

Atlantida Consortium



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The global socio-economics and politics evolution along with the recent technological advances have precipitated the rise of new airspace users such as the Unmanned Aerial Systems (UAS) and the Personal Aerial Vehicles (PAVs), of whose phenomena the known Very Light Jets (VLJ) do only constitute the tip of the iceberg. Due to these emerging users, during the next decades the demand for air vehicle operations might exceed by an order of magnitude that one foreseen for conventional aviation, which confronts the future ATM system with new challenges of very considerable proportions.

In particular, UAS sit at the technological fore-front with respect to automation of air vehicle operations, and so for this reason, the integration of these operations in the ATM system is often perceived as the most difficult problem that the solution for the future ATM system needs to address.

Ongoing R&D initiatives in Europe (SESAR) and USA (NextGen) are aimed at mobilizing during the next decades considerable investments in the modernization of the ATM system. With similar objectives, the European and North-American initiatives advocate for the replacement of the current operational concept centered on the management of airspace volumes by human controllers that have a pro-active active function on diverse processes, with a new concept called TBO (Trajectory-Based Operations). In TBO, the aircraft trajectory becomes the fundamental resource for air space management and the role of the human element shifts to focus on supervising/taking decisions about optimal solutions provided by advanced automation tools. These tools will allow a collaborative and strategic approach to the management of the aircraft trajectories ultimately facilitated by a net-centric service-oriented architecture.

It is the intention of the Atlantida project to demonstrate how the UAS could be integrated in the airspace in accordance with the new TBO paradigm.

The transition to a trajectory based operations environment is expected to bring significant improvements to the system in terms of capacity, operational safety and response to system failure or illicit interference. In this sense, the Atlantida project presents the following high level objectives regarding UAS trajectory based operations:

1. Improve the available air space use information by using high fidelity trajectory predictions including the actual flight path and the aircraft future flight intent.
2. Improve the conflict detection and resolution process by making available, in a timely manner, the right information, with the required reliability, to the right system.

These high level objectives have been translated in to the following technological challenges:

1. Accurate prediction of the aircraft trajectories based on the use of a standard formal language allowing to unambiguously formulate the aircraft intent. The description of the aircraft intent using this standard language will allow, by using a trajectory computation infrastructure, to univocally describe the aircraft trajectory. Also, it is intended to provide this language with optimization tools allowing

taking into account the user preferences.

2. Development of new decision support tools and automation capabilities for UAS taking advance of the advantages related to the use of the trajectory based operations concept and the accuracy associated to the trajectory calculation using aircraft intent and flight intent.

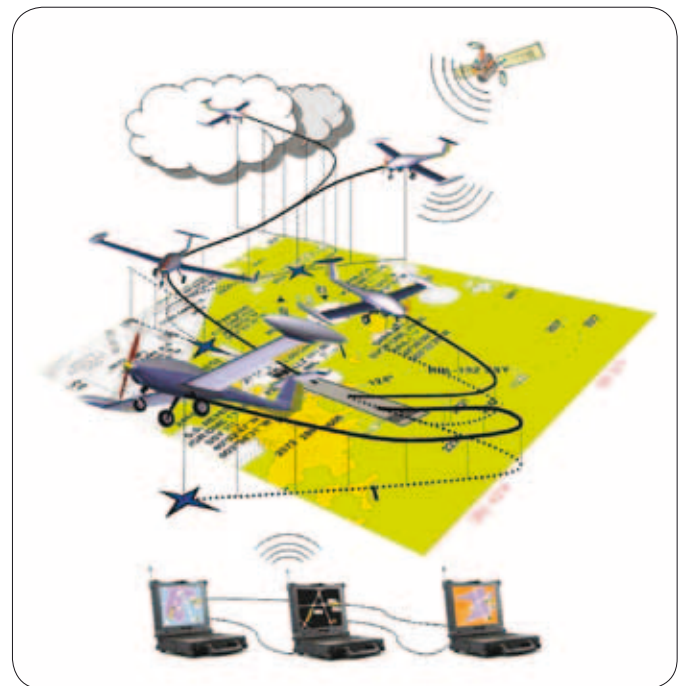


Figure 1 Schematics of the Atlantida experimental setup

With a budget of 28,9 million euro (44% financed by the Spanish Government) and 2010 as the time horizon, the Atlantida project will tackle the technological and scientific challenges that need to be addressed for high levels of automation to be introduced into the management of complex air spaces. Atlantida will explore an approach for automation in the management of air traffic seamlessly applicable to any air vehicle operations, including conventional aviation, civil and military UAS, VLJ operations and the futuristic personal air transport systems.

To this end, the development of advanced high-fidelity simulations are planned along with the employment of experimental means based on UAS, which will allow the development, validation and ultimately the evaluation of innovative concepts and technologies for air vehicle trajectory management in a net-centric environment, in line with the premises of the TBO paradigm.

The core of the technical approach that sustains the Atlantida initiative consists on an advanced technology being developed by the Boeing Research & Technology Europe (BR&TE) center known as Aircraft Intent

Description Language (AIDL).

The AIDL is a formal language that describes arbitrary air vehicle trajectories with minimum information and no ambiguity at all, thereby enabling the possibility to exchange them throughout the different automation tools that will realize the TBO paradigm, eventually addressing an important set of the central problems inherent to the new concept. It is our intention to test this technology along this year as well as promoting the use of this technology in different projects and initiatives to reinforce the concept of AIDL as a trajectory exchange industry standard.

BR&TE leads the ATLANTIDA Consortium, which encompasses another 16 leading aerospace, information technology and communications companies: Indra Sistemas, Atos Origin, TCP Sistemas e Ingeniería, GMV Aerospace & Defense, Altran Technologies, TTI Norte, Aernnova Engineering Solutions, INSA (Ingeniería y Servicios Aeroespaciales), Aertec Ingeniería y Desarrollos, Indisys (Intelligent Dialogue Systems), Integrasy, Aerovision Vehículos Aéreos, MDU (Militärtechnologie Dienst Überwachung), Isdefe (Ingeniería y Sistemas para la Defensa de España), Catón Sistemas Alternativos and Iberia Líneas Aéreas de España. The consortium also includes 16 prestigious public R&D entities, among which are the Spanish universities more reputed in the aforementioned technologies.

The project has received explicit endorsement by Eurocontrol (the European agency for Air Navigation safety), and has invited the major international ATM R&D and UAS organizations, such as the European Commission, NASA, FAA, as well as numerous international providers of air navigation services to join its international advisory committee.

Derived from the work done in the ATLANTIDA project, Boeing research & Technology Europe has structured its UAS roadmap in Europe underpinned by four main pillars:

Platforms

BR&TE is currently executing the SINTONIA project which is aimed at the development of environmentally friendly technologies to enable zero-environmental impact UAS. The project is structured in five Technological Areas that will cover the entire UAS life cycle, from the development of new, greener materials and manufacturing processes, to new aerodynamic concepts for the aircraft and new operational procedures to enable atmospheric energy harvesting. BR&TE's efforts will be

focused on the use of fuel cells to power both conventional and unconventional aircraft, using solar generation for the required hydrogen in an off-grid station.

Infrastructures

- Development of a reliable datalink for UAS by developing a robust and economically affordable wide area datalink capability based on the integration of COTS communications systems offering worldwide coverage without relying solely on satellite systems.
- Boeing is seriously committed to promote, actively participate and help the industry and regulators to set up UAS experimental facilities in suitable places along Europe as a way to help foster the European technical excellence in unmanned systems.

Regulatory Framework

Boeing is actively collaborating and participating with different European organizations and associations helping to develop the future regulatory framework for the UAS operations. Those collaborations include Eurocae, UVSI and Eurocontrol as well as contact with different European Civil Aviation Authorities.

UAS Operations

Taking onboard the extensive work been done by other initiatives like the framework 7 project INOUI in the field of civil UAS operations definition and UAS regulatory framework analysis, summed to those technologies developed in ATLANTIDA, we are well positioned to start developing our vision for the future UAS operations: a highly automated UAS management system.

This system can be briefly described as the required technological infrastructure, which will automate air traffic management in a defined area, providing any traffic inside that area with automatic trajectory management, conflict detection and resolution, as well as navigation advice.

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