



# ICAO

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WORKING PAPER

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**Seventh Eastern Caribbean Civil Aviation Technical Group (E/CAR/CATG/7) Meeting**  
Miami, United States, 26-28 July 2023

**Agenda Item 3: Air Navigation Matters**  
**3.3 Status of Air Navigation Services (ANS) implementation in the E/CAR States**

**KEY PERFORMANCE INDICATORS (KPIs)**

(Presented by the Secretariat)

**EXECUTIVE SUMMARY**

This working paper provides an evaluation of the Key Performance Indicators (KPIs) under the new Global Air Navigation Plan (GANP) Seventh Edition that was approved in October 2022 at the 41st ICAO Assembly. The working paper provides an analysis, recommendations and suggested actions that will help establish the regional and national measurement mechanisms of CAR States.

<b>Action:</b>	Suggested actions are described under item 5.
<i>Strategic Objectives:</i>	<ul style="list-style-type: none"><li>• Strategic Objective 1 – Safety</li><li>• Strategic Objective 2 – Air Navigation Capacity and Efficiency</li><li>• Strategic Objective 4 – Economic Development of Air Transport</li><li>• Strategic Objective 5 – Environmental Protection</li></ul>
<i>References:</i>	<ul style="list-style-type: none"><li>• Global Air Navigation Plan, seventh version: <a href="https://www4.icao.int/ganpportal/">https://www4.icao.int/ganpportal/</a></li></ul>

**1. Introduction**

1.1 KPIs are quantitative means of measuring current/past performance, expected future performance as well as actual progress in achieving performance objectives. For Air Navigation Services, they provide information to be reviewed by States on service performance and support decision-making for operational improvements.

1.2 KPIs are key fundamentals that provide information regarding actions taken, systems implemented, and so on. An action allows objective measurement of performance over time for a specific objective.

1.3 With the new version of the Global Air Navigation Plan (GANP), 23 different KPIs were defined, they can be found in this link: <https://www4.icao.int/ganpportal/ASBU/KPI>.

## 2. Performance objective catalogue

2.1 Key performance area (KPA) is a way of categorizing performance subjects related to high-level ambitions and expectations.

2.2 Performance ambitions, at a global level, will be met by pursuing more specific performance objectives. At a regional level, Volume III of the regional Air Navigation Plans provides regional performance objectives according to specific regional requirements. These objectives are “SMART” — (specific, measurable, achievable, relevant and timely), and although expressed in qualitative terms they may include a desired or required trend for a performance indicator while not yet expressing the performance objective in numeric terms (this is done as part of a performance target setting).

2.3 The regional performance objectives assist the aviation community in identifying relevant and timely enhancements (operational improvements) to a given region’s air navigation system. In addition, at a national level, States can set performance targets for their different operational environments using the list of KPIs, taking into account regional performance requirements.

2.4 According to the GANP, Seventh Edition, the performance objectives are:

- Efficiency
- Capacity
- Predictability
- Safety
- Security
- Environment
- Cost effectiveness
- Interoperability
- Access and equity
- Participation by the Air Traffic Management (ATM) community
- Flexibility

*Note: See [https://www4.icao.int/ganportal/ASBU/PerformanceObjective for further details](https://www4.icao.int/ganportal/ASBU/PerformanceObjective%20for%20further%20details).*

2.5 Following the assessment of the ASBU elements "Ready for implementation" there are 17 KPIs related to these elements, which are of regional interest and which we as a ECAR Working Group must analyze. See **Appendix A** of this working paper for a full list.

2.6 Important notes regarding KPIs:

- a. The System Wide Information Management (SWIM), Digital Aeronautical Information Management (DAIM), Advanced Meteorological Information (AMET), Flight and Flow Information for a Collaborative Environment (FF-ICE) modules are information enablers and do not have related KPIs.

- b. All modules in the technology thread are also information enablers, Communication infrastructure (COMI), ATS Communication service (COMS), Alternative Surveillance (ASUR) and Navigation systems (NAVS). They also have no related KPIs.
- c. All KPIs are related to operational aviation and airport services, supported by information and technology

2.7 In summary, the ASBU information and technology modules play an important role in the provision of information to provide air navigation services, but performance values are measured through the aeronautical services already in operation.

### 3. Information needed to establish KPIs

3.1 To obtain the results of the different KPIs it is necessary to obtain pre-set data that feeds the algorithm to calculate the KPI. The necessary information is displayed under the following link: <https://www4.icao.int/ganpportal/ASBU/KPI>.

3.2 Data collection involves asking the following questions:

- What type of data is it?
- What is the source of the data?
- What is the precision of the data?
- What is the periodicity with which the data is obtained?
- What are the formatting characteristics of the data?
- What is the data validation process?
- Who are the suppliers of the data?
- What is the metadata of the data (type of data, date, time, system that obtained it, who obtained it, etc.)? A clear and precise definition of the data.

3.3 It is necessary for us as a regional Working Group to establish regional requirements for obtaining this information in terms of the KPIs that are available and that we can assess. There are two important aspects to bear in mind when carrying out this activity:

- a) Establish the regional implementation status through the BBBs: <https://www4.icao.int/ganpportal/BBB> and the ASBU elements in their "Ready for implementation" maturity status.
- b) Make a regional analysis to obtain the information that every State could provide. Some States can provide all data; in that sense, as a NACC/WG, we must provide information regarding the minimal requirement that data will integrate.

3.4 Each State, according to the information available, can define the KPIs that apply to its operations and that will feed into its continuous improvement objectives. However, at the regional level, the KPIs that we define should be those for which most of the data is available for each of the States.

3.5 To obtain results that truly define the regional state of performance it is necessary that all States provide information, the same information, that measures KPIs based on equal requirements, only in this way will we obtain data that validly measure regional air navigation performance.

#### 4. Recommendations

4.1 **Recommendation 1:** Evaluate the information provided in this working paper and establish an action plan to develop a gap analysis on KPIs regional implementation.

4.2 **Recommendation 2:** Every ECAR working group must integrate under their Task Force action plan their contributions to establish regional KPIs.

4.3 **Recommendation 3:** It is necessary that as a Regional Group we establish the minimum requirements that each State must meet in order to obtain the data that will feed the KPIs.

#### 5. Suggested actions

5.1 The Meeting is invited to:

- a) analyze the information provided in this working paper;
- b) all ECAR Task Force according to their own evaluation, provide their contribution to the establishment of the regional KPIs;
- c) to jointly set up the pilot programme (draft) as a regional project of the NACC/WG to establish regional KPIs; and
- d) any other actions needed.

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## ASBU ELEMENTS ELEMENTS READY FOR IMPLEMENTATION

ACAS (Airborne Collision Avoidance System )			
Element	KPA	Focus Area	Performance Objective Suuported
ACAS-B1/1 ACAS Improvements Operational	Safety		Improve mid-air collision avoidance (safety net)

ACDM (Airport Collaborative Decision Making)			
Element	KPA	Focus Area	Performance Objective Suuported
ACDM-B0/1 Airport CDM Information Sharing (ACIS) Operational	ACDM has no direct benefit on the performance objectives we have in the catalogue of objectives. All benefits are direct to the operator such as efficiency, awareness and indirect benefit like increased safety.		Most specific performance objective(s) supported
ACDM-B0/2 Integration with ATM Network function Operational			Most specific performance objective(s) supported

AMET (Advanced Meteorological Information)			
Element	KPA	Focus Area	Performance Objective Suuported
AMET-B0/1 Meteorological observations products Information	Information enablers	Information enablers	All
AMET-B0/2 Meteorological forecast and warning products Information	Information enablers	Information enablers	All
AMET-B0/3 Climatological and historical meteorological products Information	Information enablers	Information enablers	All
AMET-B0/4 Dissemination of meteorological products Information	Information enablers	Information enablers	All

APTA (Airport Accessibility)			
Element	KPA	Focus Area	Performance Objective Suuported
APTA-B0/1 PBN Approaches (with basic capabilities) Operational	Capacity	Capacity, throughput & utilization	Equip additional RWY ends with instrument approaches
	Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)
APTA-B0/2 PBN SID and STAR procedures (with basic capabilities) Operational	Capacity	Capacity, throughput & utilization	Increase airport arrival rate
	Capacity	Capacity, throughput & utilization	Mitigate local airspace capacity constraints if this is the problem
	Capacity	Capacity, throughput & utilization	Mitigate noise constraints if this is the problem
	Efficiency	Vertical flight efficiency	Reduce permanent (airspace and approach procedure design) and semi-permanent (ATFCM measures) altitude constraints (level capping) along the climb portion of traffic flows, in terminal and en-route airspace
APTA-B0/3 SBAS/GBAS CAT I precision approach procedures Operational	Capacity	Capacity, throughput & utilization	Equip additional RWY ends with instrument approaches
	Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)
APTA-B0/4 CDO (Basic) Operational	Efficiency	Vertical flight efficiency	Avoid efficiency penalties attributable to non-optimum ToD (descent starts before or after the optimum ToD)
	Efficiency	Vertical flight efficiency	Avoid tactical lengthening of arrival path (eg vectoring, holding, trombone extension) because this leads to level flight
	Efficiency	Vertical flight efficiency	Reduce descent inefficiency attributable to altitude constraints imposed by ATM
APTA-B0/5 CCO (Basic) Operational	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
APTA-B0/6 PBN Helicopter Point in Space (PinS) Operations Operational	Capacity	Capacity, throughput & utilization	Mitigate local airspace capacity constraints if this is the problem
	Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)
APTA-B0/7 Performance based aerodrome operating minima – Advanced aircraft Operational	Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)
APTA-B0/8 Performance based aerodrome operating minima – Basic aircraft	Capacity	Capacity, throughput & utilization	Equip additional RWY ends with instrument approaches
	Capacity	Capacity, throughput & utilization	Reduce approach minima (ceiling & visibility)

ASUR (Alternative Surveillance)			
Element	KPA	Focus Area	Performance Objective Suuported
ASUR-B0/1 Automatic Dependent Surveillance – Broadcast (ADS-B) Technology	Information enablers	Information enablers	All
ASUR-B0/2 Multilateration cooperative surveillance systems (MLAT) Technology	Information enablers	Information enablers	All
ASUR-B0/3 Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS) Technology	Information enablers	Information enablers	All

## ASBU ELEMENTS ELEMENTS READY FOR IMPLEMENTATION

ASUR-B1/1 Reception of aircraft ADS-B signals from space (SB ADS-B) Technology	Information enablers	Information enablers	All
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### COMI (Communication infrastructure)

Element	KPA	Focus Area	Performance Objective Suuported
COMI-B0/1 Aircraft Communication Addressing and Reporting System (ACARS) Technology	Information enablers	Information enablers	All
COMI-B0/2 Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI) Technology	Information enablers	Information enablers	All
COMI-B0/3 VHF Data Link (VDL) Mode 0/A Technology	Information enablers	Information enablers	All
COMI-B0/4 VHF Data Link (VDL) Mode 2 Basic Technology	Information enablers	Information enablers	All
COMI-B0/5 Satellite communications (SATCOM) Class C Data Technology	Information enablers	Information enablers	All
COMI-B0/6 High Frequency Data Link (HFDL) Technology	Information enablers	Information enablers	All
COMI-B0/7 ATS Message Handling System (AMHS) Technology	Information enablers	Information enablers	All
COMI-B1/2 VHF Data Link (VDL) Mode 2 Multi-Frequency	Information enablers	Information enablers	All
COMI-B1/3 SATCOM Class B Voice and Data Technology	Information enablers	Information enablers	All
COMI-B1/4 Aeronautical Mobile Airport Communication System (AeroMACS) Ground-Ground Technology	Information enablers	Information enablers	All

### COMS (ATS Communication service)

Element	KPA	Focus Area	Performance Objective Suuported
COMS-B0/1 CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace Technology	Information enablers	Information enablers	All
COMS-B0/2 ADS-C (FANS 1/A) for procedural airspace Technology	Information enablers	Information enablers	All
COMS-B1/1 PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace Technology	Information enablers	Information enablers	All
COMS-B1/2 PBCS approved ADS-C (FANS 1/A+) for procedural airspace Technology	Information enablers	Information enablers	All
COMS-B1/3 SATVOICE (incl. routine communications) for procedural airspace Technology	Information enablers	Information enablers	All

### CSEP (Cooperative Separation)

Element	KPA	Focus Area	Performance Objective Suuported
CSEP-B1/1 Basic airborne situational awareness during flight operations (AIRB) Operational	Safety		Improve mid-air collision avoidance (safety net)
	Safety		Improve separation provision (at a planning horizon > 2 minutes)
CSEP-B1/2 Visual Separation on Approach (VSA) Operational	Safety		Improve separation provision (at a planning horizon > 2 minutes)

### DAIM (Digital Aeronautical Information Management)

Element	KPA	Focus Area	Performance Objective Suuported
DAIM-B1/2 Provision of digital Aeronautical Information Publication (AIP) data sets Information	Information enablers	Information enablers	All
DAIM-B1/3 Provision of digital terrain data sets Information	Information enablers	Information enablers	All

## ASBU ELEMENTS ELEMENTS READY FOR IMPLEMENTATION

DAIM-B1/4 Provision of digital obstacle data sets Information	Information enablers	Information enablers	All
DAIM-B1/5 Provision of digital aerodrome mapping data sets Information	Information enablers	Information enablers	All
DAIM-B1/6 Provision of digital instrument flight procedure data sets Information	Information enablers	Information enablers	All
DAIM-B1/7 NOTAM improvements Information	Information enablers	Information enablers	All

### FICE (Flight and Flow Information for a Collaborative Environment (FF-ICE))

Element	KPA	Focus Area	Performance Objective Suported
FICE-B0/1 Automated basic inter facility data exchange (AIDC) Information	Information enablers	Information enablers	All

### FRTO (Improved operations through enhanced en-route trajectories)

Element	KPA	Focus Area	Performance Objective Suported
FRTO-B0/1 Direct routing (DCT) Operational	Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route network design
FRTO-B0/2 Airspace planning and Flexible Use of Airspace (FUA) Operational	Access and equity		Improve airspace reservation management
	Efficiency	Flight time & distance	Facilitate direct routing of portions of the flight (if this does not cause network problems)
	Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route & airspace availability as known at the flight planning stage
	Efficiency	Flight time & distance	Reduce need for tactical ATFM rerouting to circumnavigate airspace closed at short notice
	Efficiency	Flight time & distance	Reduce need to avoid airspace because of lack of confirmation that it will be open
	Efficiency	Vertical flight efficiency	Reduce altitude restrictions during climb to avoid Special Use Airspace
	Efficiency	Vertical flight efficiency	Reduce altitude restrictions during cruise to avoid Special Use Airspace
FRTO-B0/3 Pre-validated and coordinated ATS routes to support flight and flow Operational	Capacity	Capacity shortfall & associated delay	Establish/update/publish the catalogue of strategic ATFM measures designed to respond to a variety of possible/typical/recurring events degrading the airspace system (e.g. predefined action plans)
	Flexibility		Improve flexibility of the Air Navigation System
FRTO-B0/4 Basic conflict detection and conformance monitoring Operational	Capacity	Capacity, throughput & utilization	Reduce ATCO workload (en-route)
	Safety		Avoid vertical & lateral navigation errors during flight (cases of non-conformance with clearance)
	Safety		Improve early detection of conflicting ATC Clearances (CATC) (en-route / departure / approach)
	Safety		Improve separation provision (at a planning horizon > 2 minutes)

### GADS (Global Aeronautical Distress and Safety System (GADSS))

Element	KPA	Focus Area	Performance Objective Suported
GADS-B1/1 Aircraft Tracking Operational			Most specific performance objective(s) supported
GADS-B1/2 Operational Control Directory Operational			Most specific performance objective(s) supported
GADS-B2/1 Location of an aircraft in Distress Operational			Most specific performance objective(s) supported
GADS-B2/2 Distress tracking information management Operational			Most specific performance objective(s) supported
GADS-B2/4 Flight Data Recovery Operational			Most specific performance objective(s) supported

### NAVS (Navigation systems)

Element	KPA	Focus Area	Performance Objective Suported
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## ASBU ELEMENTS ELEMENTS READY FOR IMPLEMENTATION

NAVS-B0/1 Ground Based Augmentation Systems (GBAS) Technology	Information enablers	Information enablers	All
Satellite Based Augmentation Systems (SBAS) Technology	Information enablers	Information enablers	All
NAVS-B0/3 Aircraft Based Augmentation Systems (ABAS) Technology	Information enablers	Information enablers	All
NAVS-B0/4 Navigation Minimal Operating Networks (Nav. MON) Technology	Information enablers	Information enablers	All

### NOPS (Network Operations)

Element	KPA	Focus Area	Performance Objective Suuported
NOPS-B0/1 Initial integration of collaborative airspace management with air traffic flow management Operational	Efficiency	Flight time & distance	Facilitate tactical decisions leading to a shorter actual route than in the FPL
	Efficiency	Flight time & distance	Overcome route selection inefficiencies associated with route & airspace availability as known at the flight planning stage
	Efficiency	Flight time & distance	Reduce need for tactical ATFM rerouting to circumnavigate airspace closed at short notice
	Efficiency	Vertical flight efficiency	Reduce altitude restrictions during climb introduced to avoid airspace above
	Efficiency	Vertical flight efficiency	Reduce altitude restrictions during cruise introduced to avoid airspace above
	Efficiency	Vertical flight efficiency	Reduce altitude restrictions during descent to avoid Special Use Airspace
NOPS-B0/2 Collaborative Network Flight Updates Operational	Capacity	Capacity shortfall & associated delay	Ensure that the measures applied are absolutely necessary and that unnecessary measures are avoided
	Capacity	Capacity shortfall & associated delay	Establish/improve the capability to use opportunities to mitigate disturbances, originating from: More precise surveillance data
NOPS-B0/3 Network Operation Planning basic features Operational		Focus Areas	Most specific performance objective(s) supported
NOPS-B0/4 Initial Airport/ATFM slots and A-CDM Network interface Operational	Capacity	Capacity shortfall & associated delay	For a given airspace entry slot: let airspace users swap the slot to another flight (slot substitution or UDPP – User Driven Prioritisation Process)
NOPS-B0/5 Dynamic ATFM slot allocation Operational	Capacity	Capacity shortfall & associated delay	Implement TMIs to delay take-off times
	Capacity	Capacity shortfall & associated delay	Use ATFM oriented flow management: delay push-back of inbound traffic

### OPFL (Improved access to optimum flight levels in oceanic and remote airspace)

Element	KPA	Focus Area	Performance Objective Suuported
OPFL-B0/1 In Trail Procedure (ITP) Operational	Efficiency	Vertical flight efficiency	Increase acceptance of pilot requests for higher cruise level
	Efficiency	Vertical flight efficiency	Reduce level restrictions during cruise issued by ATCOs for
OPFL-B2/1 Separation minima using ATS surveillance systems where VHF voice communications are not available Operational	Efficiency	Flight time & distance	Improve route selection after the flight planning stage
	Efficiency	Flight time & distance	Improve route selection at the flight planning stage
	Efficiency	Fuel burn	Reduce fuel burn impact of impeded conditions
	Efficiency	Vertical flight efficiency	Reduce vertical flight inefficiency during the cruise phase

### RSEQ (Improved traffic flow through runway sequencing)

Element	KPA	Focus Area	Performance Objective Suuported
RSEQ-B0/1 Arrival Management Operational	Capacity	Capacity, throughput & utilization	Apply arrival balancing
	Capacity	Capacity, throughput & utilization	Apply smart sequencing to harmonise final approach speeds
	Capacity	Capacity, throughput & utilization	Apply smart sequencing to optimise wake vortex separations
	Capacity	Capacity, throughput & utilization	Improve arrival sequencing and metering to fill all arrival slots
	Efficiency	Flight time & distance	Apply TTA and en-route speed reduction if traffic is already
	Efficiency	Flight time & distance	Reduce need to fine-tune traffic spacing in terminal airspace (arrival)
RSEQ-B0/2 Departure Management Operational	Capacity	Capacity, throughput & utilization	Maintain or improve departure rate of the RWY
	Efficiency	Flight time & distance	Avoid additional holding time after line up caused by departure metering not factored in during pushback planning
	Efficiency	Flight time & distance	Improve the delivery of departing traffic into the overhead stream
Point merge Operational	Capacity	Capacity, throughput & utilization	Apply merging & synchronisation of arrival flows

### SNET (Ground-based Safety Nets)

Element	KPA	Focus Area	Performance Objective Suuported
SNET-B0/1 Short Term Conflict Alert (STCA) Operational	Safety		Improve mid-air collision avoidance (safety net)



## ASBU ELEMENTS ELEMENTS READY FOR IMPLEMENTATION

SNET-B0/2 Minimum Safe Altitude Warning (MSAW) Operational	Safety		Avoid controlled flight into terrain (CFIT) and obstacle collision risk
SNET-B0/3 Area Proximity Warning (APW) Operational	Safety		Avoid unauthorized penetration of segregated airspace
SNET-B0/4 Approach Path Monitoring (APM) Operational	Safety		Avoid controlled flight into terrain (CFIT) and obstacle collision risk
SNET-B1/1 Enhanced STCA with aircraft parameters Operational	Safety		Improve mid-air collision avoidance (safety net)
SNET-B1/2 Enhanced STCA in complex TMAs Operational	Safety		Improve mid-air collision avoidance (safety net)

### SURF (Surface operations)

Element	KPA	Focus Area	Performance Objective Suuported
SURF-B0/1 Basic ATCO tools to manage traffic during ground operations Operational	Efficiency	Flight time & distance	Avoid taxi-in additional time resulting from adverse conditions
	Efficiency	Flight time & distance	Avoid taxi-out additional time resulting from adverse conditions
	Safety		Avoid incorrect entries of aircraft or vehicles onto the runway protected area (without or contrary to ATC clearance or due to incorrect ATC clearance)
	Safety		Avoid incorrect runway crossings by aircraft or vehicles (without or contrary to ATC clearance or due to incorrect ATC clearance)
	Safety		Avoid incorrect taxiing (cases of non-conformance with clearance)
SURF-B0/2 Comprehensive situational awareness of surface operations Operational	Safety		Improve collision avoidance during taxi operations (safety net)
	Safety		Avoid incorrect entries of aircraft or vehicles onto the runway protected area (without or contrary to ATC clearance or due to incorrect ATC clearance)
	Safety		Avoid incorrect presence of vacating aircraft or vehicles onto the runway protected area
	Safety		Avoid incorrect runway crossings by aircraft or vehicles (without or contrary to ATC clearance or due to incorrect ATC clearance)
SURF-B0/3 Initial ATCO alerting service for surface operations Operational	Safety		Improve runway collision avoidance (safety net)
SURF-B1/2 Comprehensive pilot situational awareness on the airport surface Operational	Safety		Improve collision avoidance during taxi operations (safety net)
	Safety		Avoid incorrect entries of aircraft or vehicles onto the runway protected area (without or contrary to ATC clearance or due to incorrect ATC clearance)
	Safety		Avoid incorrect presence of vacating aircraft or vehicles onto the runway protected area
	Safety		Avoid incorrect runway crossings by aircraft or vehicles (without or contrary to ATC clearance or due to incorrect ATC clearance)

### SWIM (System Wide Information Management)

Element	KPA	Focus Area	Performance Objective Suuported
SWIM-B2/3 SWIM registry Information	Information enablers	Information enablers	All

### TBO (Trajectory-based operations)

Element	KPA	Focus Area	Performance Objective Suuported
TBO-B0/1 Introduction of time-based management within a flow centric approach. Operational	Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance at airports and/or associated terminal airspace
	Capacity	Capacity shortfall & associated delay	Mitigate demand/capacity imbalance in en-route airspace