



SHALOM Mission



LEONARDO
SISTEMI AVIONICI E SPAZIALI

ThalesAlenia
Space
A Thales / Finmeccanica Company

 **TELESPAZIO**
a LEONARDO and THALES company

 **IAI**
ISRAEL AEROSPACE INDUSTRIES

 **Elbit Systems**

Workshop :

“Data Exploitation della missione PRISMA, precursore delle missioni iperspettrali nazionali”

1-3 Marzo 2017

 **LEONARDO**

Introduction

- Spaceborn Hyperspectral Applicative Land and Ocean Mission (SHALOM) is a joint mission of the **Italian Space Agency (ASI)** and the **Israeli Space Agency (ISA)** to develop a hyperspectral satellite for Earth Observation.
- The Mission, planned to be operative in 2021 with a single satellite, aims at exploiting hyperspectral technologies in the VNIR/SWIR/PAN bands for commercial, scientific and natural disaster applications.
- The mission was agreed upon in late 2010 and a **Joint Definition Phase (JDP)** was carried out in 2012-2014 by a **Joint Integrated Team (JIT)** including Italian and Israeli Industries.
- The SHALOM B1 Phase shall update and detail the system design and define all operational, programmatic and economic aspects in order to support the Agencies in taking the decision about the complete Mission implementation.
- The Phase B1, starting in these days, will have a duration of 12 months.

Integrated Team Approach



- The JIT is composed by:

- Italy :

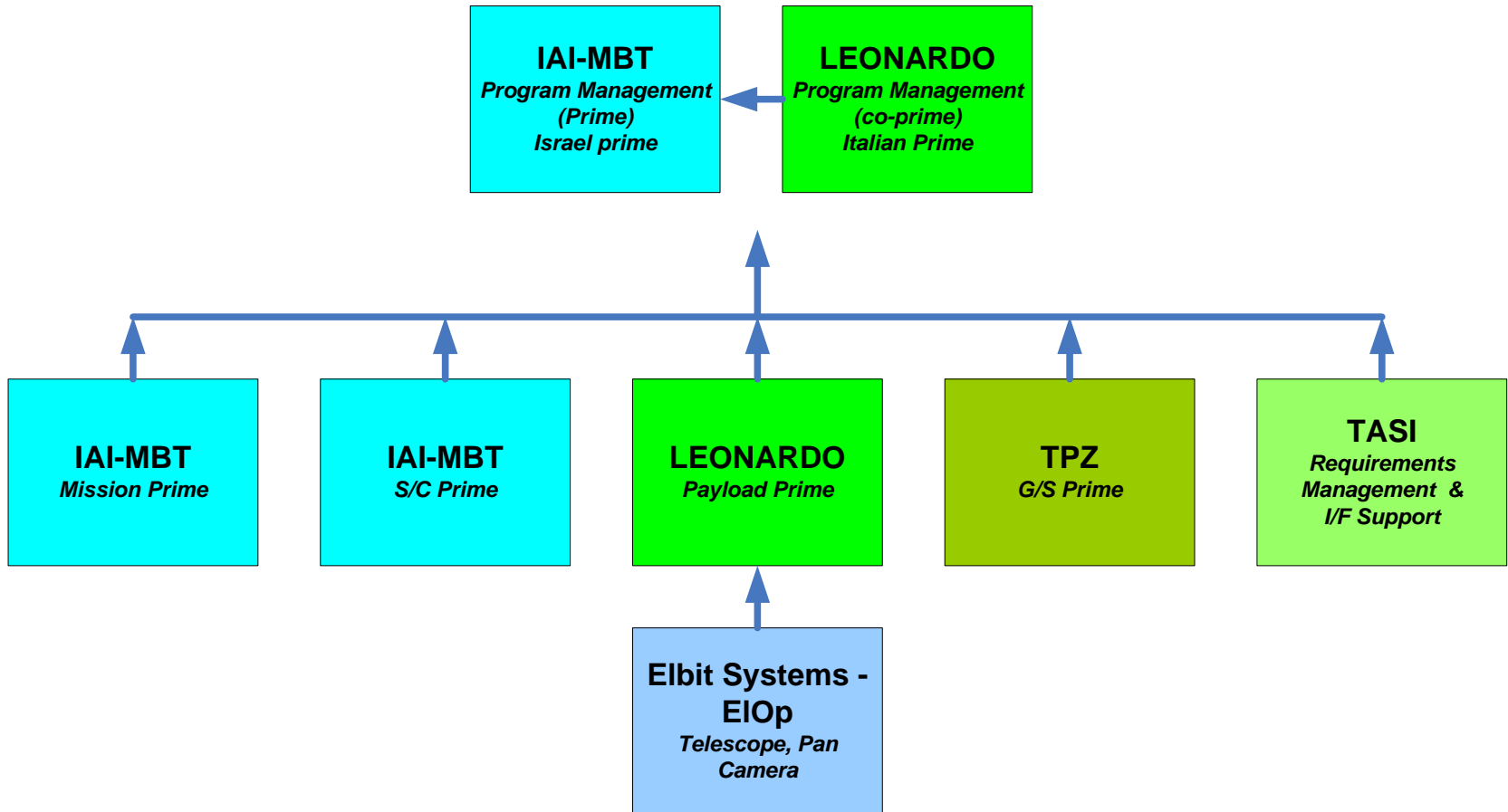


- Israel:



- During the JDP, a preliminary workshare allocation has been performed by the JIT. This initial joint activity definition was inherently tightly-coupled and required a high degree of interaction and sharing of responsibilities among the different industrial actors.
- This approach shall be further detailed during the present activities, with the objective to identify clear responsibilities from the technical and programmatic point of view, leading to a complete and unambiguous sharing of the work to be performed.

JDP (Phase A) - Integrated Team Approach



Phase B1 - Team Sharing of Activities



- Italian Industry shall have the responsibility for fulfilling the activities relevant to the Overall Payload in VNIR/SWIR/PAN and CAL/VAL activities;
- Israeli Industry shall have the responsibility for fulfilling the activities relevant to the Satellite Bus, the Payload Telescope and the Panchromatic Camera;
- A shared Italian-Israeli responsibility shall be defined for fulfilling the activities relevant to the following elements:
 - a. Joint Program Coordination;
 - b. Joint Research & Analysis;
 - c. System;
 - d. Launch;
 - e. Ground Segment and Operations;
 - f. Products development in areas of common interest;
 - g. Any other element not included above.

Phase B1 – Activities Italian Team



During SHALOM Phase B1 the following main activities will be performed by the Italian Team:

- **Optical Payload:**
 - Preliminary Design with output at level of SRR
 - AIV GSE definition. This specific activity will be devoted mainly to the identification of main GSE and facilities needed in Phase C/D in view of a complete AIT/CAL/VAL activity in Italy
 - Pre-development activities for the improvement of TRL and performances
- **Platform I/F Definition**
 - This activity will be done with support from TAS and it is needed for a correct understanding and definition of all I/Fs relevant to the platform provided by IAI / MBT
- **Ground Segment**
 - This activity will be done with support from TPZ and it is needed for the definition of the issues relevant to Ground Segment problematics in anticipation of a more in-depth analysis and detailed design to be done in Phase B2/C/D.

Main Requirements



The mission will acquire:

- Hyperspectral (VNIR/ SWIR – 400-2500 nm) images with 10 m spatial resolution in a large number of narrow, contiguous spectral bands (10 nm spectral resolution) using an imaging spectrometer in a pushbroom mode of operation.
- Panchromatic images (400 – 700 nm) of the Earth (simultaneous with the hyperspectral measurements) with 2.5 m or 5 m (TBD) spatial resolution.
- The hyperspectral images will have a rather high SNR at typical radiance (> 530 @ 550 nm; < 430 @ 1245 nm) thanks to the possibility to perform with the satellite manouvers of Ground Motion Compensation (GMC).

Satellite Agility

The IAI Bus is very agile and it allows:

- Maximum Roll angle off nadir at the satellite from the center of the swath shall be ± 30 deg to reduce revisit time.
- **GMC** Manouvers up to a factor 5x to increase integration time. This allows a higher SNR with a smaller optics aperture.

Image Operations

- Start Storage
- OBR 1 (0.00%)
- OBR 2 (0.00%)
- Current Plop
- 00046101
- 00046102
- 00046103
- 00046104
- 00046105
- End Storage

Plop Details

Plop Persistent Data

Base Plop
Plop ID: 14
Name: 00046_004_0...
Plop Status: Valid for ...
ORB Name: ORB_00002...
User Name: MBT-DOMAI...
Create Date: 06/06/2013 ...
Modified Date: 06/06/2013 ...
Is Selected: <input type="checkbox"/>
Remark:
Type: <input type="checkbox"/> Delayed
Source File:

Scow Persistent Data

Scow: Scow_oc1_FU...
Wop Start: 24/06/2014 0...
Original Wc: 24/06/2014 0...
Wop End Time: 24/06/2014 1...
Wop Start: 5287.896675...
Original Wc: 5287.896675...

Base Plop

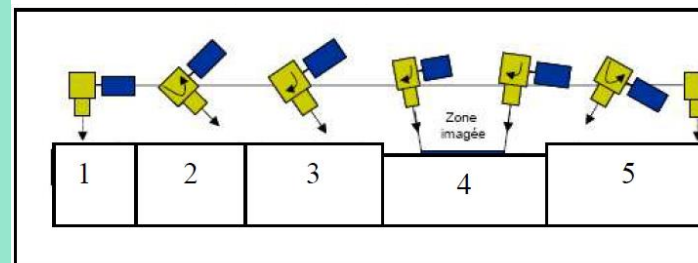
Name of base plop

Time Line

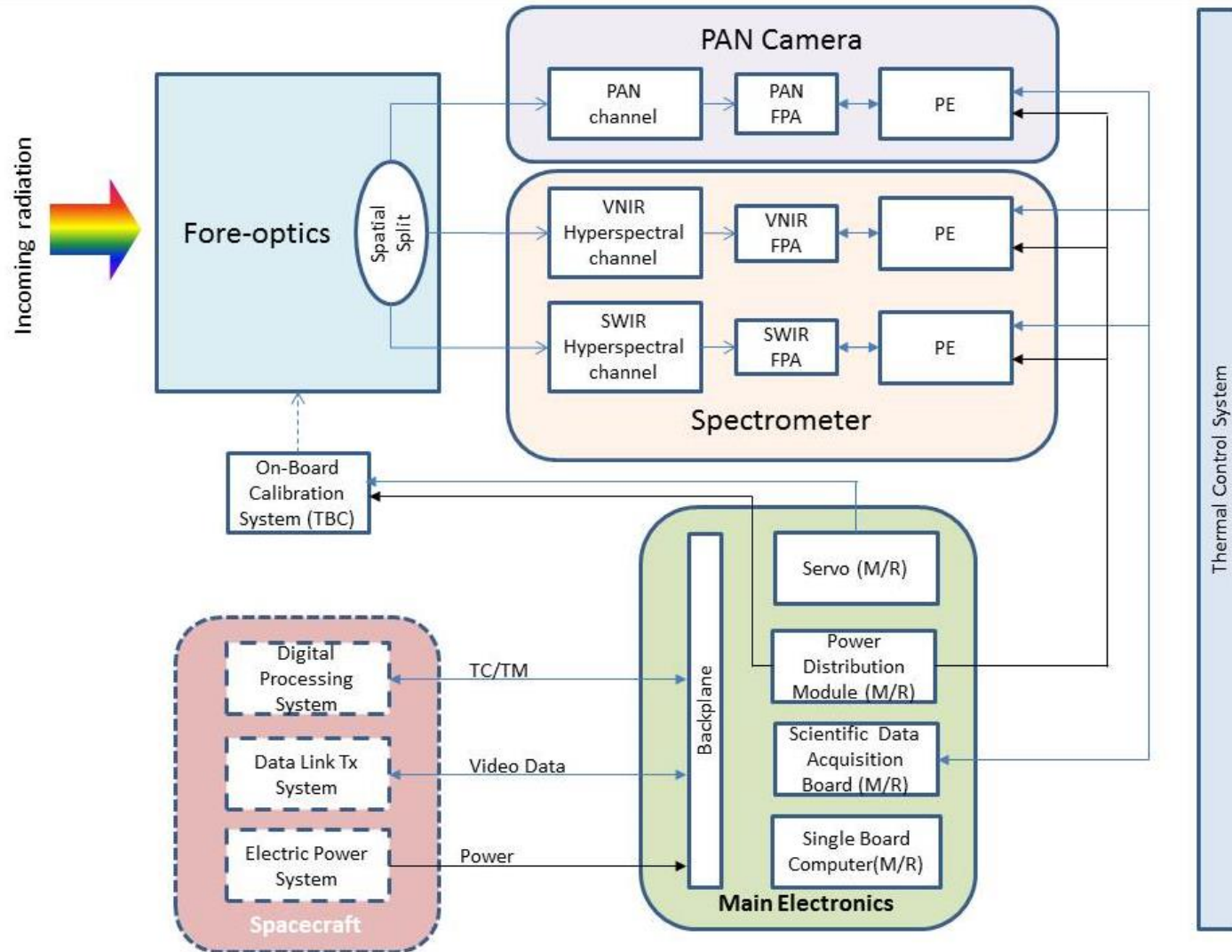
Images Downloads

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800

Mission Rules | Replan Report | TimeLines | OBRresources

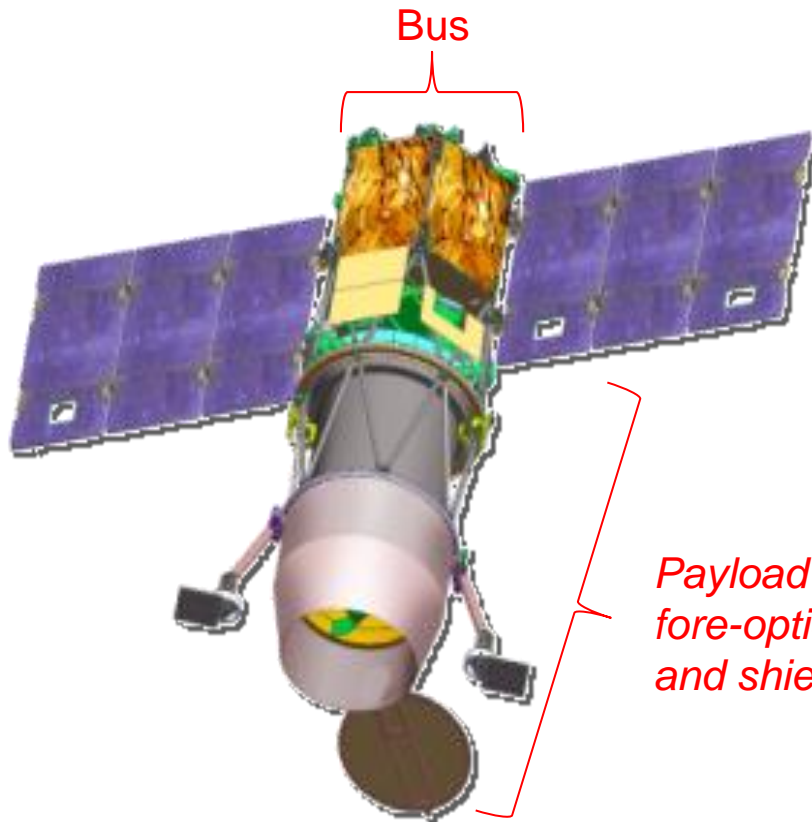


Payload Block Scheme



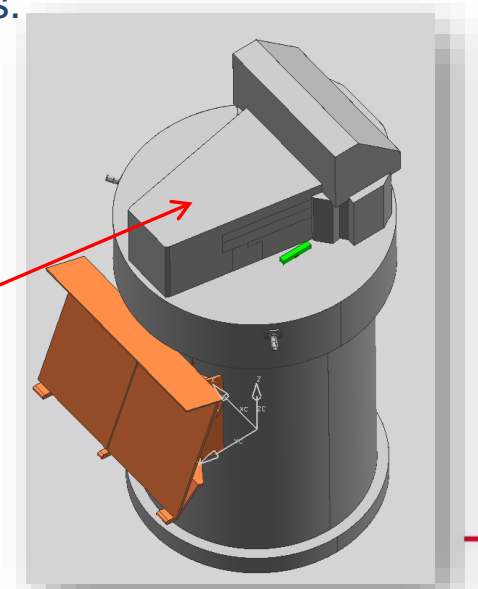
Instrument and Bus

- The payload (telescope aperture 650 mm) is highly integrated in the OPSAT-3000 bus.
- The use of a recurrent platform (mandatory to reduce overall mission development cost) imposes some limitations to the payload budgets (e.g. 120 kg total mass).
- Therefore a "smart design" and state-of-the-art technologies are needed to achieve the high mission requirements.

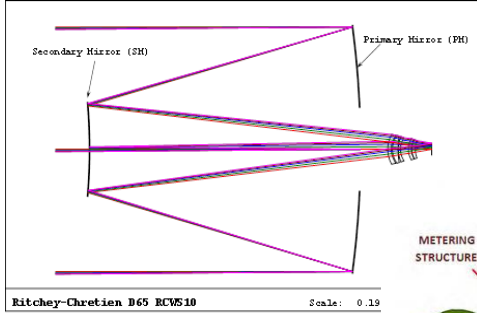


*Payload including
fore-optics, cover
and shield*

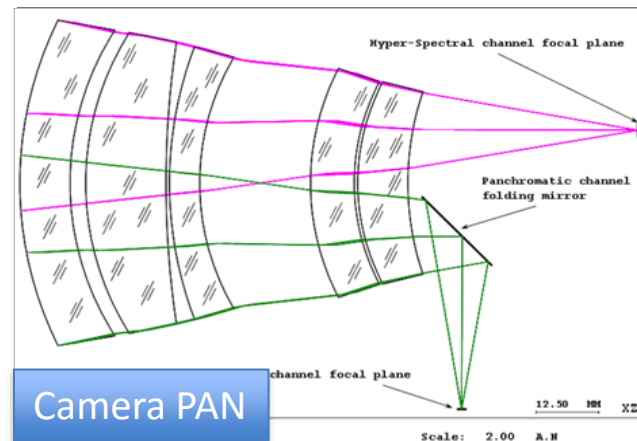
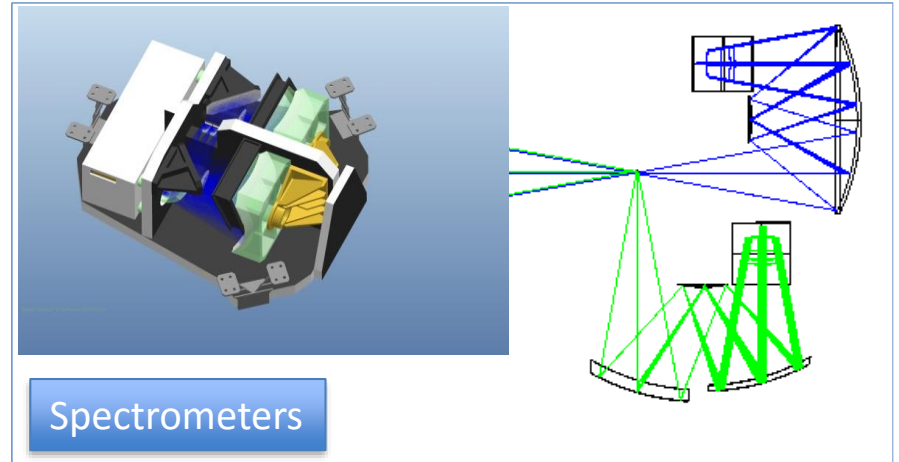
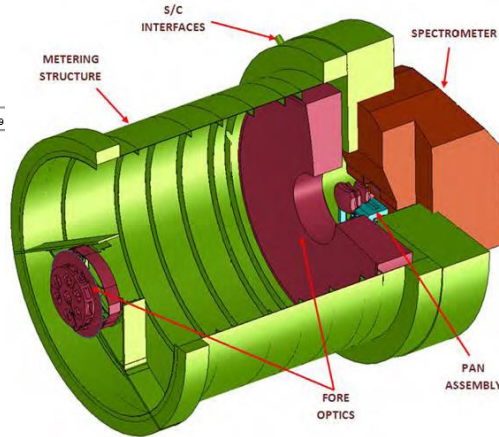
*Leonardo Spectrometer
(Offner with diffraction gratings)*



Optical Systems



Telescope



Conclusions

- The SHALOM mission has the main aim to provide high-resolution (spectral, spatial, temporal) hyperspectral / panchromatic with a very high quality in terms of accuracy.
- A Market Survey Analysis done during JDP confirmed that :
 - The SHALOM products will be demanded by many end-users
 - Good products will be required and customers are willing to pay for them
 - Many applications are not yet available due to the lack of data and algorithms
 - The market has a promising potential if the Mission will be realized in short time so to catch all the possibilities before possible competitors
- Therefore the JIT is highly motivated to support the Agencies for a quick in-orbit delivery of a hyperspectral system with the best performance ever reached by a civilian satellite.

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THANK **YOU** FOR YOUR ATTENTION