

WE LOOK AFTER THE EARTH BEAT

IXV Program and Mission Overview

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Thales Alenia Space – Turin

CESMA Hypersonic flight symposium # 2

ROME, June 30th – July 1st

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ThalesAlenia
A Thales / Finmeccanica Company *Space*

February 11th 2015 – IXV Successful Mission

- On February 11th 2015 Europe has successfully flown the Intermediate eXperimental Vehicle (IXV), the first full lifting body re-entry vehicle.
- The mission has been an outstanding success and both flight data (from telemetry and data recorders) and vehicle have been successfully retrieved after the mission
- The full In-Flight Experimentation program has been performed and critical technologies developed for the mission have been qualified in flight.
- All mission objectives have been fully accomplished



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Project Objectives

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SYSTEM DEMONSTRATION

Experience and master the complete design, development, verification loop of an aerodynamically controlled re-entry system

TECHNOLOGY VALIDATION

Investigation in the hypersonic regime and verification and improvement of design methodologies and standards

CRITICAL RE-ENTRY TECHNOLOGY EXP.

Integration and test in realistic flight conditions

- Aerothermodynamics
- Thermal Protection System
- Guidance Navigation Control
- In Flight Experimentation
 - Conventional
 - Advanced

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Driving Requirements

MISSION SUCCESS CRITERIA

- To recover and deliver exploitable flight data
- To recover the vehicle in an exploitable state

SYSTEM REQUIREMENTS

- Launch with VEGA from Kourou
- Atmospheric re-entry with automatic guidance and control
- Recovery at Sea

EXPERIMENTATION REQUIREMENTS

- TPS utilization conditions that are representative of operative re-entry vehicle
- Collection of in-flight data for investigation of Aerodynamic and Aerothermodynamics phenomena and design tools validation
- Perform in-flight experimentation of TPS and HS materials, GNC and VMI

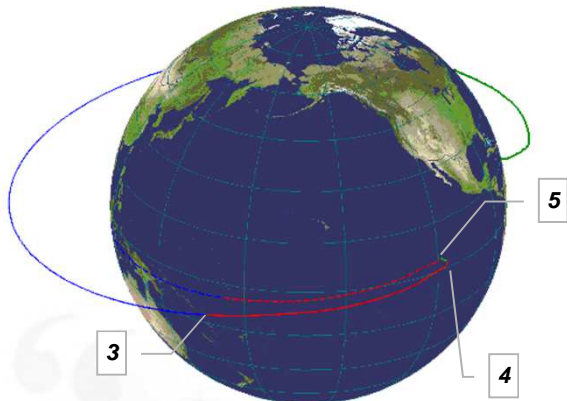
DESIGN TO COST

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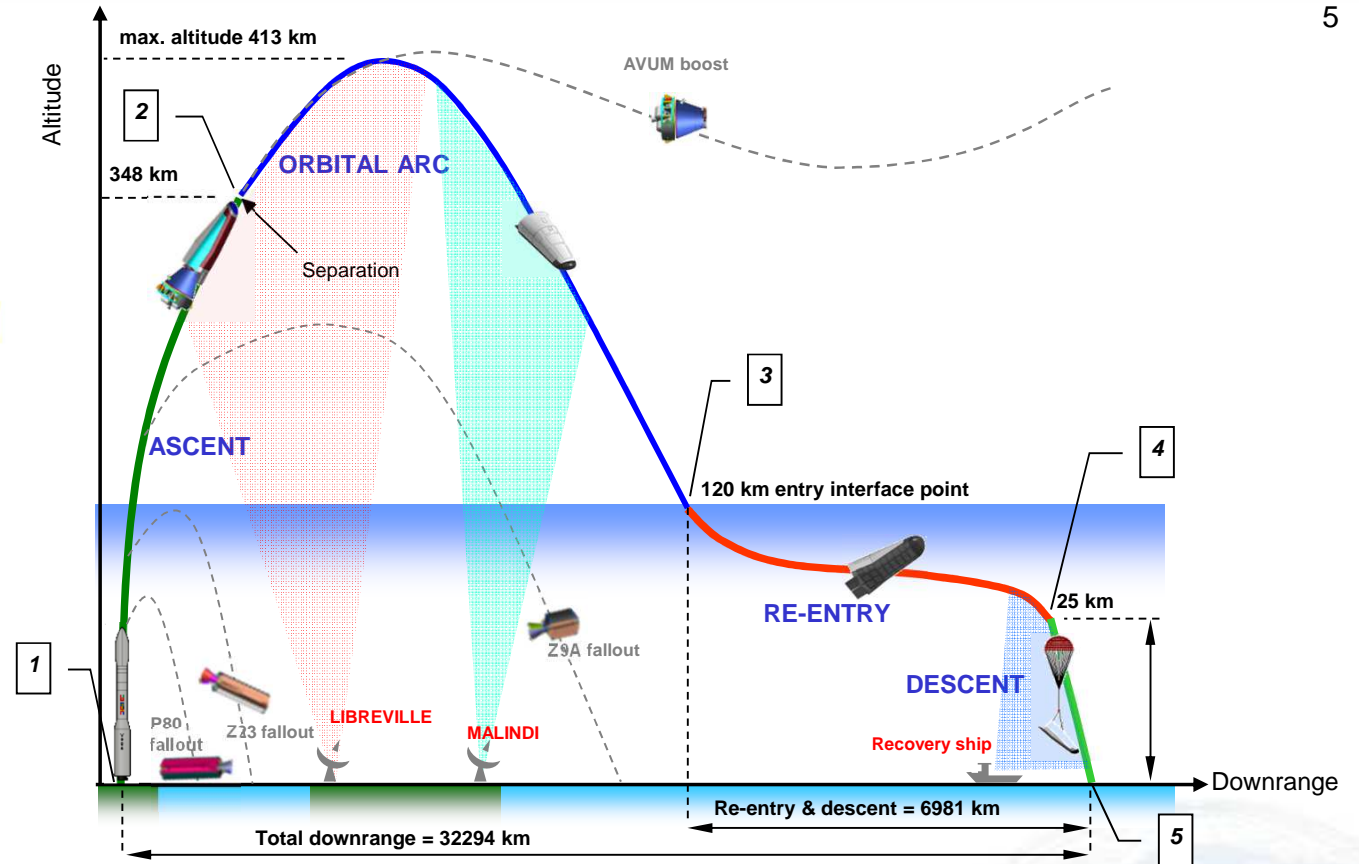
IXV Mission Profile



Reference Trajectory 3D view



[Altitude scale: 10X]



Reference Timeline

1 – Lift off	T = 0 [s]
2 – Separation	T = 1130 [s]
3 – Entry gate	T = 3899 [s]
4 – Descent gate	T = 5112 [s]
5 – Splashdown	T = 6105 [s]

→ Ascent segment	1130 [s]
→ Orbital segment	2769[s]
→ Re-entry segment	1213 [s]
→ Descent segment	685 [s]

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The IXV System

Disciplines and Subsystems

SYSTEM AUTHORITY

Margin Policy
Requirements Management
Environments
Verification
Configuration & Layout
MCI ICD

Interfaces

Launcher

MCC + Stations

Facilities

Recovery Ship

Assembly Integration & Test

Ground Support Equipment

MGSE

FES

EGSE

ATF

FGSE

SVF

Ground Segment

Ground Stations

Mission Control Center

Recovery

Operations

Flight Ops

Ground Ops

Recovery Ops

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AED & ATD

In Flight Experimentation

Mission Analysis

Guidance Navigation Control

Thermal Control System

Cold Structure

TPS and HS

Mechanisms

Flap Control System

Reaction Control System

Descent System

Recovery System

Avionics (POW, DHS, RTC)

Harness

Software

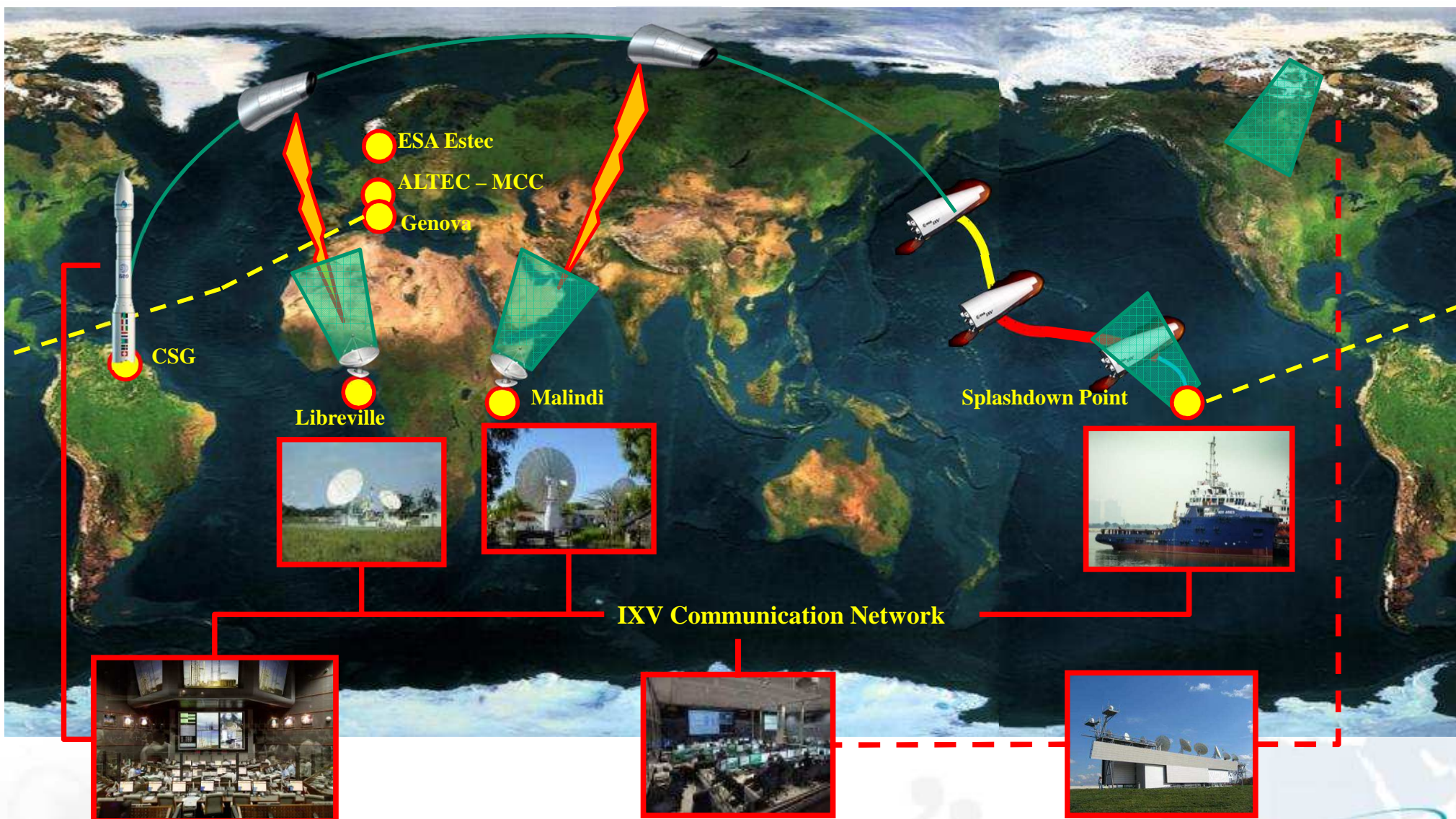
System Drop Test

IXV Flight Segment



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IXV Ground Segment & Logistics Deployment



CSG Launch Control Center

ALTEC Mission Control Center

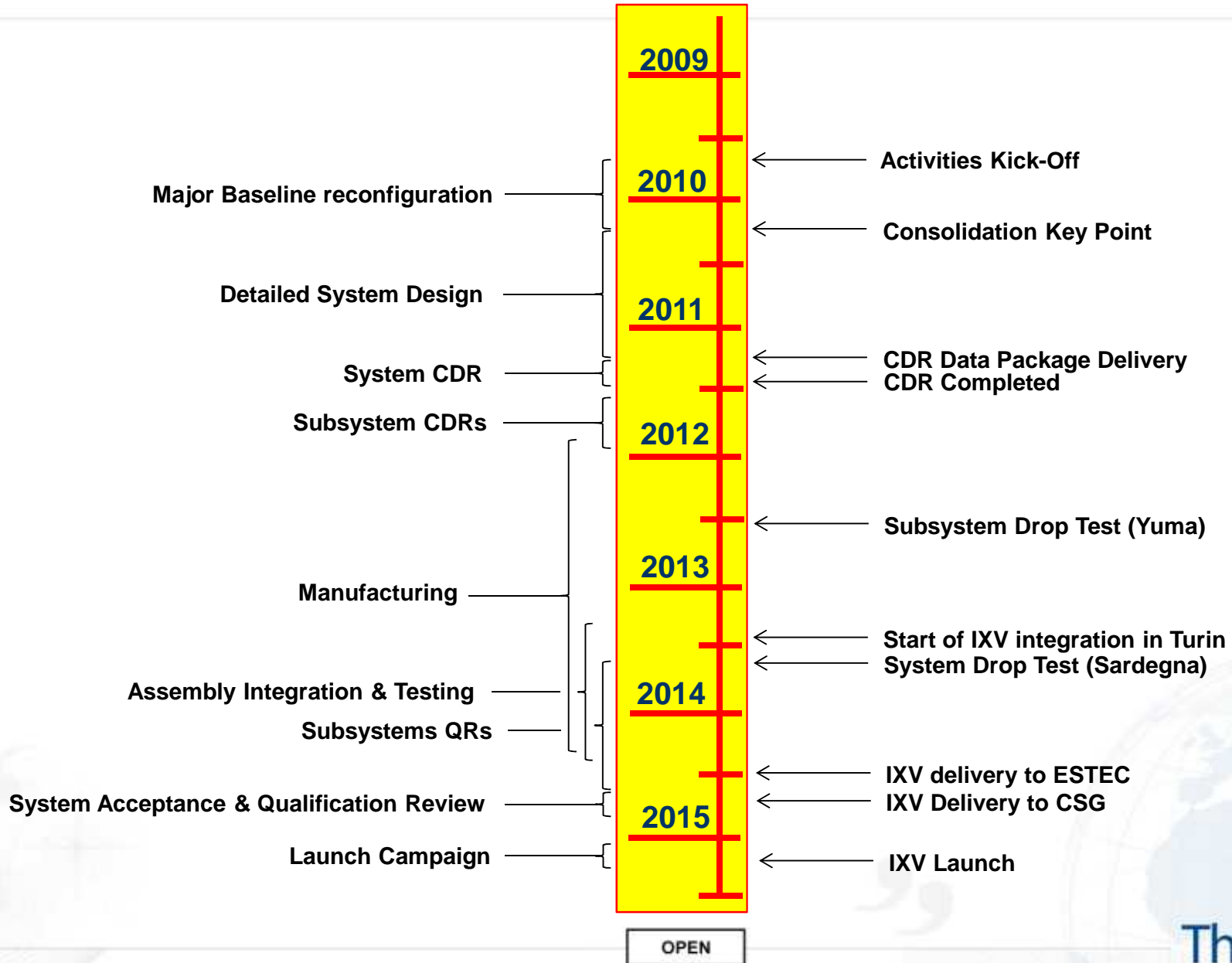
Localization Satellites

IXV Recovery Service



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IXV Planning



IXV Industrial Organization

IXV Prime Contractor



Mission Analysis & Trajectories



RCS / FGSE



Cold Structure & Mech.



GNC



Descent System



Recovery System



Drop Test



AED/ATD



IFE



MGSE/EGSE



Operations & Ground Segment



Recovery & Transport.



TPS & HS



Avionics & SW



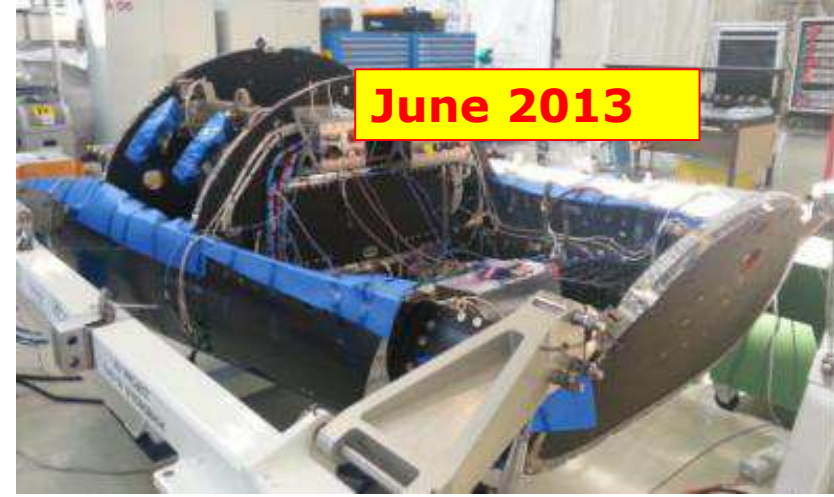
Flap Control



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IXV Major AIT Events



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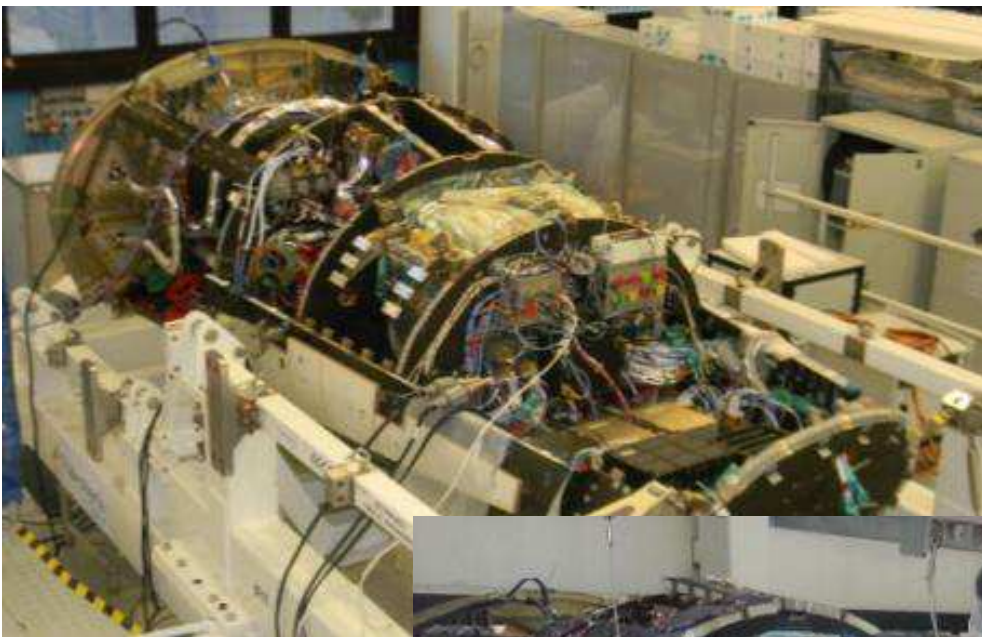
IXV Major AIT Events



Fwd & Aft Mating - December 2013

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IXV Major AIT Events



Vehicle Finalization – January/May 2014

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IXV Major AIT Events

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Final Shingles Installation – June 2014

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IXV Major AIT Events



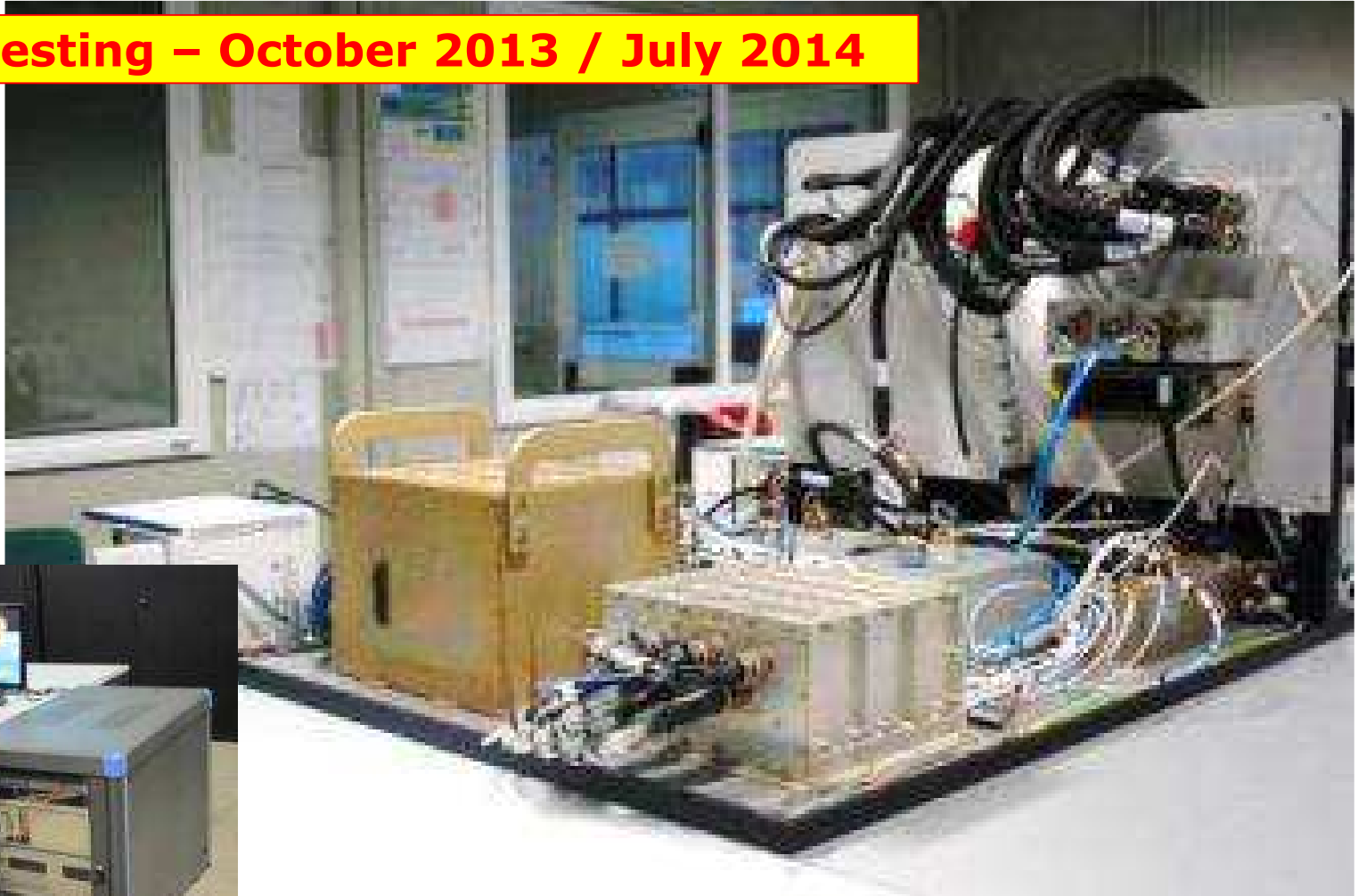
Final Installation – June 2014

Delivery in ESTEC – June 26th 2014

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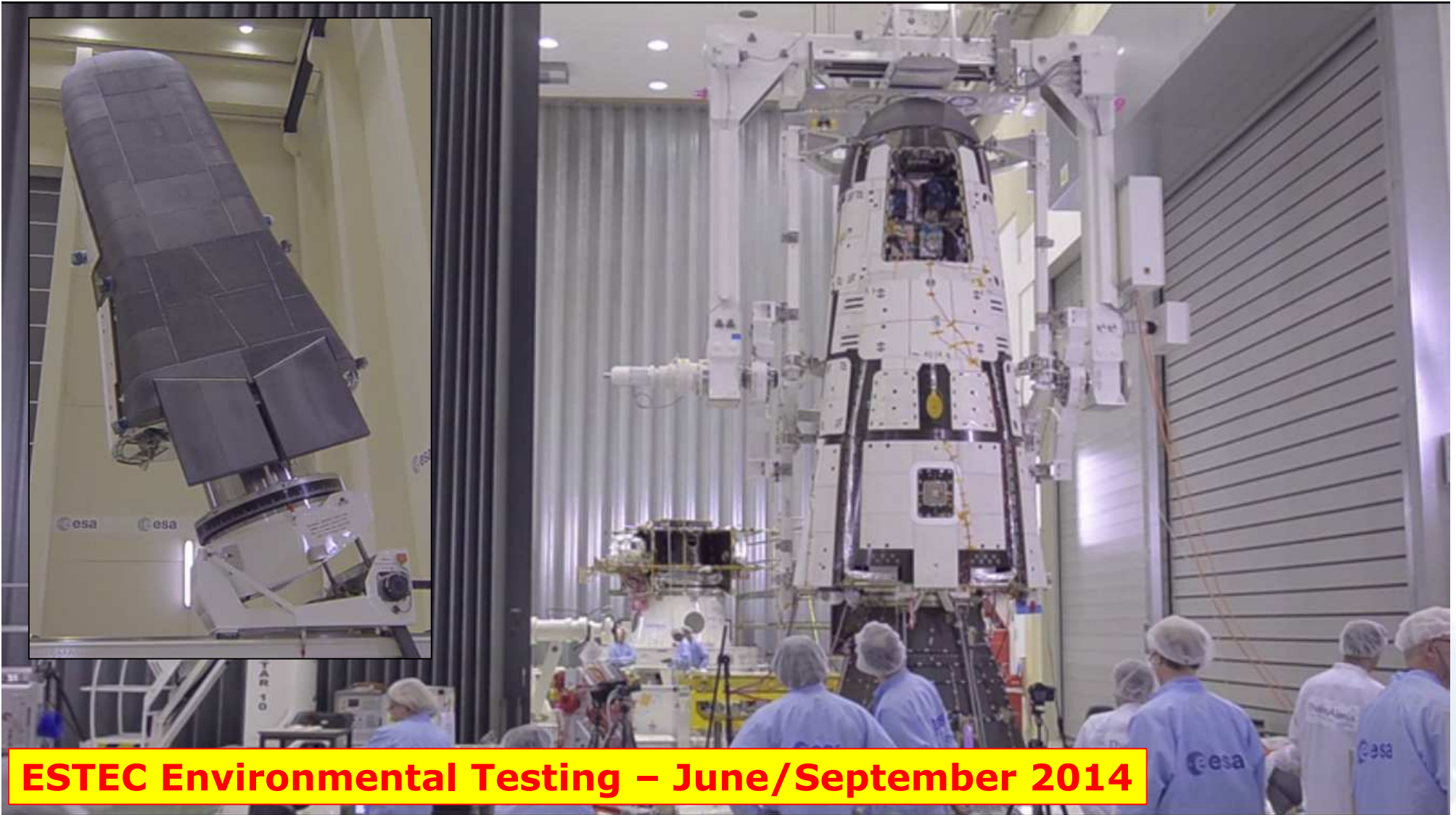
IXV Major AIT Events

GNC & SW Testing – October 2013 / July 2014



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IXV Major AIT Events



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IXV Major Launch Campaign Events

IXV Arrival in French Guyana – September 24th 2014



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IXV Major Launch Campaign Events



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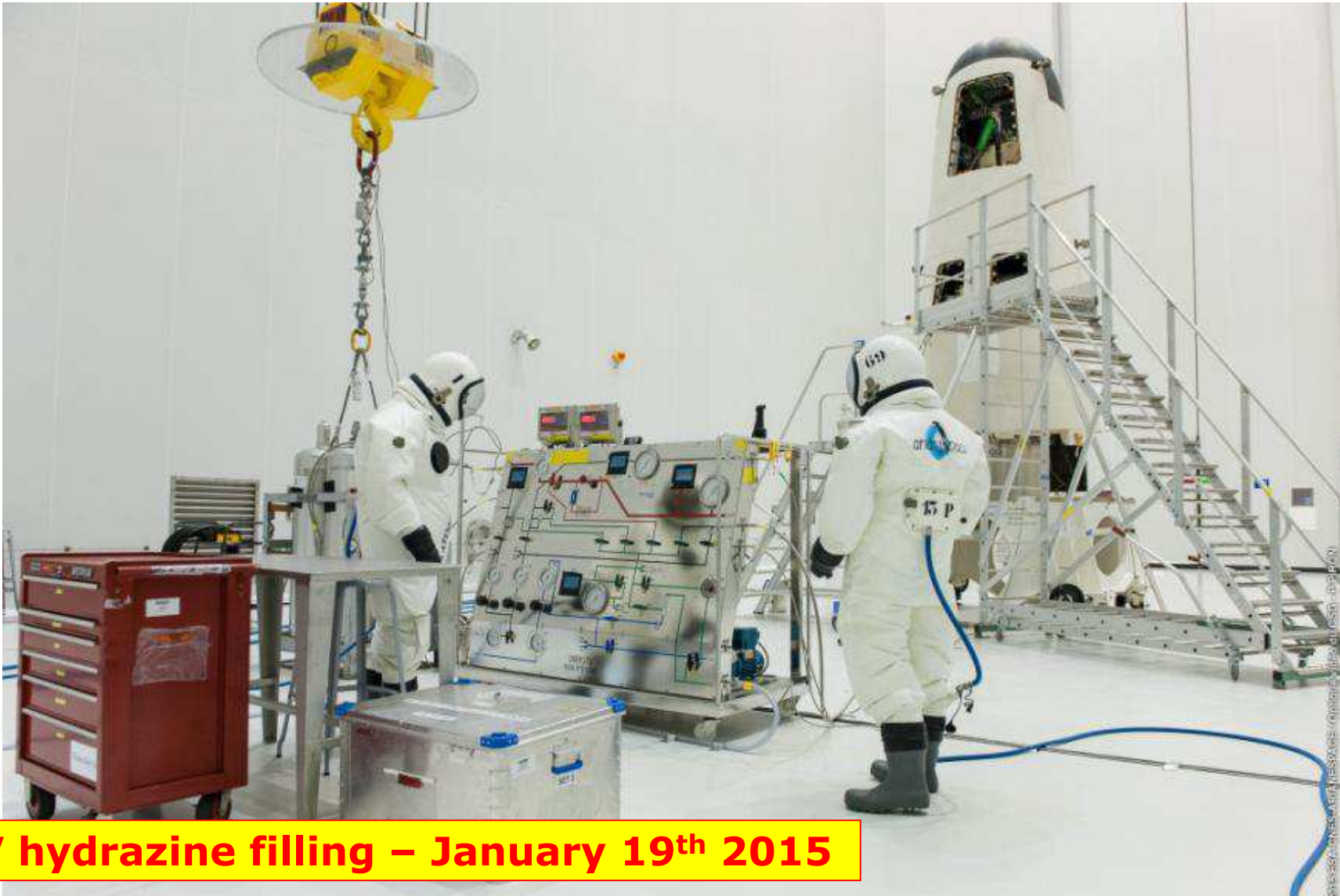
IXV Major Launch Campaign Events



IXV retrieved from stowage – January 9th 2015

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IXV Major Launch Campaign Events



IXV hydrazine filling – January 19th 2015

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IXV Major Launch Campaign Events



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IXV Major Launch Campaign Events



IXV installation on VEGA adapter and final AIT doors sealing – January 26nd 2015

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IXV Major Launch Campaign Events

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IXV encapsulation – January 28th 2015

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IXV Major Launch Campaign Events



IXV transportation to Launch Pad and installation on VEGA – January 31st 2015

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IXV Major Launch Campaign Events



IXV dress rehearsal – February 6th 2015

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The IXV Mission

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IXV Launch – February 11th 2015 – 13:40 UTC

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The IXV Mission

Real Time Operations from CSG – Turin – Pacific Ocean



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The IXV Mission



IXV Successful Splashdown!

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The IXV Mission



IXV Recovery Operations

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The IXV Mission

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IXV decontamination activities

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The IXV Mission

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IXV safely secured on board heading towards Panama

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The Intermediate eXperimental Vehicle!



IXV

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IXV Flight Data Collected

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- More than 200 Gb of raw and pre-processed data have been collected from the downloaded telemetry and from the memory cards installed on board the IXV (data recorders – IR Camera - parachute camera).
- The data have been delivered to ESA and are ready for detailed post flight analysis
- Thales Alenia Space has completed the Level 0/1a post flight assessment and is looking forward to perform the Post Flight Review (PFR) as final event of the Phase E2A/F
- All IXV H/W is being collected in Turin and will be soon ready for shipment to ESTEC

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Thanks for Your Attention!