Contextual note – PJ.02-01-02 "Optimised Separation Delivery for Departure" (V3) Description Form for Deployment Planning

1. Purpose

This contextual note describes SESAR solution PJ.02-01-02 "Optimised Separation Delivery for Departure" with a summary of the results stemming from R&D activities contributing to deliver it. It provides (to both those external and internal to the SESAR programme) an overview of PJ.02-01-02 in terms of scope, main operational and performance benefits, relevant system impacts and recommends additional activities that should be conducted during the industrialisation phase or as part of deployment.

This contextual note complements the solution Data Pack comprising the SESAR deliverables required for industrialisation and deployment.

2. Improvements in Air Traffic Management (ATM)

The solution "Optimised Separation Delivery for Departure" (OSD) enables safe, consistent and efficient delivery of the required separation or spacing between departure pairs from the follower aircraft becoming airborne. Different variants of the solution have been developed in Wave 1. These variants include an automatic wake count down timer and a distance indicator displayed on the tower controller's radar screen.

The solution is supported by the OSD tool that can be used to support the tower controllers in the delivery of time or distance separations. This includes the departure wake separations of ICAO, RECAT-EU, PWS-D and WDS-D as well as departure route separations such as the SID separations and MDIs and ADIs. In airports that require support for both TB and DB separation and spacing rules a combined TBS / DBS variant of the OSD tool may be necessary.

The solution will provide benefits in terms of human performance and safety. Benefits in terms of runway throughput capacity will also be gained during peak traffic periods in those airport that are capacity constrained.

The solution targets capacity constrained runways during high intensity runway operations and applies to very large, large and possibly medium airports.

Note that solution PJ.02-01-02 is an ATM solution even if the SPR-INTEROP/OSED is not always explicit about this.

Relevant Operational Environments

OEs	Sub Operating Environments	Definition
Airport (capacity constrained)	Very Large Airport	Airports with more than 250k movements per year
	Large Airport	Airports with more or equal than 150k and less or equal than 250k movements per year
	Medium Airport	Airports with more or equal than 40k and less than 150k movements per year

Note: The investment on the OSD tool may be only justified only in large and very large airports.

3. Operational Improvement Steps (OIs) & Enablers

Applicable OI Step:

AO-0329 — Optimised Separation Delivery for Departure.

Required Enablers:

AERODROME-ATC-69 — ATC system to support optimised departure separation.

Optional Enablers:

A/C-37a — Downlink of trajectory data according to contract terms (ADS-C) compliant to ATN baseline 2 (FANS 3/C);

A/C-47 — On-board management of meteorological data from on-board sensors for sharing and integration by ATM and ATM-MET systems;

AERODROME-ATC-55 — Aerodrome ATC System to support Optimised Runway Delivery on Final Approach based on Aircraft ROT categorization;

AERODROME-ATC-93 — Aerodrome ATC system to support optimised runway separation delivery in mixed mode operations;

SWIM-APS-07a — Stakeholder systems consumption of G/G Meteorological Information services.

Applicable Integrated Roadmap Dataset is DS20.

4. Background and Validation Process

Significant work was performed by EUROCONTROL and ANSPs (NATS, DSNA, and AUSTROCONTROL) on Pairwise separation and TBS throughout SESAR 1.

SESAR1 Validation:

- **SESAR1 P06.08.01:** Flexible and Dynamic Use of Wake Turbulence Separations.

Solution PJ.02-01-02 builds on this work and completed V3 thanks to a series of real-time simulation activities:

- **RTS3a:** Validation to assess Static Pairwise Separations on the arrival approach (S-PWS-A) with Optimised Runway Delivery (ORD) tool plus Static Pairwise Separations for departures (S-PWS-D) with Optimised Separation Delivery (OSD) tool under mixed runway operations;
- **RTS4a:** Validation to assess the ORD tool for arrivals plus Static Pairwise Separations on for departures (S-PWS-D) with Optimised Separation Delivery (OSD) tool under mixed runway operations;
- **RTS4b:** Validation to assess Static Pairwise Separations on the arrival approach (S-PWS-A) with Optimised Separation Delivery (OSD) tool plus Static Pairwise Separations for departures (S-PWS-D) with Optimised Separation Delivery (OSD) tool in a dual approach environment with CSPR under segregated and partially segregated runway operations;
- **RTS5:** Validation of Static Pairwise Separations on Departure (S-PWS-D) and Weather Dependent Separations on Departure (WDS-D) and their integration with a departure Optimised Separation Delivery (OSD) tool on a single runway in segregated mode (London Heathrow);
- **RTS6:** Validation of Wake Turbulence Separations based on Static Aircraft Characteristics on Departure (S-PWS-D) and their integration with a departure Optimised Separation Delivery (OSD) tool plus Weather Dependent Separations on the arrival approach (WDS-A) and their integration with an arrival Optimised Runway Delivery (ORD) tool.

5. Results and Performance Achievements

The results show that the Optimised Separation Delivery (OSD) tool is operationally feasible and acceptable. The OSD tool reduces the workload of the ATCO providing them with additional thinking time to perform other tasks. The tool aided the ATCOs in providing current RECAT-EU wake separations with reduced workload.

The solution showed a departure throughput benefit compared to the reference scenario, between 0,2 – 1,0 % increase.

Overall, the fuel burn results show a 6% reduction in taxi-out fuel burn in the solution scenario compared to the reference scenario. This is due to higher departure throughputs that led to reduced taxi-out time and hence taxi-out fuel burn.

The safety results showed the controllers believe the solution will either have no impact or a positive impact on operational safety compared to current operations. No major detrimental impact on human performance while a clear benefit was measured in terms of controller mental workload, time management and task organisation.

6. Recommendations and Additional activities

The following recommendations should be taken into consideration during the industrialisation and deployment phases:

- Further work is required to address the potential for human error from the risk of over-reliance on the tool leading to de-skilling of the ATCOs, and the HMI being misleading in the case of SID separation requirements.
- To optimise operations the tool will have to be refined and adapted to the local environment. This industrialised version of the OSD tool will need to be developed using a methodology appropriate to the software assurance level required in the local deployment environment;
- The activities in the industrialization phase should address improvements on the OSD tool identified during the validation activities:
    - Moreover the value showed by the clock should take into account the rest of factors affecting separations among departures, in this sense the OSD tool should consider other constraints such as:
        - Airport/RWY conditions
        - LOA with departures sector (SIDs, aircraft performance, hold for release traffics, departures from intersection…)
        - CFMU
    - The OSD tool should provide several options not only one counter. Currently the OSD only provide a value (separation in seconds between the flight that is in line up and the next flight in the sequence) but it doesn´t allow to change the follower. The tool could enhance given the separation between the fight that is lined up on the runway and the flights that are on the holding points. In this way the controller could choose the appropriate sequence of flights optimizing the throughput of the runway.
    - The OSD gap spacing delivery information needs to be more stable and reliable. One potential solution to achieve it could be to use the predicted touch down time based on the standard descend profiles in order to avoid the recalculation and constant updates of the gap values.
    - The OSD tool/ CWP HMI should timestamp the time of the instructions given/inputted by the controllers. In current operations, the TWR ATCO usually writes down time of instruction, or in case the electronic flight strips the time of the instruction is marked automatically on the strip.
    - An alert should be provided to Tower controller in case the aircraft follows the wrong track (SID).
    - An alert of a departing aircraft performance that is outside its normal performance envelope should be provided to the controller to avoid the separation infringement due to the aircraft not conforming to the speed. One potential solution could be to display of a ruler indicating distance to the leader aircraft to make controllers aware of possible decease of separation to the leader aircraft.
    - If the OSD tool is to be applied in partially segregated/ mixed mode runway operations, an additional HMI support is required to visualise the planned arrivals and departures sequence on the runway in

partially segregated / mixed mode, this could be done using electronic flight strips, or with an AMAN/DMAN or with a bespoke sequencing tool.

- Furthermore, in addition recommended that there is a means of protection and/ or warning (safety net) to indicate to the controller that the runway is engaged and no departures or crossing are allowed until the arriving aircraft had vacated the runway.
- In order to prevent any separation infringement, the OSD tool must integrate the adequate buffers to accommodate for variability related to aircraft performance on the climb profiles. The size of the buffer should be based on the analysis of the aircraft performance data derived from operational data collected from the local airport where the OSD is to be implemented. This should be done as part of the local safety case conducted prior to implementation.
- The OSD tool should be developed to ensure it can be used for aircraft departing from different runway entry points, and also developed to take into consideration any regulations related to the TMA exit point.

Future development of the OSD tool could include:

- The integration of OSD tools within the CWP.
- The integration the OSD (including the DDI-T, DDI-D and gap spacing management tool) with the AMAN / DMAN.
- The development of a moving chevron for departing aircraft as is done for the arriving aircraft with the ORD tool in order to facilitate the TWR ATCO monitoring task.

7. Actors Impacted by the SESAR Solution

The following actors are impacted by AO-0329:

- Air Traffic Controllers;
- Flight Crew;
- ANSPs;
- Airlines /airspace Users;
- Airport Operators;
- Regulatory Authorities.

8. Impact on Aircraft System

No impact on aircraft system.

9. Impact on Ground Systems

OSD requires OSD tool support to be integrated in CWP and current TBS system (if present).

10. Regulatory Framework Considerations

No regulatory or standardisation change is currently foreseen as necessary regarding the Optimised Separation Delivery tool.

11. Standardisation Framework Considerations

N/A

12. Solution Data pack

The solution PJ.02-01-02 is covered by PJ.02-01 Data Pack that includes the following documents:

- D1.1.01 – PJ02-01 OSED-SPR-INTEROP (Final) Parts I 00.01.02, II, IV and V – 01.02.01 (31/01/2020);
- D1.1.02 – PJ02-01 TS/IRS (Final) – 00.03.04 (06/03/2020)[1];
- D1.1.04 – PJ02-01 VALR (Final) – 00.01.01 (31/01/2020);
- D1.1.05 – PJ02-01 CBA – 00.01.01 (31/01/2020)[2].

[1] The final version of the TS/IRS MS Word document still contains many requirements that are “in progress” status while they have been actually validated. The status of these requirements is properly updated and documented in the SE-DMF that represents the reference for the list of validated requirements.

[2] Note that PJ.02-01-02 can be independently deployed even if the CBA does not consider the solution and a standalone one explicitly.