DLR-ESA Workshop on ARTES-11

SGEO: Implementation of Artes-11

Dr. Andreas Winkler

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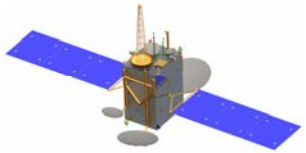
Tegernsee, Germany

OHB SYSTEM Swedish Space Corporation Contraves Space LUX SPACE



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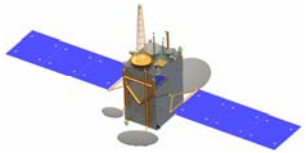
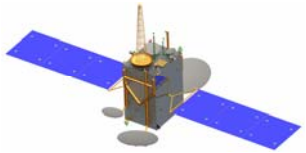


SGEO/LUX History

- Based on a company internal feasibility study on a small geostationary satellite system, OHB-System has performed a co-funded Phase A/B0 study called LUX for DLR, completed in May 2006
- The LUX baseline is under consolidation with our European partners in a Phase A study under Artes-1 plus co-funding by the companies
- Euroconsult Market Study done under ARTES-1
- A detailed business plan for small geostationary telecom satellites has also been completed, supported by Booz-Allen-Hamilton
- The industrial team is currently extended to project needs with special focus on payload competence
- A technology roadmap for the product evolution is under definition

Product Overview

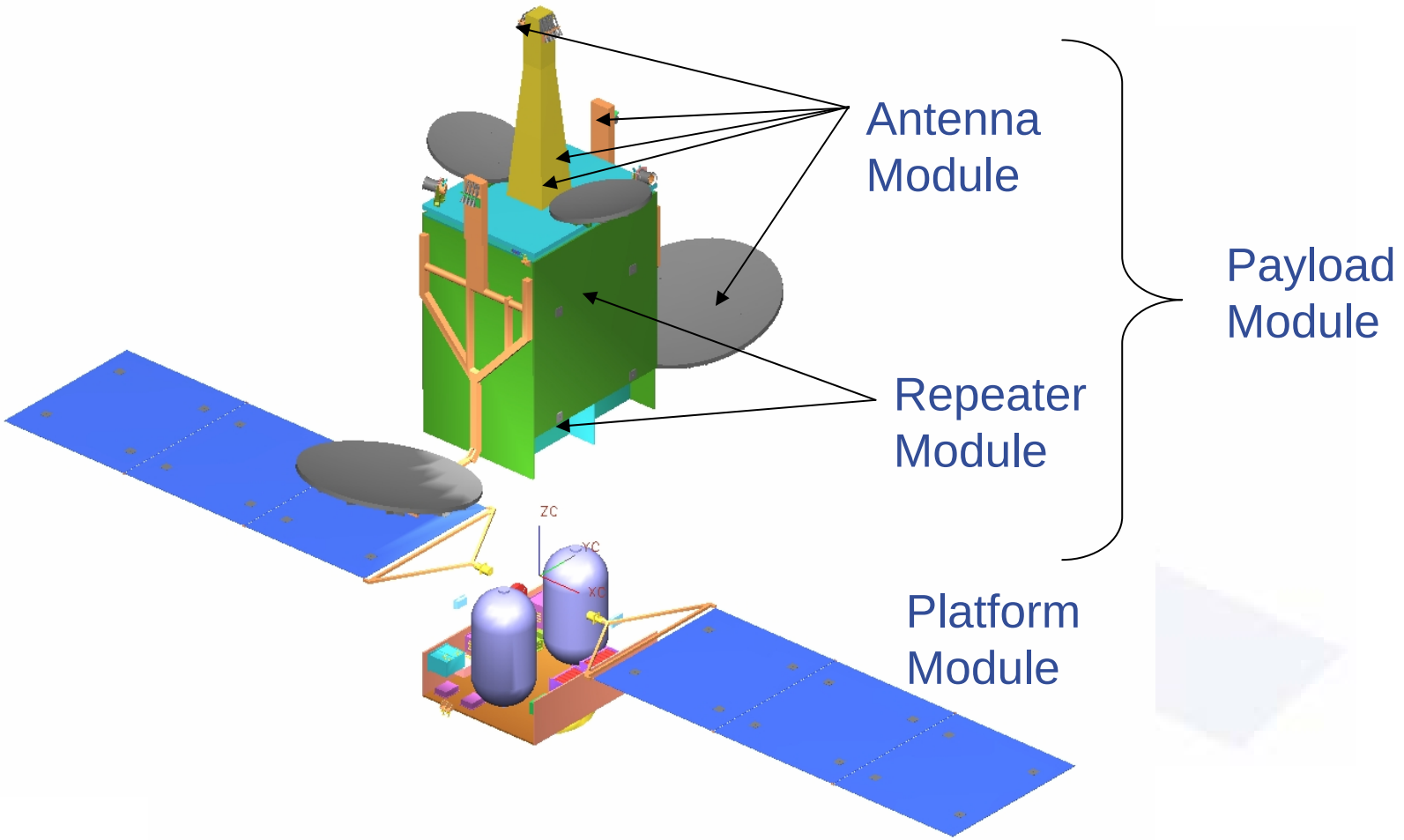
SGEO Satellite	
Payload Mass	- 300 kg class
Payload Power	- ~3 kW
Launch	- Optimised for Direct Injection Launcher - Baseline SGEO model is based on direct injection - Scalable models for all GTO Launcher - Compatible with different launchers, including as a minimum: PROTON, ZENIT, SOYUZ and ARIANE-5 - Apogee Engine Module will be provided for GTO option (ongoing study)



Key Features of Product

- Modular platform architecture to accommodate different payloads and implement new technologies as they become available to reduce cost and/or delivery time
- Design lifetime of up to 15 years
- Fast recurring time (18 months) envisaged
- Compatibility with European and non-European launchers will be ensured
- Future objective is to deliver platform based on European technologies, i.e. ITAR free subsystems and components

SGEO Structure Modules



Product Evolution

Technology Roadmap

The objective of Artes-11 is develop a cost-effective platform based on use of innovation.

- Technology developments for the first platform generation
  - modifications/adaptations of existing hardware (with flight heritage)
  - new materials for structure envisaged
- Continuous R&D for SGEO product maintenance for further generations
  - to reduce cost and delivery time
  - to reach the ITAR free goal

Product Evolution

ITAR Issue

Special emphasis will be given to the ITAR-issue with respect to risk (delay of deliveries) and export restrictions

- It is the goal to establish an ITAR-free platform configuration. The evolution of the product may require R&D activities for the development of ITAR-free equipment.

- However, due to the required development time and the associated risk it is not a requirement for the first missions to become ITAR-free

Product Evolution

Flexibility

Flexibility and modularity of the system in the following areas is provided:

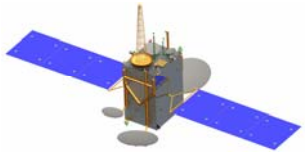
- An Apogee Engine Module that can be removed from the satellite in a modular way
- Option to include a separate encryption unit (a separate box)
- Use of any frequency band transponder for TT&C
- Optional use of GPS receiver (e.g. to provide more onboard autonomy)
- Battery radiator, in order to support scalability
- AOCS system with high performance for dedicated missions

Model Philosophy

The protoflight approach will be applied for SGEO platform.

The following models are planned:

- Structural Thermal Model (STM): It will be used for structure and thermal qualification
- Electrical Engineering Model: It is used for testing, validation of test procedures and SW development
- Engineering Model (EM): It is a replicate of the Protoflight Model (PFM), except for solar generator and components standard.
- Protoflight Model (PFM)



Integration and Test of the Satellites by the Consortium

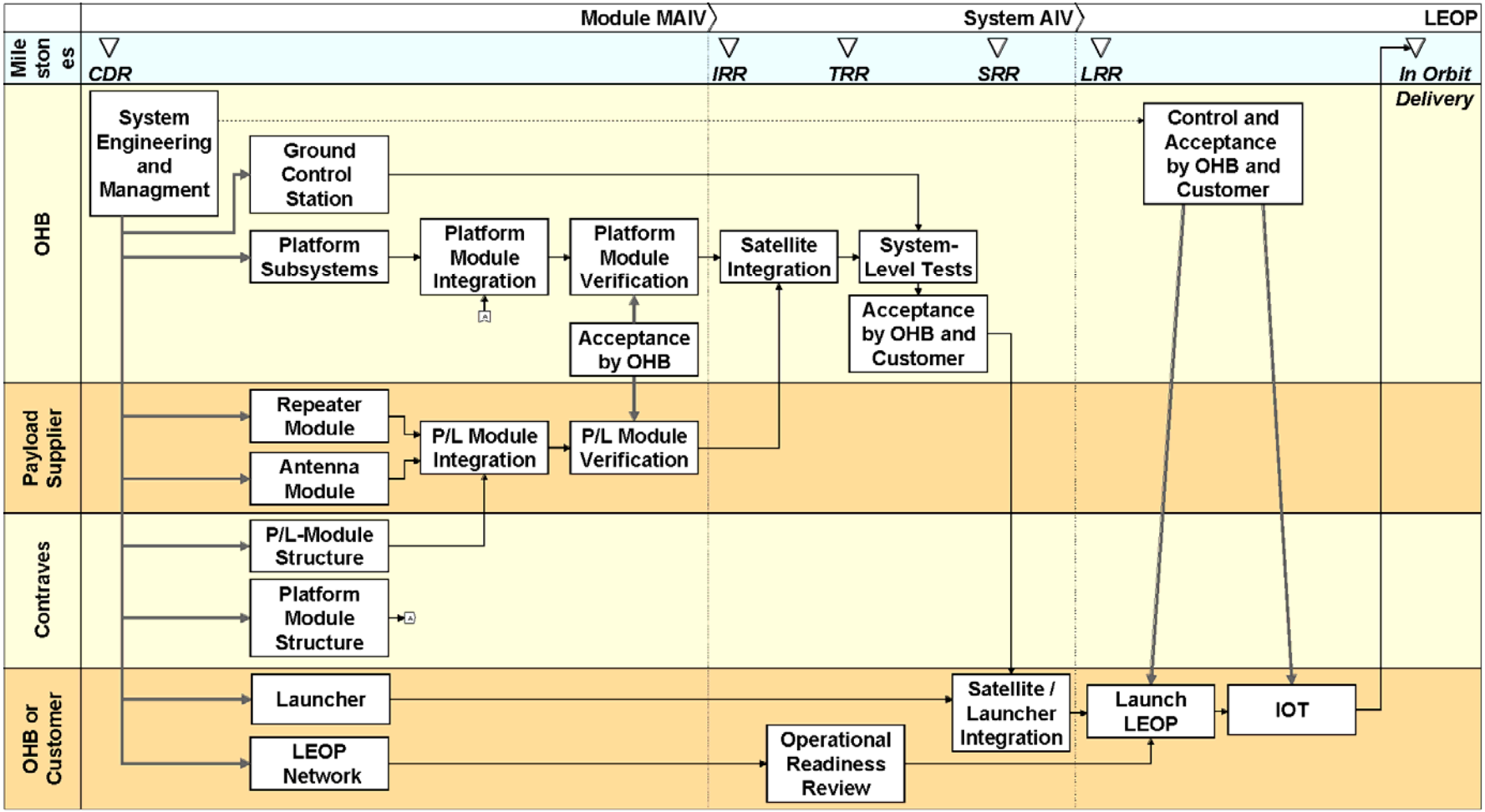
OHB as mission prime will integrate and test the satellites

- Satellite integration at OHB/Bremen, environmental tests e.g. in IABG/Munich, Intespace/Toulouse or ESTEC/Noordwijk

The Consortium is currently open for various payload scenarios

- payload subsystems to be provided by external supplier, who will also support integration and testing: Payload integration at suppliers
- components to be procured by payload suppliers, based on design by consortium: Payload integration at OHB or partner

Integration Sequence



Supplier Selection

Key Elements

- Selection as early as possible, starting in phase B
- Long term agreements envisaged for critical components
- Competitive tenders to commercial products
- Heritage in space programs
- Technical and schedule credibility
- Strong commitment by the Consortium to apply fair competition, guided by ESA

Overview of Reference Missions

Four reference missions have been defined in order to derive the payload envelopes and interface design.

The four reference satellites are:

1. Ku-Band TV-Broadcast Mission
2. Hybrid P-(UHF)/X-/Ka-Band ComSAT Mission (Defense Application)
3. Scalable Multimedia Mission (SMM, Ka-band mission, OHB phase A study for ESA)
4. Data Relay Satellite Mission

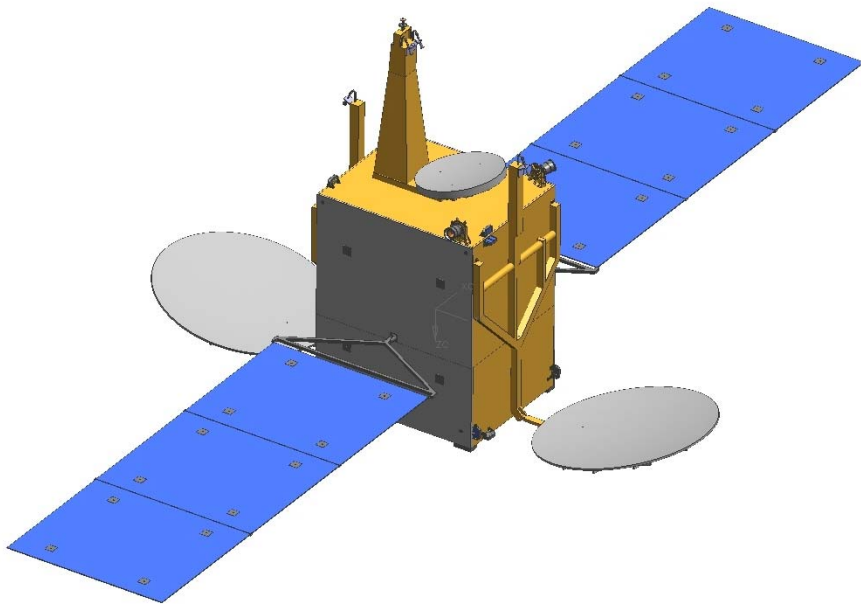
1) Ku-Band TV broadcast mission

Overview

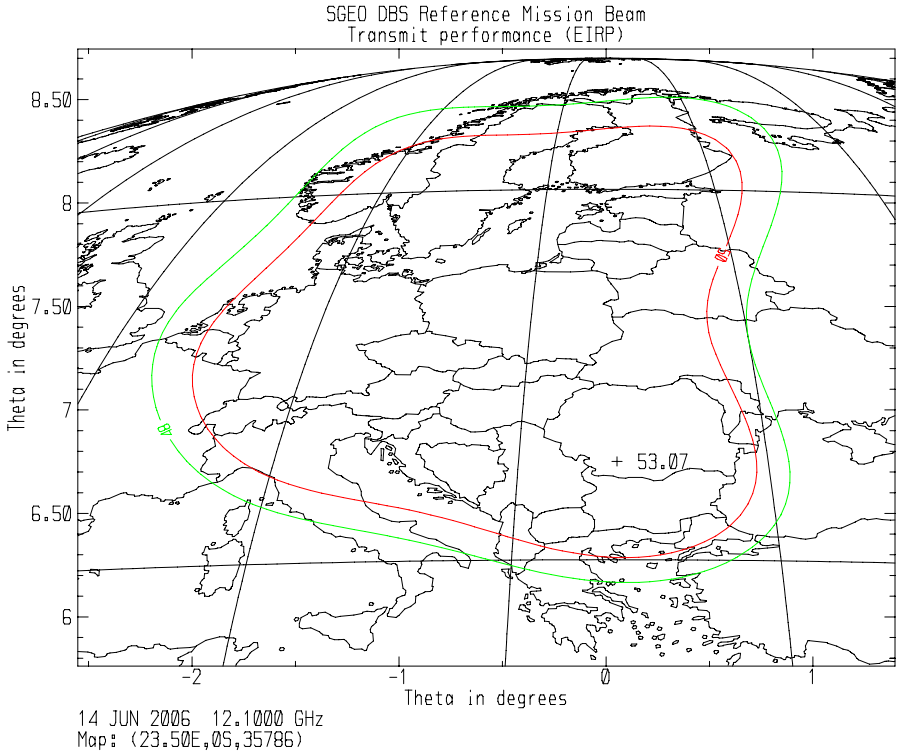
- Used as bench-mark mission
- Based on layout for 40 accommodated TWTAs, 32 TWTAs in operation
- Utilization of the max. DC power consumption of 3 kW for payload
- DC power available for 32 TWTAs with saturated RF output power of 50 W
- EIRP of 50 dBW over Central Europe

1) Ku-Band TV broadcast mission

Payload Accommodation:



Service Area:



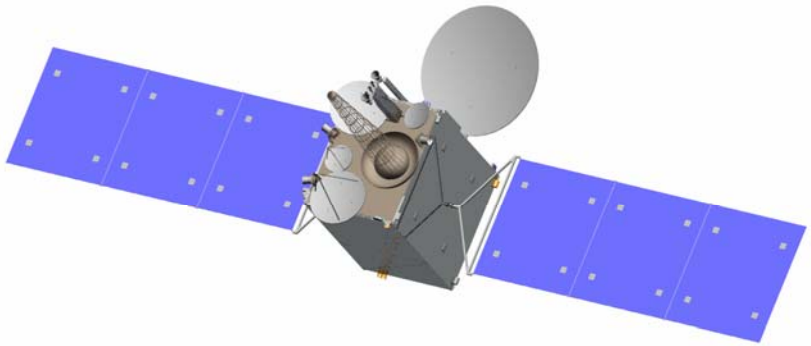
2) Hybrid P(UHF)-/X-/Ka-band COMSAT

Overview

- Provides P-/X- and Ka-band communication links for a fictive Ministry of Foreign Affairs and Defense.
- 8 active X-band transponders in 4 coverage areas
- 5 active Ka-band transponders in 2 coverage areas
- 2 active P-band transponders in 1 coverage area
- Intra- and inter beam communications capability within the frequency bands (no cross-strapping)

2) Hybrid P(UHF)-/X-/Ka-band COMSAT

Payload Accommodation:



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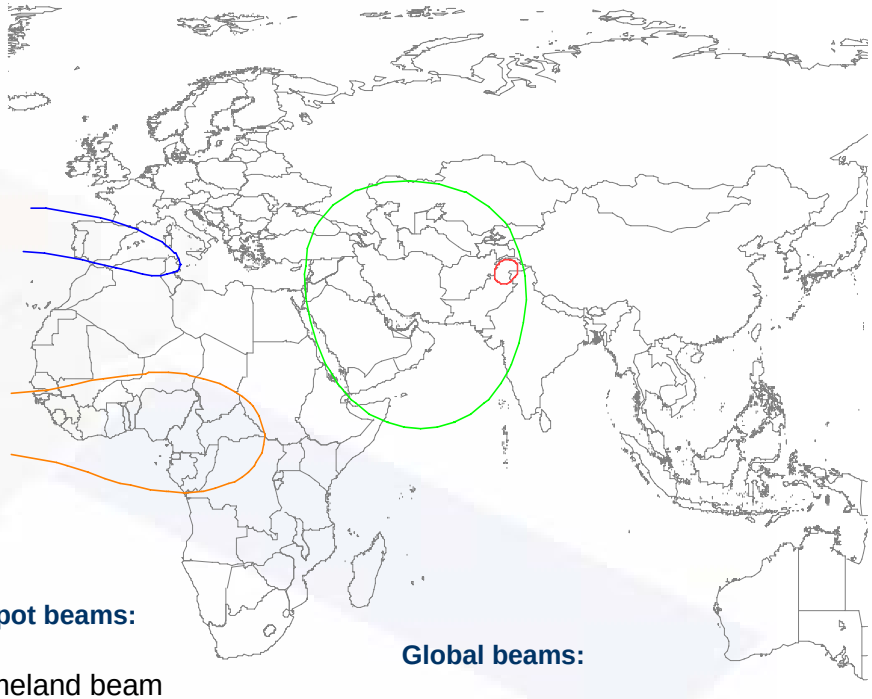


Regional/Spot beams:

- Homeland beam
- 2000-Km X-band beam
- 4000-Km X-band beam
- 600-Km Ka-band beam

Global beams:

- X-band global beam
- Ka-band global beam
- UHF band global beam

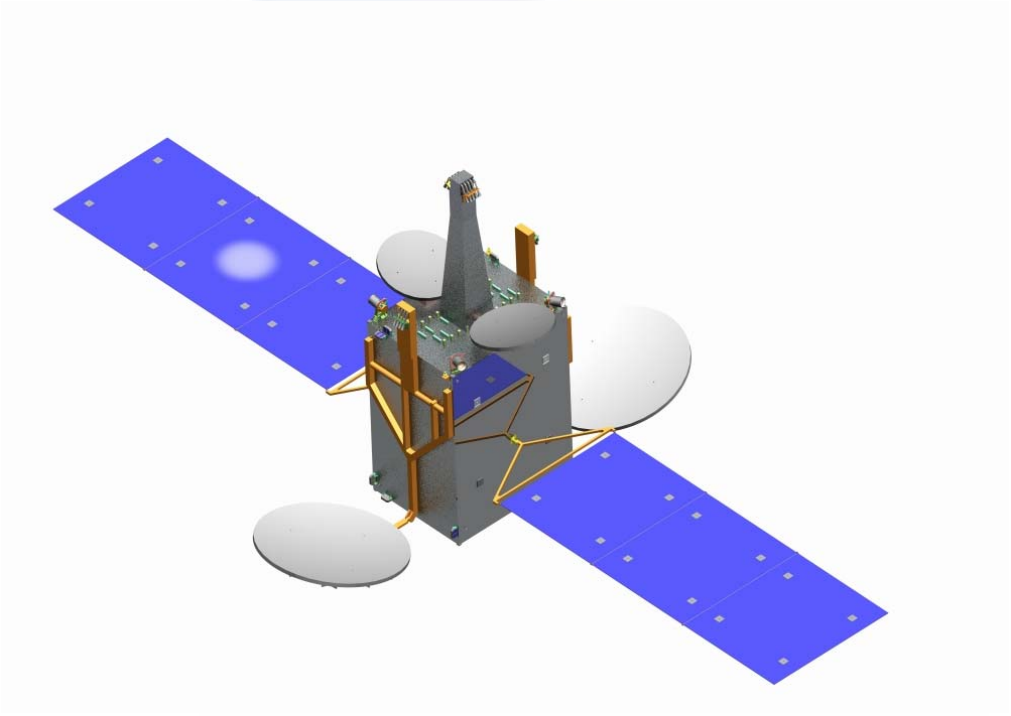
3) Scalable Multimedia Mission (SMM, Ka-Band mission)

Overview

- Ka-band multi-spot mission
- 16 Tx/Rx spot beams
- Intra- beam communications capability
- Services based on DVB-RCS (Transparent transponder)
- Scalability of capacity by co-location of additional satellites with adapted frequency band and/or spot beam locations

3) Scalable Multimedia Mission (SMM, Ka-Band mission)

Payload Accommodation:



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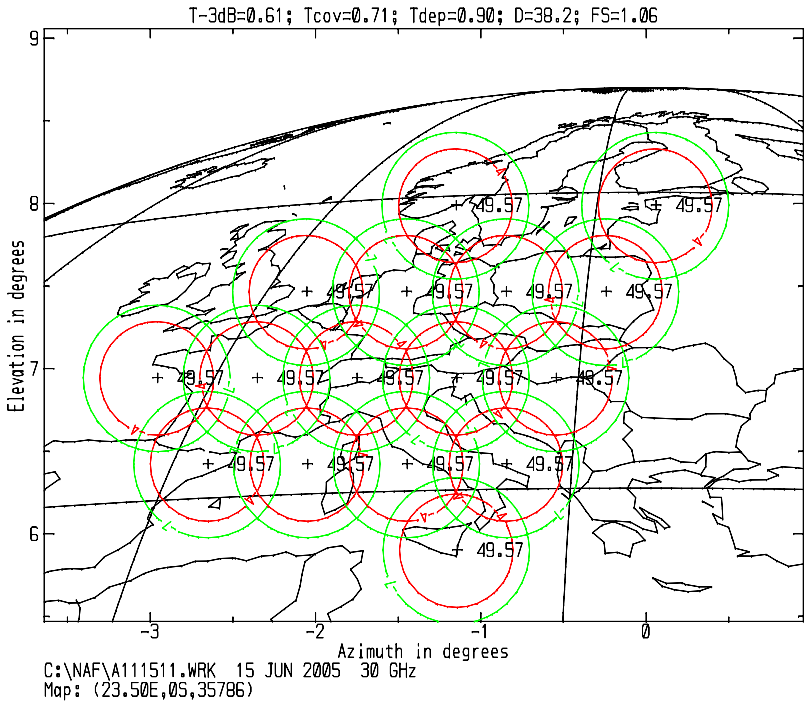


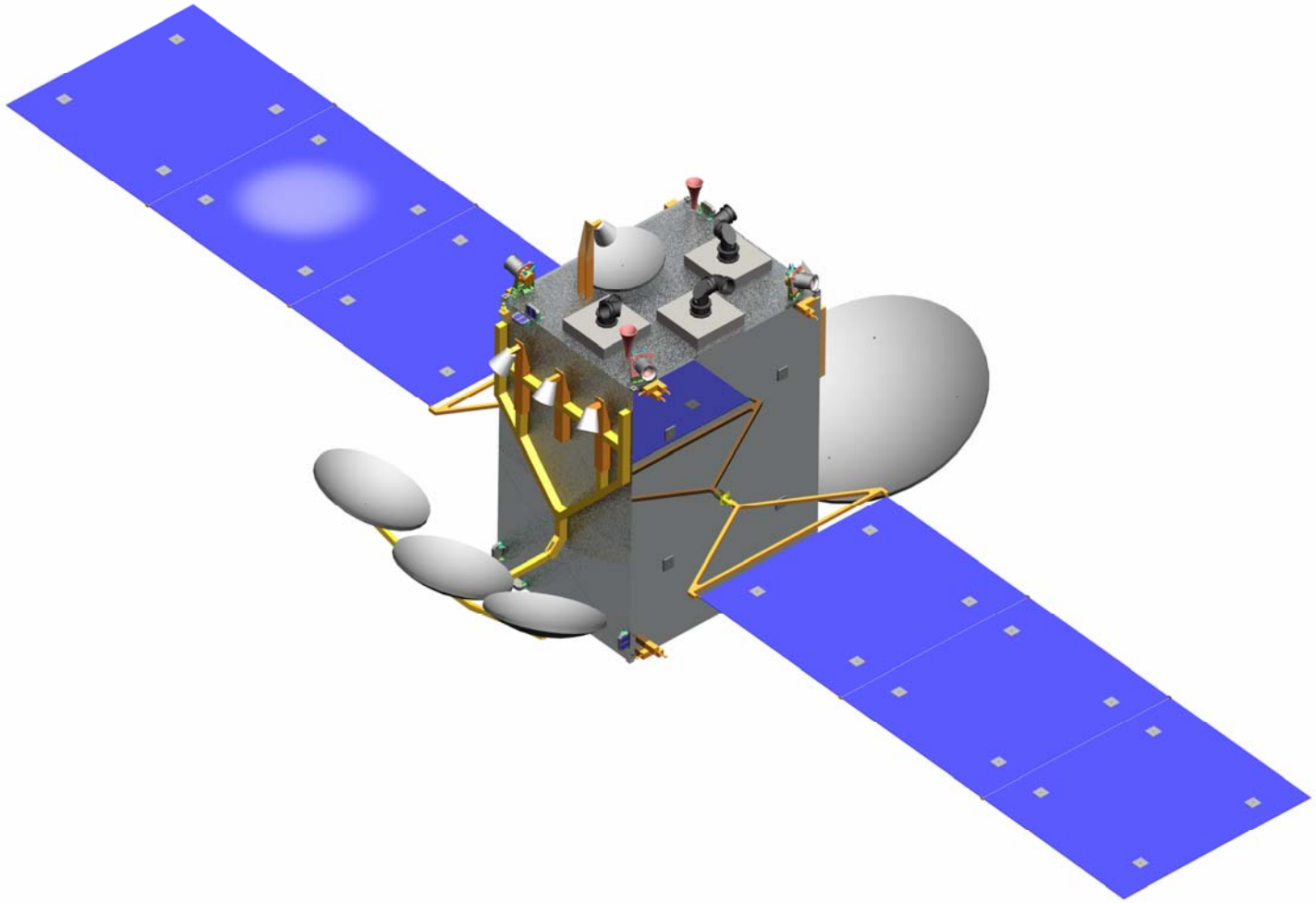
4) Data Relay Satellite

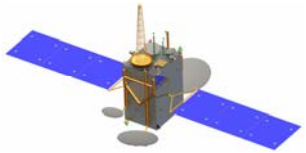
Overview

- Provides real time data from earth observation satellites (in LEO) or from Unmanned Aeronautical Vehicles (UAV)
- Reduces on-board storage capability requirements for earth observation satellites and reduces load on most popular used ground stations (e.g. Svalbard)
- May be used for commanding satellites
- 4 Ka-band links to UAVs
- 3-for-2 redundant Optical Inter-Satellite Link for high data rate communications with LEO satellites
- 1 Ka-band link to user Ground Station

4) Data Relay Satellite

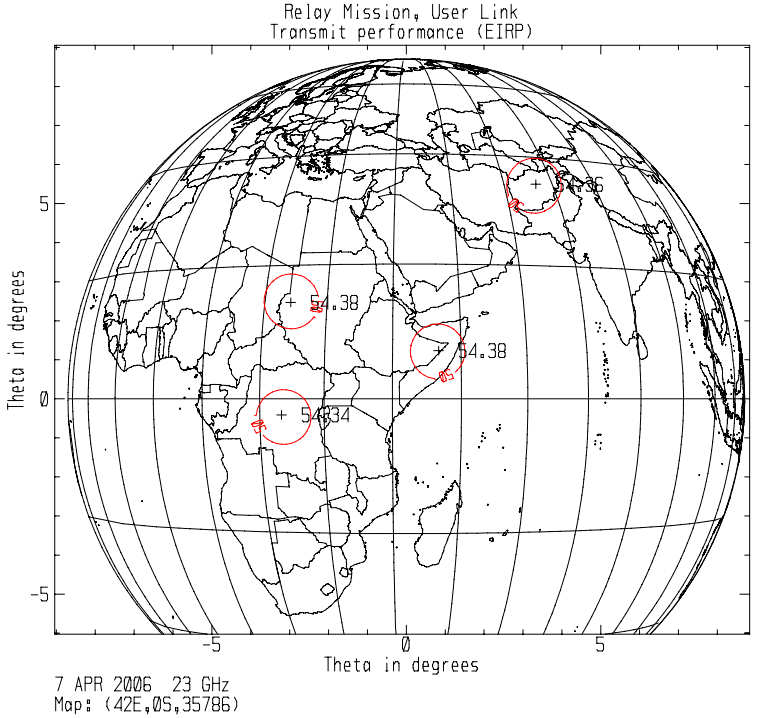
Payload
Accommodation



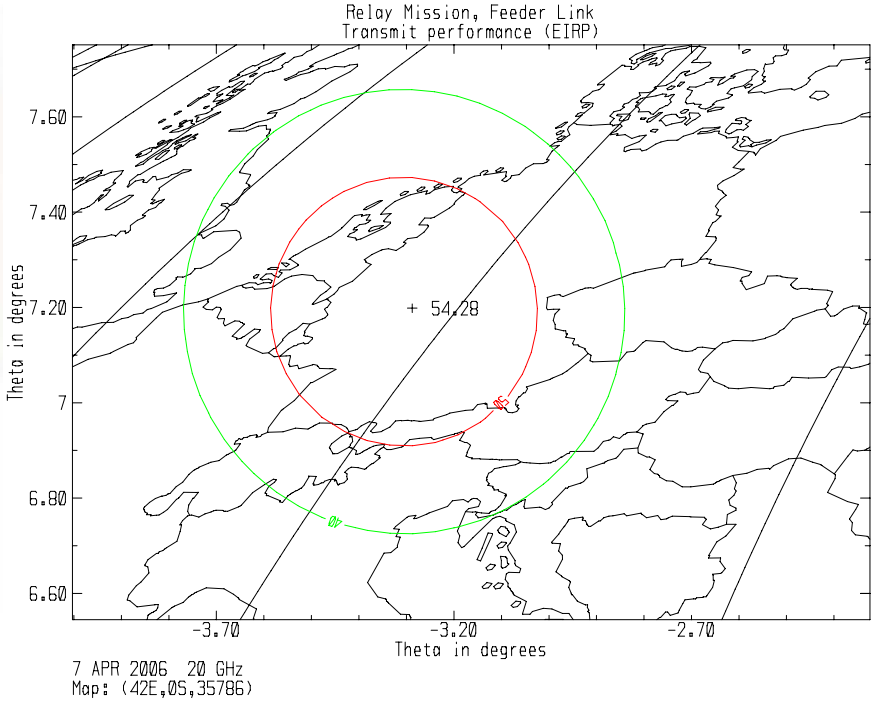


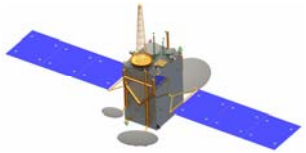
4) Data Relay Satellite

RF Inter-Orbit-Link
Service Area:
4 steerable Ka-band spot beams to UAVs



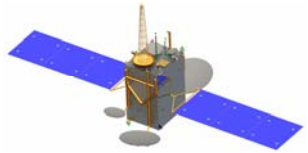
Feeder Link
Service Area:
1 steerable Ka-band user spot beam





Next program milestones in 2006

- Major Tasks for Phase A/Consolidation Study of the LUX concept in addition to normal work:
  - Study of Apogee Engine Module that can be removed from the satellite in a modular way (ongoing)
  - Baseline selection for station keeping propulsion system
  - Preparation of a Draft Payload Accommodation Handbook
- Start of Platform Definition (Phase B) Q4/2006



Point of Contact

SGEO Study and Project:

Andreas Winkler

OHB-System AG

Universitaetsallee 27-29, D-28359 Bremen, Germany

Tel. +49 421 2020-729, fax: -610

E-mail: winkler@ohb-system.de