

European Space Agency

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Background

The ESA Directorate of Telecommunications and Integrated Applications has stepped up its activities in the area of Unmanned Aerial Systems. The particular interest of ESA to be involved in this domain is to support the challenge of Air Traffic Integration of UAS, which will trigger new markets for satellite communications in areas such as Command & Control, ATC Relay as well as Sense & Avoid. In addition, it is expected that the routine use of UAS will also increase the demand for high data rate links via satellite from mission payloads and stimulate technology developments in various areas of satellite communications.

The ESA Integrated Applications Programme more specifically aims at fostering the integrated use of space assets (satellite communications, navigation and earth observation) in direct response to identified user needs. Against this background, studies that are synchronised with EDA take place on the added value of space-based services for the operation of UAS and their integration into non-segregated airspace.

Ongoing UAS-related Activities in ESA

The issue of UAS-Satellite interfaces and associated technical and standardisation challenges has been included in a variety of ESA activities in recent years:

- As part of its General Studies Programme, ESA has already initiated some activities that assess the state-of-the art for cooperative satellite-UAS missions, and analyse future missions that can be supported by improved BLOS (Beyond Line of Sight) communications.
- For many years ESA has equally been supporting satellite communications through its ARTES (Advanced Research on Telecommunication Satellites) programme, by providing support to essential elements such as new antenna development, advanced payloads, secure telecommand and telemetry subsystems and small ground stations. Standardisation is also considered as an important area: ESA projects have made major contributions to the DVB-RCS (Digital Video Broadcasting - Return Channel via Satellite) standard. In addition, a number of ESA projects have supported the DVB-RCS Mobile extension of this standard which have made possible standardised satellite communication with mobile platforms, providing features for hand-over and stable transmission: UAS BLOS communication payloads could be users of this standard. Currently ESA is developing test beds to test and demonstrate the evolution of this standard, also for what concerns security.
- ESA has also performed studies on systems that are truly of cooperative nature: using UAV's with passive sensors to receive radar emitted by satellites, and as such being able to obtain very high resolution radar imagery.

Synchronised ESA/EDA Activities

The EDAAir4All study and its follow up activities have identified a number of barriers and technological challenges for the integration of UAS in General Air Traffic, notably with regard to collision avoidance, secure and sustainable communications for command and control, radio bandwidth allocation and ATC interfacing. ESA considers that satellite communication

and navigation could be helpful to solve some of the issues identified, and has embarked on initiating complementary activities, aiming at a synchronised approach between ESA and EDA.

In the beginning of February 2010 ESA and EDA each signed contracts for feasibility studies on satellite services for the integration of Unmanned Aircraft Systems (UAS) into European airspace. The signature event was co-located with EDA's conference "Bridging Efforts - Connecting Civilian Security and Military Capability Development" and draw a wide public. The two studies will be carried out by two international consortia, where ESA's study is led by Indra Espacio (Spain) and EDA's study by EADS Astrium (France).

The studies, which were kicked-off a few weeks later, address the use of satellites to enable insertion of UAS into non-segregated airspace, using satellite communication for command and control, sense and avoid, and ATC. Another application is to downlink payload data to the end-user in (near) real time. Together these features should enable a wide range of new services related to among others surveillance, inspection, and monitoring. Close coordination between the two agencies ensures that both European civilian and defence actors will benefit from the use of multiple integrated space systems as enablers for cost-effective, sustainable and competitive UAS services.

The projects should also make preparations for a demonstration project, which is planned to start in 2011 and will be supported by both ESA and EDA. At the time of writing the final preparations are made for the ESA/EDA workshop on New Capabilities for UAS, which will be held in Noordwijk, the Netherlands. This workshop emphasizes the user needs and requirements and will help paving the way for the upcoming demonstration project.

Future Technology Developments Supporting Satellite Communications with UAS.

Within the various technology development and support programs, the ESA Directorate of Telecommunications and Integrated Applications is supporting Industry to develop new products and services.

ESA will initiate a system study, building upon ongoing and completed activities within ESA, EASA and EuroCAE WG-73, on a satellite system (or piggy back payload on a satellite) that supports UAS command and control. This activity is planned to start in December 2010 and should encompass not only technical, but also operational, legal, and the financial aspects of such a system.

Finally, command and control of UAV's is in many ways similar to command and control of satellites or robotic control. ESA intends to start an activity to see what is of mutual interest to the two communities.

With regards to frequencies for future command and control links using satellite communications, ESA is actively following the various ITU and CEPT activities and has expressed its intention to support any activities necessary to justify proposals involving satellite spectrum.