

M.A.R.S.

MULTIPLE AIRDRONES RESPONSE SYSTEM

M.A.R.S.: piattaforma UAV e algoritmi per il monitoraggio di incendi boschivi

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Tavola Rotonda “Innovation hub”



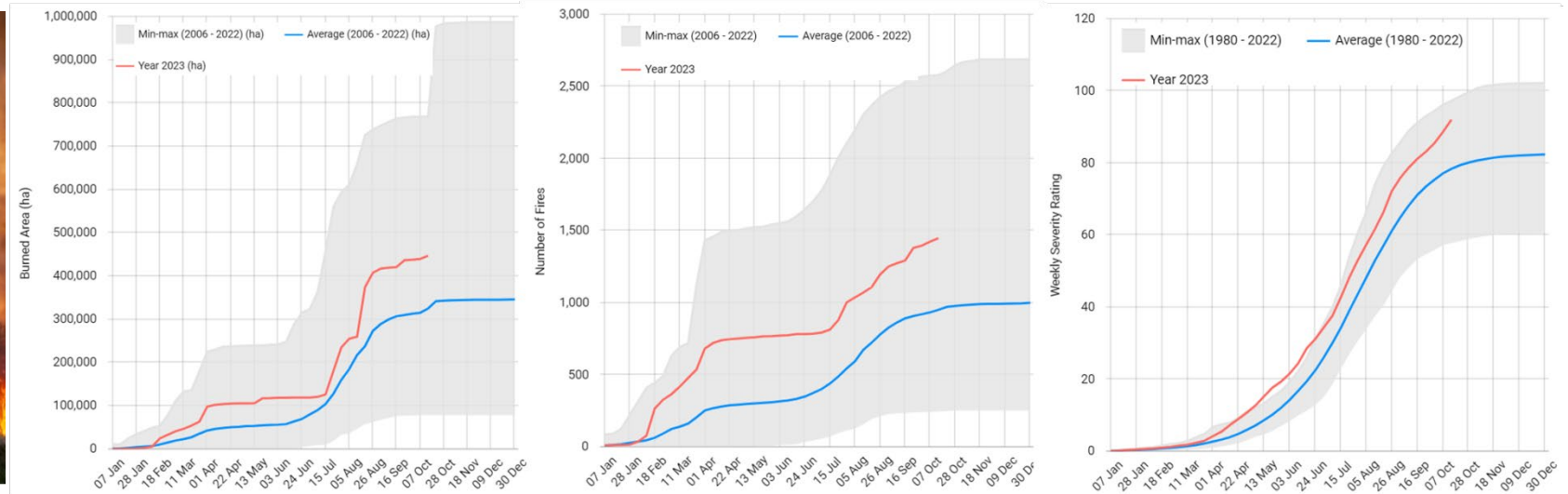
**Università
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AN URGENT SOCIETAL CHALLENGE TO ADDRESS



Source: European Forest Fire Information System (EFFIS)

- Since 1980 an average of 47.000 fires per year have affected approximately 442.000 hectares of vegetated areas in Mediterranean countries (Italy, France, Portugal, Spain, and Greece),
- In the European Union, Wildfires in 2023 have dramatically surpassed historical averages 2006-2022 in terms of burned areas, number of fires, and their severity confirming a continuous trends of the last years
- The EU has recognized this threat and bolstered its firefighting capabilities through the EU Civil Protection Mechanism
- Furthermore, the EU recognizing the pivotal role of aerial units in combating wildfires, has announced the purchase of 12 new Canadair aircraft which will be stationed in various southern European nations
- However, the critical aspect lies not only in the substantial financial investment and in the intrinsic constrains of these aircraft but also in and the release time for the supply: they will not be available until the 2027 forest fire season.



Analysis of the limits of the different wood fire-fighting vehicles

- **Challenges in Ground Logistics:** Terrestrial vehicles, primarily designed for urban interventions, face hurdles in reaching wildfire fronts, necessitating human operators. This process exposes operators to safety risks
- **Limitations in Current Firefighting Aircraft and Helicopters:** Challenges exist in the quantity of available units, the complexity of flight procedures, and the necessity to operate within constrained schedule limited to daylight hours and optimal weather conditions.
- **Constrained Drone Autonomy:** Heavy-duty hybrid UAVs possess limited autonomy, necessitating frequent refills of extinguishing liquids and fuel—approximately 3 operations per hour—undermining their operational efficiency
- **Absence of Comprehensive Platforms:** There is a lack of platforms capable of monitoring, predicting, and coordinating the operations of various actors and vehicles. These platforms need to be fully interoperable with civil protection mechanisms.

INTERFACE FIRE: Fire that hits interlink areas between urbanized and natural areas.

Focus on drones: Current baseline

Drones have been used in Agriculture and Inspection for several years.

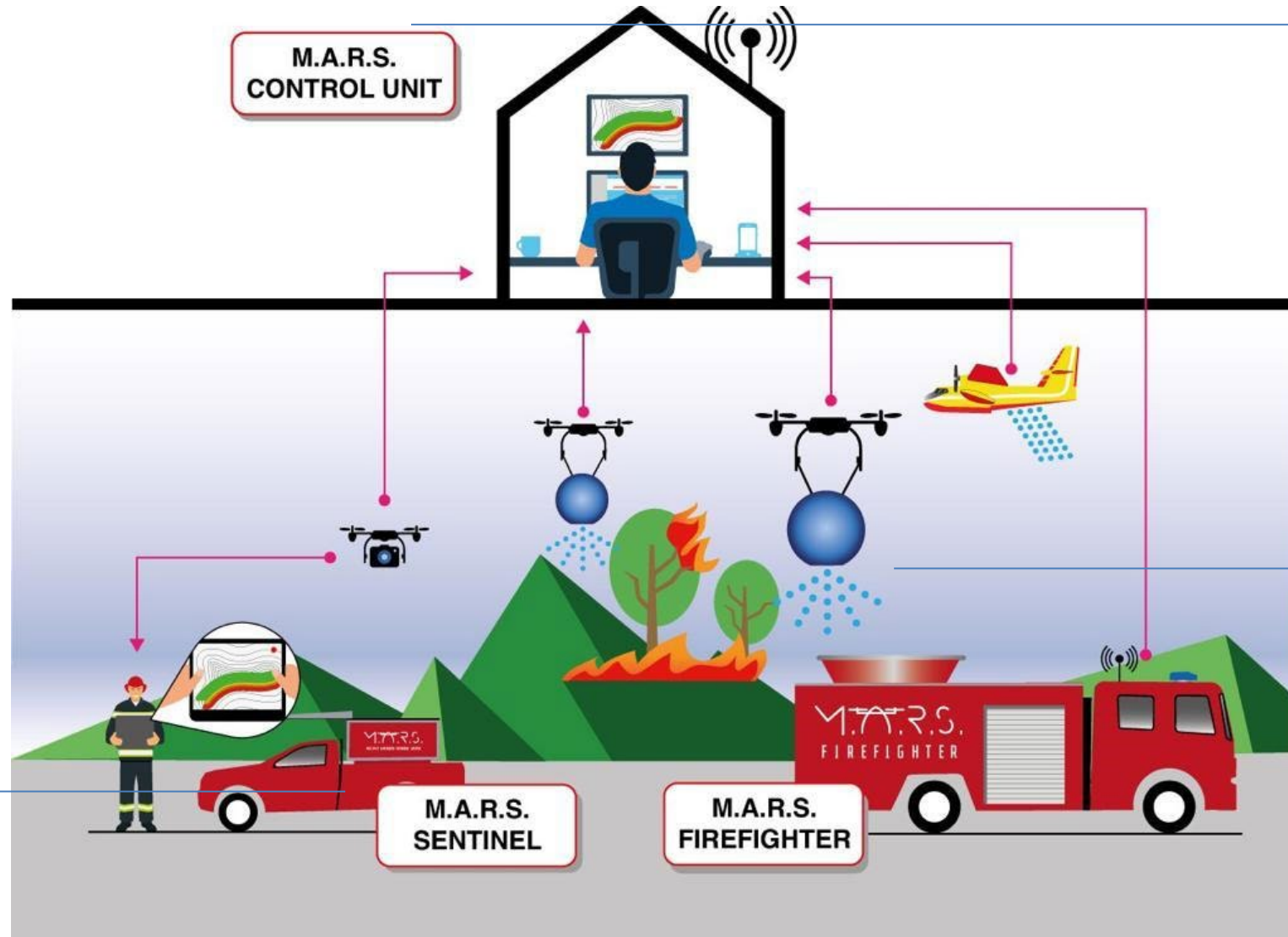
However typical commercial drone-based solutions suffer of:

- **Limited autonomy** due to battery capacity
- **Payload limitations**
- **Single mission** configuration (no «swarm» organization)



M.A.R.S. COULD BE THE SOLUTION

Our first product: a platform for converting professional drone into a truly 24 hours / 7 days autonomous device unleashing the true continuity of service extending virtually never-ending flight missions by automatically replacing battery and payload in few seconds thanks to proprietary mechatronics as well as AI and machine learning algorithms able to monitor firefronts through data acquisition and precise image capture .



An advanced forecasting system for the temporal and spatial evolution of fires, integrated with an innovative simulation system using "what-if analysis" to estimate the effects of different firefighting strategies in advance, providing able to coordinate in a collaborative approach the UAV based M.A.R.S HW platforms and traditional aerial firefighting units

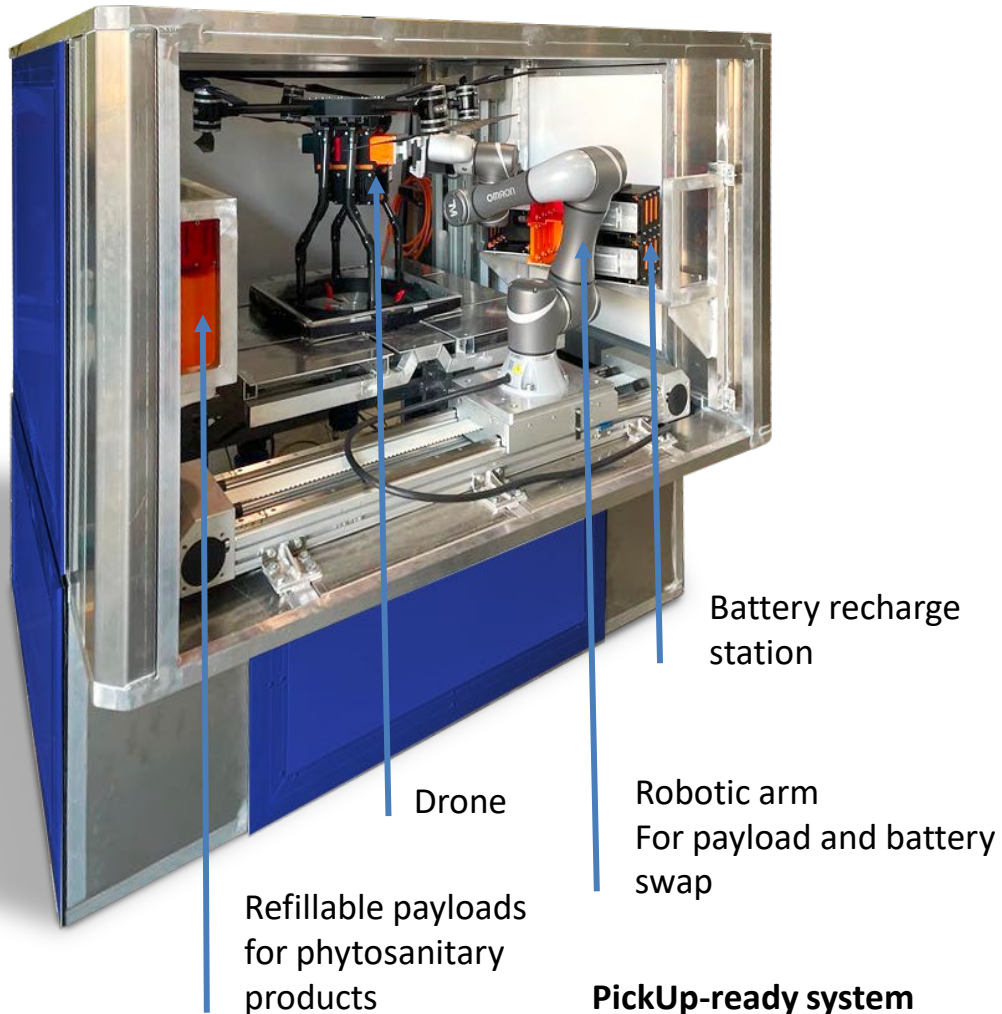
Our revolutionary solution for heavy duty drones for the refilling of operational fluids without landing enabling early wildfire attack and fire containing

M.A.R.S.: the «game changer»

- The M.A.R.S. system provides the **logistic services** for the transport and storage of the drones.
- It is **fully autonomous in servicing** its drones by quick replacement of the power battery pack and loading of mission specific payloads.
- Similar to an aircraft carrier, the M.A.R.S. system enhances the **operational reach and performance** of the drone swarms it provisions, ensuring the full execution of a variety of missions.



M.A.R.S. the «game changer»



- Drone swarms **affix on a dedicated service deck** where each drone is **instantly resupplied** of charged batteries and new payloads to pursue its mission
- **Resupply time** may be as short as 40 seconds to accomodate a large fleet of multirole drones
- **Different payloads** may be used according to the mission profile (camera, thermal imager, phytosanitary products dispenser)
- The battery packs are recharged by the platform to **be used again**

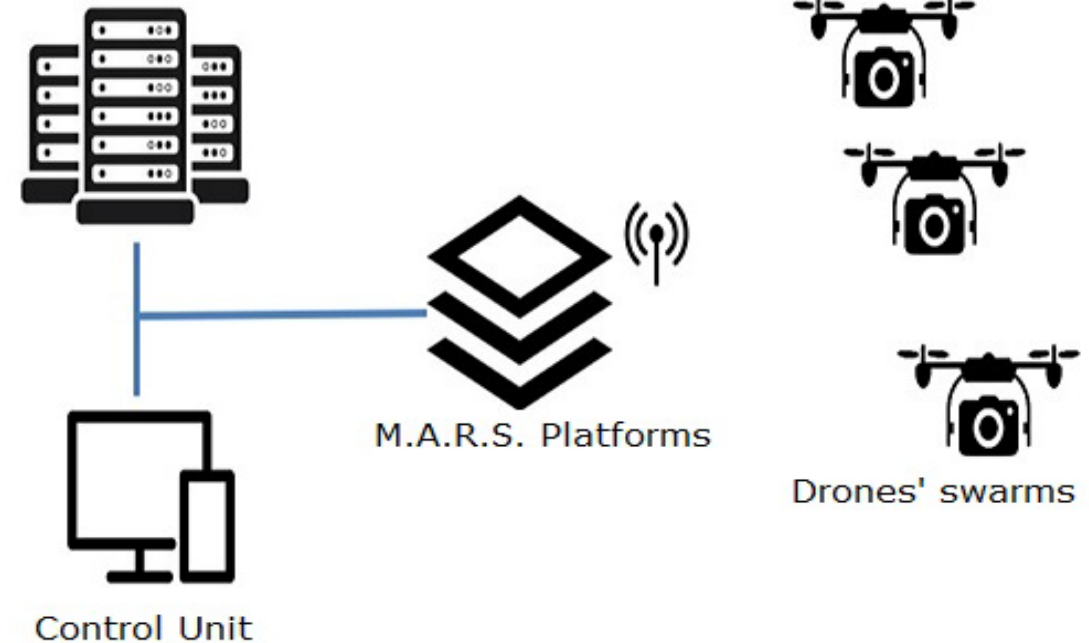
M.A.R.S.: the «game changer»

The M.A.R.S. local-area software system manages each drone flight and each payload provision, ensuring mission execution

Exploits **AI algorithms** to:

- Reduces pit-stop time to a minimum
- Optimize overall performance

Manages the archives of the missions



M.A.R.S.: our development strategy



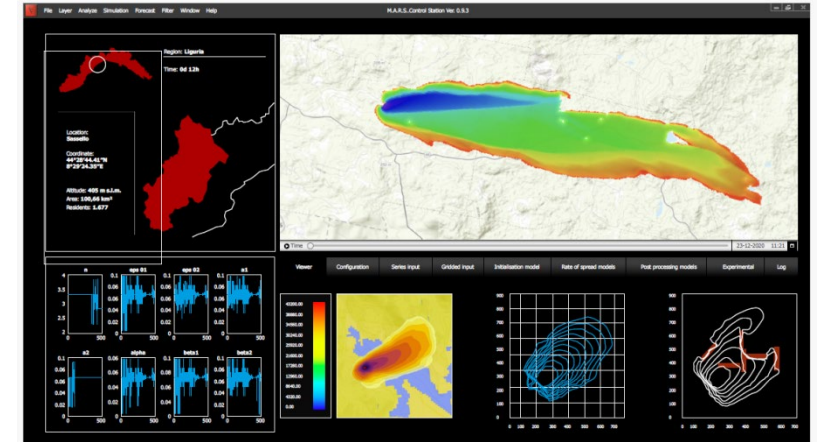
Continuous Wildfire Monitoring (M.A.R.S. Sentinel)

24/7 wildfire monitoring through M.A.R.S. Sentinel, allowing quick battery and payload replacement for uninterrupted service and precise data acquisition.



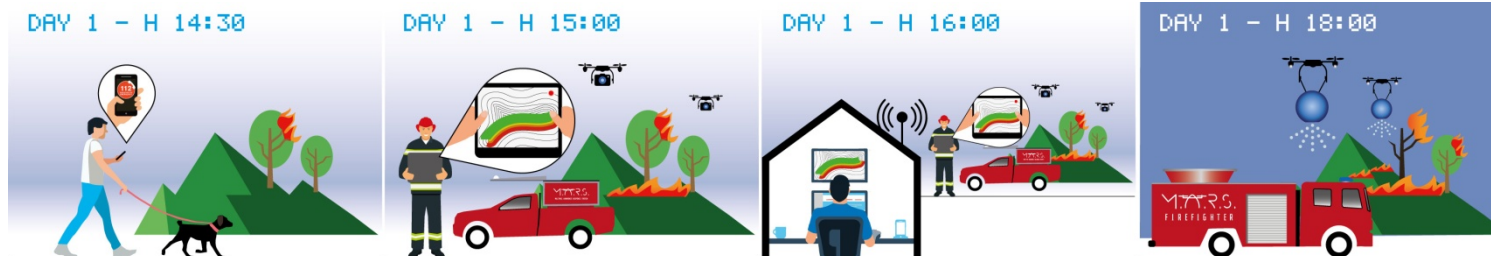
Early Fire Attack (M.A.R.S. Firefighter)

Continuous in-flight refueling of drones with 500 kg payloads, ensuring early attack and effective containment of fires. No need for a nearby water basin.



Fire Evolution Simulation and Coordination (M.A.R.S. Control Unit)

Fire evolution simulation and planning, ensuring optimal logistics and cooperation with traditional firefighting units and various agencies.



Thanks for your attention!

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