

SESAR PJ31 DIGITS/-AU
Open Day Webinar (Dec 1&2, 2020)

Questions and Answers

AVIONICS / AIRBORNE / TRAINING	
Question	Answer
<p>Is FANS C an option for airlines to choose, or will all aircraft delivered by Airbus come with FANS C as standard once it is ready for deployment?</p>	<p>On the Airbus A320 family, FANS C will remain an option (exactly like today with FANS B+ or FANS A+ options). From 2021 onwards:</p> <ul style="list-style-type: none"> • On A320 family, FANS C will be proposed by Airbus as the preferred FANS option. • On A330, FANS C will become the standard Data Link function as it encompasses FANS A+, FANS B+ and ATS B2 capabilities.
<p>How is weather information (notably 4D winds) injected in the FMC ? How do you manage Wind consistency between Ground and Airborne trajectory computation ?</p>	<p>Regarding impact of weather on predictions, short term predictions (up to 100NM) also consider current wind as measured by the aircraft in order to have predictions as accurate as possible. Indeed there is a blending between current wind measured and predicted wind received by datalink (or inserted manually by the pilot based on information provided by the dispatcher. The blending principle is the following:</p> <ul style="list-style-type: none"> - at aircraft position only current wind is considered - from 100NM ahead of the aircraft (in cruise) only predicted wind is considered - in between, a combination of both values is used, with a ponderation between measured and predicted values depending on aircraft position within the 100NM. For eg at 25NM from a/c position measured wind has more importance than predicted wind.
<p>Relevance of Met info for FMS EPP calculation was mentioned only briefly. Is this not most critical for accuracy and stability of EPP? Are there any plans to develop a kind of air accessible dynamic atmospheric repository?</p>	<p>Winds (as well as T°C, ...) are indeed key inputs for ETA accuracy. On board computations have been enhanced:</p> <ul style="list-style-type: none"> - the Airbus FANS C implements a wind grid with 10 levels in descent (vs 3 levels on legacy FMS). - FMS also performs real time updates of wind models, based on the difference between actual and predicted winds. Thus ensuring robustness against wind models inaccuracy.

	<p>Aircraft are capable for years to downlink actual winds via ACARS. Provided a sufficient number of participating a/c, this wind information could be used to feed a dynamic airspace repository. But the business for such a project may be hampered by the growing number of 4D aircraft capable of downlinking accurate ETAs and ready for use in ground trajectory predictors.</p>
<p>The system downloads up to 120 waypoints but how does it fit in a future free flight system with no waypoints at all?</p>	<p>The question likely addresses Free Route, rather than Free Flight. The Extended Projected Profile (EPP) downlinked in the ADS-C report can contain up to 128 Trajectory Points. Those 4D points encompass both fixes belonging to the Lateral Flight Plan of the FMS ; and additional pseudo-waypoints defined by the FMS to enrich the Vertical profile, such as Top of Climb/of Descent, speed changes ... The Lateral Flight plan can contain any fix included in portions of SIDs, STARs, airways, fixes defined by the Airspace User Flight Operations Center, typically sent by ACARS ; and any fix(es) built or selected by the crew ; or uplinked by the ATCO via CPDLC. In all cases such fixes may be either published waypoints or Lat/lon fixes (non published). Ad-hoc Lat/lon fixes defined by the FOC can reflect the preferred Trajectory inside a Free Route Airspace negotiated in the Planning Phase. As a conclusion, EPP allows to reflect with high fidelity, in 4 dimensions, any portion of trajectory pre-defined by the Airspace User (both Fixed Route and Free Route), defined/modified by the crew, or instructed by the ATC.</p> <p>Nota: From an airline and aircraft system point of view, Free Route does not mean that there is no planned trajectory (only be for regular fuel check). On the contrary, the EPP report provides the ATC with a visibility on the trajectory which is not reflected in the ATC flight plan.</p>
<p>Is FANS and/or CPDLC routinely available to airline pilots on short and medium haul (continental) routes, or only on long haul aircraft? I.e. is more training required for short haul crews than long haul crews when transitioning to ADS-C?</p>	<p>The training for a pilot already familiar with either FANS A+ or FANS B+, transitioning to FANS C is similar. The new ADS-C part of the FANS C is not the core of the modification for the pilot, considering that ADS-C is relatively transparent in the cockpit (ATC manages the ADS contract, and the aircraft system automatically downloads the report). The main objective remains to understand the concept of use of the ATC datalink messages, onboard HMIs, and associated automations.</p> <p>Airbus cockpit design relies on a high level of commonality for HMI and principle of use. Whatever the aircraft programme from A320 to A380 families, and whatever the FANS solution (A+, B+, A+B, or C), the Airbus design for the ATC datalink communication intends to be intuitive, to reduce the workload of the pilot during the operations, and ease use of datalink for a pilot in a mixed fleet context.</p> <p>The Airbus ATC datalink function relies on a common use of the attention getters (ATC MSG push button), the datalink pages to find all the set of ATC datalink messages and management of log on with ground ATC centers (MCDU or MFD), and the central display for the message (received or to be transmitted), and the active ATC centers (DCDU or mailbox).</p> <p>The pilot does not need to select the technology of the ground station (ACARS or ATN), it is automatically selected by the system.</p>

	<p>In addition, some complex route clearances can be transferred directly from the "inbox" to the FMS temporary or secondary flight plan.</p> <p>Therefore the Airbus e-learning (Computer-Based training) for FANS C lasts about 2 hours to cover the following items:</p> <ul style="list-style-type: none"> - a necessary theoretical part on the concept of the different technologies : FANS 1/A (with CPDLC/ADS-C), ATN B1(with CPDLC), ATN B2 (with Continental ADS-C and ground clearances) as well as ATS 623 features (D-ATIS/Oceanic Clearance/Departure Clearance), - the use of HMI and applications. - the operational use of the different features during the operational scenario of a flight passing through airspaces with different ground ATC center capabilities. - the key items: the correct understanding of the CPDLC inhibition and cancellation mechanism, how to load from "inbox" to FMS, datalink page organization, management of the deferred clearance, and management of the route request. <p>Note: Our training support for FANS C has been reworked in order to focus on an operational scenario, and is even shorter compared to our former FANS A+ or FANS B+ e-learning..</p>
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<p>Does an airline have a say in what data to be included by default?</p>	<p>The airlines can no longer modify what is standardized (IATA contributed to the standardization bodies). Basic data are sent by default and other groups are provided upon request by the ATC.</p>
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<p>As I understood both Airbus and MUAC implementations are capable of ATS-B2 including CPDLC, so did you experiment CPDLC messages operationally during the VLD ?</p>	<p>MUAC: At MUAC only the currently implemented B1 messages (translated to the B2 version) were used.</p>
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USE OF AIRCRAFT TRAJECTORY DATA IN ATC GROUND TOOLS

Question	Answer
<p>Do ATCOs use the Flight Level info per WPT from EPP to have a clearer knowledge of the vertical profile of the flights?</p>	<p>DFS: There seem to be two options and both can apply in certain situations</p> <ol style="list-style-type: none"> 1) ATCOs use the FL info from EPP directly 2) EPP information is used to improve/enhance the vertical profile calculation of the ground TP and ATCO profits from this enhancement.

	<p>Option 1) will in certain situations suffer when air and ground constraints are not sufficiently synchronized, in this case Option 2) would be superior.</p> <p>MUAC: At MUAC the controllers have reported using the top of climb and FLs associated with relevant waypoints to judge the climb and assess which downstream sector (high/low configurations) to coordinate with. They have reported that in general the EPP FLs are reliable but in unpredictable weather conditions they become more variable. Note that due to the small number of equipped aircraft and only a subset of those actually climbing and needing coordination this is a very preliminary view.</p>
<p>Are the vertical info from the EPP used by the ATCOs in case of vertically evolving flights?</p> <p>Were there some data used in EPP to feed kind of ground trajectory prediction?</p>	<p>The TP validated in 18-06a did not use the vertical data except for the TOC and TOD altitude (being relevant for the identification of flight phases and selection of the appropriate speed schedule).</p> <p>Airbus made a laboratory test of a BADA calibration process making use of detailed vertical profiles, and this provides very promising results.</p> <p>Similar calibration process will also be implemented and validated in PJ.18-W2-53B solution, in industrial TPs.</p>
<p>All other 8 groups – such as Meteorological Information, Air Vector or TOA Range - are broadcasted during a contract – either periodic or demand -, or just the ones selected by the ATC side (or set perhaps previously by Airbus during installation)?</p>	<p>The airlines can no longer modify what is standardized (IATA contributed to the standardization body). Basic data are sent by default and other groups are provided upon request by the ATC.</p>
<p>How many waypoints were requested in the EPP reports per partner ? Is there any lesson learnt to not request 128 waypoints everytime ?</p>	<p>MUAC started the project by requesting 10 waypoints and changed this part way through to 20 waypoints. The reason for not requesting 128 waypoints is that this is far more than what is needed to cover the MUAC area. If a Common Service is developed this number will become more relevant. ENAV requested 70 EPP waypoints with a 4 minutes frequency.</p>
<p>At MUAC, did you observe side effect with CPDLC B1 traffic when EPP were used ?</p>	<p>MUAC: No side effect was observed or reported.</p>

<p>Thanks to Ground Traffic Predictor improvement with EPP, did you observe better predictability ? Did you compare recorded EPP data with Ground TP improved with EPP ?</p>	<p>In solution 18-06a, we have promising results but still not confirmed improvement. We have detected the need to further improve the industrial TP as described in the 18-06a presentation in order to secure/maximize the benefits, and this will be validated in PJ.18-W2-53B solution.</p> <p>Additionally, within PJ31, Airbus performed an initial analysis (in the lab) of the potential benefits of some of those ideas for further TP improvements, and the results confirm the initial hypothesis (see presentation "ADS-C contribution to ground TP enhancement: a few figures"). In this study, recorded EPP were also compared to Ground TP improved with EPP, and with the use of the mass, speed and calibration, the predictions from Ground TP are similar to the recorded EPP data.</p>
<p>Could we consider an adaptive HMI, to be able to decrease the number of data displayed during peak hours (high load in the sector) ?</p> <p>In other terms, does the workload of ATCo increase because of these new EPP data during rush hours ?</p>	<p>MUAC: There were no reports of an increase in workload due to the display of the EPP. In fact the controllers preferred to have the discrepancy warning as traffic increased and this was an extra safety aid. A decision related to an adaptive HMI would be up to the individual ANSP/units experience.</p>
<p>Have there been incidents where aircraft did not adhere to the trajectory downlinked to the ground?</p>	<p>MUAC: This is difficult to answer as to what accuracy of adherence is needed (TMA may be different from en-route).</p>
<p>There should be an operational incentive for airlines to equip (best equipped best served). There is no ensurance that by displaying EPP to ATCOs (too much information when all aircraft will do it) will ensure that FMS trajectory is used in the ground (by ATCOs and/or FDP) to the maximum extent possible (no discrepancy between air-ground trajectories). How ANSPS will have to adapt ATCOs procedures/training or change FDP to</p>	<p>This is for the SESAR DM to assess the principle of "Most Capable Best Served" to accelerate function deployment and adoption. We suggest this question is addressed at EC level.</p>

<p>make sure that best equipped are best served ?</p>	
<p>When FMS and ground route are consistent, do you think estimates over each waypoint could be used?</p> <p>Could a FDP use those EPP estimates?</p>	<p>Once the TP implements the described ADS-C data usage, the ETOs accuracy on both FMS and FDP sides would be limited by:</p> <ul style="list-style-type: none"> · Wrong or incomplete flight plan data (route and/or applicable restrictions) · Unpredictable tactical ATCO/Crew decisions modifying the trajectory · Meteo data accuracy <p>Assuming that both the FMS and the FDP have correct flight plan information, and assuming no tactical deviations are happening, the accuracy is only limited by MET data. Normally, the FMS manages better short-term data, while the FDP manages better mid/long-term data.</p> <p>Yes, but the ground TP (improved by ADS-C) is also able to predict good ETOs. However, having an on-board computed ETO might be useful to better estimate the FIR entry time before being coordinated by upstream centre, and before having correlated tracks. This could be achieved through ground distribution of downlinked ADS-C data.</p>
<p>Trajectory is used in the ground (by ATCOs and/or FDP) to the maximum extent possible (no discrepancy between air-ground trajectories). How ANSPS will have to adapt ATCOs procedures / training or change FDP to make sure that best equipped are best served ?</p>	<p>MUAC: Once it is understood what best equipped best served means we will be able to assess the impact on procedures etc.</p>
<p>Question for Airbus: which version of BADA did you use in your ground TP implementation ? 3.x or 4.X ?</p>	<p>Latest BADA 3 version</p>
<p>Are there any AMAN manufacturer involved in the research , potentially developing functions for integration of ADS-C data in their algorithms?</p>	<p>No, not currently</p>

<p>NATS signed a cooperation agreement with AIREON for supply of space based ADS-B. According to NATS, how ADS-B and ADS-C are complementary for arrival management improvement?</p>	<p>ADS-B and ADS-C are unrelated technologies, despite the similar names: ADS-B provides surveillance (position reporting) whereas ADS-C enables us to receive the aircraft's prediction of its future trajectory (including estimated arrival time -ETA). ADS-B position reports are no use to arrival management on their own, but can be used as input data to initialise a ground-based trajectory prediction to calculate an ETA Because of predicted equipage rates and times, in the short term an AMAN will rely on ground trajectory prediction (as it does today), and this can include using ADS-B as input data, for example for oceanic arrivals. As ADS-B equipage increases, there is an opportunity to use aircraft-calculated ETAs in AMAN, when available. As the equipage of ADS-C may take an extended period of time, it is likely that the two solutions will be used concurrently.</p>
<p>What is the legal framework for sharing ADS-C EPP data regarding IPR ? Who is proprietary of the data ? Airlines ? Can all ANSPs and other organisations (Research, statistics, other service providers) use this data ?</p>	<p>Our understanding is that data might be the ownership of the airlines but that the addressees of datalink messages (ie. ANSP) and Services suppliers (at network level) can make use of information operationally, or through research activity as long as the objective is to improve aircraft operations. In the short term, research actors have to sign an agreement with airlines (e.g. PJ18W2 NDA) but this question must be addressed beyond SESAR level. Under investigation with legal support.</p>
<p>Are you taking into account new airspace users like UAS / Drones ?</p>	<p>The ADS-C ATS-B2 standard was defined on the basis of IFR flights operating in Controlled Airspaces. This standard might apply to RPAS (Remotely Piloted Aircraft System) the day they can be better accommodated or integrated in such airspaces, and if (or where) regulations on use of ADS-C apply to them. SESAR 2020 PJ 13 R&T is in charge of the RPAS integration in A, B, C airspace classes.</p>
<p>The CP1 only mandates ADS-C/ EPP. Does it mean that the ground end systems will accept CM logon from aircraft equipped with CPDLC v1 (B1) and ADS-C v1 (B2) and ATCs will only use services based on this combination of applications?</p>	<p>DFS: from our point of view CPDLC v1 (B1) and ADS-C v1 (B2) shall be supported. Several PJ31 ground partners factually operated this way (B1 CPDLC from OPS and B2 ADS-C from Shadow Mode Test System). When ADS-C comes via ADS-C Common Service, local CPDLC version of ANSP will not matter.</p>

REGULATION / STANDARDIZATION

Question	Answer
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<p>Is there a difference between ATS B2 and ATN B2?</p>	<p>ATS-B2 and ATN-B2 actually refer to the same applications. The standardized name is ATS (Air Traffic Services)-B2 to reflect the neutrality of these applications with regard to technology (OSI or IPS). The acronym ATN (Air Telecommunication Network) is theoretically "technology-agnostic" as well as ATS; but is often confused with OSI as the only existing implementation (Europe) is relying on this technology.</p>
<p>Previously, there was a PCP AF6 (intended mandate) for ANSP deployment - what is its status ?</p> <p>What is the current status of the CP1? Is it available for public?</p>	<p>PCP (Pilot Common Project) was the current EU Regulation No 716/2014 supporting the deployment of the European Air Traffic Management modernization. PCP AF6 was addressing the deployment of Trajectory Information Sharing. PCP is now superseded by Common Project 1 (CP1) which has been officially published by EU on Feb 1st, 2021 (EU COMMISSION IMPLEMENTING REGULATION 2021/116). This document is public.</p> <p>Note: please consult this Regulation for further information on this mandate on European ANSP, Network Manager and new aircraft delivered from 31/12/2027.</p>
<p>Is CP1 (AF6) applicable airspace the same as the Baseline 1 mandate (above FL 285) or will it extend to lower airspace ?</p>	<p>Yes (FL 285)</p>
<p>CP1 requires ATS providers to ensure they enable i4D above flight level 285". The limit of FL > 285 is a significant drawback from the PCP. What are the plans for ATSUs controlling only lower airspace. Are they expected to implement EPP processing?</p>	<p>CP1 requires FL285 and above. For lower airspace, it may be implemented locally by ANSPs (i.e. MUAC FL245) if data link service is reliable enough. This depends also on ATN coverage.</p>
<p>Best Equipped - Best Served (BEBS) is (also) a legal issue. Is there some effort on the European level to solve this issue?</p>	<p>There is no legal impediment to the deployment of operational incentives (e.g. Best Equipped Best Served , Most Capable Best Served, ...). This was set forth in ICAO ANC 13 report.</p>

<p>Where does ATS B2 stand as a global standard and ICAO?</p>	<p>ATS-B2 standards (resp. for CPDLC and for ADS-C Air/Ground exchanges) are referred to in two main ICAO documents :</p> <p>1) the PANS ATM (Doc 4444 - Procedures for Air Navigation Services - Air Traffic Management)</p> <p>2) in the GOLD (Doc 10037 - Global Operational Data Link, the second edition of which is anticipated to be released in 2021).</p>
<p>What would be the Airspace Users' and Controllers stance on the use of "complex" CPDLC route clearances? Based on current experience with current "FANS C" avionics, is room for growth for longer and more complex clearances deemed likely?</p>	<p>1) The feedback gathered by MUAC during DIGITS was quite positive with regards to the usage of some complex CPDLC instructions relative to the MUAC airspace.</p> <p>2) with regards to the expansion of the concept, an anticipated feedback can be retrieved from SESAR 2020 R&T, where complex CPDLC clearances were studied (complex clearances were either multi elements clearances for delivering the start of descent clearance or lateral closed loop route clearances using UM79R or UM266). Whatever the case, these clearances were delivered 'by anticipation' (e.g some minutes before the start of change is needed). Results from numerous coupled manned simulations (Airbus cockpit simulator, ATC simulators in three adjacent european ACCs), led to the early conclusion that CPDLC ATS-B2 saved workload for controllers and for crews (reducing tactical intervention or voice exchanges), increased situation awareness on both side and that such CPDCL complex clearances were easily understandable by the pilots.</p>
<p>NEXT STEPS</p>	
<p>Question</p>	<p>Answer</p>
<p>Any plans to deploy ATN/IPS in coordination with LDACS and/or SATCOM deployment? Or will these links be still used with ATN/OSI?</p>	<p>ATN/IPS does not provide any benefits (bandwidth, performance, ...) vs ATN/OSI. ATN/IPS will introduce increased vulnerability of ATC Com to data Security. So, the European vision is to defer the transition to ATN/IPS with the transition to future Datalink media (LDACS, ...).</p>
<p>Any views on potential VDL2 improvements currently under standardisation, like Connection less VDL2?</p>	<p>Any VDL2 improvements, allowing to delay the need for a future datalink media, is worth being considered. But this is beyond DIGITS project remits.</p>