ICAO GANP PORTAL

ASBU ELEMENTS

OPFL RATS RSEQ SNET SURF TBO WAKE B0 B1 B2 Concept Validation Standardization
Ready for implementation Taxi-out Departure En-route Arrival Taxi-in Turn-around ATM planning Pre-tactical
Tactical-Pre ops Strategical Post operations Tactical-During ops

☑ Functional Description | ☑ Enablers | ☑ Deployment Applicability | ☑ Performance Impact Assessment

OPFL

OPFL-B0/1	In Trail Procedure (ITP)	Operational

Main Purpose
To enable aircraft to reach a more satisfactory flight level for flight efficiency or to avoid turbulence for safety.

New Capabilities
The procedure couples the capability of the controller to receive the current position and intent from a pair(s) of aircraft with the ability of the trailing aircraft to space itself accurately from the preceding aircraft(s) to allow for the safe issuance of the ITP clearance.

Description
ITP is primarily intended to help facilitate access to optimum flight levels for aircraft operating in airspace where no ATS surveillance service is available. The ITP aircraft must acquire and process position broadcast (ADS-B) data from up to two non-manoeuvring aircraft. Aircraft identification, altitude, position and ground speed of reference aircraft would be assessed by the ITP aircraft's on-board equipment (on-board decision support system) to determine whether an ITP climb or descent is possible. Based on the processed broadcast data from the reference aircraft(s), a pilot can make an ITP climb or descent request to air traffic control (ATC). Pilots are responsible for using the on-board equipment to evaluate the situation and provide the required information to the controller.

Maturity Level
Ready for implementation

Human Factor Considerations

PLANNING LAYERS

Tactical-During ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of flight crew and ATCO	ANSP Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

OPFL-B0/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Vertical flight efficiency	Increase acceptance of pilot requests for higher cruise level	++	KPI18: Level capping during cruise
Efficiency	Vertical flight efficiency	Reduce level restrictions during cruise issued by ATCOs for conflict resolution purposes	++	KPI18: Level capping during cruise

OPFL-B1/1 Climb and Descend Procedure (CDP) Operational

Main Purpose
The CDP was designed to improve service to appropriately equipped aircraft by providing an air traffic controller with another option for initiating an altitude change when existing separation minima do not allow an aircraft to climb or descend through the altitude of a blocking aircraft.

New Capabilities
The capability for the controller to request current position and intent from pair(s) (ADS-C capability) aircraft provides the situational awareness to allow the controller to use the simultaneous reporting of position to support the procedure at less than the nominal separation.

Description
The CDP utilizes existing ADS-C aircraft equipage and air traffic control (ATC) capabilities to allow more flights to achieve their preferred vertical profiles. Integral to the CDP is the use of advanced communication and surveillance capabilities (i.e. ADS-C and CPDLC). The CDP is conceptually modelled after existing in-trail distance measuring equipment (DME) rules set forth in the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444), paragraph 5.4.2.3.4. Aircraft pair distance verification is performed by the ground automation system using simultaneous ADS-C demand contract reports.

Maturity Level
Standardization

Human Factor Considerations

PLANNING LAYERS

OPERATIONS

Tactical-During ops

En-route

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of flight crew and ATCO	ANSP Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

OPFL-B1/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Vertical flight efficiency	Increase acceptance of pilot requests for higher cruise level	++	KPI18: Level capping during cruise
Efficiency	Vertical flight efficiency	Reduce level restrictions during cruise issued by ATCOs for conflict resolution purposes	++	KPI18: Level capping during cruise

RATS

RATS-B1/1	Remotely Operated Aerodrome Air Traffic Services	Operational

Main Purpose: To provide ATS at aerodromes not from a traditional on-site tower, but remotely from either a local or a distant location. The service provided may be a control service or flight information service as appropriate.

New Capabilities: Provision of an aerodrome ATS from a remote location using digital video or surveillance technologies, or non-surveillance procedures.

Description

This element represents the provision of Aerodrome Control or Aerodrome Flight Information Services (AFIS) at aerodromes from other than an on-site facility. This could be achieved by utilizing either video surveillance, digital surveillance, procedural processes, or a combination thereof, which is commensurate with the complexities and traffic demands at the aerodrome. A Remote Tower Centre (RTC) will be remotely connected to one or more aerodromes and consist of one or more Controller Working Positions (CWP), dependent on the requirements of the connected aerodrome(s).

Maturity Level

Standardization

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

Taxi-out | Departure | Arrival | Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology benefit	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology benefit	ASUR-B0/2 - Multilateration cooperative surveillance systems (MLAT)
Relation-technology benefit	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)
Relation-operational benefit	SURF-B0/1 - Basic ATCO tools to manage traffic during ground operations
Relation-information need	AMET-B1/1 - Meteorological observations information
Relation-information need	AMET-B1/2 - Meteorological forecast and warning information
Relation-information need	AMET-B1/4 - Dissemination of meteorological information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	Amendment of the national regulatory framework for the provision of remote ATS at aerodromes	Depending on existing state regulations, new provisions on remotely operated ATS may be required, based on ICAO Annex 10, 11 and/or PANS-ATM.	CAA	2019

Operational procedures	Regular operations	Procedures for the provision of remote ATS at aerodromes	Procedures may be required for the operation depending on the capabilities of the implementation.	ANSP	2019
Operational procedures	Contingency operations	Procedures for the provision of remote ATS at aerodromes in contingency situations.	Contingency procedures in case of full or partial failure of the RTC based on ICAO PANS-ATM.	ANSP	2019
Training	-	Training requirements for the provision of remote ATS at aerodromes	ATCO Training in the RTC operational standards, limitations and procedures. ATSEP training on the RTC Equipment and Datalink Systems.	ANSP	2019
Ground system infrastructure	Surveillance	Surveillance means at the remote tower centre	At the remote facility: Visual reproduction of the out-of-the window view on data/monitor screens, projectors or similar technical solutions or Procedural Systems. References:	ANSP	2019
Ground system infrastructure	Surveillance	Surveillance means at the aerodrome where remote ATS are provided	At the aerodrome where ATS are provided: visual surveillance cameras, surface movement radar, surveillance radar, multilateration or other positioning and surveillance implementations as required.	ANSP	2019
Ground system infrastructure	Communications	Communication means between the remote tower centre and the aerodrome where remote ATS are provided	Suitable communication and data transfer capabilities between the airports and the RTC including suitable redundancies for technical infrastructure at the aerodrome, remote facility and data links.	ANSP	2019
Regulatory provisions	Operational Approval	Operational approval required for remote tower centre	Operational Approval required for Remote Tower Facility and associated equipment and system components linking the RTC to the aerodrome.	ANSP	2019
Regulatory provisions	Certification	ATS Unit Certification to include level of service to be provided by the RTC.	ATS Unit Certification to include level of service to be provided by the RTC.	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Provide ATS for an aerodrome which due to its location has limited support living facilities for staff and results in increased overall operational costs to build and maintain a conventional on-site tower. Provide a contingency ATC Tower Facility from a remote tower in the event the regular on-site tower is unavailable. A remote facility may be sited at a location which is ideally located to provide better living conditions for operational staff. Providing a remote facility may enable substantial cost savings in construction. The deployment may enable provision of ATS at aerodromes where it would otherwise be uneconomical or unsustainable. Provide an ATC Tower Facility from a remote tower located on the aerodrome or within close proximity to the aerodrome as the main facility which may enable a more cost effective and efficient service compared to that of a conventional tower.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Enabling options for an ATS Facility to be constructed at a cost efficient, easily accessible location particularly when the aerodrome is situated in a remote region.	ANSP
	Facility construction, equipage and maintenance cost benefits. Minimise cost to Aerodromes for provision of ATS Services at a low traffic density aerodromes Staffing benefits.	ANSP
	Service Improvement through use of digital cameras and systems to provide an improved level of surveillance as compared to a conventional tower with basically only direct out of the window surveillance and possible limitations to viewing all relevant parts of an aerodrome or its associated circuit or airspace.	ANSP
	Minimise cost to Aerodromes for provision of ATS Services at low traffic density aerodromes. Reduced ATS and Maintenance staff requirements.	ANSP
	Enabling options to combine multiple aerodromes ATS from one ATS facility.	ANSP
	Enabling ATS provision at new locations which were previously uneconomical or unsustainable.	Airspace user
	Improve situational awareness of ATCO	ANSP
Indirect benefits	Staffing and Human Resources benefits through options for ATS Facility being located in easily assessable areas with better access to facilities such as schools, shops and hospitals.	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS RATS-B1/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Cost effectiveness		Reduce costs in the Air Navigation System	++	
Flexibility		Improve flexibility of the Air Navigation System	++	
Safety		Maintain or improve safety during surface movement	++	
Safety		Maintain or improve safety on the runway	++	

RSEQ

RSEQ-B0/1	Arrival Management	Operational

Main Purpose	To optimize sequencing for arrivals.
New Capabilities	Arrival management metering and sequencing by ATC is based on inbound traffic prediction information, and decision making support.
Description	This element represents management of arrival sequences, thereby allowing aircraft to fly more efficiently to the necessary fix and to reduce the use of holding stacks, especially at low altitude. Based on inbound traffic prediction information and decision making support, ATC operational techniques (metering points, speed-control, Time-To-Gain/Time-To-Lose, etc.) will be used to sequence inbound flights at minimum separation on final approach (time or distance based) so as to optimise runway utilization. Time-based metering (as opposed to time-based separations) is the practice of planning a sequence of traffic by time rather than distance. Typically, the relevant ATC authorities will assign a time in which a flight must arrive at the aerodrome or at a specific control point, and/or advises subject flights of speed changes as required to achieve the optimal separation on final approach. Besides inbound traffic predication information, input can include aerodrome capacity, terminal airspace capacity, aircraft capability, wind and other meteorological factors. Time-based metering is the primary mechanism in which arrival sequencing is achieved.
Maturity Level	Ready for implementation
Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes 2. Does it imply processing of new information by the user? Yes 3. Does it imply the use of new equipment? Yes 4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information benefit	AMET-B0/1 - Meteorological observations products
Relation-information benefit	AMET-B0/2 - Meteorological forecast and warning products
Relation-operational benefit	WAKE-B2/1 - Wake turbulence separation minima based on 7 aircraft groups
Relation-operational benefit	WAKE-B2/4 - Wake turbulence separation minima based on leader/follower static pairs-wise
Relation-operational benefit	WAKE-B2/7 - Time based wake separation minima for arrival based on leader/follower static pair-wise
Relation-operational benefit	SURF-B0/2 - Comprehensive situational awareness of surface operations
Relation-operational benefit	SURF-B1/4 - Routing service to support ATCO surface operations management
Relation-operational benefit	ACDM-B0/1 - Airport CDM Information Sharing (ACIS)
Relation-operational benefit	ACDM-B0/2 - Integration with ATM Network function

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Arrival Sequencing Procedure	Local ATM procedure for arrival sequencing	ANSP	2013
Ground system infrastructure	ATC systems	Arrival Sequencing ATC Automation system	Automation for calculating optimum arrival sequence with presentation to ATCOs	ANSP	2013
Training	-	Training requirements for arrival management	ATCO Arrival Sequencing Training - ATCOs trained to use arrival sequencing automation, supported by arrival sequencing procedure. Pilot Time-Based Metering Training - Pilots trained to use airborne system to arrive at waypoint specified by ATCOs at specific timing	ANSP Aircraft operator	2013
Regulatory provisions	SMS	Arrival Sequencing Safety Assessment	Safety assessment of arrival sequencing operation	ANSP	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Runways and terminal manoeuvring area in major hubs and metropolitan areas.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce holding and low level vectoring	ANSP, Aircraft operator
	Enable dynamic scheduling	ANSP
	Decreased uncertainties in aerodrome/terminal demand prediction	ANSP
	Increase aerodrome throughput	Airport operator, ANSP
	Increase aerodrome capacity	Airport operator, ANSP
	Efficiency	Airport operator, ANSP, Aircraft operator
	Flexibility	Aircraft operator
	Predictability	ANSP, Aircraft operator
Indirect benefits	Fuel consumption	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

RSEQ-B0/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Apply arrival balancing	+	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Apply smart sequencing to harmonise final approach speeds (arrival)	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Apply smart sequencing to optimise wake vortex separations (arrival)	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Improve arrival sequencing and metering to fill all arrival slots	++	KPI11: Airport throughput efficiency
Efficiency	Flight time & distance	Apply TTA and en-route speed reduction if traffic is already airborne	++	KPI08: Additional time in terminal airspace

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Reduce need to fine-tune traffic spacing in terminal airspace (arrival)	++	KPI08: Additional time in terminal airspace

RSEQ-B0/2 Departure Management Operational

Main Purpose: To optimize departure operations.

New Capabilities: Departure management sequences the aircraft for optimized utilization of ground infrastructure and efficiently meet en-route and destination airport constraints, taking on board user preferences.

Description: Departure management, like its arrival counterpart, serves to optimize departure operation to ensure the most efficient utilization of aerodrome and terminal resources. Slots assignment and adjustments will be supported by departure management automation like department management or departure flow management. Dynamic ATFM slot allocation will foster smoother integration into overhead streams and help airspace users to better meet metering points and comply with other ATM requirements. It will sequence aircraft, based on the ground and airspace structure, wake turbulence, aircraft capability, en-route and destination ATFM constraints, and airspace users' preferences. This will serve to increase aerodrome throughput and compliance with allotted departure time. Where Airport CDM is implemented, departure management will interface with the associated A-CDM processes (including the pre-departure sequencing of A-CDM) in determining optimal departure sequencing.

Maturity Level: Ready for implementation

Human Factor Considerations:

1. Does it imply a change in task by a user or affected others? Yes
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

Departure

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information benefit	AMET-B0/1 - Meteorological observations products
Relation-information benefit	AMET-B0/2 - Meteorological forecast and warning products
Relation-operational benefit	ACDM-B0/1 - Airport CDM Information Sharing (ACIS)
Relation-operational benefit	ACDM-B0/2 - Integration with ATM Network function

Relation-operational benefit	SURF-B1/4 - Routing service to support ATCO surface operations management
Relation-operational benefit	WAKE-B2/1 - Wake turbulence separation minima based on 7 aircraft groups
Relation-operational benefit	WAKE-B2/4 - Wake turbulence separation minima based on leader/follower static pairs-wise
Relation-operational benefit	WAKE-B2/8 - Time based wake separation minima for departure based on leader/follower static pair-wise
Relation-operational benefit	SURF-B0/2 - Comprehensive situational awareness of surface operations
Relation-operational benefit	APTA-B0/2 - PBN SID and STAR procedures (with basic capabilities)
Relation-information benefit	NOPS-B0/5 - Dynamic ATFM slot allocation

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Departure Sequencing Procedure	Local ATM procedure for departure sequencing	ANSP	2013
Ground system infrastructure	ATC systems	Departure Sequencing ATC Automation system	Automation for calculating an optimum departure sequence with presentation to ATCOs	ANSP	2013
Training	-	Training requirements for departure management	ATCO Departure Sequencing Training - ATCOs trained to use departure sequencing automation, supported by departure sequencing procedure	ANSP	2013
Regulatory provisions	SMS	Departure Sequencing Safety Assessment	Safety assessment of departure sequencing operation	ANSP	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Runways and terminal manoeuvring area in major hubs and metropolitan areas. It will streamline departure traffic flow and smooth transition into en-route airspace. Automated dissemination of departure information and clearances.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
	Decreased lead time for departure request	Aircraft operator
	Decrease time between call for release and departure time	Airport operator ANSP Aircraft operator

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Enable dynamic scheduling	ANSP
	Increase aerodrome throughput	Airport operator ANSP
	Increase aerodrome capacity	Airport operator ANSP
	Efficiency	Airport operator ANSP Aircraft operator
	Flexibility	ANSP Aircraft operator
	Predictability	ANSP Aircraft operator
Indirect benefits	Fuel consumption	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

RSEQ-B0/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Maintain or improve departure rate of the RWY	++	KPI10: Airport peak throughput
Efficiency	Flight time & distance	Avoid additional holding time after line up caused by departure metering not factored in during pushback planning	++	KPI02: Taxi-out additional time
Efficiency	Flight time & distance	Improve the delivery of departing traffic into the overhead stream	++	KPI02: Taxi-out additional time

RSEQ-B0/3	Point merge	Operational

Main Purpose: To allow merging of arrival flows.

New Capabilities: Sequencing using pre-defined legs equidistant from a point that are used for shortening or stretching the arrival path.

Description: This element represents a procedural concept that uses existing technology to merge arrival flows. Its purpose is to improve and harmonize arrival operations by enabling continuous descent operations (CDO) and increasing arrival predictability, thereby enhancing airport capacity and limiting the environmental impact of aircraft emissions. Point Merge is based on a specific route structure that is made of a point (the merge point) with pre-defined legs (the sequencing legs) equidistant from this point that are used for shortening or stretching the arrival path.

Maturity Level: Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes
2. Does it imply processing of new information by the user? No
3. Does it imply the use of new equipment? No
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational benefit	WAKE-B2/1 - Wake turbulence separation minima based on 7 aircraft groups
Relation-operational benefit	WAKE-B2/4 - Wake turbulence separation minima based on leader/follower static pairs-wise
Relation-operational benefit	WAKE-B2/7 - Time based wake separation minima for arrival based on leader/follower static pair-wise
Relation-information benefit	AMET-B0/1 - Meteorological observations products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Arrival Traffic Merging Procedure	Local ATM procedure to merge traffic during arrivals	ANSP	2013
Training	-	Training requirements for point merge	ATCO Point Merge Arrival Traffic Merging Training - ATCOs trained to merge arrival traffic using point merge procedure	ANSP	2013
Training	Awareness	Pilot Point Merge Briefing	Pilots briefed on airport's point merge procedure	Aircraft operator	2013
Regulatory provisions	SMS	Point Merge Safety Assessment	Safety assessment of point merge operation	ANSP	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Runways and terminal manoeuvring area in major hubs and metropolitan areas.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce holding and low level vectoring	Aircraft operator
	Enable dynamic scheduling	ANSP
	Decreased uncertainties in aerodrome/terminal demand prediction	ANSP
	Increase aerodrome throughput	Airport operator, ANSP
	Increase aerodrome capacity	Airport operator, ANSP
	Efficiency	Airport operator, ANSP, Aircraft operator
	Flexibility	Aircraft operator
	Predictability	ANSP, Aircraft operator
Indirect benefits	Fuel consumption	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

RSEQ-B0/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Apply merging & synchronisation of arrival flows	++	KPI10: Airport peak throughput

RSEQ-B1/1 Extended arrival metering — Operational

Main Purpose

To enhance predictability and ATM decision compliance.

New Capabilities

Synchronization between adjacent FIRs, arrival management taking into account extended metering requirements.

Description

Extended metering will enhance predictability and ATM decision compliance. The ATS units will be able to meter across FIR boundaries. Extended metering will enable ATS units to continue metering during high volume traffic and will improve metering accuracy. This will also facilitate synchronization between adjacent FIRs. With extended metering, delays can be shifted to higher attitudes or even to the departure gate, where it can be more efficiently absorbed by incoming flights. This metering will provide extended arrival management, increasing arrival management effectiveness and benefits (e.g. in terms of reduced holding time) while reducing approach ATC workload. Extended metering may set requirements on flights pre-departure, if departing within the arrival metering range of the destination airport.

Maturity Level

Standardization

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes 2. Does it imply processing of new information by the user? Yes 3. Does it imply the use of new equipment? Yes 4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	RSEQ-B0/1 - Arrival Management
Relation-operational benefit	NOPS-B1/8 - Extended Arrival Management supported by the ATM Network function
Relation-information benefit	AMET-B1/1 - Meteorological observations information
Relation-information benefit	AMET-B1/2 - Meteorological forecast and warning information
Relation-operational benefit	APTA-B1/4 - CDO (Advanced)
Relation-information benefit	SWIM-B2/1 - Information service provision
Relation-information benefit	FICE-B3/1 - Flight information management services for enhanced trajectory operations

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Extended Arrival Metering Procedure	ATM procedure for extended arrival metering including exchange of metering information with affected neighboring ATC units	ANSP	2019
Operational procedures	Letter of agreement	Extended Arrival Metering Letter of Agreement	Letter of Agreement or equivalent document outlining procedure to exchange metering information with affected neighboring ATC units	ANSP	2019
Operational procedures	-	Procedure to Reconcile ATFM Constraint with Extended Metering Requirements	ATM procedure for reconciling ATFM constraints with Extended Arrival Metering requirements	ANSP	2019

Ground system infrastructure	ATM systems	Extended Arrival Metering Local ATM Automation systems	ATM automation for calculation and presentation of extended arrival metering to ATCOs and exchange metering information with affected neighboring ATC units	ANSP	2019
Training	-	Training requirements for extended arrival management	ATCO Extended Arrival Metering Training - ATCOs trained to use extended arrival metering automation, supported by extended arrival metering procedure and Letter of Agreement with affected neighboring ATC units, along with Procedure to Reconcile ATFM Constraint with Extended Metering Requirements. Pilot Time-Based Metering Training - Pilots trained to use airborne system to arrive at waypoint specified by ATCOs at specific timing	ANSP Aircraft operator	2019
Regulatory provisions	SMS	Extended Arrival Metering Safety Assessment	Safety assessment of extended arrival metering operation	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Runways and terminal manoeuvring areas in major hubs and metropolitan areas.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduction in airborne delay/holding	ANSP, Aircraft operator
	Traffic flow synchronization between en-route and terminal domain	ANSP
	Enables dynamic scheduling	ANSP
	Decrease uncertainties in aerodrome/terminal demand prediction	ANSP
	Efficiency	Airport operator, ANSP, Aircraft operator
	Flexibility	ANSP
	Predictability	ANSP
Indirect benefits	Reduction in fuel burn and environment impact (emission and noise)	Aircraft operator
	Capacity at the airport	Airport operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS RSEQ-B1/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Apply (unplanned) airborne holding to inbound traffic	++	
Capacity	Capacity shortfall & associated delay	Delay take-off of inbound traffic (sequencing & metering measures)	++	
Capacity	Capacity shortfall & associated delay	Slow down inbound traffic during en-route	++	
Efficiency	Flight time & distance	Extend arrival management to a greater radius around the destination airport	++	KPI08: Additional time in terminal airspace

RSEQ-B2/1 Integration of arrival and departure management Operational

Main Purpose: To set up detailed integrated arrival and departure sequence for the same runway.

New Capabilities: Integration of arrival and departure management sequences into a single runway or dependent runways.

Description: A fully integrated and throughput-optimized sequence of arrivals and departures for the same runway (or for dependent runways) is set up by an algorithm considering minimum separations. The sequence is characterized by high planning stability and all controllers working towards delivering this sequence. Thus, in order to meter arrival and sequence pre-departure, controllers will follow Target Take-Off Time (TTOT) and Target Landing Time (TLDT) as closely as possible. Feeder controllers will provide the required gaps in the arrival sequence to allow for the respective departure flights.

Maturity Level: Validation

Human Factor Considerations:

1. Does it imply a change in task by a user or affected others? Yes
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

Departure | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	RSEQ-B0/2 - Departure Management
Relation-operational benefit	AMET-B2/1 - Meteorological observations information
Relation-information benefit	SWIM-B2/1 - Information service provision
Relation-information benefit	SWIM-B2/2 - Information service consumption
Relation-operational benefit	AMET-B2/2 - Meteorological forecast and warning information
Relation-information benefit	FICE-B3/1 - Flight information management services for enhanced trajectory operations
Relation-operational benefit	APTA-B1/4 - CDO (Advanced)
Evolution	RSEQ-B1/1 - Extended arrival metering

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Departure Sequencing Procedure	Local ATM procedure for departure sequencing	ANSP	2013
Ground system infrastructure	ATC systems	Departure Sequencing ATC Automation system	Automation for calculating an optimum departure sequence with presentation to ATCOs	ANSP	2013
Operational procedures	Operations	Extended Arrival Metering Procedure	ATM procedure for extended arrival metering including exchange of metering information with affected neighboring ATC units	ANSP	2019
Operational procedures	Letter of agreement	Extended Arrival Metering Letter of Agreement	Letter of Agreement or equivalent document outlining procedure to exchange metering information with affected neighboring ATC units	ANSP	2019
Operational procedures	-	Procedure to Reconcile ATFM Constraint with Extended Metering Requirements	ATM procedure for reconciling ATFM constraints with Extended Arrival Metering requirements	ANSP	2019
Ground system infrastructure	ATM systems	Extended Arrival Metering Local ATM Automation systems	ATM automation for calculation and presentation of extended arrival metering to ATCOs and exchange metering information with affected neighboring ATC units	ANSP	2019

Operational procedures	Operations	Common Operating Procedure for Departure – Arrival Sequencing Integration	Common Operating Procedure in support of departure and arrival sequencing integration	Airport operator ANSP	2025
Operational procedures	-	Departure – Arrival Sequencing Integration Procedure	Local ATM procedure in support of departure and arrival sequencing integration	ANSP	2025
Ground system infrastructure	ATM systems	Departure – Arrival Sequencing Automation	Automation for calculating optimum departure and arrival sequencing especially for airports with mixed-mode runway used for both arriving and departing flights considering minimum separations applicable	ANSP	2025
Training	-	Training requirements for integration of arrival and departure management	ATCO Departure Sequencing Training - ATCOs trained to use departure sequencing automation, supported by departure sequencing procedure ATCO Extended Arrival Metering Training - ATCOs trained to use extended arrival metering automation, supported by extended arrival metering procedure and Letter of Agreement with affected neighboring ATC units, along with Procedure to Reconcile ATFM Constraint with Extended Metering Requirements ATCO Departure – Arrival Sequencing Training: ATCOs trained to use Departure – Arrival Sequencing Automation supported by Departure – Arrival Sequencing Integration Procedure Pilot Time-Based Metering Training - Pilots trained to use airborne system to arrive at waypoint specified by ATCOs at specific timing	ANSP Aircraft operator	2025
Regulatory provisions	SMS	Arrival-Departure Management Integration Safety Assessment	Safety assessment of integrated arrival – departure management operation	ANSP	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

At aerodrome with existing arrival management and departure management operation, interrelated through significant use of mixed-mode operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Decreased lead time for departure request	Aircraft operator
	Decrease time between call for release and departure time	Airport operator, ANSP, Aircraft operator
	Reduce holding and low level vectoring	ANSP, Aircraft operator
	Enable dynamic scheduling	ANSP
	Decreased uncertainties in aerodrome/terminal demand prediction	ANSP
	Increase aerodrome throughput	Airport operator, ANSP
	Increase aerodrome capacity	Airport operator, ANSP
	Efficiency	Airport operator, ANSP, Aircraft operator
	Flexibility	Aircraft operator
	Predictability	ANSP, Aircraft operator
Indirect benefits	Fuel Consumption	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

RSEQ-B2/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Introduce integrated arrival and departure sequencing for a single runway or dependent runways of the same airport	++	KPI11: Airport throughput efficiency

RSEQ-B2/2	Arrival management in terminal airspace with multiple airports	Operational

Main Purpose: To provide more efficient arrival management support for TMAs with multiple airports.

New Capabilities: Further development of arrival management in support of TMAs with multiple airports and associated interaction among traffic flows into airports within the same TMA.

Description

In terminal airspace with multiple airports, advisory notices from arrival management operations for these airports need to be harmonized in the form of traffic flows to ensure that bunching does not occur in sectors adjacent to TMAs where inbound routes merge or intersect as well as other sectors in adjacent FIRs.

Maturity Level

Validation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	RSEQ-B1/1 - Extended arrival metering
Relation-operational benefit	APTA-B1/4 - CDO (Advanced)
Relation-information benefit	AMET-B2/4 - Meteorological information service in SWIM

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Extended Arrival Metering Procedure	ATM procedure for extended arrival metering including exchange of metering information with affected neighboring ATC units	ANSP	2019
Operational procedures	Letter of agreement	Extended Arrival Metering Letter of Agreement	Letter of Agreement or equivalent document outlining procedure to exchange metering information with affected neighboring ATC units	ANSP	2019
Operational procedures	-	Procedure to Reconcile ATFM Constraint with Extended Metering Requirements	ATM procedure for reconciling ATFM constraints with Extended Arrival Metering requirements	ANSP	2019

Ground system infrastructure	ATM systems	Extended Arrival Metering Local ATM Automation systems	ATM automation for calculation and presentation of extended arrival metering to ATCOs and exchange metering information with affected neighboring ATC units	ANSP	2019
Operational procedures	Operations	Mixed Arrival Stream Traffic Sequencing Procedure	ATC procedure to accommodate mixed traffic streams into multiple aerodromes	ANSP	2025
Operational procedures	Letter of agreement	Mixed Arrival Stream Traffic Sequencing Letter of Agreement	ATC Unit Letter of Agreement specifying procedure to accommodate mixed traffic streams into multiple aerodromes	ANSP	2025
Ground system infrastructure	ATM systems	Mixed Arrival Stream Traffic Sequencing ATM Automation systems	ATM automation to support metering of interacting flows of traffic to multiple aerodromes within same terminal airspace	ANSP	2025
Training	-	Training requirements for arrival management for multi-airport terminal airspace	ATCO Extended Arrival Metering Training - ATCOs trained to use extended arrival metering automation, supported by extended arrival metering procedure and Letter of Agreement with affected neighboring ATC units, along with Procedure to Reconcile ATFM Constraint with Extended Metering Requirements ATCO Mixed Arrival Stream Traffic Sequencing Training - ATCOs trained to use Mixed Arrival Stream Traffic Sequencing ATM automation supported by Mixed Arrival Stream Traffic Sequencing Procedure and Letter of Agreement Pilot Time-Based Metering Training- Pilots trained to use airborne system to arrive at waypoint specified by ATCOs at specific timing	ANSP	2025
Regulatory provisions	SMS	Arrival Management for Multi-Airport Terminal Airspace Safety Assessment	Safety assessment of arrival management operation for multi-airport terminal airspace	ANSP	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

In terminal airspace with multiple aerodromes requiring arrival management operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce holding and low level vectoring	ANSP, Aircraft operator
	Enable dynamic scheduling	ANSP
	Decreased uncertainties in aerodrome/terminal demand prediction	ANSP
	Increase aerodrome throughput	Airport operator, ANSP
	Increase aerodrome capacity	Airport operator, ANSP
	Efficiency	Airport operator, ANSP, Aircraft operator
	Flexibility	Aircraft operator
	Predictability	ANSP, Aircraft operator
Indirect benefits	Fuel Consumption	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS RSEQ-B2/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Increase multi-airport terminal airspace arrival rate	++	KPI10: Airport peak throughput

SNET

SNET-B0/1	Short Term Conflict Alert (STCA)	Operational

Main Purpose: To assist the air traffic controller in preventing collision between aircraft, using position data from ground surveillance.

New Capabilities: STCA systems alert the controller when a given separation between two aircraft is actually lost or may be lost within a given amount of time.

Description

Surveillance data from ground radars and ADS-B stations is used to track aircraft. For each pair of aircraft which are sufficiently close, a short term conflict alert is raised if at least one of the following tests is true:

- (current proximity test) their current horizontal separation is lower than a horizontal threshold and their current vertical separation is lower than a vertical threshold; or
- (linear prediction test) at any of their future positions within a given amount of time (warning time), as linearly extrapolated from their current track, their horizontal separation will be lower than a horizontal threshold and their vertical separation will be lower than a vertical threshold.

The horizontal and vertical thresholds may be different in each test but are equal or lower than the ATC separation standards for the airspace covered by the STCA system. The warning time for the linear prediction may depend on the control unit specificities but is typically equal to or lower than 2 minutes.

The above parameters may be configured differently in defined geographic areas of the control unit. Additionally, inhibitions of alerts may be set up for a list of aircraft and for defined geographic areas.

On noticing the alert, the controller has to analyse the situation and, if deemed necessary, issue an avoiding instruction to one or both aircraft, with the appropriate emergency phraseology.

Maturity Level

Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	ASUR-B0/2 - Multilateration cooperative surveillance systems (MLAT)
Relation-technology benefit	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Safety nets	Controller reaction to short term conflict alerts	Procedures for air traffic controllers reaction to short term conflict alerts. References: Doc 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	ANSP	2013

Airborne system capability	Surveillance	Surveillance system capabilities required for short term conflict alerts	SSR mode S transponder with Ext.squitter version 0, version 1 and version 2 ADS-B out compliant with … References: Doc 100xx - Ground-based Safety Nets Manual http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii	Airspace user Aircraft manufacturer	2013
Ground system infrastructure	Safety nets	Surveillance ground capabilities required for short term conflict alerts	SSR radar ADS-B in station References: Doc 100xx - Ground-based Safety Nets Manual Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii	ANSP Ground systems supplier	2013
Ground system infrastructure	Safety nets	Display for short term conflict alerts	Capability to indicate alerts on the radar screen of the controller working positions. References: Doc 100xx - Ground-based Safety Nets Manual Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii	ANSP Ground systems supplier	2013
Training	-	Training requirements for short term conflict alerts	Air traffic controller knowledge and reaction to alerts. References: Indications in Doc 100xx - Ground-based Safety Nets Manual	ANSP	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

STCA systems are applicable in all controlled airspace for all aircraft for which a controller has responsibility for separation or traffic information. Before operational use, the system must have been configured for the target airspace, to maximize the number of relevant alerts while keeping the number of unnecessary alerts to an acceptable level.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	STCA use improves safety by making controllers aware of potentially dangerous situations that may otherwise have been missed or detected later.	ANSP Airspace user
	Improve situational awareness of ATCO	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SNET-B0/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve mid-air collision avoidance (safety net)	++	

SNET-B0/2 Minimum Safe Altitude Warning (MSAW) Operational

Main Purpose

To assist the air traffic controller in preventing controlled flight into terrain accidents by generating, in a timely manner, an alert of aircraft proximity to terrain or obstacles.

New Capabilities

MSAW systems warns the controller about the increased risk of controlled flight into terrain accidents by generating, in a timely manner, an alert of aircraft proximity to terrain or obstacles.

Note: MSAW systems are providing protection on all aircraft in particular those not equipped with Ground Proximity Warning Systems.

Description

Surveillance data (including tracked pressure altitude), flight data (including cleared flight levels) and environment data (including terrain and obstacle data) are input to the MSAW system to generate the alerts to the controller working position.

On noticing the alert, the controller has to analyse the situation and, if deemed necessary, issue an instruction to the aircraft, with the appropriate emergency phraseology.

Maturity Level

Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-operational benefit	SNET-B0/1 - Short Term Conflict Alert (STCA)
Relation-technology benefit	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Safety nets	Controller reaction to minimum safe altitude warning	Procedures for air traffic controllers to react to minimum safe altitude warnings. Reference: Doc 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM); Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP	2013
Airborne system capability	Safety nets	Surveillance system capabilities required for minimum safe altitude warning	SSR transponder compliant with … ADS-B out compliant with … Reference: Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	Airspace user Aircraft manufacturer	2013
Ground system infrastructure	Safety nets	Surveillance ground capabilities required for minimum safe altitude warning	SSR radar ADS-B in station Reference: Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP Ground systems supplier	2013
Ground system infrastructure	Safety nets	Display for minimum safe altitude warnings	Capability to indicate alerts on the controller working position. Reference: Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP Ground systems supplier	2013
Training	-	Training requirements for minimum safe altitude warnings	Air traffic controller knowledge and reaction to alerts. Reference: Doc 100xx - Ground-based Safety Nets Manual	ANSP	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

All controlled airspace for all aircraft.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of ATCO	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS SNET-B0/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Reduce controlled flight into terrain (CFIT) and obstacle collision risk	++	

SNET-B0/3	Area Proximity Warning (APW)	Operational

Main Purpose: APW is designed, configured and used to make a significant positive contribution to the prevention of accidents arising from unauthorized penetration of an airspace volume.

New Capabilities: APW systems warn the air traffic controller about unauthorised penetration into the airspace (either restricted or controlled) by a flight (either controlled or uncontrolled).

Description: Surveillance data (including tracked pressure altitude), flight data (including cleared flight levels and RVSM status) and environment data (including airspace volumes) are input to the APW system to generate the alerts to the controller working position(s).

On noticing the alert, the controller has to analyse the situation and, if deemed necessary, issue an instruction to the aircraft, with the appropriate emergency phraseology.

Maturity Level: Ready for implementation

Human Factor Considerations:

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Safety nets	Controller reaction to area proximity warning	Procedures for air traffic controllers to react to area proximity warnings. Reference: Future amendment of Doc 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM); Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP	2013
Airborne system capability	Safety nets	Surveillance system capabilities required for area proximity warning	SSR transponder compliant with … ADS-B out compliant with … Reference: Doc 100xx - Ground-based Safety Nets Manual - http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	Aircraft manufacturer Aircraft operator	2013
Ground system infrastructure	Safety nets	Surveillance ground capabilities required for area proximity warning	SSR radar ADS-B in station Reference: Doc 100xx - Ground-based Safety Nets Manual - http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP Ground systems supplier	2013
Ground system infrastructure	Safety nets	Display for area proximity warning	Capability to indicate alerts on the controller working position. Reference: Doc 100xx - Ground-based Safety Nets Manual - http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP Ground systems supplier	2013
Training	-	Training requirements for area proximity warnings	Air traffic controller knowledge and reaction to alerts. Reference: Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

All controlled airspace for all aircraft.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of ATCO	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SNET-B0/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Reduce unauthorized penetration of airspace risk	++	

SNET-B0/4 Approach Path Monitoring (APM) Operational

Main Purpose

APM is a ground-based safety net intended to warn the controller about increased risk of controlled flight into terrain accidents by generating, in a timely manner, an alert of aircraft proximity to terrain or obstacles during final approach.

New Capabilities

APM is designed, configured and used to make a significant positive contribution to avoidance of controlled flight into terrain accidents by generating, in a timely manner, an alert of aircraft proximity to terrain or obstacles during final approach.

Description

Surveillance data (including tracked pressure altitude), flight data (including concerned sectors) and environment data (including terrain and obstacle data) are input to the APM system to generate the alerts to the controller working position(s).

On noticing the alert, the controller has to analyse the situation and, if deemed necessary, issue an instruction to the aircraft, with the appropriate emergency phraseology.

Maturity Level

Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Safety nets	Controller reaction to approach path monitoring alerts	Procedures for air traffic controllers to react to approach path monitoring alerts. Reference: Future amendment of Doc 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM); Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP	2013
Airborne system capability	Safety nets	Surveillance system capabilities required for approach path monitoring alerts	SSR transponder compliant with … ADS-B out compliant with … Reference: Doc 100xx - Ground-based Safety Nets Manual - http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	Aircraft manufacturer Aircraft operator	2013
Ground system infrastructure	Safety nets	Surveillance ground capabilities required for approach path monitoring alerts	SSR radar ADS-B in station Reference: Doc 100xx - Ground-based Safety Nets Manual - http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP Ground systems supplier	2013
Ground system infrastructure	Safety nets	Display for approach path monitoring alerts	Capability to indicate alerts on the controller working position. Reference: Doc 100xx - Ground-based Safety Nets Manual - http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-ii	Aircraft manufacturer Aircraft operator	2013
Training	-	Training requirements for approach path monitoring alerts	Air traffic controller knowledge and reaction to alerts. Reference: Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

All controlled airspace for all aircraft in final approach.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of ATCO	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS SNET-B0/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Reduce controlled flight into terrain (CFIT) and obstacle collision risk	++	

SNET-B1/1 Enhanced STCA with aircraft parameters Operational

Main Purpose: Assist the air traffic controller in preventing collision between aircraft, using position data from ground surveillance and flight intent reported by aircraft.

New Capabilities: Using aircraft intent parameters allows STCA systems to reduce the number of unnecessary alerts, to increase the number of relevant alerts and to alert earlier, compared to the basic STCA system in Block 0.

Description: This enhanced STCA works the same as the basic STCA system in Block 0, but stops the linear extrapolation of the vertical position of an aircraft when it reached the Selected Flight Level information reported from ADS-B or downlinked from Mode S transponders.

Maturity Level: Ready for implementation

Human Factor Considerations:

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology need	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)

Evolution	SNET-B0/1 - Short Term Conflict Alert (STCA)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Safety nets	Controller reaction to short term conflict alerts	Procedures for air traffic controllers reaction to short term conflict alerts. References: Doc 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	ANSP	2013
Airborne system capability	Safety nets	Surveillance system capabilities required for enhanced short term conflict alerts	SSR transponder compliant with … ADS-B out compliant with … References: Doc 100xx - Ground-based Safety Nets Manual http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii	Aircraft manufacturer Aircraft operator	2019
Ground system infrastructure	Safety nets	Surveillance ground capabilities required for enhanced short term conflict alerts	SSR radar ADS-B in station References: Doc 100xx - Ground-based Safety Nets Manual Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii	ANSP Ground systems supplier	2019
Ground system infrastructure	Safety nets	Display for enhanced short term conflict alerts	Capability to indicate alerts on the radar screen of the controller working positions. References: Doc 100xx - Ground-based Safety Nets Manual Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii	ANSP Ground systems supplier	2019
Training	-	Training requirements for enhanced short term conflict alerts	Air traffic controller knowledge and reaction to alerts. Reference: Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Enhanced STCA systems with aircraft parameters are applicable in all controlled airspace for all aircraft for which a controller has responsibility for separation or traffic information. Before operational use, the system must have been configured for the target airspace, to maximize the number of relevant alerts while keeping the number of unnecessary alerts to an acceptable level. It will bring incremental benefits as the number of ADS-B out capable aircraft or Mode S

EHS capable aircraft increase.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Enhanced STCA use improves on basic STCA safety benefits by providing more relevant and earlier alerts for aircraft in vertical evolution. It also improves controllers' efficiency by reducing the number of unnecessary alerts for aircraft in vertical evolution.	ANSP Aircraft operator
	Improve situational awareness of ATCO	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS SNET-B1/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve mid-air collision avoidance (safety net)	++	

SNET-B1/2 Enhanced STCA in complex TMAs Operational

Main Purpose Assist the air traffic controller in preventing collision between aircraft, using position data from ground surveillance and taking into account possible crew intents linked to traffic patterns and ATC practices in complex TMAs.

New Capabilities Taking into account traffic patterns and ATC practices allows STCA systems to reduce the number of unnecessary alerts, to increase the number of relevant alerts and to alert earlier, compared to the basic STCA system in Block 0.

Description This enhanced STCA works the same as the basic STCA system in Block 0, but, in addition of the current proximity test and the linear prediction test, performs the following tests:

- (level-off prediction test) The vertical positions of aircraft in vertical evolution are extrapolated to level-off at the next reasonable FL.
- (turn prediction test) The horizontal positions of aircraft in proximity of a final approach path are extrapolated to turn in alignment with this final approach path.

Care is also taken to setup a specific set of alerting parameters (horizontal threshold, vertical threshold and warning time) for each approach area within the TMAS, where unnecessary alerts could affect runway throughputs.

Maturity Level Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)
Evolution	SNET-B0/1 - Short Term Conflict Alert (STCA)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Safety nets	Controller reaction to short term conflict alerts	Procedures for air traffic controllers reaction to short term conflict alerts. References: Doc 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	ANSP	2013
Airborne system capability	Safety nets	Surveillance system capabilities required for enhanced short term conflict alerts in complex TMAs	SSR transponder compliant with … ADS-B out compliant with … References: Doc 100xx - Ground-based Safety Nets Manual http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii	Aircraft manufacturer Aircraft operator	2019
Ground system infrastructure	Safety nets	Surveillance ground capabilities required for enhanced short term conflict alerts in complex TMAs	SSR radar ADS-B in station References: Doc 100xx - Ground-based Safety Nets Manual Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii	ANSP Ground systems supplier	2019

Ground system infrastructure	Safety nets	Display for enhanced short term conflict alerts in complex TMAs	Capability to indicate alerts on the radar screen of the controller working positions. References: Doc 100xx - Ground-based Safety Nets Manual Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii	ANSP Ground systems supplier	2019
Training	-	Training requirements for enhanced short term conflict alerts in complex TMAs	Air traffic controller knowledge and reaction to alerts. Reference: Doc 100xx - Ground-based Safety Nets Manual - Details in Eurocontrol documents at http://www.eurocontrol.int/publications/eurocontrol-guidelines-minimum-safe-altitude-warning-msaw-part-i-iii	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Enhanced STCA systems in complex TMAs are applicable in all controlled complex TMAs for all aircraft for which a controller has responsibility for separation or traffic information. The deployment of such an enhanced STCA is necessary in TMAs where the basic STCA would produce an unacceptable level of unnecessary alerts or would fail to produce timely alerts for traffic with frequent trajectory changes. Before operational use, the system must have been configured for the target airspace, to maximize the number of relevant alerts while keeping the number of unnecessary alerts to an acceptable level.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Enhanced STCA use improves on basic STCA safety benefits by providing more relevant and earlier alerts for aircraft in horizontal and vertical evolution. It also improves controllers' efficiency by reducing the number of unnecessary alerts for aircraft in horizontal and vertical evolution.	ANSP Aircraft operator
	Improve situational awareness of ATCO	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS SNET-B1/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve mid-air collision avoidance (safety net)	++	

SURF

SURF-B0/1	Basic ATCO tools to manage traffic during ground operations	Operational

Main Purpose

To improve safety and efficiency during ground operations by providing proper indications to pilots and vehicle drivers.

New Capabilities

The guiding and routing service is delivered using visual aids and signals on the platform. Information is managed by the controller to provide pilots and vehicle drivers all necessary information to taxi and avoid incursion on the runway.

Description

This element represents the provision of guidance and routing information to the pilot in order to manage the traffic in a safe and efficient way by the controller:

- to confirm the routing of all aircraft and vehicles according to the defined identification procedures;
- to prevent incursions on the runway using visual aids, stop bars in particular.

The Controller monitors and commands the lighting systems.

Maturity Level

Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? No
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out Taxi-in

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Runway incursion is traditionally prevented using lighting systems on the Airport. Stop bars and other systems are highly contributing to the fluidity and safety of taxi operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety of surface operations	Airport operator, ANSP, Aircraft operator
	Efficiency of surface operations	Airport operator, ANSP, Aircraft operator
	Improved Management of the platform	Airport operator
	Prevention of Runway incursion	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of flight crew and vehicle driver	Airport operator, ANSP, Aircraft operator, Ground handling agent

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SURF-B0/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Avoid taxi-in additional time resulting from adverse conditions	++	KPI13: Taxi-in additional time
Efficiency	Flight time & distance	Avoid taxi-out additional time resulting from adverse conditions	++	KPI02: Taxi-out additional time
Safety		Avoid incorrect entries of aircraft or vehicles onto the runway protected area (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	
Safety		Avoid incorrect runway crossings by aircraft or vehicles (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	
Safety		Reduce number of taxi errors (cases of non-conformance with clearance)	++	

SURF-B0/2	Comprehensive situational awareness of surface operations	Operational

Main Purpose To better maintain ATCO awareness of ground operations.

New Capabilities

The surveillance service of A-SMGCS provides airport traffic situational awareness through the position, identification and tracking of aircraft and vehicle suitably equipped on the aerodrome surface. Information is presented on the controller and airport operator display independent of visibility conditions and controller line of sight.

Description

This service represents the provision of surveillance information to the controller in order to manage the traffic in a more efficient way and allows the controller:

- to confirm the identity of all participating vehicles according to the defined identification procedures;
- to prevent collisions between all aircraft and vehicles especially in conditions when visual contact cannot be maintained;
- to manually correlate (link a target with a call sign) targets for the rare cases where there is an operational need to, e.g. areas of poor cooperative surveillance coverage and the need to track non-cooperative targets such as towed aircraft;
- to detect and indicate the position of potential intruders.

Maturity Level

Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? No
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	ASUR-B0/2 - Multilateration cooperative surveillance systems (MLAT)
Relation-technology benefit	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex Airports, the introduction of SMGCS functions is highly contributing to the safety and efficiency of surface operations by providing to the ATCO the necessary situation awareness to control operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety of surface operations	Airport operator ANSP Aircraft operator
	Efficiency of surface operations	Airport operator ANSP Aircraft operator
	Improved management of the platform	Airport operator
	Prevention of runway incursion	Airport operator ANSP Aircraft operator
	Improve situational awareness of ATCO	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS SURF-B0/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Avoid incorrect entries of aircraft or vehicles onto the runway protected area (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	
Safety		Avoid incorrect presence of vacating aircraft or vehicles onto the runway protected area)	++	
Safety		Avoid incorrect runway crossings by aircraft or vehicles (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	
Safety		Improve collision avoidance during taxi operations (safety net)	++	

SURF-B0/3	Initial ATCO alerting service for surface operations	Operational

Main Purpose: Detection by the ATCO of potentially unsafe situations with regard to runway operations.

New Capabilities: The ATCO will be provided with a short term conflicting alerting tool (A-SMGCS initial alerting service) that monitors movements on or near the runway and detects conflicts between an aircraft and another vehicle as well as runway incursion by intruders. Appropriate alerts will be visualized on the ATCO display.

Description

This element represents the first step of A-SMGCS alerting service and is based on A-SMGCS surveillance. It takes into account elements such as:

- the runway configuration of the airport (e.g. one, two or more runways);
- the associated procedures (e.g. multiple line ups and reduced separation on the runway when approved by the ATS authorities);
- the position and type of the aircraft and vehicles (e.g. arrival, departure or vehicle) according to the set time parameters and their relative speeds and positions when within or about to enter a predefined area around the runway;
- aircraft in the vicinity of the runway (e.g. on final approach, climb out and helicopters crossing);
- meteorological conditions.

Maturity Level

Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? No
4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out | Departure | Arrival | Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	ASUR-B0/2 - Multilateration cooperative surveillance systems (MLAT)
Relation-technology benefit	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)
Evolution	SURF-B0/1 - Basic ATCO tools to manage traffic during ground operations

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex airports, the complexity of the infrastructure and the traffic can induce possibility of errors in the management of taxi operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
	Safety of surface operations	Airport operator | ANSP | Aircraft operator

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Prevention of runway incursion	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of ATCO	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SURF-B0/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve runway collision avoidance (safety net)	++	

SURF-B1/1 Advanced features using visual aids to support traffic management during ground operations — Operational

Main Purpose

To improve surface operations with the aim to reduce taxi time and fuel burn, potential mistakes.

New Capabilities

Advanced features including “Follows the Greens” (FTG) and Variable Message Panels are used to optimize routing during taxi operations. The lighting system is used to direct the aircraft, making the guidance safer, as errors are minimized.

Lighting system for other vehicles than aircraft is connected to the SMGCS in order to optimize ground circulation and prevent collision.

Description

Advanced features including FTG and Variable Message Panels are used to optimize routing during taxi operations. The lighting system is used to direct the aircraft, making the guidance safer, as errors are minimized.

Lighting system for other vehicles than aircraft is connected to the SMGCS in order to optimize ground circulation and prevent collision.

Maturity Level

Standardization

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out, Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	SURF-B0/1 - Basic ATCO tools to manage traffic during ground operations
Relation-operational need	ACDM-B0/1 - Airport CDM Information Sharing (ACIS)

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex airports, the management of the platform is introducing numerous changes and an increased complexity in managing maintenance or construction together with ensuring safety and efficiency of operations. The introduction of dynamic aids is highly improving accuracy of the navigation on the surface and as such safety and efficiency.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety of surface operations	Airport operator, ANSP, Aircraft operator
	Efficiency of surface operations	Airport operator, ANSP, Aircraft manufacturer
	Improved management of the platform	Airport operator
	Prevention of runway incursion	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of flight crew and vehicle driver	Airport operator, ANSP, Aircraft operator, Ground handling agent

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SURF-B1/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Avoid taxi-in additional time resulting from adverse conditions	++	KPI13: Taxi-in additional time
Efficiency	Flight time & distance	Avoid taxi-out additional time resulting from adverse conditions	++	KPI02: Taxi-out additional time
Safety		Improve collision avoidance during taxi operations (safety net)	++	

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Reduce number of taxi errors (cases of non-conformance with clearance)	++	

SURF-B1/2 Comprehensive pilot situational awareness on the airport surface

Operational

Main Purpose: To improve ground operations based on increasing pilot's situational awareness and safety especially at taxiway and runway intersections, as well as for aircraft landing and taking off.

New Capabilities: In addition to display of the airport layout (showing taxiways, runways, fixed obstacles) and the own aircraft position, the pilot has an improved situational awareness thanks to the additional display of surrounding traffic (incl. both aircraft and optionally airport vehicles).

Description: The pilot can visualize surrounding traffic to be presented on traffic computer and display. Different technologies enable this capability, among which ADS-B OUT/ADS-B IN. In order to maximize the benefits, it is suitable that all aircraft be equipped in a homogeneous manner. However, a transition period can be observed and a partial equipage will result in the display of only the appropriately equipped aircraft.

Maturity Level: Ready for implementation

Human Factor Considerations:

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? No
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out | Departure | Arrival | Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-operational need	CSEP-B1/1 - Basic airborne situational awareness during flight operations (AIRB)

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex airports, the complexity of the infrastructure and the traffic can induce possibility of errors in the management of taxi operations. Full pilot situational awareness will first compensate possible mistakes from the controllers but also assist in improving the efficient management of taxi operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety of surface operations	Airport operator, ANSP, Aircraft operator
	Efficiency of surface operations	Airport operator, ANSP, Aircraft operator
	Improved management of the platform	Airport operator
	Prevention of runway incursion	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of flight crew	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SURF-B1/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Avoid incorrect entries of aircraft or vehicles onto the runway protected area (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	
Safety		Avoid incorrect presence of vacating aircraft or vehicles onto the runway protected area)	++	
Safety		Avoid incorrect runway crossings by aircraft or vehicles (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	
Safety		Improve collision avoidance during taxi operations (safety net)	++	

SURF-B1/3	Enhanced ATCO alerting service for surface operations	Operational

Main Purpose: The enhanced A-SMGCS alerting service anticipates potential runway conflicts, runway incursion and other hazardous situations on the aerodrome surface.

New Capabilities: Early detection of aircraft and vehicles that are not following given clearances/ instructions or provision of alerts when clearances given by the controller do not comply with local ATC rules/procedures.

Description: The A-SMGCS Alerting service for controllers is complemented with the detection of conflicting ATC Clearances (CATC) given by the controller (e.g. Line-up versus Land on same runway) and with the detection of non-conformance to procedures or instructions (e.g. route deviation). An electronic clearance input means is used by the controller to make the clearances known to the system. Surveillance data and routing information are also used by the logic to generate alerts to the controller.

Maturity Level: Standardization

Human Factor Considerations:

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? No
4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out | Departure | Arrival | Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	SURF-B0/2 - Comprehensive situational awareness of surface operations
Evolution	SURF-B0/3 - Initial ATCO alerting service for surface operations
Relation-operational need	SURF-B1/4 - Routing service to support ATCO surface operations management

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex airports, the complexity of the infrastructure and the traffic can induce possibility of errors in the management of taxi operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety of surface operations	Airport operator, ANSP, Aircraft operator
	Prevention of runway incursion	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of ATCO	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SURF-B1/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve early detection of conflicting ATC Clearances (CATC) related to runway usage	++	
Safety		Improve early detection of conflicting ATC Clearances (CATC) related to taxi operations	++	

SURF-B1/4 Routing service to support ATCO surface operations management — Operational

Main Purpose

To improve pre-departure and departure sequencing by provision of accurate taxi times and efficient routing service.

New Capabilities

The A-SMGCS routing service calculates individual routes for mobiles for representation to the controller in order to support the runway sequencing strategy.

Description

The A-SMGCS routing service calculates individual routes for mobiles based on known airport parameters and constraints or following an interaction by the controller. The controller is presented with planned or cleared routes and has means to modify these routes or to create new route if necessary. Information is updated in real time in order to improve predictability of surface operations.

Maturity Level

Standardization

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

OPERATIONS

Tactical-Pre ops | Tactical-During ops

Taxi-out | Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	SURF-B0/2 - Comprehensive situational awareness of surface operations
Relation-operational need	RSEQ-B0/1 - Arrival Management
Relation-operational need	RSEQ-B0/2 - Departure Management

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex airports, the management of the platform is introducing numerous changes and an increased complexity in managing maintenance or construction together with ensuring safety and efficiency of operations. Appropriate and potentially tailored routing services can highly improve safety and efficiency of airport surface management. When fully consistent with ACDM and Runway sequencing strategies, it clearly contributes to the performance of the airport and surrounding airspace management.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety of surface operations	Airport operator | ANSP | Aircraft operator
	Efficiency of surface operations	Airport operator | ANSP | Aircraft operator
	Improved management of the platform	Airport operator
	Prevention of runway incursions	Airport operator | ANSP | Aircraft operator
	Improve situational awareness of ATCO	ANSP
Indirect benefits	Improved efficiency of terminal airspace management and network operations.	ANSP | Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SURF-B1/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Avoid taxi-in additional time resulting from adverse conditions	++	KPI13: Taxi-in additional time

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Avoid taxi-out additional time resulting from adverse conditions	++	KPI02: Taxi-out additional time
Efficiency	Flight time & distance	Introduce 4D planning of taxi-in surface movements	++	KPI13: Taxi-in additional time
Efficiency	Flight time & distance	Introduce 4D planning of taxi-out surface movements	++	KPI02: Taxi-out additional time

SURF-B1/5 Enhanced vision systems for taxi operations Operational

Main Purpose: Allow for improved navigation by visual reference, even during conditions of low-light or weather obscuration such as fog.

New Capabilities: The addition of cockpit enhanced vision capabilities will improve flight crew awareness of own ship position, and reduce navigation errors during periods of reduced visibility. In addition, improved situational awareness of aircraft position will allow for more confidence by the flight crew in the conduct of the taxi operation during periods of reduced visibility and ensure accurate application of received clearances.

Description: Additional avionics add electromagnetic sensors outside the visible light spectrum (e.g., infrared cameras, millimetre wave radar). These sensors will allow for improved navigation by visual reference, even during conditions of low-light or weather obscuration such as fog. Presentation to the flight crew may be through an instrument panel display or via heads-up display (HUD), etc.

Maturity Level: Standardization

Human Factor Considerations:

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? Yes
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information benefit	AMET-B0/1 - Meteorological observations products

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex airports, the capacity of the airport may decrease a lot in LVC due to surface operations. The introduction of enhance vision systems on board aircraft able to recognize lightings and ground indications can highly improve accuracy of the navigation on the surface and as such safety and efficiency and limit negative impact.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Efficiency of surface operations	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of flight crew	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SURF-B1/5

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Avoid longer taxi-in due to taxi errors	++	KPI13: Taxi-in additional time
Efficiency	Flight time & distance	Avoid longer taxi-out routes due to taxi errors	++	KPI02: Taxi-out additional time
Efficiency	Flight time & distance	Avoid slow taxi-in due to ATC and/or pilot	++	KPI13: Taxi-in additional time
Efficiency	Flight time & distance	Avoid slow taxi-in due to weather conditions	++	KPI13: Taxi-in additional time
Efficiency	Flight time & distance	Avoid slow taxi-out due to ATC and/or pilot	++	KPI02: Taxi-out additional time
Efficiency	Flight time & distance	Avoid slow taxi-out due to weather conditions	++	KPI02: Taxi-out additional time
Efficiency	Flight time & distance	Reduce ATC constraints during low visibility taxi-in	++	KPI13: Taxi-in additional time
Efficiency	Flight time & distance	Reduce ATC constraints during low visibility taxi-out	++	KPI02: Taxi-out additional time
Safety		Avoid incorrect entries of aircraft or vehicles onto the runway protected area (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Avoid incorrect presence of vacating aircraft or vehicles onto the runway protected area)	++	
Safety		Avoid incorrect runway crossings by aircraft or vehicles (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	
Safety		Improve early detection of conflicting ATC Clearances (CATC) related to taxi operations	++	
Safety		Reduce number of taxi errors (cases of non-conformance with clearance)	++	

SURF-B2/1 Enhanced surface guidance for pilots and vehicle drivers — Operational

Main Purpose

To improve the guidance of pilots and vehicle drivers on the aerodrome surface. Depending from the level of equipage of aircrafts and vehicles, the operational objective may be achieved either by airport ground equipment or through on-board capabilities.

New Capabilities

Automatic triggering of airport ground signs according to the route and clearances issued by ATC.

Description

The A-SMGCS guidance service is using the routing service in conjunction with ATCO inputs to allow the automated switching of Taxiway Centreline Lights (TCL) and/or stop bars. The guidance service improves the movement of mobiles on the movement area and reduces the workload of controllers.

Maturity Level

Validation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? No
4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	SURF-B0/1 - Basic ATCO tools to manage traffic during ground operations
Evolution	SURF-B1/1 - Advanced features using visual aids to support traffic management during ground operations

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex airports with very demanding traffic, the accuracy of the ground trajectory management is conditioning the overall performance of the management of the platform together with ensuring safety and efficiency of operations. Appropriate and potentially tailored routing services can highly improve safety and efficiency of Airport surface management. When fully consistent with ACDM and Runway sequencing strategies, it clearly contributes to the performance of the Airport and surrounding Airspace management.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety of surface operations	Airport operator, ANSP, Aircraft operator
	Safety of surface operations	Airport operator, ANSP, Aircraft operator
	Improved management of the platform	Airport operator
	Prevention of runway incursion	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of flight crew and vehicle driver	Airport operator, ANSP, Aircraft operator, Ground handling agent
Indirect benefits	Improved efficiency of terminal airspace management and network operations	ANSP, Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS SURF-2/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Avoid taxi-in additional time resulting from adverse conditions	++	KPI13: Taxi-in additional time
Efficiency	Flight time & distance	Avoid taxi-out additional time resulting from adverse conditions	++	KPI02: Taxi-out additional time

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve collision avoidance during taxi operations (safety net)	++	
Safety		Reduce number of taxi errors (cases of non-conformance with clearance)	++	

SURF-B2/2	Comprehensive vehicle driver situational awareness on the airport surface	Operational

Main Purpose

Expansion of situation awareness to vehicle's drivers by the provision of own position and surrounding traffic position on a display in the vehicle. Considered vehicles can be small UAS used for airport specific functions. The vehicle driver is informed about potential and actual risk of collision with aircraft and infringement of restricted or closed areas.

New Capabilities

Information regarding the surrounding traffic (including both aircraft and airport vehicles) during taxi and runway operations is displayed in the vehicle driver's cockpit. The system detects hazardous situations and provides the vehicle driver with the appropriate alert, either generated by the on-board system or uplinked from a centralized airport function.

Description

For the vehicles operating on the manoeuvring area of the airport, a display on-board of the vehicle is showing the surrounding traffic and own position to enhance the situational awareness of the vehicle driver and providing the appropriate alerts to ensure safer operations of vehicles on the manoeuvring area.

Maturity Level

Standardization

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out | Departure | Arrival | Taxi-in

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex airports with very demanding traffic, vehicle drivers may have difficulty to get the full situation awareness. The provision of a comprehensive situational awareness and associated alerts through appropriate means associated with appropriate alerts will ensure safety and efficiency of operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety of surface operations	Airport operator, ANSP, Aircraft operator
	Efficiency of surface operations	Airport operator, ANSP, Aircraft operator
	Improved management of the platform	Airport operator
	Prevention of runway incursion	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of flight crew	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SURF-2/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Avoid incorrect entries of aircraft or vehicles onto the runway protected area (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	
Safety		Avoid incorrect presence of vacating aircraft or vehicles onto the runway protected area)	++	
Safety		Avoid incorrect runway crossings by aircraft or vehicles (without or contrary to ATC clearance or due to incorrect ATC clearance)	++	
Safety		Improve collision avoidance during taxi operations (safety net)	++	
Safety		Improve runway collision avoidance (safety net)	++	

SURF-B2/3	Conflict alerting for pilots for runway operations	Operational

Main Purpose: To improve safety during runway operations by providing traffic indication and alerts to pilots and/or vehicle drivers.

New Capabilities: The on-board system detects potential and actual risk of collision with other traffic during runway operations and provides the pilot with the appropriate alert.

Description: This enhancement represents a key on-board feature to significantly decrease the risk of conflict with any mobile on or near the runway, improving safety on airport surface. Aircraft data is broadcasted with the proper level of performance and quality in order to provide adequate alerts to the pilots.

Broadcasted aircraft data can also be presented on board airport ground vehicles

Maturity Level: Standardization

Human Factor Considerations:

1. Does it imply a change in task by a user or affected others? No
2. Does it imply processing of new information by the user? Yes
3. Does it imply the use of new equipment? No
4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Taxi-out | Departure | Arrival | Taxi-in

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	SURF-B1/2 - Comprehensive pilot situational awareness on the airport surface

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Runway incursion prevention.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
	Prevention of runway incursions.	Airport operator | ANSP | Aircraft operator

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of flight crew and vehicle driver	Airport operator, ANSP, Aircraft operator, Ground handling agent
Indirect benefits	The enabling infrastructure comprising traffic position broadcast as well as Data Link services is serving at least the general operational efficiency of the airport.	Airport operator, ANSP, Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

SURF-B2/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve runway collision avoidance (safety net)	++	

TBO

TBO-B0/1	Introduction of time-based management within a flow centric approach.	Operational

Main Purpose: Provides for more efficient flight operation by using time-based scheduling versus more tactical measures such as holding to manage tactical synchronization.

New Capabilities: Strategic and tactical time based management are introduced via initial decision-making processes for network operations (demand capacity balancing) and runway sequencing (traffic synchronization).

Description: Individual time-based initiatives are available in decision making processes related to network operations or flight sequencing. The individual time-based initiatives are not synchronized, and any synchronization of individual time advisories is left to the tactical ATCO. The main focus is on the traffic flow activity without consideration to individual flights or gate-to gate focus.

Maturity Level: Ready for implementation

Human Factor Considerations

PLANNING LAYERS

Strategical, Pre-tactical, Tactical-Pre ops, Tactical-During ops

OPERATIONS

Taxi-out, Departure, En-route, Arrival, Taxi-in

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

TBO-0/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance at airports and/or associated terminal airspace	++	
Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance in en-route airspace	++	

TBO-B1/1 Initial Integration of time-based decision making processes — Operational

Main Purpose: Provides initial support to network operations by integrating network applied constraints into local arrival and departure management. Overall operations are still locally conducted with time-based decision-making tools.

New Capabilities: Network operations and runway sequencing are the main contributors. Coordination is conducted between the two contributors. Some strategic and tactical decisions are locally coordinated but not necessarily fully synchronized.

Description: Information about individual and some sets of flights are available for time-based decision-making tools. Some pre-departure and in-flight synchronization is conducted locally via ATCO and automation. Flights are subject to local/regional initial synchronization processes.

Maturity Level: Standardization

Human Factor Considerations

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

Taxi-out | Departure | En-route | Arrival | Taxi-in

Tactical-During ops

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

TBO-B1/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance at airports and/or associated terminal airspace	++	
Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance in en-route airspace	++	

TBO-B2/1 Pre-departure trajectory synchronization within a flight centric and network performance approach — Operational

Main Purpose: To achieve pre-departure synchronisation of aircraft trajectories through time-based decision-making processes. The objective of the pre-departure synchronization is to improve the performance of the network by sharing information and negotiating trajectories.

New Capabilities: Access to time targets from time-based decision-making processes to be used for local synchronization of either the insertion of a flight into ongoing time-based management or adherence to the advisories for flights in pre-departure. AU and ANSP planning is consistent based upon information exchange, including trajectory information, and information/knowledge of the evolution of the constraints.

Description

The move from data exchange to consistent information sharing provides the basis for managing departure times to meet time advisories provided by the different decision-making processes. Flow Managers provide synchronisation of trajectories (within their local (e.g. FIR) remit) via adjustments to departures times and flight profiles. The lack of automated processes across local boundaries to support synchronisation of a larger set of trajectories means that flights with non-aligned trajectories and potentially conflicting time constraints are still managed as in Block 0.

Maturity Level

Validation

Human Factor Considerations

PLANNING LAYERS

Tactical-Pre ops

OPERATIONS

Taxi-out | Departure | En-route | Arrival | Taxi-in

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

TBO-2/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance at airports and/or associated terminal airspace	++	
Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance in en-route airspace	++	

TBO-B2/2	Extended time-based management across multiple FIRs for active flight synchronization	Operational

Main Purpose

Achieve a locally efficiently-converging coordination process across time-based capabilities leading to stable, consistent and robust local trajectory solutions to improve individual flight efficiency while optimising the overall network performance. Trajectory information is shared between the AU and ANSPs for all flight phases. Post-departure trajectory sharing and negotiation with the AU allows the meeting of flight-specific business objectives and improved ground-based trajectory predictions

New Capabilities

Ability locally to link and synchronize various time advisories and paths for flights and individual aircraft across flight segments to provide equitable efficient operations. New performance specifications to meet the time component of the 4D intended trajectory to be taken into account for the local on-demand synchronization. Trajectory predictions are consistent and accurate for the aircraft that become “connected” aircraft (FMS, AOC and ANSPs have consistent predictions and each prediction is modified as a result of any change as this change is always shared and reflected in the position). Maintain custom trajectory predictions for each aircraft within the area of jurisdiction. Trajectory predictions are sufficiently synchronised across ANSPs to allow for traffic synchronization.

Description

Based on the move from data exchange to information sharing and providing that information to all components of individual or regional ANSP(s), AOC and the aircraft operator/pilot, automation exists which supports the synchronization of time and trajectory advisories within a state or region. Synchronization is based on rules and processes which take into consideration not only the objectives of the individual time-based decision-making processes, also but both dynamic and static constraints which may change/set new priorities rather than a single set of fixed rules.

UTM Rules are established to define airspace use by the different users and to locally synchronize the decision-making processes, based on the overall optimization of the performance.

Global rules for transitioning from different operating environments (including higher airspace and lower airspace) should be established based on local synchronization of decision making processes [coupled time-based management] in the affected airspace.

Note: TBO provisions are envisaged at this point. In order for a 4DT capability that is consistent across ANSPs, processes and information exchanges are required, which will include the definition and application of tolerances for various purposes (e.g. trajectory updates).

Maturity Level

Validation

Human Factor Considerations

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

Taxi-out | Departure | En-route | Arrival | Taxi-in

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

TBO-B2/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance at airports and/or associated terminal airspace	++	
Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance in en-route airspace	++	

WAKE

WAKE-B2/1 Wake turbulence separation minima based on 7 aircraft groups — Operational

Main Purpose

To safely optimise the separation minima to be applied between groups of aircraft due to wake turbulence on arrival and departure phases of flight.

New Capabilities

Replacement of the 3 aircraft wake turbulence categories defined in ICAO PANS-ATM by 7 aircraft wake turbulence groups based on safety and operational requirement criteria.

Description

This element defines new wake turbulence separation minima between wake turbulence groups. The placement of aircraft into groups may be based on new aircraft designs, aircraft performance, collected wake and wind data, and flight trials.

Maturity Level

Standardization

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

Adaptation of working methods to separate traffic based on wake turbulence groups.

2. Does it imply processing of new information by the user? Yes

Processing of more wake turbulence categories/groups and associated separation minima.

3. Does it imply the use of new equipment? No

4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-operational option	APTA-B0/3 - SBAS/GBAS CAT I precision approach procedures
Relation-operational option	APTA-B1/2 - PBN SID and STAR procedures (with advanced capabilities)
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	NAVS-B0/1 - Ground Based Augmentation Systems (GBAS)
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	ATC Procedure to separate arrival and departure traffic based on Wake Turbulence Groups	Procedure, working methods and separation look-up tables for Approach and Tower Air Traffic Controllers to operate Wake Turbulence separation based 7 aircraft Wake Turbulence Groups (WTG). References:	ANSP	2020
Ground system infrastructure	ATC systems	Flight Plan Processing System adaptation to operate WTG	Association in the local flight data processing system of an aircraft type to the corresponding Wake Turbulence Groups. References:	ANSP	2019
Ground system infrastructure	ATC systems	ATC system adaptation to display the WTG	Display on the approach and aerodrome controller's surveillance display systems of the Wake Turbulence Group code associated to an aircraft type. References:	ANSP	2019
Training	-	Training requirements for WTG	ATC Training to separate arrival and departure traffic based on WTG: Training of Approach and Tower Air Traffic Controllers on separation minima and delivery using 7 wake turbulence groups.	ANSP	2019
Regulatory provisions	National regulatory framework	National framework amendment for Arrival and departure separation provisions based on Wake Turbulence Groups	National regulation amendment for arrival and departure separation provisions based on of WTG. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended with distance-based separation (under ATS surveillance service) based 7 aircraft Wake Turbulence Groups (WTG)	CAA	2020

Ground system infrastructure	Surveillance	Surveillance capabilities for separation in arrivals and departures	Provide the necessary surveillance means to comply with applicable surveillance performance requirements.	ANSP	2013
Ground system infrastructure	Navigation	Navigation capabilities for separation in arrivals and departures	Provide the necessary navigation capabilities (e.g. ILS for precision approach).	ANSP	2013
Training	Awareness	Awareness requirements for WTG	Flight Crew awareness of separation based on WTG: Briefing material for Flight Crew awareness of the change in applicable wake separation minima.	Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with demand that nears or exceeds peak capacity during periods of the operational day or overall daily capacity resulting in arrival and departure delay, and aerodromes where additional operational resilience is required to manage peak traffic in response to unplanned events.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce separation minima	Airport operator, ANSP, Airspace user
	Reduce delay	Airport operator, ANSP, Airspace user, ATM network function
	Increase peak capacity	Airport operator, ANSP, Airspace user
Indirect benefits	Efficiency (temporal efficiency, i.e. delay)	ANSP, Airspace user
	Fuel savings: from taxi-out and arrival track miles	Airspace user
	Resilience: additional headroom for spacing and sequence management	ANSP
	Safety: reduced under spacing, number of go-arounds	Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

WAKE-B2/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Improved categorisation of aircraft (arrival)	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce wake vortex separation penalty from other traffic using the departure RWY	++	KPI10: Airport peak throughput

WAKE-B2/2 Dependent parallel approaches Operational

Main Purpose
To safely optimise the wake turbulence separation applied to instrument landing operations on parallel runways with centre lines spaced less than 760m (2500ft) through reduced separation.

New Capabilities
Simultaneous use of parallel runways through the definition of new landing and go around procedures with a revised wake vortex separation 7 group separation minimum.

Description
This element defines a dependent paired approach procedure to parallel runways, with centre lines spaced less than 760m (2500ft) apart, threshold staggers, and/or glide path height differences, under ILS Category I minimums, or the minimums depicted for an RNAV or LPV approach. It covers airports exploiting ICAO 3 Category or Revised Wake Vortex Separation of 7 groups.

Maturity Level
Standardization

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

Adaptation of working methods to separate traffic based on wake turbulence groups.

2. Does it imply processing of new information by the user? Yes

Processing of more wake turbulence categories/groups and associated separation minima.

3. Does it imply the use of new equipment? No

4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information benefit	AMET-B1/2 - Meteorological forecast and warning information
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-operational need	WAKE-B2/1 - Wake turbulence separation minima based on 7 aircraft groups
Relation-operational option	APTA-B0/3 - SBAS/GBAS CAT I precision approach procedures

Relation-operational option	APTA-B1/2 - PBN SID and STAR procedures (with advanced capabilities)
Relation-operational option	APTA-B2/2 - Simultaneous operations to parallel runways
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	NAVS-B0/1 - Ground Based Augmentation Systems (GBAS)
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)
Relation-operational benefit	SNET-B0/4 - Approach Path Monitoring (APM)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for wake turbulence separation for staggered dependent parallel approaches	National regulation amendment for wake turbulence separation for staggered dependent parallel approaches. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended with distance-based separation (under ATS surveillance service) between staggered dependent parallel approaches based on Wake Turbulence Categories or Wake Turbulence Groups (WTG)	CAA	2022
Operational procedures	Operations	ATC Procedure to separate staggered dependent parallel approaches	Design of local procedure and minima (if wind-dependent), working methods and separation look-up tables for Approach and Tower Air Traffic Controllers to operate wake turbulence separation for staggered dependent parallel approaches based on Wake Turbulence Categories (WTC) or Wake Turbulence Groups (WTG). References:	ANSP	2022
Ground system infrastructure	Ground infrastructure	Adaptation of runway threshold location enabling staggered dependent parallel approaches	Displacement of one landing threshold location to create a stagger with the other threshold, if not already existing. References:	ANSP	2019

Ground system infrastructure	ATC systems	Flight Plan Processing System adaptation to operate staggered dependent parallel approaches based on WTG	Local association of an aircraft type to the Wake Turbulence Groups in the flight data processing system (required when operating separation based on 7 WTG). References:	ANSP	2019
Ground system infrastructure	ATC systems	ATC system adaptation to display the WTG for staggered dependent parallel approaches	Display on the approach and aerodrome controller's surveillance display systems on the Wake Turbulence Group code associated to an aircraft type (required when operating separation based on 7 WTG). References:	ANSP	2019
Training	-	Training requirements for dependent parallel approaches	ATC Training to separate traffic under staggered dependent parallel approaches: Training of Approach and Tower Air Traffic Controllers to operate separation minima for staggered dependent parallel approaches based	ANSP	2019
Ground system infrastructure	Surveillance	Surveillance capabilities for separation in arrivals and departures	Provide the necessary surveillance means to comply with applicable surveillance performance requirements.	ANSP	2013
Ground system infrastructure	Navigation	Navigation capabilities for separation in arrivals and departures	Provide the necessary navigation capabilities (e.g. ILS for precision approach).	ANSP	2013
Training	Awareness	Awareness requirements for dependent parallel approaches	Wake Turbulence Categories (WTC) or Wake Turbulence Groups (WTG) Flight Crew awareness of separation applicable under staggered dependent parallel approaches: Briefing material for Flight Crew awareness of the change in applicable wake separation minima for staggered dependent parallel approaches	Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with demand that exceeds peak capacity during periods of the operational day or overall daily capacity resulting in arrival and departure delay, and aerodromes where additional operational resilience is required to manage peak traffic in response to unplanned events operating dependent parallel approaches with parallel runways having centrelines spaced less than 760 m (2500 feet) apart.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce separation minima on approach	Airport operator, ANSP, Airspace user
	Reduce delay	Airport operator, ANSP, Airspace user, ATM network function
	Increase peak capacity by using parallel RWY operations	Airport operator, ANSP, Airspace user
Indirect benefits	Efficiency (temporal efficiency, i.e. delay)	ANSP, Airspace user
	Resilience: additional headroom for spacing and sequence management	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

WAKE-B2/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce wake turbulence impact from parallel RWY during crosswind (arrival)	++	KPI10: Airport peak throughput

WAKE-B2/3 Independent segregated parallel operations Operational

Main Purpose

To safely optimise the wake turbulence separation applied to segregated operations on parallel runways, with centre lines spaced less than 760m (2500ft) apart for wake independent departure and arrival operations based on wind transport of wake turbulence.

New Capabilities

- Simultaneous use of parallel runways through the definition of new landing, departure, go around and departure procedures;
- Revised wake vortex separation 7 group separation minimum.

Description

This element defines independent segregated parallel operations procedures to parallel runways with centre lines spaced less than 760m (2500ft) apart based on detailed wind and wake analysis. It is aerodrome specific in terms of runway layout and weather conditions. It covers airports exploiting ICAO 3 Category or Wake Vortex Separation of 7 groups.

Maturity Level

Standardization

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes Adaptation of working methods to separate traffic based on wake turbulence groups. 2. Does it imply processing of new information by the user? Yes Processing of more wake turbulence categories/groups and associated separation minima. 3. Does it imply the use of new equipment? No 4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	WAKE-B2/1 - Wake turbulence separation minima based on 7 aircraft groups
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-operational option	APTA-B0/3 - SBAS/GBAS CAT I precision approach procedures
Relation-operational option	APTA-B1/2 - PBN SID and STAR procedures (with advanced capabilities)
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	NAVS-B0/1 - Ground Based Augmentation Systems (GBAS)
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for wake-independent segregated parallel operations	National regulation amendment for wake-independent segregated parallel operations. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended with wake-independent segregated parallel operations for closely spaced parallel runways based on Wake Turbulence Categories or Wake Turbulence Groups (WTG)	CAA	2022
Operational procedures	Operations	ATC Procedure for wake-independent segregated parallel operations	Design of local procedure, working methods and separation look-up tables for Approach and Tower Air Traffic Controllers to operate based on Wake Turbulence Categories (WTC) or Wake Turbulence Groups (WTG). References:	ANSP	2022

Ground system infrastructure	ATC systems	Flight Plan Processing System adaptation to operate wake-independent segregated parallel operations based on WTG	Local assocation of an aircraft type to the Wake Turbulence Groups in the flight data processing system (required when operating separation based on 7 WTG). References:	ANSP	2019
Ground system infrastructure	ATC systems	ATC system adaptation to display the WTG for wake-independent segregated parallel operations	Display on the approach and aerodrome controller's surveillance display systems on the Wake Turbulence Group code associated to an aircraft type (required when operating separation based on 7 WTG). References:	ANSP	2019
Training	-	Training requirements for wake-independent segregated parallel operations	ATC Training to separate traffic unde Wake-independent segregated parallel operations: Training of Approach and Tower Air Traffic Controllers to operate based Wake Turbulence Categories (WTC) or Wake Turbulence Groups (WTG).	ANSP	2019
Ground system infrastructure	Surveillance	Surveillance capabilities for separation in arrivals and departures	Provide the necessary surveillance means to comply with applicable surveillance performance requirements.	ANSP	2013
Ground system infrastructure	Navigation	Navigation capabilities for separation in arrivals and departures	Provide the necessary navigation capabilities (e.g. ILS for precision approach).	ANSP	2013
Training	Awareness	Awareness requirements for wake-independent segregated parallel operations	Flight Crew awareness of separation applicable under wake-independent segregated parallel operations: Briefing material for Flight Crew awareness of the change in applicable wake separation minima for closely spaced parallel runway operations.	Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with demand that exceeds peak capacity during periods of the operational day or overall daily capacity resulting in arrival and departure delay, and aerodromes where additional operational resilience is required to manage peak traffic in response to unplanned events operating Independent segregated parallel operations with

parallel runways having centrelines spaced less than 760 m (2500 feet) apart.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce separation minima independently on parallel approach and departure runways.	Airport operator ANSP Airspace user
	Increase peak capacity	Airport operator ANSP Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

WAKE-2/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce wake turbulence impact from parallel RWY during crosswind (arrival)	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce wake turbulence impact from parallel RWY during crosswind (departures)	++	KPI10: Airport peak throughput

WAKE-B2/4 Wake turbulence separation minima based on leader/follower static pairs-wise — Operational

Main Purpose: To safely optimise the separation minima to be applied between aircraft pairs due to wake turbulence on arrival and departure phases of flight.

New Capabilities: Aircraft separated by a tailored 7 (or more) separation groups or leader / follower pair-wise static matrix of aircraft type wake separation pairings with system support, for a specific airport or terminal area.

Description: This element defines new tailored wake turbulence separations for frequent aircraft pairs based on the performance characteristics of the leading aircraft generating wake turbulence and the following aircraft that might encounter the wake turbulence. It consists of a leader / follower pair-wise static matrix of aircraft type wake separation pairings that can be exploited by the ATCO with system support, or used to tailor a wake turbulence separation group system for a given traffic mix for a specific airport or terminal area. Existing categorisation or grouping systems will be used to determine separation minima for all types of aircraft pairs not specifically included in the pairwise separation matrix.

Maturity Level: Validation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

2. Does it imply processing of new information by the user? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

3. Does it imply the use of new equipment? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

4. Does it imply a change to levels of automation? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	WAKE-B2/1 - Wake turbulence separation minima based on 7 aircraft groups
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-operational option	APTA-B0/3 - SBAS/GBAS CAT I precision approach procedures
Relation-operational option	APTA-B1/2 - PBN SID and STAR procedures (with advanced capabilities)
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	NAVS-B0/1 - Ground Based Augmentation Systems (GBAS)
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for wake turbulence longitudinal separation provisions based on pair-wise minima	National regulation amendment for the provision of separation based on pair-wise minima. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended with distance-based separation (under ATS surveillance service) based on wake turbulence pair-wise minima	CAA	2024

Operational procedures	Operations	ATC Procedure to separate arrival and departure traffic based on wake turbulence longitudinal pair-wise minima	Design of procedure and working methods for Approach and Tower Air Traffic Controllers to operate Wake Turbulence separation based on pair-wise minima with ATC separation delivery function. References:	ANSP	2024
Ground system infrastructure	ATC systems	ATC separation delivery tool to operate wake turbulence longitudinal pair-wise minima	Processing and display on the approach and aerodrome controller's ATC surveillance display systems OF: - a separation deliver indicator (the distance separation minimum, or spacing constraint) applicable to a sequenced pair of aircraft, - a spacing aid indicator to assist Air Traffic Controllers for optimising Separation Delivery taking into account predicted aircraft speed profiles (optional), - a safety alerting function of imminent risk of separation infringement or wrong aircraft being turned on to a separation indicator, fed by flight data, surveillance data and separation rules	ANSP	2024
Training	-	Training requirements for wake turbulence longitudinal separation provisions based on Pair-wise minima	ATC Training to separate arrival and departure traffic based on Pair-wise minima: Training of Approach and Tower Air Traffic Controllers on separation delivery using an separation delivery function, in nominal and degraded mode of operations .	ANSP	2024
Ground system infrastructure	Surveillance	Surveillance capabilities for separation in arrivals and departures	Provide the necessary surveillance means to comply with applicable surveillance performance requirements.	ANSP	2013
Ground system infrastructure	Navigation	Navigation capabilities for separation in arrivals and departures	Provide the necessary navigation capabilities (e.g. ILS for precision approach).	ANSP	2013
Training	Awareness	Awareness requirements for wake turbulence longitudinal separation provisions based on Pair-wise minima	Flight Crew awareness of applicable separation based on Pair-wise minima: Briefing material for Flight Crew awareness of the change in applicable wake separation minima.	Aircraft operator	2024

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with demand nears or exceeds peak capacity during periods of the operational day or overall daily capacity with a dense heterogeneous traffic mix resulting in arrival and departure delay, and aerodromes where additional operational resilience and predictability is required to manage peak traffic in response to unplanned events.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce separation minima	Airport operator, ANSP, Airspace user
	Reduce delay	Airport operator, ANSP, Airspace user, ATM network function
	Prevent reduction of arrival rate during headwind conditions	Airport operator, ANSP, Airspace user, ATM network function
	Increase peak capacity	Airport operator, ANSP, Airspace user
Indirect benefits	Efficiency (temporal efficiency, i.e. delay)	ANSP, Airspace user
	Predictability: delivery of traffic more consistent, allowing increased throughput	ANSP, Airspace user
	Fuel savings: from taxi-out and arrival track miles	Airspace user
	Resilience: additional headroom for spacing and sequence management	ANSP
	Safety: reduced under-spacing, number of go-arounds	Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

WAKE-B2/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Base minima on more accurate wake vortex characteristics of aircraft pairs (static) (arrival)	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce wake vortex separation penalty from other traffic using the departure RWY	++	KPI10: Airport peak throughput

WAKE-B2/5	Enhanced dependent parallel approaches	Operational

Main Purpose

To safely optimise the wake turbulence separation applied to instrument landing operations on parallel runways with centre lines spaced less than 760m (2500ft) through reduced tailored or pairwise minimum.

New Capabilities

- Simultaneous use of runways through the definition of new landing and go around procedures
- System monitored real time wind and improved forecast meteo information (optional)
- A tailored wake turbulence separation category system for a specific airport or terminal area or
- Aircraft separated by leader / follower pair-wise static matrix of aircraft type wake separation pairings with system support.

Description

This element defines a dependent paired approach procedure to parallel runways, with centre lines spaced less than 760m (2500ft) apart, threshold staggers, and/or glide path height differences, under ILS Category I minimums, or the minimums depicted for an RNAV or LPV approach. It covers aircraft separation by leader / follower pair-wise static matrix of aircraft type wake separation pairings with system support, or a customised a wake turbulence separation category system for a specific airport or terminal area . It may include improved forecast meteo information available (optional).

Maturity Level

Validation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

2. Does it imply processing of new information by the user? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

3. Does it imply the use of new equipment? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

4. Does it imply a change to levels of automation? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	WAKE-B2/2 - Dependent parallel approaches
Relation-operational need	WAKE-B2/4 - Wake turbulence separation minima based on leader/follower static pairs-wise
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information

Relation-operational option	APTA-B0/3 - SBAS/GBAS CAT I precision approach procedures
Relation-operational option	APTA-B1/2 - PBN SID and STAR procedures (with advanced capabilities)
Relation-operational option	APTA-B2/2 - Simultaneous operations to parallel runways
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	NAVS-B0/1 - Ground Based Augmentation Systems (GBAS)
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)
Relation-operational benefit	SNET-B0/4 - Approach Path Monitoring (APM)
Relation-information benefit	AMET-B2/2 - Meteorological forecast and warning information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for wake turbulence separation for staggered dependent parallel approaches based on pair-wise minima	National regulation amendment for staggered dependent parallel approaches based on pair-wise minima. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended with distance-based separation (under ATS surveillance service) between staggered dependent parallel approaches based on pair-wise minima	CAA	2024
Operational procedures	Operations	ATC Procedure to separate staggered dependent parallel approaches based on PWM	Design of local procedure and minima (if wind-dependent), working methods and separation look-up tables for Approach and Tower Air Traffic Controllers to operate wake turbulence separation for staggered dependent parallel approaches based on pair-wise minima with ATC separation delivery function. References:	ANSP	2024
Ground system infrastructure	Ground infrastructure	Adaptation of runway threshold location enabling staggered dependent parallel approaches based on PWM	Displacement of one landing threshold location to create a stagger with the other threshold, if not already existing. References:	ANSP	2024

Ground system infrastructure	ATC systems	ATC separation delivery tool to operate staggered dependent parallel approaches based on wake turbulence longitudinal pair-wise minima	Processing and display on the approach and aerodrome controller's ATC surveillance display systems of: - a separation delivery indicator (the distance separation minimum, or spacing constraint) applicable to a sequenced pair of aircraft, - a spacing aid indicator to assist Air Traffic Controllers for optimising Separation Delivery taking into account predicted aircraft speed profiles (optional), - a safety alerting function of imminent risk of separation infringement or wrong aircraft being turned on to a separation indicator, fed by flight data, surveillance data and separation rules. References:	ANSP	2024
Ground system infrastructure	MET instrument	MET tool to operate staggered dependent parallel approaches based on pair-wise minima	Actual final approach wind profile information shall be provided to the TBS function, based on ground-based and/or aircraft measurements (optional if separation are wind-dependent). References:	ANSP MET Information Service Provider	2024
Training	-	Training requirements for enhanced dependent parallel approaches	ATC Training to separate traffic under staggered dependent parallel approaches: Training of Approach and Tower Air Traffic Controllers on separation delivery using an separation delivery function, in nominal and degraded mode of operations.	ANSP	2024
Ground system infrastructure	Surveillance	Surveillance capabilities for separation in arrivals and departures	Provide the necessary surveillance means to comply with applicable surveillance performance requirements.	ANSP	2013
Ground system infrastructure	Navigation	Navigation capabilities for separation in arrivals and departures	Provide the necessary navigation capabilities (e.g. ILS for precision approach).	ANSP	2013
Training	Awareness	Awareness requirements for enhanced dependent parallel approaches	Flight Crew awareness of separation applicable under staggered dependent parallel approaches: Briefing material for Flight Crew awareness of the change in applicable wake separation minima.	Aircraft operator	2024

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with parallel runways having centrelines spaced less than 760 m (2500 feet) apart operating enhanced dependent parallel approaches with demand near to or exceeds peak capacity during periods of the operational day or overall daily capacity with a dense heterogeneous traffic mix resulting in arrival delay, and aerodromes where additional operational resilience and predictability is required to manage peak traffic in response to unplanned events.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce separation minima on approach	Airport operator, ANSP, Airspace user
	Reduce delay	Airport operator, ANSP, Airspace user, ATM network function
	Increase peak capacity by using parallel RWY operations	Airport operator, ANSP, Airspace user
Indirect benefits	Efficiency (temporal efficiency, i.e. delay)	ANSP, Airspace user
	Resilience: additional headroom for spacing and sequence management	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS WAKE-B2/5

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce wake turbulence impact from parallel RWY during crosswind (arrival)	++	KPI10: Airport peak throughput

WAKE-B2/6	Enhanced independent segregated parallel operations	Operational

Main Purpose

To safely optimise the wake turbulence separation applied to segregated operations on parallel runways, with centre lines spaced less than 760m (2500ft) apart for wake independent departure and arrival operations based on wind transport of wake turbulence and reduced tailored or pairwise separation minimum.

New Capabilities

- Simultaneous use of parallel runways for segregated operations on parallel runways through the definition of new landing, go around and departure procedures;
- System monitored real time wind and improved forecast meteo information (optional);
- Aircraft separated by leader / follower pair-wise static matrix of aircraft type wake separation pairings with system support, or a customised a wake turbulence separation category system for a specific airport or terminal area.

Description

This element defines an independent segregated parallel operation procedure to parallel runways, with centre lines spaced less than 760m (2500ft) apart under ILS Category I minimum, or the minimums depicted for an RNAV or LPV approach. It covers independent landing and departing aircraft separation by leader / follower pair-wise static matrix of aircraft type wake separation pairings with system support, or a customised a wake turbulence separation category system for a specific airport or terminal area. It may include improved forecast meteo information and predicted and monitored winds on final approach and along the airport parallel runways that determine if the wake turbulence of arriving aircraft will be mitigated by crosswinds from moving into the path of departing aircraft on the adjacent parallel runway (optional). It is aerodrome specific in terms of runway layout and weather conditions.

Maturity Level

Validation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

2. Does it imply processing of new information by the user? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

3. Does it imply the use of new equipment? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

4. Does it imply a change to levels of automation? Yes

Adaptation of working methods to separate based on wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	WAKE-B2/4 - Wake turbulence separation minima based on leader/follower static pairs-wise
Evolution	WAKE-B2/3 - Independent segregated parallel operations
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-operational option	APTA-B0/3 - SBAS/GBAS CAT I precision approach procedures
Relation-operational option	APTA-B1/2 - PBN SID and STAR procedures (with advanced capabilities)
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	NAVS-B0/1 - Ground Based Augmentation Systems (GBAS)
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for wake-independent segregated parallel operations based on longitudinal pair-wise minima	National regulation amendment for wake-independent segregated parallel operations based on longitudinal pair-wise minima. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended with wake-independent segregated parallel operations for closely spaced parallel runways based on pair-wise minima	CAA	2024
Operational procedures	Operations	ATC Procedure for wake-independent segregated parallel operations based on PWM	Design of local procedure, working methods and separation look-up tables for Approach and Tower Air Traffic Controllers to operate based on pair-wise minima with ATC separation delivery function. References:	ANSP	2024
Ground system infrastructure	ATC systems	ATC separation delivery tool to operate wake-independent segregated parallel operations based on longitudinal pair-wise minima	Processing and display on the approach and aerodrome controller's ATC surveillance display systems: - the distance separation minimum, or spacing constraint applicable to a sequenced pair of aircraft, - a spacing aid indicator to assist Air Traffic Controllers for optimising Separation Delivery taking into account predicted aircraft speed profiles (optional), - a safety alerting function of imminent risk of separation infringement or wrong aircraft being turned on to a separation indicator, fed by flight data, surveillance data and separation rules. References:	ANSP	2024
Training	-	Training requirements for enhanced independent segregated parallel operations	ATC Training to separate traffic unde Wake-independent segregated parallel operations: Training of Approach and Tower Air Traffic Controllers on separation delivery using an separation delivery function, in nominal and degraded mode of operations.	ANSP	2024
Ground system infrastructure	Surveillance	Surveillance capabilities for separation in arrivals and departures	Provide the necessary surveillance means to comply with applicable surveillance performance requirements.	ANSP	2013

Ground system infrastructure	Navigation	Navigation capabilities for separation in arrivals and departures	Provide the necessary navigation capabilities (e.g. ILS for precision approach).	ANSP	2013
Training	Awareness	Awareness requirements for enhanced independent segregated parallel operations	Flight Crew awareness of separation applicable under wake-independent segregated parallel operations: Briefing material for Flight Crew awareness of the change in applicable wake separation minima.	Aircraft operator	2024

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with parallel runways having centrelines spaced less than 760 m (2500 feet) apart operating independent segregated parallel approaches with demand near to or exceeds peak capacity during periods of the operational day or overall daily capacity with a dense heterogeneous traffic mix resulting in arrival delay, and aerodromes where additional operational resilience and predictability is required to manage peak traffic in response to unplanned events.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce separation minima independently on parallel approach and departure runways.	Airport operator, ANSP, Airspace user
	Reduce delay	Airport operator, ANSP, Airspace user, ATM network function
	Increase peak capacity	Airport operator, ANSP, Airspace user
Indirect benefits	Efficiency (temporal efficiency, i.e. delay)	ANSP, Airspace user
	Resilience: additional headroom for spacing and sequence management	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

WAKE-B2/6

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce wake turbulence impact from parallel RWY during crosswind (arrival)	++	KPI10: Airport peak throughput

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce wake turbulence impact from parallel RWY during crosswind (departures)	++	KPI10: Airport peak throughput

WAKE-B2/7 Time based wake separation minima for arrival based on leader/follower static pair-wise — Operational

Main Purpose

To improve runway throughput and resilience due to wake turbulence on arrival phase of flight and to mitigate the impact of strong headwind conditions by safely optimising the separation minima to be applied between aircraft pairs by time rather than distance.

New Capabilities

- Time based separation minima for aircraft pairs supporting the safe reduction of wake turbulence separations which can be frequent in traffic;
- Mitigating the impact of strong headwind conditions;
- System monitored real time wind and improved forecast meteo information.

Description

This element defines a new set of time based wake turbulence separations for frequent aircraft pairs based on the performance characteristics of the leading aircraft generating wake turbulence and the following aircraft that might encounter the wake turbulence. It consists of a leader / follower pair-wise static matrix of aircraft type wake separation pairings that can be exploited by the ATCO with system support to increase runway throughput, enhance resilience and mitigate the impact of strong headwinds. Existing categorisation systems may be used to determine separation minima for types of aircraft pairs not specifically included in the pairwise separation matrix.

Maturity Level

Concept

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No

2. Does it imply processing of new information by the user? Yes

Adaptation of working methods to separate based on time-based wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

3. Does it imply the use of new equipment? Yes

Adaptation of working methods to separate based on time-based wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

4. Does it imply a change to levels of automation? Yes

Adaptation of working methods to separate based on time-based wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	WAKE-B2/4 - Wake turbulence separation minima based on leader/follower static pairs-wise
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-information need	AMET-B2/1 - Meteorological observations information
Relation-operational option	APTA-B0/3 - SBAS/GBAS CAT I precision approach procedures
Relation-operational option	APTA-B1/2 - PBN SID and STAR procedures (with advanced capabilities)
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	NAVS-B0/1 - Ground Based Augmentation Systems (GBAS)
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for time-based pair-wise wake turbulence separation provision on approach (TBS-PWS-A)	National regulation amendment for Time-based pair-wise wake turbulence separation provision on Approach . References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended for allowing time-based separation on final appproach (under ATS surveillance service) derived from distance wake turbulence pair-wise minima	CAA	2024
Regulatory provisions	National regulatory framework	Local TBS-PWS-A minima separation rules	Local establishment of time-based pair-wise minima applicable to local traffic, converted from local reference air speed profiles per aircraft type over the distance separation minimum in calm wind (e.g.from analysis of surveillance data). References:	ANSP CAA	2024
Operational procedures	Operations	TBS-PWS-A Operational Procedure	Design of procedure and working methods for Approach and Tower Air Traffic Controllers to operate TBS on final approach. References:	ANSP	2024
Airborne system capability	Aircraft system	Aircraft-derived wind to feed the ATC Separation delivery tool	Aircraft-derived wind speed and direction on final approach. References:	ANSP Aircraft manufacturer MET Information Service Provider	2024

Ground system infrastructure	ATC systems	ATC separation delivery tool to operate wake turbulence longitudinal TBS-PWS-A minima	Processing and display on the approach and aerodrome controller's ATC surveillance display systems: - the distance separation minimum, or spacing constraint applicable to a sequenced pair of aircraft, - a spacing aid indicator to assist Air Traffic Controllers for optimising Separation Delivery taking into account predicted aircraft speed profiles (optional), - a safety alerting function of imminent risk of separation infringement or wrong aircraft being turned on to a separation indicator, fed by flight data, surveillance data, meteo data and separation rules. References: EUROCONTROL Specification for Time Based Separation (TBS) support tool for Final Approach, ed 1.0 (2017)	ANSP	2024
Ground system infrastructure	MET instrument	Wind profile information to feed the ground-based ATC Separation delivery tool	Actual final approach wind profile information shall be provided to the TBS function, based on ground-based and/or aircraft measurements. References:	MET Information Service Provider	2024
Training	-	Training requirements for time based wake separation minima for arrivals based on leader/follower static pairs-wise	TBS-PWS-A training on working methods and tool: Training of Approach and Tower Air Traffic Controllers on separation delivery using an TBS function, in nominal and degraded mode of operations.	ANSP	2024
Ground system infrastructure	Surveillance	Surveillance capabilities for separation in arrivals and departures	Provide the necessary surveillance means to comply with applicable surveillance performance requirements.	ANSP	2013
Ground system infrastructure	Navigation	Navigation capabilities for separation in arrivals and departures	Provide the necessary navigation capabilities (e.g. ILS for precision approach).	ANSP	2013

Training	Awareness	Awareness requirements for time based wake separation minima for arrivals based on leader/follower static pairs-wise	TBS-PWS-A awareness by Fligh Crews: Briefing material for Flight Crew awareness of the change in applicable wake separation minima.	Aircraft operator	2024

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with demand nears or exceeds peak capacity during periods of the operational day or overall daily capacity with a dense heterogeneous traffic mix resulting in arrival and departure delay, and aerodromes where additional operational resilience, predictability and head wind mitigation is required to manage peak traffic in response to unplanned events.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce separation minima	Airport operator, ANSP, Airspace user
	Reduce delay	Airport operator, ANSP, Airspace user, ATM network function
	Prevent reduction of arrival rate during headwind conditions	Airport operator, ANSP, Airspace user, ATM network function
	Increase peak capacity	Airport operator, ANSP, Airspace user
Indirect benefits	Efficiency (temporal efficiency, i.e. delay)	ANSP, Airspace user
	Predictability: delivery of traffic more consistent, allowing increased throughput	ANSP, Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

WAKE-B2/7

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Apply time-based separation instead of distance-based (arrival)	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Improved categorisation of aircraft (arrival)	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce wake vortex separation penalty from other traffic using the departure RWY	++	KPI10: Airport peak throughput

WAKE-B2/8	Time based wake separation minima for departure based on leader/follower static pair-wise	Operational

Main Purpose

To improve runway throughput and resilience due to wake turbulence on departure phases of flight by safely optimising the separation minima delivery between aircraft pairs.

New Capabilities

- Optimised delivery of Time based separation minima for aircraft pairs supporting the safe reduction of wake turbulence separations which can be frequent in traffic.

Description

This element defines a new ATC tool for assisting Tower Runway Controllers in delivering time-based pair-wise wake turbulence separations on departure, taking into account take-off rolling distance and speed profiles per aircraft type (e.g. obtained from analysis of surveillance data).

The tool processes and displays on the aerodrome tower controller's surveillance systems:

- an aircraft positioning indicator to visualise in distance the applicable equivalent time-based pair-wise separation minimum, or spacing constraint to be delivered by the controller, or
- a timer indication to provide the take-off clearance for delivering the time-based pair-wise minima in an optimum manner, and
- a safety alerting function of imminent risk of separation infringement.

Maturity Level

Concept

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

Adaptation of working methods to separate based on time-based wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

2. Does it imply processing of new information by the user? Yes

Adaptation of working methods to separate based on time-based wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

3. Does it imply the use of new equipment? Yes

Adaptation of working methods to separate based on time-based wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

4. Does it imply a change to levels of automation? Yes

Adaptation of working methods to separate based on time-based wake turbulence pair-wise minima with ATC support tool with separation delivery indicator(s).

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element

Evolution	WAKE-B2/4 - Wake turbulence separation minima based on leader/follower static pairs-wise
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-information need	AMET-B2/1 - Meteorological observations information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for time-based pair-wise wake turbulence separation provision on departure (TBS-PWS-D)	National regulation amendment for Time-based pair-wise wake turbulence separation provision on Departure. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended with static time-based pair-wise separation delivery based on distance wake turbulence pair-wise separation minima	CAA	2024
Regulatory provisions	National regulatory framework	Local TBS-PWS-D minima separation rules	Local establishment of static time-based pair-wise minima applicable to local traffic, based on local reference departure speed and take-off distance profiles per aircraft type (e.g. obtained from analysis of surveillance data). References:	ANSP CAA	2024
Operational procedures	Operations	TBS-PWS-D Oprational Procedure	Design of procedure and working methods for Tower Air Traffic Controllers to operate TBS on final approach. References:	ANSP	2024
Ground system infrastructure	ATC systems	TBS-PWS-D ATC system capability	Provide flight data, surveillance data , meteorological data and separation rules to the TBS Optimised Separation Delivery (OSD) function. References:	ANSP	2024
Ground system infrastructure	ATC systems	TBS-PWS-D ATC system capability	Processing and display on the aerodrome tower controller's surveillance display systems: - an aircraft positioning indicator to visualise in distance the applicable equivalent time-based pair-wise separation minimum, or spacing constraint to be delivered by the controller, or - a timer indication to provide the take-off clearance for delivering the time-based pair-wise minima in an optimum manner, and - a safety alerting function of imminent risk of separation infringement	ANSP	2024

Training	-	Training requirements for time based wake separation minima for departures based on leader/follower static pairs-wise	TBS-PWS-D training on working methods and tool Training of Tower Air Traffic Controllers ontime-based pair-wise separation delivery, in nominal and degraded mode of operations	ANSP	2024
Training	Awareness	Awareness requirements for time based wake separation minima for departures based on leader/follower static pairs-wise	TBS-PWS-D awareness by Flight Crews Briefing material for Flight Crew awareness of the change in applicable wake separation minima	Aircraft operator	2024

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with demand nears or exceeds peak capacity during periods of the operational day or overall daily capacity with a dense traffic mix resulting in departure delay, and aerodromes where additional operational resilience and predictability is required to manage peak traffic in response to unplanned events.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce delay	Airport operator, ANSP, ATM network function, Aircraft operator
	Increase peak capacity	Airport operator, ANSP, Aircraft manufacturer
Indirect benefits	Efficiency (temporal efficiency, i.e. delay)	ANSP, Aircraft operator
	Predictability: delivery of traffic more consistent, allowing increased throughput	ANSP, Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

WAKE-B2/8

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce wake vortex separation penalty from other traffic using the departure RWY	++	KPI10: Airport peak throughput