SESAR RPAS Demonstration projects
Progress and initial findings

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Initial preliminary findings will be presented:  
- They apply to the specific conditions of each individual project and should not be considered as final

Thank you to RPAS demos Project managers and their teams for their inputs:
• Carlos Regidor Gil; Daniel Cobo Vuilleumier; Edoardo Filippone; Emma Bell; Eric Thomas; Jos Stevens; Paolo Nurra; Rene Zanni; Simona Turco; and their teams.
SESAR RPAS Demonstration Projects

• Nine co-funded demonstration projects – started approximately one year ago;

• Common goals:
  – Demonstrate how to integrate RPAS into non-segregated airspace in a multi-aircraft and manned flight environment, in order to explore the feasibility of integration with the wider aviation community by 2016;
  – focus on concrete results filling the operational and technical gaps identified for RPAS integration into non-segregated airspace;
  – capitalise on the SESAR delivery approach by providing synergies, risk and opportunities, with the overall SESAR programme;
  – be relevant at European scale (performed in European Union and/or Eurocontrol member States);
  – cover various types and sizes of RPAS; and
  – be performed between the third quarter 2013 and last quarter of 2015.
Stakeholders locations

Source: Google Maps, SJU analysis, simplified for clarity reasons
MAIN OBJECTIVES: Ensure the safe execution of a RPAS flight using a Detect and Avoid system compatible with existing safety nets. Controller situational awareness will be improved by providing the remote pilots with a display presenting the same information the Air Traffic Controllers have in their Controller Working Position.

DEMONSTRATION APPROACH: Three types of exercises (live trials) with 2 types of short range fully remotely piloted small aircrafts (SIVA, ALO) and 1 motor glide: STEMME S15) will be performed.

TYPE OF RPAS: Small short range and mid-range RPAS

LOCATION: Spain – Salamanca Airport/Matacán Airbase

STATUS: Preparation work finalised - Trials to take place early 2015 – some difficulties related to get the approvals to carry out the trials.
DEMORPAS’s Exercises

1. Isolated Operations

2. Simultaneous Operations

3. Integrated Operations
INSuRE - Integration into non-segregated ATM

**MAIN OBJECTIVES:** Verify civil RPAS integration in a complex traffic environment; Verify multiple RPAS impact in airport capacity; and Test multiple RPAS control by a single pilot.

**DEMONSTRATION APPROACH:** Simulations and flight trials on SD-150 Hero piloted from a fixed station on the ground using CPDLC, ADS-B, and TCAS technology.

**TYPE OF RPAS:** Rotary wing RPAS - HERO (from Sistemi Dinamici).

**STATUS:** Trials still to start – Safety and security requirements (also related to storage of the RPAS in BRNO airport premises prior and in between flights) have been identified.

**LOCATION:** Czech Republic
INSuRE - Trials details

- Flight trials and technology based on CPDLC, ADS-B and TCAS;

- Flights in CTR and TMA LKTB (BRNO airspace);

- Strong implication of the ANSP;

- Close coordination between the civil RPAS operator and Air Traffic Control services.
MAIN OBJECTIVE: Test single and multiple manned aircraft interaction with RPAS; Investigate security aspects of the Command and Control link (C2L); Analyse procedures and working methods, as well as Human Performance for both Air Traffic Controllers and remote pilots for operations involving different size/weight classes of RPAS (NIMBUS Esarotor, and CIRA FLARE Optionally Piloted Aircraft) – using an innovative Detect and Avoid System acting as a safety-net in mixed traffic scenarios.

DEMONSTRATION APPROACH: 1.) Real-Time simulations with Human – in – the –loop. Real time test beds for the RPAS, other traffic and environmental conditions as well as Controller Working Position will be settled. Both RPAS Pilots and Air Traffic Controllers will be involved in the simulations. The RTS test bed will be located at CIRA (RPA+RPV+Scenario) and MATS (ATCo CWP) premises. 2.) Flight trials with simulated traffic. The RPAS will execute a number of flight trials under the control of ATCOs. The traffic surrounding the RPA will be simulated. 3.)Full Flight trials with real traffic. synthetic traffic will be replaced by real traffic. The involvement of manned and unmanned aircraft is foreseen.

LOCATION: Malta

STATUS: Preparation of the Real Time Simulations platform; preparation of all documentation required to obtain the permit to fly for the evaluation system; and set-up of the Optionally Piloted Vehicle (OPV) Flare

http://raid-sjuproject.eu/
MAIN OBJECTIVE: Demonstrate the validity and limits of the ad-hoc operational procedures and airworthiness rules as well as of the existing technologies and systems focusing on a gap analysis between existing RPAS capabilities and the ones required for RPAS insertion into non-segregated airspace.

DEMONSTRATION APPROACH: Two demonstration environments at different levels of complexity: 1) Multi RPAS interaction/operation within the under definition ATM SESAR environment, including BRLOS operations in non-segregated airspace via a Networked Simulation, 2) a single RPAS real flight operation in an airspace under control of the Italian Air Navigation Service Provider (ENAV), from an Italian airport. The RPAS will be equipped with a cooperative suite based on ADS-B.

TYPE OF RPAS: MALE remotely piloted

STATUS: Simulations completed; Live Trial Requirements done. Sky-Y RPAS adaptation and getting the approvals for using Air Force Base and Operation Area for Live Trial in progress

LOCATION: Italy
**MAIN OBJECTIVE:** Investigate RPAS performance in low-medium TMA airspace through live trials and simulations represented by an optionally-piloted vehicle (OPV) of single-engine GA class. Research area- ability to insert RPAS in the aerodrome circulation of a middle sized airport (real flight), ability to issue an IFR-like flight plan for RPAS.

**DEMONSTRATION APPROACH:** Real flights will be conducted in order to investigate the impact of RPAS insertion on a middle size airport (Bordeaux) focusing on assessing the impact of slow RPAS (MALE) on traffic safety and regularity at a mid-sized, mid-traffic density airport and assessing the impact on ATC performance of RPAS non nominal modes (communication failure, command and control failure).

**TYPE OF RPAS:** OPV Beech 58

**STATUS:** Everything prepared to carry out the live trials - permit to fly has been granted. Simulations platform also ready;

http://www.tempaeris.org/
ODREA - Operational Demonstration of RPAS in European Airspace

**MAIN OBJECTIVE:** Demonstrate the readily available operational technologies for OPV/RPA systems, Detect and avoid suite and gateways between RPAS and ATM systems. The project will address a wide range of topics covering all phases of flight and airport operations, from take-off to landing and taxiing and will include degraded situations.

**DEMONSTRATION APPROACH:** Define & validate procedures for RPAS (SID, STAR...); Investigate and Demonstrate (Simu + Flight): Capability to integrate an RPA into the managed traffic of mid size commercial airport; Capability to conduct missions in lower airspace, incl. abnormal situations (C2 link loss, D&A, ...)

**TYPE OF RPAS:** ENAC’s Beech 58 and live trials using SAGEM’s Patroller

**STATUS:** All exercises took place (including live trials) – results being analysed

www.odrea.org
## ODREA exercises

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MAIN OBJECTIVES: To operate an RPAS within a non-segregated mixed traffic environment & demonstrate ATM procedures that need to be applied within different classes of airspace;

To undertake a series of live flights using a certified RPAS enabling the completion of an extended Safety Case using Hazard Analysis for flights in non-segregated airspace;

Key activities will also include logistical planning; agreed Contingency Management procedures; ATC sector hand-over.

VALIDATION APPROACH: Multiple high-fidelity ATM simulations using specialist facilities at NATS and NLR to demonstrate how RPAS may operate in non-segregated airspace.

Exercises will identify technical and operational gaps and inform flight trials using a true RPAS with regulatory approval from both civilian and military authorities. A Safety Case will be completed and approved for both RPAS platform and airspace utilisation.
STATUS: Simulations completed for ground operations and en-route flights in a mixed traffic, non-segregated airspace using an agreed set of flight scenarios in the existing airspace structure.

Initial findings suggest RPAS make little difference to ATM operations though some alternative techniques may be necessary to allow for speed differentials and handling characteristics;

Work is on schedule with the regulatory authorities to complete the Safety Case and ‘permit-to-fly’ WATCHKEEPER in non-segregated airspace in spring 2015

TYPE OF RPAS: Tactical Unmanned Air Vehicle (without on-board Safety Pilot)

LOCATION: UK and Netherlands
**MAIN OBJECTIVE:** Demonstrate realistic Coast Guard surveillance mission under military Air Traffic Control and Beyond Visual Line Of Sight. Using on-board Detect and Avoid capabilities, (D&A based separation) in segregated airspace: intruder test flights and non-segregated airspace: demonstration flight.

**SPECIFIC CHALLENGES:** Flying low level; Beyond Visual Line Of Sight, in different airspace classes (segregated & non-segregated) with other traffic, en-route and on airport.

**DEMONSTRATION APPROACH** Flight trials.

**STATUS:** Change of RPAS operator from Glasemann to Schiebel being finalised; Detect and avoid system development quite advanced.

**PARTNERS:**

**LOCATION:** Netherlands

http://www.airica.eu/
AIRICA - Detect & Avoid System

• Named AirScout
  – Advanced In-flight Resolution and Self-separation of Conflicts Occurring Under Traffic insertion

• AirScout implements AIRICA user and system requirements

• D&A algorithm generates evasive manoeuvre
  – By adding additional waypoints
  – Whilst respecting VFR right of way rules
  – And constantly monitoring progress of intruder
ARIADNA - Activities on RPAS Integration Assistance and Demonstration for operations in Non-segregated Airspace

**MAIN OBJECTIVE:** (1) Demonstrate the feasibility of adapting a navigation procedure for (manned) helicopter "SBAS-based approach" (PinS) to RPAS low performance aircraft and airspace limitations. (2) Demonstrate the use of concepts for a ground-based situational awareness system (GBSAS) that can be integrated in a RPAS, using ADS-B technology and ATC radar data to provide remote pilots with improved situational awareness of surrounding traffic (plus safety backup in case of C2 link loss)

**DEMONSTRATION APPROACH:** Two flight trials exercises. Exercise 1: SBAS based approach and landing procedures applicable to rotary wing RPAS. Exercise 2: GBSAS using ADS-B technology (in all aircraft involved in the demo) data and ATC radar (for RW RPAS). Human factors and other aspects will be evaluated.

**STATUS:** Exercise 1: Draft procedures produced and being discussed with Spanish Air Force. Exercise 2: Integration of ADS-B in the three systems in progress; internal joint demo in preparation

**TYPES OF AIRCRAFT:** RPAS (CONDOR), Small FW RPAS (Viewer), and Manned GA aircraft (MRI)

**PARTNERS:**

**LOCATION:** Spain
Initial findings
Preliminary findings

- Getting approvals and permits to fly for the live trials somewhat more challenging than initially planned;
- Harmonize phraseology and standardize separation (both vertical and lateral) considered useful;
- "Different" D&A systems being tested – insight will be brought to what works and not;
- An RPA could be managed as a light aircraft within a certain density of commercial traffic. Nevertheless, its flight performance is an important impacting factor. Adapted approach and departure procedures should be defined to limit impact on safety and capacity;
- Latency (lag) of a few seconds in voice communication could likely be coped with in cruise, but is an important impacting factor for approach phases;
- Procedures for abnormal and emergency situations (e.g. C2 link loss) should be defined and exchanged together with ATC. Also, the RPAS should propose alternative means to coordinate with ATC. This would then really facilitate the handling of the RPA should the failure occur;
- How much contingency information should shared with ATC:
  - In Advance? During Flight? Event Driven?
  - Accommodation within flight plan.
Nominal vs non-nominal

In nominal operations:
- Unmanned aircraft made little or no difference to ATM operations:
  - Radio Telecommunications for normal operation was the same as manned aviation and sector handover with no issues / no significant increase in ATCO workload;
  - however the speed differentials for some RPAS compared to commercial aviation posed more of a challenge but well within ability of ATCOs;
- Operational transponder considered essential;
- Control Station handovers:
  - seamless, but RPAS pilots should ensure that handovers do not coincide with sector handovers;
  - should be as transparent as possible to the ATCO.

In non-nominal conditions:
- Increase of ATCO workload but in line with that for manned aviation;
- Slow speed of RPAS was considered positive and negative - RPAS considered significantly more predictable than manned aviation;
- RPAS performance might seriously affect the efficiency of civil aviation;
- Procedures for abnormal and emergency situations should be defined and shared with all actors.
Thanks for your attention

www.sesarju.eu