



**Ingenio and PAZ Ground Segment Interoperability
Programa Nacional de Observación de la Tierra por Satélite - PNOTS
(Spanish Earth Observation Satellite Programme)**

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**GSCB Workshop, 18th – 19th June 2009
ESA/ESRIN Frascati**

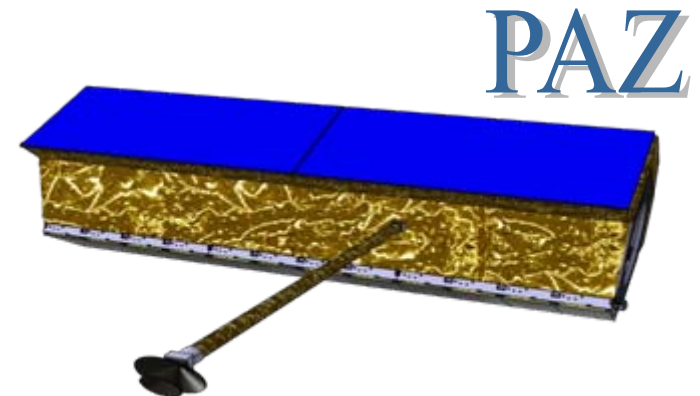
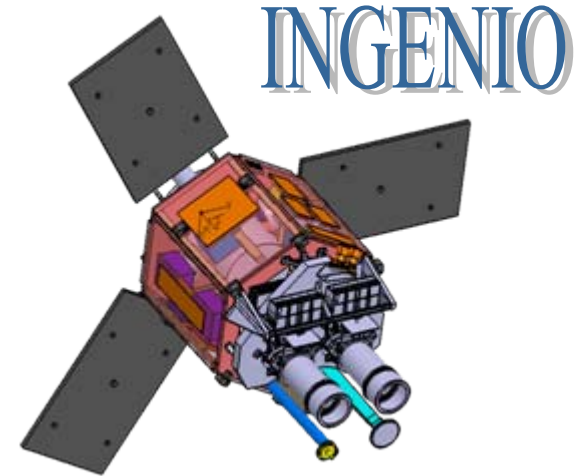
PNOTS FRAME



Ministerial Agreement of **Industry & Defence** July of 2007



- The Spanish National Earth-Observation Programme (**PNOTS**) will be a complete system, based on two spacecrafts:
 - **INGENIO/SEOSAT**
 - Optical technology.
 - Managed by CDTI in the frame of ESA.
 - Covers the needs of civil users (and Defence if it is needed)
 - **PAZ**
 - Radar satellite based on TS-X platform
 - Managed by Ministry of Defence by means of HISDESAT and INTA.
 - Dual system, mainly devoted to Defence
- Both missions shall try to maximize their common developments.
- System financed and owned by the Spanish Government and operated by **HISDESAT** (Spanish private company with public share) and **INTA** (Spanish Aerospace National Institute).

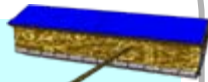


PNOTS SYSTEM



INGENIO/SEOSAT

- Civil System and contribution to GMES.
- Operative in 2013
- 1 PAN and 4 MX bands
 - Max image size: 60 x 60 km
 - PAN resolution: 2.5 m
 - MX resolution: 10m
 - Daily images: ~2.5MKm² (monthly avg)
- It will provided more than 4 coverages of the Spanish territory in one year, for each band.



PAZ

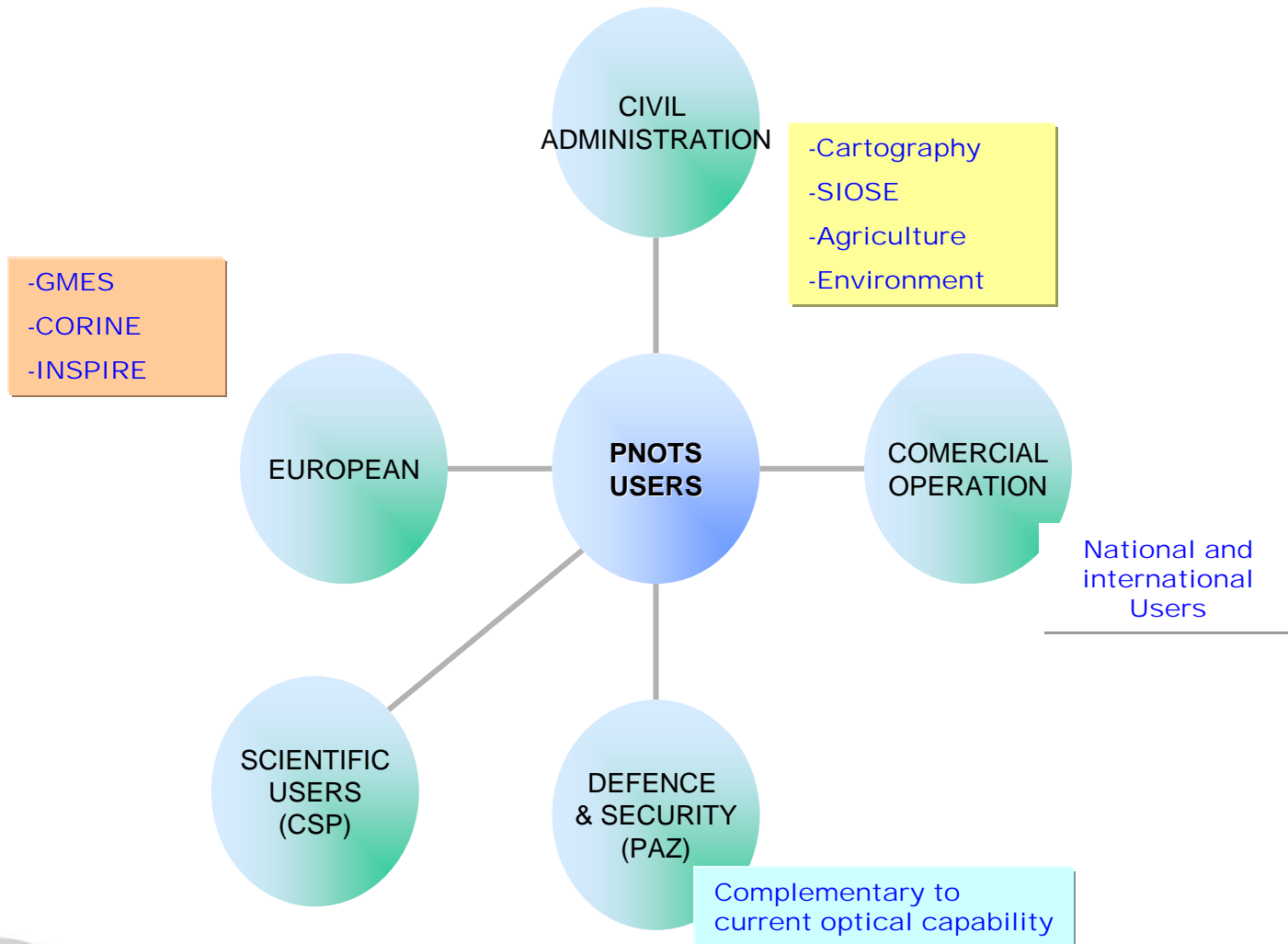
- Dual system, civil and Defence and contribution to GMES.
- Operative in 2012
- The system will acquire radar data in X-band, in three modes:
 - Spot (10 X 5 Km @ 1m),
 - Scan (100 km @ 15m),
 - Stripmap (30 km @ 3m)
- More than 200 images per day

GROUND SEGMENT

- A ground segment for both missions located at INTA.



PNOTS USERS



SEOSAT / INGENIO

1.PNOTS (CDTI)

2.INGENIO / SEOSAT (CDTI)

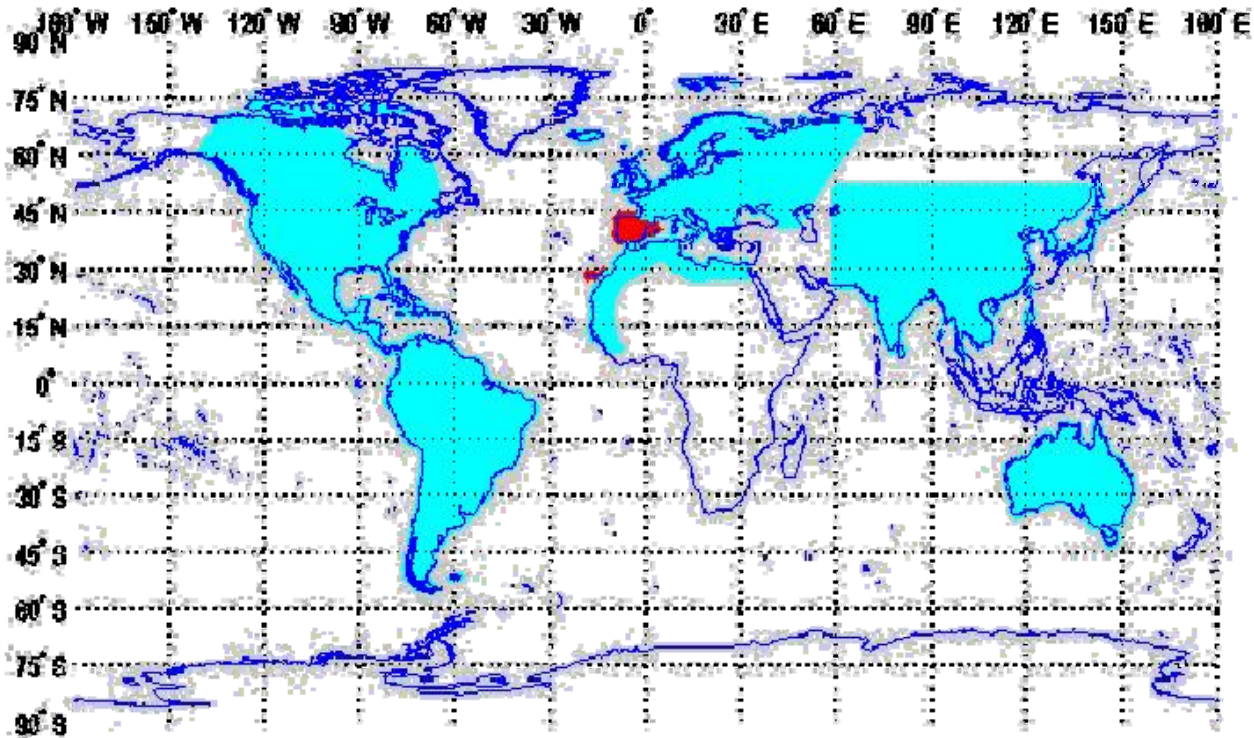
3.PAZ (INTA)

Management

- SEOSAT/Ingenio is a Spanish National Mission managed by CDTI, who has entrusted ESA to provide its technical and managerial support.
- Basis is the Assistance Agreement ESA/CDTI for the implementation of SEOSAT/Ingenio Space & Ground Segments, approved by ESA Council and signed by respective DGs end July 2007.
- **CDTI's role:**
 - CDTI retains overall programmatic and financial responsibility.
 - CDTI retains full responsibility on Industrial Policy.
 - CDTI provides GS infrastructure, launcher services and Complementary Scientific Payload (CSP).
- **ESA's role:**
 - ESA is in charge of technical and contractual management.
 - Using standard ESA rules and procedures with adaptations.
 - ESA procures space segment, LEOP services and routine ground segment.

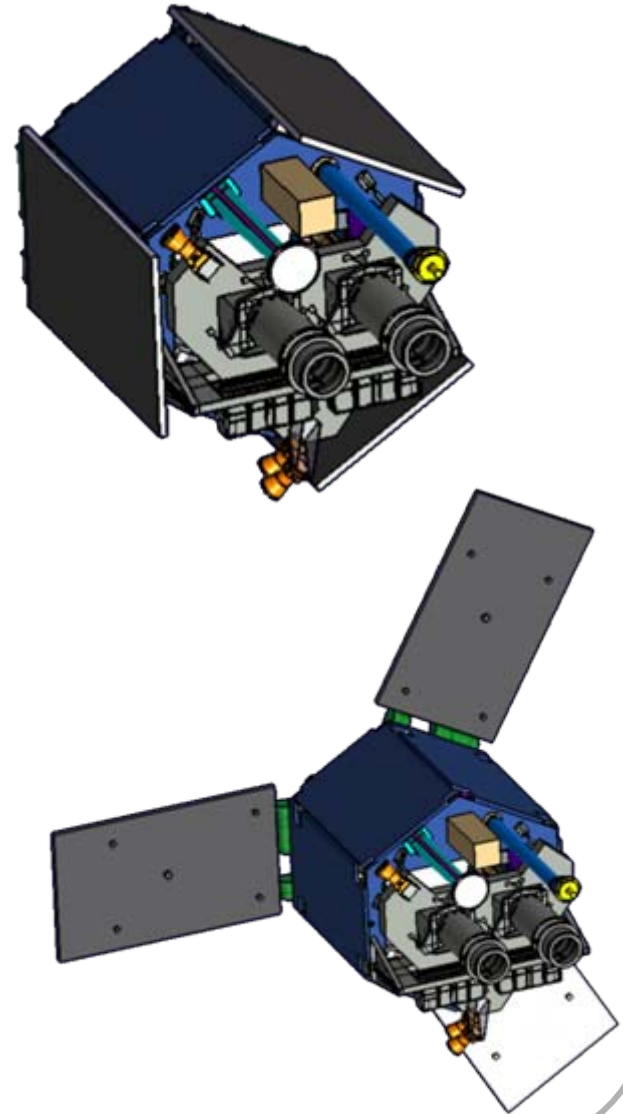
Mission description

- **Mission capabilities - High Resolution Optical Mission:**
 - Global land mission with primary objective of “Carpet mapping of Spain”
+ Image acquisition over main areas of interest (Europe, South America and North of Africa).



Mission description

- **Mission capabilities - High Resolution Optical Mission:**
 - 1 PAN channel max 2.5 m and 4 MS channels max 10 m resolution.
 - 12 bits per pixel (compression in the range 2-6bpp)
 - ~ 60 Km max swath.
 - High quality images
 - SNR > 100 at reference radiance
 - L1 SW/SSD < 1.1
 - > 2.5 MKm²/day (monthly average).
 - Handling of nominal (1wk), priority (24 hrs) and emergency (< 3hrs) requests.
 - Revisit time 30 days with OZA < 6.5° (nominal mode) and 3 days with OZA < 40° (extended mode).



Mission status

- **Schedule:**
SPACECRAFT

- SRR March 2009 / PDR November 2009 / CDR Q4 2011 / Launch Q4 2012-Q1 2013

GROUND SEGMENT

- Consolidation phase in 2008 (parallel contracts ESA-INTA)
- GSRR September 2009 (TBC)



Mission data

- **Data Products:**
 - Standard L0, L1a, L1b and L1c.
 - Higher levels (e.g. pan-sharpening, carpet maps, etc.) still to be defined.
- **Data Policy:**
 - Still TBD.
 - Will follow European directives for GMES Contributing Missions.
- **Current mission definition:**
 - “Systematic” for carpet mapping of Spain and acquisition over the main areas of interest and “on-demand” for other products.
 - Nominal operation with nadir acquisitions, with capability of de-pointing of $\pm 40^\circ$.
- **Data Storage:**
 - Archiving of L0, L1a, L1b and L1c products (TBC).

HMA implementation

- According to the Assistance Agreement ESA/CDTI, ESA Project Team shall ensure that SEOSAT/Ingenio interfaces will allow the SEOSAT system to become a candidate national mission contributing to GMES and to participate to the ESA third party mission scheme, within the EO multi-mission environment (and therefore to HMA).
- SEOSAT/Ingenio GS will share infrastructures, antennas and maximize its commonalities with PAZ GS, which is also included as part of GMES potential contributing missions.
- All GMES relevant/applicable documentation was applicable during Consolidation Phase (up to GSPRR in December 2008).
- All future GMES relevant/applicable will be applicable (if feasible due to schedule) in following phases.

- **GS configuration:**

- **Control Centres:**

- Main CC -Torrejón (Madrid).
- Back Up CC – Maspalomas (Canary Islands).

- **PDGS:**

- Processing and long term archive in Torrejón.
- Temporary archive in Maspalomas.

- **(Nominal) Stations:**

- Dual antenna X-band / S-band in Torrejón.
- X-band download on every pass in Torrejón and Maspalomas.
- Polar station X-band download depending on needs (amount of data and data ageing, e.g. emergency requests) and potentially S-band link.

- **Further downlink stations TBD.**

Ground EO data flow

- **Communication network:**

- Link Torrejón-Maspalomas via V-SAT and Spainsat (TBC) and ground link (mid speed).
- Link Polar Station-Torrejón: high speed link.
- Data distribution still to be defined: Optical link (where available, e.g. Spanish users), electronic communication (e.g. ftp), media delivery, etc.
- Access according to data policy via catalogue, quick view and web request.

Implication analysis, Quality Assurance for Earth Observation (QA4EO) and Recommendations

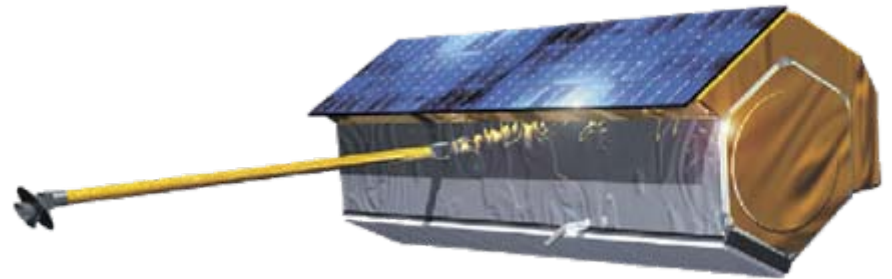
- Due to the early stage of the system development, QA4EO issues are still TBD, BUT:
Quality to be monitored by IMAG (Ingenio Mission Advisory Group)
- Being SEOSAT/Ingenio development and implementation currently undergoing, the operator will follow whatever standard and guideline might be ready and implementation feasible within budget and schedule.
- Inputs on pending points and more detailed information will be provided at future workshops.



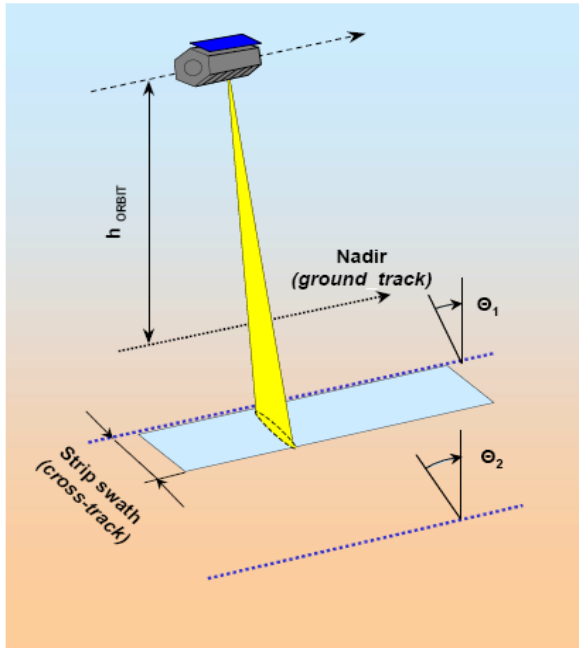
PAZ MISSION

PAZ Mission Status

- PAZ is a dual mission.
- The PAZ satellite owner is HISDESAT, the PAZ ground segment owner is INTA.
- The Launch Date will be in the first quarter of **2012**
- On the Terrasar-X platform will be boarded a new radar front-end (antenna and T/R modules) developed by EADS CASA Espacio,
- Imaging capacity
 - Quantisation 8 bits I,Q
 - Compression to 6-4-3-2bpp. Nominal 4bpp
- Satellite
 - Dawn-dust orbit at 514 km
 - Payload management:
 - X-band downlink: 300 Mbps
 - Storage memory > 256 Gbits (EOL)
 - Hydrazine 78 kg (sized for 7 years)

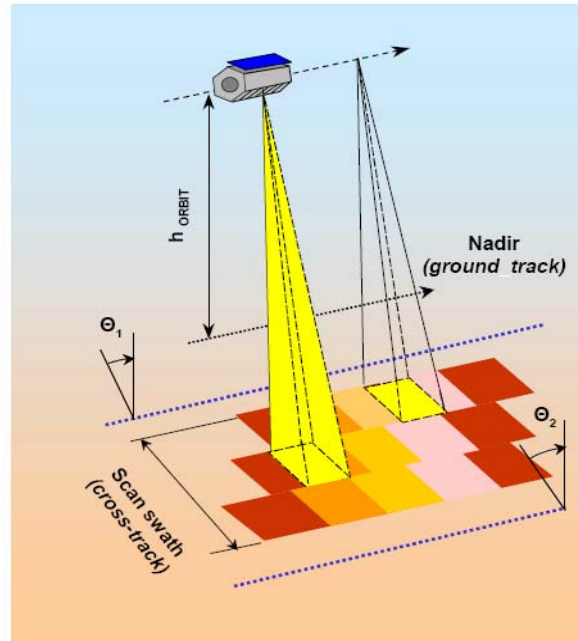


PAZ Mission Status: Basic Operation Modes



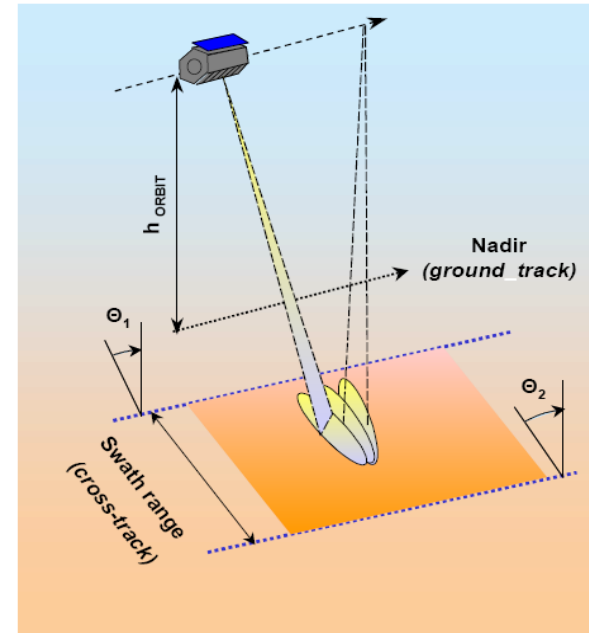
STRIPMAP

Single Polarization: 30 km @ 3m
Dual Polarization: 15 km @ 6m



SCANSAR

100 km @ 15m



SPOTLIGHT

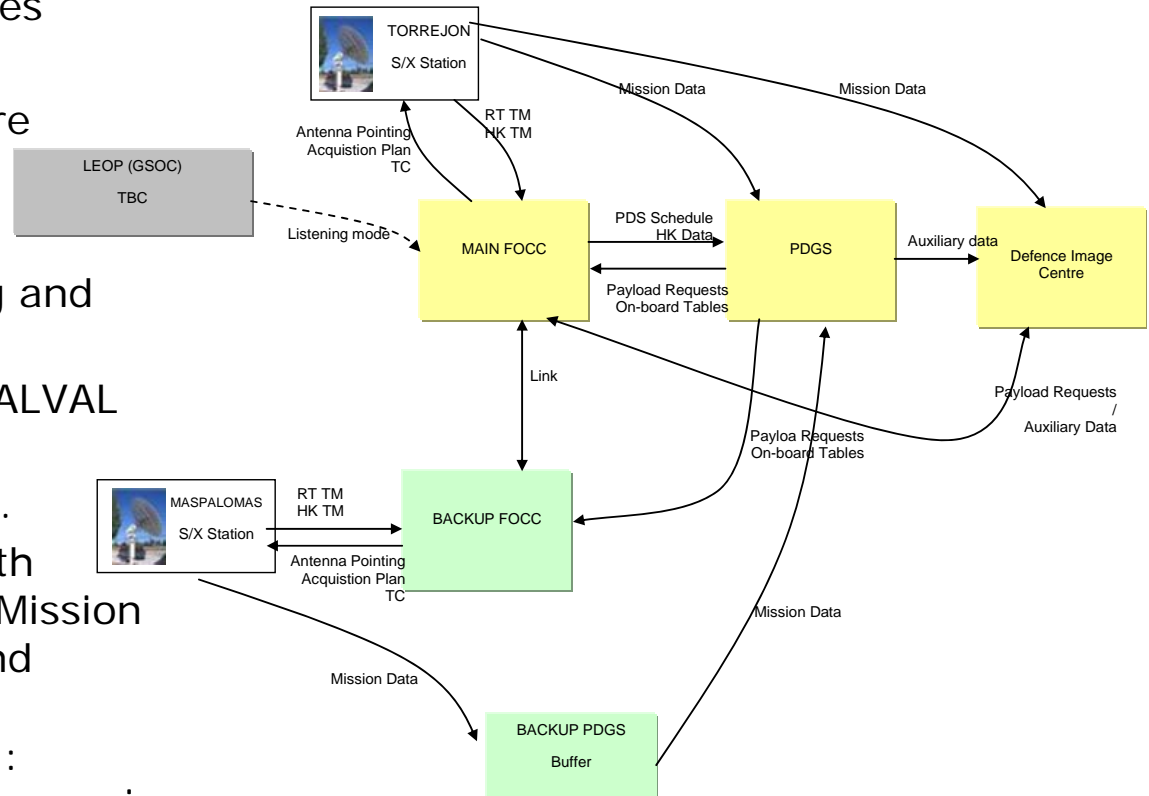
Single Polarization: 10 km x 10 km @ 2m
5 km x 10 km @ 1m
Dual Polarization: 10km x 10 km @ 4m

PAZ HMA implementation

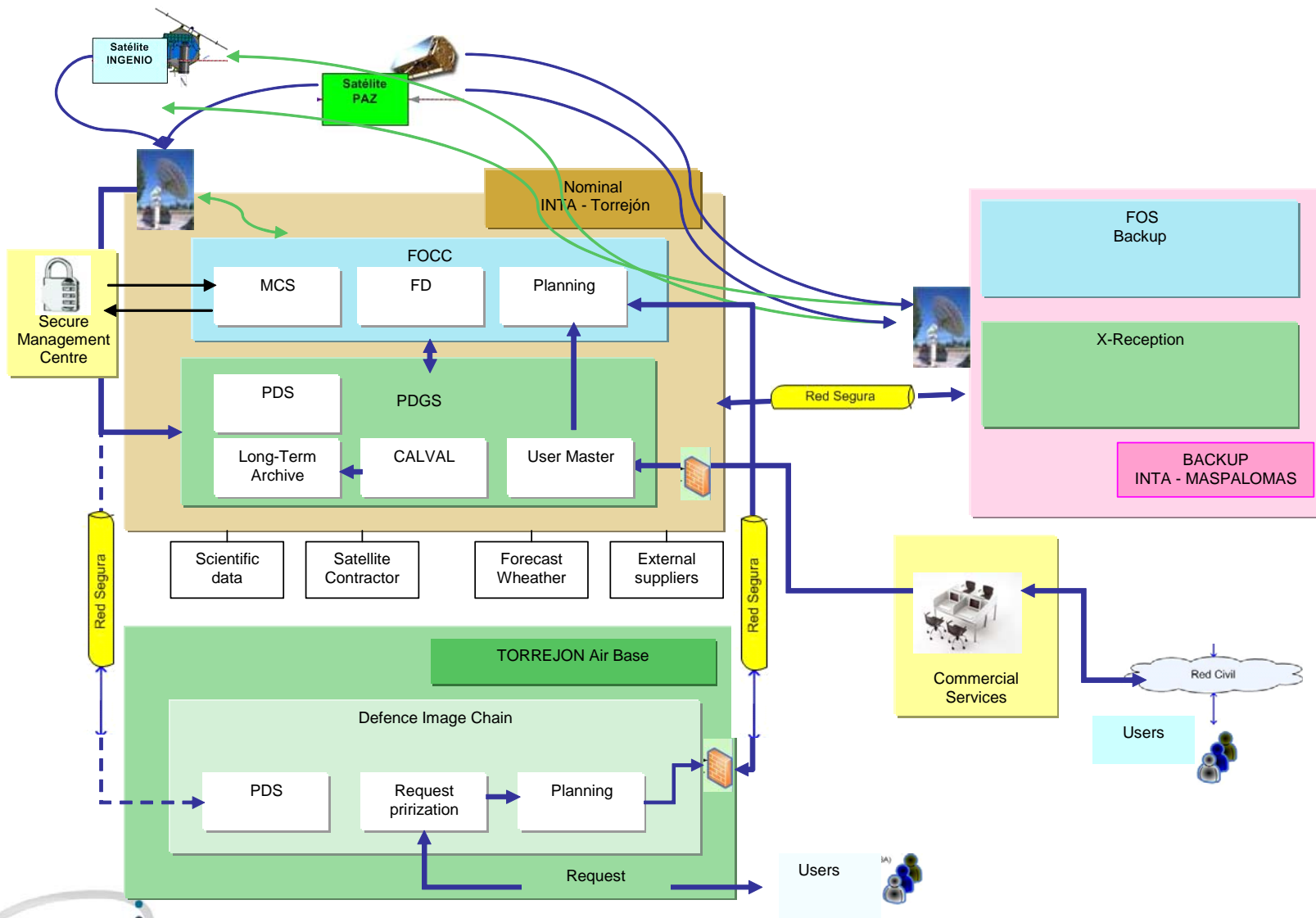
- The PAZ Ground Segment (PGS) shall be a multi-mission ground segment, with PAZ as first instance and shall be ready at 2012.
- The PGS program is in the pre-phase B. At this level, only requirements to assure the compatibility of the ground segment design with the HMA standard has been established.
- The PGS advances in coordination with INGENIO Ground Segment also supporting the HMA interface.
- The PGS has **security** constraints due to the DUAL use of the system → the HMA requirements shall be carefully analysis inside this duality.

PAZ Ground Data Flow

- The ground segment will be located at INTA:
 - **Nominal:** Torrejón de Ardoz with the following functionalities
 - Station in S/X-Band
 - Mission Control Centre
 - Mission Planning
 - Flight Dynamics
 - Processing, Archiving and Distribution Centre.
 - Image Quality and CALVAL Centre
 - Master User Services.
 - **Backup:** Maspalomas with Station in S/X-Band and Mission Control Centre and X-band temporal archive .
- **Secure and Defence users :**
 - Reception: line secure from main station (optical link)
 - Processing
 - Archive
 - Secure connexion with nominal centre (optical link)



PAZ Ground Data Flow



PAZ Data & QA4EO

- INTA and HISDESAT will be the operators of the system and are involved in the ground segment development.
- **Basic Data Products**
 - Stripmap, Single Polarization (SSC, MGD, GEC, EEC)
 - Stripmap, Dual Polarization (SSC, MGD, GEC, EEC)
 - High Resolution Spotlight, Single Polarization (SSC, MGD, GEC, EEC)
 - High Resolution Spotlight, Dual Polarization (SSC, MGD, GEC, EEC)
 - Single Polarization Spotlight (SSC, MGD, GEC, EEC)
 - Dual Polarization Spotlight (SSC, MGD, GEC, EEC)
 - ScanSAR Products (MGD, GEC, EEC, single pol.)
- **Experimental products**
 - Aperture Switching Mode: ATI (Along-Track Interferometry) Mode
 - Dual Receive Antenna Mode (DRA)
 - Quadpol (Quad Polarization) Mode
 - Improved ATI Mode
- The guidelines for **QA4EO** shall be taken into consideration.
- **Data Policy**
 - Not established yet, but shall take into account:
 - Commercial users.
 - European directives for GMES Contributing Missions.
 - Defence users

THANK YOU FOR YOUR ATTENTION