

SCIENTIFIC & TECHNICAL GAPS IN THE SHIFT TO A MORE AUTONOMOUS FORCE – MULTIPURPOSE UNMANNED GROUND SYSTEM (MUGS)

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Autonomous ground system: benefits

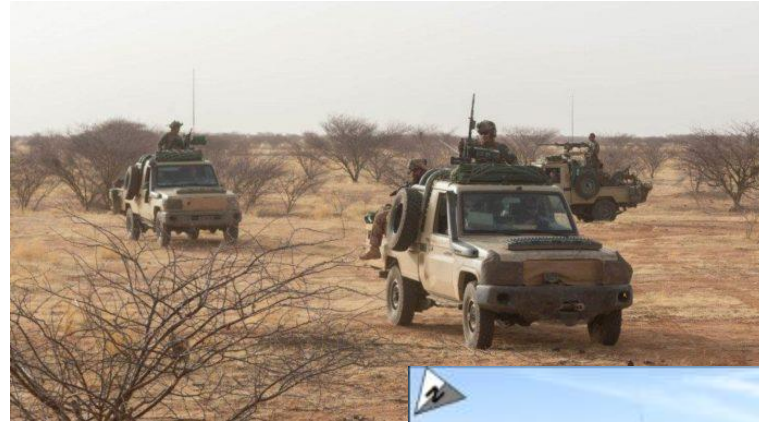
■ Less exposure of soldiers

■ Force multipliers

- > Observation
- > Mobility

■ Task delegation

■ Improved logistic to the point of contact



Improvised
Explosive
Device
(Malia)



Autonomous ground system: gaps

■ Situation Awareness & Localisation

- > Proximal environment, localisation (navigation, trajectory management, avoidance)
- > Mutual « state representation » between man and machine (impact on autonomy and man-system interaction)

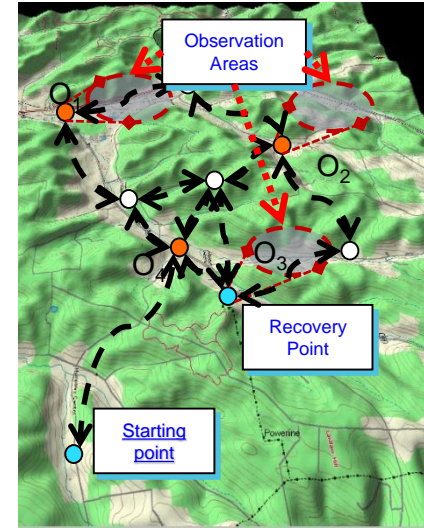
■ Artificial Intelligence for autonomy

- > Mission / Mobility Management
- > Interactive decision making, level of autonomy?
- > Safety
- > Processing Power

■ Trustworthy/comprehensive AI

■ Acceptability and ethical conditions

■ Affordability of autonomous functionalities



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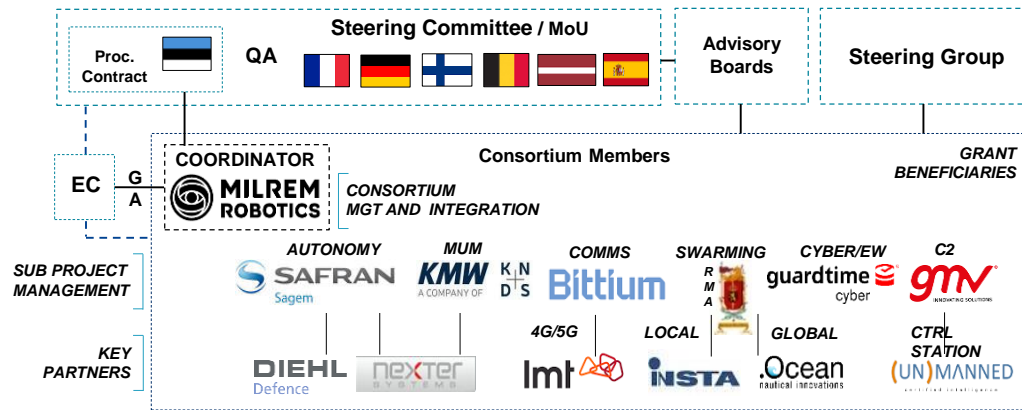
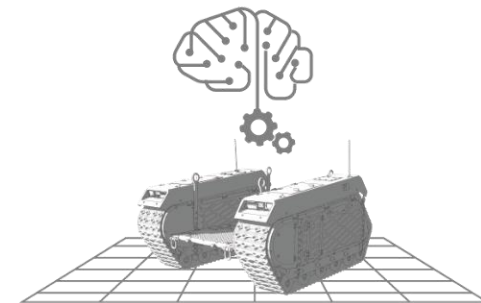
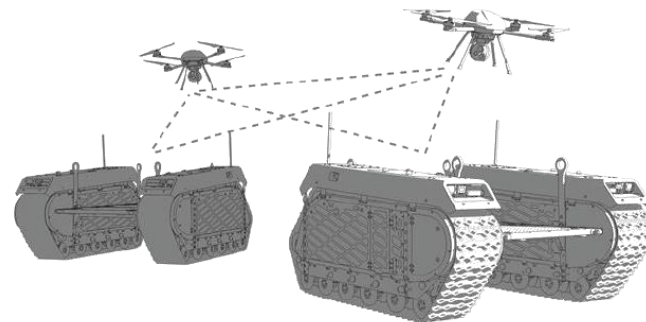
A European project to more autonomous ground systems

The overall budget of iMUGS is 32,6 M€:

up to 30,6 M€ by the EDIDP

up to 2 M€ by the participating Member States.

Participants:



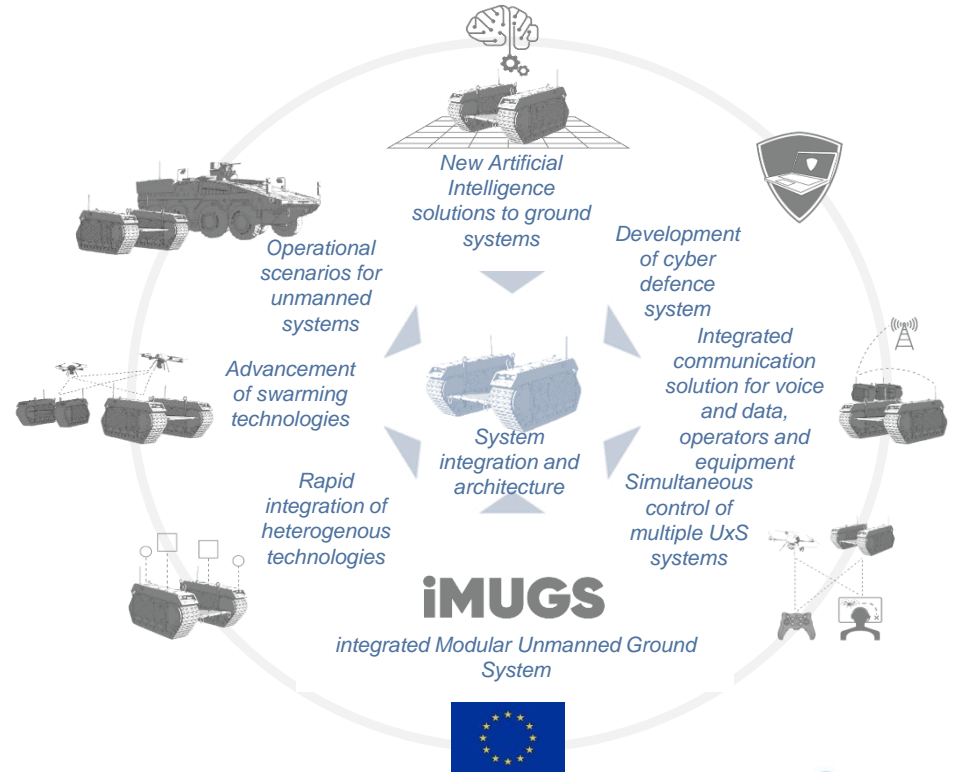
EDIDP-MUGS-2019: Integrated Modular Unmanned Ground System

Contribution of iMUGS to autonomous vehicles' gaps

The objectives of iMUGS project are to:

- develop modular and scalable architectural framework for hybrid manned-unmanned systems with embedded autonomous functions:
 - Increase situation awareness and localization
 - Includes Artificial intelligence algorithms for different type of autonomous missions (way point navigation, follow me mode, surveillance and patrolling)
 - Dedicated data warehouse for AI algorithms
 - Designed for safety
- Define man-system interactions (level of requested autonomy depending on mission type and environment)
- analyze ethical aspects as well as acceptability of unmanned systems in military personnel.

At the end of the project, an affordable and scalable autonomy kit will be available.



Autonomous System: a challenge for safety certification

iMUGS target



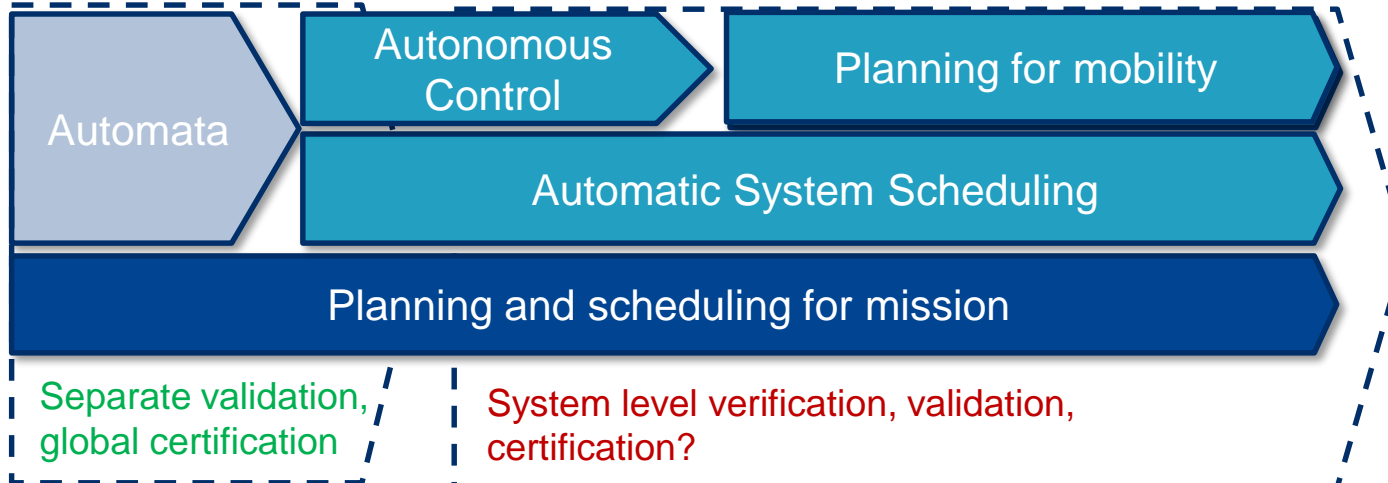
Known and mastered environment
Full controllability



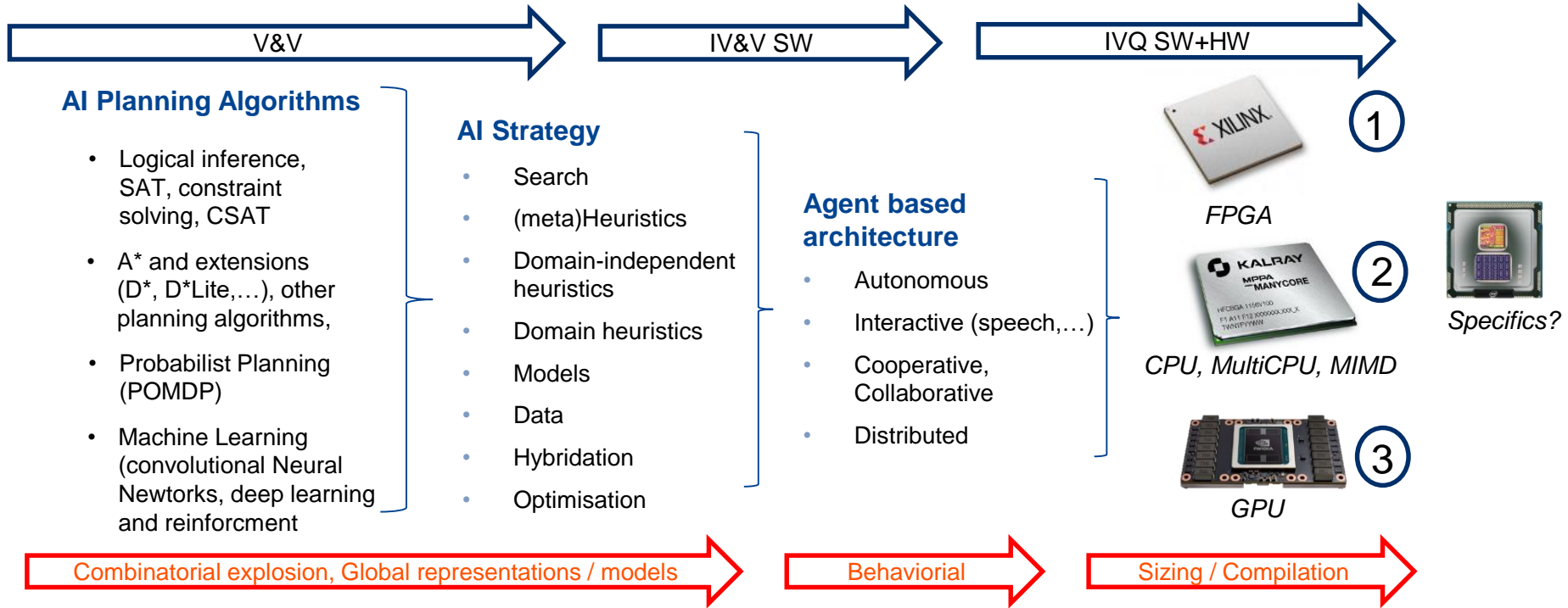
Partially known environment
Long term uncertainty



Unknown environment
Short term uncertainty and contingencies

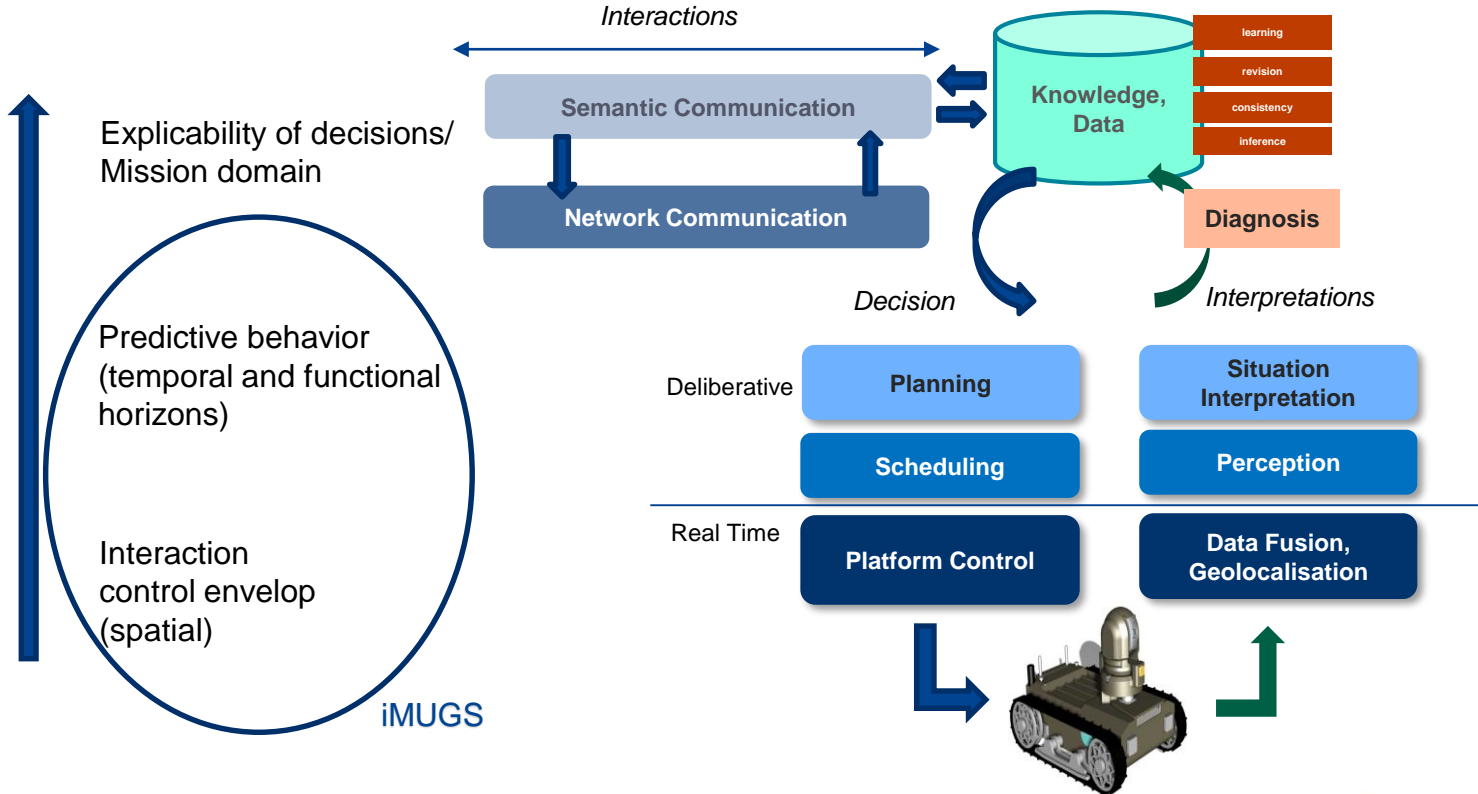


The challenge of Verification, Validation and Certification for AI



Certification of AI should consider: AI technics, Ai architectures but also tools (compilation SW) and processors

Impact of safety constraints on Engineering interactions



Conclusion

**Autonomous ground systems could bring some real added value to forces
But still some gaps needs to be addressed as safety and Man-System interactions**

Safety: Use of artificial intelligence

- IVQ and Certification methodology

- ◆ Bound the functional domain over a given horizon (temperature, flight envelope)
- ◆ How to adapt existing methodologies to AI implementations for certified application
 - Live testing, dynamic validation approach?
 - Certification also needs to address learning stages → how to perform a test drive?

- 3 domains: Ai algorithms, AI architectures, Tools

Man-System interactions could benefit from safety constraints at all levels (spatial, temporal and mission domain)

Within iMUGS european project, we will develop and implement solutions covering spatial and temporal domain.