ICAO GANP PORTAL

ASBU ELEMENTS

ACDM APTA CSEP ACAS FRTO GADS NOPS B0 B1 B2 Concept Validation Standardization
Ready for implementation Taxi-out Departure En-route Arrival Taxi-in Turn-around ATM planning Pre-tactical
Tactical-Pre ops Strategical Post operations Tactical-During ops

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

ACAS

ACAS-B1/1	ACAS Improvements	Operational

Main Purpose	To provide airborne collision avoidance as a last resort safety net for pilots.
New Capabilities	The traffic alert and collision avoidance system (TCAS) version 7.1 provides short-term improvements to existing airborne collision avoidance systems (ACAS) to reduce nuisance alerts as well as to enhance the logic for some geometries (i.e., Uberlinghen accident). This will reduce trajectory deviations and increase safety in cases where there is a breakdown of separation.
Description	TCAS systems selectively interrogate nearby aircraft to determine their position and velocity (using Mode C/S replies); this information is passed through “threat logic” to determine proximate traffic, issue traffic alerts, and issue collision avoidance “resolution advisories” to flight crews. Resolution advisories provide flight crews with vertical guidance (climb, descend, remain level, do not descend/climb) as appropriate to avoid collisions. Modern “hybrid surveillance” TCAS systems use ADS-B information to reduce the interrogations needed to perform some of these functions – however, resolution advisories are only issued based on interrogation/reply information (ADS-B data is not used).
Maturity Level	Ready for implementation
Human Factor Considerations	1. Does it imply a change in task by a user or affected others? No 2. Does it imply processing of new information by the user? Yes New resolution advisories. 3. Does it imply the use of new equipment? Yes 4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure En-route Arrival

DEPENDENCIES AND RELATIONS

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

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	TCAS version 7.1 certification	SARPs for TCAS version 7.1, which provides short-term improvements to previous airborne collision avoidance systems (ACAS). Reference: ICAO Annex 6, ICAO Annex 10 Volume IV technical requirements (amendment 85 to Annex 10, Volume IV).	CAA Aircraft manufacturer	2014
Operational procedures	Operations	Procedures for the operation of ACAS including phraseology	Procedures for the operation of ACAS including phraseology. References: ICAO Doc 4444 (PANS-ATM), ICAO Doc 8168 (PANS-OPS), ICAO Doc 9863 Airborne Collision Avoidance System (ACAS) Manual.	ANSP Aircraft operator	2010
Airborne system capability	Aircraft system	TCAS II version 7.1 avionics	TCAS II version 7.1 avionics. References: EUROCAE ED-143 or RTCA DO-185B	Aircraft manufacturer	2008
Regulatory provisions	Operational Approval	TCAS II version 7.1 operational approval	Responsibility of State of the operator. References: ICAO Annex 6 Part I	CAA	2014
Airborne system capability	Surveillance	Avionics for extended hybrid surveillance (optional)	Avionics standards for Extended Hybrid Surveillance. References: EUROCAE ED-221A or RTCA DO-300A, Change 1	Aircraft manufacturer	2015
Training	-	Training requirements for TCAS version 7.1 operations	Pilot training for TCAS version 7.1, which provides information on new TCAS RA alert wording.	Aircraft operator	2012

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

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

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

ACAS-B1/1

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

ACAS-B2/1	New collision avoidance system	Operational

Main Purpose

To provide airborne collision avoidance as a last resort safety net for pilots (improving functionality provided in BBB and Block 0).

Implementation must minimize “nuisance alerts” while maintaining or improving existing levels of safety, and must be able to more quickly adapt to changes in procedures and the environment. Also, this successor system must be capable of accommodating reduced separation minima and other new procedures such as 4D trajectory management.

New Capabilities

Implementation of a new airborne collision avoidance system will enable more efficient operations and airspace procedures while complying with safety regulations. Fewer “nuisance alerts” will reduce pilot and controller workload as personnel spend less time responding to such alerts, increasing safety. Operation-specific collision avoidance logic can be engaged via the pilot’s use of their ADS-B-In system for a particular application.

Description

ACAS systems use ADS-B information and selective interrogations of nearby aircraft to determine their position and velocity; this information is passed through “threat logic” to determine proximate traffic, issue traffic alerts, and issue collision avoidance “resolution advisories” to flight crews. Resolution advisories provide flight crews with vertical guidance (climb, descend, remain level, do not descend/climb) as appropriate to avoid collisions.

In order to achieve a high level of safety, the alerting criteria used by current ACAS systems often overlap with the horizontal and vertical separation associated with many safe and legal procedures (e.g., visual separation operations). ACAS monitoring data from the U.S. indicate that as many as 90% of observed resolution advisories (RAs) are due to the interaction between ACAS II alerting criteria and normal ATC separation procedures (e.g., 500 feet IFR/VFR separation, visual parallel approach procedures, level-off with a high vertical rate, or VFR traffic pattern procedures). This new ACAS system will address this deficiency.

Maturity Level

Standardization

Human Factor Considerations

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	ACAS-B1/1 - ACAS Improvements
Relation-operational need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-benefit	ASUR-B2/1 - Evolution of ADS-B and Mode S

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	Certification for for ACAS Xa/Xo	SARPs for ACAS Xa/Xo, a new airborne collision avoidance system that will enable more efficient operations and airspace procedures while ensuring safety. References: ICAO Annex 10 Volume IV technical requirements	CAA Aircraft manufacturer	2020
Operational procedures	Operations	Procedures for ACAS Xa/Xo operation	Procedures for ACAS Xa/Xo operation. References: ICAO Doc 9863, 3rd edition-Airborne Collision Avoidance System (ACAS) Manual	ANSP Aircraft operator	2022
Airborne system capability	Aircraft system	Avionics for ACAS Xa/Xo	Avionics standards for ACAS Xa/Xo. References: EUROCAE/RTCA ED-256/DO-385	Aircraft manufacturer	2018
Training	-	Training requirements for ACAS Xo	Training on use of ACAS Xo is recommended/required. References: ICAO Doc 9863, 3rd edition	Aircraft operator	2020
Regulatory provisions	Operational Approval	ACAS Xo operational approval	Responsibility of State of the aircraft operator. References: Future Annex 6	CAA	2020

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

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

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS ACAS-B2/1

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

ACAS-B2/2 New collision avoidance capability as part of an overall detect and avoid system for RPAS Operational

Main Purpose

As part of a detect and avoid system, to provide the airborne collision avoidance function as a last resort safety net for RPAS' pilots.

Implementation will minimize “nuisance alerts” while maintaining safety, and will quickly adapt to changes in procedures and the environment. Also, this system must accommodate the particularities of RPAS.

New Capabilities

Implementation of a new airborne collision avoidance function of a detect and avoid system will enable a new capability for RPAS. The systems will be tailored to provide the last resort collision avoidance function including horizontal resolution advisories (in addition to the vertical resolution advisories provided by current collision avoidance systems).

Description

ACAS systems for RPAS use multiple surveillance sensor inputs to determine the position and velocity of nearby aircraft; this information is passed through “threat logic” to determine proximate traffic, issue alerts, and issue collision avoidance “resolution advisories” to RPAS' pilots. Resolution advisories include both horizontal (turn left or right) and/or vertical guidance (climb, descend, remain level, do not descend/climb) as appropriate to avoid collisions.

Maturity Level

Validation

Human Factor Considerations

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

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

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

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure En-route Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	ACAS-B2/1 - New collision avoidance system
Relation-technology need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology benefit	ASUR-B2/1 - Evolution of ADS-B and Mode S

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	ACAS Xu certification	SARPs for ACAS Xu, a new airborne collision avoidance system that will be part of an overall RPAS Detect & Avoid system. References: ICAO Annex 10 Volume IV technical requirements	CAA Aircraft manufacturer	2022
Operational procedures	Operations	Procedures for the operation of ACAS Xu	Procedures for the operation of ACAS Xu. References: ICAO Doc 9863 Airborne Collision Avoidance System (ACAS) Manual, 4rd edition; ICAO Doc 10019 Manual on Remotely Piloted Aircraft Systems (RPAS); Potential changes to ICAO Doc 4444 New definitions and procedures for Detect & Avoid Remain Well Clear (RWC); Potential changes to ICAO Doc 8168 New definitions and procedures for Detect & Avoid Remain Well Clear (RWC)	ANSP Aircraft operator	2024
Airborne system capability	Aircraft system	Avionics for ACAS Xu	Avionics standards for ACAS Xu. References: EUROCAE/RTCA ED-yyy/ DO-xxx	Aircraft manufacturer	2020
Regulatory provisions	Operational Approval	ACAS Xu operational approval	Responsibility of State of the operator. References: ICAO Annex 6 Part IV future editions	CAA	2024
Training	-	Training requirements for new collision avoidance capability for RPAS	Operator training on Remain Well Clear, Detect & Avoid systems functionality, and related collision avoidance functionality.	Aircraft operator	2022

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

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

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

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

ACDM

ACDM-B0/1 Airport CDM Information Sharing (ACIS) Operational

Main Purpose: To generate common situational awareness, which will foster improved decision making within aerodromes, by sharing relevant surface operations data among the local stakeholders involved in aerodrome operations.

New Capabilities: Stakeholders will be able to collaborate and take actions towards the achievement of a set of defined milestones by being aware of the status of an individual flight measured against known target times and milestones.

Description: This element represents the first collaboration step among stakeholders involved in aerodrome operations. It consists in the definition of common specific milestones for several flight events taking place during surface operations. The stakeholders involved have to, based on accurate operational data, achieve the agreed milestones.

Maturity Level: Ready for implementation

Human Factor Considerations:

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

PLANNING LAYERS

Pre-tactical | Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products
Relation-operational benefit	SURF-B0/2 - Comprehensive situational awareness of surface operations

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Surface operation milestones procedure	Reference: Manual on Collaborative Air Traffic Flow Management (ATFM) ICAO Doc 9971	Airport operator, ANSP, Aircraft operator, Ground handling agent	2013
Ground system infrastructure	Airport systems	ACIS system	A simple A-CDM dialog system to a more advanced A-CDM Information sharing platform (ACISP) to achieve A-CDM information sharing.	Airport operator, ANSP, Aircraft operator, Ground handling agent	2013
Training	-	Training requirements for ACIS	Training in the operational standards and procedures	Airport operator, ANSP, ATM network function, Aircraft operator, Ground handling agent	2013
Operational procedures	Phraseology	ACIS Phraseology	Phraseology for the implementation of ACIS. References: Procedures for Air Navigation Services-Air Traffic Management (Doc 4444)	ANSP, Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is expected to bring benefits in complex or even simple but constrained airports. Collaborative decision-making by information sharing can highly facilitate coordination of common operational solutions in order to improve access and equity to ATM resources.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
	Efficiency of operations	Airport operator, ANSP, Aircraft operator

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of airport operator, aircraft operator and ANSP	Airport operator ANSP Aircraft operator
Indirect benefits	Increased safety	Airport operator ANSP Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

ACDM-B0/2 — Integration with ATM Network function — Operational

Main Purpose

Airport CDM operations will be enriched by enhanced arrival information from the ATM network and, at the same time, network operations will benefit from more accurate departure information from CDM airports.

New Capabilities

To connect airport operations to the ATM network.

Description

This element consists in feeding arrival information from the network into A-CDM and, at the same time, coordinate specific departure milestones. The involved stakeholders have to, based on accurate operational data, achieve the agreed milestones.

Maturity Level

Ready for implementation

Human Factor Considerations

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

PLANNING LAYERS

Pre-tactical | Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

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

Relation-benefit	FICE-B0/1 - Automated basic inter facility data exchange (AIDC)
Relation-operational need	NOPS-B0/4 - Initial Airport/ATFM slots and A-CDM Network Interface

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Procedures for turnaround integration	Procedures for: integration of aircraft turnaround with ATM/ATFM objectives. References: Manual on Collaborative Air Traffic Flow Management (ATFM) (Doc 9971)	Airport operator, ANSP, ATM network function, Aircraft operator	2013
Operational procedures	Phraseology	Phraseology for turnaround integration	Phraseology for the integration of the turnaround within the network. . References: Procedures for Air Navigation Services-Air Traffic Management (Doc 4444).	ANSP, Aircraft operator	2013
Ground system infrastructure	-	A-CDM system/platform-ATFM system interconnectivity	Interconnection of ACDM and the network using data exchange models.	Airport operator, ANSP, ATM network function, Aircraft operator	2013
Training	-	Training requirements for the integration of the turnaround	Training in the operational standards and procedures	Airport operator, ANSP, ATM network function, Aircraft operator, Ground handling agent	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is expected to bring benefits in complex or even simple but constrained airports surrounded by complex airspace. Collaborative decision-making by information sharing can highly facilitate coordination of common operational solutions in order to improve access and equity to ATM resources. The integration of aerodromes with the ATM network is naturally contributing to more accurate and efficient tactical and operational decision-making.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
	Efficiency of Operations	Airport operator, ANSP, Aircraft operator

Direct benefits Type	Operational description	Benefitting stakeholder(s)
	Improve situational awareness of network manager, airport operator, aircraft operator and ANSP	Airport operator, ANSP, ATM network function, Aircraft operator
Indirect benefits	Increased safety	Airport operator, ANSP, Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

ACDM-B1/1 Airport Operations Plan (AOP) Operational

Main Purpose

To enhance the planning and management of airport operations and allow their fully integration in the ATM network and enhance collaboration between airport stakeholders.

New Capabilities

Airport stakeholders will be able to better communicate and coordinate among themselves to develop and maintain dynamically joint plans and to execute those in their respective area of responsibility.

Description

This element consists of a collaborative airport operations plan (AOP) which encompasses “local” airport information and shared information with the ATM network in order to develop a synchronized view for the integration of local airport operations as well as aircraft operations into the overall ATM network.

The AOP includes an airport performance framework and steers with specific performance indicators and targets aligned with the regional/national performance frameworks, building upon A-CDM. Information on resources and aircraft operation plans is available to the different operational units on the airport and elsewhere in ATM.

The AOP may be managed and monitored by the Airport Operations Centre (APOC).

Maturity Level

Standardization

Human Factor Considerations

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

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

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

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

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	ACDM-B0/1 - Airport CDM Information Sharing (ACIS)
Relation-operational need	ACDM-B0/2 - Integration with ATM Network function
Relation-operational need	NOPS-B1/3 - Enhanced integration of Airport operations planning with network operations planning
Relation-information need	AMET-B1/1 - Meteorological observations information
Relation-information need	AMET-B1/2 - Meteorological forecast and warning information
Relation-benefit	ACDM-B1/2 - Airport Operations Centre (APOC)
Relation-benefit	SURF-B1/1 - Advanced features using visual aids to support traffic management during ground operations
Relation-benefit	SURF-B1/5 - Enhanced vision systems for taxi operations
Relation-benefit	FICE-B2/2 - Filing Service
Relation-benefit	FICE-B2/4 - Flight Data Request Service
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-information need	DAIM-B1/7 - NOTAM improvements

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Ground system infrastructure	Airport systems	AOP	Develop the Airport Operations Plan module	Airport operator	2019
Operational procedures	-	CDM information management processes	Definition of roles, responsibilities and processes to fully integrate airports in the ATM network. References: Manual on Collaborative Air Traffic Flow Management (ATFM) (Doc 9971)	Airport operator ANSP ATM network function Aircraft operator	2019
Training	-	Training requirements for AOP	Training in the operational standards and procedure	Airport operator ANSP ATM network function Aircraft operator Ground handling agent	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is expected to bring benefits in complex or even simple but constrained airports surrounded by complex airspace. Collaborative decision-making by information sharing can highly facilitate coordination of common operational solutions in order to improve access and equity to ATM resources. The full integration of aerodromes within the ATM network using standardized data and information is naturally contributing to more accurate and efficient tactical and operational decision-making.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Efficiency of Operations	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of stakeholders	
Indirect benefits	Increased safety	Airport operator, ANSP, Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

ACDM-B1/2	Airport Operations Centre (APOC)	Operational

Main Purpose

The integration of all stakeholders, both landside and airside, into a coherent decision making entity/process (and team), using the shared information and capabilities provided through the AOP.

New Capabilities

The APOC is an additional but important means by which the efficiency of the overall airport operations will be further enhanced. This will be achieved by bringing all stakeholders together in a physical facility, using the shared information and capabilities of the AOP (ensuring thereby a coherent overall airport performance monitoring), decision making and steering process, addressing all phases of operations (strategic planning, through operation to post operations).

Description

The APOC will bring stakeholders together in a physical entity (team) enabling them to better communicate and coordinate, to develop and dynamically maintain joint plans which are executed in their respective areas of responsibility at the airport.

Its main information source is the Airport Operations Plan, which integrates information from the appropriate process monitors, collating it into consistent, timely and reliable knowledge for the airport's various operational units, in particular the APOC.

The APOC will be equipped with a real-time monitoring system, a decision support system and will apply a set of collaborative procedures that build upon the capabilities of the AOP. This will ensure that the management of landside and airside airport processes will be fully integrated.

Maturity Level

Standardization

Human Factor Considerations

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

PLANNING LAYERS

Pre-tactical | Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information need	ACDM-B1/1 - Airport Operations Plan (AOP)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Operational procedures to support operations within the APOC	Procedures for data sharing, management and decision making within the APOC. References: Manual on Collaborative Air Traffic Flow Management (ATFM) (Doc 9971) Manual on the System-wide Information Management (SWIM) Concept (Doc 10039)	Airport operator, ANSP, ATM network function, Aircraft operator, Ground handling agent	2019
Ground system infrastructure	-	APOC information sharing system	Implementation of a system for information sharing between the APOC actors.	Airport operator, ANSP, ATM network function, Aircraft operator, Ground handling agent	2019
Ground system infrastructure	-	APOC monitoring and decision support systems	Implementation of real-time monitoring and decision support systems within an operational facility able to accommodate representation from all stakeholders.	Airport operator, ANSP, ATM network function, Aircraft operator, Ground handling agent	2019
Ground system infrastructure	-	Physical APOC	Designation and equipage of a physical infrastructure as an APOC.	Airport operator, ANSP	2019

Training	-	Training requirements for APOC	Training and competency monitoring in the use of procedures, responsibilities and decision support tools.	Airport operator ANSP ATM network function Aircraft operator Ground handling agent	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex or even simple but constrained airports, Collaborative Decision Making by information sharing can highly facilitate coordination of common operational solutions in order to improve access and equity to ATM resources. Full Integration with ATM network using standardized data and information is naturally contributing to more accurate and efficient tactical and operational decision-making. Applicable in aerodromes with complex traffic and infrastructure as well as complexity within the surrounding airspace. The airport should also operate during a certain period at a level of saturation.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Efficiency of Operations	Airport operator, ANSP, Aircraft operator
	Improve situational awareness of airport operator, aircraft operator and ANSP	Airport operator, ANSP, Aircraft operator
Indirect benefits	Increased safety	Airport operator, ANSP, Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

ACDM-B2/1	Total Airport Management (TAM)	Operational

Main Purpose

Total Airport Management (TAM) is an approach that takes a holistic view of airport performance management, integrating all stakeholders including the ATM network, local ATM, passenger terminal operations, service providers, passenger and baggage management and ground transportation. All stakeholders are integrated into a coherent planning and collaborative decision-making process using shared information and capabilities.

New Capabilities

TAM is an enhancement of the APOC with integration of the landside management aspects to support further improvement of the efficiency of the overall airport operation including passenger management. This will be achieved using the shared information and capabilities of the AOP, APOC and landside management thereby ensuring a coherent overall airport performance monitoring, decision making and steering process, addressing all phases of operations (strategic planning, through operation to post operations).

All essential airport processes from passenger check-in to aircraft turn-round work collaboratively with the common goal of ensuring that each departure meets its agreed 4D-trajectory. The airport is considered as one node of the overall air transport network. In order to ensure an overall Quality of Service (QoS) of an airport to the customers and to the air transport network, the integrated APOC concentrates on the initial strategic and pre-tactical planning phases using the most accurate information available, followed by the monitoring (and when required, reactive planning) of the tactical working process.

Description

TAM will bring stakeholders together as physical entity (team) enabling them to better communicate and coordinate, to develop and dynamically maintain joint plans which are executed in their respective areas of responsibility at an airport.
Its main information source will be the Airport Operations Plan with the level of predictability allowed by TBO as well as Landside Management including Passenger management, which integrates information from the appropriate process monitors, collating it into consistent, timely and reliable knowledge for the airport's various operational units, in particular the APOC.

TAM will be equipped with a real-time monitoring system, a decision support system and will apply a set of collaborative procedures that build upon the capabilities of the APOC. This will ensure that the management of landside and airside airport processes will be fully integrated including passenger management.

Maturity Level

Validation

Human Factor Considerations

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

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

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

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

PLANNING LAYERS

Pre-tactical | Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	SWIM-B2/1 - Information service provision
Relation-operational need	SWIM-B2/2 - Information service consumption
Relation-operational need	SWIM-B2/3 - SWIM registry

Relation-information benefit	FICE-B2/2 - Filing Service
Relation-information benefit	FICE-B2/4 - Flight Data Request Service
Relation-information need	AMET-B2/1 - Meteorological observations information
Relation-information need	AMET-B2/2 - Meteorological forecast and warning information
Relation-information benefit	FICE-B2/5 - Notification Service

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	TAM airside operational procedures	Procedures for data sharing, management and decision making within the APOC. References: Manual on Collaborative Air Traffic Flow Management (ATFM) (Doc 9971) Manual on the System-wide Information Management (SWIM) Concept (Doc 10039)	Airport operator, ANSP, ATM network function, Aircraft operator, Ground handling agent	2025
Operational procedures	Operations	Operational procedures to support TAM landside airport management	Landside Operational procedures for passenger and luggage management	Airport operator, Aircraft operator	2025
Ground system infrastructure	-	TAM information sharing system	Implementation of SWIM information services to support the exchange of information between the APOC actors	Airport operator, ANSP, ATM network function, Aircraft operator, Ground handling agent	2025
Ground system infrastructure	-	TAM monitoring and decision support systems	Implementation of real-time monitoring and decision support systems within an operational facility able to accommodate representation from all stakeholders.	Airport operator, ANSP, ATM network function, Aircraft operator, Ground handling agent	2025
Ground system infrastructure	-	TAM landside systems	Landside Management systems including passenger management, which integrate information from the appropriate process monitors, collating it into consistent, timely and reliable knowledge for the airport's various operational units, in particular the APOC.	Airport operator, ANSP, ATM network function, Aircraft operator, Ground handling agent	2025

Information exchange model	Flight and flow information	Flight Information Exchange Model (FIXM) Version x.x.x	Reference: PANS-ATM (Doc 4444) and FF-ICE Manual (Doc 9965, 3rd Edition)	ANSP ATM network function	2023

DEPLOYMENT APPLICABILITY

Operational conditions:

On complex or even simple but constrained Airports, Collaborative Decision Making by Information Sharing can highly facilitate coordination of common terminal throughput solutions in order to improve airside operations. The Cooperative Airport Management is benefiting from Trajectory based operations and provids predictable performance to the TBO. Better predictability of the landside is achieved for the benefit of APOC processes and airside operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Efficiency of oeprations	Airport operator, ANSP, Aircraft operator
Indirect benefits	Increased safety	Airport operator, ANSP, Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

APTA

APTA-B0/1	PBN Approaches (with basic capabilities)	Operational

Main Purpose

This element represents the use of PBN in design of approach procedures to provide more flexibility to airspace planners to manage the use of airspace, and to facilitate access to airports. It includes the provision of instrument approach procedures with vertical guidance in support of stabilized approaches.

New Capabilities

Development of PBN instrument approach procedures that are independent of ground based navigation aids. The use of new approach design criteria can often achieve the lowest possible minimums due to optimized lateral and vertical paths.

The PBN procedures also support stabilized approach operations for aircraft equipped with advisory Baro-VNAV functionality. Stable vertical paths can be established using vertical guidance for aircraft equipped with either advisory Baro-VNAV functionality or by using SBAS.

Description

PBN approaches allow for guided lateral paths and optionally, with associated advisory vertical paths based on Baro-VNAV functionality for aircraft so equipped. Such Baro-VNAV functionality enables stabilized decent operations on the final segment of the approach at airports which do not have ground infrastructure to support precision approaches. These procedures can also be implemented to allow continued approach operations in the case of failure of an existing ILS or traditional non precision approaches that are based on ground navigation aids.

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? No

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	PBN approach (with basic capabilities) procedures design and use.	These operational procedures should be designed and used (aircraft operation criteria) as specified in ICAO Doc 8168 PANS-OPS Vol II and I or equivalent.	ANSP	2013
Operational procedures	Design	PBN approach (with basic capabilities) validation, approval and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. References: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2013

Operational procedures	Operations	SOPs for PBN approaches (with basic capabilities)	Procedures for the crew to follow to fly a PBN approach. Defined in the Ops Manual. Reference: Doc 9613 (PBN Manual)	Aircraft operator	2013
Operational procedures	Operations	Contingency procedures for PBN approaches (with basic capabilities)	Procedures for the crew to follow in case of abnormal events. Defined in the Ops Manual. Reference: Doc 9613 (PBN Manual)	Aircraft operator	2013
Airborne system capability	-	Aircraft capability for PBN approach (with basic capabilities)	Aircraft eligible for RNP APCH Navigation specification as defined in Doc 9613 (PBN Manual) and listed in the Aircraft Flight Manual.	Aircraft manufacturer Aircraft operator	2013
Training	-	Training requirements for PBN approaches (with basic capabilities)	Crew trained to fly PBN approaches (with basic capabilities). References: As defined in Doc 9613 (PBN Manual). PBN approaches (with basic capabilities) training for Air traffic controllers. References: As defined in Doc 9613 (PBN Manual). PBN approaches (with basic capabilities) training for Procedure designers, Airspace planners. References: PANS-OPS Vol II and Doc 9992 Manual on the Use of Performance-Based Navigation (PBN) in Airspace Design	ANSP Aircraft operator	2013
Operational Authorization	-	Operational Authorization for PBN approaches (with basic capabilities)	Aircraft operator flying a PBN approach should have an operational authorization related to the specified performance of the procedure, as described in Doc 9997 (PBN Ops Approval Manual).	CAA Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Any runway ends with or without existing procedures. Can be used to facilitate access at aerodromes where conventional procedures are not implementable, or in support of existing procedures for contingency use.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Add availability of airports/runways not served by conventional instrument approach procedures. Increase availability of airports where lower minima are achieved, or facilitate continued airport operations when conventional procedures become unserviceable.	Airport operator ANSP Airspace user
	Added safety by potentially replacing circle to land procedures.	ANSP Airspace user
	Improve safety where both lateral and vertical guidance is provided (stabilized approach).	Airspace user
Indirect benefits	Flexibility to reduce environmental impact (noise and emissions) due to the possible avoidance of sensitive flight paths dictated by ground based navigation aids, and shorter paths to transition from en-route to the approach.	Airport operator ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B0/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Equip additional RWY ends with instrument approaches	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)	++	KPI10: Airport peak throughput

APTA-B0/2	PBN SID and STAR procedures (with basic capabilities)	Operational

Main Purpose

Use of PBN capabilities allows more flexible placement of arrival and departure routing without the need for ground based infrastructure to support these routes.

New Capabilities

The flexibility of arrival path design supports the ability to connect en-route to the approach in an optimal manner, enabling better airspace management, reduced path distance, and reduced noise footprint. A precisely defined arrival path supports more optimum descent planning in operations and provides a building block for reducing ATC intervention during descent.

This flexibility is also applicable to providing more optimum departure paths to the exit of terminal airspace. These new capabilities are essential elements to support the development of Continuous Descent Operations/Continuous Climb Operations (CDO/CCO).

Description

This element represents the use of PBN in design of arrival and departure procedures to provide more flexibility to airspace planners to manage the use of airspace for enhancing arrival and departures in terminal areas. It provides the basic capability to support the implementation of CDO and CCO operations.

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	PBN SID and STAR Procedures (with basic capabilities) procedure design and use	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent.	ANSP	2013
Operational procedures	Design	PBN SID and STAR Procedures (with basic capabilities) validation, approval and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. References: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design).	ANSP CAA	2013

Operational procedures	Operations	SOPs for PBN SID/STAR (with basic capabilities)	Procedures for the crew to follow to fly a PBN SID/STAR. Reference: Defined in the Ops Manual Reference: Doc 9613 (PBN Manual)	Aircraft operator	2013
Operational procedures	Operations	Contingencies for PBN SID/STAR (with basic capabilities)	Procedures for the crew to follow in case of abnormal events. Defined in the Ops Manual Reference: Doc 9613 (PBN Manual)	Aircraft operator	2013
Airborne system capability	-	Aircraft capability for PBN SID/STAR (with basic capabilities)	Aircraft eligible for applicable Navigation specification as defined in Doc 9613 (PBN Manual) and listed in the Aircraft Flight Manual.	Aircraft manufacturer Aircraft operator	2013
Operational Authorization	-	Operational Authorization for PBN SID/STAR (with basic capabilities)	Aircraft operator flying a PBN SID/STAR should have an operational authorization related to the specified performance of the procedure, as described in Doc 9997 (PBN Ops Approval Manual)	CAA Aircraft operator	2013
Ground system infrastructure	Navigation	NAVAIDS to support the applicable navigation specification used for SID/STAR (with basic capabilities)	Depending on the navigation specification used, suitable ground based navigational aids will be required. See Doc 9613 (PBN Manual) for details.	ANSP	2013
Training	-	Training requirements for PBN SID/STAR (with basic capabilities)	Crew trained to fly PBN SID/STAR (with basic capabilities). References: As defined in Doc 9613 (PBN Manual). PBN SID/STAR (with basic capabilities) training for Air traffic controllers. References: As defined in Doc 9613 (PBN Manual). PBN SID/STAR (with basic capabilities) training for procedure designers, airspace planners. Ref Doc 8168 (PANS OPS Vol II); Doc 9992 (PBN airspace design Manual); Doc 9906 (Vol 2)	ANSP Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Applicable in all terminal areas. Arrivals facilitates descent and connects to the approach phase. Departures facilitates climb and provides lateral path top exit terminal area. The use of PBN procedures supports flexible airspace planning and development.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Flexible airspace planning and development.	ANSP
	Increase in terminal airspace capacity due to the ability to develop optimized routes independent of the ground based navigation.	Airport operator ANSP
Indirect benefits	Contingencies afforded by additional procedures not reliant on ground based radio aids.	ANSP Airspace user
	Increased efficiency of traffic flow through the terminal area.	ANSP Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B0/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Increase airport arrival rate	++	KPI11: Airport throughput efficiency
Capacity	Capacity, throughput & utilization	Mitigate local airspace capacity constraints if this is the problem	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Mitigate noise constraints if this is the problem	++	KPI10: Airport peak throughput
Efficiency	Vertical flight efficiency	Reduce permanent (airspace and approach procedure design) and semi-permanent (ATFCM measures) altitude constraints along the descent portion of traffic flows, in en-route and terminal airspace	++	KPI19: Level-off during descent
Efficiency	Vertical flight efficiency	Reduce permanent (airspace and departure procedure design) and semi-permanent (ATFCM measures) altitude constraints (level capping) along the climb portion of traffic flows, in terminal and en-route airspace	++	KPI17: Level-off during climb

APTA-B0/3	SBAS/GBAS CAT I precision approach procedures	Operational

Main Purpose: Introduction of SBAS and GBAS CAT I procedures allow for reduced minima at aerodromes situated in areas of significant terrain, where ILS is not possible.

New Capabilities: Implementation of CAT I at airports, where ILS is precluded, increases accessibility.

It also provides a building block for aircraft with equipment such as SVS, EVS HGS to operate to decision altitudes below standard CAT I Minimums using Special operational Authorizations. For aircraft with such approvals, this increases airport availability in weather conditions that would otherwise preclude operations.

Description: This element represents the use of augmented GNSS systems to allow aircraft operation with a more precise vertical and lateral navigation capability. It also includes the development of SA CAT I operations below existing minima.

Maturity Level: Ready for implementation

Human Factor Considerations:

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	NAVS-B0/2 - Satellite Based Augmentation Systems (SBAS)
Relation-technology need	NAVS-B0/1 - Ground Based Augmentation Systems (GBAS)
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	Cat I Precision Approach Procedure design and use	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent.	ANSP	2013

Operational procedures	Design	Cat I Precision Approach procedure validation, approval and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. References: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2013
Operational procedures	Operations	SOPs for Cat I Precision Approaches	Procedures for the crew to follow to fly a Cat I Precision Approach. Reference: Ops Manual defines SOPs	Aircraft operator	2013
Operational procedures	Operations	Contingencies for Cat I Precision Approaches	Procedures for the crew to follow in case of abnormal events. Reference: Ops Manual defines SOPs	Aircraft operator	2013
Airborne system capability	Navigation	Aircraft capability for Cat I Precision Approaches	TSO C145 or C146 or equivalent required for SBAS avionics. TSO C161A required for GBAS CAT I	Aircraft manufacturer Aircraft operator	2013
Ground system infrastructure	Navigation	Ground based system for Cat I Precision Approach	GBAS Ground Station SBAS Ground stations Ref Annex 10 Vol I	Airport operator ANSP	2013
Training	-	Training requirements for Cat I Precision Approach Procedures	Crew trained to fly Cat I precision approaches. Reference: Doc 8168 (Vol I). Cat I Precision Approach training for ATC. Reference: Doc 8168 (Vol I). Cat I Precision Approach training for procedure designers, airspace planners. Ref : Doc 8168 (PANS OPS Vol II); Doc 9906 (Vol 2)	ANSP Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Runway ends where precision approach guidance is considered a requirement.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity: Improved airport access from reduced operating minima.	ANSP Airspace user
	Vertical guidance for stable approach.	ANSP Airspace user

Type	Operational description	Benefitting stakeholder(s)
	Reduced probability of go-around.	ANSP, Airspace user
Indirect benefits	Increase in terminal airspace capacity due to the ability to conduct landing operations in adverse weather.	Airport operator, ANSP, Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B0/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Equip additional RWY ends with instrument approaches	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)	++	KPI10: Airport peak throughput

APTA-B0/4 CDO (Basic) Operational

Main Purpose: Reduce fuel burn by not requiring application or power during descent.

New Capabilities: ATC procedures to facilitate uninterrupted descent, reducing ATC/Pilot interaction.

Description: Arriving aircraft are allowed to descend continuously from top of descent by employing minimum engine thrust, ideally in a low drag configuration, prior to the Initial Approach Fix (IAF).

Maturity Level: Ready for implementation

Human Factor Considerations:

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

In ATC.

2. Does it imply processing of new information by the user? No

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

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	APTA-B0/2 - PBN SID and STAR procedures (with basic capabilities)
Relation-operational benefit	RSEQ-B0/3 - Point merge

Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	Development of CDO (Basic) procedures	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent, with reference to Doc 9931 (CDO Manual)	ANSP, Aircraft operator	2013
Operational procedures	Design	CDO (Basic) procedures validation, approval and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. References: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP, CAA	2013
Operational procedures	Operations	SOPs for CDO (Basic) operations	Procedures for the crew to follow to facilitate the flying of a CDO. OPS Manual defines SOPs	Aircraft operator	2013
Operational procedures	Operations	Contingencies for CDO (Basic)	Procedures for the crew to follow in case of abnormal events. Reference: Ops Manual defines SOPs	Aircraft operator	2013
Airborne system capability	Aircraft system	Aircraft Capability for CDO (Basic)	Eligibility for the applicable PBN navigation specification (if required) and vertical path capability, as defined in Doc 9613 (PBN Manual) and listed in the Aircraft Flight Manual (AFM)	Aircraft manufacturer, Aircraft operator	2013
Ground system infrastructure	Navigation	NAVAIDS to support the applicable navigation specification used for CDO (Basic)	Depending on the navigation specification used, suitable ground based navigational aids will be required. See Doc 9613 (PBN Manual) for details.	ANSP	2013
Training	-	Training requirements for CDOs (Basic)	Crew trained to fly CDOs (Basic) CDO (Basic) training for Air traffic controllers CDO (Basic) training for procedure designers, Airspace planners. References: Doc 9906 (Vol 2); Doc 9992	ANSP, Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Non-congested terminal airspace with PBN STAR routings where greater efficiency is required. Noise sensitive areas requiring reduced noise footprint.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce fuel burn by not requiring power during descent.	Airspace user
Indirect benefits	Increase in terminal area efficiency from reduced ATC intervention in the aircraft routing and vertical profile.	ANSP, Airspace user
	Reduction in noise footprint.	Local community

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B0/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Vertical flight efficiency	Avoid efficiency penalties attributable to non-optimum ToD (descent starts before or after the optimum ToD)	++	KPI19: Level-off during descent
Efficiency	Vertical flight efficiency	Avoid tactical lengthening of arrival path (eg vectoring, holding, trombone extension) because this leads to level flight	++	KPI19: Level-off during descent
Efficiency	Vertical flight efficiency	Reduce descent inefficiency attributable to altitude constraints imposed by ATM	++	KPI19: Level-off during descent

APTA-B0/5	CCO (Basic)	Operational

Main Purpose: Reduce fuel burn by not requiring level-offs during climb.

New Capabilities: ATC procedures to facilitate uninterrupted climb, reducing ATC/Pilot interaction.

Description: Departing aircraft are allowed to climb continuously, to the greatest possible extent, by employing optimum engine thrust. An optimal continuous climb should start on take-off and allow the aircraft to climb efficiently using climb profiles that reduce controller pilot communications and segments of level flight until the top of climb.

Maturity Level	Ready for implementation
Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes In ATC. 2. Does it imply processing of new information by the user? No 3. Does it imply the use of new equipment? No 4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	APTA-B0/2 - PBN SID and STAR procedures (with basic capabilities)
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	Development of CCO (Basic) procedures	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent, with reference to Doc 9993 (CCO Manual)	ANSP Aircraft operator	2013
Operational procedures	Design	CCO (basic) procedures validation, approval and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2013
Operational procedures	Operations	SOPs for CCO (Basic) operations	Procedures for the crew to follow to facilitate the flying of a CCO. OPS Manual defines SOPs	Aircraft operator	2013
Operational procedures	Operations	Contingencies for CCO (Basic)	Procedures for the crew to follow in case of abnormal events. Reference: Ops Manual defines SOPs	Aircraft operator	2013

Airborne system capability	Aircraft system	Aircraft Capability for CCO (Basic)	Eligibility for the applicable PBN navigation specification (if required) and vertical path capability, as defined in Doc 9613 (PBN Manual) and listed in the Aircraft Flight Manual (AFM)	Aircraft manufacturer Aircraft operator	2013
Ground system infrastructure	Navigation	NAVAIDS to support the applicable navigation specification used for CCO (Basic)	Depending on the navigation specification used, suitable ground based navigational aids will be required. See Doc 9613 (PBN Manual) for details.	ANSP	2013
Training	-	Training requirements for CCOs (Basic)	Crew trained to fly CCOs (Basic). Reference: Training to support the CCO concept. ATC trained to provides CCOs (Basic). Reference: Training to support the CCO concept. CDO (Basic) training for procedure designers, Airspace planners. References: Doc 9906 (Vol 2); Doc 9992	ANSP Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Non-congested terminal airspace with PBN SID routings where greater efficiency is required. Noise sensitive areas requiring noise abatement procedures.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduce fuel burn by not requiring level-offs during climb.	Airspace user
Indirect benefits	Increase in terminal area efficiency from reduced ATC intervention in the aircraft routing and vertical profile.	ANSP Airspace user
	Reduction in noise footprint.	Local community

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
Efficiency	Vertical flight efficiency	Reduce permanent (airspace and departure procedure design) and semi-permanent (ATFCM measures) altitude constraints (level capping) along the climb portion of traffic flows, in terminal and en-route airspace	++	KPI17: Level-off during climb

APTA-B0/6 PBN Helicopter Point in Space (PinS) Operations Operational

Main Purpose: Helicopter unique capabilities allow IFR operations that start or terminate from any suitable point in space (PinS), as long as visual conditions support take-off/landing capability from that point.

New Capabilities: Facilitating arrivals and departures to landing locations which do not otherwise support such operations.

Description: PBN PinS operations include arrivals and departure procedures, specific to helicopters, that allow visual landing and take-off operations from heliports or other landing locations.

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? 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-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Operational procedures	Design	Helicopter PBN Point in Space (PinS) procedure design	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent.	ANSP	2013
Operational procedures	Design	Helicopter PBN Point in Space (PinS) procedure validation, approval and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should be in accordance with Doc 8168 (PANS OPS Vol II). Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design) The publication of the procedures should be in accordance with Doc 8168 (PANS OPS Vol II).	ANSP CAA	2013
Operational procedures	Operations	SOPs for Helicopter PBN Point in Space (PinS) operations	Procedures for the crew to follow to facilitate the flying of a CDO. OPS Manual defines SOPs	Aircraft operator	2013
Operational procedures	Operations	Contingencies for Helicopter PBN Point in Space (PinS) operations	Procedures for the crew to follow in case of abnormal events. Reference: Ops Manual defines SOPs	Aircraft operator	2019
Airborne system capability	Aircraft system	Aircraft capability for PBN Helicopter Point in Space (PinS) operations	Requires applicable PBN Navigation specification, as defined in Doc 9613 (PBN Manual) and listed in the Rotorcraft Flight Manual (RFM)	Aircraft manufacturer Aircraft operator	2013
Operational Authorization	-	Operational Authorization PBN Helicopter Point in Space (PinS) operations	Aircraft operator flying a PBN Helicopter Point in Space (PinS) operation should have an operational authorization related to the specified performance of the procedure, as described in Doc 9997 (PBN Ops Approval Manual)	CAA Aircraft operator	2013
Training	-	Training requirements for Helicopter PBN Point in Space (PinS)	Crew trained to fly Helicopter PBN Point in Space (PinS) procedures. Ref.: As defined in Doc 8168 (PANS OPS Vol I) Helicopter PBN Point in Space (PinS) training for ATC Helicopter PBN Point in Space (PinS) training for procedure designers, Airspace planners. References: Doc 8168 (PANS OPS Vol II); Doc 9906 (Vol 2).	ANSP Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Obstacle rich environments containing helicopter landing locations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve access to helicopter landing areas through approach procedures with improved minima.	ANSP Airspace user
	Reduce number of diversions.	ANSP Airspace user
Indirect benefits	Airspace capacity enhancement through design flexibility and removal of existing operational restrictions.	ANSP
	Enhance helicopter operations availability and continuity.	ANSP Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B0/6

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Mitigate local airspace capacity constraints if this is the problem	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)	++	KPI10: Airport peak throughput

APTA-B0/7 Performance based aerodrome operating minima – Advanced aircraft Operational

Main Purpose

Standard Aerodrome operating minima are predicated upon aircraft equipped with the minimum required equipment (the basic aircraft) for that approach. These aerodrome operating minima relate directly to the established types and categories of operations and the associated infrastructure requirements (e.g. runway lights, approach lights). Aircraft with more advanced equipage can take advantage of existing infrastructure to obtain special authorizations for enhanced approach operations to lower minimums than basic aircraft can use.

New Capabilities

Advanced Aircraft are those aircraft with equipment in addition to that required for a Basic Aircraft for a given approach or landing operation. Examples of additional equipment could include EVS, HUD and/or autoland. The additional equipment allows the aircraft to operate to lower RVR values and/or to lower DH than would be achievable with a basic equipped aircraft. PB AOM are derived are derived by taking account of the combined capabilities of an Advanced Aircraft, and available ground facilities.

Description

For advanced aircraft, Improvements include:

- EVS operations using existing Type A or Type B CAT I procedures, requiring natural vision from 100 ft, but with significantly reduced RVR
- Lower that standard CAT I (SA CAT I) operations by means of HUD or autoland. CAT II operations with less infrastructure (SA CAT II) by means of HUD or autoland.
- EVS to land operations, using existing CAT I facilities but without the need to have natural visual references before landing.

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? No

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	APTA-B0/3 - SBAS/GBAS CAT I precision approach procedures
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	Operational credits	Provisions for operational credits to enable lower minima based on advanced aircraft capabilities. Reference: Annex 6 Part I	CAA	2013
Operational procedures	Operations	SOPs for Performance-based Aerodrome Operating Minima (Advanced aircraft)	Procedures for the crew to operate to minima determined by the combination of aircraft equipage and ground infrastructure. Defined in the Ops Manual. Reference: Doc 9365 (AWO Manual)	Aircraft operator	2013

Operational procedures	Operations	Contingency procedures for Performance-based Aerodrome Operating Minima (Advanced aircraft)	Procedures for the crew to follow in case of abnormal events. Defined in the Ops Manual	Aircraft operator	2013
Operational procedures	Operations	ATC procedures for Performance-based Aerodrome Operating Minima (Advanced aircraft)	Procedures for ATC to use in order to facilitate the use of performance-based minima at aerodromes. Low visibility operating plan for aerodrome ATC	ANSP	2013
Operational procedures	Operations	Aerodrome procedures for Performance-based Aerodrome Operating Minima (Advanced aircraft)	Procedures for ground operations by aircraft with advanced capabilities	Airport operator	2013
Airborne system capability	Aircraft system	Advanced aircraft capability	SBAS and GBAS as required EVS and HUD installation Reference: Doc 9365 (AWO Manual)	Aircraft manufacturer Aircraft operator	2013
Operational Authorization	-	Operational Authorization for Performance-based Aerodrome Operating Minima (Advanced aircraft)	Aircraft operator conducting PBAOM operations for low visibility operations require a specific approval detailing the operational credit applied Reference: Doc 9365 (AWO Manual)	CAA Aircraft operator	2013
Ground system infrastructure	Navigation	NAVAIDS to support the intended operation	Pre threshold terrain information for advanced aircraft operations SBAS/GBAS ground stations (as required)	Airport operator ANSP	2013

Training	-	Training requirements for Performance-based Aerodrome Operating Minima (Advanced aircraft)	Crew trained to fly using Performance-based Aerodrome Operating Minima (Advanced aircraft). Training on the use of advanced aircraft equipment such as EVS Reference: Doc 9365 (AWO Manual). ATC trained to understand implications of Performance-based Aerodrome Operating Minima (Advanced aircraft). Training for ATC on the application of operational credits for advanced aircraft and the effect on determining minima used by crews.	ANSP Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Approach operations in adverse weather conditions to lower than standard minima for operators of advanced aircraft.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Reduced minima operations without additional infrastructure on the ground, based on aircraft equipment (SVS, EVS, HUD) Increased capacity of the airport under adverse conditions by improving access to airports.	ANSP Airspace user
	Reduced number of diversions.	ANSP Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B0/7

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)	++	KPI10: Airport peak throughput

APTA-B0/8 Performance based aerodrome operating minima – Basic aircraft Operational

Main Purpose

For Basic aircraft, improvements include:

- Instrument approaches to non-instrument runways, improving airport access
- Flexibility to gradually improve the ground infrastructure with consequent improvements in operating minima

New Capabilities

New approach procedures can be added based on GNSS, without the need for any additional ground infrastructure. Non-instrument runways can support an instrument approach procedure, but with relatively high minima. Reduction of this minima is achieved by upgrading the runway to at least a non-precision runway, along with other improvements such as lighting and visual aids.

Description

Aerodrome operating minima are predicated upon the aircraft with the minimum equipment required (the basic aircraft). These aerodrome operating minima relate directly to the established types and categories of operations and the associated infrastructure requirements. An airport operator can choose to upgrade ground based infrastructure to add approach capability and/or to enable lower minimums for increased airport availability for all operations. Examples of such infrastructure upgrades include runway lighting, approach lighting, centreline lights. This also includes upgrade of runway from non-instrument to non-precision.

Maturity Level

Ready for implementation

Human Factor Considerations

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

2. Does it imply processing of new information by the user? No

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

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	Design of approach procedures to non-instrument runways	Procedures should be designed in accordance with published criteria. Reference: Doc 8168 (PANS OPS Vol II)	ANSP	2013

Operational procedures	Design	Validation, approval and publication of approach procedures to non-instrument runways	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2013
Operational procedures	Operations	SOPs for operations using instrument approaches to non-instrument runways	Additional requirements for operating crews should be detailed in the Ops Manual.	Aircraft operator	2013
Operational procedures	Operations	Contingencies for operations using instrument approaches to non-instrument runways	Specific contingencies associated with operations to non-instrument runways should be detailed in the Ops manual	Aircraft operator	2013
Airborne system capability	Aircraft system	Aircraft capability for operating in instrument approaches to non-instrument runways	Aircraft eligible for applicable Navigation specification as defined in Doc 9613 (PBN Manual) and listed in the Aircraft Flight Manual.	Aircraft manufacturer Aircraft operator	2013
Ground system infrastructure	-	Ground based infrastructure to support the desired operating minima	Minimum requirement is a non-instrument runway for basic aircraft Additional elements may be used to reduce operating minim (lighting, visual aids etc.)	Airport operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

Airports with limited infrastructure wanting to implement or improve instrument approach procedures.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Increased capacity of the airport under adverse conditions by improving access to airports.	Airport operator ANSP Airspace user
	Reduced number of diversions.	ANSP Airspace user

Type	Operational description	Benefitting stakeholder(s)
Indirect benefits	Reduced initial costs to implement vertically guided approaches.	Airport operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B0/8

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Equip additional RWY ends with instrument approaches	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)	++	KPI10: Airport peak throughput

APTA-B1/1 PBN Approaches (with advanced capabilities) Operational

Main Purpose

PBN approaches with advanced functionality allow for the introduction of more flexible approaches including the use of RF legs within the Final Approach Segment (FAS) and RNP.

New Capabilities

Use of advanced functionality as included in A-RNP and RNP AR (RF legs).

Description

This element represents the use advanced features of PBN in design of approach procedures to provide more access to airports in challenging environments, where conventional procedures are unsuitable.

Advanced RNP is the navigation specification which encompasses all elements of PBN (but excluding RNP AR APCH). It requires an FMS based on a TSO-C.

With A-RNP Ops approval, an operator can conduct any PBN operation except RNP AR APCH. RNP AR APCH requires a Specific Approval.

Maturity Level

Standardization

Human Factor Considerations

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

2. Does it imply processing of new information by the user? No

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

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	APTA-B0/1 - PBN Approaches (with basic capabilities)
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	PBN approach (with advanced capabilities) procedures design and use	These instrument flight procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) and Doc 9905 (Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual).	ANSP	2019
Operational procedures	Design	PBN approach (with advanced capabilities) validation, approval, and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2019
Operational procedures	Operations	SOPs for PBN approaches (with advanced capabilities)	Procedures for the crew to follow to fly a PBN approach. Defined in the Ops Manual Reference: Doc 9613 (PBN Manual)	Aircraft operator	2019
Operational procedures	Operations	Contingency procedures for PBN approaches (with advanced capabilities)	Procedures for the crew to follow in case of abnormal events. Defined in the Ops Manual Reference: Doc 9613 (PBN Manual)	Aircraft operator	2019
Airborne system capability	Navigation	Aircraft capability for PBN approach (with advanced capabilities)	Aircraft eligible for RNP AR APCH Navigation specification, Advanced-RNP navigation specification as required. Defined in Doc 9613 (PBN Manual) and listed in the Aircraft Flight Manual.	Aircraft manufacturer Aircraft operator	2019
Operational Authorizatio n	-	Operational Authorization for PBN approaches (with advanced capabilities)	Operations based on RNP AR APCH require a specific approval. Advanced-RNP requires an operational authorization Reference: Doc 9997 (PBN Ops Approval Manual)	CAA Aircraft operator	2019

Training	-	Training requirements for PBN Approaches (with advanced capabilities)	Training for ATCOs, procedure designers, airspace planners and crew to fly PBN Approaches (with advanced capabilities). References: Doc 9613 (PBN Manual). Additional training on the use of advanced capabilities in procedure design: PANS-OPS Vol II Doc 9905 (Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual) Doc 9992 (Manual on the Use of Performance-Based Navigation (PBN) in Airspace Design) Doc 9906 (Vol 2)	ANSP Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Any runway ends with or without existing procedures. Particularly relevant for airports situated in congested or challenging operating environments.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Increased capacity of the airport under adverse conditions by Improving access to airports not served by instrument approach procedures.	Airport operator, ANSP, Airspace user
	Contingencies afforded by additional procedures not reliant on ground based radio aids.	Airport operator, ANSP, Airspace user
Indirect benefits	Increase in runway capacity due to the possible avoidance of sensitive and critical areas for ground based navigation aids without increasing length of flying routes.	Airport operator, ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B1/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Equip additional RWY ends with instrument approaches	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)	++	KPI10: Airport peak throughput

APTA-B1/2	PBN SID and STAR procedures (with advanced capabilities)	Operational

Main Purpose: Advanced PBN functionality further supports flexibility of route placements in airspace design.

New Capabilities: Use of advanced functionality to enable more flexibility in airspace design, such as RF legs outside of the Final Approach Segment. Introduction of RNP AR Departures.

Description: This element represents the use advanced features of PBN in design of arrival procedures to provide more flexibility in airspace design, leading to greater efficiency in the terminal area and increased capacity.

Advanced RNP is the navigation specification which encompasses all elements of PBN (but excluding RNP AR APCH). It requires an FMS based on a TSO-C115d.

With A-RNP Ops approval, an operator can conduct any PBN operation except RNP AR APCH. RNP AR APCH requires a separate Ops approval.

Maturity Level: Standardization

Human Factor Considerations:

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	APTA-B0/2 - PBN SID and STAR procedures (with basic capabilities)
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	PBN SID and STAR Procedures (with advanced capabilities) procedure design and use	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent.	ANSP	2019

Operational procedures	Design	PBN SID and STAR Procedures (with advanced capabilities) validation, approval, and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2019
Operational procedures	Operations	SOPs for PBN SID/STAR (with advanced capabilities)	Procedures for the crew to follow to fly a PBN SID/STAR. Defined in the Ops Manual Reference: Doc 9613 (PBN Manual)	Aircraft operator	2019
Operational procedures	Operations	Contingencies for PBN SID/STAR (with advanced capabilities)	Procedures for the crew to follow in case of abnormal events. Defined in the Ops Manual. Reference: Doc 9613 (PBN Manual)	Aircraft operator	2019
Airborne system capability	-	Aircraft capability for PBN SID/STAR (with advanced capabilities)	Aircraft eligible for applicable Navigation specification as defined in Doc 9613 (PBN Manual) and listed in the Aircraft Flight Manual.	Aircraft manufacturer Aircraft operator	2019
Operational Authorization	-	Operational Authorization for PBN SID/STAR (with advanced capabilities)	Aircraft operator flying a PBN SID/STAR should have an operational authorization related to the specified performance of the procedure, as described in Doc 9997 (PBN Ops Approval Manual)	CAA Aircraft operator	2019
Ground system infrastructure	Navigation	NAVAIDS to support the applicable navigation specification used for SID/STAR (with advanced capabilities)	Depending on the navigation specification used, suitable ground based navigational aids will be required. Reference: Doc 9613 (PBN Manual)	ANSP	2019
Training	-	Training requirements for PBN SID/STAR (with advanced capabilities)	Training for ATCOs, procedures designers and crew to fly PBN SID/STAR (with advanced capabilities). References: Doc 9613 (PBN Manual); Additional training for advanced capabilities as defined in Doc 9613 (PBN Manual) Reference: Doc 8168 (PANS OPS Vol II) Doc 9906 (Vol 2)	ANSP Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Applicable in all terminal areas. Particularly suited to airports situated in congested or challenging operating environments.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Flexible airspace planning and development.	ANSP
	Increase in terminal airspace capacity due to the ability to develop optimized routes independent of the ground based navigation.	ANSP, Airspace user
Indirect benefits	Contingencies afforded by additional procedures not reliant on ground based radio aids.	Airport operator, ANSP
	Environmental benefits; paths can be optimized to stay away from noise sensitive areas, and shorter distances to connect from en-route to approach for reduced emissions.	

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Increase airport arrival rate	++	KPI11: Airport throughput efficiency
Capacity	Capacity, throughput & utilization	Mitigate local airspace capacity constraints if this is the problem	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Mitigate noise constraints if this is the problem	++	KPI10: Airport peak throughput
Efficiency	Vertical flight efficiency	Reduce permanent (airspace and approach procedure design) and semi-permanent (ATFCM measures) altitude constraints along the descent portion of traffic flows, in en-route and terminal airspace	++	KPI19: Level-off during descent

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Vertical flight efficiency	Reduce permanent (airspace and departure procedure design) and semi-permanent (ATFCM measures) altitude constraints (level capping) along the climb portion of traffic flows, in terminal and en-route airspace	++	KPI17: Level-off during climb

APTA-B1/3 Performance based aerodrome operating minima – Advanced aircraft with SVGS Operational

Main Purpose Use of advanced features on aircraft permit operations using lower than standard minima on existing procedures. This builds on the Block 0 element for PB AOM (Advanced Aircraft) and enables the use of Synthetic Vision Guidance Systems (SVGS).

New Capabilities Definition of more precise approaches down to SA CAT I minima by use of SVGS.

Description This element builds on the PB AOM concept to allow operations for advanced aircraft utilizing the concept of operational credit. The use of guidance systems based on synthetic vision expands on the previous capability to use SVS for situational awareness only.

Maturity Level Standardization

Human Factor Considerations

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	APTA-B0/7 - Performance based aerodrome operating minima – Advanced aircraft
Relation-operational need	APTA-B0/3 - SBAS/GBAS CAT I precision approach procedures
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	Operational credits	Provisions for operational credits to enable lower minima based on advanced aircraft capabilities. Reference: Annex 6 Part I	CAA	2013
Operational procedures	Operations	SOPs for Performance-based Aerodrome Operating Minima (Advanced aircraft with SVGS)	Procedures for the crew to operate to minima determined by the combination of aircraft equipage and ground infrastructure. Defined in the Ops Manual. Reference: Doc 9365 (AWO Manual)	Aircraft operator	2019
Operational procedures	Operations	Contingency procedures for Performance-based Aerodrome Operating Minima (Advanced aircraft with SVGS)	Procedures for the crew to follow in case of abnormal events. Defined in the Ops Manual	Aircraft operator	2019
Operational procedures	Operations	ATC procedures for Performance-based Aerodrome Operating Minima (Advanced aircraft with SVGS)	Procedures for ATC to use in order to facilitate the use of performance-based minima at aerodromes. Low visibility operating plan for aerodrome ATC	ANSP	2019
Operational procedures	Operations	Aerodrome procedures for Performance-based Aerodrome Operating Minima (Advanced aircraft with SVGS)	Procedures for ground operations by aircraft with advanced capabilities	Airport operator	2019

Airborne system capability	Aircraft system	Advanced aircraft capability with SVGS	SBAS and GBAS as required SVGS and HUD installation Reference: Doc 9365 (AWO Manual)	Aircraft manufacturer Aircraft operator	2019
Ground system infrastructure	Navigation	NAVAIDS to support the intended operation with SVGS	Pre threshold terrain information for advanced aircraft operations SBAS/GBAS ground stations (as required)	Airport operator ANSP	2019
Training	-	Training requirements for Performance-based aerodrome operating minima (Advanced Aircraft with SVGS)	Crew trained to fly using Performance-based Aerodrome Operating Minima (Advanced aircraft with SVGS) Training on the use of advanced aircraft equipment such as SVGS Reference: Doc 9365 (AWO Manual) ATC trained to understand implications of Performance-based Aerodrome Operating Minima (Advanced aircraft with SVGS) Training for ATC on the application of operational credits for advanced aircraft and the effect on determining minima used by crews.	ANSP Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Operators wanting to obtain better minima by investing in advanced aircraft.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improved airport access from reduced minima (RVR, DH) for equipped operators.	Airspace user
Indirect benefits	Increased capacity of the airport under adverse conditions.	Airport operator, ANSP, Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS APTA-B1/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)	++	KPI10: Airport peak throughput

APTA-B1/4	CDO (Advanced)	Operational

Main Purpose: Increase the ability CDO operations to contribute to terminal airspace efficiency.

New Capabilities: High accuracy vertical navigation permits more precise paths to be flown by arriving aircraft.

Description: This element builds on the basic CDO capabilities and adds advanced vertical path management. This gives the ability to more precisely define the path flown by arriving aircraft, which allows for more flexible and efficient use of airspace. Compromise between aircraft optimal performance and airspace optimal efficiency can be achieved.

PBN with vertical navigation (VNAV) which is an altimetry-based capability is used and allows an equipped aircraft to precisely descend on a vertical path, as computed by avionics equipment, while providing the flight crew with navigation performance information through avionics. To this end, vertical windows in procedure design enable CDOs, particularly where SID/STARs cross each other.

Initially the benefits will be realised for airspace outside of the TMA, and for less congested environments.

Maturity Level: Standardization

Human Factor Considerations:

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	APTA-B0/4 - CDO (Basic)
Relation-operational need	APTA-B0/2 - PBN SID and STAR procedures (with basic capabilities)
Relation-operational benefit	RSEQ-B0/3 - Point merge
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	Development of CDO (advanced) procedures	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent, with reference to Doc 9931 (CDO Manual)	ANSP, Aircraft operator	2019

Operational procedures	Design	CDO (advanced) procedures validation, approval and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2019
Operational procedures	Operations	SOPs for CDO (advanced) operations	Procedures for the crew to follow to facilitate the flying of a CDO. OPS Manual defines SOPs	Aircraft operator	2019
Operational procedures	-	Contingencies for CDO (advanced)	Procedures for the crew to follow in case of abnormal events. Reference: Ops Manual defines SOPs	Aircraft operator	2019
Airborne system capability	Aircraft system	Aircraft Capability for CDO (advanced)	Eligibility for the applicable PBN navigation specification with vertical navigation (VNAV) capability Reference: Doc 9613 (PBN Manual)	Aircraft manufacturer Aircraft operator	2019
Ground system infrastructure	Navigation	NAVAIDS to support the applicable navigation specification used for CDO (advanced)	Depending on the navigation specification used, suitable ground based navigational aids will be required. Reference Doc 9613 (PBN Manual).	ANSP	2019
Training	-	Training requirements for CDOs (advanced)	Crew trained to fly CDOs (advanced) CDO (advanced) training for Air traffic controllers CDO (advanced) training for procedure designers. References: Doc 9906 (Vol 2) Doc 8168 (PANS OPS Vol II)	ANSP Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Congested terminal airspace with existing PBN STAR routings already utilizing CDO operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Optimized vertical profile.	ANSP Airspace user
	Increase in terminal airspace capacity from reduced vertical airspace requirements.	ANSP Airspace user
	Reduced fuel consumption.	Airspace user

Type	Operational description	Benefitting stakeholder(s)
Indirect benefits	Increase in terminal area efficiency from reduced ATC intervention in the aircraft routing and vertical profile.	ANSP Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B1/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Vertical flight efficiency	Avoid efficiency penalties attributable to non-optimum ToD (descent starts before or after the optimum ToD)	++	KPI19: Level-off during descent
Efficiency	Vertical flight efficiency	Avoid tactical lengthening of arrival path (eg vectoring, holding, trombone extension) because this leads to level flight	++	KPI19: Level-off during descent
Efficiency	Vertical flight efficiency	Reduce descent inefficiency attributable to altitude constraints imposed by ATM	++	KPI19: Level-off during descent

APTA-B1/5	CCO (Advanced)	Operational

Main Purpose: Increase the ability CCO operations to contribute to terminal airspace efficiency.

New Capabilities: High accuracy vertical navigation permits more precise paths to be flown by departing aircraft.

Description: This element builds on the basic CCO capabilities and adds advanced vertical path management. This gives the ability to more precisely define the path flown by departing aircraft, which allows for more flexible and efficient use of airspace. Compromise between aircraft optimal performance and airspace optimal efficiency can be achieved.

PBN with vertical navigation (VNAV) which is an altimetry-based capability is used and allows an equipped aircraft to precisely ascend on a vertical path, as computed by avionics equipment, while providing the flight crew with navigation performance information through avionics. To this end, vertical windows in procedure design enable CCOs, particularly where SID/STARs cross each other.

Initially the benefits will be realised for airspace outside of the TMA, and for less congested environments.

Maturity Level: Standardization

Human Factor Considerations

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	APTA-B0/5 - CCO (Basic)
Relation-operational need	APTA-B0/2 - PBN SID and STAR procedures (with basic capabilities)
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	Development of CCO (advanced) procedures	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent, with reference to Doc 9993 (CCO Manual)	ANSP, Aircraft operator	2019
Operational procedures	Design	CCO (advanced) procedures validation, approval and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP, CAA	2019
Operational procedures	Operations	SOPs for CCO (advanced) operations	Procedures for the crew to follow to facilitate the flying of a CCO. OPS Manual defines SOPs	Aircraft operator	2019
Operational procedures	Operations	Contingencies for CCO (advanced)	Procedures for the crew to follow in case of abnormal events. Reference: Ops Manual defines SOPs	Aircraft operator	2019

Airborne system capability	Aircraft system	Aircraft Capability for CCO (advanced)	Eligibility for the applicable PBN navigation specification with vertical navigation (VNAV) capability Reference: Doc 9613 (PBN Manual)	Aircraft manufacturer Aircraft operator	2019
Ground system infrastructure	Navigation	NAVAIDS to support the applicable navigation specification used for CCO (advanced)	Depending on the navigation specification used, suitable ground based navigational aids will be required. See Doc 9613 (PBN Manual) for details.	ANSP	2019
Training	-	Training requirements for CCOs (advanced)	Crew trained to fly CCOs (advanced). Training to support the CCO concept. ATC trained to provides CCOs (advanced). Training to support the CCO concept. CCO (advanced) training for procedure designers. Reference: Doc 9906 (Vol 2)	ANSP Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Congested terminal airspace with existing PBN SID routings already utilizing CCO operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Optimized vertical profile.	ANSP Airspace user
	Increase in terminal airspace capacity from reduced vertical airspace requirements.	ANSP Airspace user
	Reduced fuel consumption.	Airspace user
Indirect benefits	Increase in terminal area efficiency from reduced ATC intervention in the aircraft routing and vertical profile.	ANSP Airspace user

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
Efficiency	Vertical flight efficiency	Reduce permanent (airspace and departure procedure design) and semi-permanent (ATFCM measures) altitude constraints (level capping) along the climb portion of traffic flows, in terminal and en-route airspace	++	KPI17: Level-off during climb

APTA-B2/1 GBAS CAT II/III precision approach procedures Operational

Main Purpose Definition of approach procedures with Cat II and III minima based on ground-based augmentation system (GBAS). The goal of GBAS implementation is to provide an alternative to the Instrument Landing System (ILS) supporting the full range of operations.

New Capabilities Definition of approach procedures with Cat II and III minima based on ground-based augmentation system (GBAS).

Description The GBAS system provides several advantages such as increased coverage (all runways on an airport) and reduction of time between approaches. It can provide precision approaches where ILS cannot due to terrain constraints. The development of approach procedures with CAT II and III minima based on GBAS will allow approach procedures with lower minima even in challenging obstacle-environments and reduce the limitations due to the infrastructure constraints.

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	NAVS-B2/1 - Dual Frequency Multi Constellation (DF MC) GBAS
Relation-technology option	NAVS-B1/1 - Extended GBAS
Relation-information need	AMET-B2/1 - Meteorological observations information

Relation-information need	AMET-B2/2 - Meteorological forecast and warning information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	GBAS CAT II/III precision approach procedure design and use	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II) or equivalent.	ANSP	2025
Operational procedures	Design	GBAS CAT II/III precision approach procedure validation, approval and publication	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should be as described in Doc 10066 (PANS AIM). Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2025
Operational procedures	Operations	SOPs for GBAS CAT II/III precision approach procedures	Procedures for the crew to follow to fly a Cat I Precision Approach. Reference: Ops Manual defines SOPs	Aircraft operator	2025
Operational procedures	Operations	Contingencies for GBAS CAT II/III precision approach procedures	Procedures for the crew to follow in case of abnormal events. Reference: Ops Manual defines SOPs	Aircraft operator	2025
Airborne system capability	-	Aircraft capability for GBAS CAT II/III precision approach procedures	GBAS receiver to support CAT II/III requirements	Aircraft manufacturer Aircraft operator	2025
Ground system infrastructure	Navigation	Ground based system for GBAS CAT II/III precision approach procedures	GBAS Ground Station Ref Annex 10 Vol I	Airport operator ANSP	2025

Training	-	Training requirements for GBAS CAT II/III precision approach procedures	Crew trained to fly GBAS CAT II/III precision approach procedures. Reference: Doc 8168 (Vol I) GBAS CAT II/III precision approach procedures for ATC GBAS CAT II/III precision approach training for Procedure designers, Airspace planners. Ref : Doc 8168 (PANS OPS Vol II); Doc 9906 (Vol 2)	ANSP Aircraft operator	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

Runway ends with high number of hours operating under adverse weather conditions but without the facility to implement traditional Precision approach landing systems (due to terrain or other issues).

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Allows continued approach and landing operations when weather minimums are below CAT I.	ANSP, Airspace user
	Reduced probability of go arounds.	ANSP, Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B2/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Equip additional RWY ends with instrument approaches	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)	++	KPI10: Airport peak throughput

APTA-B2/2 Simultaneous operations to parallel runways — Operational

Main Purpose: Introduction of Approach Procedures with Vertical Guidance (APVs) to parallel runways to permit parallel operations without ground based infrastructure.

New Capabilities: Introduces the capability to conduct simultaneous approach operations to parallel runways using any combination of APV and/or precision approach.

Description: This element adds the facility to use APV procedures (based on RNP AR APCH and RNP APCH) in parallel approach operations.

Maturity Level: Standardization

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	APTA-B0/1 - PBN Approaches (with basic capabilities)
Relation-operational benefit	APTA-B1/1 - PBN Approaches (with advanced capabilities)
Relation-information need	AMET-B2/1 - Meteorological observations information
Relation-information need	AMET-B2/2 - Meteorological forecast and warning information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design	Development of approach procedures to support simultaneous operations	Procedures developed according to published criteria and guidance Reference Doc 8168 (PANS OPS Vol II and III) Doc 4444 (PANS ATM) Doc 9643 (Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways)	ANSP	2020
Operational procedures	Design	Validation, approval and publication of approach procedures to support simultaneous operations	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2020
Operational procedures	Operations	Operational procedures for crew to conduct simultaneous operations	SOPs defined in the OPS manual Reference: Doc 8168 (PANS OPS Vol III)	Aircraft operator	2019

Operational procedures	Operations	Operational Procedures for ATC to conduct simultaneous operations	Reference: Doc 4444 (PANS ATM)	ANSP	2019
Airborne system capability	Aircraft system	Aircraft capability to conduct simultaneous operations	Eligibility for applicable PBN Navigation specification as required (depending on design of procedures) Reference: Doc 9613 (PBN Manual)	Aircraft manufacturer Aircraft operator	2019
Operational Authorization	-	Operational Authorization for simultaneous operations	Aircraft operator conducting simultaneous operations based on a PBN Navigation specification should have an operational authorization related to the specified performance of the procedure, as described in Doc 9997 (PBN Ops Approval Manual)	CAA Aircraft operator	2019
Ground system infrastructure	Navigation	NAVAIDS to support the applicable navigation specification used for simultaneous operations	SBAS ground station if required GBAS ground station if required	ANSP	2019
Training	-	Training requirements for simultaneous oeprations	Training for pilots to conduct simultaneous operations. Reference: Reference: Doc 8168 (PANS OPS Vol III) Training for ATC to conduct simultaneous operations Reference: Reference: Doc 4444 (PANS ATM)	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Aerodromes with two or more parallel runways with sufficient demand or other operational need to conduct simultaneous approaches.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Increased capacity at the aerodrome with closely spaced parallel runways by use of simultaneous approaches.	ANSP Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

APTA-B2/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Use other RWY configuration if available	++	KPI10: Airport peak throughput

APTA-B2/3 PBN Helicopter Steep Approach Operations Operational

Main Purpose
Helicopters can use steeper approach angles allowing additional flexibility for unique approach operations. By allowing modern helicopters to fly steeper approach angles, it will be possible to safely fly over higher obstacles or to decrease the size of the helicopter noise footprint. Where beneficial, PinS and steeper approach can also be combined.

New Capabilities
Application of steeper helicopter approach design procedures to allow helicopters to take advantage of their higher approach angle capability.

Description
PBN procedures specific to helicopter operations with approach angles exceeding 6.3 degrees. May be used in combination with point in space procedures.

Maturity Level
Standardization

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

PLANNING LAYERS
Tactical-During ops

OPERATIONS
Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	APTA-B0/6 - PBN Helicopter Point in Space (PinS) Operations
Relation-information need	AMET-B2/1 - Meteorological observations information
Relation-information need	AMET-B2/2 - Meteorological forecast and warning information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Training	-	Training requirements for Helicopter PBN Point in Space (PinS)	Crew trained to fly Helicopter PBN Point in Space (PinS) procedures. Ref.: As defined in Doc 8168 (PANS OPS Vol I) Helicopter PBN Point in Space (PinS) training for ATC Helicopter PBN Point in Space (PinS) training for procedure designers, Airspace planners. References: Doc 8168 (PANS OPS Vol II); Doc 9906 (Vol 2).	ANSP Aircraft operator	2013
Operational procedures	Design	Procedures design for PBN Helicopter Steep Approach Operations	These procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent.	ANSP	2022
Operational procedures	Design	Validation, approval and publication of procedures for PBN Helicopter Steep Approach Operations	A flight inspection and/or validation of the procedures might be required before publication. The publication of the procedures should follow Annex 4. Ref: ICAO Doc 8071 (Volume I — Testing of Ground-based Radio Navigation Systems) Doc 9906 (Quality Assurance Manual for Flight Procedure Design). Doc 9906 Vol 6 (Quality Assurance Manual for Flight Procedure Design)	ANSP CAA	2019
Operational procedures	Operations	SOPs for PBN Helicopter Steep Approach Operations	Procedures for the crew to follow to fly a PBN Helicopter Steep Approach. Defined in the Ops Manual	Aircraft operator	2019
Operational procedures	Operations	Contingencies for PBN Helicopter Steep Approach Operations	Procedures for the crew to follow in case of abnormal events. Defined in the Ops Manual	Aircraft operator	2019
Airborne system capability	-	Aircraft capability for PBN Helicopter Steep Approach Operations	Eligibility for the applicable PBN navigation specification (if required) and vertical path capability, as defined in Doc 9613 (PBN Manual) and listed in the Aircraft Flight Manual (AFM)	Aircraft manufacturer Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Obstacle rich environments containing helicopter landing locations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve access to helicopter landing sites through approach procedures with improved minima.	Airspace user
	Reduced number of diversions.	ANSP Airspace user
	Helicopter procedures with steeper approach angles allow the aircraft to safely fly over higher obstacles and to decrease the size of the helicopter noise foot print.	Local community
Indirect benefits	Airspace capacity enhancement through design flexibility and removal of existing operational restrictions.	ANSP Airspace user
	Enhanced helicopter operations availability and resilience.	Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS APTA-B2/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Mitigate local airspace capacity constraints if this is the problem	++	KPI10: Airport peak throughput
Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)	++	KPI10: Airport peak throughput

CSEP

CSEP-B1/1	Basic airborne situational awareness during flight operations (AIRB)	Operational

Main Purpose To improve traffic situational awareness in all phases of flight.

New Capabilities

- AIRB facilitates out-the-window visual acquisition of airborne traffic within visual range and traffic situational awareness for traffic beyond visual range.
- It enhances traffic situational awareness and quicker visual acquisition of targets through basic airborne situational awareness during flight operations enabled by the use of a cockpit display traffic information (CDTI).
- It supplements the flight crew's out the window scan and radio communications listening.
- It supports the flight crew in integrating information from these sources into a comprehensive and accurate traffic picture including long traffic detection range.
- It also enables communication with surrounding aircraft on common/local frequency (e.g. turbulence reports, uncontrolled airfield operations).

Description

The use of cockpit displays to provide the flight crew with a graphical depiction of traffic using relative range and bearing, supplemented by altitude, flight ID and other information. This element represents the use of the cockpit display traffic information (CDTI) with appropriate ADS-B data filtered for traffic situational awareness. The CDTI is capable of merging data with TCAS. It is recommended to use the display where ACAS information is already provided (if ACAS-equipped)

Maturity Level

Ready for implementation

Human Factor Considerations

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology benefit	ACAS-B1/1 - ACAS Improvements

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	Certification of CDTI for airborne situational awareness	References: ICAO Annex 10 Volume IV basic technical requirements ICAO Doc 9994 ADS-B IN equipment/function compliant with DO-317B/ED194A (2015)	CAA Aircraft manufacturer Aircraft operator	2015
Operational procedures	Operations	SOPs for the use of CDTI for AIRB	References: PANS-OPS (Doc 8168) operation of ADS-B IN traffic display (2016) Standard Operating Procedures	Aircraft operator	2013

Airborne system capability	Surveillance	ADS-B IN equipment/function	ADS-B IN equipment/function compliant with DO-317B/ED194A (2015)	Airspace user Aircraft manufacturer	2015
Airborne system capability	Aircraft system	CDTI	Cockpit Display of Traffic Information (CDTI). The CDTI may be shared with ACAS information traffic display but we should not assume this capability is only for ACAS-equipped aircraft. References:	Aircraft manufacturer Aircraft operator	2013
Training	-	Training requirements for AIRB	The appropriate use of the traffic display could be evaluated during recurrent training on ACAS. The equipage of AIRB capability is unknown to ATC. The use of AIRB must remain transparent to ATC. References:	Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

AIRB may be introduced in a partial equipage of ADS-B OUT, in which only some aircraft are equipped with ADS-B OUT.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety and efficiency: Improving the flight crew's decision-making process and the resulting actions for the safe and efficient operation of the flight with earlier detection of developing unsafe situations and better flight trajectory execution. Note: NOTE: Benefits vary depending on the airspace and operational flight rules.	Airspace user
	Safety and efficiency: Identification of the traffic ahead, enabling direct pilot-to-pilot communications, in oceanic airspace, to request turbulence information. Note: NOTE: Benefits vary depending on the airspace and operational flight rules.	Airspace user
	Vertical flight efficiency: Saving up to 15 000 Kg fuel per aircraft annually in North Atlantic airspace (5 min separation, about 40 NM). Substantially higher benefits in larger separation environments	Aircraft operator
	Safety: Reduced weather turbulence encounters through direct pilot-to-pilot communications Enhanced traffic situation awareness	Airspace user

Type	Operational description	Benefitting stakeholder(s)
	Improve situational awareness of the flight crew	Airspace user
Indirect benefits	Improved efficiency, reduced exchanges of R/T.	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

CSEP-B1/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve mid-air collision avoidance (safety net)	++	
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	

CSEP-B1/2 Visual Separation on Approach (VSA) Operational

Main Purpose To assist pilots in maintaining own separation during successive visual approach procedures. VSA is defined to support aircraft performing successive visual approach and landing operations.

New Capabilities VSA is a situational awareness capability that offers a support tool for pilots to conduct existing procedures described in PANS-ATM (6.5.3.4 and 6.5.3.5). It assist the flight crew in maintaining own separation and quicker visual acquisition of preceding aircraft during successive visual approach procedures enabled by the use of a CDTI. It supplements the flight crew's out the window scan and radio communications listening.

Description This element is used to support existing procedures, i.e., the pilot can use the traffic display to support his visual scan of the preceding aircraft during the approach procedure if the preceding aircraft is transmitting ADS-B OUT surveillance data.

Maturity Level Ready for implementation

Human Factor Considerations

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology benefit	ACAS-B1/1 - ACAS Improvements

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	Certification of CDTI for airborne situational awareness	References: ICAO Annex 10 Volume IV basic technical requirements ICAO Doc 9994 ADS-B IN equipment/function compliant with DO-317B/ED194A (2015)	CAA Aircraft manufacturer Aircraft operator	2015
Airborne system capability	Surveillance	ADS-B IN equipment/function	ADS-B IN equipment/function compliant with DO-317B/ED194A (2015)	Airspace user Aircraft manufacturer	2015
Airborne system capability	Aircraft system	CDTI	Cockpit Display of Traffic Information (CDTI). The CDTI may be shared with ACAS information traffic display but we should not assume this capability is only for ACAS-equipped aircraft. References:	Aircraft manufacturer Aircraft operator	2013
Training	-	Training requirements for VSA	Training should be developed and given for the system functions, indications and interactions for each application/capability. The equipage of ADS-B IN is unknown to ATC. The use of ADS-B IN must remain transparent to ATC.	Aircraft operator	2013
Operational procedures	Operations	SOPs for the use of CDTI for VSA	References: ICAO Doc 8168 - PANS-OPS; operation of ADS-B IN traffic display (2016)	Aircraft operator	2016
Airborne system capability	Surveillance	ADS-B OUT equipment/function	ADS-B OUT capability required for the reference aircraft	Aircraft operator	2015

DEPLOYMENT APPLICABILITY

Operational conditions:

The application can be used by all suitably equipped aircraft during approach to any airports where own separation is used. VSA may be introduced in a partial equipage of ADS-B OUT environment, in which only some aircraft are equipped with ADS-B OUT. VSA is applicable for all types of runway configurations where successive visual approaches are in use (PANS-ATM 6.5.3).

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	VSA improve the efficiency and safety of arrival traffic at airports.	Airport operator, ANSP
	The safety of the operation will be improved through the provision of accurate data to the pilots (e.g. preceding traffic ground speed) allowing them to better predict the evolution of the traffic.	Airport operator
	Improve situational awareness of the flight crew	Aircraft operator

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	

CSEP-B1/3 Performance Based Longitudinal Separation Minima — Operational

Main Purpose: Reduced separation allowing more flights to operate in their optimum flight levels.

New Capabilities: The ability of aircraft to accurately navigate along a specified path and the ability to provide via data communication the position, intent and current navigation performance of the aircraft allow flights to be cleared to fly at reduced longitudinal separations.

Description: 50 NM, 30 NM and 5 minutes longitudinal separation have been made conditional on Required Communication Performance 240 (RCP 240) and Required Surveillance Performance 180 (RSP 180). Application of the separation may also require an RNP approval.

(*Table to be inserted)*

Maturity Level: Standardization

Human Factor Considerations:

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

PLANNING LAYERS

OPERATIONS

Tactical-During ops

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	COMI-B0/3 - VHF Data Link (VDL) Mode 0/A
Relation-technology option	COMI-B0/4 - VHF Data Link (VDL) Mode 2 Basic
Relation-technology option	COMS-B0/1 - CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace
Relation-technology option	COMS-B1/1 - PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace
Relation-technology option	COMS-B0/2 - ADS-C (FANS 1/A) for procedural airspace
Relation-technology option	COMS-B1/2 - PBCS approved ADS-C (FANS 1/A+) for procedural airspace
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Operational Approval	Operational Approval for performance-based longitudinal separation	PBN, PBCS (when required)	CAA	2019
Operational procedures	Design and operations	Procedures for PBLoSM	Design and use of operational procedures shall be designed and used for the application of reduced longitudinal separation minima Reference : ICAO PBN, PBCS and GOLD manual	ANSP	2019
Ground system infrastructure	Surveillance	Surveillance systems for PBLoSM	To support RSP 180	ANSP	2019
Ground system infrastructure	Navigation	Navigation systems for PBLoSM	To support RNP 2, 4 or 10	ANSP	2019
Ground system infrastructure	Communications	Communication systems for PBLoSM	To support RCP 240	ANSP	2019

Training	-	Training requirements for PBLoSM	ATCO Training and Flight Crew Training Train for PBN Reduced Longitudinal Separation Minima Provide training to staff prior to implementation	ANSP Aircraft operator	2019
Airborne system capability	Communication service	Communication capabilities for PBLoSM	Aircraft and crew approvals for appropriate RNP specifications Reference: Aircraft and crew approvals for RCP 240 and ADS-C/CPDLC	Aircraft manufacturer Aircraft operator	2019
Airborne system capability	Navigation	Navigation capabilities for PBLoSM	Aircraft and crew approvals for appropriate RNP specifications	Aircraft manufacturer Aircraft operator	2019
Airborne system capability	Surveillance	Surveillance capabilities for PBLoSM	Aircraft and crew approvals for appropriate RNP specifications Reference: Aircraft and crew approvals for RSP 180	Aircraft manufacturer Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Applicable to oceanic airspace and/or remote areas.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

CSEP-B1/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Improve what's needed to reduce longitudinal separation minima	++	KPI06: En-route airspace capacity
Capacity	Capacity, throughput & utilization	Take advantage of increased navigation precision (airspace with PBN operations) to implement route networks and airspace structures with smaller lateral and vertical safety buffers	++	KPI06: En-route airspace capacity

CSEP-B1/4 Performance Based Lateral Separation Minima Operational

Main Purpose To increase airspace capacity and allow optimum utilization of available airspace.

New Capabilities: The ability of aircraft to accurately navigate along a specified path and the ability to provide via data communication the position, intent and current navigation performance of the aircraft allow flights to be cleared to fly at reduced lateral separations.

Description: This element describes the application of lateral separation of 23 NM between any combination of RNP 4 and RNP 2 approved aircraft operating on parallel or non-intersecting tracks.

Maturity Level: Standardization

Human Factor Considerations:

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology option	COMI-B0/3 - VHF Data Link (VDL) Mode 0/A
Relation-technology option	COMI-B0/4 - VHF Data Link (VDL) Mode 2 Basic
Relation-technology option	COMS-B0/1 - CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace
Relation-technology option	COMS-B1/1 - PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace
Relation-technology option	COMS-B0/2 - ADS-C (FANS 1/A) for procedural airspace
Relation-technology option	COMS-B1/2 - PBCS approved ADS-C (FANS 1/A+) for procedural airspace
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Operational Approval	Operational Approval for performance-based lateral separation	Approval of PBN, PBCS	CAA	2019

Operational procedures	Design and operations	Procedures for PBLaSM	Design and use of operational procedures for the application of reduced lateral separation minima Reference : ICAO PBN, PBCS and GOLD manual	ANSP	2019
Training	-	Training requirements for PBLaSM	ATCO training ATCO and Flight Crew training Performance Based Lateral Separation Minima Provide training to staff prior to implementation	ANSP Aircraft operator	2019
Airborne system capability	Communication service	Communication capabilities for PBLaSM	Aircraft and crew approvals for RCP 240	Aircraft manufacturer Aircraft operator	2019
Airborne system capability	Navigation	Navigation capabilities for PBLaSM	Aircraft and crew approvals for appropriate RNP specifications	Aircraft manufacturer Aircraft operator	2019
Airborne system capability	Surveillance	Surveillance capabilities for PBLaSM	Aircraft and crew approvals for RSP 180	Aircraft manufacturer Aircraft operator	2019
Ground system infrastructure	Communications	Communication systems for PBLaSM	To support the specified RCP	ANSP	2019
Ground system infrastructure	Navigation	Navigation systems for PBLaSM	To support the specified RNP	ANSP	2019
Ground system infrastructure	Surveillance	Surveillance systems for PBLaSM	To support the specified RSP	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS CSEP-B1/4

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Improve what's needed to reduce lateral separation minima	++	KPI06: En-route airspace capacity

CSEP-B2/1 Interval Management (IM) Procedure Operational

Main Purpose

The objective of the IM application is to achieve and/or maintain an assigned spacing between one aircraft and the designated aircraft (referred as the reference aircraft), using the guidance on the flight deck that enables the pilot to actively manage the spacing relative to the reference aircraft.

New Capabilities

This element allows management by the pilot of the assigned spacing from a reference aircraft using airborne tools.

Description

The air traffic controller chooses to use IM operations to manage the interval between aircraft when the aircraft need to be spaced closely together in an orderly manner or their timing synchronized. This is accomplished by the air traffic controller providing a clearance to the IM aircraft which includes the assigned interval. The assigned interval can be defined in time or distance. The pilot is responsible for identifying the reference aircraft (designated by the air traffic controller) and to implement the IM clearance. While some IM clearances will keep the IM aircraft on its current route and result only in speed management, other clearances may include a controller-defined path lengthening or shortening.

Maturity Level

Standardization

Human Factor Considerations

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

En-route Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology benefit	ACAS-B1/1 - ACAS Improvements
Relation-benefit	ASUR-B2/1 - Evolution of ADS-B and Mode S

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Procedures for the use of IM	PANS-ATM/PANS-OPS Interval Management Procedure (To be developed)	ANSP	2022
Airborne system capability	Surveillance	Surveillance system capabilities for IM	ADS-B IN equipment/function compliant with DO-317B/ED194A (and subsequent versions) (2014) + ADS-B OUT capability required for the reference aircraft	Aircraft manufacturer Aircraft operator	2014
Airborne system capability	Navigation	Navigation system capabilities for IM	FIM equipment /spacing functions with advisories	Aircraft operator	2019
Airborne system capability	Aircraft system	Traffic display for IM	Cockpit display of traffic information	Aircraft manufacturer Aircraft operator	2019
Training	-	Training requirements for IM	Air traffic controllers, Pilots	ANSP Aircraft operator	2019
Ground system infrastructure	ATC systems	ATC tool for IM	Ground tools/capabilities that assist the air traffic controller in issuing ATC clearances to merge and space aircraft safely and efficiently by allowing ATC to use IM clearances	ANSP	2019
Regulatory provisions	Certification	IM Certification	ICAO Annex 10 Technical requirements (to be developed) ICAO DOC9994 (2018)	CAA Aircraft manufacturer Aircraft operator	2022

DEPLOYMENT APPLICABILITY

Operational conditions:

The air traffic controller chooses to use IM operations to manage the interval between aircraft when the aircraft need to be spaced closely together in an orderly manner or their timing synchronized. This is accomplished by the air traffic controller providing a clearance to the IM aircraft which includes the assigned interval. The assigned interval can be defined in time or distance. The pilot is responsible for identifying the reference aircraft (designated by the air traffic controller) and to implement the IM clearance. While some IM clearances will keep the IM aircraft on its current route and result only in speed management, other clearances may include a controller-defined path lengthening or shortening Note.— IM may not work in all conditions. A combination of air traffic controller judgment and ATC automation will be needed to determine the conditions of which IM can be completed successfully. The assigned interval can be defined in time or distance.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	The precise management of intervals between aircraft with common or merging trajectories, maximizes airspace throughput while reducing ATC workload along with more efficient aircraft fuel burn reducing environmental impact.	Airport operator ANSP
	Punctuality: IM will improve consistent spacing precision by making more frequent trajectory adjustments than is possible with a ground system alone.	ANSP Aircraft operator
	Reduction flight time variability	ANSP Aircraft operator
	Potential benefits of IM operations include: a) Timely speed advisories removing later requirement for path-lengthening; b) Consistent and low variance spacing between paired aircraft (e.g. at the entry to an arrival procedure and on final approach). More precise spacing can allow for higher throughput and more efficient aircraft operations; c) Optimized descent profile in high density environments; d) Reduced ATC instructions due to the reduced number of speed instructions; and e) More efficient aircraft operations for FIM-equipped aircraft, when aircraft are pre-sequenced, e.g. with the use of an arrival manager (AMAN).	ANSP Aircraft operator
	Improve situational awareness of the flight crew	Aircraft operator
Indirect benefits	Reduction of radar vectoring (and of R/T exchanges between ATCO and FC).	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

CSEP-B2/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce ATCO workload (en-route)	++	KPI06: En-route airspace capacity
Capacity	Capacity, throughput & utilization	Resolve ATC staffing, workload, frequency congestion problems	++	KPI10: Airport peak throughput
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	

CSEP-B2/2	Cooperative separation at low altitudes	Operational

Main Purpose	To maintain own separation with respect to manned aviation and other UAS in the UTM airspace.
New Capabilities	A dedicated function to support separation assurance is provided to the UAS, which is supported by detection capability as well as a guidance to remain well clear of any other UAS. Note: in the UTM, this function may be automated and not operated by a remote pilot.
Description	The UAS is capable of building a traffic picture associated to a separation assurance functionality enabling to establish and maintain the required separation from any other vehicle aka “remain well clear” using ADS-B IN for manned aviation and broadcast technologies to be determined for UAS to UAS.
Maturity Level	Validation
Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes 2. Does it imply processing of new information by the user? Yes 3. Does it imply the use of new equipment? Yes 4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	CSEP-B1/1 - Basic airborne situational awareness during flight operations (AIRB)
Relation-technology need	ASUR-B2/2 - New community based surveillance system for airborne aircraft (low and higher airspace)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	Low-altitude UAS separation certification	TBD	CAA UAS operator	2025
Regulatory provisions	Operational Approval	Low-altitude UAS separation operational approval	TBD	UAS operator	2025

Operational procedures	-	UTM rules for separation	TBC: in UTM, rules need to be established such as “remain well clear” definition, performance requirements…	UAS operator	2025
Airborne system capability	Surveillance	UAS airborne surveillance	ADS-B IN 1090ES (to be clear of manned aviation) and UAT	UAS operator UAS manufacturer	2025
Ground system infrastructure	-	Display for UTM	N/A for UAS UTM service provider and/or Remote Pilot Ground station	UAS operator UTM operator	2025
Ground system infrastructure	Surveillance	UAT for UAS	No new requirements (maybe UAT for UAS will trigger the need for ADS-R or TIS-R ground infrastructure?	UAS operator	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

At low altitudes.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

CSEP-B2/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Maintain or improve safety of very low level operations (<500ft)	++	

CSEP-B2/3	Cooperative separation at higher airspace	Operational

Main Purpose: To maintain own separation with respect to manned aviation and other UAS in the upper airspace.

New Capabilities: A dedicated function to support separation assurance is provided to the UAS, which is supported by detection capability as well as a guidance to remain well clear of any other UAS. Note: in the UTM, this function may be automated and not operated by a remote pilot.

Description: The UAS is capable of building a traffic picture associated to a separation assurance functionality enabling to establish and maintain the required separation from any other vehicle aka “remain well clear” using ADS-B IN for manned aviation and broadcast technologies to be determined for UAS to UAS.

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	CSEP-B1/1 - Basic airborne situational awareness during flight operations (AIRB)
Relation-technology need	ASUR-B2/2 - New community based surveillance system for airborne aircraft (low and higher airspace)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	Higher airspace UAS separation certification	TBD	CAA UAS operator	2025
Regulatory provisions	Operational Approval	Higher airspace UAS separation operational approval	TBD	UAS operator	2025
Operational procedures	-	Higher airspace rules for separation	In higher airspace, rules need to be established such as “remain well clear” definition, performance requirements…	UAS operator	2025
Airborne system capability	Surveillance	Higher UAS airborne surveillance	ADS-B IN 1090ES (to be clear of manned aviation) and UAT	UAS operator UAS manufacturer	2025
Ground system infrastructure	-	Display for higher UTM	N/A for UAS UTM service provider and/or Remote Pilot Ground station	UAS operator UTM operator	2025
Ground system infrastructure	Surveillance	UAT for higher UAS	No new requirements (maybe UAT for UAS will trigger the need for ADS-R or TIS-R ground infrastructure?	UAS operator	2025

Other	-	MEL, performance compliance for higher UAS	Before reaching the higher airspace, the UAS will cross ATM airspace and may have to comply with the airspace requirements in terms of MEL, performance,… It is possible that in transition period, such operations will be conducted in temporarily segregated airspace to ensure safe and limited impact on ATM operations.	UAS operator	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

At higher airspace.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS CSEP-B2/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Maintain or improve safety of high altitude operations (>FL600)	++	

FRTO

FRTO-B0/1	Direct routing (DCT)	Operational

Main Purpose: Direct routings are established with the aim of providing airspace users with additional flight planning route options on a larger scale across FIRs such that overall planned leg distances are reduced in comparison with the fixed route network.

New Capabilities: Direct routings (DCTs) are established at national and regional levels and made available for flight planning (with published conditions of use). DCTs should be considered as an early iteration of the Free Route Airspace (FRA) concept. Direct routing operations allow airspace users to optimize flight and fuel planning.

Description

DCTs could be implemented in a limited way e.g.:

- time constraint (fixed or depending on traffic/availability);
- traffic constraint (based on flow and/or level of traffic);
- flight level;
- lateral constraints;
- entry/exit conditions.

The extension of direct routings within and across the FIR boundaries also requires Network and ANSPs ground system upgrades for airspace management and flight data processing.

The following procedures and process might need to be considered:

- identify the direct routing airspace volume (lateral and vertical) and applicable time;
- direct routings may co-exists with ATS route structure;
- identify direct routing entry and exit points;
- adapt airspace design and ensure direct routing horizontal and vertical connectivity;
- ATFM direct routing procedures;
- adapt the LoA with adjacent ATS units;
- publish relevant data for direct routing in AIP;
- airspace management procedure for the implementation of direct routings;
- ATC procedures to cover direct routing co-ordination and transfer of control, trajectory change in direct routing; environment, conflict detection.

The ATM system upgrades of FDP and CWP, if required, are related to:

- upgrade of network flight planning and ASM/ATFM system for DCTs;
- direct routing clearances;
- rerouting capabilities in cases the direct routing traversed the military airspace; differentiation between different traffic type airspaces;
- direct route beyond AoR;
- calculation of 4D trajectory with AoI;
- editing function for 4D trajectories.

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

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	NOPS-B0/1 - Initial integration of collaborative airspace management with air traffic flow management

Relation-operational need	FRTO-B0/2 - Airspace planning and Flexible Use of Airspace (FUA)
Relation-operational need	FRTO-B0/4 - Basic conflict detection and conformance monitoring
Relation-information need	FICE-B0/1 - Automated basic inter facility data exchange (AIDC)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design and operations	DCT Procedures	Design and use of operational procedures for direct routes. Reference: EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 1: European Airspace Design Methodology - Guidelines - Edition December 2018 (https://www.eurocontrol.int/publications/european-route-network-improvement-plan-ernip-part-1-european-airspace-design)	ANSP ATM network function Aircraft operator	2013
Ground system infrastructure	ATC systems	ATC system upgrades for monitoring aids functions	ATC systems to be upgraded for DCT clearances, notification and co-ordination data exchanges and management of relevant airspace data. Reference: EUROCONTROL specification for the on-line Data exchanges (OLDI) https://eurocontrol.int/sites/default/files/publication/files/EUROCONTROL%20Specification%20OLDI%204.3.pdf	ANSP	2013
Ground system infrastructure	CFSP systems	Upgrade of AOs Flight Planning Systems for DCTs	AO-CFSPS systems to be upgraded to enable flight planning of DCTs Reference: EUROCONTROL NM Flight Planning Requirements document December 2018 https://www.eurocontrol.int/publications/nm-flight-planning-requirements-guidelines	Aircraft operator	2013
Training	-	Training requirements for direct routing	ATCO Training, AO Training, ATM Network Training Training for DCT Provide training to staff prior to implementation	ANSP ATM network function Aircraft operator	2013
Ground system infrastructure	ATM systems	ATFM system for FUA	Upgrade ATFM/flight planning systems to support FUA Reference: EUROCONTROL NM Flight Planning Requirements document December 2018 (https://www.eurocontrol.int/publications/nm-flight-planning-requirements-guidelines)	ATM network function	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

This element will bring benefits in en-route airspace with low, medium and high complexity traffic.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS FRTO-B0/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route network design	++	KPI04: Filed flight plan en-route extension

FRTO-B0/2 Airspace planning and Flexible Use of Airspace (FUA) Operational

Main Purpose

Establish the Flexible Use of Airspace (FUA) process and improve data exchange between civil and military stakeholders by automation to enable a more efficient use of airspace based on transparency and due regard to national security needs.

New Capabilities

Deployment of automated airspace management (ASM) support systems to manage the airspace reservations based on the airspace user needs and resulting from civil-military collaborative decision-making process and more flexibly according to the airspace user needs.

Description

This element addresses strategic/long term airspace management, pre-tactical planning and tactical operations. Automated ASM support systems improve airspace management processes and flexible airspace planning including time horizon specifications in all flight phases (strategic, pre-tactical and tactical time horizon) by providing mutual visibility on civil and military requirements. They also support flexible airspace planning according to civil and military ANSPs and airspace user requirements, including permit cross border and use of segregated areas operations regardless of national boundaries.

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

OPERATIONS

Departure | En-route | Arrival

Tactical-Pre ops | Tactical-During ops

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	FRTO-B0/1 - Direct routing (DCT)
Relation-operational need	NOPS-B0/1 - Initial integration of collaborative airspace management with air traffic flow management

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Operational Approval	Operational approval to provide FUA	Follow regulations for regulatory approval Reference : ICAO Circular 330 Civil/Military Coordination European Union Regulation (EC) No 2150/2005 of 23 December 2005 laying down common rules for the flexible use of airspace. https://www.eurocontrol.int/articles/flexible-use-airspace-fua-mandate	CAA ICAO	2013
Operational procedures	Design and operations	FUA Procedures for Dynamic Airspace Management	Design and use of operational procedures Reference: EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 1: European Airspace Design Methodology - Guidelines - Edition December 2018 https://www.eurocontrol.int/publications/european-route-network-improvement-plan-ernip-part-1-european-airspace-design EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 3: Airspace Management Handbook - Edition December 2018 https://www.eurocontrol.int/sites/default/files/publication/files/ernip-part-3-asm-handbook-edition-5-v5-5.pdf	ANSP Aircraft operator	2013

Ground system infrastructure	ATM systems	Tools and System to support FUA	Tools to be implemented and existing systems upgraded to conduct FUA operations. Reference European Route Network Improvement Plan (ERNIP) - Part 3: Airspace Management Handbook - Annex 12 Edition December 2018 (https://www.eurocontrol.int/sites/default/files/publication/files/ernip-part-3-asm-handbook-edition-5-v5-5.pdf) EUROCONTROL Local And sub-Regional Airspace Management support system (https://www.eurocontrol.int/services/local-and-sub-regional-airspace-management-support-system-lara)	ANSP	2013
Training	-	Training requirements for FUA	Training for FUA Provide training to staff prior to implementation	ANSP Aircraft operator	2013
Ground system infrastructure	ATM systems	ATFM system for FUA	Upgrade ATFM/flight planning systems to support FUA Reference: EUROCONTROL NM Flight Planning Requirements document December 2018 (https://www.eurocontrol.int/publications/nm-flight-planning-requirements-guidelines)	ATM network function	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

This element will bring benefits in en-route airspace with low, medium and high complexity traffic.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Ensure that the right airspace is available at the right time for the mission	ANSP ATM network function Aircraft operator

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Access and equity		Improve airspace reservation management	++	
Efficiency	Flight time & distance	Facilitate direct routing of portions of the flight (if this does not cause network problems)	++	KPI05: Actual en-route extension

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route & airspace availability as known at the flight planning stage	++	KPI04: Filed flight plan en-route extension
Efficiency	Flight time & distance	Reduce need for tactical ATFM rerouting to circumnavigate airspace closed at short notice	++	KPI05: Actual en-route extension
Efficiency	Flight time & distance	Reduce need to avoid airspace because of lack of confirmation that it will be open	++	KPI04: Filed flight plan en-route extension
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during climb to avoid Special Use Airspace	++	KPI17: Level-off during climb
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during cruise to avoid Special Use Airspace	++	KPI18: Level capping during cruise
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during descent to avoid Special Use Airspace	++	KPI19: Level-off during descent

FRTO-B0/3 Pre-validated and coordinated ATS routes to support flight and flow — Operational

Main Purpose

A collection of routes that have been pre-validated and coordinated with impacted air route traffic control centers and airspace users.

New Capabilities

There are three main options for the flexible routings:

- Preferred Routes
- Playbook Routes
- Coded Departure Routes (CDR)

Description

There are many instances when ATC needs to move air traffic away from, or into, a particular area of airspace. When this happens, traffic managers will typically implement reroutes – a common route, or set of routes, that they want aircraft to use in a particular area. These routes are predetermined and applied to the certain sector/airport accordingly. Routes are available through ANSP database and are published for the airspace users.

Preferred routes are the normal, everyday routes that ATC would like operators to file. These routes were developed to increase system efficiency and capacity by having balanced traffic flows among high-density airports, as well as de-conflicting traffic flows where possible. Preferred routes are those that operators will most commonly file.

Playbook routes are a set of standard routes that ATC can utilize to fit a particular set of circumstances, when the preferred routes are not available. These routes were created to allow for rapid implementation as needed.

CDRs are a combination of coded air traffic routings and refined coordination procedures, designed to reduce the amount of information that needs to be exchanged between ATC and flight crews.

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? No

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

PLANNING LAYERS

Pre-tactical | Tactical-Pre ops | Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	FRTO-B0/1 - Direct routing (DCT)
Relation-operational need	FRTO-B0/2 - Airspace planning and Flexible Use of Airspace (FUA)
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products
Relation-information need	AMET-B0/4 - Dissemination of meteorological products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design and operations	Procedures on flexible routing tools	Design and operational procedures for ANSPs and AOs on how to use flexible routing tools.	ANSP, Aircraft operator	2013

Ground system infrastructure	ATM systems	Tools and system to support Flexible routing	ANSP implemented tools to support preferred, playbook, and CDR routes. Reference: https://www.fly.faa.gov/Products/products.jsp	ANSP	2013
Ground system infrastructure	CFSP systems	Upgrade of AOs Flight Planning Systems for Flexible routings (optional)	AO-CFSPS systems to be upgraded to enable flight planning of flexible routings. Although AOs can just look up these routes on the weblink, they can also integrate these data into their flight planning system and have it in their tool. Reference: https://www.fly.faa.gov/Products/products.jsp	Aircraft operator	2013
Training	-	Training requirements for flexible routings	Training provided to TMC, ATCO, FOC on how to use flexible routing	ANSP Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

This element will bring benefits in en-route airspace with low, medium and high complexity traffic.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

FRTO-B0/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Establish/update/publish the catalogue of strategic ATFM measures designed to respond to a variety of possible/typical/recurring events degrading the airspace system (e.g. predefined action plans)	++	
Flexibility		Improve flexibility of the Air Navigation System	++	

FRTO-B0/4	Basic conflict detection and conformance monitoring	Operational

Main Purpose	Reduction of ATCO's workload via early and systematic conflict detection and conformance monitoring.
New Capabilities	Deployment of basic conflict detection tools (Medium Term Conflict Detection Tool- MTCD) and conformance monitoring warnings.
Description	MTCD assists the controller in conflict identification and planning tasks by providing automated early detection of potential conflicts; facilitating identification of flexible routing/conflict free trajectories; identifying aircraft constraining the resolution of a conflict or occupying a flight level requested by another aircraft. The monitoring aids (MONA) function provides the controller with warnings if aircraft deviate from a clearance or planned trajectories and reminders related to the ATCO instructions to be issued. MONA might include the flight progress monitoring as well as the lateral, longitudinal, vertical and Cleared Flight Level (CFL) deviations.
Maturity Level	Ready for implementation
Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes 2. Does it imply processing of new information by the user? Yes 3. Does it imply the use of new equipment? Yes 4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	FRTO-B0/1 - Direct routing (DCT)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design and operations	ATC Procedures for Medium Term Conflict Detection (MTCD) and Monitoring Aids (MONA)	Design and use of operational procedures	ANSP	2013

Ground system infrastructure	ATC systems	ATM system Upgrades for MTCD and MONA functions	ATC systems to be upgraded to ensure conformance monitoring of flights and conflict detection for ATC planning purposes. Reference: EUROCONTROL Monitoring Aids (MONA) specification 3 March 2017. This document provides system requirements for Monitoring Aids (MONA).https://www.eurocontrol.int/standards?page= Reference: EUROCONTROL Medium-Term Conflict Detection (MTCD) specification 3 March 2017.This document provides system requirements for Medium-Term Conflict Detection (MTCD). https://www.eurocontrol.int/standards?page=4 EUROCONTROL Trajectory Prediction Specification Edition 2.0 March 2017 (https://www.eurocontrol.int/publications/trajectory-prediction-specification)	ANSP	2013
Training	-	Training requirements for MTCD and MONA	ATCO Training Provide training to staff prior to implementation	ANSP	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

This element will bring benefits in en-route airspace with low, medium and high complexity traffic.

Main intended benefits:

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

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

FRTO-B0/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce ATCO workload (en-route)	++	KPI06: En-route airspace capacity
Safety		Improve early detection of conflicting ATC Clearances (CATC) (en-route / departure / approach)	++	
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Reduce number of vertical & lateral navigation errors during flight (cases of non-conformance with clearance)	++	

FRTO-B1/1	Free Route Airspace (FRA)	Operational

Main Purpose

The Free Route Airspace (FRA) concept brings significant flight efficiency benefits and a choice of user preferred routes to airspace users.

As a step to full trajectory-based operations, the FRA concept brings increased flight predictability, reduced uncertainty for the ATM network function, which in turn can lead to potential capacity increases for ATM, which will also benefit the user.

New Capabilities

FRA is a specified volume of airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) waypoints, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control.

FRA enables airspace users to fly as close as possible to what they consider the optimal trajectory without the constraints of a fixed route network structure.

Description

FRA implementation can be customized for instance:

- laterally and vertically;
- during specific periods;
- with a set of entry/exit conditions;
- with initial system upgrades.

The extension of FRA within and across the FIR boundaries also requires upgrades of the ATM network function system and the ANSPs ground system for airspace management and flight data processing.

The following procedures and process might need to be considered:

- FRA airspace volume (lateral and vertical) and applicable time (not necessary H24 7/7);
- FRA entry and exit points, arrival transition point and departure transition point, and intermediate points;
- adapt airspace design and ensure FRA horizontal and vertical connectivity;
- ATFM FRA procedures;
- adapt the LoA with adjacent -and military- ATS units;
- publish relevant data for FRA in AIP;
- charts for FRA operations;
- airspace management procedure for the implementation of free routes operation;
- ATC procedures to cover free route co-ordination and transfer of control, trajectory change in a free route environment, conflict detection.

The upgrades of ATM systems for flight data processing and controller working postition, if required, are related to:

- ATC clearances beyond AoR;
- differentiation between different traffic type airspaces;
- calculation of 4D trajectory with AoI;
- editing function for 4D trajectories;
- coordination point management for FRA;
- coordination with military agencies;
- enhance conflict management and controller HMI functions to support conflict detection and resolution.

Maturity Level

Standardization

Human Factor Considerations

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

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

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

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

PLANNING LAYERS

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

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	NOPS-B1/5 - Full integration of airspace management with air traffic flow management
Relation-operational need	FRTO-B1/4 - Dynamic sectorization
Relation-operational need	FRTO-B1/3 - Advanced Flexible Use of Airspace (FUA) and management of real time airspace data
Relation-information need	FICE-B0/1 - Automated basic inter facility data exchange (AIDC)
Relation-operational need	FRTO-B1/5 - Enhanced Conflict Detection Tools and Conformance Monitoring
Relation-information need	DAIM-B2/2 - Daily Airspace Management information to support flight and flow
Evolution	FRTO-B0/1 - Direct routing (DCT)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design and operations	Procedures for FRA Airspace Design	Design and use of operational procedures. Reference: EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 1: European Airspace Design Methodology - Guidelines - Edition December 2018 https://www.eurocontrol.int/publications/european-route-network-improvement-plan-ernip-part-1-european-airspace-design	ANSP ATM network function	2019

Ground system infrastructure	ATM systems	ATC System Upgrade for FRA	AATM system upgrades for MTCD and MONA functions. ATC systems to be upgraded to ensure conformance monitoring of flights and conflict detection for ATC planning purposes Reference: EUROCONTROL Monitoring Aids (MONA) specification 3 March 2017. This document provides system requirements for Monitoring Aids (MONA).https://www.eurocontrol.int/standards?page= Reference: EUROCONTROL Medium-Term Conflict Detection (MTCD) specification 3 March 2017.This document provides system requirements for Medium-Term Conflict Detection (MTCD). https://www.eurocontrol.int/standards?page=4 EUROCONTROL Trajectory Prediction Specification Edition 2.0 March 2017 https://www.eurocontrol.int/publications/trajectory-prediction-specification	ANSP	2019
Ground system infrastructure	CFSP systems	Upgrade of AOs flight planning systems for FRA	AO-CFSPS systems to be upgraded to enable flight planning of FRA operations. Reference: EUROCONTROL NM Flight Planning Requirements document December 2018 https://www.eurocontrol.int/publications/nm-flight-planning-requirements-guidelines	Aircraft operator	2019
Training	-	Training requirements for FRA	ATCO Training: FRA Training Provide training to staff prior to implementation Reference: EUROCONTROL European Free Route Airspace Developments 2016 https://www.eurocontrol.int/sites/default/files/publication/files/free-route-airspace-brochure-20161216.pdf AO and ATM Network Function Training: FRA Training Provide training to staff prior to implementation Reference: EUROCONTROL European Free Route Airspace Developments 2016 https://www.eurocontrol.int/sites/default/files/publication/files/free-route-airspace-brochure-20161216.pdf	ANSP ATM network function Aircraft operator	2019
Ground system infrastructure	ATM systems	ATFM system for FRA	Upgrade ATFM/flight planning systems to support FRA	ATM network function	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

This element will bring benefits in en-route airspace with low, medium and high complexity traffic.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route network design	++	KPI04: Filed flight plan en-route extension

FRTO-B1/2 Required Navigation Performance (RNP) routes Operational

Main Purpose

RNP routes should be deployed within en-route airspace where Free Route Airspace (FRA) is not planned or if FRA is deployed the RNP routes should ensure the connectivity between FRA and TMAs.

The objective is to provide consistent navigation using the most appropriate PBN type, infrastructure and navigation applications.

New Capabilities

Performance-based navigation (PBN) specifications allow aircraft to fly a specific path between two 3D-defined points in space. The new capability refers to the Implementation of PBN/RNP routes within en-route airspace.

Description

With the introduction of a RNP navigation specification, the advantages gained from RNAV will be further enhanced by on-board performance monitoring and alerting and the execution of more predictable aircraft behavior.

Design of optimized routes which may include closely spaced parallel routes, Fixed Radius Transition (FRT) and Tactical Parallel Offset (TPO) functionality in en-route, supported by infrastructure and system improvements to support PBN routes.

The adequate navigation infrastructure is required. GNSS or DME ground infrastructure needs to be optimised to support RNP operations and main reversionary capability in case of GNSS outages.

PBN requires a full digital chain, to critical data quality levels, for aeronautical data provided to the airborne systems. The system improvements for controller support tools which might be required are covered by other FRTO elements (MTCD, monitoring aids) or other threads (Safety Nets).

Maturity Level

Standardization

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

PLANNING LAYERS

Pre-tactical | Tactical-Pre ops | Tactical-During ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	APTA-B0/1 - PBN Approaches (with basic capabilities)
Relation-operational need	APTA-B1/1 - PBN Approaches (with advanced capabilities)
Relation-operational need	SNET-B0/1 - Short Term Conflict Alert (STCA)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Operational Approval	Operational approval to provide RNP Routes	Provide appropriate terrestrial navigation infrastructure to support RNP operations - ground based stations Reference: ICAO Docs, 9613 (Ed 5 – when it is released), Airspace Design – 9992, Operation Approval – 9997. Annexes 6, 11 and 15 (for the data) and the PANS, 4444, 8168 and the new PANS AIM	CAA, ICAO	2019
Operational procedures	Design and operations	Procedures to design the RNP routes	Design and use of operational procedures Reference: EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 1: European Airspace Design Methodology - Guidelines - Edition December 2018 https://www.eurocontrol.int/publications/european-route-network-improvement-plan-ernip-part-1-european-airspace-design European Airspace Concept Handbook for PBN Implementation Edition 3.0 2013 https://www.eurocontrol.int/sites/default/files/publication/files/handbook-pbn-implement-2013-ed-3a.pdf	ANSP	2019
Airborne system capability	Aircraft system	Install appropriate RNP equipment	Equip aircraft eligible for RNP operations as defined in ICAO DOC 9613	Aircraft manufacturer, Aircraft operator	2019

Ground system infrastructure	ATC systems	Adapt ATC ground system HMI for RNP routes	Upgrade HMI to provide presentation of PBN equipage to ATC	ANSP	2019
Training	-	Training requirements for RNP routes	Flight Crew Training: Train flight crews in RNP Provide training to staff prior to implementation ATCO Training: Train ATCOs in RNP Provide training to staff prior to implementation	ANSP Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Overcome capacity limitations attributable to route network design	++	KPI06: En-route airspace capacity
Capacity	Capacity, throughput & utilization	Take advantage of increased navigation precision (airspace with PBN operations) to implement route networks and airspace structures with smaller lateral and vertical safety buffers	++	KPI06: En-route airspace capacity

FRTO-B1/3	Advanced Flexible Use of Airspace (FUA) and management of real time airspace data	Operational

Main Purpose

FUA and airspace mangement (ASM) need to be enhanced with collaborative airspace data sharing between all ATM actors, negotiation procedures, system support and real time ASM data integration.

New Capabilities

FUA procedures are enhanced by ASM data sharing between the ATM network function, ASM actors, airspace users and ATC. ASM data regarding the planning and tactical management of airspace reservations are continuously exchanged and integrated in real time between the ATM systems. Continuous exchange of ASM data between civil and military national actors will be enhanced.

Description

Automated ASM systems to ensure uninterrupted data flow between ATM Network functions and the neighbouring ASM systems from the pre-tactical planning to the real time airspace status.

ASM is enhanced by automated data exchange services during the pre-tactical and tactical execution phases continuously in real time. ASM information is shared between ASM systems and ATS units/systems, and communicated to the ATM network function in the tactical and execution phases. These data, consisting of pre-notification of activation, notification of activation, de-activation, modification and release are collected, saved and processed. Furthermore, these data need to be exchanged between ASM stakeholders and made available to other actors and relevant airspace users not involved in ASM processed.

Maturity Level

Standardization

Human Factor Considerations

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

PLANNING LAYERS

Pre-tactical | Tactical-Pre ops | Tactical-During ops | Post operations

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	FRTO-B0/2 - Airspace planning and Flexible Use of Airspace (FUA)
Relation-operational need	FRTO-B1/1 - Free Route Airspace (FRA)
Relation-operational need	NOPS-B1/5 - Full integration of airspace management with air traffic flow management

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Regulatory provisions	Operational Approval	Operational approval to provide Advanced FUA	Follow regulations for regulatory approval Reference : ICAO Circular 330 Civil/Military Coordination European Union Regulation (EC) No 2150/2005 of 23 December 2005 laying down common rules for the flexible use of airspace. https://www.eurocontrol.int/articles/flexible-use-airspace-fua-mandate	CAA ICAO	2019
Operational procedures	Design and operations	Procedures for Exchange of Real Time Airspace Data	Design and use of operational procedures. Reference: EUROCONTROL Centralised Advanced Flexible Use of Airspace Support Service Concept of Operations (CONOPS) Edition 2.1 October 2014 EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 3: Airspace Management Handbook - Edition December 2018 https://www.eurocontrol.int/sites/default/files/publication/files/ernip-part-3-asm-handbook-edition-5-v5-5.pdf ICAO Guidance for Civil/Military Cooperation Reference: 10088 ICAO Doc Civil Military co-operation	ANSP ATM network function Aircraft operator	2019
Ground system infrastructure	ATM systems	System Upgrades for Exchange of Real Time Airspace Data	Upgrade systems for partners to exchange real time data Reference: EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 3: Airspace Management Handbook - Annex 12 Edition December 2018 https://www.eurocontrol.int/sites/default/files/publication/files/ernip-part-3-asm-handbook-edition-5-v5-5.pdf	ANSP ATM network function	2019
Ground system infrastructure	ATC systems	Integration and Management of ASM real-time Data	Upgrade systems to handle real time data in ATM systems and AU flight planning systems Reference: EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 3: Airspace Management Handbook - Annex 12 Edition December 2018 https://www.eurocontrol.int/sites/default/files/publication/files/ernip-part-3-asm-handbook-edition-5-v5-5.pdf EUROCONTROL Local And sub-Regional Airspace Management support system https://www.eurocontrol.int/services/local-and-sub-regional-airspace-management-support-system-lara	ANSP	2019

Training	-	Training requirements for Advanced FUA	Training for the real time ASM data exchanges Provide training to staff prior to implementation	ANSP ATM network function Aircraft operator	2019
Ground system infrastructure	CFSP systems	Upgrade of AOs flight planning systems for FUA	Upgrade systems to handle real time data in AU flight planning systems Reference: EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 3: Airspace Management Handbook - Annex 12 Edition December 2018 https://www.eurocontrol.int/sites/default/files/publication/files/ernip-part-3-asm-handbook-edition-5-v5-5.pdf	Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve sitautional awareness of network managers, aircraft operators, ANSPs, flight crew, ATCO and airspace managers.	ANSP, ATM network function, Aircraft operator
	Ensure that the right airspace is available at the right time for the mission	ANSP, ATM network function, Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

FRTO-B1/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Access and equity		Improve airspace reservation management	++	
Efficiency	Flight time & distance	Facilitate direct routing of portions of the flight (if this does not cause network problems)	++	KPI05: Actual en-route extension
Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route & airspace availability as known at the flight planning stage	++	KPI04: Filed flight plan en-route extension

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Reduce need for tactical ATFM rerouting to circumnavigate airspace closed at short notice	++	KPI05: Actual en-route extension
Efficiency	Flight time & distance	Reduce need to avoid airspace because of lack of confirmation that it will be open	++	KPI04: Filed flight plan en-route extension
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during climb to avoid Special Use Airspace	++	KPI17: Level-off during climb
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during cruise to avoid Special Use Airspace	++	KPI18: Level capping during cruise
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during descent to avoid Special Use Airspace	++	KPI19: Level-off during descent

FRTO-B1/4	Dynamic sectorization	Operational

Main Purpose

Dynamically adapt ATC sectorization to respond to traffic demand without increasing the number of controllers working position in use.

New Capabilities

This tool will provide real-time support to the operations room supervisor to select the most appropriate sector configuration according to the traffic demand and complexity, taking into account predefined sector configuration as well as the change of the ATC sector shapes by adding/removing the elementary sectors.

Description

The sectorization tool enables the dynamic management of a large number of possible sector configurations. Based on the volume of pre-defined ATC sector configurations, the automated system continuously evaluates traffic demand and complexity in the future and proposes optimum sectorization solutions.

This tool supports real-time shaping of the airspace volumes allocated to the physical controller working position by adding/removing elementary sectors in order to respond to the predicted traffic demand and complexity.

Maturity Level

Standardization

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

PLANNING LAYERS

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

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	NOPS-B1/6 - Initial Dynamic Airspace configurations
Relation-operational need	FRTO-B1/2 - Required Navigation Performance (RNP) routes
Relation-operational need	NOPS-B1/4 - Dynamic Traffic Complexity Management

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design and operations	ATC Operational Supervisor Procedures for Dynamic Sectorization	Design and use of operational procedures	ANSP	2019
Ground system infrastructure	ATC systems	ATC System Tools for Support of Dynamic Sectorization	ATC system Upgrade relevant to dynamic handling of airspace volumes	ANSP	2019
Training	-	Training requirements for dynamic sectorization	ATCO/Operational Supervisor Training for Dynamic Sectorization Provide training to staff prior to implementation	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS FRTO-B1/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Improve flexibility of sector configuration management	++	
Capacity	Capacity, throughput & utilization	Improve flexibility to modify sector configuration at short notice to cope with traffic pattern variations	++	

FRTO-B1/5	Enhanced Conflict Detection Tools and Conformance Monitoring	Operational

Main Purpose

Enhancements of basic mid-term conflict detection (MTCD)/ monitoring alert (MONA) functions and thus further improving the ATCO productivity and reducing the workload.

New Capabilities

Conflict Detection Tools (CDT) will include enhancements to MTCD (up to 20 minutes planning horizon) function, plus tactical functions based on a shorter look-ahead time, typically from 10 to 2 minutes ahead. MTCD will be complemented by basic a conflict resolution advisor and a what if function.

Monitoring aids (MONA) provide controllers with reminders and warnings and are enhanced via the integration of Aircraft Derived Data (ADD). The provision of a trajectory warning with respect to downlinked parameters, as well as the additional reminders for change of frequency and manual coordination enhance support provided to controllers.

Description

CDT provides real-time assistance to the en-route controllers (both planning and tactical) in conflict detection and resolution. It is based on new approaches that enhance and refine the existing tools yielding more efficient and usable services.

MTCD aids the planning ATCO by showing only the most probable conflicts within the predefined look-ahead time, discarding detected conflicts with lower probabilities. The MTCD includes the what if probe function showing the problems that would occur if the given clearances is applied and identify the contextual traffic that may impair the manual identified conflict resolution.

The tactical tool is based on the tactical trajectories and identifies the conflicts within the sectors, including the what-if capabilities.

MONA provides the en-route controller with warnings if aircraft deviate from the calculated ground system trajectory or the ATCOs tactical clearances (e.g. heading, vertical rate).

Maturity Level

Standardization

Human Factor Considerations

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	FRTO-B0/4 - Basic conflict detection and conformance monitoring
Relation-operational need	FRTO-B1/1 - Free Route Airspace (FRA)
Relation-operational need	FRTO-B1/6 - Multi-Sector Planning

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design and operations	ATC procedures for enhanced CDT and MONA	Design and use of operational	ANSP	2019
Ground system infrastructure	ATC systems	ATC system upgrades for enhanced CDT and MONA functions	Upgrade ATC systems to provide enhanced monitoring capabilities as well as detection of planned/tactical conflicts Reference: EUROCONTROL Monitoring Aids (MONA) specification 3 March 2017. This document provides system requirements for Monitoring Aids (MONA).https://www.eurocontrol.int/standards?page= Reference: EUROCONTROL Medium-Term Conflict Detection (MTCD) specification 3 March 2017.This document provides system requirements for Medium-Term Conflict Detection (MTCD). https://www.eurocontrol.int/standards?page=4 EUROCONTROL Trajectory Prediction Specification Edition 2.0 March 2017 https://www.eurocontrol.int/publications/trajectory-prediction-specification	ANSP	2019
Training	-	Training requirements for enhanced CDT and MONA	ATCO Training for CDT and MONA Provide training to staff prior to implementation	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

Main intended benefits:

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

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

FRTO-B1/5

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve early detection of conflicting ATC Clearances (CATC) (en-route / departure / approach)	++	
Safety		Reduce number of vertical & lateral navigation errors during flight (cases of non-conformance with clearance)	++	

FRTO-B1/6	Multi-Sector Planning	Operational

Main Purpose

This element is applicable only to en-route sectors that are currently staffed by two ATCOs (planning and tactical).

The multi-sector planning (MSP) function defines a new organization of controller team(s) and new operating procedures to enable the planning controller to provide support to several tactical controllers operating in different adjacent sectors.

This function might reduce the ATCO workload related to intra/inter centre coordination. The workload conversion to potential capacity gains might vary considerably depending on the sector configurations.

New Capabilities

New tools and operating procedures are needed for the planning controller to provide support to several tactical controllers operating in different sectors. The Multi Sector Planning (MSP) controller ensures suitable coordination agreements between sectors and assists in managing the workload of the tactical controllers.

Description

The ATM system functions are enhanced to allow a single planner role to be associated to multiple sector tactical roles and the planner and tactical roles to be combined on a controller work position. The multi-sector planner needs to have an access to flight data, system tracks, trajectory, warnings and tools for the airspace of several ATC sectors allocated to him.

The multi-sector planner needs to provide an extended planner functions within the sectors allocated to this role, including the coordination function.

Maturity Level

Standardization

Human Factor Considerations

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

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

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

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	FRTO-B1/3 - Advanced Flexible Use of Airspace (FUA) and management of real time airspace data
Relation-operational need	FRTO-B1/5 - Enhanced Conflict Detection Tools and Conformance Monitoring

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design and operations	ATC procedures for MSP	Design and use of operational procedures	ANSP	2019

Ground system infrastructure	ATC systems	ATC system Upgrade for Support of MSP Role	Upgrade ATC systems with the capabilities to support the planning controller taking the responsibility of more than one sector. The tactical responsibilities are distributed to several tactical controllers. Reference: EUROCONTROL Medium-Term Conflict Detection (MTCD) specification 3 March 2017.This document provides system requirements for Medium-Term Conflict Detection (MTCD). https://www.eurocontrol.int/standards?page=4 EUROCONTROL Trajectory Prediction Specification Edition 2.0 March 2017 https://www.eurocontrol.int/publications/trajectory-prediction-specification	ANSP	2019
Training	-	Training requirements for MSP	ATCO Training Provide training to staff prior to implementation	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS FRTO-B1/6

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Cost effectiveness		Reduce costs in the Air Navigation System	++	

FRTO-B1/7	Trajectory Options Set (TOS)	Operational

Main Purpose To give airspace users greater flexibility and control over their trajectory with respect to airspace constraints.

New Capabilities

Airspace users have the capability to develop and file a set of desired reroute options (called a Trajectory Options Set or TOS) that is the operator's preference for routing around airspace constraints.

From these options, ATFM will choose the one that the operator is expected to fly. Operators have te capability to receive and process these notifications.

Description

Trajectory Options Sets (TOS) are used when airspace users are participating in Collaborative Option Programs (CTOP). These work as follows:

1. ATFM creates an airspace boundary and establishes flow control on any air traffic that crosses that boundary. (This is a NOPS action).
2. Airspace Users based on the notice of the airspace constraint develop and submit in advance of the issuance of the program, a set of desired reroute options (called a Trajectory Options Set or TOS) that is the operator's preference for routing around the constraint.
3. CTOP uses the preferred options to automatically assign delays or reroutes to flights in order to dynamically manage the demand as conditions change.

Maturity Level

Standardization

Human Factor Considerations

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

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

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

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

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational benefit	FRTO-B1/1 - Free Route Airspace (FRA)
Relation-operational benefit	FRTO-B1/2 - Required Navigation Performance (RNP) routes
Relation-operational benefit	FRTO-B1/3 - Advanced Flexible Use of Airspace (FUA) and management of real time airspace data
Evolution	FRTO-B0/3 - Pre-validated and coordinated ATS routes to support flight and flow

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Advisory circular	CTOP advisory circular	Guidance to customers how to manage flights in the constrained area Reference: FAA AC 90-115	CAA	2019

Operational procedures	Operations	Operational procedures for the use of CTOP	Operational guidelines on CTOP usage	ANSP Aircraft operator	2019
Ground system infrastructure	ATM systems	Tools and system to support CTOP	Tools and systems in place at ANSP to support CTOP operations Reference: https://cdm.fly.faa.gov/?page_id=983	ANSP	2019
Ground system infrastructure	CFSP systems	CSFP to support CTOP	Tools and systems in place at AOs to support CTOP operations Reference: https://cdm.fly.faa.gov/?page_id=983	Aircraft operator	2019
Training	-	Training requirements for CTOP	ATM Training, Flight Dispatcher training Training is provided on how to use CTOP system to increase flight operation efficiency	ANSP Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

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

FRTO-B2/1 Local components of integrated ATFM and ATC Planning function (INAP) Operational

Main Purpose

Bridge the planning gap between local ATFM and ATC processes and facilitate layered ATM planning in the execution phase.

New Capabilities

1. Transparency and exchange of information between local ATFM and ATC in respect of necessary action the execution phase.
2. Relevant and shared information on the predicted complexity of the operation with workload impact in short and medium term up to 45 minutes.
3. Informed decision making via integration with local resource management (scheduling tools)
4. Full use of DAC system capabilities.
5. Use of the information in the local ATFM and ATC decision support tools in a harmonised and integrated manner.

Description

In the ATM layered planning the gap between the ATFM planning and ATC planning is being closed. On one side ATFM planning traditionally dealing in pre-departure is being extended into the execution phase). On the other side ATC planning, due better precision of the Trajectory Prediction and thus ATC support tools, is pushed further than the traditional sector entry and exist planning with the horizon of 8 to 15 minutes to extended ATC planning with the horizon up to 45 minutes, especially with further progression of the concept like MSP and Flight Centric Operations. Basis for this integration is the use and exchange of predicted workload information based on complexity assessment as a best approximation for ATCO workload.

The enhanced tool will take into account all available information combine them and deliver resolutions for overload situations with the less disruption and most performant network effect. The tool is the main enabler for optimization of the two main resources of the ATM - the airspace and the ATCOs. It is designed in such a way to keep the airspace and ATCO workload related constrains always at the optimal level in the real time. Therefore, what was considered as a planning gap is becoming an overlap requiring integration and harmonization of Local ATFM and ATC operations. This integration will eventually result in complete transformation and disappearance of the “sector defensive” traditional ATC planning into seamless ATM planning process.

Maturity Level

Validation

Human Factor Considerations

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

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

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

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	FRTO-B1/6 - Multi-Sector Planning
Evolution	NOPS-B1/4 - Dynamic Traffic Complexity Management
Relation-operational need	NOPS-B2/1 - Optimised ATM Network Services in the initial TBO context
Relation-operational need	NOPS-B2/6 - ATFM adapted for cross-border Free Route Airspace (FRA)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design and operations	Operational procedures for INAP	Design and use of operational procedures for Dynamic Capacity Balancing - DCB and Extended ATC planning (INAP)	ANSP ATM network function	2025

Ground system infrastructure	ATM systems	ATC/ATFM system upgrade for support of INAP	Upgrade the ATC/ATFM system to support the integration of ATFM and ATC planning function	ANSP ATM network function	2025
Training	-	Training requirements for INAP	ATCO Training for INAP FMP training for INAP Provide training to staff prior to implementation	ANSP	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS FRTO-B2/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Optimise actual capacity (capacity monitoring values and sector configurations actually used on the day of operation)	++	

FRTO-B2/2	Local components of Dynamic Airspace Configurations (DAC)	Operational

Main Purpose: To provide optimum use of the airspace, with minimum impact on the AU business needs

New Capabilities: Re-organisation and re-structuring of the airspace in the execution phase and in real time including transition from between different type of airspace configurations and related ATC operations

Description: In order to satisfy stakeholders business needs, it will be required that the airspace configuration changes and transfer from one type of ATC operation to another happens more dynamically. This is enabled by automation and existence of large number of airspace configuration scenarios adapted for different traffic flow or complexity situations.

It is clear the efficient forms of configurations supporting Free-route or concepts like Fight Centric Operations become impracticable when certain level of complexity is reached. Dynamic Airspace Configurations using local tools and procedures in short term are supposed to optimize these transitions and make them possible in real time.

Dynamic mobile areas introduction will allow for restricted/reserved areas to be either planned along a trajectory or a protective area that will accompany the user during the whole or part of the trajectory to ensure the safety of all airspace users.

Maturity Level: Validation

Human Factor Considerations:

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

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B1/6 - Initial Dynamic Airspace configurations
Relation-operational need	NOPS-B2/1 - Optimised ATM Network Services in the initial TBO context
Relation-operational need	FRTO-B2/1 - Local components of integrated ATFM and ATC Planning function (INAP)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Operational Approval	Operational approval for DAC	Follow regulations for approval Adapt present airspace classification. Define responsibility and liability in DAC environment	CAA ICAO	2025

Operational procedures	Design and operations	Operational procedures for DAC	Design and use of operational procedures: Transitional procedures for different ATC operations in DAC situations. Procedures for instantaneous airspace delegation. Procedures for dynamic change of mode of ATC operations in a portion of an airspace.	ANSP ATM network function	2025
Ground system infrastructure	ATM systems	ATM system Upgrade Provide upgrade to support of DAC	Upgrade ATC/ATFM system with automated tools capable of predicting traffic and complexity evolution and applying low-altitude DAC based resolution scenarios.	ANSP ATM network function	2025
Training	-	Training requirements for DAC	ATC, Local Airspace Mangers, supervisors, Network function staff and FMP training Provide training to staff prior to implementation	ANSP ATM network function	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

FRTO-B2/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Improve flexibility of sector configuration management	++	
Capacity	Capacity, throughput & utilization	Optimise actual capacity (capacity monitoring values and sector configurations actually used on the day of operation)	++	

FRTO-B2/3	Large Scale Cross Border Free Route Airspace (FRA)	Operational

Main Purpose

The Free Route Airspace (FRA) concept brings significant flight efficiency benefits and a choice of user preferred routes to airspace users. Large -scale operations based on regional implementation can provide even greater freedom and benefits to AUs to fly according to their own business models leading to full trajectory based operations. Large scale FRA will continue to provide increased flight predictability, reduced uncertainty for the ATM Network function, which in turn can lead to potential capacity increases for ATM, which will also benefit the user.

New Capabilities

FRA is specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) waypoints, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control. In large scale operations the concept is applied across a large scale geographical area typically changing from State implementation to regional implementation.

Description

The initial implementation of FRA comes with certain limitations e.g. FL, dimensions, timing, functions and tools, Lat/Long use as a significant point etc. Large scale operations of FRA will ensure that these limitation are solved and no longer required leading to seamless operations in a large volume of airspace crossing State borders.

Maturity Level

Validation

Human Factor Considerations

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

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	FRTO-B1/1 - Free Route Airspace (FRA)
Relation-operational need	FRTO-B1/3 - Advanced Flexible Use of Airspace (FUA) and management of real time airspace data
Relation-operational need	FRTO-B1/6 - Multi-Sector Planning
Relation-operational need	FRTO-B1/5 - Enhanced Conflict Detection Tools and Conformance Monitoring
Relation-operational need	NOPS-B1/4 - Dynamic Traffic Complexity Management
Relation-operational need	NOPS-B2/6 - ATFM adapted for cross-border Free Route Airspace (FRA)
Relation-operational need	FRTO-B2/4 - Enhanced Conflict Resolution Tools
Relation-operational need	FRTO-B2/1 - Local components of integrated ATFM and ATC Planning function (INAP)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Design and operations	Cross border FRA Airspace Design	Design and use of operational procedures Reference: EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 1: European Airspace Design Methodology - Guidelines - Edition 5 December 2018 https://www.eurocontrol.int/publications/european-route-network-improvement-plan-ernip-part-1-european-airspace-design	ANSP ATM network function	2025
Ground system infrastructure	ATM systems	Upgrade ATM systems for improvements for cross-border FRA	ATM system upgraded for cross-border FRA clearances, notification and co-ordination data exchanges relevant for cross –border FRA and management of relevant cross-border FRA airspace data. Reference: EUROCONTROL Monitoring Aids (MONA) specification 3 March 2017. This document provides system requirements for Monitoring Aids (MONA).https://www.eurocontrol.int/standards?page= Reference: EUROCONTROL Medium-Term Conflict Detection (MTCD) specification 3 March 2017.This document provides system requirements for Medium-Term Conflict Detection (MTCD). https://www.eurocontrol.int/standards?page=4 EUROCONTROL Trajectory Prediction Specification Edition 2.0 March 2017 https://www.eurocontrol.int/publications/trajectory-prediction-specification EUROCONTROL specification for the on-line Data exchanges (OLDI) https://eurocontrol.int/sites/default/files/publication/files/EUROCONTROL%20Specification%20OLDI%204.3.pdf	ANSP ATM network function	2025
Ground system infrastructure	CFSP systems	Upgrade of AOs Flight Planning Systems for cross-border FRA	Upgrade of AOs flight planning systems Reference: EUROCONTROL NM Flight Planning Requirements document 10 December 2018 https://www.eurocontrol.int/publications/nm-flight-planning-requirements-guidelines	Aircraft operator	2025
Training	-	Training requirements for cross-border FRA	ATCO, AO and ATM Network Function Training Training for Cross-Border FRA Provide training to staff prior to implementation	ANSP ATM network function Aircraft operator	2025

Ground system infrastructure	ATM systems	ATFM system for cross border FRA	Upgrade ATFM/flight planning systems to support cross border FRA. Reference: EUROCONTROL NM Flight Planning Requirements document December 2018 https://www.eurocontrol.int/publications/nm-flight-planning-requirements-guidelines	ATM network function	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS FRTO-B2/3

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route network design	++	KPI04: Filed flight plan en-route extension

FRTO-B2/4	Enhanced Conflict Resolution Tools	Operational

Main Purpose: Providing conflict resolution support for ATCOs considering elements of ATM layered planning and overall network effect.

New Capabilities:

1. Taking into account additional INAP and network effect elements when providing conflict resolutions.
2. Harmonisation and integration with the ATFM support tools resulting in informed decision making
3. Integration of foreseen conflict resolution options for workload assessment and prediction

Description: Basic conflict resolution tools are designed to provide resolution solutions for immanent conflict taking into account certain time horizon for which the resolution trajectory has to be conflict free. In the new planning environment with extended panning horizons and integration between local ATFM and ATC processes this feature is insufficient. In order to provide informed decision on conflict resolution, which will have no negative network effect, enhanced resolution tools are to be designed. They will exploit the SWIM enabled capability to exchange and probe possible conflict resolutions taking into account the network effect to some extend (compatibility with Target Times, CTA and CTO) and the effect on the workload on other ATCOs on a longer planning scale. This approach induces substantial changes in the ATCO's working methods but on other side should provide for the flexibility and required level of freedom for safe separation in human centric environment.

Maturity Level: Validation

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	FRTO-B1/5 - Enhanced Conflict Detection Tools and Conformance Monitoring
Relation-operational need	FRTO-B2/3 - Large Scale Cross Border Free Route Airspace (FRA)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Operational Approval	Operational Approval for enhanced conflict resolution tools	Obtain Regulatory Approval Provisions for limited delegation of Responsibility and Liability to the automation will be required	CAA	2025
Operational procedures	-	Operational procedures for enhanced conflict resolution tools	Adaptation of Manuals Design and use of operational Procedures	ANSP	2025
Airborne system capability	Aircraft system	Capability	Downlink of airborne calculation of the Trajectory and other aircraft derived data for improvement of TP	Airspace user Aircraft manufacturer	2025
Ground system infrastructure	ATC systems	Integrate enhanced Conflict Resolution Tools	Upgrade ATC system with advance conflict resolution capabilities	ANSP	2025
Training	-	Training requirements for enhanced conflict resolution tools	Training for the use of the function Provide training to staff prior to implementation	ANSP	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

The element will bring benefit in an en-route medium to high complexity traffic environment.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

FRTO-B2/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve early detection of conflicting ATC Clearances (CATC) (en-route / departure / approach)	++	
Safety		Reduce number of vertical & lateral navigation errors during flight (cases of non-conformance with clearance)	++	

GADS

GADS-B1/1	Aircraft Tracking	Operational

Main Purpose	To provide support to the ATSU Alerting Service in areas without ATS surveillance with an update rate of the aircraft position of at least once per 15 mins. The objective is to assist the relevant stakeholders in the timely identification and location of aircraft in distress, to reduce reliance on the procedural methods for determining aircraft position and helping to ensure the availability and sharing of aircraft position data.
New Capabilities	Aircraft operator will be able to track the aircraft, detect missing position reports, notify if necessary the relevant ATSUs and timely share relevant information including last known position(s).
Description	Aircraft tracking is one of the Global Aeronautical Distress and Safety System (GADSS) functions (ref, GADSS ConOPS V6). Aircraft tracking is a process, established by the operator, that maintains and updates, at standardised intervals, a groundbased record of the four dimensional position of individual aircraft in flight. (ICAO Annex 6)
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 If the aircraft operator is not already tracking its aircraft. 4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	GADS-B1/2 - Contact directory service
Relation-technology option	COMS-B0/2 - ADS-C (FANS 1/A) for procedural airspace
Relation-technology option	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology option	ASUR-B1/1 - Reception of aircraft ADS-B signals from space (SB ADS-B)
Relation-technology option	COMI-B0/5 - Satellite communications (SATCOM) Class C Data
Relation-technology option	COMI-B1/3 - SATCOM Class B Voice and Data
Relation-technology option	COMS-B1/2 - PBCS approved ADS-C (FANS 1/A+) for procedural airspace

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Search and rescue	Procedures for aircraft tracking	Operator aircraft tracking policy, process and procedures. References: ICAO Annex 6 – Aircraft Tracking and ICAO Circular 347 - Aircraft Tracking Implementation Guidelines	Aircraft operator	2018
Airborne system capability	Search and rescue	Airborne aircraft tracking system	Airborne aircraft tracking capability. Note: copy table in the circular. Reference: ICAO Annex 6 – Aircraft Tracking and ICAO Circular 347 - Aircraft Tracking Implementation Guidelines.	Aircraft operator	2018
Ground system infrastructure	Search and rescue	Data link for aircraft tracking	Airborne aircraft tracking capability. Note: copy table in the circular. Reference: ICAO Annex 6 – Aircraft Tracking and ICAO Circular 347 - Aircraft Tracking Implementation Guidelines.	Aircraft operator	2018
Ground system infrastructure	Search and rescue	Ground aircraft tracking system	System with capability to process and monitor aircraft tracking data. Airborne aircraft tracking capability. Note: copy table in the circular. Reference: ICAO Annex 6 – Aircraft Tracking and ICAO Circular 347 - Aircraft Tracking Implementation Guidelines.	Aircraft operator	2018

Training	Search and rescue	Aircraft tracking training	Aircraft Operator procedures for detecting missing position reports and notifying ATSU's	Aircraft operator	2018

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is only applicable in oceanic airspace lacking ATS surveillance with a position update rate of at least once per 15 mins.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Earlier detection of aircraft in operational anomalies	ANSP, Aircraft operator
	Better position information of aircraft in distress	ANSP, Aircraft operator, RCC, SAR authority
	Improve situational awareness of aircraft operator	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

GADS-B1/1

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

GADS-B1/2	Contact directory service	Operational

Main Purpose: To ensure that Point of Contact (PoC) information is available and can be accessed by Rescue Coordination Centres (RCCs), ATSUs and aircraft operators in support of emergency situations.

New Capabilities: Access to point of Contact information of relevant ATSUs and aircraft operators.

Description: Point of Contact repository is part of the Global Aeronautical Distress and Safety System (GADSS) and is used to enable timely contact between the persons relevant to an emergency situation involving an aircraft in a specified area.

Maturity Level: Ready for implementation

Human Factor Considerations:

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

PLANNING LAYERS

Strategical | Tactical-Pre ops | Tactical-During ops | Post operations

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Search and rescue	Procedures for contact directory service	Procedures for maintaining PoC information and making PoC updates available. Procedures for using PoC repository. Reference: ICAO Circular 347 - Aircraft Tracking Implementation Guidelines	ANSP, Aircraft operator, RCC	2018

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is applicable in emergency situations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Faster and more effective response to emergency situations	ANSP, Aircraft operator, RCC, SAR authority
	Improve situational awareness of aircraft operator, ANSP and RCCs.	ANSP, Aircraft operator, RCC, SAR authority

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

GADS-B2/1	Autonomous Distress Tracking	Operational

Main Purpose: To ensure tracking of aircraft in distress and timely and accurate location of end of flight position to accurately direct search and rescue (SAR) operations in an efficient and effective way.

New Capabilities: To be able to determine the position of an aircraft in distress at least once every minute. This capability is resilient to failures of the aircraft's electrical power, navigation and communication systems.

Description: The autonomous distress tracking (ADT) function is one of the Global Aeronauical Distress and Safety System (GADSS) functions (ref, GADSS ConOPS V6). This function uses on board systems to broadcast aircraft position (latitude and longitude), or distinctive distress signals from which the aircraft position and time can be derived. The aircraft position information will be transmitted, without the need for flight crew action, at least once every minute, when an aircraft is in a distress condition.

An aircraft is in a distress condition when it is in a state that, if the aircraft behaviour event is left uncorrected, may result in an accident. When the distress tracking information is received by the operator, the operator is responsible for making this information available to the actors involved in the emergency using a Distress Tracking Repository.

Maturity Level: Standardization

Human Factor Considerations:

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

PLANNING LAYERS

Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology need	GADS-B1/2 - Contact directory service

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Search and rescue	Procedures for location of aircraft in distress	References: ICAO Annex 6 – Location of an aircraft in distress and ICAO Doc 10054 Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery	ANSP, Aircraft operator, RCC	2018
Airborne system capability	Search and rescue	Autonomous distress tracking (ADT)	Applicable to new production aircraft from 2021. Reference: ICAO Annex 6 – Location of an aircraft in distress	Aircraft operator	2021

Ground system infrastructure	Search and rescue	Capability to receive a distress signal	Distress Tracking Repository. Reference: ICAO Annex 6 – Location of an aircraft in distress and ICAO Doc 10054 Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery	Aircraft operator	2021
Training	Search and rescue	Training requirements for Autonomous Distress Tracking	Aircraft Operator procedures for ADT	Aircraft operator	2021

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is applicable in emergency situations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Faster and more effective response to emergency situations	ANSP, Aircraft operator, RCC, SAR authority
	More reliable accident site location	ANSP, Aircraft operator, RCC, SAR authority

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

GADS-B2/2	Distress tracking information management	Operational

Main Purpose: To ensure distress tracking information is available and can be accessed by RCCs, ATSUs and aircraft operators in support of emergency procedures.

New Capabilities: Access to autonomous distress tracking (ADT) data.

Description: Distress tracking information is of vital importance for efficient and effective handling of distress situations and SAR operations. Distress tracking information management provides a means to make the last known position of an aircraft in distress available to the relevant stakeholders in atimely manner.

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? No 3. Does it imply the use of new equipment? No 4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Tactical-During ops | Post operations

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational option	SWIM-B2/1 - Information service provision
Relation-operational option	SWIM-B2/2 - Information service consumption

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Search and rescue	Procedures for making available and accessing distress tracking information	Reference: ICAO Annex 6 – Location of an aircraft in distress/Flight Recorders and ICAO Doc 10054 Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery.	ANSP Aircraft operator RCC	2021

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is applicable in emergency situations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Faster and more effective response to emergency situations	ANSP, Aircraft operator, RCC, SAR authority
	More reliable accident site location	ANSP, Aircraft operator, RCC, SAR authority
	Improve situational awareness of aircraft operator, ANSP and RCCs.	ANSP, Aircraft operator, RCC, SAR authority

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

GADS-B2/3	Post Flight Localization	Operational

Main Purpose: To enable efficient and effective SAR operations by providing accurate position information of the end of flight location following a crash.

New Capabilities: The capability to locate the end of flight with a level of accuracy required by SAR.

Description: Post Flight Localization is one of the GADSS functions (ref, GADSS ConOPS V6). When an accident occurs there is a phase beginning immediately at the end of flight where the rescue of possible survivors has the immediate and highest priority. Accurate aircraft position information (1 NM or better) is provided through the Post Flight Localization function to guide SAR services on site.

Maturity Level: Standardization

Human Factor Considerations

PLANNING LAYERS

Post operations

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational benefit	GADS-B2/1 - Autonomous Distress Tracking

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Search and rescue	Procedures regarding the operation of the system intended for timely recovery of flight recorder data	Description of the operator capabilities. Reference: Annex 6 – Location of an aircraft in distress and ICAO Doc 10054 Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery	Aircraft operator	2021

Airborne system capability	Search and rescue	ELT	Reference: ICAO Annex 6 – Location of an aircraft in distress and ICAO Doc 10054 Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery	Aircraft operator RCC	2019
Airborne system capability	Search and rescue	ULD	Reference: ICAO Annex 6 – Location of an aircraft in distress and ICAO Doc 10054 Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery	Aircraft operator RCC	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is applicable in emergency situations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Faster and more effective response to emergency situations	Aircraft operator, RCC, SAR authority

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

GADS-B2/4	Flight Data Recovery	Operational

Main Purpose: To enable timely and efficiently recovery of information for accident investigation.

New Capabilities: Timely recovery and availability of information relevant for accident investigation. Avoiding long and costly search operations to recover Flight Data Recorder.

Description: To ensure accident investigation authorities obtain timely access to the flight recorder information, the aircraft will be equipped with a means, approved by the State of the aircraft operator, to recover the flight recorder data and make it available in a timely manner. The requirements for approving the means to make flight recorder data available in a timely manner are detailed in ICAO Annex 6.

Maturity Level: Concept

Human Factor Considerations

PLANNING LAYERS

Post operations

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational benefit	GADS-B2/1 - Autonomous Distress Tracking

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Search and rescue	Procedures regarding the operation of the system intended for timely recovery of flight recorder data	Description of the operator capabilities. Reference: Annex 6 – Location of an aircraft in distress and ICAO Doc 10054 Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery	Aircraft operator	2021
Airborne system capability	Search and rescue	System intended for timely recovery of flight recorder data	Reference: ICAO Annex 6 – Location of an aircraft in distress and ICAO Doc 10054 Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery	Aircraft operator	2025
Ground system infrastructure	Search and rescue	C,N,S	No CNS needed for Automatic Deployable Flight Recorder. Satellite Link needed for flight recorder streaming before impact.	Aircraft operator	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is applicable in emergency situations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Timely retrieval flight recorder data	Aircraft operator Accident Investigation Authority
	Improve AIA understanding of the flight environment pre the end of flight.	Accident Investigation Authority

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

NOPS

NOPS-B0/1	Initial integration of collaborative airspace management with air traffic flow management	Operational

Main Purpose

Introduce ASM/ATFM techniques, procedures and tools for the initial establishment of an integrated collaborative airspace management and air traffic flow and capacity management process applicable to the strategic through to the tactical phases of operations.

New Capabilities

Collaborative airspace planning process is extended by harmonizing the ASM/ATFM rules and procedures for the establishment, allocation and use of airspace structures in response to ATFM requirements.

Description

This element represents the initial step to enhancing the common situational awareness supporting optimum availability of airspace and ATC capacity to meet air traffic demands. It will result in a dynamic/rolling process supporting the enhancement of network operations. It will improve the cross border operations and optimise network operations based on the richest and more accurate information. It requires the implementation of new tools/systems and processes notably:

- ASM/ATFM process for the provision of the airspace use plan;
- Improved ASM/ATFM process for the provision of updated airspace use plan;
- System/tools for provision of airspace plan to ATM network function;
- Improved notification process for the ASM/ATFM purposes;
- Improved accuracy of airspace booking;
- Interoperability between local ASM and ATFM systems.

Maturity Level

Ready for implementation

Human Factor Considerations

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

Coordination between different airspace planning actors is more efficient and the need for paper/phone coordination is minimised.

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

Integrated airspace planning implies an utilisation of new data stream.

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

ASM tool.

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

The manual process of airspace notification is semi-automated.

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

Departure | En-route | Arrival

Tactical-During ops

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information need	AMET-B0/1 - Meteorological observations products
Relation-operational need	FRTO-B0/2 - Airspace planning and Flexible Use of Airspace (FUA)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Procedures for dynamic co-operative management of the airspace	Develop the ASM/ATFM procedures related to dynamic co-operative management of the airspace (improved ASM/ATFM process via e.g. Airspace Use Plan/Updated airspace Use Plan). Reference: ICAO Doc 9971 Manual on Collaborative ATFM.	ANSP ATM network function	2013
Operational procedures	-	Procedures for improved notification process	Improved ASM/ATFM notification process. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function	2013
Operational procedures	-	Procedures for released of reserved airspace	Develop the ASM/ATFM procedures to identify and release previously reserved airspace. References: Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function	2013
Operational procedures	-	Procedures for promulgation and notification of receipt	Develop the ASM/ATFM procedure for promulgation and notification of receipt of ASM data- Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function	2013
Ground system infrastructure	ATM systems	Distribution of planned airspace usage information	Enhance the Airspace Management System and ATFM systems to distribute planned airspace usage information.	ANSP ATM network function	2013
Ground system infrastructure	ATM systems	Integrated airspace planning process	Upgrade the Airspace Management System and ATFM system to support an integrated airspace planning process	ANSP ATM network function	2013
Ground system infrastructure	ATM systems	Pre-tactical scenario management	Enhancements of Scenario management sub-system equipped with function to support pre-tactical CDM	ANSP ATM network function	2013

Ground system infrastructure	ATM systems	Airspace status information	Upgrade the Airspace Management Systems to provide airspace status information	ANSP ATM network function Aircraft operator	2013
Ground system infrastructure	ATM systems	ATFM systems interoperability with ASM system	Interoperability of ATFM systems for ASM zone shapes and timing with local ASM tools	ANSP ATM network function	2013
Ground system infrastructure	ATM systems	Reception of planned and actual airspace status	Enhance to ASM/ATFCM tools to receive information on planned and actual airspace status and support decision-making based on this information	Aircraft operator	2013
Training	-	Training requirements for initial integration of collaborative ASM with ATFM	Collaborative Airspace management training. Training on new procedures and tools.	ANSP ATM network function Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

This element should be undertaken by all ANSPs, AUs and the ATM Network function affecting both en-route and TMA operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity. Flight delays will be reduced through better utilization of airspace resources within and across airspace boundaries.	ANSP, Airspace user, ATM network function
	Flight efficiency increased through the chance to plan more optimum routes/trajectories allowing lower fuel burn.	Airspace user
	Improve situational awareness of network manager	ATM network function
Indirect benefits	Safety. Better knowledge of traffic environment, common situational awareness, and some enhancement through reduction in controller workload.	ANSP, Airspace user, ATM network function

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B0/1

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Facilitate tactical decisions leading to a shorter actual route than in the FPL	++	KPI05: Actual en-route extension
Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route & airspace availability as known at the flight planning stage	++	KPI04: Filed flight plan en-route extension
Efficiency	Flight time & distance	Reduce need for tactical ATFM rerouting to circumnavigate airspace closed at short notice	++	KPI05: Actual en-route extension
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during climb introduced to avoid airspace above	++	KPI17: Level-off during climb
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during cruise introduced to avoid airspace above	++	KPI18: Level capping during cruise
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during descent to avoid Special Use Airspace	++	KPI19: Level-off during descent

NOPS-B0/2 Collaborative Network Flight Updates Operational

Main Purpose

Improve ATFM situation awareness in order to facilitate re-routings and coordinated application of ATFM measures.

New Capabilities

Seamless exchange and processing of correlated position information, flight activation status and up to date flight plan information for airborne flights. Such data are required within the Area of Responsibility (AOR) of the ATFM unit, but also within the Area of Interest (AOI) of the ATFM unit for all flights entering the ATFM area.

Description

This element will ensure:

- Effective interface between ATC and ATFM with regard to deviations from the current flight plan.
- Enhanced tactical flow management service based on real-time aircraft position data and flight activation information resulting to more accurate ATFM measures and thus better use of scarce airspace resources.

It will require implementation ATFM/ATC systems related to provision, processing and presentation of ATFM messages.

Maturity Level

Ready for implementation

Human Factor Considerations

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

Manual notification disappeared.

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

ATFM message, CPRs and flight plan proposals are new items that were not previously exchanged.

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 | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Network Planning procedures	Develop the ATFM procedures to incorporate information received from multiple sources into the Network Planning.- Doc 9971 Manual on Collaborative ATFM	ATM network function	2008
Operational procedures	-	Procedures for updated flight plan information	Develop the ATFM/ATC procedures for provision of updated flight plan information.- Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function	2008
Ground system infrastructure	ATM systems	Correlated Position Reports	Upgrade of ATFM/ATC system related to the provision and reception of correlated position reports for airborne flights.	ANSP ATM network function	2008
Ground system infrastructure	ATM systems	ATFM message exchanges	Enhancement of ATFM/ATC system related to the provision and processing of ATFM messages.	ANSP ATM network function	2008
Ground system infrastructure	ATM systems	Flight activation messages	Upgrade of ATFM/ATC system related to the flight activation.	ANSP ATM network function	2008
Ground system infrastructure	ATM systems	Updated flight plan info	Upgrade the ATFM/ATC system for handling of flight plan info for airborne flights.	ANSP ATM network function	2008

DEPLOYMENT APPLICABILITY

Operational conditions:

This element will involve all ANSPs, AUs and the ATM Network Function for the collaborative updates of the flight status within an ATFM area. This will enhance predictability and better utilisation of available capacity.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity. Better use of the available network capacity hence reducing delays.	ANSP, ATM network function
	Predictability	ANSP, Airspace user, ATM network function
	Improve situational awareness of network manager.	ATM network function
Indirect benefits	Safety. Prevention of ATCO overload.	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B0/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Ensure that the measures applied are absolutely necessary and that unnecessary measures are avoided	++	
Capacity	Capacity shortfall & associated delay	Establish/improve the capability to use opportunities to mitigate disturbances, originating from: More precise surveillance data	++	

NOPS-B0/3 Network Operation Planning basic features Operational

Main Purpose: The Network Operation Planning provides an overview of the situation from strategic planning through real time operations with ever increasing accuracy up to and including the day of operations by a common situational awareness for all ATFM actors within and adjacent to the ATFM area and allowing network wide demand and capacity balancing.

New Capabilities: A Network Operations Plan will be accessible online by stakeholders for consultation and update as needed.

Description

Network Operation Planning is based on enhanced participation in a dynamically updated collaborative planning process. This requires the sharing of the latest flight status and intentions; airport and airspace component, associated demand and capacity balancing measures in a frequently updated plan which is aimed to be realised as target by all actors. The elements and formats of the plan need to be established and harmonized, taking into account the requirements of the users of these plans. It will be possible for them to access and extract data for selected areas to support their operation and, if required, to create their specific operations plan.

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

Strategical | Pre-tactical | Tactical-Pre ops | Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-information need	AMET-B0/2 - Meteorological forecast and warning products
Relation-information need	AMET-B0/3 - Climatological and historical meteorological products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Tactical changes procedures	Develop the ATFM procedures to modify the Network operations planning in real-time in response to tactical changes to trajectories and airport/airspace capacities..- References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function	2012
Operational procedures	-	Capacity balancing procedures	Develop the ATFM procedures for systematically incorporating changes to capacity balance as revised information enables the updating of the Network operations plan. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator ANSP ATM network function Aircraft operator	2012

Operational procedures	-	Coordination procedures	Develop the ATFM procedures for coordinating refined plans between ANSP, Airspace Users and Airport Operators.	Airport operator ANSP ATM network function Aircraft operator	2012
Operational procedures	-	Network Operation Planning procedures	Develop the ATFM procedures for on-line collaborative determination access/update to the Network Operation Planning and notification of updates.	Airport operator ANSP ATM network function Aircraft operator	2013
Operational procedures	-	Predefined scenario management	Develop the ATFM procedures for identifying the appropriate scenario from the catalogue of scenarios through collaborative decision making and initiating its implementation. References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function	2013
Operational procedures	-	Dynamic sectorization procedures	Develop the ATFM procedures for initiating dynamic sectorization responses in collaboration with the ANSPs. References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function	2013
Ground system infrastructure	ATM systems	Exchange of ATFM related data	Tool for exchange, presentation, visualization and update of ATFM related data.	Airport operator ANSP ATM network function Aircraft operator	2013
Ground system infrastructure	ATM systems	Capacity planning	Upgrade the capacity planning and scenario management with sector management tool to assist ANSPs in defining sector configurations.	ATM network function	2013
Training	-	Training requirements for network operation planning basic features	Network Operation Planning (basic features) training. Training on new procedures and tools	Airport operator ANSP ATM network function Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

The Network Operation Planning will involve all the operational stakeholders providing an overview of the situation from strategic planning to real time operations with ever increasing accuracy optimising the efficiency of the ATM system while balancing demand with capacity.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity.	Airport operator, ANSP, Airspace user, ATM network function
	Predictability.	Airport operator, ANSP, Airspace user, ATM network function
	Improve situational awareness of stakeholders.	Airport operator, ANSP, Airspace user, ATM network function
Indirect benefits	Safety by planning scarce resources in the most optimum way.	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

NOPS-B0/4	Initial Airport/ATFM slots and A-CDM Network Interface	Operational

Main Purpose: Initial integration of airports into the ATM network function.

New Capabilities: Stakeholders will be able to share relevant airport and flight turnaround information with ATM network function resulting in better predictability and better use of existing capacity whilst considering user preferences and requirements.

Description: The first objective is the A-CDM (Airport Collaborative Decision Making) integration with ATFM via exchanges of specific messages. The second objective is to ensure ATFM slot adherence and limited ATFM slot swapping in order to meet airline demands in line with capacity declarations.

Convergence is ensured between airport slots, and flight plans, together with airport slot monitoring processes in order to improve consistency. That will require the deployment of new systems and processes for A-CDM and ATFM slot swapping:

- ATFM and airports system modules related to data exchanges for A-CDM
- Tools for airport and ATFM slot monitoring post-ops

Maturity Level: Ready for implementation

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes Phone coordination is reduced. 2. Does it imply processing of new information by the user? Yes ATFM data presentation and scenario management are new data streams. 3. Does it imply the use of new equipment? Yes Network Operation planning is a new tool, it might require specialised equipment for data access. 4. Does it imply a change to levels of automation? Yes Manual process is semi-automated.

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

Departure | Arrival | Turn-around

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	ACDM-B0/1 - Airport CDM Information Sharing (ACIS)
Relation-operational need	ACDM-B0/2 - Integration with ATM Network function

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Airport slot procedure	Develop procedures for the collection of the Airport slots. References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function Aircraft operator	2013
Operational procedures	-	ATFM A-CDM procedure	Develop the ATFM Collaborative procedures for improving Airport Operations in Adverse Conditions. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator ANSP ATM network function Aircraft operator	2012
Ground system infrastructure	ATM systems	Airport Slot Monitoring Tool	Tools supporting Airport Slot Monitoring post ops.	Airport operator ATM network function Aircraft operator	2012
Ground system infrastructure	ATM systems	Departure planning estimate	Enhance the ATFM system for provision of planned departure information. Enhance the ATC and airport systems for reception and processing of planned departure information.	Airport operator ANSP ATM network function	2010

Ground system infrastructure	ATM systems	Flight data for airborne flights	Enhance the ATFM system for provision of real time flight data for airborne flights. Enhance the ATC and airport systems for reception and processing of real time flight data for airborne flights	Airport operator ANSP ATM network function	2010

DEPLOYMENT APPLICABILITY

Operational conditions:

It concerns airports which have implemented A-CDM. The integration of airport planning with ATFM will involve all respective stakeholders in a collaborative decision facilitating slot adherence and some AUs preferences (limited slot swapping).

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity.	Airport operator, ANSP, Airspace user, ATM network function
	Predictability.	Airport operator, ANSP, Airspace user, ATM network function
	Improve situational awareness of network manager.	ATM network function
Indirect benefits	Airspace users specific preferences /efficiency criteria of operations.	Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B0/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	For a given airspace entry slot: let airspace users swap the slot to another flight (slot substitution or UDPP – User Driven Prioritisation Process)	++	

NOPS-B0/5	Dynamic ATFM slot allocation	Operational

Main Purpose

Provision of dynamic departure ATFM slot allocation including Calculated Take-off Time (CTOT) for regulated flights to avoid ATFM congestions.

New Capabilities: ATM network function to provide the departure ATFM slots, including CTOT for regulated flight to all concerned operational stakeholders. ANSPs/ Airport/ AU to be capable to receive and process CTOT and update Estimated Take-off Time (EOBT) in accordance with the agreed operational procedures.

Description: The CTOT is defined as a time at which the aircraft shall take-off. CTOT is sent to AU / ATS when a flight becomes regulated (e.g. new flight entering the system, new period of regulation in the system, change of runway in use) at a system parameter time before the last received EOBT. AU/ATS/Airport need to adhere with the CTOT. The calculation of take-off times takes into account the off-block times and an average taxiing time for the runway in use at the airfield concerned.

Maturity Level: Ready for implementation

Human Factor Considerations:

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

Constrains need to be handled.

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

CTOT and DPI are new items.

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

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

Instead being active user, only monitoring of data exchange and reacting in abnormal situations.

PLANNING LAYERS

Tactical-Pre ops

OPERATIONS

Departure

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Slot revision procedures	Develop the ATFM procedures for slot revision. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator, ANSP, ATM network function, Aircraft operator	2000
Ground system infrastructure	ATM systems	CTOT	System upgrade for provision, exchange and processing of CTOT	Airport operator, ANSP, ATM network function, Aircraft operator	2000

DEPLOYMENT APPLICABILITY

Operational conditions:

It concerns airports integrated in ATFM. All operational stakeholders participate in smoothing traffic flows facilitating ATFM slot adherence.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Predictability.	Airport operator, ANSP, Airspace user, ATM network function
	Fuel consumption.	Airspace user
	ATFM delays.	Airport operator, ANSP, Airspace user, ATM network function

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B0/5

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Implement TMIs to delay take-off times	++	KPI07: En-route ATFM delay
Capacity	Capacity shortfall & associated delay	Use ATFM oriented flow management: delay push-back of inbound traffic	++	

NOPS-B1/1	Short Term ATFM measures	Operational

Main Purpose: Short Term ATFM Measures (STAM) intends to smooth sector workloads by reducing traffic peaks through short-term applications of minor ground delays, appropriate flight level capping, timing and modalities of ATC re-sectorisation These measures are capable of reducing the traffic complexity for ATC with minimum curtailing impact on the airspace users.

New Capabilities: Stakeholders can optimize capacity throughput by adopting and improving the tactical capacity management procedures with the use of STAM.

Description

The rigid application of ATFM measures based on standard capacity thresholds as the pre-dominant tactical capacity measure needs to be replaced by a close working relationship between ANSP, AU and ATM Network function, which monitors both the real demand and the effective capacity of sectors having taken into account the complexity of expected traffic situation.

In order to close the gap between ATC and ATFM, new tools and local operational procedures need to be developed. The aim is to improve the efficiency of the system using flow management techniques close to the real time operations with direct impact on tactical capacity management and tactical action on traffic.

The target of the Short Term ATFM Measures is to replace en-route measures for situations where the capacity is nominal. These measures are capable of reducing the traffic complexity for ATC with minimum constraints for the airspace users. STAM tools and procedures are based on accurate short-term occupancy counts. The tactical capacity management procedures can be supported by the ATFM Tools (system based STAM with the hot-spot detections in the network view, the “what-if” function and capabilities of promulgation and implementation of STAM measures, including CDM). This will require the introduction of:

- Pre-tactical and Tactical Demand Capacity Balancing (DCB) evaluation tools;
- DCB tool based on occupancy counts;
- Enhanced monitoring techniques;
- DCB Coordination tools;
- DCB What-if function;
- DCB Network impact assessment;
- ATFM procedures to enable application of flow management closer to real time.

Maturity Level

Standardization

Human Factor Considerations

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

New task for all ATFM actors.

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

STAM measures are new items.

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

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

Reduced need for late and tactical interventions.

PLANNING LAYERS

Tactical-Pre ops

OPERATIONS

En-route Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B0/3 - Network Operation Planning basic features

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Operational procedures	-	DCB change procedure	Develop the ATFM procedures to respond to change of demand/ capacity balance. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function Aircraft operator	2014
Operational procedures	-	DCB optimisation procedure	Develop the ATFM procedures for demand/ capacity balance optimization. References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function	2014
Operational procedures	-	STAM procedures	Develop the ATFM procedures to enable application of flow management techniques on traffic streams closer to real-time. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function Aircraft operator	2019
Ground system infrastructure	ATM systems	Strategic DCB tools	Strategic and pre-tactical demand-capacity balancing evaluation, simulation and display tools.	ATM network function	2014
Ground system infrastructure	ATM systems	Routings and Flow changes	Upgrade the Capacity planning and scenario management with tools to identify the most beneficial routings and flows changes implemented within the Collaborative Decision Making processes.	ANSP ATM network function Aircraft operator	2014
Ground system infrastructure	ATM systems	Basic STAM tool	Demand capacity balancing tool base on occupancy counts.	ANSP ATM network function	2014
Ground system infrastructure	ATM systems	Sector configuration integration	Integration of ANSPs sector configuration into ATFM Systems	ANSP ATM network function	2014
Ground system infrastructure	ATM systems	Enhanced STAM tool	Enhanced STAM tool (Coordination, what-if, network impact assessment).	ATM network function	2019
Ground system infrastructure	ATM systems	Local STAM tool	Local tool and interface with ATFM tools	ANSP	2019
Training	-	Training requirements for STAM	Staff training	ANSP ATM network function Aircraft operator	2014

DEPLOYMENT APPLICABILITY

Operational conditions:

It is applicable in areas where significant ATFM measures are required. This element will involve ANSPs as well AUs and the ATM Network function as required in a collaborative manner, during tactical planning in applying demand and capacity balancing actions for a limited time and affecting selected flights.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity. Effective capacity is globally optimized thanks to the application of certain techniques affecting only selected flights.	ANSP Airspace user ATM network function
Indirect benefits	Safety. Small enhancement through the resolution of some conflicts through STAM measures, Predictability	ANSP Airspace user ATM network function

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B1/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Establish/improve the capability to use opportunities to mitigate disturbances	++	
Capacity	Capacity shortfall & associated delay	TMI-based optimisation (only impacts traffic when a TMI or restriction is manually activated for one or more constraint satisfaction points)	++	

NOPS-B1/10 Collaborative Trajectory Options Program (CTOP) Operational

Main Purpose

Collaborative Trajectory Options Programs are Traffic Management Initiatives (TMI) that allow ATFM to choose the best possible balance between ATFM dalay and rerouting by using airspace user provided Trajectory Option Sets (TOS) to mitigate the operational impact of weather or traffic demand airspace constraints.

New Capabilities

ATFM has the capability to receive and process Trajectory Option Sets (TOS) provided by airspace users. These are ranked trajectories that represent the operator's preference for the trade-off between receiving ATFM delay and routing around airspace constraints.

When there is an airspace constraint, ATFM has the flexibility to use the trajectory options provided by all participating operators to optimize the choice between accepting a subset of the flights to use the available airspace capacity, applying ATFM delay to others, and rerouting the remaining traffic around the constraint.

Finally, ATFM has the capability to electronically notify the participating airspace users of the chosen trajectory that they are expected to fly.

Description

CTOP works as follows:

1. ATFM creates an airspace boundary and establishes flow control on any air traffic that crosses that boundary.
2. Airspace Users based on the notice of the airspace constraint develop and submit in advance of the issuance of the program, a set of desired reroute options (called a Trajectory Options Set or TOS) that is the operator's preference for routing around the constraint.
3. CTOP uses the preferred options to automatically assign delays or reroutes to flights in order to dynamically manage the demand as conditions change.

Maturity Level

Standardization

Human Factor Considerations

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

PLANNING LAYERS

Pre-tactical | Tactical-Pre ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	FRTO-B1/7 - Trajectory Options Set (TOS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Advisory circular	CTOP advisory circular	Guidance to customers how to manage flights in the constrained area Reference: FAA AC 90-115	CAA	2019
Operational procedures	Operations	Operational procedures for the use of CTOP	Operational guidelines on CTOP usage	ANSP, Aircraft operator	2019

Ground system infrastructure	ATM systems	Tools and system to support CTOP	Tools and systems in place at ANSP to support CTOP operations Reference: https://cdm.fly.faa.gov/?page_id=983	ANSP	2019
Ground system infrastructure	CFSP systems	CSFP to support CTOP	Tools and systems in place at AOs to support CTOP operations Reference: https://cdm.fly.faa.gov/?page_id=983	Aircraft operator	2019
Training	-	Training requirements for CTOP	ATM Training, Flight Dispatcher training Training is provided on how to use CTOP system to increase flight operation efficiency	ANSP Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS NOPS-B1/10

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	For a given flight: at flight plan filing time airspace users provide network management with a range of trajectory options and associated trade-off criteria, from which one solution is chosen (CTOP – Collaborative Trajectory Options Program)	++	KPI04: Filed flight plan en-route extension KPI07: En-route ATFM delay KPI18: Level capping during cruise

NOPS-B1/2	Enhanced Network Operations Planning	Operational

Main Purpose The Network Operations Planning needs to be enhanced to achieve collaborative planning with the support of services which can be automated (B2B interfaces/SWIM services).

New Capabilities Tools and procedures to be deployed to enhance Network Operations planning.

Description

The Network Operations Planning process will be enhanced to continuously provide up-to-date situational information on all components of the network. Furthermore, it will provide access to initial network performance objectives and support to network performance assessment in post-operations.

The required technological platform will use the state-of-the-art technologies for creation of a virtual operations room for the physically distributed network operations, in support of collaborative Network Operations Planning. These interfaces will support the network collaborative dynamic/rolling processes from strategic to real-time operations, including capabilities for online performance monitoring integrated and feeding back into the collaborative network planning.

The information and dialogue tools shall be accessed via different interfaces. Access to information is done in a secure way, tailored according to stakeholders needs and subject to access control rules, so that only those who have an operational need to access particular information are able to do so. A common interface to all stakeholders needs to be developed to enable the collaborative decision-making processes used to build and execute the Network Operations Planning.

The following new features will be introduced:

- Enhanced Network Operations Planning interfaces (B2B/SWIM based);
- Initial steps related to the Network Operations Planning extended functions (crisis management and network disruption);
- Tools for on-line performance monitoring;
- Tools for network impact assessments.

Maturity Level

Standardization

Human Factor Considerations

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

New role and responsibilities for some ATFM actor.

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

New info stream are handled as impact assessment and crisis management.

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

New platform and interfaces are needed.

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

New function were added , those that did not exist before.

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B0/3 - Network Operation Planning basic features
Relation-information need	AMET-B1/3 - Climatological and historical meteorological information
Relation-information benefit	FICE-B2/4 - Flight Data Request Service
Relation-operational benefit	SWIM-B2/1 - Information service provision

Relation-operational benefit	SWIM-B2/2 - Information service consumption

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Enhanced NOP dissemination procedure	Develop the ATFM procedures for communicating refined Network plans to ANSP, Airspace Users and Airport Operators...- Doc 9971 Manual on Collaborative ATFM	Airport operator ANSP ATM network function Aircraft operator	2019
Operational procedures	-	Enhanced NOP notification procedure	Develop the ATFM procedures for on-line access/update to the Network Plan and notification of updates. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator ANSP ATM network function Aircraft operator	2019
Operational procedures	-	Critical event procedure	Develop the ATFM procedures for handling of a critical event.	ATM network function	2019
Operational procedures	-	Airspace availability procedure	Develop the ATFM procedures to ensure that Network is constantly updated to reflect all changes to the airspace availability and airspace users requests. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator ANSP ATM network function Aircraft operator	2019
Operational procedures	-	B2B/SWIM services procedure	Real-time technical support procedures for B2B(2019)/SWIM(2020) services. References: ICAO Doc 9971 Manual on Collaborative ATFM	Aircraft operator	2019
Ground system infrastructure	-	Enhanced NOP platform	Enhance the ATFM technical platform.	ATM network function	2019
Ground system infrastructure	ATM systems	Enhanced NOP functions	Upgrade the ATFM system with extended function (crisis management, impact assessment, performance monitoring).	ATM network function	2019
Ground system infrastructure	ATM systems	Enhanced NOP interfaces	B2B (2019)/ SWIM (2020) Network system interfaces with concerned stakeholders.	Airport operator ANSP ATM network function Aircraft operator	2019

Training	-	Training requirements for enhanced network operations planning	Training in new operational procedures and ground systems.	Airport operator ANSP ATM network function Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

An enhanced common platform is available to all Stakeholders needs enabling the collaborative decision making processes used to maintain and execute the Network Operations Planning.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity Enhanced planning will ensure better use of available capacity and reduce delays.	Airport operator, ANSP, Airspace user, ATM network function
	Cost Efficiency Enhanced planning will allow better use of human resources.	Airport operator, ANSP, Airspace user, ATM network function
	Improve situational awareness of network manager	ATM network function
Indirect benefits	Safety Enhanced by improved sharing of the network situation awareness.	Airport operator, ANSP, Airspace user, ATM network function

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B1/2

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Establish/update the crisis management capabilities and plans (to cope with the risk of large scale disruptions)	++	

NOPS-B1/3	Enhanced integration of Airport operations planning with network operations planning	Operational

Main Purpose ? Integrate the airport operations planning into the network operations planning.

New Capabilities

The airport operations plan will be a single common and collaborative agreed dynamic/rolling plan available to all airport stakeholders. This plan will be integrated with the enhanced network operations planning.

Description

The airport operations plan will contain all data and information related to the different status of planning phases and will be a dynamic/rolling plan, which naturally evolves over time. The integration of airport operations planning within the network operations planning provides a dynamic/rolling picture of the network situation to be used by all operational stakeholders to prepare their plans and their inputs to the network CDM processes.

The data exchanges are based on the subset of B2B/SWIM services that are most widely available to all stakeholders, communicating with local airport A-CDM systems to exchange relevant operational information.

This element is a step prior to the full integration of the airport operations planning to the network operations planning.

Maturity Level

Standardization

Human Factor Considerations

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

Yes, manual coordination is automated.

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

AOP/NOP interfaces contain a full set of new data exchange items.

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

In some cases. New modules and interfaces.

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

Reduced need for phone coordination.

PLANNING LAYERS

ATM planning | Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B0/4 - Initial Airport/ATFM slots and A-CDM Network Interface
Relation-operational need	ACDM-B1/1 - Airport Operations Plan (AOP)
Relation-operational need	NOPS-B1/2 - Enhanced Network Operations Planning
Relation-operational benefit	SWIM-B2/1 - Information service provision
Relation-operational benefit	SWIM-B2/2 - Information service consumption

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	AOP/NOP procedure	Develop the ATFM/Airport procedures for AOP/Network Operation Planning integration. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator ATM network function	2019
Ground system infrastructure	Airport systems	AOP	Develop the Airport Operations Plan module	Airport operator	2019
Ground system infrastructure	ATM systems	AOP/NOP interface	Develop the Airport Operations/ /Network Operations Planning interfaces	Airport operator ATM network function	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

It concerns airports which have already implemented AOP. This element will involve Airports and the ATM Network function. Airport planning will be integrated in the Network operations planning. The integration of Airport operations planning within the Network operations planning.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity. An integrated planning will facilitate better utilization of available airspace and airport capacities and will reduce delays. Support optimal use of facilities and services, better use of airport and ATFM slots. Predictability Efficiency Decrease in fuel burn through better timed operations.	Airport operator, ANSP, Airspace user, ATM network function
	Improve situational awareness of stakeholders	Airport operator, ANSP, Airspace user, ATM network function

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

NOPS-B1/4	Dynamic Traffic Complexity Management	Operational

Main Purpose Enhanced traffic complexity assessment by automation.

New Capabilities: The predicted complexity coupled with traffic demand enables the ATM Network function to take timely action to better address demand and capacity balancing, or request the trajectory changes in coordination with ATC and Airspace Users.

Description: The rigid application of ATFM measures based on standard capacity thresholds as the pre-dominant tactical capacity measure needs to be replaced by a close working relationship between ANSPs and ATM Network function, which would monitor both the real demand and the effective capacity of sectors having taken into account the complexity of expected traffic situation. The local traffic complexity assessment continuously monitors sector demand and evaluate traffic complexity (by applying predefined complexity metrics) according to a predetermined qualitative scale. It provides support in the determination of solutions in order to plan airspace, sectors and staff to handle the predicted traffic. The local complexity assessment would benefit by receiving processing and integrating the ATM Network function information in order to supplement the local traffic counts with the relevant flight plan data. This will improve the quality of the planned trajectory and further enhance the traffic complexity management.

Maturity Level: Standardization

Human Factor Considerations:

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

New task to manage traffic complexity.

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

New stream of data.

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

It could be module of existing system or separate system.

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

Mental activates are automated, complexity tool provides additional data to facilitate the traffic de-confliction well in advance.

PLANNING LAYERS

Tactical-During ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Complexity management procedure	Complexity management procedures. References: ICAO Doc 9971 Manual on Collaborative ATFM.	ANSP, ATM network function	2018
Ground system infrastructure	ATM systems	Local Traffic load	Local Traffic Load Management tool.	ANSP	2014

Ground system infrastructure	ATM systems	Local Traffic complexity	Local Traffic Complexity tools	ANSP	2016
Ground system infrastructure	ATM systems	ATFM Planned Trajectory (basic feature)	Provision and integration of ATFM Planned Trajectory.	ANSP ATM network function	2016
Ground system infrastructure	ATM systems	ATFM Planned Trajectory (enhanced feature)	Upgrade the ATFM systems with the Planned Trajectory improvements	ATM network function	2018
Ground system infrastructure	ATM systems	Network traffic complexity	Enhancements related to ATFM Traffic complexity assessment.	ATM network function	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

It is applicable only in areas with dense and complex traffic. This element needs to be addressed by the ANSPs and the ATM Network function in their endeavour to find optimum solutions to accommodate the traffic demand.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity	ANSP, ATM network function
	Cost-Efficiency	ANSP
	Improve situational awareness of network manager	ATM network function
Indirect benefits	Safety	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B1/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Overcome operational ATC service delivery limitations if these are the blocking factor	++	KPI06: En-route airspace capacity

NOPS-B1/5	Full integration of airspace management with air traffic flow management	Operational

Main Purpose

Ensure a continuous, seamless and iterative airspace management and air traffic flow management approach.

New Capabilities

Fully dynamic/rolling ASM/ ATFM integration process supporting information collection, processing and sharing with all concerned stakeholders.

Description

The full dynamic/rolling ASM/ATFM process focuses on improving airspace planning. It will ensure a continuous, seamless and iterative airspace planning and management/allocation based on airspace requests at any time period within strategic, pre-tactical and tactical ASM levels. It will result in a rolling process, supporting the enhancement of dynamic Network Operations Planning. The real time ASM data exchanges relates to the automated exchange services of ASM data during the tactical phase continuously in real time. ASM information (real-time Airspace Reservation status) is shared between different systems and Stakeholders and communicated to ATFM in the tactical phase.

Several new improvements are introduced as:

- Process/system modules supporting a full rolling ASM/ATFM and dynamic ASM/ATFM process allowing data sharing to all operational stakeholders,
- Process/System changes for initial Collaborative Decision Making (CDM) between ATFM function and the local designated authorities and between neighboring ASM actors.
- ASM information sharing addresses requirements aiming to improve the notification to airspace users based on automated data exchange processes
- Procedural and system modules for exchange of real time airspace status data;
- The Flexible Use of Airspace (FUA) process is improved with more dynamic airspace management enabling dynamic responses to airspace requests (or very short term changes)
- Real-time ASM coordination is further enhanced through "what-if" functionalities and automated support to airspace booking and airspace management.
- Real-time ASM data are exchanged between ASM support systems and ATC system
- Integration and management of ASM real-time data into ANSPs' ATM systems and into AUs flight planning systems;

The full dynamic/rolling ASM/ATFM process will be supported by the sharing of civil-military airspace data and by continuously updating Airspace Reservation information with other demand information among the authorized operational stakeholders in order to enhance the coordination of Cross-Border Operations, and to optimise the whole network operations based on the most timely and correct information. The process is enhanced with “what-if” functionalities enabling a better use of available capacity. ASM real-time data exchanges consisting of pre-notification of activation, notification of activation, de-activation, modification and release of airspace are collected, saved and processed in order to be exchanged between stakeholders and be made available to ATM actors, including Airspace Users (AUs). ATM systems need to be upgraded to exchange real-time ASM data messages containing real time activation status of predefined airspace structures with local ASM support systems and to display airspace status data at the Controller Working Position (CWP).

Maturity Level

Standardization

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? No 2. Does it imply processing of new information by the user? Yes Real time ASM data is new data stream. 3. Does it imply the use of new equipment? No 4. Does it imply a change to levels of automation? Yes Automation increased compared with B0.

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B0/1 - Initial integration of collaborative airspace management with air traffic flow management
Relation-operational need	FRTO-B1/1 - Free Route Airspace (FRA)
Relation-operational need	FRTO-B1/2 - Required Navigation Performance (RNP) routes
Relation-operational need	FRTO-B1/3 - Advanced Flexible Use of Airspace (FUA) and management of real time airspace data
Relation-operational need	FRTO-B1/4 - Dynamic sectorization

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Rolling ASM/ATFM procedure	Develop the Procedures and processes for a dynamic/rolling ASM/ATFM process. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function	2019
Operational procedures	-	ASM data sharing procedure	Develop the Procedures in support of ASM data sharing. References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function Aircraft operator	2019
Operational procedures	-	ASM real time exchanges procedure	Develop the Procedures related to real-time ASM data exchanges. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function	2019
Operational procedures	-	Advanced FUA procedure	Develop the to advanced FUA procedure. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP	2019

Operational procedures	-	Airspace changes procedure	Procedures to respond to changes submitted by Airspace users resulting from changes in airspace availability. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function	2019
Ground system infrastructure	ATM systems	Rolling ASM/ATFM	Adapt ASM/ATFM/AUs systems to support a rolling ASM/ATFM process	ANSP ATM network function Aircraft operator	2019
Ground system infrastructure	ATM systems	ASM notification process	Upgrade the ATFM System modules for improved ASM notification process	ATM network function	2019
Ground system infrastructure	ATM systems	ASM real time exchanges-ATC part	Upgrade the ATC systems for real-time ASM data exchanges	ATM network function	2019
Ground system infrastructure	ATM systems	ASM real time exchanges-ASM and ATFM part	Adapt ASM system, ATFM and AU systems for real-time ASM data exchanges	ANSP ATM network function Aircraft operator	2019
Training	-	Training requirements for full integration of ASM with ATFM	Rolling ASM/ATFCM process training. Training in new operational procedures and ground system changes	ANSP ATM network function Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

This element is an evolution of element NOPS-B0/1 and should be undertaken by all ANSPs, AUs and the ATM Network function affecting both en-route and TMA operations.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity Flight delays will be reduced through better utilisation of airspace resources within and across airspace boundaries.	ANSP Airspace user ATM network function
	Flight efficiency Increased through the chance to plan more optimum routes/trajectories allowing lower fuel burn.	Airspace user
	Improve situational awareness of network manager and airspace manager	ANSP ATM network function

Type	Operational description	Benefitting stakeholder(s)
Indirect benefits	Safety Better knowledge of traffic environment, common situational awareness, and some enhancement through reduction in controller workload.	ANSP Airspace user ATM network function

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B1/5

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Facilitate tactical decisions leading to a shorter actual route than in the FPL	++	KPI05: Actual en-route extension
Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route & airspace availability as known at the flight planning stage	++	KPI04: Filed flight plan en-route extension
Efficiency	Flight time & distance	Reduce need for tactical ATFM rerouting to circumnavigate airspace closed at short notice	++	KPI05: Actual en-route extension
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during climb introduced to avoid airspace above	++	KPI17: Level-off during climb
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during cruise introduced to avoid airspace above	++	KPI18: Level capping during cruise
Efficiency	Vertical flight efficiency	Reduce altitude restrictions during descent to avoid Special Use Airspace	++	KPI19: Level-off during descent

NOPS-B1/6 Initial Dynamic Airspace configurations Operational

Main Purpose: ASM solutions and initial dynamic airspace configurations for ATFM planning, synchronisation of traffic flows and demand/capacity balancing

New Capabilities: Availability of optimised Airspace solutions/Initial Dynamic Airspace configurations based on traffic demand and dynamic sectors management taken into account for ATFM purposes.

Description

This element addresses the following ASM/ATFM improvements:

- Airspace solutions
- Pre-defined airspace configurations
- ANSPs/ ATM Network function data exchanges pertinent to pre-defined airspace configurations

The ASM solutions process is aimed at delivering ASM options/solutions that can help reducing or even alleviate the ATFM measures and address capacity issues identified in any particular area as well as to improve flight efficiency assessing impact on capacity and ensuring the synchronised availability of optimized airspace structures based on traffic demand and dynamic sectors management.

The Airspace configurations are pre-defined and coordinated airspace structures and ATC dynamic sectorisation, to meet the ATFM and airspace needs in terms of capacity and/or flight efficiency. The implementation of pre-defined airspace configuration exchange covers the improvements of ATFM systems, to allow exchange of predefined airspace configurations information.

The decisions required for dynamic sectorisation could benefit from real time exchanges with ATM Network function for ATFM planning, synchronisation of traffic flows and demand/capacity balancing. The notification of Airspace Configurations will be based on automatic flows of information between the different stakeholders supported by the ATM Network function. The airspace configurations and flexible sector configurations are already used when the flows and constraints can be predicted well in advance (e.g. weekend routes or seasonal flows of traffic).

A more efficient and dynamic process involving the ATM Network function, ATC would require new functionalities and procedures and well defined collaborative decision making processes at pre-tactical level. The ANSPs systems needs to support the dynamic sectorisation by dynamic resizing and change of sector shapes and volumes based on pre-defined airspace configurations.

Maturity Level

Standardization

Human Factor Considerations

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

Utilisation of pre-defined airspace configuration.

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

Airspace structure and ATC sectorisation are new data information.

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

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

Manual Task are semi-automated.

PLANNING LAYERS

Strategical | Pre-tactical

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	FRTO-B0/1 - Direct routing (DCT)
Relation-operational need	FRTO-B0/2 - Airspace planning and Flexible Use of Airspace (FUA)

Relation-operational need	FRTO-B0/3 - Pre-validated and coordinated ATS routes to support flight and flow
Relation-operational need	FRTO-B1/1 - Free Route Airspace (FRA)
Relation-operational need	FRTO-B1/2 - Required Navigation Performance (RNP) routes
Relation-operational need	FRTO-B1/3 - Advanced Flexible Use of Airspace (FUA) and management of real time airspace data
Relation-operational need	FRTO-B1/4 - Dynamic sectorization

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Airspace solution procedure	Develop the ASM/ATFM procedures for airspace solution. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP, ATM network function	2016
Operational procedures	-	Predefined airspace configuration procedure	Develop the ASM/ATFM procedures for pre-defined airspace configurations. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP, ATM network function	2018
Operational procedures	-	Constrain management procedure	Develop the ASM/ATFM procedures for dynamic sectorization and constrain management. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP	2019
Ground system infrastructure	ATM systems	Airspace solution	Upgrade the ATFM system modules related to the airspace solution	ATM network function	2016
Ground system infrastructure	ATM systems	Predefined airspace configuration	Upgrade the ATFM system modules related to the pre-defined airspace configurations	ATM network function	2018
Ground system infrastructure	ATM systems	Dynamic sectorization	Enhance the ATC system capabilities with dynamic sectorization and constraint management.	ANSP	2019
Ground system infrastructure	ATM systems	Airspace configuration data exchanges (basic feature)	SWIM data exchanges for pre-defined airspace configurations	ANSP, ATM network function	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

This element will be addressed by ANSPs and the ATM Network function as required ensuring a synchronised availability of optimised airspace structures supported by dynamic sectors management to better address traffic

demand.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity	ANSP ATM network function

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS NOPS-B1/6

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Establish/update/publish the catalogue of strategic ATFM measures designed to respond to a variety of possible/typical/recurring events degrading the airspace system (e.g. predefined action plans)	++	

NOPS-B1/7 Enhanced ATFM slot swapping Operational

Main Purpose: Improve the Airspace Users driven ATFM slot swapping process

New Capabilities: The swapping of ATFM measure impacted flights within the same ATFM measure will be extended to all ATFM measure impacted flights.

Description: ATFM slot swapping allows Airspace Users (AU) to request a rearrangement of their own flights subject to an ATFM measure in order to better suit their needs. The enhanced ATFM Slot Swapping improves the slot swapping currently used by Airspace Users (AU), by allowing the function to be extended gradually to all airspace users, by re-prioritizing their flights during the pre-departure part of operations. The Enhanced Slot swapping increases flexibility for Airspace Users; and provides a wider range of possibilities, by facilitating the identification of possible swaps for an ATFM Measure impacted flight (through B2B/SWIM-based Network Operations Planning interfaces) and by reducing the rate of rejection of swap requests by refining current processes. The AUs requests for these changes in flight priority will be introduced at the initiative of the AUs themselves, airport authorities or the ATM Network function.

Maturity Level: Standardization

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes Change of tasks for many ATFM actors. 2. Does it imply processing of new information by the user? Yes New data stream for slot swapping and airport slot monitoring. 3. Does it imply the use of new equipment? Yes Change of system and interfaces. 4. Does it imply a change to levels of automation? Yes Coordination is semi-automated.

PLANNING LAYERS

Tactical-Pre ops

OPERATIONS

Departure

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B0/4 - Initial Airport/ATFM slots and A-CDM Network Interface
Relation-operational need	NOPS-B1/2 - Enhanced Network Operations Planning
Relation-operational benefit	SWIM-B2/1 - Information service provision
Relation-operational benefit	SWIM-B2/2 - Information service consumption

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Slot swapping procedure	Develop the Procedures for ATFM slot swapping. References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function Aircraft operator	2019
Ground system infrastructure	ATM systems	FOC interface to slot swapping module	Upgrade the The Flight Operations Centre (FOC) system modules with interfaces, automation, and decision-support for ATFM slot swapping	Aircraft operator	2019
Ground system infrastructure	ATM systems	ATFM slot swapping module	Enhance the ATFM systems with ATFM slot swapping capabilities supporting as well the Airport Slot Monitoring in real time	ATM network function	2019
Training	-	Training requirements for slot swapping	Slot swapping training. Train Flight Operation Centre personnel	ATM network function Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

This element will support AUs businesses by reprioritizing their flights during the pre-tactical part of operations if and as requested by them. The ATM Network function will keep all impacted stakeholders in the loop in the context of the Collaborative Decision Making processes.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Indirect benefits	Efficiency of airlines operations. Airlines cost savings related to each slot swap that is executed.	Airspace user

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B1/7

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	For a given airspace entry slot: let airspace users swap the slot to another flight (slot substitution or UDPP – User Driven Prioritisation Process)	++	

NOPS-B1/8 Extended Arrival Management supported by the ATM Network function — Operational

Main Purpose: ATM Network function contributions to extended Arrival Management.

New Capabilities: Extended Arrival Management information is taken on board by the Network ATM function to improve the quality of the ATFM service.

Description: The ATM Network function involvement in extended Arrival Management process is addressed by this element. It does include the following elements:

- Enhancements of ATFM Planned Trajectory about the accuracy/predictability of estimates to meet the extended arrival management operational requirements;
- Provision of ATFM Planned Trajectory to ANSPs;
- Reception and processing of ANSPs extended Arrival Management info by ATM Network function;
- ATFM assessment tool for extended Arrival Management.

Bilateral agreements need be established between the sectors involved that can be in different ATC units and also in different countries, including the ATM Network function for the notification purposes. The ATFM procedures need to be revised for the management of the extended Arrival Management information.

Maturity Level: Standardization

Human Factor Considerations

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

Propagation of delay further en-route will increase the task for some ATFM actors.

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

AMAN delay is propagated further en-route and the Network function is notified.

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

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

Some ATFM actors got new tasks for the optimisation of arrival traffic flows.

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	RSEQ-B1/1 - Extended arrival metering

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Extended AMAN LoA	Define the data exchanges and operational procedures with ANSP. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP, ATM network function	2017
Operational procedures	-	ATFM procedure for Extended AMAN	Develop the ATFM procedures for management of extended Arrival Management information. References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function	2017
Ground system infrastructure	ATM systems	ATFM extended AMAN module	Upgrade the ATFM system modules to support extended Arrival Management	ATM network function	2017

DEPLOYMENT APPLICABILITY

Operational conditions:

It is applicable in areas where extended AMAN tools and procedures are implemented. This element will be addressed by the ANSPs at high density TMAs, if and as required, in improving arrival management. The ATM Network function will ensure that all impacted stakeholders (different ATC units also maybe in different countries) are properly involved and appropriate ATFM actions are undertaken.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Capacity Operational Efficiency: Improved arrival flow.	ANSP, Airspace user, ATM network function
	Improve situational awareness of network managers and ANSPs	ANSP, ATM network function

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

NOPS-B1/9	Target Times for ATFM purposes	Operational

Main Purpose	Use of Target Times for ATFM purposes including an initial level of arrival sequencing in case of an arrival ATFM measure.
New Capabilities	Calculation and provision of Target Times by the ATM Network function in addition to CTOT, for the most penalised measure.
Description	In order to improve the flight predictability at the entry of the congested area, a target time of entry at the congested area (most penalised measure) will be provided by ATM Network function. At this stage, the target times will be applied for ATFM purpose only, including an initial level of arrival sequencing in case of an arrival ATFM measure. The ATM Network function will provide the calculated Target Time (TT) at the most penalising measure reference point in addition to Calculated Take-Off Time (CTOT) to all concerned users. TT will be distributed by data exchanges with the concerned Stakeholders. Stakeholders using TTs should be able to receive, extract and present the target times delivered by ATM Network function. ANSPs have access to the relevant information on flights that are subject to a Target Time to manage these flights as required in accordance with local procedures that need to be developed. The Flight Operating centres should provide Target Times to pilots prior to departure; pilots should endeavour to adhere to the Target Times to the extent possible.
Maturity Level	Standardization
Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes Target time adherence by AUs and ANSPs. 2. Does it imply processing of new information by the user? Yes Target time to be presented to affected users. 3. Does it imply the use of new equipment? No 4. Does it imply a change to levels of automation? Yes AUs and ANSPs to process and comply with target times.

PLANNING LAYERS

Tactical-Pre ops

OPERATIONS

En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	RSEQ-B1/1 - Extended arrival metering

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Target Time procedure	Develop the ATFM Target Times procedures and processes. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function Aircraft operator	2018
Ground system infrastructure	ATM systems	Target time module	Upgrade the ATFM Systems to support Target Time processing and sharing	ATM network function	2019
Ground system infrastructure	CFSP systems	Target time interface	AUs Operation Centre systems to extract and distribute Target Times	Aircraft operator	2019
Training	-	Training requirements for Target Times	Target Time training. Target Time training	ANSP Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

This element will involve ANSPs, Airspace Users and the ATM Network function in their endeavour to improve predictability of operations through the sharing and use of Target Times (Target Times Over/Target Times of Arrival).

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Predictability. Capacity	ANSP | Airspace user | ATM network function
	Improve situational awareness of ANSPs and flight crew	ANSP | Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B1/9

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	TMI-based optimisation (only impacts traffic when a TMI or restriction is manually activated for one or more constraint satisfaction points)	++	

NOPS-B2/1	Optimised ATM Network Services in the initial TBO context	Operational

Main Purpose

Optimised Air Traffic Flow and Capacity Management stemming from enhanced Trajectory prediction and further integration of ATC with ATFM.

New Capabilities

Availability of “BIG” data and enhanced statistical approaches will improve Trajectory forecast and provide more accurate and consistent end to end 4D trajectories which will in turn optimise the provision of Flow and Capacity Management Services also in the context of the global ATFM concept. New systems, tools and procedures supporting the ATFM/ATC integration (e.g. advanced STAM, TT exchanges) will be introduced.

Description

Computation and sharing of more accurate and consistent end to end 4D trajectories will constitute the basis for forecasting traffic complexity for the relevant look-ahead time horizons, improved ATFM scenario management and the provision of an enhanced common network view as a key enabler to optimise collaborative network management. Interactions between trajectory management and for instance, ATFM / STAM processes and Dynamic Airspace Configuration will be further enhanced.

Tools and systems are required for improved network prediction and performances such as:

- Tools that provide functionality for simulating, evaluating the balance between demand and capacity taking into account the data from different stakeholders;
- ATFM scenario management;
- Assessment of performance of network operations with stakeholders able to evaluate the impact of their intentions and decisions on capacity and other performance indicators;
- Automated tool supporting ATFM/ATC planning environment to manage traffic complexity in order to alleviate traffic complexity, density and traffic flow problems by planning individual trajectories using advanced planning tools;
- The management of Hotspot resolution and more frequent STAM Measures in the planning and execution phase is supported by advanced capabilities (preparation, implementation, monitoring).
- The Target-Time Management: to manage the hotspot resolution, DCB actors can constrain the Time of Entry of flights into the hotspot with TTO (Target Time Over the congested en-route point) and TTA (target Time of Arrival at congested Airport) in order to smooth the traffic.

Maturity Level

Validation

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? No 2. Does it imply processing of new information by the user? Yes Additional data are exchanged. 3. Does it imply the use of new equipment? No 4. Does it imply a change to levels of automation? Yes STAM measure coordination is automated.

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B1/1 - Short Term ATFM measures
Evolution	NOPS-B1/4 - Dynamic Traffic Complexity Management
Evolution	NOPS-B1/8 - Extended Arrival Management supported by the ATM Network function
Evolution	NOPS-B1/9 - Target Times for ATFM purposes
Relation-operational need	NOPS-B2/3 - Collaborative Network Operation Planning

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Scenario management procedure	Develop the ATFM the Scenario Management procedures. References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function	2022
Operational procedures	-	Network Performance Assessment procedure	Develop the ATFM procedures for the Network performance assessments. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator ANSP ATM network function Aircraft operator	2022
Operational procedures	-	Hotspot resolution procedure	ATFM procedures for Hotspot resolution and more frequent STAM measures. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator ANSP ATM network function Aircraft operator	2022

Operational procedures	-	Target Time reconciliation procedure	ATFM/ATC/Airport procedures for TT management. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator ANSP ATM network function Aircraft operator	2022
Ground system infrastructure	ATM systems	Further traffic complexity enhancements	Further enhancement of ATC/ATFCM traffic complexity tools	ANSP ATM network function	2024
Ground system infrastructure	ATM systems	Scenario management module	Upgrade the ATFM systems with the Scenario Management module	ATM network function	2024
Ground system infrastructure	ATM systems	Network Performance Assessment module	Upgrade the ATFM systems with the Network Performance Assessment module	Airport operator ANSP ATM network function Aircraft operator	2024
Ground system infrastructure	ATM systems	Trajectory forecast module	Develop the Trajectory forecast modules	Airport operator ANSP Airspace user ATM network function	2025
Ground system infrastructure	ATM systems	Further enhancements of STAM tool	Upgrade the ATFM system to support the management of Hotspot resolution and more frequent STAM Measures in the planning and execution phase (preparation, implementation, monitoring)	ATM network function	2024
Ground system infrastructure	ATM systems	Target Time reconciliation module	Target Time management tools for the reconciliation of extended AMAN and AOP	Airport operator ANSP ATM network function Aircraft operator	2022

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS NOPS-B2/1

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	Address demand/capacity imbalance handled at the tactical ATFM stage (on the day of operations)	++	

NOPS-B2/2 Enhanced dynamic airspace configuration Operational

Main Purpose

Improve the management of airspace including restricted / reserved areas and if possible dynamic mobile areas and fully integrate ASM with ATFM.

New Capabilities

Airspace configurations modified more dynamically based on evolutions anticipated in the forecast of traffic will be introduced. Airspace configurations will better match scarce resources with anticipated Demand and Capacity imbalances thus minimising the need for ATFM measures. The Air Traffic Flow Management and the Airspace Management will be further integrated.

Description

New concepts, systems and procedures will allow full dynamicity of airspace volumes management and sector configurations. DACs integration in ATFM will provide additional means regarding the collaborative optimisation of traffic flows (strategic, pre-tactical, tactical) making best use of available scarce resources. Airspace volumes that satisfy specific operational requirements are progressively introduced to facilitate the ATM network optimization and minimize the impact on the expected traffic flows.

Maturity Level

Validation

Human Factor Considerations

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

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

Data related to dynamic airspace configurations.

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

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

The automation of DAC process is increased.

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B1/6 - Initial Dynamic Airspace configurations
Evolution	NOPS-B1/5 - Full integration of airspace management with air traffic flow management

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	DAC procedure	Develop the ASM/ATFM procedures for DAC. References: ICAO Doc 9971 Manual on Collaborative ATFM.	ANSP ATM network function	2024
Operational procedures	-	Airspace volume procedures	Develop the ASM/ATFM procedures for Dynamic Airspace Volumes. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP ATM network function	2024
Ground system infrastructure	ATM systems	DAC/DMA integration	Enhancement of ATFM system modules related to the DAC/DMA integration	ATM network function	2024
Ground system infrastructure	ATM systems	DAC/DMA interfaces	Development of data exchange interfaces for DAC/DMA	ANSP ATM network function	2024

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B2/2

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	++	
Capacity	Capacity, throughput & utilization	Optimise en-route airspace capacity	++	

NOPS-B2/3	Collaborative Network Operation Planning	Operational

Main Purpose

Enhance Network Operation Planning to support the Collaborative Network Management in the context of more dynamic /rolling planning processes and the initial Trajectory Based Operations (TBO).

New Capabilities: System and procedures for the variety of collaborative mechanisms. It includes the tools, roles, responsibilities, rules and procedures concerning the ATFM initiation, delegation, coordination, implementation and monitoring.

Description: The Collaborative Network Operation Planning provides all the information to the ATFM actors/functions to support network and local demand capacity balancing activities as:

- Conciliating multiple constraint resolution strategies from all the stakeholders in order to identify the best measure given nature, scope and time horizon;
- The provision of network consolidated imbalances figures;
- The provision of enhanced “what-if” functionalities;
- The provision of what-else capabilities to propose alternate solution;
- The provision of Network information;
- Monitoring Network performance;
- Drawing latest information shared via SWIM.

Maturity Level: Validation

Human Factor Considerations:

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

Integration of ATC and ATFM roles.

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

New data are handled and needs to presented to ATFM and ATC planning actors.

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

In some cases. It could be handled via modules and interfaces or separate sub-systems.

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

User task for extended planning horizon are automated.

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

Departure | En-route | Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B1/2 - Enhanced Network Operations Planning
Evolution	NOPS-B1/1 - Short Term ATFM measures

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Collaborative NOP procedure	Develop the ATFM procedures for the collaborative access and update of the Network Operation Planning. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator, ANSP, ATM network function, Aircraft operator	2025

Ground system infrastructure	ATM systems	Collaborative NOP platform	Develop the Collaborative Network Operation Planning platform	ATM network function	2025
Ground system infrastructure	ATM systems	Extended ATFM functions	Upgrade the ATFM system with extended functions (consolidation of imbalances, ECDM modules “what-if” and “what-else” functions, monitoring of network performances).	ANSP ATM network function Aircraft operator	2025
Ground system infrastructure	ATM systems	Collaborative NOP SWIM interfaces	SWIM Network system interfaces with concerned Stakeholders.	Airport operator ANSP ATM network function Aircraft operator	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

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

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

NOPS-B2/4	Multi ATFM slot swapping and Airspace Users priorities	Operational

Main Purpose: Introduce s Airspace Users preferences and priorities based on their business models to select flights for ATFM measures

New Capabilities: Capabilities to accommodate Airspace Users priorities are introduced enabling AUs to recommend a priority order for flights affected by delays on departure, arrival and en-route, and to share preferences with other ATM stakeholders in capacity-constrained situations. The swapping of ATFM regulated flights will be extended/enhanced (different AUs, multi-swapping, substitution on cancelations, etc.).

Description

The multi ATFM slot swapping is supported by a tool that:

- Identification of viable swaps;
- Perform multi-swap (e.g. weather deterioration);
- Slot substitution on Cancellation: capability to substitute the ATFM slot of a cancelled flight for another flight.

The systems and tools for Airspace Users priorities include:

- AU decision making tool can interface with Airport CDM system to propose flight reordering;
- Interface with the departure sequencing tool;
- Interface with the ATM network function related to the swapped flights and actions to be undertaken (e.g. new CTOT)

Maturity Level

Validation

Human Factor Considerations

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

Change of tasks for many ATFM actors.

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

New data stream for UDPP data.

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

Change of system and interfaces.

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

Airspace Users preferences are fully taken into account.

PLANNING LAYERS

Tactical-Pre ops

OPERATIONS

Departure

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B1/7 - Enhanced ATFM slot swapping
Evolution	NOPS-B1/2 - Enhanced Network Operations Planning
Evolution	NOPS-B0/4 - Initial Airport/ATFM slots and A-CDM Network Interface
Evolution	NOPS-B0/2 - Collaborative Network Flight Updates

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Multi-swap procedures	Develop the procedures for multi ATFM slot swapping and AUs priorities. References: ICAO Doc 9971 Manual on Collaborative ATFM	ATM network function Aircraft operator	2025

Ground system infrastructure	CFSP systems	Multi Swap /UDPP interfaces	The Flight Operations Centre (FOC) system modules with tools and interfaces for multi ATFM slot swapping and UDPP	Aircraft operator	2025
Ground system infrastructure	Airport systems	Airport modules for AUs priority	Upgrade the Airport system adapted to accommodate AUs priorities	Airport operator	2025
Ground system infrastructure	ATM systems	Multi Swap /UDPP modules	Develop the ATFM Tool for ATFM multi-swap and AUs priorities	ATM network function	2025
Training	-	Training requirements for multi slot swapping	Multi Swap /UDPP training. Train Flight Operation Centre personnel	Airport operator ATM network function Aircraft operator	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS NOPS-B2/4

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity shortfall & associated delay	For a given airspace entry slot: let airspace users swap the slot to another flight (slot substitution or UDPP – User Driven Prioritisation Process)	++	

NOPS-B2/5	Further airport integration within Network Operation Planning	Operational

Main Purpose: Integrated Network planning with additional Airport Operation Planning (AOP) components into the Network Operation Planning.

New Capabilities: Additional AOP components (airport performance data, airport constrains, landside part) will be integrated with the enhanced Network operations planning.

Description

The integration of additional AOP data within the Network operations planning provides an enhanced dynamic/rolling picture of the network situation to be used by all operational stakeholders to prepare their plans and their inputs to the network CDM processes. The data exchanges are based on the subset of SWIM services that are most widely available to all stakeholders, communicating with local airport A-CDM systems to exchange relevant operational information.

The concept aims to improve integration of departure planning data from medium/small size airports when serving a complex airspace with dense traffic through improved availability of aircraft pre-departure information to the ATM Network function by specific TWR tools providing accurate electronic pre-departure information.

Maturity Level

Validation

Human Factor Considerations

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

Manual coordination is automated.

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

Extended AOP/NOP interfaces contain an additional set of data items.

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

In some cases. New modules and interfaces.

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

Reduced need for phone coordination.

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B0/4 - Initial Airport/ATFM slots and A-CDM Network Interface
Evolution	ACDM-B1/1 - Airport Operations Plan (AOP)
Evolution	NOPS-B1/3 - Enhanced integration of Airport operations planning with network operations planning
Relation-operational need	NOPS-B2/2 - Enhanced dynamic airspace configuration

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Enhanced AOP/NOP procedure	Develop the ATFM/Airport procedures for additional AOP components/Network Operation Planning integration. References: ICAO Doc 9971 Manual on Collaborative ATFM	Airport operator ATM network function	2025

Ground system infrastructure	Airport systems	Enhanced AOP	Enhance the Airport Operations Plan (AOP) with additional components	Airport operator	2025
Ground system infrastructure	ATM systems	Enhanced AOP/NOP interface	Develop the Advanced AOP/Network Operations Planning interfaces	Airport operator ATM network function	2025
Ground system infrastructure	ATC systems	ATC DPI	Enhance the TWR systems for provision of ATC departure planning data	ANSP	2016
Ground system infrastructure	ATM systems	ATC DPI integration	Departure planning data interface and integration	ANSP ATM network function	2016

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of network manager, airport operator, aircraft operator and ATCOs.	Airport operator, ANSP, ATM network function, Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

NOPS-B2/6	ATFM adapted for cross-border Free Route Airspace (FRA)	Operational

Main Purpose: Adapt ATFM to accommodate cross border Free Route operations.

New Capabilities: The ATFM system tools and procedures are adapted to support the complexity management, demand capacity balancing and ATFM/ATC integration for large cross border FRA deployments.

Description: Large cross-border FRA will require the modification of existing ATFM tools and processes as:

- Demand Prediction Uncertainty in FRA environment;
- Complexity methodologies in FRA environment;
- STAM measures managed in FRA environment;
- ATFM/ATC integration in FRA environment.

Maturity Level: Validation

Human Factor Considerations

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

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

Additional and more complex data are exchanged (hotspot resolution, prediction uncertainty).

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

In some cases. It could be considered as upgrade of existing tool via new modules and interfaces, or development of new tool with SWIM interfaces.

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

The level of automation compared with B0 and B1 elements is increased.

PLANNING LAYERS

Strategical | Pre-tactical | Tactical-Pre ops

OPERATIONS

En-route

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	NOPS-B1/1 - Short Term ATFM measures
Evolution	NOPS-B1/4 - Dynamic Traffic Complexity Management
Evolution	FRTO-B1/2 - Required Navigation Performance (RNP) routes
Relation-operational need	NOPS-B2/3 - Collaborative Network Operation Planning

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	Cross-border FRA procedure	Develop the ATFM/ ATC procedures for the large cross border FRA. References: ICAO Doc 9971 Manual on Collaborative ATFM	ANSP, ATM network function	2016
Ground system infrastructure	ATM systems	Integration of ATFM/ATC planning function	Develop the tools supporting the integration of ATFM/ATC planning function	ANSP, ATM network function	2025
Ground system infrastructure	ATM systems	Advanced STAM tool	Upgrade the ATFM system to support the management of Hotspot resolution and more frequent STAM Measures in the planning and execution phase (preparation, implementation, monitoring)	ATM network function	2024
Ground system infrastructure	ATM systems	Traffic Complexity enhancements	Further enhancement of ATC/ATFCM traffic complexity tools	ANSP, ATM network function	2024

Ground system infrastructure	ATM systems	Traffic prediction module	Develop the Demand Prediction Uncertainty tools	ATM network function	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of network manager	ATM network function

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

NOPS-B2/6

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	++	
Capacity	Capacity, throughput & utilization	Optimise en-route airspace capacity	++	