

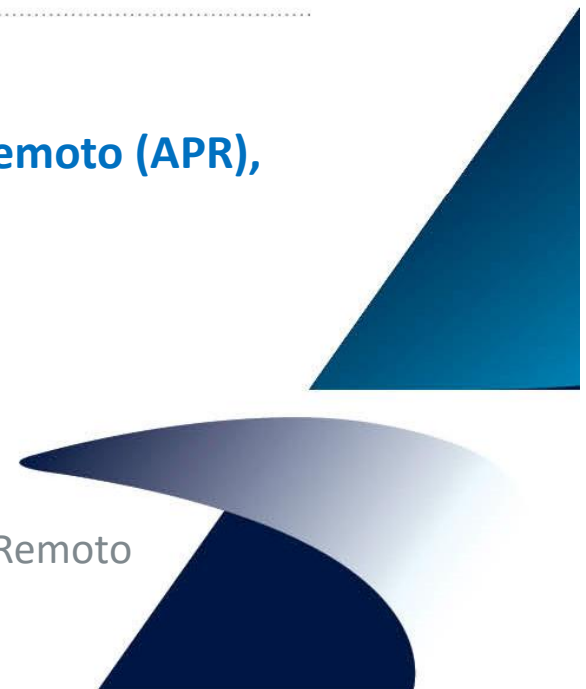


Sistemi di controllo degli Aeromobili a Pilotaggio Remoto (APR), dalle applicazioni militari a quelle civili.

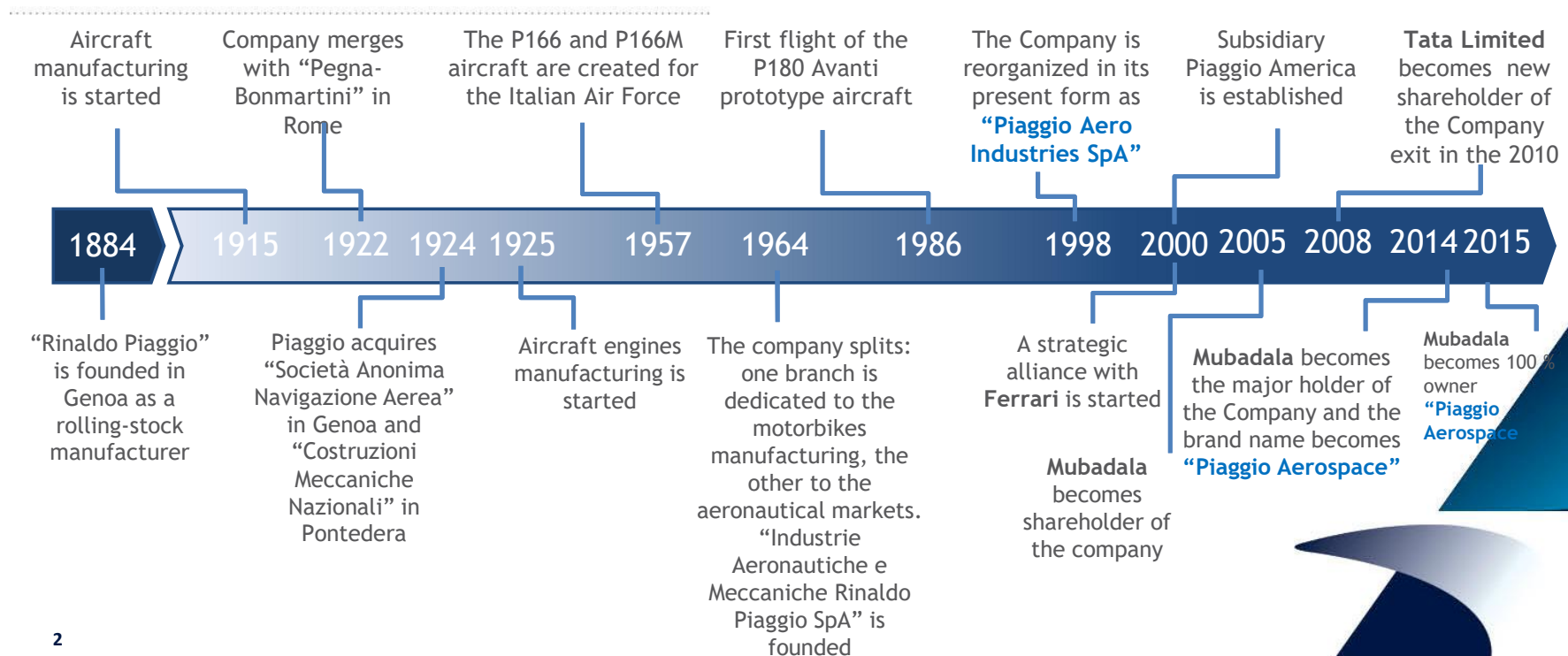
A. Cozzolino

Head Of R&TD and Preliminary Design

Seminario di Cultura Aeronautica
Innovazione e ricerca aerospaziale: Aeromobili a Pilotaggio Remoto
24 October 2015



• Piaggio Historical background



• Villanova d'Albenga plant

- ▶ New state-of-the art facility
- ▶ Designed to implement the latest lean manufacturing technologies



- ▶ Total Area: 129.000 sqm
- ▶ Current Workforce: 600
- ▶ Currently transferred activities:

- Headquarter
- Aircraft Design
- Engine Parts Manufacturing
- PW200 Engine Assembly & Test
- Engine MRO
- Aircraft production (ex Finale Ligure)
- Laboratories
- Iron Bird & Aircraft Structural Testing LAB



- Genoa Customer Support & Training plant

- ▶ Total Area: 5.000 sqm

- ▶ Current Workforce: 150

- ▶ Activities:

- P180 Maintenance
- P166 Maintenance & Upgrade
- Product Support
- Training Center for maintenance personnel (MTO) (*)



(*) = Temporarily moved in Genova Aircraft production offices



P.180 AVANTI EVO, evolution of P.180 AVANTI II, embodies the following upgrades:

- ▶ Low Noise propulsion system (Propellers and Exhaust duct)
- ▶ Additional Fuel Tank for Increased Range
- ▶ New Landing gear with new steering
- ▶ Antiskid
- ▶ New Integrated ECS (Environmental Control System)
- ▶ New Integral Winglet System
- ▶ LED External Lights
- ▶ SBAS (Satellite Based Augmentation System) Capability

Range increased by 17%
(from 2725 km to 3185 km)

Fuel consumption and CO2
emissions reduced by 3%

Climb performance
improved by 3%

Noise reduced by 68% external,
20% internal



The **Piaggio Aerospace P.1HH HammerHead** is a new, state-of-the-art UAS (Unmanned Aerial System), designed for ISR (Intelligence, Surveillance and Reconnaissance) missions, whose combination of performance and operational characteristics is at the very top end of the UAS MALE category

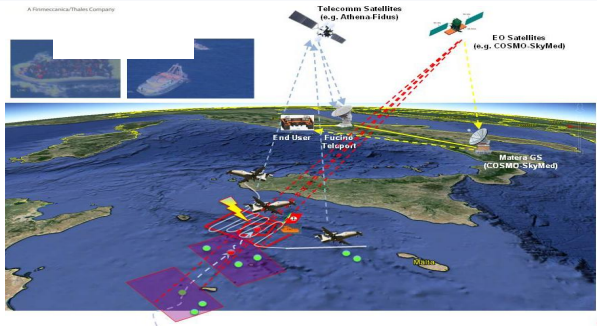


P.1HH
HAMMERHEAD

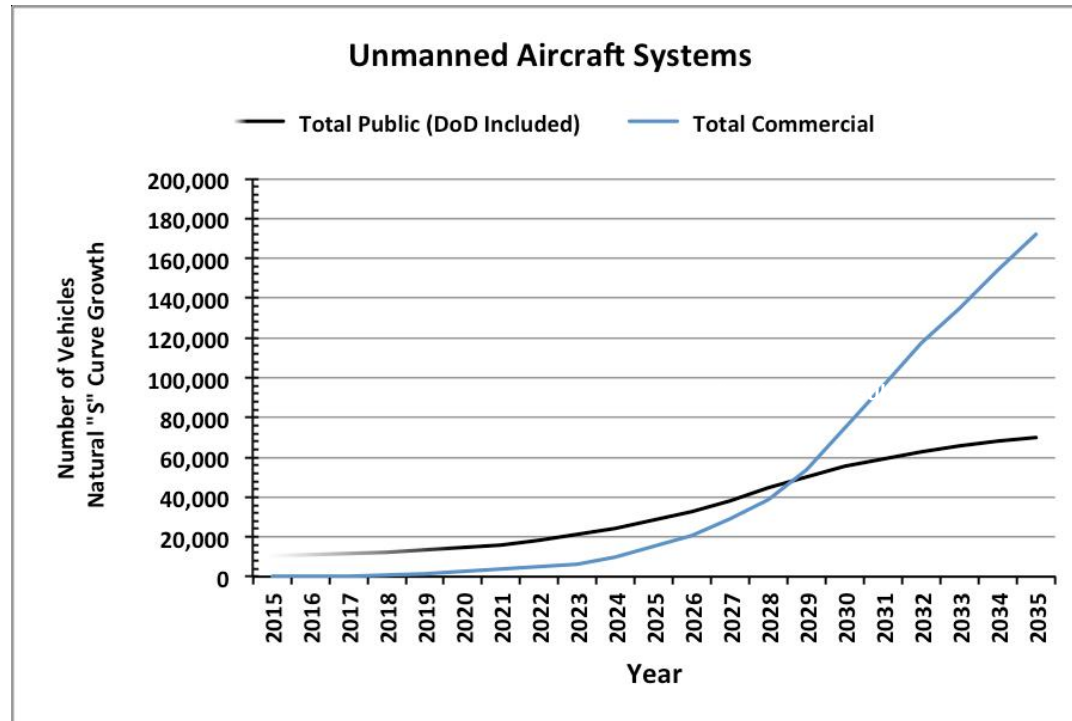
- ▶ VCMS (Vehicle Control & Management System)
- ▶ MMS (advanced Mission Management System)
- ▶ VCMS and MMS are commanded from a GCS (Ground Control Station) via an airborne Datalink system
- ▶ air vehicle command & control by LOS/BLOS (Line Of Sight/Beyond Line Of Sight)
- ▶ payload digital encrypted data transmission via RF links/SATCOM

RPAS Users Mission Need

Non Military	Military
Search & Rescue	ISR ✓
Fisheries control	Force protection ✓
Damage assessment of Natural disaster	Communications relay✓
Scientific and Research related	Electronic support measures✓
Pipe/power line surveillance	Electronic counter measures✓
Mail freight transport	Training and Exercise ✓
Critical infrastructure monitoring	Target acquisition ✓
Law enforcement (incl. Urban area)	Close Air support✓



Forecast for Commercial Market UAS



As markets are defined and refined, it is expected that beginning in the 2022 to 2023 period commercial sales of UAS vehicles



Challenges to Market Development

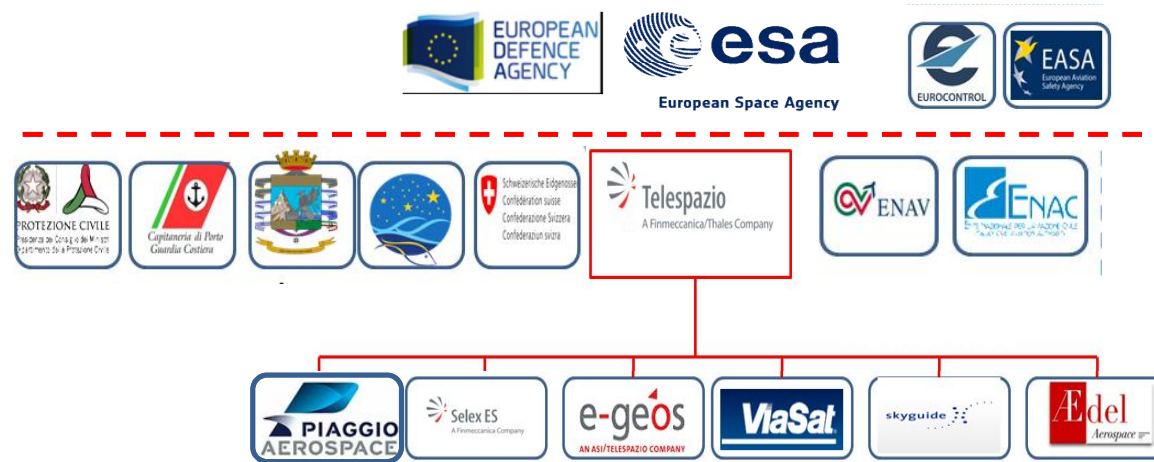


- There are a considerable number of challenges facing the development of a RPAS free market; these include:
 - Regulatory
 - Policy
 - Procedural, social, and environmental concerns.
- Furthermore key to developing RPAS markets is the ability to advance, enable and synergize technologies in:
 - Airframe
 - Propulsion
 - Communications, command and control (incl. ATC and S&A)
 - Sensors
 - Information processing

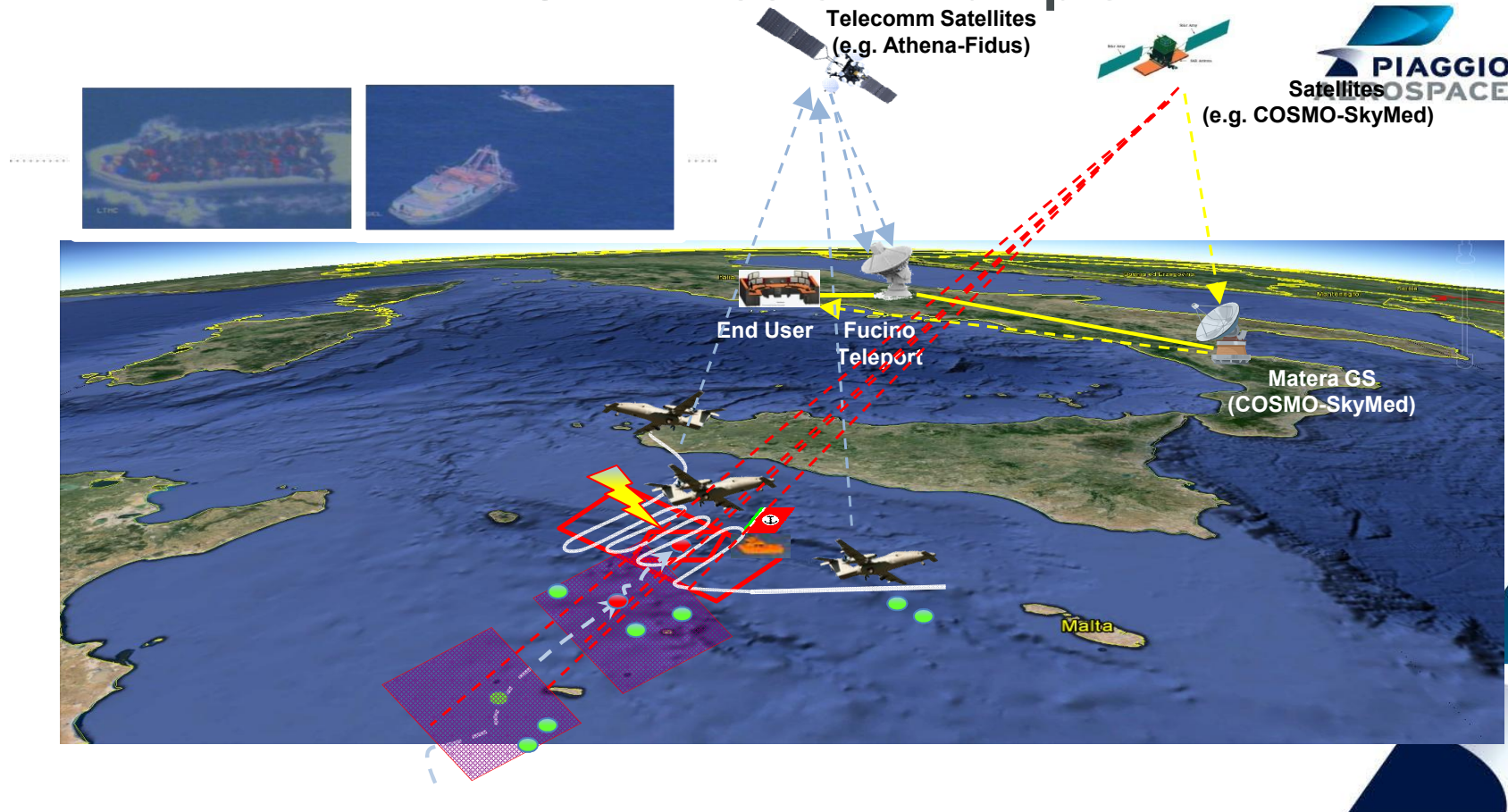


DeSIRE 2

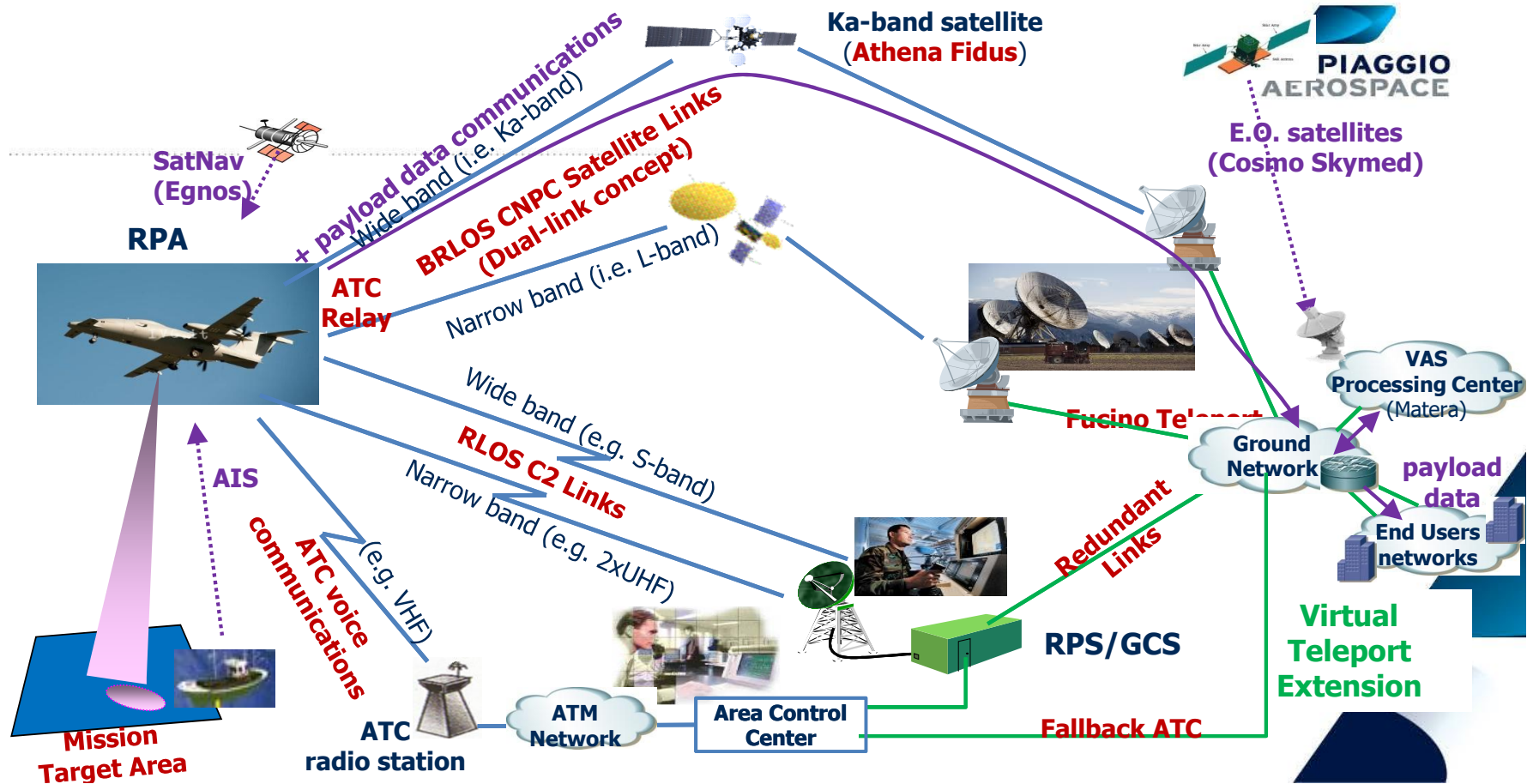
Demonstration of the use of Satellites complementing Remotely Piloted Aircraft Systems integrated in non-segregated airspace 2nd Element



SAR Mission Example



DESIRE 2 RPAS network architecture



Demonstration Approach

3 Complementary validation campaigns:

Simulation Campaign

- provide a preliminary validation both of ATI and User Requirements

Emulation Campaign

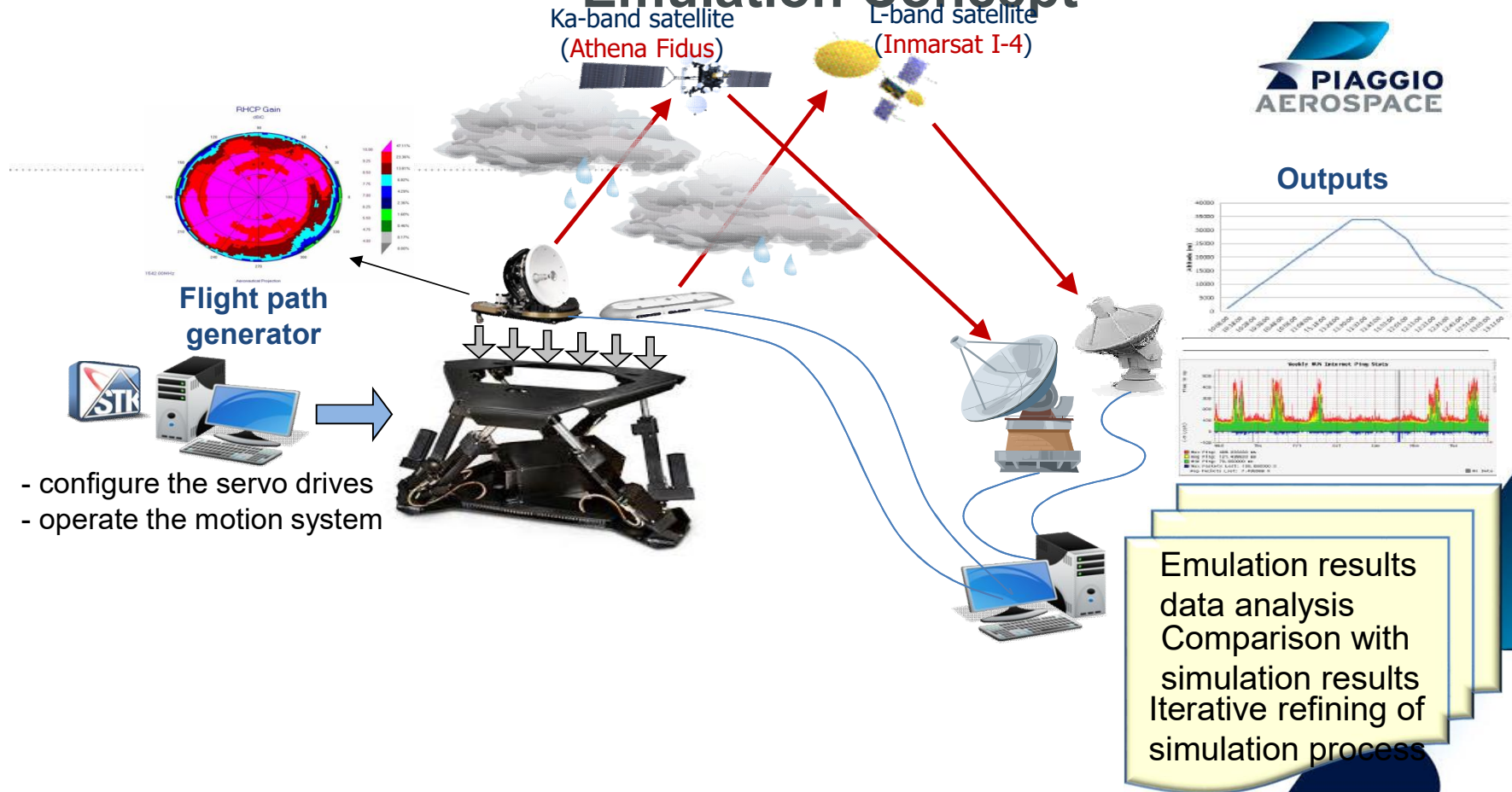
- devoted mainly to characterize the satcom links (both L and Ka bands)

Flight Campaign

- Full test in the real environment for both to demonstrate the flight conducted under guidance of the civil ATC under IFR validating the overall DeSIRE 2 RPAS Flight Network Architecture



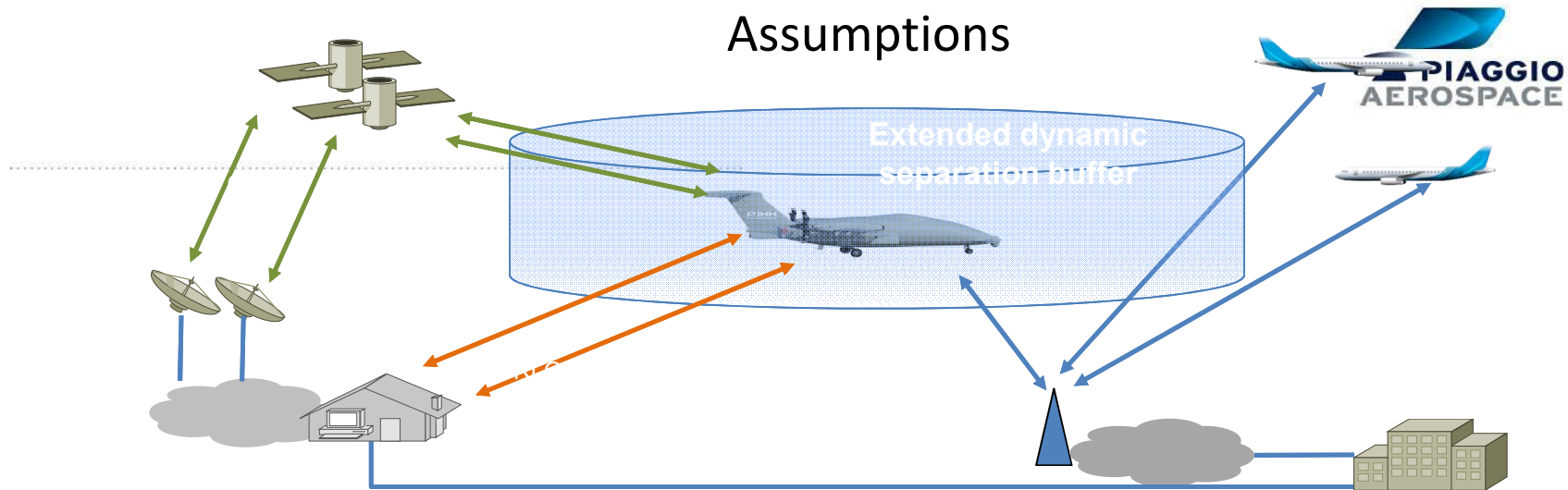
Emulation Concept



- configure the servo drives
- operate the motion system

Emulation results
data analysis
Comparison with
simulation results
Iterative refining of
simulation process

Demo Authorization Approach - Preliminary Assumptions



Approach to flight campaign & considered Airspace for experimental flights:

- Possibility to recover the RLOS condition
- Extended separation with dynamic buffer for enhanced safety flight
- Flight coordinated by Civil Air Traffic Controllers according to IFR rules
- ATC controllers talk with Pilot on Ground through RPAs (ATC Voice Relay)

- **D&A Definitions**

- Addresses RPAS equipped with a D&A system designed to fulfill the requirements for traffic separation and mid-air collision avoidance in non segregated airspace with cooperative traffic.
- Situational Awareness Provision of traffic information to allow the RPAS pilot to build situational awareness related to the surrounding traffics.
- Traffic Avoidance (TrA) is defined as the tactical process of keeping aircraft away from hazards by at least the defined separation minima.
 - S&A separation minima: 0.5 NM horizontally or 500 ft vertically around the RPA (Eurocontrol, specification requirement n°UAV11)
- Collision Avoidance (CA) is the capability where the RPAS takes appropriate action to prevent a threat from penetrating the Collision Avoidance volume. Action is expected to be initiated within a relatively short time horizon before closest point of approach. The collision avoidance capability engages when all other modes of separation fail.



- Desire 2 D&A



- Desire 2 will address cooperative D&A with BRLOS satellite Data link with aim of understanding first the Situational Awareness for the Remote Pilot (communication delay).
- Understanding the possibility to perform TrA on ATC indication
- Establish the CA volume in the BRLOS



Coordination with Aviation Stakeholders and International Working Groups



To contribute to the objectives set forth in the ERSG Regulatory Work Plan DeSIRE 2 will:

- focus on general ATI Requirements relevant to related to BRLOS operations under IFR using satcom (not limited to those required for experimental flights),
- exchange ATI Requirements with Stakeholders and competent International Working Groups in order to collect feedback and to update the requirement list

Conclusions



- RPAS are a **new component** of aviation system and are based on cutting-edge development in aerospace technologies.
 - The **integration** of RPAS into **non-segregated airspace** is a **long-term activity**, requiring advanced technology C2 BRLOS and DAA, as well as robust regulatory framework.
 - Piaggio Aerospace participation inside European Project (e.g. DeSIRE II) is contributing to a truly European flagship technology initiative on Air Traffic Insertion of RPAS.
-