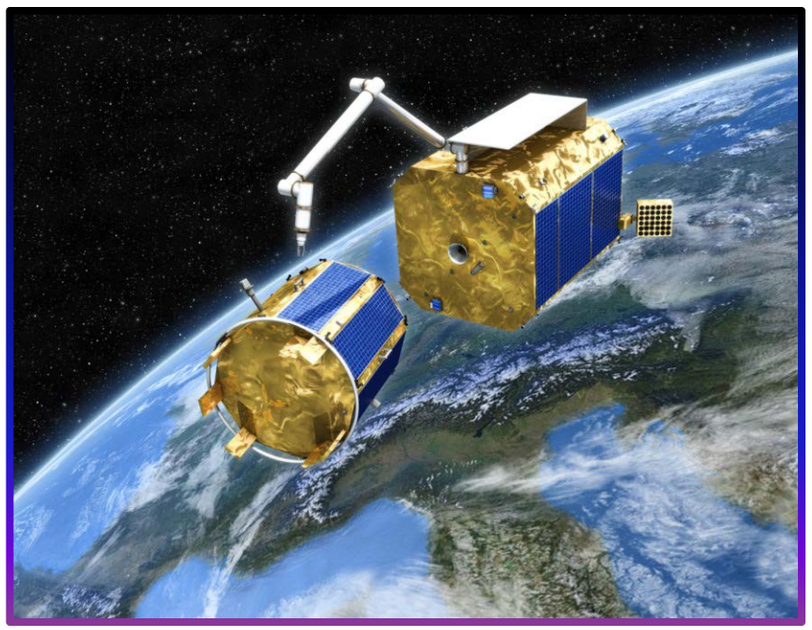
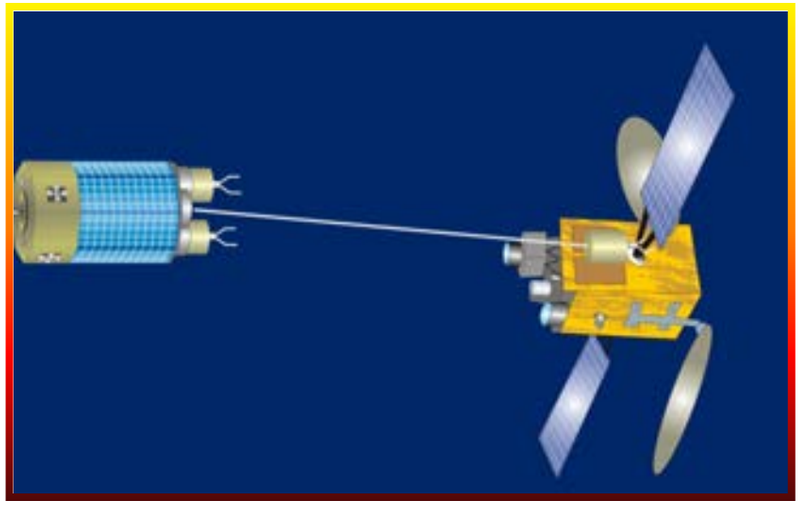
Entering a Changing World: The Perspectives of Commercial Bus Providers on Servicing

The Second International Workshop On On-Orbit Satellite Servicing
NASA Goddard Space Flight Center





John Schumacher
Vice President for Space
EADS North America

05.31.2012

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EADS in North America

Astrium Satellites | Astrium Services | Space Transportation

EADS North America is the American operating company of EADS, the world's second largest aerospace and defense company, and the largest in Europe.

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On-Orbit Servicing - Factors

- **Capabilities**
- **Servicing Prospects**
- **Business Case**

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New Capabilities in the Commercial Space Marketplace

- **Developments in Robotic and Human-tended systems**
- **ATV follow-on**
- **Liberty Transportation Service**

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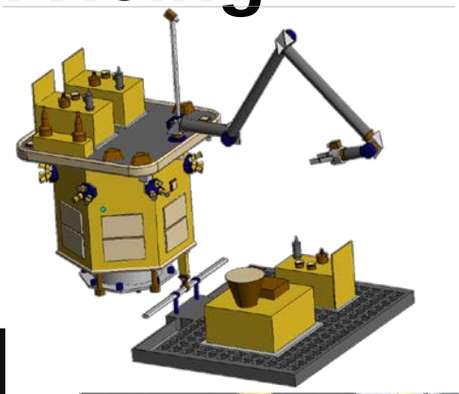
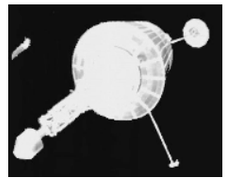
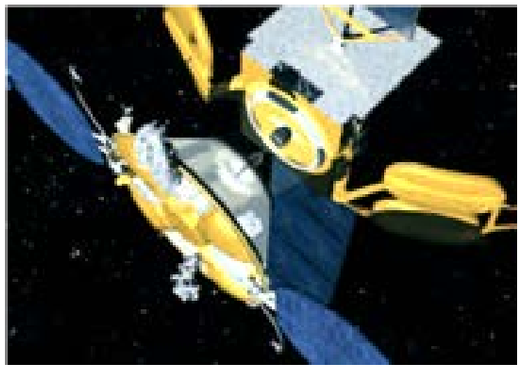
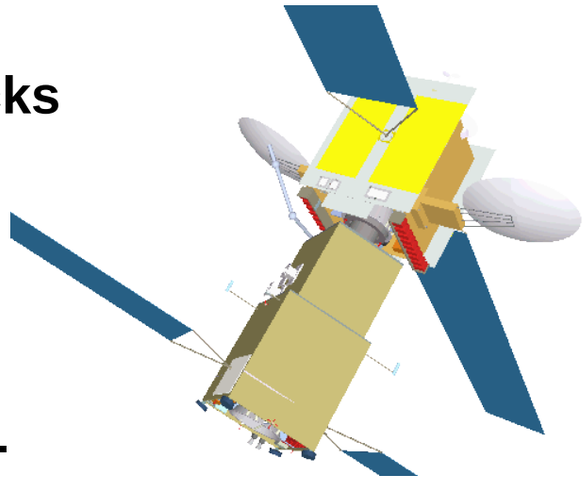
Astrium has a strong heritage in relevant studies and spacecraft missions related to on-orbit servicing

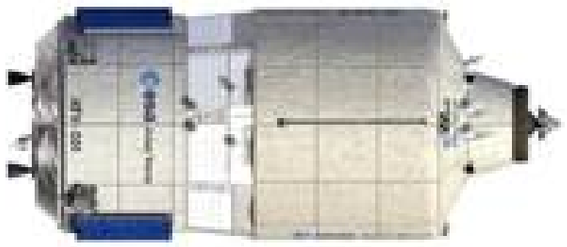
- Many studies before 1999 (ESS, GSV, SIRE…)
- FFMO (1999-ESA) Free Flying Micro Satellite - ISS Servicing
- ROSS (2000-DLR) ROsat Service Satellite - Controlled de-orbit of ROSAT
- SNAP inspection (2000), In Orbit Demo
- Conexpress Orbital (2002-ESA) GEO satellite life extension/transfer to graveyard
- ROGER (2003-ESA) RObotic GEostationary orbit Restorer - Active debris removal
- SSBB (2005-ESA) Satellite Servicing Building Blocks – System study & ground demos
- TECSAS/DEOS (2002-DLR) DEutsche Orbital Servicing Mission - Demo of capture technology
- Tether gripper (patent)
- InVeritas (ongoing – DLR): ground demo of Rendezvous and Capture of non-cooperative & co-operative targets
- OTV (ongoing – CNES)
- Automated Transfer Vehicle ATV (ongoing – ESA): operational automated on-orbit servicing











And we are ready to go further…

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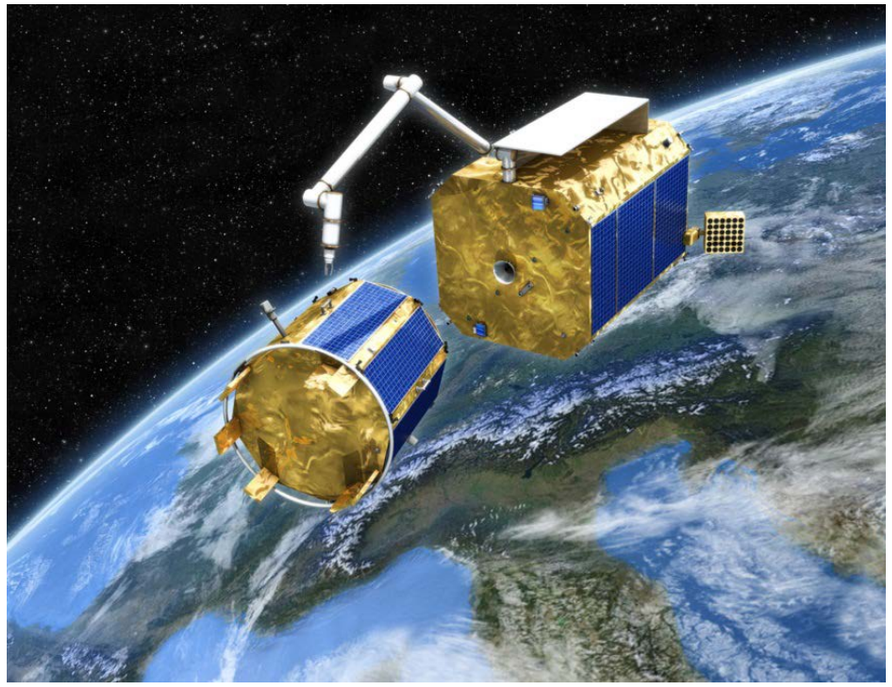
The DEOS program



- The DLR DEOS Program is currently in Phase B and could be started in C/D phase in 2013.
- Main goal is to demonstrate the use of a robotic arm for on-orbit servicing, including a capture of a tumbling space body.
- Astrium Satellites has submitted a bid for phase B2.

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Net Capture ROGER

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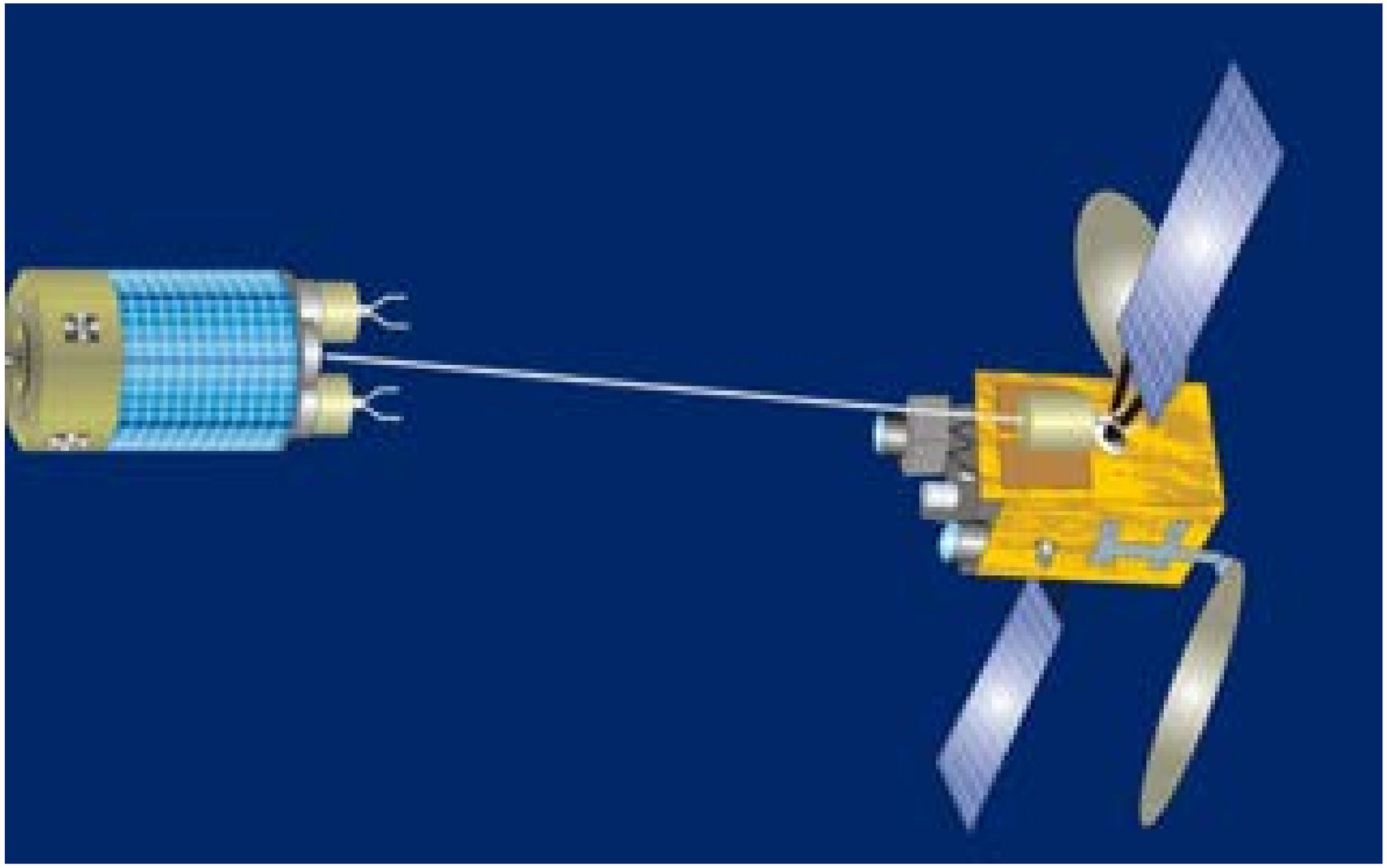
Tether Gripper Capture



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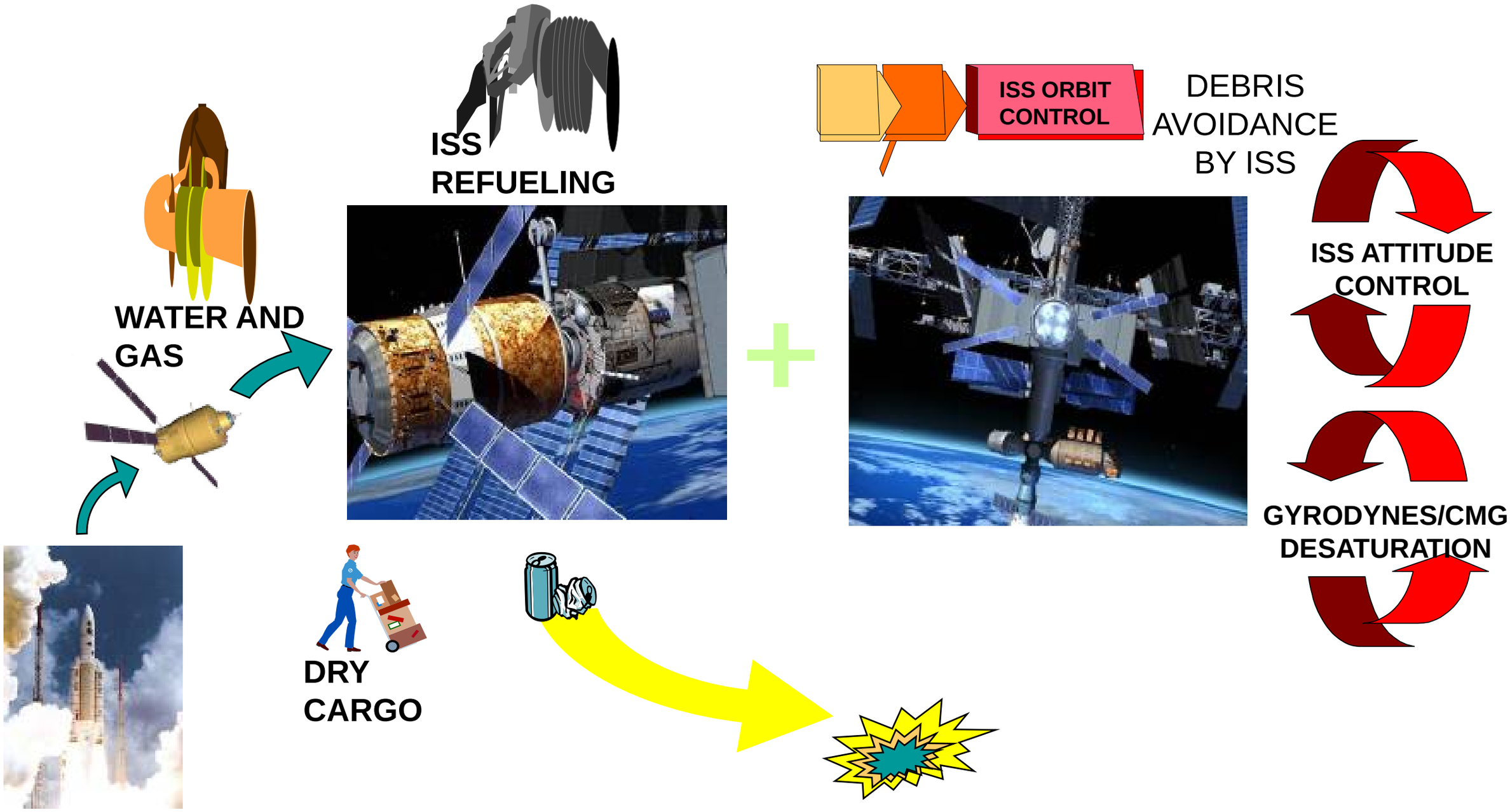
ATV: Not Just a Logistics Vehicle



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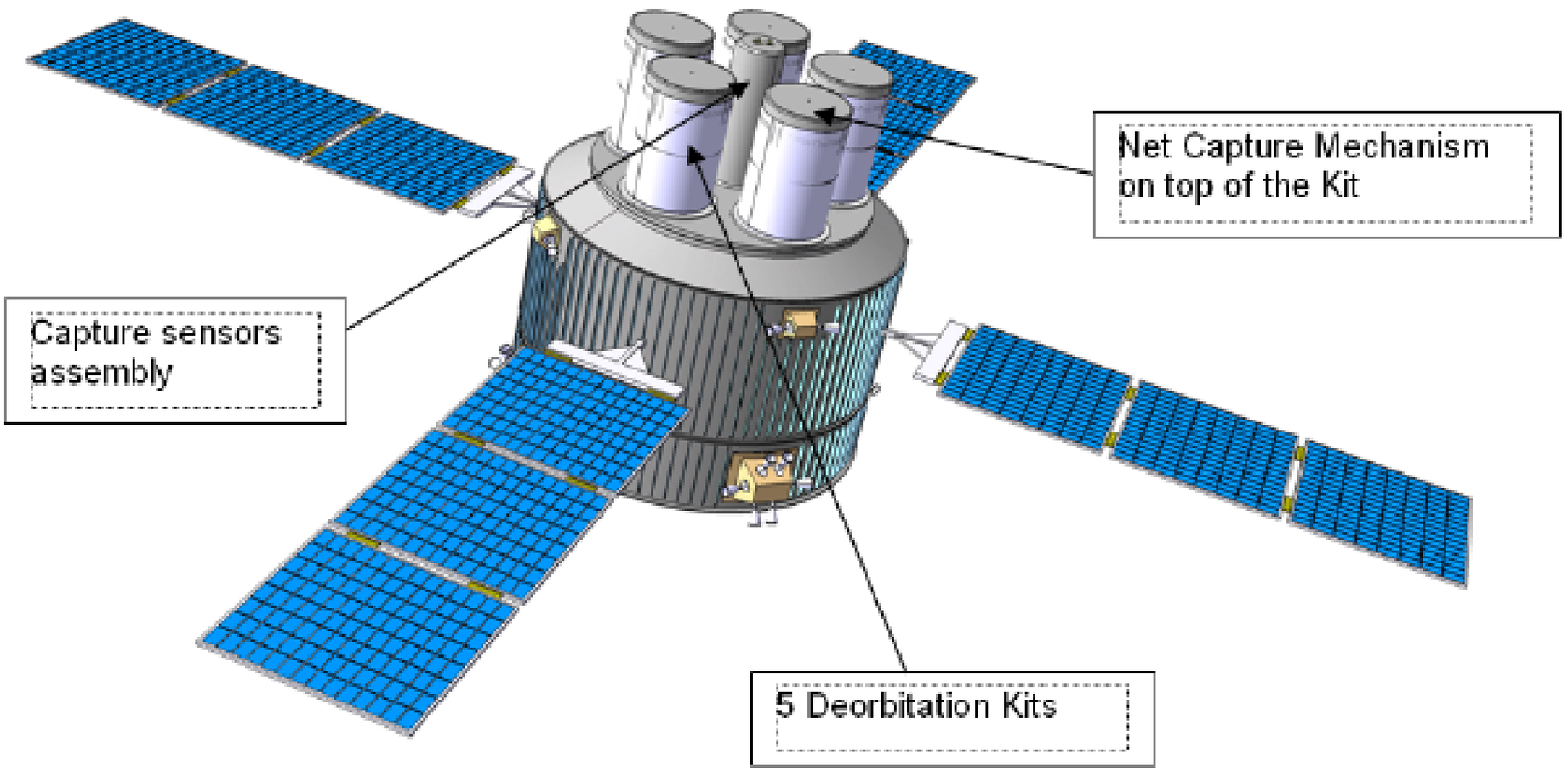
Potential ATV Follow-on Debris Removal Mission Concept developed under an ESA Contract



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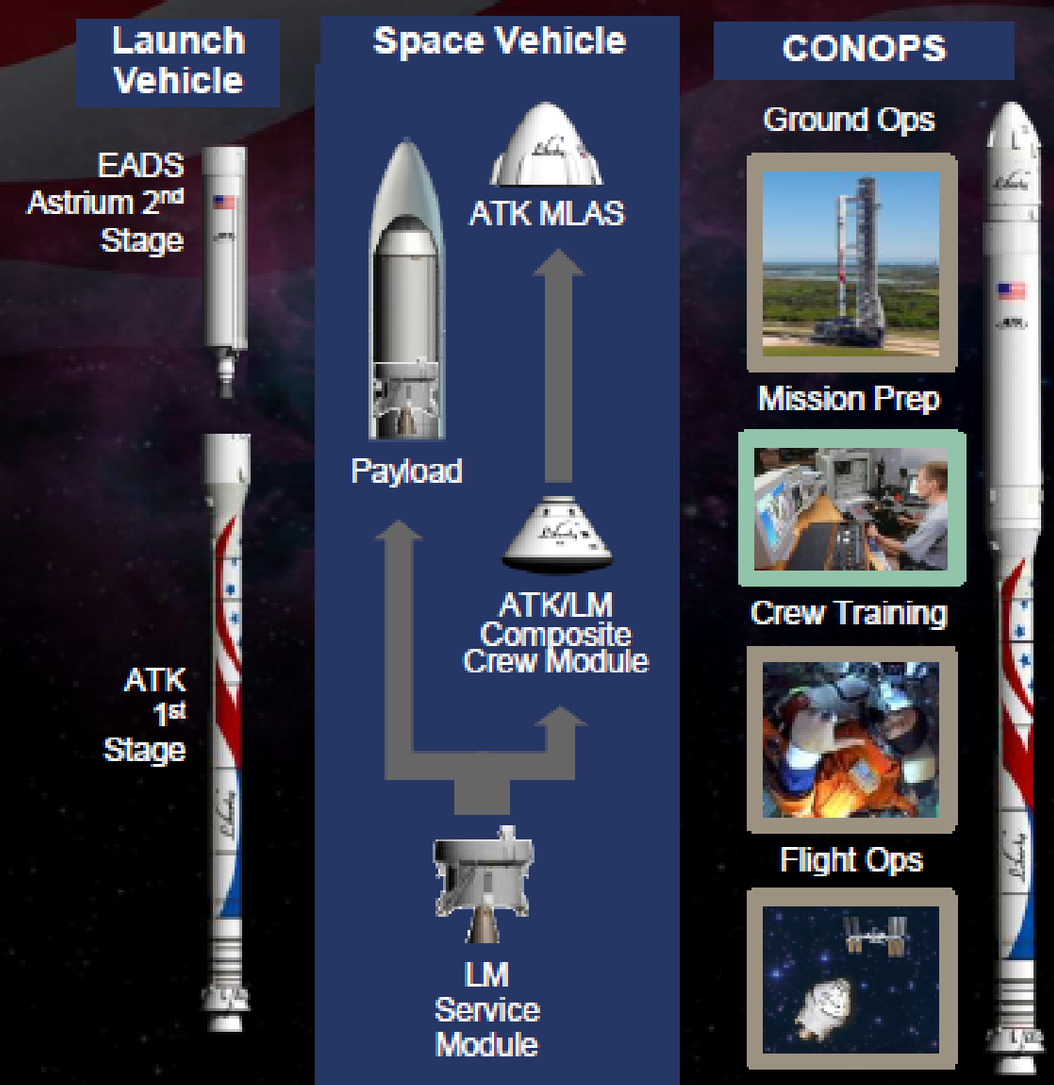
Liberty System

Revolutionizing Commercial Space

- The Liberty system includes a flexible architecture for commercial crew transportation and payload delivery
- The Launch Vehicle (LV) comprises an ATK-provided 1st stage and an EADS Astrium 2nd stage.
- The Space Vehicle (SV) for crew transportation includes the Service Module (SM), ATK/LM composite Crew Module (CM) and ATK Max Launch Abort System (MLAS).
- For payload delivery missions, the SV includes the SM, payload and associated fairing.
- Ground processing, mission preparation and flight operations complete the total solution for Liberty's Crew Transportation System (CTS).

Liberty System — Total Solution



Total Solution. Liberty provides an end-to-end transportation service for crew, cargo and payload delivery

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Liberty Overview

Revolutionizing Commercial Space

Complete Service
- Manufacturing
- Integration
- Ground ops
- Mission ops

World Class Team
- Recognized global leaders
- Successful commercial providers
- Industry top suppliers

Rapid Execution
- Commercial approach
- Streamlined best practices
- **2015 crewed flight**

Safest System
- Reliable, simple architecture
- Mature elements
- **Designed for human rating**

Robust Business
- Crew, cargo, satellite
- Capital structure
- Very Competitive

Liberty System

Liberty will provide the U.S. with unprecedented crew/cargo/satellite capabilities

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Business Case

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Possible servicing missions

Extension of lifetime

Orbit raising

No design for servicing

from docking to robotics

Refuelling of satellites

refuelling I/F & possibly docking I/F

impact on client satellite

Repair of satellites

Mission evolution

Serviceable design and robotics

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Potential Servicing Mission

On-Orbit Refuelling

- **Increase satellite lifetime**
  - **Could be attractive for an operator if expected revenues versus service cost are sufficient, the satellite is in good shape, and performances is still OK.**

- **Reduce mass at launch**
  - **On-orbit refuelling could reduce launch mass**
  - **Such gain could be used for additional payload capacity, but there are other limiting factors.**
  - **Most probable mission outcome is a cost reduction for launch.**

- **Allows operator potential to recover lifetime capability if a satellite is injected in a wrong orbit**

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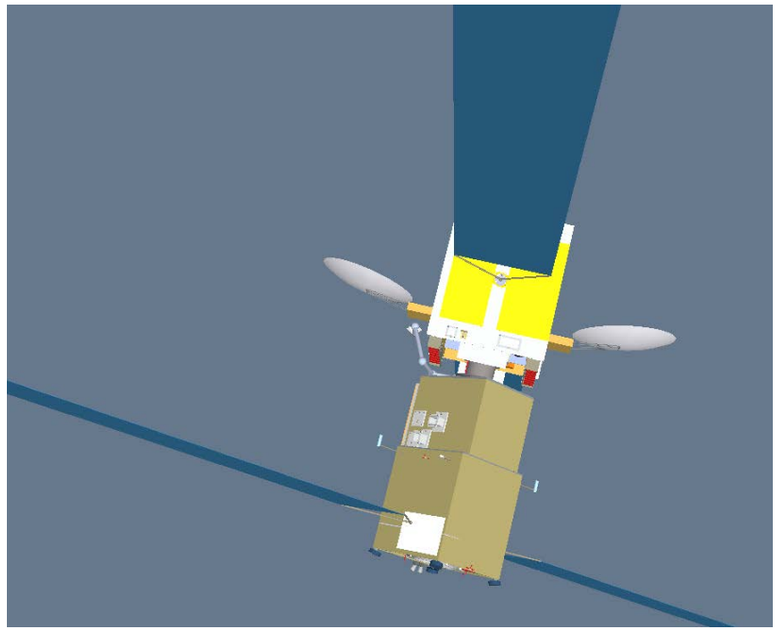
Possible Servicing Mission

Hardware Replacement

- **Maintenance**
  - **Exchange of failed equipment, such as computer, solar arrays, etc.**
  - **Demonstrated several times on Hubble space telescope.**

- **Adaptation to market needs**
  - **Examples - Exchange of an antenna, or replacement of C-band by K-band.**
  - **To be done at whole payload level and not at transponder or equipment level to avoid issues with connections.**

- **The satellite has to be designed accordingly**
  - **There is a mass and cost penalty compared to non serviceable satellites.**
  - **It will require new techniques for spacecraft architecture.**



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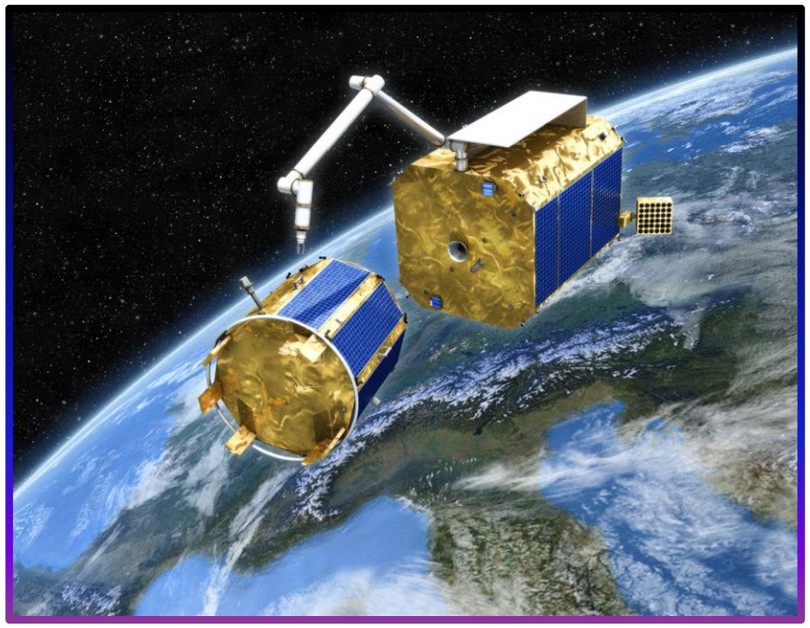
Potential Servicing Missions – Who is the Customer?

In general

- **Potential customers for on-orbit servicing are mainly the operators.**
- **On-orbit servicing will require the development of new business models - The cost of the service needs to be attractive for both the customer and the on-orbit service provider.**
  - **Operators need to consider cost of a satellite that is serviceable on-orbit, and the on-orbit servicing risk/reward trade.**
  - **Insurer will need to consider the satellite cost, and the risk/reward of the servicing.**
  - **Service provider needs to consider the cost of the service vehicle system (including launch and operations) which will not be small. The system may be unique for some on-orbit servicing applications.**
- **Considering the technical difficulties, the market for refuelling and hardware exchange remains in development.**

Summary

- **Astrium has growing experience and capabilities for on-orbit servicing – both robotic and human-tended.**
- **New capabilities are coming on line for both robotic and human-tended on-orbit servicing.**
- **The business case for on-orbit servicing needs to be developed.**



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