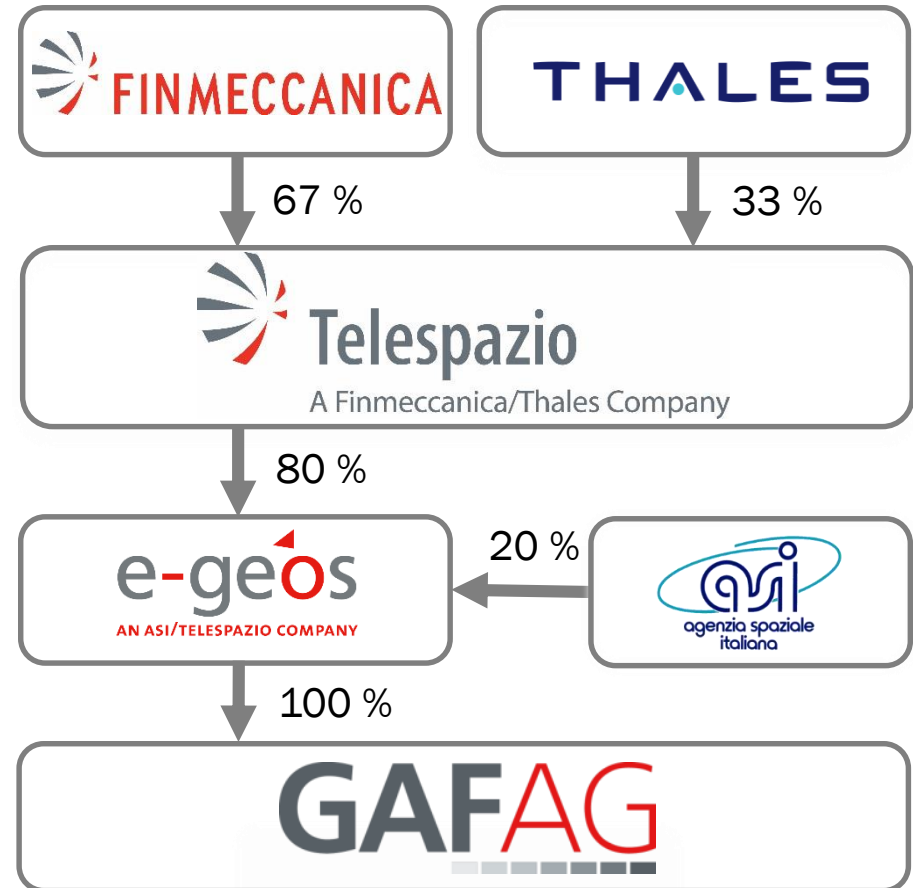# GAF AG
# Commercial Geodata Provider Activities

Jörn Reike

**Head of Image Interpretation Group (Value Adding Services)**

**23.09.2015**

- **1985**: GAF GmbH founded in Munich

- **1996**: Euromap GmbH founded in Neustrelitz

- **2001**: GAF transformed into a limited, public stock company, GAF AG

- **2003**: Telespazio holds majority of shares of GAF AG

- **April 2014**:  Euromap GmbH and GAF AG merged

- **Today:** altogether > 200 staff members in Munich (GAF Headquarter) and Neustrelitz (GAF Branch)

**FINMECCANICA** → 67 %

**THALES** → 33 %

**Telespazio** *A Finmeccanica/Thales Company* → 80 %

**e-geos** AN ASI/TELESPAZIO COMPANY ← 20 % **agenzia spaziale italiana**

→ 100 %

**GAFAG**

GAFAG

- Wide range of services, e. g. for:

  - Agriculture
  - Forestry
  - Nature Conservation
  - Water Management
  - Mineral Sector
  - Land Management
  - Coastal Zone Management
  - Defense/Security

- 30 years experience and world wide activities
- > 100 countries and > 500 Projects

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# Geo-Data Store

- EO data images and products
- Digital elevation models
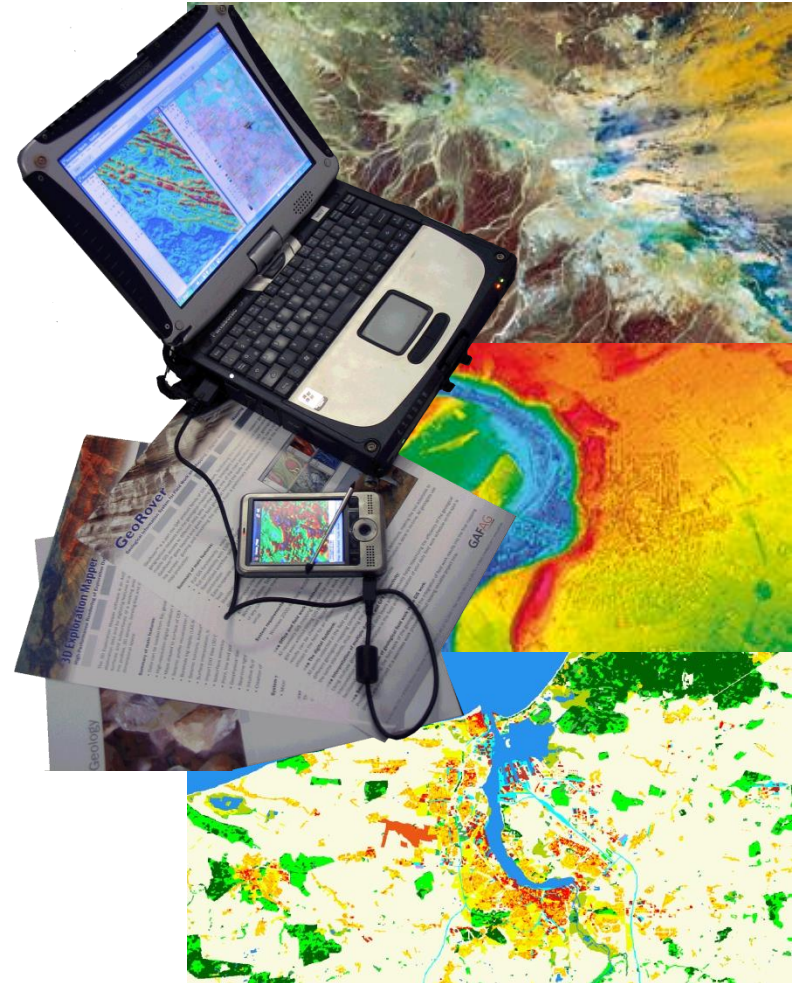- Land use and land cover data

# Data Processing

- Orthoimage production
- Digital image processing and analysis
- Mapping and monitoring
- Digital cartography and map production
- Virtual reality (3D)

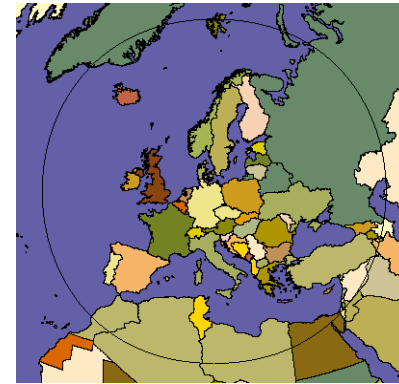# Information Systems

# Software Development

# Consulting

■ **Data reception / Data distribution**

- Indian Remote Sensing (IRS) Satellites: exclusive distribution rights for central Europe
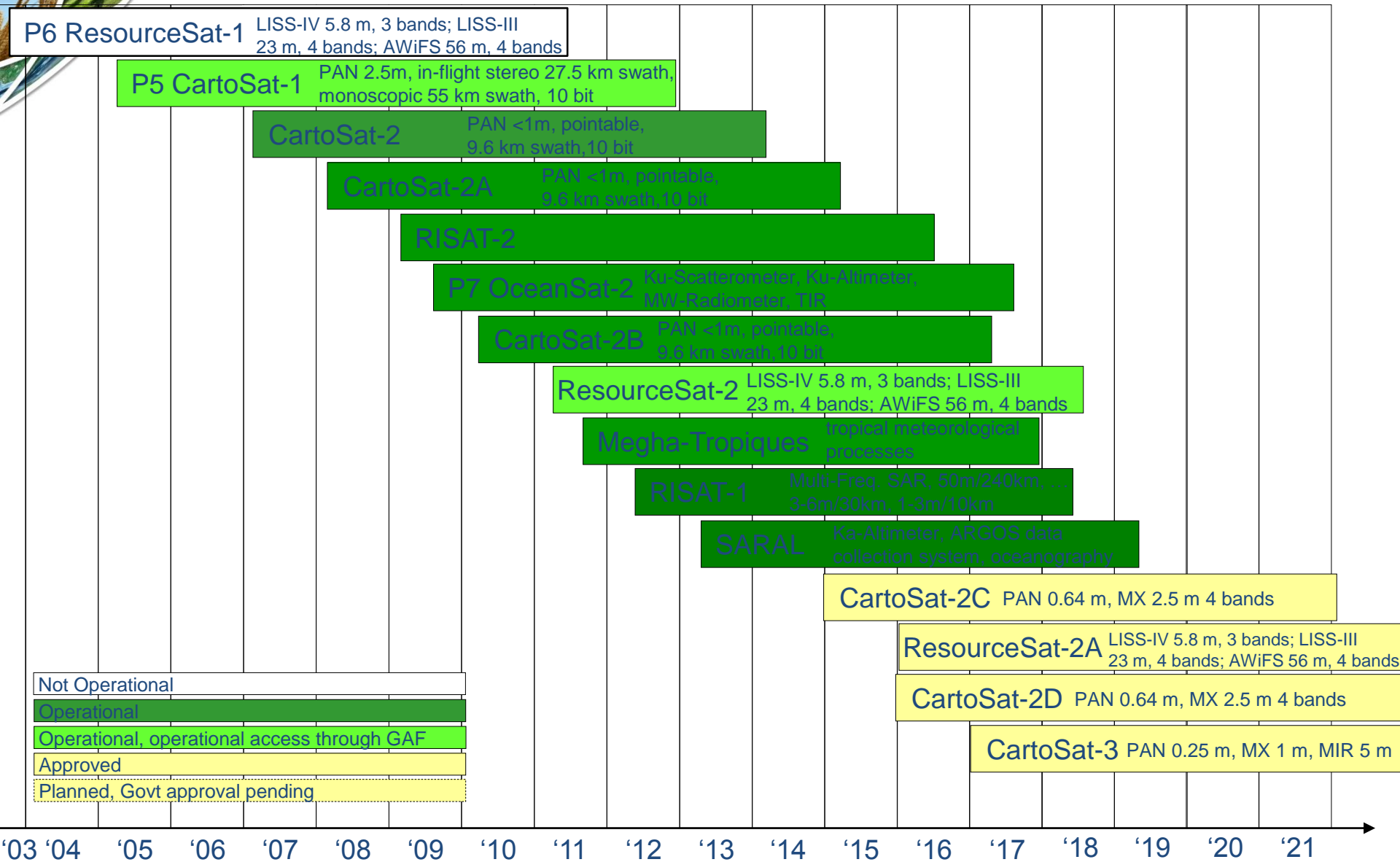
  - **Resourcesat-2**

    - LISS-IV, LISS-III, AWiFS

  - **Cartosat-2**

    - PAN

  - **IRS-P5 Cartosat-1**

    - PAN-Fore, PAN-Aft

  - **IRS-P6 Resourcesat-1**

    - LISS-IV, LISS-III, AWiFS

  - **IRS-1D**

  - **IRS-1C**



© DLR Neustrelitz

© Antrix, distributed by GAF AG Branch Neustrelitz

P6 ResourceSat-1 — LISS-IV 5.8 m, 3 bands; LISS-III 23 m, 4 bands; AWiFS 56 m, 4 bands

P5 CartoSat-1 — PAN 2.5m, in-flight stereo 27.5 km swath, monoscopic 55 km swath, 10 bit

CartoSat-2 — PAN <1m, pointable, 9.6 km swath, 10 bit

CartoSat-2A — PAN <1m, pointable, 9.6 km swath, 10 bit

RISAT-2

P7 OceanSat-2 — Ku-Scatterometer, Ku-Altimeter, MW-Radiometer, TIR

CartoSat-2B — PAN <1m, pointable, 9.6 km swath, 10 bit

ResourceSat-2 — LISS-IV 5.8 m, 3 bands; LISS-III 23 m, 4 bands; AWiFS 56 m, 4 bands

Megha-Tropiques — tropical meteorological processes

RISAT-1 — Multi-Freq. SAR, 50m/240km, ... 3-6m/30km, 1-3m/10km

SARAL — Ka-Altimeter, ARGOS data collection system, oceanography

CartoSat-2C — PAN 0.64 m, MX 2.5 m 4 bands

ResourceSat-2A — LISS-IV 5.8 m, 3 bands; LISS-III 23 m, 4 bands; AWiFS 56 m, 4 bands

CartoSat-2D — PAN 0.64 m, MX 2.5 m 4 bands

CartoSat-3 — PAN 0.25 m, MX 1 m, MIR 5 m

**Legend:**
- Not Operational
- Operational
- Operational, operational access through GAF
- Approved
- Planned, Govt approval pending

Timeline: '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16 '17 '18 '19 '20 '21

Source: Antrix Jul 2013, NRSC Feb 2012, press releases

Geodata

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# (nonexhaustive) Selection of Earth Observation

## Optical Systems

**Radar Systems**

*Resolution > 1m*

- SPOT-5
- Aster
- IRS P5
- Rapideye
- ResourceSat-2
- SPOT-6/7
- Landsat-8
- ZY-3
- CBERS-4B
- Sentinel-2A (2015)
- ALOS-3 (2016)
- EnMAP (2018)

*Resolution < = 1m*

- Ikonos
- EROS-B
- Kompsat-2
- WorldView-1
- GeoEye-1
- WorldView-2
- Pléiades-1A/1B
- Kompsat-3 & 3A
- SkySat-1/2
- Deimos-2
- WorldView-3
- Asnaro-1
- WorldView-4 (2016)

- ERS / Envisat
- SRTM
- ALOS PALSAR
- Radarsat-2
- Cosmo-Skymed
- TerraSAR-X
- TanDEM-X
- Sentinel-1A
- Kompsat-5
- ALOS-2
- PAZ (2015)
- Sentinel-1B (2016)
- RCM (2018)

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30 m
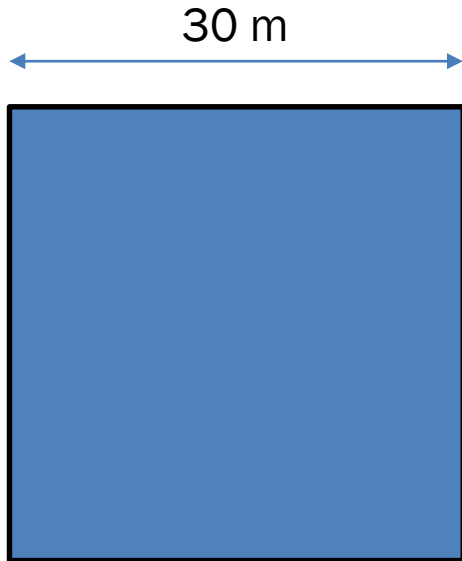
Example: Increasing Spatial Resolution (Munich)

Landsat TM: 30 m, Natural Color

Scale:
1 : 100.000

**To be continued...**
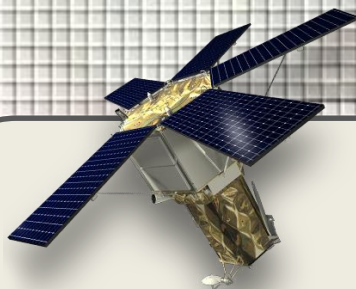


**2016**

**DigitalGlobe**
WorldView-4
30 cm ?
25 cm ?

**2017**

**ImageSat**
EROS-C
30 cm ?

**2018**

**IRS**
CartoSat-3
25 cm

## Multi- and Superspectral Systems:

RapidEye: B, G, R, RedEdge, NIR

WorldView-2: Coastal, B, G, Yellow, R, RedEdge, NIR, NIR2

Landsat-8: Violet, B, G, R, NIR, Cirrus, SWIR1, SWIR2, TIR1, TIR2

*WorldView-3: Coastal, B, G, Yellow, R, RedEdge, NIR, NIR2, 8 x SWIR, 12 x CAVIS*

*Sentinel-2: B, G, R, 4 x RedEdge, NIR, 2 x SWIR, 3 x ATM-Corr*

## Hyperspectral Systems:

*EnMap: 228 Bands, 30m Resolution, Launch: 2018*

*Alos-3: HISUI 185 Bands, 30m Resolution, Launch: 2016*

*IRS HySIS: 272 Bands, 30m Resolution, Launch: 2016*

Geodata

© DigitalGlobe, WV2

**GAF AG**

### Existing, or planned Constellations:

*RapidEye:* 5 Satellites

*AirbusDS:* Spot6/7 and Pléiades-1A/1B

*Skybox:* 24 SkySat Satellites

*Airbus/hisdeSAT:* TerraSAR-X, TanDEM-X and PAZ

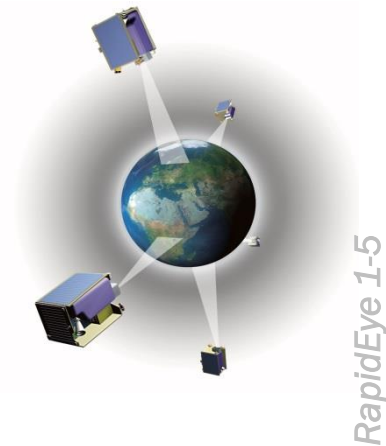*Planet Labs:* HR-Satellite Swarm 28+ Cubesats

*OmniEarth: 18 HR-Satellites from 2016*

*Dauria/Deimos: 8 HR-Satellites from 2016*

*BlackSkyGlobal: ? Satellites from 2015*

*CanadianSpaceAgency: 3 x Radarsat from 2018*

*RapidEye+: 5 HR/VHR-Satellites from 2019*



RapidEye 1-5



SkySat 1-24

7:00 am
8:00 am
9:00 am
10:00 am
11:00 am
Noon
1:00 pm
2:00 pm
3:00 pm
4:00 pm
5:00 pm

(2017)

SkySat-1 (2013)
SkySat-2 (2013)
SkySat-3 (2014)
Block 5 (#22-27) (2018)

Block 2 (#4-9) (2015)

Block 3 (#10-15) (2016)

Geodata

**GAFAG**
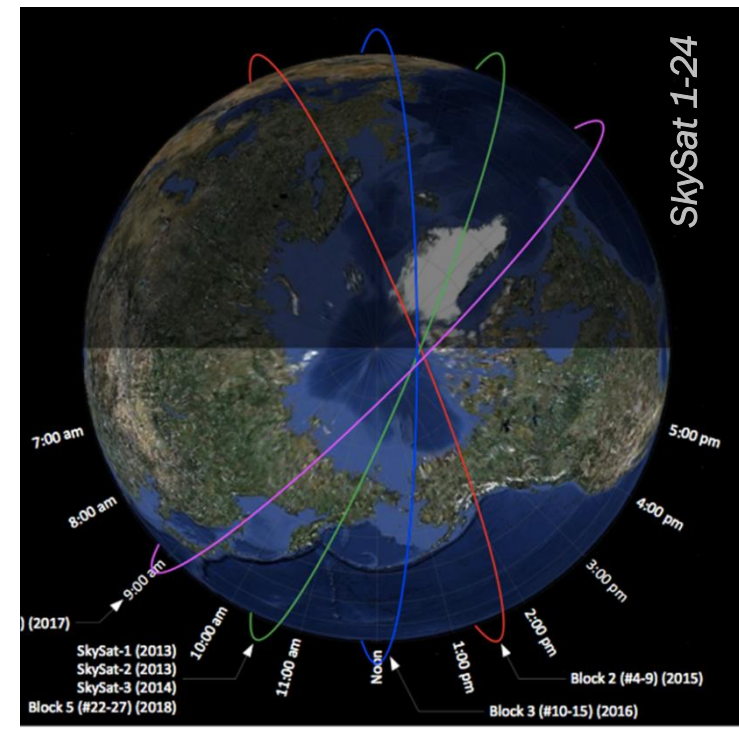
## Weight based Classification:

Source: Kramer & Cracknell, 2008

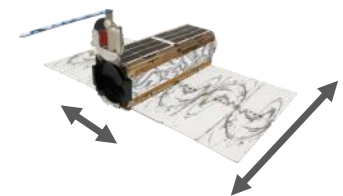| Large | > 1000 kg |
|-------|-----------|
| Mini | 100 - 1000 kg |
| Micro | 10 – 100 kg |
| Nano | 1 – 10 kg |
| Pico | 0.1 – 1 kg |

WorldView-2



4,3 m

2,5 m

2800 kg

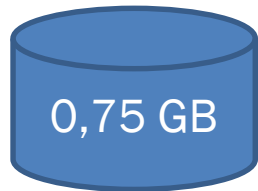Pleiades-1a



2,6 m

1,2 m

900 kg

SkySat-1



60 cm

120 kg

Flock-1



10x10x30 cm

5 kg

Example – Disk Space for 10 km x 10 km VHR:

| 0,75 GB | 2,98 GB | 4,66 GB | 8,28 GB |
|---------|---------|---------|---------|
| **IKONOS** | **GeoEye-1** | **GeoEye-1** | **WorldView-3** |
| 1 m | 0,5 m | 0,4 m | 0,3 m |
| 4 Bands | 4 Bands | 4 Bands | 4 Bands |
| 16 bit | 16 bit | 16 bit | 16 bit |

Upcoming Scenarios: more Bands (WorldView-3), increased Resolution (WorldView-4 0,25 m?), Monitoring (using Constellations), Videos …

**GAF**AG

## GAF AG – 30 Years of Experience in Commercial Satellite Imaging



- 12/7 Geo-Data Help-Desk



- 24/7 Rush-Data / Mapping
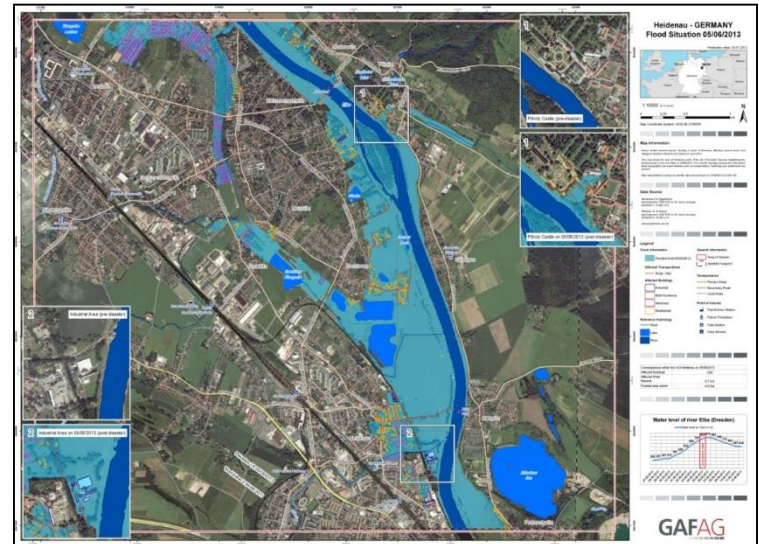
Geodata          Copernicus Emergency Management Service - Mapping

■ **Value Added Products**

**GAFAG**

Euro Maps 2D

- Ortho-mosaic, 5 m resolution

- Scale is up to 1 : 25,000
- Natural Color
  - color-matched and ortho-corrected

- 10 to 15 m positional accuracy CE90

- For visualizations and presentations
- Subsets are possible

## Euro 3 Maps D

- Digital surface model (DSM) derived from IRS-P5-Cartosat-1 Stereodata
  - scene-based: 27 x 27 km
  - tile-based: 0.5° x 0.5° tiles

- Product development based on longtime co-operation with Antrix and German Aerospace Center

- Good stereo archive data situation allows production of DSM product for large areas

- Derived products:
  - DSM (scene-based or mosaic)
  - ortho images
  - 3D-visualisations

Data: ANTRIX

Software: DLR

Production: GAF AG

Distribution: GAF AG
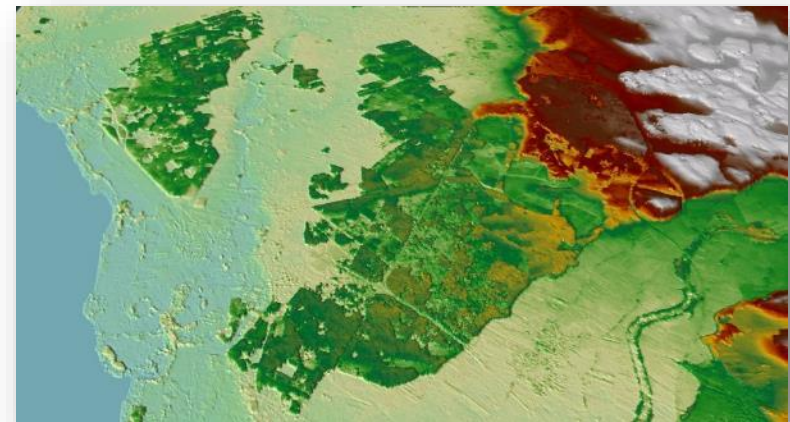


© 2014, GAF AG, includes Antrix material

Euro 3
Maps D

| Digital Surface Model<br>(incl. ortho image layer, quality and traceability layers) | Price per km² |
|---|---|
| Product < 50,000 km² | € 7.50 |
| Product > 50,000 km² | € 4.50 |

1) Minimum AOI size is 700 km²
2) Minimum width of the AOI is 14 km

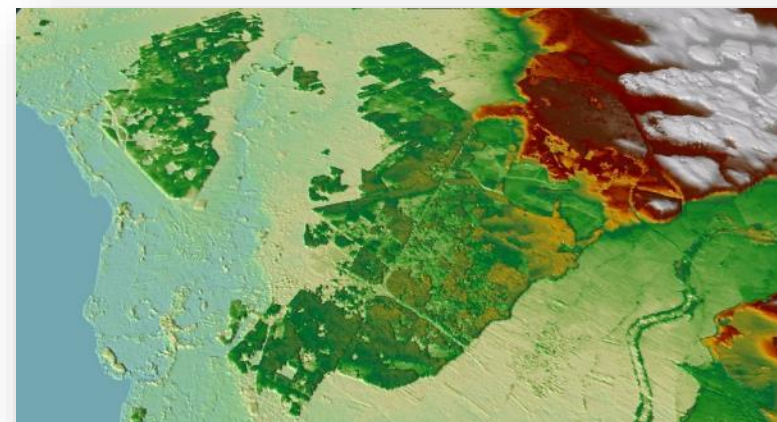See also: http://euro-maps.gaf.de/products/prod_001.html

Data: ANTRIX

Software: DLR

Production: GAFAG
Branch Neustrelitz

Distribution: GAFAG
an e-GEOS (ASI / Telespazio) Company



© 2014, GAF AG, includes Antrix material

# Euro-Maps LC

**GAF AG**

- Land use and land cover mapping product
  - data base: IRS-P6 LISS-III

- Germany-wide, homogeneous

- 22 classes
- MMU (minimum mapping unit) 0.25 ha

- > 95 % accuracy per class
- positional accuracy CE90 15 m

- Updated 2014
  - Data base: Landsat-8
  - MMU: 1 ha
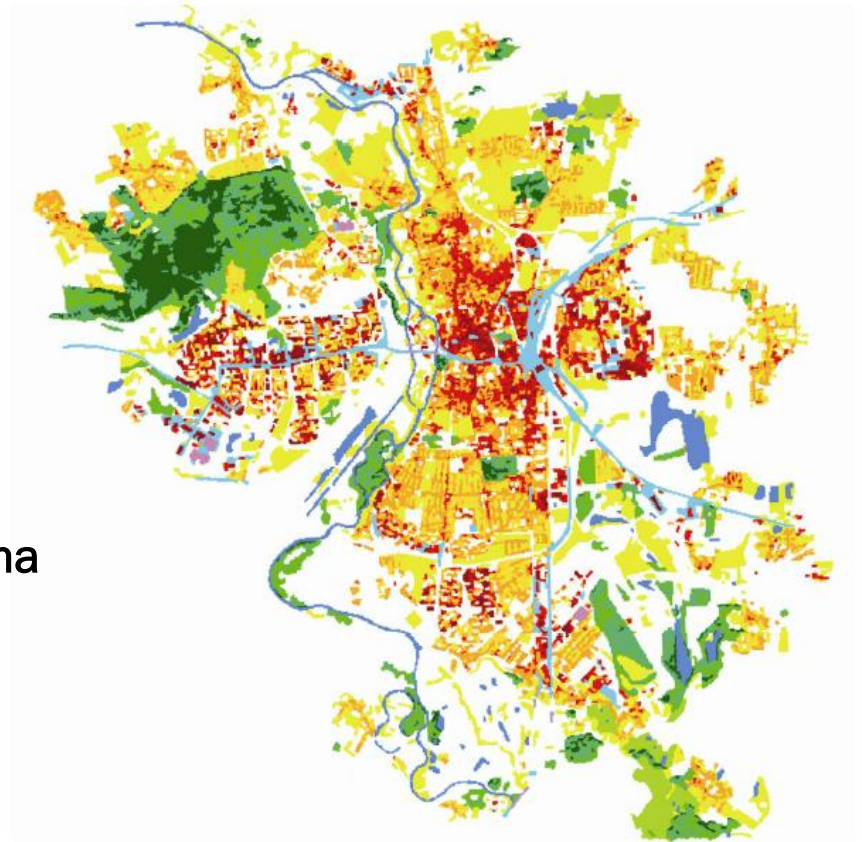
Euro-Maps LC (Halle, Germany)

Geodata

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■ **Different Geo-Services**

    ■ **Examples of projects**

# Example 1: Solutions for Forest Monitoring (Rep. of Congo)

- Thematic mapping accuracies of 90 to 95 % achievable with HR Data
- Availability of <u>cloud free EO data</u> from one sensor type for large areas (i.e. national coverage) is <u>problematic</u>
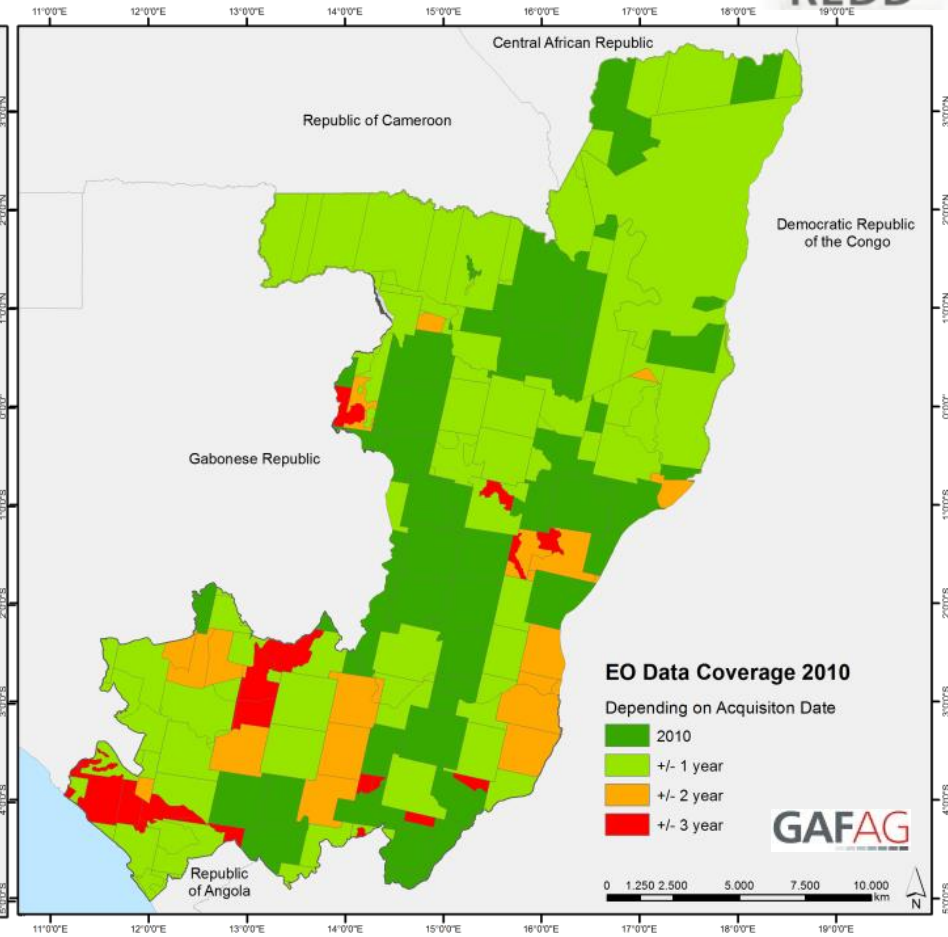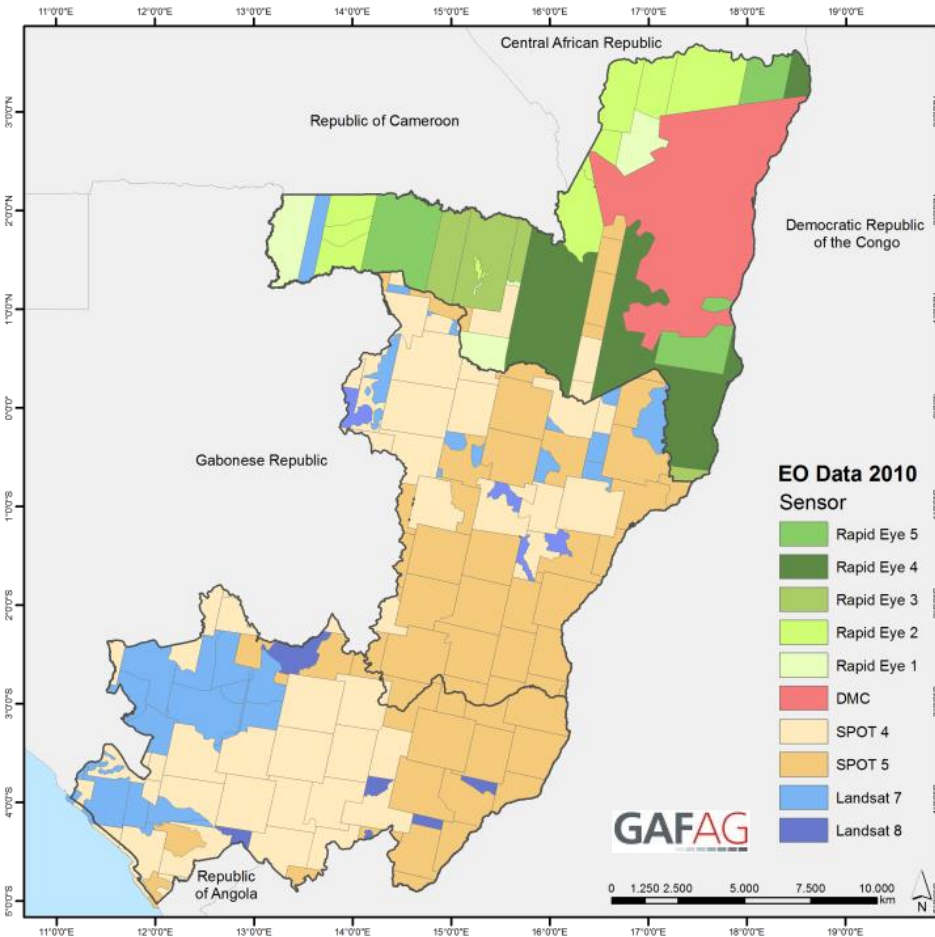
➡ Multi-sensor EO data mosaics are needed to overcome this problem

- Temporal and spectral variations between scenes have to be minimised
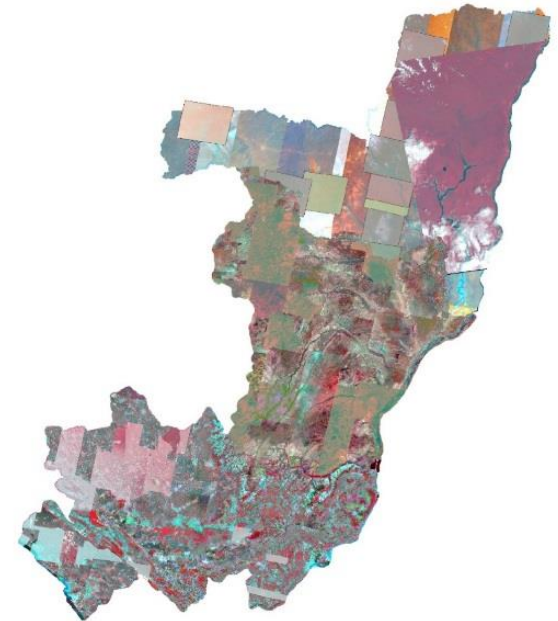
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■ Example 1: Solutions for Forest Monitoring (Rep. of Congo)

➡ GAF AG has access to almost all EO data sources!

REDD



EO Data 2010
Sensor

- Rapid Eye 5
- Rapid Eye 4
- Rapid Eye 3
- Rapid Eye 2
- Rapid Eye 1
- DMC
- SPOT 4
- SPOT 5
- Landsat 7
- Landsat 8

EO Data Coverage 2010

Depending on Acquisiton Date

- 2010
- +/- 1 year
- +/- 2 year
- +/- 3 year

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- Example 2: Stand heights based on Tri-Stereo SPOT6/7

- Derivation of stand heights based on Tri-Stereo SPOT 6/7 satellite data
- Also possible: comparable Tri-Stereo Data
- Assessment of skid trails



© GAF AG 2015, contains Airbus DS Material

SPOT6 © Airbus DS
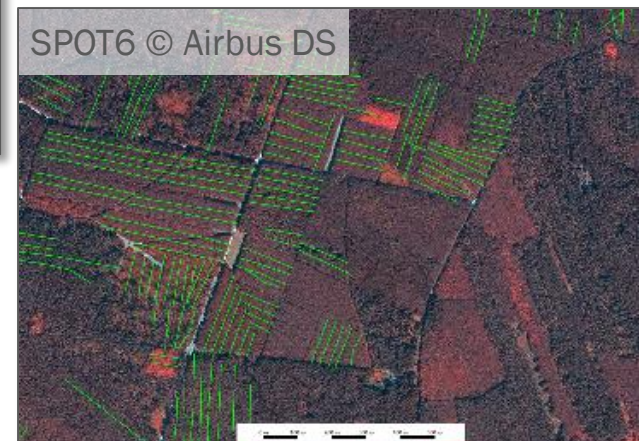
# Example 3: ESA IRS Satellite Images for Data Warehouse

- Orthorectified coverages of multispectral satellite data

- Development of interfaces
  - close and successful cooperation with German Aerospace Center Neustrelitz
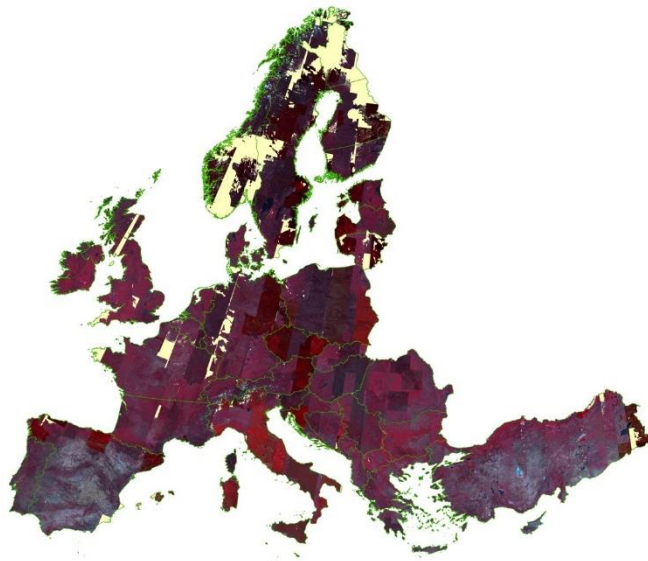
Beispiel: Coverage 1 QL mosaic,
status 15-Jun-2013

Data distribution

Orthoprozessing

Commercial Satellite Image Market is in Change:
- New Systems
- New Providers
- Constellations
- More Information (Higher Resolution: geometrical, temporal, spectral)
- Instant Access (Acquisition, Archive, Production, Delivery)

GAF AG
- Exclusive distribution rights for central Europe for Indian Satellite Data
- Access to almost all EO data sources
- Services: 12/7, 24/7, Value Added Services …

# Thank you very much
# for your attention!

If there are any questions, please contact us.

Contact:

GAF AG

http://www.gaf.de, info@gaf.de