POLITECNICO DI MILANO

THE SKY FROM ABOVE
Aermatica

Opposites Attracts: Aeronautic Determinism and Autonomous Behavior in the UAS Synthesis

Matteo Matteucci – AIRLab, Politecnico di Milano

Paolo Marras – Aermatica SPA

Presentation Outline

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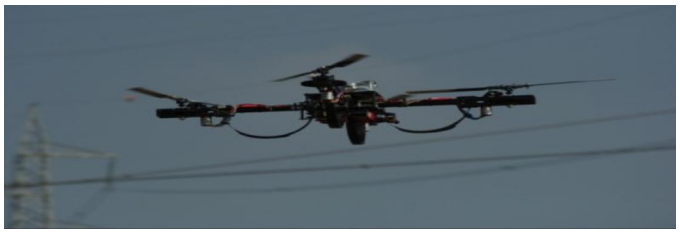
"Safety and ease of use in a fully certified UAV"

- UAS design context
- Two opposite perspectives
- A bunch of definitions
- The UAS Synthesis
- Market needs
- Our framework

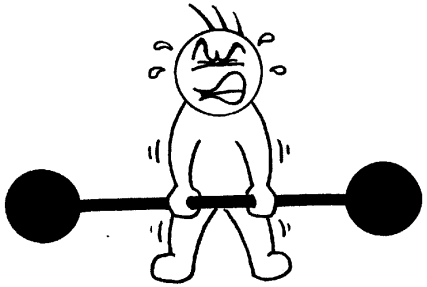


A talk to present my joint work with Aermatica, an Italian company developing and producing an UAV certifiable by ENAC

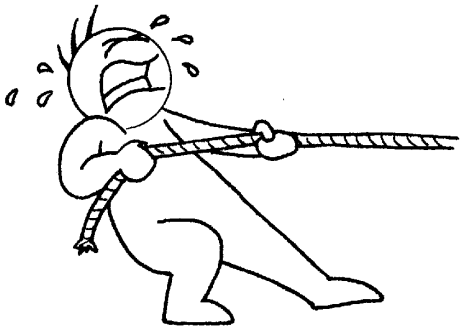
(Italian National Civil Aviation Authority)

They got already some flight permits from ENAC and they are ready for full flight permit in some European countries.

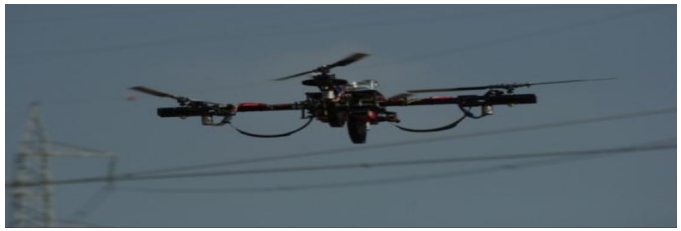
UAS design context

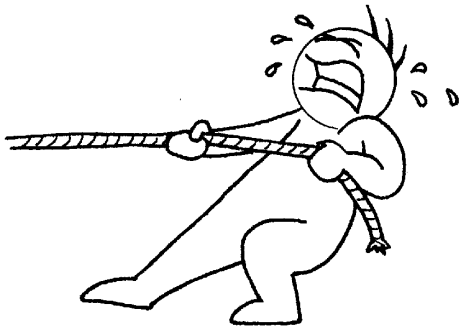


Technology

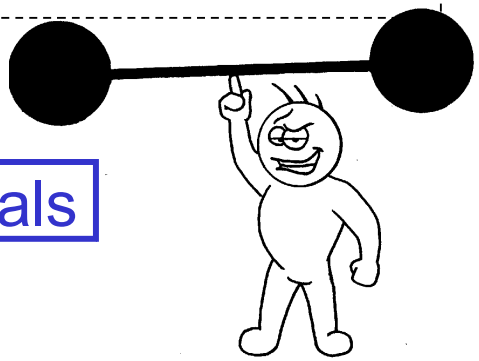


Regulations





Market Needs



Design Goals

Opposite Attracts

Autonomous Robotics Perspective:

- situation awareness through world perception
- reaction to unforeseen events through reactive behaviors
- on-board mission planning and management

Aeronautics Perspective:

- fully deterministic and certifiable actions
- “autonomy” is not admitted (use “automatic” instead)
- command-in-pilot must be able to exercise the last authority

Command in pilot? On an UAV?
What’s left for me, a roboticist?

Bunch of Definitions

Aircraft (Ref. ICAO Annexes and National Aviation Regulation): any machine that can derive support in the atmosphere from the reaction of the air other than the reaction of the air against the earth's surface.

- RPA (Remotely-Piloted Aircraft) recently defined by ICAO Circular 328 (Italian Law n. 178/2004)
- UAS (Unmanned Aircraft System), an aircraft and its associated elements which is operated with no pilot on-board

Flying pilot: a person who operates the flying controls of an aircraft and is responsible for the flight trajectory of the aircraft.

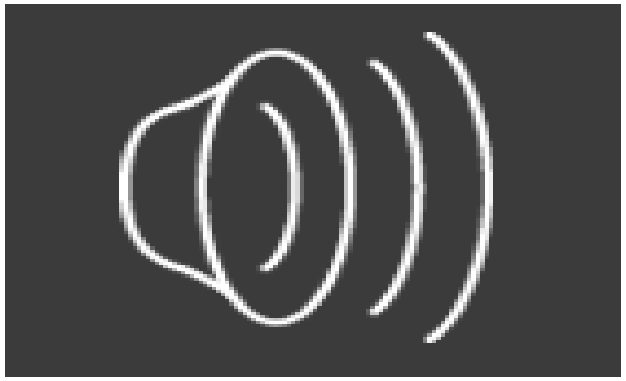
Pilotless Aircraft (Ref Art. 8 Chicago Convention): no aircraft capable of being flown without a pilot shall be flown over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft.

The UAS Synthesis

A flying system able to guarantee mission requirements in a safe and easy way calls for research efforts aimed at a deterministic and certified framework able to:

Complement pilot remote control:

- Automatic safety management
- C2 Link Connection Lost
- Flight Space Monitoring
- AR feedback through perception
- Automatic Fleet Management



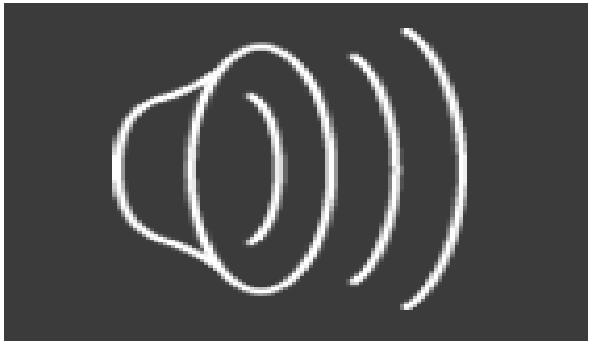
Support high level payload-aircraft tasks

- Payload coordinated management
- Record and Replay for video shots

The “Dual Use” Scenario

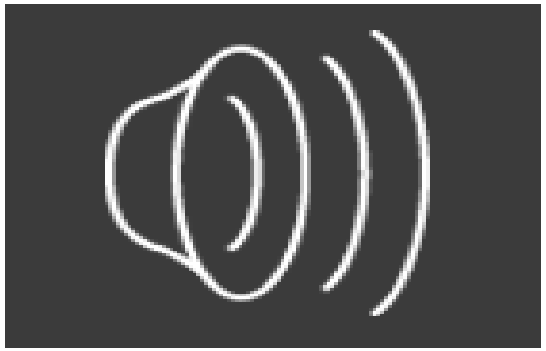
Military Market (Mission first)

- Got already public acceptance of use in war zones overseas
- Need for ***Reliability***

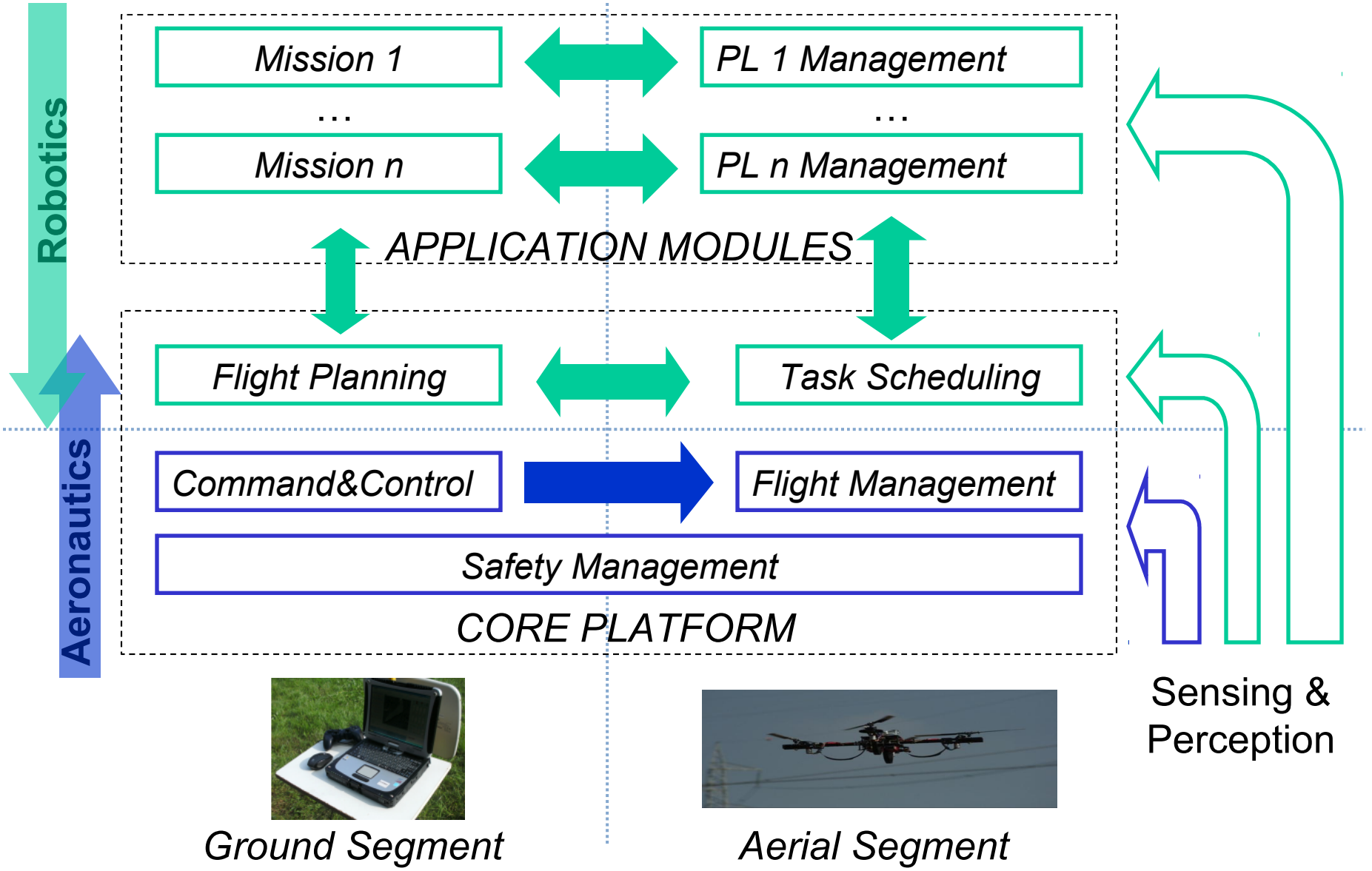


Civil Market (Safety first)

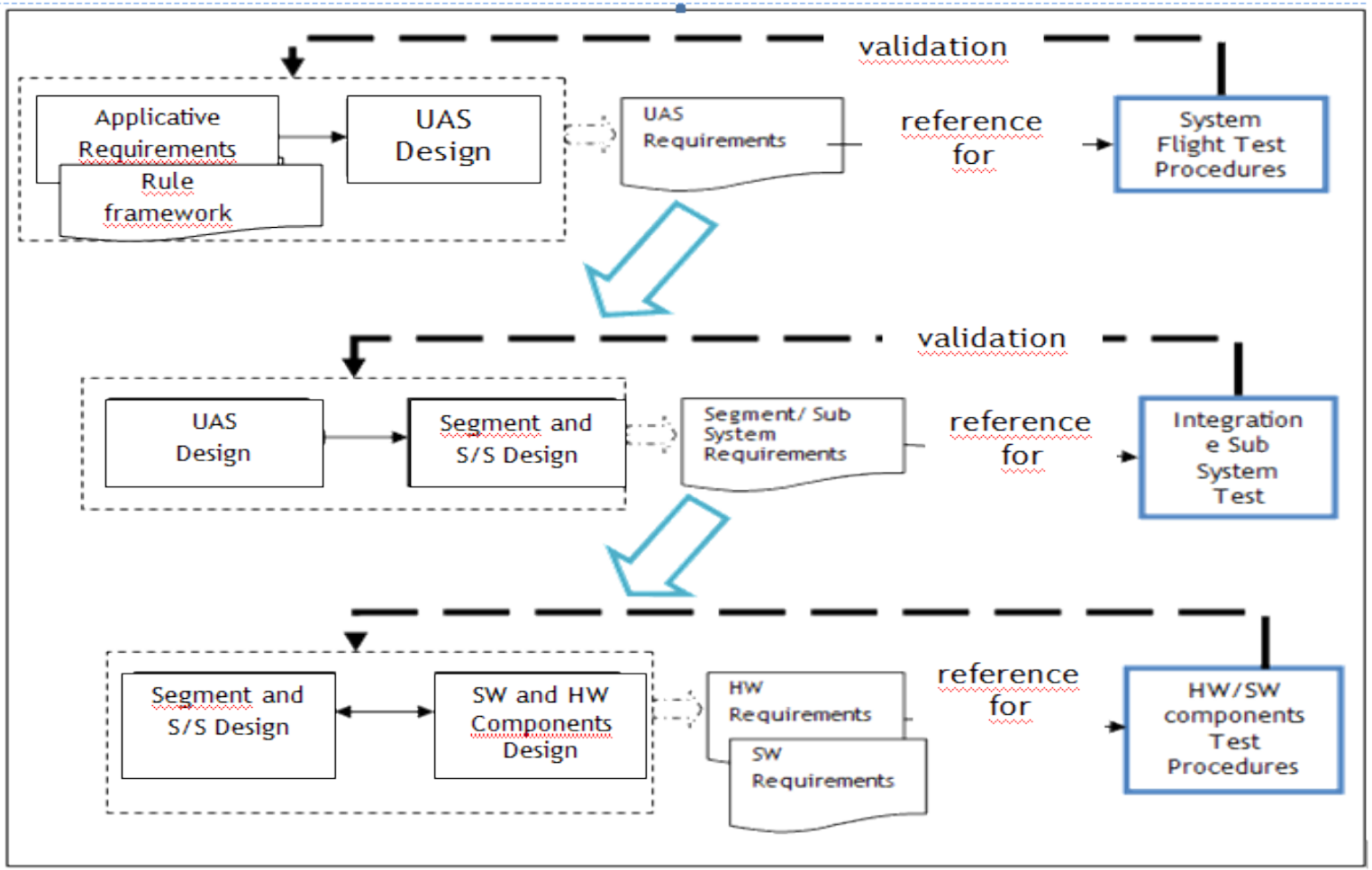
- Still concerns about safety and privacy
- Need for ***User friendly interface***



The Overall Architecture



The Only One Approved Process



- ***Prototyping*** is used for validation and requirement refinement
- ***Safety management*** has to be taken into account at any stage

… and finally …

ENAC

PERMESSO DI VOLO
(PERMIT TO FLY)

REPUBBLICA ITALIANA – ENTE NAZIONALE PER L'AVIAZIONE CIVILE

Permesso di Volo No.
(Permit to Fly No.)
2010/SCP/PV/64

L'ENAC, riconosciuta in virtù del Decreto Legislativo 25 Luglio 1997 No. 250 ed in accordo al regolamento (CE) No. 216/2008, con il presente documento autorizza l'aeromobile in oggetto a volare entro i confini dell'Italia nel rispetto delle condizioni sotto elencate. La presente autorizzazione è valida anche per il volo verso ed entro i confini di altri Stati, purché si ottenga un'approvazione separata dalle autorità competenti di detti Stati.
ENAC granted by virtue of Decreto Legislativo 25 Luglio 1997 No. 250 and according to Regulation (EC) No 216/2008 hereby permit noted aircraft to fly within Italy under conditions listed below. This permit is also valid for flight to and within other States provided separate approval is obtained from the competent authorities of such States.

1. Marche di nazionalità e di immatricolazione *(Nationality and registration marks)*
I-EASA

2. Costruttore e tipo di aeromobile *(Aircraft manufacturer/type)*
Aermatica S.p.A. – UAS Anteos A2-MINI/A'

3. Numero di Serie *(Serial number)*
ANT0001

4. Il Permesso riguarda *(The Permit covers)*
Ricerca e Sviluppo

5. Titolare *(Holder)*
Aermatica S.p.A.

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