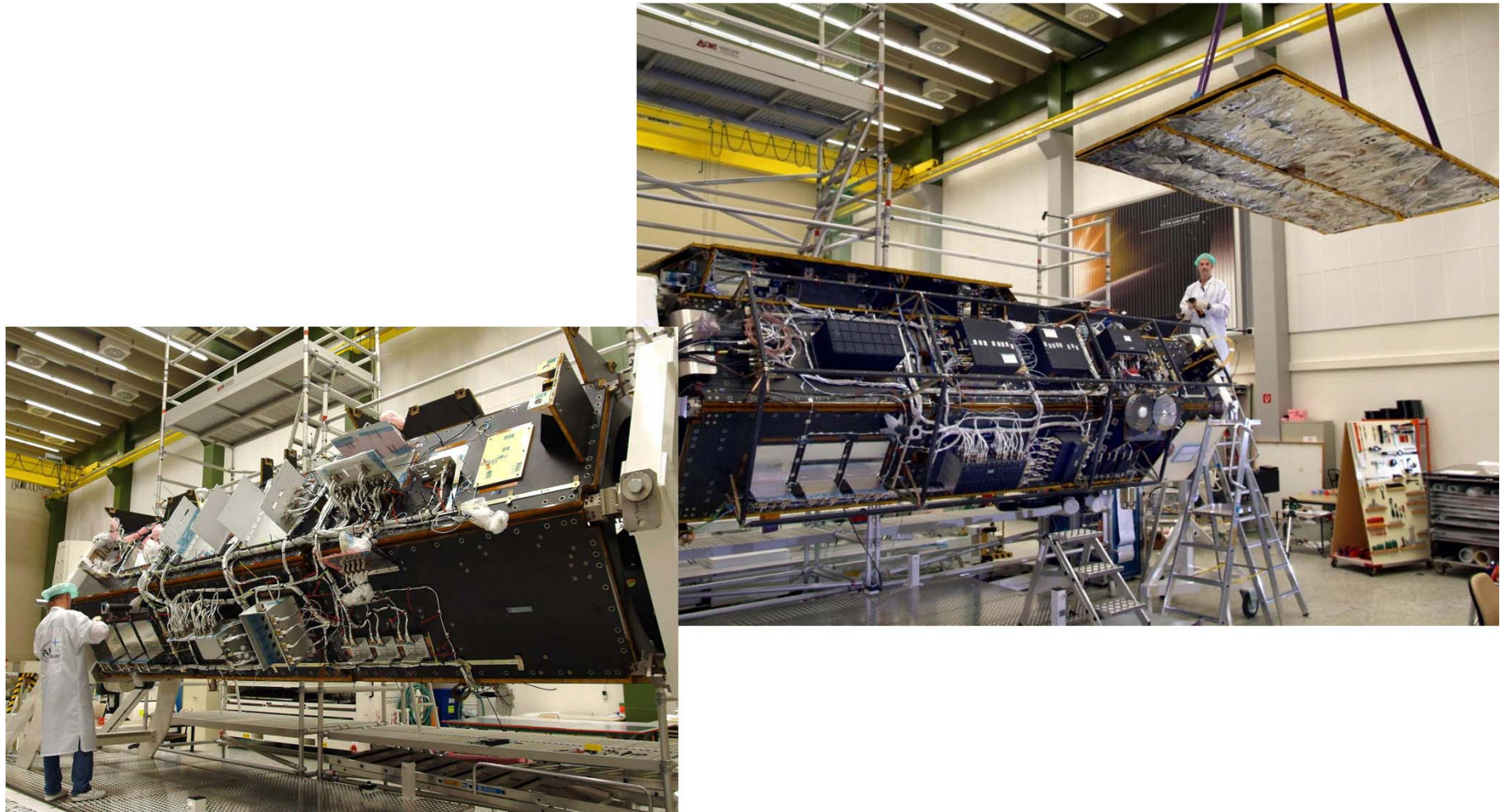
Earth Observation: Science Satellites

# ENVISAT



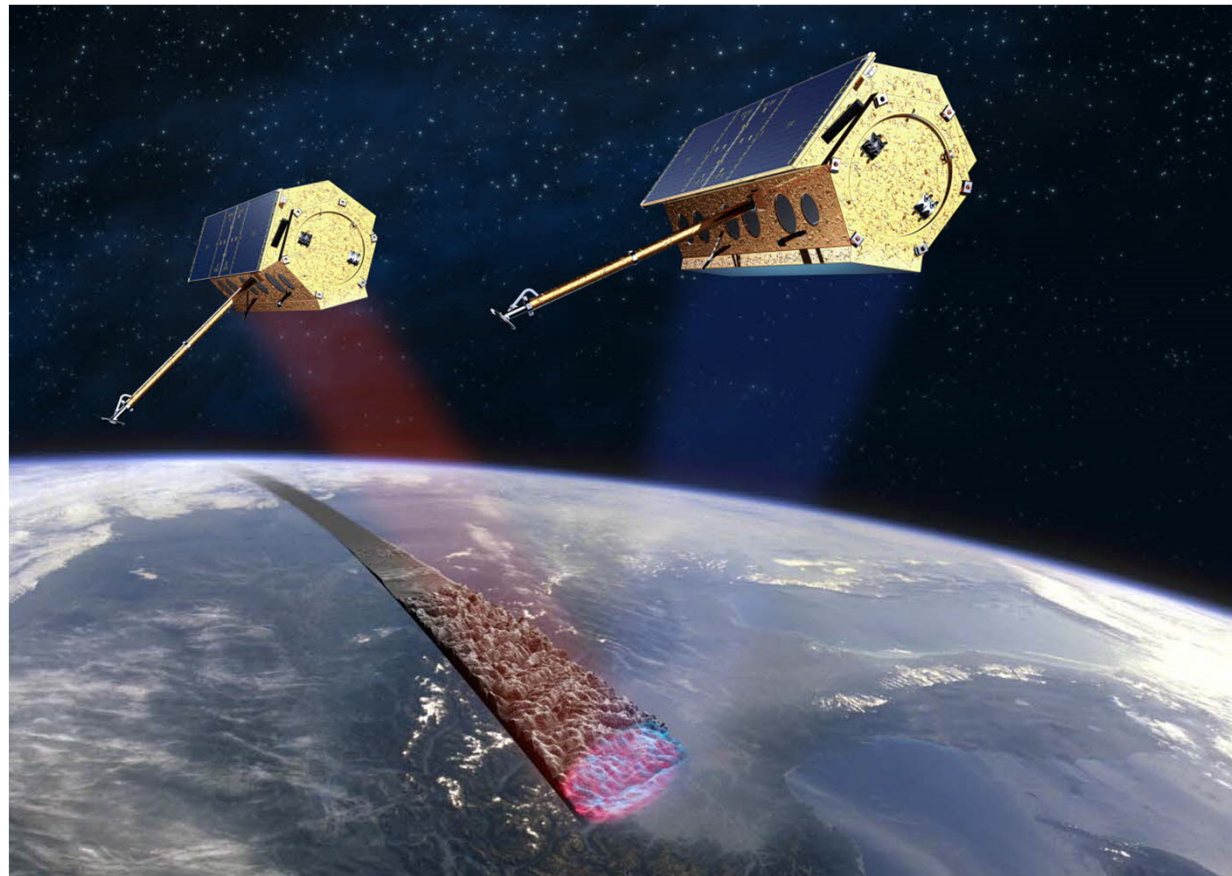
Earth Observation: Science Satellites

## TerraSAR / Tandem-X



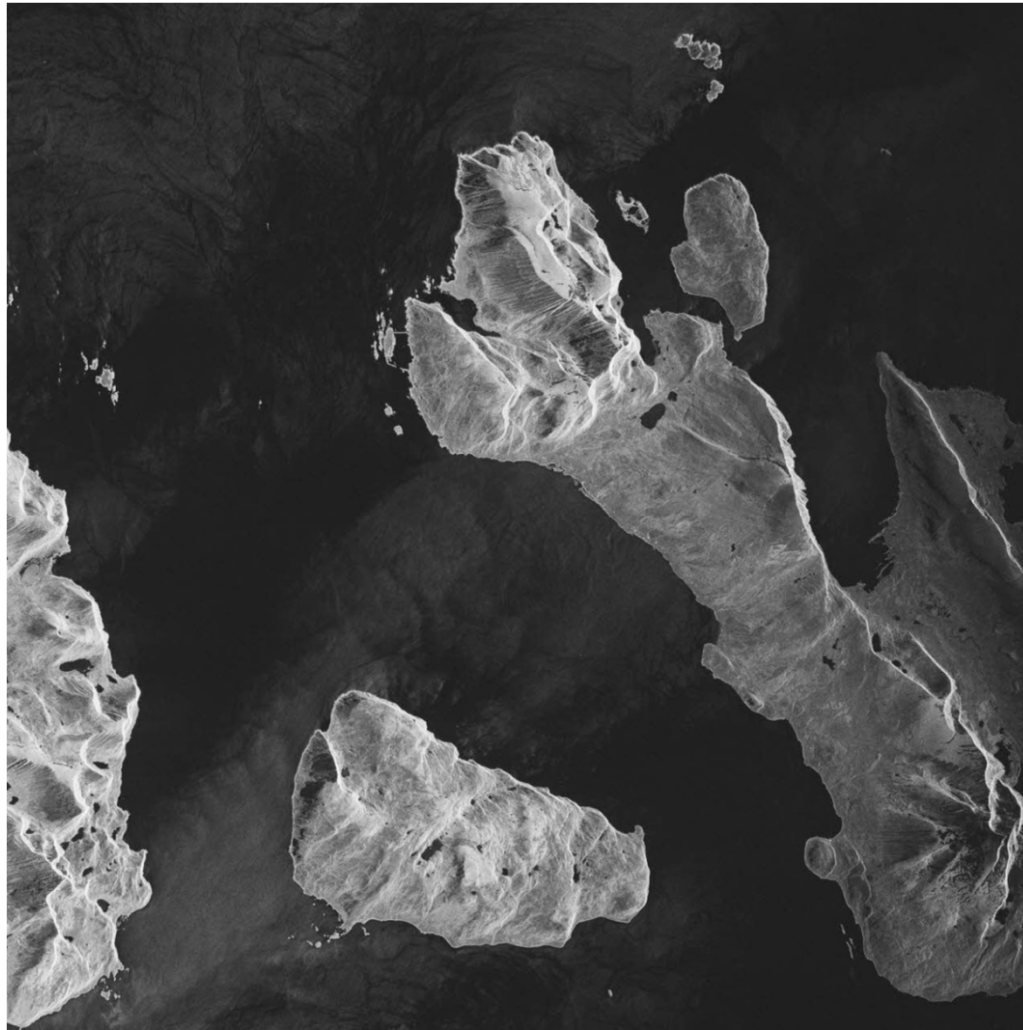
Earth Observation: Commercial Satellites

## TerraSAR / Tandem-X



Earth Observation: Commercial Satellites

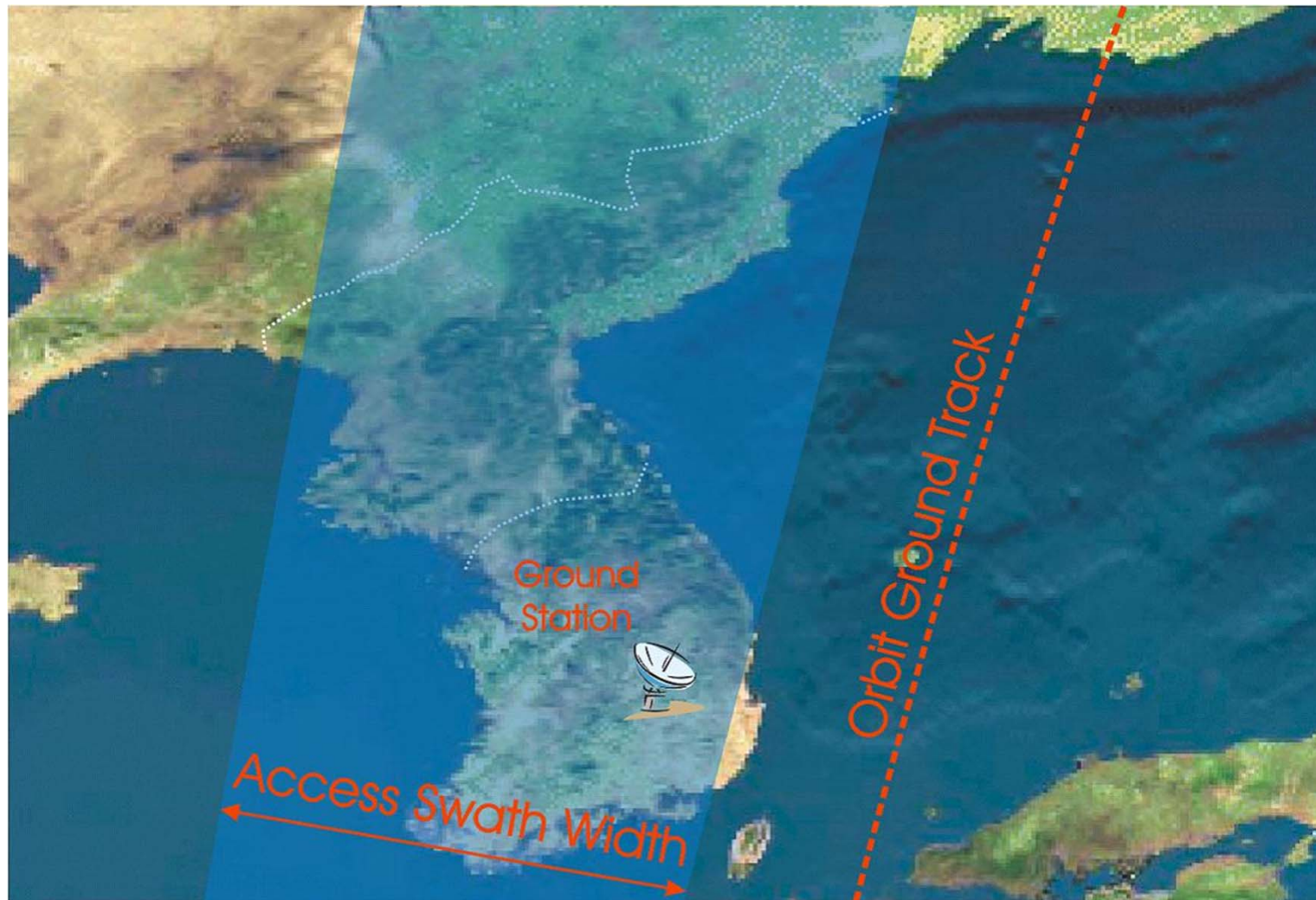
## TerraSAR / Tandem-X



Earth Observation: Commercial Satellites



# TerraSAR



Earth Observation: Commercial Satellites

# TerraSAR



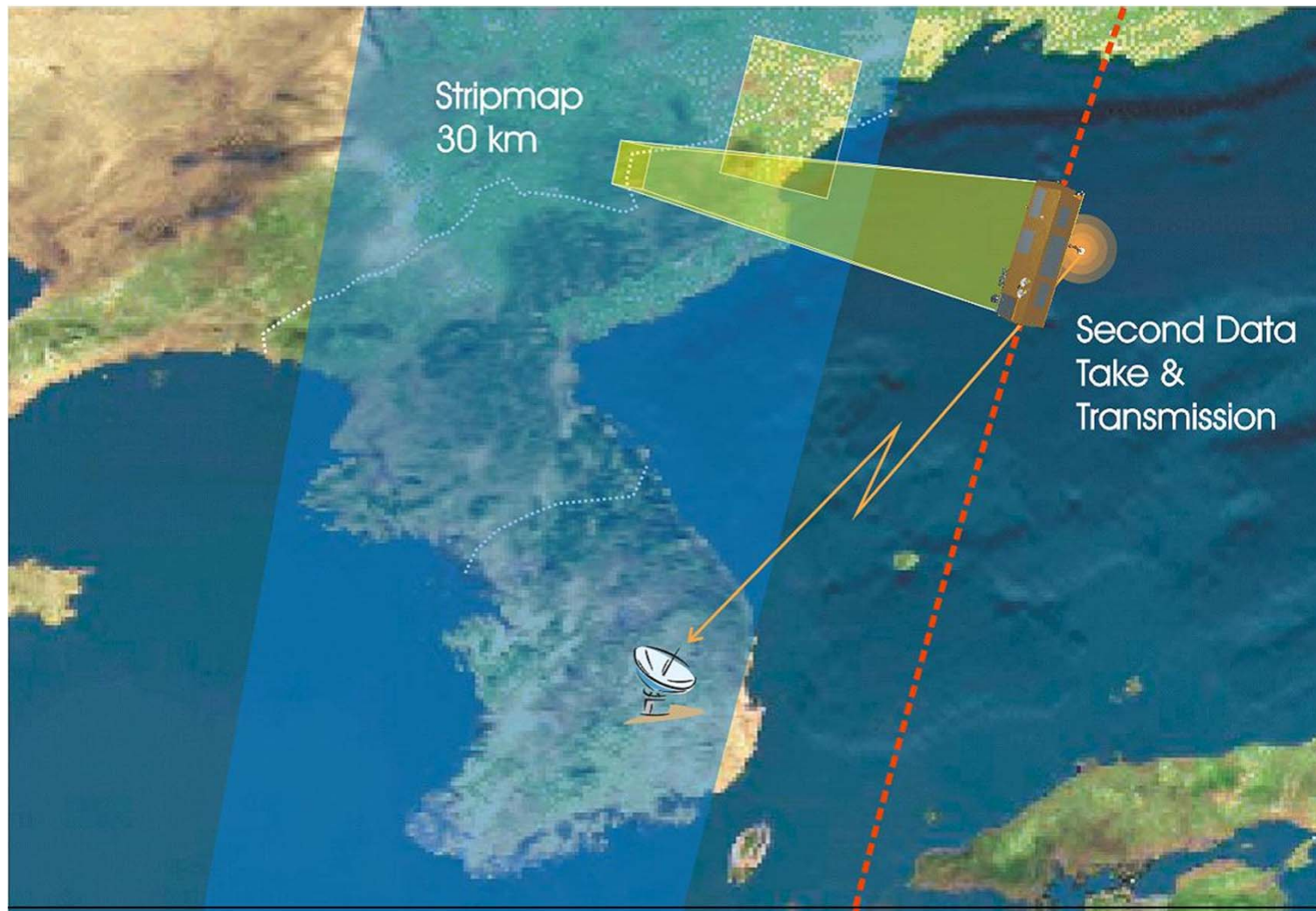
Earth Observation: Commercial Satellites

# TerraSAR



Earth Observation: Commercial Satellites

# TerraSAR



Earth Observation: Commercial Satellites

# TerraSAR



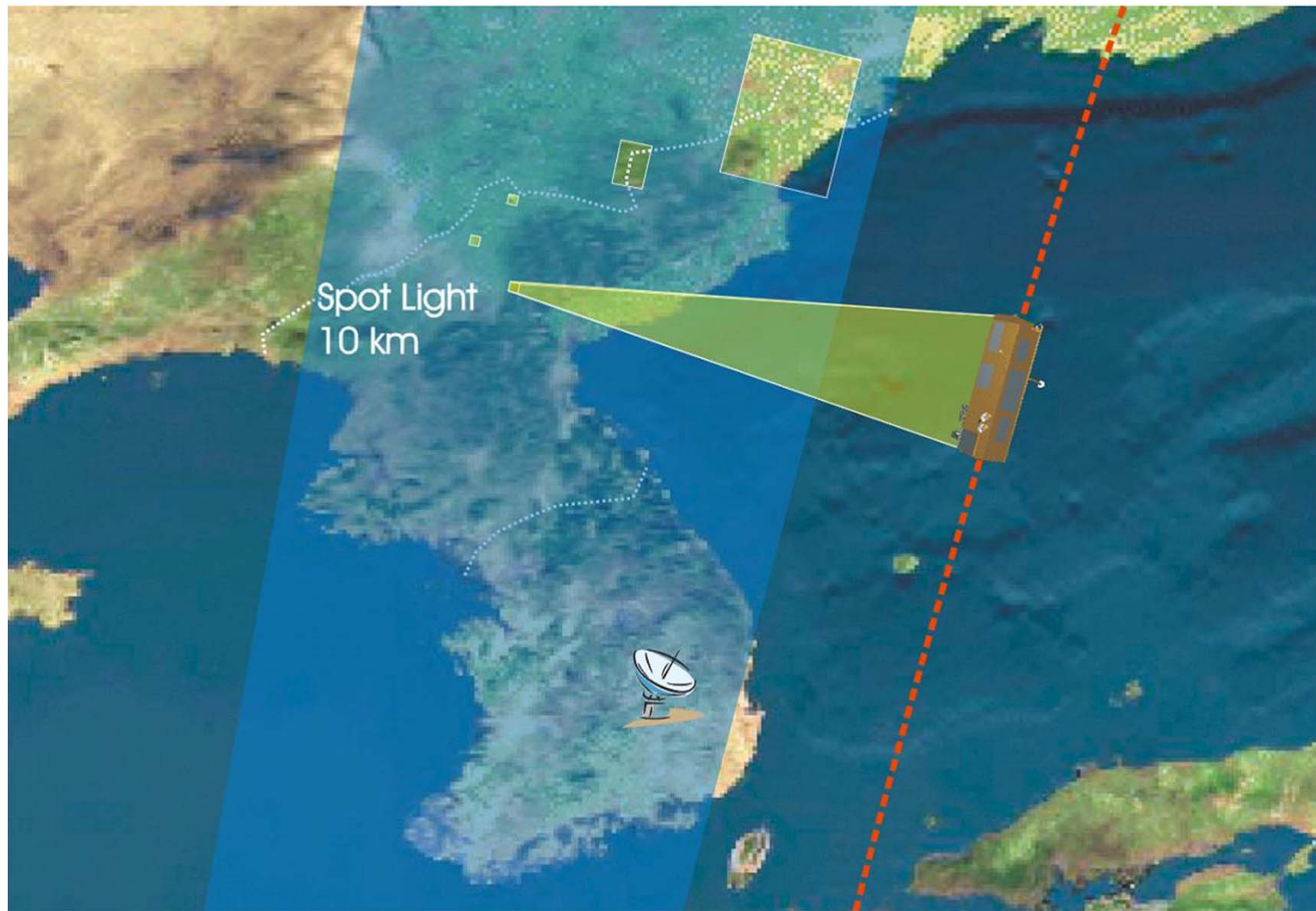
Earth Observation: Commercial Satellites

# TerraSAR



Earth Observation: Commercial Satellites

# TerraSAR



Earth Observation: Commercial Satellites

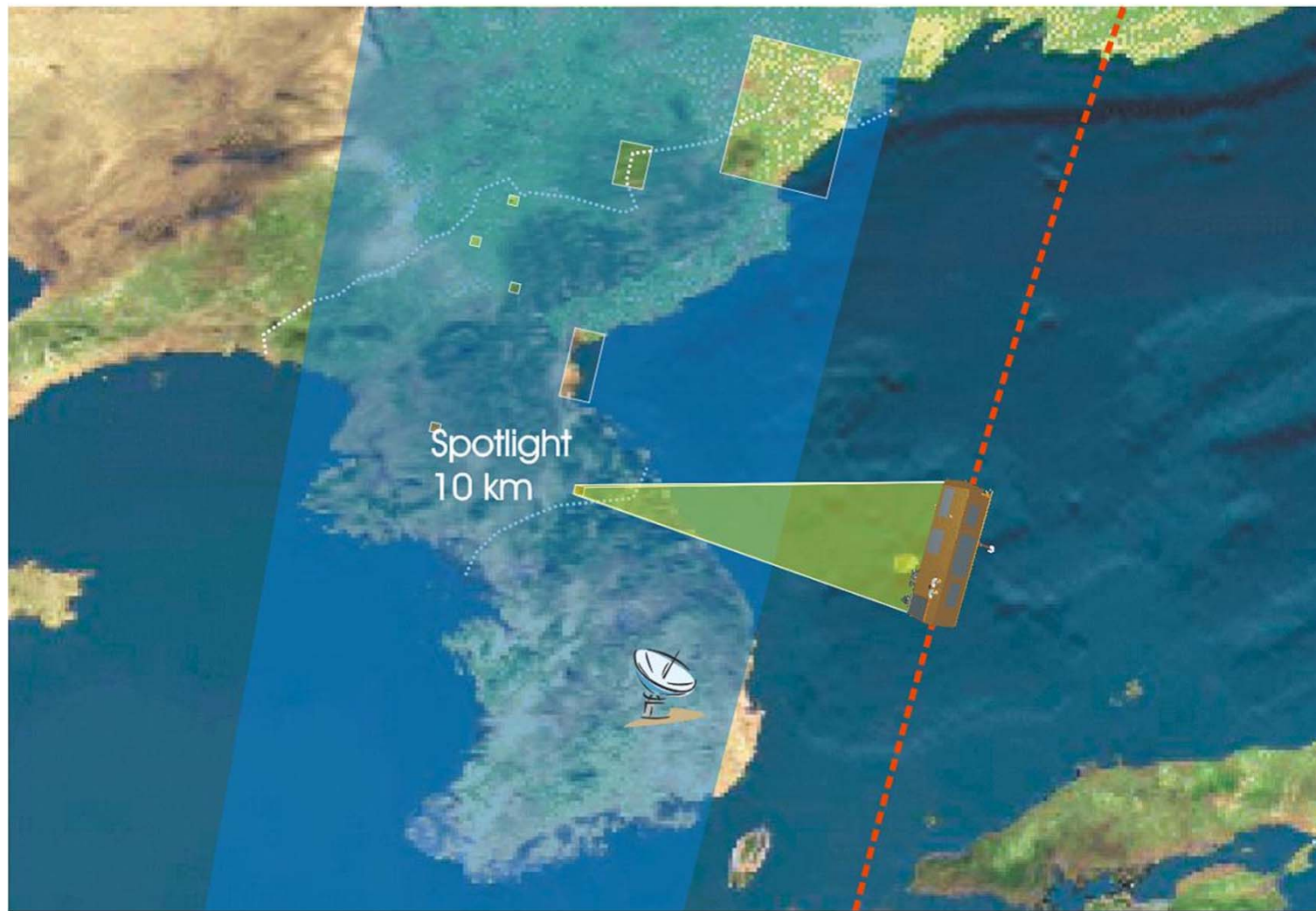
# TerraSAR



Earth Observation: Commercial Satellites



# TerraSAR



Earth Observation: Commercial Satellites

# TerraSAR



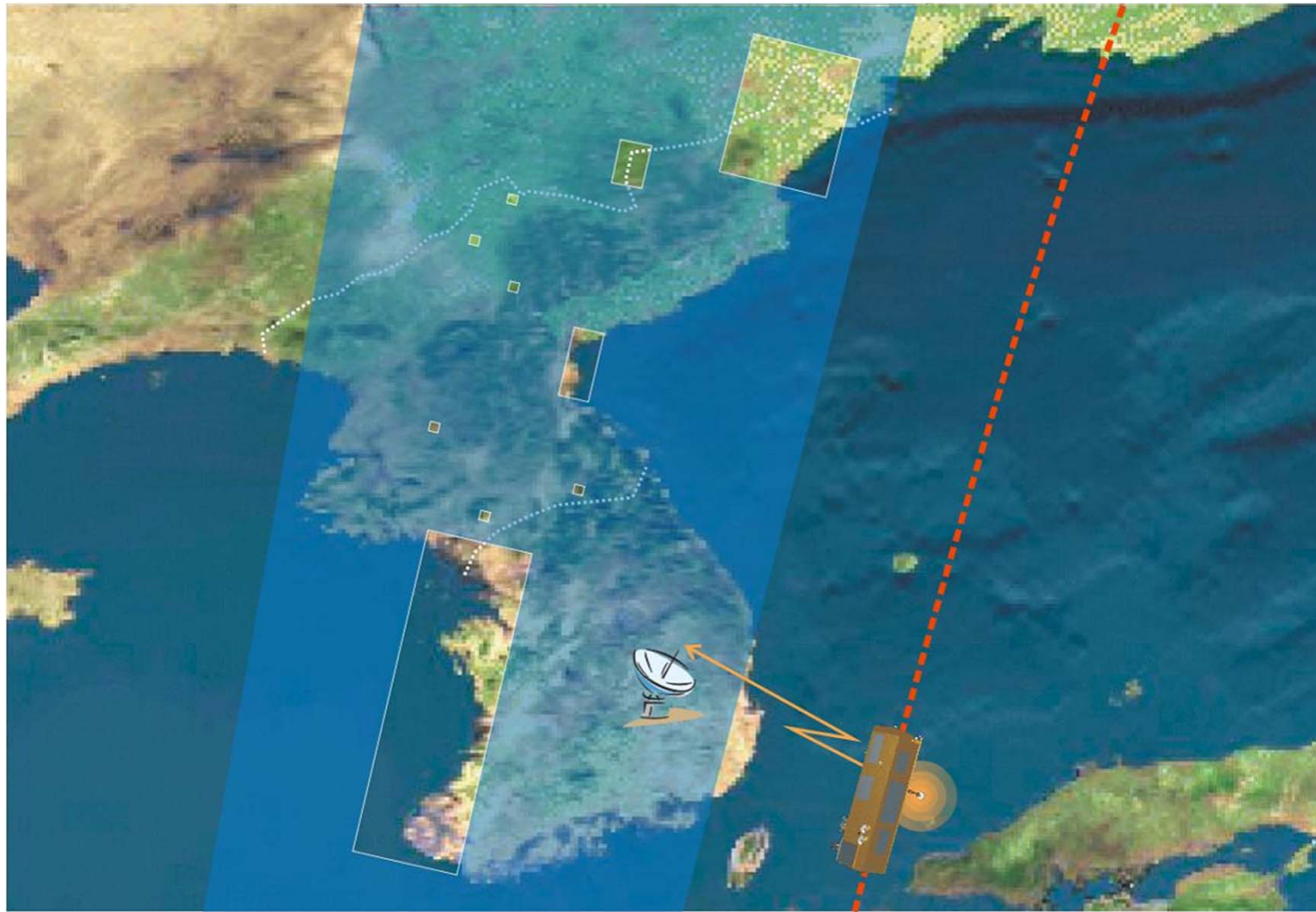
Earth Observation: Commercial Satellites

# TerraSAR



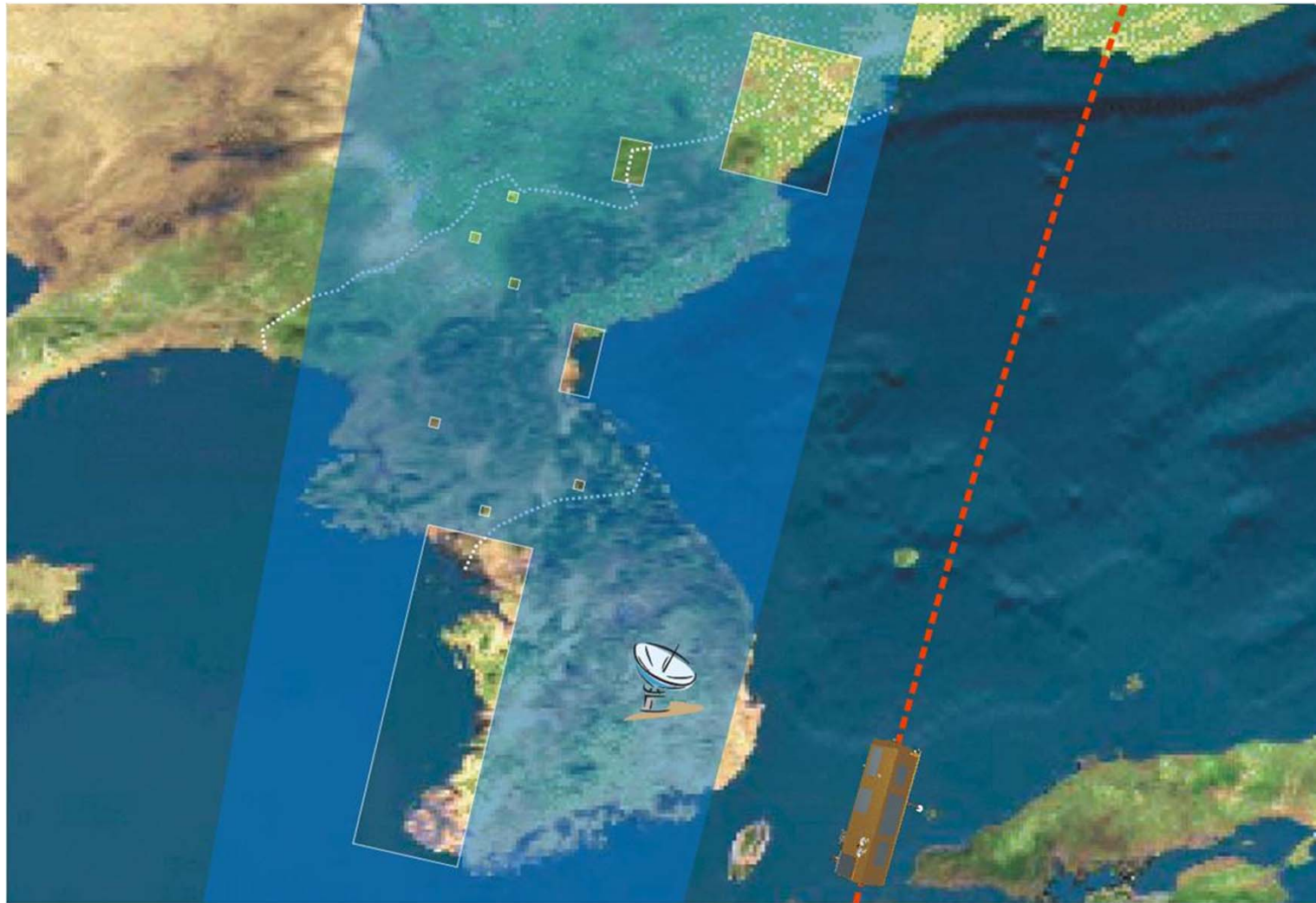
Earth Observation: Commercial Satellites

# TerraSAR



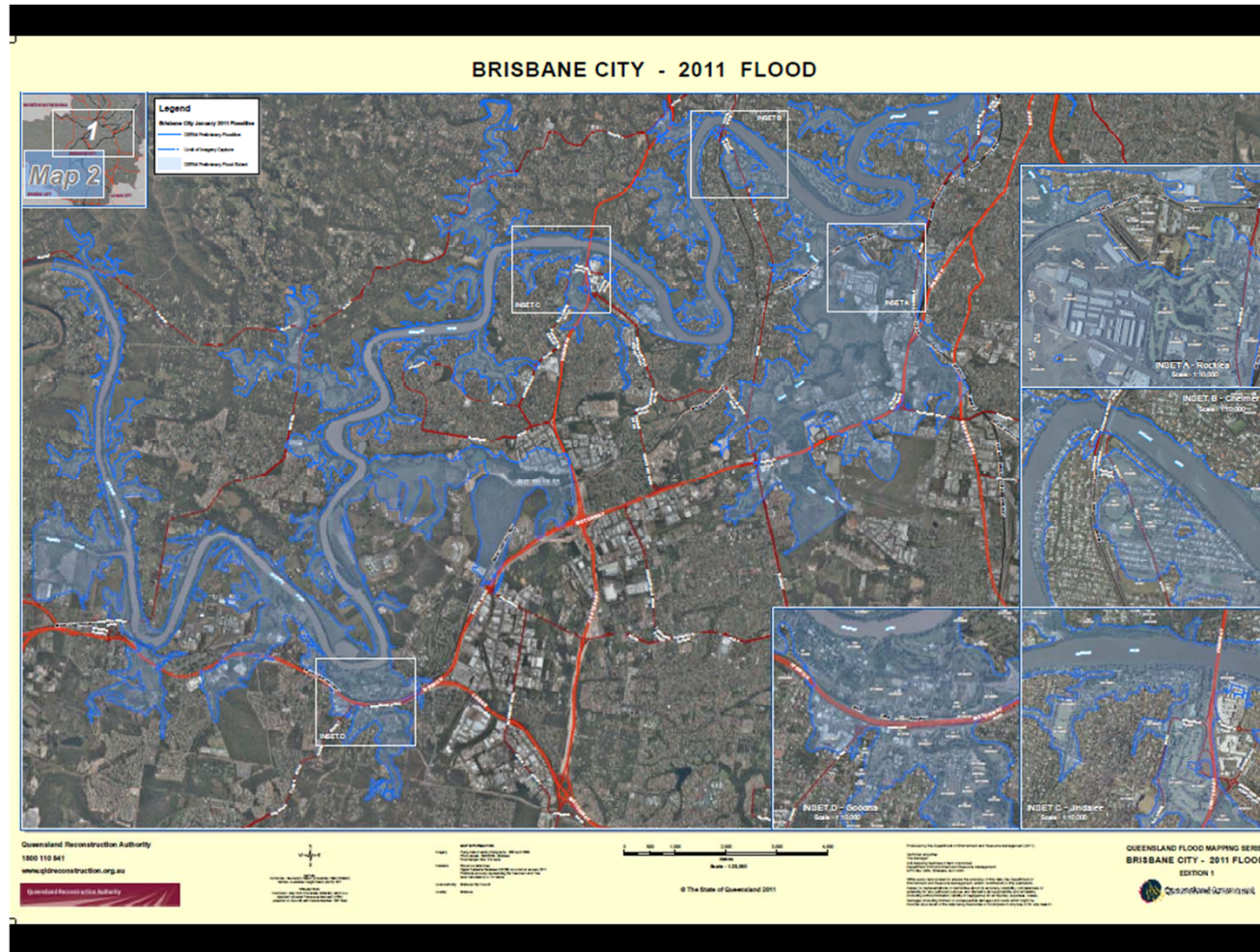
Earth Observation: Commercial Satellites

# TerraSAR



Earth Observation: Commercial Satellites

# Commercial Satellites



Earth Observation

Quelle: <http://www.qldreconstruction.org.au>

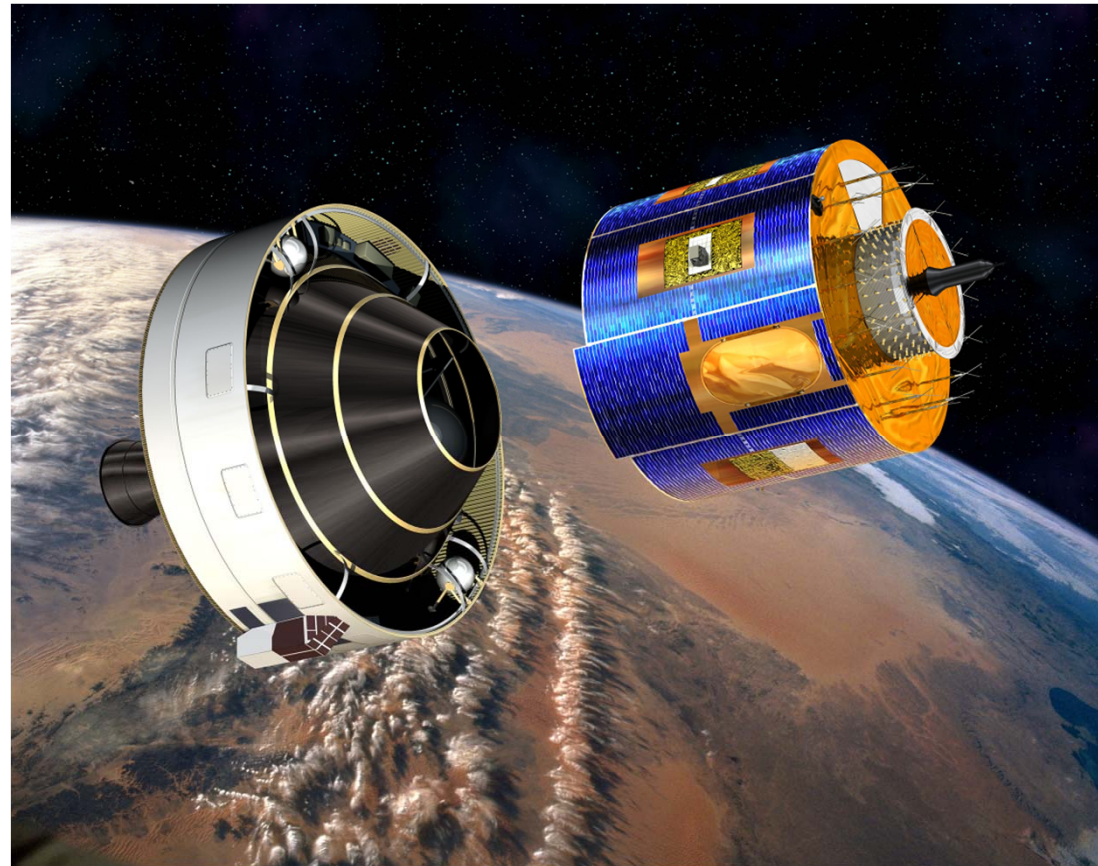
# METEOSAT



Earth Observation: Weather

Quelle: ESA

# METEOSAT





# METEOSAT



Earth Observation: Weather

Quelle: ESA

# Herschel



Science: Deep Space

# Herschel



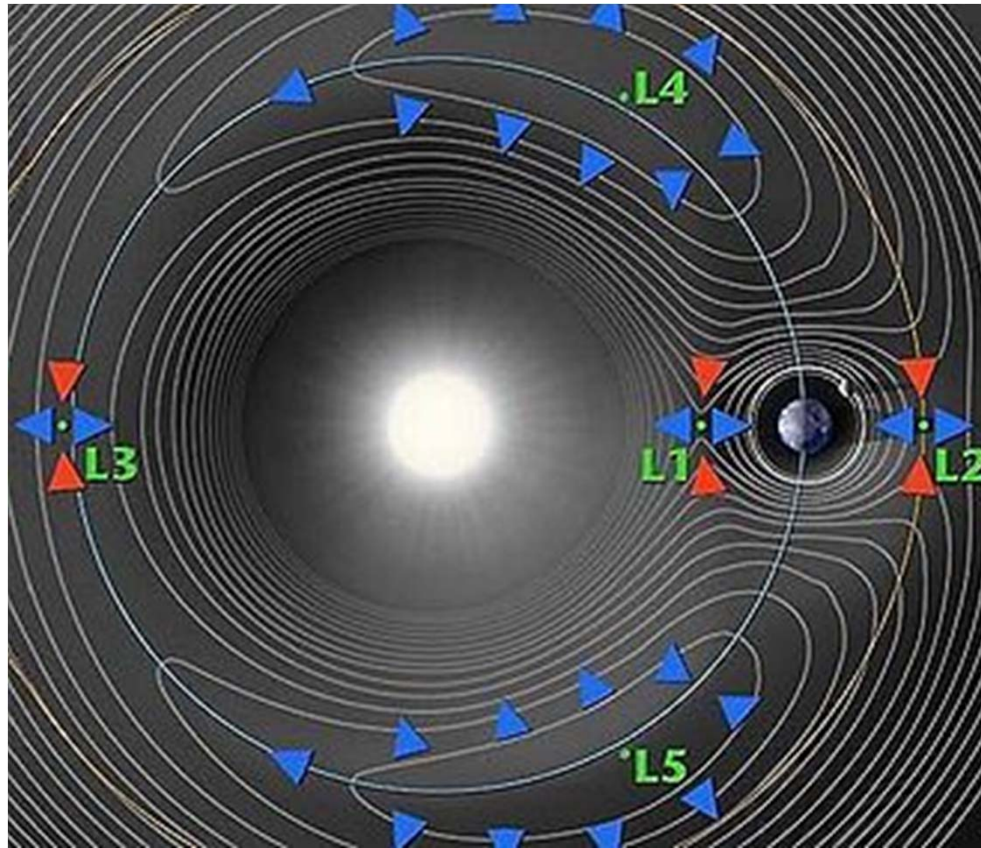
Science: Deep Space

# Herschel



Science: Deep Space

## Herschel/ Planck



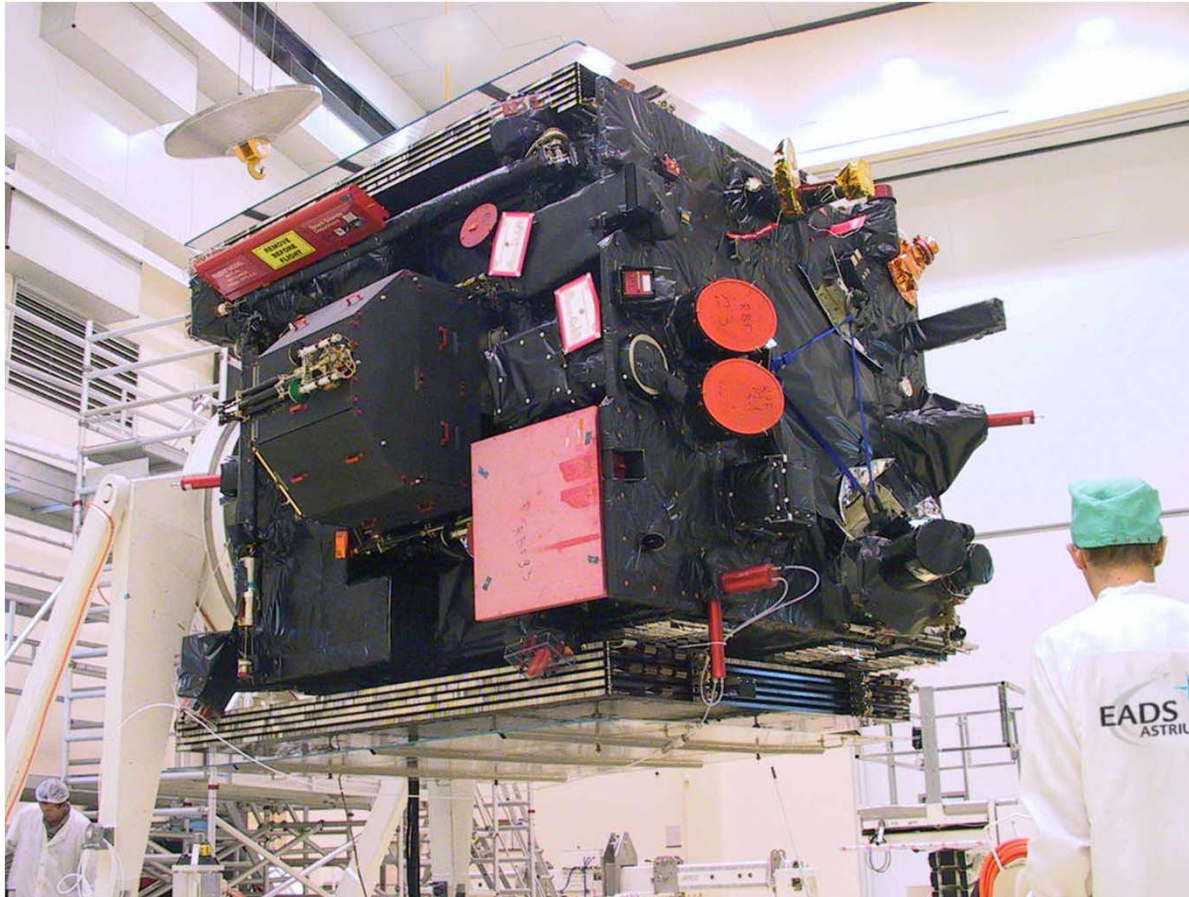
Herschel and Planck are positioned in the Lagrange point L2.

This point is about 1.5 millions kilometers outside of the Earth's orbit. At this point the two satellites are permanently in the earth shadow.

Ariane exposes Herschel and Planck after 1900 seconds.

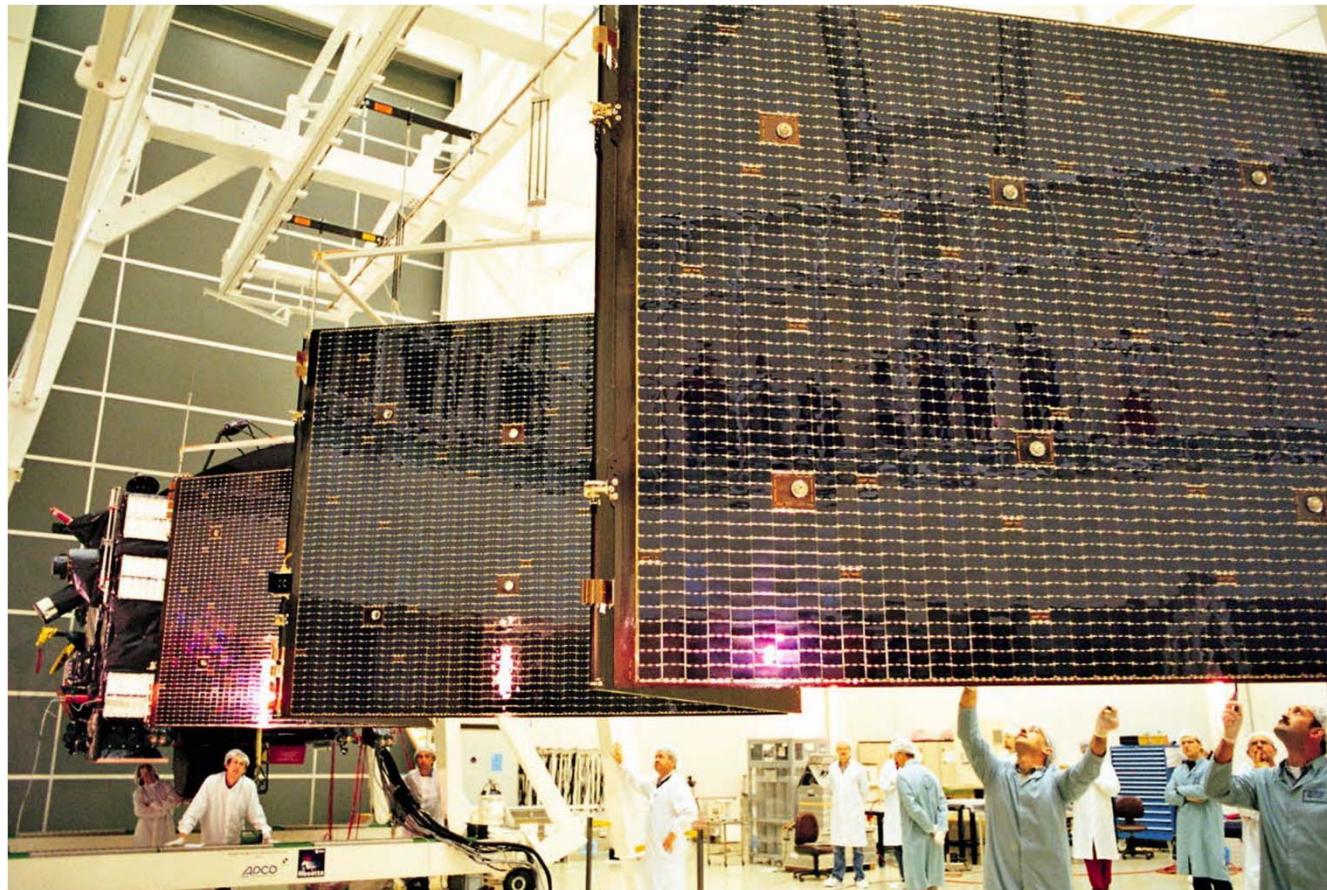
The two satellites „screw themselves“ then into the L2.

# Rosetta



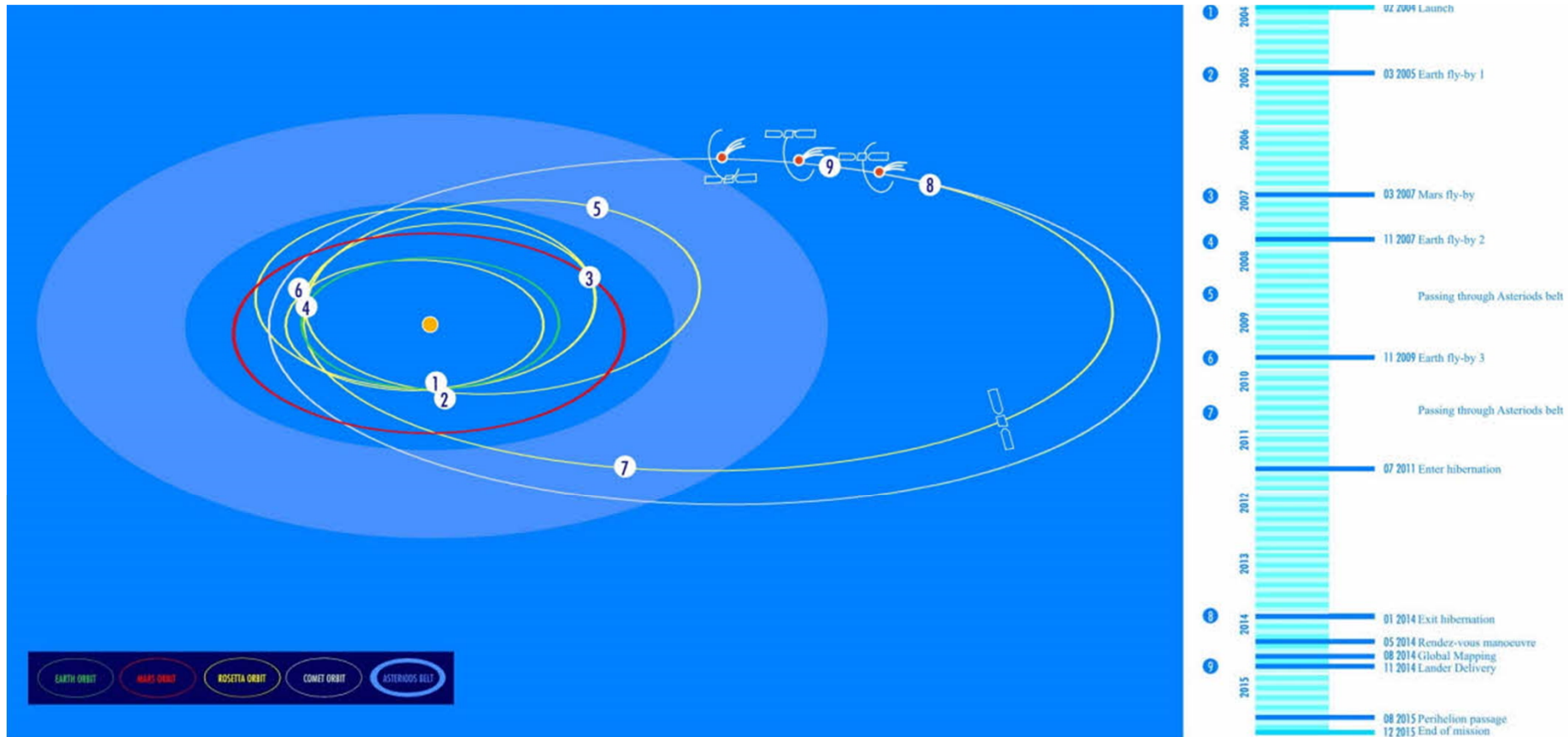
Science: Deep Space

# Rosetta



Science: Deep Space

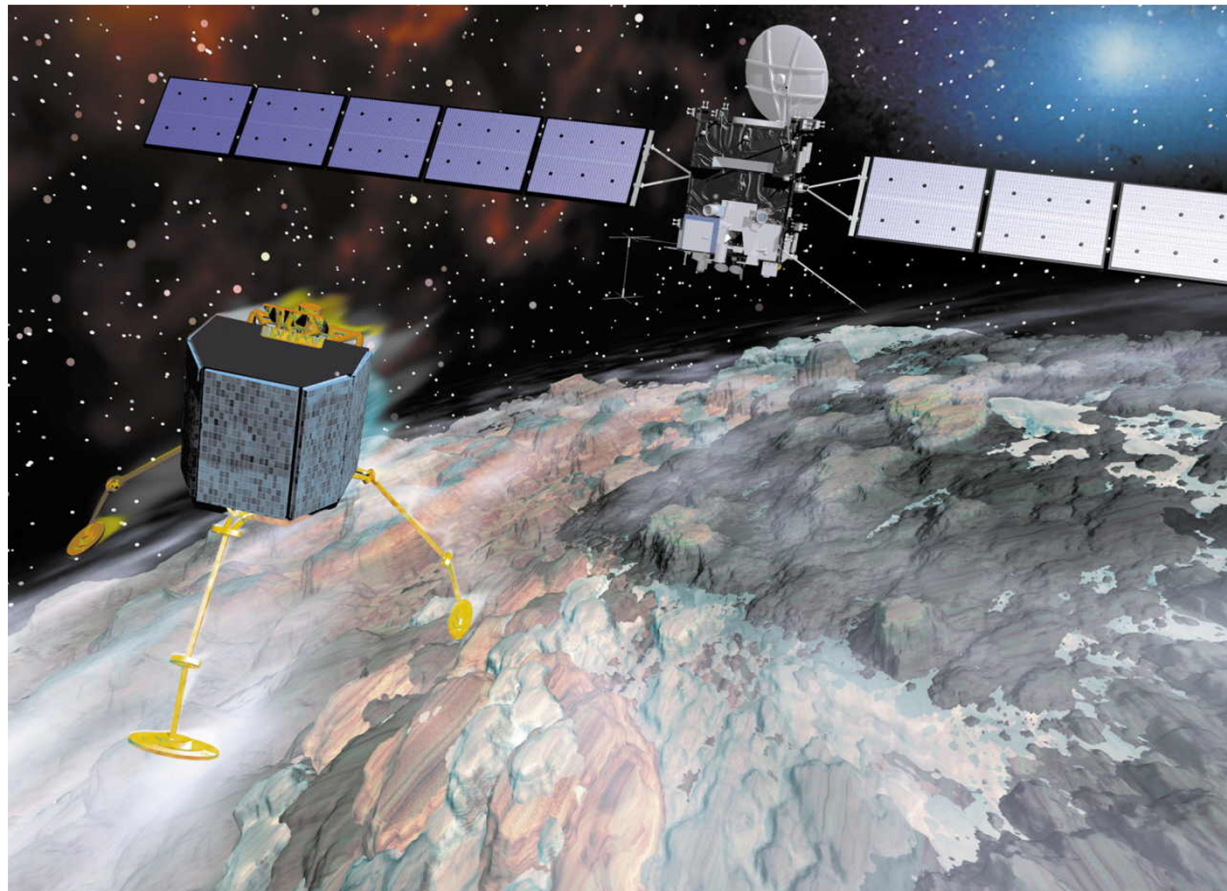
# Rosetta



Science: Deep Space



# Rosetta



Science: Deep Space

# European booster rocket family



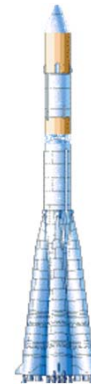
**Ariane 5  
ESC-B**



**Ariane 5  
ESC-A**



**Ariane 5**



**Soyuz  
Starsem**



**Rockot**



**Vega**

## GTO Capability (Double Launch)

12 t	10 t	6 t
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## LEO Capability

> 20 t	2,5 t / 5 t	1,1 t	1,5 t
300 km - 51° 6	1.400 km	700 km	700 km

## The launch by the example of a ARIANE 5 flight



Space Transportation

## The launch by the example of a ARIANE 5 flight



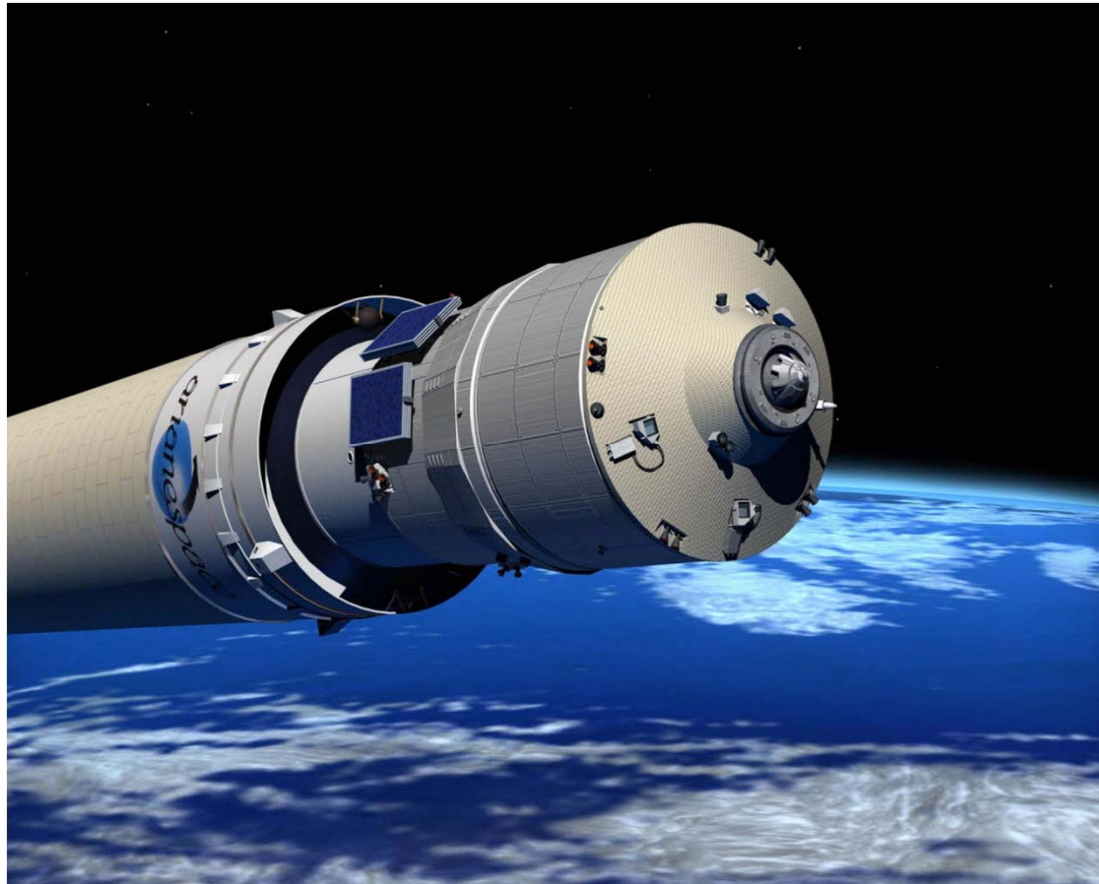
Space Transportation

# ATV



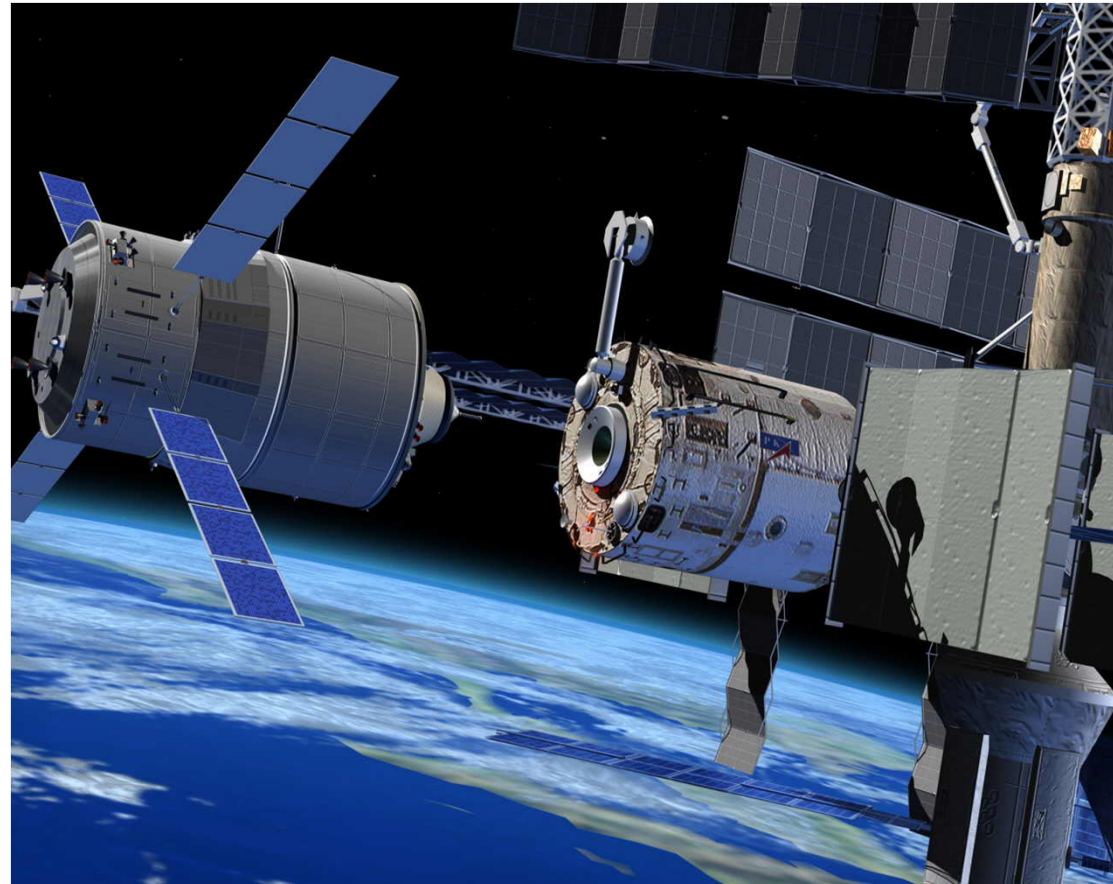
Space Transportation

# ATV



Space Transportation

# ATV



Space Transportation

## Columbus



26.03.2009

ISS present configuration -picture taken from the dedocked shuttle Discovery, STS 119



## Abbreviations in this Lecture

<b>ATV</b>	Automated Transfer Vehicle
<b>DLR</b>	Deutsches Zentrum für Luft- und Raumfahrt e.V. (German Aerospace Center)
<b>ESA</b>	European Space Agency
<b>ISS</b>	International Space Station
<b>NASA</b>	National Aeronautics and Space Administration
<b>PPP</b>	Public Private Partnership
<b>SME</b>	Small Medium Entities

## Web-links und Data Sources for this Lecture

### **Earth Observation Data**

[http://www.zki.caf.dlr.de/intro\\_de.html](http://www.zki.caf.dlr.de/intro_de.html)

### **Media Archive**

<http://www.esa.int/>

### **Satellite Visibility**

<http://www.heavens-above.com>

### **Arianespace Video Archive**

<http://www.videocorner.tv/index.php?langue=en>

### **ISS History**

[http://i.usatoday.net/tech/graphics/iss\\_timeline/flash.htm](http://i.usatoday.net/tech/graphics/iss_timeline/flash.htm)

## Aufgaben für das Selbststudium

1. Seit einiger Zeit werden privat finanzierte Raumfahrtprojekte wie Virgin Galactic diskutiert. Erläutern Sie, vor welchen Herausforderungen insbesondere privat finanzierte Projekte standen, stehen oder stehen können.
2. Welche zusätzlichen geplanten Raumfahrtprojekte sind Ihnen bekannt. Gehen Sie auch auf Besonderheiten der jeweiligen Projektbeispiele ein.
3. Gibt es besondere Unterschiede zwischen Raumfahrtprojekten, z.B. hinsichtlich der Finanzierung (privat vs. staatlich) oder hinsichtlich der planenden und ausführenden Organisation (NASA, ESA, Roskosmos, CNSA)? Wenn ja, welche?

## Gastreferent

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Vielen Dank für Ihre Aufmerksamkeit!

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