ICAO GANP PORTAL

ASBU ELEMENTS

ACAS ACDM AMET APTA

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

ACAS

ACAS-B1/1	ACAS Improvements	Operational

☐ Sixth edition of the GANP

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)
Direct benefits	Improve situational awareness of flight crew	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve mid-air collision avoidance (safety net)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)

ACAS-B2/1 New collision avoidance system Operational

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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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve mid-air collision avoidance (safety net)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)

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

☐ Sixth edition of the GANP

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve mid-air collision avoidance (safety net)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)

ACDM

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

☐ Sixth edition of the GANP

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)
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-B0/2 Integration with ATM Network function Operational

☐ Sixth edition of the GANP

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)
Direct benefits	Efficiency of Operations	Airport operator, ANSP, Aircraft operator
	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-B2/1 Airport Operations Plan (AOP) Operational

☐ Sixth edition of the GANP

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-B2/2 - 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 (total) Airport Management (Doc xxxx)	Airport operator ANSP ATM network function Aircraft operator	2025
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-B2/2	Airport Operations Centre (APOC)	Operational

☐ Sixth edition of the GANP

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-B2/1 - 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 (total) Airport Management	Airport operator ANSP ATM network function Aircraft operator Ground handling agent	2025
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)
	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-B2/3 Total Airport Management (TAM) Operational

☐ Sixth edition of the GANP

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).	ANSP ATM network function	2024

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

ACDM-B3/1 Full integration of ACDM and TAM in TBO Operational

☐ Sixth edition of the GANP

Main Purpose

To use the integration of ACDM in the overall synchronization of the ATM network, to contribute to end-to-end stable, consistent and robust trajectory-based operations providing the adequate level of performance.

New Capabilities

ACDM is fully synchronized with TBO.

Description

All stakeholders are fully connected. All tactical decisions are fully synchronized and operations are fully trajectory-based. Aerodrome operations are considering the en-route to en-route view with the turnaround process, agree on, and subsequently manage the flights on the surface, to deliver expected surface event times with known impacts to the ATM system, and to ensure that the agreed trajectory is consistent with the Airport Operations Plan.

ACDM is contributing to the network based, efficiently-converging coordination process as a subcomponent of the overall ATM network synchronization process.

Maturity Level

Concept

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

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

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Information exchange model	Flight and flow information	Flight Information Exchange Model (FIXM) Version 4.2.0	References: PANS-ATM ICAO Doc 4444 - Procedures for Air Navigation Services and ICAO Doc 9965- FF-ICE Manual 1st Edition.	ANSP ATM network function	2020
Operational procedures	Operations	Operational procedures to support operations within a full integrated TAM	Procedures for data sharing, management and decision making within the APOC. References: Manual on Collaborative Air Traffic Flow Management (ATFM) (Doc 9971) Trajectory Based Operations Concept Manual on the System-wide Information Management (SWIM) Concept (Doc 10039)	Airport operator ANSP ATM network function Aircraft operator Ground handling agent	2031
Operational procedures	Operations	Operational procedures to support integrated TAM Landside	Landside Operational procedures for passenger and luggage management.	Airport operator Aircraft operator	2031
Ground system infrastructure	-	Information sharing systems in support of the integration of TAM	Implementation of SWIM information services to support the exchange of information between the APOC actors. References: Manual on the System-wide Information Management (SWIM) Concept (Doc 10039)	Airport operator ANSP ATM network function Aircraft operator Ground handling agent	2031

Training	-	Training requirements for integrated TAM	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	2031

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

AMET

AMET-B0/1	Meteorological observations products	Information

☐ Sixth edition of the GANP

Main Purpose: Meteorological observations in support of flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning.

New Capabilities: Provision of observations of additional meteorological parameters/elements. More automated observations. Higher temporal and spatial resolution for lightning, radar and satellite information.

Description: This element represents the provision of meteorological observational products including:

- Automatic Weather Observation System (AWOS) information (including real-time exchange of wind and RVR data)
- Local reports (MET REPORT / SPECIAL)
- Aerodrome reports (METAR / SPECI)
- Lightning information
- Ground-based weather radar information
- Meteorological satellite imagery
- Aircraft meteorological report (ie. ADS-B, AIREP, AMDAR etc.)
- Vertical wind and temperature profiles
- Volcano Observatory Notice for Aviation (VONA)
- Wind shear alerts

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

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-technology benefit	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)
Relation-technology benefit	COMS-B0/2 - ADS-C (FANS 1/A) for procedural airspace
Relation-technology need	COMI-B0/7 - ATS Message Handling System (AMHS)
Relation-technology benefit	COMI-B0/1 - Aircraft Communication Addressing and Reporting System (ACARS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of meteorological observations products	Amendment to national regulations to include changes to the provision of quality-assured meteorological observation products to support flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Doc. 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	CAA	2013

Operational procedures	Information exchange	Procedures for the provision of meteorological observations products	Procedures for changes to the provision of quality-assured meteorological observation products, including additional meteorological parameters and higher spatial and temporal resolution observations. References: • WMO No.8 - Guide to Meteorological Instruments and Methods of Observation • WMO No.306 - Manual on Codes – International Codes • WMO No.731 – Guide to Meteorological Observing and Information Distribution Systems for Aviation Weather Services • WMO No.732 - Guide to Practices for Meteorological Offices Serving Aviation • WMO No.782 – Aerodrome Reports and Forecasts • WMO No.1100 - Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services • Doc. 7488 – Manual of the ICAO Standard Atmosphere • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9328 - Manual of Runway Visual Range Observing and Reporting Practices • Doc 9837 - Manual on Automatic Meteorological Observing Systems at Aerodromes	ANSP MET Information Service Provider	2013
Airborne system capability	Aircraft system	Transmission of meteorological observations data from aircraft	Onboard sensors and communication means for the measurement and transmission of meteorological data by: ACAR, Mode-S, ADS-B & ADS-C.	Aircraft manufacturer	2013
Ground system infrastructure	Information exchange	Automated systems and infrastructure to support the provision of meteorological observations products	Meteorological instrumentation, IT systems and communications infrastructure for the measurement, storage, display and transmission (including AFS) of meteorological observations products. References: • WMO No.8 - Guide to Meteorological Instruments and Methods of Observation • Annex 10 - Aeronautical Telecommunications	Airport operator ANSP MET Information Service Provider	2013
Training	-	Training requirements for the provision of meteorological observations products	Training for meteorological personnel and aviation industry stakeholders on meteorological observations products. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2013

AMET-B0/2	Meteorological forecast and warning products	Information

☐ Sixth edition of the GANP

Main Purpose: Meteorological forecasts, advisories and warnings in support of flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning.

New Capabilities: Improved visualisation of meteorological forecast products. Greater resolution (spatial and temporal) of gridded WAFS information (e.g. wind, temperature, icing, turbulence, CB clouds).

Description: This element represents the provision of meteorological forecast (including advisory and warning) products including:

- World Area Forecast System (WAFS) gridded products
- Significant Weather (SIGWX)
- Low-level Area Forecast (GAMET)
- Aerodrome Forecast (TAF)
- Trend Forecast (TREND)
- Take-off Forecast
- Tropical Cyclone Advisory (TCA)
- Volcanic Ash Advisory (VAA)
- AIRMET
- SIGMET
- Aerodrome Warning
- Wind Shear Warning

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? 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 | En-route | Arrival | Taxi-in | Turn-around

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	AMET-B0/1 - Meteorological observations products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Regulatory provisions	National regulatory framework	National framework amendment for the provision of meteorological forecast products and warnings	Amendment to national regulations to include changes to the provision of quality-assured meteorological forecast and warning products to support flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Doc. 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	CAA	2013
Operational procedures	Information exchange	Procedures for the provision of Meteorological forecast products and warnings	Procedures for changes to the provision of quality-assured meteorological forecast and warning products, including improved visualisation and higher spatial and temporal resolution of gridded products. References: • WMO No.306 - Manual on Codes – International Codes • WMO No.732 - Guide to Practices for Meteorological Offices Serving Aviation • WMO No.782 – Aerodrome Reports and Forecasts • WMO No.1100 - Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services • Doc. 7488 – Manual of the ICAO Standard Atmosphere • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9691 - Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds • Doc. 9766 - Handbook on the International Airways Volcano Watch (IAVW) • Regional SIGMET Guides	ANSP MET Information Service Provider	2013
Training	-	Training requirements for the provision of meteorological forecast products and warnings	Training for meteorological personnel and aviation industry stakeholders on meteorological forecast and warning products. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2013

Ground system infrastructure	Information exchange	Systems and infrastructure to support the provision of meteorological forecast and warning products	IT systems and communications infrastructure for the storage, forecasting, display and transmission (including AFS) of meteorological forecast and warning products. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2013

AMET-B0/3 Climatological and historical meteorological products — Information

☐ Sixth edition of the GANP

Main Purpose

Climatological products in support of the design and planning of infrastructure, flight routes and airspace management. Historical meteorological observations, forecasts, advisories and warnings in support of incident and accident investigations.

New Capabilities

Nil

Description

This element represents the provision of climatological products including:

- Aerodrome climatological tables;
- Aerodrome climatological summaries.

This element also represents the provision of historical products including meteorological observations, forecasts, advisories and warnings.

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

Post operations

OPERATIONS

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	AMET-B0/1 - Meteorological observations products

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of climatological meteorological information products	Amendment to national regulations to include changes to the provision of climatological and historical meteorological products in support of the design and planning of infrastructure, flight routes and airspace management and to support incident and accident investigations. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management	CAA	2013
Operational procedures	Information exchange	Procedures for the provision of climatological meteorological information products	Procedures for changes to the provision of climatological and historical meteorological, including aerodrome climatological tables and summaries. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2013
Training	-	Training requirements for the provision of climatological meteorological information products	Training for meteorological personnel and aviation industry stakeholders on climatological and historical meteorological products. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2013
Ground system infrastructure	Information exchange	Systems and infrastructure to support the provision of climatological meteorological products	IT systems and communications infrastructure for the storage, display and transmission (including AFS) of climatological meteorological products. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2013

AMET-B0/4	Dissemination of meteorological products	Information

☐ Sixth edition of the GANP

Main Purpose: Dissemination of meteorological products in support of flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning

New Capabilities: Commencement of the exchange of meteorological information using the ICAO Meteorological Information Exchange Model (IWXXM), being the conversion of Traditional Alphanumeric Code (TAC), using an IWXXM schema, into XML/GML.

Description: This element represents the dissemination of meteorological products using a variety of formats and means.

Formats include:

- TAC
- Gridded
- Graphical (i.e., PNG format)
- BUFR code
- IWXXM (in XML/GML)

Dissemination means includes aeronautical fixed service (AFTN with increasing use of AMHS), and via secure internet services (ie. WIFS/SADIS).

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

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

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	AMET-B0/1 - Meteorological observations products
Relation-operational need	AMET-B0/2 - Meteorological forecast and warning products
Relation-technology need	COMI-B0/7 - ATS Message Handling System (AMHS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Regulatory provisions	National regulatory framework	National framework amendment for meteorological information exchange	Amendment to national regulations to include changes to the dissemination of meteorological products in support of flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • Annex 10 – Aeronautical Telecommunications • Annex 15 - Aeronautical Information Services	CAA	2013
Operational procedures	Information exchange	Procedures for meteorological information exchange	Procedures for changes to the dissemination of meteorological products, including the exchange of meteorological information using the ICAO Meteorological Information Exchange Model (IWXXM). References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9377 – Manual on the Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services • Doc. 9855 - Guidelines on the use of the Public Internet for Aeronautical Applications • Doc. 9880 - Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols • Doc. 9896 – Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocol • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP MET Information Service Provider	2013

Ground system infrastructure	Information exchange	Communications infrastructure for meteorological information exchange	Ground system infrastructure and dissemination systems for meteorological products, including message switching systems and the roll-out of the Aeronautical Message Handling System (AMHS) to replace the Aeronautical Fixed Telecommunications Network (AFTN). References: • Doc. 9880 - Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols • Doc. 9896 – Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocol; • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP MET Information Service Provider	2013
Training	-	Training for meteorological information exchange	Training for meteorological and aviation IT personnel, including NOC/ROC/RODB/IROG personnel on the exchange of meteorological products. References: • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP MET Information Service Provider	2013
Information exchange model	Meteorological information	ICAO Meteorological Information Exchange Model (IWXXM) V1-V2	ICAO Meteorological Information Exchange Model (IWXXM) schema used to enable the provision meteorological information in XML/GML form. Version 1.1 supported Annex 3 amendment 76 (2013). Version 2.1 supported Annex 3 amendment 77 (2016). References: • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • WMO IWXXM Wiki: https://wiswiki.wmo.int/tiki-index.php?page=IWXXM&structure=WIS+up	ANSP MET Information Service Provider	2013

AMET-B1/1 Meteorological observations information Information

☐ Sixth edition of the GANP

Main Purpose Meteorological observations information in support of automated decision processes or aids and performance based requirements, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support.

New Capabilities

Commencement of change from product-centric to data-centric information. Commencement of space weather and sulphur dioxide (SO2) services. Enhanced hazardous weather services. Indroduction of new and enhanced space-based observations. Introduction of new observational information from both un-manned and manned aircraft (ie. observations from lidar).

Description

Meteorological observations will begin to transition from traditional alphanumeric code (TAC) form to data-centric information to better support the common understanding on the various operational constraints, capabilities and needs. The following SWIM-compliant observational parameters and phenomena will begin to be made available to users and will include:

- Wind speed and direction (aerodrome) including gusts
- Wind speed and direction from departure to Top of Climb (TOC) and then Top of Descent (TOD) to landing
- Wind speed and direction en-route
- Air temperature and dew point temperature (aerodrome)
- Air temperature and dew point temperature (or equivalent, i.e. humidity) from departure to TOC and then TOD to landing (including the following derived outputs: freezing level, lower tropospheric temperature inversions)
- Air temperature and dew point temperature (or equivalent) en-route
- Pressure (aerodrome) (i.e. QNH/QFE)
- Visibility (aerodrome) (horizontal, slant, vertical), Runway visual range (RVR)
- Cloud type (of operational significance)
- Cloud coverage, bases, tops and layers
- Thunderstorms, Lightning, Convection (TCU & CB)
- Precipitation (ie. drizzle, rain, freezing rain, snow, hail)
- Weather (ie. dust storm, sand storm, funnel cloud, squall, smoke, haze, mist, fog)
- Icing, including airframe and engine
- Liquid Water Content, Iced Water Content
- Turbulence, Mountain waves, Wind shear
- Fronts
- Radioactive clouds, Toxic chemicals
- Tropical cyclones
- Volcanic ash
- Sulphur dioxide (SO2) and other hazardous gases
- Aerodrome surface (runway) temperature, state
- Sea temperature, state and wave height (seaports)
- Space weather events
- Tsunami, Flood

Characteristics of the meteorological information include:

- Time (ie. observation time)
- Units of measurement
- Resolution (spatial)
- Geo Location (2D/3D/4D context, point, line or polyhedron)
- Movement
- Severity, Accumulation, Intensity
- Range (Max. – Min.)
- Variations
- Data sample period
- Auto or Human (Observed, Measured or Calculated)
- Amendment / Correction
- Operational Status
- Source

- Thresholds
- Format (TAC, Gridded, Graphical, IWXXM)
- Data quality flag
- Runway identification or location identifier
- Effects/impact on aviation systems (i.e. communications, navigation & surveillance systems)
- Radiation (exposure)

An increase in the use of performance measures (via compliance, availability and regularity indices) of meteorological observations.

Maturity Level: Standardization

Human Factor Considerations:

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

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B0/1 - Meteorological observations products
Relation-technology benefit	COMS-B1/2 - PBCS approved ADS-C (FANS 1/A+) for procedural airspace
Relation-technology need	COMI-B0/7 - ATS Message Handling System (AMHS)
Relation-technology need	COMI-B0/1 - Aircraft Communication Addressing and Reporting System (ACARS)
Relation-technology need	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Regulatory provisions	National regulatory framework	National framework amendment for the provision of meteorological observations information	Amendment of national regulations to include the provision of quality-assured meteorological observations information in support of automated decision processes or aids and performance based requirements, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed • Doc. 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	CAA	2019
Operational procedures	Information exchange	Procedures for the provision of meteorological observations information	Procedures for changes to the provision of quality-assured meteorological observations information, including space weather. References: • WMO No.8 - Guide to Meteorological Instruments and Methods of Observation • WMO No.306 - Manual on Codes – International Codes • WMO No.731 – Guide to Meteorological Observing and Information Distribution Systems for Aviation Weather Services • WMO No.732 - Guide to Practices for Meteorological Offices Serving Aviation • WMO No.782 – Aerodrome Reports and Forecasts • WMO No.1100 - Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services • Doc. 7488 – Manual of the ICAO Standard Atmosphere • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9328 - Manual of Runway Visual Range Observing and Reporting Practices • Doc 9837 - Manual on Automatic Meteorological Observing Systems at Aerodromes • Doc. 10100 – Manual on Space Weather Information in Support of Air Navigation	ANSP MET Information Service Provider	2019

Airborne system capability	Aircraft system	Transmission of meteorological observations information from aircraft	Onboard sensors and communication means for the measurement and transmission of meteorological information by: ACAR, Mode-S, ADS-B & ADS-C	Aircraft manufacturer	2019
Ground system infrastructure	Information exchange	Automated systems and infrastructure to support the provision of meteorological observations information	Meteorological instrumentation, IT systems and communications infrastructure for the measurement, storage, display and transmission (including AFS) of meteorological observations information. References: • WMO No.8 - Guide to Meteorological Instruments and Methods of Observation • Annex 10 - Aeronautical Telecommunications	Airport operator ANSP MET Information Service Provider	2019
Training	-	Training requirements for meteorological observations information	Training for meteorological personnel and aviation industry stakeholders on meteorological observations information. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2019

AMET-B1/2 Meteorological forecast and warning information Information

☐ Sixth edition of the GANP

Main Purpose

Meteorological forecast and warning information for automated support for decision processes or aids and performance based requirements, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision processes.

New Capabilities

Commencement of change from product-centric to data-centric information. Commencement of space weather and sulphur dioxide (SO2) services. Enhanced hazardous weather services. First steps in the provision of probabilistic information derived from ensemble prediction systems.

Description

Meteorological forecasts and warnings will begin to transition from traditional alphanumeric code (TAC) form to data-centric information to better support the common understanding on the various operational constraints, capabilities and needs. The following SWIM-compliant forecast parameters and phenomena will begin to be made available to users and will include:

- Wind speed and direction (aerodrome) including gusts and operationally significant wind shifts
- Air temperature and dew point temperature (aerodrome)
- Upper level:
  - Wind (speed and direction), including departure to Top of Climb (TOC) and then Top of Descent (TOD) to landing
  - Air temperature and dew point temperature or equivalent (i.e. humidity), including height of freezing level and lower tropospheric temperature inversions
- Flight level and temperature of tropopause

- Geopotential altitude for flight levels
- Pressure (aerodrome) (i.e. QNH, QFE)
- Visibility (aerodrome), Runway visual range (RVR)
- Cloud type (of operational significance)
- Cloud coverage, bases, tops and layers
- Thunderstorms, Lightning, Convection (TCU & CB)
- Precipitation (ie. drizzle, rain, freezing rain, snow, hail)
- Weather (ie. dust storm, sand storm, funnel cloud, squall, smoke, haze, mist, fog)
- Icing (airframe and engine),
- Liquid Water Content, Iced Water Content
- Turbulence, Mountain waves, Wind shear
- Fronts
- Radioactive clouds, Toxic chemicals
- Tropical cyclones
- Volcanic ash
- Sulphur dioxide (SO2) and other hazardous gases
- Aerodrome surface (runway) temperature, state
- Sea temperature, state and wave height (seaports)
- Space weather events
- Tsunami, Flood

Characteristics of the meteorological information include:

- Time (ie. issue time, validity, commencement/cessation, lead time)
- Units of measurement
- Resolution (temporal & spatial)
- Geo Location (2D/3D/4D context, point, line or polyhedron)
- Movement
- Severity, Accumulation, Intensity
- Range (Max. – Min.)
- Variations
- Probability of occurrence
- Confidence/Uncertainty of forecast
- Reliability
- Data sample period
- Auto
- Change indicator/period
- Amendment / Correction
- Operational Status
- Source
- Thresholds
- Format (TAC, Gridded, Graphical, IWXXM)
- Data quality flag
- Runway identification or location identifier
- Effects/impact on aviation systems (i.e. communications, navigation & surveillance systems)
- Radiation (exposure)

Human-readable meteorological advisory and warning products start to be derived from the meteorological information/data to better suit user needs and can be based on user defined thresholds. Meteorological information to be used to assess impact.

Verification of quality (accuracy) of forecast parameters. An increased use performance measures (via compliance, availability and regularity indices) of forecast parameters.

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

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B0/2 - Meteorological forecast and warning products
Relation-operational need	AMET-B1/1 - Meteorological observations information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of meteorological forecast and warnings information	Amendment to national regulations to include changes to the provision of meteorological forecast and warning information in support of automated decision processes or aids and performance based requirements, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed • Doc. 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	CAA	2019

Operational procedures	Information exchange	Procedures for the provision of meteorological forecast and warnings information	Procedures for changes to the provision of quality-assured meteorological forecast and warning information, including commencement of the change from product-centric to data-centric information, space weather, enhanced hazardous weather services and the provision of probabilistic information derived from ensemble prediction systems. References: • WMO No.306 - Manual on Codes – International Codes • WMO No.732 - Guide to Practices for Meteorological Offices Serving Aviation • WMO No.782 – Aerodrome Reports and Forecasts • WMO No.1100 - Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services • Doc. 7488 – Manual of the ICAO Standard Atmosphere • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9691 - Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds • Doc. 9766 - Handbook on the International Airways Volcano Watch (IAVW) • Doc. 10100 – Manual on Space Weather Information in Support of Air Navigation • Regional SIGMET Guides	ANSP MET Information Service Provider	2019
Training	-	Training requirements for Meteorological forecast and warning information	Training for meteorological personnel and aviation industry stakeholders on meteorological forecast and warning information. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2019
Ground system infrastructure	Information exchange	Systems and infrastructure to support the provision of meteorological forecast and warning information	IT systems and communications infrastructure for the storage, forecasting, display and transmission (including AFS) of meteorological forecast and warning information. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2019

AMET-B1/3	Climatological and historical meteorological information	Information

☐ Sixth edition of the GANP

Main Purpose: Climatological information in support of the design and planning of infrastructure, flight routes and airspace management. Historical meteorological observations, forecasts, advisories and warnings in support of incident and accident investigations.

New Capabilities: Enhanced climatological data.

Description: This element represents the provision of climatological information for the range of meteorological parameters and phenomena and their associated characteristics (metadata).

This element also represents the provision of historical information including meteorological observations and forecasts and their associated characteristics (metadata).

Climatological information services will be required to support the design and planning of infrastructure, flight routes and airspace management. The following climatology parameters and phenomena will begin to be made available to users and will include:

- En-route winds
- Airport parameters (i.e. air and surface temperature, wind, precipitation, etc.)

Characteristics of the climatological information will include:

- Averages (daily/monthly/yearly) over 10, 20, 30, 50 years
- Extremes over 1, 5, 10, 20, 30 years, since start of measurement

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

Post operations

OPERATIONS

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B0/3 - Climatological and historical meteorological products
Relation-operational need	AMET-B1/1 - Meteorological observations information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Operational procedures	Information exchange	Procedures for the provision of climatological meteorological information	Procedures for changes to the provision of climatological and historical meteorological information, including en-route winds and enhanced information for the terminal area. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2019
Training	-	Training requirements for climatological meteorological information	Training for meteorological personnel and aviation industry stakeholders on climatological and historical meteorological information. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2019
Regulatory provisions	National regulatory framework	National framework amendment for the provision of climatological meteorological information	Amendment to national regulations to include changes to the provision of climatological and historical meteorological information in support of the design and planning of infrastructure, flight routes and airspace management and to support incident and accident investigations. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed	CAA	2019
Ground system infrastructure	Information exchange	Systems and infrastructure to support the provision of climatological meteorological information	IT systems and communications infrastructure for the storage, display and transmission (including AFS) of climatological meteorological information. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2019

AMET-B1/4	Dissemination of meteorological information	Information

☐ Sixth edition of the GANP

Main Purpose

Dissemination of meteorological information in support of automated decision process or aids, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support.

New Capabilities

Meteorological information in ICAO Meteorological Information Exchange Model (IWXXM) form starts to replace traditional alphanumeric code (TAC) products. Human-readable products will start to be derived from the IWXXM information (rather than the other way around). The introduction of web services allows for progressive replacement of fixed line dissemination systems.

Description

This element represents the dissemination of meteorological products using a variety of formats, including:

- Tailored products (human-readable)
- Impact-translated products
- Gridded
- Graphical (PNG and BUFR to be phased out)
- ICAO Meteorological Information Exchange Model (IWXXM) format
- Traditional alphanumeric code (TAC) – being phased out

Dissemination means include aeronautical fixed service (ie. AMHS) and via secure internet services (ie. WIFS/SADIS). Commencement of SWIM-compliant web service capability to access the exact meteorological information required by users (in terms of geographical coverage, resolution etc).

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

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B0/4 - Dissemination of meteorological products
Relation-operational need	AMET-B1/1 - Meteorological observations information
Relation-operational need	AMET-B1/2 - Meteorological forecast and warning information
Relation-technology need	COMI-B0/7 - ATS Message Handling System (AMHS)
Relation-information need	DAIM-B1/1 - Provision of quality-assured aeronautical data and information
Relation-information need	DAIM-B1/2 - Provision of digital Aeronautical Information Publication (AIP) data sets

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Information exchange	Procedures for the dissemination of meteorological information	Procedures for changes to the dissemination of meteorological information, including the exchange of meteorological information using the latest version of the ICAO Meteorological Information Exchange Model (IWXXM). References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9377 – Manual on the Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services • Doc. 9855 - Guidelines on the use of the Public Internet for Aeronautical Applications • Doc. 9880 - Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols • Doc. 9896 – Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocol • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • Doc. 10039 - Manual on System Wide Information Management (SWIM) Concept • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • WMO No.731 – Guide to Meteorological Observing and Information Distribution Systems for Aviation Weather Services • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP MET Information Service Provider	2019
Ground system infrastructure	Information exchange	Communication infrastructure for meteorological information exchange	Ground system infrastructure and dissemination systems for meteorological information, including the implementation of the Aeronautical Message Handling System (AMHS). References: • Doc. 9880 - Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols • Doc. 9896 – Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocol; • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP MET Information Service Provider	2019

Information exchange model	Meteorological information	ICAO Meteorological Information Exchange Model (IWXXM) V3	ICAO Meteorological Information Exchange Model (IWXXM) schema used to enable the provision meteorological information in XML/GML form. Version 3 supporting Annex 3 amendment 78 (2018). References: • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • WMO IWXXM Wiki: https://wiswiki.wmo.int/tiki-index.php?page=IWXXM&structure=WIS+up	ANSP MET Information Service Provider	2019
Training	-	Training for the dissemination of meteorological information	Training for meteorological and aviation IT personnel, including NOC/ROC/RODB/IROG personnel on the exchange of meteorological information. References: • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP MET Information Service Provider	2019
Regulatory provisions	National regulatory framework	National framework amendment for the dissemination of meteorological information	Amendment to national regulations to include changes to the dissemination of meteorological information in support of automated decision process or aids, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed • Annex 10 – Aeronautical Telecommunications • Annex 15 - Aeronautical Information Services	CAA	2019

AMET-B2/1	Meteorological observations information	Information

☐ Sixth edition of the GANP

Main Purpose: Integrated meteorological observations in support of enhanced ATM and airport decision-making processes, particularly in the near-term.

New Capabilities: Further development of space weather observation services. Further development of services for terminal areas. Implementation of information services to support a data-centric environment. Higher spatial and temporal resolution of meteorological observations. Automated observations which will support user-defined services using meteorological information in ICAO Meteorological Information Exchange Model (IWXXM) form.

Description: This module builds on the meteorological information services defined in AMET-B1. Full MET-ATM integration will ensure that meteorological information is included in the logic of a decision process and the impact of the meteorological conditions on the operations are automatically derived, understood and taken into account. Increased situational awareness to support tactical in-flight avoidance of hazardous meteorological conditions.

Recognising that space weather affecting the earth's surface or atmosphere pose a hazard to communications and navigation systems and may also pose a radiation risk to flight crew members and passengers, this module builds on AMET-B1 for space weather information services in support of safe and efficient international air navigation, particularly in the area of regional services.

Considering the impact of adverse meteorological conditions on high traffic density terminal areas around major aerodromes and air traffic management operations within those areas as well as the increasing requirements by airspace users to be able to optimise their flight profile, this module acknowledges the need to provide meteorological information services with the accuracy, resolution and frequency to support ATM operations within those areas.

Meteorological observations will increasingly include performance measurement (via compliance, availability and regularity indices).

It is assumed that aircraft will be equiped for meteorological information display capabilities, such as EFBs. Taking advantage of enhanced aircraft connectivity to maximise observation functionality of aircraft.

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 | Post operations

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element

Evolution	AMET-B1/1 - Meteorological observations information
Relation-technology benefit	ASUR-B2/1 - Evolution of ADS-B and Mode S
Relation-technology option	COMS-B2/2 - PBCS Approved ADS-C (B2) for domestic and procedural airspace
Relation-technology option	SWIM-B2/4 - Air/Ground SWIM for non-safety critical information
Relation-technology need	SWIM-B2/1 - Information service provision

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of meteorological observations information in a SWIM environment	Amendment of national regulations to include the provision of integrated meteorological observations information in a SWIM environment in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed • Doc. 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	CAA	2025

Operational procedures	Information exchange	Procedures for the provision of meteorological observations information in a SWIM environment	Procedures for changes to the provision of integrated meteorological observations information in a SWIM environment, including enhanced terminal area, space weather, sulphur dioxide (SO2) and radioactive material services. References: • WMO No.8 - Guide to Meteorological Instruments and Methods of Observation • WMO No.306 - Manual on Codes – International Codes • WMO No.731 – Guide to Meteorological Observing and Information Distribution Systems for Aviation Weather Services • WMO No.732 - Guide to Practices for Meteorological Offices Serving Aviation • WMO No.782 – Aerodrome Reports and Forecasts • WMO No.1100 - Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services • Doc. 7488 – Manual of the ICAO Standard Atmosphere • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9328 - Manual of Runway Visual Range Observing and Reporting Practices • Doc 9837 - Manual on Automatic Meteorological Observing Systems at Aerodromes • Doc. 10100 – Manual on Space Weather Information in Support of Air Navigation	ANSP MET Information Service Provider	2025
Airborne system capability	Aircraft system	Transmission of meteorological observations information from aircraft for a SWIM environment	On-board sensors and communication means for the measurement and transmission of meteorological information by: ACAR, Mode-S, ADS-B & C.	Aircraft manufacturer	2025
Ground system infrastructure	Information exchange	Automated systems and infrastructure to support the provision of meteorological observations information over SWIM	Meteorological instrumentation, IT systems and communications infrastructure for the measurement, storage, display and transmission of meteorological observations information to support ground and air decision-making processes in a SWIM environment References: • WMO No.8 - Guide to Meteorological Instruments and Methods of Observation • Annex 10 - Aeronautical Telecommunications	Airport operator ANSP MET Information Service Provider	2025

Training	-	Training requirements for meteorological observations information over SWIM	Training for meteorological personnel and aviation industry stakeholders on meteorological observations information in a SWIM environment. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2025

AMET-B2/2 Meteorological forecast and warning information Information

☐ Sixth edition of the GANP

Main Purpose

Integrated meteorological forecast and warning information in support of enhanced operational ground and air decision-making processes, particularly in the near-term.

New Capabilities

Further development of space weather services. Further development of forecast and warning services for terminal areas. Phenomena-based meteorological information is no longer constrained by Flight Information Regions (FIRs). Implementation of a data-centric information set. Higher spatial and temporal resolution of meteorological forecasts and warnings. Automated forecast and warning services derived from meteorological information in ICAO Meteorological Information Exchange Model (IWXXM) form. Further development of probabilistic information derived from ensemble prediction systems and how this type of information can be presented or integrated into user's decision processes.

Description

This module builds on the meteorological forecast and warning services defined in AMET-B1. Full MET-ATM integration will ensure that meteorological information is included in the logic of a decision process and the impact of the meteorological conditions on the operations are automatically derived, understood and taken into account. Support for tactical in-flight avoidance of hazardous meteorological conditions (improved in-flight situational awareness) to typical near-term and planning (>20 minutes) type of decision making. Specifically, the addition of probabilistic forecasts will provide decision makers with an assessment of the likelihood of some meteorological phenomena/parameters exceeding a defined magnitude (or threshold) at a particular time and place. The probabilistic element further helps decision makers apply their own operational constraints (i.e. business rules) to determine the risk to their operations.

Recognising that space weather affecting the earth's surface or atmosphere pose a hazard to communications and navigation systems and may also pose a radiation risk to flight crew members and passengers, this module builds on AMET-B1 for space weather information services in support of safe and efficient international air navigation, particularly in the area of regional services.

Considering the impact of adverse meteorological conditions on high traffic density terminal areas around major aerodromes and air traffic management operations within those areas as well as the increasing requirements by airspace users to be able to optimise their flight profile, this module acknowledges the need to provide meteorological information services with the accuracy, resolution and frequency to support ATM operations within those areas.

A significant evolution is planned for volcanic ash information. Next generation volcanic ash cloud forecasts will be fully implemented. It will allow decision makers to use both deterministic and probabilistic forecasts for contamination levels, taking into account their risk management practices

and the quantitative exposures allowed by the engine manufacturers. Specifically, the addition of probabilistic forecasts will provide decision makers with an assessment of the likelihood of the volcanic ash exceeding a defined magnitude (or threshold) at a particular time and place. The probabilistic element further helps decision makers apply their own operational constraints (i.e. business rules) to determine the risk to their operations.

Enhanced global MET forecasts will be provided under the World Area Forecast System (WAFS), which will include higher resolution and probabilistic information. Enhanced higher resolution regional MET forecasts will also be provided. Forecast services for the terminal area will be further enhances with the accuracy, resolution and frequency to support ATM operations within those areas.

Evolving the nature of enroute hazard forecasting into the future SWIM environment, will require the development of new services, which is planned for this module. These will be supported by new forecasting methodologies to ensure global and regional consistency and will involve a harmonised and coordinated approach between MET service providers. This module will build and demonstrate the concept, based on defined user requirements, as well as design the infrastructure and system architecture.

This enhanced global, regional and terminal area information will be integrated into flight planning, flight management and ATM decision support systems, including systems for air traffic control around and at airports.

Meteorological forecast and warning parameters and phenomena will include performance measurement (via compliance, availability and regularity indices) of some meteorological observations. Greater use of the probability of occurrence of meteorological phenomena and the level of confidence/uncertainty of the forecast will enable better risk management.

Human-readable products can be derived from the meteorological information to suit specific user needs. Meteorological advisories and warnings are derived from forecast data and based on user-defined thresholds.

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B1/2 - Meteorological forecast and warning information
Relation-operational need	AMET-B2/1 - Meteorological observations information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of meteorological forecast and warnings information in a SWIM environment	Amendment of national regulations to include the provision of integrated meteorological forecast and warning information in a SWIM environment, in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed • Doc. 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	CAA	2025
Operational procedures	Information exchange	Procedures for the provision of meteorological forecast and warnings information in a SWIM environment	Procedures for changes to the provision of integrated meteorological forecast and warning information in a SWIM environment, including enhanced terminal area, space weather, sulphur dioxide (SO2) and radioactive material services. References: • WMO No.306 - Manual on Codes – International Codes • WMO No.732 - Guide to Practices for Meteorological Offices Serving Aviation • WMO No.782 – Aerodrome Reports and Forecasts • WMO No.1100 - Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services • Doc. 7488 – Manual of the ICAO Standard Atmosphere • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9691 - Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds • Doc. 9766 - Handbook on the International Airways Volcano Watch (IAVW) • Doc. 10100 – Manual on Space Weather Information in Support of Air Navigation • Regional SIGMET Guides	ANSP MET Information Service Provider	2025

Training	-	Training requirements for Meteorological forecast and warnings information in a SWIM environment	Training for meteorological personnel and aviation industry stakeholders on meteorological forecast and warning information in a SWIM environment. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2025
Ground system infrastructure	Information exchange	Systems and infrastructure to support the provision of meteorological forecast and warning information in a SWIM environment	IT systems and communications infrastructure for the storage, forecasting, display and transmission of meteorological forecast and warning information in a SWIM environment. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2025

AMET-B2/3 Climatological and historical meteorological information — Information

☐ Sixth edition of the GANP

Main Purpose

Climatological products (historical and forecast) in support of the design and planning of infrastructure, flight routes and airspace management. Historical meteorological observations, forecasts, advisories and warnings in support of incident and accident investigations.

New Capabilities

Climatological data (including satellite-based and in-situ climatological data, and a combination of the two) and climate change information available for more locations and more frequently updated.

Description

This element represents the provision of climatological information for the range of meteorological parameters and phenomena and their associated characteristics (metadata). This element also represents the provision of historical information including meteorological observations and forecasts and their associated characteristics (metadata). This element also includes the provision of information on climate change and its impact on aviation, such as upper air wind flow changes, turbulence patterns evolutions, airport temperature and wind future evolutions, etc.

Climatological information services will support the design and planning of infrastructure, flight routes and airspace 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? No
4. Does it imply a change to levels of automation? No

PLANNING LAYERS

Post operations

OPERATIONS

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B1/3 - Climatological and historical meteorological information
Relation-operational need	AMET-B2/1 - Meteorological observations information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of climatological meteorological information in a SWIM environment	Amendment of national regulations to include changes to the provision of climatological information, both historical and forecast, in a SWIM environment, in support of the design and planning of infrastructure, flight routes and airspace management and to support incident and accident investigations. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed	CAA	2025
Operational procedures	Information exchange	Procedures for the provision of climatological meteorological information in a SWIM environment	Procedures for changes to the provision of climatological information, both historical and forecast, in a SWIM environment, including satellite-based and in-situ climatological data and climate change forecasts. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2025

Training	-	Training for the provision of climatological meteorological information in a SWIM environment	Training for meteorological personnel and aviation industry stakeholders on climatological information, both historical and forecast, in a SWIM environment. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2025
Ground system infrastructure	Information exchange	Systems and infrastructure to support the provision of climatological meteorological information in a SWIM environment	IT systems and communications infrastructure for the storage, forecasting, display and transmission of climatological meteorological information in a SWIM environment. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2025

AMET-B2/4 Meteorological information service in SWIM Information

☐ Sixth edition of the GANP

Main Purpose: Integrated meteorological information service in the SWIM environment in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term.

New Capabilities: Implementation of data-centric meteorological information services, integrated into the System Wide Information Management (SWIM) environment. User-defined services derived from meteorological information in ICAO Meteorological Information Exchange Model (IWXXM) form. Wider use of secure web services and message brokers as part of the transition from fixed line dissemination systems. Commencement of the use of business-to-business services that allows integration of meteorological information into ATM systems.

Description

The establishment of standards for global exchange of the MET information within the SWIM environment.

This element represents the integration of meteorological information into the SWIM environment. Wider use of MET-SWIM services will support flexible airspace management, airborne re-routing, improved situational awareness, collaborative decision-making, including in terminal areas and at airports, dynamically optimized flight trajectory planning, ATM impact conversion and ATM decision support, hazard avoidance.

In coordination with stakeholders, the development of guidance on visualisation of some MET information, where deemed appropriate.

SWIM-compliant meteorological information to be more readily exchanged with the aircraft to improve operational awareness and decision making using air/ground data connectivity and aircraft on-board systems.

MET-SWIM information services will support request/reply or publish/subscribe access mechanisms and will provide quality & timely information to users in a range of formats to best enable their optimal decision making.

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 | Post operations

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B1/1 - Meteorological observations information
Relation-operational need	AMET-B2/1 - Meteorological observations information
Relation-operational need	AMET-B2/2 - Meteorological forecast and warning information
Relation-information need	DAIM-B2/1 - Dissemination of aeronautical information in a SWIM environment
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-operational benefit	SWIM-B2/4 - Air/Ground SWIM for non-safety critical information
Relation-operational benefit	SWIM-B2/5 - Global SWIM processes

Relation-operational need	AMET-B2/3 - Climatological and historical meteorological information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of meteorological information service in SWIM	Amendment to national regulations to include changes to the dissemination of meteorological information in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed • Annex 10 – Aeronautical Telecommunications • Annex 15 - Aeronautical Information Services	CAA	2025

Operational procedures	Information exchange	Procedures for the provision of meteorological information service in SWIM	Procedures for changes to the dissemination of meteorological information, including the exchange of meteorological information using the latest version of the ICAO Meteorological Information Exchange Model (IWXXM) and the introduction of web services. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9377 – Manual on the Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services • Doc. 9855 - Guidelines on the use of the Public Internet for Aeronautical Applications • Doc. 9880 - Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols • Doc. 9896 – Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocol • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • Doc. 10039 - Manual on System Wide Information Management (SWIM) Concept • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • WMO No.731 – Guide to Meteorological Observing and Information Distribution Systems for Aviation Weather Services • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP MET Information Service Provider	2025
Ground system infrastructure	Information exchange	Communication infrastructure for meteorological information exchange in SWIM	Ground system infrastructure and dissemination systems for meteorological information within a SWIM environment. References: • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP MET Information Service Provider	2025
Information exchange model	Meteorological information	ICAO Meteorological Information Exchange Model (IWXXM) Vxx	ICAO Meteorological Information Exchange Model (IWXXM) schema used to enable the provision meteorological information in XML/GML form. References: • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • WMO IWXXM Wiki: https://wiswiki.wmo.int/tiki-index.php?page=IWXXM&structure=WIS+up	ANSP MET Information Service Provider	2025

Training	-	Training for the provision of a Meteorological information service	Training for meteorological and aviation IT personnel, including NOC/ROC/RODB/IROG and SWIM services personnel, on the exchange of meteorological information in a SWIM environment. References: • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • Doc. 10039 - Manual on System Wide Information Management (SWIM) Concept • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP MET Information Service Provider	2025

AMET-B3/1 Meteorological observations information — Information

☐ Sixth edition of the GANP

Main Purpose

Integrated high resolution meteorological observation information in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic control operations, allowing gate-to-gate seamless operations.

New Capabilities

Further development of space weather information service and of observation services for terminal areas. Higher spatial and temporal resolution of meteorological observations.

Observations to support tactical routing decisions under environmental considerations i.e. contrail or noise avoidance, if required.

Description

This module builds on the meteorological information services defined in AMET-B2. Full MET-ATM integration will ensure that high resolution meteorological observation information is included in the logic of a decision process and the impact of the meteorological conditions on the operations are automatically derived, understood and taken into account. Increased situational awareness to support tactical in-flight avoidance of hazardous meteorological conditions.

Recognising that space weather affecting the earth's surface or atmosphere poses a hazard to communications and navigation systems especially satellite-based systems and may also pose a radiation risk to flight crew members and passengers, this module builds on AMET-B2 for space weather information services in support of safe and efficient international air navigation.

Considering the impact of adverse meteorological conditions on high traffic density terminal areas around major aerodromes and air traffic management operations within those areas as well as the increasing requirements by airspace users to be able to optimise their flight profile, this module acknowledges the need to provide meteorological observation information services with the accuracy, resolution and frequency to support ATM operations within those areas.

Meteorological observations will increasingly include performance measurement (via compliance, availability and regularity indices).

Applicable to air traffic flow planning, en-route operations, terminal operations (arrival/departure) and surface.

Aircraft equipage is assumed in the areas of ADS-B IN/CDTI, aircraft based meteorological observations, and meteorological information display capabilities, such as EFBs.

Maturity Level

Concept

Human Factor Considerations

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

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

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

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

PLANNING LAYERS

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

OPERATIONS

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B2/1 - Meteorological observations information
Relation-technology need	COMS-B3/1 - Extended CPDLC (B2 incl. Adv-IM and dynamic RNP) for dense and complex airspace
Relation-technology need	COMS-B3/2 - Extended ADS-C (B2 incl. Adv-IM and dynamic RNP) for dense and complex airspace
Relation-operational need	SWIM-B2/1 - Information service provision
Relation-technology need	ASUR-B2/1 - Evolution of ADS-B and Mode S

Relation-operational need	SWIM-B3/1 - Air/Ground SWIM for safety critical information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Training	-	Training requirements for meteorological observations information service	References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2031
Ground system infrastructure	Information exchange	Automated systems and infrastructure to support the provision of meteorological observations information service over SWIM	Meteorological instrumentation Communications infrastructure (including AFS) Data exchange infrastructure supporting SWIM References:	ANSP MET Information Service Provider	2031
Airborne system capability	Aircraft system	Transmission of meteorological observations from aircraft for a SWIM environment	Transmission of meteorological information by: ACAR, Mode-S, ADS-B & C	Aircraft manufacturer	2031

Regulatory provisions	National regulatory framework	National framework amendment for the provision of meteorological observations information service	Amendment of national regulations to include the provision of integrated high-resolution meteorological observations information in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic control operations, allowing gate-to-gate seamless operations. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed • Doc. 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	CAA	2031
Operational procedures	Information exchange	Procedures for the provision of meteorological observations information service	Procedures for changes to the provision of integrated high-resolution meteorological observations information, including space weather and services for the terminal area. References: • WMO No.8 - Guide to Meteorological Instruments and Methods of Observation • WMO No.306 - Manual on Codes – International Codes • WMO No.731 – Guide to Meteorological Observing and Information Distribution Systems for Aviation Weather Services • WMO No.732 - Guide to Practices for Meteorological Offices Serving Aviation • WMO No.782 – Aerodrome Reports and Forecasts • WMO No.1100 - Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services • Doc. 7488 – Manual of the ICAO Standard Atmosphere • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9328 - Manual of Runway Visual Range Observing and Reporting Practices • Doc 9837 - Manual on Automatic Meteorological Observing Systems at Aerodromes • Doc. 10100 – Manual on Space Weather Information in Support of Air Navigation	ANSP MET Information Service Provider	2031

AMET-B3/2 Meteorological forecast and warning information Information

☐ Sixth edition of the GANP

Main Purpose

Integrated high resolution meteorological forecast and warning information in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic control operations, allowing gate-to-gate seamless operations.

New Capabilities

Further development of space weather information service and of forecast and warning services for terminal areas. Higher spatial and temporal resolution of meteorological forecasts and warnings. Further development of probabilistic forecast information. Further development towards a fully integrated meteorological forecast service fit for the purpose of all flight phases and ATC operations, in support of gate-to-gate seamless operations.

Description

This module builds on the meteorological forecast and warning services defined in AMET-B2. Full MET-ATM integration will ensure that meteorological information is included in the logic of a decision process for each flight phase and the impact of the meteorological conditions on the operations are automatically derived, understood and taken into account.

The probabilistic element of the forecasts and warnings further helps decision makers apply their own operational constraints (i.e. business rules) to determine the risk to their operations. Greater use of the probability of occurrence of meteorological phenomena and the level of confidence/uncertainty of the forecast will enable better risk management.

Enroute SWIM services that are produced collaboratively (between MET providers) will provide tailored information on hazards.

Greater use of forecast information from ensemble prediction systems (multiple scenarios) will enable ATM stakeholders to consider multiple air traffic scenarios from air traffic management systems, flight management systems and airport management systems, and to derive uncertainty information on air traffic situation.

Meteorological forecast and warning parameters and phenomena will be made available to users only through SWIM information services.

Maturity Level

Concept

Human Factor Considerations

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

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

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

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B2/2 - Meteorological forecast and warning information

Relation-operational need	AMET-B3/1 - Meteorological observations information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of meteorological forecast and warnings information service	Amendment of national regulations to include the provision of integrated high-resolution meteorological forecast and warning information in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic control operations, allowing gate-to-gate seamless operations. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed • Doc. 4444 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	CAA	2031
Operational procedures	Information exchange	Procedures for the provision of meteorological forecast and warnings information service	Procedures for changes to the provision of integrated high-resolution meteorological forecast and warning information, including space weather and services for the terminal area. References: • WMO No.306 - Manual on Codes – International Codes • WMO No.732 - Guide to Practices for Meteorological Offices Serving Aviation • WMO No.782 – Aerodrome Reports and Forecasts • WMO No.1100 - Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services • Doc. 7488 – Manual of the ICAO Standard Atmosphere • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9691 - Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds • Doc. 9766 - Handbook on the International Airways Volcano Watch (IAVW) • Doc. 10100 – Manual on Space Weather Information in Support of Air Navigation • Regional SIGMET Guides	ANSP MET Information Service Provider	2031

Training	-	Training requirements for meteorological forecast and warnings information service	Training for meteorological personnel and aviation industry stakeholders on meteorological forecast and warning information to support ground and air decision-making processes in a SWIM environment. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP CAA Aircraft operator MET Information Service Provider	2031
Ground system infrastructure	Information exchange	Systems and infrastructure to support the provision of meteorological forecast and warnings information service	IT systems and communications infrastructure for the storage, forecasting, display and transmission of meteorological forecast and warnings. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2031

AMET-B3/3 Climatological and historical meteorological information — Information

☐ Sixth edition of the GANP

Main Purpose

Climatological products in support of the design and planning of infrastructure, flight routes and airspace management. Historical meteorological observations, forecasts, advisories and warnings in support of incident and accident investigations.

New Capabilities

Climatological data and climate change information available for more locations and more frequently updated.

Description

This element represents the provision of climatological information for the range of meteorological parameters and phenomena and their associated characteristics (metadata). This element also represents the provision of historical information including meteorological observations and forecasts and their associated characteristics (metadata).

Climatological information services will support the design and planning of infrastructure, flight routes and airspace management.

Maturity Level

-

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? Yes

PLANNING LAYERS

Post operations

OPERATIONS

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B2/3 - Climatological and historical meteorological information
Relation-operational need	AMET-B3/1 - Meteorological observations information

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of a climatological meteorological information service	Amendment of national regulations to include changes to the provision of climatological information, in particular climate change forecasts, in in support of the design and planning of infrastructure, flight routes and airspace management and to support incident and accident investigations. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed	CAA	2031
Operational procedures	Information exchange	Procedures for the provision of a climatological meteorological information service	Procedures for changes to the provision of a climatological information, in particular climate change forecasts. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2031
Training	-	Training requirements for a climatological meteorological information service	Training for meteorological personnel and aviation industry stakeholders on climatological information, in particular climate change forecasts, and its impact on aviation. References: • WMO No. 1083 – Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology • WMO No.1205 – Guide to Competency	Airport operator ANSP Aircraft operator MET Information Service Provider	2031

Ground system infrastructure	Information exchange	Systems and infrastructure to support the provision of a climatological meteorological service	IT systems and communications infrastructure for the storage, forecasting, display and transmission of climatological meteorological service. References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice	MET Information Service Provider	2031

AMET-B3/4	Meteorological information service in SWIM	Information

☐ Sixth edition of the GANP

Main Purpose

Integrated meteorological information service in the SWIM environment in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic control operations.

New Capabilities

Implementation of a data-centric meteorological information service, integrated into the System Wide Information Management (SWIM) environment. Enhancement of ICAO Meteorological Information Exchange Model (IWXXM) with further schemas and formats for meteorological information exchange. User-defined products automatically derived from meteorological information in ICAO Meteorological Information Exchange Model (IWXXM) form. Extensive use of secure web services, in particular business-to-business services that allows full integration of meteorological information

Description

The establishment of standards for global exchange of the MET information within the SWIM environment.

This element represents the full integration of meteorological information into the System Wide Information Management (SWIM) environment. Extensive use of MET-SWIM services will support flexible airspace management, airborne re-routing, improved situational awareness, collaborative decision-making, including in terminal areas and at airports, dynamically optimized flight trajectory planning, ATM impact conversion and ATM decision support, hazard avoidance.

Meteorological information to be more readily exchanged with the aircraft to improve operational awareness and decision making using air/ground data connectivity and aircraft on-board systems.

MET-SWIM information services will support request/reply or publish/subscribe access mechanisms and will provide quality & timely information to users in a range of formats to best enable their optimal decision making.

Maturity Level

Concept

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

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

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

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Evolution	AMET-B2/4 - Meteorological information service in SWIM
Relation-operational need	AMET-B3/1 - Meteorological observations information
Relation-operational need	AMET-B3/2 - Meteorological forecast and warning information
Relation-operational need	SWIM-B3/1 - Air/Ground SWIM for safety critical information
Relation-operational need	AMET-B3/3 - Climatological and historical meteorological information
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-operational need	SWIM-B2/4 - Air/Ground SWIM for non-safety critical information
Relation-operational need	SWIM-B2/5 - Global SWIM processes

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	National regulatory framework	National framework amendment for the provision of a meteorological information service	Amendment to national regulations to include changes to the dissemination of meteorological information in SWIM to support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic control operations, allowing gate-to-gate seamless operations. References: • Annex 3 - Meteorological Service for International Air Navigation • WMO No.49 Vol II - Technical Regulations - Basic Documents No. 2, Volume II – Meteorological Service for International Air Navigation • WMO No.49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management • Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed • Annex 10 – Aeronautical Telecommunications • Annex 15 - Aeronautical Information Services	CAA	2031

Operational procedures	Information exchange	Procedures for the provision of a meteorological information service	Procedures for changes to the dissemination of meteorological information in SWIM, including the exchange of meteorological information using the latest version of the ICAO Meteorological Information Exchange Model (IWXXM). References: • Doc. 8896 - Manual of Aeronautical Meteorological Practice • Doc. 9377 – Manual on the Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services • Doc. 9855 - Guidelines on the use of the Public Internet for Aeronautical Applications • Doc. 9880 - Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols • Doc. 9896 – Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocol • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • Doc. 10039 - Manual on System Wide Information Management (SWIM) Concept • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • WMO No.731 – Guide to Meteorological Observing and Information Distribution Systems for Aviation Weather Services • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP ATM SWIM service provider MET Information Service Provider	2031
Information exchange model	Meteorological information	ICAO Meteorological Information Exchange Model (IWXXM) Vxx (for 2031)	ICAO Meteorological Information Exchange Model (IWXXM) used to provide meteorological information in XML/GML form. References: • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • WMO IWXXM Wiki: https://wiswiki.wmo.int/tiki-index.php?page=IWXXM&structure=WIS+up	ANSP ATM SWIM service provider MET Information Service Provider	2031
Ground system infrastructure	Information exchange	Communication infrastructure for a meteorological information service	Ground system infrastructure and dissemination systems for meteorological information within a SWIM environment, supporting request/reply or publish/subscribe access mechanisms and providing quality & timely information to users in a range of formats to best enable their optimal decision making.	ANSP ATM SWIM service provider MET Information Service Provider	2031

Training	-	Training for the provision of meteorological information service in SWIM	Training for meteorological, aviation IT personnel and SWIM service providers, on the exchange of meteorological information in a SWIM environment. References: • Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information • Doc. 10039 - Manual on System Wide Information Management (SWIM) Concept • ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM • Regional OPMET Interface Control Documents • Regional OPMET Bulletin Exchange Handbooks	ANSP ATM SWIM service provider MET Information Service Provider	2031

AMET-B4/1 Meteorological observations information Information

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Main Purpose

New Capabilities

Description

Maturity Level -

Human Factor Considerations

PLANNING LAYERS

Tactical-Pre ops | Tactical-During ops

OPERATIONS

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

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

AMET-B4/2 Meteorological forecast and warning information Information

☐ Sixth edition of the GANP

Main Purpose

New Capabilities

Description

Maturity Level -

Human Factor Considerations

PLANNING LAYERS

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

OPERATIONS

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

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

AMET-B4/3	Climatological and historical meteorological information	Information

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Main Purpose

New Capabilities

Description

Maturity Level -

Human Factor Considerations

PLANNING LAYERS

Post operations

OPERATIONS

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

AMET-B4/4	Meteorological information service in SWIM	Information

Sixth edition of the GANP

Main Purpose

New Capabilities

Description

Maturity Level -

Human Factor Considerations

PLANNING LAYERS

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

OPERATIONS

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

DEPENDENCIES AND RELATIONS

There are currently no dependencies.

ENABLERS

There are currently no enablers.

APTA

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

Sixth edition of the GANP

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

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

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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

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

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

☐ Sixth edition of the GANP

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

OPERATIONS

Tactical-During ops

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
	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

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

☐ Sixth edition of the GANP

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

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	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

☐ Sixth edition of the GANP

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
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

☐ Sixth edition of the GANP

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

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

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

☐ Sixth edition of the GANP

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 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)

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

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

☐ Sixth edition of the GANP

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
Indirect benefits	Reduced initial costs to implement vertically guided approaches.	Airport operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	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

☐ Sixth edition of the GANP

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 Authorization	-	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

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

☐ Sixth edition of the GANP

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)
	Flexible airspace planning and development.	ANSP

Direct benefits Type	Operational description	Benefitting stakeholder(s)
	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

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

☐ Sixth edition of the GANP

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)
	Optimized vertical profile.	ANSP Airspace user

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	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
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

☐ Sixth edition of the GANP

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

Type	Operational description	Benefitting stakeholder(s)
	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
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

☐ Sixth edition of the GANP

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

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

☐ Sixth edition of the GANP

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

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

☐ Sixth edition of the GANP

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)
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

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-B2/4 Performance based aerodrome operating minima – Advanced aircraft with SVGS Operational

☐ Sixth edition of the GANP

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	2024
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	2024
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	2024
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	2024
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	2024
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	2024

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	2024

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

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-B3/1 Parallel approaches without vertical guidance Operational

☐ Sixth edition of the GANP

Main Purpose: Simultaneous independent parallel approach paths to parallel or near parallel runways based on RNP capabilities are based on 3D operations. The use of A-RNP and/or RNP APCH to provide demonstrated track keeping performance will safely provide lateral performance and could enable the removal of the vertical guidance requirement for specific operations. This would enable improved access, provide flexibility in degraded environments and could optimized the vertical profile leading to increased operational efficiency and reduced noise nuisance.

New Capabilities: Independent closely spaced 2D RNP approach operations.

Description: This element overcomes the necessity to require 3D operations for parallel approach operations providing increased flexibility and supporting aircraft in a degraded 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? 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 Authorization	-	Operational Authorization for PBN specification	Aircraft operator flying a PBN procedure 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	2022
Regulatory provisions	National regulatory framework	National framework amendment for parallel approaches without vertical guidance	National regulation amendment for parallel approaches without vertical guidance. References: DOC. 4444 – Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)	CAA	2026
Operational procedures	Design	PBN procedures design and use for parallel approaches without vertical guidance.	These operational procedures should be designed and used as specified in Doc 8168 (PANS-OPS Vol II and I) or equivalent.	ANSP	2026

Operational procedures	Design	PBN procedure validation, approval and publication for parallel approaches without vertical guidance.	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 9906 (Quality Assurance Manual for Flight Procedure Design).	ANSP CAA	2026
Operational procedures	Design	PBN procedure validation, approval and publication for parallel approaches without vertical guidance	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 9906 (Quality Assurance Manual for Flight Procedure Design).	ANSP CAA	2026
Operational procedures	Operations	SOPs for parallel approaches without vertical guidance.	Procedures for the crew to follow to fly a PBN approach. Defined in the Ops Manual. Reference: Doc 9613 (PBN Manual)	Aircraft operator	2026
Operational procedures	Operations	Contingency procedures for parallel approaches without vertical guidance	Procedures for the crew to follow in case of abnormal events. Defined in the Ops Manual. Reference: Doc 9613 (PBN Manual)	Aircraft operator	2026
Operational procedures	Separation	Application of separation for parallel approaches without vertical guidance	Procedures for separation. Reference: PANS-ATM	ANSP	2026
Airborne system capability	Navigation	PBN Approaches (with basic capabilities)	PBN Approaches (with basic capabilities)	Aircraft manufacturer Aircraft operator	2021
Space system infrastructure	-	Training requirements for parallel approaches without vertical guidance.	Crew trained to fly the procedure. References: As defined in Doc 9613 (PBN Manual). For Air traffic controllers. References: PANS-ATM.	ANSP Aircraft operator	2026

DEPLOYMENT APPLICABILITY

Operational conditions:

Airports with simultaneous independent parallel approach paths to parallel or near parallel runways without the need

for vertical guidance. To enhance access and capacity at aerodromes with parallel or near parallel runways.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety	Aircraft operator, General citizen
	Access	Airport operator, Aircraft operator, General citizen
	Capacity	Airport operator, ANSP, Aircraft operator
Indirect benefits	Environment	General citizen

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Increase airport arrival rate	++	KPI10: Airport peak throughput
Efficiency	Flight time & distance	Reduce additional time in terminal airspace	++	KPI08: Additional time in terminal airspace
Efficiency	Fuel burn	Reduce fuel burn impact of impeded conditions	++	KPI16: Additional fuel burn
Efficiency	Vertical flight efficiency	Reduce ToD uncertainty by early assignment of landing RWY and approach procedure	++	KPI19: Level-off during descent

APTA-B3/2 Implementation of A-RNP to support non-complex simultaneous independent parallel approaches — Operational

☐ Sixth edition of the GANP

Main Purpose: To provide additional flexibility to support parallel approach operations where RNP AR operations may not be cost effective or practicable.

New Capabilities: The advent of A-RNP may allow RNP 0.3 to be coded in the initial and intermediate segments of an approach allowing PBN to provide more flexibility in supporting parallel approach operations for non-AR operators at aerodromes with parallel runway spacings of 2224 m or greater.

Description

Parallel approach operations (Mode 1) not designed iaw 'Established on RNP AR APCH' must be established on the Final Approach course or track before the No Transgression Zone (NTZ) can be invoked and the 1000' vertical separation cancelled. The performance of RNP APCH outside of the Final Approach Segment (FAS) is +/-1NM and this performance effectively minimizes the use of the RNP APCH application to support parallel approach without significant additional safety work. The A-RNP specification will provide a required navigational performance of +/-0.3 throughout the terminal airspace (missed approach might be an exception). This means that provided the aircraft are aligned with the runway centreline, by requiring A-RNP prior to the Final Approach the NTZ can be invoked earlier, the 1000' separation cancelled, and aircraft can start their final descents from higher altitudes (and greater distances from the threshold). This should be both a cost efficiency (fuel burn) and environmental (noise) benefit.

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

Arrival

DEPENDENCIES AND RELATIONS

Type of Dependencies	ASBU Element
Relation-operational need	APTA-B0/1 - PBN Approaches (with basic capabilities)
Relation-operational benefit	APTA-B1/5 - CCO (Advanced)
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
Regulatory provisions	National regulatory framework	National framework amendment for A-RNP for independent parallel approaches where the runway spacing of ≥ 2224m can be assured.	National framework amendment for A-RNP for independent parallel approaches where the runway spacing of ≥ 2224m can be assured.	CAA	2026

Operational procedures	Design	PBN procedures design and use for A-RNP for independent parallel approaches where the runway spacing of ≥ 2224m can be assured.	TPBN procedures design and use for A-RNP for independent parallel approaches where the runway spacing of ≥ 2224m can be assured.	ANSP	2026
Operational procedures	Design	PBN approval and publication for A-RNP for independent parallel approaches where the runway spacing of ≥ 2224m can be assured..	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 9906 (Quality Assurance Manual for Flight Procedure Design).	ANSP CAA	2026
Operational procedures	Operations	SOPs for A-RNP for independent parallel approaches where the runway spacing of ≥ 2224m can be assured.	Procedures for the crew to follow to fly a PBN approach. Defined in the Ops Manual. Reference: Doc 9613 (PBN Manual)	Aircraft operator	2026
Operational procedures	Operations	Contingency procedures for A-RNP for independent parallel approaches where the runway spacing of ≥ 2224m can be assured.	Procedures for the crew to follow in case of abnormal events. Defined in the Ops Manual. Reference: Doc 9613 (PBN Manual)	Aircraft operator	2026
Operational procedures	Separation	Application of separation for A-RNP for independent parallel approaches where the runway spacing of ≥ 2224m can be assured.	Procedures for separation. Reference: PANS-ATM	ANSP	2026

Operational Authorization	-	Operational Authorization for A-RNP	Aircraft operator flying a PBN procedure 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	2022
Airborne system capability	Navigation	PBN Approaches for A-RNP	PBN Approaches for A-RNP	Aircraft manufacturer Aircraft operator	2026
Space system infrastructure	-	Training requirements for A-RNP for independent parallel approaches (RWY spacing of ≥ 2224m)	Crew trained to fly the procedure. References: As defined in Doc 9613 (PBN Manual). For Air traffic controllers. References: PANS-ATM.	ANSP Aircraft operator	2026

DEPLOYMENT APPLICABILITY

Operational conditions:

Airports with non-complex simultaneous independent parallel approaches where the runway spacing of ≥ 2224m can be assured. To provide additional flexibility to support parallel approach operations where RNP AR operations may not be cost effective or practicable.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Flexibility	Airport operator, ANSP, Aircraft operator
	Access	Airport operator, Aircraft operator, General citizen
	Capacity	Airport operator, ANSP, Aircraft operator
Indirect benefits	Safety	Aircraft operator
	Environment	General citizen

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

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

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Efficiency	Flight time & distance	Reduce additional time in terminal airspace	++	KPI08: Additional time in terminal airspace
Efficiency	Fuel burn	Reduce fuel burn impact of impeded conditions	++	KPI16: Additional fuel burn
Efficiency	Vertical flight efficiency	Reduce ToD uncertainty by early assignment of landing RWY and approach procedure	++	KPI19: Level-off during descent