

ASSESSMENT OF PERFORMANCE FORECAST AND MONITORING

SERVICE FOR UAS

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U-Space is a set of new airspace-management services and procedures designed to ensure unmanned aircraft's airspace access while looking out for operational security, the right to privacy and the safety of persons and infrastructure. These services rely on a high level of digitization and function automation, whether on-board the drone itself or part of the ground-based environment. Several initiatives are now underway at European level to develop U-Space and work towards the safe and efficient coexistence of manned and unmanned air traffic. At the same time the new European legislation on operating unmanned systems has now come into force, providing a uniform, Europe-wide framework.

The European Commission project, called SUGUS, aims to analyse and propose EGNOS and Galileo as U-Space services for UAS/drones segment. The endeavour followed by SUGUS comprises the following tasks:

- To review the results of previous E-GNSS projects while also pinpointing the needs of drone operators and unmanned traffic service providers in complex operations and built-up areas. In order to identify Open and Specific UAS Category operational requirements the consortium has executed an EGNSS survey.
- To identify gaps from user's operational requirements for the acceptance of EGNSS as an additional service in U-Space. As a consequence of this analysis the need of developing an EGNSS Performance Forecast and Monitoring Service has been identified. In order to foster the penetration of EGNSS in the UAS domain several actions have been proposed to fulfil these gaps. Additionally, a high-level implementation plan for the introduction of an EGNSS service for U-Space has been proposed.
- This analysis has helped to define and then implement in the frame of this project a new E-GNSS-based Application Programming Interface (API). This API aims to act as an interface between U-Space service providers and users. In the frame of the project the API developed would provide the interface for a EGNSS Performance Forecast and Monitoring Service, which would compute the expected EGNSS performances for a grid of users within a timeframe. API data would feed commercially available tools for mission planning, flight conformance monitoring, etc.
- SUGUS will also be running a proof of concept trials in complex environments to prove the benefits from the proposed solutions to the drone-operation. The overarching idea is to demonstrate the added value of the proposed new service, to raise awareness and contribute towards drone standardization and regulation to maximize the chances of the proposed services being implemented as an U-Space service.

These activities have highlighted the UAS users need of tailored EGNSS services. The analysis made to fulfil those needs has concluded that information provision of current EGNSS services needs to be modified and adapted to the UAS domain. Furthermore, additional services have been proposed, such as a new SoL service for complex environments, an interference monitoring service or the aforementioned Performance Forecast and Monitoring Service, for which the API has been developed.

The API has been designed to allow multiple GNSS Prediction Servers connection to address a situation in which there were multiple institutional server providers and multiple commercial service facilitators providing other GNSS information services. Besides, this architecture would be also beneficial to end users because the data interface through the EGNSS API would be decoupled from the GNSS Service facilitators. Hence, those servers could be changed or removed, or new servers added, with a minimum impact on the end users applications. The API has been designed taking into account that a devoted website or any Data Access Service may be put in place to provide the data to the users. Finally, the API design shall take into account the interoperability with U-Space and other U-Space services. The API may also become an efficient and harmonized means for implementing mitigations on GNSS services according to SORA safety assessment.

This service would allow users to check in the pre-flight phase that the achievable GNSS-based performances along the trajectory associated with a drone mission (or flight plan) meet any applicable requirement and provide the information to modify the operation according to the expected performances.

Project proof of concept will demonstrate the benefits for drone operations of the measures implemented at service-provision level. These benefits included the mitigation of operating risks, improvement of preparation processes and clearance of the operator's mission. The positioning information recorded during the trials has been processed in order to compare several EGNSS technologies performances (accuracy, availability, integrity related figures, etc.). In addition, a specific analysis for the performances of the use of the EGNSS API and the potential prediction service has been done, in order to validate the benefits that the SUGUS solution will bring to the users and other UAS stakeholders.

As a conclusion, the purpose of this paper is to analyse the benefits of the EGNSS API for drone operations and to show the main results of the demonstrations performed to validate its added value in terms of enhancing the access to certain information about EGNSS performance by the stakeholders of the U-Space ecosystem (e.g. drone operators, U-Space Service Providers, etc.). The most relevant information identified along the project whose provision will be detailed is the performance forecast and monitoring, for which the API will play a key role. The outcomes from the flight trials aimed at demonstrating the added value for drone operations of the measures implemented at service provision level and the new EGNSS API will be presented.