INVIRCAT – Investigating IFR RPAS Control in Airports and TMA

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Abstract—**This short paper and the associated poster present the INVIRCAT project. The project, carried out by a consortium composed by DLR, CIRA, EUROCONTROL, DeepBlue, ISDEFE, ISSNOVA and NLR, investigates innovative solutions to integrate RPAS into the TMA and airport environments without imposing a significant impact on current airspace users.**

Keywords- RPAS Integration, Airport, TMA, CONOPS, Real-Time Simulation.

I. INTRODUCTION

Drones, including Remotely Piloted Aircraft Systems (RPAS), represent a rapidly developing sector of aviation with a great potential to create new jobs and economic growth in the European Union. According to the SESAR European Drones Outlook study [1], the growing drone market shows a significant potential, with an European demand of potentially EUR 10 billion annually, in nominal terms, by 2035 and over EUR 15 billion annually by 2050. The study also forecasts that by 2035 the European drone sector is expected to directly employ more than 100,000 people in Europe.

This is why the EU adopted a regulation to safely integrate remotely piloted drones into the European airspace. However, the full potential of RPAS can only be realised if these actors become an integral part of the aviation system.

A seamless integration of RPAS with manned aviation is a complex task. In order to maintain current technological infrastructures, systems and procedures established for manned aviation and to preserve the currently achieved levels of performance and safety in Air Traffic Management (ATM), RPAS should be handled like any other airspace user (principles of "Equivalence" and "Transparency" [2]).

According to the Concept of Operations for RPAS integration in ATM developed by EURCONTROL [3] the following four integration principles shall be taken in to account:

- the integration of RPAS shall not entail a significant impact on the current users of the airspace.
- RPAS shall comply with existing and future regulations and procedures.
- RPAS integration shall not compromise existing aviation safety levels nor increase risk: the way RPAS operations are conducted shall be equivalent to that of manned aircraft, to the best possible extent.
- RPAS must be transparent to ATC and other airspace users

It is generally recognized that the integration of RPAS into aerodrome operations will prove to be among the greatest challenges. Many stakeholders have been involved, e.g. manned aviation pilots, air traffic controllers, airport operators, RPAS manufacturers and operators, trying to define solutions to meet the overall objectives of safety, efficiency and capacity.

Although many advancements have already been achieved at technical, operational and regulatory level, and interesting initiatives are ongoing at European level, RPAS integration in non-segregated airspace is still a challenge, particularly the full and seamless integration into the airport environment and in the TMA.

The INVIRCAT project, carried out by a consortium composed by DLR, CIRA, EUROCONTROL, DeepBlue, ISDEFE, ISSNOVA and NLR, aims at **developing and validating a suitable and harmonized Concept of Operations (CONOPS) for the safe and efficient integration of RPAS into IFR traffic carried out in the airport environment and in the TMA.**

Moving from the analysis of what has been achieved in already completed projects, and coordinating its work with on-going and future projects and initiatives, in particular with SESAR project PJ13-ERICA which addresses the safe integration of RPAS in class A to C airspaces and with the SESAR Exploratory Research project URCLEARED that explores RPAS integration in class D to G airspaces, the project has the ambition to support the next step of RPAS integration in the European airspace: the control of IFR RPAS in TMA environments.

II. PROJECT GOALS AND OBJECTIVES

In detail the project has the following objectives.

Objective #1: CONOPS for IFR RPAS integration in TMA.

The project will develop a complete CONOPS for full integration of RPAS in TMA environments. The CONOPS will be intended to enable IFR RPAS operating from airports. Special focus will be set on the development of Automatic Take-Off and Landing (ATOL) procedures, ATC procedures, adaptations to the flight planning processes, separation requirements and necessary technical equipment to enable those new processes. These CONOPS will serve as a basis for implementing a cooperative, heterogeneous and distributed simulation infrastructure to enable a full IFR RPAS flight from one airport to another including all phases of flight. Based on the results of the simulations and the validation of the CONOPS, a set of high level operational and technical requirements will be defined.

Objective #2: Technical and operational requirements for RPAS integration into TMA operations.

The INVIRCAT project will provide high-level requirements on technical capabilities and procedural means to allow IFR RPAS to safely operate in airport environments. This will include requirements to fully comply with ATC instructions and the development of new procedures and tools to allow ATC to handle IFR RPAS in a cooperative environment with the objective of full integration with manned aviation.

Objective #3: Airport RPAS GCS infrastructure, interfaces and requirements.

The INVIRCAT project will investigate alternative means of integrating airport located remote pilot stations for the control of RPAS in a TMA. This will include (1) alternative technical architectures for integrating this GCS (Ground Control Station) into the ATC infrastructure, (2) different/adapted roles of remote pilot and ATCOs, (3) information requirements of remote pilots, ATCOs and manned aviation pilots, (4) performance requirements for the systems proposed and (5) recommendations for enhancing situational awareness for all roles involved.
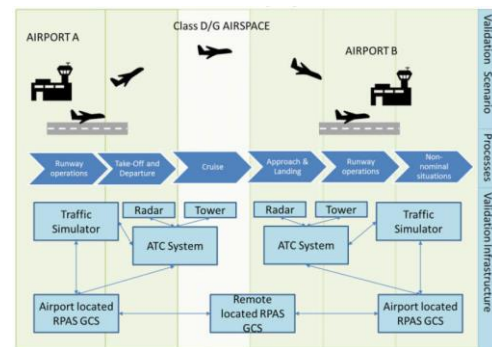
Objective #4: Accommodation and integration with U-space.

U-space will bring advancements for large-scale drone operations in the VLL and in the long-term will have an impact to all classes of airspace. In INVIRCAT, current architecture and service designs of future U-space services will be considered and analysed with regard to possible interfaces and integration aspects with regard to aerodrome operations. A set of recommendations will be elaborated to make use of future U-space services and the architectural requirements provided.

III. RESEARCH PLAN

The following figure shows the research plan and methodology of the INVIRCAT project. In an iterative process, the state-of-the-art will be reviewed to elaborate a preliminary version of a CONOPS for the integration of RPAS into the TMA and airport operations. This CONOPS will include operational aspects to be considered when integrating RPAS into airport operations: ATC interaction, flight rules, separation, roles and tasks, and procedures enabling Automatic Take-Off and Landing (ATOL).

Based on the INVIRCAT CONOPS, a set of functional and operational requirements will be defined and incorporated into a reference architecture enabling a safe and efficient interaction with the new airspace users. In addition, the consortium partners will provide their simulation infrastructures to set up a comprehensive validation environment. This will include all necessary infrastructure to deploy an airport-based GCS as a gateway to control RPAS at the airport. In a series of validation campaigns a complete IFR RPAS flight, including handover between the proposed remote and airport located GCS, as well as ATOL procedures will be simulated and validated with controllers and remote pilots in the loop. The simulation results will be reviewed carefully with regard to possible impacts on the current TMA/airport environment and will be used to refine the previously defined requirements.

CONCLUSIONS

In conclusion, the integration of RPAS into non-segregated airspace has been a topic for research and standardisation for many years now. Although significant progress has been made, solutions need to be established that allow full integration of RPAS into non-segregated airspace. The growing demand puts additional pressure on this topic. INVIRCAT aims at facilitating the integration of RPAS in the TMA through the generation of a harmonized CONOPS that takes past and on-going results of relevant activities into account. Additionally, a set of conclusions and recommendations will be disseminated and communicated that will help decision makers developing a harmonized approach for the RPAS integration in the TMA. Being well-aware of the existence of other projects and initiatives addressing the topic, the project has already started a process of cooperation intended to avoid work duplication and to benefit by the existing synergies with the final aim of having a harmonized set of CONOPS and operational and technical requirements. Having a stable CONOPS, high-level requirements and reference architecture definition on which the relevant industry can rely on will enable a seamless integration that will unlock the potential of global and efficient RPAS operations.

REFERENCES

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