INOUI

Innovative Operational UAV Integration

**Funding:** European (6th RTD Framework Programme)

**Duration:** Oct 2007 - Mar 2010

**Status:** Complete with results

**Total project cost:** €4,308,659

**EU contribution:** €2,317,414

**Call for proposal:** FP6-2005-TREN-4-AERO

**CORDIS RCN:** 86569

**Background & policy context:**

The driving force behind creating the INOUI project stemmed from the fact that no ongoing European ATM project focused on the crucial matter of unmanned aerial vehicles (UAVs, or drones). Regardless of the fact that there are many drones in the skies, albeit either at a very low altitude or in segregated airspace due to their mostly military nature, integration in the non-restricted airspace was not happening.

In particular, the topic of UAV is almost totally absent from SESAR (Single European Sky Air traffic management Research) and its high-level Definition Phase (Phase I). INOUI aimed at complementing SESAR to compensate for this.

**Objectives:**

The main objective of the INOUI project was to provide a roadmap for the future of unmanned aerial vehicles (UAVs) in the context of the ever-changing Air Traffic Management (ATM) environment. Furthermore, INOUI aimed at complementing the SESAR activities with regard to the operational concept and the architecture, as well as the roadmap for research and development activities.

In particular, INOUI aimed to:

- identify the spread of operational concepts for UAV applications and describe the resulting procedures and requirements in the different timeframes up to 2020;
- identify how UAVs can fit into the ATM system of 2020 and what activities have to be achieved, especially from the UAV point of view (research road-map);
- identify existing certification requirements, and process and suggest an optimum certification blueprint for human resources and, as far as is required, UAV-related technologies;
- identify how UAV can benefit from European System Wide Information Management (SWIM) and what activities have to be taken to achieve the benefit;
- identify the safety issues related to UAVs and developing high-level safety objectives and requirements and
- identify the potential airport types for UAV operations and describing the operational impact.

**Methodology:**

The work within INOUI was divided into seven Work Packages:

1. Identification of the future ATM environment and UAV applications - Existing know-how from, for example, Eurocontrol, SESAR and international organisations like ICAO, was analysed and ideas and existing plans projected into the future. This comprises the assumed operational concepts or
2. Assess the impact of the future ATM system on UAVs - Analysis and definition of how UAV systems will be integrated in the 2020 ATM architecture in terms of technological concepts and requirements. The available, planned or envisaged technologies identified for either UAVs or ATM systems were assessed for their ability to fulfill the operational concept and the related operational requirements for different UAV applications.

3. Assess the requirements on the UAV-related technology and human resources - This investigated procedures and requirements on certification and licensing of personnel dealing with UAVs and classifies UAV operators' working environments, based on those for pilots and controllers. If required, INOUI also supported certification and licensing issues for technology.

4. Assess how situational awareness can be assured - Here, the aim was to analyse and define how UAV systems will be integrated in the 2020 ATM architecture, focusing on the common operating picture. In this step INOUI identified how situational awareness could be assured by studying the differences between the 'traditional' users of ATM systems and the 'new' users, the UAV-users. This study focused both on the information and communications layer, and on the applications layer.

5. Assess and identify safety issues - A safety assessment cycle from system/model definition, via hazard identification to the definition of safety requirements.

6. Identify challenges for airports with regard to UAVs - This focused on the operational and technological perspective from the airport point of view by defining an operational concept for the UAV operations at airports of 2020 and beyond. The technologies under development were assessed with regard to their capability to enable airport operations to facilitate the integration of UAVs.

7. Dissemination and exploitation.

Parent Programmes:
FP6-AEROSPACE - Aeronautics and Space - Priority Thematic Area 4 (PTA4)

Institute type: Public institution
Institute name: European Commission
Funding type: Public (EU)

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Key Results:

INOUI produced a general assessment of UAS integration with the following set of results.

INOUI's first set of results related to the inclusion of UAS ATM concepts, procedures and requirements in the 2020 time scale and, of course, its fitting within the SESAR initiative and the concepts involved.

In particular, expecting considerable growth in the use of UAS, to be treated just like another routine airspace user, INOUI stated that integration of UAS into non-segregated airspace must be accomplished without compromising existing aviation safety levels or increasing risk to third parties in the air or on the ground.

Therefore, UAS operations have to be compatible with the SESAR concepts and will have to have self separation capability, ACAS (Airborne Collision Avoidance System), ASAS (Airborne Separation Assistance System) and ADS-B (Automatic Dependent Surveillance – Broadcast).

A second result related to UAS-enabled ATM architecture, where INOUI noted that, although most of the technology needed is available for manned aircraft and for unmanned aircraft systems, there is a need for compatibility and interoperability. Further, technologies stemming from manned aviation are subject to be adapted to the UAS world and vice versa and the key issue is to ensure compatibility and interoperability of current and future technologies among all air space users.

At the present time, UAS applications are defined and ready to be performed, while Unmanned Aircraft Systems are not cleared to be used due to the lack of a regulatory framework and respective technological gaps, and the INOUI project showed that the work to be completed is huge. The INOUI project therefore advocated a stepwise approach in integrating UAS until 2020. Indeed, the sequence to
implement the different modes of UAS operations depends on how the system designs are able to comply with regulations in order to meet the required safety objectives. Regulators and decision makers must bear in mind that once the regulations are available, the UAS community will need time to adapt their products and services to the regulations.

Another result concerned UAS operations and their interactions with the European System Wide Information Management (SWIM). Indeed, SWIM will be the backbone of the future ATM system, so it is important to assure UAS interoperability in the SWIM environment if we want to succeed in its integration in the non segregated airspace. Moreover, SWIM may be a key enabler for UAS integration.

**Technical Implications**

Although not technically oriented, INOUI did produce some technical guidelines to be assessed through future research, in particular regarding standardisation. Firstly, INOUI remarked that different UAS applications may need different technologies and dialogue between standardisation and regulatory bodies and UAS technology developers is required to address systems specifics and to reach consensus on the certification procedures for each system.

Aside from standardisation issues, INOUI called for considering technical implementation difficulties. For example, how will UA pilot receive data in the control station? Will this data be timely so as to avoid collisions? Will UA be fitted with technologies such as MLAT, ADS-B or similar to comply with the requirements of such manned aviation technologies? Will size, weight and power consumption (among others) requirements of UAS be capable of support the avionics needed?

Finally, INOUI noted that UAS specific operational technology for UAS in aerodromes is available or under development, and that focus should be put under regulatory compliance and procedures.

**Policy implications**

INOUI drew the two following general conclusions:

1. The UAS community is not the only one who can benefit from INOUI results.
2. SESAR and the manned aviation community in general can benefit as well.

In particular, INOUI studied the integration of UAS in the context of SESAR, as SESAR implies a new dimension to European ATM and has a wide effect on all airspace users including UAS. In particular, several of the characteristic issues regarding the integration of UAS may become less difficult in the SESAR context. These safety issues will however still occur, especially in a context where traffic density will be significantly higher.

Finally, regarding regulation, INOUI remarked that many certification and licensing hurdles still have to be cleared for UAS to obtain full operational approval and become 'legitimate' airspace users. UAS will therefore have to comply with existing rules and operational procedures established for manned aviation.

**Documents:**

INOUI Deliverable 0.7 Final Activity Report (June 2010) (Final report)

**STRIA Roadmaps:**

Cooperative, connected and automated transport, Network and traffic management systems

**Transport mode:** Air transport

**Transport sectors:** Passenger transport, Freight transport

**Transport policies:** Safety/Security

**Geo-spatial type:** Other