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*Proactive Engineering for Technology Innovation  
and competence enhancement*



Technologies for  
Defense and Security



## Miseno Project

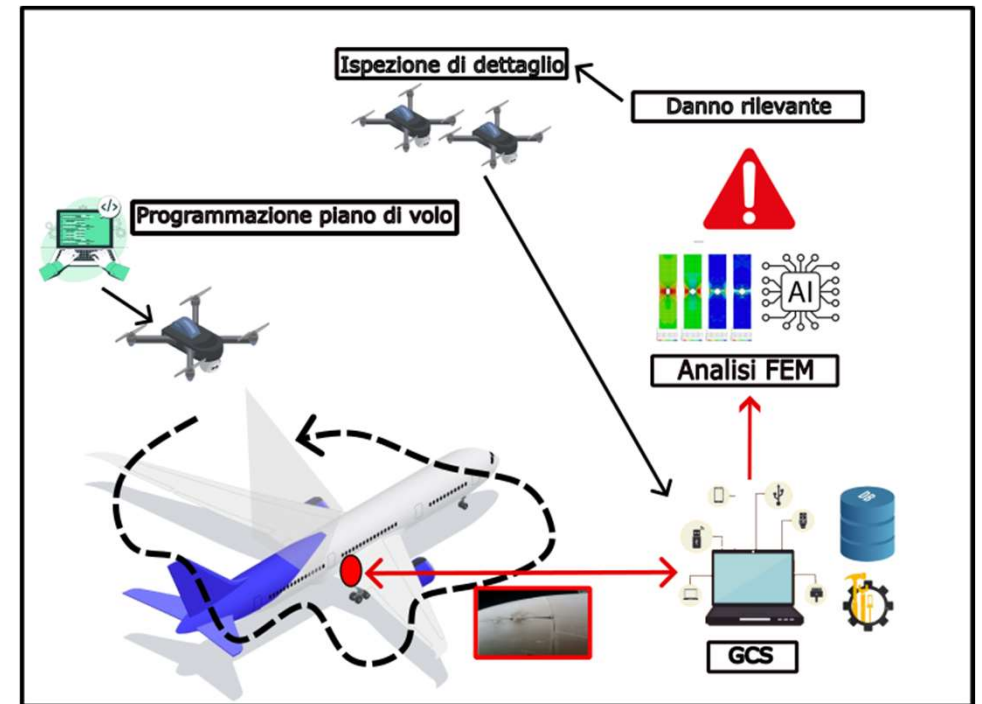
# MISENO – Multi purpose integrated Inspection System EvolutionN for mro Operation

Ing. Rosario Giordano – ceo ProEtico Srl

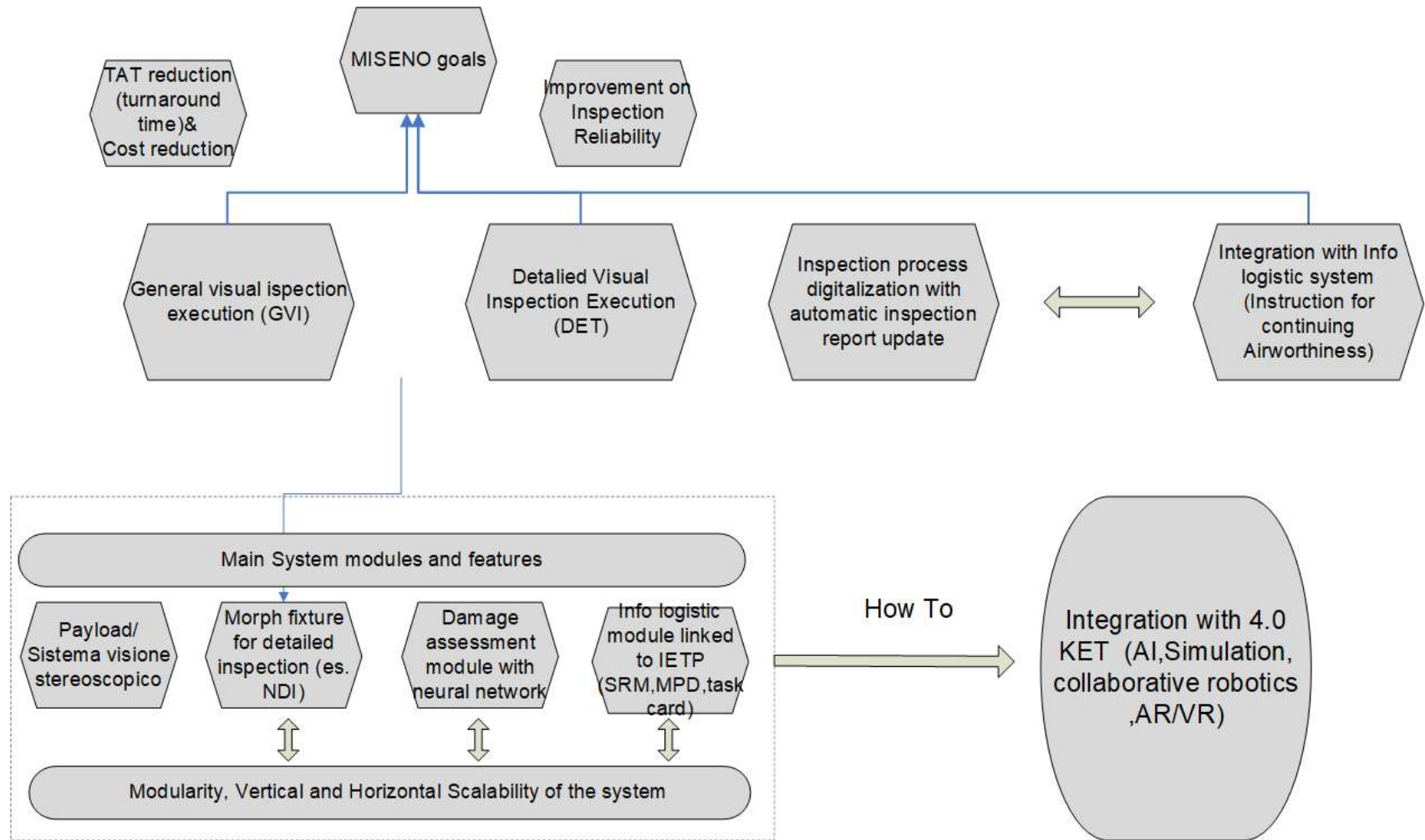
Ing. Emanuele Della Volpe – ceo Green Tech Solution Srl



Inspection integrated system based on the use of two or more drones, a system of Collaborative UAVs integrated with the infologistic system, for the execution of inspection and analysis (damage assessment) activities on aircraft and systems.



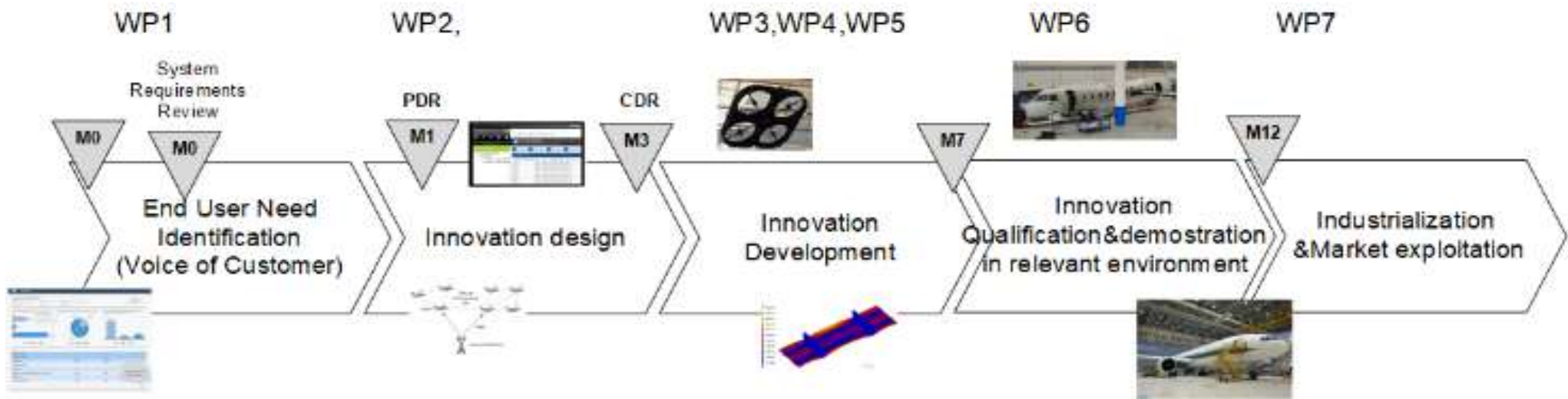
## Breakdown Project goals

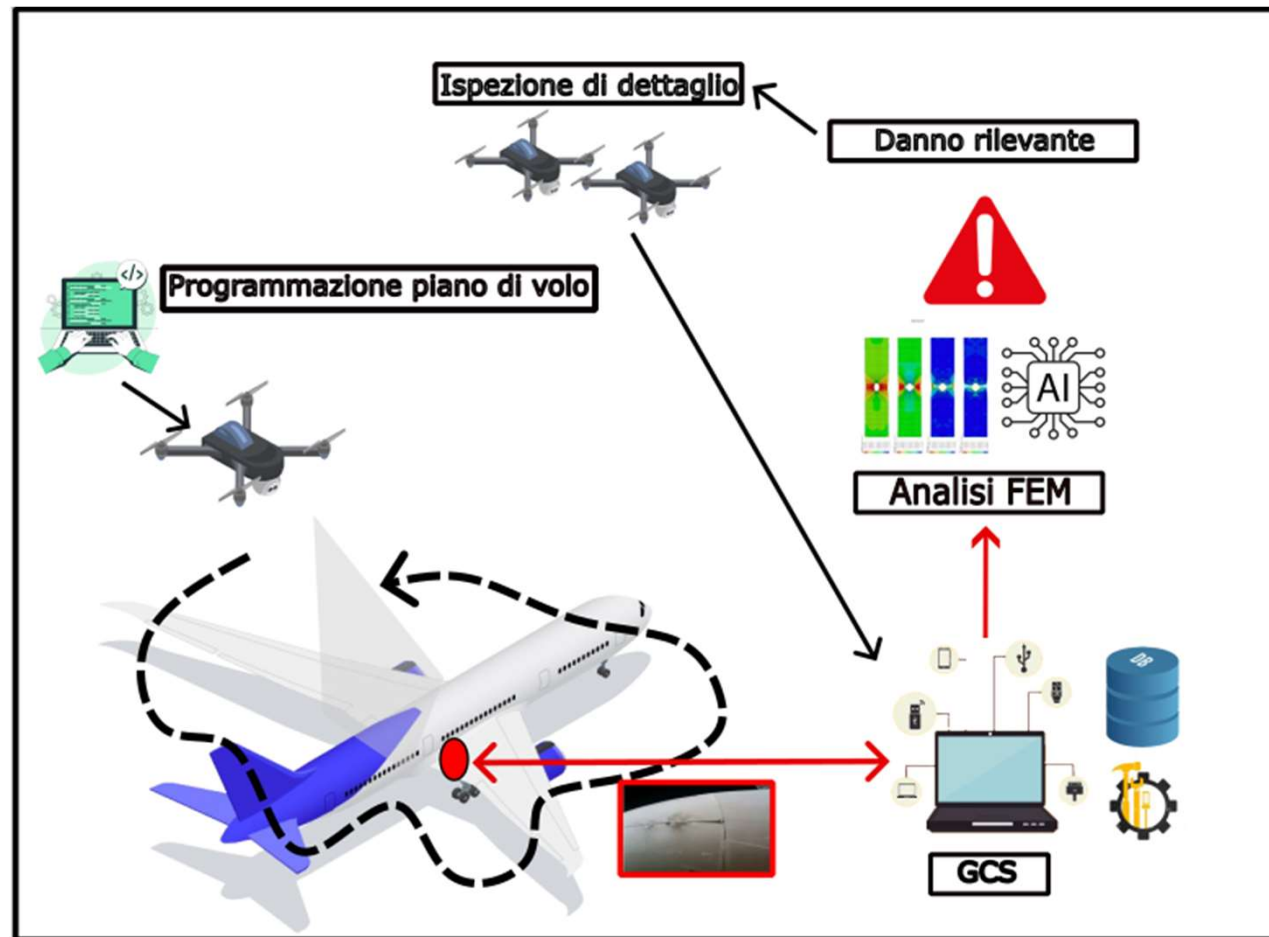




# MISENO Project Roadmap

- Miseno has started in May 2024
- Now is the System development phase
- Industrialization and Market Exploitation foreseen from June 2025





○ AI

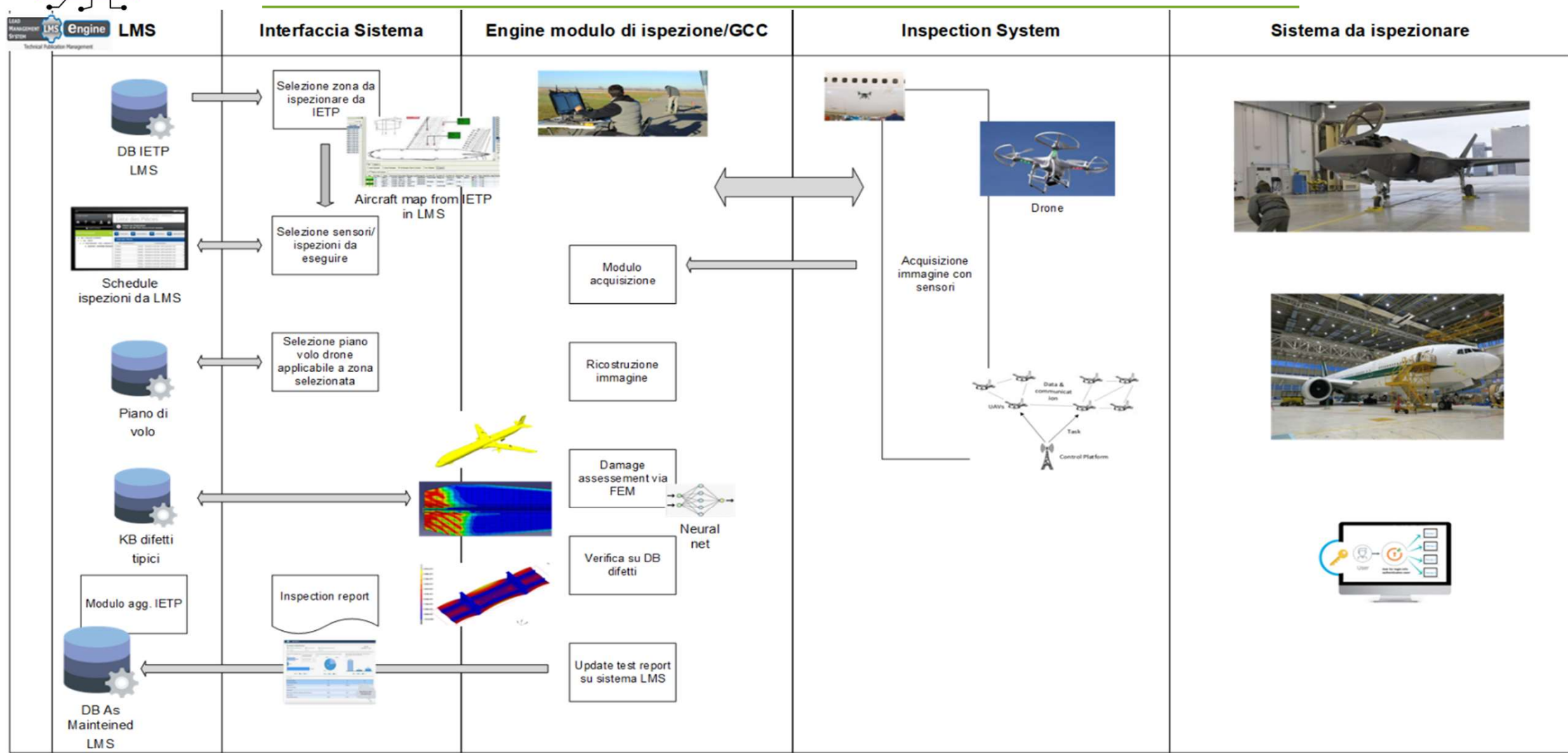


○ FEM analysis with Neural Network



○ Predictive and on Condition Maintenance

# Usage scenario and main workflow of the Concept of Operation





## Main System Function & Modules



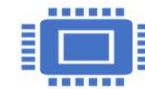
I4.0 KET implemented are: IA, digital twin, simulation and collaborative robotic.

FEM analysis and Damage assessment modules make use of Neural Network and AI



The info logistic System is an improved and upgraded version Lead Tech **LMS (Lead Management System)**

This system is already used on ATR MP and C27J attualmente utilizzato per ATR MP e C-27J



High Technology Readiness Level (TRL),

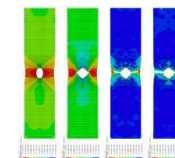
Miseno is based on already available Modules, improved and upgraded to fulfil project ambitions





## Scalability and further application use cases

MISENO project consists of an integrated, modular, adaptable, and scalable system for various application contexts, not only in the aeronautical field but also in, for example, the railway or naval sectors. The Industry 4.0 technologies applied in the project are mainly related to AI, digital twin, simulation, and collaborative robotics.



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## Improvement over State of Art

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Makin Visual inspections (GVI and DET) more efficient, precise and suitable for a variety of applications within the MRO inspection environment, in particular:

**1) Using multiple drones** Stereoscopic vision Reduced time needed to complete operations, as multiple drones can cover a larger surface area at the same time. Inspections or monitoring can be performed in less time, increasing operational efficiency.

Selective use, acting in master and slave configuration. In particular, a drone performs a GVI (General Visual Inspection) scan, while the slave performs a detailed scan, called up if necessary by the master

**2) Stereoscopy with Double Drone in Formation:** Using stereoscopy with two drones in formation allows you to obtain much more precise three-dimensional data than a single drone. The ability to perceive depth and create three-dimensional models is critical to accurately identify damage or anomalies. This approach will help improve the quality of the information collected and allow for a more detailed inspection.



## Improvement over State of Art

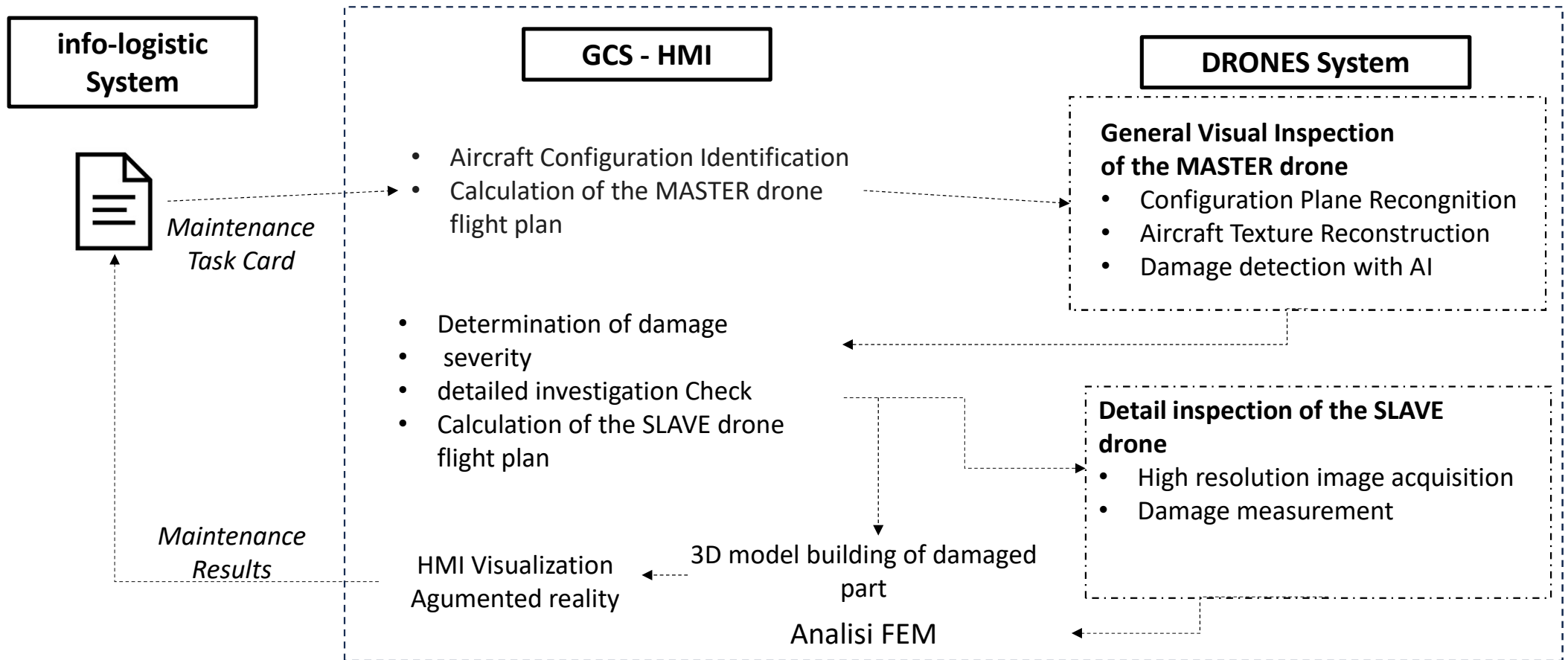
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**3) Automatic Flight Plan Determination:** Automatic flight plan determination based on the aircraft's aviation manuals is another key innovation. This automated approach greatly simplifies mission planning, allowing the system to generate optimized flight plans based on the specific data of the aircraft being inspected. This not only saves time, but also reduces the margin for human error in designing flight plans.

**4) Info-logistics system, integration with IETP and SRM, damage assessment** MISENO allows for the integrated management of inspections, comprehensively digitizing the process, providing valid support to operators in the operation of aircraft/systems.

**5) Augmented Reality on the Drone Flight Plan:** Use of augmented reality on the drone flight plan represents a significant improvement in terms of monitoring and controlling operations. Operators can view real-time drone progress, mission status and sensor data directly in their field of view. This enables more responsive and precise management of operations and helps ensure safety and compliance during flight.

## MISENO System



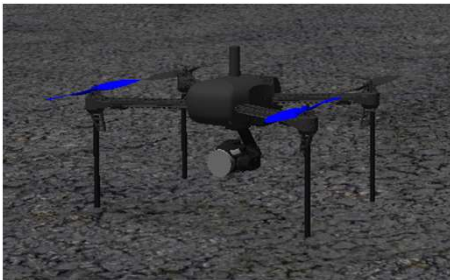


### Ground Control Station (GCS):

- Mission Planner
- Software for 2D/3D photogrammetry
- Software for FEM Analysis
- Deep Damage Detection (AI)

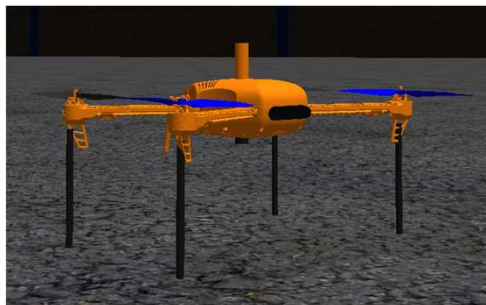
### Human Machine Interfac (HMI):

- Real-time virtual mission visualization
- Access to images and all acquired data
- Access to maintenance metadata
- Augmented Reality damage on the aircraft



### Drone MASTER:

- Indoor localization system (UWB) *Ultra Wave Band*
- Flight Control Unit (FCU)
- On board computer (GPU)
  - Damage detection module (AI)
- Gimbal a 3 GDL
- RGB-Dept camera whit High Resolution



### Drone SLAVE:

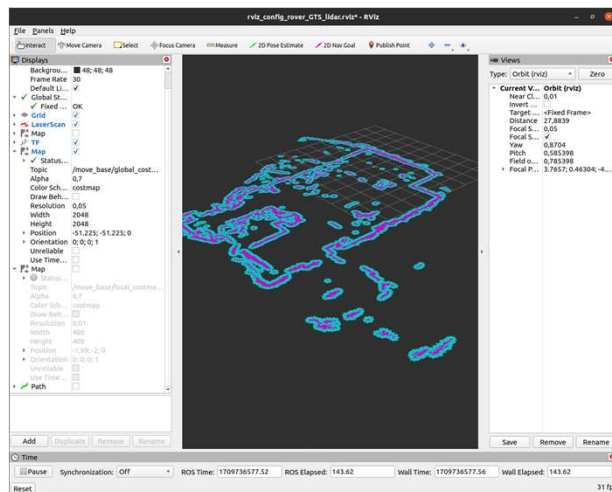
- Indoor localization system (UWB) *Ultra Wave Band*
- Flight Control Unit (FCU)
- On board computer (GPU) High Performance
- RGB-Dept frontal camera
- RGB-Dept camera whit Ultra High Resolution

## Drone MASTER: General Visual Inspection (GVI)

The MASTER drone carries out a general reconnaissance flight of the aircraft to be inspected to identify its general configuration, and reconstruct the high resolution texture on the determined point cloud

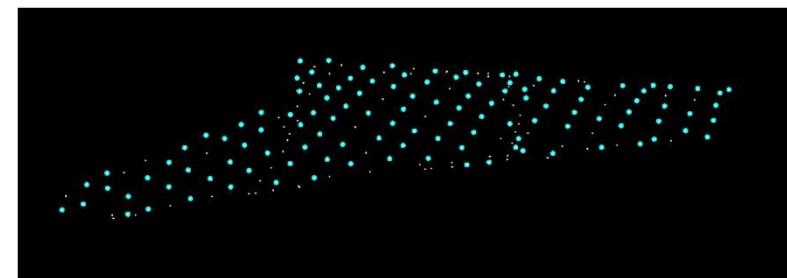
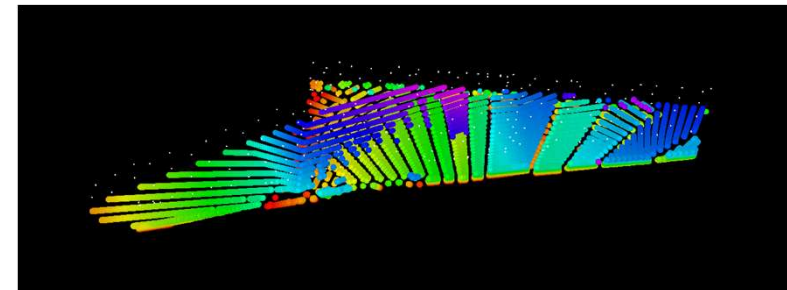
### Creation of the operational context

Thanks to sensors positioned in the operations area, a general map of the plant is obtained and position information is synchronized with respect to the take-off points of the drones



### Coverage Path Planning algorithm

- Calculation of optimal viewpoints (camera poses in space)
- Sorting of viewpoints for path creation

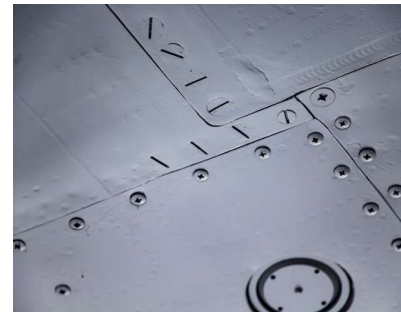


## Drone MASTER: General Visual Inspection (GVI)

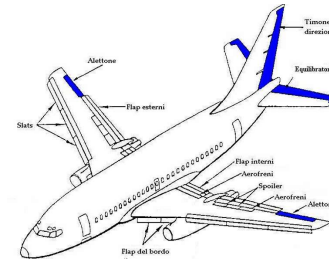
- Damage detection (AI)

### Defect categories:

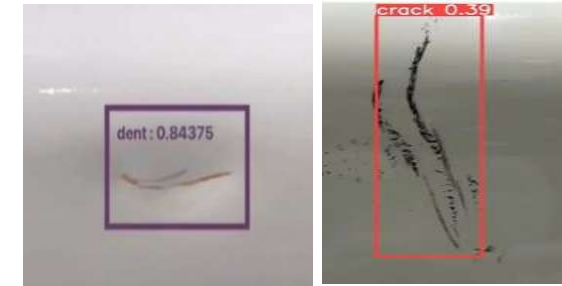
1. Scratches
2. Absence of paint
3. Rust
4. Missing Rivets
5. Dents



## Configuration Plane Recognition



## Damage detection (AI)

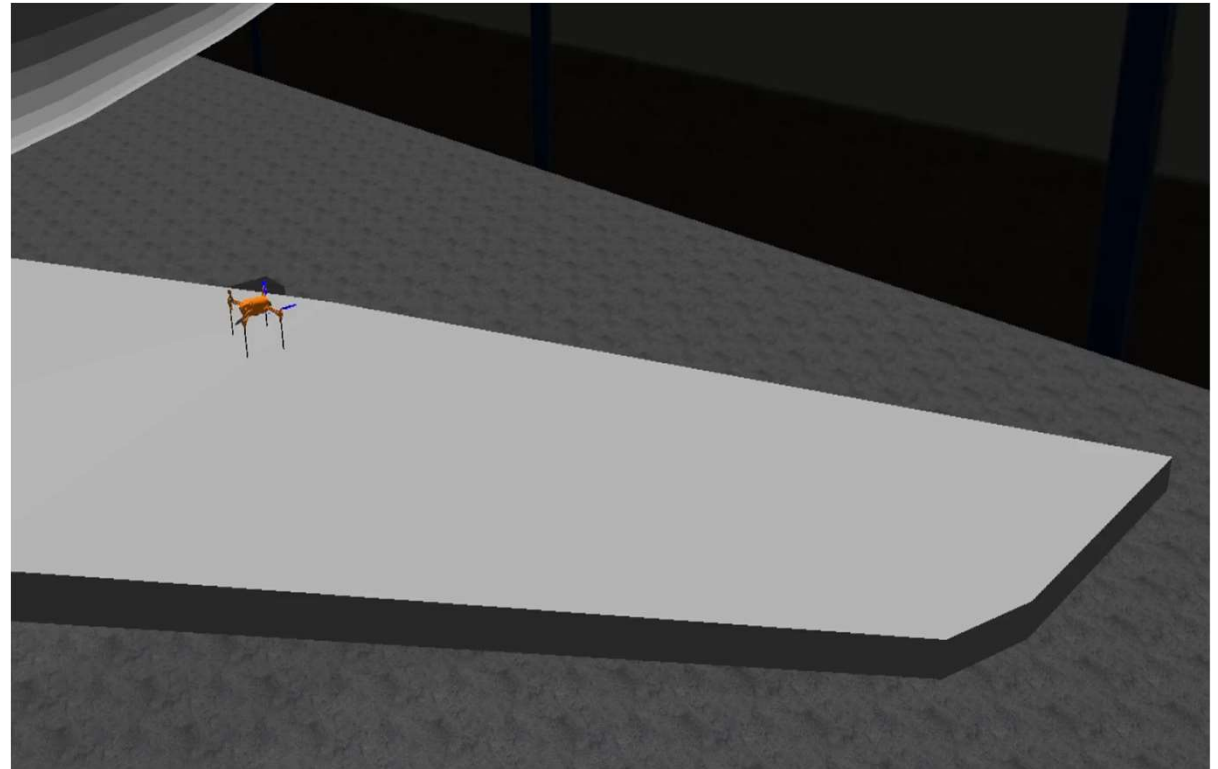


## Texture Plane building

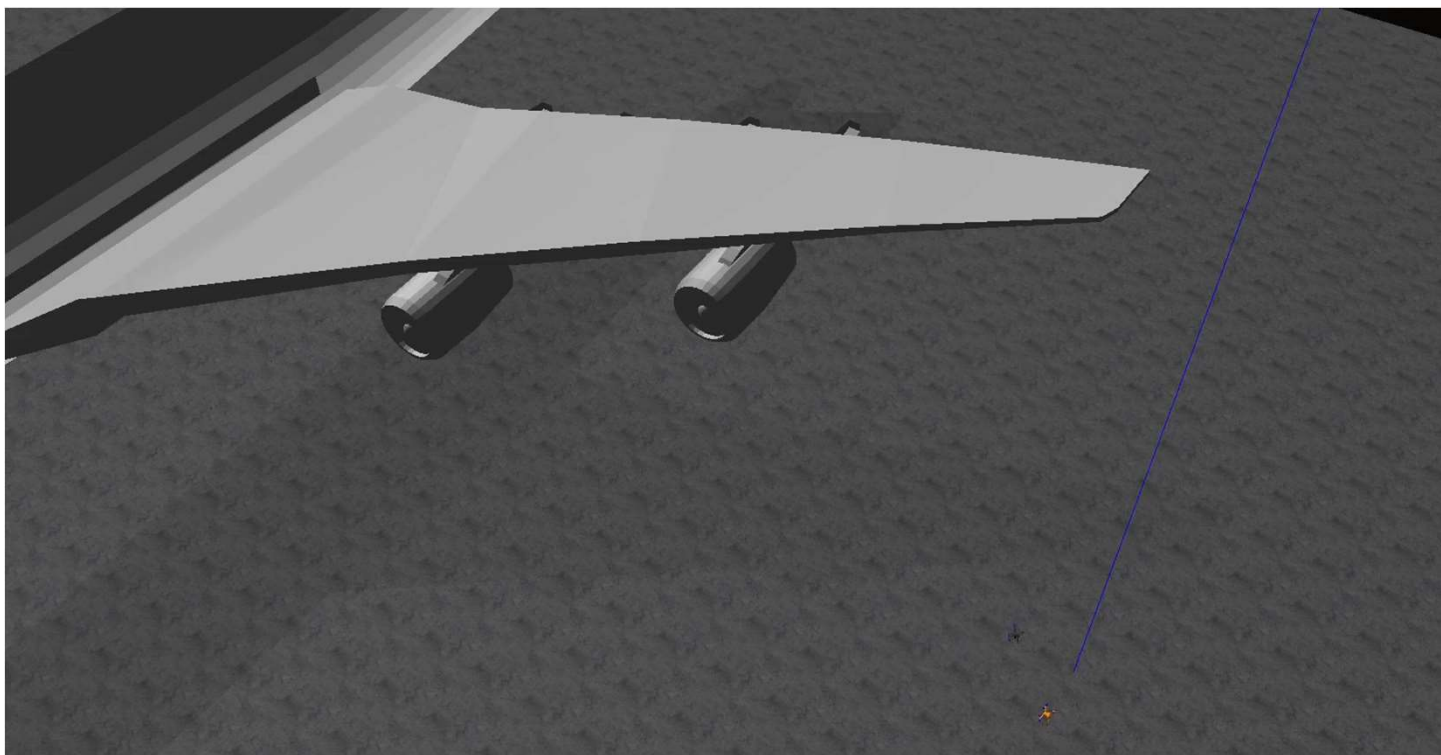


### Drone SLAVE: Detail Inspection steps

- Reaching waypoints corresponding to damage that requires additional inspection.
- During navigation, an Obstacle Avoidance module is active within the on-board computer which guarantees the drone does not collide with obstacles present in space and identified via the RGB-D camera.
- Acquisition of Ultra high resolution images of the damage (RGB images and depth,



## Virtual Environment Real Time Mission Visualization





Rosario Giordano,  
 ceo ProEtico Srl



Emanuele Della Volpe,  
 ceo Greentech Solution



Arturo Moccia, ceo  
 Lead Tech Srl



Giovanni Baglivo



Gianmarco Concilio



Antonio di Lallo



Filippo Frassinetti



Diego Grassi



Ramona Golluccio



Gaetano Ambrosino

*Thanks for your attention from Miseno Team*



## Main Contacts:

CEO - Eng. Rosario Giordano  
[ceo@proetico.it](mailto:ceo@proetico.it)



CEO - Eng. Emanuele Della Volpe  
[emanuele.dellavolpe@greentechsolution.it](mailto:emanuele.dellavolpe@greentechsolution.it)



CEO – Eng. Arturo Moccia  
[arturo.moccia@leadtech.it](mailto:arturo.moccia@leadtech.it)

