

ESA RPAS Activities

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RPAS related ESA IAP (Integrated Applications Promotion) activities



Maritime Surveillance

LUMEN

DeSIRE

RAPSODY



Energy



SURMON

Demining

SAFEDEM



RPAS range:
Micro to MALE
RPAS

Space assets:
Satcom,
SatNav
integration
with sat EO
data

Agriculture

KORE

BIOSCOPE

PalmOil



Emergency response

B-LIFE



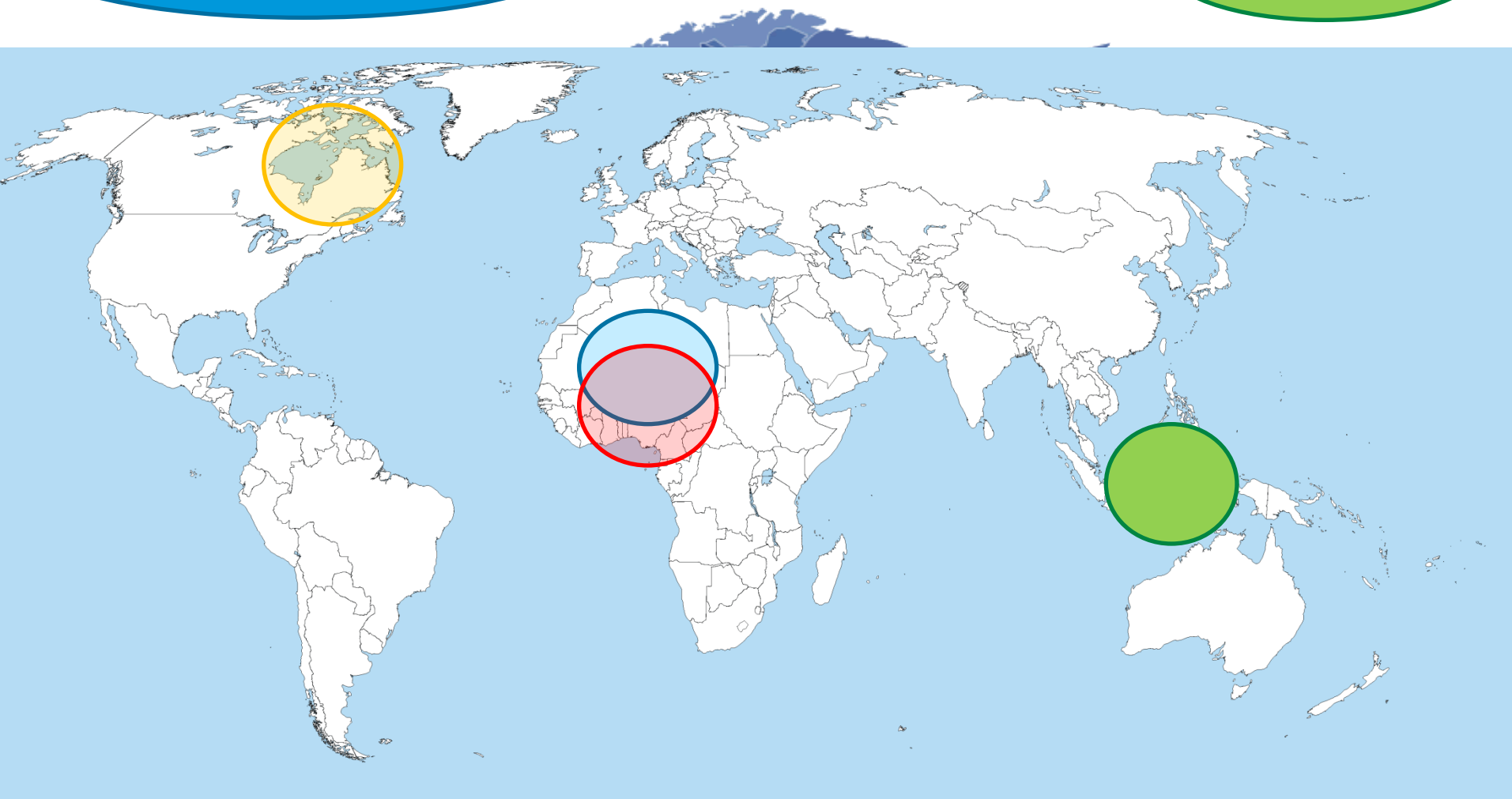
Transport

*Unmanned postal
delivery*

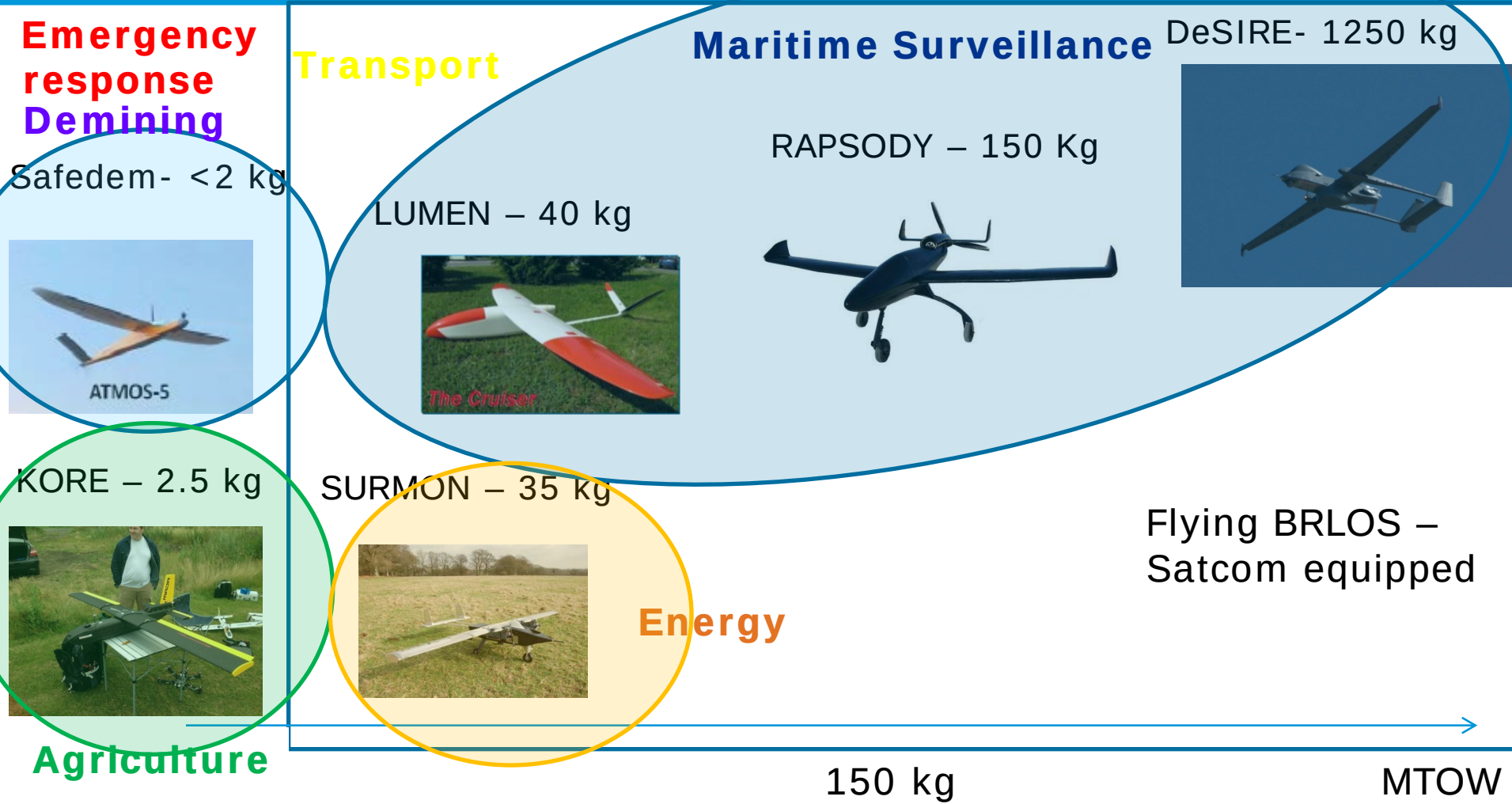


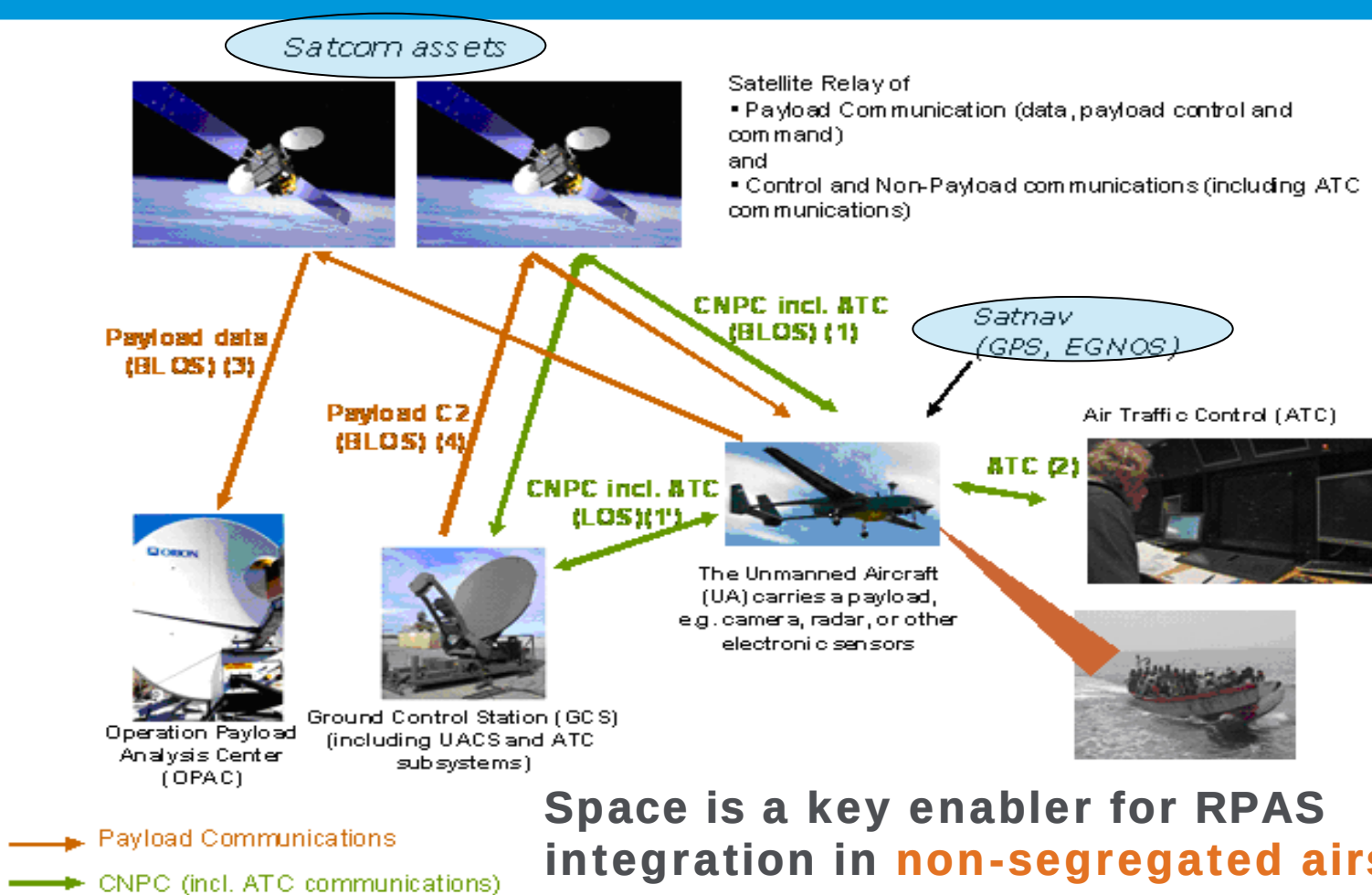
Maritime Surveillance

Agriculture



Applications needs





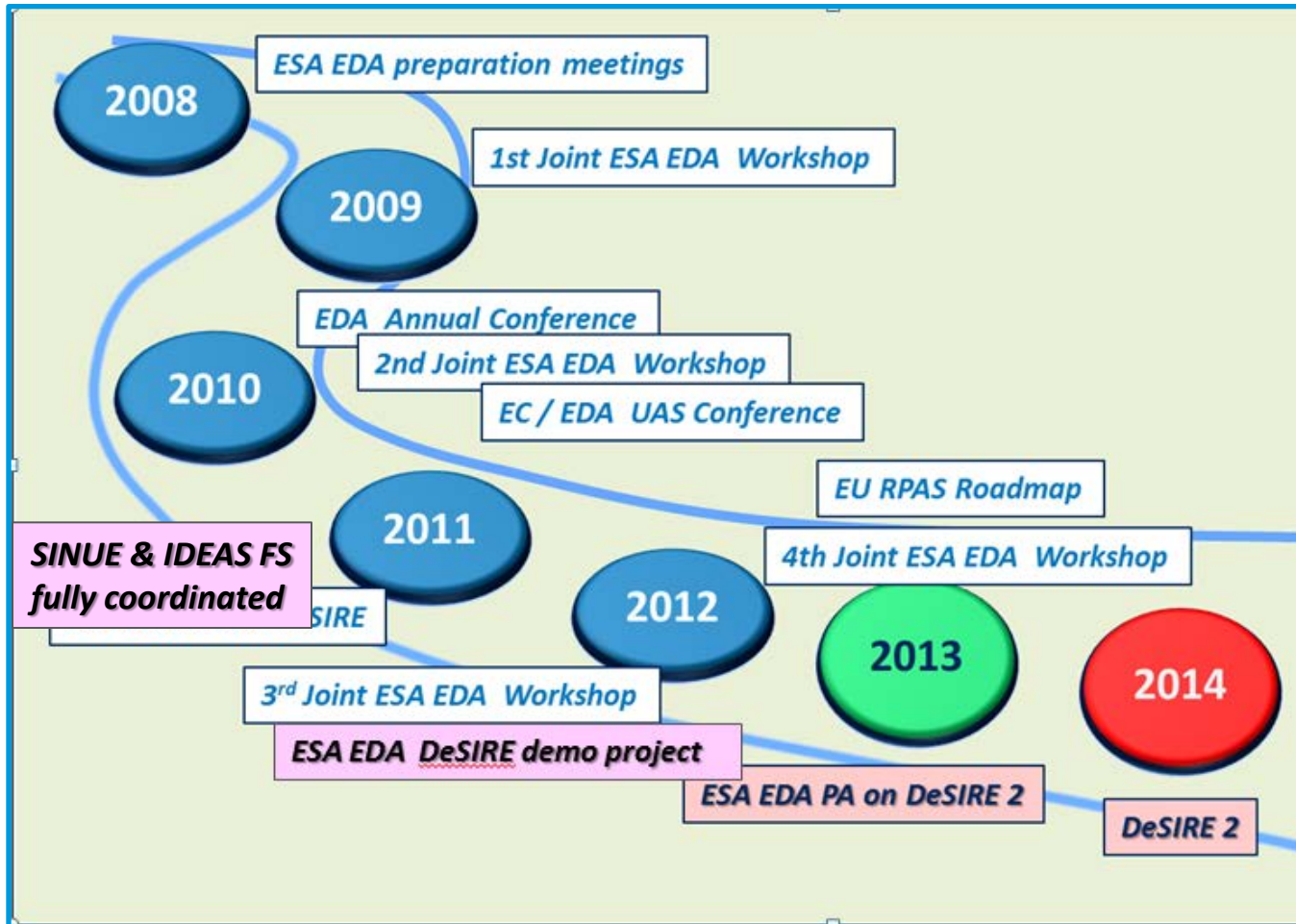
Space is a key enabler for RPAS integration in non-segregated airspace - pre-requisite for extensive adoption of RPAS-based applications

ESA activities on RPAS: Main goals



- To **demonstrate and promote** to user communities the potential of **satellite-based RPAS services** in order to foster their adoption for **civilian (commercial and institutional) applications**.
- To support the regulatory process for the **insertion in non-segregated airspace** of RPAS flying in BRLOS using satellite communications.
- Stimulate **the development of space technologies** for RPAS **air traffic insertion** and **advanced services**.

EDA-ESA collaboration on RPAS



EASA and Eurocontrol have joined this initiative supporting the DeSIRE and DeSIRE2 projects.

DeSIRE: Demonstration of satellites enabling the insertion of RPAS in Europe



The **DeSIRE demonstration project** is a joint **ESA-EDA** initiative which started in August 2012 and was completed in August 2014, following ESA and EDA parallel feasibility studies SINUE and IDEAS.

High-level objectives:

- Demonstrating the capability of safe insertion of RPAS **in non-segregated airspace** using **satellites**, identifying issues and required procedures, and providing early inputs to regulatory bodies.
- Demonstrating to the potential user communities that **RPAS supported by satellites** and flying in non-segregated airspace can fulfil their needs in terms of **maritime surveillance services**.

Prime: Indra (ES)

Sub-contractors: AT-One (DE), SES (Lux), TAS-I (IT), TAS-F (FR)

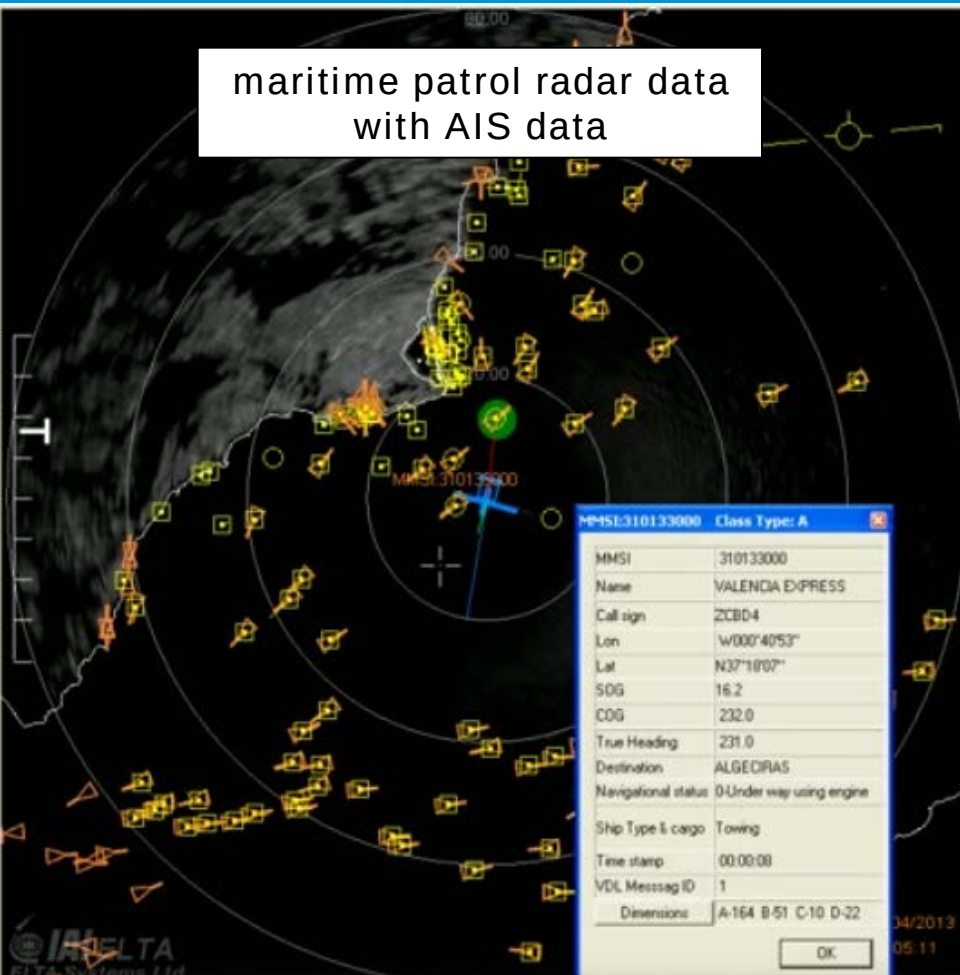
Project web page: <http://artes-apps.esa.int/projects/desire>



RLOS antenna



maritime patrol radar data
with AIS data



GENERAL

Tx: ☐ SIL: ☐ MAINT: ☐ 360 D

OPERATION MODES

SS: ☐ MTI: ☐ NAW: ☐ A2A: ☐ SPOT SAR: ☐ STRIP SAR: ☐ GMTI: ☐

INTLV: ☐ INTLV RATE: ☐ SAR RES: ☐

RANGE

10 20 30 40 80 160 200

CLASSIFICATION

ISAR: ☐ RS: ☐ RES: ☐ 1M

ISAR FREQ: ☐ RS FREQ: ☐

ZOOM

OFF 2 4 8 16

THRESHOLD

GAIN: ☐ 11 CON: ☐ 1 PLR: ☐ Nrl RAW: ☐ CLR

DTHR: ☐ MAN: ☐ 1.28 LRU: ☐ TVEL: ☐ LDW

TARGETS HANDLING

CLT: ☐ INIT: ☐

Payloads Operation

MFR: ☐ On

COMINT: ☐ On

ESM



multimission optronic
stabilized payload data



- ❑ DeSIRE has generated **first evidences** that **using satellite technologies** for RPAS safety communications **is acceptable in terms of link quality** for integration in non-segregated airspace.
- ❑ Feedback from involved users , i.e. Spanish Guardia Civil, RPAS supported by satellites can satisfy their needs for **maritime surveillance missions** in terms of near real time **detection, location, tracking, recognition and identification of mobile and fixed targets both on sea and coastline**
- ❑ The project has demonstrated that RPAS in BRLOS conditions relying on Satcom **could timely proceed with Traffic Controller instructions/clearances** in non-segregated airspace (civil controlled Class C), notably with a realistic **separation exercise**.
- ❑ **Coordination with civil and military ATC** for entering and leaving different control areas (military or civil) was demonstrated

DeSIRE 2 (2nd element of the ESA-EDA RPAS demonstration roadmap)



- ❑ Objectives: To develop and demonstrate a service based on a RPA flying Beyond Radio Line of Sight (BRLOS) using space assets (SatCom, SatNav) for:
 1. **Further supporting the regulatory process within the European context:** focus on **BRLOS operations under IFR** using **satellite communications**
 2. **providing new applications to relevant user communities**

This entails the following perspectives:

- ❑ Regulatory perspective: demonstrate a set of capabilities (in terms of e.g. **performances, operational procedures**) contributing to the **regulatory improvement 18** set forth in the ERSG Roadmap.
- ❑ User perspective: develop and demonstrate the application(s) in **pre-operational conditions**, allowing for **operational service provision shortly after the completion of the project**.
- ❑ Technology perspective: demonstrate the **technology** required for supporting the **regulatory improvement 18** defined by ERSG as well as for **satisfying user needs**.

Air Traffic Insertion requirements:

- ❑ **Accurate and comprehensive measurements of BRLOS satcom links**, also in degraded conditions, for multiple frequency bands (**FSS and AMS(R)S**)
- ❑ Consolidation of **safety requirements** for Satcom C2 data link and verification of BRLOS link performances wrt. them
- ❑ **Switch over** between 2 satcom systems to be verified
- ❑ Enhanced **emergency procedures** to be implemented and verified.
- ❑ **D&A data transmission** for situational awareness improvement

Mission requirements:

- ❑ Several civilian applications to be demonstrated such as **maritime surveillance , S&R, Environmental surveillance**
- ❑ **Users** will participate to the project
- ❑ Targeted missions will require **BRLOS flights**

- ❑ Use of an **European platform** for the demonstration campaign
- ❑ **Emulation / Simulation** will be undertaken in complement to the **demonstration campaign** to achieve the targeted objectives
- ❑ The activity will build on the most recent developments in the European regulatory fora as well as on the results of precursor ESA activities (esp. ESA ARTES 1 activity “Certification requirements and performances standards of satcom links for RPAS C2/ATS/D&A - **CERES**”)
- ❑ Overall project costs: circa. 2,400,000 EUR, co-funded by ESA ARTES 20, EDA and Industry.
- ❑ Currently under negotiation, to be Kicked off in **Q1 2015**, for a **18 month duration**

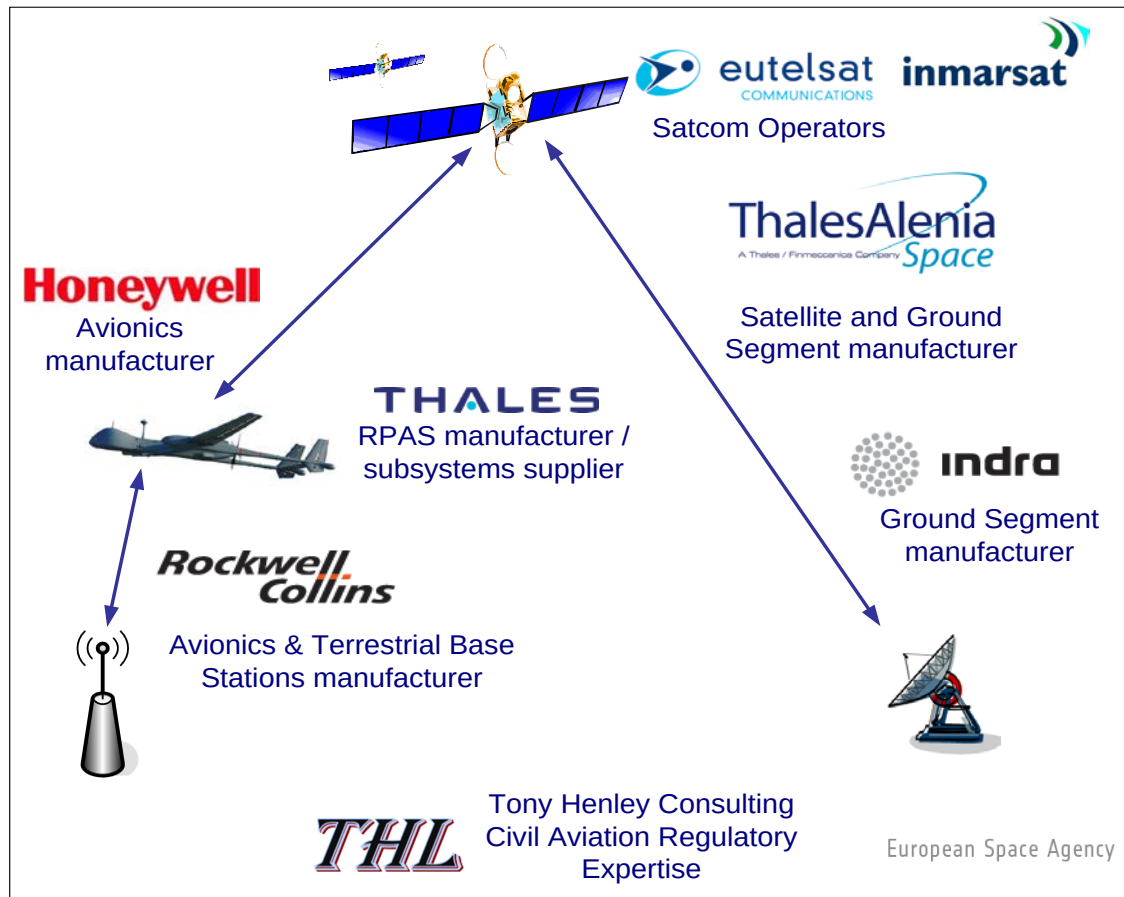
CERES Study overview



- ❑ The study kicked-off in October 2013 and is currently finalized (Final Review took place on 16 September)

- ❑ Consortium:

- Prime : Thales Alenia Space France
- Sub-Contractors: Eutelsat, Honeywell International, Indra, Rockwell Collins France, Thales Alenia Space Italy, Thales Airborne Systems
- Stakeholder: Inmarsat



- ❑ Proposition of a methodology for defining end-to-end C2 RCPs and for the apportionment of these requirements to the individual sub-systems, including the satcom system. Application of this methodology to derive end-to-end and satcom C2 RCP figures.
- ❑ Proposition of the full regulatory process scheme leading as final objective to the approval of operations to be performed by a RPAS using satcom.
- ❑ Analysis of four candidate satellite systems (FSS and MSS systems) wrt. defined RCPs, identification of the gaps and needed technology developments
- ❑ Dissemination to EUROCAE WG73 in October 2014 (Technical contributions on RCP figures and allocation to satcom) and ICAO UASSG / RPAS Panel in June 2014 (RPAS C2 regulatory process definition)

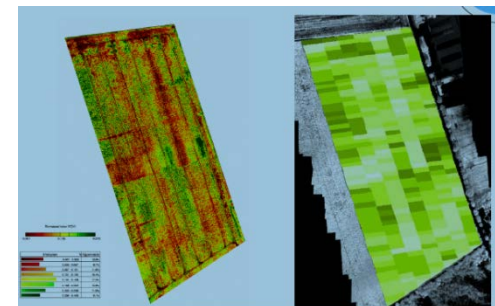
ARTES 1 CERES outcomes are a relevant starting point in the definition of end-to-end C3 RCPs and performances requirements for the C3 satcom link.

Way forward should be based on a joint top-down and bottom-up analysis for ensuring technical feasibility.

Examples of IAP applications projects (I)



- ❑ **KORE**, to facilitate **precision agricultural practices** thereby increasing productivity and reducing environmental impact in potatoes, wheat and grassland fields (DP)
- ❑ **BIOSCOPE**, to facilitate farmers **crop management** of high-cash crops throughout Europe (FS & DP)
- ❑ **Palm oil: enhanced palm oil certification service** based on data collection related to carbon stocks and plantation productivity (FS)
- ❑ **Unmanned Postal Delivery** for offer reliable **express deliveries** and rush services to all parts of a country (FS)
- ❑ **B-LIFE**: fast responding medical diagnose services for **emergencies and life-threatening bio-threats** (FS)

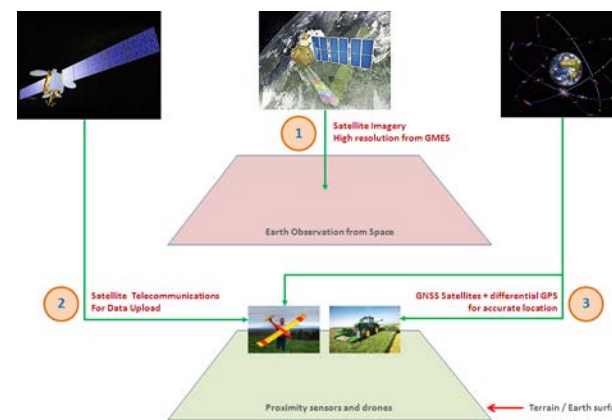
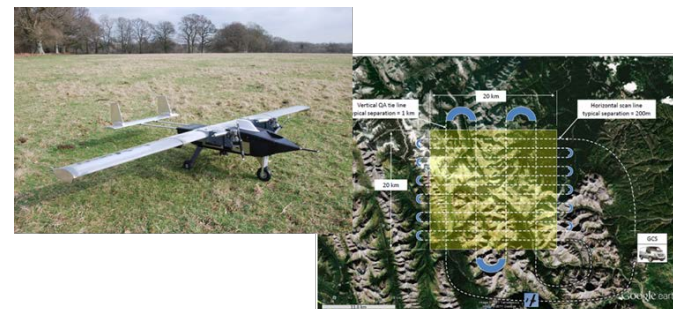


<http://artes-apps.esa.int/projects/surmon>
<http://artes-apps.esa.int/projects/lumen>
<http://artes-apps.esa.int/projects/safedem>
<http://artes-apps.esa.int/projects/bioscope>
<http://artes-apps.esa.int/projects/b-life>

European Space Agency

Examples of IAP applications projects (II)

- ❑ **SURMON** to perform **mineral/gas/oil exploration surveys** and **oil & gas pipelines monitoring** using Unmanned Aircraft Systems (FS & DP)
- ❑ **SAFEDEM** (Space Assets for Enhanced DEMining) to improve and optimize planning, preparation & efficiency of **demining activities** (FS & DP)
- ❑ **LUMEN** (Light UAS in non-segregated airspace for Maritime and ENvironmental surveillance) to support **flood monitoring and maritime pollution surveillance** activities (DP)
- ❑ **RAPSODY** (Remote Airborne Platform with Satellite Oversight DependencY), to improve **maritime surveillance services** (DP)



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