Question	Answer
Has SESAR envisaged which data base that will be used for aeronautical data storage? Do you think that specific technology like Blockchain will offer additional protection to aeronautical data?	Emilien Robert In the Aeronautical Information Management (AIM) world, the current transition is from paper AIP's published by States and then transposed into electronic charts by the data houses, to a completely digital data chain, where the Aeronautical Information Publication is based on the Aeronautical Information Exchange Model (AIXM). Obviously blockchain could be an option here, personally I believe there are simpler methods. However, that should really be more the subject of a webinar on AIM rather than CNS (even if AIM admittedly also contains data about CNS). This question would better be answered by AIM experts.
How can we develop a unified Framework for CNS integrity monitoring and augmentation? What are the key performance metrics and how can we apply this framework to trusted autonomous low-level ATM operations (UTM and UAM in particular)?	Emilien Robert In GNSS we developed a framework for using a non-aviation-specific service by adding augmentation systems which, in combination with the core satellite constellation services, provide integrity. I am not sure why we would need a unified framework for all of CNS since integrity requirements are usually derived from the safety assurance level required by the supported operation. Currently it is still difficult to compare the different performance based concepts in C, N and S as they all grew from different origins and needs. For sure UTM could and maybe even should build on ATM principles, but as far as I am aware there is not much work being done in this area.
Hello Gary, I have liked very much the comparison in terms of bit/s. If I am not wrong, telecom companies differentiate between critical and not critical services. Air Navigation services could be considered safety critical, so how can we consider criticality and not only bit/s?	Gerhard Berz In COM they already use this distinction (such as AOC -airline internal COMs versus ATC COM). While we don't really have a lot of non-critical services in aviation, new concepts such as RPAS / UTM will need to have a very clear service architecture to ensure that the most safety critical parts of the service are well protected.
A measure for channel spacing has been invented for voice TX/Rxs. Do you envisage a similar measure for the operation of NAV or RADAR? Will also ADS contribute to improvement of the spectrum management?	Gerhard Berz For all navigation systems, frequency assignment planning criteria exist. They are currently in Annex 10 but are being moved to Doc 9718. For RADAR operating on the same channels, there is also a coordination in place, but for more details this would need to come from the SUR colleagues. ADS-B can be used as a tool to detect RF interference, and is efficient in the sense that a new service was added to 1030 / 1090 SSR without requiring a new link.
What is your position of assigning C-band for 5G for aviation usage?	Gerhard Berz I strongly support preserving the former MLS C band for aviation use. Whether that is 5G adapted to aviation requirements or something else, will still need to be seen.
For Gerry: What are you mean by stop taking Spectrum for granted and doing more?	Gerhard Berz At ITU, you will have 1 or 2 aviation guys trying to defend their turf facing a whole army of somewhat hostile and impatient telecom guys... we need to be better represented in spectrum groups and need to explain better what our needs and constraints are, many other industries are doing this much better than aviation (SATCOM operators for example, or Broadcasting and electronic news gathering services)

Aviation cycles are long and so transition is complex , A/C life is between 20 and 35 years....	Emilien Robert Agreed, but along its lifecyle, A/C will go through major maintenance during which CNS equipment can be upgraded.
Nowadays, each and every State is legally liable for the traffic being carried out over its airspace. With the introduction of GNSS, how the liability issues (that inevitably arisen), will be addressed ?	Gerhard BerzGerhard The question does not really fit the Webinar topic, but as it seems to be of interest: in short, the best way is through monitoring to ensure that performance requirements are being met. If there is no underperformance, then there is also no liability risk. I wrote a paper on this which can be provided on request: "A Practical Way forward for Multi-Constellation Service Provision based on the ICAO GNSS Charter", Berz and Bergamasco, ION GNSS Conference 2017
Ref. Rationalisation. In our case, we might want to receive the CNS as a Service as well. What solutions do you see for an ANSP to "get rid" of the infrastructure on the ground, allowing them to only buy the data they need? Will there be an EU Infrastructure Company?	Emilien Robert The concept of ATM Data Service Provider is currently being developed, several concept and models are being assessed. Some of these different concept are already capture in the Airspace Architecture Study. For the moment, I am not aware of a single EU infrastructure compagny.
Really pleased to hear Okuary's presentation. We need to treat security at the same level and stage in programme developments as we do safety. ATM has long held safety in high regard and security must be the same.	Okuary Osechas Thank you Robert!
request your view - SESAR CP-PBN IR mentions FOC in 2025 where as PBN IR it is 2030 and moreover some states are pressing for RNAV1 instead of RNP1 in TMA Thanks.	Gerhard Berz Always hard to keep all these documents up to date. The SESAR CP needs to be updated to be in line with the PBN IR. We are also working to update DME standards to enable support to RNP (EUROCAE WG107, RTCA SC227). This should facilitate RNP implementation.
For Okuary: I am Clad to hear that the approach for cybersecurity should be very much different than the IT one. This is something everybody should realise, as Aviation is not like banking industry. What is your opinion? and what is the human role in this on the System Monitoring and Control?	Okuary Osechas Thank you Costas! We have done some work on cybersecurity at the radio interface. At that level the typical methods of IT security aren't much help. To your question: I really don't see an easy way of getting rid of the human in the loop. Maybe that will be increasingly remote, but not completely removed. It's those previously unknown situations that will be hard to tackle.

You talk about a fixed figure for the approach seperation. How do you include the subject of time based separation?	Esther Delgado Pinedo Time based separation is related to weather conditions and to aircraft mix. This is included in the safety case analysis, as well as the communication and surveillance performances. From here, the minimum separation is obtained
Hello Esther, I understand that update rate and error are critical for a surveillance service but there is no reference to probability of detection or false alarms?	Esther Delgado Pinedo Hello Victor, Indeed false alarms and pod have to be consider and be below certain limits, and they will also be addressed in a complete safety case. but the most critical items are considered position accuracy and update rate, that is why in this example I used those
Are KPIs or QoS defined for Satellite VHF Voice	Esther Delgado Pinedo new intiatives are emerging for the use of VHF-like voice in oceanic areas and are still being developed (more difficult implementation for continental areas but also being studied). In next CNS webinar there will be more elaboration on this communication topics.
How will we find VHF spectrum for Satellite VHF in Europe and the vicinity ? Would a digital Voice System (VoIP based) not a better longterm solution?	Esther Delgado Pinedo At this stage the VHF satellite based is being firstly studied for the oceanic areas, taking advantage that there is no need in changing any aircaft system in order to use it. All the solutions will be need to be studied and taked into account depending on the airspace type. taking into account that having a new technology does not imply having to use it in all airspaces
Concerning the GNSS, how the interruption issues being recorded i.e. in Eurocontrol EVAIR data base (more than 850 during 2018) will be tackled?	Gerhard Berz We are working intensely with concerned States, developing guidance and are raising awareness at the ICAO and ITU levels. See a recent ITU Webinar as an example: https://www.itu.int/en/myitu/News/2020/09/21/12/10/Reducing-harmful-interference-to-satellites
how to use satellite VHF voice?	Esther Delgado Pinedo New intiatives are emerging for the use of Satellite based VHF voice in oceanic areas, still being described.

To enable secure CNS, especially secure ADS-B, we need improved avionics STD and impkementation. How long do you expect to force users to invest additional features.	Gerhard Berz We try to improve security with every avionics upgrade step. However, there are many things which can be done to improve CNS security without requiring avionics upgrades. Analysis on this topic is ongoing but typically not openly shared due to the sensitivity of the topic. For GNSS security, I wrote an article on Inside GNSS, titled "Aviation and Spoofing: An Evolving Relationship".
Re the plan to consider the cybersecurity element, building on the question from Thomas, how will this work be undertaken and what standards will be used? How do we ensure that the resulting cybersecurity is and remains robust in the face of an ever changing threat landscape?	Gerhard Berz In GNSS, SBAS navigation authentication authentication and other methods are being analyzed. They usually build on existing security frameworks, and whether for example we need quantum resistant keys is being debated. But continuous assessment is needed.
By Multiconstellation, should we understand GPS+Galileo+Beidou+Glonass? Or only GPS+Galileo?	Gerhard Berz Any core satellite constellation that is standardized in Annex 10 is included. ICAO Navigation Systems Panel is working to approve new SARPs for Galileo, Beidou and new signals on GPS and GLONASS at their November 2020 meeting, which will then go into the State letter review process.
Is there any avionics manufacture planing deliver AeroMACS airborne equipment in2025	Gerhard Berz I think that would be fantastic (preserving aviation use of C band) but I do not know of any, would need to check with COM experts.
"who" will pay for new terrestrial networks such as LDACS ? (the operators ?)	Emilien Robert Dear Claude, The CNS (and more generally ATM) infrastructure cost are covered by the passengers through the redevances. Now what will be the funding flow within the ATM community is not defined yet(or at least I am not aware of) for LDACS. Multiple possibilities exists. VLDM2 is covered by different approaches for instances.
Who shall deal, by what CNS systems, with General Aviation, Leisure traffic in the future?	Emilien Robert Dear Michael, General Aviation is a very broad domain, it ranges from high-end fully equipped jet to light aircraft, mainly for leisure under VFR rules. For the first one, the evolution is the same as all the other aircraft, supported by the concept of best-equipped/best-served, hence the concept of Performance-Based Aerodrome Operating Minima. Concerning small aircraft, a compatible set of equiment will be needed if integration into controlled airspace is foreseen. Besides, new research has been made on improving the traffic awareness using dedicated position reports

On cybersecurity, will you reuse existing standards from the banking or other domains?	<u>Emilien Robert</u> Hello Thomas, Yes, the scope of the on-going SESAR project PJ14-solution 76 is to capture the development performed by other projects.
(For Emilien) Concerning the Performance Based CNS, Please be reminded that in the existing performance regulation there is no any KPI for CNS performance measurement. Do you think that targets etc. you mentioned along with KPIs for CNS have to be introduced ?	<u>Emilien Robert</u> Dear Konstantinos, Yes, the infrastructure is currently monitored, but yes, PKI to further monitor the the CNS performance are needed. SESAR solution PJ14_Solution 76 is working on this aspect together with the further development of the PB CNS concept.
I feel that the target set for 'safe, secure & resilient infrastructure is very high and demanding goal. What practical steps and research are ongoing towards this goal and what is the human role inside all these?	<u>Emilien Robert</u> The practical steps are all the evolution identified in the CNS roadmap. In a way, all evolution of the CNS infrastructure participate in improving this objective. As for research, the SJU projects also form a set of research items supporting this vision. Concerning the human role, it will evolve as new technology emerge, but it will remain at the center of the ATM system. For more information, you can refer to section 4.5 THE ROLE OF THE HUMAN of the European ATM Master Plan ed 2020.
(For Emilien) Concerning the Performance Based CNS what does it mean in practical terms? Will all the European States be obliged to implement specific (future) regulations based on ICAO docs like the 9869 (dealing with RCP)?	<u>Emilien Robert</u> Dear Konstantinos, This roadmap provide a view on how the evolution of CNS is foreseen. Regulation may or may not be a way to implement further the concept in the future.
What about HF enhanced ?	<u>Emilien Robert</u> Dear Claude, I am not aware of HF enhanced. I would be very glad to have more information on it. Also, I can see that you are from Airbus. Airbus is part of the SESAR project 14/Solution 76, we could further elaborate on this. Looking forward for more coordination in this subject.
Minimum Ops Network , Fully agree but devil is in the details Refer to current GNSS performances SARPS, in some case minimum will not be sufficient	<u>Emilien Robert</u> Dear Claude, In some case, MON is foreseen to be a strong rationalisation (ex NDB), on other cases, it will be about optimizing the current infrastructure (ex DME as the short/mid-term APNT).

When you look at the rationalisation, what incentive do you foresee for the ANSP/State owning the System to give it up or to shift it to a different location?	Emilien Robert Dear Thomas, At this stage, rationalisation is based on cost-benefit analysis. If an ANSP can provide the same level of service with less infrastructure, it can mean less cost for the ANSP.
By suitable spectrum, do you mean Safety of life spectrum ?	Gerhard Berz So far we know that safety spectrum is suitable, and we also know that it has not been proven yet that non-safety spectrum is suitable. We can not afford to experiment on this, prior to this being proven. And proving that non-safety spectrum is suitable is not a simple matter as it depends on a lot of dynamics. In a variety of cases, we already have all sorts of problems with safety spectrum.
is it possible to have the recording of this presentation?	Ruben Flohr Yes, the recordings will be published on the SESAR website