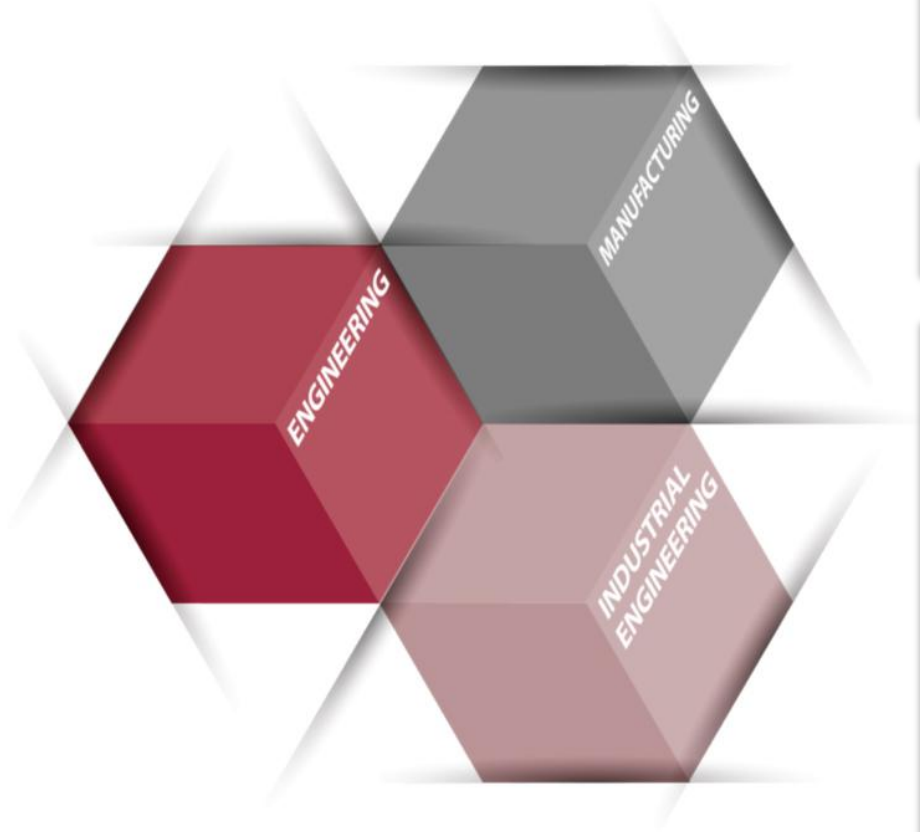
ema spa

Shaping the challenges

Progetto ULTRAS: integrazione di un MALE in in uno spazio aereo civile

A. Miraglia, Product Engineering Manager

The Company



DEMA has been operating in the aerospace field since 1993, as a prominent innovative company with the capabilities to offer a complete, *integrated* product.

MISSION STATEMENT

- To be **World-Class Supplier** for Aerostructures
- To create **Added Value** through Integrating Design, Industrialization, Manufacturing and Assembly
- To be **Your Partner to Share the Challenges**

DEMA Vision

Strategic View

- Design to build
- R&D and Innovation
- Customer Management
- Lean thinking
- International Supply Chain

Core Competencies

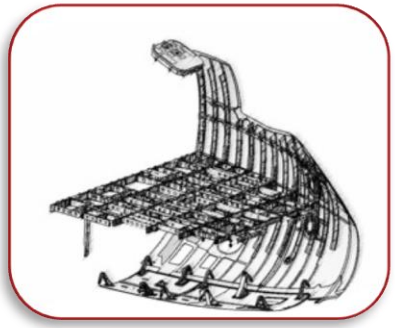
- Aerostructure Components Design, Manufacturing and Assembly
- Sheet Metals, Machining, Composites
- Innovative Materials and Processes

Values

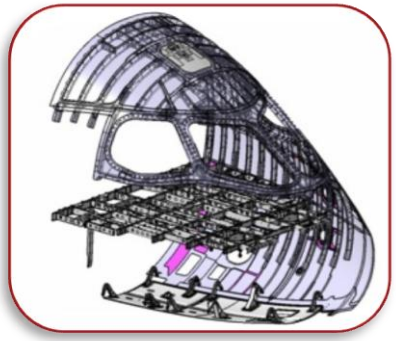
- Engagement
- Perseverance
- People
- Respect

DEMA Group

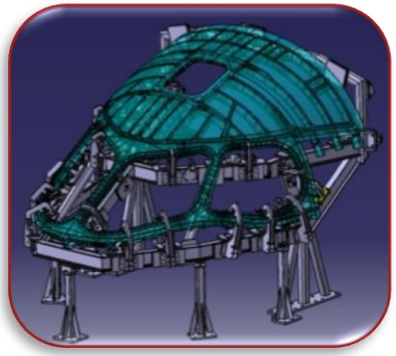
Capabilities



Concept



Design



Industrialization

Production

Customer Support

Main Customers

LEONARDO HELICOPTERS

LEONARDO AIRCRAFT

LEONARDO AEROSTRUCTURES

BOMBARDIER

Pratt & Whitney
A United Technologies Company

BOEING

AIRBUS DEFENCE & SPACE

Avio

Aero | VODOCHODY

STELIA
RELIABILITY. PERFORMANCE.

IAI
ISRAEL AEROSPACE INDUSTRIES

STRATA
A Mubadala Company

YOUR PARTNER TO SHARE THE CHALLENGES.

ULTRAS

Unmanned Light-Weight Tactical Regional Aerial System

ULTRAS

General Description

ULTRAS is a Tactical UAS able to take off and land in small spaces, transportable along with its ground station in reduced volumes, equipped with advanced datalink systems and capable to integrate with other aircraft in manned/unmanned air traffic.

ULTRAS is able to guarantee, both in the Operative Field by Ground station and in Headquarters, to have the Situational Awareness theater enhanced by 'HD video feed' 24 hours a day in real time, providing for multiple use, in part by performing a mission to type F2T2EA (Find, Fix, Track, target, Engage and Assess).

- Medium range category
- Flight management system
- Robust safe & secure command, control and communication
- Ground control station
- Modularity architecture
- Dual use, ready for civil certification
- High stability aerodynamics
- Suitable for Automatic Take off and Landing
- Interoperability Concept per STANAG 4586

ULTRAS

General Description

Airframe

- wingspan 8m
- taper ratio 0.7
- wing manufactured in CFRP
- center fuse in sandwich panel CFRP
- front and real fuselage panels GFRP
- Wankel - rotary engine 50 hp

Systems

- Flight Control Computer (FCC) e Command Data Handling (CDH)
- ATM/CNS
- Electronic Control Unit
- Power Conditioning and Distribution Module (PCDM)
- Data Attitude Heading Reference System (ADAHRS)
- Radio & Satellite link

ULTRAS UNMANNED LIGHT-WEIGHT TACTICAL REGIONAL AERIAL SYSTEM

Payload

- Synthetic Aperture Radar SAR
- Thermal imaging, Night vision and Forward looking infrared FLIR
- Payload Data Transmitter (PDT)
- Customized (up to 40Kg)
- Supplementary payload (+20kg)

Mission

- Max Endurance > 20h
- Max speed 172 km/h
- Range 200 Km BLOS
- Max operative altitude 8000 meters
- Waypoint flight
- Relative Waypoint
- Targeting
- Automatic Approach

Ground Segment

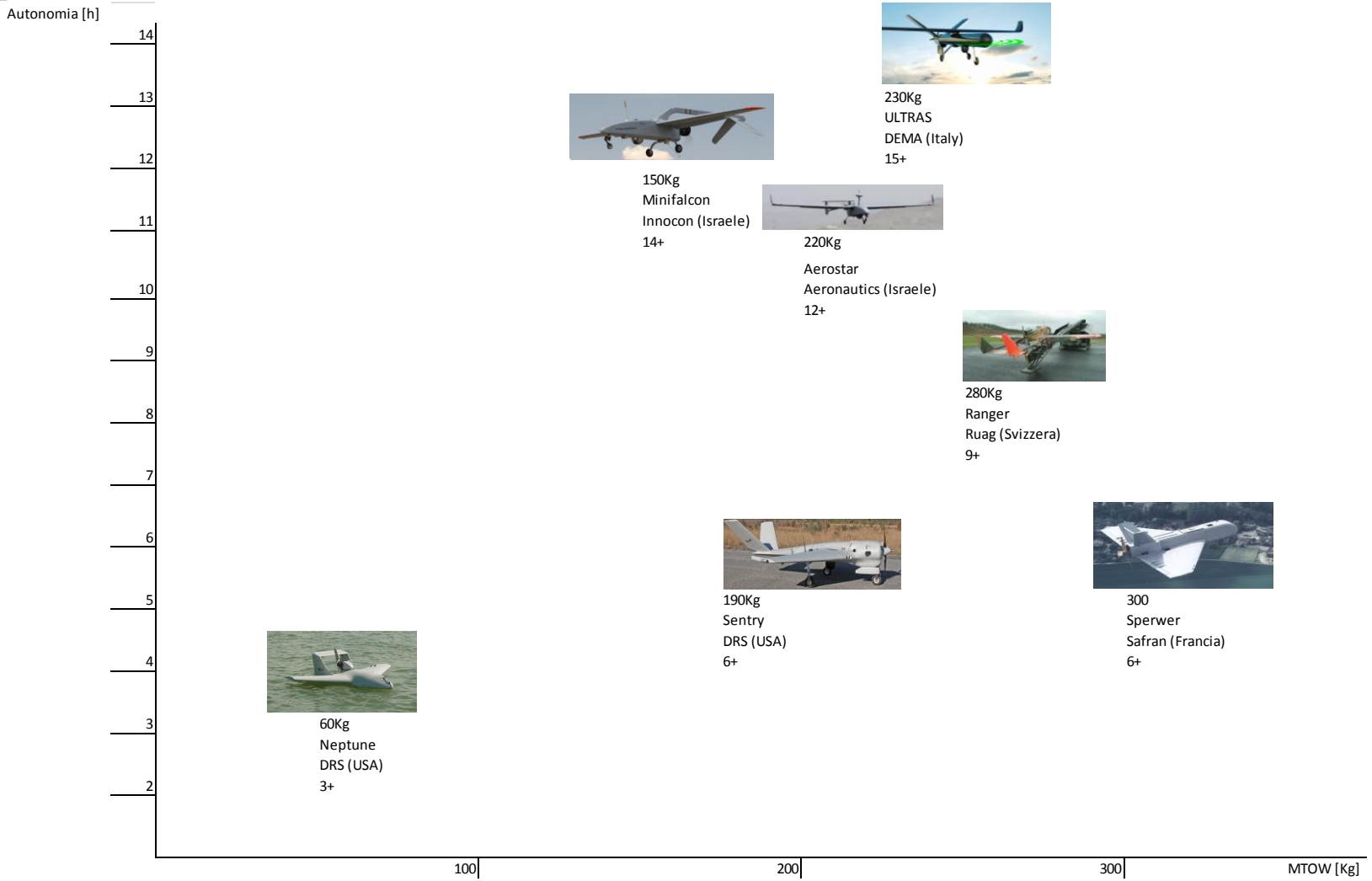
- Portable ground station
- Virtual Cockpit Compliant with NATO standardization STANAG 4586
- Easy-to-read display
- Drag and drop waypoints
- Joystick control
- Payload control
- Modular and easily networked for an infinitely scalable solution

ULTRAS UNMANNED LIGHT-WEIGHT TACTICAL REGIONAL AERIAL SYSTEM

ULTRAS

Market Scenario

According to the current market, ULTRAS would be located in an area devoid of Italian products with similar performance (Class II - Tactical).



ULTRAS

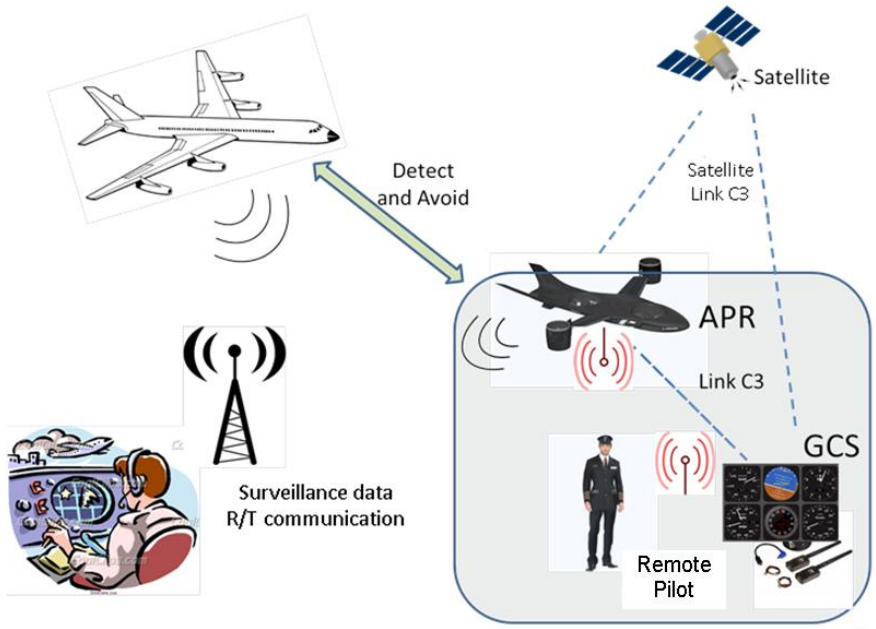
Operative Scenario

ULTRAS can flights **Beyond Visual Line Of Sight (B-VLOS)** under instrument flight rules **(IFR)** or visual flight rules **(VFR).**

IFR (or VFR) operations **in radio line-of-sight (RLOS)** of ULTRAS in non-segregated airspace is allowed by key capability of 'detect and avoid' (D&A) required in relation to cooperative and non-cooperative nearby traffic;

IFR (or VFR) operations **beyond radio line-of-sight (BRLOS) operations,** when ULTRAS can no longer be in direct radio contact with the RPS, satellite link can be used as backup for GNC operation.

- **Traffic Detection and Avoidance:**
  - ✓ Non Cooperative Sensors: EO/IR, Radar;
  - ✓ Cooperative Sensors: Transponder Interrogator, ACAS, ADS-B IN;
  - ✓ Separation and Avoidance Logics including manoeuvres;
  - ✓ Navigation Data Base.
- **Ground and Obstacle Detection and Avoidance.**
- **Safe Flight/Landing Termination Protocol** (via pre-planning)



ULTRAS

Airworthiness & Performance

In order to be compliant to civil type certificate, once the regulations will be ready, a Certification Basis was developed in accordance with EASA (European Aviation Safety Agency) and ENAC (Ente Nazionale Aviazione Civile) actual requirements on RPAS.

- CS-VLA "Certification Specifications for Very Light Aeroplanes" - amendment 1 of 5/03/2009 (STRUCTURE, FLIGHT ENVELOPE)
- CS-23 "Certification Specifications and Acceptable Means of Compliance for Normal, Utility, Aerobatic, and Commuter Category Aeroplanes" - amendment 4 of 15/07/2015 (EQUIPMENT)
- STANAG 4671 "Unmanned Aerial Vehicles Systems Airworthiness requirements", NATO Standardization Agency, Ed 1
- STANAG 4586 "Standard Interface of the Unmanned Control System (UCS) for NATO UAS Interoperability", NATO Standardization Agency, Ed 3
- JARUS CS23-1309 "Safety Assessment of Remotely Piloted Aircraft Systems", Joint Authorities for Rulemaking of Unmanned Systems, Issue 2 (SYSTEM SAFETY ANALYSIS)
- ICAO-10019-RPAS "Manual on remotely Piloted Aircraft Systems (RPAS)", International Civil Aviation Organization (RPAS operations & communications)

Technical requirements are following listed :

MTOW = 230kg
Endurance = 21hrs @ 1.000 feet with 20Kg payload
Ceiling altitude= 26000 feet
Best Economy speed = 105 km/h
Maximum Operative speed = 170km/h
Wing span = 8m
BLOS Operative Range = 200km

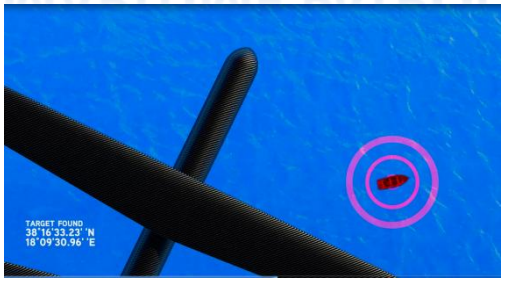
ULTRAS

Mission

Typical Mission Profile:

1. **Aero-photogrammetry**
2. **Border patrol**
3. **Area monitoring**
4. **Visual Reconnaissance**
5. **Crowd and riot control**

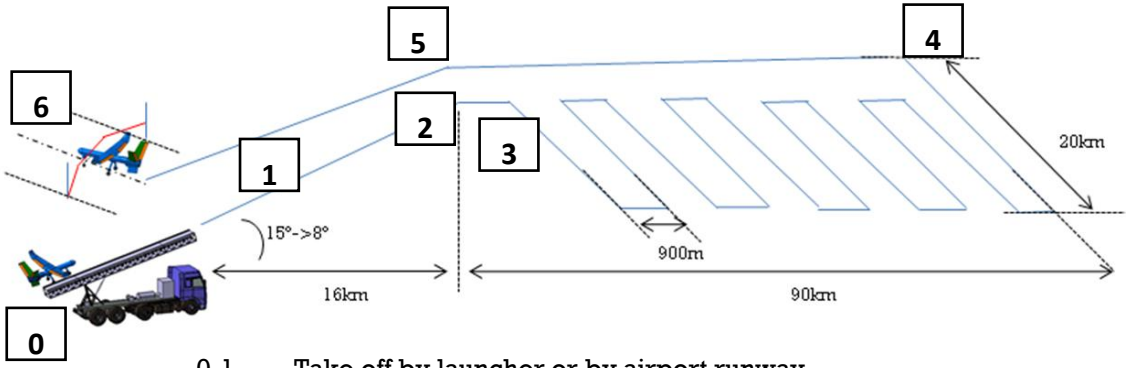
MARITIME PATROL



TERRAIN MAP

F2T2EA

Mapped **Area**: 1800 km2



0-1	Take off by launcher or by airport runway
1-2	Climb by 2 typical missions: (a) "Long range": climb up to 3.000 m (10.000 ft) for Low altitude mission (survellaince by Electroptical payload) (b) "Short range": climb up to 6.000 m (18.000 ft) for High altitude mission (monitoring by Radar payload)
2-3	Cruise up to 200 km from the start point
3-4	Loiter
4-5	Cruise
5-6	Descent and Landing by net or cable assisted recovery

ULTRAS

Peculiar Systems

Mission Payload:

Currently developed Payloads : EO/IR camera and Synthetic aperture radar (SAR)

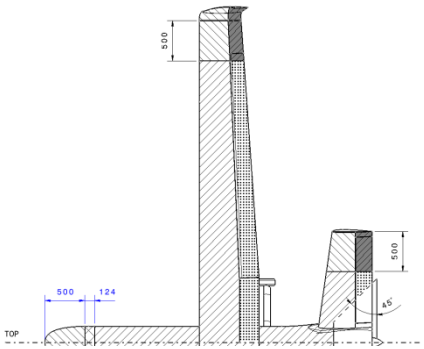
Provision for NATO STANAG Wing Hard Point

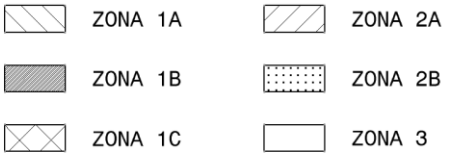
Fuselage payload up to 40 kg, 20kg additional payload under the wings

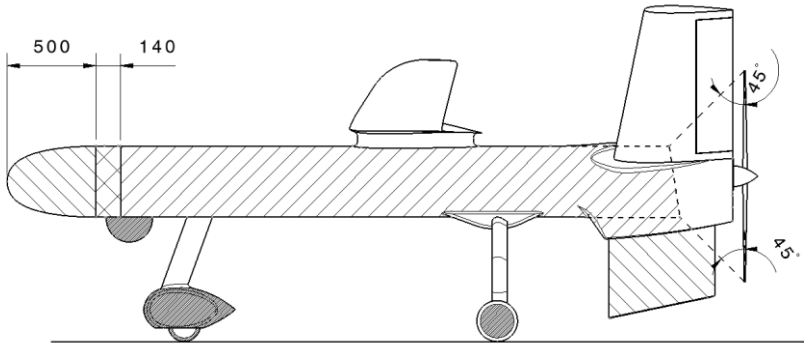
Max 1.5 kw power consumption for payload

Lightening protection System:

The direct and indirect effects from lightening have been identified and the adequate protection systems have been defined for each region of vehicle, according to the criticality of the effects on the structure and systems





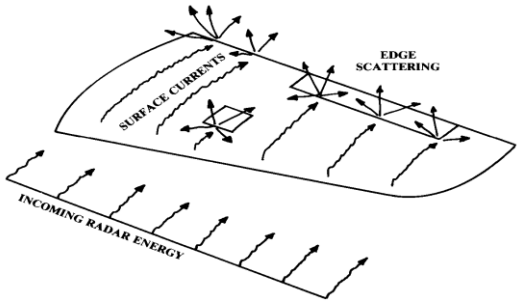


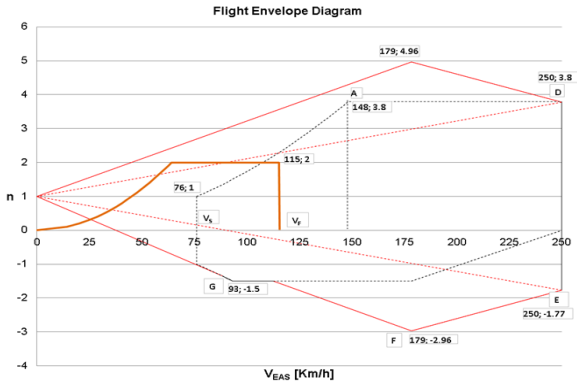
Icing Solution:

Critical Icing growth regions have been identified on the structure. Wing and V-tail planes need to be icing protected for specific mission. Sensitive structural elements are designed to install anti-icing systems.

Radar detectability:

The structure can be easily customized using RAM (Radiation Absorbent Material) to reduce radar detectability.





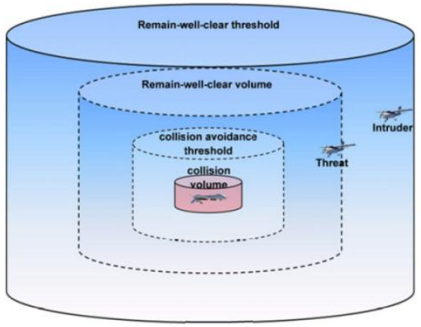
Adverse Environment Reliability:

High Stability Aerodynamic thanks to large Tail Plane and high wing configuration in turbulence low/medium altitude.

Gust and atmospheric turbulence have been taken into account in the structure sizing according to CS-VLA flight envelope (gust load factor up to 4.96, gust dynamic response, flutter).

Air Traffic Management and Detect And Avoid:

UAS is able to include the capability to see, detect air traffic conflicts or other hazards and take the appropriate action (Detect And Avoid). This capability aims to ensure the safe execution of an RPA flight and to enable full integration in all airspace classes with all airspace users. Hazards such as conflicting traffic, terrain and obstacles, meteorological conditions, ground operations can be detect through ADS-B transponder, strobe lights, navigation cameras and specific RADAR equipment and auto-pilot software algorithms can elaborate adequate maneuvers to assure a safe flight.

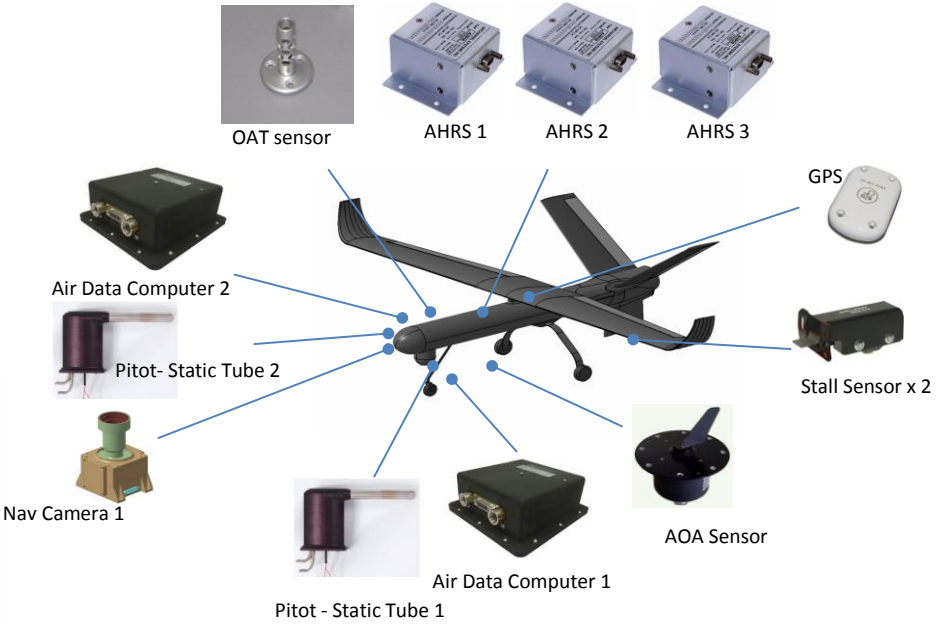


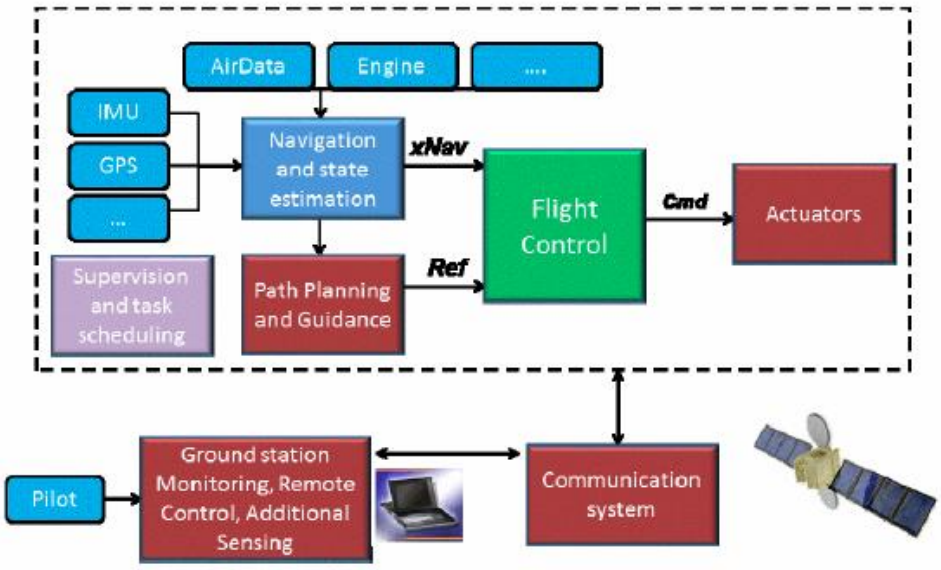
ULTRAS

Flight Control System

The Flight Control Computer and Command&Data Handling (FCC & CDH) Unit is based on a hot spare redundant architecture with the core module of the unit fully redundant.

Mother Board implements mainly the GN&C algorithms and control logic and the command and data handling for the entire on board subsystems.





Telemetry and Telecommand (TM/TC) and Guidance Navigation and Control sections implement FPGA coding and encoding and data interface with sensors/systems.

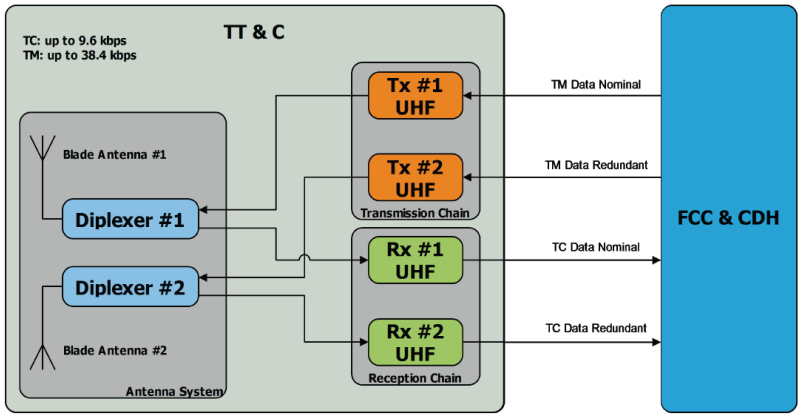
ULTRAS

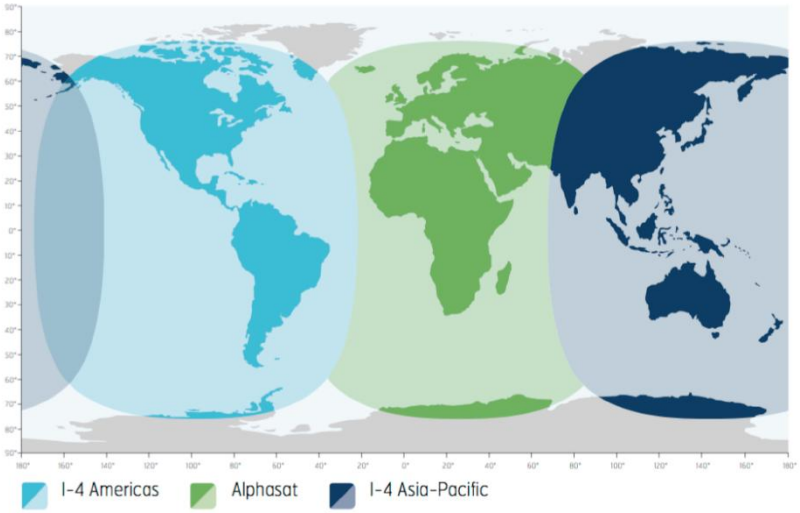
Data link

Telemetry Tracking And Command TT&C Data Link architecture is based on redundant transmission and reception chain operating in UHF band.

In case of loss of the TT&C data link system in LOS, payload telemetry shall be automatically switched off and the Payload Data Link system shall be used for TT&C communication with ground.

Moreover, the third level of reduncance is assured by the satellite communication that is also able to assure the BLOS operations





The Satellite System for ULTRAS is the Swift Broadband low gain antenna supported by Inmarsat Satellite System: SwiftBroadband supports high-assurance applications, including NATO secret and NSA Type-1 encryption systems providing remote mobile access to classified networks – STUIII/IIb, STE, KIV-7,

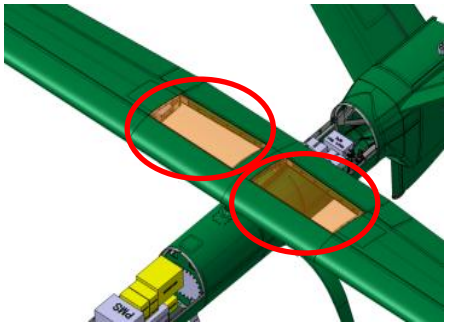
Brent and HAIPE devices including KG-175 TACLANE, KG- 235 Sectera, KG-250 Altasec, subject to verification testing.

ULTRAS

Specific Configurations

Extended range:

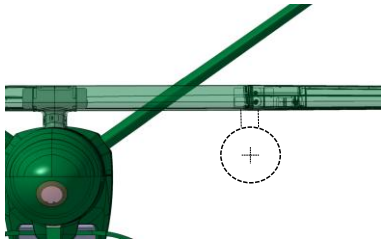
Additional Fuel tanks can be installed at the center box in order to provide 13 litres that grant +14% endurance to achieve **24hrs at 1.000 feet**



Aerodynamic Improvements:

Some features have been added to be compliant with Civil Airworthiness Rules such as Landing Gear, arresting cable, systems redundancy, structure reinforcement to stand the gust load factors, landing and inertia load factor

Non-civil use can lead to alternative solutions such as parachute, catapult launch, structure and systems weight savings, that can lead to an endurance improvement +2hrs achieving **26hrs at 1.000 feet**.



Extended Payload:

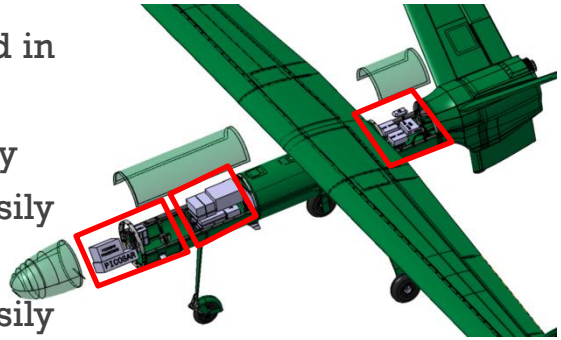
Additional payload up to 20kg can be positioned under the wings by installing two pylons (NATO STANDARD MIL-STD-8591) on the existing ribs at the external wing attachment

Avionic Module: All flight data computers (AHRS, ADC, GPS) are positioned in the rear bay

Flight Control System Module: PMS, FCC, Tx/Rx are located in the FWD bay

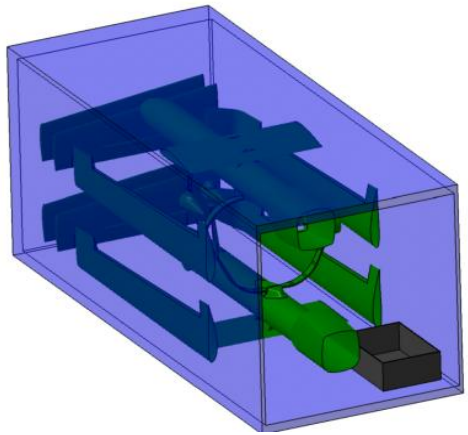
Payload Module: the payload is positioned in the nose bay and it is easily adaptable to the mission target

All the modules are easily accessible through removable panels and easily removable



Logistics:

The UAS has been designed in order to be easily transportable on the operative field through a reduced number of pallets and human resources. Two modular vehicle structures can fit in a 20feet container, with all tools and spare parts, including GCS.



The catapult can be transported through another 20 feet container

Deployment time:

A timing evaluation to provide full operability to UAS has been fixed to 2.5 hrs through 2 operators by assembling wings, tail planes, centring, refuelling and set-up the catapult and GCS.

Manuals:

The following list of manuals will be provided to the RPAS customer

- Operations manual
- Illustrated Part Catalogue
- Flight manual
- Maintenance control manual
- Standard Repair Manual
- Specific certificates (noise, special loads)

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