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SESAR Digital Academy Webinar:
Smarter, Safer and More Efficient Arrivals
Moderated by Olivia Nunez
ATM expert, SESAR JU
Hosted by
SESAR

Today's speakers

Enhanced Arrivals and Departures (Descent Phase Support)

- Sian Andrews, SESAR Solution Lead, NATS

Zurich's streaming processes for early morning long-haul arrivals

- Anaïs Lacroix, Capacity Management, Skyguide

Mitigating Wake Turbulence Risk During Final Approach via Plate Lines

- Dr. Frank Holzäpfel, Senior Scientist, DLR

Question	Answer
Aren't all these time constraints overloading the ATCOs (e.g.: in the upper airspace)?	In the current XMAN operation, neighbouring ANSPs pass XMAN instructions to about 50% of Heathrow arrivals (in 2019). The concept we are working on will be configurable, so we can decide on the threshold that would trigger a target time and decide upon a manageable level of workload. However, the wider subject is certainly an issue and one which ANSPs 'in the middle' of lots of airports are concerned about. Really, a datalink solution would be better.
Can the "Time over Metering Fix" be compared to the principle of Controlled Time of arrival worked out with notably LFV based on CPDLC and ADS-C exchanges?	Yes, they are similar. This version is based upon 'best endeavours' because we do not want to prevent an ATCO from using speed to solve a separation issue. Datalink would certainly help the concept though, provided that the local ANSP was also aware of what time had been passed.
How is compliance for the TOMs or speed instructions monitored/enforced?	At this stage of research, it is envisioned as a "best endeavours" target. The AMAN will continue to track the aircraft.
Please explain the rules applied when sequencing the aircraft aiming towards the TOM? Question is: Who get priority and based on what reason?	The aircraft are sequenced based on their Estimated Time of Arrival (ETA) order at the metering point. i.e. first come first served.
Have you considered the fuel inefficiencies caused by the TOM concept because of incorrect wind information in the FMC's? Also the consequences of the speed unpredictability for ATC of a/c chasing an RTA in a high-density arrival stream?	Our baseline is orbiting London at 10,000ft for several minutes and the slight inefficiency caused by the difference between the FMS wind model and reality is much less. The target time concept is based on best endeavours, i.e. 'getting it about right'. We do not want to give aircraft the non-deviating status implied by CTA/RTA, because this would make life harder for ATCOs. It may come one day, but we certainly don't plan on introducing the concept using CTA/RTA
Are there any other ANSPs or technology solution providers working on AMAN/DMAN systems?	Yes, as an example LFV are working on an integrated AMAN/DMAN system and are demonstrating this in another SESAR project, VLD3 (Safely Optimised Runway Throughput). LFV presented their concept in a SESAR Digital Academy webinar on 04/12/2021. The presentations and the replay are available on this link: https://www.sesarju.eu/node/3704
What about in horizon departures from Dublin, IAA	This is always one of the hardest problems to solve. In practice, these aircraft tend to level off below the cruise phase of the other aircraft but the in-horizon aircraft still need to join the sequence at some point. Ideally, (from a sequencing

	perspective, we would provide a separate STAR for in-horizon aircraft but this isn't always practical. We're experimenting with increasing spacing when in-horizon aircraft are due
Is the TOM communicated directly to the pilot? Or is the ATCo responsible to meet that time? Are pilots using the RTA function to meet the TOM?	The current proposal is that the Time Over the Metering Fix (TOM) is notified to partner ANSPs in the same way as the XMAN delay currently is. The ATCOs will then pass the TOM to aircraft on a best endeavours basis. The pilots can arrange the flight to achieve the time, but there is no requirement specifically to use RTA.
Do you see any issues with the aircraft equipage levels? Do you have a 100% in-flight capability and if not how would you manage the traffic mix?	With Heathrow, we tend to have the luxury of mostly modern aircraft so we do not consider this a major risk. Some level of non-compliance to target times is expected, this could be for equipage reasons or for operational reasons. We are researching the impact of varying levels of compliance on the concept as a whole.
so does NATS has LOA/MOU for cross border exchange	We are very much working at the conceptual stage at the moment, and are just having initial conversations with our ANSP partners. We plan to model this on how we currently work together for XMAN, at least initially.
It is not clear what the purpose of this metering and spacing is. To increase arrival capacity, optimize fuel consumption, etc. Principle of serving is "first come-first served" at given metering point. Aiming to avoid holding at Heathrow is something to immediately forget.	The goal of spacing is primarily to support systemised airspace; by controlling entry into the airspace, we hope to avoid conflicts that require tactical intervention (vectoring & level constraints) to resolve. Aircraft should be able to remain on their routes. Delay absorption ahead of the stack should reduce overall fuel burn The objectives were on the first slide: 1. To transfer delay out of the TMA and into a slower en route and descent 2. To debunch aircraft prior to descent
How does the system consider uncertainty, e.g. flights which are still on their way but not in the scope of the E-AMAN yet, or if the scope of the AMAN is large enough, flights which might not have even departed yet? Is capacity saved for them or manatged dynamically as they arrive to the scope?	It does not consider uncertainty. AMAN receives data on aircraft that are 550nm away and starts to build a sequence. However, nobody uses the results until the XMAN horizon of around 350nm. Getting a stable source of Estimated Times of Arrival (ETA) data is essential, as constant small changes in the ETA would cause instability and the sequence to jump around. We're assessing the use of ADS-B data as a source of data from which to calculate the ETA, potentially with a 'smoothing' function
in ADSCENSIO (VLD PJ38); a lot of work of accurate prediction based on aircraft EPP + focus on identifying the preferred ToD to	We are interested in knowing more about the work of PJ38, although the timeframe may suit more future work on this - in fact we are currently scheduling a meeting for a couple of weeks' time to explore any potential areas for coordination. Note: PJ38 is an ongoing SESAR demonstration project working on data collection of Extended Projected Profile (EPP) from revenue flights, distribution of EPP between ground actors (EPP common service) and demonstration of the benefits of the PP. More information on it is available on this link: https://www.sesarju.eu/projects/ADSCENSIO

optimize the descent profile. Worth we work together?	
@NATS: Are you using any form of Artificial intelligence or machine learning for this solution?	Not within the PJ01 project at this stage
Who is dictating these hub incoming and outgoing waves - airlines or airport once accepting airline schedule as it is. What is "space" for deviating some flights from their already approved schedule?	The landing times are unaffected – we are just holding in the form of slower cruise and descent, rather than in a holding stack. If the question is about Zurich, Anais can edit my answer if required, but I'm pretty sure that what they're doing is providing a more accurate time for pilots to plan to arrive at the airport but where the time is within the normal scheduled arrival slot
What is the difference between Target Time of Arrival and Tactical Time of Arrival?	I have not heard the acronym 'tactical time of arrival'. AMAN produces a time at a metering point. If the intention is to use it as a clearance, we would call it a Controlled Time of Arrival (CTA) and the aircraft would fly it precisely. However, we do not want to do that because we don't want to give the aircraft non-deviating status. ATC need the freedom to intervene to solve separation problems
@NATS: Does it happen often that flights are asked to arrive earlier or later, but afterwards the requested change was not needed, resulting in an unnecessary cost to the flight?	There is a buffer (currently 7 minutes with XMAN) to avoid this.
How accurate are the D-1 predictions, given that they're based on STA?	Our horizon is 550nm, so approximately 90 minutes. For D-1, we'd use another tool called Heathrow Demand-Capacity Balancing, which behaves more like an airport network management-type tool to manage overall demand.
Crucial question is "who serves whom" and what are tolerable deviations from the schedule. Airlines schedule bunches of arriving and departing flights. Do they plan eventual deviations in advance and the airport accept them?	In theory, the landing times are not affected. The choice is between accommodating the excess demand in a holding stack in the TMA at around 10,000ft, or slowing earlier to absorb some of this holding in the form of a slower cruise and descent.
It sounds as if this is an extension to the scheduling process (e.g. if aircraft were flying to schedule the early morning arrivals sequence should already be good) so how	Indeed, there is not much change to the Strategic Sequence (part of this process is to increase awareness of the STAs, so they are taken into account already at the flight planning phase, and the STA adherence could be improved). They are still some small adjustments up to 5 minutes in the Tactical sequence. The “biggest” changes in the Tactical sequence are when an aircraft operator swap flights within the sequence.

much does this change between tactical and strategic phases on a day to day basis?	
do you have possibility to take the ADS-Bb estimates in account for long haul flights	In iStream this possibility is not supported yet. For PJ01 we are investigating using ADS-B estimates fro when aircraft pass the 550nm horizon.
What are the limitations on operators exchanging Target Times? At some point, their position in the sequence is frozen, correct?	The aircraft operators can exchange their TTs within their own flights (or within the Alliance's flights), and provide these TTs to SKYGUIDE before 1:00 LT on the day of operations
did you consider DEP aircraft as well when planning the ARR?	No, DEP are not considered in the establishment of the sequence
Apologies Ade - question was for Sian re: PJ25...How accurate are the D-1 predictions, given that they're based on STA?	Generally, the tactical TTAs are within the 10-min strategic window (but we do not have precise statistics related to the D-1 adherence)
There are a lot acronyms in presentations, which most are understandable for presenters and other cooperating with them. For the rest of audience they are of the little added value. Therefore, the suggestion is to reduce their use as much as possible in the future.	Thank you for your suggestion. We will take this into account for future webinars.
How many times would a flight get an update on their target time of arrival? How is this managed?	There is no update to the sequence. Once it is sent, the sequence is "frozen".
In case of complete lack of wakes, what would be the arrival runway capacity?	We cannot provide one single number for all runways. Apart from wake vortex separations, there are also other factors limiting the runway capacity, for example minimum radar separation or runway occupancy time. The arrival capacity also highly depends on the traffic mix. Without wakes all aircraft could land in principle at minimum radar separation given that no other restrictions limit the capacity. So as example for ICAO separations for a leading HVY and a following MED aircraft, separations could be reduced from 5 NM to 2.5 NM or 3 NM. SJU note: SESAR has done extensive research on this topic. You can find more information on this link: https://cordis.europa.eu/project/id/731781/results (in particular, PJ.02-03 V3 datapack on the reduction of radar separation to 2NM between aircraft on final approach, and PJ.02-01 V3 datapack for the pair-wise separation, and PJ.02-08 V3 datapack for runway occupancy time)

Is there a collision risk for the plates, given the proximity of hardware to the runway?	During normal operation, no collisions would occur. The plates are designed to be frangible, i.e. not dangerous in case of a collision, in case of e.g. a runway overrun.
would it be interesting to use solar panels seen more frequently around airports as opportunistic plate lines even though they are not vertical?	We have not thought about this before. But it may be difficult to include solar panels into the plates, because the plates also have to be frangible. The plates should also be vertical for best efficiency.
Do these plate lines generate vortices of their own that could be a problem for flights?	With substantial crosswind the plates also generate some wake turbulence including vortices. But these are much weaker and less coherent than the aircraft wake vortices, in particular as long as the crosswind is not too strong to allow for landings. Further, these vortices would develop in the wake of the plates and thus could never reach into the flight corridor.
For PJ01: who provides ADS-B data? NATS itself ?	An ANSP can choose their own commercial supplier for ADS-B.
What is the actual purpose of dynamic WV? If it is dynamic and pair-to-pair separation changes in time, the capacity becomes unstable, then what airport is going to declare as the capacity in allocating slots to airlines.	Dynamic separations may allow for higher peak capacity, but obviously only during favourable weather conditions. So, they are only helpful in high demand situations in order to avoid delays or to faster lower congestion. No additional slots can be allocated based on dynamic methods. But this is not different from the current situation, which is already dependent on weather, e.g. lightning storms. The dynamic separations must be known e.g. 20 mins in advance to allow for stable operations. For information on time based separation on this concept please refer to the PJ.02-01 V3 datapack, available at https://cordis.europa.eu/project/id/731781/results
@DLR, If the installation of the plates in VIE provided successful results, what was the reason for needing them to be removed?	The plates we installed during the measurement campaign were a temporary design, which was meant to be removed after the measurement. It was made of wood and could only withstand low crosswinds, it could not be upright without supervision. We now have developed the permanent design, which can be installed permanently.
how close to runway threshold are platelines most efficient ?	During the 2019 campaign, we had two plate lines. One was about 400 m from the threshold, the second was about 750 m from the threshold. We did measurement with both plate lines and with one plate line. We found that the plate line at 400 m alone is almost as effective as the two together. So about 400 m from the threshold is best.
Can you build a frangible plate that is also robust to strong crosswinds?	Yes this has been achieved during the design phase. It was one of the big challenges.
Could these types of plates also be installed next to the runway to reduce crosswinds on the runway?	I do not think this is feasible.

@DLR Would you be able to share an order fo magnitude of the cost and time for implementing the plate lines?	The design of the plates is ready and we plan to install them in Vienna next year. The time for installation is on the order of several days to two weeks. The certification process can vary a lot. Future certification processes will be faster, as they will benefit from the experience and material collected in the current process. About the cost, I am a bit cautious to say a number, because we do not have an in-depth economic assessment yet. But costs are rather low compared to other airport equipment.
Can dynamic separation increase the ATC controllers' workload? Until which point of time and space when it is dynamic and after that becomes fixed/static?.	Dynamic separations need some kind of software tool to help the controller, because the separations matrix becomes very big. SESAR project PJ.02-01 developed the Optimised Runway Delivery (ORD) tool, you can find information on it in PJ.02-01 V3 datapack, available at https://cordis.europa.eu/project/id/731781/results
it seems from preceding slide you envision tree hedges acting as plate lines What were the drawbacks ? frangibility? fast growth?	We did an in-depth analysis of all the possible designs. One problem with the hedges is that they take a very long time to remove. One design goal was to enable quick removal of the plates if needed. And then hedges need to be cut in shape regularly and they might provide shelter to birds.
@ Skyguide Freezing the sequence at 11:00 the day before looks constraining; Is there a plan to go for more real time with connection to departure A/P DMAN ?	The sequence is frozen at 01:40LT on the day of operations with the Tactical sequence, but yes would be ideal indeed to connect with AMAN/DMAN in the future (but it's not defined yet when/how)
@DLR: linked to Laurent previous question : what's the expected lifetime/lifecycle of the plates ? Especially if they have to be removed/reinstalled ? Meaning, can we evaluate their "footprint" ?	The panels are also used in architecture ... the masts are even more robust ... so lifetimes will be several decades ... similar as those of a house façade.
Sorry, quick question, the CTOT is for all flights going to Zurich from all around Europe? How are different airlines/delays managed/prioritised?	Yes, Calculated Take-off Times (CTOT) were for all short-haul flights, and were based on the Target Take off Times (TTOs), based on the Schedule Time of Arrival (STA), and at that time of the day, there were no conflicts (only 2 or 3 flights) - but in case there would be conflicts, NM is the arbitrator and attributes the slots upon the principle first come, first served (upon the flight plan)
@DLR: regarding the benefits compared to RECAT-EU, do you have any timeline to share on when the results would be endorsed by the WV community?	The concept is well known and supported in the wake vortex (WV) community. The most important part is of course to get the certification from the authorities to install the plate lines. For the temporary design this is already achieved. For the permanent design, we plan to gain the authority approval for Vienna airport in April 2022.

What are the next steps related to the acceptance of such reduction by pilots for instance?	
@DLR: how does wind influence the effect of the plates on wake decay?	The crosswind has a small influence on the effect of the plates. But, already with quite weak crosswinds, the vortices are transported away from the glide path quickly, so the limiting factor currently are actually situations where crosswind is very low. That's when long-lasting vortices are generated that may stall in the flight path of a follower aircraft.
@DLR: have you checked that the plate lines are compatible with the use of autoland ? having CAT2/3 approaches require to not have any obstacles in the runway axis from 400m before the treshold up to the treshold...or at least with a limited height	At Vienna, the plate lines where installed just outside of this 400 m space before the threshold that you mentioned. So, this should not have an impact. Also, they were further from the threshold than the ILS. So, if the ILS is acceptable as an obstacle, we believe the plates are as well. Obstacle free heights were also considered of course.
@DLR: did you envision plates made of cloth which would make it easier to replace or remove in case of strong crosswinds?	The temporary design used truck tarpaulin ... so this was one kind of cloth ... we considered this also for permanent plates ... but the honeycomb panels achieved better results in the experts' ranking.
I presume you have investigated the distribution measurements of the plate lines for each aircraft type that is arriving? And would tailoring the plate lines to each aircraft make a difference to the decay of the wake vortex?	We used numerical simulations to find the best compromise for aircraft with different sizes ... the measurements indicate that the plates are more efficient for larger planes, which is of course good, because wake vortices of larger aircraft are stronger and potentially more dangerous.
My second question is have you considered a mechanical plate line system that would move and adjust height/separation to compliment the next aircraft type arriving if this would give benefit?	Basically, the higher the better for any aircraft type ... but the height limits how close you can get to the runway ... this way the 4.5 m height is a good compromise ... meaning we didn't consider dynamic height adjustments ... we also feel the simpler the plate design, the better, because it is cheaper and more robust and less sensitive to environmental threats like storms, snow, icing etc.
How much is the ELDT prediction accuracy of the ATFCM?	The iStream & PJ25 trials have shown that the long-haul Estimates taken from NM ETFMS profiles diverged from more than 5 minutes of the actual flown profiles.For the short-hauls, no specific study of accuracy was conducted; ELDT from ETFMS are consistent with the ETOT. In PJ01 we are using ETAs calculated by the AMAN and are currently investigating the best input for better AMAN trajectory prediction.
Until EASA and FAA confirm this reduced minimums which have to	The safety case for RECAT-EU-PWS has been submitted to EASA recently. The partnering of the RECAT-EU-PWS with the plates could bring about increased capacity (RECAT-EU-PWS) with encounter risks below RECAT-EU (plate line). The

be specified clearly, nothing about implementation will happen? Aviation is very conservative system just because of maintaining required safety.	installation of the plates at an airport requires only the approval of the national authorities. All SESAR solutions make a safety assessment, which is part of the OSED in the datapack, as well as a regulatory impact assessment. In the regulatory impact assessment, the potential changes to regulation required to implement the solution are identified. The safety assessment is essential in support of the proposed changes to the regulations.
Which are the dynamic parameters were considered for ELDT prediction for Long haul flight?	The ELDT for long-hauls in the sequence rely upon the Estimates over the STAR entry at Zurich received from the flights (extracted from the FMS, after flights have reached Top of Climb). So these Estimates take into account all the flight's information, Actual Take Off Time, Flight time (considering all operational parameters at that time, flight route, weather, cost index of the flight) etc.
You are going to base separation based on the fast and more intensive factor such as weather. Nobody will approve these new standards.	There are indeed challenges to overcome related to the fact that weather changes, and this definitely needs to be considered in the safety assessment. However, there is a precedent in the case of time-based separation, whereby separation in distance between successive arrivals is reduced when there is a headwind. This was researched and validated in SESAR, and has been in operation for several years, e.g. at London Heathrow. You can find more information on this topic in the corresponding solution datapack, available at https://www.sesarju.eu/sesar-solutions/time-based-separation. In SESAR weather dependent separations have been investigated. Here the challenge is the right characterization, prediction and duration of favourable weather conditions.