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
“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
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  |  Service-Elements & Users
                |                      |  Archiving  |  
                |                      |  Distribution  |  

Deutsches Zentrum für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft
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

Sequence fully automated and multi mission capable
Subsystems of TerraSAR-X Payload Ground Segment

- Production Management
- Receiving Station Neustrelitz
- Direct Access Station
- Data and Information Management System
  - EOWEB
  - Order Management
  - Product Library
  - Production Control
  - Product Generation
  - Delivery
- Communication Subnet
- Auxiliary Data Ingestion
  - Level 0 Data Ingestion
  - TMSP
    - Processor Control System
  - Multimode SAR Processor and Geocoding
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
- **Ny Álesund** (with GFZ, Spitzbergen)
  - S-band 4.0 m

**Transportable**
- **Inuvik**
  - SX-band 9.0 m

**In preparation**
- **GARS_OHiggins**
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 Antarctic 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)
    - Champ, Grace (national)
    - BIRD (national)
    - Koronas-F (national)
    - Orbview-2 (Orbimage)
    - TerraSAR-X (national/Infoterra)
    - IRS-P6 (Resource-Sat)
    - ALOS (ESA)
    - IRS-P3 (Euromap, national)
    - MarocTubsat (national)
    - MarocTubsat (national)

- **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!