ICAO GANP PORTAL

ASBU ELEMENTS

SWIM TBO WAKE

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

SWIM

SWIM-B2/1	Information service provision	Information

☐ Sixth edition of the GANP

Main Purpose

To define the requirements for an information service provider to make aviation-related information available as an information service.

New Capabilities

Once an information service is created by an information service provider, it can be discovered by the ATM community through its service overview made available via a registry. The service overview includes metadata specifying the characteristics of the provided information service including the means by which the service is accessed by the authorized users.

SWIM Information services typically apply publish/subscribe or request/reply message exchange patterns. SWIM information services facilitate integration with automation systems.

Description

The service overview is the means for the information service provider to publicize the characteristics of an information service. Based on the service characteristics provided, potential information service consumers can evaluate whether or not to use that information service. The service overview includes, for example, a description of the information, the exchange format, the service performance, and the access rules. The service overview should be exposed preferably via a registry and available to all stakeholders, while the access to the information service may only be granted to authorized users.

An information service provider can provide information falling into one of the traditional information domains (i.e., AIM, FF-ICE, MET or surveillance), or any other information deemed appropriate.

Information service providers have to have a quality management system in place to ensure the quality of the information and the quality of the information service provided.

State aviation entities involved in civil-military cooperation and coordination –ground centres or aircraft– will be able to act as SWIM information service provider.

Maturity Level

Validation

Human Factor Considerations

PLANNING LAYERS

ATM planning | Strategical | Pre-tactical | Tactical-Pre ops | Tactical-During ops | Post operations

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational benefit	SWIM-B2/5 - Global SWIM processes
Relation-operational benefit	SWIM-B2/3 - SWIM registry
Relation-technology need	COMI-B1/1 - Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Information exchange	Procedures for how to publish and access a service overview	Reference guidance: Manual on System Wide Information Management (SWIM) Implementation	ATM SWIM service provider	2023
Operational procedures	Information exchange	Procedures for defining the content of a service overview and how an information service can be discovered via a registry.	Standards and procedures: Future ICAO PANS-IM	Information service provider	2023
Operational procedures	Information exchange	Procedures for quality management system	Procedures for quality management system to ensure the quality of the information services. Reference guidance material: Manual on System Wide Information Management (SWIM) Implementation	Information service provider	2023

Ground system infrastructure	Information exchange	Automated systems capable to provide information over an IP network following the required message exchange patterns.	Automated systems capable to exchange information: - Over IP network (OSI Layer 1 to 5) Standards and guidance material: ICAO Annex 10 - Aeronautical Telecommunications Vol III -Rules to access an IP network Future Manual on System Wide Information Management (SWIM) Implementation - Following exchange patterns required to support the service provision (e.g. publish/subscribe or request/reply) (OSI Layer 7)	Information service provider	2023
Ground system infrastructure	Information exchange	Automated systems with logon and authentication mechanisms	OSI Layer 5 Guidance material:Future Manual on system wide information management (SWIM) Implementation	ATM SWIM service provider	2023
Information exchange model	-	Information exchange models	Information exchange models such as FIXM, AIXM, IWXXM,... These exchange models are to be selected by the information service providers depending on the domain of the information to be provided.	Airport operator ANSP Airspace user	2018
Training	-	Training requirements for information service provision.	Training on how to define, develop and provide information services.	Information service provider ATM SWIM service provider	2023

SWIM-B2/2 Information service consumption Information

☐ Sixth edition of the GANP

Main Purpose To define the requirements for an information service consumer to discover and access aviation-related information provided via information services.

New Capabilities An information service consumer has access to a registry to discover available information services. A registry's search and filter capability helps an information service consumer discover an information service appropriate to their specific needs. The information service consumer needs to implement publish/subscribe and request/reply message exchange patterns over an internet protocol-based communication infrastructure in order to consume information services.

Description

An information service consumer makes use of a registry to discover available information services. A registry contains a listing of service overviews which provide details about the information services. The information service consumer makes use of the registry's search and filter capability to identify and select the information service appropriate to their specific needs (e.g. quality of service requirements).

Once an information service is selected, assuming that the information service consumer is authorized to access it, the information service consumer obtains the access point information and implements one of the available message exchange patterns to obtain the information. The information (e.g. AIM, FF-ICE or MET) can be readily consumed by automation systems.

State aviation entities involved in civil-military cooperation and coordination –ground centres or aircraft– will be able to act as SWIM information service consumers.

Maturity Level: Validation

Human Factor Considerations

PLANNING LAYERS

ATM planning | Strategical | Pre-tactical | Tactical-Pre ops | Tactical-During ops | Post operations

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	SWIM-B2/1 - Information service provision
Relation-operational benefit	SWIM-B2/3 - SWIM registry
Relation-technology need	COMI-B1/1 - Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)
Relation-operational benefit	SWIM-B2/5 - Global SWIM processes

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Information exchange model	-	Information exchange models	Information exchange models such as FIXM, AIXM, IWXXM,... These exchange models are to be selected by the information service providers depending on the domain of the information to be provided.	Airport operator, ANSP, Airspace user	2018

Operational procedures	Information exchange	Procedures to access registry and information services	Procedures to be followed to access the registry and how to access information services as defined in the service overview. Guidance material: Future Manual on System Wide Information Management (SWIM) Implementation.	Information service consumer	2023
Ground system infrastructure	Information exchange	Automated systems capable to consume information over an IP network following required message exchange patterns	Automated systems capable to exchange information: - Over IP network (OSI Layer 1 to 5) Standards and guidance material: ICAO Annex 10 - Aeronautical Telecommunications Vol III -Rules to access an IP network Future Manual on System Wide Information Management (SWIM) Implementation - Following exchange patterns required to support the service provision (e.g. publish/subscribe or request/reply) (OSI Layer 7)	Information service consumer	2023
Ground system infrastructure	Information exchange	Automated systems capable of accessing a registry	Guidance material: Future Manual on System Wide Information Management (SWIM) Implementation	Information service consumer	2023

SWIM-B2/3	SWIM registry	Information

☐ Sixth edition of the GANP

Main Purpose: A registry is a means for the information service producer to publicize and for an information service consumer to discover information services within a SWIM environment.

New Capabilities: A registry contains a listing of service overviews. It has a search and filter capability to identify and select information services, permits managing service overviews, and provides user access control mechanism.

Description: The registry is a means to link information providers with information consumers and thereby facilitates the exchange of information. The main purpose of a registry is to enable discoverability by making available a service overview describing information services in a structured and searchable format.

The registry permits an information service provider to enter and update a service overview, has a search and filter capability, and provides controlled user access. In addition, it facilitates service lifecycle management, including versioning of an information service. A registry can be provided at State, regional or multi-national levels.

State aviation entities involved in civil-military cooperation and coordination –ground centres or aircraft– will be enabled to access the SWIM registry.

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

ATM planning | Strategical | Pre-tactical | Tactical-Pre ops | Tactical-During ops | Post operations

OPERATIONS

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

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Ground system infrastructure	Information exchange	*Automated system capable of operating and managing a registry	Guidance Material: Future Manual on System Wide Information Management (SWIM) Implementation	SWIM Registry Manager	2023
Operational procedures	Information exchange	Procedures to populate the registry	Procedures to publish the service overview of an information service in the registry. Reference: Guidance material: Future Manual on System Wide Information Management (SWIM) Implementation	SWIM Registry Manager	2023
Operational procedures	Information exchange	Procedure for registry management	Provisions addressing registry management and content. Reference: PANS-IM	SWIM Registry Manager	2023
Operational procedures	Information exchange	Procedures to find the registry	Procedures for publishing the reference to the registry that contain service overviews of the information services provided. Reference: Future Manual on System Wide Information Management (SWIM) Implementation	SWIM Registry Manager	2023
Training	-	Training requirements for SWIM registry	Training on how to set up and operate a registry for the SWIM registry manager.	SWIM Registry Manager	2023

SWIM-B2/4	Air/Ground SWIM for non-safety critical information	Information

☐ Sixth edition of the GANP

Main Purpose

Exchange of non-safety critical information with the aircraft to improve operational awareness and efficiency.

New Capabilities

Air/Ground (A/G) SWIM leverages inflight internet connectivity (e.g., broadband) capabilities, along with the air navigation service provider's ground SWIM infrastructure, to enable information exchange with the aircraft.

Description

A/G SWIM will enable airspace users, specifically flight crew, to make information available to the air navigation service provider (ANSP), including reroute preferences and air reports / airspace conditions. A/G SWIM will also allow the flight crew to have access to more information in a timely manner. In an A/G SWIM environment, the management and use of information on-board the aircraft is expanded.

A/G SWIM expands information exchange between the aircraft (including its automation systems) and ANSPs without the constraints imposed by voice communications. A/G SWIM requires flight deck applications like electronic flight bags (EFBs) or other devices to be enabled for the exchange of information. Flight deck application access to SWIM will allow the flight crew to obtain, for example, airspace constraint information and flow restrictions to assist them in re-planning their flights, provide them with information that supports negotiation with ATFM, or enable coordination of flight plan updates initiated by an airline operations center.

State aircraft will have access to A/G SWIM to obtain and share information needed for their operations –especially when operating in civil controlled airspace–, while giving due regard for military information security aspects.

Maturity Level

Validation

Human Factor Considerations

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	SWIM-B2/1 - Information service provision
Evolution	SWIM-B2/2 - Information service consumption
Relation-technology need	COMI-B1/1 - Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)
Relation-technology need	COMI-B2/3 - Links meeting requirements for non-safety critical communication

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Information exchange	Procedures to access registry and information services	Procedures to be followed to access the registry and how to access information services as defined in the service overview. Guidance material: Future Manual on System Wide Information Management (SWIM) Implementation.	Information service consumer	2023
Ground system infrastructure	Information exchange	Automated systems capable to consume information over an IP network following required message exchange patterns	Automated systems capable to exchange information: - Over IP network (OSI Layer 1 to 5) Standards and guidance material: ICAO Annex 10 - Aeronautical Telecommunications Vol III -Rules to access an IP network Future Manual on System Wide Information Management (SWIM) Implementation - Following exchange patterns required to support the service provision (e.g. publish/subscribe or request/reply) (OSI Layer 7)	Information service consumer	2023
Operational procedures	Information exchange	Procedures for the exchange of non-safety critical information with the aircraft	Procedures to be followed for the exchange of non-safety critical information with the aircraft. Reference: Future Manual on System Wide Information Management (SWIM) Implementation	Airspace user	2025
Airborne system capability	Information exchange	Airborne SWIM capability for exchanging non-safety critical information	Onboard systems capable of exchanging non-safety critical information (e.g. EFB).	Airspace user	2025
Ground system infrastructure	Information exchange	G/G SWIM communications between ANSP and airspace user to exchange non-safety critical information	G/G SWIM communications between ANSP and airspace user to exchange non-safety critical information.	ANSP Airspace user	2025

SWIM-B2/5	Global SWIM processes	Information

☐ Sixth edition of the GANP

Main Purpose

SWIM governance helps establish global access to aviation-related information by connecting information service providers and consumers within a global interoperability framework.

New Capabilities

SWIM governance comprises a set of standards, policies and processes in support of, for example, rights of usage of information, quality of service aspects and trust. Within a global interoperability framework, registries will be inter-connected to provide a single access point for information services.

Description

SWIM governance comprises a set of standards, policies and processes to ensure that globally interoperable information services are provided by reliable and trusted information service providers and accessed by authorized consumers. SWIM governance helps establish confidence by addressing topics such as rights of usage and aspects related to quality of service.

The establishment of SWIM governance entails activities which can be applied at different levels (e.g., national, regional, global and organizational). These activities include establishment of a common set of standards, policies and processes for information, information services and technical infrastructure; interconnection of registries; definition and establishment of governance structures; promotion of interoperability within a global framework; definition of common processes to be followed; and definition of the transition to a SWIM environment through national or regional arrangements. The interconnection of registries will provide information consumers with a single access point at a global level to all available information services.

SWIM governance considers and supports involvement of State aviation authorities, with the aim of increasing civil-military cooperation and coordination functions in SWIM, while giving due regard for military information security aspects.

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? No

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

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

PLANNING LAYERS

ATM planning | Strategical | Pre-tactical | Tactical-Pre ops | Tactical-During ops | Post operations

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	SWIM-B2/1 - Information service provision
Evolution	SWIM-B2/2 - Information service consumption
Evolution	SWIM-B2/3 - SWIM registry
Relation-technology need	COMI-B1/1 - Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Information exchange	Procedure to provide access to SWIM information consumers	Provide SWIM information consumers a single access point. Reference: Future Manual on System Wide Information Management (SWIM) Implementation.	ATM SWIM service consumer	2025
Ground system infrastructure	Information exchange	Interconnection of SWIM registries	Standards and procedures needed to interconnect registries at a local and/or regional level to form a single access point for information service consumers. Reference: Future Manual on System Wide Information Management (SWIM) Implementation.	ATM SWIM service provider SWIM Registry Manager	2025
Regulatory provisions	National regulatory framework	National Regulatory framework amendment to address SWIM governance	Standards, policy and procedures needed for SWIM governance.	CAA	2021

SWIM-B3/1 Air/Ground SWIM for safety critical information Information

☐ Sixth edition of the GANP

Main Purpose: Exchange of safety critical information with the aircraft to improve operational awareness and efficiency.

New Capabilities: A/G SWIM capability is extended to address the exchange of safety critical information with the aircraft.

Description: A/G SWIM will be extended to enable the exchange of safety critical information.

Maturity Level: Concept

Human Factor Considerations

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	COMI-B3/4 - Links meeting requirements for safety critical communication
Evolution	SWIM-B2/4 - Air/Ground SWIM for non-safety critical information
Relation-technology need	COMI-B1/1 - Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Information exchange	Procedures to access registry and information services	Procedures to be followed to access the registry and how to access information services as defined in the service overview. Guidance material: Future Manual on System Wide Information Management (SWIM) Implementation.	Information service consumer	2023
Ground system infrastructure	Information exchange	Automated systems capable to consume information over an IP network following required message exchange patterns	Automated systems capable to exchange information: - Over IP network (OSI Layer 1 to 5) Standards and guidance material: ICAO Annex 10 - Aeronautical Telecommunications Vol III -Rules to access an IP network Future Manual on System Wide Information Management (SWIM) Implementation - Following exchange patterns required to support the service provision (e.g. publish/subscribe or request/reply) (OSI Layer 7)	Information service consumer	2023
Operational procedures	Information exchange	Procedures for the exchange of safety critical information with the aircraft	Procedures to be followed for the exchange of safety critical information with the aircraft. Reference: Future Manual on System Wide Information Management (SWIM) Implementation	Airspace user	2031
Airborne system capability	Information exchange	Airborne SWIM capability for exchanging safety critical information	Onboard systems capable of exchanging safety critical information (e.g. EFB).	Airspace user	2031
Ground system infrastructure	Information exchange	G/G SWIM communications between ANSP and airspace user to exchange safety critical information	G/G SWIM communications between ANSP and airspace user to exchange safety critical information.	ANSP Airspace user	2031

TBO

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

☐ Sixth edition of the GANP

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

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

☐ Sixth edition of the GANP

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 | 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

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

☐ Sixth edition of the GANP

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

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

☐ Sixth edition of the GANP

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

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	++	

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

TBO-B3/1	Network based on-demand synchronization of trajectory based operations	Operational

☐ Sixth edition of the GANP

Main Purpose: Achieve a network based, efficiently-converging coordination process, across all time-based decision-making processes. In this process a flight is subject to an end-to-end stable, consistent and robust trajectory solution.

New Capabilities: Ability to link and synchronize relevant time advisories and paths for flights and individual aircraft across all flight segments to provide equitable efficient operations. Trajectories and intents are synchronized along ANSPs, AOC and FMS. Synchronisation between airborne and ground systems is realised by means of exchanging and reconciling flight data including the airborne trajectory prediction.

Description: Based on the global availability of information and its sharing to all downstream ANSPs, AOC and the aircraft operator/pilot, automation exists which supports the synchronization of time and path in all flight phases. Synchronization is based on rules and processes which take into consideration not only the objectives of the individual time-based decision-making processes but both dynamic and static constraints which may alter the priority of solutions.

Note: TBO provisions are envisaged at this point. Full integration of strategic with tactical is implied. This includes the integration of multiple decision support tools within large ANSPs and between ANSPs. Strategic and tactical decisions will need to be compatible. As mentioned, rules and the conditions under which various rules are applicable will need to be defined. Convergence involving distributed decision-making is needed. Provisions & guidance will be required to standardize the distributed decision making and the sharing of information.

Maturity Level: Concept

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

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-B4/1 Total airspace management performance system Operational

☐ Sixth edition of the GANP

Main Purpose: Realize safe minimum separation trajectories (spatially and temporarily) to allow the users, through better information exchange, to manage their business trajectories.

New Capabilities: All constraints are provided to the airspace users so that they can determine and execute their business trajectories.

Description: ANSPs to provide on time minimum constraints, shifting the management of the trajectory from ANSP to airspace user centric. This is a shift from the ANSP choosing preferred airspace users' trajectories to full provision of constraints so that the airspace user can manage their own business trajectories.

Note: TBO provisions are envisaged at this point. Provisions to define the interactions between trajectories and constraints are foreseen.

Maturity Level: Concept

Human Factor Considerations

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

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

Tactical-During ops | Post operations

Turn-around

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

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

☐ Sixth edition of the GANP

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: Alternative of the aircraft wake turbulence categories defined in ICAO PANS-ATM by 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
	Efficiency (temporal efficiency, i.e. delay)	ANSP, Airspace user

Type	Operational description	Benefitting stakeholder(s)
Indirect benefits	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

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 Time based wake separation minima for final approach — Operational

☐ Sixth edition of the GANP

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 on final approach under ATS surveillance service, derived from distance-based separation (DBS) minima, allowing a dynamic DBS application for stabilizing landing rates across headwind conditions. It consists of optimized wake separation pairings that can be exploited by the ATCO with system support, for enhancing resilience and mitigating the impact of strong headwinds.

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-B3/3 - 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

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-B3/1 Dependent parallel approaches Operational

☐ Sixth edition of the GANP

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 applying ICAO Wake Turbulence Categories or wake turbulence aircraft 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	2028
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	2028
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

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-B3/2 Independent segregated parallel operations Operational

☐ Sixth edition of the GANP

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	2028
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	2028

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

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-B3/3 Wake turbulence separation minima based on leader/follower static pairs-wise Operational

☐ Sixth edition of the GANP

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	2030

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	2030
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	2030
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	2030
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	2030

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

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-B3/4	Enhanced dependent parallel approaches	Operational

☐ Sixth edition of the GANP

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-B3/1 - Dependent parallel approaches
Relation-operational need	WAKE-B3/3 - 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	2030
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	2030
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	2030

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	2030
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	2030
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	2030
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	2030

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

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-B3/5	Enhanced independent segregated parallel operations	Operational

☐ Sixth edition of the GANP

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-B3/3 - Wake turbulence separation minima based on leader/follower static pairs-wise
Evolution	WAKE-B3/2 - 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	2030
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	2030
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	2030

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	2030
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	2030

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
	Efficiency (temporal efficiency, i.e. delay)	ANSP, Airspace user

Indirect benefits Type	Operational description	Benefitting stakeholder(s)
	Resilience: additional headroom for spacing and sequence management	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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-B3/6	Time based wake separation minima for departure based on leader/follower static pair-wise	Operational

☐ Sixth edition of the GANP

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-B3/3 - 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	2030
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	2030

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	2030
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	2030
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	2030
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	2030
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	2030

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)

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

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

WAKE-B3/7 Time based dependent parallel approaches Operational

☐ Sixth edition of the GANP

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 for instrument landing operations on parallel runways with centre lines spaced less than 760m (2500ft) apart by safely optimising the separation minima to be applied between aircraft pairs by time rather than distance, applied.

New Capabilities:

- Time based separation minima for aircraft pairs supporting the safe reduction of wake turbulence which can be frequent in traffic applied during the simultaneous use of closely spaced parallel runways through the definition of new landing and go around procedures;
- Mitigating the impact of strong headwind conditions;
- System monitored real time wind and improved forecast meteo information.

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.

Aircraft are separated by time based wake turbulence separations rather than distance, based on the performance characteristics of the leading aircraft generating wake turbulence and the following aircraft that might encounter the wake turbulence.

The controller is provided with system support to separate aircraft with the goal of increasing runway throughput, enhancing resilience and mitigating 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-B3/4 - Enhanced dependent parallel approaches
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-information benefit	AMET-B2/2 - Meteorological forecast and warning 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-operational need	WAKE-B2/2 - Time based wake separation minima for final approach
Relation-information need	AMET-B2/1 - Meteorological observations information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
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	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
Regulatory provisions	National regulatory framework	National framework amendment for wake turbulence separation provision for staggered dependent parallel approaches based on TBS-PWS-A minima	National regulation amendment for wake turbulence separation provision for staggered dependent parallel approaches based on TBS-PWS-A minima. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended for allowing time-based separation between staggered dependent parallel approaches based on distance wake turbulence pair-wise minima	CAA	2030
Regulatory provisions	National regulatory framework	Local TBS-PWS-A minima separation rules for staggered dependent parallel approaches	Local establishment of time-based pair-wise minima applicable to local traffic for staggered dependent parallel approache, 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	2030

Operational procedures	Operations	ATC Procedure to separate staggered dependent parallel approaches based on TBS-PWS-A minima	Design of local procedure, working methods and separation look-up tables for Approach and Tower Air Traffic Controllers to operate with ATC separation delivery function wake turbulence separation for staggered dependent parallel approaches based on time-based pair-wise minima. Refrences:	ANSP	2030
Ground system infrastructure	ATC systems	ATC separation delivery tool to operate staggered dependent parallel approaches based on wake turbulence longitudinal TBS-PWS-A 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 optimizing 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: ICAO camera ready TBS	ANSP	2030
Training	-	Training requirements for time based 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 TBS function, in nominal and degraded mode of operations.	ANSP	2030
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 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	2030

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with parallel runways having centrelines spaced less than 760 m (2500 feet) apart operating time based 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
	Prevent reduction of arrival rate during headwind conditions	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

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 turbulence impact from parallel RWY during crosswind (arrival)	++	KPI10: Airport peak throughput

WAKE-B3/8 | Time based independent segregated parallel operations | Operational

☐ Sixth edition of the GANP

Main Purpose

To improve runway throughput and resilience due to wake turbulence on arrival and departure phases of flight and to mitigate the impact of strong headwind conditions for segregated operations on parallel runways, with centre lines spaced less than 760m (2500ft) apart covering wake independent departure and arrival operations through the safe application of separation minima between aircraft pairs by time rather than distance.

New Capabilities

- Time based separation minima for aircraft pairs supporting the safe reduction of wake turbulence which can be frequent in traffic, for independent arrivals and departures, applied during the simultaneous use of closely spaced parallel runways through the definition of new landing and go around procedures;
- Mitigating the impact of strong headwind conditions;
- System monitored real time wind and improved forecast meteo information.

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 minimums, or the minimums depicted for an RNAV or LPV approach.

Aircraft are separated by time based wake turbulence separations rather than distance, based on the performance characteristics of the leading aircraft generating wake turbulence and the following aircraft that might encounter the wake turbulence.

The controller is provided with system support to separate aircraft with the goal of increasing runway throughput, enhancing resilience and mitigating 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? 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 Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element

Evolution	WAKE-B3/5 - Enhanced independent segregated parallel operations
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-operational need	WAKE-B2/2 - Time based wake separation minima for final approach
Relation-operational need	WAKE-B3/6 - Time based wake separation minima for departure based on leader/follower static pair-wise
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)
Relation-information need	AMET-B2/2 - Meteorological forecast and warning information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
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	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
Regulatory provisions	National regulatory framework	National framework amendment for wake-independent segregated parallel operations with time-based pair-wise minima	National regulation amendment for wake-independent segregated parallel operations with Time-based pair-wise minima. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM) to be amended for allowing wake independent time-based pair-wise separation between segregated approaches operations for closely spaced parallel runways	CAA	2030

Regulatory provisions	National regulatory framework	Wake-independent segregated parallel operations with Time-based pair-wise minima	Local establishment of time-based pair-wise minima applicable to local traffic for independent segregated parallel operations, 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)	ANSP CAA	2030
Operational procedures	Operations	ATC Procedure for independent segregated parallel operations with time-based pair-wise minima	Design of local procedure, working methods and separation look-up tables for Approach and Tower Air Traffic Controllers to operate with ATC separation delivery function wake independent time-based pair-wise separation between segregated approaches operations for closely spaced parallel runways. References:	ANSP	2030
Ground system infrastructure	ATC systems	ATC separation delivery tool to operate Wake-independent segregated parallel operations based Time-based 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, meteo data and separation rules. References:	ANSP	2030
Training	-	Training requirements for time based independent segregated parallel operations	ATC Training to separate traffic unde Wake-independent segregated parallel operations based Time-based Pair-wise minima: Training of Approach and Tower Air Traffic Controllers on separation delivery using an TBS function, in nominal and degraded mode of operations.	ANSP	2030
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 independent segregated parallel operations	Flight Crew awareness of separation applicable under wake-independent segregated parallel operations based Time-based Pair-wise minima: Briefing material for Flight Crew awareness of the change in applicable wake separation minima	Aircraft operator	2030

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with parallel runways having centrelines spaced less than 760 m (2500 feet) apart operating time based 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
	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
	Resilience: additional headroom for spacing and sequence management	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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 penalty caused by parallel dependent RWYs (departures)	++	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 (arrival)	++	KPI10: Airport peak throughput

WAKE-B4/1 — En-route Wake Encounter Ground based Prediction — Operational

☐ Sixth edition of the GANP

Main Purpose

New Capabilities

Description

Maturity Level -

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)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Avoid en-route wake vortex encounters	++	KPI20: Number of aircraft accidents

WAKE-B4/2 En-Route Wake Encounter on-board flight management/mitigation — Operational

☐ Sixth edition of the GANP

Main Purpose

New Capabilities

Description

Maturity Level -

Human Factor Considerations

PLANNING LAYERS

Tactical-During ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

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ENABLERS

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DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Avoid en-route wake vortex encounters	++	KPI20: Number of aircraft accidents