European Global Navigation Satellite Systems Agency

UCP 2020 MINUTES OF MEETING OF AVIATION, DRONES

Meeting Date	12.02.2020	Time	14:00-18:00
Meeting Called By	Carmen Aguilera, Katerina Strelcova	Location	Online via Webex
Minutes Taken By	Philip Church (Helios)		
Panellists	**Carmen Aguilera (GSA), panel moderator** **Katerina Strelcova (GSA), panel moderator** **Philip Church (Helios), panel coordinator** **User Community Representatives:** Cristina Ananasso (European Commission) Javier De Blas (GSA) Antoine Borg (GSA) Jean Pierre Barboux (GSA) Maria Di Palma (ERA) Dr. Eduardo García González (CANSO) Vanessa Rullier-Francaud (EBAA) Philippe Lenne (SJU) Benoit Roturier (DSNA) Jan Stibor (SDM) Raúl Sánchez Ramírez (EASA) Samuel Cardon (ASL France) Michel Rocca (Europe Air Sports) Aaron Child (Collins) Aline Troadec (EUROCONTROL) Bert Leijen (Fokker) Alain Ducollet (Airbus Helicopters) Antonio Fernández (DEIMOS Space) Marc Troller (Skyguide, CANSO) Pierre Bouniol (Thales) Cristina Angulo (EASA) Jorge Chorniqué Sánchez (Airbus) Carmen González Rodríguez (Correos) Pere Molina (Geonumerics) Dominique Colin (EUROCONTROL) Ian Kealy (Drone Consultants Ireland) Antidio Viguria (CATEC) Enrique Casado (Boeing) Maurizio Trezza (Everis) Marta Cueto (GMV) Carlos Hernandez-Medel (Telespazio)
Distribution (in addition to panellists)	UCP Plenary, GSA, Public		

Organisation	Name	Signature
GSA	Carmen Aguilera	
GSA	Katerina Strelcova	
Helios	Philip Church	

Agenda

Welcome and opening - by Carmen Aguilera, Katerina Strelcova, GSA

1. What we have learnt last time - status of the actions
2. What we will do today – agenda
3. EGNOS and Galileo for aviation: today and upcoming evolutions (incl. DFMC SBAS, ARAIM, OS-NMA, HAS, governmental authorized services)

Copernicus services for aviation, focus on CAMS and Land services - by Cristina Ananasso, EC

1st PANEL: User requirements on space to enable greener aviation

1. Green Deal strategy of regional airlines – by Martina Di Palma, ERA
2. Challenges and opportunities from ANSP perspective - by Eduardo Garcia, CANSO

Panel discussion on requirements and needs from users on the program to support their Green Deal Strategies and support synergies of GNSS and Copernicus:
   a. Feedback from users on use of Copernicus for emissions monitoring and data needed
   b. Feedback from users on 'green operations' enabled by GNSS and performance needs
   c. Feedback from users on Copernicus and Galileo potential to improve airport operations planning

Panellists:
- Vanessa Rullier, EBAA
- Philippe Lenne, SJU
- Jan Stibor, SDM
- Benoit Roturier, DSNA

2nd PANEL: PBN Implementation and future evolution for navigation

1. PBN Regulation and implementation status - by Raul Sanchez, EASA
2. French ATM Strategy on PBN – by Benoit Roturier, DSNA
3. ASL-F EGNOS project and challenges and opportunities from airline perspective – by Samuel Cardon, ASL France

Panel discussion on requirements and needs from users on the program to support PBN implementation:
   a. Feedback from users on status and needs to meet the deadline (performance, equipage, implementation and how EC/GSA can support)
   b. Feedback from users on performance needs to enable transition plan to PBN
   c. Feedback on needs to improve airport survey to facilitate procedure design (Copernicus services)
   d. Feedback from users' implementation to non-IRE
   e. Feedback from users on governmental applications for State aircraft
   f. Feedback from users on requirements and needs to implement DFMC SBAS, DFMC GBAS and ARAIM
   g. Feedback from users on surveillance operations' needs, including surface movements

Panellists:
- Aline Troadec, Eurocontrol
- Vanessa Rullier, EBAA
- Marc Troller, Skyguide, CANSO
- Alain Ducollet, Airbus Helicopter, EHA
- Michel Rocca, Europe Air Sports
- Jan Stibor, SDM
- Aaron Child, Collins Aerospace
- Pierre Bouniol, Thales AVS
- Bert Leijen, Fokker
- Antonio Fernandez, Deimos Space

3rd PANEL: User requirements for GNSS for Drone operations and urban mobility
1. Overview of EASA UAS regulations status and plans – by Cristina Angulo, EASA
2. GNSS user requirements for Urban Air Mobility and Urban Air Delivery (DELOREAN project) – by Jorge Chorniqué, Airbus and Carmen Gonzalez, Correos
3. The need for GNSS integrity for drones and preliminary requirements (REALITY project)-by Pere Molina, Geonumerics

Panel discussion on requirements and needs from users on the program to support drone applications and integration in the airspace
   a. Needs on GNSS authentication
   b. Needs on GNSS high accuracy
   c. Needs for integrity tailored to drones
   d. Needs on specific EGNSS service (notifications, performance monitoring and alerting, etc) and type approved receivers
   e. User needs on GNSS as contribution to SORA
   f. User requirements for e-identification, geoawareness and integration in UTM

Panellists:
- Dominique Colin, Eurocontrol
- Ian Kealy, Drone Consultants Ireland
- Enrique Casado, Boeing
- Carlos Hernandez Medel, Telespazio, Eurocae WG 105-SORA Chair
- Antidio Viguria, CATEC
- Maurizio Trezza, Everis
- Marta Cueto, GMV

Closure

Summary

The Drones and Aviation panel of the third User Consultation Platform (UCP) took place on the 2nd December 2020 online via Webex. As in the first and second UCP, the variety of topic and the

breadth of experience of the stakeholders promoted detailed and lengthy discussions on the requirements from GNSS to enable greener aviation, support PBN implementation and future evolution for navigation, and support drone operations and urban mobility.

The group confirmed that the main trends affecting the Aviation community are:
1. The global move towards greener aviation and a more sustainable environment;
2. The global move to Performance-Based Navigation;
3. Digitalisation of ATM;
4. The integrity for drone operations and urban mobility.

In terms of greener aviation, several initiatives to create a more sustainable environment have been already put in place and more are yet to be implemented. During the panel session, a number of operations, and GNSS and Copernicus applications were identified and discussed as having a great impact on greener aviation. For instance, EGNOS-based approaches can contribute to noise and CO_2 reduction around airports, RNP procedures can contribute to CO_2 reduction and a scalable ATM system based on satellite-based logic can support implementation of other environmental solutions. Another potential benefit of GNSS and Copernicus applications can be support to better flight path selection by avoiding hyper saturated areas in the sky that can be identified by these applications. In addition, GNSS and Copernicus applications can support mitigation of secondary effects of environmental solutions, such as solar farms negatively affecting ATM network.

Minutes of Meeting

General discussion notes
- **Introduction and Update on 2018 UCP Requirements**

Katerina Strelcova (GSA) welcomed everyone at the third User Consultation Platform for Aviation and Drones and opened the webinar, informing the housekeeping rules, and noting that the UCP was co-moderated by herself and Ms Carmen Aguilera (GSA).

Ms Strelcova presented the agenda of the session, noting that the Copernicus service for aviation would be presented for the first time at UCP.

Ms Aguilera continued by introducing the objective of the third UCP – discuss aviation user needs and requirements, process the outcome of the discussion and publish the third revision of the Report on Aviation user needs and requirements in 2021.

Considering that aviation is a conservative market and a sector where evolution of operations takes time, it is paramount to understand user needs and requirements from the very beginning of the development of new operations. Apart understanding user needs, another key target of the UCP is to brainstorm new requirements for the GNSS application and new services, explore synergies within the aviation sector and discuss how the aviation sector should be shaped.

Ms Aguilera provided a summary of the user requirements identified at the UCP 2018 and presented a couple of examples of how the user requirements were addressed by GSA. For instance:
- At the UCP 2018 users requested funding opportunities for uptake by airspace users and GSA responded with launches of 17 projects in 2019 with €10M funding.

- Users expressed a need for high levels of GNSS performance and GSA addressed this need with further GNSS evolution, such as development of EGNOS v3, SUGUS project or development of new Galileo services such as HAS or OS-NMA.

- At the UCP 2018, users requested greater support of R&D and innovation projects and in 2020 GSA launched the competition MyGalileoDrone which supports exploration of new businesses.

More examples of GSA's responses to the user requirements identified at the UCP 2018 are provided in the *Attachment 1: UCP 2020 Day 1 – Aviation panel moderation presentation.*

Ms Aguilera also provided an overview of Galileo and EGNOS Services/Systems through an evolution roadmap, noting that the corrections of dual frequency in Galileo constellation are planned from the year 2020 onwards. There is a number of activities ongoing in parallel in order to support the deployment of the system itself, but also the development of standards that will make the system usable for users.

Javier de Blas (GSA) introduced the new Galileo service, HAS and presented its main characteristics. Galileo HAS will be gradually rolled out as of 2020 though three phases:
- Phase 1 – HAS testing and experimentation involving signal in space tests,

- Phase 2 – targeting the initial delivery of the high accuracy and achieving relaxed performance targets,

- Phase 3 – HAS full service.

Mr de Blas highlighted that good progress has already been made on HAS. Ms Aguilera added that this topic will be addressed later in the session.

Jean Pierre Barboux (GSA) provided an introduction of the OS-NMA, explaining it is a data authentication function based on the transmission of cryptographic material in previously reserved fields on the I/NAV message on the E1B signal component. Mr Barboux presented the OS-NMA roadmap, noting that there is ongoing live testing with the objective to finalise the readiness of the system at the operational level in order to start public testing in 2021. Mr Barboux noted that GSA needs users' feedback in order to understand what is useful and invited all to participate in the public testing. Mr Barboux added that all information will be published in due course.

Antoine Borg (GSA) provided a brief overview of the three Galileo Authentication levels - Open Service Authentication (OSNMA), Commercial Authentication Service (CAS) and Public Regulated Service (PRS). Governmental authorized applications provide increased performance compared with standard positioning service, in the aspects of guaranteed continuity and reliable position and timing information. PRS is implemented using governmental access control which means that the end user needs to be registered and authorised by the government of the Member State in order to be able to use the PRS. In other words, the signal provided by PRS is encrypted and therefore the user needs necessary keys that are provided by the authorised governmental entity.

There is a number of interesting applications that might benefit from the use of PRS, such as application related to state use of infrastructure, i.e. civil aircraft managed by the state or drone application used for border control.

- **Copernicus services for aviation, focus on CAMS and Land services**

Ms Aguilera presented Ms Cristina Ananasso and invited her to present the topic of Copernicus services, for the first time in the UCP.

Ms Ananasso presented on the topic of Copernicus contribution to Aviation and Drones, highlighting that Commission and users are working closely together.

Copernicus is unique in the world. There are 6 different operational services in 6 different domains, i.e. climate change, marine monitoring, atmosphere monitoring, land monitoring, security and emergency management. Ms Ananasso noted that together with GSA, two services potentially beneficial for airspace users were identified – Copernicus Atmosphere Monitoring Service (CAMS) and Copernicus Land Monitoring Service. Mr Ananasso invited users to contact Commission in case they were interested in other services than the two presented at the UCP 2020.

Ms Ananasso provided an introduction of CAMS, noting it provides a huge number of products in the different domains that can be of interest from air quality, emissions, aviation, etc. For instance, CAMS can provide input for the active fires map, as well as four-day forecasts of surface fine particulate matter (PM2.5) and aerosol optical depth. A specific use case for CAMS is ASSIST that uses CAMS information products in order to estimate the exposure of aircraft to certain atmospheric constituents along the flight path and on the ground and supports optimization of aircraft maintenance plans by assessing the impact of harmful particles/gases over plane bodies.

In terms of the Copernicus Land Monitoring Service, there is a number of products which can be useful in different domains such as ecosystems, biodiversity, agriculture, forestry, energy and more. Ms Ananasso highlighted a new Copernicus component, the European Ground Motion Service which aims to provide consistent, regular, standardised, harmonised and reliable information regarding natural and anthropogenic ground motion phenomena over Europe and across national borders, with millimetre accuracy. This component can support number of different applications in areas such as natural and man-induced geohazard risk assessment, geodesy, climate services and many others. Monitoring of housing and infrastructure is another concrete example of products that can be found in the Copernicus land monitoring service.

- **User requirements on Space to enable greener aviation**

This panel presented the view of ERA on Europe's Green Deal and Aviation and the view of CANSO on Challenges and opportunities.

Europe's Green Deal and Aviation (Martina Di Palma, ERA)

Ms Di Palma presented on the topic of Europe's Green Deal and Aviation with the aim to demonstrate how the topic of greener aviation is important nowadays.

Ms Di Palma provided a brief overview of ERAs membership and the impact of COVID-19 on the airline members. ERA represents more than 160 airlines and all of them have been significantly impacted by COVID-19. Flights reduced by 43.6% compared to 2019 traffic levels and the forecasts are not looking very promising.

Ms Di Palma emphasized that despite the challenges the aviation industry is facing, sustainability is still at the top of the ERA priorities. The goal of the European Green Deal is to become climate neutral in 2050 and to develop smart and sustainable mobility strategy. ERA member's efforts are captured within the published Green and sustainable connectivity report. This report contains a list of all steps and actions that ERA's members have been taking to reduce the environmental footprint. Ms Di Palma highlighted that one of ERA's airlines, Braathens Regional performed the perfect flight from Halmstad to Bromma with ATR 72-600 during which they reduced the CO_2 emission by 46%.

Another key document is the Aviation Round Table Report on the Recovery of European Aviation. This report was developed in cooperation of 24 associations and endorsed by multiple industry stakeholders such as airlines, ANSPs, tourism sector, etc. The report was published in November 2020 and the topics addressed include PAX confidence, environmental and social sustainability, digitalisation, competition, and resilience. The environmental goals outlined in the report are:

- Significant CO_2 emission reductions by 2030.

- Net zero CO_2 by 2050.

- Consider the feasibility of making 2019 peak year for CO_2 emissions.

Ms Di Palma concluded that the main message of the Aviation Round Table Report on the Recovery of European Aviation is to find the balance between environmental, social and economic activities by bringing together the entire aviation ecosystem, EU and Member States.

Challenges and opportunities from an ANSP perspective (Eduardo Garcia, CANSO)

Mr Garcia presented the challenges and opportunities from an ANSP perspective.

Mr Garcia provided a brief overview of CANSO, noting its role within the aviation industry, i.e. maintain a network for global ATM experts, leverage global expertise to develop policies, positions and guidance to promote best practices in ATM, work with all aviation stakeholders and serve as the global voice of ATM and represent the views of Members.

In terms of CANSO and the environment, CANSO has published multiple documents to tackle the environmental issues, such as Performance-Based Navigation for ANSPs: Concept 2030, Air Navigation Service Provider: Carbon Footprinting, Managing the Impacts of Aviation Noise or Measuring Operational Environmental Performance. Mr Garcia highlighted the Aviation Round Table Report on the Recovery on the Recovery of European Aviation, noting it is a joint commitment to work with policy makers to achieve net zero CO_2 emissions by 2050. Mr Garcia invited all participants to read the report as it has a strong message and shows the progress being made within the aviation industry.

In terms of reducing the impact of the COVID-19 on the aviation industry, Mr Garcia outlined that the ATM needs to be more scalable and resilient.

Regarding the GNSS benefits for ATM, GNSS is a crucial technology for the digitalisation of ATM as it allows for a more flexible and optimised design of flight procedures and enable us to maximise environmental benefits in relation with PBN concept. Mr Garcia named a few PBN Programs that have a potential for Sustainability Improvement, such as Continuous Descent Approaches, Optimized PBN Arrival and Departure Procedures, RNP Approach Procedures or Poor weather operations. When it comes to emission reduction, there is a number of benefits from PBN such as

reduction of levels, more direct and efficient arrival, and departure routes to reduce track miles and many others. Mr Garcia provided real examples of GNSS benefits by showing VPT RNAV approach at Bordeaux and optimised departures from Frankfurt Main Airport and Geneva International Airport.

In relation to aviation, Mr Garcia emphasized that we should not forget about the environmental benefit of the satellite-based surveillance and communication applications, such as increased use of ADS-B to enable reductions in separation minima and associated capacity advantages and to enable aircraft fly optimal speeds, or use of datalink services to enable the Trajectory Based Operations concept and use of i4D which can deliver route optimisations and reduced fuel consumption due to fewer holding patterns and related reductions in CO_2 emissions per flight.

Mr Garcia presented CANSO's recommendations related to GNSS, such as ensure that GNSS signals are interference-free and/or protected, address there is a single point of failure when using GNSS for navigation and surveillance, early adopt modern in satellite-based navigation, communication, and surveillance equipment and processes, increase cooperation and full alignment between the aviation sector and policy makers and regulators and increase the public co-funding rates for Civil Aviation Research & Innovation (Clean Aviation and SESAR).

All recommendations of CANSO are provided in the *Attachment 1: UCP 2020 Day 1 – Aviation panel moderation presentation.*

Mr Garcia concluded with the point that the key priority is the acceleration of digital transformation of the industry.

Discussion panel

Ms Strelcova introduced the panellists for the first panel discussion on the user requirements on Space to enable greener aviation, Vanessa Rullier-Francaud (EBAA), Philippe Lenne (SJU), Benoit Roturier (DSNA) and Jan Stibor (SDM).

A set of questions was presented to the panellists aiming to obtain users' view on operations and applications based on space data and their potential impact on greener aviation.

Q1: Which operations or applications based on space data (GNSS or Copernicus) might have the greatest impact on greener aviation? How can EGNSS and the GSA support aviation users' strategies towards the Green Deal?

Vanessa Rullier-Francaud (EBAA) noted that several benefits have been already mentioned during today's presentations on aviation and environment. GNSS applications will contribute to build a more modern ATM system which will offer significant reductions in aviation fuel burn and CO_2 emissions between 6 % and 10%. Thus, EBAA promotes to further deploy the RNP procedures which permit the operation of aircraft along a precise flight path with a high level of accuracy and the ability to determine aircraft position with both accuracy and integrity. Ms Rullier-Francaud emphasized that the implementation of EGNOS-based technologies that enable a better access and safety to all airports and heliports by providing precision approach capabilities in all weathers, are paramount for helicopter operations. Furthermore, Ms Rullier-Francaud noted that the environmental issues also include noise and air quality, noting that EGNOS-based approaches

combined with adapted approach procedures will contribute to reduce noise around airports. Thus, EBAA highly promotes to incorporate this type of approach in the scope of PBN IR.

Full EBAA's responses to all four questions presented in this panel are provided in the Attachment 1: UCP 2020 Day 1 – Aviation panel moderation presentation.

Philippe Lenne (SJU) stressed that the focus area for sustainability and environment is not only CO_2 emissions, but we need to also consider noise, contrails and local air quality (CO_2 and non-CO_2 emissions). Thus, we should focus also on reduction of noise and improvement of air quality. Mr Lenne added that the three mentioned areas are interdependent, and it is a very complex setting that needs to be worked on. When it comes to mitigation of the aviation footprint, Mr Lenne emphasized that we cannot afford to miss the targets. As such, the industry needs robust and reliable solutions based on reliable data sources that are key to analyse the environmental impacts. As a second point, Mr Lenne noted that a mature and scalable ATM system is needed in order to deploy any of the solutions. Considering that all these settings require satellite-based logic, it was concluded that there is a strong need for a synchronised development. This the aim of SESAR – an environment that supports interoperability and hyper connectivity.

Benoit Roturier (DSNA) added that within PBN the EGNOS solution is very important as its main benefit is CAT I minima. If the possibility of CAT I landing is higher, the number of diversions will decrease. Mr Roturier noted that this is a basic thing that we should not forget about, highlighting that in France they try to develop the concept 'CAT I everywhere any time' by using EGNOS.

Ms Strelcova noted that GSA is currently conducting a research on this topic, i.e. analysing how much fuel we can reduce when we have the opportunity to use closer airport thanks to EGNOS.

Jan Stibor (SDM) noted that there are three key areas in which operations or applications based on space data (GNSS or Copernicus) might have the greatest impact on greener aviation. The first area is EGNOS to PRS which is a high priority to ATM community too. Any work towards security and resilience is priority to aviation sector at present. Secondly, the new entrants (UAV) can also benefit from PRS as their operations will require high accuracy to unlock new potential particularly in urban environments. Thirdly, drone operations have a massive potential to make aviation greener as most of drones are electric. Considering the higher sensitivity of population to the climate questions, conversion to alternative sources of fuel such as electrical or solar power is key for the future. However, there might be a conflict on the ground level, as renewable power generation installations such as solar panels or wind turbines might have an effect on the ATM network. As such, a rigorous assessment of impacts, for instance when developing solar farms, will be needed and this is the area where GNSS applications could potentially help.

Ms Strelcova noted that from the energy point of view, GSA was looking on the rationalisation for the current conventional navigation aids, using the land monitoring that is provided by Copernicus (obstacle survey, etc.).

Q2: What benefit do you believe the use of Earth Observation data can bring supporting greener aviation?

Philippe Lenne (SJU) noted that the key benefit can be mitigation of contrails. One of the stakeholders SJU is working with use these technologies to identify hyper saturated areas in the sky and as a result, they can then limit the penetration and avoid generation of more contrails. In

addition, meteorological observation can allow users to identify areas with high density of CO_2 and thus they can avoid passing though those areas to avoid generating additional emissions from aircraft.

Ms Strelcova added that GSA will again have a closer look at this project and coordinate together on its future evolution.

- **User requirements on PBN Implementation and future evolution for navigation**

This panel presented the view of EASA on Regulation (EU) 2018/1048, the view of DSNA on French ATM Strategy on PBN and the view of ASL France on LPV and ADS-B Out project.

Regulation (EU) 2018/1048 (Raúl Sánchez Ramírez, EASA)

Raúl Sánchez Ramírez (EASA) provided an overview of the regulation (EU) 2018/1048: PBN Implementation and future evolution for navigation. The regulation helped optimise the available airspace and it will provide airspace users safety, capacity, and efficiency gains. Mr Sánchez noted that the regulation was developed with the aim to harmonise common airspace usage requirements, noting it is complemented by other regulations that require e.g. aircraft to be properly equipped or flight crew to be suitable qualified.

Mr Sánchez summarised the implementation requirements on approach procedures, arrival/departure procedures and en-route procedures, emphasizing the publication of LPV minima. Mr Sánchez presented the implementation timelines from 2018 to 2030, noting that the complete transition to PBN is expected in 2030. The implementation is divided into three phases represented by dates by which specific procedures shall be implemented.

Mr Sánchez presented the transition and contingency measures needed for the implementation, i.e. transition plans consistent with Common Projects and ATM Master Plan and development of contingency measures such as provision of services after PBN-related failure modes, back-up CNS infrastructure in support of contingency or contingency modes based on non-GNSS technologies. Mr Sánchez highlighted that during the transition to PBN, non-compliant ATS routes and procedures are allowed.

Regarding the navigation scenario after June 2030, the use of PBN will be exclusive and no conventional navigation procedures will be allowed, except two explicit exceptions:
- CAT II & CAT III landing systems can remain in service unaffected.

- Other instrument flight procedures can be designed/kept in support of contingency measures, in particular, conventional navigation procedures.

It was outlined that the EASA GM to the PBN Regulation was produced in coordination with the affected stakeholders. The guidance material to provide information and guidance orientation on how to interpret the relevant issues, transition arrangements, contingency measures, etc. was published in November 2018 after the Regulation was adopted. Mr Sánchez invited participants to check EASA's website for more information.

As a last point, Mr Sánchez noted that based on an agreement at the SSC 77, the Regulation (EU) No 716/2014 will be repealed and replaced by Commission Implementing Regulation on the establishment of the Common Project 1 (CP1).

French ATM Strategy on PBN (Benoit Roturier, DSNA)

Benoit Roturier (DSNA) commenced with the presentation by highlighting that the DSNA PBN Transition plan has been completed and handled to regulator. The Transition Plan is a result of consultation with airspace users. According to PBN IR, France regulator has requested transition plans to all French airspace ANSPs – this represents another set of 60 airports in addition to DSNA managed 69 airports. Mr Roturier noted that DSNA is proud to achieve this stage of the regulation, highlighting that there is a high level of compliance for LNAV (98%), LNAV/VNAV (91%) and LPV (98%), and this was high work given the large of airports under DSNA umbrella. DSNA compliance with 2024 objectives is already above 90% for approaches, and next target is to complete SID/STAR PBN deployments and reduce the number of VOR/NDB.

Mr Roturier presented the PBN implementation timeline. A new WG was set-up following COVID-19 crisis (DSNA+IATA, main airlines) and considering that PBN is about optimising trajectories, PBN is deemed a major asset to restart aviation.

Regarding DSNA Green Aviation policy, they have separate priorities for upper and lower airspace. For upper airspace, the priority is to reduce CO2 emission and for lower airspace the priority is to reduce noise. In order to reduce noise within the lower airspace, DSNA wants to increase the use of continuous climb operations (CCO) and continuous descent operations (CDO). Furthermore, DSNA launched a big project at Paris-CDG called PBN to ILS which is still in development. At the beginning of 2021, live trials of CDOs will start to be implemented at one of the runways at CDG. This project brings operational (increased capacity, simplification of the radar control), environmental (CDO generalized H24, concentration of the traffic flows over less populated areas) and safety (secure the interception phase with a better lateral precision) benefits. The project is aimed to be completed in 2023.

In terms of the VPT RNAV at Bordeaux, Benoit presented an example of routes with and without VPT RNAV and emphasized the benefits of VPT RNAV such as definition of trajectory to respect environmental constraints.

Mr Roturier noted that GBAS was also discussed within the group, specifically for CAT III operations. Currently there is a project at CDG called GCAS@CDG. Mr Roturier highlighted that there is a need for GBAS CAT III, in particular to address ILS vulnerabilities in the future. The group developed a roadmap of how to implement GBAS at CDG and also conducted a cost-benefit analysis.. Mr Roturier also noted that they intend to join the GBAS Alliance Memorandum of Understanding.

In a summary, there are three layers of PBN within France airspace:
-   First layer was compliance with A37/11 ICAO resolution + take advantage of EGNOS LPV to decommission ILS Cat I.

-   Second layer was implementation in compliance with PBN IR + continue rationalization with VOR/NDB.

-   Third layer starting now aims to derive new benefits from PBN, in particular related to greener aviation by implementing specific projects in close consultation with airspace users (such as increased use of CCO/CDO, PBN to ILS, VPT, RNAV, etc.)

Mr Roturier noted that they are now implementing the third layer of PBN within France airspace.

LPV and ADSB-Out project (Samuel Cardon, ASL France)

Samuel Cardon (ASL France) presented on the ASL France Project on EGNOS. Mr Cardon commenced the presentation by providing an introduction of ASL France. ASL France is an experienced airline as it was created in 1991. ASL Aviation Holdings comprise 25 companies including various aircraft leasing entities and seven airline operations out of which four are in Europe, namely ASL Airlines Ireland, France, Belgium, and Hungary. The group is composed of cargo and passenger aircraft.

ASL Airlines France fleet in 2019 comprised B737 aircraft. There was no solution from Boeing for B737 to enable the use of LPV. As such, they requested a grant from GSA to develop a new STC for LPV and ADSB-out for the six B 737-700 within their fleet, in partnership with Fokker Services. Mr Cardon highlighted that 77% of ASLF flights land at destination with at least x1 procedure authorised for SBAS guidance.

In terms of the technical solution, ASL France B737-700 aircraft is equipped with standard MMR that does not support LPV and ADSB-out, SA-aware function. Therefore, two CMC electronics CMA-5024 GLSSU and two active GPC antennas were installed on the aircraft. Secondly, the ASL France B737-700 transponders are not compliant with DO-260B and therefore the transponders were replaced by transponders with TRA-100B and connection to the SA aware GNSS receiver.

The overall concept design diagram of the B737NG SBAS Landing System (SLS) is provided in the *Attachment 1: UCP 2020 Day 1 – Aviation panel moderation presentation.*

Regarding implementation, Mr Cardon reminded that ASL France has been developing a new STC for B73 NG in partnership with Fokker Services co-funded by GSA. The expected development time was 9 months starting in May 2019, but due to several causes, the development of STC took longer than expected, for instance:
- Integrate SBAS receiver in existing avionics architecture complex search towards locations without any interference with other systems. Fokker now holds STC for 737 with Stand-alone GNSS.

- Complexity of SLS system architecture which is interfacing with a lot of other (existing) systems that all needs to come together with the GLSSU (CMA-5024) at the heart of the system.

- Maintain Boeing cockpit philosophy (human-machine interface) (Indications/operational)

- Operational procedure for the flight crew, differences and similarities used to the ILS approach and approach and missed approach procedure.

- Complex modification invites significant EASA involvement, meaning a lot of reviewing of certification Reports and discussions on showing compliance is needed.

Furthermore, the timeline had to be modified to reflect the impacts of COVID-19 crisis.

The first aircraft has been equipped with GNSS receiver CMA 5024 in August 2020 and the ADSB-out certification test was carried out. In September 2020, EASA validated 2 STCs:
- STC 10066148: ADSB-out on B737-NG series
- STC 10074404: activation of standalone GNSS receiver on B737-NG series

The next step is to continue the development process for LPV certification. Mr Cardon noted that the LPV STC is expected in March 2021, highlighting that the first LPV approach of ASL France should

be performed during the first quarter of 2021. It is expected that other aircraft will be modified after that. The passenger NG fleet should be ready for LPV approach before end of second quarter of 2021

Mr Cardon summarized that there are number of benefits associated with the LPV and ADSB-Out project, such as:
- Use of RNP approach in 70% of the total approaches performed by the passenger fleet is expected to reduce fuel cost and save time around airports within 3 years.

- The number of accessible airports to ASL France fleet will increase. Mr Cardon noted that in 2017 they had to refuse 34 contracts because they were not LPV and/or GNSS RNP approach capable. That resulted in a financial loss of about 450,000 EUR.

- Reduction of disruption costs due to weather and lack of ILS procedures on some airport.

Mr Cardon outlined the main challenges, i.e. challenge with investment planning into fleet due to the COVID-19 crisis and uncertainties around the shape of market in future.

As a last point, Mr Cardon presented ASL France view on the implementation of PBN. ASL Airlines France's technical investments have to be consolidated at the ASL Group Level, considering the impact on the ASL Group fleet. As such, ASLF is not planning to equip their B737 classic cargo fleet with EGNOS due to their duration in their fleet. Mr Cardon noted that LPV approaches are enabling CAT I operations, similar to ILS CAT I (200 ft at this time), adding that ASLF main destinations are airport equipped with ILS CAT III. Therefore, ASLF would welcome reduction of minima enabled by GNSS, e. g. 50ft. In this case, new GNSS avionics and DFMC may be supportive.

Mr Cardon concluded with the point that to go forward with this kind of modification and investment in the future, ASLF will need from GSA more return on investment studies and data showing clear impact on the costs of flights, as the amount of investment necessary to upgrade older aircraft can be disproportionate compared to the value of the aircraft.

Discussion panel

Ms Strelcova thanked Mr Cardon for his presentation and presented the panellists for the second panel discussion on User requirements on PBN Implementation and future evolution for navigation. In addition to Mr Jan Stibor and Vanessa Ms Rullier-Francaud from previous panel, the following attendees were presented:
- Aline Troadec (Eurocontrol);

- Alain Ducollet (Airbus Helicopters);

- Marc Troller (skyguide, CANSO);

- Michel Rocca (Europe Air Sports);

- Aaeon Child (Collins);

- Pierre Bouniol (Thales);

- Bert Leijen (Fokker);

- Antonio Ferníndez (DEIMOS Space).

Ms Strelcova initiated the discussion with the first question and encouraged Marc Troller to provide his views.

Q1 - How ready are you and what additional steps do you believe are necessary to meet the PBN IR objectives by 2030? (i.e. transition to a full PBN environment with rationalisation of traditional navaids) In other words, what are the user needs to meet the deadline (performance, equipage, implementation and how EC/GSA can support)?

Marc Troller thanked Katerina for the opportunity to attend and provided his views.

ANSPs already developed PBN transition plans which is a first step. They show a way how to meet the objectives by 2030, and ANSPs are also continuously implementing PBN procedures.

There are many advantages but there is one challenge and that is the vulnerability to RFI (jamming events / interference events). For the full PBN implementation, ANSPs need operational procedures to address this kind of events and train their ATCOs to handle the threats associated with PBN. In order to minimise GNSS loss ANSPs need a robust GNSS system, designed to fulfil the ICAO requirements.

In the light of 2030 requirements, Skyguide as well as many ANSPs, sees the requirements to densify the existing DME network. However, this becomes a challenge in the current economic environment. Mr. Troller expects challenges to densify the DME network on time.

Skyguide sees from flight plan data that aircraft equipage rate is sufficient to transition to PBN. When it comes to SBAS CAT I equipage, there is a need to increase the effort to have sufficient number of aircraft with SBAS CAT I equipage.

After Mr Troller finished, Vanessa Rullier from EBAA was invited to share her opinion.
The transition plan has been consulted and the business aviation fully supports the PBN mandate. We are pushing for any help to member states and service providers to speed up the implementation. However, there are of course challenges with interferences and GNSS failures therefore a robust mitigation measures need to be put in place. Any help to support the mitigation is welcome.

In terms of PBN opportunities they see a lot of added value besides those in the current scope. We would like even additional features to be added to the PBN Implementing Rule scope. RNP procedure for parallel runways could be one example. It could reduce separation and reduce workload for ATCOs as well.

Ms Rullier highlighted the need to deploy LPV procedures at VFR aerodrome. There is a key added value for operators of business and light aircraft. LPV will enable them to land with better approach stability especially on short and narrow runways. As a result, there are benefits in speed, accuracy, and safety. Additionally, there is an opportunity for young pilots to train and get familiar with 3D approaches.

Final but very important point is that EGNOS together with head up display (HUD-EVS) equipage can allow operators to operate in CAT II operations and enable better access to regional airports and lower minima providing them with a larger margin and improved safety.

Ms Strelcova thanked Ms Rullier and appreciated the points she made. After that she moved on to second question:

Q2: Do you see EGNOS performance today – or with its planned improvements – as sufficient for enable transition plan to PBN and all future applications?

Aline Troadec (Eurocontrol) agreed with a lot of things already said by Mr Troller, Ms Rullier and Mr Roturier. As far as EGNOS is concerned, the system performance is not an obstacle to LPV deployment and is good enough for the use of it today where access to airports rarely depends on EGNOS performance because the number of equipped users is rather low. But we need to consider the transition to PBN (2030 deadline). If the performances are good enough for today, it might not be sufficient for 2030 and we need to work on that.

PBN and GNSS expectations are very high. Indeed, GNSS and the PBN concept open up the possibility to publish instrument approach procedures everywhere. But there are reasons why instrument procedures are not always published and we need to understand these. The wider availability of instrument approach procedures, including LPV, can provide benefits to helicopters and GA community, but we need to work on demonstrating that these are safe operations (it does not depend only on the performance of the navigation system).

Other expectations from PBN is to optimise procedures to be environmentally friendly. It is promising, but one challenge will be to introduce these new procedures into the airspace, making sure that they are compatible with other procedure flows.

In terms of expectations, there is a potential for rationalisation. It is going to have positive economic and environmental impact, but it will depend on a solid operational concept, including the definition of contingency procedures in case of GNSS failure. To conclude, GNSS system performance is an important contributing factor to a better aviation future, but it is not sufficient alone. There are many other things to consider apart from the GNSS performance.

After Ms Troadec finished, Mr Roturier offered a perspective from DSNA. The performances of EGNOS are good, however the continuity of service is insufficient today for parts of Europe (border areas in particular). Mr Roturier's biggest concern for the future is the performances specified for EGNOS V3 being insufficient. He pointed to ICAO SARPs, which says that minimum availability performance requirement is 99.0% for LPV landings, but this is for desertic or low traffic areas. However, this is still the objective assigned to industry for EGNOS V3.1, which will be used for many years and by many aircraft in Europe. There is urge for GSA to consider what is really required for the EGNOS performance. In Europe, the intention is to use EGNOS V3 as the main landing system for CAT I operations after 2030, but it is not what the system is currently being designed for, in terms of performance.

Q3: Are there any specific operations that you believe need additional focus or have specific performance to support their current or future operations, such as for helicopters or general aviation?

Alain Ducollet (Airbus Helicopters) – All helicopters now have GNSS on board (since 2010), based on the fact that for HMS (Helicopter Medical Services) operations they need to fly low altitude level and perform in adverse weather conditions. Mr Ducollet highlighted the issue with jamming.

Although PBN is very useful they continue using conventional means of navigation (VOR, DME, ILS) as a backup system, although it is an extra cost.

Once the helicopter flies at low level, there is an issue of masking the EGNOS signal. This happens during operations in narrow valleys where RNP is performed and due to that there is a lack of robustness of the system. Once the GNSS is lost, they are entering the emergency procedures and are left with a lack of back up options because the conventional means of navigation are not always available in such conditions. In such cases when all GNSS dependant systems (synthetic vision, digital map, etc.) are lost, crew relies on dead reckoning system which is based on inertial systems and is relatively expensive, but it is an only way to continue the flight.

Where there is risk of masking, there is also a risk of multipath. We sometimes face this issue when we perform LPV approach close to lake as we have a lot of signal reflection from the water surface. The next problem is for the future. There is a real effort to decrease the number of pilots onboard, there will be remotely piloted vehicles too and they will rely more and more on GNSS not only for navigation and awareness but also for piloting. Therefore, there is a need for a reliable GNSS, in order to perform advanced operations.

Michel Rocca (Europe Air Sports) – With regards to general aviation, the operations are less demanding than those presented by Mr Ducollet. They have expectations towards navigation and surveillance service. We support the further development of PBN implementation plan as presented by Mr Sánchez. We support further development of simplified procedures allowing PBN operations on non-instrument runway ends as we already mentioned in 2018.

We also support the smooth transition to DFMC for GA which will result in costly retrofitting of GA and other airspace users' aircraft. Concerning the performance-based surveillance – for ADS-B, we support the alignment of EU performance standards on US performance standards which could be achieved by introducing EGNOS to determine aircraft's position. Finally, we feel that the GNSS is key for the success of the U-Space concept.

Q4: As, we have here also Avionics manufacturers and PART 21, what is the driver for including GNSS in the aircraft, what are the needs of users and challenges? How can EGNSS programme help?

Aaron Child (Collins) – from Mr Child's perspective, customers are looking at operational solutions that bring value at affordable costs. Software updates with minimal down-time are very important. They need to know that their operational service improves the access to the airports and provides them with more reliable operations. Mr Child introduced a GSA's MUGG project studying DFMC, ARAIM. He appreciated that many customers talk about LPV CAT I minima or even something beyond that. Move to DFMC would allow customers to perform advanced RAIM techniques opening up advantageous operations.

Pierre Bouniol (Thales) considers that installing GNSS is standard now. It has been proven that PBN RNP and LPV using EGNSS provides a full operational advantage and benefits to the users. Thales' customers are aircraft manufacturers and airlines. Their objective is safety and efficient operations. EGNSS has been proven a good standard to meet those two goals, but they are facing two main challenges – interference and efficiency (e.g. efficiency can be improved by flying lower minimum heights). There will be next steps in addition to the prototypes – first one is that having a prototype is not sufficient. The formal specification baseline is needed to proceed to installation. Additionally, there is a need for ETSOs and TSOs for constellations – not only Galileo and EGNOS but also GPS

dual frequency. In terms of the lower decision heights – SBAS could be a solution if the performance is there. In terms of interferences, the use of several frequencies is probably a good way to tackle this problem. SBAS DFMC can be a success, if all aforementioned challenges are solved, i.e. better efficiency and ensured safety.

Bert Leijen (Fokker) emphasised that airlines do not want to invest. It is either mandated or there is a positive return of profit. Some aircraft will need to be replaced, updated, etc. and it will be very expensive. If they are going to install an additional piece of navigation, what are the benefits? In terms of the accuracy, airlines like KLM are very positive about the system, but most of their network is still using ILS and they ask why they should update it now, in the Covid-19 year? It is a huge investment for large airlines, so they really need to see the benefits, e.g. via cost-benefit analyses.

Antonio Fernández (DEIMOS Space) – DEIMOS is trying to optimise the computations of load and have seen that the reliability of the GNSS system is a concern. He thinks that it would be good to implement features of Galileo authentication to the system without additional robustness. We should try to keep the EU and US system as compatible as possible. The availability of multi-constellation and multifrequency is a good solution to improve the reliability.

Ms Strelcova thanked to all the speakers and panellists for their comments and insights.

- **User requirements on Space for Drone operations and urban mobility**

Ms Aguilera presented the speakers: Cristina Angulo (EASA), Jorge Chorniqué (Airbus), Carmen González Rodríguez (Correos) and Pere Molina (GeoNumerics).

Jorge Chorniqué (Airbus) and Carmen Gonzalez Rodriguez (Correos) - Urban Air Mobility and Urban Air Delivery

There are emerging technologies and new business models to support the mobility and sustainability. GNSS can provide value, especially in urban areas. The global availability and scalability are the key drivers of using satellite-based navigation.

Mr Chorniqué summarised the known challenges for EGNSS application in Urban Areas. These are for instance external interference (either intentional or due to dense radio frequency), specific characteristics of the environment i.e. obstacles and signal reflection but also dynamic obstacles for example traffic.

In terms of the potential application of EGNSS service, there is a clear need for real-time position and geo-awareness. It will also provide information of the potential navigation coverage. Such data can also be used to improve the fleet management, optimise missions or to estimate demand. It will open the door for UAM ancillary services, such as location-based services for passengers.

Mr Chorniqué introduced the DELOREAN project they are working on with other partners e.g. Correos. The key idea of the project is to perform tests in real life environment (in Benidorm). The aim of this project is to review different use cases. DELOREAN results will contribute to be able to assess the actual accuracy and compare it against the precision needed for the operation.

Carmen González Rodríguez presented GNSS User Requirements for Urban Air Delivery operations. These are mainly – emergency deliveries and urgent deliveries. The use of drones provides innovative solutions and decreases the risk for the people involved. Ms González Rodríguez also highlighted the need for high accuracy of positioning in order to deliver goods. The idea behind delivery service is to provide very fast delivery of goods by avoiding congested infrastructure. For this type of operation (in urban area with many obstacles – i.e. buildings) a high availability and accuracy of navigation are needed.

Pere Molina (GeoNumerics) – The need of integrity for drones & preliminary RNPs

Mr Molina communicated requirements on the integrity. First message is for the integrators – the technology is ready, so use it or lose it! The measurements are added there, the more measurements there are the better chance that the results will improve.

Second message is that GNSS integrity events are not an option for drones! This is based on past events (a satellite experienced a clock drift and become unhealthy – erroneous measurements). GNSS integrity can be solved by EGNOS. SIGMAS checking is not sufficient.

Third message is that EGNOS can be used as a starting point, but more is needed! What if we come to a scenario when drone traffic is very dense? In such case we will probably need more than just EGNOS.

Mr Molina also introduced the project REALITY which aims at understanding and adapt GNSS++ integrity to drones and produce a consolidated set of conclusions and recommendations for key entities (e.g. drone operators, EGNSS policy makers, regulators & standardisation bodies) through massive drone flight campaign and data collection.

Mr Molina explained required nav performance & SORA. He also presented scenarios representative for certain type of missions and provided RNP values that they believe can be achievable. Next goals are to fly tirelessly and to collect data in order to see if these can be achieved.

Ms Aguilera presented the panellists Dominique Colin (Eurocontrol), Ian Kealy (Drone Consultants Ireland), Antidio Viguria (CATEC), Maurizio Trezza (Everis), Marta Cueto (GMV), Carlos Hernandez-Medel (Telespazio), Enrique Casado (Boeing).

Q1: Within the current and evolving drone regulations and u-Space roadmap what role do you foresee for EGNSS?

Dominique Colin thanked the presenters. Wants to add a few more details to the last presentation from Mr Molina. SORA is an acceptable mean of compliance; it is not a requirement. But that is a detail. U-Space will be heavily supported by the communication industry. Because there is a lot of communication involved. It is not very common to the aviation as of today. They are also seeking for a more collective approach. U-Space can be seen as system of systems. Beyond the technical performance, there is a competency and the experience as a service provider that can be useful. A satellite service provide could act as a flagship for the new industry which has a very small aviation culture. GSA has this experience in providing services in the aviation industry. You know the requirements, users and use cases. EGNSS is a valuable asset.

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Ian Kiely appreciated that what Mr Colin has said is important. There are already companies delivering foods fore supermarkets and homes, it is important to have a baseline.

Q2: Do you think a standard for EGNSS receiver for drones would support operations in the specific category? If so, why?

Ian Kiely is convinced that if we (Europe) were setting the standards, it would bring up the quality of being available and it would create jobs. It has already brought us a lot of research and development. It is a really good starting point to have that baseline.

Q3: Eurocae is developing guidelines for EGNSS introduction in drone operations to support OSO-13. Which scenarios or operations would benefit from such guidelines the most and in which areas do you think additional work is needed to better understand the performance needed from EGNSS to underpin drone operations?

Carlos Hernandez Medel thanked Ms Aguilera for the opportunity to be present at the panel. SORA has a number of safety requirements that must be met. Use of external systems supporting the operations (4G, 5G communications for CNPC link). Working Group 62 and Working Group 105 started 2 years ago following the proposed regulation from EASA. So far, we have worked with scenarios where the risk of scenarios can be considered as low. From medium and high risk there are still lack of standards. The current approach is to identify the use cases and to identify what could be the standards and what would be the process of demonstrating that the operation meets the standards.

Taking advantage that Ms Angulo has not been able to speak, EASA is working currently in the new special conditions for light UAS. This will see its light in the next months. The work currently being done by the Working Group focuses mainly on Urban Environment and BVLOS Flights.

With respect to your question of what is missing, additional work needs to be done. I would like to highlight two points. Firstly, there is a vision of having thousands of UAVs in urban environment. For that we will need a detect and avoid solution (D&A) such as ACAS. Secondly, we will need an advanced airspace structure which includes potential use of flight level, flight corridors and the possibility to define these volumes (e.g. never to leave the specific corridor).

Dominique Colin complemented Mr Hernandez Medel by highlighting that the regulation seems like there is just a single UAS in the skies. When you go to traffic, this is a different story and therefore we need to understand the separation between two UAS (and for that we need to know the accuracy). People fail to understand that we are trying to organise a new traffic, not to add new airspace user to the sky! Surveillance and D&A are important concepts.

Q4: Which applications of Copernicus data supporting drone operations do you believe has most value? How can GNSS and Copernicus complement each other to support drone operations?

Enrique Casado thinks that we cannot just rely on one solution to provide an accurate positioning in urban environment. Using D&A is an enabler to ensure that the operations are safe. Advantage of Copernicus is that it uses images to have more robust and reliable capabilities. It would be valuable if they could have access to infrared images with regards to solutions for UAVs (D&A solution). It would be also valuable if Copernicus could be reliable source of weather information.

Dominique Colin said that the images from Copernicus could be used also used as a mapping solution during the pre-flight in order to define the best flight trajectory for the UAS (real-time is always complicated).

Enrique Casado is convinced that we do not need a real time images. We just need a reliable information about ground, buildings, etc. to identify key points.

Jorge Chorniqué agrees with the above, e.g. Copernicus provides pollution services, maybe it can be considered when planning routes for UAM. If there are highly populated areas, we may want to avoid these. The more we know in advance the better we can plan the operations and optimise the system's performance.

Carmen González Rodríguez agreed with other panellists

Q5: What advantages do you see from the use of the Galileo High Accuracy Service (HAS) for drone operations and where do you see the benefits being realised?

Jorge Chorniqué introduced the accuracy as the most relevant thing to mention. When we see the use of UAVs in the city, higher accuracy will enable us to define better separation, increase the capacity of the airspace, etc. In the long term end-to-end, we can think of highly automated operations, where drones need to work closely with building (e.g. maintenance of buildings)– the accuracy needs to be really high (up to decimeter[3]). Last advantage is the encryption of the signal that provides the HAS which will provide additional layer of security into the solution and mitigate the risk of spoofing.

Pere Molina provided his views – the more and more I think, I see more that aviation is the grandfather of drones, however, the automotive and driver-less industry represents brothers and sisters to drones. There have been discussions about HAS and NMA already and as drones are going lower and lower, they start to face the same challenges as the automotive industry.
If we have this in mind, automotive industry is going for PPP schemes in real time (HAS, real-time authentication, etc.). for their operations. This could be considered for drones as well.

Dominique Colin explained that the Public Regulated Service (PRS) is targeted at public services but was not aware of the technical implementation requirements. He expressed that it will be complicated to manage the keys.

Antoine Borg confirmed that keys will need to be managed, that is true, but this will not be an issue. There will be bureaucracy, but the security should not be an issue. It is up to member states to decide what they want to do with the service. One country may decide to use PRS for the police force and other country may want to use HAS service for the police force. Just because it is a PRS it will not be only used for governmental use cases. If you feel that your requirements are demanding enough to make a use of PSR, you can reach out the authority and they will guide you accordingly. They will not say no just because your case is not governmental.

Dominique Colin posed a question – How does it work for cross border operations with PRS?

Antoine Borg clarified that Galileo PRS is a worldwide service. If you are authorised to use the drone in one country, you do not have to register to use PRS in other country because you are already authorised to use the PRS. There are no issues in terms of cross border operations.

Q6: Based on the research being undertaken, how appropriate do you believe the following EGNSS performance requirements are for drone positioning in an URBAN environment?

Horizontal accuracy	*1m*
Vertical accuracy	*1m*
Continuity risk	*< once per year*
Integrity risk	*$<= 10^{-7}$ per flight hour*
Time to alarm	*<= 6s*
Horizontal alarm	*<=10m*
Vertical alarm limit	*<=5m*
TTFF	*<= 30s*
Update rate	*<= 1s*
Availability in urban canyon	*99% to 99.9% probability*

Enrique Casado was invited to answer the question. As mentioned, it is not only questions about having very reliable GNSS solutions, at the end you need to have a backup anyway. For sure these matrices are very good and in general - the better accuracy, the better solutions that can be developed. Any navigational solution should be fusion of different solutions. If reaching this matrix is hard, maybe it does not make sense to move it forward because at the end there should be other backup solutions or different approaches. We do not know what those will be at the moment, we will need to test it in the real-life environment.

Carlos Hernandez Medel agrees that these requirements are very challenging. In terms of the urban environment, for the HAS we are missing the integrity and continuity because it is not a part of the definition. This is the challenge – how to complement the high accuracy service with PPP (real-time) but provide an integrity at the same time. The prediction of the performance will be fundamental to minimise the risk.

Javier De Blas appreciated that the discussion is really interesting. We conclude more and more that drone movements in urban areas come closer to the discussion about the road environment and automotive. When it comes to accuracy, we could reach such level of accuracy (HAS), but specifically when it comes to integrity, the challenge is the **definition of solid and robust integrity model** to support such applications. We can accommodate different sources of data, but in the end, it would not be realistic to have such integrity using single source model. In the H2020 project there is a similar mission project that is looking at the definition of the EGNSS higher accuracy, looking at other sources that could contribute to higher accuracy. The additional elements will be brought in the future. Service elements in terms of notifications, performance forecasts, could be used as inputs to mobility solutions. We are interested in seeing panellists' view on this. We will define a delivery scheme and we are looking forward to hearing your views. A link to a survey will be distributed later offline.

Dominique Colin said that in a service-based environment, you need monitoring anyway. It is mandatory. It means that there should be some alerting function if the performance parameters deteriorate. The latency of the communication of the system status needs to be also taken into the account, because the pilot is not in the cockpit. Everything is integrated and we need to understand that.

Javier De Blas clarified that the GSA wants and needs to support these other functions with a necessary input coming from HAS. Therefore, as part of the integrated system we support all functions. There is a parallel activity to traditional aviation. If we foresee that the service will be unavailable, we will communicate it to users, maybe not in a form of NOTAM, but some kind of communication will be in place.

Q7: At the last UCP we received feedback on the importance of notifications on EGNSS performance to drone users. Could you give us more info on SUGUS project and how this is being addressed?

Marta Cueto thanked Ms Aguilera and the panellists. The project SUGUS aims to analyse and propose EGNOS and Galileo for U-Space services and UAM segment. It focuses on both open and specific categories. Marta mentioned that user needs have been already analysed through surveys, identified operational and technical requirements from UAS stakeholders and potential new EGNSS services to cover the identified needs. The next step is to analyse the impact of the new proposals of EGNSS services at different levels.

Additionally, SUGUS project aims at developing an Application Program Interface for GNSS which could be offered in the future to UTM service providers, UAS segment, system developers, etc. As part of the project there will also be a demonstration to show the benefits of the proposed solution. Ms Cueto invited attendees to contact her directly in case of any questions.

Maurizio Trezza complemented Ms Cueto. SUGUS project aims to fill gaps in the current EGNSS system. In order to ensure that we have analysed operational experience that we gathered from past projects. It is nice to see how our results are relevant to the questions we just heard. We have got an operational experience from U-Space projects and demonstrators (GAUSS).

According to our stakeholders, most of the drone operators intend to fly below 50m within a specific category, under BVLOS conditions and occasionally in the urban environment with a duration of a flight about 30 minutes. Flight notification time spans from 30 minutes to one day in advance. GNSS outage has a potential of medium to high impact on the operation.

Ms Aguilera proposed to link some results from the project to the communication on the UCP. She suggested they should discuss offline how to provide this material to the group. Maurizio noted that they have a dedicated site, where project results are shared.

Ms Aguilera thanked all participants, panellist and closed the meeting.

- **Closure**

Ms Aguilera thanked all speakers and panellists for the fruitful discussions and invited all attendees of the plenary of UCP 2020 on Monday 07 December 2020.

Conclusions

The discussion during the UCP 2020 Aviation and Drones highlighted the following points:

User requirements on Space to enable greener aviation

Space-based CNS solutions provide a number of benefits for greener aviation and more sustainable environment. For instance:

- EGNOS-based approaches can contribute to noise and CO_2 reduction around airports.

- RNP procedures can contribute to CO_2 reduction.

- A scalable ATM system based on satellite-based logic can support implementation of other environmental solutions.

- GNSS and Copernicus applications can support better flight path selection by avoiding hyper saturated areas in the sky identified by these applications.

- GNSS and Copernicus applications can support mitigation of negative secondary effects of environmental solutions, such as solar farms affecting ATM network.

User requirements on PBN Implementation and future evolution for navigation

Navigation is evolving and PBN offers major benefits to stakeholders, but the pandemic brings certain challenges:

- Airlines highlighted the challenges with planning of investments into fleet and emphasised the challenge to estimate the cost benefit.

- PBN can provide additional opportunities on the top of its current scope (e.g. RNP Procedures for parallel runways).

- LPV procedures at VFR aerodromes could provide number of benefits.

- With a remotely piloted aircraft and increased dependency on GNSS, its reliability becomes utterly important.

User requirements on Space for Drone operations and urban mobility

With a technological advance, drone-based use cases are widening, and it is clear that access to urban airspace will bring strict requirements:

- The global availability and scalability are the key drivers of using satellite-based navigation.
- For operations in an urban environment, a high availability and accuracy of navigation are needed.
- Technology is ready and the more data is analysed the better improvements can be offered.
- GNSS integrity events are unacceptable. EGNOS is a great tool to ensure high integrity among other but in the future when traffic is high, more than EGNOS will be needed.
- The industry will require advanced airspace structures, advanced surveillance, and D&A capabilities.
- In an urban environment drones should not reply on a single positioning solution

Actions					
ID	Action Description	Responsible	Due Date	Status	Comments
1	Attendees are requested to complete the questionnaire on user requirements available from: https://ec.europa.eu/eusurvey/runner/AviationUCP2020	Attendees	1.3.2021	Open	

[Include Reference if Actions are traced at another location]

Annexes & Attachments
Attachment 1: UCP 2020 Day 1 – Aviation panel moderation presentation

End of Document