

# WWRP CAS/CAeM Aviation Research Demonstration Project (AvRDP) Training Workshop

8 to 10 October 2018

*Hong-Kong Observatory*

*Hong-Kong, China*



**WMO OMM**

World Meteorological Organization

Organisation météorologique mondiale

# ATM Requirements for Meteorology under the GANP/ASBU

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What is the GANP ?

What does ASBU mean ?

Any meteorology in there ?

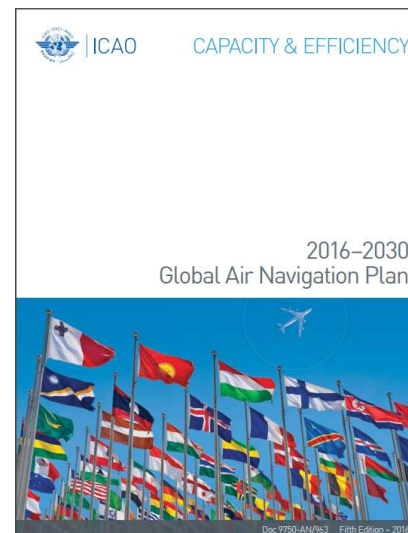
# The Global Air Navigation Plan

## ICAO's 15-year Plan Addressing Global Air Navigation

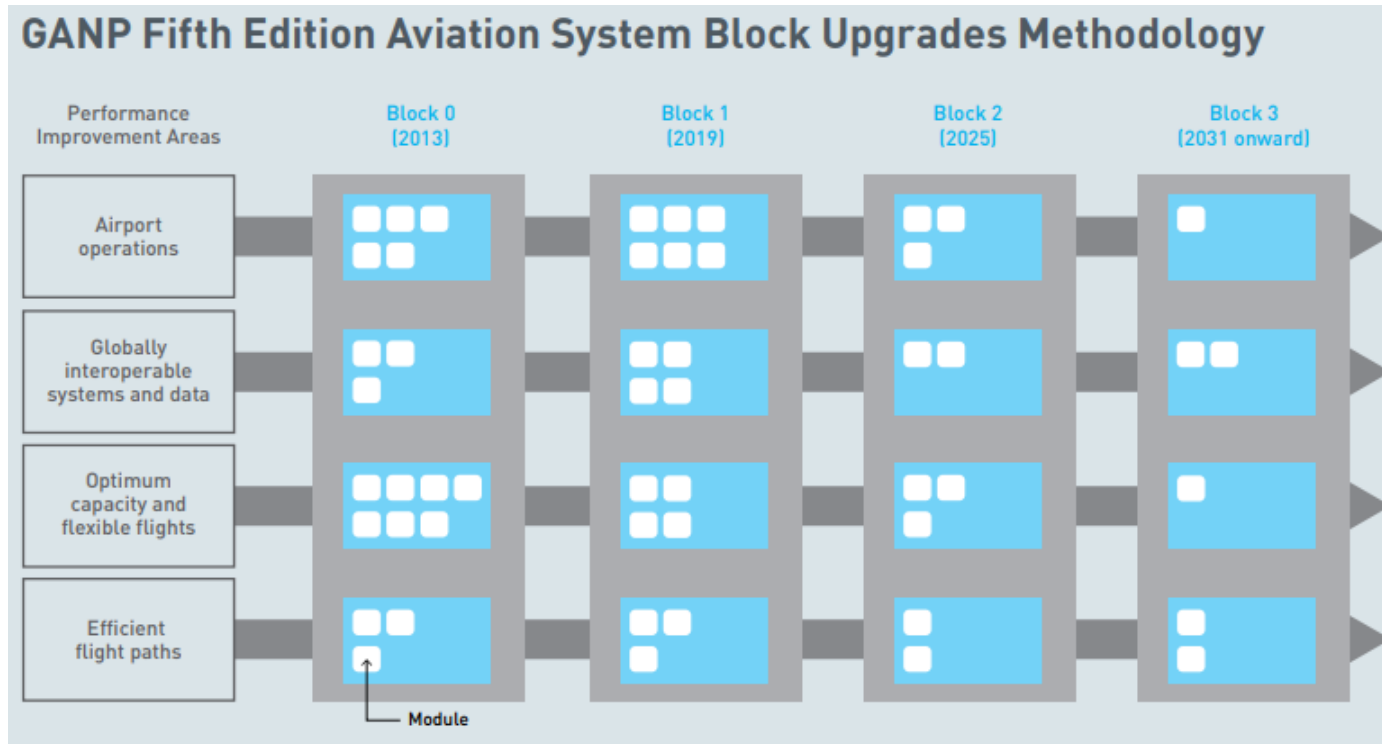
- The Global Air Navigation Plan (GANP) is a means to help achieve a global interoperable air navigation system for all users for all phases of flight, which meets agreed safety levels, provides optimum economic operations, is environmentally sustainable and meets national security requirements.
- Objective is to increase capacity and improve efficiency of the global civil aviation system whilst improving or at least maintaining safety.
- Long-term vision to ensure continuity and harmonization with ICAO, States and industry modernization programs.
- A reference for ICAO, States, manufacturers and other organizations to develop the necessary technology, standards and procedures.

# The Global Air Navigation Plan

- A **rolling, 15-year strategic methodology** which leverages existing technologies and anticipates future developments based on State/industry agreed operational objectives.
- Methodology based on **Block Upgrades**, organized in non-overlapping six-year time increments starting in 2013 and continuing through 2035 and beyond.
- Triannual revision cycle, with major updates every six years, One major in 2019



# Aviation System Block Upgrades (ASBU)



Refer to the target availability timelines for a group of operational improvements i.e. technologies and procedures organized into unique **Modules**

This block upgrade and module-based methodology would allow Member States to only consider and adopt the Modules appropriate to their operational needs.

# Aviation System Block Upgrades (ASBU)

Key concepts in developing the draft 2019 version of the GANP :

**ASBU Block:** a six year timeframe whose starting date defines a deadline for an element to be available for implementation.

**ASBU Thread:** key feature area of the air navigation system that needs improvement in order to achieve the vision outlined in the Global ATM Operational Concept (GATMOC).

**ASBU Element:** a specific change in operations designed to improve the performance of the air navigation system under specified operational conditions.

**ASBU Module:** a group of elements from a thread that, according to the enablers' roadmap, will be available for implementation within the defined deadline established by the ASBU Block.

**ASBU Enabler:** component (standards, procedures, training, technology, etc) required to implement an element.

=> **Operational** threads, **Enabler** threads and **Network/Infrastructure** threads

# Aviation System Block Upgrades (ASBU)

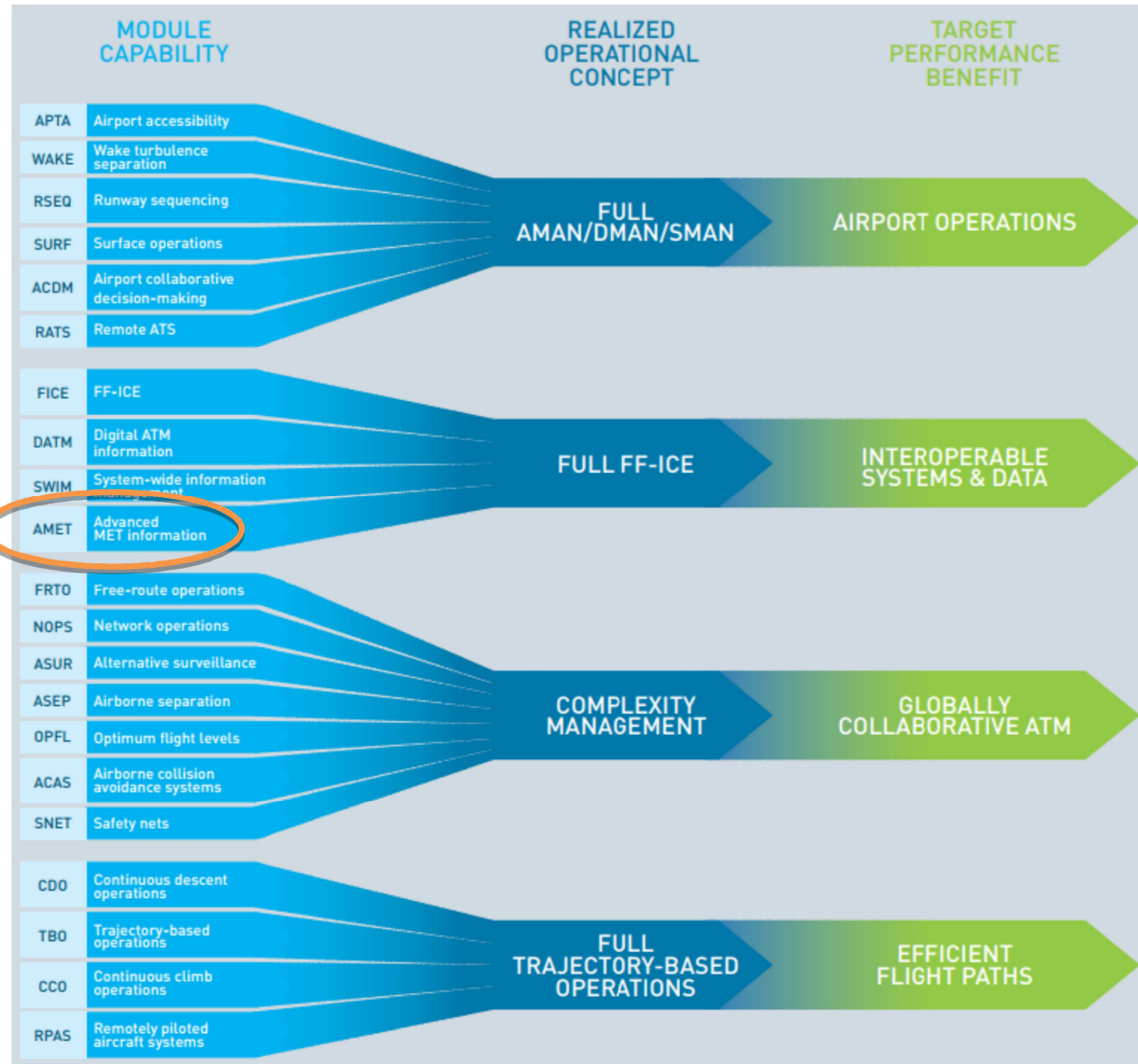
GANP Thread modules

Operational threads

Enabler threads

Operational threads

Operational threads





# Meteorology in 2019 GANP/ASBU

From the ICAO ASBU Panel Project Team work:

- Meteorology is an Enabler for the majority of the other Threads.
- Challenge is to ensure that all the other ASBU threads and related modules are able to fully articulate the requirements they have for MET information in the future.
- This means looking at the MET information required, rather than existing products.
- Information includes phenomenon/parameter and data characteristics such as severity, accumulation, intensity, probability of occurrence, confidence/uncertainty of forecasts and reliability, etc.
- Evolution of AMET thread and modules is driven by the transition to the SWIM environment and by the need for more interoperability allowing integration of MET information in ATM systems

# Meteorology in 2019 GANP/ASBU

## AMET Block 0:

Global, regional and local meteorological information to support flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning.

(from 2013)

## AMET Block 1:

Meteorological information supporting automated decision process or aids, involving meteorological information, **meteorological information translation, ATM impact conversion** and ATM decision support.

(from 2019)

# Meteorology in 2019 GANP/ASBU

## AMET Block 2:

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

(from 2025)

## AMET Block 3:

**Integrated meteorological information** in support of enhanced operational ground and air decision-making processes, **for all flight phases and corresponding air traffic management operations.**

(from 2031)

## AMET Block 4:

**Integrated meteorological information** supporting both air and ground decision making for all phases of flight and ATM operation, especially **for implementing immediate weather mitigation strategies.**

(from 2037)

# AMET – METEOROLOGICAL INFORMATION

TEMPLATE TABLE 1: Thread overview

## Meteorology in 2019 GANP/ASBU

AMET	METEOROLOGICAL INFORMATION		
<b>CONCEPT OF OPERATIONS OF THE THREAD BY BLOCK</b>			
BBB	Meteorological information provided to support operational efficiency and safety.		
<b>PART 1</b>	Block 0	Global, regional and local meteorological information to support flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning.	
	Block 1	Meteorological information supporting automated decision process or aids, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support.	
	Block 2	Integrated meteorological information in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term.	
	Block 3	Integrated meteorological information in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic management operations.	
	Block 4	Integrated meteorological information supporting both air and ground decision making for all phases of flight and ATM operations, especially for implementing immediate weather mitigation strategies.	
<b>PART 2</b>	<b>Block</b>	<b>Element ID</b>	<b>Title</b>
	Block 0	AMET-B0/1	Meteorological observations products
	Block 0	AMET-B0/2	Meteorological forecast and warning products
	Block 0	AMET-B0/3	Climatological and historical meteorological products
	Block 0	AMET-B0/4	Dissemination of meteorological products
	Block 1	AMET-B1/1	Meteorological observations information
	Block 1	AMET-B1/2	Meteorological forecast and warning information
	Block 1	AMET-B1/3	Climatological and historical meteorological information
	Block 1	AMET-B1/4	Dissemination of meteorological information
	Block 2	AMET-B2/1	Meteorological observations information
	Block 2	AMET-B2/2	Meteorological forecast and warning information
	Block 2	AMET-B2/3	Climatological and historical meteorological information
	Block 2	AMET-B2/4	Meteorological information service in SWIM
	Block 3	AMET-B3/1	Meteorological observations information
	Block 3	AMET-B3/2	Meteorological forecast and warning information
	Block 3	AMET-B3/3	Climatological and historical meteorological information
	Block 3	AMET-B3/4	Meteorological information service in SWIM
	Block 4	AMET-B4/1	Meteorological observations information
	Block 4	AMET-B4/2	Meteorological forecast and warning information
	Block 4	AMET-B4/3	Climatological and historical meteorological information
Block 4	AMET-B4/4	Meteorological information service in SWIM	



AMET-B1/2	METEOROLOGICAL FORECAST AND WARNING INFORMATION
Main purpose	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.
New capabilities	Commencement of change from product-centric to data-centric information. Commencement of space weather and sulphur dioxide (SO <sub>2</sub> ) 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: <ul style="list-style-type: none"> <li>• Wind speed and direction (aerodrome) including gusts and operationally significant wind shifts</li> <li>• Air temperature and dew point temperature (aerodrome)</li> <li>• Upper level: <ul style="list-style-type: none"> <li>o Wind (speed and direction), including departure to Top of Climb (TOC) and then Top of Descent (TOD) to landing</li> <li>o Air temperature and dew point temperature or equivalent (i.e. humidity), including height of freezing level and lower tropospheric temperature inversions</li> </ul> </li> <li>• Flight level and temperature of tropopause</li> <li>• Geopotential altitude for flight levels</li> <li>• Pressure (aerodrome) (i.e. QNH, QFE)</li> <li>• Visibility (aerodrome), Runway visual range (RVR)</li> <li>• Cloud type (of operational significance)</li> <li>• Cloud coverage, bases, tops and layers</li> <li>• Thunderstorms, Lightning, Convection (TCU &amp; CB)</li> <li>• Precipitation (ie. drizzle, rain, freezing rain, snow, hail)</li> <li>• Weather (ie. dust storm, sand storm, funnel cloud, squall, smoke, haze, mist, fog)</li> <li>• Icing (airframe and engine),</li> <li>• Liquid Water Content, Iced Water Content</li> <li>• Turbulence, Mountain waves, Wind shear</li> <li>• Fronts</li> <li>• Radioactive clouds, Toxic chemicals</li> <li>• Tropical cyclones</li> <li>• Volcanic ash</li> <li>• Sulphur dioxide (SO<sub>2</sub>) and other hazardous gases</li> <li>• Sea temperature, state and wave height (seaports)</li> <li>• Space weather events</li> <li>• Tsunami, Flood</li> </ul>
	Characteristics of the meteorological information include: <ul style="list-style-type: none"> <li>• Time (ie. issue time, validity, commencement/cessation, lead time)</li> <li>• Units of measurement</li> <li>• Resolution (temporal &amp; spatial)</li> <li>• Geo Location (2D/3D/4D context, point, line or polyhedron)</li> <li>• Movement</li> <li>• Severity, Accumulation, Intensity</li> <li>• Range (Max. – Min.)</li> <li>• Variations</li> <li>• Probability of occurrence</li> <li>• Confidence/Uncertainty of forecast</li> <li>• Reliability</li> <li>• Data sample period</li> <li>• Auto</li> <li>• Change indicator/period</li> <li>• Amendment / Correction</li> <li>• Operational Status</li> <li>• Source</li> </ul>

	<ul style="list-style-type: none"> <li>• Thresholds</li> <li>• Format (TAC, Gridded, Graphical, IWXXM)</li> <li>• Data quality flag</li> <li>• Runway identification or location identifier</li> <li>• Effects/impact on aviation systems (i.e. communications, navigation &amp; surveillance systems)</li> <li>• Radiation (exposure)</li> </ul>																																													
	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.																																													
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AMET-B1/4		DISSEMINATION OF METEOROLOGICAL INFORMATION				
Main purpose	Dissemination of meteorological information in support of automated decision process or aids, involving meteorological information, meteorological information translation, ATW 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	<p>This element represents the dissemination of meteorological products using a variety of formats, including:</p> <ul style="list-style-type: none"> <li>Tailored products (human-readable)</li> <li>Impact-related products</li> <li>Gridded</li> <li>Graphical (PNG and BUFR to be phased out)</li> <li>ICAO Meteorological Information Exchange Model (IWXXM) format</li> <li>Traditional alphanumeric code (TAC) – being phased out</li> </ul> <p>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).</p>					
Human Factors	Change in task by user?	Yes				
	Processing of new information by user?	Yes				
	Use of new equipment?	Yes				
	Change in level of automation?	Yes				
PART 3 Dependencies and relations	Type of dependencies		ASBU element			
	Evolution	Relation	ID	Title		
	X		AMET-B0/4	Dissemination of meteorological products		
		X	AMET-B1/1	Meteorological observations information (operational requirement)		
		X	AMET-B1/2	Meteorological forecast and warning information (operational requirement)		
		X	COMS-B1/1	PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace		
		X	COMS-B1/2	PBSC approved ADS-C (FANS 1/A+) for procedural airspace		
		X	COMS-B1/3	SATVOICE (incl. routine communications) for procedural airspace		
		X	COMI-B1/1	VHF Data Link (VDL) Mode 2 Multi-Frequency		
		X	COMI-B1/2	SATCOM Class B (SB-S) Voice and Data		
		X	COMI-B1/3	Commercial links for non-safety critical		
		X	DAIM-B1/1	Provision of quality-assured aeronautical data and information		
	X	DAIM-B1/2	Provision of digital Aeronautical Information Publication (AIP) data sets			
Operations	Flight phases					
	Taxi-out	Departure	En-route	Arrival	Taxi-in	Turn-around
	X	X	X	X	X	X
Planning layers	ATM planning	Strategical	Pre-tactical	Tactical		Post operations
				Pre ops	During ops	
	X	X	X	X	X	X
PART 4 Enablers	Category		Description/Examples		Stakeholder(s)	
	Regulatory Provisions	Annex	Annex 3 - Meteorological Service for International Air Navigation			
		Technical Regulation	WMO No.49 Vol II - Technical Regulations Basic Documents No. 2, Volume II – Meteorological Service for			

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	PANS	Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed
	Annex	Annex 10 – Aeronautical Telecommunications
Annex	Annex 15 - Aeronautical Information Services	
Operational Procedures	Manual	Doc. 8896 - Manual of Aeronautical Meteorological Practice
	Manual	Doc. 9377 – Manual on the Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services
	Guidance	Doc. 9855 - Guidelines on the use of the Public Internet for Aeronautical Applications
	Manual	Doc. 9880 - Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols
	Manual	Doc. 9896 – Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocol
	Manual	Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information
	Manual	Doc. 10039 - Manual on System Wide Information Management (SWIM) Concept
	Guidance	WMO No.731 – Guide to Meteorological Observing and Information Distribution Systems for Aviation Weather Services
	Guidance	ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM
	Guidance	Regional OPMET Interface Control Documents
	Guidance	Regional OPMET Bulletin Exchange Handbooks
	Airborne System capability	
Ground system infrastructure		
Training		
Information Exchange Model	ICAO Meteorological Information Exchange Model (IWXXM)	
Other		

SWIM and IWXXM ... necessary to allow interoperability and integration of MET information into ATM systems

IWXXM = model ; built on XML schemes defined by WMO CBS TT-AvXML

AMET-B2/2		METEOROLOGICAL FORECAST AND WARNING INFORMATION			
PART 3	Main purpose	Integrated meteorological forecast and warning information in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term.			
	New capabilities	Further development of space weather and radioactive material 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 user-defined forecast and warning products derived from meteorological information in ICAO Meteorological Information Exchange Model (IWXXM) form. Further development of probabilistic information derived from ensemble prediction systems.			
	Description	<p>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 (&gt;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.</p> <p>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.</p> <p>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.</p> <p>A significant evolution is planned for volcanic ash information. Next generation volcanic ash cloud forecasts will be fully implemented, which will provide both deterministic and probabilistic forecasts for contamination levels that will allow decision makers to use, 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.</p> <p>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 enhanced with the accuracy, resolution and frequency to support ATM operations within those areas. 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.</p> <p>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.</p> <p>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.</p>			
Human Factors	Change in task by user?	Yes			
	Processing of new information by user?	Yes			
	Use of new equipment?	Yes			
	Change in level of automation?	Yes			
Dependencies and relations	Type of dependencies		ASBU element		
	Evolution	Relation	ID	Title	

Terminal area

Description	<p>efficient international air navigation, particularly in the area of regional services.</p> <p>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.</p> <p>A significant evolution is planned for volcanic ash information. Next generation volcanic ash cloud forecasts will be fully implemented, which will provide both deterministic and probabilistic forecasts for contamination levels that will allow decision makers to use, taking into account their risk management practices and the</p>
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...this module acknowledges the need to provide meteorological information services with the **accuracy, resolution and frequency** to support ATM operations within those areas.



# Meteorology in 2019 GANP/ASBU

From the ICAO ASBU Panel Project Team work:

- Meteorology is an **Enabler** for the majority of the other Threads.
- ▷ Dependencies between threads and/or elements:
  - *what relations AMET has with other threads,*
  - *what are the elements in other threads the AMET modules depend on, and*
  - *what are the AMET elements that modules in other threads depend on.*

PART 3

PART 4

AMET-B1/4 DISSEMINATION OF METEOROLOGICAL INFORMATION						
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	<p>This element represents the dissemination of meteorological products using a variety of formats, including:</p> <ul style="list-style-type: none"> <li>Tailored products (human-readable)</li> <li>Impact-translated products</li> <li>Gridded</li> <li>Graphical (PNG and BUFR to be phased out)</li> <li>ICAO Meteorological Information Exchange Model (IWXXM) format</li> <li>Traditional alphanumeric code (TAC) – being phased out</li> </ul> <p>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).</p>					
Human Factors	<p>Change in task by user? Yes</p> <p>Processing of new information by user? Yes</p> <p>Use of new equipment? Yes</p> <p>Change in level of automation? Yes</p>					
Dependencies and relations	Type of dependencies		ASBU element			
	Evolution	Relation	ID	Title		
	X		AMET-B0/4	Dissemination of meteorological products		
		X	AMET-B1/1	Meteorological observations information (operational requirement)		
		X	AMET-B1/2	Meteorological forecast and warning information (operational requirement)		
		X	COMS-B1/1	PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace		
		X	COMS-B1/2	PBCS approved ADS-C (FANS 1/A+) for procedural airspace		
		X	COMS-B1/3	SATVOICE (incl. routine communications) for procedural airspace		
		X	COMI-B1/1	VHF Data Link (VDL) Mode 2 Multi-Frequency		
		X	COMI-B1/2	SATCOM Class B (SB-S) Voice and Data		
		X	COMI-B1/3	Commercial links for non-safety critical		
		X	DAIM-B1/1	Provision of quality-assured aeronautical data and information		
	X	DAIM-B1/2	Provision of digital Aeronautical Information Publication (AIP) data sets			
Operations	Flight phases					
	Taxi-out	Departure	En-route	Arrival	Taxi-in	Turn-around
	X	X	X	X	X	X
Planning layers	ATM planning		Strategical	Pre-tactical	Tactical	
					Pre ops	During ops
	X	X	X	X	X	X
Enablers						
Category	Type	Description/Examples				Stakeholder(s)
Regulatory Provisions	Annex	Annex 3 - Meteorological Service for International Air Navigation				
	Technical Regulation	WMO No. 49 Vol II - Technical Regulations Basic Documents No. 2, Volume II – Meteorological Service for				

Technical Regulation	International Air Navigation	
	WMO No. 49 Vol IV - Technical Regulations - Basic Documents No. 2, Volume IV – Quality Management	
	PANS	Procedures for Air Navigation Services – Meteorology (PANS-MET) – being developed
	Annex	Annex 10 – Aeronautical Telecommunications
Annex	Annex 15 - Aeronautical Information Services	
Operational Procedures	Manual	Doc. 8896 - Manual of Aeronautical Meteorological Practice
	Manual	Doc. 9377 – Manual on the Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services
	Guidance	Doc. 9855 - Guidelines on the use of the Public Internet for Aeronautical Applications
	Manual	Doc. 9880 - Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols
	Manual	Doc. 9896 – Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocol
	Manual	Doc. 10003 - Manual on the Digital Exchange of Aeronautical Meteorological Information
	Manual	Doc. 10039 - Manual on System Wide Information Management (SWIM) Concept
	Guidance	WMO No. 731 – Guide to Meteorological Observing and Information Distribution Systems for Aviation Weather Services
	Guidance	ICAO Guidelines for the Implementation of OPMET Data Exchange using IWXXM
	Guidance	Regional OPMET Interface Control Documents
Guidance	Regional OPMET Bulletin Exchange Handbooks	
Airborne System capability		
Ground system infrastructure		
Training		
Information Exchange Model	ICAO Meteorological Information Exchange Model (IWXXM)	
Other		



# Example of dependency of one ATM element on AMET

## **ACDM-B1/1 – Airport CDM – Airport Operations Plan**

### Main purpose :

To fully integrate airports in the ATM network and enhance collaboration between airports 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.

### Dependencies on AMET (type= Relation-Information need)

AMET-B1/1 - Meteorological observations information

AMET-B1/2 - Meteorological forecast and warning information

AMET-B1/4 - Dissemination of meteorological information

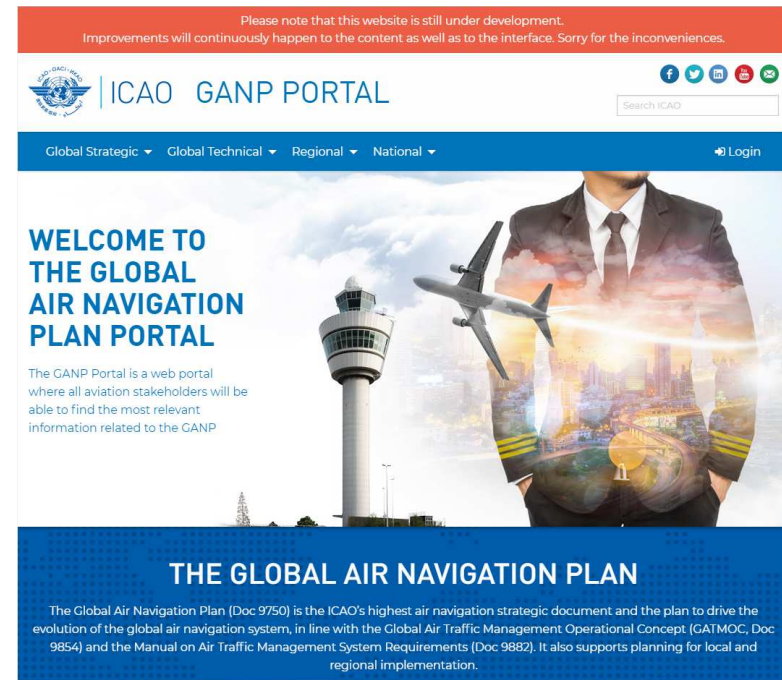
# ICAO GANP web portal

<https://www4.icao.int/ganpportal/>

- Where to find the most relevant information related to the GANP;
- It provides **elements and threads overview** including AMET elements:


<https://www4.icao.int/ganpportal/ASBU>

- And a **graphics of dependencies**.



# ICAO GANP web portal - Dependencies

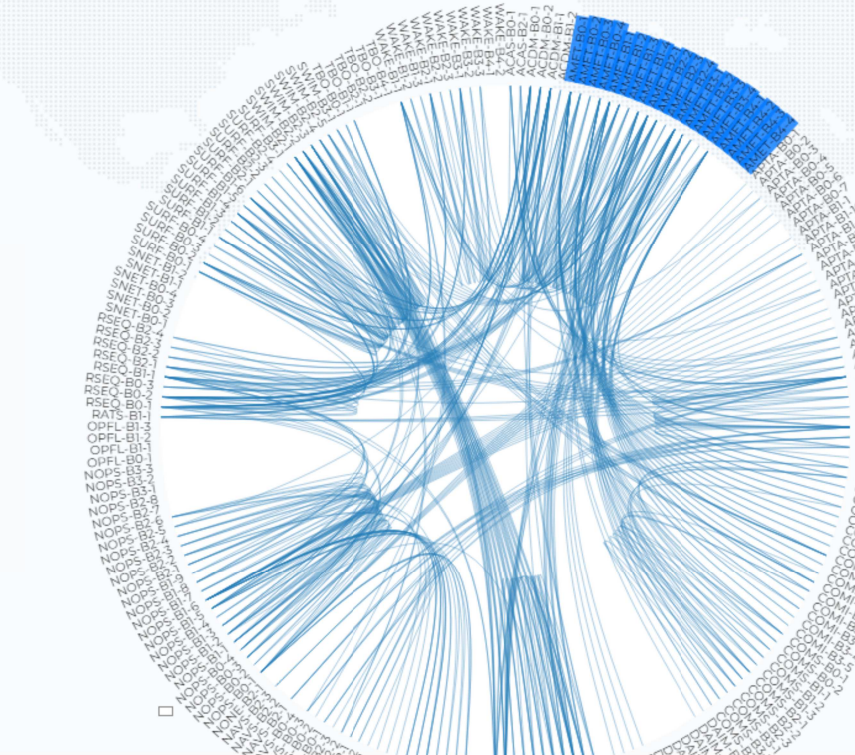
Please note that this website is still under development.  
Improvements will continuously happen to the content as well as to the interface. Sorry for the inconveniences.

 ICAO GANP PORTAL

Search ICAO

Back to Portal | Element Overview | Thread Overview | Performance Objectives | Dependencies | Login

## DEPENDENCY GRAPH



- Evolution
- Relation-information need
- Relation-technology need
- Relation-operational need
- Relation-benefit
- TBO

APPLY CLEAR

Dimension:

# ICAO GANP/ASBU more information

Also presented at WMO Aeronautical Meteorology Scientific Conference, in Toulouse, France in November 2017:

- AeM Series, 02. Proceedings of the 2017 WMO Aeronautical Meteorology Scientific Conference
- [https://library.wmo.int/doc\\_num.php?explnum\\_id=4339](https://library.wmo.int/doc_num.php?explnum_id=4339)

# Thank you Merci



**WMO OMM**

World Meteorological Organization

Organisation météorologique mondiale