



WORKING PAPER

ASSEMBLY — 39TH SESSION

TECHNICAL COMMISSION

Agenda Item 36: Aviation safety and air navigation implementation support

AVIATION SYSTEM BLOCK UPGRADE (ASBU) HANDBOOK

(Presented by Canada and the United States)

EXECUTIVE SUMMARY

The *Global Air Navigation Plan* (GANP Doc 9750) defines the Aviation System Block Upgrade (ASBU) framework and provides guidance for States, planning and implementation regional groups (PIRGs), air navigation service providers (ANSPs), airspace users and other industry stakeholders to advance their Air Navigation capabilities based on their specific operational requirements.

However, the ASBUs are outlined at such a high level in the GANP, it is difficult and in some cases, impossible, for States to understand the components which contribute to the operational improvement described in the module as well as to identify the enablers required to implement, when needed, these components.

In order to have a common understanding of the ASBU framework, the States of the North American (NAM) Region created the NAM ASBU Handbook.

Action: The Assembly is invited to:

- a) consider the creation of an ICAO ASBU Handbook that will act as the base of regional and possibly state ASBU Handbooks;
- b) recommend States use the ICAO ASBU Handbook or similar documents to assist them in ASBU implementation and reporting; and
- c) include the ICAO ASBU handbook or similar material in the GANP.

<i>Strategic Objectives:</i>	This working paper relates to the Air Navigation Capacity and Efficiency Strategic Objectives.
<i>Financial implications:</i>	None
<i>References:</i>	Doc 10007, <i>Report of the Twelfth Air Navigation Conference (AN-Conf/12)</i> Doc 10022, <i>Assembly Resolutions in Force (as of 4 October 2013)</i> Doc 9750, <i>Global Air Navigation Plan</i> <i>Working Document for the Aviation System Block Upgrades</i> (Edition 28 March 2013)

1. INTRODUCTION

1.1 The *NAM ASBU Handbook* was created to assist in the application of the Aviation System Block Upgrade (ASBU) framework as detailed in the Fourth Edition of the *Global Air Navigation Plan* (GANP, Doc 9750).

1.2 The ASBU framework was globally endorsed during the 38th Assembly of the International Civil Aviation Organization (ICAO) which took place at ICAO Headquarters in Montréal, Canada, from 28 September to 4 October 2013, via the adoption of the 4th Edition of the GANP, which was presented to the Technical Commission of the 38th Assembly by the Council of ICAO in Appendix A to A38-WP/39 – A Comprehensive Strategy for Air Navigation: Endorsement of the Global Air Navigation Plan.

1.3 As noted in A38-WP/39, the Fourth Edition of the GANP was meant to “provide clear guidance on the guiding operational targets and supporting technologies, avionics, procedures, standards and regulatory approvals needed to realize them” and to establish “a framework for incremental implementations based on the specific operational profiles and traffic densities of each State” (A38-WP/39 paragraph 2.1 refers).

1.4 The detailed material which formed the basis of the Fourth Edition of the GANP was presented at the 12th Air Navigation Conference (ANConf/12) which took place at ICAO Headquarters from 19 to 30 November, 2012. This base material was subsequently updated to incorporate the recommendations of the ANConf/12 and is made available by ICAO as the *Working Document for the Aviation System Block Upgrades* (Edition 28 March 2013).

1.5 The *NAM ASBU Handbook* references both the GANP and the ASBU Working Document.

2. EXPLANATION OF THE NAM ASBU HANDBOOK

2.1 When analyzing the ASBU Modules for applicability in a Region or a State, it can be difficult to determine what specific technological or procedural implementations are associated with each module. The descriptions provided in the GANP are at a very high level. Specific information for each module was found in the ASBU Working Document, including, for most Modules, “elements” which represented a component that provides some performance improvement and together achieve the full operational improvement aimed by the ASBU module. In some cases, the elements could be directly copied from the ASBU Working Document, but in many cases, the elements were derived through careful review of the module text. Additionally, there have been some elements added by the NAM Region which have also been identified by both the NACC and NAT Regions, lending to the assumption that they may be universally recognized as module elements.

2.2 The *NAM ASBU Handbook* provides an outline of the ASBU modules to the element level.

2.3 In the GANP and the ASBU Working Document the ASBU Modules appear in various different orders. For the sake of clarity and ease of reference, it is suggested that all ICAO documents list the ASBU Modules in the same order.

2.4 The *NAM ASBU Handbook* provides the ASBU Modules first by Block, then alphabetically.

3. OPERATIONAL BENEFITS

3.1 Identifying the ASBU module “elements” should provide enough detail for a Service Provider, State or Region to determine whether an ASBU element would address their specific operational requirements. This approach supports an implementation reporting system that is scalable from the service provider all the way up to a global perspective.

3.2 Both Canada and the United States have used the ASBU elements to analyse the need, plan for, and track the progress of ASBU implementation. This will, in turn, enable better and faster reporting in the implementation of a particular element, block module, or performance improvement area at both the State and Regional level.

4. CONCLUSION AND RECOMMENDATIONS

4.1 The Aviation System Block Upgrades are meant to be a comprehensive way to harmonize global enhancement of air navigation. The use of ASBU elements will enable a better understanding of the specific operational changes described in the modules. Discussing applicability and implementation of modules at the element level would also support harmonization, interoperability and a more streamlined and well-defined implementation strategy and reporting protocol.

4.2 The Assembly is therefore invited to consider the *NAM ASBU Handbook* as an example of guidance material for use by Contracting States to identify the elements available within the Aviation System Block Upgrade framework to address their specific operational requirements.

A39-WP/239
TE/93
Appendix
(English only)

APPENDIX

NAM ASBU Handbook

**Supporting analysis and implementation
reporting of the ICAO ASBU Modules**



November 2015

Foreword

The *NAM ASBU Handbook* was created to assist in the application of the Aviation System Block Upgrade (ASBU) approach as detailed in the Fourth Edition of the *Global Air Navigation Plan* (GANP, Doc 9750).

The ASBU approach was globally endorsed during the 38th Assembly of the International Civil Aviation Organization (ICAO) which took place at ICAO Headquarters in Montréal, Canada, from 28 September to 4 October 2013, via the adoption of the 4th Edition of the GANP, which was presented to the Technical Commission of the 38th Assembly by the Council of ICAO in Appendix A to A38-WP/39 - . A Comprehensive Strategy for Air Navigation: Endorsement of the Global Air Navigation Plan.

As noted in A38-WP/39, the Fourth Edition of the GANP was meant to “provide clear guidance on the guiding operational targets and supporting technologies, avionics, procedures, standards and regulatory approvals needed to realize them” and to establish “a framework for incremental implementations based on the specific operational profiles and traffic densities of each State” (A38-WP/39 paragraph 2.1 refers).

The detailed material which formed the basis of the Fourth Edition of the GANP was presented at the 12th Air Navigation Conference (12th ANC) which took place at ICAO Headquarters from 19 to 30 November, 2012. This base material was subsequently updated to incorporate the recommendations of the 12th ANC and is made available by ICAO as *The Aviation System Block Upgrades - ASBUs (Edition March 2013)* (ASBU Working Document); this document is only accessible on the website for the 12th ANC, via the following link:

<http://www.icao.int/Meetings/anconf12/Pages/Aviation-System-Block-Upgrades.aspx>

The *NAM ASBU Handbook* references both the GANP and the ASBU Working Document.

Please provide any comments, corrections or suggestions regarding the *NAM ASBU Handbook* to:

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Explanation of the Handbook

When analyzing the ASBU Modules for applicability in a Region or a State, it can be difficult to determine what specific technological or procedural implementations are associated with each Module. The descriptions provided in the GANP are at a very high level of detail. Specific information for each Module was found in the ASBU Working Document, including, for most Modules, “Elements” which represented specific technical or procedural implementations. In some cases, the Elements could be directly copied from the ASBU Working Document, but in many cases, the specific technical or procedural implementation needed to be derived through careful review of the Module text.

The *NAM ASBU Handbook* provides an outline of the ASBU Modules to the Element level. The Elements are categorized as follows:

Defined - Word for word, the text for the Element as provided in the ASBU Working Document

Derived - An Element from the ASBU Working Document edited for clarity or specificity or developed on the basis of the Module description in the ASBU Working Document.

Identified - An Element developed by a Region or State which uses a similar technology or method to achieve the same results as other Elements Defined or Derived for that Module.

The sources of the detailed Module descriptions in this Handbook are indicated in the following diagram:

<i>Module Designation</i> B# - Acronym - GANP	<i>Thread - Module Name</i> Thread name GANP, page 45, Module name, GANP
Begins page # - ASBU Working Document	<i>Performance Improvement Area (PIA)</i> GANP
<i>Summary Description</i> GANP, pages 46-87	
<i>Operating Environment/Phases of Flight</i> ASBU Working Document	
<i>Applicability Considerations</i> GANP, pages 46-87	
<i>Elements</i> ASBU Working Document “Derived from” indicates the paragraph number where the source concept was described “Defined” indicates the Element number as per the ASBU Working Document “Identified” indicates the Region or State which developed the Element	

The Handbook provides the ASBU Modules in alphabetical order. This is different from the order in which they appear in the GANP on pages 46-87, the order on pages 40-44, the order in which the Threads are presented on page 45 and the order corresponding to the Table of Contents of the ASBU Working Document. None of these orders matches another.

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Index of ASBU Modules by Thread, Block and Page

Module Code	Thread	B0	B1	B2	B3
ACAS	Airborne Collision Avoidance Systems	15		34	
ACDM	Airport Collaborative Decision Making	9	21		
AMET	Advanced Meteorological Information	12	25		38
APTA	Airport Accessibility	9	21		
ASEP	Airborne Separation	15	27	35	
ASUR	Alternative Surveillance	16			
CCO	Continuous Climb Operations	19			
CDO	Continuous Descent Operations	19	30	36	
DATM	Digital Air Traffic Management	13	26		
FICE	Flight and Flow Information for a Collaborative Environment (FF-ICE)	14	26	34	39
FRTO	Free-Route Operations	16	28		
NOPS	Network Operations	17	28	35	39
OPFL	Optimum Flight Levels	18			
RATS	Remote Aerodrome Control Towers		22		
RPAS	Remotely Piloted Aircraft Systems (RPAS)		30	36	40
RSEQ	Runway Sequencing	10	23	32	38
SNET	Safety Nets	18	29		
SURF	Surface Operations	11	23	33	
SWIM	System-Wide Information Management		27	34	
TBO	Trajectory-Based Operations	20	31		40
WAKE	Wake Turbulence Separation	11	24	33	

ASBU Modules by Block

Block 0 - For implementation in the 2013 - 2018 timeframe

PIA 1: Airport Operations

<p><i>Module Designation</i> B0-ACDM Begins page 99</p>	<p><i>Thread - Module Name</i> Airport Collaborative Decision Making - Improved Airport Operations through Airport-CDM</p> <p><i>Performance Improvement Area</i> 1: Airport Operations</p>
<p><i>Summary Description</i> Implements collaborative applications that will allow the sharing of surface operations data among the different stakeholders on the airport. This will improve surface traffic management reducing delays on movement and manoeuvring areas and enhance safety, efficiency and situational awareness.</p>	
<p><i>Operating Environment/Phases of Flight</i> Aerodrome, terminal.</p>	
<p><i>Applicability Considerations</i> Local for equipped/capable fleets and already established airport surface infrastructure.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.1.2 and 1.2.2) Airport CDM procedures 2. (Derived from 1.1.2 and 1.2.2) Airport CDM tools 3. (Derived from 3.1 & 7.2.1) Collaborative departure queue management 	
<p><i>Module Designation</i> B0-APTA Begins on page 13</p>	<p><i>Thread - Module Name</i> Airport Accessibility - Optimization of Approach Procedures including vertical guidance</p> <p><i>Performance Improvement Area</i> 1: Airport Operations</p>

<p><i>Summary Description</i></p> <p>The use of Performance-based Navigation (PBN) and ground-based augmentation system (GBAS) landing system (GLS) procedures to enhance the reliability and predictability of approaches to runways, thus increasing safety, accessibility and efficiency. This is possible through the application of basic global navigation satellite system (GNSS), Baro-vertical navigation (VNAV), satellite-based augmentation system (SBAS) and GLS. The flexibility inherent in PBN approach design can be exploited to increase runway capacity.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>Approach.</p>	
<p><i>Applicability Considerations</i></p> <p>This Module is applicable to all instrument, and precision instrument runway ends, and to a limited extent, non-instrument runway ends.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 4.1.1) PBN Approach Procedures with vertical guidance (LPV, LNAV/VNAV minima, using SBAS and Baro VNAV) 2. (Derived from 4.1.1) PBN Approach Procedures without vertical guidance (LP, LNAV minima; using SBAS) 3. (Derived from 1.3.2) GBAS Landing System (GLS) Approach procedures 	
<p><i>Module Designation</i></p> <p>B0-RSEQ Begins page 49</p>	<p><i>Thread - Module Name</i></p> <p>Runway Sequencing - Improved Traffic Flow through Sequencing (AMAN/DMAN)</p>
	<p><i>Performance Improvement Area</i></p> <p>1: Airport Operations</p>
<p><i>Summary Description</i></p> <p>Manage arrivals and departures (including time-based metering) to and from a multi-runway aerodrome or locations with multiple dependent runways at closely proximate aerodromes, to efficiently utilize the inherent runway capacity.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>Aerodrome and terminal.</p>	
<p><i>Applicability Considerations</i></p> <p>Runways and terminal manoeuvring area in major hubs and metropolitan areas will be most in need of these improvements.</p> <p>The improvement is least complex – runway sequencing procedures are widely used in aerodromes globally. However, some locations might have to confront environmental and operational challenges that will increase the complexity of development and implementation of technology and procedures to realize this Module.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from Element 1) AMAN via controlled time of arrival to a reference fix 2. (Derived from Element 1) AMAN via controlled time of arrival at the aerodrome 3. (Defined: Element 2) Departure management 4. (Derived from Element 2) Departure flow management 5. (Defined: Element 3) Point merge 	

<p><i>Module Designation</i> B0-SURF Begins page 77</p>	<p><i>Thread - Module Name</i> Surface Operations - Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2)</p>
	<p><i>Performance Improvement Area</i> 1: Airport Operations</p>
<p><i>Summary Description</i> Basic advanced-surface movement guidance and control systems (A-SMGCS) provides surveillance and alerting of movements of both aircraft and vehicles at the aerodrome, thus improving runway/aerodrome safety. Automatic dependent surveillance-broadcast (ADS-B) information is used when available (ADS-B APT).</p>	
<p><i>Operating Environment/Phases of Flight</i> Aerodrome surface movements (aircraft + vehicles), taxi, push-back, parking.</p>	
<p><i>Applicability Considerations</i> A-SMGCS is applicable to any aerodrome and all classes of aircraft/vehicles. Implementation is to be based on requirements stemming from individual aerodrome operational and cost-benefit assessments. ADS-B APT, when applied is an element of A-SMGCS, is designed to be applied at aerodromes with medium traffic complexity, having up to two active runways at a time and the runway width of minimum 45 m.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from Element 1) A-SMGCS with at least one cooperative surface surveillance system 2. (Derived from Element 1) Including ADS-B APT as an element of A-SMGCS 3. (Derived from Element 2) A-SMGCS alerting with flight identification information 4. (Derive from 1.4.1) Airport vehicles equipped with transponders 	
<p><i>Module Designation</i> B0-WAKE Begins page 27</p>	<p><i>Thread - Module Name</i> Wake Turbulence Separation - Increased Runway Throughput through Optimized Wake Turbulence Separation</p>
	<p><i>Performance Improvement Area</i> 1: Airport Operations</p>

<p><i>Summary Description</i></p> <p>Improves throughput on departure and arrival runways through optimized wake turbulence separation minima, revised aircraft wake turbulence categories and procedures.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>Arrival and departure.</p>
<p><i>Applicability Considerations</i></p> <p>Least complex – Implementation of revised wake turbulence categories is mainly procedural. No changes to automation systems are needed.</p>
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Defined: Element 1) New PANS-ATM wake turbulence categories and separation minima 2. (Derived from Element 2) Dependent diagonal paired approach procedures for parallel runways with centrelines spaced less than 760 meters (2,500 feet) apart 3. (Derived from Element 3) Wake independent departure and arrival procedures for parallel runways with centrelines spaced less than 760 meters (2,500 feet) apart 4. (Derived from Element 3) Wake turbulence mitigation for departures procedures for parallel runways with centrelines spaced less than 760 meters (2,500 feet) apart 5. (Identified by the United States) 6 wake turbulence categories and separation minima

PIA 2: Globally Interoperable Systems and Data - Through Globally Interoperable System Wide Information Management

<p><i>Module Designation</i></p> <p>B0-AMET Begins page 171</p>	<p><i>Thread - Module Name</i></p> <p>Advanced Meteorological Information - Meteorological information supporting enhanced operational efficiency and safety</p>
	<p><i>Performance Improvement Area</i></p> <p>2: Globally Interoperable Systems and Data - Through Globally Interoperable System Wide Information Management</p>

<p><i>Summary Description</i></p> <p>Global, regional and local meteorological information:</p> <ol style="list-style-type: none"> a) Forecasts provided by world area forecast centres (WAFCs), volcanic ash advisory centres (VAACs) and tropical cyclone advisory centres (TCAC). b) Aerodrome warnings to give concise information of meteorological conditions that could adversely affect all aircraft at an aerodrome, including wind shear. c) SIGMETs to provide information on occurrence or expected occurrence of specific en-route weather phenomena which may affect the safety of aircraft operations and other operational meteorological (OPMET) information, including METAR/SPECI and TAF, to provide routine and special observations and forecasts of meteorological conditions occurring or expected to occur at the aerodrome. <p>This information supports flexible airspace management, improved situational awareness and collaborative decision-making, and dynamically-optimized flight trajectory planning. This Module includes elements which should be viewed as a subset of all available meteorological information that can be used to support enhanced operational efficiency and safety.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>All phases of flight.</p>	
<p><i>Applicability Considerations</i></p> <p>Applicable to traffic flow planning, and to all aircraft operations in all domains and flight phases, regardless of level of aircraft equipage.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Defined: Element 1) WAFS 2. (Defined: Element 2) IAVW 3. (Defined: Element 3) TCAC forecasts 4. (Defined: Element 4) Aerodrome warnings 5. (Defined: Element 5) Wind shear warnings and alerts 6. (Derived from Element 6) SIGMET 7. (Derived from Element 6) Other OPMET information (METAR, SPECI and/or TAF) 8. (Identified by NAT) QMS for MET 	
<p><i>Module Designation</i></p> <p>B0-DATM Begins page 147</p>	<p><i>Thread - Module Name</i></p> <p>Digital Air Traffic Management - Service Improvement through Digital Aeronautical Information Management</p>
	<p><i>Performance Improvement Area</i></p> <p>2: Globally Interoperable Systems and Data - Through Globally Interoperable System Wide Information Management</p>

<p><i>Summary Description</i></p> <p>The initial introduction of digital processing and management of information through, aeronautical information service (AIS)/aeronautical information management (AIM) implementation, use of aeronautical exchange model (AIXM), migration to electronic aeronautical information publication (AIP) and better quality and availability of data.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>All phases of flight.</p>	
<p><i>Applicability Considerations</i></p> <p>Applicable at State level with increased benefits as more States participate.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.1.1) Aeronautical Information Exchange Model (AIXM) 2. (Derived from 3.1.3) eAIP 3. (Derived from 7.1) Digital NOTAM 4. (Identified by NACC) eTOD 5. (Identified by NACC) WGS-84 6. (Identified by NACC) QMS for AIM 	
<p><i>Module Designation</i></p> <p>B0-FICE Begins page 123</p>	<p><i>Thread - Module Name</i></p> <p>Flight and Flow Information for a Collaborative Environment (FF-ICE) - Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration</p>
	<p><i>Performance Improvement Area</i></p> <p>2: Globally Interoperable Systems and Data - Through Globally Interoperable System Wide Information Management</p>
<p><i>Summary Description</i></p> <p>Improves coordination between air traffic service units (ATSUs) by using ATS interfacility data communication (AIDC) defined by the ICAO Manual of Air Traffic Services Data Link Applications (Doc 9694). The transfer of communication in a data link environment improves the efficiency of this process, particularly for oceanic ATSUs.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>All flight phases and all type of ATS units.</p>	
<p><i>Applicability Considerations</i></p> <p>Applicable to at least two area control centres (ACCs) dealing with en-route and/or terminal control area (TMA) airspace. A greater number of consecutive participating ACCs will increase the benefits.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.1.4) AIDC to provide initial flight data to adjacent ATSUs 2. (Derived from 1.1.5) AIDC to update previously coordinated flight data 3. (Derived from 1.1.5) AIDC for control transfer 4. (Derived from 1.1.6) AIDC to transfer CPDLC logon information to the Next Data Authority 	

PIA 3: Optimum Capacity and Flexible Flights – Through Global Collaborative ATM

<p><i>Module Designation</i> B0-ACAS Begins page 279</p>	<p><i>Thread - Module Name</i> Airborne Collision Avoidance Systems - ACAS Improvements</p> <hr/> <p><i>Performance Improvement Area</i> 3: Optimum Capacity and Flexible Flights – Through Global Collaborative ATM</p>
<p><i>Summary Description</i> Provides short-term improvements to existing airborne collision avoidance systems (ACAS) to reduce nuisance alerts while maintaining existing levels of safety. This will reduce trajectory deviations and increase safety in cases where there is a breakdown of separation.</p>	
<p><i>Operating Environment/Phases of Flight</i> En-route flight phases and approach flight phases.</p>	
<p><i>Applicability F</i> Safety and operational benefits increase with the proportion of equipped aircraft.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.3.2) ACAS II (TCAS version 7.1) 2. (Derived from 1.3.7 a) Auto Pilot/Flight Director (AP/FD) TCAS 3. (Derived from 1.3.7 b) TCAS Alert Prevention (TCAP) 	
<p><i>Module Designation</i> B0-ASEP Begins page 253</p>	<p><i>Thread - Module Name</i> Airborne Separation - Air Traffic Situational Awareness (ATSA)</p> <hr/> <p><i>Performance Improvement Area</i> 3: Optimum Capacity and Flexible Flights – Through Global Collaborative ATM</p>
<p><i>Summary Description</i> Two air traffic situational awareness (ATSA) applications which will enhance safety and efficiency by providing pilots with the means to enhance traffic situational awareness and achieve quicker visual acquisition of targets: a) AIRB (basic airborne situational awareness during flight operations). b) VSA (visual separation on approach).</p>	
<p><i>Operating Environment/Phases of Flight</i> En-route, terminal, approach.</p>	
<p><i>Applicability Considerations</i> These are cockpit-based applications which do not require any support from the ground hence they can be used by any suitably equipped aircraft. This is dependent upon aircraft being equipped with ADS-B OUT. Avionics availability at low enough costs for General Aviation (GA) is not yet available.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Defined: Element 1) ATSA-AIRB 2. (Defined: Element 2) ATSA-VSA 	

<p><i>Module Designation</i> B0-ASUR Begins page 245</p>	<p><i>Thread - Module Name</i> Alternative Surveillance - Initial Capability for Ground Surveillance</p> <hr/> <p><i>Performance Improvement Area</i> 3: Optimum Capacity and Flexible Flights – Through Global Collaborative ATM</p>
<p><i>Summary Description</i> Provides initial capability for lower cost ground surveillance supported by new technologies such as ADS-B OUT and wide area multilateration (MLAT) systems. This capability will be expressed in various ATM services, e.g. traffic information, search and rescue and separation provision.</p>	
<p><i>Operating Environment/Phases of Flight</i> All airborne flight phases in continental or subsets of oceanic airspace and on aerodrome surfaces.</p>	
<p><i>Applicability Considerations</i> This capability is characterized by being dependent/cooperative (ADS-B OUT) and independent/cooperative (MLAT). The overall performance of ADS-B is affected by avionics performance and compliant equipage rate.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Defined: Element 1) ADS-B 2. (Defined: Element 2) Multilateration (MLAT) 	
<p><i>Module Designation</i> B0-FRTO Begins page 199</p>	<p><i>Thread - Module Name</i> Free-Route Operations - Improved Operations through Enhanced En-Route Trajectories</p> <hr/> <p><i>Performance Improvement Area</i> 3: Optimum Capacity and Flexible Flights – Through Global Collaborative ATM</p>

<p><i>Summary Description</i></p> <p>Allow the use of airspace which would otherwise be segregated (i.e. Special Use Airspace) along with flexible routing adjusted for specific traffic patterns. This will allow greater routing possibilities, reducing potential congestion on trunk routes and busy crossing points, resulting in reduced flight lengths and fuel burn.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>En-route, TMA.</p>
<p><i>Applicability Considerations</i></p> <p>Applicable to en-route airspace. Benefits can start locally. The larger the size of the concerned airspace the greater the benefits, in particular for flex track aspects. Benefits accrue to individual flights and flows. Application will naturally span over a long period as traffic develops. Its features can be introduced starting with the simplest ones.</p>
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from Element 1) CDM incorporated into airspace planning 2. (Defined: Element 2) Flexible Use of Airspace (FUA) 3. (Defined: Element 3) Flexible route systems 4. (Derived from Element 3) CPDLC used to request and receive re-route clearances

<p><i>Module Designation</i></p> <p>B0-NOPS Begins page 227</p>	<p><i>Thread - Module Name</i></p> <p>Network Operations - Improved Flow Performance through Planning based on a Network-Wide view</p>
	<p><i>Performance Improvement Area</i></p> <p>3: Optimum Capacity and Flexible Flights – Through Global Collaborative ATM</p>
<p><i>Summary Description</i></p> <p>Air traffic flow management (ATFM) is used to manage the flow of traffic in a way that minimizes delays and maximizes the use of the entire airspace. ATFM can regulate traffic flows involving departure slots, smooth flows and manage rates of entry into airspace along traffic axes, manage arrival time at waypoints or flight information region (FIR)/sector boundaries and re-route traffic to avoid saturated areas. ATFM may also be used to address system disruptions including a crisis caused by human or natural phenomena.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>Pre-flight phases, some action during actual flight.</p>	
<p><i>Applicability Considerations</i></p> <p>Region or sub-region..</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.1.1) ATFM 	

<p><i>Module Designation</i> B0-OPFL Begins page 273</p>	<p><i>Thread - Module Name</i> Optimum Flight Levels - Improved access to Optimum Flight Levels through Climb/Descent Procedures using ADS-B</p> <hr/> <p><i>Performance Improvement Area</i> 3: Optimum Capacity and Flexible Flights – Through Global Collaborative ATM</p>
<p><i>Summary Description</i> Enables aircraft to reach a more satisfactory flight level for flight efficiency or to avoid turbulence for safety. The main benefit of ITP is significant fuel savings and the uplift of greater payloads.</p>	
<p><i>Operating Environment/Phases of Flight</i> En-route.</p>	
<p><i>Applicability Considerations</i> This can be applied to routes in procedural airspaces.</p>	
<p><i>Elements</i> 1. (Derived from 1.3.1) ITP using ADS-B</p>	

<p><i>Module Designation</i> B0-SNET Begins page 293</p>	<p><i>Thread - Module Name</i> Safety Nets - Increased Effectiveness of Ground-based Safety Nets</p> <hr/> <p><i>Performance Improvement Area</i> 3: Optimum Capacity and Flexible Flights – Through Global Collaborative ATM</p>
<p><i>Summary Description</i> Monitors the operational environment during airborne phases of flight to provide timely alerts on the ground of an increased risk to flight safety. In this case, short-term conflict alert, area proximity warnings and minimum safe altitude warnings are proposed. Ground-based safety nets make an essential contribution to safety and remain required as long as the operational concept remains human centred.</p>	
<p><i>Operating Environment/Phases of Flight</i> All airborne flight phases.</p>	
<p><i>Applicability Considerations</i> Benefits increase as traffic density and complexity increase. Not all ground-based safety nets are relevant for each environment. Deployment of this Module should be accelerated.</p>	
<p><i>Elements</i> 1. (Defined: Element 1) Short Term Conflict Alert (STCA) 2. (Defined: Element 2) Area Proximity Warning (APW) 3. (Defined: Element 3) Minimum Safe Altitude Warning (MSAW) 4. (Identified by NACC) Medium Term Conflict Alert (MTCA)</p>	

PIA 4: Efficient Flight Path – Through Trajectory-based Operations

<p><i>Module Designation</i> B0-CCO Begins page 347</p>	<p><i>Thread - Module Name</i> Continuous Climb Operations - Improved Flexibility and Efficiency in Departure Profiles - Continuous Climb Operations (CCO)</p> <hr/> <p><i>Performance Improvement Area</i> 4: Efficient Flight Path – Through Trajectory-based Operations</p>
<p><i>Summary Description</i> Implements continuous climb operations (CCO) in conjunction with Performance-based Navigation (PBN) to provide opportunities to optimize throughput, improve flexibility, enable fuel-efficient climb profiles, and increase capacity at congested terminal areas.</p>	
<p><i>Operating Environment/Phases of Flight</i> Departure and en-route.</p>	
<p><i>Applicability Considerations</i> Regions, States or individual locations most in need of these improvements. For simplicity and implementation success, complexity can be divided into three tiers:</p> <ul style="list-style-type: none"> a) Least complex – regional/States/locations with some foundational PBN operational experience that could capitalize on near-term enhancements, which include integrating procedures and optimizing performance. b) More complex – regional/State/locations that may or may not possess PBN experience, but would benefit from introducing new or enhanced procedures. However, many of these locations may have environmental and operational challenges that will add to the complexities of procedure development and implementation. c) Most complex – regional/State/locations in this tier will be the most challenging and complex to introduce integrated and optimized PBN operations. Traffic volume and airspace constraints are added complexities that must be confronted. Operational changes to these areas can have a profound effect on the entire State, region or location. 	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from Element 1) Procedure changes to facilitate CCO 2. (Derived from Element 1) Route changes to facilitate CCO 3. (Derived from Element 2) PBN SIDs 	

<p><i>Module Designation</i> B0-CDO Begins page 303</p>	<p><i>Thread - Module Name</i> Continuous Descent Operations - Improved Flexibility and Efficiency in Descent Profiles (CDO)</p> <hr/> <p><i>Performance Improvement Area</i> 4: Efficient Flight Path – Through Trajectory-based Operations</p>
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<p><i>Summary Description</i></p> <p>Performance-based airspace and arrival procedures allowing aircraft to fly their optimum profile using continuous descent operations (CDOs). This will optimize throughput, allow fuel efficient descent profiles, and increase capacity in terminal areas.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>Approach/arrivals and en-route.</p>
<p><i>Applicability Considerations</i></p> <p>Regions, States or individual locations most in need of these improvements. For simplicity and implementation success, complexity can be divided into three tiers:</p> <ol style="list-style-type: none"> Least complex – regional/States/locations with some foundational PBN operational experience that could capitalize on near-term enhancements, which include integrating procedures and optimizing performance. More complex – regional/State/locations that may or may not possess PBN experience, but would benefit from introducing new or enhanced procedures. However, many of these locations may have environmental and operational challenges that will add to the complexities of procedure development and implementation. Most complex – regional/State/locations in this tier will be the most challenging and complex to introduce integrated and optimized PBN operations. Traffic volume and airspace constraints are added complexities that must be confronted. Operational changes to these areas can have a profound effect on the entire State, region or location.
<p><i>Elements</i></p> <ol style="list-style-type: none"> (Derived from Element 1) Procedure changes to facilitate CDO (Derived from Element 1) Route changes to facilitate CDO (Derived from Element 2) PBN STARs

<p><i>Module Designation</i></p> <p>B0-TBO Begins page 323</p>	<p><i>Thread - Module Name</i></p> <p>Trajectory-Based Operations - Improved Safety and Efficiency through the initial application of Data Link En-Route</p>
	<p><i>Performance Improvement Area</i></p> <p>4: Efficient Flight Path – Through Trajectory-based Operations</p>
<p><i>Summary Description</i></p> <p>Implements an initial set of data link applications for surveillance and communications in air traffic control (ATC), supporting flexible routing, reduced separation and improved safety.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>En-route flight phases, including areas where radar systems cannot be installed such as remote or oceanic airspace.</p>	
<p><i>Applicability Considerations</i></p> <p>Requires good synchronization of airborne and ground deployment to generate significant benefits, in particular to those equipped. Benefits increase with the proportion of equipped aircraft.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> (Defined: Element 1) ADS-C over oceanic and remote areas (Defined: Element 2) Continental CPDLC 	

Block 1 - For implementation in the 2018 - 2023 timeframe

PIA 1: Airport Operations

<p><i>Module Designation</i> B1-ACDM Begin page 105</p>	<p><i>Thread - Module Name</i> Airport Collaborative Decision Making - Optimized Airport Operations through Airport-CDM</p>
	<p><i>Performance Improvement Area</i> 1: Airport Operations</p>
<p><i>Summary Description</i> Enhances the planning and management of Airport Operations and allows their full integration for air traffic management using performance targets compliant with those of the surrounding airspace. This entails implementing collaborative airport operations planning (AOP) and where needed, an airport operations centre (APOC).</p>	
<p><i>Operating Environment/Phases of Flight</i> Surface in, turn around, surface out.</p>	
<p><i>Applicability Considerations</i> AOP: for use at all the airports (sophistication will depend on the complexity of the operations and their impact on the network). APOC: will be implemented at major/complex airports (sophistication will depend on the complexity of the operations and their impact on the network). Not applicable to aircraft.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.3.1 a) Airport Operations Plan (AOP) which encompasses local airport information and information that is shared with the ATM system/ATM network manager 2. (Derived from 1.3.1 b) Airport performance framework integrated into AOP 3. (Derived from 1.3.1 b) Airport performance framework aligned with regional/national performance framework(s) 4. (Derived from 1.3.1 c) Decision making support to facilitate communication and coordination between airport stakeholders for joint planning 5. (Derived from 1.3.1 d) Accessible information on airport resource availability and planned aircraft operations for use by airport operators and ATM system/network managers 6. (Derived from 1.3.1 e) Real time monitoring and alerting to activate collaborative airside/landside airport operations to respond to specific conditions, such as specified meteorological conditions/events 	

<p><i>Module Designation</i> B1-APTA Begins on page 19</p>	<p><i>Thread - Module Name</i> Airport Accessibility - Optimized Airport Accessibility</p>
	<p><i>Performance Improvement Area</i> 1: Airport Operations</p>

<p><i>Summary Description</i></p> <p>Progresses further with the universal implementation of Performance-based Navigation (PBN) approaches. PBN and GLS (CAT II/III) procedures to enhance the reliability and predictability of approaches to runways, increasing safety, accessibility and efficiency.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>Approach and landing.</p>
<p><i>Applicability Considerations</i></p> <p>This module is applicable to all runway ends.</p>
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.3.1) CAT II PBN approach procedures 2. (Derived from 1.3.1) CAT III PBN approach procedures 3. (Derived from 1.3.1) CAT II GLS approach procedures 4. (Derived from 1.3.1) CAT III GLS approach procedures 5. (Derived from 1.3.1) PBN STARs directly integrated to approaches with vertical guidance

<p><i>Module Designation</i></p> <p>B1-RATS</p> <p>Begins on page 111</p>	<p><i>Thread - Module Name</i></p> <p>Remote Aerodrome Control Towers - Remotely Operated Aerodrome Control</p>
	<p><i>Performance Improvement Area</i></p> <p>1: Airport Operations</p>
<p><i>Summary Description</i></p> <p>Provides a safe and cost-effective air traffic services (ATS) from a remote facility to one or more aerodromes where dedicated, local ATS are no longer sustainable or cost-effective, but there is a local economic and social benefit from aviation. This can also be applied to contingency situations and depends on enhanced situational awareness of the aerodrome under remote control.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>TMA, descent, airport surface, climb out.</p>	
<p><i>Applicability Considerations</i></p> <p>The main target for the single and multiple remote tower services are small rural airports, which today are struggling with low business margins. Both ATC and AFIS aerodromes are expected to benefit.</p> <p>The main targets for the contingency tower solution are medium to large airports – those that are large enough to require a contingency solution, but require an alternative to A-SMGCS-based “heads down” solutions or where maintaining a visual view is required.</p> <p>Although some cost benefits are possible with remote provision of ATS to a single aerodrome, maximum benefit is expected with the remote of ATS to multiple aerodromes.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from Element 1) Provision of tower control (TWR) or aerodrome flight information service (AFIS) for single aerodrome(s) by remotely located air traffic controllers (ATCO) or aerodrome flight information service officers (AFISO). 2. (Derived from Element 2) Provision of TWR or AFIS for multiple aerodromes by a single ATCO or AFISO. 3. (Defined: Element 3) Remote provision of ATS for contingency situations 	

<p><i>Module Designation</i> B1-RSEQ Begins on page 55</p>	<p><i>Thread - Module Name</i> Runway Sequencing - Improved Airport operations through Departure, Surface and Arrival Management</p>
	<p><i>Performance Improvement Area</i> 1: Airport Operations</p>
<p><i>Summary Description</i> Extension of arrival metering and integration of surface management with departure sequencing will improve runway management and increase airport performance and flight efficiency.</p>	
<p><i>Operating Environment/Phases of Flight</i> Aerodrome and terminal.</p>	
<p><i>Applicability Considerations</i> Runways and terminal manoeuvring areas in major hubs and metropolitan areas will be most in need of these improvements. Complexity in implementation of this Module depends on several factors. Some locations might have to confront environmental and operational challenges that will increase the complexity of development and implementation of technology and procedures to realize this Module. Performance-based Navigation (PBN) routes need to be in place.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from Element 1 and 4.1.1) Surface management of runway demand and sequencing aircraft on the ground to support departure operations based on precise surface movement tracking 2. (Derived from Element 2) Integration of departure sequencing and surface management 3. (Derived from Element 3) Arrival metering extended across FIR boundaries 4. (Derived from Element 4) Assignment of RNAV/RNP routes linked to controlled time of arrival at metering fixes 	
<p><i>Module Designation</i> B1-SURF Begins on page 83</p>	<p><i>Thread - Module Name</i> Surface Operations - Enhanced Safety and Efficiency of Surface Operations-SURF, SURF IA and Enhanced Vision Systems (EVS)</p>
	<p><i>Performance Improvement Area</i> 1: Airport Operations</p>

<p><i>Summary Description</i></p> <p>Provides enhancements for surface situational awareness, including both cockpit and ground elements, in the interest of runway and taxiway safety, and surface movement efficiency. Cockpit improvements including the use of surface moving maps with traffic information (SURF), runway safety alerting logic (SURF-IA), and enhanced vision systems (EVS) for low visibility taxi operations.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>Aerodrome operations.</p>	
<p><i>Applicability</i></p> <p>For SURF and SURF-IA, applicable to large aerodromes (ICAO codes 3 and 4) and all classes of aircraft; cockpit capabilities work independently of ground infrastructure, but other aircraft equipment and/or ground surveillance broadcast will improve.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.4.1) Basic surface situation awareness (SURF) through display of other aerodrome traffic to aircraft via ADS-B or TIS-B 2. (Derived from 1.4.2) SURF with Indications and Alerts (SURF-IA) for aircraft 3. (Derived from 1.4.3 & 1.4.4) SURF for airport vehicles 4. (Derived from 1.4.4) SURF-IA for airport vehicles 5. (Defined: Element 2) Enhanced vision systems for taxi operations 	
<p><i>Module Designation</i></p> <p>B1-WAKE Begins on page 35</p>	<p><i>Thread - Module Name</i></p> <p>Wake Turbulence Separation - Increased Runway Throughput through Dynamic Wake Turbulence Separation</p>
	<p><i>Performance Improvement Area</i></p> <p>1: Airport Operations</p>
<p><i>Summary Description</i></p> <p>Improved throughput on departure and arrival runways through the dynamic management of wake turbulence separation minima based on the real-time identification of wake turbulence hazards.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>Aerodrome.</p>	
<p><i>Applicability Considerations</i></p> <p>Least complex – implementation of re-categorized wake turbulence is mainly procedural. No changes to automation systems are needed.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from Element 1 and 3.1.1) PANS-ATM aircraft leader/follower pair-wise wake turbulence separation minima. 2. (Derived from Element 2 and 3.2.1) Wake Turbulence Mitigation for Arrivals (WTMA) on parallel runways with runway centre lines spaced less than 760 m (2 500 feet) apart or on a single runway through variable application of wake turbulence separation dependant on the crosswinds present along the approach corridor. 3. (Derived from Element 3) Wake Turbulence Mitigation for Departures (WTMD) on parallel runways with runway centre lines spaced less than 760 m (2 500 feet) through reduction of separation between departures when runway crosswinds are of sufficient strength and persistence. 	

PIA 2: Globally Interoperable Systems and Data - Through Globally Interoperable System Wide Information Management

<p><i>Module Designation</i> B1-AMET Begins on page 181</p>	<p><i>Thread - Module Name</i> Advanced Meteorological Information - Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service)</p>
	<p><i>Performance Improvement Area</i> 2: Globally Interoperable Systems and Data - Through Globally Interoperable System Wide Information Management</p>
<p><i>Summary</i> Enables the reliable identification of solutions when forecast or observed meteorological conditions impact aerodromes or airspace. Full ATM-Meteorology integration is needed to ensure that meteorological information is included in the logic of a decision process and the impact of the meteorological conditions (the constraints) are automatically calculated and taken into account. The decision time-horizons range from minutes, to several hours or days ahead of the ATM operation (this includes optimum flight profile planning and tactical in-flight avoidance of hazardous meteorological conditions) to typically enable near-term and planning (>20 minutes) type of decision making. This Module also promotes the establishment of Standards for global exchange of the information. Appreciating that the number of flights operating on cross-polar and trans-polar routes continues to steadily grow and recognizing that space weather affecting the earth’s surface or atmosphere (such as solar radiation storms) pose a hazard to communications and navigation systems and may also pose a radiation risk to flight crew members and passengers, this module acknowledges the need for space weather information services in support of safe and efficient international air navigation. Unlike traditional meteorological disturbances which tend to be local or sub-regional in scale, the effects of space weather disturbances can be global in nature (although tend to be more prevalent in the polar regions), with much more rapid onset. This Module builds, in particular, upon Module B0-AMET, which detailed a subset of all available meteorological information that can be used to support enhanced operational efficiency and safety.</p>	
<p><i>Operating Environment/Phases of Flight</i> All flight phases.</p>	
<p><i>Applicability Considerations</i> Applicable to traffic flow planning, and to all aircraft operations in all domains and flight phases, regardless of level of aircraft equipage.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from Element 1 and 1.3.2) Producing meteorological information elements that can be ingested by automated decision support tools. 2. (Derived from Element 2) Automated processing of meteorological information to derive predicted effects on airspace capacity. 3. (Derived from Element 2) Automated processing of meteorological information to derive predicted effects on aerodrome capacity. 4. (Derived from Element 3) Comparison of predicted meteorological airspace capacity constraints to projected demand. 5. (Derived from Element 3) Comparison of predicted meteorological aerodrome capacity constraints to projected demand. 6. (Derived from Element 4) Meteorological information integrated decision support that creates ranked mitigation strategies. 	

<p><i>Module Designation</i> B1-DATM Begins on page 153</p>	<p><i>Thread - Module Name</i> Digital Air Traffic Management - Service Improvement through Integration of all Digital ATM Information</p> <hr/> <p><i>Performance Improvement Area</i> 2: Globally Interoperable Systems and Data - Through Globally Interoperable System Wide Information Management</p>
<p><i>Summary Description</i> Implements the ATM information reference model, integrating all ATM information, using common formats (UML/XML and WXXM) for meteorological information, FIXM for flight and flow information and Internet protocols.</p>	
<p><i>Operating Environment/Phases of Flight</i> All phases of flight.</p>	
<p><i>Applicability Considerations</i> Applicable at State level, with increased benefits as more States participate.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.1.1) Implementation of digital information management using WXXM for meteorological information 2. (Derived from 1.1.1) Implementation of digital information management using FIXM for flight and flow information 3. (Derived from 1.1.1) Implementation of digital information management for aircraft performance-related data 	
<p><i>Module Designation</i> B1-FICE Begins on page 129</p>	<p><i>Thread - Module Name</i> Flight and Flow Information for a Collaborative Environment (FF-ICE) - Increased Interoperability, Efficiency and Capacity through FF-ICE, Step 1 application before Departure</p> <hr/> <p><i>Performance Improvement Area</i> 2: Globally Interoperable Systems and Data - Through Globally Interoperable System Wide Information Management</p>
<p><i>Summary Description</i> Introduces FF-ICE, Step 1 providing ground-ground exchanges using a common flight information reference model (FIXM) and extensible markup language (XML) standard formats before departure.</p>	
<p><i>Operating Environment/Phases of Flight</i> Planning phase for FF-ICE, Step 1.</p>	
<p><i>Applicability Considerations</i> Applicable between ATS units to facilitate exchange between ATM service provider (ASP), airspace user operations and Airport Operations.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.3.5 a) Ability for ATS to receive early flight intention information 2. (Derived from 1.3.5 b) Ability for AOC and ATS to exchange 4D trajectory information 3. (Derived from 1.3.5 c) Implementation of a flight and flow information format using internet 	

<p>protocol and XML</p> <p>4. (Derived from 1.3.5 d) Allocation and use of globally unique flight identifiers (GUFI)</p> <p>5. (Derived from 1.3.5 e) Ability for ATS to receive FF-ICE information elements</p>
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<p><i>Module Designation</i> B1-SWIM Begins on page 159</p>	<p><i>Thread - Module Name</i> System-Wide Information Management - Performance Improvement through the application of System-Wide Information Management (SWIM)</p>
	<p><i>Performance Improvement Area</i> 2: Globally Interoperable Systems and Data - Through Globally Interoperable System Wide Information Management</p>
<p><i>Summary Description</i> Implementation of system-wide information management (SWIM) services (applications and infrastructure) creating the aviation Intranet based on standard data models and Internet-based protocols to maximize interoperability.</p>	
<p><i>Operating Environment/Phases of Flight</i> All phases of flight.</p>	
<p><i>Applicability Considerations</i> Applicable at State level, with increased benefits as more States participate.</p>	
<p><i>Elements</i> 1. (Derived from 1.1.5 a) Implement structure/protocols for sharing information within communities of interest 2. (Derived from 8.1) PANS-AIM</p>	

PIA 3: Optimum Capacity and Flexible Flights - Through Global Collaborative ATM

<p><i>Module Designation</i> B1-ASEP Begins on page 259</p>	<p><i>Thread - Module Name</i> Airborne Separation - Increased Capacity and Efficiency through Interval Management</p>
	<p><i>Performance Improvement Area</i> 3: Optimum Capacity and Flexible Flights - Through Global Collaborative ATM</p>
<p><i>Summary Description</i> Interval management (IM) improves the organization of traffic flows and aircraft spacing. This creates operational benefits through precise management of intervals between aircraft with common or merging trajectories, thus maximizing airspace throughput while reducing ATC workload along with more efficient aircraft fuel burn reducing environmental impact.</p>	
<p><i>Operating Environment/Phases of Flight</i> En-route, arrival, approach, departure.</p>	
<p><i>Applicability Considerations</i> En-route and terminal areas.</p>	
<p><i>Elements</i> 1. (Derived from 1.1.1, 1.1.2 and 1.3.1) Implementation of procedures for aircraft to be cleared to maintain a specified distance from a preceding aircraft from top of descent to the initial or final</p>	

<p>approach fix</p> <p>2. (Derived from 1.1.1, 1.1.2 and 1.3.1) Implementation of procedures for aircraft to be cleared to maintain a specified time interval between it and a preceding aircraft from top of descent to the initial or final approach fix</p>
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<p><i>Module Designation</i></p> <p>B1-FRTO Begins on page 213</p>	<p><i>Thread - Module Name</i></p> <p>Free-Route Operations - Improved Operations through Optimized ATS Routing</p>
	<p><i>Performance Improvement Area</i></p> <p>3: Optimum Capacity and Flexible Flights - Through Global Collaborative ATM</p>
<p><i>Summary Description</i></p> <p>Provides, through Performance-based Navigation (PBN), closer and consistent route spacing, curved approaches, parallel offsets and the reduction of holding area size. This will allow the sectorization of airspace to be adjusted more dynamically. This will reduce potential congestion on trunk routes and busy crossing points and reduce controller workload. The main goal is to allow flight plans to be filed with a significant part of the intended route specified by the user-preferred profile. Maximum freedom will be granted within the limits posed by the other traffic flows. The overall benefits are reduced fuel burn and emissions.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>En-route, including oceanic and remote areas and TMA.</p>	
<p><i>Applicability Considerations</i></p> <p>Region or sub-region: the geographical extent of the airspace of application should be large enough; significant benefits arise when the dynamic routes can apply across flight information region (FIR) boundaries rather than imposing traffic to cross boundaries at fixed predefined points.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> (Derived from Element 1) Free routing, including within defined airspace and/or at defined times and/or within defined flows (Derived from Element 2 (1.4.3 b)) Maintaining same PBN route spacing between straight and turning segments (Derived from Element 2 (1.4.3 c)) Publishing PBN holding procedures (Defined: Element 3) Dynamic sectorization 	
<p><i>Module Designation</i></p> <p>B1-NOPS Begins on page 233</p>	<p><i>Thread - Module Name</i></p> <p>Network Operations - Enhanced Flow Performance through Network Operational Planning</p>
	<p><i>Performance Improvement Area</i></p> <p>3: Optimum Capacity and Flexible Flights - Through Global Collaborative ATM</p>

<p><i>Summary Description</i></p> <p>Introduces enhanced processes to manage flows or groups of flights in order to improve overall flow. The resulting increased collaboration among stakeholders in real-time, regarding user preferences and system capabilities will result in better use of airspace with positive effects on the overall cost of ATM.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>Mainly applicable to pre-flight phases, with some application in flight.</p>
<p><i>Applicability Considerations</i></p> <p>Region or sub-region for most applications; specific airports in case of initial user-driven prioritization process (UDPP). This Module is more particularly needed in areas with the highest traffic density. However, the techniques it contains would also be of benefit to areas with less traffic, subject to the business case.</p>
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from Element 1) Improving ATFM algorithms and techniques 2. (Derived from Element 1) Integrating ATFM and Airspace Organization and Management (AOM) in the design of alternative route options for ATFM 3. (Derived from Element 2) Using trajectory projections as soon as possible after departure to update ATFM requirements and perform additional ATFM smoothing for single flows 4. (Derived from Element 2) Using trajectory projections as soon as possible after departure to update ATFM requirements and perform additional ATFM smoothing for converging flows 5. (Derived from Element 3) Initial User Driven Prioritization Process (UDPP) whereby operators affected by ATFM measures can collaborate with each other and ATFM to devise alternative measures that serve ATFM requirements while at the same time taking account of operators' priorities

<p><i>Module Designation</i></p> <p>B1-SNET Begins on page 297</p>	<p><i>Thread - Module Name</i></p> <p>Safety Nets - Ground-based Safety Nets on Approach</p>
	<p><i>Performance Improvement Area</i></p> <p>3: Optimum Capacity and Flexible Flights - Through Global Collaborative ATM</p>
<p><i>Summary Description</i></p> <p>Enhances safety by reducing the risk of controlled flight into terrain accidents on final approach through the use of an approach path monitor (APM). APM warns the controller of increased risk of controlled flight into terrain during final approaches. The major benefit is a significant reduction of the number of major incidents.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>Approach.</p>	
<p><i>Applicability Considerations</i></p> <p>This Module will increase safety benefits during final approach particularly where terrain or obstacles represent safety hazards. Benefits increase as traffic density and complexity increase.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.3.1) Implementation of Approach Path Monitor (APM), which generates timely alerts to ATCOs if aircraft are in unsafe proximity to obstacles or terrain during final approach 2. (Derived from 1.3.2) Implementation of accurate approach path model in APM which minimizes 	

nuisance alerts

PIA 4: Efficient Flight Paths - Through Trajectory-based Operations

<p><i>Module Designation</i> B1-CDO Begins on page 311</p>	<p><i>Thread - Module Name</i> Continuous Descent Operations - Improved Flexibility and Efficiency in Descent Profiles (CDOs) using VNAV</p> <hr/> <p><i>Performance Improvement Area</i> 4: Efficient Flight Paths - Through Trajectory-based Operations</p>
<p><i>Summary Description</i> Enhances vertical flight path precision during descent, arrival, and enables aircraft to fly an arrival procedure not reliant on ground-based equipment for vertical guidance. The main benefit is higher utilization of airports, improved fuel efficiency, increased safety through improved flight predictability and reduced radio transmission, and better utilization of airspace.</p>	
<p><i>Operating Environment/Phases of Flight</i> Descent, arrival, flight in terminal area.</p>	
<p><i>Applicability Considerations</i> Terminal arrival and departure procedures.</p>	
<p><i>Elements</i> 1. (Derived from 1.2.1 and 1.3.1) CDO procedures defined as vertical paths to be followed within specified tolerances</p>	
<p><i>Module Designation</i> B1-RPAS Begins on page 357</p>	<p><i>Thread - Module Name</i> Remotely Piloted Aircraft Systems (RPAS) - Initial Integration of Remotely Piloted Aircraft (RPA) Systems into non-segregated airspace</p> <hr/> <p><i>Performance Improvement Area</i> 4: Efficient Flight Paths - Through Trajectory-based Operations</p>

<p><i>Summary Description</i></p> <p>Implementation of basic procedures for operating remotely piloted aircraft (RPA) in non-segregated airspace, including detect and avoid.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>En-route, oceanic, terminal (arrival and departure), aerodrome (taxi, takeoff and landing).</p>
<p><i>Applicability Considerations</i></p> <p>Applies to all RPA operating in non-segregated airspace and at aerodromes. Requires good synchronization of airborne and ground deployment to generate significant benefits, in particular to those able to meet minimum certification and equipment requirements.</p>
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.3.1 a) Streamlined process for RPA access to non-segregated airspace 2. (Derived from 1.3.1 b) Defined airworthiness certification for RPA 3. (Derived from 1.3.1 c) Defined operator certification for RPA operators 4. (Derived from 1.3.1 d) Defined communication performance requirements for Command and Control (C2) links and for ATC communications 5. (Derived from 1.3.1 e) Defined remote pilot licencing requirements 6. (Derived from 1.3.1 f) Defined detect and avoid technology performance requirements

<p><i>Module Designation</i></p> <p>B1-TBO</p> <p>Begins on page 331</p>	<p><i>Thread - Module Name</i></p> <p>Trajectory-Based Operations - Improved Traffic Synchronization and Initial Trajectory-Based Operation</p>
	<p><i>Performance Improvement Area</i></p> <p>4: Efficient Flight Paths - Through Trajectory-based Operations</p>

<p><i>Summary</i></p> <p>Improves the synchronization of traffic flows at en-route merging points and to optimize the approach sequence through the use of 4DTRAD capability and airport applications, e.g. D-TAXI.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>All flight phases.</p>
<p><i>Applicability Considerations</i></p> <p>Requires good synchronization of airborne and ground deployment to generate significant benefits, in particular to those equipped. Benefit increases with size of equipped aircraft population in the area where the services are provided.</p>
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. (Derived from 1.3.1) Ability to download trajectory information via air/ground data link 2. (Derived from 1.3.1) Ability to exchange complex route clearances via ground/ground data link from one ANSP to another 3. (Derived from 1.3.1) Ability to exchange complex route clearances via ground/ground data link across multiple airspace boundaries 4. (Derived from Element 1) Initial 4D operations by specifying Required Time of Arrival (RTA) 5. (Defined: Element 2) Data Link Operational Terminal Information Service (D-OTIS) 6. (Derived from Element 3) Departure clearances via data link (DCL) 7. (Defined: Element 4) Data Link Taxi (D-TAXI)

Block 2 - For implementation in the 2023 - 2028 timeframe

PIA 1: Airport Operations

<p><i>Module Designation</i></p> <p>B2-RSEQ Begins page 65</p>	<p><i>Thread - Module Name</i></p> <p>Runway Sequencing - Linked Arrival Management and Departure Management (AMAN/DMAN)</p>
	<p><i>Performance Improvement Area</i></p> <p>1: Airport Operations</p>
<p><i>Summary Description</i></p> <p>Integrated AMAN/DMAN to enable dynamic scheduling and runway configuration to better accommodate arrival/departure patterns and integrate arrival and departure management. This Module also summarizes the benefits of such integration and the elements that facilitate it.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>Aerodrome and terminal.</p>	
<p><i>Applicability Considerations</i></p> <p>Runways and terminal manoeuvring area in major hubs and metropolitan areas will be most in need of these improvements. The implementation of this Module is least complex. Some locations might have to confront environmental and operational challenges that will increase the complexity of development and implementation technology and procedures to realize this Block. Infrastructure for RNAP/RNP routes need to be in place.</p>	
<p><i>Elements</i></p> <ol style="list-style-type: none"> 1. TBD 	

<p><i>Module Designation</i> B2-SURF Begins page 89</p>	<p><i>Thread - Module Name</i> Surface Operations - Optimized Surface Routing and Safety Benefits (A-SMGCS Level 3-4 and SVS)</p> <hr/> <p><i>Performance Improvement Area</i> 1: Airport Operations</p>
<p><i>Summary Description</i> To improve efficiency and reduce the environmental impact of surface operations, even during periods of low visibility. Queuing for departure runways is reduced to the minimum necessary to optimize runway use and taxi times are also reduced. Operations will be improved so that low visibility conditions have only a minor effect on surface movement.</p>	
<p><i>Operating Environment/Phases of Flight</i> Aerodrome.</p>	
<p><i>Applicability Considerations</i> Most applicable to large aerodromes with high demand, as the Upgrades address issues surrounding queuing and management and complex aerodrome operations.</p>	
<p><i>Elements</i> 1. TBD</p>	

<p><i>Module Designation</i> B2-WAKE Begins page 43</p>	<p><i>Thread - Module Name</i> Wake Turbulence Separation - Advanced Wake Turbulence Separation (Time-based)</p> <hr/> <p><i>Performance Improvement Area</i> 1: Airport Operations</p>
<p><i>Summary Description</i> The application of time-based aircraft-to-aircraft wake separation minima and changes to the procedures the ANSP uses to apply wake separation minima.</p>	
<p><i>Operating Environment/Phases of Flight</i> Aerodrome.</p>	
<p><i>Applicability Considerations</i> Most complex – establishment of time-based separation criteria between pairs of aircraft extends the existing variable distance re-categorization of existing wake turbulence into a conditions-specific time-based interval. This will optimize the interoperation wait time to the minimum required for wake disassociation and runway occupancy. Runway throughput is increased as a result.</p>	
<p><i>Elements</i> 1. TBD</p>	

PIA 2: Globally Interoperable Systems and Data

<i>Module Designation</i> B2-FICE Begins page 135	<i>Thread - Module Name</i> Flight and Flow Information for a Collaborative Environment (FF-ICE) - Improved Coordination through Multi-centre Ground-Ground Integration (FF ICE, Step 1 and Flight Object, SWIM)
	<i>Performance Improvement Area</i> 2: Globally Interoperable Systems and Data
<i>Summary Description</i> FF-ICE supporting trajectory-based operations through exchange and distribution of information for multi-centre operations using flight object implementation and interoperability (IOP) standards. Extension of use of FF-ICE after departure, supporting trajectory-based operations. New system interoperability SARPs to support the sharing of ATM services involving more than two air traffic service units (ATSUs).	
<i>Operating Environment/Phases of Flight</i> All flight phases and all types of ground stakeholders.	
<i>Applicability Considerations</i> Applicable to all ground stakeholders (ATS, airports, airspace users) in homogeneous areas, potentially global.	
<i>Elements</i> 1. TBD	

<i>Module Designation</i> B2-SWIM Begins page 165	<i>Thread - Module Name</i> System-Wide Information Management - Enabling Airborne Participation in Collaborative ATM through SWIM
	<i>Performance Improvement Area</i> 2: Globally Interoperable Systems and Data
<i>Summary Description</i> This allows the aircraft to be fully connected as an information node in SWIM, enabling full participation in collaborative ATM processes with exchange of data including meteorology. This will start with non-safety critical exchanges supported by commercial data links.	
<i>Operating Environment/Phases of Flight</i> All phases of flight.	
<i>Applicability V</i> Long-term evolution potentially applicable to all environments.	
<i>Elements</i> 1. TBD	

PIA 3: Optimum Capacity and Flexible Flights

<i>Module Designation</i> B2-ACAS Begins page 285	<i>Thread - Module Name</i> Airborne Collision Avoidance Systems - New Collision Avoidance System
	<i>Performance Improvement Area</i> 3: Optimum Capacity and Flexible Flights

<p><i>Summary Description</i></p> <p>Implementation of the airborne collision avoidance system (ACAS) adapted to trajectory-based operations with improved surveillance function supported by ADS-B and adaptive collision avoidance logic aiming at reducing nuisance alerts and minimizing deviations.</p> <p>The implementation of a new airborne collision warning system will enable more efficient operations and future airspace procedures while complying with safety regulations. The new system will accurately discriminate between necessary alerts and “nuisance alerts”. This improved differentiation will lead to a reduction in controller workload as personnel will spend less time to respond to “nuisance alerts”. This will result in a reduction in the probability of a near mid-air collision.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>Aerodrome.</p>
<p><i>Applicability Considerations</i></p> <p>Safety and operational benefits increase with the proportion of equipped aircraft. The safety case needs to be carefully done.</p>
<p><i>Elements</i></p> <p>1. TBD</p>

<p><i>Module Designation</i></p> <p>B2-ASEP Begins page 265</p>	<p><i>Thread - Module Name</i></p> <p>Airborne Separation - Airborne Separation (ASEP)</p>
	<p><i>Performance Improvement Area</i></p> <p>3: Optimum Capacity and Flexible Flights</p>
<p><i>Summary Description</i></p> <p>Creation of operational benefits through temporary delegation of responsibility to the flight deck for separation provision with suitably equipped designated aircraft, thus reducing the need for conflict resolution clearances while reducing ATC workload and enabling more efficient flight profiles. The flight crew ensures separation from suitably equipped designated aircraft as communicated in new clearances, which relieve the controller of the responsibility for separation between these aircraft. However, the controller retains responsibility for separation from aircraft that are not part of these clearances.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>En-route phase, oceanic, and approach, departure and arrival.</p>	
<p><i>Applicability Considerations</i></p> <p>The safety case needs to be carefully done and the impact on capacity is still to be assessed in case of delegation of separation for a particular situation implying new regulation on airborne equipment and equipage roles and responsibilities (new procedure and training). First applications of ASEP are envisaged in Oceanic airspace and in approach for closely-spaced parallel runways.</p>	
<p><i>Elements</i></p> <p>1. TBD</p>	

<p><i>Module Designation</i></p> <p>B2-NOPS Begins page 239</p>	<p><i>Thread - Module Name</i></p> <p>Network Operations - Increased User Involvement in the Dynamic Utilization of the Network</p>
	<p><i>Performance Improvement Area</i></p> <p>3: Optimum Capacity and Flexible Flights</p>

<p><i>Summary Description</i></p> <p>CDM applications supported by SWIM that permit airspace users to manage competition and prioritization of complex ATFM solutions when the network or its nodes (airports, sector) no longer provide enough capacity to meet user demands. This further develops the CDM applications by which ATM will be able to offer/delegate to the users the optimization of solutions to flow problems. Benefits include an improvement in the use of available capacity and optimized airline operations in degraded situations.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>Pre-flight phases.</p>
<p><i>Applicability Considerations</i></p> <p>Region or sub-region.</p>
<p><i>Elements</i></p> <p>1. TBD</p>

PIA 4: Efficient Flight Paths

<p><i>Module Designation</i></p> <p>B2-CDO Begins page 315</p>	<p><i>Thread - Module Name</i></p> <p>Continuous Descent Operations - Improved Flexibility and Efficiency in Continuous Descent Profiles (CDOs) Using VNAV, Required Speed and Time at Arrival</p>
	<p><i>Performance Improvement Area</i></p> <p>4: Efficient Flight Paths</p>
<p><i>Summary Description</i></p> <p>A key emphasis is on the use of arrival procedures that allow the aircraft to apply little or no throttle in areas where traffic levels would otherwise prohibit this operation. This Block will consider airspace complexity, air traffic workload, and procedure design to enable optimized arrivals in dense airspace.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>En-route, terminal area, descent.</p>	
<p><i>Applicability Considerations</i></p> <p>Global, high-density airspace (based on the United States FAA procedures).</p>	
<p><i>Elements</i></p> <p>1. TBD</p>	
<p><i>Module Designation</i></p> <p>B2-RPAS Begins page 365</p>	<p><i>Thread - Module Name</i></p> <p>Remotely Piloted Aircraft Systems - Remotely Piloted Aircraft (RPA) Integration in Traffic</p>
	<p><i>Performance Improvement Area</i></p> <p>4: Efficient Flight Paths</p>

Summary Description

Continuing to improve the remotely piloted aircraft (RPA) access to non-segregated airspace; continuing to improve the remotely piloted aircraft system (RPAS) approval/certification process; continuing to define and refine the RPAS operational procedures; continuing to refine communication performance requirements; standardizing the command and control (C2) link failure procedures and agreeing on a unique squawk code for C2 link failure; and working on detect and avoid technologies, to include automatic dependent surveillance – broadcast (ADS-B) and algorithm development to integrate RPA into the airspace.

Operating Environment/Phases of Flight

All phases of flight including taxi.

Applicability Considerations

Applies to all RPA operating in non-segregated airspace and at aerodromes. Requires good synchronization of airborne and ground deployment to generate significant benefits, in particular to those able to meet minimum certification and equipment requirements.

Elements

1. TBD

Block 3 - For implementation in the 2028 - onwards timeframe

PIA 1: Airport Operations

<i>Module Designation</i> B3-RSEQ Begins page 71	<i>Thread - Module Name</i> Runway Sequencing - Integration AMAN/DMAN/SMAN
	<i>Performance Improvement Area</i> 1: Airport Operations
<i>Summary Description</i> This Module includes a brief description of integrated arrival, en-route, surface, and departure management.	
<i>Operating Environment/Phases of Flight</i> All phases of flight.	
<i>Applicability Considerations</i> Runways and terminal manoeuvring areas in major hubs and metropolitan areas will be most in need of these improvements. Complexity in implementation of this Block depends on several factors. Some locations might have to confront environmental and operational challenges that will increase the complexity of development and implementation of technology and procedures to realize this Block. Infrastructure for RNAV/RNP routes need to be in place.	
<i>Elements</i> 1. TBD	

PIA 2: Globally Interoperable Systems and Data

<i>Module Designation</i> B3-AMET Begins page 191	<i>Thread - Module Name</i> Advanced Meteorological Information - Enhanced Operational Decisions through Integrated Meteorological Information (Near-term and Immediate Service)
	<i>Performance Improvement Area</i> 2: Globally Interoperable Systems and Data <i>In the GANP, this Module is listed under Performance Improvement Area 3</i>

<p><i>Summary</i></p> <p>The aim of this Module is to enhance global ATM decision-making in the face of hazardous meteorological conditions in the context of decisions that should have an immediate effect. This Module builds upon the initial information integration concept and capabilities developed under B1-AMET. Key points are a) tactical avoidance of hazardous meteorological conditions in especially the 0-20 minute time frame; b) greater use of aircraft based capabilities to detect meteorological parameters (e.g. turbulence, winds, and humidity); and c) display of meteorological information to enhance situational awareness. This Module also promotes further the establishment of Standards for the global exchange of the information.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>All.</p>
<p><i>Applicability Considerations</i></p> <p>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.</p>
<p><i>Elements</i></p> <p>1. TBD</p>

<p><i>Module Designation</i></p> <p>B3-FICE Begins page 139</p>	<p><i>Thread - Module Name</i></p> <p>Flight and Flow Information for a Collaborative Environment (FF-ICE) - Improved Operational Performance through the Introduction of Full FF-ICE</p>
	<p><i>Performance Improvement Area</i></p> <p>2: Globally Interoperable Systems and Data</p>
<p><i>Summary Description</i></p> <p>Data for all relevant flights systematically shared between the air and ground systems using SWIM in support of collaborative ATM and trajectory-based operations.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>All phases of flight from initial planning to post-flight.</p>	
<p><i>Applicability Considerations</i></p> <p>Air and ground.</p>	
<p><i>Elements</i></p> <p>1. TBD</p>	

PIA 3: Optimum Capacity and Flexible Flights

<p><i>Module Designation</i></p> <p>B3-NOPS Begins page 221 <i>In ASBU Working Document, this is B3-FRTO</i></p>	<p><i>Thread - Module Name</i></p> <p>Network Operations - Traffic Complexity Management</p>
	<p><i>Performance Improvement Area</i></p> <p>3: Optimum Capacity and Flexible Flights</p>

<p><i>Summary Description</i></p> <p>Introduction of complexity management to address events and phenomena that affect traffic flows due to physical limitations, economic reasons or particular events and conditions by exploiting the more accurate and rich information environment of SWIM-based ATM. Benefits will include optimized usage and efficiency of system capacity.</p>
<p><i>Operating environment/Phases of flight</i></p> <p>Pre-flight and in-flight.</p>
<p><i>Applicability Considerations</i></p> <p>Regional or sub-regional. Benefits are only significant over a certain geographical size and assume that it is possible to know and control/optimize relevant parameters. Benefits mainly useful in the higher density airspace.</p>
<p><i>Elements</i></p> <p>1. TBD</p>

PIA 4: Efficient Flight Paths

<p><i>Module Designation</i></p> <p>B3-RPAS Begins page 373</p>	<p><i>Thread - Module Name</i></p> <p>Remotely Piloted Aircraft Systems (RPAS) - Remotely Piloted Aircraft (RPA) Transparent Management</p>
	<p><i>Performance Improvement Area</i></p> <p>4: Efficient Flight Paths</p>
<p><i>Summary Description</i></p> <p>Continuing to improve the certification process for remotely piloted aircraft (RPA) in all classes of airspace, working on developing a reliable command and control (C2) link, developing and certifying airborne detect and avoid (ABDAA) algorithms for collision avoidance, and integration of RPA into aerodrome procedures.</p>	
<p><i>Operating Environment/Phases of Flight</i></p> <p>En-route, oceanic, terminal (arrival and departure), aerodrome (taxi, take-off and landing).</p>	
<p><i>Applicability Considerations</i></p> <p>Applies to all RPA operating in non-segregated airspace and at aerodromes. Requires good synchronization of airborne and ground deployment to generate significant benefits, in particular to those able to meet minimum certification and equipment requirements.</p>	
<p><i>Elements</i></p> <p>1. TBD</p>	
<p><i>Module Designation</i></p> <p>B3-TBO Begins page 339</p>	<p><i>Thread - Module Name</i></p> <p>Trajectory Based Operations - Full 4D Trajectory-based Operations</p>
	<p><i>Performance Improvement Area</i></p> <p>4: Efficient Flight Paths</p>

<p><i>Summary Description</i></p> <p>The development of advanced concepts and technologies, supporting four dimensional trajectories (latitude, longitude, altitude, time) and velocity to enhance global ATM decision-making. A key emphasis is on integrating all flight information to obtain the most accurate trajectory model for ground automation.</p>
<p><i>Operating Environment/Phases of Flight</i></p> <p>En-route/cruise, terminal area, traffic flow management, descent.</p>
<p><i>Applicability Considerations</i></p> <p>Applicable to air traffic flow planning, en-route operations, terminal operations (approach/departure), and arrival operations. Benefits accrue to both flows and individual aircraft. Aircraft equipage is assumed in the areas of: ADS-B IN/CDTI; data communication and advanced navigation capabilities. Requires good synchronization of airborne and ground deployment to generate significant benefits, in particular to those equipped. Benefit increases with size of equipped aircraft population in the areas where the services are provided.</p>
<p><i>Elements</i></p> <ol style="list-style-type: none">1. TBD

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