The DLR Multi Mission EO Ground Segment

Payload Ground Segment

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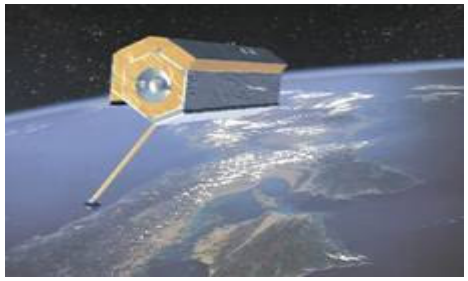
DLR Ground Segment for Earth Observation: Servicing GMES, national and commercial users

- One of the largest European earth observation data acquisition facility
  - optimal geographic position in Europe
  - and international station locations
- One of the largest European „Processing and Archiving Center“
  - National Missions
  - ESA MMFI, EUMETSAT/SAF
- Focus in ground segment engineering and development of multi mission infrastructures
  - Focus on national missions and GMES
- Strong relation to commercial partners

National Earth Observation Missions & Data Supply

- TerraSAR-X / TanDEM-X
  - PPP with ASTRIUM / Infoterra
  - Operations & Science Support at DLR
  - Set-up of global station network for TanDEM-X
- EnMAP
  - Science driven mission with hyperspectral instrument
  - National station Neustrelitz plus polar location
- Commercial Data with DFD Operations Support
  - IKONOS & GeoEye-1: European Space Imaging
  - IRS/ Indian; ResourceSAT and CartoSAT: Euromap
- Further national mission data
  - SRTM: X-Band global DEM
  - BIRD: Fire detection from space
  - CHAMP / GRACE
  - RapidEye: science data management

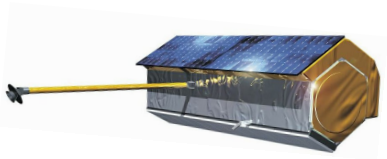


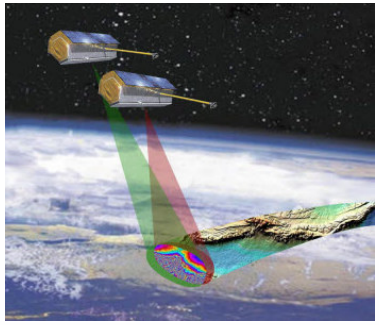
EnMAP
Hyperspectral Imager

EUROPEAN SPACE IMAGING
Visual Information. Visible Results.

“From Processor Development to Operations”

- Integration of data processors into multi mission ground segment
- Focus Payload Ground Segment
  - Multi mission infrastructure for data management and data reception
  - Engineering according international standards
  - Operations with highest possible/achievable degree of automation
  - Heritage of experience with ESA missions: ERS D-PAF, ENVISAT D-PAC, ESA MMFI
- Ground segment set up for national missions





EnMAP
Hyperspectral Imager

Functional Structure of the EO Ground Segment

Mission Operations

German Space Operations Center (GSOC)

- Satellite operations and control
- Mission planning and commanding
- Monitoring
- Flight dynamics

Payload Ground Segment

Cluster Applied Remote Sensing (DFD und IMF)

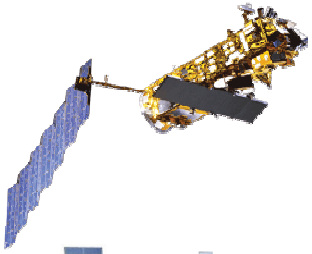
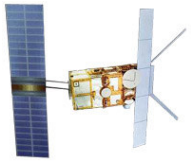
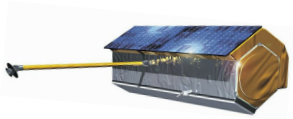
- User and service element interface
- Interface to mission planning
- Data reception and data circulation
- Processing, archiving and catalogue
- Product distribution

Instrument Operations and Calibration

Depending on instrument

- Instrument system engineering
- Instrument operations
- Calibration and long term monitoring

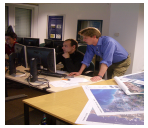
Missions, Facilities and Users








EO Satellites

Receiving Stations

Processing
Archiving
Distribution

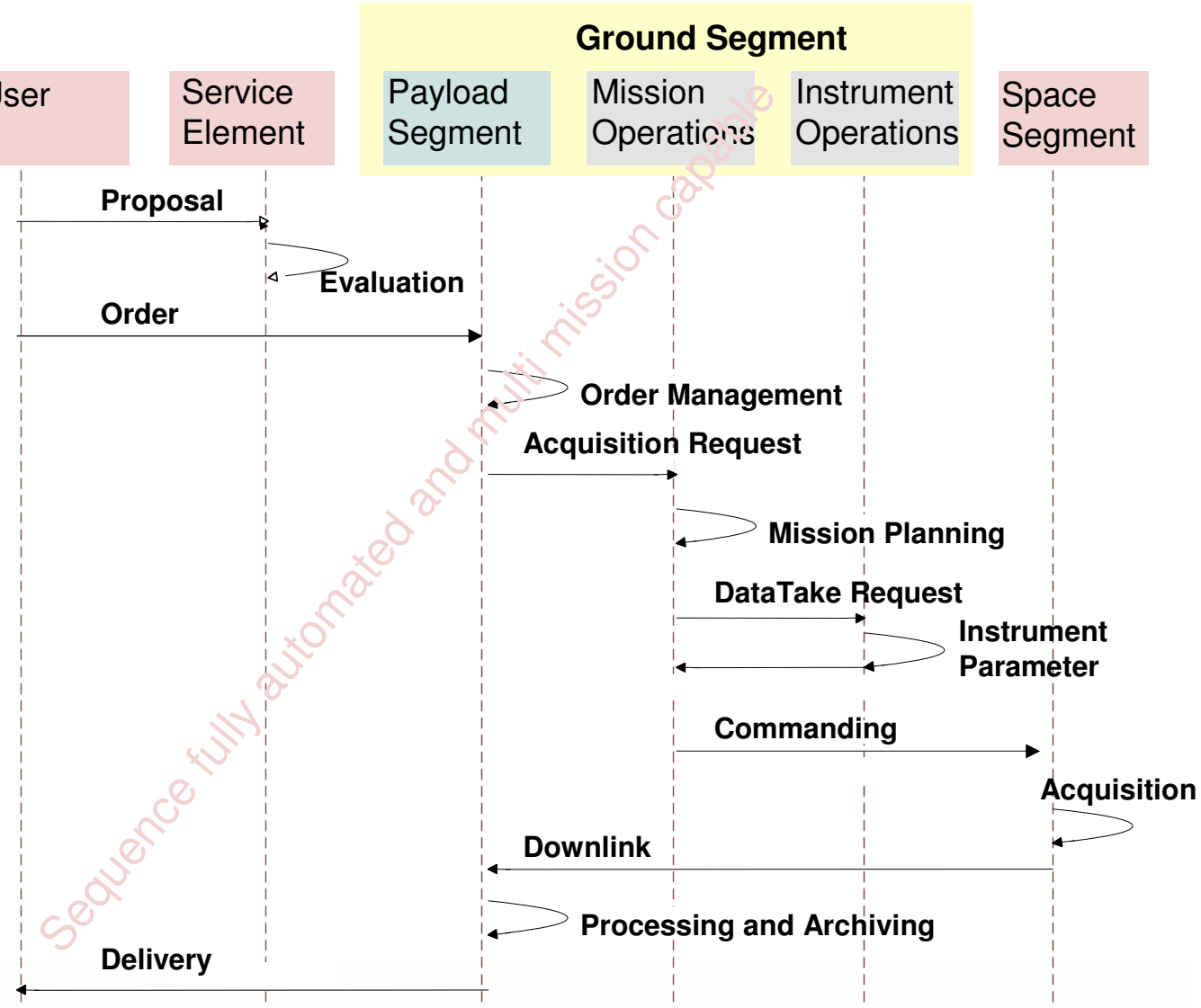
Service-Elements
& Users

Payload Ground Segment Engineering

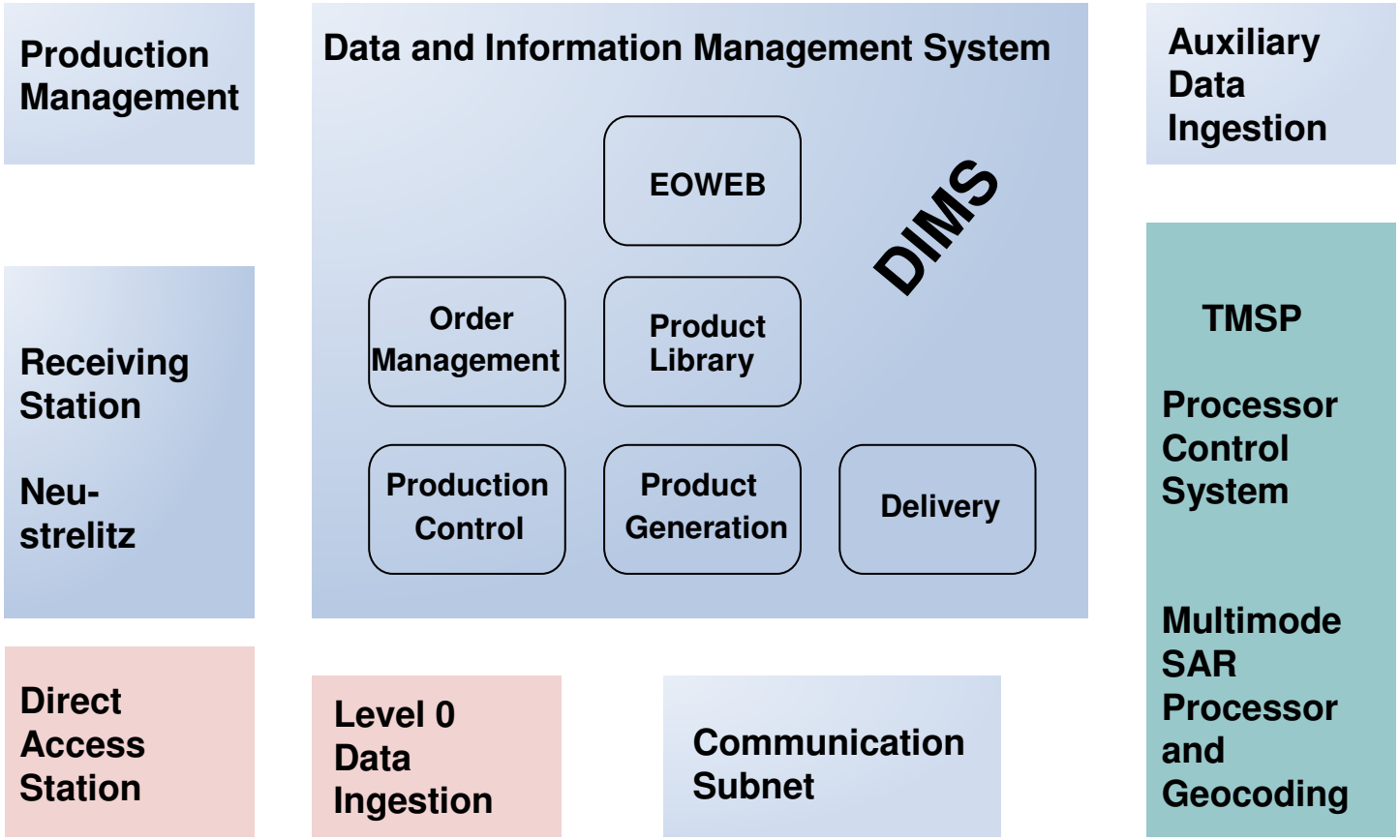
- Analysis of mission scenario
  - Order driven mission operations scenario
  - Data driven mission operations scenario with systematic acquisition
- Multi mission approach
  - Generic and missions specific elements
- Configuration of the generic multi mission elements
  - User services, archiving and cataloguing, data distribution and operations monitoring
- Integration of missions specific elements
  - Processing, scenario dependant workflow and workflow control
- To cost and in time

TerraSAR-X

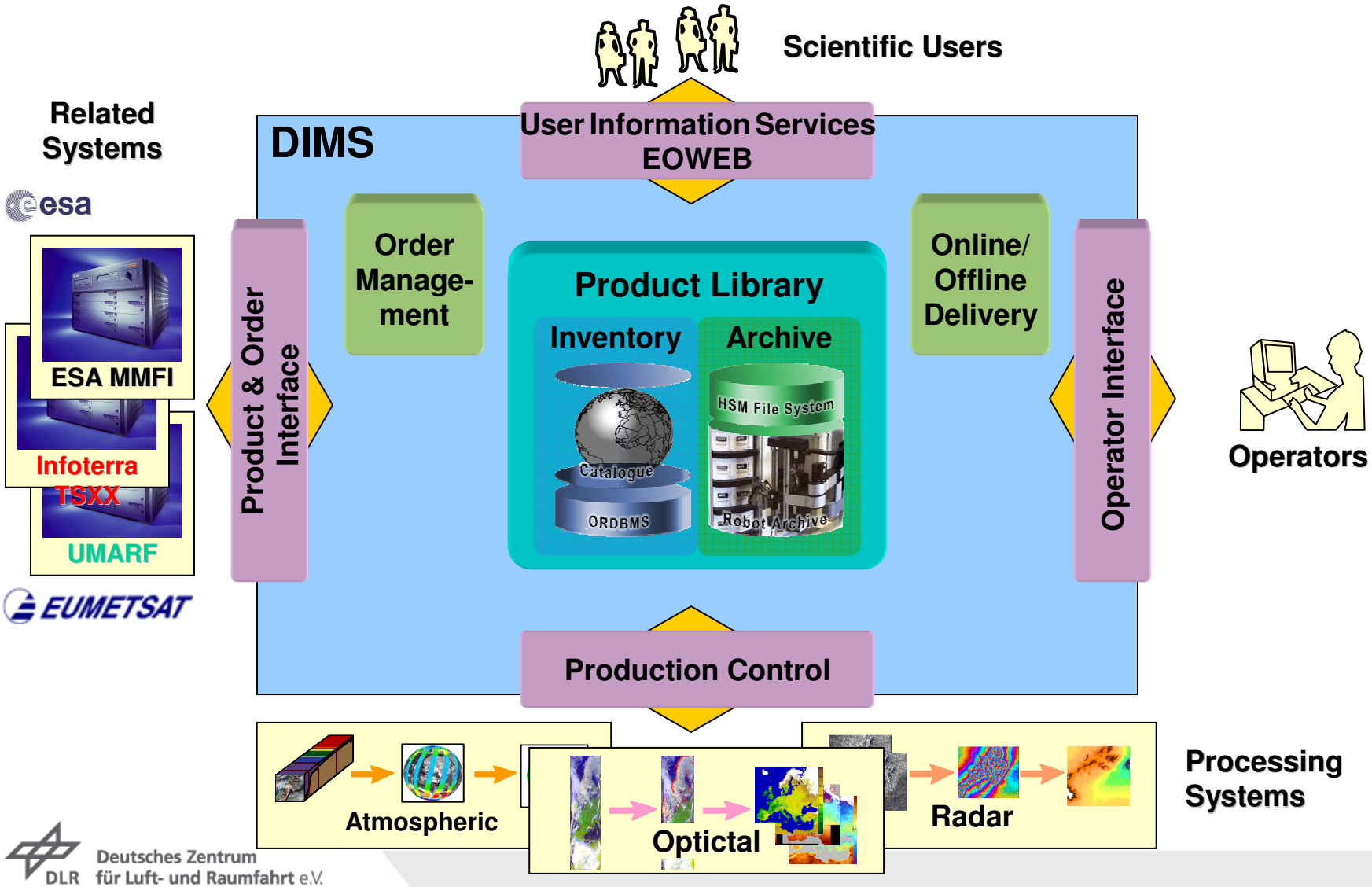
- Proposal submission
- Ordering
- Order handling
- Mission planning
- Instrument setting
- Commanding
- Data acquisition
- Data reception
- Data processing
- Product distribution



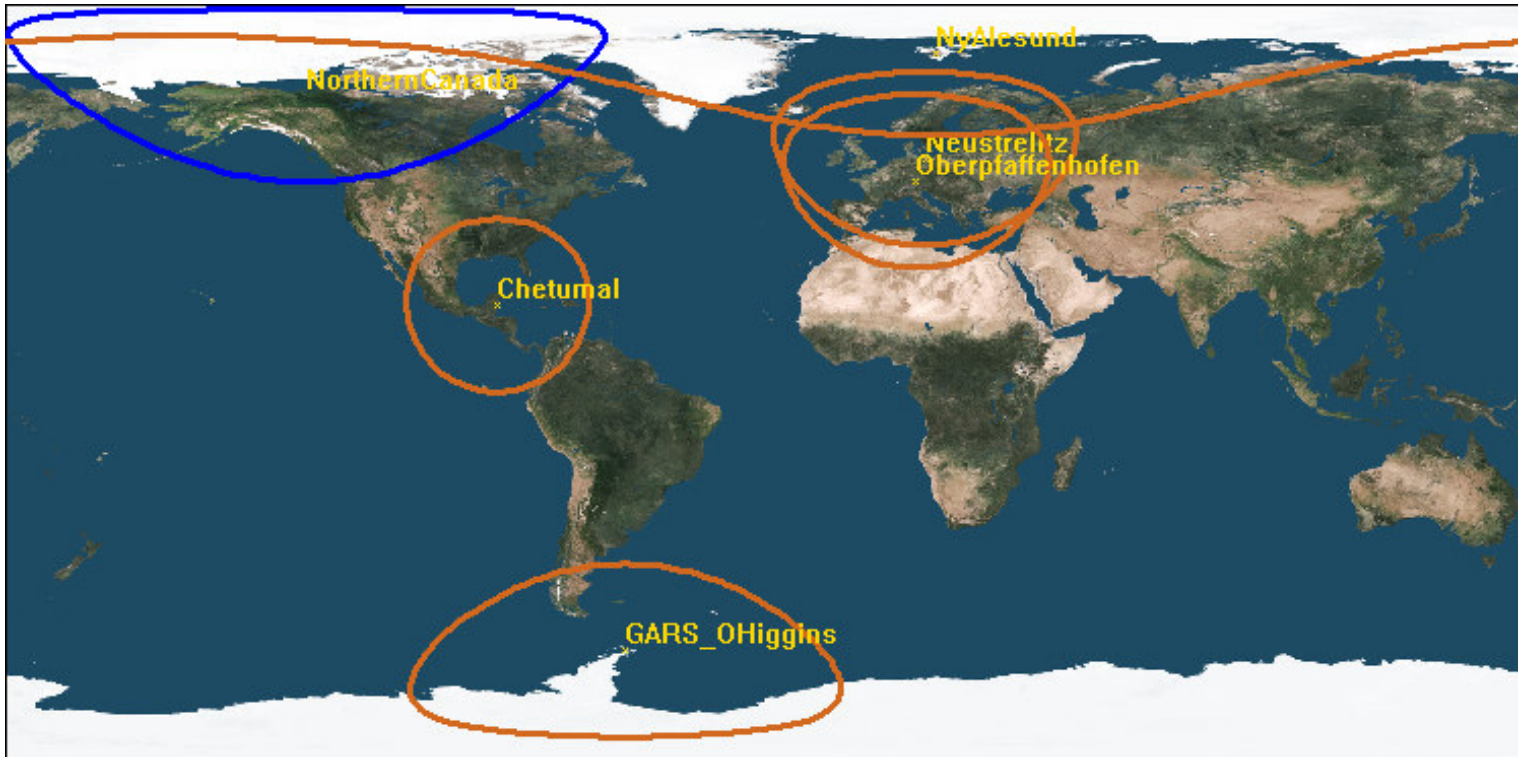
Subsystems of TerraSAR-X Payload Ground Segment



Data Management and Request Workflow: DIMS

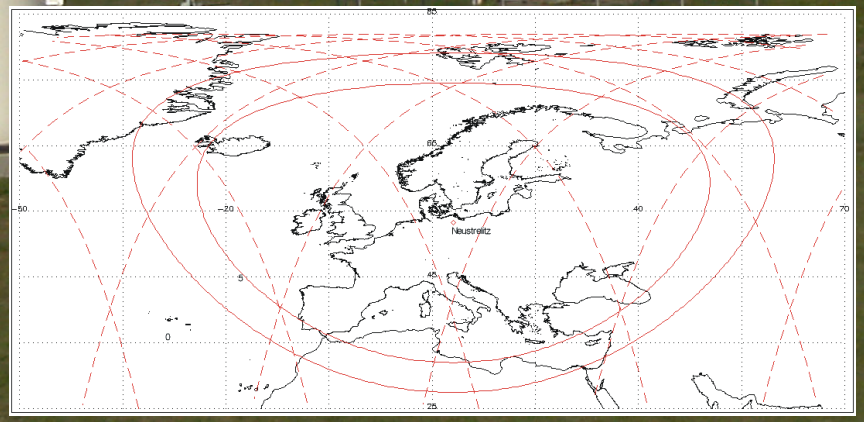


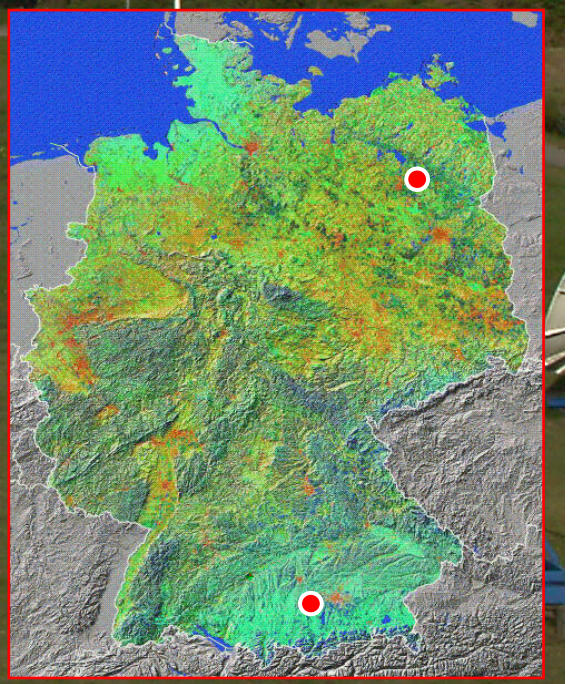
DFD Payload Ground Segment: Receiving Stations



Permanent	**Neustrelitz** (Germany)	3 LSX-band 7.3 m, LS-band 4.0 m, VHF
	Oberpfaffenhofen (Germany)	X-band 3.6 m, L-band 2.4 m, L-band 4.0 m X-band (5,6 m) for European Space Imaging
	O'Higgins (Antarctic)	LSX-band 9.0 m
	Chetumal (Mexico)	LSX-band 8.0 m
Transportable	**Ny Ålesund** (with GFZ, Spitzbergen)	S-band 4.0 m
In preparation	**Inuvik**	SX-band 9.0 m

Neustrelitz: major national site and NRT center





IKONOS Mobile ROC at DLR-Oberpfaffenhofen

International Stations I

Station Ny Alesund

78.9° N 11.9° E

German Antartic Receiving Station

63.3° S 57.9° W

International Stations II

Chetumal / Mexico

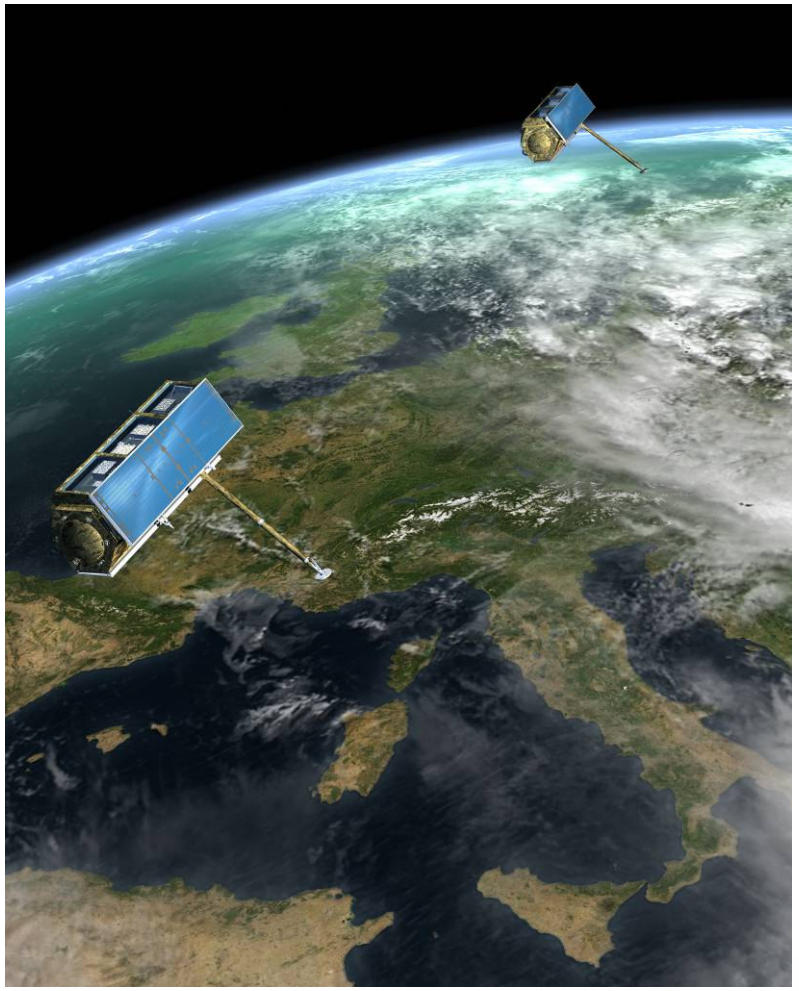
18.5° N 88.2° W

Satellite data received by DFD ground stations

- **In Neustrelitz**
  - **Ground stations primarily for high data rate reception in Europa**
    - **Landsat-7** (ESA-Earthnet)
    - **ERS-2, Envisat** (ESA, national)
    - **IRS-1C/IRS-1D** (Euromap) **IRS-P3** (Euromap, national)
    - **Champ, Grace** (national)
    - **BIRD** (national)
    - **Koronas-F** (national) **MarocTubsat** (national)
    - **Orbview-2** (Orbimage)
    - **TerraSAR-X** (national/Infoterra)
    - **IRS-P6** (Resource-Sat) **IRS-P5** (CartoSat, Euromap)
    - **ALOS** (ESA)
- **In Oberpfaffenhofen**
  - **Ground stations primarily for low data rate reception in Europa**
    - **NOAA, *Metop*** (national)
    - **Meteosat, *MSG*** (national)
    - **Terra, Aqua** (national, ESA)
    - **Ikonos** (European Space Imaging)
- **International stations network**
  - **Ground stations for missions and commercial customers**
    - **ERS-2, Landsat, IRS-1C/D, NOAA, Champ, Terra / Aqua, Envisat**

TanDEM-X

- Systematic acquisition as basis for production of global digital elevation model
  - Repeated acquisition of Earth land surface
  - No direct user orders
  - Generation of request workflow within ground segment
- Experimental modes
- Common space resources for TerraSAR-X and TanDEM-X mission goals
  - Common ground segment

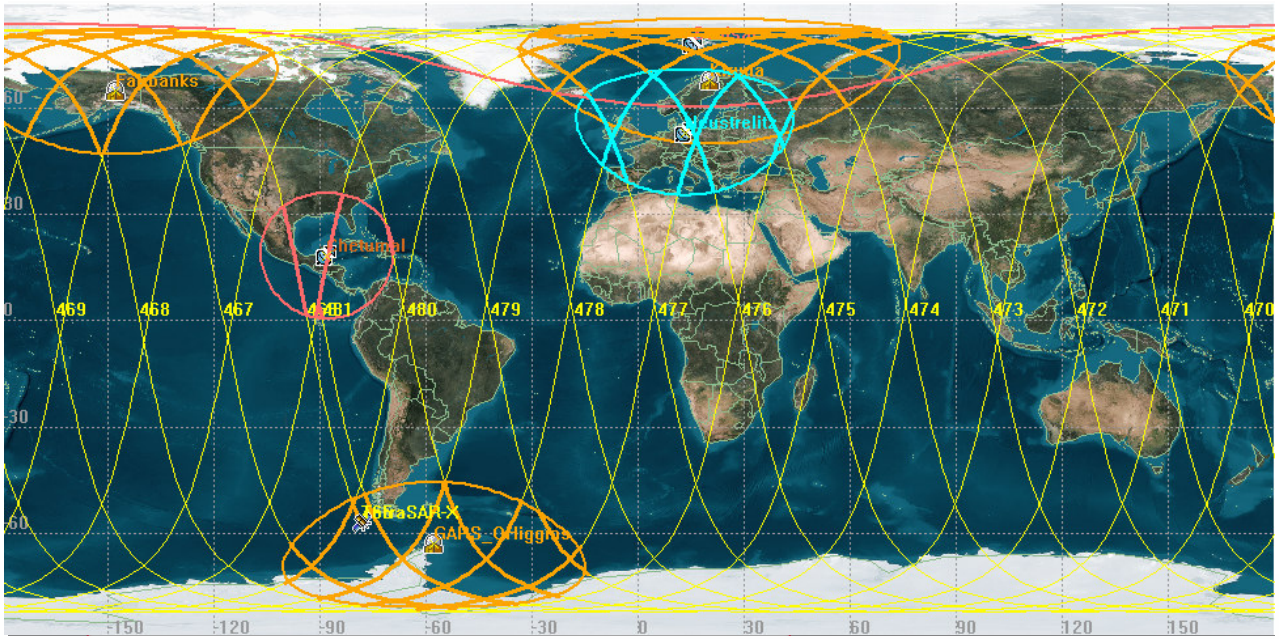


TanDEM-X Challenge for Ground Segment

- Integration of processing chain
  - Bi-static SAR-Processor
  - Multi-Baseline InSAR-DEM-Processor
  - DEM Calibration- und Mosaic-Processor
- Ground segment wide planning process
  - Different mission phases with different baselines in different geographic latitudes
  - „Production Planning“ and „Production Monitoring and Control“ as new components within the payload ground segment
- Extensive data volume
  - Data reception of about 350 GB data / day, together with TerraSAR-X up to about 500 GB data / day
  - TanDEM-X archive volume about 1.5 petabyte in 3 years

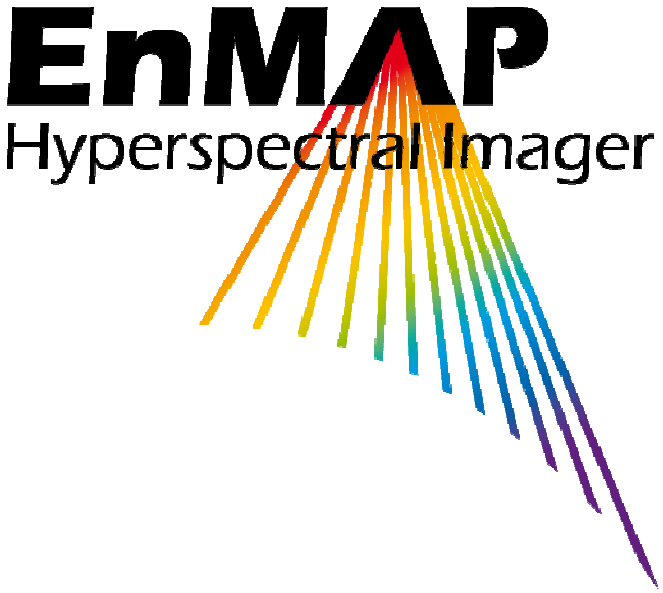
TanDEM-X Receiving Stations

- 300 MBit/s downlink capability as set by existing TerraSAR-X
- About 10000 s contact time for TanDEM-X mission with baseline of station locations Neustrelitz, O'Higgins, Kiruna and Fairbanks as "first guess"
- Additional contact time for TerraSAR-X direct access stations



EnMAP

- Current development status: end of phase B
- Data management and request workflow considers hyper spectral sensor
- Hybrid of systematic acquisition and user driven acquisition
  - “Instrument Planning”



Conclusion

- Multi mission approach well proven and also feasible for quite heterogeneous missions
- Multi mission kernel data management: DIMS
- Multi mission kernel data reception: network of national and international stations
- Usage of elements of multi mission infrastructure or their further development in cooperation for mutual advantage like the antenna in Chetumal

Many thanks for your attention,

… any kind of further discussion, comments or questions are welcome!