Presenting LDACS – 3rd Session
Deployment options and transition scenarios

Questions and Answers from the third LDACS webinar.
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No	Question	Answer
1	LDACS will be prpietary as VDLm2 or STACOM or it will be a standard?	Armin Schlereth It is currently standardized within ICAO. Draft Standards are published. Final ICAO Standards are expected in 2024.
2	You will find all presentations, Q&A and recording at https://www.sesarju.eu/webinars	
3	What is the expected LDACS developement roadmap in the frame of SESAR 3 progamme ?	Thomas Gräupl **CEF-SESAR-2022-DES-DSD-01-01: Digital Sky Demonstrators on gradual transition towards higher levels of automation** : : • **Demonstration of a multilink communication infrastructure for increased ANS productivity**: including the multilink communication environment as developed in SESAR 2020 and software defined radios, where different airborne users could be connected to the ground through different communication means e.g. SatCom geostationary, SatCom LEO, AeroMACS, L-DACS, etc., demonstrating a seamless and automatic switch between different technologies based on availability and performance needs (**PJ.14-W2-60 and PJ.14-W2-77, AAS TP Milestone 6: Trajectory Based Operations (TBO))**. This shall include: : : • The demonstration of **LDACS A/G datalink**, including revenue flights at a large scale, combined with multilink environment and addressing operational use cases. The initial deployment target date is 2024 for L-DACS capabilities (even if this DSD is focused on datalink aspects). • Relevant operational use-cases in an integrated operational-technical environment to show the benefits of the new CNS infrastructure and the scalability of the new technological datalink solutions of LDACS and Multilink. This covers initial TBO use cases that will require new communication infrastructure e.g. LDACS datalink with a higher performance (e.g. lower latency); : :

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		SRIA flagships and their R & I needs Connected and automated ATM : : Ten R & I needs have been identified in relation with this flagship: • **Enabling the deployment of a performance-based communications, navigation and surveillance (CNS) service offer**, building on the industrial research on selected technologies (e.g. SATCOM, AeroMACS, LDACS, etc.) carried out in SESAR 2020: Industrial research and demonstration of an integrated performance-based CNS service offer will be required building on the industrial research on selected technologies (e.g. SATCOM, AeroMACS, LDACS, etc.) carried out in SESAR 2020. This unified framework, made up of a backbone infrastructure, supported by a backup minimum operational network, will maximise cross-domain opportunities and synergies and will support various airspace concepts. The development of non-safety-of-life ATM applications using commercially available services (e.g. 5G, open SATCOM) will be required in or der to contribute to a hyper-connected ATM system.
4	What is airframer perspective on LDACS ? Has Airbus included LDACS as part of their FANS evolution roadmap ?	Klauspeter Hauf LDACS is on the roadmaps of Airbus and Boeing. However, the development is not confirmed as there is no final decision take by the aviation industry.
5	Do we have the opinion of aircraft manufactures on LDACS? What is their plan?	Klauspeter Hauf LDACS is on the roadmaps of Airbus and Boeing. However, the development is not confirmed as there is no final decision take by the aviation industry.
6	NAV and SUR have already moved to satellites. Could they not provide enough bandwith for our communications with aircaft as well?	Ricardo De Sousa Hi Bart, totally agree that a satellite based technology is an essential part of the future technology mix; terrestrial and satellite based systems will have many specific advantages, and a few disadvantages, which can be balanced across the multilink ideas that we put together. It should also be noted that technologies in use for SatNAV (GNSS) and Satellite ADS-B are not suitable for bidirectional communication services.
7	Many points made to ensure LDACS complies to CNS/RCP/ ANSP requirements. Can you please list all the requirements for the network? Also, should set a side some time in timeline to ensure these requirements are being met by LDACS.	Klauspeter Hauf The RCP/RSP requirements can be found at Eurocae ED228A and RTCA DO350. RCP130 is the most stringent RCP class approved up to now. LDACS is validated to comply with RCP130 but provide plenty of margin to comply also with the emerging RCP60 proposed. A LDACS validation against RCP60 will only be performed once RCP60 is approved.

No	Question	Answer
8	General question: SATCOM has a bad reputation wrt. cost. But do you think LDACS can be cheaper, considering that new infrastructure is needed?	Ricardo De Sousa The cost for LDACS service delivery still needs in-depth review with information from all manufacturers into the discussion. Overall I think that the key will be whether equivalent LDACS performance/coverage can be delivered with fewer stations than VDL for example; the lifetime cost of those stations; and how quickly any reduction in VDL stations can be realised - very important transition mapping work to be done. Klauspeter Hauf Main cost driver for both technologies is Aircraft equipage. New Avionics is needed in either case. Terrestrial infrastructure have some advantages but also disadvantages over Space Based systems. Eurocontrol / SJU are working on a Business case comparing the different technologies. Results will be available later this year.
9	Q: is there any connection to A-SMGCS EUROCAE WG41?	Klauspeter Hauf No – nothing the panel is aware of
10	Yes 3 G Services was stopped in Germany!	Klauspeter Hauf 3G is decommissioned in Europe already or will be soon by the mobile phone providers. The frequencies allocated to 3G will be reused for 4G/5G networks. This is an excellent showcase that Aircraft equipage cannot keep pace with public telecommunication industries fast evolution. By the way: 6G development have been started already
11	Can't we get rid of VDL for DL use? ANSPs can hardly afford to add on technologies and, thus, cost.	Gareth Lawton The concept of MultiLink is to introduce choice and that should include ANSPs
12	!The better LDACS is the death of the good...so AEROMACS is dead!	Armin Schlereth AeroMACS is based on 3G more or less. 3G is currently put out of service by telecom providers. LDACS is similar to 4G/5G.
13	Ric. Good presentation. Thanks. what centralized deployment means ? deploy optimal infrastructure from a European perspective without national or cross border constraints ??	Ricardo De Sousa Absolutely Paco, for me it makes complete sense to treat datalink and A/G supporting networks at the pan-European level. I can see that with an entity charged with doing this can manage deployment and transition at the European 'service' level with significant benefits to the users.
14	It sounds that LDACS communications will be integrated via satellite. If this will be the case to which extent the performance of LDACS will be affected due to low availability figures that the satellite network has from time to time?	Armin Schlereth LDACS is and independent link of SATCOM and relies on ground-based infrastructure like VDL 2 does.

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15	Does LDACS address commercial aircraft operating in airspace or does this include military and General aircraft operation? Major Ron Ogan USAF Civil Air Patrol ron.ogan@mswg.cap.gov IEEE Aerospace & Electronic Systems soiciety www.ieee-aess.org	Ricardo De Sousa LDACS addresses all Aircraft operating in controlled Airspace and having a need to exchange information with ground entities (AOC and ATC) on a high performing link. General aviation is included in various studies to allow to get them connected with even lower limits for Size, weight and power on board. Military GAT operations are considered as long as operating as regular Airspace users in controlled airspace. All Aircraft that are candidate to carry VDL technology are in scope for LDACS in the future. Benefits to smaller aircraft and RPAS are seen at some use cases like ADS-C that need to be considered.
16	Is there any estimate about the error rate during the LDACS communication? Also Is it possible a State having to adopt (eg. in TMA) RCP 30 instead of 60 that was mentioned for LDACS?	Michael Schnell BER shall be better than 10^-6. It is difficult to give RCP values. For sure LDACS will cover RCP130 and the proposed RCP60 most likely. However, we can only give a firm statement as soon as RCP60 is finally defined. It will even be able to go beyond that. The problem here to give firm statements is that RCP includes the operators response times and for the system the RCTP is more relevant. Having firm RCTP values available, we can give more detailed answers.
17	What is the strategy of IPS implementation in Europe? Is the target date compatible with VDLm2 saturation issue? No way to work with ATN?	Armin Schlereth LDACS data capability focusses on IP; i.e. ATN/IPS. However, it provides sufficient capacity to transport encapsulated ATN/OSI traffic similar to the ESA/IRIS solution. LDACS can already be used for ATN/OSI and if an aircraft or a region switches to IPS, there is no need to change the aircraft radio system. Europe is currently proposing 4 scenarios of how the IPS solution in Europe could look like. In our opinion, the most promising is the Multlink scenario, which includes a SatCom system and a terrestrial system - LDACS. In this scenario it is considered that VDLM2 is only used for OSI-based communication and not for IPS communication.
18	how to manage different protocol between VHF = OSI and LDACS = IPS ?	Armin Schlereth LDACS supports several different network protocols (e.g. IPv6 and OSI) and the LDACS ground radios will be able to transfer/manage several protocols simultaneously. There is a SDP layer in the LDACS design, which allows ATN/OSI and ATN/IPS as well. Currently we also have AOC over AVLC in parallel to ATN/OSI over AVLC in VDL Mode 2.
19	Why would an aircraft need simultaneous VDL Mode 2 and LDACS links? If an LDACS link is available, why wouldn't all data link messages go through LDACS?	Michael Schnell Actually, you are completely right. It is mainly not about having both running in parallel, it is more about available ground infrastructure. During deployment/rollout, it is important that LDACS usage can start with the first ground station deployments. Now, if LDACS and VDL is available onboard you can immediately use LDACS where deployed and switch back to VDL where not yet deployed. This way, LDACS can start deployment in areas where needed most and then successively be

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		deployed elsewhere.
20	Thanks a lot Thomas for the comprehensive presentation. However, is the only the bandwidth issue that discourage the adoption of VDL2? If yes why both systems have to coexist and for how long?	Armin Schlereth The VHF band is congested and there is only a limit number of additional channels that can be assigned to VDL (in particular in Europe). However, there is thousands of Aircraft equipped with VDL M2 today that will be operated for many more years. Some of these Aircraft are rather new and can be expected to be another 20+ years in the system It is unlikely that all these Aircraft will be retrofitted with LDACS, i.e. VDL M2 will be required as long as Aircraft are flying only equipped with VDL M2.
21	the envisaged bandwidth is 5Mhz? 25khz *200	Armin Schlereth Bandwidth is about 500 kHZ. LDACS uses higher rate digital modulation (up to 64 QAM compared to D8PSK for VDL Mod2) and has a better channel encoding and total design. The VDL 2 design has another shortcoming in it not implementing the pulse shape equally space onto TX and RX as you can read in every textbook to do so. It does it only in the receiver, which already lead to about 3dB loss.
22	Would it be possible to have the webinar slides? Thanks	Slides, Recording and the Q&A will be made available at: https://www.sesarju.eu/webinars
23	What is the status of EUROCAE MOPS for LDACS avionics ?? any MOPS development on RTCA side ?	Armin Schlereth As I am chairing WG-82: We are still waiting for interest from industry to get started working on MASPS and MOPS. It is already on our TOR for quite q while.
24	Q: So LDACS can or shall be used by the UAS/RPAS (DAA) as well in Low Airspace VLL up to 500 ft or above?	Ricardo De Sousa For me anything that is a candidate currently to carry VDL technology, will be in scope for LDACS in the future; the benefit of expanding the scope to smaller aircraft will need to be looked at during deployment planning, and I can see some use cases for especially the ADS-C capabilities for smaller aircraft and drones that need to be considered. Klauspeter Hauf LDACS focus on the controlled Airspace and Airports. Serving lower Airspaces is possible but would require more spectrum and a ground infrastructure similar to public mobile networks; i.e. very expansive and spectrum becomes a challenge
25	For Thomas: Just to make sure - the proposed LDACS/VDL combination means, that VDL+LDACS would be seen as a single air/ground link from multilink perspective rather than as two distinct air/ground links. Right?	Thomas Boegl In most cases it can be seen as one link with two modes: VHF is narrowband and LDACS is broadband.
26	What specific aircraft equipment is required for LDACS? Major Ron Ogan USAF Civil Air Patrol ron.ogan@mswg.cap.gov IEEE Aerospace & Electronic Systems soiciety www.ieee-aess.org	Armin Schlereth A LDACS capable transceiver and modified antennas are required. You will find further details on the slides of Thomas Boegl (R&S)
27	Very interesting presentation from A4E/IATA/JURG, Can we get the slides ??	You will find all presentations, Q&A and recording at https://www.sesarju.eu/webinars

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28	To Laurent: When you say VDL life can be prolonged by AOC optimization, do you think this optimization can outpace the fleets renewal? I've heard that new aircraft send up to 10x more AOC than old aircraft and this may grow. The optimization would thus have to be quite huge.	Klauspeter Hauf The AOC and ATC optimization will help to extent the VDLM2 lifetime; i.e. get us some more time before VDL get congested, but will not be sufficient to keep pace with the industry trend towards the "connected Aircraft" or to cope with the "European digital Sky" in the long run.
29	Will you please make presentation available? they are very good! Thanks!	You will find all presentations, Q&A and recording at https://www.sesarju.eu/webinars
30	IATA Supporting Laurent from AFR Position on LDACS: Considering on-going trials on electromagnetic spectrum compatibility, technical performance and use cases, further evaluation is required before a final recommendation. Potential uses of LDAC for APNT applications should also be further explored.	Klauspeter Hauf Thanks for the support!
31	Any particular reason why NON-IDRP is not mentioned as a means for off setting the congestion?	Armin Schlereth As far as I recall the numbers of IDRP contributes for approx. 20 % of the ATC traffic share, i.e. IDRP 8-10% of the total AVLC - this is pretty high figure worth to work on to remove. SDM launches a WP on the non-use of IDRP. Recommendations are expected in Q4/2021
32	90 % ratio of protocl overhead in ATN really depends on the real application traffic. In case there is not much real application traffic you get only overhead.	thanks for confirming the nature of the ATN/OSI protocol
33	Why dose the industry not yet show any confidence/benefit in the impl. of NON-IDRP?	Klauspeter Hauf SDM launches a WP on the non-use of IDRP. Recommendations are expected in Q4/2021.
34	no retrofit will be needed for SAT-VHF, it's an ITU condition!	Klauspeter Hauf Space Based VHF is focusing on oceanic Airspaces and have only a very limited use in continental Airspaces. It should be noted that the VHF band is congested (at least in Europe) and SB VHF will require dedicated Frequencies to avoid interference with the existing VHF ground infrastructure.
35	LDACS is supported by Airlines if we get a clear view on our investment costs (CBA) and AEROMACS can be stopped (hopefully) as it is a really old Technology already. MERCI	Klauspeter Hauf Eurocontrol and SJU are working on a Business Case for emerging A/G technologies (LDACS, SatCOM, Multilink). Results are expected later this year. AeroMACS is deployed in some places to interconnect Airport (ground) infrastructure but not in use for Aircraft Communication anywhere.
36	Will the recording be available later? I should leave soon...	You will find all presentations, Q&A and recording at https://www.sesarju.eu/webinars
37	Looking at the time and investment needed to implement CPDLC, the entire concept being implemented is rather old-fashioned. Let me be slightly provocative, what is new and will make this implementation worth the investment, for both the ground and the air?	Armin Schlereth Looking at LDACS. It will provide much more bandwidth, prioritisation of services and security compared to VDL 2 allowing new applications and concepts. VDL 2 is still not working as required due to its bandwidth constraints and some other limitations