

Presentation of the MAVDEM project

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Outline



- Introduction
- Project methodology
- Missions identification
- System architecture
- Vehicle configuration selection
- Guidance, navigation and flight control system
- Ground control station
- Conclusion



Introduction

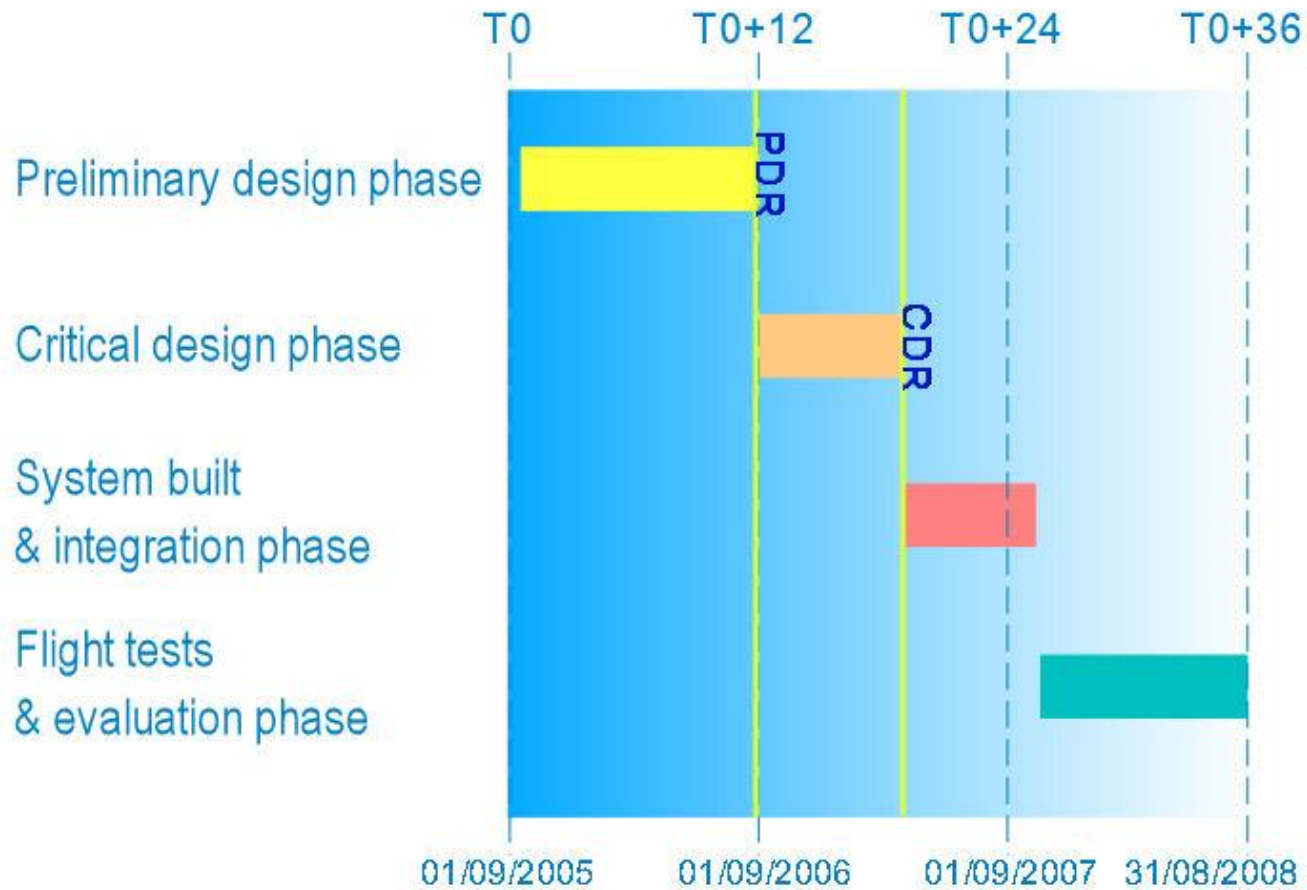


- « Design of MAV demonstrator capable of stationary flight & economic fast cruise »
- EDA project
 - France: ONERA (Alcore Tech.)
 - Italy: OTO MELARA (Celin Avio)
 - Spain: SENER
 - Norway: TELLMIE
- 4 M€ budget
- From Sept. 2005 to Sept. 2008

Wingspan	<50 cm
AV gross weight incl. Payload	One-man portable
Endurance economic cruise	30 min
Max cruise speed	20 m/s



Project methodology



Missions identification

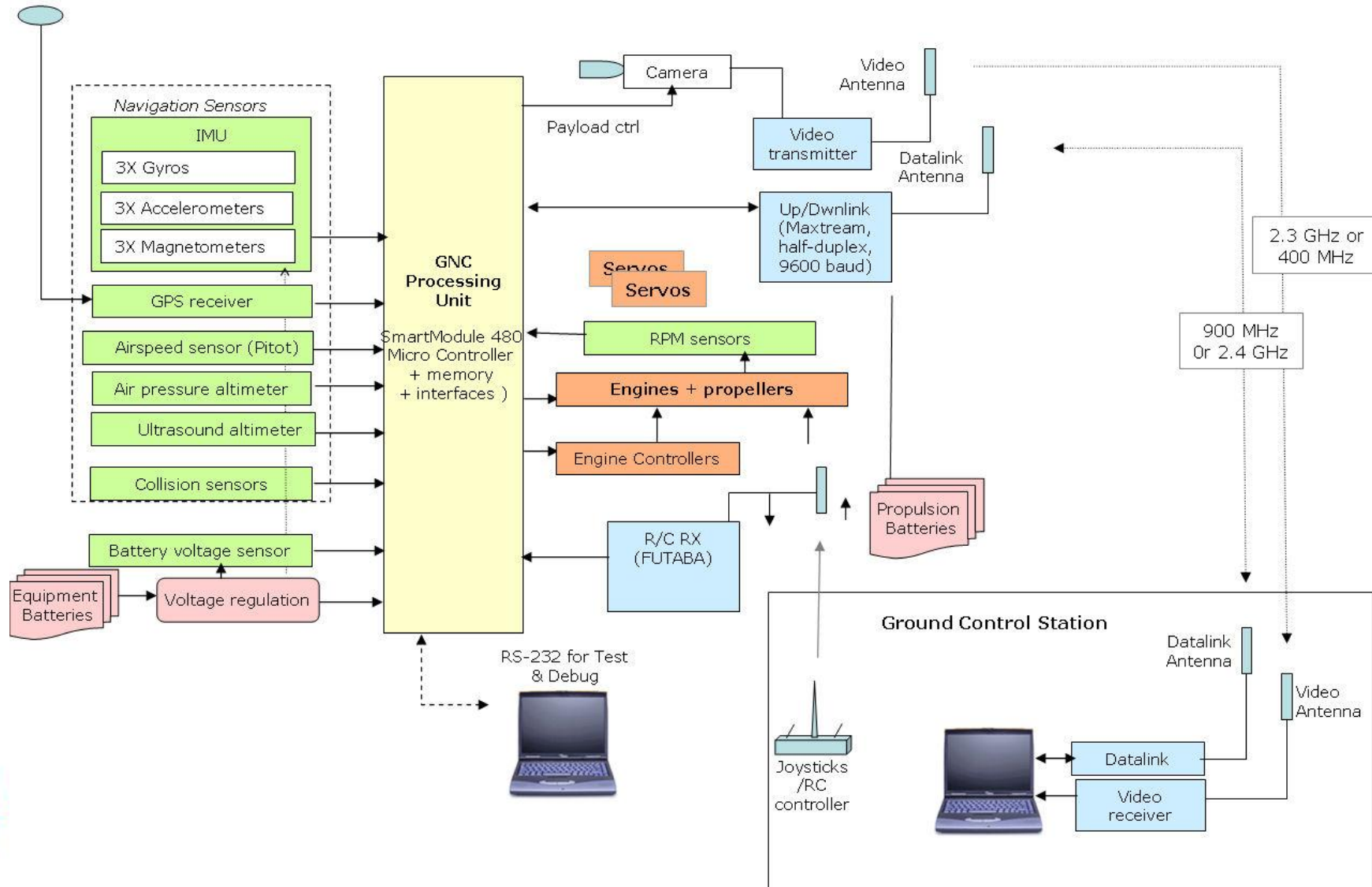


- 2 basic scenarios

- Scenario 1: the MAV should fly at maximum cruise speed and inspect in stationary flight some targets located at maximum distance away in detail and fly home at maximum cruise speed
 - Focus on the combination of fast cruise and VTOL/stationary flight capability)
- Scenario 2: the MAV should act as a scout for a small unit in an urban scenario, fly ahead of soldiers, inspect roofs and look into windows. Endurance between 15 and 30 minutes
 - Focus on slow/stationary flight and endurance

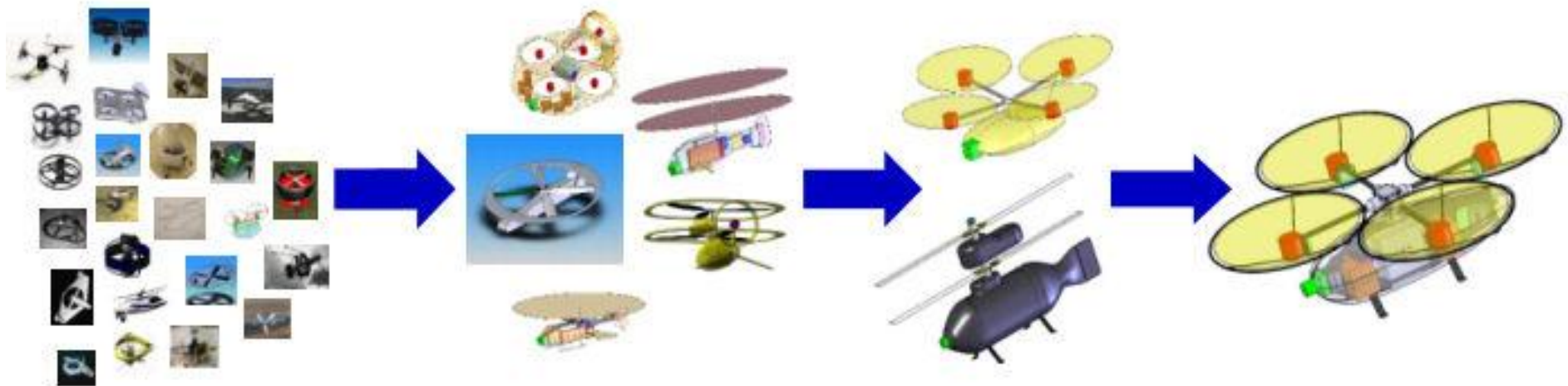


System architecture



Vehicle configuration selection

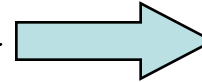
- General methodology: start from the widest spectrum of candidate concepts



Candidate concepts survey

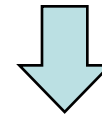


- Survey of VTOL concepts
 - As wide as possible
 - Existing and innovative concepts
- 26 concepts identified
 - 4 rotor
 - Helicopter
 - Single ducted rotor
 - Double coaxial rotors
 - Double tandem rotors
 - Tail-sitters
 - Tilt-rotors



Too many concepts!

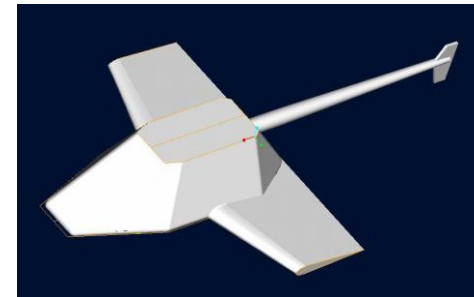
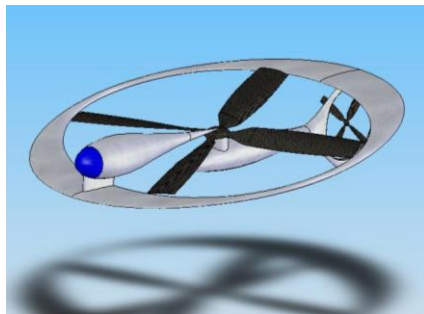
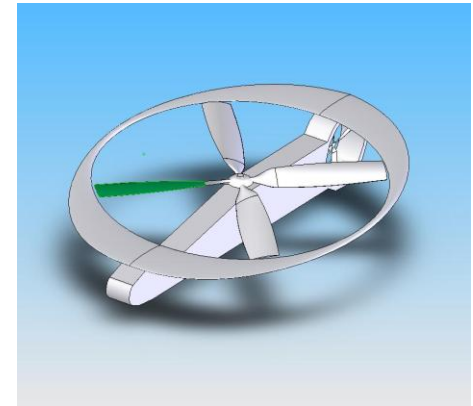
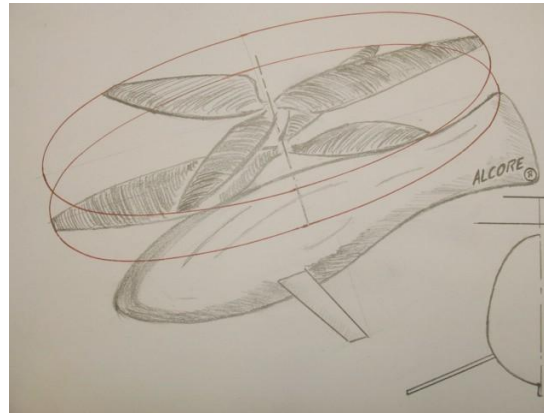
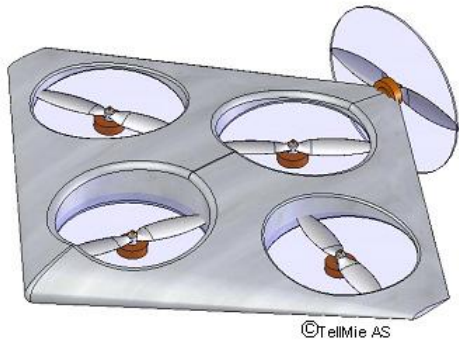
First selection through
a high level
multicriteria analysis



Down selection of 5
concepts



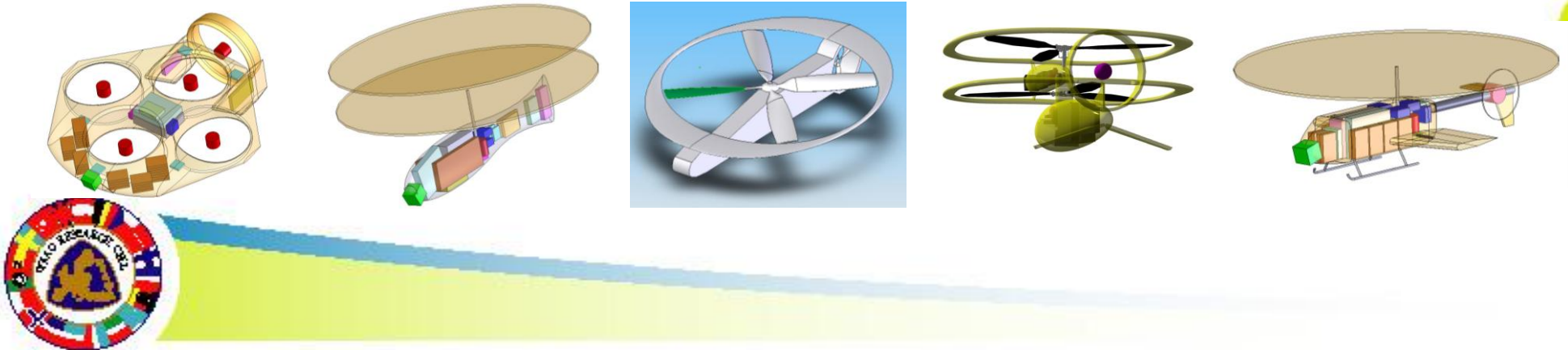
The 5 retained concepts



Design improvement



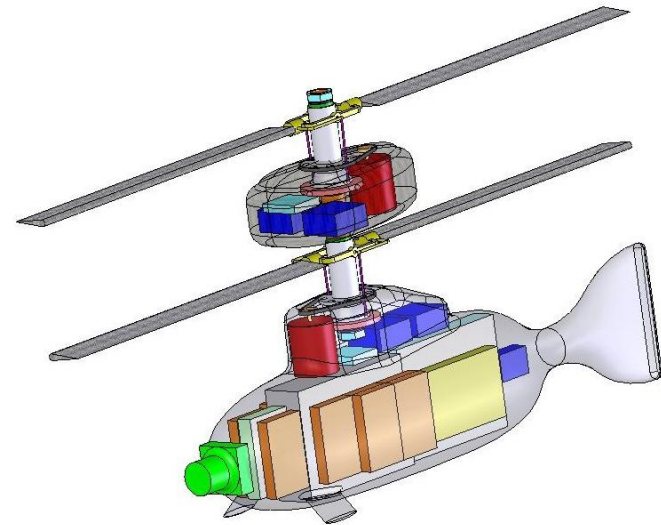
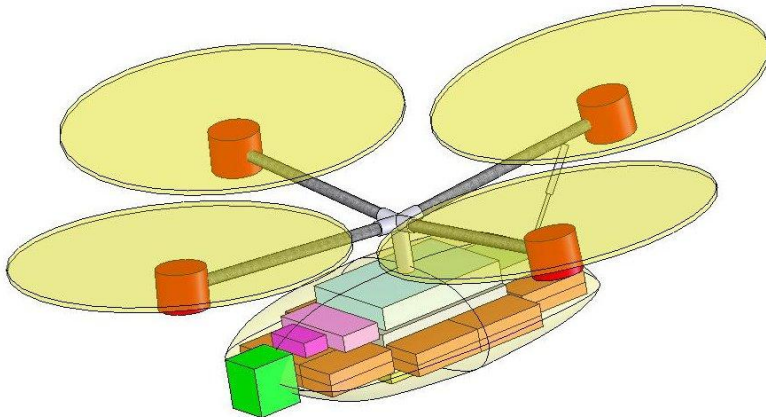
- Improvement of the level of detail of the retained concepts
 - Identification and characterization of the required onboard components
 - Propulsion considerations, especially on batteries volume and motors efficiency
 - Aeroshape design refinement, with associated estimated lift and drag
 - Performance estimation



2 last remaining concepts

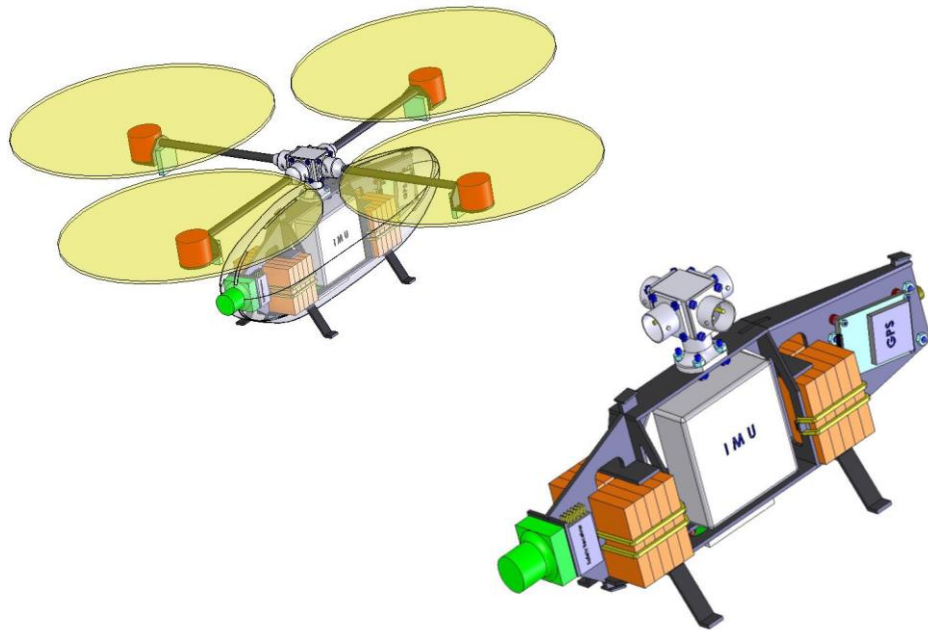


- Definition of 2 « finalists » by mixing the major advantages of the 5 previous concepts
 - Low mechanical complexity, easy manoeuvrability
 - Low drag fuselage, high performance

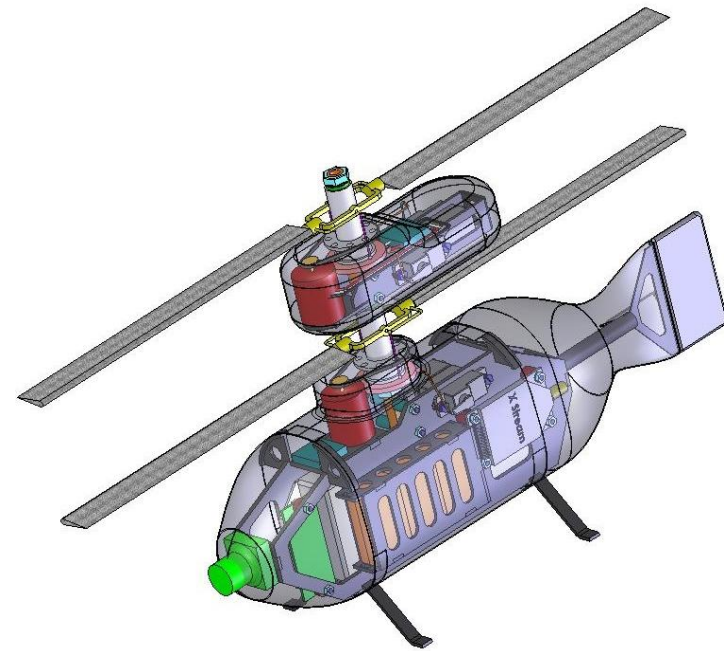


Detailed design

- Design enhancement through propulsion tests & structure and internal arrangement definition



Configuration A



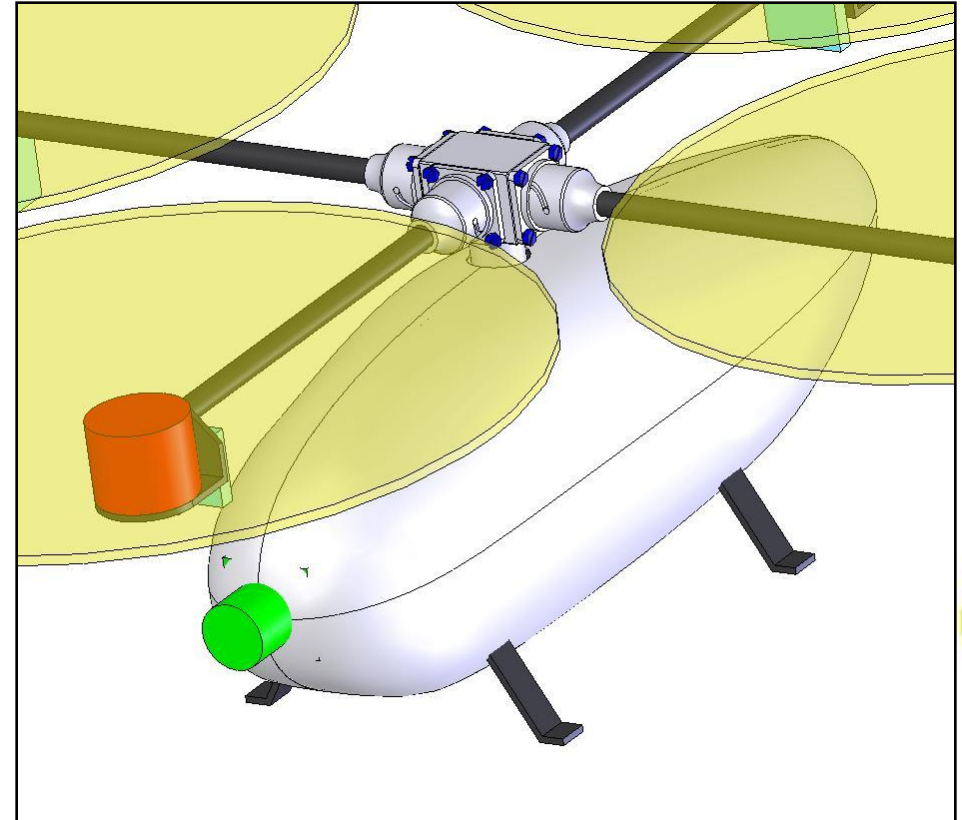
Configuration B



Final choice



- Based on
 - Detailed design
 - Aerodynamics characterization
 - Performance calculation
- And in agreement with the whole consortium



Guidance, navigation and flight control system



- Definition of generic mathematical models
 - Guidance and control
 - Navigation
- Flight management
 - Manual mode for set up
 - Automatic mode
 - Crash mode
- Simulator developed



Ground control station



MAVDEM

Open & Save for maps, routes and configuration params

Counter showing remaining flight time (changes to red when 5 min left)

Main state of MAV

MAVDEM Ground Control Station

Maps Routes View Config Help

Cursor: N61 09.424 E011 24.520 Own lat/lo: N61 09.286 E011 19.506 Own metric pos: 167 -415 59

Waypoints are defined by "point & click"

MAV symbol shows a fixed-wing to indicate heading

Zoom in/out + pan

Course, Speed & Height instruments. Red: Wanted value, Green: Actual value

Status: **On Track**

DTG: 213 Distance and Time To Go (to next WP)

TTG: 09s

Selection of cmd modes

Go To Hover

Track -1 02 +

RTB Manual Auto land

Def of Base, WP and Landing pos

Latitude: N61 09.3 Longitude: E011 18.677

Base Pos Way point Landing Pos

Status

Payloadlink Controllink Prop battery GNC Battery Sensors

Waypoint

WP no: 20 Hide

Latitude: N61 09.574 Longitude: E011 18.677

Flight Mode: Forward Flight

Duration (s): 0 Height (m): 100 Speed (m/s): 20

Delete OK Cancel

Field for editing of Waypoints

Status for important sub-systems

Rena, Norway

Rena

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Conclusion



- MAVDEM project now entering the « System built & integration phase »
- Manufacture and procurement of the components have started
- Integration should start at the end of October 2007
- Preliminary flight tests in Spain during the first half of 2008
- Final flight demonstration in Norway during summer 2008

