



COSMO-SkyMed Solutions for Ground Segment Expandability and Interoperability





Contents



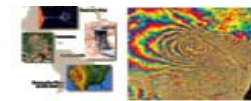
- COSMO-SkyMed System and Mission Overview
- Ground Segment Architecture
- Interoperability, Expandability and Multisensor Capabilities
- National and International Cooperations
- Future Plans
- Conclusions



COSMO-SkyMed Mission and System Overview (1/3)



- **COSMO-SkyMed** is the largest Italian investment in Space Systems for Earth Observation, commissioned and funded by the Italian Space Agency (ASI) and the Italian Ministry of Defense (MoD)
- COSMO-SkyMed is an **integrated spaceborne Earth Observation System** for Civil Institutional, Defence/Intelligence and Commercial Applications
- Industrial partners are: Thales Alenia Space Italy (prime contractor and spacecraft manufacturer), Telespazio S.p.A. (main sub-contractor for Ground Segment and Logistic & Operations)



Risk Management



Strategic Surveillance & Intelligence



Shores & Seas



Cartography



Agriculture



Forestry



Geology & Hydrology

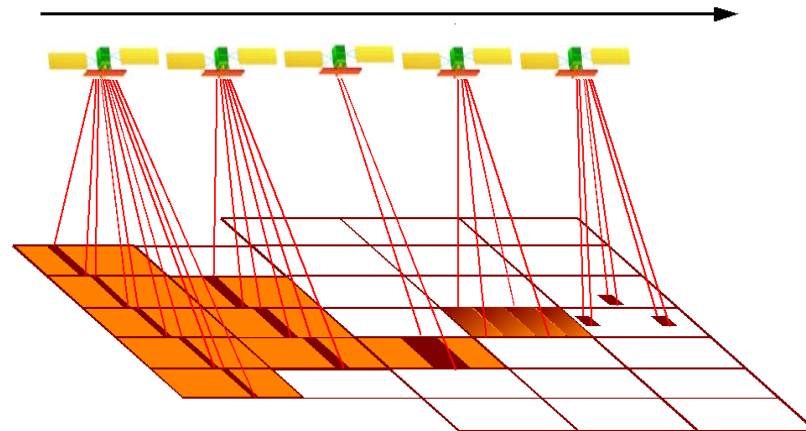


COSMO-SkyMed Mission and System Overview (2/3)



COSMO-SkyMed **SAR Standard Product** types are:

- Spotlight
- Himage (Wide/Huge Region)
- Ping Pong
- Scansar



COSMO-SkyMed Mission and System Overview (3/3)



COSMO-SkyMed System consists in:

- a **constellation of four mid-sized satellites**, in Low Earth Orbit, each carrying a multi-mode high resolution Synthetic Aperture Radar (SAR) instrument
- a **dual Ground Segment** aimed at providing services for resource management, environmental security (risk prevention, damage assessment), strategic surveillance to both Civilian and Defense users

Current status: system starting performing **pre-operational phase** activities, with two satellites successfully launched and commissioned. Constellation **completion by end of 2009**.





Interoperability, Expandability and Multisensor Concepts

IEM features constitute the key aspects for COSMO-SkyMed Multi-Mission/Multi-Sensor capabilities

INTEROPERABILITY

Ability of exchanging data and information with external heterogeneous systems according to pre-defined agreed modalities and standards, and irrespective of internal design of the cooperating parts

EXPANDABILITY

Ability of its architecture to embody mission-specific components "imported" from Partner's EO Systems and to be scaled up for increasing system performance



MULTI-SENSORIALITY

Ability to request, process and manage data related to different observation sensors



IEM Design Drivers

- **Standards:** wide use of international standards and guidelines
- **Interfaces:** definition of a well-defined, consistent and complete set of interface points
- **Product Furnished Items (PFIs):** identification of elementary functional blocks suitable for importing (from foreign systems) and/or exporting (towards other systems) COSMO-SkyMed service and product capabilities



IEM Capabilities in COSMO-SkyMed (1/2)

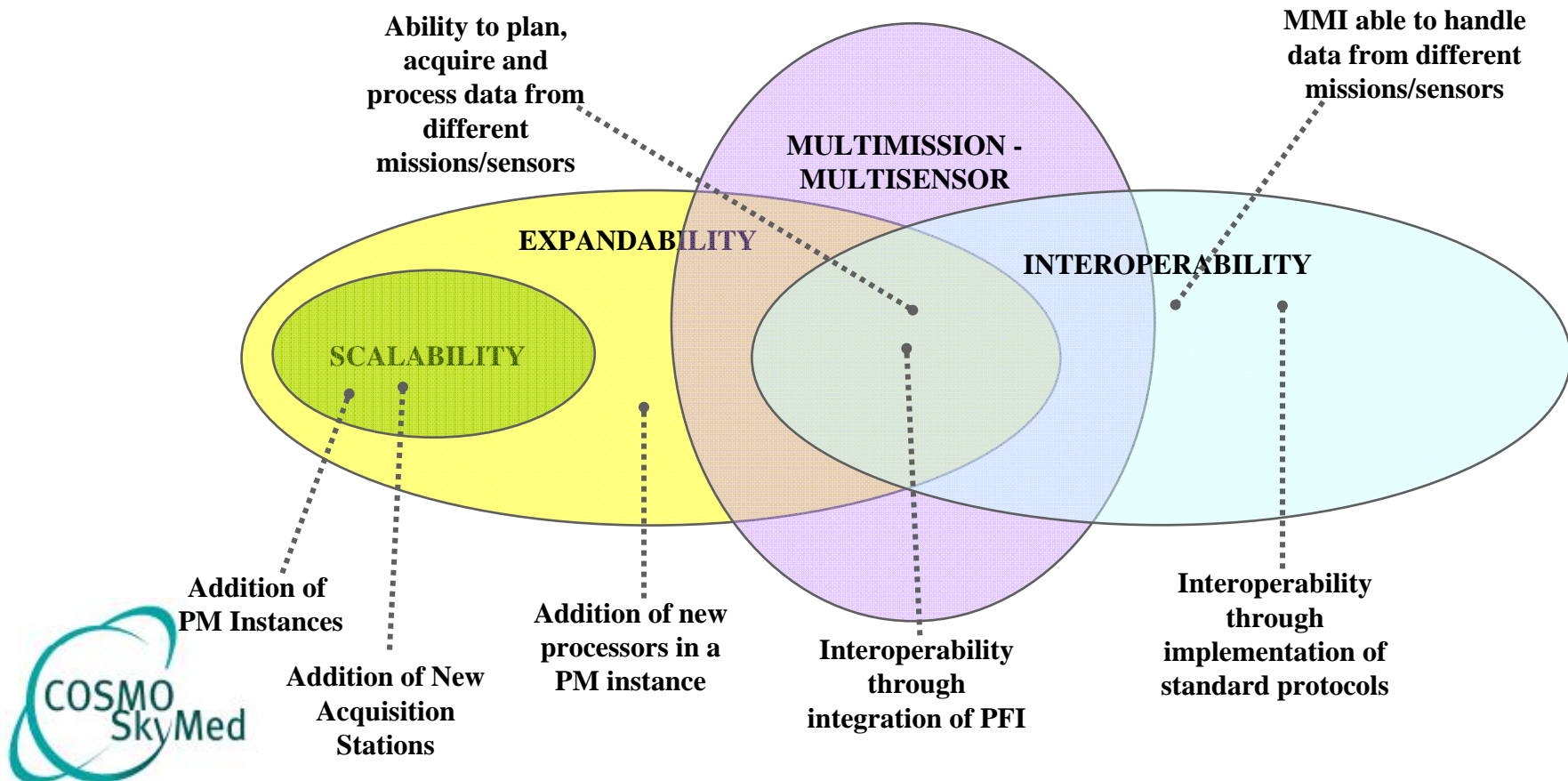


- **Interoperability:** “browse-order-receive” paradigm for image data catalogue and product exchange between heterogeneous systems, irrespectively from their internal architecture, and according to CEOS standards and guidelines.
- **Expandability:** increase system capability and performance reconfigure involved architectural elements, without any impact on design, for what concern:
 - end-user terminals (up to 10)
 - external Ground Stations (SAR data acquisition and TM/TC support)
 - data production chainsEmbody, without (or minimizing) architectural changes, foreign systems/sensors modules (so called foreign PFIs).
- **Multisensoriality:** well-defined set of interface points (including HCIs) providing the end-user with the same operational approach for multi-sensor request handling.





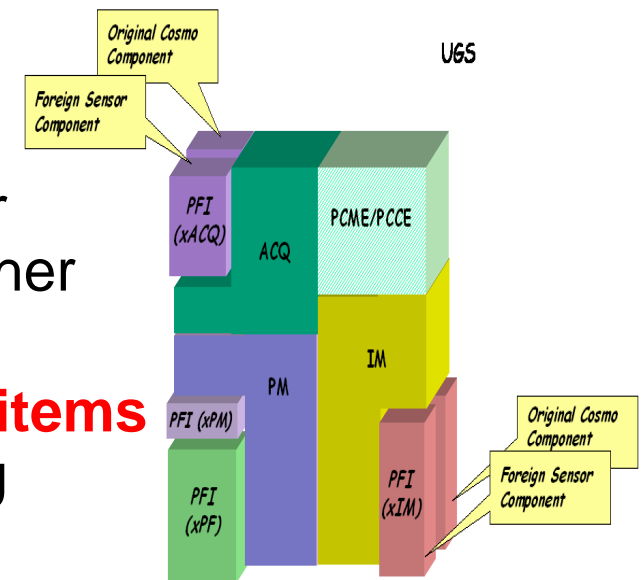
IEM Capabilities in COSMO-SkyMed (2/2)



Expandability by means of Partner Furnished Items (1/2)



- **Partner Furnished Items (PFI)** is the basic design element for providing COSMO-SkyMed expandability capabilities.
- PFIs apply to:
 - integration of **foreign items** for expand COSMO-SkyMed to other sensors (F-PFI)
 - provision of **COSMO-SkyMed items** to a foreign partner for allowing access (I-PFI)
- COSMO-SkyMed is able to embody without design changes F-PFIs respecting a predefined ICD.



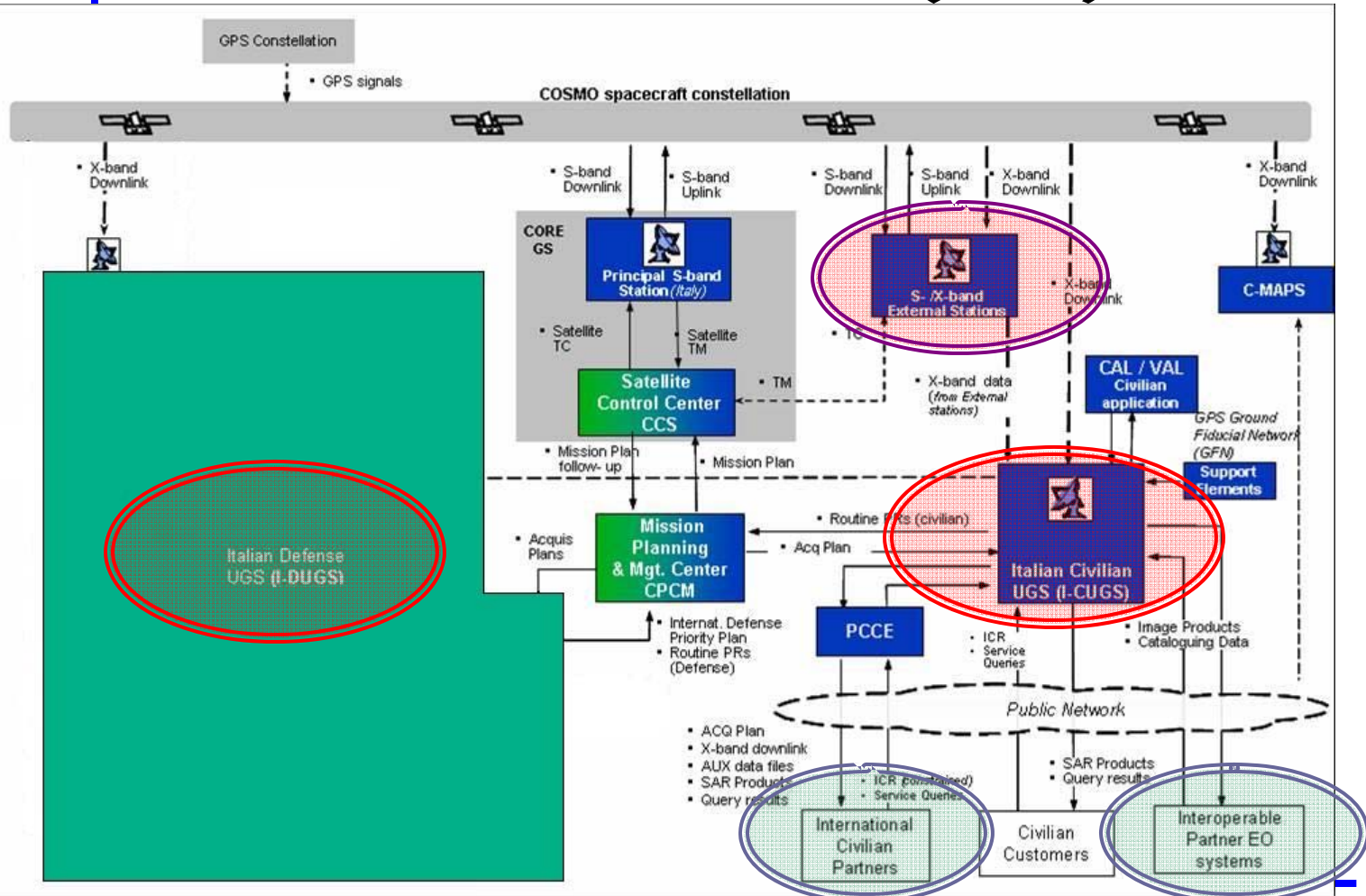
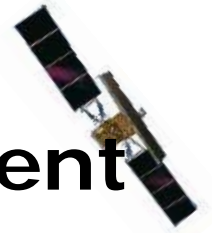


Expandability by means of Partner Furnished Items (2/2)

- **PFI Portfolio**: set of available PFIs, which can be selected as standalone blocks or aggregated together, till a complete user G/S configuration.
 - Pre-feasibility
 - Acquisition (full station or Base-Band only)
 - Production (full chain or processors only)
 - Mini-UGS

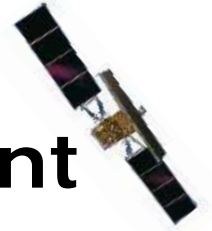
- PFI-based scenario's choice depends on several different aspects such as design issues, mission-specific constraints, and strategies and costs: **trade-off decision** is requested.

"IEM Areas" in Ground Segment Architecture (1/2)





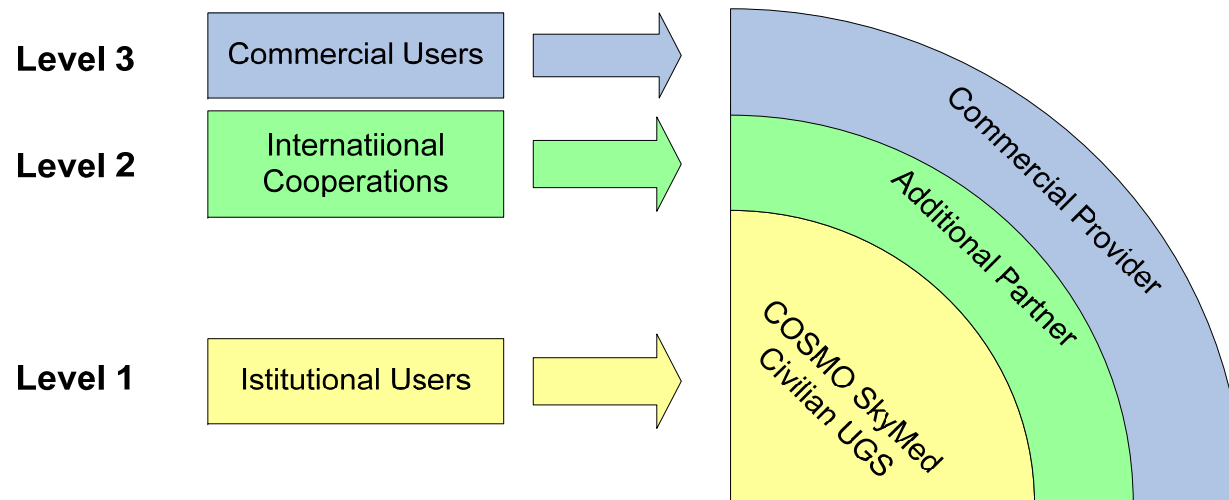
“IEM Areas” in Ground Segment Architecture (2/2)



- **External Stations:** configuration modifiable for replacing existing station or increasing ground network coverage
- **Civilian/Defence UGS:** scalable processing capabilities and embodying of foreign partner UGS components (Foreign PFIs)
- **International Civilian/Defence Partners:** support for up to 5 + 5 partners, including **Commercial Provider and Users**
- **Interoperable Partner EO Systems:** standardized interface (CEOS compliant) to exchange catalogues and products with foreign EO systems



COSMO-SkyMed User Access Levels



- **Commercial Provider** acts as an additional partner for COSMO-SkyMed System, by means of the expandability of Civilian UGS
- **Commercial Users** access COSMO-SkyMed services via WEB by Provider, which is able autonomously to perform pre-feasibility analysis and programming, and which route final products from Civilian UGS to requesting user



Expansion Programs (1/4)



- COSMO-SkyMed IEM capabilities are strongly used by ASI and it-Mod to set-up **national and international cooperation's** with Partners to let access to COSMO-SkyMed System or to create **Multi-Mission EO Satellite Systems** aimed at providing both (multi-band) radar and optical imaging products to a variety of Users with different size, accuracy, and resolution.
- Expansion to additional foreign users:
 - French MoD
 - Argentinean Space Agency
- Expansion for supporting multi-sensor programs:
 - ORFEO
 - SIASGE
 - SABRINA
- Further contacts with other Space Agencies for further cooperation programs are in place.



Expansion Programs (2/4)



Cooperation with France aimed to:

- provide access to COSMO-SkyMed System to French Defence Users, by means of an additional Defence UGS located in France (F-DUGS Program)
- expand COSMO-SkyMed to optical products from PLEIADES satellites, by integrating relevant F-PFIs into Italian UGS (ORFEO Program)



Expansion Programs (3/4)



Cooperation with Argentine aimed to:

- provide access to COSMO-SkyMed System to CONAE Users, by means of an additional Civilian UGS located at Cordoba site in Argentine (A-CUGS Program)
- expand COSMO-SkyMed to SAR-L products from SAOCOM satellite, by integrating relevant F-PFIs into Italian Civilian UGS (SIASGE Program)



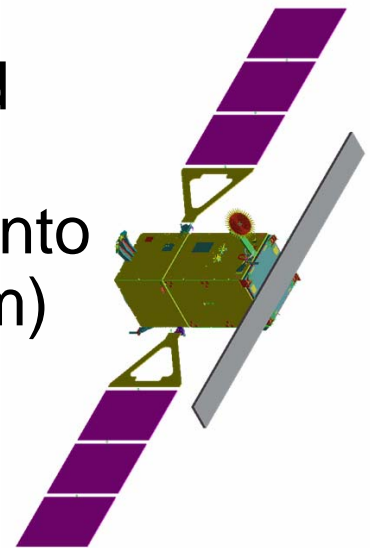


Expansion Programs (4/4)



Cooperation program with Italian
Research and University
Departments aimed to:

- expand COSMO-SkyMed to bistatic and interferometric products from BISSAT satellite, by integrating relevant F-PFIs into Italian Civilian UGS (SABRINA Program)



Future Plans



- Complete COSMO-SkyMed constellation deployment (by end of 2009)
- Start products dissemination to research institutes and commercial users
- Make operative cooperation programs now on-going or under negotiation
- Evolve COSMO-SkyMed G/S capabilities to support SAR and mission technology upgrade foreseen for the new generation of COSMO-SkyMed satellites
- Consolidate and eventually increase IEM capabilities using the lessons-learned obtained from started expansion programs



Conclusions



- COSMO-SkyMed is now a reality in European and World-wide EO Systems
- One of its peculiar aspects it's the intrinsic Interoperability, Expandability and Multisensor Capability
- Basing of above capability, many different international cooperation programs have been started or are under negotiation both to provide foreign partners with COSMO-SkyMed System access and to create added-value multisensor systems
- Future steps for COSMO-SkyMed System will be the achievement of full constellation deployment and operations, and the fulfillment of on-going expansion programs.
- Moreover G/S upgrades for supporting new generation of SAR satellites and for putting in place lessons-learned from cooperation programs will be implemented.





Contacts



Italian Space Agency - COSMO-SkyMed Ground Segment Program Office Team

- ❑ G. F. De Luca – giuseppefrancesco.deluca@asi.it
- ❑ G. Casonato – gianni.casonato@asi.it
- ❑ F. Covello – fabio.covello@asi.it

