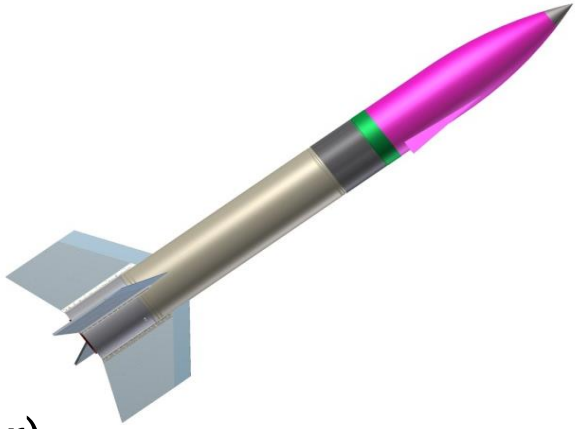
HEXAFLY-INT Research project

ITALIAN SMEs PARTECIPATION EXPERIENCE

01.07.2014
First Symposium on Hypersonic Flight
ROMA

S. Cardone
TECNOSISTEM

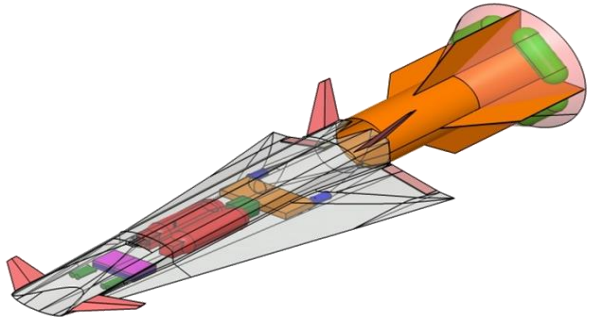
The EU FP7 HEXAFLY-INT project objective is based on a flight experiment focused on a self-controlled air vehicle glider configuration to demonstrate high aerodynamic efficiency, i.e., high Lift/Drag ratio in flight



HEXAFLY-INT is a prosecution of HEXAFLY.

The HEXAFLY-INT system is composed by:

- A Launch Segment
  - Ground launched solution (S43-S40 booster)
  - The Launch Facilities (for the launch phase preparation)
- An experimental payload
  - Experimental Support Module (ESM)
  - Experimental Flight Test vehicle (EFTV)



The HEXAFLY-INT project duration is 5 years.

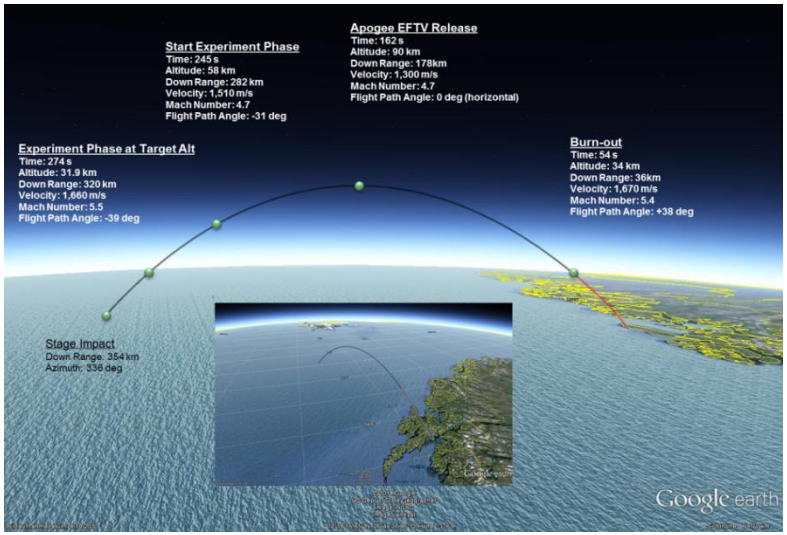
HEXAFLY-INT PARTNERS

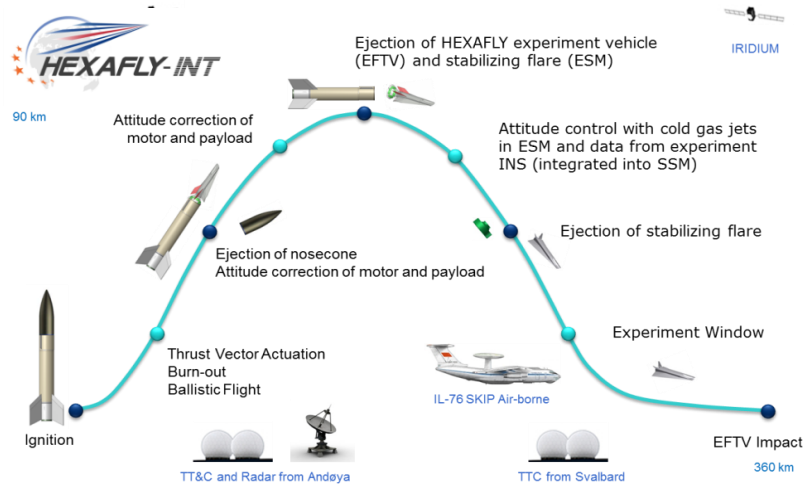
European Consortium

Russian Federation Consortium

Australian Consortium

HEXAFLY-INT: Mission & Launch Vehicle Lay-out





✓ Mission

Launch Vehicle Layout

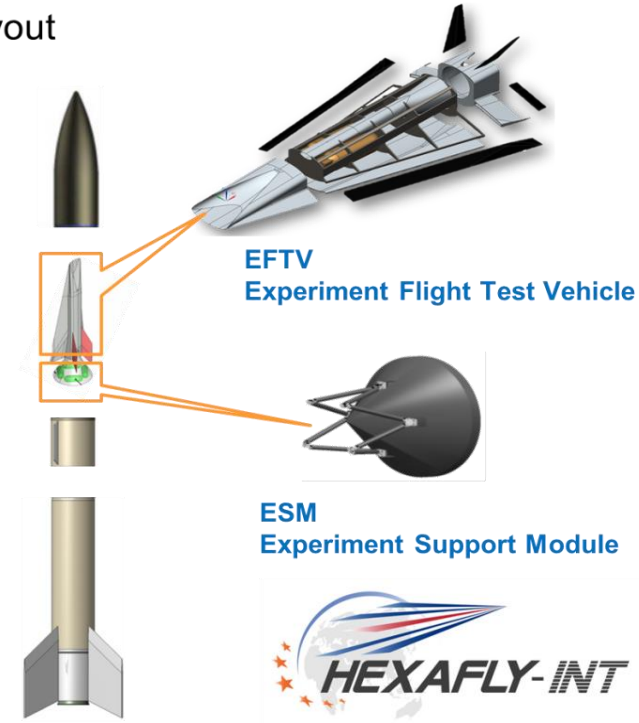
Nose Cone (NC)

EFTV
Experiment Flight Test Vehicle

ESM
Experiment Support Module

Motor Support Module (MSM)

Launch Vehicle (L/V)

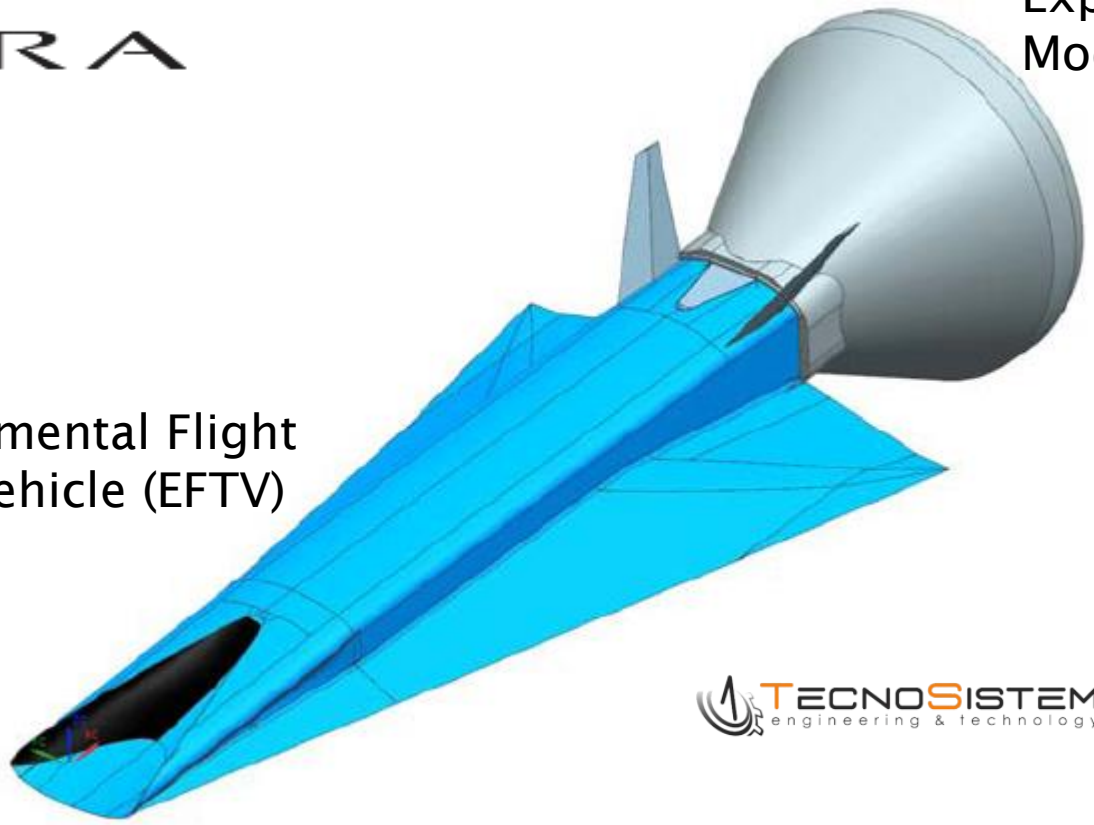


✓ Launch Vehicle Layout

HEXAFLY-INT: CIRA & Italian SME Activities & Responsibilities

CIRA

Experiment Support Module (ESM)



Experimental Flight Test Vehicle (EFTV)

Marotta Advanced Technologies

TECNOSISTEM engineering & technology

TSD Space

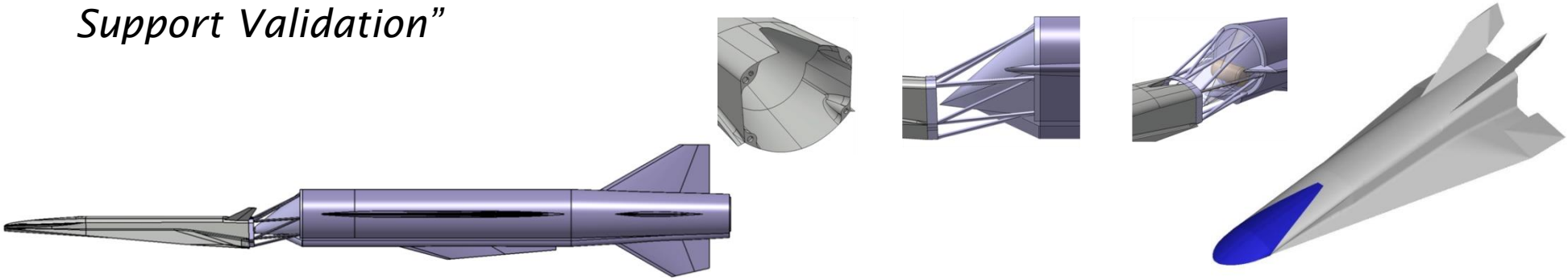
HEXAFLY-INT: CIRA & Italian SME Activities & Responsibilities

- *CIRA & Italian SMEs (MAT, TSD, TET) activities are the Definition, Design and Integration/Assembling/Testing of the scientific payload included the on-board subsystems/units*

- *CIRA is Project Engineer (Design Authority) of scientific payload composed by the Experimental Support Module (ESM) and by the Experimental Flight Test Vehicle (EFTV)*

- *The EFTV AIV/AIT activities will be performed at CIRA facilities under CIRA authority*

- *CIRA, as european WP leader, is mainly involved on the "Simulation and Support Validation"*



Tecnosistem Engineering and Technology is a modern company providing state-of-the-art engineering services throughout the whole Italian market.

Covering a number of specific competencies, built up after a complex diversification process, it is involved within the engineering development of major infrastructures as well as the most modern transportation systems.
This makes our company unique among the Italian engineering services suppliers.

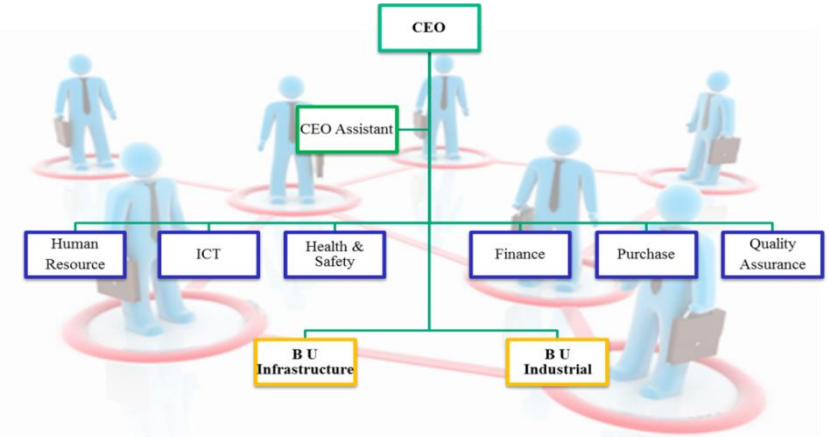
Tecnosistem offers a wide range of solutions, from the conceptual design all the way up to the industrialization of the product, this is provided through well-honed engineering skills covering the whole life-cycle of the transportation market vehicles, providing support to the manufacturers with the following services: integrated engineering (CAD/CAM/CAE), certifying documentation (structural/stress analysis dossier), CFD analysis, production support and Project Management.

Tecnosistem is also involved in several National research program concerning aeronautical, automotive and rail sector, gathering wide experience on design and structural analysis for metallic and composite structure.

One of these is ASIA "Architetture Strutturali e processi Innovativi per l'Ala" (Wing Innovative processes and Structural Architectures)

And also High-Speed Experimental Fly Vehicles – INTernational HEXAFLY - INT

TecnoSistem: Company Profile



Organization : Business Unit

Organization : Sites

Customers : Our Goodwill

PRIMARY AND SECONDARY STRUCTURES

- Preliminary sizing
- Structural component design
- Finite Element Analysis
- Stress Analysis (Linear & Non linear static analysis; Stationary & Non stationary Thermal Analysis; Fatigue Analysis; Crash Analysis)
- Manufacturing 3D models/drawings
- Dynamic analysis (normal modes, frequency response and transient analysis);

COMPUTATIONAL FLUID DYNAMICS

- Steady and transient analysis on internal flow
- Conjugate heat transfer and radiation problems
- Multicomponent multiphase flows and free surface treatment
- Passenger cabin thermal comfort analysis
- Coupled CFD, thermal & stress analysis

DESIGN & STYLING

- Transportation Systems Design
- Interior Design
- 3D Modelling & Rendering
- Virtual Animation
- Ergonomic Control

INTERIOR DESIGN

- Seat Component Design
- Manufacturing models/drawings
- Production support

MECHANICAL SYSTEMS INSTALLATION

- Concept layout definition
- Routing and cabling design
- Manufacturing models/drawings
- Integration e Testing Procedure

Capabilities

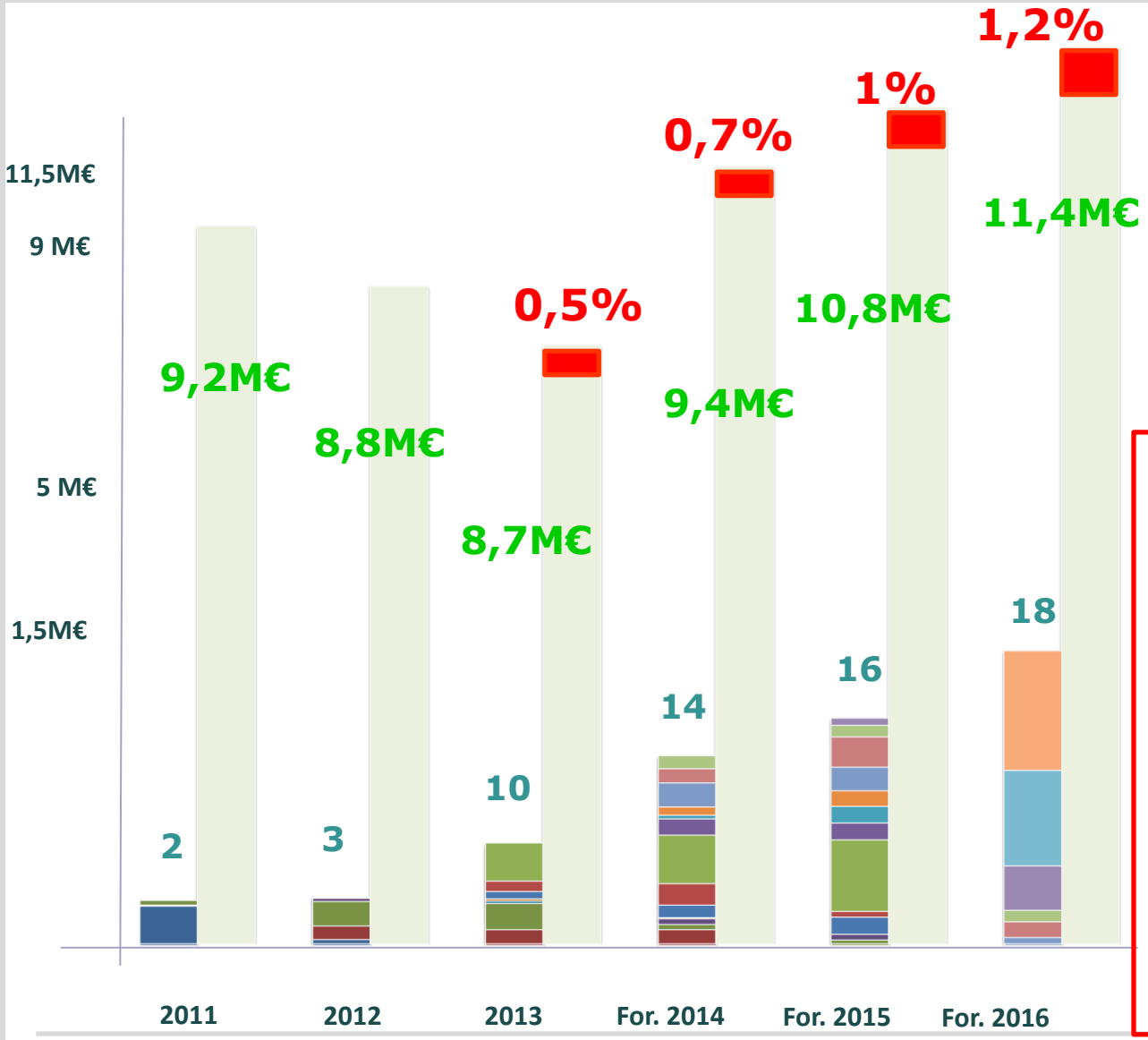
TECNOSISTEM engineering & technology

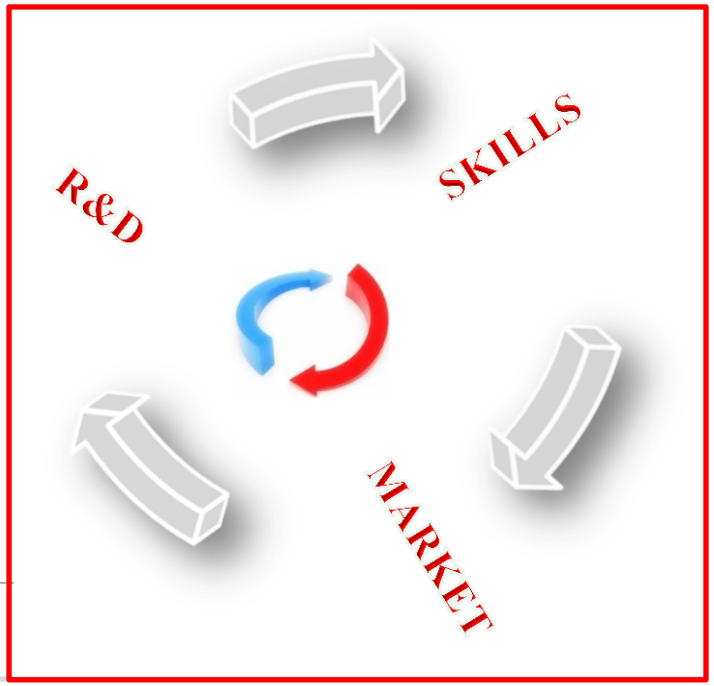
TSD Space

Marotta Advanced Technologies

HEXAFLY-INT

TecnoSistem: R&D





TECNOSISTEM engineering & technology

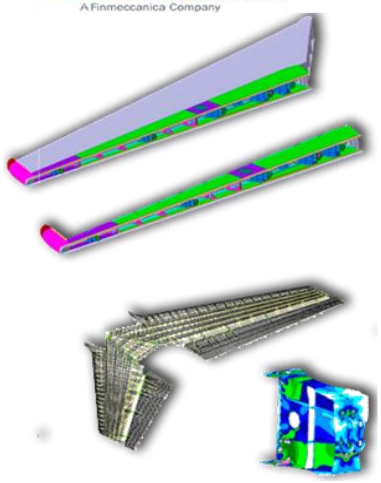
TSD Space

Marotta Advanced Technologies

HEXAFLY-INT

TecnoSistem: References

AleniaAeronautica
A Finmeccanica Company



➢ **Program**

Bombardier CSERIES

HSTAB Trailing Edge & Tip

➢ **Activities Performed**

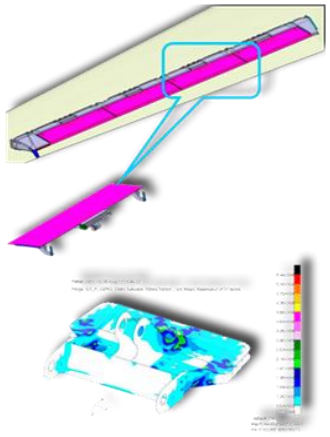
DESIGN

- Layout Design
- 3D Modelling Single Parts, Assemblies and Installations
- Lay up for composite part
- Part & Instl. Drawing
- Part List

STRESS

- Linear and non linear analysis
- Fatigue & Damage Tolerance Analysis
- Structural substantiation based on FEM analysis and analytical methods
- Justification Dossiers

MAGNAGHI AERONAUTICA S.p.A.



➢ **Program**

Bombardier CSERIES

OUTER WING SPOILERS

➢ **Activities Performed**

DESIGN

- Layout Design
- 3D Modelling Single Parts, Assemblies and Installations
- Lay up for composite part
- Part & Instl. Drawing
- Part List

STRESS

- Linear and non linear analysis
- Fatigue & Damage Tolerance Analysis
- Structural substantiation based on FEM analysis and analytical methods
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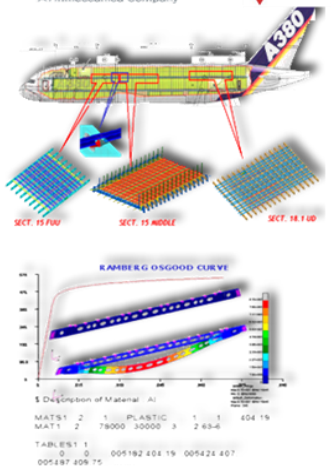
A Finmeccanica Company



➢ **Program**

A380 Pax & Cargo

Floor Grids Sect 15 FUU & 18 .1 UD

➢ **Activities Performed**

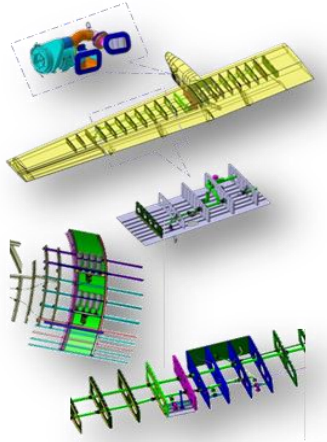
DESIGN

- Program Management
- 3D Modelling Single Parts, Assemblies and Installations
- Part & Instl. Drawing
- Part List

STRESS

- Linear and non linear analysis
- Fatigue & Damage Tolerance Analysis
- Justification Dossiers

AleniaAeronautica
A Finmeccanica Company



➢ **Program**

ALENIA ATR 42 MELTEM 3

FUEL DUMP, WIND SHIELD WASHER, ALTERNATOR COOLING INSTALLATION

➢ **Activities Performed**

DESIGN

- Layout Design
- 3D Modelling Single Parts, Assemblies and Installations
- Part & Instl. Drawing
- Part List

STRESS

- Linear and non linear analysis
- Structural substantiation based on FEM analysis and analytical methods
- Justification Dossiers

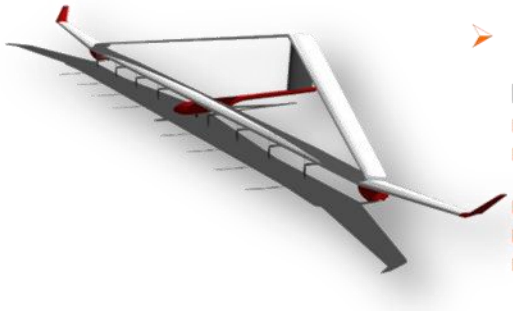
TECNOSISTEM engineering & technology

TSD Space

Marotta Advanced Technologies

HEXAFLY-INT

CIRA



➢ **Program**

HAPD

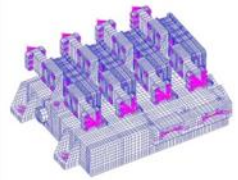
PRIMARY STRUCTURE & LANDING GEAR

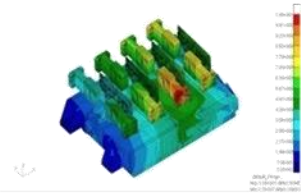
➢ **Activities Performed**

DESIGN

- Layout Design
- 3D Modelling Single Parts, Assemblies and Installations
- Lay up for composite part
- Part, Assies & Instl. Drawing
- Part List

ThalesAlenia Space





➢ **Program**

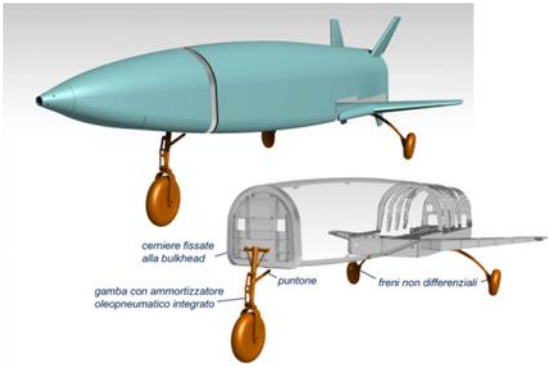
BLAGOVEST

KA BAND TELEMETRY TRANSMITTER

➢ **Activities Performed**

- Static Analysis
- Modal Analysis
- Dynamic Analysis
- Stress Report

CIRA



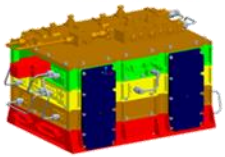
➢ **Program**

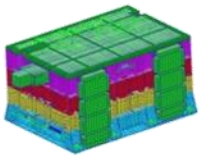
USV POLLUCE Landing Gear

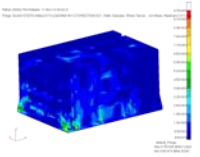
➢ **Activities Performed**

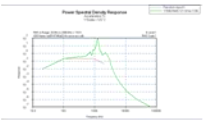
- Feasability Studies
- Trade off analysis
- Nose & Main Landing Gear preliminary design

ThalesAlenia Space









➢ **Program**

COSMO 2° GENERATION

SBDT (S BAND TRANSPONDER)

➢ **Activities Performed**

- Static Analysis
- Modal Analysis
- Dynamic Analysis
- Venting Analysis
- Thermal Analysis
- Stress Report

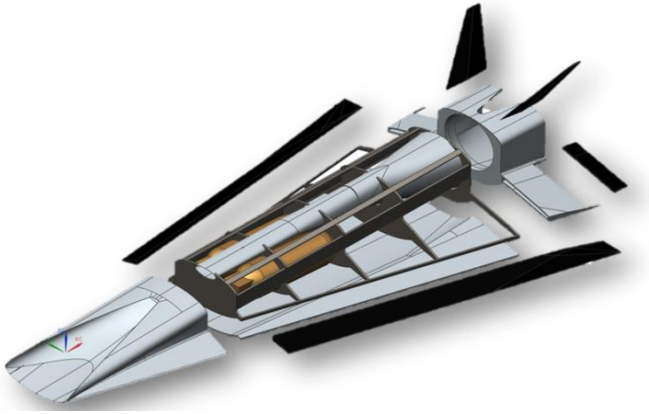
TECNOSISTEM engineering & technology

TSD Space

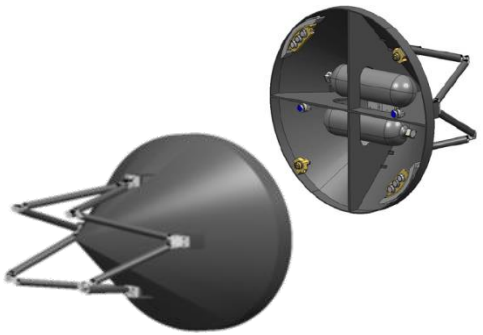
Marotta Advanced Technologies

HEXAFLY-INT

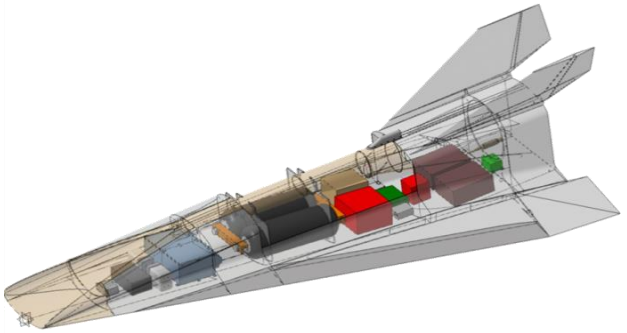
Based upon the designs from HEXAFLY and the Phase-0 Study of HEXAFLY-INT TecnoSistem is in charge for the following main activities included in WP3



EFTV
Experiment Flight Test Vehicle
Cold Structure



ESM
Experiment Support Module
Structure



EFTV
Experiment Flight Test Vehicle
Subsystem Integration

- ✓ Preparation of the global Finite Elements Model
- ✓ Preliminary sizing
- ✓ Stress Analysis
- ✓ Design of the Experiment Support Module
- ✓ Design of the mechanical interfaces for all subsystems
- ✓ Structural Design of EFTV Cold structure
- ✓ Subsystem integration
- ✓ 3D CAD Models and drawings

TSD Space: Company Profile

Techno System developments is a private SME developing on board and ground electronic equipment for space with specific focus on real time processing and small platform applications. The main products are Electronics for Optical Payloads and Video Systems, Spacecraft Avionics, Control and Data Management Systems for Scientific Payloads & Instruments, EGSE & SCOE. TSD long track record includes flight proven applications for Satellites, Capsules, ISS, Sounding Rockets, UAV/USV, Stratospheric Balloon.

TECNOSISTEM engineering & technology

TSD Space

Marotta Advanced Technologies

HEXAFLY-INT

TSD Space: References

MAIN SPACE PROGRAMS

Satellites
- Digital Video System for PRISMA Formation flying satellite
- ACS I/F and HK boards for the SMU of SAR-LUPE
- On board electronic platform for small satellites OLOS
- CDMU boards for ARGO
- Data Handling Electronics for Optical payload of MIOSAT and PRISMA

Capsule
- Data Handling Unit for Foton 12, m-1, m-2, m-3

Unmanned Space Vehicle
- Avionics System including OBDH, GN&C, PMS, TT&C, Harness;
- Extended Operating System of on board SW;
- Rapid prototyping SW environment
- Ground Segment Network

ISS
- Stereoscopic camera Electronics
- Digital Video System for EML multiuser facility

Sounding rockets
- CDMS for payloads on board Maser 10- Maser 8- Maser 6- Maxus 5- Texus 34 - Minitexus;
- Digital Video System for payloads on board Maser 8-9-10-11-12

ROSETTA
- EGSE for VIRTIS Instrument

SHUTTLE
- GET AWAY payload G-22
- GET AWAY payload EMITS
- SCOE for BDPU

Stratospheric Balloon
- Carrier Located Avionics
- Telecommand System

Unmanned Air Vehicle
- Control & data management system for payload

GMES Sentinel

1553 SCOE – OLCI Camera SCOE – OLCI Image SCOE

CUSTOMERS

- ✓EUROPEAN SPACE AGENCY
- ✓ITALIAN SPACE AGENCY
- ✓CIRA
- ✓TAS-I
- ✓TAS-F
- ✓SWEDISH SPACE CORPORATION
- ✓EADS/ASTRIUM
- ✓ROVSING
- ✓COSINE
- ✓CARLO GAVAZZI SPACE
- ✓LABEN
- ✓GALILEO AVIONICA
- ✓OHB
- ✓FERRARI
- ✓VERAHERT
- ✓MARS
- ✓CORISTA
- ✓ANSALDO
- ✓CENTROSPAZIO
- ✓MIUR

TECNOSISTEM engineering & technology

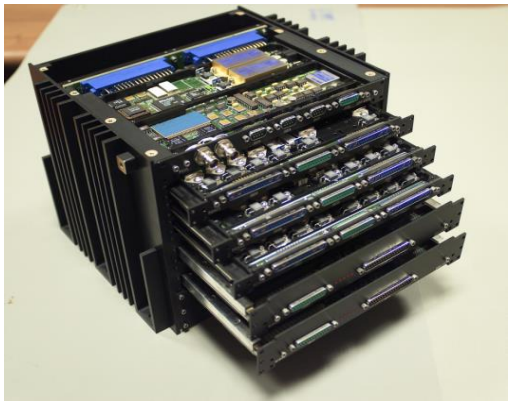
TSD Space

Marotta Advanced Technologies

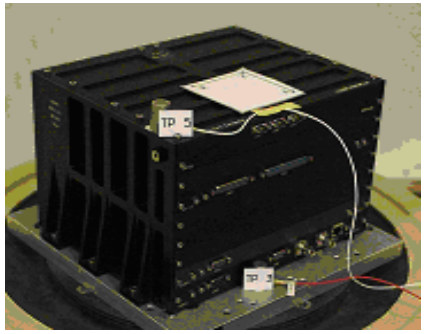
HEXAFLY-INT

For USV TSD developed the entire Avionic System

- DHOB Data Handling On Board Computer
- GNOB Guidance Navigation & Control On Board Computer
- RTU Remote Terminal Unit
- The Electrical Power System composed by:
  - PMS Power Management System
  - Two Batteries
  - CLAV Carrier Located Avionics

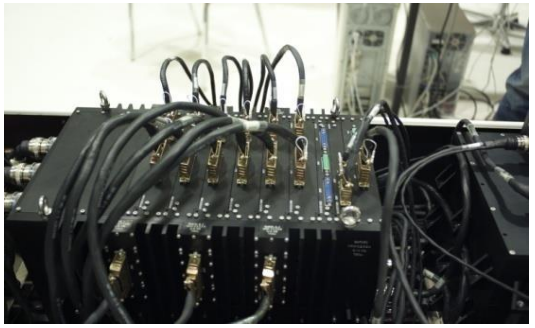


PMS



GNOB

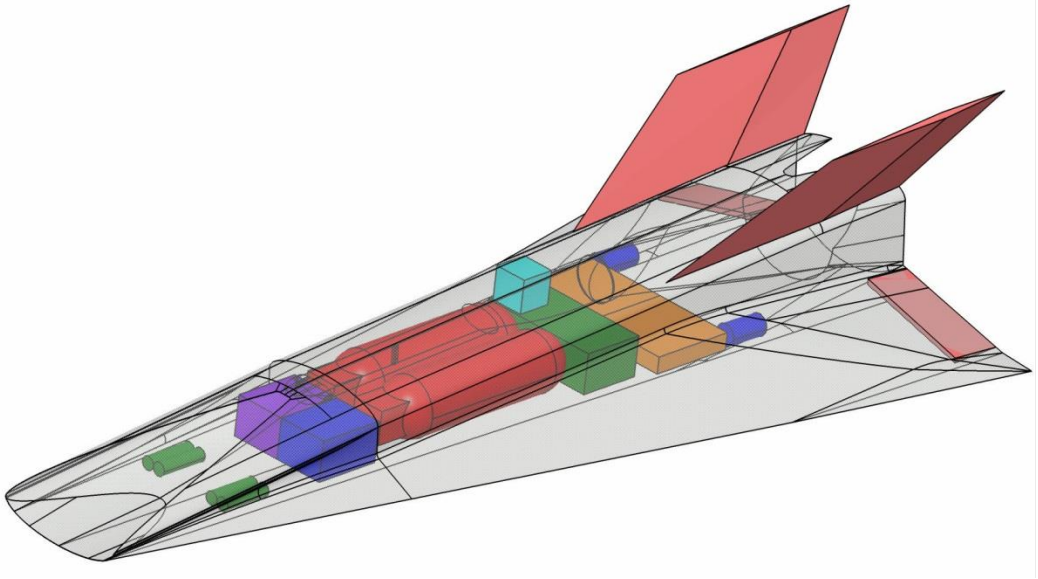
DHOB



CLAV

RTU

Batteries



TSD will contribute to HEXAFLY-INT with the followings:

- **POWER SYSTEM**
- **GNC**
- **SUPPORT TO INTEGRATION & AIT**

The Marotta S.r.l. is specialized in the production of precision mechanical components. The Marotta has been on the market since 1957.

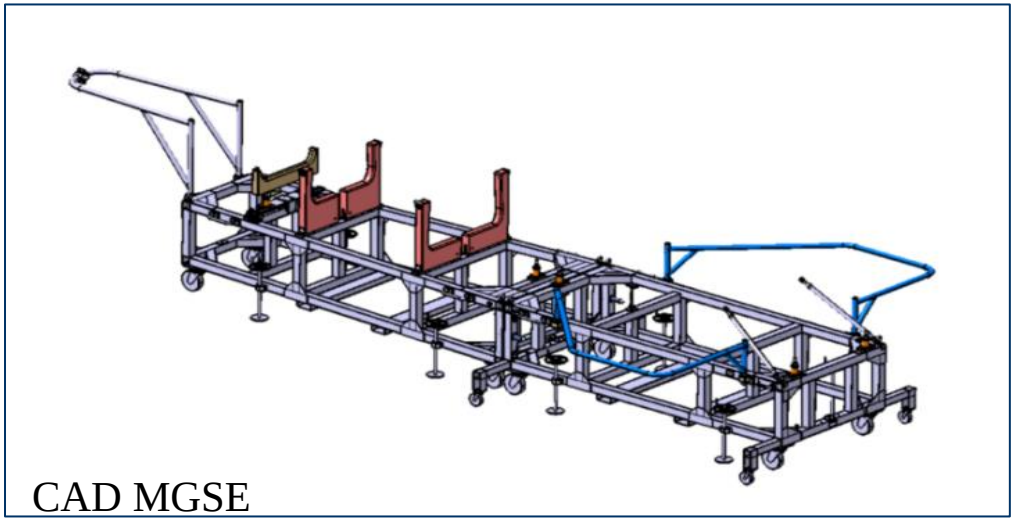
The techniques of traditional production have been replaced by automatic systems that integrate CAD/CAM, CNC machines and 3D measurements, so that the process of production is rapid and safe.
The production area is almost 1500 mqs, divided in 2 specializations:

- **Design:** design of scientific tools for the research in Optics, Aerospace, Physics of the Particles

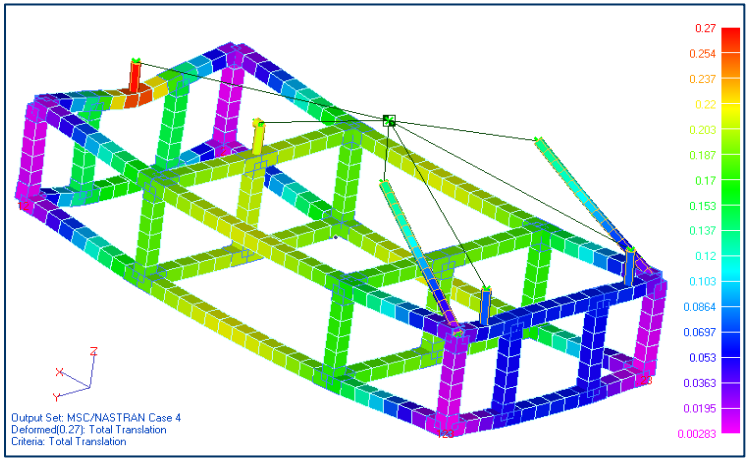
-**Production**: CNC machines up to 4 axis

USV (Unmanned Space Vehicle) Project and manufacturing of two aircrafts and the Integration Stand Assembly (ISA)

MGSE- USV

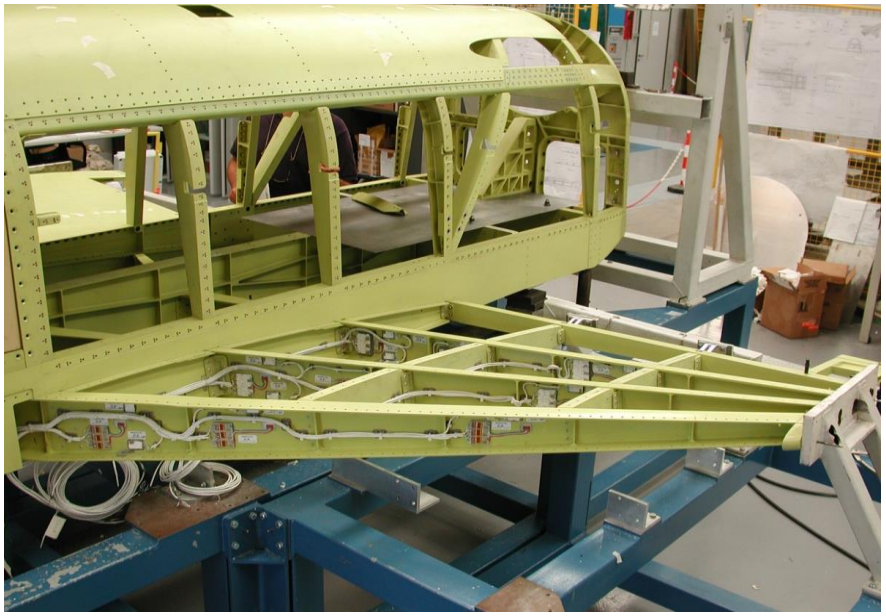


CAD MGSE



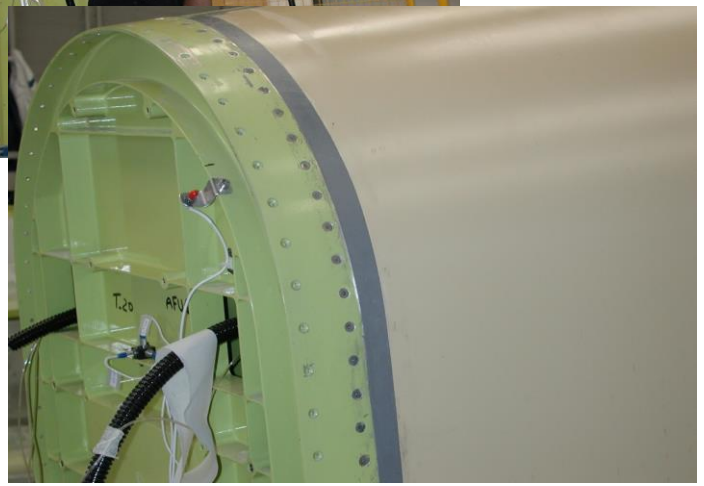
Detail FEM MGSE

CIRA-USV Project & MGSE

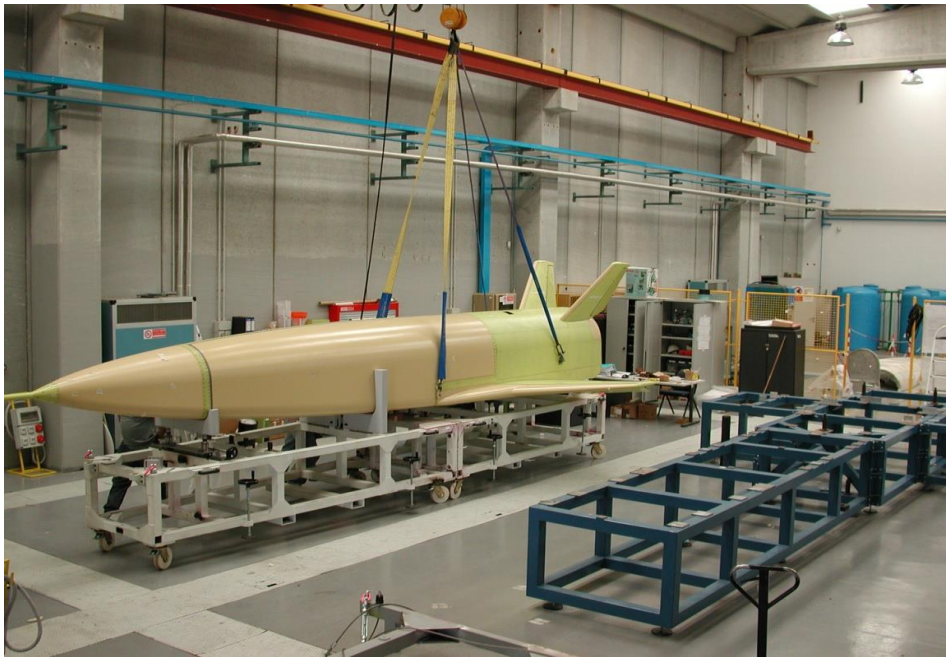


Strain Gauge installation and testing

Pressure taps installation and Wing Rivetting

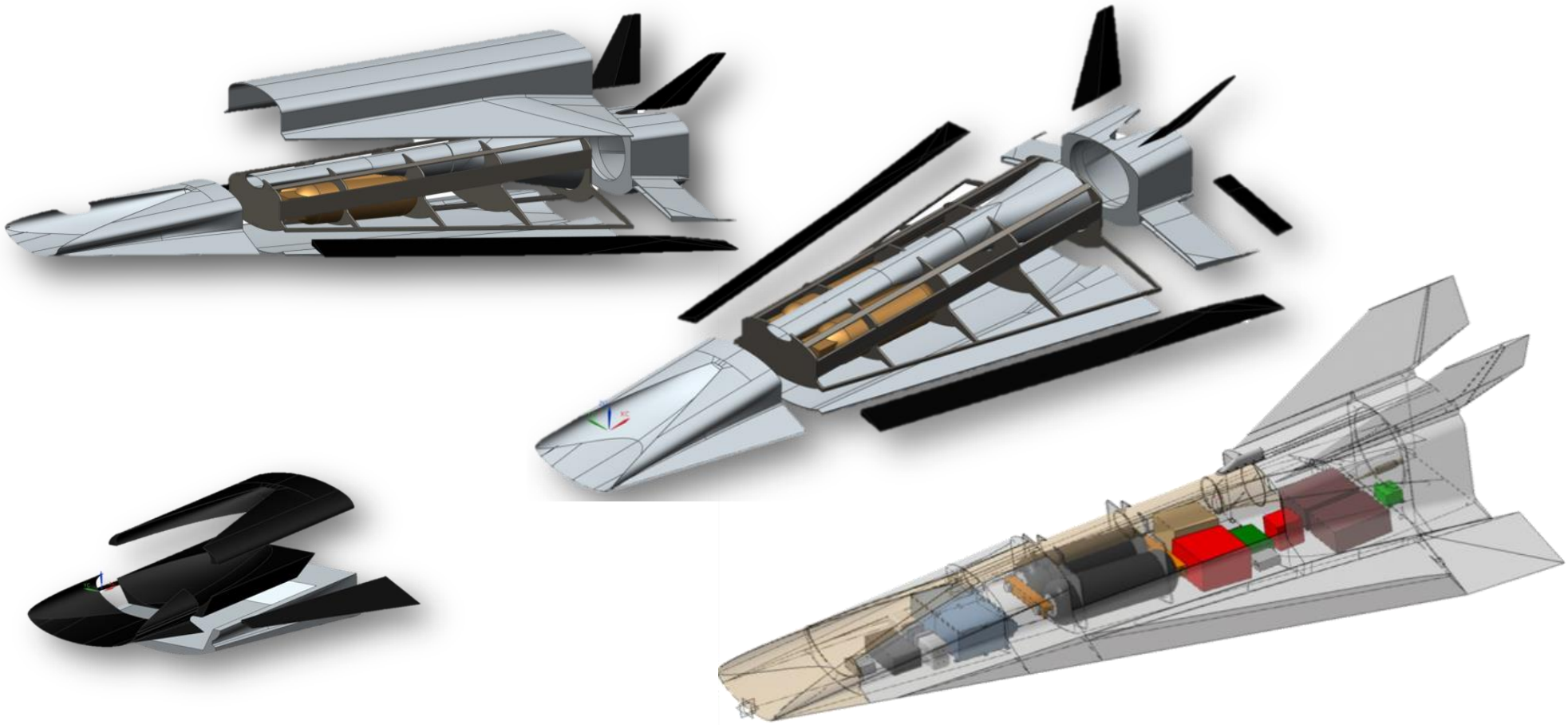


CIRA-USV Project & MGSE



Integration facility and handling device

Launch Site Support



MAROTTA WILL CONTRIBUTE TO HEXAFLY-INT WITH THE MECHANICAL ASSEMBLY , INTEGRATION AND TESTING OF THE EXPERIMENTAL FLIGHT TEST VEHICLE (EFTV)

CIRA

Thank You !

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