

# LUMEN

Light UAS in non segregated airspace for Maritime and ENvironmental surveillance

16/04/2015

## **LUMEN: Light UAS (RPAS) in non-segregated airspace for **M**aritime and **EN**vironmental surveillance - Demonstration project**

Koen Meuleman and LUMEN partners

Bonn Agreement Remote Sensing Workshop – 14-16 April 2015

# Introduction - Objectives of the project

» 22 months project – funded through ESA-IAP

1) Demonstrate the use of RPAS for offering near real-time imaging (video HR/IR)/information in a pre-operational setting:

- » Use case 1: Maritime surveillance: near real-time video imagery
- » Use case 2: Real-time Flood Monitoring: near real-time geo-corrected image information

2) Demonstrate to the user community that RPAS service supported by satellites (C&C, Data transmission) can fulfill their needs.

3) RPAS as **part of** an overall system/service!

4) RPAS can be integrated safely in non-segregated airspace

# Project Consortium



Agentschap voor  
Geografische Informatie  
Vlaanderen



- » **VITO(B)**: prime
  - » RPAS systems + payload + satellite communication
  - » Subcontractors VITO: **Flight Plus(B)** (ATC coordination and scenario builder)
- » **Newtec(B)**: demonstration of high bandwidth satellite communication: payload sat com,
- » **AGIV(B)**: delineation of flooded area's → service provider for VMM and Watlab
- » **Norut (Norwegian Research Institute)**: demonstration of satcom for BRLOS Command & Control and Payload transmission

# Stakeholders/Users

## Stakeholders:

- » Belgian CAA,
- » Belgocontrol,
- » Composair (Belgian Defence)
- » BIPT

## Users

- » **Use case 1:** FOD Leefmilieu, DG Marien Milieu
- » **Use case 2:** VMM en WatLAB



# Use case 1: Maritime surveillance - Needs

## Current situation: Maritime surveillance

- » Survey done with helicopter + RPAS + manned aircraft
- » Survey time limited
- » Real-time link or recorded video (VIS/IR)
- » Limited availability of resources: money and platforms



## LUMEN User needs

- » Less detectable
- » Less risks to people involved
- » Real-time video link
- » Increased surveillance coverage by decreasing operations costs



# Use case 2: Floodmapping - Needs

## Current situation: Flood mapping

- » Survey done with helicopter
- » Mobilisation helicopter + camera : 8 hours
- » Survey ~ 2 hours (main rivers)
- » Need presence of expert on board
- » Raw data on disk => AGIV
- » Data digitalized manually
- » Manual definition extend flood
- » Product available after 3-4 days

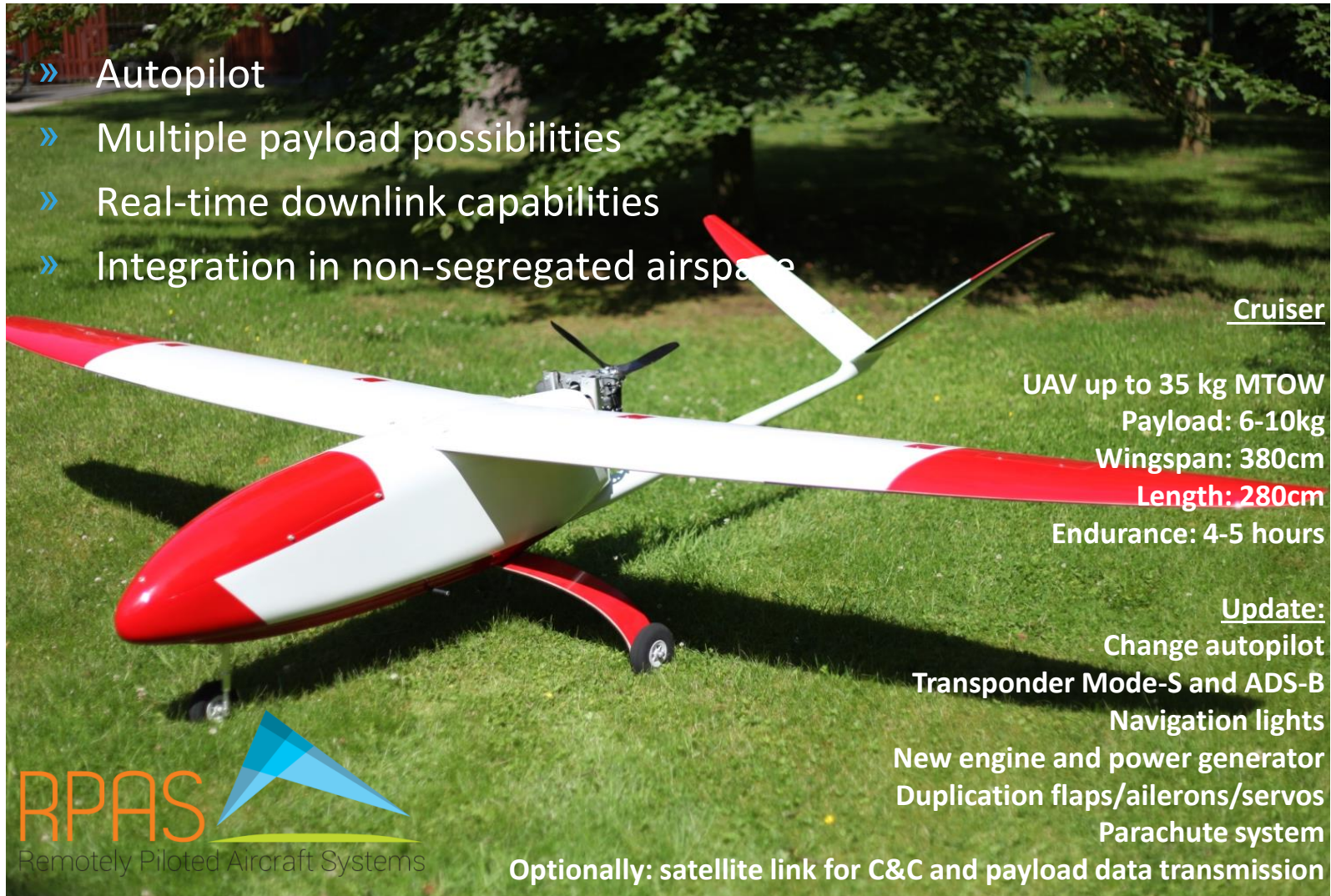


## LUMEN User Needs

- » Airborne platform longer endurance
- » Less operational risk
- » Faster product delivery
- » Internet/WMS access

# LUMEN RPAS platforms – BLOS

- » Autopilot
- » Multiple payload possibilities
- » Real-time downlink capabilities
- » Integration in non-segregated airspace



## Cruiser

UAV up to 35 kg MTOW  
Payload: 6-10kg  
Wingspan: 380cm  
**Length: 280cm**  
Endurance: 4-5 hours

## Update:

Change autopilot  
Transponder Mode-S and ADS-B  
Navigation lights  
New engine and power generator  
Duplication flaps/ailerons/servos  
Parachute system

Optionally: satellite link for C&C and payload data transmission

**RPAS**  
Remotely Piloted Aircraft Systems

# Payload properties

- » *DST OTUS L-170: HD RGB Video + Uncooled Thermal Imager*
- » *2 kg*
- » *TV Camera: SONY FCB-EH6300, HFOV 2.9-55°, analog HD component or composite PAL*
- » *IR-Camera: FLIR Tau 640, 35mm lens, HFOV 18°, 9Hz, 7.5 -13.5  $\mu\text{m}$  composite PAL*
- » *De-stabilisation: <100  $\mu\text{rad}$*
- » *Geo-location – Geo-Tracking*







Visionair  
 File Preset Map Maintenance Help | SW2 | SW4 | SW5 | SW6 | SW7 | N 40° 54' 31.58" W 004° 13' 50.04" 958 m

Video

Snapshot

W 004° 14' 28.72" N 40° 53' 21.09" 13:23:19  
 TAL 098 ft  
 RNG 1.0 Km

BRG 180° DEP -46 GEO ASL: 1597 m IAS: 108 Km/h

Engine

x1000 rpm 5.37

Fuel level

Set MIN [Slider] Set MAX

LPL 100%  
 DWN 96%  
 AGL: 623 m

Alarms

Visionair UAV

ASL ALT TOO HIGH

AHRS

Km/h -2m HLD 1.1 G m

115 108 105 100 150 168 80 1597 1550 1500

48% 2% 3% 0% 3%

OVERLAYS (F1) | SCROLL (F2) | ZOOM IN (F3) | ZOOM OUT (F4) | VIDEO (F5) | AHRS (F7) | ENGINE (F8) | FP EDITOR (F9) | MORE WINDOWS (F10) | UAV MODE (F11) | CAMERA (F12)

N 40° 53' 45.12" W 004° 14' 28.25" ASL: 1598 m AGL: 623 m 107 Km/h  
 23.4V 1.2V 12.3V UTC 12:23:16 MT 00:50:31 HOLD COM OK  
 13:23 31/10/2014

Visionair


File Preset Map Maintenance Help | SW2 | SW4 | SW5 | SW6 | SW7 | N 40° 52' 34.53" W 004° 13' 39.14" 959 m

Video

Snapshot

W 004° 14' 28.16" N 40° 53' 20.33" 13:30:01  
 TAL 0976 m 31-10-14  
 RNG 1.5 Km

HOLD



BRG 267R ASL: 1599 m  
 DEP -06 IAS: 115 Km/h

Engine

x1000 rpm 4.61

1 Km

UPL 100%  
 DVM 96%  
 AGL: 622 m

AHRS

Km/h 14m HLD 1.3 G m  
 125 1650  
 120 1550  
 115 1500  
 110 1450  
 105 1400  
 300 318 30  
 0% 1% 2%  
 31%

Alarms

Visionair UAV  
 ASL ALT TOO HIGH

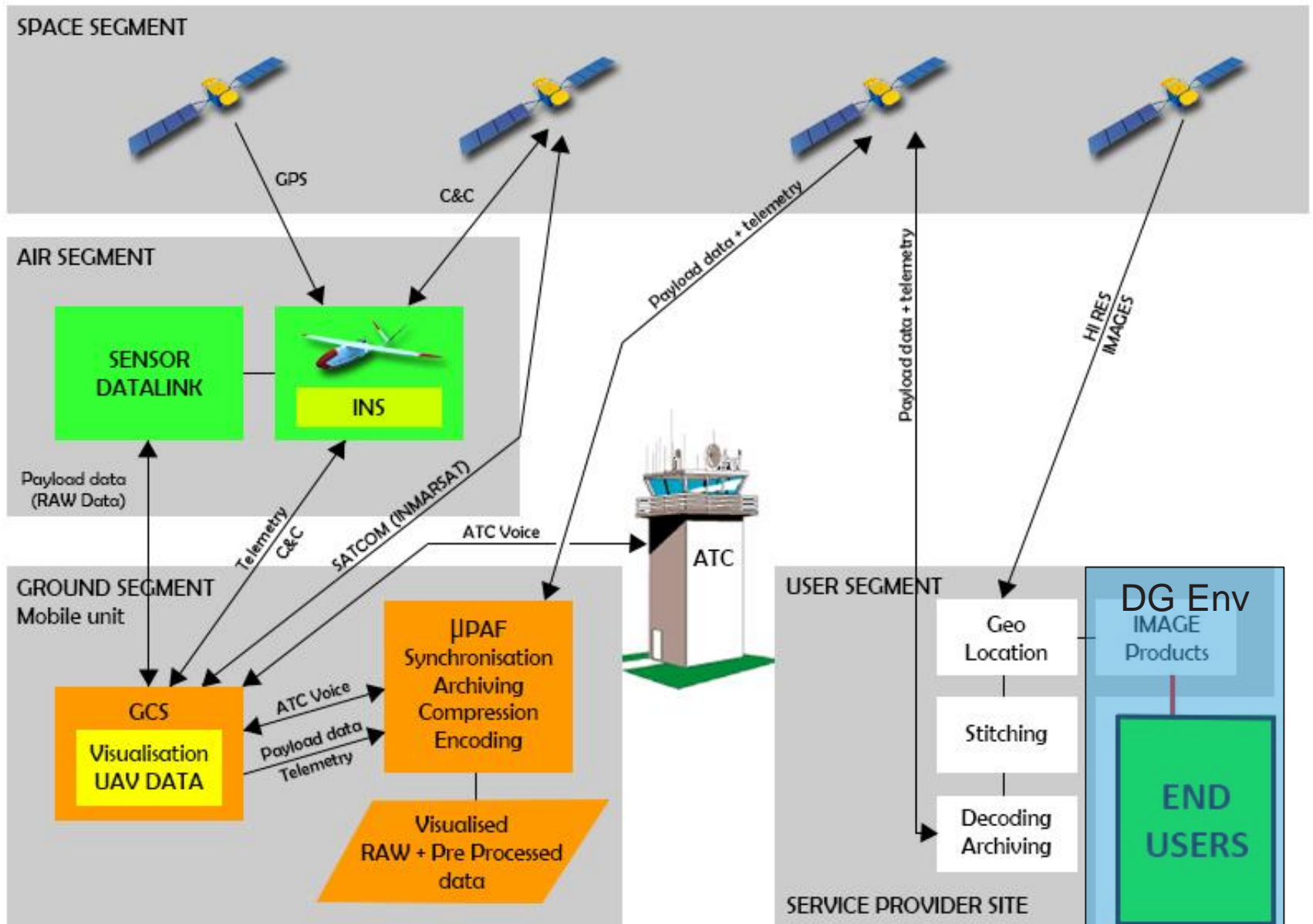
OVERLAYS (F1) SCROLL (F2) ZOOM IN (F3) ZOOM OUT (F4) VIDEO (F5) AHRS (F7) ENGINE (F8) FP EDITOR (F9) MORE WINDOWS(F10) UAV MODE (F11) CAMERA (F12)

N 40° 53' 21.70" W 004° 13' 31.32" ASL: 1599 m AGL: 623 m 116 Km/h

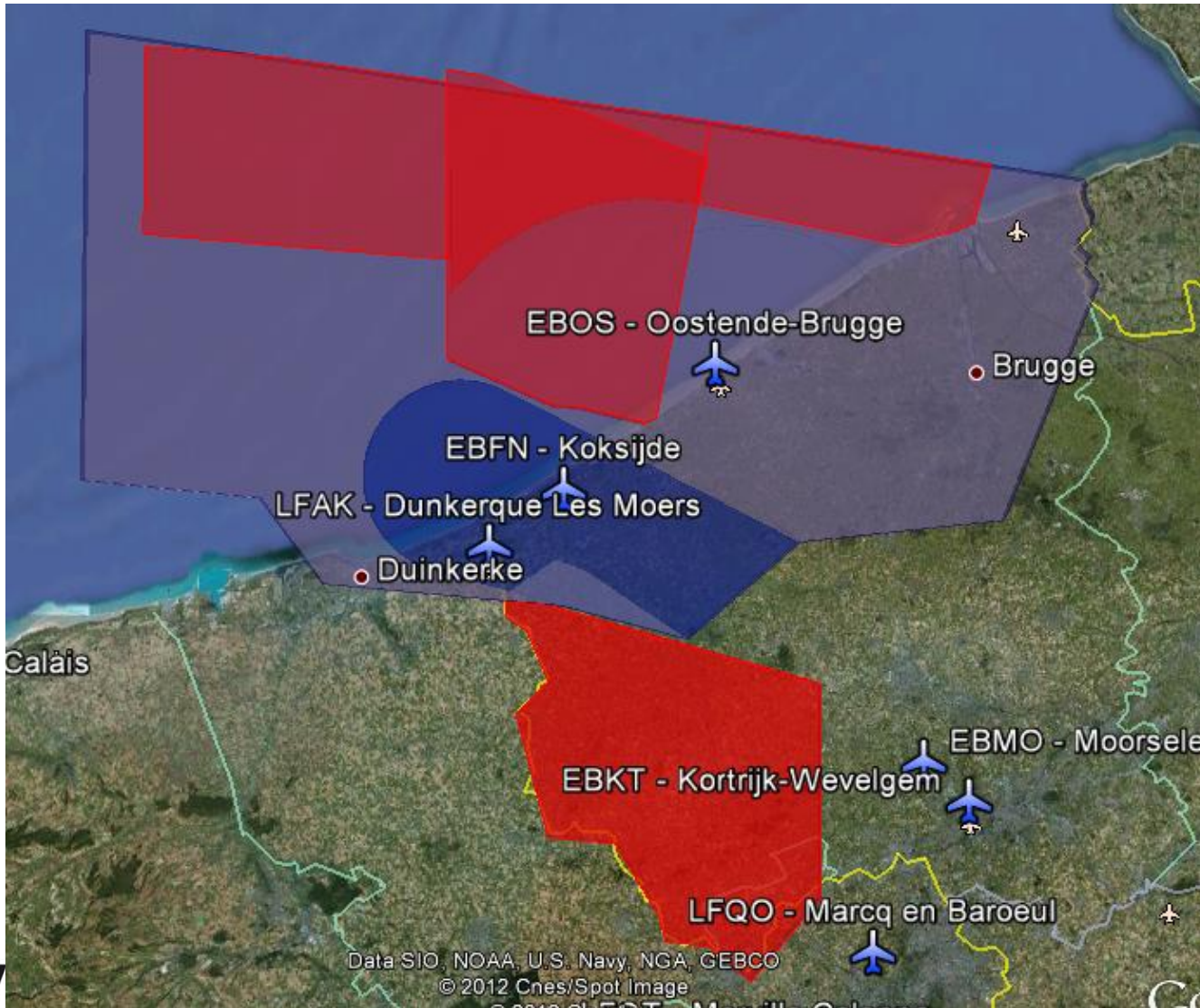
23.4V 1.3V 12.4V UTC 12:29:58 MT 00:57:08 HOLD COM OK

13:30 31/10/2014

# LUMEN system architecture



# Overview of the airspace for demonstration



# LUMEN overall “Service Concept”

- » Utilization of a ‘light-weight’ RPA platform acquiring data/information according to the expressed user needs. As a consequence, a flexible payload system is foreseen.
- » The data acquired is transmitted in near real-time from the RPA to the Ground Control Station (GCS). From the GCS, the data is either send directly via terrestrial means or over a satellite link to a service/processing centre.
- » The use of an RPA platform provides additional flexibility, is cost-effective, and implies less risk
- » Fast provisioning of data/information to the end-user by using satellite uplink and internet services.

# Outlook

- » Get the platforms delivered (!) → next week
- » Continue to develop opportunities in the next upcoming months with the partners identified:
  - » Maritime surveillance/Situational awareness → LUMEN
  - » NO2/SO2 mapping
- » Demonstration flights starting second half of 2015 – Spring 2016
- » RPAS are part of an overall system/service
  - » Operations costs – increased operational coverage
  - » Reducing risks
  - » Fast data/information delivery
- » Legal constraints remain a major concern

# Thanks for your attention!!

## Q&A

Koen Meuleman – VITO

[koen.meuleman@vito.be](mailto:koen.meuleman@vito.be)

<http://artes-apps.esa.int/projects/lumen>