TerraSAR-X
Products, Services, and Applications

UN-OOSA, 5th Industry Symposium
Vienna, 20 February 2006
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Issue: Cloud Cover, Complementarity
Regional Advantage of Radar

World-wide Cloud Cover Prevalence (8 year mean average)

Cloud Amount (%)

Current Mapping Status

North America
South America
Europe
Africa
CIS
Asia
Australia / Oceania
Commercial Services

- TerraSAR-X Program
  - implemented by a German public private partnership (PPP, 2002)
  - Parties: EADS Astrium GmbH and German Aerospace Centre (DLR)

- Infoterra GmbH
  - created in 2000 to structure and market TerraSAR
  - 100% subsidiary of EADS Astrium GmbH
  - exclusive world-wide commercial tasking / data rights for TerraSAR-X

- Commercial data will be available Dec 2006, for > 10 years

- 1st Subscription Contract signed for Japan (February 2005)

Global Monitoring of Environment and Security (EU, ESA)
We are addressing the “E” and the “S” in GMES
Production Experience

Air- or Spaceborne Survey

SAR Processing

INSAR Processing

DEM Generation

Ortho - Rectification

Image Interpretation

Height Modelling

GIS Application

Source Data Acquisition

Radar Images

Interferogram

DEM

Ortho - rectified Image Map

Thematic Map

Vector Map

• Repeat Pass (2007)
• TanDEM-X (2009)

• Ground Survey
• DEM Data Base

Contour Map
Heritage in Airborne SAR Mapping

Protected Forest Indonesia

- Airborne single-pass SAR interferometry 1996 (DoSAR, X-band)
- Resolution
  - Imaging up to 0.8 m
  - Height up to 0.1 m
- 300,000 km² with 20,000 km² per week
- Near real-time digital processing up to final map printouts
Heritage in SAR Application: Topo Mapping

- 260,000 km² airborne INSAR mapping in Venezuela
- Radar-orthoimages and topographic maps 1:50,000
- In-country production 05/2003 – 12/2003, 520 map sheets
- P&X-Band survey:

- P-Band DTM
- X-Band DEM
TerraSAR-X Radar-Modes

**SpotLight mode**
- 5/10 km x 10 km
- 1 m resolution

**StripMap mode**
- 30 km swath
- 3 m resolution

**ScanSAR mode**
- 100 km swath
- 16 m resolution

**Dual receive antenna mode**
- along-track interferometry
- Moving Target Identification
TerraSAR-X Operational Flexibility
TerraSAR-X Image Simulation

Autobahn bridge
Bad Neuenahr/Ahrweiler
XHH

Man made targets
can be identified
(bridge pillars, railway, industry, housing)

1m resolution
TerraSAR-X Image Simulation (Solothurn)

Possible interpretation:
- rivers
- forest/non-f.
- cities
- major roads
- coast lines

16m resolution
TerraSAR-X Image Simulation (Solothurn)

Railway Station, Bridges, Landcover
SpotLight Mode vs. Aerial Photo

Solothurn, CH

Urban mapping application.

Comparison to aerial image data.
Metal roofs and structures along the railway tracks clearly stand out.
Polarimetric Products

Full polarimetric Image (RGB: HH/HV/VV)

Automated Classification
- water: blue
- grass: green
- forest: yellow
- bare soil: purple
- urban: red
TerraSAR-X Products and Services

- **Basic Products (Level 1B)**
  - Spotlight (up to 1 m resolution)
  - Stripmap (up to 3 m resolution)
  - ScanSar (up to 16 m resolution)

- **Enhanced Image and Geoinformation Products**
  - Orthorectified Images
  - Mosaic, Oriented Images
  - Orthomap
  - Coherent Change Detection (CCD), Subsidence Map (mm vertical accuracy)

- **Basic Applications *)**
  - DEM, GCP
  - Regional monitoring
  - Land Use/Land Cover Maps
  - Topographic Base Maps
  - Ship Detection, etc.

- **Services (Direct Access, Training)**

*) direct or thru/with partners
Direct Access Service

- Most direct means to receive TerraSAR-X
- Certified processor and equipment in terminal ensures best performance
- TerraSAR-X terminal operator training
- Multimission station upgrade, or Station setup support
- Service and terminal maintenance
- Upgrade and enhancement packages
Data Security Policy

- German data security policy for EO satellite data is being established as a federal law

- Objectives:
  - Avoid any threats or hazards for national security and security of other nations
  - Support commercialization by defining reliable and transparent policies
  - Guarantee positive control over “high quality” satellites

- Implementation by Infoterra GmbH through sensitivity check
  - Customer
  - Observation Area
  - Delivery Time
  - Technical Product Parameters

- Final Judgement by German governmental body (sensitivity case)
TerraSAR-X Commercial Applications
Example: Very High Resolution Imagery

Test Site: Oberpfaffenhofen (1,5 m resolution)

⇒ Security Applications
Example: Topographic Mapping

SAR Image

SAR image superimposed with topo. map

Topographic Maps
© Bundesamt für Landestopographie (Schwitzerland)

⇒ Survey Authorities
Example: Land Cover Change

Customer specific change detection:

Change probability map

⇒ Environmental Control Reporting
Example: Urban and Regional Planning
Example: Base Mapping of Rural Areas

TerraSAR-X

Multitemporal images
- Sept.00 (red)
- March01 (green)
- May01 (blue)
Example: Agri/Environmental Application

Stand density map
Results of stand density modelling on Flight 3 data (acquired June 2001) at test site Neezow:

- Field borders
- Stand density
  - Very high
  - High
  - Medium
  - Low

UTM WGS84
Zone 33N

0 500 Meters

⇒ Fungicide Application
Example: Timber Volume Map

High timber volume areas and topography
Kirkkonummi test site

Legend
High volume areas, m³/ha
- 200 - 249
- 250 - 280

Base map with topography
Topographic maps 2041 and 2002
- Agricultural areas
- Water

Scale
500 0 1000 1500 Meters

Overview Map
Finland

→ Forest Harvesting
Example: Flood Mapping

Flood extent map superimposed with land use map

Insurance Application:
- Risks
- Claims

⇒ Mission Planning / Claims Management
Example: Fire Damages

Pre-fire situation

Damage extent

Post-fire situation

Sensor: SIR-C/X-SAR
Images: X-SAR, VV-polarisation
Acquisition: April, 14 1994
May, 05 1994
Location: Catalunya/Spain
Material: © DLR
Example: Marine Applications

Natural Oil Seeps

Drift

Ship Pollution

Pollution trail

Ship

Rig Pollution

Wind

Pollution slick

Rig
Conclusion

- Weather independence, complementary timing
- 1 meter resolution
- Multi modes
- Acquisition flexibility
- Quick global access
- High productivity
- Sustainability
- Secrecy

TerraSAR-X provides unique space imagery from 2006

www.terrasar.de