SRI LANKA AIR NAVIGATION PLAN (SLANP) 2022-2036

Version 1.0

SRI LANKA
AIR NAVIGATION PLAN
2022 - 2036

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Foreword

Aviation plays a vital role in Sri Lanka's Economic development. It is essential to maintain the vitality of Aviation through safe, efficient, cost effective and environmentally sustainable Air Navigation Services. It is also important to keep pace with the global developments in the field of Air Navigation to reap the benefits of the technological advancements to support the delivery of safe, efficient and optimal delivery of Air Navigation Services.

The objective of the Sri Lanka Air Navigation Plan (SLANP) is to provide the direction and guidance to the industry for comprehensive planning and implementation initiatives for the future developments of delivering Air Navigation Services.

SLANP describes the State's planning arrangements to align itself with both Regional and Global objectives, to ensure the greatest degree of harmonization and interoperability with other States. It also initiates the assignment of responsibilities for the provision of safe and efficient Air navigation services within the Sri Lanka airspace and the investments to be made for upgrades and modernization of communication, navigation and surveillance facilities and the services.

In line with the international efforts described in the ICAO Aviation System Block Upgrade (ASBU) and the Asia Pacific Seamless ANS Plan, the Sri Lanka Air Navigation Plan (SLANP) has been developed under five interconnected areas (viz. Airport Operations, Communication Navigation and Surveillance, Air Traffic Management, Aeronautical Information Management and Meteorology) to modernize the Sri Lankan Aviation system for the future.

The detailed descriptions contained in the SLANP will provide the industry with a clear indication of the roadmap that will be followed to enhance the capacity of the Airspace and Aerodromes. Regulatory decisions and key policies on future projects and investments on the sphere of Air Navigation in Sri Lanka will be made based on the SLANP.

Realizing the social, environmental and economic benefits Sri Lanka deserves in a safe, secure and modern aviation system, the Civil Aviation Authority endeavors to work in collaboration with our Aviation stakeholders to achieve the SLANP in a realistic time frame commensurate to the growth of the Aviation Industry.

Capt. Themiya Abeywickrama
Director General of Civil Aviation & Chief Executive Officer

Executive Summary

Whilst the Air Navigation has witnessed some important improvements and developments during the passage of time, yet a considerable remainder of the Global Air Navigation System stems from conceptual framework that was conceived in the twentieth century. The legacy Air Navigation capabilities have placed limitations in air traffic capacity enhancements and growth causing inefficiencies in many aspects of the Aviation system.

ICAO Global Air Navigation Plan (GANP) presented a framework supporting a harmonized Global Air Navigation system that has identified all potential performance improvements needed considering the present and future of the ground navigation infrastructure and avionics technologies. The objective of the GANP is to increase capacity and improve efficiency of the global civil aviation system whilst improving or at least maintaining safety.

As a signatory to the Convention on International Civil Aviation and also being a member State of the ICAO Asia Pacific region, Sri Lanka endorses and facilitates the ICAO's strategic methodology for the safe and orderly development of international civil aviation throughout the world. As Such, Sri Lanka Air Navigation Plan (SLANP) confirms Sri Lanka's commitment to be consistent with International Civil Aviation Organization's (ICAO) methodology in developing Air Navigation systems in Sri Lanka.

A National Air Navigation Plan of a State describes the planning modules and time horizons for implementation of its Air Traffic Management (ATM) systems, Aerodromes and Airspace for aligning them with the global and regional objectives, ensuring the greatest degree of harmonization and interoperability with other States.

Recognizing the importance of development of the Aviation systems in the Asia Pacific (APAC) Region, during the APAC regional Aviation Ministerial Summit held in 2018, the Ministers have committed for the implementation of the Asia/Pacific Seamless Air Traffic Management Plan through a National planning framework supported by a National Air Navigation Plan by 2022.

In line with the international efforts described in the ICAO Aviation System Block Upgrade (ASBU) and the Asia Pacific Seamless ANS Plan, the SLANP is intended to provide the direction and guidance for the strategic planning of the country's future Air Navigation system to enhance the capacity and efficiency of the overall system necessary for safe, efficient and regular navigation of aircraft within the sovereign airspace of Sri Lanka and also in the oceanic airspace of Colombo Flight Information Region (FIR) which has been delegated to Sri Lanka by ICAO through Regional Air Navigation Agreements, for the provision of Air Navigation Services.

Accordingly, SLANP represents a rolling plan beginning from the year 2022 spanning for 15 years under five implementation phases each comprising a duration of 3 years, within five interconnecting subject areas, viz. Air Traffic Management (ATM), Communication, Navigation and Surveillance technology and services (CNS), Aeronautical Information Management (AIM), Airport Operations (AOP), and Meteorology (MET) which form parts of the entire National Air Navigation system in harmony.

Contents

Abbreviations

A

AASL	Airport and Aviation Services (Sri Lanka) (Pvt) Ltd
ABI	Advanced Boundary Information (AIDC)
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ACDM	Airport Collaborative Decision Making
ACP	Acceptance (AIDC)
ADS-B	Automatic Dependent Surveillance - Broadcast
ADS-C	Automatic Dependent Surveillance - Contract
AFTN	Aeronautical Fixed Telecommunication Network
AIC	Aeronautical Information Circular
AICM	Aeronautical Information Conceptual Model
AIDC	ATS Interfaculty Data Communications
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AIRB	Enhanced Traffic situational awareness during flight operations
AIS	Aeronautical Information Service
AIXM	Aeronautical Information Exchange Model
AMAN	Arrival Manager
AMHS	ATS Message Handling System
AN-Conf/11	Eleventh Air Navigation Conference (2003)
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
AOC	Assumption of Control (AIDC)
AOP	Airport Operations Plan
AOPC	Airport Operations Centre
APAC	Asia/Pacific

APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APCH	Approach
APM	Approach path Monitoring
APV	Approach procedure with Vertical Guidance
APW	Area Proximity Warning
ARCC	Aeronautical Rescue Coordination Center
ASBU	Aviation System Block Upgrade
ASEP	Airborne Separation
ASM	Airspace Management
A-SMGCS	Advanced Surface Movement Guidance and Control System
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSU	ATS Unit
AU	Airspace User

B

BIA	Bandaranaike International Airport
BARO VNAV	Barometric Vertical Navigation
B-RNAV	Basic area navigation

C

CCO	Continuous Climb Operations
CDM	Collaborative Decision Making
CDO	Continuous Descent Operations
CDP	Climb and Descent Procedures
CDR	Coded Departure Routes
CDT	Detection Tools

CDTI	Cockpit Display of Traffic Information
CFIT	Controlled Flight Into Terrain
CLAM	Cleared Level Adherence Monitoring
CPAR	Conflict Prediction and Resolution
CPDLC	Controller Pilot Data Link Communications

D

DARP	Dynamic Airborne Reroute Procedure
DMAN	Departure Management
DME	Distance Measuring Equipment

E

e-AIP	Electronic AIP
e-PUBS	Electronic Publications
e-TOD	Electronic Terrain and Obstacle Data
EVS	Enhanced Vision System

F

FANS	Future Air Navigation System
FIR	Flight Information Region
FMS	Flight Management System
FRA	Free Route Airspace
FRT	Fixed Radius Transition
FUA	Flexible Use of Airspace

G

GANP	Global Air Navigation Plan
GBAS	Ground-Based Augmentation System
GNSS	Global Navigation Satellite System
GPI	Global Plan Initiative
GPS	Global Positioning System

H

HF	High Frequency

I

IAF	Initial Approach Fix
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Information Management
IP	Internet Protocol
ITP	In-Trail-Procedure
IWXXM	ICAO Weather Exchange Model

L

LDACS	L-Band Digital Aeronautical Communication System
LNAV	Lateral Navigation
LPV	Localizer Performance with Vertical Guidance
LVP	Low Visibility Procedures

M

MLAT	Multilateration
MRCC	Maritime Rescue Coordination Center
MSA	Multi Sector Area
MSAW	Minimum Safe Altitude Warning
MSSR	Monopulse Secondary Surveillance Radar
MTCD	Mid Term Conflict Detection
MTOW	Maximum Take-off Weight

N

NOTAM	Notice to airmen
NCAP	National Civil Aviation Policy

P

PANS	Procedures for Air Navigation Services
PARS	Preferred Aerodrome/Airspace and Route Specifications
PASL	Preferred ANS Service Levels
PIB	Pre-flight Information Bulletin
PBN	Performance-Based Navigation

R

RAIM	Receiver Autonomous Integrity Monitoring
RAM	Route Adherence Monitoring
RNAV	Area Navigation
RNP	Required Navigation Performance

S

SARPs	Standards and Recommended Practices
SATCOM	Satellite Communication
SBAS	Satellite-Based Augmentation System
SID	Standard instrument Departure
SLANP	Sri Lanka Air Navigation Plan
SMGCS	Surface Movement Guidance and Control System (A-SMGCS)
SNET	Ground-Based Safety Net
SSR	Secondary Surveillance Radar
STAR	Standard Instrument Arrival Route
STCA	Short Term Conflict Alerts
SWIM	System-Wide Information Management

T

TBO	Trajectory-Based Operations
TCAS	Traffic Alert and Collision Avoidance System
TIS-B	Traffic Information Service - Broadcast
TMA	Terminal Control Area
TPO	Tactical Parallel Offset

U

UPR	User Preferred Routes

V

VDL	VHF Data Link
VFR	Visual Flight Rules
VHF	Very High Frequency
VNAV	Vertical Navigation
VOR	VHF Omnidirectional Radio Range
VSA	Enhanced Visual Separation on Approach

W

WAF	Weather Avoidance Field
WGS-84	World Geodetic System-1984

References

Doc 9750 - Global Air Navigation Plan

Doc 9854 - Global ATM operational Concept

Doc 10004 - Global Aviation Safety Plan *(GASP)*

Doc 9882 - Manual on ATM System Requirements

Doc 9883 - Global Performance of the Air Navigation System

Doc 9673 - Asia/ Pacific Regional Air Navigation Plan

Asia/ Pacific Seamless ATM Plan *(version 2.3, April 2019)*

Part - II
Introduction

Domestic and International Air Transport sectors in Sri Lanka have been experiencing a steady growth showing a positive correlation with much predicted growth in the Asia Pacific Region. As per International Air Transport Association (IATA) and ICAO forecasts, the Asia Pacific region is expected to achieve unprecedented long term growth in aviation.

Aviation sector plays a pivotal role in economic growth in Sri Lanka as it has shown increased dependency on the tourism sector to drive the economy. The Civil Aviation Authority of Sri Lanka (CAASL), being the State regulatory body, aspires the aviation sector to play the expected role catalyzing and driving sustainable economic and social development in Sri Lanka for which a safe, efficient and dependable Air Navigation system is an essential prerequisite.

SLANP is intended to provide appropriate direction and guidance for the strategic planning of the country's future Air Navigation System required for the safe, efficient and regular navigation of aircraft within the sovereign airspace of Sri Lanka and the oceanic airspace that has been delegated to Sri Lanka by ICAO under Regional Air Navigation Agreements.

The Government of Sri Lanka through the National Civil Aviation Policy (NCAP) supports the effective implementation and consistent enforcement of international standards and best practices to provide a safe and efficient Air Navigation service, in line with the policies and objectives of the Global Air Navigation Plan (GANP) of ICAO and associated Aviation System Block Upgrades (ASBU).

As such, SLANP is drawn with a view of harmonizing the State Air Navigation System capabilities in congruence with the Asia-Pacific Regional Air Navigation Plan (RANP-APAC) and the GANP where ASBU priorities are embedded.

Accordingly SLANP envisages constant review and upgrades in Airport Operations (AOP), Communication, Navigation and Surveillance infrastructure and Air Traffic Management System (CNS-ATM), Aeronautical Information Management (AIM) and Meteorology (MET) which form part of the entire national air navigation system in harmony with the advancement of Science and Technology satisfying global, regional and local service delivery and performance expectations whilst upholding safety and capacity enhancement of air navigation system for the environment friendly growth of overall aviation sector.

2.1 Global Air Navigation Plan – GANP

The objective of the GANP is to increase capacity and improve the efficiency of the global civil aviation system whilst improving or at least maintaining safety. The GANP encapsulates the framework that includes key civil aviation policies and principles where Regional and State Air Navigation Plans are required to be aligned to and also provides Regions and States with a comprehensive planning tool supporting the harmonization with the global air navigation system. Furthermore, GANP identifies all potential performance improvements available at present, details the next generation of ground and avionics technologies that will be deployed worldwide, and provides the investment certainty needed for States to make strategic decisions for their individual planning purposes.

The GANP includes the Aviation System Block Upgrade (ASBU) framework, its Modules and its associated technology Roadmaps covering, inter alia, Communications, Surveillance, Navigation, information management and avionics that will eventually realize a fully-harmonized global interoperable air navigation system, described within six-year timeframes for each ASBU Block starting with Block 0 in 2013.

Deriving from the GANP, the RANP-APAC presents the framework for the APAC States in harmonizing the APAC region with the global interoperable navigation system. The SLANP is designed to be in harmony with the RANP-APAC and the ASBU framework included in the GANP.

ASBU Framework

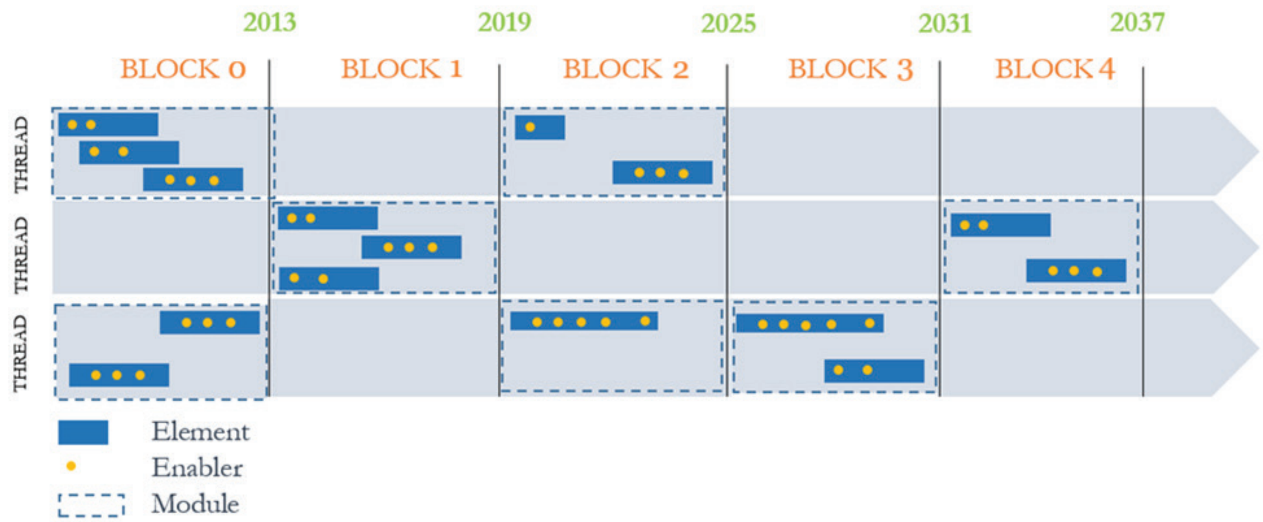


Figure 1

Block - is made up of modules that, when combined, enable significant improvements and benefits within a defined time frame. (Time blocks viz. Block 0, Block 1, Block 2, Block 3, each with a 6 years timespan commenced in 2013). It is recognized that Blocks 0 and 1 represent the most mature of the modules. Blocks 2 and 3 provide the necessary vision to ensure that earlier implementations are on the path to the future.

Thread - describes the evolution of a given capability through the successive block upgrades, from basic to more advanced capability and associated performance, while representing key aspects of the global ATM concept. (ASBU threads are been categorized in 3 groups, stated below)

Module - a deployable package based on performance or capability. It offers a clear operational benefit, supported by procedures, technology, regulation/standards as necessary. A module will be also characterized by the operating environment within which it may be applied.

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

Enabler - components (standards, procedures, training, technology, etc.) required to implement an element. (Some of the enablers can be elements in other threads).

The ASBU threads are been categorized into three functional categories as shown below:

- Information;
- Operational; and
- CNS Technology and Services.

Information	
AMET	Meteorological information provided to support operational efficiency and safety.
DAIM	Digital Aeronautical Information Management
FICE	Flight and Flow Information for a Collaborative Environment (FF-ICE)
SWIM	System Wide Information Management

Operational	
ACAS	Airborne Collision Avoidance System (ACAS)
ACDM	Airport Collaborative Decision Making
APTA	Improve arrival and departure operations
CSEP	Cooperative Separation
FRTO	Improved operations through enhanced en-route trajectories
GADS	Global Aeronautical Distress and Safety System (GADSS)
NOPS	Network Operations
OPFL	Improved access to optimum flight levels in oceanic and remote airspace
RATS	Remote Aerodrome Air Traffic Services
RSEQ	Improved traffic flow through runway sequencing
SNET	Ground-based Safety Nets
SURF	Surface operations
TBO	Trajectory-based operations
WAKE	Wake Turbulence Separation

CNS technology and services	
ASUR	Surveillance systems
COMI	Communication infrastructure
COMS	ATS Communication service
NAVS	Navigation systems

Figure 1 explains the basic ASBU concept. The modules under each block carry the same module number indicating that they are a part of the same thread. Each block includes a target date reference for its availability. Each of the modules that form the Blocks must meet a readiness review that includes the availability of standards (to include performance standards, approvals, and advisory/guidance documents, etc.), avionics, infrastructure, ground automation and other enabling capabilities.

Although GANP is global in scope, it is not expected that all ASBU modules will be applied worldwide. Some of the ASBU modules contained in the GANP are specialized packages that must be applied wherever there are specific operational requirements or corresponding benefits.

The SLANP has extensively considered and selected applicable ASBU modules that will be required for meeting the Air Navigation objectives of Sri Lanka, and to be implemented in a time bound manner. The SLANP provides linkages to respective ASBU modules at the end of each chapter.

Table 1 shows a summary of ASBU Elements specified in GANP 6th Edition in different Blocks. All ASBU Elements are listed in detail in the **Appendix - A** of this document.

	BLOCK 0	BLOCK 1	BLOCK 2	BLOCK 3	BLOCK 4
Information					
AMET	AMET B0/1 AMET B0/2 AMET B0/3 AMET B0/4	AMET B1/1 AMET B1/2 AMET B1/3 AMET B1/4	AMET B2/1 AMET B2/2 AMET B2/3 AMET B2/4	AMET B3/1 AMET B3/2 AMET B3/3 AMET B3/4	AMET B4/1
DAIM	-	DAIM B1/1 DAIM B1/2 DAIM B1/3 DAIM B1/4 DAIM B1/5 DAIM B1/6 DAIM B1/7	DAIM B2/1 DAIM B2/2 DAIM B2/3 DAIM B2/4 DAIM B2/5	-	-
FICE	FICE B0/1	-	FICE B2/1 FICE B2/2 FICE B2/3 FICE B2/4 FICE B2/5 FICE B2/6 FICE B2/7 FICE B2/8 FICE B2/9	FICE B3/1	FICE B4/1 FICE B4/2
SWIM	-	-	SWIM B2/1 SWIM B2/2 SWIM B2/3 SWIM B2/4 SWIM B2/5	SWIM B3/1	

Operational					
ACAS	-	ACAS B1/1	ACAS B2/1 ACAS B2/2	-	-
ACDM	ACDM B0/1 ACDM B0/2	ACDM B1/1 ACDM B1/2	ACDM B2/1	ACDM B3/1	-
APTA	APTA B0/1 APTA B0/2 APTA B0/3 APTA B0/4 APTA B0/5 APTA B0/6 APTA B0/7 APTA B0/8	APTA B1/1 APTA B1/2 APTA B1/3 APTA B1-4 APTA B1/5	APTA B2/1 APTA B2/2 APTA B2/3	-	-
CSEP	-	CSEP B1/1 CSEP B1/2 CSEP B1/3 CSEP B1/4	CSEP B2/1 CSEP B2/2 CSEP B2/3	CSEP B3/1 CSEP B3/2	CSEP B4/1
FRTO	FRTO B0/1 FRTO B0/2 FRTO B0/3 FRTO B0/4	FRTO B1/1 FRTO B1/2 FRTO B1/3 FRTO B1/4 FRTO B1/5 FRTO B1/6 FRTO B1/7	FRTO B2/1 FRTO B2/2 FRTO B2/3 FRTO B2/4	-	-
GADS	-	GADS B1/1 GADS B1/2	GADS B2/1 GADS B2/2 GADS B2/3 GADS B2/4	-	-
NOPS	NOPS B0/1 NOPSB0/2 NOPS B0/3 NOPS B0/4 NOPS B0/5	NOPS B1/1 NOPS B1/2 NOPS B1/3 NOPS B1/4 NOPS B1/5 NOPS B1/6 NOPS B1/7 NOPS B1/8 NOPS B1/9 NOPS B1/10	NOPS B2/1 NOPS B2/2 NOPS B2/3 NOPS B2/4 NOPS B2/5 NOPS B2/6 NOPS B2/7 NOPS B2/8	NOPS B3/1 NOPS B3/2 NOPS B3/3	
OPFL	OPFL B0/1 OPFL B0/2	-	-	-	-
RATS	-	RATS B1/1	-	-	-

RSEQ	RSEQ B0/1 RSEQ B0/2 RSEQ B0/3	RSEQ B1/1	RSEQ B2/1 RSEQ B2/2	RSEQ B3/1 RSEQ B3/2 RSEQ B3/3 RSEQ B3/4	-
SNET	SNET B0/1 SNET B0/2 SNET B0/3 SNET B0/4	SNET B1/1 SNET B1/2	-	-	-
SURF	SURF B0/1 SURF B0/2 SURF B0/3	SURF B1/1 SURF B1/2 SURF B1/3 SURF B1/4 SURF B1/5	SURF B2/1 SURF B2/2 SURF B2/3	SURF B3/1	-
TBO	TBO B0/1	TBO B1/1	TBO B2/1 TBO B2/2	TBO B3/1	TBO B4/1
WAKE	-	-	WAKE B2/1 WAKE B2/2 WAKE B2/3 WAKE B2/4 WAKE B2/5 WAKE B2/6 WAKE B2/7 WAKE B2/8	WAKE B3/1 WAKE B3/2	WAKE B4/1 WAKE B4/2
CNS Technology and Services					
ASUR	ASUR B0/1 ASUR B0/2 ASUR B0/3	ASUR B1/1	ASUR B2/1 ASUR B2/2	ASUR B3/1	ASUR B4/1
COMI	COMI B0/1 COMI B0/2 COMI B0/3 COMI B0/4 COMI B0/5 COMI B0/6 COMI B0/7 COMI B0/4 COMI B0/5 COMI B0/6 COMI B0/7	COMI B1/1 COMI B1/2 COMI B1/3 COMI B1/4	COMI B2/1 COMI B2/2 COMI B2/3	COMI B3/1 COMI B3/2 COMI B3/3 COMI B3/4	-
COMS	COMS B0/1 COMS B0/2	COMS B1/1 COMS B1/2 COMS B1/3	COMS B2/1 COMS B2/2 COMS B2/3	COMS B3/1 COMS B3/2	-

NAVS	NAVS B0/1 NAVS B0/2 NAVS B0/3 NAVS B0/4	NAVS B1/1	NAVS B2/1 NAVS B2/2 NAVS B2/3	-	-

Ref. ICAO GANP 6th Edition

2.2 Asia - Pacific Regional Air Navigation plan (ANP-APAC)

Regional Air Navigation Plan (RANP) represents the bridge between, from one side, the global provisions in the ICAO Standards and Recommended Practices (SARPs) and the GANP, and from the other side, the States' national plans and current implementation, and are developed to meet those needs of specific areas not covered in the worldwide provisions.

RANP-APAC contains requirements related to the facilities and services to be implemented by the States in the APAC Region in accordance with Regional Air Navigation Plan and is used as a repository document for the assignment of responsibilities to those States for the provision of required facilities and services within a specified area in accordance with Article 28 of the Convention on International Civil Aviation.

2.3 Asia/ Pacific Seamless ATM Plan

As agreed by the Asia/ Pacific Seamless ATM Planning Group (APSAPG), the objective of Seamless ATM is the safe and interoperable provision of harmonized and consistent Air Traffic Management service provided to a flight, appropriate to the airspace category and free of transitions due to a change in the Air Navigation Service provider or Flight Information Region.
The Seamless ATM Plan was developed as part of a suite of ANP-APAC with the aim of facilitating Asia/ Pacific Seamless ATM operations, by developing and deploying ATM solutions capable of ensuring the safety and efficiency of Air Transport throughout the APAC Region. It provides a framework for a transition to a Seamless ATM environment, in order to meet future performance requirements.

2.3.1 ASBU Elements

The APAC Seamless ATM Plan version 3.0 (November 2019) provides a summary of the Block 0 and Block 1 elements, and their priority for implementation within the Asia/Pacific Region (Ref. Table 2). The allocation of priority is based on factors including its importance in promoting Seamless ANS:

Priority 1 - critical upgrade assignment based on whether the implementation of an element could bring most benefit to the region or regional upgrade by States and is essential to achieve the service level required globally;

Priority 2 - recommended upgrade for those elements which would bring benefits to the region and generally to be implemented from 2022, but are encouraged to implement earlier if beneficial; and

Priority 3 - assigned to those elements which may not be universally implemented in the Asia/Pacific Region.

(Asia/Pacific Seamless ANS Plan V3.0, 2019)

In addition, APAC Seamless ANS Plan introduces a Performance Improvement Plan which includes Preferred Aerodrome/Airspace and Route Specifications (PARS) and Preferred ANS Service Levels (PASL).

Preferred Aerodrome/Airspace and Route Specifications (PARS) Implementation timeline:

PARS Phase I (had an expected implementation by 12 November 2015)
PARS Phase II (had an expected implementation by 07 November 2019)
PARS Phase III (expected implementation by 03 November 2022)
PARS Phase IV (expected implementation by 27 November 2025)

Preferred ANS Levels (PASL) Implementation timeline

PASL Phase I (had an expected implementation by 12 November 2015)
PASL Phase II (had an expected implementation by 07 November 2019)
PASL Phase III (expected implementation by 03 November 2022)
PASL Phase IV (expected implementation by 27 November 2025)

Table 2 - **ASBU Block B0 and B1 implementation within APAC Region**

(Ref. Asia/ Pacific Seamless ANS Plan V3.0)

Note - Detailed Information on all PASL & PARS elements are available in **Appendix - B**.

Cat.	Element	Description	APAC Regional Priority	Impl. Phase
Information Phase II				
AMET B0	AMET B0/1	Meteorological observations products	Priority 1	
	AMET B0/2	Meteorological forecast and warning products		
	AMET B0/3	Climatological and historical meteorological products		
	AMET B0/4	Dissemination of meteorological products		
		Ref. PASL 7.41	Priority 1	Phase II
AMET B1	AMET B1/1	Meteorological observations information	Priority 2	
	AMET B1/2	Meteorological forecast and warning information		
	AMET B1/3	Climatological and historical meteorological information		
	AMET B1/4	Dissemination of meteorological information		
		Ref. PASL 7.56	Priority 2	Phase III
DAIM B1	DAIM B1/1	Provision of quality-assured aeronautical data and information	Priority 1	
	DAIM B1/2	Provision of digital Aeronautical Information Publication (AIP) Data sets		
	DAIM B1/3	Provision of digital terrain data sets		
	DAIM B1/4	Provision of digital obstacle data sets		
	DAIM B1/5	Provision of digital aerodrome mapping data sets		
	DAIM B1/6	Provision of digital instrument flight procedure data sets		
		Ref. PASL 7.40	Priority 2	Phase II

	DAIM B1/7	NOTAM improvements	Priority 2	
		Ref. PASL 7.55	Priority 2	Phase III
FICE B0	FICE B0/1	Automated basic inter facility data exchange (AIDC)	Priority 1	
		Ref. PASL 7.26	Priority 1	Phase II
		Operational		
ACDM B0	ACDM B0/1 ACDM B0/2	Airport CDM Information Sharing (ACIS) Integration with ATM Network function	Priority 1	
		Ref. PARS 7.3	Priority 1	Phase II
ACDM B1	ACDM B1/1 ACDM B1/2	Airport Operations Plan (AOP) Airport Operations Centre (APOC)	Priority 2	
		Ref. PARS 7.18	Priority 2	Phase III
APTA B0	APTA B0/1 APTA B0/2	PBN Approaches (with basic capabilities) PBN SID and STAR procedures (with basic capabilities)	Priority 1	
		Ref. PARS 7.4, 7.5, 7.10, 7.13, 7.14 Ref. PARS 7.21	Priority 1 Priority 1	Phase II Phase III
APTA B0	APTA B0/3 APTA B0/6	SBAS/GBAS CAT I precision approach procedures PBN Helicopter Point in Space (PinS) Operations	Priority 3	
		Ref. PARS 7.6	Priority 3	Phase II
APTA B0	APTA B0/4 APTA B0/5 APTA B0/7 APTA B0/8	CDO (Basic) CCO (Basic) Performance based aerodrome operating minima - Advanced aircraft Performance based aerodrome operating minima - Basic aircraft	Priority 2	
		Ref. PARS 7.14, 7.19, 7.21	Priority 2	Phase III
APTA B1	APTA B1/1 APTA B1/2 APTA B1/3 APTA B1/4 APTA B1/5	PBN Approaches (with advanced capabilities) PBN SID and STAR procedures (with advanced capabilities) Performance based aerodrome operating minima – Advanced aircraft with SVGS CDO (Advanced) P1 CCO (Advanced)	Priority 3	
		Ref. PARS 7.14, 7.21, 7.22, 7.23	Priority 3	Phase IV
CSEP B1	CSEP B1/1 CSEP B1/2 CSEP B1/3 CSEP B1/4	Basic airborne situational awareness during flight operations (AIRB) Visual Separation on Approach (VSA) Performance Based Longitudinal Separation Minima Performance Based Lateral Separation Minima	Priority 2	
		Ref. PARS 7.20	Priority 2	Phase III
FRTO B0	FRTO B0/1 FRTO B0/2 FRTO B0/3	Direct routing (DCT) Airspace planning and Flexible Use of Airspace (FUA) Pre-validated & coordinated ATS routes to support flight & flow	Priority 2	

	FRTO B0/4	Basic conflict detection and conformance monitoring		
		Ref. PASL 7.29, 7.31, 7.36	Priority 1	Phase II
FRTO B1	FRTO B1/1	Free Route Airspace (FRA)	Priority 2	
	FRTO B1/2	Required Navigation Performance (RNP) routes		
	FRTO B1/3	Advanced Flexible Use of Airspace (FUA) and management of real time airspace data P2		
	FRTO B1/4	Dynamic Sectorization		
	FRTO B1/5	Enhanced Conflict Detection Tools and Conformance Monitoring P1		
	FRTO B1/6	Multi-Sector Planning		
	FRTO B1/7	Trajectory Options Set (TOS)		
		Ref. PASL 7.29, 7.51	Priority 2	Phase III
NOPS B0	NOPS B0/1	Initial integration of collaborative airspace management with air traffic flow management	Priority 1	
	NOPSB0/2	Collaborative Network Flight Updates		
	NOPS B0/3	Network Operation Planning basic features		
	NOPS B0/4	Initial Airport/ATFM slots and A-CDM Network Interface		
	NOPS B0/5	Dynamic ATFM slot allocation		
		Ref. PASL 7.38	Priority I	Phase II
NOPS B1	NOPS B1/1	Short Term ATFM measures	Priority 1	
	NOPS B1/2	Enhanced Network Operations Planning		
	NOPS B1/3	Enhanced integration of Airport operations planning with network operations planning		
	NOPS B1/4	Dynamic Traffic Complexity Management		
	NOPS B1/5	Full integration of airspace management with air traffic flow management		
	NOPS B1/6	Initial Dynamic Airspace configurations		
	NOPS B1/7	Enhanced ATFM slot swapping		
	NOPS B1/8	Extended Arrival Management supported by the ATM Network function		
	NOPS B1/9	Target Times for ATFM purposes		
	NOPS B1/10	Collaborative Trajectory Options Program (CTOP)		
		Ref. PASL 7.52	Priority 2	Phase III
OPFL B0	OPFL B0/1	In Trail Procedure (ITP)	Priority 3	
OPFL B1	OPEL B1/1	Climb and Descend Procedure (CDP)	Priority 3	
RATS B1	RATS B1/1	Remotely Operated Aerodrome Air Traffic Services	Priority 3	
RSEQ B0	RSEQ B0/1	Arrival Management	Priority 1	
	RSEQ B0/2	Departure Management		
		Ref. PASL 7.32	Priority 1	Phase II
RSEQ B0	RSEQ B0/3	Point merge	Priority 3	
	RSEQ B1/1	Extended arrival metering	Priority 2	
		Ref. PASL 7.46	Priority 2	Phase III

SNET B0	SNET B0/1 SNET B0/2 SNET B0/3 SNET B0/4	Short Term Conflict Alert (STCA) Minimum Safe Altitude Warning (MSAW) Area Proximity Warning (APW) Approach Path Monitoring (APM)	Priority 1	
		Ref. PASL 7.31	Priority 1	Phase III
SNET B1	SNET B1/1 SNET B1/2	Enhanced STCA with aircraft parameters Enhanced STCA in complex TMAs	Priority 2	
		Ref. PASL 7.50	Priority 2	Phase III
SURF B0	SURF B0/1 SURF B0/2 SURF B0/3	Basic ATCO tools to manage traffic during ground operations Comprehensive situational awareness of surface operations Initial ATCO alerting service for surface operations	Priority 2	
		Ref. PASL 7.47	Priority 2	Phase III
SURF B1	SURF B1/1 SURF B1/2 SURF B1/3 SURF B1/4 SURF B1/5	Advanced features using visual aids to support traffic management during ground operations Comprehensive pilot situational awareness on the airport surface Enhanced ATCO alerting service for surface operations Routing service to support ATCO surface operations management Enhanced vision systems for taxi operations	Priority 2	
		Ref. PASL 7.48	Priority 2	Phase III
TBO B0	TBO B0/1	Introduction of time-based management within a flow centric approach	Priority 2	
TBO B1	TBO B1/1	Initial Integration of time-based decision making processes	Priority 2	
		Ref. PASL 7.52	Priority 2	Phase III
CNS Technology and Services				
ASUR B0	ASUR B0/1 ASUR B0/2 ASUR B0/3	Automatic Dependent Surveillance – Broadcast (ADS-B) Multilateration cooperative surveillance systems (MLAT) Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)		
		Ref. PARS 7.8, 7.11, PASL 7.26, 7.28, 7.30	Priority 1	Phase II
ASUR B1	ASUR B1/1	Reception of aircraft ADS-B signals from space (SB ADS-B)		
		Ref. PASL 7.54	Priority 2	Phase III
COMI B0	COMI B0/1 COMI B0/2 COMI B0/4 COMI B0/5 COMI B0/6	Aircraft Communication Addressing and Reporting System (ACARS) Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI) VHF Data Link (VDL) Mode 2 Basic Satellite communications (SATCOM) Class C Data High Frequency Data Link (HFDL)	Priority 2	
		Ref. PASL 7.53	Priority 2	Phase III
COMI B0	COMI B0/3	VHF Data Link (VDL) Mode 0/A	Priority 1	

	COMI B0/7	ATS Message Handling System (AMHS)		
		Ref. 7.25	Priority 1	Phase II
COMI B1	COMI B1/1	Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)	Priority 2	
	COMI B1/2	VHF Data Link (VDL) Mode 2 Multi-Frequency		
	COMI B1/3	SATCOM Class B Voice and Data		
	COMI B1/4	Aeronautical Mobile Airport Communication System (AeroMACS) Ground-Ground		
		Ref. PASL 7.53	Priority 2	Phase III
COMI B0	COMS B0/1	CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace		
	COMS B0/2	ADS-C (FANS 1/A) for procedural airspace	Priority 2	
		Ref. PARS 7.14	Priority 2	Phase II
		Ref. PASL 7.29, 7.53	Priority 2	Phase II
COMS B1	COMS B1/1	PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace	Priority 2	
	COMS B1/2	PBCS approved ADS-C (FANS 1/A+) for procedural airspace P1 Implementation		
	COMS B1/3	SATVOICE (incl. routine communications) for procedural airspace		
		Ref. PARS 7.14	Priority 2	Phase II
		Ref. PASL 7.53	Priority 2	Phase III
NAVS B0	NAVS B0/1	Ground Based Augmentation Systems (GBAS)	Priority 2	
	NAVS B0/2	Satellite Based Augmentation Systems (SBAS)		
	NAVS B0/3	Aircraft Based Augmentation Systems (ABAS)		
	NAVS B0/4	Navigation Minimal Operating Networks (Nav. MON) N/A		
PARS II	SBAS, GBAS, ABAS and MON systems should be established as appropriate to the level and type of aircraft operations and the operating environment consistent with NAVS-B0/1 - 4, subject to an assessment of benefits and costs.		Phase II Priority 2	
NAVS B1	NAVS B1/1	Extended GBAS	Priority 3	

Note: Following two ASBU elements are considered to be implemented universally, hence not included in the above table.

ACAS-B1/1: ACAS Improvements (TCAS Version 7.1); and

GADS-B1/1 - 2: Aircraft Tracking and Contact directory service (An appropriate enhanced SAR system and systems to support aircraft tracking capability should be established consistent with the provisions of Annex 12 and to support GADS-B1/1 – 2, and in accordance with the Asia/Pacific SAR Plan).

2.3.2 Regional Elements

Table 3 provides a summary of the Regional Seamless ANS elements that have been incorporated into the Seamless ANS framework and the expected priority for implementation. The allocation of priority is based on factors including its importance in promoting Seamless ANS.

Table 3 - **Regional Seamless ANS Elements**

PARS - Preferred Aerodrome/Airspace and Route Specifications

PASL - Preferred ANS Service Levels

Category	Regional Seamless ANS Element	Phase/Priority
	Operational	
PARS	**Aerodrome management and coordination -** All international a erodromes should enable, in accordance with an Airport Master Plan, aerodrome management and coordination services: (a) when traffic density requires, an appropriate apron management service to regulate aircraft operations in coordination with ATS; (b) ATS coordination (including meetings and agreements) related to: airport development and maintenance planning; local authority coordination (environmental, noise abatement, and obstacles); (c) Regular airport capacity analysis, which included a detailed assessment of passenger, airport gate, apron, taxiway and runway capacity.	Phase II Priority 2
PARS	**Optimization of runway capacity facilities -** Where practicable, all international aerodromes should provide, in accordance with an Airport Master Plan, the following facilities to optimize runway capacity: (a) additional runway(s) with adequate separation between runway centerlines for parallel independent operations; (b) parallel taxiways, rapid exit taxiways at optimal locations to minimize runway occupancy times and entry/exit taxiways; (c) rapid exit taxiway indicator lights (distance to go information to the nearest rapid exit taxiway on the runway); (d) twin parallel taxiways to separate arrivals and departures; (e) perimeter taxiways to avoid runway crossings; (f) taxiway centerline lighting systems; (g) adequate maneuvering area signage (to expedite aircraft movement); (h) holding bays; (i) additional apron space in contact stands for quick turnarounds; (j) short length or tailored runways to segregate low speed aircraft;	Phase II Priority 3

	(k) taxi bots or towing systems, preferably controlled by pilots, to ensure efficiency and the optimal fuel loading for departure; and (l) Advanced visual docking guidance systems.	
PARS	**ADS-B, SSR Mode S and PBN Airspace** **ADS-B -** Unless supported by alternative means of ATS surveillance (such as radar, where there are no plans for ADS-B), all Category T airspace supporting international aerodromes should be designated as non - exclusive or exclusive as appropriate ADS-B airspace requiring operation of ADS-B OUT using 1090ES with DO-260/260A and 260B capability to support ASUR-B0/1 **SSR Mode S -** All Category T airspace supporting international aerodromes should require the carriage of an operable mode S transponder within airspace where Mode S radar services are provided to support ASUR-B0/3. **PBN Airspace -** All Category T airspace supporting international aerodromes should be designated as non-exclusive or exclusive PBN airspace as appropriate to allow operational priority for PBN approved aircraft, except for State aircraft, to facilitate seamless operations and off-track events such as weather deviations to support APTA-B0/1 – 3 and 6.	Phase II Priority 2
PARS	**Flight Level Orientation Scheme (FLOS) -** All States should use the ICAO Table of Cruising Levels (FLOS) based on feet as contained in Annex 2 Appendix 3.	Phase II Priority 2
PARS	**Civil-Military SUA management -** Civil-Military Airspace expectations are as follows: (a) SUA should only be established after due consideration of its effect on civil air traffic by the appropriate Airspace Authority to ensure it will be: - used for the purpose that it is established; - used regularly; - as small as possible, including any internal buffers, required to contain the activity therein; - if applicable, operated in accordance with FUA principles; and activated only when it is being utilized; and (b) SUA should be regularly reviewed to ensure the activities that affect the airspace, and size and timing of such activity are accurately reflected by the SUA type, Dimensions, activation notice and duration of activation.	Phase II Priority 1
PARS	**Unmanned Aircraft Systems -** States should implement regulations supporting the integration of UAS operations in non-segregated airspace, using a risk-based approach and in accordance with the Asia/Pacific Regional Guidance for the Regulation of UAS, as a minimum.	Phase II Priority 2
PASL	**Adjacent ATS sector coordination -** All ATS sectors providing ATS surveillance in adjacent airspace should have direct speech circuits	

	or digital voice communications, meeting pre-established safety and performance requirements, and where practicable, automated hand-off procedures that allow the TOC of aircraft without the necessity for voice communications, unless an aircraft requires special handling.	Phase II Priority 2
PASL	**Airspace classification -** Controlled airspace classification should be consistent with Annex 11 Appendix 4 and applied as follows: (a) Category R upper controlled airspace– Class A; and (b) Category S upper controlled airspace– Class A, or if there are high level general aviation or military VFR operations: Class B or C; and (c) Category S lower controlled airspace- Class C, D or E airspace, as determined by safety assessments.	Phase II Priority 2
PASL	**ATC horizontal separation -** All ATC units should authorize the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable, taking into account such factors as: (a) the automation of the ATM system, including automated hand-off between sectors; (b) the capability of the ATC communications system; (c) the performance of the ATS surveillance system, including data - sharing or overlapping coverage at TOC points; and (d) Ensuring the competency of air traffic controllers to apply the full tactical capability of ATS surveillance systems.	Phase II Priority 2
PASL	**Flight Level Allocation Schemes (FLAS) -** Priority for FLAS level allocations should be given to higher density ATS routes over lower density ATS routes. FLAS should comply with Annex 2, Appendix 3a unless part of an OTS. FLAS other than OTS should only be utilized for safety and efficiency reasons within: a) Category R airspace with the agreement of all ANSPs that provide services: within the airspace concerned; and within adjacent airspace which is affected by the FLAS; or b) Category S airspace with the agreement of all ANSPs that provide services: where crossing track conflictions occur within 50NM of the FIRB; and ATS surveillance coverage does not overlap the FIRB concerned, or ATS surveillance data is not exchanged between the ATC units concerned.	Phase II Priority 2
PASL	**ATC sector capacity -** All ATC Sectors should have a nominal aircraft capacity figure based on a scientific capacity study and safety assessment, to ensure safe and efficient aircraft operations.	Phase II Priority 2
PASL	**Electronic Flight Progress Strips -** ATC systems should utilize electronic flight progress strips wherever automation systems allow the capability due to efficiency and transcription error/data mismatch issues.	Phase II Priority 2

PASL	**Enhanced SAR systems -** An appropriate enhanced SAR system and systems to support aircraft tracking capability should be established consistent with the provisions of Annex 12 and to support GADS-B1/1 – 2, and in accordance with the Asia/Pacific SAR Plan.	Phase II Priority1
PASL	**ANSP human and simulator performance -** The following systems should be established to support human performance in the delivery of a Seamless ANS service. The systems should consider all the elements of the SHEL Model (Software, Hardware, Environment and Liveware - humans), in accordance with the ICAO Human Factors Digest No. 1 and related reference material: (a) human performance training for all managers of operational air navigation services (such as aerodrome operators, ATC organisations and aeronautical telecommunications), such training to include the importance of: - a proactive organisational culture where managers and operational staff are informed and safety is a first priority, using open communications and an effective team management approach; - assessment and management of risks by safety review and assessment teams comprising multidisciplinary operational staff and managers which review safety performance and assess significant proposals for change to ATM systems, particularly those related to human capabilities and limitations; - human factors in ■ air safety investigation; ■ system design (ergonomics, human-in-the-loop); ■ effective training (including the improved application of simulators); ■ fatigue management; ■ automated safety nets; and o ■ contingency planning; - effective safety reporting systems that – ■ are non-punitive, supporting a 'Just Culture'; ■ promote open reporting to management; and ■ Focus on preventive (systemic), not corrective (individual) actions in response to safety concerns, incidents and accidents. (b) human performance-based training and procedures for operational staff providing ATS, including: - the application of tactical, surveillance-based ATC separation;	Phase II Priority1

	- control techniques near minimum ATC separation; and - Responses to ATM contingency operations, irregular/abnormal operations and safety net alerts. (c) human performance-based training and procedures for staff providing operational air navigation services (such as aerodrome staff operating 'airside', air traffic controllers and aeronautical telecommunications technicians) regarding the importance of: - an effective safety reporting culture; and - 'Just Culture'	
PASL	**Civil-Military strategic and tactical coordination**	Priority1
	Civil-Military common procedures and training	Priority 2
	Civil-Military ATM expectations are as follows: (a) a national Civil-Military body should be formed to coordinate strategic civil-military activities (military training should be conducted in locations and/or at times that do not adversely affect civilian operations, particularly those associated with major aerodromes); (b) formal civil-military liaison should take place for tactical responses by encouraging military participation at civil ATM meetings and within ATC Centres; (c) integration of civil and military ATM systems using joint procurement, and sharing of ATS surveillance data (especially from ADS-B systems) should be provided as far as practicable; (d) joint provision of Civil-Military navigation aids and aerodromes; (e) common training should be conducted between civil and military ATM units in areas of common interest; and (f) Civil and military ATM units should utilize common procedures as far as practicable.	Phase II
PASL	**Ballistic launches/space re-entry management -** All States with organisations that conduct ballistic launch or space re-entry activities should ensure: (a) the development of written coordination agreements between the State civil aviation authority and the launch/re-entry agency concerned; (b) that strategic coordination is conducted between the State civil aviation authority and any States affected by the launch/re-entry activity at least 14 days prior to the proposed activity, providing	Phase II Priority1

	notice of at least: (i) three days for the defined launch window; and (ii) 24 hours for the actual planned launch timing; (c) that consideration of affected airspace users and ANSPs is made after consultation, so that the size of the airspace affected is minimized and the launch window is optimized for the least possible disruption to other users ; and (d) that communication is established with affected ANSPs to provide accurate and timely information on the launch/re-entry activity to manage tactical responses (for example, emergencies and activity completion)	Phase II Priority1
	CNS Technology and Services	
PASL	**ATS surveillance data sharing -** Subject to appropriate filtering, ATS surveillance data, particularly from ADS-B, should be shared with neighboring ATC units to support ASUR-B0/1 – 2. P1	Phase II Priority 2
PASL	**Civil-Military integrated systems and facilities -** Civil-Military ATM expectations are as follows: (a) a national Civil-Military body should be formed to coordinate strategic civil-military activities (military training should be conducted in locations and/or at times that do not adversely a effect civilian operations, particularly those associated with major aerodromes); (b) formal civil-military liaison should take place for tactical responses by encouraging military participation at civil ATM meetings and within ATC Centres; (c) integration of civil and military ATM systems using joint procurement, and sharing of ATS surveillance data (especially from ADS-B systems) should be provided as far as practicable; (d) joint provision of Civil-Military navigation aids and aerodromes; (e) common training should be conducted between civil and military ATM units in areas of common interest; and (f) Civil and military ATM units should utilize common procedures as far as practicable.	Phase II Priority 2
PASL	**Departure Clearance (DCL) -** All ATM systems serving international aerodromes should implement Data-link Departure Clearance (DCL) compliant with EUROCAE WG78/RTCA SC 214 standards.	Phase III Priority 2

Note - All Category R and S upper controlled airspace should require the carriage of an operable mode S transponder within airspace where Mode S radar services are provided to support ASURB0/3.

ADS-B (using 1090ES), MLAT or radar surveillance systems should be used to provide coverage of all Category S airspace as far as practicable, and Category T airspace supporting international aerodromes, consistent with ASUR-B0/1 – 2. Data from ATS surveillance systems should be integrated into operational ATC aircraft situation displays (standalone displays of ATS surveillance data should not be used operationally)

2.4 National Civil Aviation Policy of Sri Lanka

The National Civil Aviation Policy (NCAP) projects the future direction and positioning of Sri Lanka as a leading aviation and transport hub in the South Asian region. The overarching objective of the policy is to transform the country into a superior air transport service provider that is connected to the global aviation network.

The NCAP identifies that timely modernising Air Traffic Management (ATM) with its CNS facilities, upgrading and expansion of Airport infrastructure are critical to cater the growth in air traffic and to ensure the efficient use and management of airspace. The policy recognizes the need for different levels of development and process of continuous improvement with multi-level of standards underlying ICAO standards to be the minimum. Developing guidance, sharing best practices and working in collaboration with industry partners on efficient use of infrastructure are important to achieve the policy objectives.

The key elements of the NCAP are aligned to utilize the full potential of the country's airspace, giving optimum freedom for its use for peaceful purposes that includes liberalized use of Freedoms of the Air recognized by the Chicago Convention.

SLANP has taken into consideration the declarations in the NCAP and it is envisioned to foster the development of States Air Navigation System capabilities ensuring safe, efficient and reliable air transport network in Sri Lanka catering to the growing needs of its expansion while accommodating global technological transformations and modernization.

2.5 Sri Lanka Air Navigation Plan (SLANP)

SLANP is projected to a planning horizon of fifteen (15) years from 2022 with a strategic intent of aligning itself with the GANP which embodies the ASBU principles while anticipating to cater to the future developments predicted based on State and industry agreed operational objectives.

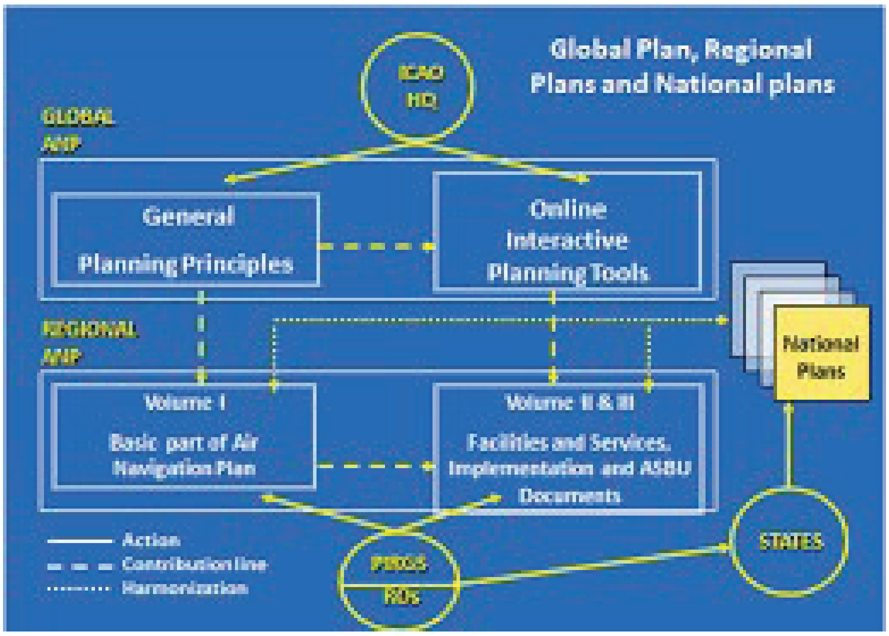
In drawing up the SLANP due consideration was accorded to key factors such as changes in Technology, Information Management, Communication, Air Traffic Management and capture more efficient use of airspace to save fuel, time and less impact on the environment. The SLANP also has focused on the management of airspace, absorbing the increasing demands of the air traffic growth while coping up with aging of existing infrastructure such as radar, ground based nav-aids etc.

SLANP provides certainty to the aviation community to harness the benefits of the new technologies and ensure that the transition takes place safely. As such, SLANP covers all aspects of the aviation system to position it for the future in five overlapping areas, viz, Airport Operations (AOP), Communication, Navigation and Surveillance infrastructure (CNS), Air Traffic Management System (ATM), Aeronautical Information Management (AIM) and Meteorology (MET) with significant proposals in line with ICAO ASBU implementation and Asia/ Pacific Seamless ATM Plan.

Implementation elements discussed in Phase I of the SLANP are planned to be completed by the end of 2024, Phase II implementation should be commenced from 2025 and completed by the end of 2027. Phase III will be commenced with the completion of Phase II in 2027 and completed by December 2030. Phase IV will be commenced from 2031. Uncompleted elements of each phase will be moved to the next phase. Although the SLANP has encompassed a greater time horizon for planning, it will be reviewed and updated in every 3 years to align with the review cycle of the GANP, to ensure it remains relevant and current with aviation system changes. SLANP and its subsequent revisions shall be endorsed by the Director General of Civil Aviation.

This Plan provides the required direction and guidance to the aviation stakeholders to efficiently utilize the existing resources. It aims at exploiting the future capabilities and technology required to deliver a dynamic, efficient and productive ANS system. The Implementation elements discussed in the plan will guide the Air Navigation Service provider to advance the Air Navigation system in Sri Lanka according to the operational requirements in commensurate with the Global requirements.

Relationship between Global, Regional and National Plans



2.6 Summary of the Sri Lanka Air Navigation Plan

	Implementation Element	ICAO/ Regional Ref.	Phase of Implementation/ Applicability				
			Phase I 2022 -2024	Phase II 2025-2027	Phase III 2028-2030	Phase IV 2031-2033	Phase V 2034-2036
AOP	Airport Collaborative Decision Making	ACDM					
	Airport CDM Information Sharing (ACIS)	ACDM B0/1					
	Integration with ATM Network function	ACDM B0/2					
	Airport Operations Plan (AOP)	ACDM B1/1					
	Airport Operations Centre (APOC)	ACDM B1/2					
	Optimization of runway capacity facilities	Regional	Depends on the future traffic predictions & development project of GOSL				

	Implementation Element	ICAO/ Regional Ref.	Phase of Implementation/ Applicability				
			Phase I 2022 -2024	Phase II 2025-2027	Phase III 2028-2030	Phase IV 2031-2033	Phase V 2034-2036
CNS	CRV Implementation	-					
	Flight and Flow Information for a Collaborative Environment (FF-ICE)	FICE					
	Automated basic inter facility data exchange (AIDC)	FICE B0/1					
	Communication infrastructure	COMI					

	VHF Data Link (VDL) Mode 0/A	COMI B0/3					
	VHF Data Link (VDL) Mode 2 Basic	COMI B0/4					
	ATS Message Handling System (AMHS)	COMI B0/7					
	Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)	COMI B1/1					
	SATCOM Class B Voice and Data	COMI B1/3					
	ATS Communication service	COMS					
	PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace	COMS B1/1					
	PBCS approved ADS-C (FANS 1/A+) for procedural airspace	COMS B1/2					
	SATVOICE (incl. routine communications) for procedural airspace	COMS B1/3					
	Navigation systems	NAVS					
	Ground Based Augmentation Systems (GBAS)	NAVS B0/1					
	Satellite Based Augmentation Systems (SBAS)	NAVS B0/2					
	Aircraft Based Augmentation Systems (ABAS)	NAVS B0/3					
	Surveillance systems	ASUR					

	Automatic Dependent Surveillance – Broadcast (ADS-B)	ASUR B0/1					
	Multilateration cooperative surveillance systems (MLAT)	ASUR B0/2					
	Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)	ASUR B0/3					
	Reception of aircraft ADS-B signals from space (SB ADS-B)	ASUR B1/1					

	Implementation Element	ICAO/ Regional Ref.	Phase of Implementation/ Applicability				
			Phase I 2022 -2024	Phase II 2025-2027	Phase III 2028-2030	Phase IV 2031-2033	Phase V 2034-2036
ATM	Improved arrival and departure operations	APTA					
	PBN Approaches (with basic capabilities)	APTA B0/1					
	PBN SID and STAR procedures (with basic capabilities)	APTA B0/2					
	SBAS/GBAS CAT I precision approach procedures	APTA B0/3					
	CDO (Basic)	APTA B0/4					
	CCO (Basic)	APTA B0/5					

	Improved operations through enhanced en-route trajectories	FRTO					
	Direct routing (DCT)	FRTO B0/1					
	Airspace planning and Flexible Use of Airspace (FUA)	FRTO B0/2					
	Pre-validated and coordinated ATS routes to support flight and flow	FRTO B0/3					
	Free Route Airspace (FRA)	FRTO B1/1					
	Required Navigation Performance (RNP) routes	FRTO B1/2					
	Advanced FUA & management of real time airspace data	FRTO B1/3					
	Enhanced Conflict Detection Tools and Conformance Monitoring	FRTO B1/5					
	Multi-Sector Planning	FRTO B1/6					
	Trajectory Options Set (TOS)	FRTO B1/7					

Network Operations	NOPS					
Network Operations	B0 - B3	X	will be decided based on post COVID - 19 Traffic prediction			
Improved access to optimum flight levels in oceanic & remote airspace	OPFL					
In Trail Procedure (ITP)	OPFL-B0/1					
Climb and Descend Procedure (CDP)	OPFL-B1/1					
Improved traffic flow through runway sequencing	RSEQ					
Arrival Management	RSEQ B0/1					
Departure Management	RSEQ B0/2					
Point merge	RSEQ B0/3					
Ground-based Safety Nets	SNET					
Short Term Conflict Alert (STCA)	SNET B0/1					
Minimum Safe Altitude Warning (MSAW)	SNET B0/2					
Area Proximity Warning (APW)	SNET B0/3					
Approach Path Monitoring (APM)	SNET B0/4					

Enhanced STCA with aircraft parameters	SNET B1/1					
Enhanced STCA in complex TMAs	SNET B1/2					
Surface Operation	SURF					
Basic ATCO tools to manage traffic during ground operations	SURF B0/1					
Comprehensive situational awareness of surface operations	SURF B0/2					
Initial ATCO alerting service for surface operations	SURF B0/3					
Wake Turbulence Separation	WAKE					
Wake turbulence separation minima based on 7 aircraft groups	WAKE B2/1					
ATC sector capacity	Regional					
Electronic Flight Progress Strips	Regional					

	Implementation Element	ICAO/ Regional Ref.	Phase of Implementation/ Applicability				
			Phase I 2022 -2024	Phase II 2025-2027	Phase III 2028-2030	Phase IV 2031-2033	Phase V 2034-2036
AIS	Digital Aeronautical Information Management	DAIM					
	Provision of quality-assured aeronautical data and information	DAIM B1/1					
	Provision of digital Aeronautical Information Publication (AIP) data sets	DAIM B1/2					
	Provision of digital terrain data sets	DAIM B1/3					
	Provision of digital obstacle data sets	DAIM B1/4					
	Provision of digital aerodrome mapping data sets	DAIM B1/5					
	Provision of digital instrument flight procedure data sets	DAIM B1/6					
	NOTAM improvements	DAIM B1/7					
	Dissemination of aeronautical information in a SWIM environment	DAIM-B2/1					
	Daily Airspace Management information to support flight and flow	DAIM-B2/2	X	DAIM-B2 Implementation will be updated based on the APAC Regional requirements and the progress made on DAIM Block 1			
	Aeronautical information to support higher airspace operations	DAIM-B2/3	X				

	Aeronautical information requirements tailored to UTM	DAIM-B2/4	X				
	NOTAM replacement	DAIM-B2/5	X				
	System Wide Information Management	SWIM					
	Information service provision	SWIM-B2/1					
	Information service consumption	SWIM-B2/2					
	SWIM registry	SWIM-B2/3					
	Air/Ground SWIM for non-safety critical information	SWIM-B2/4					
	Air/Ground SWIM for safety critical information	SWIM-B3/1					

	Implementation Element	ICAO/ Regional Ref.	Phase of Implementation/ Applicability				
			Phase I 2022 -2024	Phase II 2025-2027	Phase III 2028-2030	Phase IV 2031-2033	Phase V 2034-2036
MET	Meteorological information provided to support operational efficiency & safety	AMET					
	Meteorological observations information	AMET B1/1					
	Meteorological forecast and warning information	AMET B1/2					
	Climatological and historical meteorological information	AMET B1/3					
	Dissemination of meteorological information	AMET B1/4					
	Integrated meteorological information in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term.	AMET B2	X	will consider based on the implementation progress of Phase I			
	Integrated meteorological information in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic management operations.	AMET B3	X	based on the implementation & completion of Block 2			

	Integrated meteorological information both air and ground decision making for all phases of flight and ATM operations, especially supporting both air and ground decision making for all phases of flight and ATM operations, especially for implementing immediate weather mitigation strategies.	AMET B4	X	based on the implementation & completion of Block 3

Part III
Airport Operations

Airport Operations

- increasing the capacity and efficiency

3.1 Introduction

Airports are critical components of Sri Lanka's national economic infrastructure. They support investment, tourism and trade and commerce and help drive socio economic growth across the economy. Continual investment in, and upgrading of the aviation infrastructure at airports is needed to drive national productivity and economic performance. Airports can generate significant social and economic benefits to communities, but they need to be properly planned and protected over the long term to realize these benefits and ensure their safe and efficient operation.

Airports are part of a much wider "eco-system". A change in one part of the system may have a significant impact on another. Anticipating expansion steps is therefore important and can be helpful to others in the system. The most efficient plan for the airport as a whole is that it provides the required capacity (including future requirements) for aircraft, passenger, cargo and vehicle movements, with the maximum passenger, aircraft operator and staff convenience at the lowest capital and operating costs. Flexibility and provision for expansion should feature in all aspects of the planning. While the expansion of some infrastructure means a step change in capacity and investment, there can be many operational initiatives and minor investments that progressively enhance capacity of existing infrastructure before the next step change is necessary. While anticipating expansion steps is highly desirable, each development will be designed and considered on its merits at the appropriate time.

While the main focus is on developing International Airport Operations through effective contribution from the Air Navigation system, SLANP has identified as a priority the need in developing the operations of domestic airports by upgrading Communication, Navigation, Surveillance and ATM infrastructure.

3.2 Current Status of aerodrome management in Sri Lanka

Sri Lanka's Civil Aviation industry was born in the 1930's with the construction of an aerodrome in Ratmalana, currently known as Colombo International Airport Ratmalana. It was used as a Royal Air Force Base during the Second World War and was taken over by the Air force for civil flying in 1946. In 1967, once Bandaranaike International Airport (BIA) was converted to a civil aerodrome, all international services operated from BIA. Ratmalana airport recommended its limited International operations to cater to small international commercial flights in 2012. The airport currently serves several domestic services and is home to several aviation training organisations.

Faced with an ever increasing number of airlines, passengers and cargo, the single runway 04/22 at BIA with a length of 3350m has facilitated 67,351 International Flight movements in 2018 with a growth of 7.2% comparative to 2017. 10.8 million Passenger movements and 279, 560 MT Cargo movements had been handled by BIA in 2018. It has connected Sri Lanka to 109 destinations in 48 countries covering North America, Europe, Central Asia, Africa, Canada and Australia in 2018 (SriLankan Airlines, Annual Report 2018/19). The single runway at BIA was resurfaced enabling the landing of the largest passenger aircraft in the world. In line with the runway overlay project. Airfield Ground Lighting (AGL), Airfield Lighting Control and Monitoring System (ALCMS), Airfield signs and Power Management Systems utilizing LED illumination, being the 1st airport in South Asia to use LEDs to minimize the environmental impact.

Mattala Rajapaksa International Airport (MRIA) being the 2nd gateway commenced operations on 18th March 2013. This airport complements the traffic handling capacity of BIA to accommodate the growing air travel needs efficiently. MRIA has a single runway, 05/23 with a runway length of 3,500 m (11,483 ft), making it capable of receiving the world's largest passenger aircraft, the Airbus A380 (code 4F). The airport features a 12,000-square-meter passenger terminal which can handle one million passengers per annum, a cargo terminal with an area of 10,000 square meters and a 35-meter-tall air traffic control tower. Today, while serving as the main alternative for BIA, MRIA has become a hot spot among international tourists.

Batticaloa Domestic Airport was reconstructed and declared open for civil operations from 25th March 2018. Batticaloa has one runway designated 06/24 with 1,368m length and 30m width for operations.

The Jaffna International Airport (JIA) was declared open for international operations on the 17th of October 2019 as the third international airport in Sri Lanka, marking a milestone in the country's aviation history. Jaffna International, formerly known as Palaly Airport is located in the town of Palaly near Kankesanturai. The airport was originally built by the Royal Airforce during the Second World War and was taken over by the Sri Lanka Air Force during the Civil War and had been operated as a military air base and a domestic airport as well until it was developed as an international airport in 2019.

The Jaffna International airport will be developed in 3 phases. The first phase enables the operation of international flights of aircraft Category C or lower to regional short-distance destinations. Under the second phase the airport will be further developed to accommodate Category D aircraft that will connect medium-distance destinations in neighboring countries, with the aim of capturing a portion of the rapidly growing travel market in the South Indian sectors which has an annual growth of 12%.

In the third phase the airport will be upgraded with larger scale development to enable handling of wide bodied aircraft.

3.3 Implementation plan

3.3.1 Implementation plan for Phase I (2022 - 2024)

- Nil -

3.3.2 Implementation plan for Phase II (2025 - 2027)

1. Airport Collaborative Information Sharing (ACIS)

Objective - **Aerodrome operators, airline operators, air traffic controllers, ground handling agents, pilots and air traffic flow managers to share live information that may be dynamic, in order to make better and coordinated decisions.**

Applicability - To VCBI International airport*

VCBI to operate an A - CDM system for ACIS integrated with the ATM network function consistent with ACDM-B0/1 – 2.
(* applicable to VCRI in Phase III)

i. Airport CDM Information Sharing (ACIS)

This is the first collaboration step among stakeholders involved in aerodrome operations. Stakeholders will be able to collaborate and take actions towards the achievement of a set of defined milestones by being aware of the status of an individual flight measured against known target times and milestones. Common situational awareness, will foster improved decision making within aerodromes, by sharing relevant surface operations data among the local stakeholders involved in aerodrome operations.
(ACDM B0/1, ICAO GANP 6th Edition)

ii. Integration with ATM Network function

By connecting airport operations to the ATM network, airport CDM operations will be enriched by enhanced arrival information from the ATM network and, at the same time, network operations will benefit from more accurate departure information from CDM airports. The stakeholders will get the most accurate operational data and achieve the agreed milestones.

(ACDM B0/2, ICAO GANP 6th Edition)

2. Airport Operations Plan (AOP) and Airport Operations Centre(APOC)

Objective - **To enhance the planning and management of airport operations and allow their full integration in the ATM network and enhance collaboration between airport stakeholders.**

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

Applicability - To VCBI International airport*

VCBI to operate an A-CDM system integrated with the ATM network, and an AOP and where practicable an APOC consistent with ACDM-B1/1 – 2.
(* applicable to VCRI in Phase III)

i. Airport Operations Plan (AOP)

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

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

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

The AOP may be managed and monitored by the Airport Operations Centre (APOC).
(ACDM B1/1, ICAO GANP 6th Edition)

ii. Airport Operations Centre (APOC)

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

The APOC should be equipped with a real-time monitoring system, a decision support system and apply a set of collaborative procedures that build upon the capabilities of the AOP.
(ACDM B1/2, ICAO GANP 6th Edition)

3.3.3 Implementation plan for Phase III (2028 - 2030)

1. Airport Collaborative Information Sharing (ACIS) (ACDM B0/1- 2)
   Applicability - VCRI International Airport (Ref. 3.3.2. 1. i & ii)

2. Airport Operations Plan(AOP) and Airport Operations Centre (APOC) (ACDM B1/1 –2)
   Applicability - VCRI International Airport (Ref. 3.3.2. 2. i & ii)

3.4 Benefits of Implementation

Airport Collaborative Decision Making (ACDM)	
Efficiency	Reduced fuel consumption due to the major reduction in on-ground and in-air holding. The planning and proactive actions will also support efficient use of resources. Increased efficiency of the ATM system for all stakeholders. Improved situational awareness (aircraft status both home and away); enhanced fleet predictability and punctuality; improved operational efficiency (fleet management); Reduced delay.
Environmental	Reduced taxi time; lower aircraft engine run time. Major reduction in on-ground and in-air holding will reduce noise and air pollution in the vicinity of the airport.
Capacity	Enhanced use of existing infrastructure of gates and stands. Reduced workload, better organization of the activities to manage flights.

3.5 Remotely Operated Aerodrome Air Traffic Services

Remote Tower Service (RTS) allows Aerodrome Control or Aerodrome Flight Information Services (AFIS) to be provided from a location other than the aerodrome, whilst maintaining a level of operational safety which is equivalent to or better than that can be achieved using a manned Tower at the aerodrome to oversee both air and ground movements.

This could be achieved by utilizing either video surveillance, digital surveillance, procedural processes, or a combination thereof, which is commensurate with the complexities and traffic demands at the aerodrome.

The Government strategies to develop the domestic aviation industry and the tourism of the country, by constructing new domestic airports to boost tourism and renovating the existing domestic airports with modern facilities and infrastructure to cater the International business community may consider this facility in their future plans.

The building and operational costs of a remote tower and facilities are much lower compared to a traditional tower. This will also facilitate more efficient use of human resources (ATCOs), especially by allowing services to multiple rural airports with medium to low traffic levels from a centralized location. It reduces the need to establish and maintain separate ATM systems at the airports. Several technical systems can be centralized, hence cost savings are possible.

Some airports in Europe (ex. London Heathrow) currently use this facility as a contingency arrangement to facilitate any temporary non-availability of the normal TWR/GND control operations due to fire, technical failure or a security issue.

(Ref. ASBU RATS-B1/1)

3.6 Optimization of runway capacity facilities

Based on the future traffic prediction the following facilities may be considered for providing at international airports to optimize the runway capacity as applicable;

- rapid exit taxiways at optimal locations to minimize runway occupancy times and entry/exit taxiways;
- taxiway centerline lighting systems;
- adequate maneuvering area signage (to expedite aircraft movement);
- holding bays;
- additional apron space in contact stands for quick turnarounds;
- advanced visual docking guidance systems;

Part IV
Communication Navigation and Surveillance (CNS)

Communication Navigation and Surveillance (CNS)

4.1 Communication - increased Communication for safe operations

4.1.1 Introduction

Communication plays a vital role in Air Navigation. They provide the contact between the aircraft and the ground that keeps aircraft safe, ensure efficient aircraft flow, and provide the aeronautical and weather information that enables good decision-making.

This part of the SLANP describes the existing communication infrastructure in Sri Lanka and introduces the basic planning principles. As per the plan, there will be a significant increase in the use of data link with the benefit of high speed, high integrity data transfers, reduced frequency congestion and improved message clarity. However, voice communication will remain as the most efficient method of achieving Direct Controller Pilot Communication and the use of existing CPDLC message sets will be expanded.

The planning criteria given in this part of SLANP is intended to provide strategic direction for the modernization of the communication infrastructure in Sri Lanka meeting the criteria of Global interoperability.

Radio Communication

Voice Radio Communications between air and ground generally use the Very High Frequency (VHF) with Line of Sight limitations. High Frequency communication (HF) is used for long range communication within the entire FIR including oceanic airspace.

Data-Link Communication

Digital data-link technology has made a significant change to aviation communications, particularly in the remote and oceanic airspace.

Automatic Dependent Surveillance-Contract (ADS-C)
ADS-C system relays the Positional information derived onboard using available GNSS systems utilizing any connected data-link. Reports are sent at specified intervals, or events, in accordance with a 'contract' set by the Air Traffic Service provider during the ADS-C log-on process.

Controller-Pilot Data-Link Communications (CPDLC)
Controller to Pilot Data Link Communications, or CPDLC, refers to air-ground data messages sent between flight crew/ Flight Management System (FMS) and ground Air Traffic Controllers (ATCOs). CPDLC used in Oceanic airspaces allows direct pilot controller communication, thereby improving connectivity. The use of CPDLC messages provides several advantages over traditional voice communications. Text-based messages reduce the margin for error due to a poor voice radio connection and they liberate space on the congested VHF/HF channels for more urgent voice communications.

CPDLC does not yet provide the utmost instantaneous communication as VHF/HF voice and is mainly used for oceanic airspace operations. The data-link communication process is included in FANS 1/A package and is based on the Aircraft Communication Addressing and Reporting System (ACARS).

Ground - Ground communications

Ground-Ground communications are also undergoing development. Currently, Aeronautical Fixed Telecommunication Network (AFTN) is being replaced by the ATS Message Handling System (AMHS). Aeronautical Telecommunication Network (ATN), which will be the new standard for transfer of information among the Civil Aviation community in future. The ATN will be the backbone for the AMHS traffic and all ATS message traffic. More modern protocols will be developed to cater for longer messages at higher speeds. ATN is not confined to ground communication, but will cater to the air segment as well.

4.1.2 Current communication infrastructure in Sri Lanka

According to the APAC requirements Sri Lanka satisfies the communication requirements of ATS, AIS/AIM, MET and SAR, including specific requirements in terms of system reliability, message integrity and transit times, with respect to printed as well as digital data and voice communication.

Current status of Radio Communication

Aeronautical Mobile Service (AMS):

Air-Ground Voice Communication: Air-ground communications facilities meet the agreed communication requirements of the Air Traffic Services, as well as all other types of communications which are acceptable on the AMS to the extent that the latter types of communications can be accommodated.

Aircraft in flight within Colombo FIR an outside VHF coverage, (oceanic airspace) shall maintain listening watch on assigned HF RTF frequencies. Colombo HF communications facility utilizers SELCAL system to alert an aircraft by sending a specific predetermined 4 letter code. Aircraft operating within VHF coverage shall maintain a continuous listening watch on prescribed VHF frequency.

Aeronautical Fixed Service (AFS):

The aeronautical fixed service (AFS) is a telecommunication service between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient and economical operation of air services. AFS shall comprise the following systems and applications:

ATS direct speech circuits: Air Traffic Services direct speech circuits are used for direct voice communications between Air Traffic units, both domestic and international typically for coordination and handing over/ taking over of traffic.

Ground-Ground messaging: The Aeronautical Fixed Telecommunication Network (AFTN) and ATS Message Handling System (AMHS) which has been in operation since 2013, facilitates the exchange of ATS messages or data between Air Traffic Control Units. It is being used for disseminating NOTAMs and Meteorological information as well. Sri Lanka is connected to AFTN through satellite communication circuits with Singapore, Mumbai and Maldives.

With an upgraded ATM system, Sri Lanka expects to implement AIDC (ATS Interfacility Data-link Communication) which will support information exchanges such as Notification, Coordination, and the Transfer of Communications and Control functions between automated ATS systems located at different ATSUs, nationally and internationally.

Current status of Data-Link Communication

Air-ground Data-Link Communications: Controller Pilot Data Link Communication uses a two-way data link, instead of voice, to transfer information between Air Traffic Control (ATC) and the Aircraft. CPDLC is being used to issue clearances, such as weather deviations, altitude clearances, amended route clearances, speed instructions, as well as secondary surveillance radar (SSR) codes and frequency transfers, in Colombo Oceanic airspace. In 2012, Sri Lanka became the first state in the South Asia Region to implement ADS-C / CPDLC.

4.1.3 Implementation plan (Communication)

4.1.3.1 Implementation plan for Phase I (2022 - 2024)

1. Implementation of Common Regional Virtual Private Network (CRV)

Objective - To offer a safe, secure and cost effective telecommunications transport service

CRV will facilitate voice and data communications between member States, by allowing all participants on the network to establish communications with each other. Telecommunication costs will be minimized as countries will only need a small number of connections to a far reaching network, rather than individual connections to each neighboring state. This will be provided by a common network service provider.

CRV facilitates a number of ASBU modules, including SWIM, FICE, DAIM, NOPS and AMET, and solves current limitations (obsolescence, lack of standardization, poor escalation processes) and aeronautical communication deficiencies.

2. Automated basic inter facility data exchange (AIDC)

Objective - To improve the efficiency of coordination and transfer of control between ATS units with the replacement of voice communication by automatic message exchange.

Applicability - Colombo Area Control Centre (ACC) for en-route and terminal control (TMA) operations.

AIDC will be a supplementary system for coordination on voice communication between ATS units. This is the first automation step in the evolution of the coordination and transfer of control between neighbouring ATS units to guarantee that all related and necessary flight information will be available to the other unit as per agreement. The system will improve coordination between Air Traffic Service Units (ATSUs) and adjacent ACCs by providing automatic message exchange as defined by ICAO's Manual of Air Traffic Services Data Link Applications (Doc 9694). An additional benefit is the improved efficiency of the transfer of communication in a data link environment.
(FICE-B0/1, ICAO GANP 6th Edition)

3. ATS Message Handling System (AMHS)

Objective - To have improved flight information coordination among ATS units, all international aerodromes in Sri Lanka will be supported by AMHS to disseminate NOTAMs, FPLs and Meteorological data with its greater flexibility and Improved Communication over AFTN.

Applicability - Availability of AMHS externally with all neighbouring ACCs and internally to cover all ATC units at International Airports.

AMHS makes use of higher speed communication than AFTN. It also allows the use of bit-oriented communications allowing greater flexibility in message types. Attachments to messages can also be supported thus allowing the exchange of graphics. It provides direct communication between adjacent FIRs using data communication to minimize the use of voice communication.
AMHS is expected to be utilized to carry traffic for AIDC/Flight Plan/MET until SWIM is ready in Block 2. In the meantime, AMHS will accommodate SWIM compliance data messages (IWXXM) as required.
(COMI-B0/7, ICAO GANP 6th Edition)

(Note - Upon successful completion of pre-operational trials and training for operational personnel, AMHS facility interconnecting BIA (except for BIA Tower), MRIA and RMA was commissioned in 2013. Hence this element is expected to be implemented in BIA Tower and International airports other than mentioned above, in Phase I)

4. Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)

Objective - To provide for a more modern, more efficient and cost-effective data communications network infrastructure.

The ATN/IPS internetwork consists of IPS nodes and networks operating in a multinational environment will enable the efficient integration of technologies with improved integrity to support air to ground aeronautical safety services and regularity of flight communications.
(COMI-B1/1, ICAO GANP 6th Edition)

5. PBCS approved CPDLC (FANS 1/A+) for procedural airspace

Objective - To support introduction of performance-based reduced separation minima in procedural airspace.

Applicability - Colombo Area Control Centre

In procedural airspace, RCP240 authorized CPDLC (FANS 1/A+) provides the controller with intervention capability, allowing when used in conjunction with other enablers (ADS-C, navigation capabilities etc.), reduced separation minima and thus increase the capacity.
(COMS-B1/1, ICAO GANP 6th Edition)

6. PBCS approved ADS-C (FANS 1/A+) for procedural airspace

Objective - To support introduction of performance-based reduced separation minima in procedural airspace.

Applicability - Colombo Area Control Centre

ADS-C (FANS 1/A) RSP180 authorized provides separation assurance, allowing when used in conjunction with other enablers (CPDLC, navigation capabilities etc.), reduced separation minima and thus capacity increase.
(COMS-B1/2, ICAO GANP 6th Edition)

7. SATVOICE for procedural airspace

Objective - Use of SATVOICE for all types of ATS communications (routine and emergency/urgency communications increasing the quality of voice communications in procedural airspace without VHF coverage.

Applicability - Colombo Area Control Centre

A priority level will be used by dedicated networks and the aircraft system to pre-empt calls of lower priority, if necessary, and establish precedence for incoming calls of higher priority (usually routine ATS communication will be Priority 2 out of 4, Priority 1 being dedicated to distress/urgent calls).
(COMS-B1/3, ICAO GANP 6th Edition)

8. VHF Data Link (VDL) Mode 0/A

Objective - To support the transmission of data link messages.

VDL Mode 0/A is a narrow-band transceiver operating in the VHF aviation protected spectrum band which will transmit data to and from the aircraft to support data communications. The VHF digital radio system is based on the double side band AM multi-shift keying modulation to transfer 2400 bps.

Introduction of a datalink to support domestic data communications operations will be a supplement to voice communications, and support exchange of aviation data (AOC, CPDLC and ADS)
(COMI-B0/3, ICAO GANP 6th Edition)

4.1.3.2 Implementation plan for Phase II (2025 - 2027)

1. SATCOM Class B Voice and Data

Objective - Introduction of SATVOICE and SATDATA as a complement to HF voice communications for safe and regular flight operations within oceanic airspace.

Applicability - SATVOICE and SATDATA for oceanic airspace

SATCOM System is a broadband, IP based communication system that provides voice and high-speed data communications between the aircraft and the air-traffic controller.
(COMI-B1/3, ICAO GANP 6th Edition)

2. VHF Data Link (VDL) Mode 2 Basic

Objective - To support the transmission of data link messages with higher performance.

VDL Mode 2 is narrow-band transceiver operating in the VHF aviation protected spectrum band, which will transmit data to support data communications between the aircraft and ground. It consists of a set of air-ground protocols that increase the data rate to 31.5 kbits.
(COMI-B0/4, ICAO GANP 6th Edition)

4.2 Navigation - transition from Ground- Based to Performance- Based Navigation (PBN)

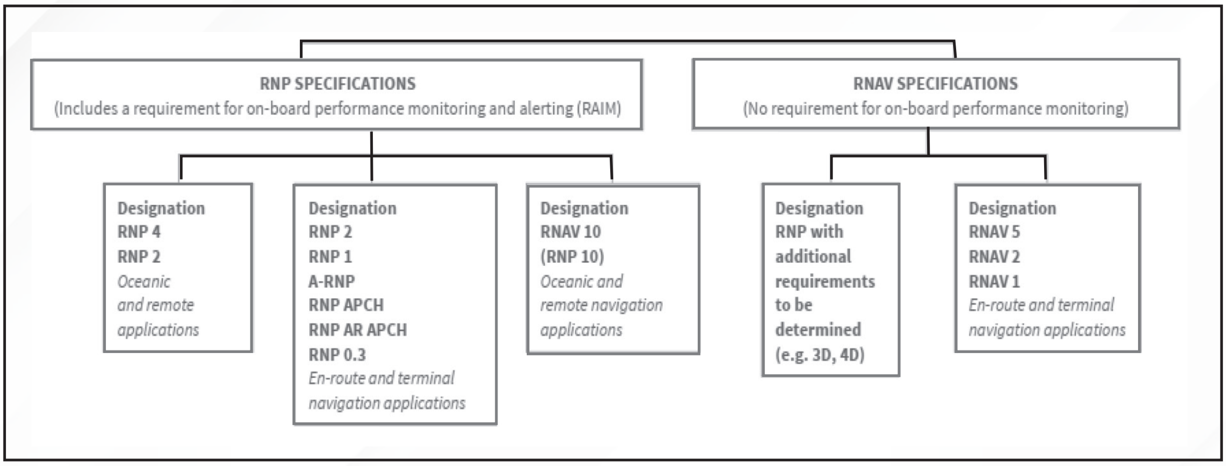
4.2.1 Introduction

In the early days of flight, aircraft navigated visually by dead reckoning–identifying geographical points with the aid of maps and compasses. Favorable weather conditions were needed so that pilots could keep the ground in sight. Then, new technologies were introduced and new types of ground-based navigation aids were installed to enable pilots to find their way without the need for visual reference. They allowed aircraft to navigate from a position relative to one ground-based navaid — such as very-high-frequency (VHF) omni-directional range (VOR), distance measurement equipment (DME), or non-directional beacon (NDB) - to a position relative to another navaid. Because airplanes are inhibited from flying the most direct possible routes, this method leads to inefficient routes and procedures. Adding to this inefficiency are large airspace separation buffers that commercial airplanes must use because of both the inherent inaccuracies of conventional navigation methods and the need to protect against operational errors.

RNAV began as a means of navigation on a flight path from any point, or fix, to another. These fixes could be defined by a latitude and longitude, and the airplane's position relative to them could be established using a variety of navaids. RNAV facilitated a type of flight operation and navigation in which the flight path no longer had to be tied directly to overflight of ground navigation stations.

RNP is built on RNAV. ICAO recognized that global navigation satellite systems, the navigation infrastructure, airline operations, and airplane systems were undergoing change faster than traditional processes for equipment, including RNAV, could support. RNP was developed to allow airspace designers to specify airspace and operation requirements without relying on specific equipment or systems. The original RNP concept was oriented toward enroute, remote, and oceanic airspace, and was primarily concerned with precise navigation and safe separation of routes. Both RNAV and RNP offer a number of advantages over conventional, ground-based navigation systems, including greater safety and efficiency.

Following figure shows ICAO specifications for Performance-Based Navigation



Application of PBN specifications depends on many factors – the navigation infrastructure, communications capability, surveillance capability, the operational requirement, the aircraft fleet capability and operational approvals etc. Those mentioned factors will be taken into consideration in consultation with all stakeholders when implementing PBN specifications in Sri Lanka.

This part of SLANP provides guidance for the implementation of ICAO PBN concept within Colombo FIR which will afford Sri Lanka significant benefits including improved safety through more straight-in instrument approaches with vertical guidance, increased airspace capacity, increased airport accessibility, more efficient operations, reduced infrastructure costs, and reduced environmental impact.

4.2.2 Current Status of air navigation in Sri Lanka

Colombo Flight Information Region (FIR) shares boundaries with four other neighboring FIRs; namely Chennai, Jakarta, Melbourne and Male. The airspace within Colombo FIR is largely over the high seas and as such, widespread siting of ground navigational aids are not possible. Air traffic into and out of the international airports, and the high density of international air traffic movements across the Oceanic FIR between Europe/Middle-East and Eastern Asia/ Australia make Air Traffic Management a challenge.

PBN procedures have been implemented in Sri Lanka in a steady and progressive manner through a 3-phase approach in line with ICAO guidance.

RNAV En-route –

Sri Lanka is currently on an agreement of 50 NM /80 NM horizontal separation based on Mach number technique as the standard separation minima for the RNP 10 environment.

Taking into account the growth of air traffic in oceanic airspaces, India and adjacent participating countries in the Oceanic airspace of Bay of Bengal-Indian Ocean-Arabian Sea Corridor moved towards reduced horizontal separation on the existing RNP 10 routes.

In 2011 Reduced Horizontal Separation Minima (RHSM) of 50 NM longitudinal separation based on RNP 10 operations was introduced on ATS route P762. In 2013, RHSM was introduced for two more ATS routes, M300 and P570 within Colombo FIR, to cater to the high traffic flow between Europe/ Middle -East and Southeastern Asia.

Terminal Areas –

Standard Instrument Departure (SID)/ Standard Terminal Arrival Route (STAR)

SIDs are designated IFR departure routes linking an aerodrome or a specified runway of an aerodrome with a specified point, normally on a designated ATS route, at which the en-route phase of flight commences. STARs are a designated IFR arrival route linking a significant point, normally on an ATS route, with a point from which a published Instrument approach procedure can be commenced.

Approach –

Conventional approach procedures include ILS, VOR and NDB which exclusively use ground based navigational aids as the basis of the procedure design. Under PBN there is no requirement for ground based navigation aids to support the procedure. PBN does not include RNAV approach specifications as integrity monitoring is required for approach operations. Consequently RNAV (GNSS) approaches have been reclassified as RNP APCH - LNAV. This is reflected in the performance specifications where only RNP APCH specifications include a lateral accuracy value for all segments of an Instrument approach (initial, intermediate, final and missed approach).

Sri Lanka has implemented RNP APCH LNAV/VNAV at two international Aerodromes (VCBI and VCRI) and will continue to develop and implement them at Colombo International Airport Ratmalana, Jaffna International Airport and Batticaloa Airport.

Implementing RNAV-5 city pair routes and establishing RNAV-2 routes will also be explored.

It is expected that RNP-4 will be progressively implemented in the Bay of Bengal-Indian Ocean Arabian Sea Corridor, using ADS/CPDLC, in order to permit the use of a 30-NM lateral and longitudinal separation. This implementation will depend on the increased participation of the aircraft fleet operating in these airspaces for using data link services (ADS-C/CPDLC).

Sri Lanka will support the creation of exclusive airspaces for suitably equipped aircraft to progressively move towards reduced horizontal separation standards, thereby improving efficiency and capacity.

It will be necessary to ensure availability/continuity of contingency procedures in case of GNSS failure. Entire en-route controlled airspace could be designated as being exclusive/nonexclusive PBN airspace with mandatory carriage of GNSS utilizing RNP navigation specifications, except for State aircraft. Such implementation mandates will be harmonized with adjacent States.

The use of ADS-C and CPDLC in the oceanic airspace will foster the necessary conditions for using 30-NM horizontal separation minima in the Bay of Bengal- Indian Ocean- Arabian Sea Corridor.

In the Terminal airspace, the use of enhanced surveillance techniques (RADAR, ADS-B and/or multilateration) will help reduced horizontal separation minima, enhance safety, increase capacity, and improve the cost-effectiveness of flights.

4.2.3 Implementation Plan (Navigation)

4.2.3.1 Implementation Plan for Phase I (2022 - 2024)

- Nil -

4.2.3.2 Implementation Plan for Phase II (2025 - 2027)

- Nil -

4.2.3.3 Implementation Plan for Phase III (2028 - 2030)

The RNAV/RNP Navigation method requires the use of GNSS to derive primarily position information on information on aircraft. Depending on the phase of a flight this position information demands more when used in more critical phases of flight such as Approach phase and landing phase compared to cruising phase and terminal (Climbing/descending) phase. Therefore an advanced technology/mechanism is required to ensure this level of accuracy, which is achieved through the introduction of an augmentation to the GNSS-derived information.

The three such methods of augmentation are described in the sub-paragraphs ahead.

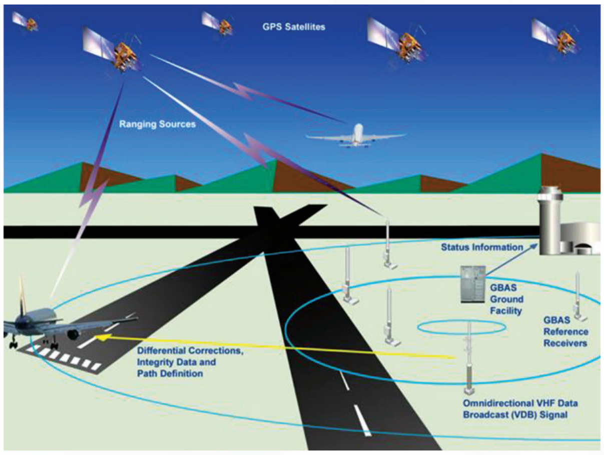
Sri Lanka recognizes the importance in the use of G-BAS and S-BAS, whilst looking forward to determining on the type of augmentation whichever provides the best benefit to its ATM System.

1. Ground Based Augmentation Systems (GBAS)

Objective - to support Precision Approach and landing operations at Airports.

This element introduces improved accuracy, integrity and availability through a local airport based differential satellite navigation and monitoring system.

A local network of reference receivers are deployed at or near an airport. Observations from these reference receivers are used to compute corrections for each satellite as well as to monitor for system integrity. The information is broadcasted to users via a VHF Data Broadcast service on VHF NAV band.



As an option, this may also support arrival and departure phases of flight, i.e PBN in terminal area (RNAV 1 and RNP 1 operations) can be supported using GBAS positioning service.

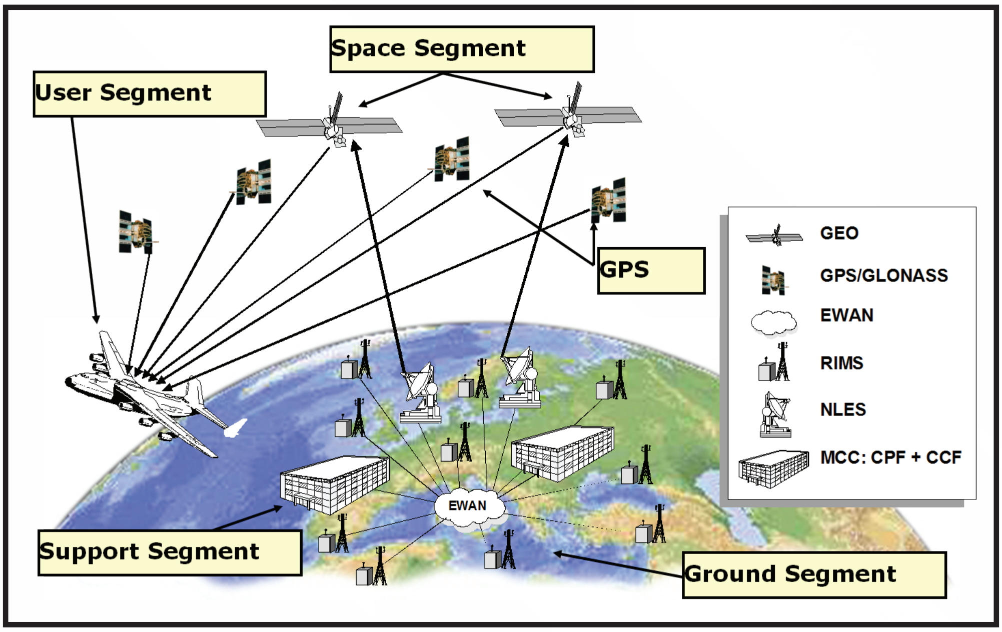
(NAVS-B0/1, ICAO GANP 6th Edition)

2. Satellite Based Augmentation Systems (SBAS)

Objective - to support PBN in all phases of flight with an increased accuracy, integrity and availability.

This element will introduce improvements in the availability, accuracy and integrity of satellite navigation through a wide area differential satellite navigation position and integrity monitoring system. Observations from the reference systems will be used to monitor satellite signals and produce corrections and integrity information which will be then broadcasted over a geostationary satellite link to aircraft. The LPV (Localizer Performance with Vertical guidance) service volume will be mainly determined by the distribution of the monitoring network, depending on the implementation, a wider service volume may be achieved supporting RNP 0.3 and RNP 0.1 performance.

(NAVS-B0/2, ICAO GANP 6th Edition)



SBAS Architecture

3. Aircraft Based Augmentation Systems (ABAS)

Objective - to support non-precision (LNAV) and vertically guided (LNAV/VNAV) approaches with BaroVNAV and other terminal and enroute navigations.

An ABAS is basically a system that augments and/or integrates the information obtained from the other GNSS elements with information available on board the aircraft.

ABAS will support non-precision (LNAV) and vertically guided (LNAV/VNAV) approaches using GNSS lateral navigation and barometric vertical (Baro-VNAV) guidance. However the use of this element, which is primarily an airborne equipment on board aircraft, depends on the overall capability of the aircraft population that would traverse across Colombo FIR. Nevertheless, Sri Lanka recognizes the use of this technology to achieve more accuracy in navigation and will implement it in proportion to the level of equipage of the above population of aircraft.

(NAVS-B0/3, ICAO GANP 6th Edition)

4.3 Surveillance - new technologies for interaction and control over the entire airspace

4.3.1 Introduction

Surveillance plays an important role in Air Traffic Control (ATC). The ability to accurately and reliably determine the location of aircraft has a direct influence on the separation distances required between aircraft (i.e. Separation standards), and therefore on how efficiently the airspace may be utilized.

In areas without surveillance, where ATC is reliant on pilots to verbally report their position, aircraft have to be separated by relatively large distances to account for the uncertainty in the estimated position of aircraft and the timeliness of the information. Conversely in terminal areas where accurate and reliable surveillance systems are used and aircraft positions are updated more frequently, the airspace can be used more efficiently to safely accommodate a higher density of aircraft.

It also allows aircraft vectoring for efficiency, capacity and safety reasons. ATC surveillance serves to close the gap between ATC expectations of aircraft movements based on clearances or instructions issued to pilots, and the actual trajectories of these aircraft.

The demand for increased flexibility to airspace users by reducing restrictions associated with flying along fixed routes requires improved navigation capability on board the aircraft. Equally, accurate surveillance is required to assist in the detection and resolution of any potential conflicts associated with the flexible use of the airspace which is likely to result in a more dynamic environment.

4.3.2 Current surveillance systems in Sri Lanka

Secondary Surveillance Radar (SSR)

Sri Lanka provides area radar coverage to a range of 240 NM using Monopulse Secondary Surveillance Radar (MSSR) mounted at Mt. Pidurutalagala peak and a Terminal MSSR at Bandaranaike International Airport covering 60 NM range.

Automatic Dependent Surveillance Broadcast (ADS-B) OUT

ADS-B (Out) service was implemented within Colombo FIR for Tier-2 Operations (Traffic situational awareness service with procedural separation) covering the entire sovereign airspace of Sri Lanka in compliance with ICAO ASBU requirements with effect from 2nd September 2019.

At present ADS-B (Out) service for Tier-1 operations that enable application of separation between aircraft within a designated volume of airspace named Colombo Exclusive ADS–B (Out) airspace (as mentioned below), is operational effective from 10th September 2020.

Colombo Exclusive ADS–B (Out) airspace

Volume of Airspace between FL290 and FL460 (inclusive) enclosed by the boundary starting from a point 100000N 0800000E thence along straight lines joining the points 100000N 0820000E – 082048N 0860758E thence clockwise along an arc of 330NM radius centre on 070003N 0804618E up to a point 030000N 0843509E thence along straight lines joining the points 030000N 0780000E (LAVOX) - 060000N 0780000E - 060000N 0770000E - 070000N 0770000E - 090000N 0793000E thence straight line to the starting point (100000N 0800000E), (Depicted in Figure - 1)

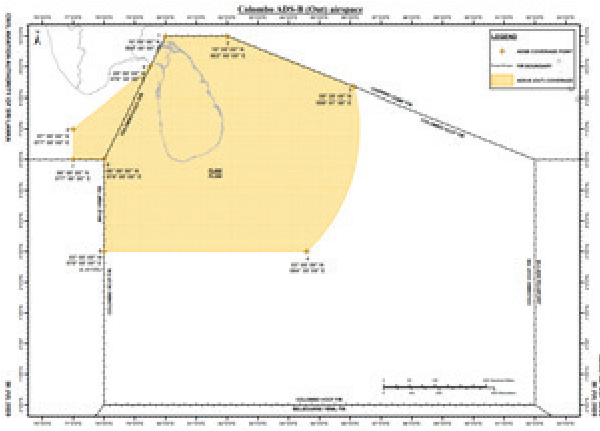


Figure - 1

An Aeronautical Information Publication on the Implementation of (ADS-B) OUT Exclusive Airspace within Colombo FIR was issued in 2020 (AIP SUP 02/20).

Plans are in place to increase the volume of the exclusive airspace by lowering the lower limit of the vertical extent in a phased approach. Accordingly the aircraft operators will have to equip their aircraft suitably in order to operate through the airspace expected to be designated as exclusive ADS-B airspace where non-ADS-B aircraft will not be allowed.

ADS-B Surveillance Coverage

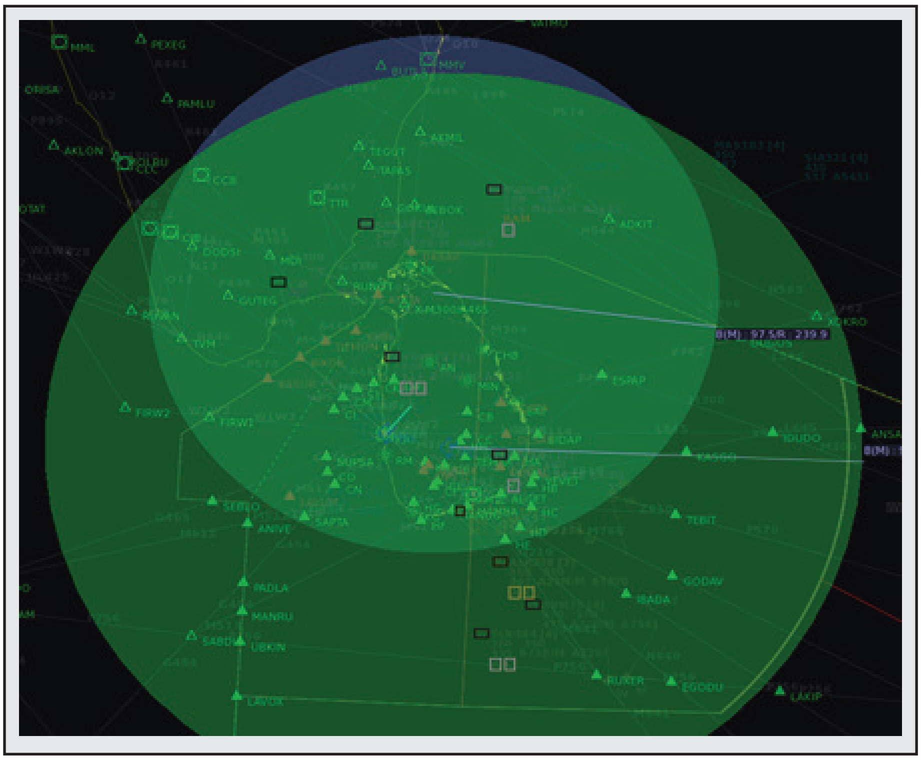


Figure - 2

Note - Primary Surveillance Radar (PSR)
In the past PSR provided useful support to en-route Air Traffic Control. But the subsequent implementation of Automatic Dependent Surveillance Broadcast (ADS - B) and the Secondary Surveillance Radar (SSR) suppressed the need for PSR. Hence the Primary Radar System of Sri Lanka was decommissioned in 2019.

The Air Defence Radar squadron of Sri Lanka Air Force uses Primary Radar systems to support the national Air Defence.

Aircraft Tracking

The Global Aeronautical Distress and Safety System (GADSS) and Autonomous Distress Tracking (ATD) concept adopted by ICAO incorporate new Standards and Recommended Practices (SARPs) to prevent any repetition of MH370 disappearance in 2014.

Two SARPs were established- Amendments 39 and 40 to Annex 6 of the Chicago Convention which are applicable from Nov. 8, 2018. Amendment 39 establishes an aircraft-tracking time interval of 15 min. That is recommended for all operations of aircraft with a takeoff mass of 27,000 kg (59,524 lb.) and is required for aircraft with a takeoff mass of 45,500 kg flying oceanic routes.

Sri Lanka has identified the importance of ICAO circular 347 regarding Aircraft tracking implementation guidelines and has taken initial steps to provide 4D/tracking* within the area in Colombo airspace where 4D/service is not available.
** 4D/15 tracking* - The operator obtains four-dimensional (latitude, longitude, altitude, time) aircraft position information at 15-minute intervals or less.

4.3.3 Implementation Plan (Surveillance)

4.3.3.1 Implementation plan for Phase I (2022 - 2024)

1. Automatic Dependent Surveillance – Broadcast (ADS-B)

Objective - To support the provision of Air Traffic Services and operational applications at reduced cost and increased surveillance coverage.

ADS-B provides an aircraft's identification, position, altitude, velocity, and other information to any receiver (airborne or ground) within range. The broadcasted aircraft position/velocity is normally based on the global navigation satellite system (GNSS) and transmitted at least once per second.
(ASUR-B0/1, ICAO GANP 6th Edition)

As mentioned above in 4.3.2, ADS-B (Out) service for Tier-1 operations is currently available within the Colombo Exclusive ADS–B (Out) airspace and it covers the entire Sri Lankan sovereign airspace and extends beyond the present Secondary Surveillance (SSR) coverage in Colombo FIR. Plans are drawn to designate the Sri Lankan airspace as an exclusive ADS-B Airspace with Tier 1 operations for Separation purposes, in a phased approach as mentioned below.

In the 1st phase of implementation (2022 - 2024), the vertical limit of the exclusive ADS - B airspace will be brought down to FL220 within the same lateral limits.

2. Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)

Objective - To obtain additional information from an aircraft transponder in support of the provision of Air Traffic Services.

Applicability - All ATM Surveillance Systems

SSR - DAPS enables ATM systems to obtain additional information from an aircraft transponder, via interrogation by a cooperative surveillance system (Mode S radar or MLAT). This additional information can be used to increase controller awareness and reduce the volume of air-ground voice communications, and/or to improve the performance of tracking systems or safety net systems such as STCA and MSAW.
(ASUR-B0/3, ICAO GANP 6th Edition)

3. Reception of aircraft ADS-B signals from space (SB ADS-B)

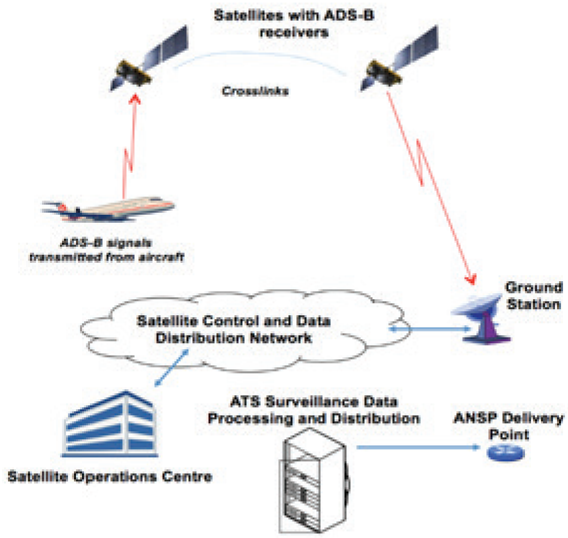
Objective - To provide surveillance coverage in Colombo oceanic airspace where ground stations siting is not possible.

Applicability - Colombo oceanic airspace

Space - based ADS - B is a surveillance mechanism providing ATS surveillance capability to ANSPs and aircraft operators in areas where ground based ATS surveillance is not possible. It will allow integration of received ATS surveillance data from oceanic and remote regions via satellites with data from ground- based ATS surveillance networks to provide global coverage and a seamless surveillance picture.

Space - based ADS - B is compatible with all DO-260 series transponders, as is ground-based ADS-B. As with other cooperative ATS surveillance systems, aircraft will not be detected if they are not equipped with a transponder or if their transponder is malfunctioning or turned off. Space- based ADS-B is not affected by the line of sight issues that can limit the effective range of ground based systems.

Space based ADS - B is a near perfect surveillance solution available to a country like Sri Lanka where almost the entire FIR except the land area of the island is oceanic airspace. While presently available surveillance systems (SSR and ADS-B) cover the airspace adjacent to the land area, a major portion of the oceanic airspace is not covered by a surveillance mode. Space based ADS-B would bring about the solution covering the entire airspace.
(ASUR-B1/1, ICAO GANP 6th Edition)



4.3.3.2 Implementation plan for Phase II (2025 - 2027)

1. Automatic Dependent Surveillance – Broadcast (ADS-B)

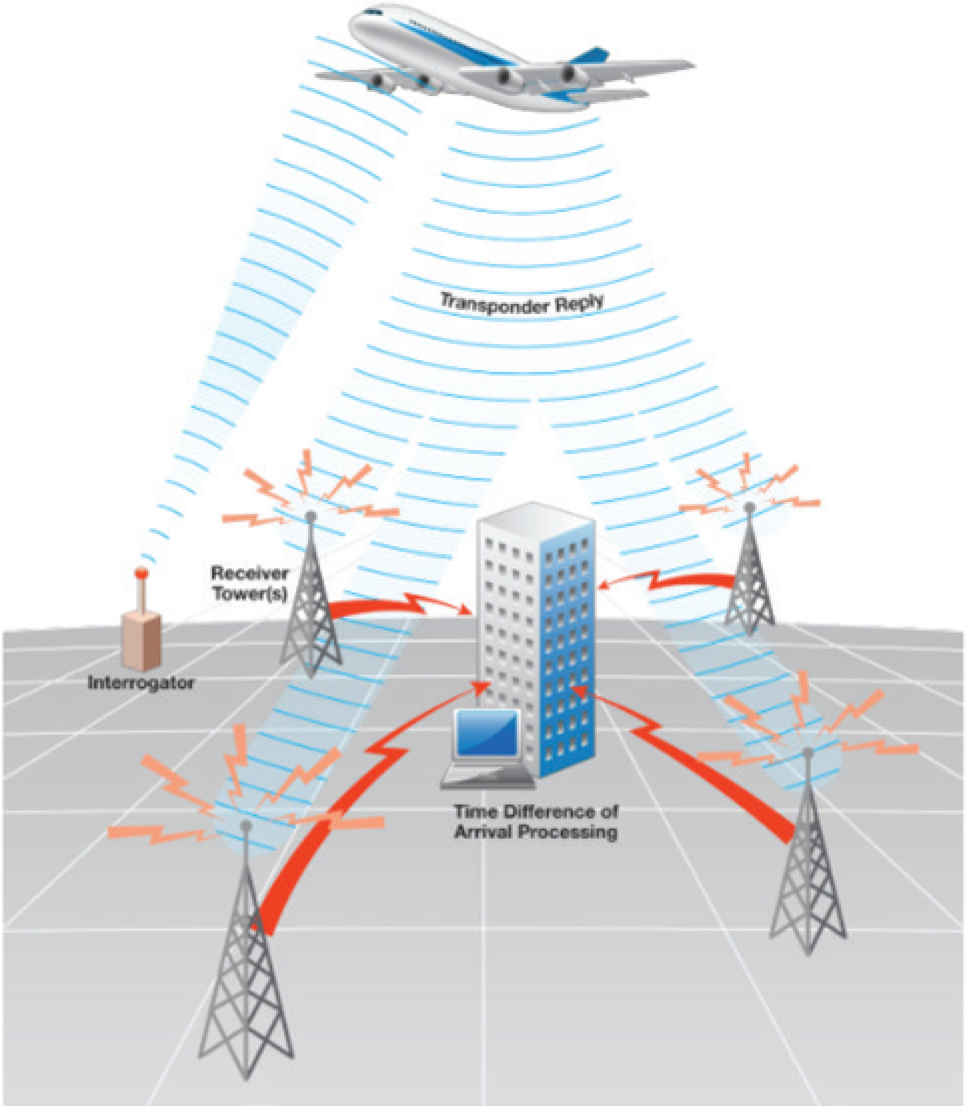
An exclusive ADS - B airspace will be established and promulgated from GND/MSL to FL460 within the existing lateral limits of the Colombo ADS - B airspace mentioned in 4.3.3.1.1.

2. Multilateration cooperative surveillance systems (MLAT)

Objective - To provide redundancy to approach radar surveillance by using available aircraft transponders.

Applicability - To provide surveillance coverage within the sovereign airspace of Sri Lanka

MLAT is a new technique providing independent cooperative surveillance. The MLAT system interrogates an aircraft and the transponder reply is received by multiple receivers located in different places. The reply's times of arrival difference at the receivers allows the position of the source of signals to be determined, with an accuracy that is dependent on the number of receivers and their location relative to the aircraft. MLAT systems do not require a rotating radar dish and were initially deployed on airports to provide surface surveillance of aircraft. The technique is now used to provide surveillance over a wide area (wide area MLAT system - WAM), sometimes in conjunction with ADS-B. MLAT requires more ground stations than ADS-B, but has the early implementation advantage of using existing aircraft transponders.
(ASUR-B0/2, ICAO GANP 6th Edition)



4.4 Intended Benefits of Implementation

Common Regional Virtual Private Network (CRV)	
Interoperability	Potential to carry new services (i.e., ATFM, SWIM, etc.).
Efficiency	Reduced procurement time and effort, as each ANSP will require only the initial connection to the CRV. Greater ease of handling of network service issues.
Cost	Cost efficiencies as compared to multiple point-to-point connections

Automated basic inter facility data exchange (AIDC)	
Capacity	Reduced controller workload and increased data integrity supporting reduced separations.
Efficiency	The reduced separation can also be used to offer aircraft with optimum flight levels. Reduced en-route holding.
Interoperability	Seamlessness: Allows Air Traffic Controllers to apply the same procedures at the boundaries of all participating centers and FIR boundary crossing becomes more transparent to flights.
Safety	Better knowledge of more accurate flight plan information for receiving ATS units and reduced risk of coordination errors.

ATS Message Handling System (AMHS)	
Efficiency	Increase performance to handle large files

SATCOM Class B Voice and Data	
Efficiency	Provide high-speed IP based broadband networks
Safety	Improved security
Cost	Lower cost than the traditional circuit switched services

ADS-B, MLAT, SSR-DAPS	
Capacity	Separation minima with surveillance will enable a significant increase in traffic density compared to procedural minima.
Efficiency	Availability of optimum flight levels and priority to the equipped aircraft and operators. Reduction of flight delays and more efficient handling of air traffic at FIR boundaries. Reduces workload of Air Traffic controllers. Improved coverage, capacity, velocity vector performance and accuracy can improve ATC performance.
Safety	Reduction of the number of major incidents. Support to Search and Rescue.

Part V
Air Traffic Management (ATM)

Air Traffic Management

from Controlling to Enabling

5.1 Introduction

Air Traffic Management (ATM) is defined by the International Civil Aviation Organization (ICAO) as the "dynamic, integrated management of air traffic and airspace - safely, economically and efficiently - through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions". ICAO has estimated that Air Traffic in Asia/ Pacific will triple by 2030 and to cater to this high traffic growth in the region, new ATM technologies and solutions must be developed and high safety and service standards must be maintained.

This chapter of SLANP on ATM aligns changes in Air Traffic Management with regulatory requirements, technology and infrastructure implementation in order to meet global, regional and local performance expectations particularly in areas of safety, environment and demand & capacity management. Thus future initiatives outlined in this Plan are designed to enhance and maintain the Air Navigation system of Sri Lanka, delivering safety, efficiency, capacity and environmental benefits to the aviation industry and the community.

In developing this ATM segment for the SLANP, we have taken into account International, Regional strategic, tactical and operational development plans and national aviation industry and stakeholder expectations.

As a signatory to the Convention on International Civil Aviation, the ATM Plan confirms Sri Lanka's commitment to consistency with ICAO Standards and Recommended Practices (SARPs). Any deviations from the SARPs will be well justified, documented and formally notified to ICAO as a filed difference.

5.2 Current status in Sri Lanka

Air Traffic Management in Sri Lanka is carried out through a collaborative arrangement among four main organizations as mentioned below.

a. The Civil Aviation Authority of Sri Lanka is responsible for the adoption, development, implementation of Regulations and overseeing the provision of Air Navigation Services.

b. Airport & Aviation Services (Sri Lanka) (Private) Ltd (AASL) as the statutory Air Navigation Service Provider has undertaken provision of Aeronautical Services within Colombo FIR.

c. Meteorological services provided by the Department of Meteorology.

d. Provision of Search & Rescue Services within the Sri Lanka Search and Rescue Region has been undertaken by AASL (ARCC) and Merchant Shipping Secretariat (MRCC).

Safety will always be the most important consideration in Sri Lanka's ATM system. In line with Global and Asia/ Pacific Regional priorities, other key priorities are:

a. Effective use of, and investment in, technology, infrastructure and services.

In upgrading and expanding the ATM infrastructure, Sri Lanka will continue to adopt advanced technologies and international standards. The adoption of these applications will not only enhance aviation safety but can also generate efficiency, capacity and environmental benefits.

b. Alignment with ICAO SARPs.

ICAO continues to encourage all States to better plan the enhancement of safety, environmental and operational efficiency of future ATM and navigation systems to assist in eventual global harmonization.

This chapter on ATM describes how Sri Lanka supports the ICAO initiatives of:

-enhanced collision risk mitigation through the increased effectiveness of Ground-Based Safety Nets (SNET): and

-Trajectory Based Operations (TBO) that support optimum aircraft routes, reducing fuel burn with attendant economic and environmental benefits.

c. Effective management of environmental impacts from aviation operations.

As well as safety and efficiency benefits, modern ATM systems can enable improved management of environmental impacts from aviation operations, including noise as well as the reduction of carbon emissions by reducing the amount of fuel burnt by aircraft. This is achieved by the concept of flexible routing, i.e. migrating away from the fixed route structure towards a more flexible route structure.

d. Civil-Military ATM harmonization.

Sri Lankan airspace has been identified as a national resource by both Civil and Military. And also, it is a critical enabler to national imperatives including national security, the environment, the economy and public safety.

Close coordination and cooperation among the civilian and military establishments for the usage and utilization of Air Space has been prevalent in Sri Lanka since the inception of civil Aviation activities in Sri Lanka. Ensuring the safety aspects and the optimization of the public Airspace for the economic benefits to be accrued for the betterment of the public whilst providing due consideration to National Security has been the policy of Civilian authorities in regards to the airspace. Civilian entities have cooperated with the Military establishments in instances where National Security has been threatened and also Military authorities have reciprocated vice versa when normalcy is restored. At ATM operational spheres including data sharing, the pre-tactical to tactical coordination levels have been established between Civilian and Military Authorities. Additionally Military authorities are the main SAR asset providers for the Civilian Authorities.

5.3 Implementation plan

5.3.1 Implementation plan for Phase I (2022 - 2024)

1. Improved arrival operations with basic PBN Approaches

Objective - Application of PBN, in design of approach procedures to provide more flexibility when using the airspace and to facilitate access to airports.

Applicability - All International airports to have PBN non-precision approaches consistent with APTA-B0/1.

PBN approaches will allow for guided lateral paths and optionally, with associated advisory vertical paths based on Baro-VNAV functionality for aircraft so equipped. Such Baro-VNAV functionality will enable stabilized descent operations on the final segment of the approach at airports which do not have ground infrastructure to support precision approaches.
(APTA B0/1, ICAO GANP 6th Edition)

2. Improved arrival and departure operations with PBN SID and STAR procedures

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

Applicability - VCRI International Airport to have RNP-1 SID/STAR procedures consistent with APTA-B0/2.

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

This flexibility is also applicable to providing more optimum departure paths to the exit of terminal airspace. These new capabilities are essential elements to support the development of Continuous Descent Operations/Continuous Climb Operations (CDO/CCO).
(APTA B0/2, ICAO GANP 6th Edition)

3. Continuous Descent Operations (CDO)

Objective - To reduce fuel burn by not requiring application of power during descent.

Applicability - All International Aerodromes

Arriving aircraft will be allowed uninterrupted descent, continuously from top of descent by employing minimum engine thrust, ideally in a low drag configuration, prior to the Initial Approach Fix (IAF) by applying ATC procedures with reducing ATC/Pilot interaction.
(APTA B0/4, ICAO GANP 6th Edition)

4. Continuous Climb Operations (CCO)

Objective - To reduce fuel burn by not requiring level-offs during climb.

Applicability - All International Aerodromes

Departing aircraft will be allowed to climb continuously, to the greatest possible extent, by employing optimum engine thrust. An optimal continuous climb should start on take-off and allow the aircraft to climb efficiently using climb profiles that reduce controller pilot communications and segments of level flight until the top of climb. ATC procedures should be implemented to facilitate uninterrupted climb, reducing ATC/Pilot interaction.
(APTA B0/5, ICAO GANP 6th Edition)

5. Direct routing (DCT)

Objective - To provide airspace users with additional flight planning route options on a larger scale across the Colombo FIR such that overall planned leg distances are reduced in comparison with the fixed route network.

Applicability - Colombo Area Control Centre (applicable within RNP 10 airspace of VCCF)

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

DCTs could be implemented with limitations (ex. time constraint - fixed or depending on traffic/availability, traffic constraint - based on flow and/or level of traffic, flight level, lateral constraints, entry/exit conditions. etc.)

ANSP should conduct Airspace Planning and enable systems that manage direct and flexible routings. Within Category R airspace, ADS surveillance and CPDLC should be enabled to support PBN-based separations.
(FRTO B0/1, ICAO GANP 6th Edition)

6. Airspace planning and Flexible Use of Airspace (FUA)

Objective - To improve data exchange between civil and military stakeholders by automation to enable a more efficient use of airspace based on transparency and due regard to national security needs.

Applicability - Entire Colombo airspace

Deployment of automated airspace management (ASM) support systems to manage the airspace reservations based on the airspace user needs and resulting from civil-military collaborative decision-making process and more flexibly according to the airspace user needs.
(FRTO B0/2, ICAO GANP 6th Edition)

7. Pre-validated and coordinated ATS routes to support flight and flow

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

Applicability - Colombo Area Control Centre (applicable within RNP 10 airspace of VCCF)

There are many instances when ATC needs to move air traffic away from, or into, a particular area of airspace. When this happens, traffic managers will typically implement reroutes – a common route, or set of routes, that are designed to move aircraft off from their originally planned routes to another area where they want the aircraft to be flown. This rerouting may be issued due to weather, excess volume, military activity, volcanic ash clouds or other reasons.

The flight may be rerouted in the air or on the ground. The operator should file or amend flight plans with the appropriate routes when the aircraft is 45 minutes or more from the proposed departure time. If within 45 minutes from departure or airborne, ATC facilities will enter the reroute. Operators have the right of refusal of a specific reroute and may elect an alternative. Alternatives include but are not limited to ground delay, diversion to another airport or a request to stay on the filed route. (Federal Air Regulations).

If a reroute cannot be accepted due to safety of flight or fuel concerns, the pilot should notify the controller. The controller may find an acceptable route. If there are no acceptable alternatives the flight is required to accept the delay on the ground until the route becomes available.

Reroute information may be available through an ANSP database and are published for the airspace users either on a website or in the AIP.

There are three main options for rerouting:

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

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

c. ***Coded Departure Routes (CDR)*** - a combination of coded air traffic routings and refined coordination procedures, designed to reduce the amount of information that needs to be exchanged between ATC and flight crews.
(FRTO B0/3, ICAO GANP 6th Edition)

8. Free Route Airspace (FRA)

Objective - To offer significant flight efficiency benefits and a choice of user preferred routes to airspace users.

Applicability - Colombo Area Control Centre (applicable within RNP 10 airspace of VCCF)

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

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

FRA implementation may be customized according to, laterally and vertically, during specific periods; with a set of entry/exit conditions, with initial system upgrades etc.

As a step to full trajectory-based operations, the FRA concept will bring increased flight predictability, reduced uncertainty for the ATM network function, which in turn can lead to potential capacity increases for ATM, which will also benefit the user.
(FRTO B1/1, ICAO GANP 6th Edition)

9. Required Navigation Performance (RNP) routes

Objective - To provide consistent navigation using the most appropriate PBN type, infrastructure and navigation applications.

Applicability - Category R and S airspace of Colombo FIR. All new ATS Routes to be PBN Routes in accordance with the following specifications:
Category R airspace – RNP 4, RNP 10 (RNAV 10) or RNP 2 oceanic
Category S airspace – RNAV 2 or RNP 2.

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

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

Design of optimized routes which may include closely spaced parallel routes, Fixed Radius Transition (FRT) and Tactical Parallel Offset (TPO) functionality in en-route, supported by infrastructure and system improvements to support PBN routes. This requires additional navigation infrastructure. GNSS or DME ground infrastructure needs to be optimised to support RNP operations and main reversionary capability in case of GNSS outages.

PBN requires a full digital chain, to critical data quality levels, for aeronautical data provided to the airborne systems. The system improvements for controller support tools which might be required are covered under FRTO elements (MTCD, monitoring aids) and SNET elements in this document.
(FRTO B1/2, ICAO GANP 6th Edition)

10. Enhanced Conflict Detection Tools and Conformance Monitoring

Objective - To enhance the basic mid-term conflict detection (MTCD)/ monitoring alert (MONA) functions and to further improve the ATCO productivity and reduce the workload.

Applicability - Colombo Area Control Centre/ APP
ATS surveillance systems should enable Enhanced Conflict Detection Tools and Conformance Monitoring, consistent with FRTO-B1/5.

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

MTCD will support the ATCO by showing only the most probable conflicts within the predefined look-ahead time, discarding detected conflicts with lower probabilities. Conflict Detection Tools (CDT) will include enhancements to MTCD (up to 20 minutes planning horizon) function, plus tactical functions based on a shorter look-ahead time, typically from 10 to 2 minutes ahead. MTCD will be complemented by a basic conflict resolution advisor and a what if function, which shows the problems that would occur if the given clearances is applied and identify the contextual traffic that may impair the manual identified conflict resolution.

MONA will provide the en-route controller with reminders and warnings if aircraft deviate from the calculated ground system trajectory or the ATCOs tactical clearances (e.g. heading, vertical rate) and are enhanced via the integration of Aircraft Derived Data (ADD). The provision of a trajectory warning with respect to downlinked parameters, as well as the additional reminders for change of frequency and manual coordination enhance support provided to controllers.
(FRTO B1/5, ICAO GANP 6th Edition)

11. Application of In Trail Procedure (ITP) for improved access to optimum flight levels in oceanic and remote airspace

Objective - To enable aircraft to reach a more satisfactory flight level for flight efficiency or to avoid turbulence for safety.

Applicability - Colombo Oceanic Control Centre

ITP is primarily intended to facilitate access to optimum flight levels for aircraft operating in airspace where no ATS surveillance service is available. The ITP aircraft must acquire and process position broadcast (ADS-B) data from up to two non-manoeuvring aircraft. Aircraft identification, altitude, position and ground speed of reference aircraft would be assessed by the ITP aircraft's on-board equipment (on-board decision support system) to determine whether an ITP climb or descent is possible. Based on the processed broadcast data from the reference aircraft(s), a pilot can make an ITP climb or descent request to air traffic control (ATC).

Note 1 - The procedure couples the capability of the controller to receive the current position and intent from a pair(s) of aircraft with the ability of the trailing aircraft to space itself accurately from the preceding aircraft(s) to allow for the safe issuance of the ITP clearance. Pilots are responsible for using the on-board equipment to evaluate the situation and provide the required information to the controller.
(OPFL-B0/1, ICAO GANP 6th Edition)

Note 2 - The routes or airspace where application of the in-trail procedure is authorized, shall be promulgated in aeronautical information publications (AIPs).
(Ref. ICAO PANS - ATM Doc. 4444 Chapter 5 for detailed description)

12. Application of Climb and Descend Procedure (CDP) for improved access to optimum flight levels in oceanic and remote airspace

Objective - To improve service to appropriately equipped aircraft by providing an altitude change when existing separation minima do not allow an aircraft to climb or descend through the altitude of a blocking aircraft. (Initiation by an air traffic controller)

Applicability - Colombo Oceanic Control Centre

The capability for the controller to request current position and intent from pair(s) (ADS-C capability) aircraft will provide the situational awareness to allow the controller to use the simultaneous reporting of position to support the procedure at less than the nominal separation.

The CDP utilizes existing ADS-C aircraft equipage and air traffic control (ATC) capabilities to allow more flights to achieve their preferred vertical profiles. Integral to the CDP is the use of advanced communication and surveillance capabilities (i.e. ADS-C and CPDLC). The CDP is conceptually modelled after existing in - trail distance measuring equipment (DME) rules set forth in the Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM, Doc 4444), paragraph 5.4.2.3.4. Aircraft pair distance verification is performed by the ground automation system using simultaneous ADS-C demand contract reports.
(OPFL-B1/1, ICAO GANP 6th Edition)

(Ref. ICAO PANS - ATM Doc. 4444 Chapter 5 for detailed description)

13. Safety Nets

Applicability - ATS surveillance systems to enable basic conflict detection and conformance monitoring STCA, MTCD, APW, APM and MSAW consistent with SNET-B0/1 – 4.

Route Adherence Monitoring (RAM) to be utilised when monitoring PBN route separations. Cleared Level Adherence Monitoring (CLAM) to be utilised when monitoring RVSM airspace.

i. Short Term Conflict Alert (STCA)

Objective - To assist the air traffic controller in preventing collision between aircraft, using position data from ground surveillance.

Surveillance data from ground radars and ADS-B stations is used to track aircraft. For each pair of aircraft which are sufficiently close, a short term conflict alert is raised if at least one of the following tests is true:

- (current proximity test) their current horizontal separation is lower than a horizontal threshold and their current vertical separation is lower than a vertical threshold; or
- (Linear prediction test) at any of their future positions within a given amount of time (warning time), as linearly extrapolated from their current track, their horizontal separation will be lower than a horizontal threshold and their vertical separation will be lower than a vertical threshold.

The horizontal and vertical thresholds may be different in each test but are equal or lower than the ATC separation standards for the airspace covered by the STCA system. The warning time for the linear prediction may depend on the control unit specificities but is typically equal to or lower than 2 minutes.

On noticing the alert, the controller has to analyse the situation and, if deemed necessary, issue an avoiding instruction to one or both aircraft, with the appropriate emergency phraseology.
(SNET B0/1, ICAO GANP 6th Edition)

ii. Minimum Safe Altitude Warning (MSAW)

Objective - To assist the air traffic controller in preventing controlled flight into terrain accidents by generating, in a timely manner, an alert of aircraft proximity to terrain or obstacles.

Surveillance data (including tracked pressure altitude), flight data (including cleared flight levels) and environment data (including terrain and obstacle data) are input to the MSAW system to generate the alerts to the controller working position.

On noticing the alert, the controller has to analyse the situation and, if deemed necessary, issue an instruction to the aircraft, with the appropriate emergency phraseology.
(SNET-B0/2, ICAO GANP 6th Edition)

iii. Area Proximity Warning (APW)

Objective - To prevent accidents arising from unauthorized penetration of an airspace volume.

Surveillance data (including tracked pressure altitude), flight data (including cleared flight levels and RVSM status) and environment data (including airspace volumes) are input to the APW system to generate the alerts to the controller working positions.

On noticing the alert, the controller has to analyse the situation and, if deemed necessary, issue an instruction to the aircraft, with the appropriate emergency phraseology.
(SNET-B0/3, ICAO GANP 6th Edition)

iv. Approach Path Monitoring (APM)

Objective - To warn the controller about increased risk of controlled flight into terrain accidents by generating, in a timely manner, an alert of aircraft proximity to terrain or obstacles during final approach.

Surveillance data (including tracked pressure altitude), flight data (including concerned sectors) and environment data (including terrain and obstacle data) are input to the APM system to generate the alerts to the controller working position(s).

On noticing the alert, the controller has to analyse the situation and, if deemed necessary, issue an instruction to the aircraft, with the appropriate emergency phraseology.
(SNET-B0/4, ICAO GANP 6th Edition)

14. Enhanced STCA with aircraft parameters

Objective - To assist the air traffic controller in preventing collision between aircraft, using position data from ground surveillance and flight intent reported by aircraft.

Applicability - ATS surveillance systems to enable enhanced STCA with aircraft parameters.

This enhanced STCA will work the same as the basic STCA system in Block 0, but stops the linear extrapolation of the vertical position of an aircraft when it reaches the selected Flight Level information reported from ADS-B or downlinked from Mode S transponders.

These aircraft intent parameters will allow STCA systems to reduce the number of unnecessary alerts, to increase the number of relevant alerts and to alert earlier, compared to the basic STCA system in Block 0.
(SNET-B1/1, ICAO GANP 6th Edition)

15. Enhanced STCA in complex TMAs

Objective - To assist the air traffic controller in preventing collision between aircraft, using position data from ground surveillance and taking into account possible crew intents linked to traffic patterns and ATC practices in complex TMAs.

Applicability - ATS surveillance systems at approach control to enable enhanced STCA with aircraft parameters.

This enhanced STCA works the same as the basic STCA system in Block 0, but, in addition of the current proximity test and the linear prediction test, performs the following tests:

- (level-off prediction test) The vertical positions of aircraft in vertical evolution are extrapolated to level-off at the next reasonable FL.
- (turn prediction test) The horizontal positions of aircraft in proximity of a final approach path are extrapolated to turn in alignment with this final approach path.

  Care is also taken to set up a specific set of alerting parameters (horizontal threshold, vertical threshold and warning time) for the approach area, where unnecessary alerts could affect runway throughputs.

(Note - Implementation in Phase I may depend on the Post COVID - 19 traffic prediction, risk factors and mainly the cost)
(SNET-B1/2, ICAO GANP 6th Edition)

16. Wake turbulence separation minima based on 7 aircraft groups

Objective - To safely optimise the separation minima to be applied between groups of aircraft due to wake turbulence on arrival and departure phases of flight.

Applicability - All International Airports

Replacement of the 3 aircraft wake turbulence categories defined in ICAO PANS-ATM by 7 aircraft wake turbulence groups based on safety and operational requirement criteria.
(WAKE B2/1, ICAO GANP 6th Edition)

17. Determination of ATC sector capacity

Objective - To ensure safe and efficient aircraft operations.

Applicability - All ATC sectors

ATC sector capacity measures the ability of the ATC system or any of its operating positions to provide service to aircraft during normal activities. ATC sector capacity is generally expressed as the number of aircraft that can be served per hour within a specified portion of airspace, taking into account airspace size and structure, expected traffic flow, the equipment available, weather, ATC unit configuration, staff and any other factors that may affect the workload of the controller responsible for the airspace. The exact value can be determined using a variety of methods (ex. simulation, expert assessment, etc.)

These declared capacities should be periodically reviewed by the ANSPs.

18. Application of Electronic Flight Progress Strips

Objective - To ensure safe and efficient aircraft operations.

Applicability - BIA Tower and Approach Control Center

As defined by the Eurocontrol, Flight Progress Strip is an electronic or paper strip containing planned and current flight plan data for a specific flight, made available on an electronic display or flight progress board for use by air traffic controllers in the provision of Air Traffic Services. It facilitates recording specific pieces of information such as aircraft identification, type, transponder code, departure and destination aerodromes, clearances, estimates etc.

Paper strips have a number of inherent limitations such as;

- Difficulty in linking with other systems (e.g. Safety Nets)
- time consuming to print and update
- no information sharing (if the controller updates a strip, the data can only reach others through verbal coordination)
- updated information may be unreadable due to poor handwriting/misspelling, lack of discipline (controller input in the wrong field)
- require maintenance - consumables (paper, ink, toner, etc.) need to be changed on a regular basis

Electronic strips are a solution for these paper strip limitations. Their appearance is similar to the paper strips in terms of layout, colours and strip management.

Electronic strips offer a number of advantages over the paper ones:

- More visualization tools available, (ex. different colours may represent a field being updated/ coordinated with other controllers/communicated to the crew, etc.);
- different fonts and background shades may be used to highlight specific portions of the flight strip;
- colours may change dynamically to attract attention;

- can be linked to the ATM system safety features, (ex. if a controller inputs a conflicting clearance, the system may issue an early warning);
- Flight information can be updated and shared (coordinated) instantly.

5.3.2 Implementation plan for Phase II (2025 - 2027)

1. PBN SID and STAR procedures (with basic capabilities)

Objective - To have more efficient terminal procedures in non - ATS surveillance environments.

Applicability - VCBI International Airport
VCBI International Airport to have RNP 1 SID/STAR procedures consistent with APTA-B0/2.
Ref. 5.3.1.2

2. Required Navigation Performance (RNP) routes

Objective - To provide consistent navigation using the most appropriate PBN type, infrastructure and navigation applications.

Applicability - Category R and S airspace of Colombo FIR. All new ATS Routes to be PBN Routes in accordance with the following specifications:
Category R airspace – RNP 2 Oceanic (other acceptable navigation specification –RNP 4);
Category S airspace – RNAV 2 or RNP 2.
Ref. 5.3.1.9

3. Application of Electronic Flight Progress Strips

Objective - To ensure safe and efficient aircraft operations.

Applicability - Colombo Area Control Center
Ref. 5.3.1.18

4. Improved traffic flow through runway sequencing - Arrival Management

Objective - To optimize sequencing for arrivals

Applicability - VCBI International Airport to be served by AMAN facility consistent with RSEQ-B0/1.

Arrival management metering and sequencing by ATC is based on inbound traffic prediction information, and decision making support, thereby allowing aircraft to fly more efficiently to the necessary fix and to reduce the use of holding stacks, especially at low altitude.

Based on inbound traffic prediction information and decision making support, ATC operational techniques (metering points, speed-control, Time-To-Gain/Time-To-Lose, etc.) will be used to sequence inbound flights at minimum separation on final approach (time or distance based) so as to optimise runway utilization.

Time-based metering (as opposed to time-based separations) is the practice of planning a sequence of traffic by time rather than distance. Typically, the relevant ATC authority will assign a time in which a flight must arrive at the aerodrome or at a specific control point, and/or advise subject flights of speed changes as required to achieve the optimal separation on final approach. Besides inbound traffic prediction information, input can include aerodrome capacity, terminal airspace capacity, aircraft capability, wind and other meteorological factors. Time-based metering is the primary mechanism in which arrival sequencing is achieved.
(RSEQ B0/1, ICAO GANP 6th Edition)

5. Improved traffic flow through runway sequencing - Departure Management

Objective - To optimize departure operations

Applicability - VCBI International Airport to be served by DMAN facility consistent with RSEQ-B0/2.

Departure management, like its arrival counterpart, serves to optimize departure operation to meet en-route and destination airport constraints along with user preferences, ensuring the most efficient utilization of ground infrastructure, aerodrome and terminal resources.

Slots assignment and adjustments will be supported by departure management automation like departure flow management. Aircraft will be sequenced, based on the ground and airspace structure, wake turbulence, aircraft capability, en-route and destination ATFM constraints, and airspace users' preferences. This will serve to increase aerodrome throughput and compliance with allotted departure time. Where Airport CDM is implemented, departure management will interface with the associated A-CDM processes (including the pre-departure sequencing of A-CDM) in determining optimal departure sequencing.
(RSEQ B0/2, ICAO GANP 6th Edition)

6. Basic ATCO tools to manage traffic during ground operations

Objective - To improve safety and efficiency during ground operations by providing proper indications to pilots and vehicle drivers.

Applicability - VCRI International Airport to operate stop bars in accordance with SURF B0/1.

Guidance and routing information will be managed by the controller to provide pilots and vehicle drivers to avoid incursion on the runway. Implementation of Stopbar operation and other visual aids will ensure safe aerodrome operations at VCRI.
(SURF B0/1, ICAO GANP 6th Edition)

7. Multi-Sector Planning

Objective - Providing support to several tactical controllers operating in different adjacent sectors with the availability of a planning controller.

Applicability - Colombo Area Control center

A Multi-Sector Area (MSA) comprises a number of traditional ATC sectors. The Multi Sector Planner is responsible for the medium-term planning of the trajectories of the aircraft that enter the Multi-Sector Area (MSA). He will ensure that the controllers of the individual sectors are never subjected to a workload that is so high that safety is jeopardised.
(FRTO-B1/6, ICAO GANP 6th Edition)

5.3.3 Implementation plan for Phase III (2028 - 2030)

1. SBAS/GBAS CAT I precision approach procedures

Objective - Introduction of SBAS and GBAS CAT I procedures for aerodromes, where ILS is not available/ precluded.

Applicability - International Aerodromes where ILS is not available or precluded.

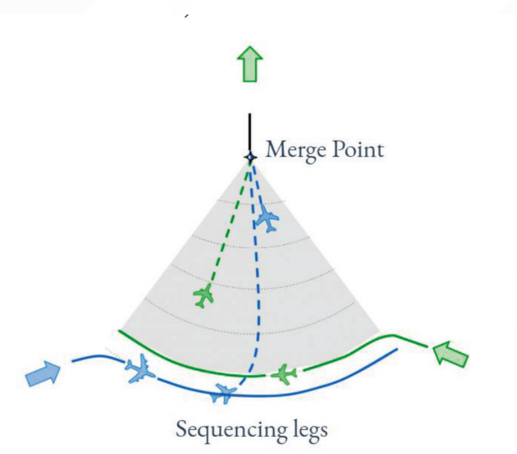
A GLS or GBAS Landing System is a Global Navigation Satellite System-dependent alternative to Instrument Landing System (ILS) which uses a single GBAS airport ground station to transmit corrected GNSS data to suitably-equipped aircraft to enable them to fly a precision approach with much greater flexibility.

The Satellite-Based Augmentation System (SBAS) is a differential technique that relies on geostationary satellites to broadcast the augmentation information (corrections and integrity-related).

2. Point merge

Objective - To allow merging of arrival flows

Applicability - En-route to terminal and aerodrome, to sequence arrivals using pre-defined legs equidistant from a point that are used for shortening or stretching the arrival path.



Point merge is a procedural concept that uses existing technology to merge arrival flows. Its purpose is to improve and harmonize arrival operations by enabling continuous descent operations (CDO) and increasing arrival predictability, thereby enhancing airport capacity and limiting the environmental impact of aircraft emissions. Point Merge is based on a specific route structure that is made of a point (the merge point) with pre-defined legs (the sequencing legs) equidistant from this point that are used for shortening or stretching the arrival path.(as shown in the figure)
(RSEQ B0/3, ICAO GANP 6th Edition)

3. Advanced FUA & management of real time airspace data

Objective - To enhance the FUA and airspace management (ASM) by collaborative airspace data sharing between all ATM stakeholders, negotiation procedures, system support and real time ASM data integration.

Applicability - Entire Colombo FIR

FUA procedures are enhanced by airspace management (ASM) data sharing between the ATM network function, ATM stakeholders, airspace users and ATC. ASM data regarding the planning and tactical management of airspace reservations are continuously exchanged and integrated in real time between the ATM systems. Continuous exchange of ASM data (pre-notification of activation, notification of activation, de-activation, modification and releases etc.) between civil and military national entities will be enhanced. (FRTO-B1/3, ICAO GANP 6th Edition)

4. Trajectory Options Set (TOS)

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

Applicability - Colombo Area Control Centre (applicable within RNP 10 airspace of VCCF)

Airspace users have the capability to develop and file a set of desired re-route options (called a Trajectory Options Set or TOS) that is the operator's preference for routing around airspace constraints. From these options, ATFM will choose the one that the operator is expected to fly. Operators have the capability to receive and process these notifications.

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

a. ATFM creates an airspace boundary and establishes flow control on any air traffic that crosses that boundary. (This is a NOPS action).

b. Airspace Users based on the notice of the airspace constraint develop and submit in advance of the issuance of the program, the TOS.

c. CTOP uses the preferred options to automatically assign delays or re-routes to flights in order to dynamically manage the demand as conditions change.
(FRTO-B1/7, ICAO GANP 6th Edition)

5.3.4 Implementation plan for Phase IV (2031 - 2033)

1. Comprehensive situational awareness of surface operations

Objective - To better maintain ATCO awareness of ground operations.

Applicability - VCBI International Airport

This provides the surveillance information (airport traffic situational awareness through the position, identification and tracking of aircraft and vehicle suitably equipped on the aerodrome surface) to the controller in order to manage the traffic in a more efficient way and allows the controller:

- to confirm the identity of all participating vehicles according to the defined identification procedures;
- to prevent collisions between all aircraft and vehicles especially in conditions when visual contact cannot be maintained;
- to manually correlate (link a target with a call sign) targets for the rare cases where there is an operational need;
- to detect and indicate the position of potential intruders.

(Note - Implementation depends on the completion of Phase II development at BIA, pre COVID -19 traffic growth rate, post COVID - 19 traffic prediction and the cost)
(SURF B0/2, ICAO GANP 6th Edition)

2. Initial ATCO alerting service for surface operations

Objective - To detect potentially unsafe situations with regard to runway operations, by the ATCO.

Applicability - VCBI International airport

The ATCO will be provided with a short term conflicting alerting tool (A-SMGCS initial alerting service) that monitors movements on or near the runway and detects conflicts between an aircraft and another vehicle as well as runway incursion by intruders. Appropriate alerts will be visualized on the ATCO display.

This is the first step of A-SMGCS alerting service and is based on A-SMGCS surveillance. It takes into account elements such as:

- the runway configuration of the airport;
- the associated procedures of the ATS authority;
- the position and type of the aircraft and vehicles (e.g. arrival, departure or vehicle) according to the set time parameters and their relative speeds and positions when within or about to enter a predefined area around the runway;
- aircraft in the vicinity of the runway (e.g. on final approach, climb out and helicopters crossing);
- Meteorological conditions.

(SURF B0/3, ICAO GANP 6th Edition)

5.4 Benefits of Implementation

Improve arrival and departure operations (APTA)	
Access and Equity	Better access to airspace by a reduction of the permanently segregated volumes.
Capacity	The availability of a greater set of routing possibilities allows reducing potential congestion on trunk routes and at busy crossing points. The flexible use of airspace gives greater possibilities to separate flights horizontally. PBN helps to reduce route spacing and aircraft separations. Reducing controller workload by flight.
Efficiency	Reduce the flight length and related fuel burn and emissions. The potential savings are a significant proportion of the ATM related inefficiencies. Reduce the number of flight diversions and cancellations. Allow avoidance of noise sensitive areas.
Environment	Fuel burn and emissions will be reduced; however, the area where emissions and contrails will be formed may be larger.
Flexibility	The various tactical functions allow rapid reaction to changing conditions.
Predictability	Improved planning allows stakeholders to anticipate on expected situations and be better prepared.
Cost	For example, early modelling of flexible routing suggests that airlines operating a 10-hour intercontinental flight can cut flight time by six minutes, reduce fuel burn by as much as 2 per cent and save 3,000 kilograms of CO_2 emissions.

Improved operations through enhanced en-route trajectories (FRTO)	
Access and Equity	Better access to airspace by a reduction of the permanently segregated volumes.
Capacity	The availability of a greater set of routing possibilities allows reducing potential congestion at busy crossing points. The flexible use of airspace gives greater possibilities to separate flights horizontally. PBN helps to reduce route spacing and aircraft separations. This in turn allows reducing controller workload by flight.
Environmental	Fuel burn and emissions will be reduced.
Flexibility	The various tactical functions allow rapid reaction to changing conditions. Mitigate the impact of adverse conditions like traffic congestion, severe weather and reduce departure delays.
Predictability	Improved planning allows to anticipate expected situations and be better prepared.

Improved access to optimum flight levels in oceanic & remote airspace (OPEL)	
Capacity	Improvement in capacity on a given air route.
Efficiency	Increased efficiency on oceanic and potentially continental en-route
Environment	Reduced emissions

Improved traffic flow through runway sequencing (RSEQ)	
Capacity	Time-based metering will optimize usage of terminal airspace and runway capacity. Optimized utilization of terminal and runway resources.
Efficiency	More orderly flows of traffic with a better view of arrival sequences. Improved containment of flown trajectories after the merge point. Better trajectory prediction, allowing for improved flight efficiency. Standardisation of operations and better airspace management.
Environment	Reduced holding and low level vectoring has a positive environmental effect in terms of noise and fuel usage.
Flexibility	By enabling dynamic scheduling.
Predictability	Decreased uncertainties in aerodrome/terminal demand prediction.
Safety	Better pilot situational awareness. Simplification of controller tasks, reduction of communications and workload.

Ground-based Safety Nets (SNET)	
Safety	Significant reduction of the number of major incidents.

Surface Operation (SURF)	
Efficiency	Potentially reduces taxi times by providing improved traffic situational awareness (especially during low visibility conditions)
Safety	Reduced runway incursions. Improved response to unsafe situations. Improved situational awareness leading to reduced ATC workload.
Environment	Reduced aircraft emissions stemming from improved efficiencies.

Part VI
Aeronautical
Information Management
(AIM)

From AIS to AIM

- a core ATM enabler

6.1 Introduction

The 36th Session of the ICAO Assembly recognized that to satisfy new requirements arising from the Global ATM Operational Concept, aeronautical information service (AIS) should transit to the broader concept of aeronautical information management.

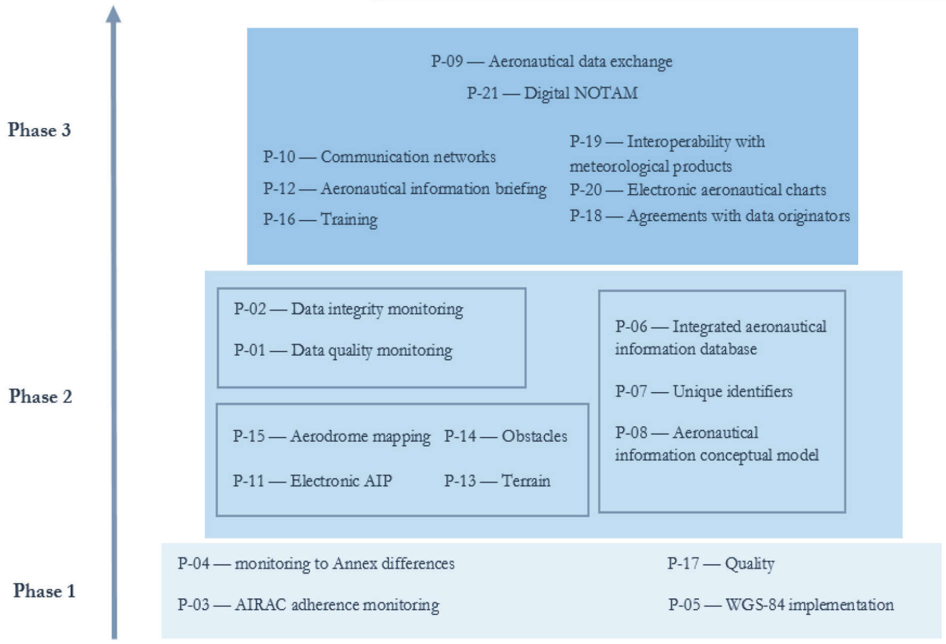
AIM is the integrated management of aeronautical information services through the provision and exchange of quality-assured digital aeronautical data. This provision and exchange of data ensures the flow of information necessary for the safety, regularity and efficiency of international air navigation.

ASBU Block 0 Module - B0-DATM Digital Aeronautical Information Management (AIM) is one of the "critical" modules identified by Asia Pacific Seamless ATM Plan as essential for Seamless ATM implementation.

AIM is one of the foundation elements that supports other aspects of ASBU, and as such requires a high priority. A key strategy activity during Block 0 may include the development of the System-Wide Information Management (SWIM) concept of operations to support the next phase of AIM development and integration within the future SWIM framework.

ATM systems should be supported by digitally-based AIM systems (using Aeronautical Information Exchange Model version 5.1 or later) through implementation of Phase 1 and 2 of the AIS-AIM Roadmap in adherence with ICAO and regional AIM planning and guidance material (ASBU Priority 1). ATM systems should be supported by complete implementation of AIM Phase 3.

The AIS to AIM transition roadmap envisages the transition from the supply of predetermined products to the management of data from which Aeronautical Information in its entirety can be extracted and subsequently customized in a variety of ways to serve future ATM needs.



AIS-AIM Roadmap

This challenge will be met by the transition to AIM. AIM will be responsible for both the content (including formats, timeliness, collection, checking, distribution, etc.) and the proper management of the data (storage, consistency between databases, interfacing with other systems, etc.).

AIM will manage data on the basis of the System Wide Information Management (SWIM) concept which is a globally all-encompassing, structured but open approach to data management. Progressive implementation of the SWIM principles in AIM is in fact AIM's evolution to IM, or Information Management that is fully SWIM based and which is the ultimate goal.

User applications are an important new element of the concept. AIM will ensure that user applications can access data immediately and from any location, including aircraft in flight or on the ground, where appropriate connectivity is available. The role of user applications is to transform data into aeronautical information, customized to the specific requirements of a given user at a given time. User applications for self-briefing, flight planning, operational control, CDM and in- flight use (e.g. Electronic Flight Bag - EFB, 4D displays for taxiing) can be envisaged among others. These applications will also be system independent, scalable and will cover the needs of a broad spectrum of aeronautical information users.

In AIM, the frontier between textual and graphical formats will dissolve. Only data of the required quality will be managed and made available, and it will be the role of the applications to select and then intelligently use and if required display information in whichever format (textual or graphical) is the most appropriate and as requested by the user.

AIM will be able to meet users' needs on several levels. It will be a significant driver of the transition also on the user side. It will offer superior data service and total flexibility for users via the user applications concept. It will also retain the ability to offer traditional AIS products to users who have yet to make the transition (AIS is one component of AIM).

AIM is a concept for managing the content of aeronautical data and the data itself, providing quality assured data to user applications for the benefit of all aviation stakeholders. Its open standards and common data exchange models will ensure platform independence and Interoperability.

Appropriate rules and procedures will need to be developed to ensure that all data sources meet the AIM requirements for data quality.

AIM will bring benefits to all parts of the ATM system by enabling the provision of aeronautical data of the required quality, accessible by all users (human as well as systems) at all times. As such, it will especially contribute to Safety, ATM performance, Flight Efficiency, Uniformity and interoperability of systems and it offers a cost effective, uniform data management environment.

6.2 Current status of AIM in Sri Lanka

Sri Lanka Aeronautical Information Services (AIS) including Aeronautical Cartography, operated by the Airport & Aviation Services (Sri Lanka) (PVT) Ltd on behalf of the Civil Aviation Authority of Sri Lanka to ensure that the flow of information necessary for the safety and efficiency of international and national air navigation, is being achieved within the area of its responsibility.

For accomplishing operational tasks, the AIS consists of following main sections,

1. AIS Headquarters
2. International NOTAM Office (NOF)
3. AIS Aerodrome briefing/ ARO Units
    - AIS Aerodrome Briefing/ ARO Unit at Katunayake/ Bandaranaike International Airport
    - AIS Aerodrome Briefing/ ARO Unit at Mattala/ Mattala Rajapaksa International Airport
    - AIS Aerodrome Briefing/ ARO Unit at Colombo International Airport - Ratmalana

4. Aeronautical Cartography
5. Aeronautical Information Quality Management
6. Training and assessment

AIS issues Aeronautical Information Publications which is provided in the form of the Integrated Aeronautical Information Product consisting of the following elements.

- Aeronautical Information Publication (AIP)
- Amendment service to the AIP (AIP AMDT)
- Supplement to the AIP (AIP SUP)
- NOTAM and Pre-flight information Bulletins (PIB)
- Aeronautical Information Circulars (AIC)
- Checklists and Lists of valid NOTAMs

AIS is responsible for the provision of aeronautical information and data on the entire territory of Sri Lanka and the areas over the high seas for which Sri Lanka is responsible for the provision of air traffic services & dissemination them timely to the aviation industry for safer operation of Aircraft.

6.3 Implementation plan

6.3.1 Implementation plan for Phase I (2022 - 2024)

Implementation phase I includes ASBU DAIM B1/1 - 7 elements to ensure the provision of quality-assured digital aeronautical data and information.

Objective - To provide improved aeronautical information based on enhanced data quality (accuracy, resolution, integrity, timeliness, traceability, completeness, and format) to support Performance - Based Navigation (PBN), airborne computer-based navigation systems and ground automation.

Digital exchange and processing of aeronautical information which allows more efficient management of information by avoiding reliance on manual processing and manipulation.

Applicability - ATM systems should be supported by digitally-based AIM systems in adherence with ICAO and regional AIM planning and guidance material. ATM systems should be supported by aeronautical information digital data exchange of at a minimum, version AIXM 5.1

1. Provision of quality-assured aeronautical data and information

Ensures that processes, procedures and systems are improved to allow for an enhanced quality of aeronautical information products and services. This element includes:

- Implementation of quality management systems to ensure that aeronautical data and information comply with the required standards.

- Use of common reference systems (spatial – WGS84 and temporal- AIRAC) to facilitate consistent interpretation of aeronautical data and information and facilitate their timely exchange.

- Full move into an automated data-centric environment so that the management, processing, verification, usage and exchange can be done in a structured, automatic manner and human intervention is reduced.

- Aeronautical data and information is of high quality if it is aggregated and provided by authoritative sources. This requires to properly control relationships along the whole data chain from the origination to the distribution to the next intended user (formal arrangements with data originators, neighbouring States, data and information service providers and others). (DAIM-B1/1, ICAO GANP 6th Edition)

2. Provision of digital Aeronautical Information Publication (AIP) data sets

Interoperable exchange of AIP data and information requires providing them in digital form and complying with digital data exchange requirements. This element consists in the replacement of existing sections of the AIP by digital AIP data sets. Therefore, this element supports the migration to a data-centric environment where aeronautical data and information (AIP) will be provided in a structured and digital form through the use of information exchange models (e.g. AIXM).
(DAIM-B1/2, ICAO GANP 6th Edition)

3. Provision of digital terrain data sets

Provision of terrain data as digital data sets. This element consists in the replacement of existing terrain data by digital terrain datasets and migrating to a data-centric environment where terrain data will be provided in a digital form and in a structured way to facilitate the easy exchange, easy integration and easy filtering of terrain data, thus increasing cost effectiveness and efficiency.
(DAIM-B1/3, ICAO GANP 6th Edition)

4. Provision of digital obstacle data sets

Provision of obstacle data as digital data sets to facilitate their exchange in a more easy to integrate and easily filtered manner, thus increasing the cost effectiveness and efficiency. This will be achieved by migrating to a data centric environment where obstacle data will be provided in a structured and digital form through the use of information exchange models (e.g. AIXM).
(DAIM-B1/4, ICAO GANP 6th Edition)

5. Provision of digital aerodrome mapping data sets

Provision of aerodrome mapping data as digital data sets in an interoperable and mutually-understood manner.
(DAIM-B1/5, ICAO GANP 6th Edition)

6. Provision of digital instrument flight procedure data sets

Provision of instrument flight procedure data as digital data sets; and, compliance with the navigation specifications, consistency in design, coding and operation of performance-based navigation (PBN) procedures to avoid differences in the aircraft behaviour in response to the coded path terminators by the use specific criteria for coding instrument flight procedures.

This element consists in the replacement of existing instrument flight procedure data by digital instrument flight procedure data sets. In addition, it includes consistent coding of procedures to match the procedure design intent and ensure more repeatable flight paths. Applying new rules for coding Instrument flight procedures will limit the number of allowable path terminators for PBN procedures in compliance with the PBN Navigation Specifications. Therefore, this element supports the migration to a data centric environment where instrument flight procedure data will be provided in a structured and digital form through the use of information exchange models (e.g. AIXM).
(DAIM-B1/6, ICAO GANP 6th Edition)

7. NOTAM improvements

Objective - To provide timely and relevant information about status and condition of the ANS infrastructure to the next intended users via NOTAM.

Applicability - ATM systems should be supported by digitally-based NOTAM consistent with DAIM-B1/7.

Identification of clear operational conditions to determine when a NOTAM shall or shall not be originated, thus ensuring that the information provided meets the needs of the users; provision of digital NOTAMs to enhance the quality of the information provided and allow the graphical representation and better filtering of information to assist operators in retrieving the relevant information.

This element includes the replacement of paper NOTAMs by a digital version through the use of information exchange models (e.g. AIXM) and refining the criteria to ensure that the users receive the right information.
(DAIM-B1/7, ICAO GANP 6th Edition)

6.3.2 Implementation of DAIM Block 2

The exchange of aeronautical information is based on service orientation in accordance with the SWIM concept.

Fully digital aeronautical information should be the standard and paper aeronautical information should have been abandoned. ANSP and all airspace users are required to continuously provide and subscribe airspace constraint alerts so that any changes to any constraint are immediately available.

Improvement in the position and time accuracy of the data - All airspace constraints have an applicability time, including static constraints. Additional aeronautical information is provided in support of network operations.

Within this timeframe a considerable amount of traffic in higher and lower airspace is flying. Traditional aeronautical information will be complemented by new information required to support operations in high airspace. A rich dynamic obstacle database is available for this environment and automated dynamic geo-fence restrictions apply.
(DAIM-B2, ICAO GANP 6th Edition)

Implementation of DAIM Block 2 (except DAIM B2/1) will be based on the APAC Regional requirements and the progress made on DAIM Block 1. This section of the SLANP will be updated before the end of Phase I.

6.3.3 Implementation plan for Phase II (2025 - 2027)

System Wide Information Management (SWIM)

Objective - To replace the current ground-ground point-to-point information exchange by an aviation intranet relying on internet technologies enabling information services to be provided to the ATM community.

1. Information service provision

Main purpose of this element is to define the requirements for an information service provider to make aviation-related information available as an information service. Once an information service is created by an information service provider, it can be discovered by the ATM community through its service overview made available via a registry. The service overview includes metadata specifying the characteristics of the provided information service including the means by which the service is accessed by the authorized users.

SWIM Information services typically apply publish/subscribe or request/reply message exchange patterns. SWIM information services facilitate integration with automation systems.

The service overview is the means for the information service provider to publicize the characteristics of an information service. Based on the service characteristics provided, potential information service consumers can evaluate whether or not to use that information service. The service overview includes, for example, a description of the information, the exchange format, the service performance, and the access rules. The service overview should be exposed preferably via a registry and available to all stakeholders, while the access to the information service may only be granted to authorize users.

An information service provider can provide information falling into one of the traditional information domains (i.e., AIM, FF-ICE, MET or surveillance), or any other information deemed appropriate.

Information service providers have to have a quality management system in place to ensure the quality of the information and the quality of the information service provided.
(SWIM-B2/1, ICAO GANP 6th Edition)

2. Information service consumption

Purpose of this element is to define the requirements for an information service consumer to discover and access aviation-related information provided via information services.

An information service consumer makes use of a registry to discover available information services. A registry contains a listing of service overviews which provide details about the information services. The information service consumer makes use of the registry's search and filter capability to identify and select the information service appropriate to their specific needs (e.g. quality of service requirements).

Once an information service is selected, assuming that the information service consumer is authorized to access it, the information service consumer obtains the access point information and implements one of the available message exchange patterns to obtain the information. The information (e.g. AIM, FF-ICE or MET) can be readily consumed by automation systems.
(SWIM-B2/2, ICAO GANP 6th Edition)

3. SWIM registry

The registry is a means to link information providers with information consumers and thereby facilitates the exchange of information. The main purpose of a registry is to enable discoverability by making available a service overview describing information services in a structured and searchable format.

The registry permits an information service provider to enter and update a service overview, has a search and filter capability, and provides controlled user access. In addition, it facilitates service lifecycle management, including versioning of an information service.
(SWIM-B2/3, ICAO GANP 6th Edition)

4. Air/Ground (A/G) SWIM for non-safety critical information

Exchange of non-safety critical information with the aircraft to improve operational awareness and efficiency.

A/G SWIM will enable airspace users, specifically flight crew, to make information available to the air navigation service provider (ANSP), including reroute preferences and air reports /airspace conditions. A/G SWIM will also allow the flight crew to have access to more information in a timely manner. In an A/G SWIM environment, the management and use of information on-board the aircraft is expanded.

A/G SWIM expands information exchange between the aircraft (including its automation systems) and ANSPs without the constraints imposed by voice communications. A/G SWIM requires flight deck applications like electronic flight bags (EFBs) or other devices to be enabled for the exchange of information. Flight deck application access to SWIM will allow the flight crew to obtain, for example, airspace constraint information and flow restrictions to assist them in re-planning their flights, provide them with information that supports negotiation with ATFM, or enable coordination of flight plan updates initiated by an airline operations center.
(SWIM-B2/4, ICAO GANP 6th Edition)

5. Dissemination of aeronautical information in a SWIM environment

Objective - Integrated AIS in a SWIM environment to support enhanced operational efficiency in decision making for all phases of flight.

This is the full integration of aeronautical information into the SWIM environment. The use of AIM SWIM services will allow the user to access relevant and mutually understood aeronautical information in an interoperable manner. This will include the ability to communicate and exchange aeronautical information and also to interpret it in a meaningful manner.

AIM-SWIM information services will support request/reply or publish/subscribe access mechanisms and will provide quality & timely information in a range of formats to best enable the optimal decision making. AIM-SWIM information services will also include web-services supporting the graphical representation of aeronautical information in a geo-referenced environment.
(DAIM-B2/1, ICAO GANP 6th Edition)

6.3.4 Implementation plan for Phase III (2028 - 2030)

1. Air/Ground SWIM for safety critical information

Objective - Exchange of safety critical information with the aircraft for improved operational awareness and efficiency.

A/G SWIM capability will be extended to address the exchange of safety critical information with the aircraft.
(SWIM-B3/1, ICAO GANP 6th Edition)

6.4 Benefits of Implementation

Digital Aeronautical Information Management (DAIM)	
Access and Equity	Greater and timelier access to up-to-date information by a wider set of users.
Efficiency	Reduced processing time for new information; increased ability of the system to create new applications through the availability of standardized data. In terms of Flight Efficiency the interaction of all elements of gate-to-gate activities will be harmonized to efficiently exploit the full capacity of airports and airspace.
Safety	Provides timely and most accurate aeronautical data. Reduced probability of data errors or inconsistencies Reduced possibility to introduce additional errors through manual inputs.
Uniformity and interoperability	AIM acts in the direction of improved uniformity and interoperability both on a regional level, and on a global scale. AIM is an essential enabler for concepts like CDM and enhanced airspace management.
Cost	AIM offers a cost effective, uniform data management environment meeting the needs of all users in an open and interoperable networked system.

System Wide Information Management (SWIM)	
AEfficiency	Operators and service providers will be allowed to plan and execute better trajectories.
Environment	Further reduction of paper usage, more cost-efficient flights as the most up - to - date information is available to all stakeholders in the ATM system.
Safety	Access protocols and data quality will be designed to reduce current limitations in these areas.
Cost	Further reduction of costs as all information can be managed consistently across the network.

PART VII
Meteorology (MET)

Meteorology

- Integration of weather data with Aeronautical Information systems

7.1 Introduction

Airport & Aviation Services (Sri Lanka) (Pvt) Ltd, the Statutory Service provider for Sri Lanka is responsible for the provision of Aeronautical Meteorological Services for domestic and International Air Navigation. The Aeronautical Meteorological services are provided by The Department of Meteorology (DOM) listed under the Ministry of Defence.

The following MET stations are engaged in providing services mainly in terms of Meteorological observations, warnings, forecasts and reports.

1. KATUNAYAKE/ Bandaranaike Intl Airport Colombo – VCBI
2. RATMALANA/ Colombo International Airport Ratmalana – VCCC
3. MATTALA / Mattala Rajapaksa Intl Airport - VCRI

Service provided,

The Meteorological Office and Meteorological Watch Office at Katunayake/ Bandaranaike Intl. Airport Colombo operates throughout the 24 hours (H24) and provides following services for Civil Aviation.

1. Meteorological services for pre-flight/current operational planning for all flights operating out of Katunayake/ Bandaranaike Intl. Airport Colombo by means of Flight documentation and/ or Displays.

2. Area meteorological watch over the Colombo FIR with the supply of meteorological information including SIGMET information to aircraft in flight through ATS radio channels.

3. Supply half hourly weather reports with trend-type landing forecasts at (H+10 UTC) for the VOLMET Broadcasts.

4. Supply of meteorological information for ATS.

   Sri Lanka adopted the Amendment 79 to ICAO Annex 3, the use of ICAO Meteorological Information Exchange Model (IWXXM) to facilitate the exchange of meteorological observations and reports (METAR/SPECI), aerodrome forecasts (TAF), SIGMETs, AIRMETs, and tropical cyclone advisory information, in a futuristic system-wide information management (SWIM)-compliant environment.

7.2 Implementation plan

7.2.1 Implementation plan for Phase I (2022 - 2024)

1.Meteorological Products Supported by Automated Decision Systems or Aids using IWXXM (AMET-B1/1 – 4)

Objective - Meteorological information to support automated decision process or aids, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support.

Applicability - To all International airports.
All aeronautical meteorological products should be supported by automated decision systems or aids using IWXXM consistent with AMET-B1/1 – 4

i. Meteorological observations information

Meteorological observation products recognized in Phase Zero of Meteorological observation information in the ASBU framework i.e. some elements of AMET-B0/1, identified as

- lightning information
- Meteorological satellite imagery
- Aircraft meteorological report (i.e. ADS-B, AIREP, AMDAR etc.)

Which have not been implemented as yet are identified for the implementation in phase 1.

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

- Wind speed and direction (aerodrome) including gusts
- Wind speed and direction from departure to Top of Climb (TOC) and then Top of Descent (TOD) to landing
- Wind speed and direction en-route
- Air temperature and dew point temperature (aerodrome)
- Air temperature and dew point temperature (or equivalent, i.e. humidity) from departure to TOC and then TOD to landing (including the following derived outputs: freezing level, lower tropospheric temperature inversions)
- Air temperature and dew point temperature (or equivalent) en-route
- Pressure (aerodrome) (i.e. QNH/QFE)
- Visibility (aerodrome) (horizontal, slant, vertical), Runway visual range (RVR)
- Cloud type (of operational significance)
- Cloud coverage, bases, tops and layers
- Thunderstorms, Lightning, Convection (TCU & CB)
- Precipitation (i.e. drizzle, rain, hail)

- Weather (i.e. funnel cloud, squall, smoke, haze, mist, fog)
- Icing, including airframe and engine
- Liquid Water Content, Iced Water Content
- Turbulence, Mountain waves, Wind shear
- Radioactive clouds, Toxic chemicals
- Tropical cyclones
- Volcanic ash
- Sulphur dioxide (SO_2) and other hazardous gases
- Aerodrome surface (runway) temperature, state
- Space weather events
- Tsunami, Flood

Characteristics of the meteorological information include:

- Time (i.e. observation time)
- Units of measurement
- Resolution (spatial)
- Geo Location (2D/3D/4D context, point, line or polyhedron)
- Movement
- Severity, Accumulation, Intensity
- Range (Max. – Min.)
- Variations
- Data sample period
- Auto or Human (Observed, Measured or Calculated)
- Amendment / Correction
- Operational Status
- Source
- Thresholds
- Format (TAC, Gridded, Graphical, IWXXM)
- Data quality flag
- Runway identification or location identifier
- Effects/impact on aviation systems (i.e. communications, navigation & surveillance systems)
- Radiation (exposure)

  (AMET-B1/1, ICAO GANP 6th Edition)

ii. Meteorological forecast and warning information

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

(AMET-B1/2, ICAO GANP 6th Edition)

iii. Climatological and historical meteorological information

Provision of climatological information, including satellite-based and in-situ climatological data, and climate change information for more locations and more frequently updated.

Provision of historical meteorological observations, forecasts, advisories and warnings in support of incident and accident investigations.
Provision of information on climate change and its impact on aviation, such as upper air wind flow changes, turbulence patterns evolutions, airport temperature and wind future evolutions, etc. to support the design and planning of flight routes and airspace management.
(AMET-B1/3, ICAO GANP 6th Edition)

iv. Dissemination of meteorological information

Sri Lanka has been disseminating Meteorological information using traditional alphanumeric code (TAC) products using Aeronautical fixed Service, earlier AFTN and subsequently AMHS.

Sri Lanka has also subscribed to Meteorological Information Satellite Distribution System (SADIS) provided on behalf of, and under the oversight of the International Civil Aviation Organization (ICAO) which provides meteorological data for international air navigation as specified in Annex 3 and as also as described in the Regional Air Navigation Plan of Asia Pacific region. SADIS delivers World Area Forecast System (WAFS) products in digital format (BUFR and GRIB), PNG chart format, and alphanumeric formats, as well as other character-orientated OpMEt information required for pre-flight planning and flight documentation. It makes data available for extraction, processing and/or visualisation by end user systems.

Sri Lanka's subscription to the SADIS system has been discontinued since 2013 due to equipment failure.

Continuation of obtaining SADIS information for the usage of producing State Meteorological products is recognized in the SLANP aligning it with ASBU element AMET-B0/4 and also for the implementation of AMET-B1/1 – 4 elements in phase 1.

AMET-B1/1 – 4 requires Meteorological information in traditional alphanumeric code (TAC) products to be replaced by the ICAO Meteorological Information Exchange Model (IWXXM) form. Human-readable products to be derived from the IWXXM information. The introduction of web services for progressive replacement of fixed line dissemination systems.

Dissemination means include aeronautical fixed service (i.e. AMHS) and via secure internet services (i.e. WIFS/SADIS). Commencement of SWIM-compliant web service capability to access the exact meteorological information required by users (in terms of geographical coverage, resolution etc.).
(AMET-B1/4, ICAO GANP 6th Edition)

7.3 Implementation plan beyond 2025

AMET Block 2 - Integrated meteorological information in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term.

AMET Block 3 - Integrated meteorological information in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic management operations.

AMET Block 4 - Integrated meteorological information supporting both air and ground decision making for all phases of flight and ATM operations, especially for implementing immediate weather mitigation strategies.

Implementation of AMET Block 2, Block 3 and Block 4 will be based on the progress of completion of Block 1 and APAC Regional requirements. Hence this section of the SLANP will be updated before the end of Phase I.

7.4 Benefits of Implementation

Capacity	Optimized use of airspace capacity.
Efficiency	Harmonized arriving air traffic (en-route to terminal area to aerodrome) and harmonized departing air traffic (aerodrome to terminal area to en-route) will translate to reduced arrival and departure holding times and thus reduced fuel burn
Environmental	Reduced fuel burn through optimized departure and arrival profiling/scheduling
Flexibility	Supports pre-tactical and tactical arrival and departure sequencing and thus dynamic air traffic scheduling.
Interoperability	Gate-to-gate seamless operations through common access to, and use of, the available WAFS (World Area Forecast Centre), IAVW and tropical cyclone watch forecast information.
Participation	Common understanding of operational constraints, capabilities and needs, based on expected (forecast) meteorological conditions.
Predictability	Decreased variance between the predicted and actual air traffic schedule. (Block time variability, flight-time error/buffer built into schedules)
Safety	Increased situational awareness and improved consistent and collaborative decision-making.

Appendix A - ICAO ASBU Elements

(GANP- 6th Edition)

Information	
AMET	Meteorological information provided to support operational efficiency and safety.
AMET-B0/1	Meteorological observations products
AMET-B0/2	Meteorological forecast and warning products
AMET-B0/3	Climatological and historical meteorological products
AMET-B0/4	Dissemination of meteorological products
AMET-B1/1	Meteorological observations information
AMET-B1/2	Meteorological forecast and warning information
AMET-B1/3	Climatological and historical meteorological information
AMET-B1/4	Dissemination of meteorological information
AMET-B2/1	Meteorological observations information
AMET-B2/2	Meteorological forecast and warning information
AMET-B2/3	Climatological and historical meteorological information
AMET-B2/4	Meteorological information service in SWIM
AMET-B3/1	Meteorological observations information
AMET-B3/2	Meteorological forecast and warning information
AMET-B3/3	Climatological and historical meteorological information
AMET-B3/4	Meteorological information service in SWIM
AMET-B4/1	Meteorological observations information
AMET-B4/2	Meteorological forecast and warning information
AMET-B4/3	Climatological and historical meteorological information
AMET-B4/4	Meteorological information service in SWIM
DAIM	Digital Aeronautical Information Management
DAIM-B1/1	Provision of quality-assured aeronautical data and information
DAIM-B1/2	Provision of digital Aeronautical Information Publication (AIP) data sets
DAIM-B1/3	Provision of digital terrain data sets
DAIM-B1/4	Provision of digital obstacle data sets
DAIM-B1/5	Provision of digital aerodrome mapping data sets
DAIM-B1/6	Provision of digital instrument flight procedure data sets
DAIM-B1/7	NOTAM improvements
DAIM-B2/1	Dissemination of aeronautical information in a SWIM environment
DAIM-B2/2	Daily Airspace Management information to support flight and flow

DAIM-B2/3	Aeronautical information to support higher airspace operations
DAIM-B2/4	Aeronautical information requirements tailored to UTM
DAIM-B2/5	NOTAM replacement
FICE	Flight and Flow Information for a Collaborative Environment (FF-ICE)
FICE-B0/1	Automated basic inter facility data exchange (AIDC)
FICE-B2/1	Planning Service
FICE-B2/2	Filing Service
FICE-B2/3	Trial Service
FICE-B2/4	Flight Data Request Service
FICE-B2/5	Notification Service
FICE-B2/6	Publication Service
FICE-B2/7	Flight information management service for higher airspace operations
FICE-B2/8	Flight information management service for low-altitude operations
FICE-B2/9	Flight information management support for inflight re-planning
FICE-B3/1	Flight information management services for enhanced trajectory operations
FICE-B4/1	Integrated flight information management system for end-to-end global flight planning
FICE-B4/2	Real-Time Participation of operators in flight information
SWIM	System Wide Information Management
SWIM-B2/1	Information service provision
SWIM-B2/2	Information service consumption
SWIM-B2/3	SWIM registry
SWIM-B2/4	Air/Ground SWIM for non-safety critical information
SWIM-B2/5	Global SWIM processes
SWIM-B3/1	Air/Ground SWIM for safety critical information

Operational	
ACAS	Airborne Collision Avoidance System (ACAS)
ACAS-B1/1	ACAS Improvements
ACAS-B2/1	New collision avoidance system
ACAS-B2/2	New collision avoidance capability as part of an overall detect and avoid system for RPAS
ACDM	Airport Collaborative Decision Making
ACDM-B0/1	Airport CDM Information Sharing (ACIS)
ACDM-B0/2	Integration with ATM Network function
ACDM-B1/1	Airport Operations Plan (AOP)
ACDM-B1/2	Airport Operations Centre (APOC)
ACDM-B2/1	Total Airport Management (TAM)
ACDM-B3/1	Full integration of ACDM and TAM in TBO
APTA	Improve arrival and departure operations
APTA-B0/1	PBN Approaches (with basic capabilities)
APTA-B0/2	PBN SID and STAR procedures (with basic capabilities)
APTA-B0/3	SBAS/GBAS CAT I precision approach procedures
APTA-B0/4	CDO (Basic)
APTA-B0/5	CCO (Basic)
APTA-B0/6	PBN Helicopter Point in Space (PinS) Operations
APTA-B0/7	Performance based aerodrome operating minima – Advanced aircraft
APTA-B0/8	Performance based aerodrome operating minima – Basic aircraft
APTA-B1/1	PBN Approaches (with advanced capabilities)
APTA-B1/2	PBN SID and STAR procedures (with advanced capabilities)
APTA-B1/3	Performance based aerodrome operating minima – Advanced aircraft with SVGS
APTA-B1/4	CDO (Advanced)
APTA-B1/5	CCO (Advanced)
APTA-B2/1	GBAS CAT II/III precision approach procedures
APTA-B2/2	Simultaneous operations to parallel runways
APTA-B2/3	PBN Helicopter Steep Approach Operations
CSEP	Cooperative Separation
CSEP-B1/1	Basic airborne situational awareness during flight operations (AIRB)
CSEP-B1/2	Visual Separation on Approach (VSA)
CSEP-B1/3	Performance Based Longitudinal Separation Minima
CSEP-B1/4	Performance Based Lateral Separation Minima
CSEP-B2/1	Interval Management (IM) Procedure

CSEP-B2/2	Cooperative separation at low altitudes
CSEP-B2/3	Cooperative separation at higher airspace
CSEP-B3/1	Interval Management (IM) Procedure with complex geometries
CSEP-B3/2	Remain Well Clear (RWC) functionality for UAS/RPAS
CSEP-B4/1	Airborne separation
FRTO	Improved operations through enhanced en-route trajectories
FRTO-B0/1	Direct routing (DCT)
FRTO-B0/2	Airspace planning and Flexible Use of Airspace (FUA)
FRTO-B0/3	Pre-validated and coordinated ATS routes to support flight and flow
FRTO-B0/4	Basic conflict detection and conformance monitoring
FRTO-B1/1	Free Route Airspace (FRA)
FRTO-B1/2	Required Navigation Performance (RNP) routes
FRTO-B1/3	Advanced Flexible Use of Airspace (FUA) and management of real time airspace data
FRTO-B1/4	Dynamic sectorization
FRTO-B1/5	Enhanced Conflict Detection Tools and Conformance Monitoring
FRTO-B1/6	Multi-Sector Planning
FRTO-B1/7	Trajectory Options Set (TOS)
FRTO-B2/1	Local components of integrated ATFM and ATC Planning function (INAP)
FRTO-B2/2	Local components of Dynamic Airspace Configurations (DAC)
FRTO-B2/3	Large Scale Cross Border Free Route Airspace (FRA)
FRTO-B2/4	Enhanced Conflict Resolution Tools
GADS	Global Aeronautical Distress and Safety System (GADSS)
GADS-B1/1	Aircraft Tracking
GADS-B1/2	Contact directory service
GADS-B2/1	Autonomous Distress Tracking
GADS-B2/2	Distress tracking information management
GADS-B2/3	Post Flight Localization
GADS-B2/4	Flight Data Recovery
NOPS	Network Operations
NOPS-B0/1	Initial integration of collaborative airspace management with air traffic flow management
NOPS-B0/2	Collaborative Network Flight Updates
NOPS-B0/3	Network Operation Planning basic features
NOPS-B0/4	Initial Airport/ATFM slots and A-CDM Network Interface
NOPS-B0/5	Dynamic ATFM slot allocation
NOPS-B1/1	Short Term ATFM measures
NOPS-B1/2	Enhanced Network Operations Planning

NOPS-B1/3	Enhanced integration of Airport operations planning with network operations planning
NOPS-B1/4	Dynamic Traffic Complexity Management
NOPS-B1/5	Full integration of airspace management with air traffic flow management
NOPS-B1/6	Initial Dynamic Airspace configurations
NOPS-B1/7	Enhanced ATFM slot swapping
NOPS-B1/8	Extended Arrival Management supported by the ATM Network function
NOPS-B1/9	Target Times for ATFM purposes
NOPS-B1/10	Collaborative Trajectory Options Program (CTOP)
NOPS-B2/1	Optimised ATM Network Services in the initial TBO context
NOPS-B2/2	Enhanced dynamic airspace configuration
NOPS-B2/3	Collaborative Network Operation Planning
NOPS-B2/4	Multi ATFM slot swapping and Airspace Users priorities
NOPS-B2/5	Further airport integration within Network Operation Planning
NOPS-B2/6	ATFM adapted for cross-border Free Route Airspace (FRA)
NOPS-B2/7	UTM Network operations
NOPS-B2/8	High upper airspace network operations
NOPS-B3/1	ATM Network Services in full TBO context
NOPS-B3/2	Cooperative Network Operations Planning
NOPS-B3/3	Innovative airspace architecture
OPFL	Improved access to optimum flight levels in oceanic and remote airspace
OPFL-B0/1	In Trail Procedure (ITP)
OPFL-B0/2	Climb and Descend Procedure (CDP)
RATS	Remote Aerodrome Air Traffic Services
RATS-B1/1	Remotely Operated Aerodrome Air Traffic Services
RSEQ	Improved traffic flow through runway sequencing
RSEQ-B0/1	Arrival Management
RSEQ-B0/2	Departure Management
RSEQ-B0/3	Point merge
RSEQ-B1/1	Extended arrival metering
RSEQ-B2/1	Integration of arrival and departure management
RSEQ-B2/2	Arrival management in terminal airspace with multiple airports
RSEQ-B3/1	Departure management in terminal airspace from multiple airports
RSEQ-B3/2	Extended arrival management supporting overlapping operations into multiple airports
RSEQ-B3/3	Increased utilization of runway capacity by improved real-time runway scheduling
RSEQ-B3/4	Improved operator fleet management in runway sequencing
SNET	Ground-based Safety Nets

SNET-B0/1	Short Term Conflict Alert (STCA)
SNET-B0/2	Minimum Safe Altitude Warning (MSAW)
SNET-B0/3	Area Proximity Warning (APW)
SNET-B0/4	Approach Path Monitoring (APM)
SNET-B1/1	Enhanced STCA with aircraft parameters
SNET-B1/2	Enhanced STCA in complex TMAs
SURF	Surface operations
SURF-B0/1	Basic ATCO tools to manage traffic during ground operations
SURF-B0/2	Comprehensive situational awareness of surface operations
SURF-B0/3	Initial ATCO alerting service for surface operations
SURF-B1/1	Advanced features using visual aids to support traffic management during ground operations
SURF-B1/2	Comprehensive pilot situational awareness on the airport surface
SURF-B1/3	Enhanced ATCO alerting service for surface operations
SURF-B1/4	Routing service to support ATCO surface operations management
SURF-B1/5	Enhanced vision systems for taxi operations
SURF-B2/1	Enhanced surface guidance for pilots and vehicle drivers
SURF-B2/2	Comprehensive vehicle driver situational awareness on the airport surface
SURF-B2/3	Conflict alerting for pilots for runway operations
SURF-B3/1	Optimization of surface traffic management in complex situations
TBO	Trajectory-based operations
TBO-B0/1	Introduction of time-based management within a flow centric approach
TBO-B1/1	Initial Integration of time-based decision making processes
TBO-B2/1	Pre-departure trajectory synchronization within a flight centric and network performance approach
TBO-B2/2	Extended time-based management across multiple FIRs for active flight synchronization
TBO-B3/1	Network based on-demand synchronization of trajectory based operations
TBO-B4/1	Total airspace management performance system
WAKE	Wake Turbulence Separation
WAKE-B2/1	Wake turbulence separation minima based on 7 aircraft groups
WAKE-B2/2	Dependent parallel approaches
WAKE-B2/3	Independent segregated parallel operations
WAKE-B2/4	Wake turbulence separation minima based on leader/follower static pairs-wise
WAKE-B2/5	Enhanced dependent parallel approaches
WAKE-B2/6	Enhanced independent segregated parallel operations
WAKE-B2/7	Time based wake separation minima for arrival based on leader/follower static pair-wise
WAKE-B2/8	Time based wake separation minima for departure based on leader/follower static pair-wise
WAKE-B3/1	Time based dependent parallel approaches

WAKE-B3/2	Time based independent segregated parallel operations
WAKE-B4/1	En-route Wake Encounter Ground based Prediction
WAKE-B4/2	En-Route Wake Encounter on-board flight management/mitigation

CNS technology and services	
ASUR	Surveillance systems
ASUR-B0/1	Automatic Dependent Surveillance – Broadcast (ADS-B)
ASUR-B0/2	Multilateration cooperative surveillance systems (MLAT)
ASUR-B0/3	Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)
ASUR-B1/1	Reception of aircraft ADS-B signals from space (SB ADS-B)
ASUR-B2/1	Evolution of ADS-B and Mode S
ASUR-B2/2	New community based surveillance system for airborne aircraft (low and higher airspace)
ASUR-B3/1	New non-cooperative surveillance system for airborne aircraft (medium altitudes)
ASUR-B4/1	Further evolution of ADS-B and MLAT
COMI	Communication infrastructure
COMI-B0/1	Aircraft Communication Addressing and Reporting System (ACARS)
COMI-B0/2	Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI)
COMI-B0/3	VHF Data Link (VDL) Mode 0/A
COMI-B0/4	VHF Data Link (VDL) Mode 2 Basic
COMI-B0/5	Satellite communications (SATCOM) Class C Data
COMI-B0/6	High Frequency Data Link (HFDL)
COMI-B0/7	ATS Message Handling System (AMHS)
COMI-B1/1	Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)
COMI-B1/2	VHF Data Link (VDL) Mode 2 Multi-Frequency
COMI-B1/3	SATCOM Class B Voice and Data
COMI-B1/4	Aeronautical Mobile Airport Communication System (AeroMACS) Ground-Ground
COMI-B2/1	Air-Ground ATN/IPS
COMI-B2/2	Aeronautical Mobile Airport Communication System (AeroMACS) aircraft mobile connection
COMI-B2/3	Links meeting requirements for non-safety critical communication
COMI-B3/1	VHF Data Link (VDL) Mode-2 Connectionless
COMI-B3/2	SATCOM Class A voice and data
COMI-B3/3	L-band Digital Aeronautical Communication System (LDACS)
COMI-B3/4	Links meeting requirements for safety critical communication
COMS	ATS Communication service
COMS-B0/1	CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace
COMS-B0/2	ADS-C (FANS 1/A) for procedural airspace

COMS-B1/1	PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace
COMS-B1/2	PBCS approved ADS-C (FANS 1/A+) for procedural airspace
COMS-B1/3	SATVOICE (incl. routine communications) for procedural airspace
COMS-B2/1	PBCS approved CPDLC (B2) for domestic and procedural airspace
COMS-B2/2	PBCS Approved ADS-C (B2) for domestic and procedural airspace
COMS-B2/3	PBCS approved SATVOICE (incl. routine communications) for procedural airspace
COMS-B3/1	Extended CPDLC (B2 incl. Adv-IM and dynamic RNP) for dense and complex airspace
COMS-B3/2	Extended ADS-C (B2 incl. Adv-IM and dynamic RNP) for dense and complex airspace
NAVS	Navigation systems
NAVS-B0/1	Ground Based Augmentation Systems (GBAS)
NAVS-B0/2	Satellite Based Augmentation Systems (SBAS)
NAVS-B0/3	Aircraft Based Augmentation Systems (ABAS)
NAVS-B0/4	Navigation Minimal Operating Networks (Nav. MON)
NAVS-B1/1	Extended GBAS
NAVS-B2/1	Dual Frequency Multi Constellation (DF MC) GBAS
NAVS-B2/2	Dual Frequency Multi Constellation (DF MC) SBAS
NAVS-B2/3	Dual Frequency Multi Constellation (DF MC) ABAS

Appendix B

APAC Regional Implementation of ASBU Elements

Cat.	Element	Description	APAC Regional Phase /Priority
Information			
AMET B0	AMET B0/1 AMET B0/2 AMET B0/3 AMET B0/4	Meteorological observations products Meteorological forecast and warning products Climatological and historical meteorological products Dissemination of meteorological products	Priority 1
AMET B1	AMET B1/1 AMET B1/2 AMET B1/3 AMET B1/4	Meteorological observations information Meteorological forecast and warning information Climatological and historical meteorological information Dissemination of meteorological information	Priority 2
PASL II	Aeronautical meteorological observations, forecast, warning, climatological and historical products (such as aerodrome meteorological forecasts and reports, aerodrome warnings and wind shear warnings) should be disseminated to users consistent with AMET-B0/1-4, and in accordance with global and regional guidance material. An agreement between the MET authority and the appropriate ATS authority should be established to ensure the appropriate exchange of meteorological information obtained from aircraft.		Phase II Priority 1
PASL III	All States should ensure that aeronautical meteorological products supported by automated decision systems or aids using IWXXM consistent with AMET-B1/1 – 4		Phase III Priority 2
DAIM B1	DAIM B1/1 DAIM B1/2 DAIM B1/3 DAIM B1-4 DAIM B1/5 DAIM B1/6	Provision of quality-assured aeronautical data and information Provision of digital Aeronautical Information Publication (AIP) data sets Provision of digital terrain data sets Provision of digital obstacle data sets Provision of digital aerodrome mapping data sets Provision of digital instrument flight procedure data sets	Priority 1
	DAIM B1/7	NOTAM improvements	Priority 2

PASL II	ATM systems should be supported by digitally-based AIM systems consistent with DAIM-B1/1 – 6, in adherence with ICAO and regional AIM planning and guidance material. ATM systems should be supported by aeronautical information digital data exchange of at a minimum, version AIXM 5.1		Priority 2 Phase II
PASL III	ATM systems should be supported by digitally-based NOTAM consistent with DAIMB1/7.		Priority 2 Phase III
FICE B0	FICE B0/1	Automated basic inter facility data exchange (AIDC)	Priority 1
PASL II	ATS systems should enable AIDC (version 3 or later), or an alternative process that achieves at least the same level of performance as AIDC, between en - route ATC units and terminal ATC units where transfers of control are conducted consistent with FICE-B0/1, unless alternate means of automated communication of ATM system track and flight plan data are employed. As far as practicable, the following AIDC messages types should be implemented: - Advanced Boundary Information (ABI); - Coordinate Estimate (EST); - Acceptance (ACP); TOC; and - Assumption of Control (AOC).		Phase II Priority 1

Operational			
ACDM B0	ACDM B0/1 ACDM B0/2	Airport CDM Information Sharing (ACIS) Integration with ATM Network function	Priority 1
PARS II	All international aerodromes should operate an A-CDM system for ACIS inte grated with the ATM network function consistent with ACDM-B0/1 – 2		Phase II Priority 1
ACDM B1	ACDM B1/1 ACDM B1/2	Airport Operations Plan (AOP) Airport Operations Centre (APOC)	Priority 2
PARS III	All international aerodromes should operate an A-CDM system integrated with the ATM network, and an AOP and where practicable an APOC consistent with ACDM-B1/1 – 2.		Phase III Priority 2
APTA B0	APTA B0/1 APTA B0/2	PBN Approaches (with basic capabilities) PBN SID and STAR procedures (with basic capabilities)	Priority 1
PARS II	Where practicable, all aerodromes should have RNAV 1 (ATS surveillance environment) or RNP 1 (ATS surveillance and non-ATS surveillance environments) SID/STAR procedures consistent with APTA-B0/2.		

	Where practicable, all instrument runways serving aeroplanes should have the following precision approach systems (or if an APV is not practical, PBN non-precision approaches) consistent with APTA-B0/1 and APTA-B0/3: (a) SBAS/GBAS precision approaches; or ILS/MLS approaches (with APV approach as a backup); or (b) Approaches with Vertical Guidance (APV), either RNP APCH with Barometric Vertical Navigation (Baro–VNAV) or augmented GNSS (e.g. SBAS); or (c) if an APV is not practical, straight-in RNP APCH with Lateral Navigation (LNAV).	Phase II Priority 1
	All Category T airspace supporting international aerodromes should be designated as non-exclusive or exclusive PBN airspace as appropriate to allow operational priority for PBN approved aircraft, except for State aircraft, to facilitate seamless operations and off-track events such as weather deviations to support APTA-B0/1 – 3 and 6.	
	All Category R and S upper controlled airspace should be designated as non-exclusive or exclusive PBN airspace as appropriate to allow operational priority for PBN approved aircraft, except for State aircraft, to facilitate seamless operations and off-track events such as weather deviations to support APTA-B0/2.	
	As far as practicable, all new ATS Routes should be PBN Routes in accordance with the following specifications to support APTA-B0/1 – 8, and APTA-B1/1 – 5: - Category R airspace – RNP 4, RNP 10 (RNAV 10) (other acceptable navigation specifications – RNP 2 oceanic); and - Category S airspace –RNAV 2 or RNP 2.	
	Where practicable, all aerodromes should have RNAV 1 (ATS surveillance environment) or RNP 1 (ATS surveillance and non-ATS surveillance environments) SID/STAR procedures consistent with APTA-B0/2.	
PARS III	As far as practicable, all new ATS Routes should be PBN Routes in accordance with the following specifications to support COMS-B0/1 – 2, COMS-B1/1 – 3, APTA-B0/1 – 8, and APTAB1/1 – 5: Category R airspace – RNP 2 Oceanic (other acceptable navigation specification – RNP 4); and Category S airspace –RNAV 2 or RNP 2.	Phase III Priority 1
APTA B0	APTA B0/3 SBAS/GBAS CAT I precision approach procedures APTA B0/6 PBN Helicopter Point in Space (PinS) Operations	Priority 3
PARS II	All international aerodromes with rotary wing operations should establish PBN arrival/departure, approach and/or en-route transiting procedures. PBN	Phase II Priority 2

	Helicopter PinS Operations should be established consistent with APTA-B0/6 where there is an operational benefit		
APTA B0	APTA B0/4 APTA B0/5 APTA B0/7 APTA B0/8	CDO (Basic) CCO (Basic) Performance based aerodrome operating minima – Advanced aircraft Performance based aerodrome operating minima – Basic aircraft	Priority 2
PARS III	All international aerodromes should implement CCO and CDO operations consistent with APTA-B0/4 – 5 where practicable, and performance-based aerodrome operating minima-advanced and basic aircraft consistent with APTA-B0/7 – 8.		Phase III Priority 2
APTA B1	APTA B1/1 APTA B1/2 APTA B1/3 APTA B1/4 APTA B1/5	PBN Approaches (with advanced capabilities) PBN SID and STAR procedures (with advanced capabilities) Performance based aerodrome operating minima – Advanced aircraft with SVGS CDO (Advanced) CCO (Advanced)	Priority 3
PARS IV	All international aerodromes should implement advanced capability PBN SID and STAR procedures and performance-based aerodrome operating minima for advanced aircraft with SVGS consistent with APTA-B1/1 – 3. Where there is an operational benefit, all international aerodromes shouldimplement Advanced CDO and CCO operations consistent with APTA-B1/4 – 5.		Phase IV Priority 3
CSEP B1	CSEP B1/1 CSEP B1/2 CSEP B1/3 CSEP B1/4	Basic airborne situational awareness during flight operations (AIRB) Visual Separation on Approach (VSA) Performance Based Longitudinal Separation Minima Performance Based Lateral Separation Minima	Priority 2
PARS III	Unless excepted by ATC, all aircraft operating within Category S and T controlled airspace should have systems that enable basic airborne situational awareness AIRB and VSA and where applicable, performance-based horizontal minima consistent with CSEP-B1/1 – 4.		Phase III Priority 2
FRTO B0	FRTO B0/1 FRTO B0/2 FRTO B0/3 FRTO B0/4	Direct routing (DCT) Airspace planning and Flexible Use of Airspace (FUA) Pre-validated and coordinated ATS routes to support flight and flow Basic conflict detection and conformance monitoring	Priority 2

PASL II	Within Category R airspace, ADS-C surveillance and CPDLC should be enabled to support PBN-based separations, as well as UPR and DARP, consistent withCOMS-B0/1 – 2 and FRTO-B0/1-4 and FRTO-B1/1 – 7. ATS surveillance systems should enable basic conflict detection and conformance monitoring STCA, MTCD, APW, APM and MSAW consistent with FRTO-B0/4 and SNET-B0/1 – 4 (Priority 1). Route Adherence Monitoring (RAM) should be utilised when monitoring PBN route separations. Cleared Level Adherence Monitoring (CLAM) should be utilised to monitor RVSM airspace. ATC units should conduct Airspace Planning and enable systems that manage direct and flexible routings where practicable, and the optimal operation of FUA consistent with FRTO-B0/1 – 4.		Phase II Priority 1
FRTO B1	FRTO B1/1 FRTO B1/2 FRTO B1/3 FRTO B1/4 FRTO B1/5 FRTO B1/6 FRTO B1/7	Free Route Airspace (FRA) Required Navigation Performance (RNP) routes Advanced Flexible Use of Airspace (FUA) and management of real time airspace data Dynamic sectorization Enhanced Conflict Detection Tools and Conformance Monitoring Multi-Sector Planning Trajectory Options Set (TOS)	Priority 2
PASL III	ACCs should enable, where practicable, Free Route Airspace, RNP routes, Advanced FUA and Airspace Management (ASM), Dynamic Sectorisation, Enhanced Conflict Detection Tools and Conformance Monitoring and Multi - Sector Planner Function consistent with FRTO-B1/1 – 7.		Phase III Priority 2
PASL II	As far as practicable, all new ATS Routes should be PBN Routes in accordance with the following specifications to support APTA-B0/1 - 8, and APTA-B1/1 - 5:Category R airspace - RNP 4, RNP 10 (RNAV 10) (other acceptable navigation specifications – RNP 2 oceanic); and Category S airspace –RNAV 2 or RNP 2.		Phase II
PASL III	As far as practicable, all new ATS Routes should be PBN Routes in accordance with the following specifications to support COMS-B0/1 – 2, COMS-B1/1 – 3, APTA-B0/1 – 8, and APTAB1/1 – 5:Category R airspace – RNP 2 Oceanic (other acceptable navigation specification - RNP 4); and Category S airspace - RNAV 2 or RNP 2.		Phase III
NOPS B0	NOPS B0/1 NOPSB0/2 NOPS B0/3 NOPS B0/4 NOPS B0/5	Initial integration of collaborative airspace management with air traffic flow management Collaborative Network Flight Updates Network Operation Planning basic features Initial Airport/ATFM slots and A-CDM Network Interface Dynamic ATFM slot allocation	Priority 1

PASL II	All ACCs operating within FIRs where demand may exceed capacity should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements, initial integration of ASM with ATFM, Collaborative Network Flight Updates, Basic Network Operation Planning and Initial Airport/ ATFM slots, A-CDM Network Interface and Dynamic Slot Allocation consistent with NOPS-B0/1 – 5.		Phase II Priority 1
NOPS B1	NOPS B1/1 NOPS B1/2 NOPS B1/3 NOPS B1/4 NOPS B1/5 NOPS B1/6 NOPS B1/7 NOPS B1/8 NOPS B1/9 NOPS B1/10	Short Term ATFM measures Enhanced Network Operations Planning Enhanced integration of Airport operations planning with network operations planning Dynamic Traffic Complexity Management Full integration of airspace management with air traffic flow management Initial Dynamic Airspace configurations Enhanced ATFM slot swapping Extended Arrival Management supported by the ATM Network function Target Times for ATFM purposes Collaborative Trajectory Options Program (CTOP)	Priority 1
PASL III	All ACCs operating within FIRs where demand may exceed capacity should operate systems that enable, where applicable, Short Term ATFM measures, Enhanced NOPS Planning, Enhanced integration of airport operations and NOPS planning, Enhanced Traffic Complexity Management, Full integration of ASM with ATFM, Initial Dynamic Airspace configurations, Enhanced ATFM slot swapping, Extended Arrival Management, ATFM Target Times and Collaborative Trajectory Options Programme consistent with NOPS-B1/1 – 10 supporting the integration of time-based management within a flow centric approach, consistent with TBO-B0/1 and TBO-B1/1.		Phase III Priority 2
OPFL B0	OPFL B0/1	In Trail Procedure (ITP)	Priority 3
OPEL B1	OPEL B1/1	Climb and Descend Procedure (CDP)	Priority 3
RATS B1	RATS B1/1	Remotely Operated Aerodrome Air Traffic Services	Priority 3
RSEQ B0	RSEQ B0/1 RSEQ B0/2	Arrival Management Departure Management	Priority 1
PASL II	All international aerodromes where ATFM facilities are required should be served by AMAN/DMAN facilities consistent with RSEQ-B0/1 – 2		Phase II Priority 1

RSEQ B0	RSEQ B0/3	Point merge	Priority 3
RSEQ B0	RSEQ B1/1	Extended arrival metering	Priority 2
PASL III	All ATC units providing services to international aerodromes should operate extended arrival metering consistent with RSEQ-B1/1.		Phase III Priority 2
SNET B0	SNET B0/1 SNET B0/2 SNET B0/3 SNET B0/4	Short Term Conflict Alert (STCA) Minimum Safe Altitude Warning (MSAW) Area Proximity Warning (APW) Approach Path Monitoring (APM)	Priority 1
PASL II	ATS surveillance systems should enable basic conflict detection and conformance monitoring STCA, MTCD, APW, APM and MSAW consistent with FRTO-B0/4 and SNET-B0/1 – 4 (Priority 1). Route Adherence Monitoring (RAM) should be utilised when monitoring PBN route separations. Cleared Level Adherence Monitoring (CLAM) should be utilised to monitor RVSM airspace.		Phase II Priority 1
SNET B1	SNET B1/1 SNET B1/2	Enhanced STCA with aircraft parameters Enhanced STCA in complex TMAs	Priority 2
PASL III	ATS surveillance systems should enable Enhanced STCA with aircraft parameters and in complex TMAs consistent with SNET-B1/1 – 2.		Phase III Priority 2
SURF B0	SURF B0/1 SURF B0/2 SURF B0/3	Basic ATCO tools to manage traffic during ground operations Comprehensive situational awareness of surface operations Initial ATCO alerting service for surface operations	Priority 2
PASL III	All ATC units providing services to international aerodromes should operate basic ATC surface operations tools, comprehensive situational awareness, situational awareness, alerting service consistent with SURF-B0/1 – 3		Phase III Priority 2
SURF B1	SURF B1/1 SURF B1/2 SURF B1/3 SURF B1/4 SURF B1/5	Advanced features using visual aids to support traffic management during ground operations Comprehensive pilot situational awareness on the airport surface Enhanced ATCO alerting service for surface operations Routing service to support ATCO surface operations management Enhanced vision systems for taxi operations	Priority 2
PASL III	All ATC units providing services to international (ICAO codes 3 and 4) aerodromes should operate advanced surface traffic management visual aids, pilot comprehensive awareness and runway alerting, enhanced ATC alerting, routing service to support ATC and enhanced vision systems (EVS) for taxiing and runway safety alerting logic consistent with SURF-B1/1 – 5.		Phase III Priority 2

TBO B0	TBO B0/1	Introduction of time-based management within a flow centric approach	Priority 2
TBO B1	TBO B1/1	Initial Integration of time-based decision making processes	Priority 2
PASL III	All ACCs operating within FIRs where demand may exceed capacity should operate systems that enable, where applicable, Short Term ATFM measures, Enhanced NOPS lanning, Enhanced integration of airport operations and NOPS planning, Enhanced Traffic Complexity Management, Full integration of ASM with ATFM, Initial Dynamic Airspace configurations, Enhanced ATFM slot swapping, Extended Arrival Management, ATFM Target Times and Collaborative Trajectory Options Programme consistent with NOPS-B1/1 – 10 supporting the integration of time-based management within a flow centric approach, consistent with TBO-B0/1 and TBO-B1/1.		Phase III Priority 2

CNS Technology and Services			
ASUR B0	ASUR B0/1 ASUR B0/2 ASUR B0/3	Automatic Dependent Surveillance – Broadcast (ADS-B) Multilateration cooperative surveillance systems (MLAT) Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)	Priority 1
PARS II	Unless supported by alternative means of ATS surveillance (such as radar, where there are no plans for ADS-B), all Category T airspace supporting international aerodromes should be designated as non-exclusive or exclusive as appropriate ADS-B airspace requiring operation of ADS-B OUT using 1090ES with DO-260/260A and 260B capability to support ASUR-B0/1.		Phase II Priority 1
ASUR B1	ASUR B1/1	Reception of aircraft ADS-B signals from space (SB ADS-B)	
PARS II	ACCs operating within Category R airspace should implement SB ADS - B consistent with ASUR-B1/1, subject to an assessment of costs and benefits.		Phase II Priority 2
COMI B0	COMI B0/1 COMI B0/2 COMI B0/4 COMI B0/5 COMI B0/6	Aircraft Communication Addressing and Reporting System (ACARS) Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI) VHF Data Link (VDL) Mode 2 Basic Satellite communications (SATCOM) Class C Data High Frequency Data Link (HFDL)	Priority 2

PASL III	All ATC units should be equipped with or be able to interface with communication systems appropriate to support the service provided, consistent with: a) COMI-B0/1 – 2, 4 – 6 including ACARS, ATN/OSI, VDL Mode 2 Basic, SATCOM Class C Data, and HFDL; and b) COMI-B1/1 – 4, including VDL Mode 2 Multi-Frequency, SATCOM Class B (SBS) Voice and Data, ATN/IPS and AeroMACS Ground-Ground; and c) COMS-B0/1 – 2, including CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace and ADS-C (FANS 1/A) for procedural airspace; and d) COMS-B1/1 – 3, including PBCS approved CPDLC (FANS 1/A+), ADS-C and SATVOICE for domestic and procedural airspace.		Phase III Priority 2
COMI B0	COMI B0/3 COMI B0/7	VHF Data Link (VDL) Mode 0/A ATS Message Handling System (AMHS)	Priority 1
PASL II	Where applicable, all ATC Sectors should be supported by VDL Mode O/A and AMHS communication systems consistent with COMI-B0/3, 7		Phase II Priority 1
COMI B1	COMI B1/1 COMI B1/2 COMI B1/3 COMI B1/4	Ground-Ground Aeronautical Telecommunication Network/ Internet Protocol Suite (ATN/IPS) VHF Data Link (VDL) Mode 2 Multi-Frequency SATCOM Class B Voice and Data Aeronautical Mobile Airport Communication System (AeroMACS) Ground-Ground	Priority 2
PASL III	All ATC units should be equipped with or be able to interface with communication systems appropriate to support the service provided, consistent with: (a) COMI-B0/1 – 2, 4 – 6 including ACARS, ATN/OSI, VDL Mode 2 Basic, SATCOM Class C Data, and HFDL; and (b) COMI-B1/1 – 4, including VDL Mode 2 Multi-Frequency, SATCOM Class B (SBS) Voice and Data, ATN/IPS and AeroMACS Ground-Ground; and (c) COMS-B0/1 – 2, including CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace and ADS-C (FANS 1/A) for procedural airspace; and (d) COMS-B1/1 – 3, including PBCS approved CPDLC (FANS 1/A+), ADS-C and SATVOICE for domestic and procedural airspace.		Phase III Priority 2
COMS B0	COMS B0/1 COMS B0/2	CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace ADS-C (FANS 1/A) for procedural airspace	Priority 2
PARS II	As far as practicable, all new ATS Routes should be PBN Routes in accordance with the following specifications to support APTA-B0/1 - 8, and APTA-B1/1-5: Category R airspace – RNP 4, RNP 10 (RNAV 10) (other acceptable navigationspecifications – RNP 2 oceanic); and Category S airspace –RNAV 2 or RNP 2.		Phase II Priority 2

PASL II	Within Category R airspace, ADS-C surveillance and CPDLC should be enabled to support PBN-based separations, as well as UPR and DARP, consistent with COMS-B0/1 – 2 and FRTO-B0/1-4 and FRTO-B1/1 – 7.		Phase II Priority 2
COMS B1	COMS B1/1 COMS B1/2 COMS B1/3	PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace PBCS approved ADS-C (FANS 1/A+) for procedural airspace SATVOICE (incl. routine communications) for procedural airspace	Priority 2
PASL III	All ATC units should be equipped with or be able to interface with communication systems appropriate to support the service provided, consistent with: (a) COMI-B0/1 – 2, 4 – 6 including ACARS, ATN/OSI, VDL Mode 2 Basic, SATCOM Class C Data, and HFDL; and (b) COMI-B1/1 – 4, including VDL Mode 2 Multi-Frequency, SATCOM Class B (SBS) Voice and Data, ATN/IPS and AeroMACS Ground-Ground; and (c) COMS-B0/1 – 2, including CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace and ADS-C (FANS 1/A) for procedural airspace; and (d) COMS-B1/1 – 3, including PBCS approved CPDLC (FANS 1/A+), ADS-C and SATVOICE for domestic and procedural airspace.		Phase III Priority 2
NAVS B0	NAVS B0/1 NAVS B0/2 NAVS B0/3 NAVS B0/4	Ground Based Augmentation Systems (GBAS) Satellite Based Augmentation Systems (SBAS) Aircraft Based Augmentation Systems (ABAS) Navigation Minimal Operating Networks (Nav. MON)	Priority 2
PARS II	SBAS, GBAS, ABAS and MON systems should be established as appropriate to the level and type of aircraft operations and the operating environment consistent with NAVS-B0/1 - 4, subject to an assessment of benefits and costs.		Phase II Priority 2
NAVS B1	NAVS B1/1	Extended GBAS	Priority 3

Appendix C
APAC Regional Implementation Elements

Category	Regional Seamless ANS Element	Phase/ Priority
	Operational	
PARS	**Aerodrome management and coordination -** All international aerodromes should enable, in accordance with an Airport Master Plan, aerodrome management and coordination services: (a) when traffic density requires, an appropriate apron management service to regulate aircraft operations in coordination with ATS; (b) ATS coordination (including meetings and agreements) related to: airport development and maintenance planning; local authority coordination (environmental, noise abatement, and obstacles); (c) Regular airport capacity analysis, which included a detailed assessment of passenger, airport gate, apron, taxiway and runway capacity.	Phase II Priori 2
PARS	**Optimization of runway capacity facilities -** Where practicable, all international aerodromes should provide, in accordance with an Airport Master Plan, the following facilities to optimise runway capacity: (a) additional runway(s) with adequate separation between runway centerlines for parallel independent operations; (b) parallel taxiways, rapid exit taxiways at optimal locations to minimize runway occupancy times and entry/exit taxiways; (c) rapid exit taxiway indicator lights (distance to go information to the nearest rapid exit taxiway on the runway); (d) twin parallel taxiways to separate arrivals and departures; (e) perimeter taxiways to avoid runway crossings; (f) taxiway centerline lighting systems; (g) adequate manoeuvring area signage (to expedite aircraft movement); (h) holding bays; (i) additional apron space in contact stands for quick turnarounds; (j) short length or tailored runways to segregate low speed aircraft; (k) taxi bots or towing systems, preferably controlled by pilots, to ensure efficiency and the optimal fuel loading for departure; and (l) Advanced visual docking guidance systems.	Phase II Priori 3
PARS	**ADS - B, SSR Mode S and PBN Airspace** **ADS - B -** Unless supported by alternative means of ATS surveillance (such as radar, where there are no plans for ADS-B), all Category T airspace supporting international aerodromes should be designated as non-	

	exclusive or exclusive as appropriate ADS-B airspace requiring operation of ADS-B OUT using 1090ES with DO-260/260A and 260B capability to support ASUR-B0/1 **SSR Mode S** - All Category T airspace supporting international aerodromes should require the carriage of an operable mode S transponder within airspace where Mode S radar services are provided to support ASUR-B0/3. **PBN Airspace** - All Category T airspace supporting international aerodromes should be designated as non - exclusive or exclusive PBN airspace as appropriate to allow operational priority for PBN approved aircraft, except for State aircraft, to facilitate seamless operations and off-track events such as weather deviations to support APTA-B0/1 – 3 and 6.	Phase II Priority 2
PARS	**Flight Level Orientation Scheme (FLOS)** - All States should use the ICAO Table of Cruising Levels (FLOS) based on feet as contained in Annex 2 Appendix 3a.	Phase II Priority 2
PARS	**Civil-Military SUA management** - Civil-Military Airspace expectations are as follows: (a) SUA should only be established after due consideration of its effect on civil air traffic by the appropriate Airspace Authority to ensure it will be: - used for the purpose that it is established; - used regularly; - as small as possible, including any internal buffers, required to contain the activity therein; - if applicable, operated in accordance with FUA principles; and ctivated only when it is being utilised; and (b) SUA should be regularly reviewed to ensure the activities that affect the airspace, and size and timing of such activity are accurately reflected by the SUA type, dimensions, activation notice and duration of activation.	Phase II Priority 1
PARS	**Unmanned Aircraft Systems -** States should implement regulations supporting the integration of UAS operations in non-segregated airspace, using a risk-based approach and in accordance with the Asia/Pacific Regional Guidance for the Regulation of UAS, as a minimum.	Phase II Priority 2
PASL	**Adjacent ATS sector coordination -** All ATS sectors providing ATS surveillance in adjacent airspace should have direct speech circuits or digital voice communications, meeting pre-established safety and performance requirements, and where practicable, automated hand-off procedures that allow the TOC of aircraft without the necessity for voice communications, unless an aircraft requires special handling.	Phase II Priority 2

PASL	**Airspace classification -** Controlled airspace classification should be onsistent with Annex 11 Appendix 4 and applied as follows: (a) Category R upper controlled airspace– Class A; and (b) Category S upper controlled airspace– Class A, or if there are high level general aviation or military VFR operations: Class B or C; and (c) Category S lower controlled airspace- Class C, D or E airspace, as determined by safety assessments.	Phase II Priority 2
PASL	**ATC horizontal separation -** All ATC units should authorise the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable, taking into account such factors as: (a) the automation of the ATM system, including automated hand-off between sectors; (b) the capability of the ATC communications system; (c) the performance of the ATS surveillance system, including data - sharing or overlapping coverage at TOC points; and (d) Ensuring the competency of air traffic controllers to apply the full tactical capability of ATS surveillance systems.	Phase II Priority 2
PASL	**Flight Level Allocation Schemes (FLAS) -** Priority for FLAS level allocations should be given to higher density ATS routes over lower density ATS routes. FLAS should comply with Annex 2, Appendix 3a unless part of an OTS. FLAS other than OTS should only be utilised for safety and efficiency reasons within: a) Category R airspace with the agreement of all ANSPs that provide services: within the airspace concerned; and within adjacent airspace which is affected by the FLAS; or b) Category S airspace with the agreement of all ANSPs that provide services: where crossing track conflictions occur within 50NM of the FIRB; and ATS surveillance coverage does not overlap the FIRB concerned, or ATS surveillance data is not exchanged between the ATC units concerned.	Phase II Priority 2
PASL	**ATC sector capacity -** All ATC Sectors should have a nominal aircraft capacity figure based on a scientific capacity study and safety assessment, to ensure safe and efficient aircraft operations.	Phase II Priority 2
PASL	**Electronic Flight Progress Strips -** ATC systems should utilise electronic flight progress strips wherever automation systems allow the capability due to efficiency and transcription error/data mismatch issues.	Phase II Priority 2
PASL	**Enhanced SAR systems -** An appropriate enhanced SAR system and systems to support aircraft tracking capability should be established consistent with the provisions of Annex 12 and to support GADS-B1/1- 2, and in accordance with the Asia/Pacific SAR Plan.	Phase II Priority 1

PASL	**ANSP human and simulator performance -** The following systems should be established to support human performance in the delivery of a Seamless ANS service. The systems should consider all the elements of the SHEL Model (Software, Hardware, Environment and Liveware - humans), in accordance with the ICAO Human Factors Digest No. 1 and related reference material: (a) human performance training for all managers of operational air navigation services (such as aerodrome operators, ATC organisations and aeronautical telecommunications), such training to include the importance of: - a proactive organisational culture where managers and operational staff are informed and safety is a first priority, using open communications and an effective team management approach; - assessment and management of risks by safety review and assessment teams comprising multidisciplinary operational staff and managers which review safety performance and assess significant proposals for change to ATM systems, particularly those related to human capabilities and limitations; - human factors in air safety investigation; system design (ergonomics, human-in-the-loop); effective training (including the improved application of simulators); fatigue management; automated safety nets; and o contingency planning; - effective safety reporting systems that- are non-punitive, supporting a 'Just Culture'; promote open reporting to management; and Focus on preventive (systemic), not corrective (individual) actions in response to safety concerns, incidents and accidents. (b) human performance-based training and procedures for operational staff providing ATS, including: - the application of tactical, surveillance-based ATC separation; - control techniques near minimum ATC separation; and - Responses to ATM contingency operations, irregular/abnormal operations and safety net alerts. (c) human performance-based training and procedures for staff providing operational air navigation services (such as aerodrome staff operating 'airside', air traffic controllers and aeronautical telecommunications technicians) regarding the importance of: - an effective safety reporting culture; and - 'Just Culture'	Phase II Priority 1

PASL	**Civil-Military strategic and tactical coordination**	Priority 1
	Civil-Military common procedures and training	Priority 2
	Civil-Military ATM expectations are as follows: (a) a national Civil-Military body should be formed to coordinate strategic civil-military activities (military training should be conducted in locations and/or at times that do not adversely affect civilian operations, particularly those associated with major aerodromes); (b) formal civil-military liaison should take place for tactical responses by encouraging military participation at civil ATM meetings and within ATC Centres; (c) integration of civil and military ATM systems using joint procurement, and sharing of ATS surveillance data (especially from ADS-B systems) should be provided as far as practicable; (d) joint provision of Civil-Military navigation aids and aerodromes; (e) common training should be conducted between civil and military ATM units in areas of common interest; and (f) Civil and military ATM units should utilize common procedures as far as practicable.	Phase II
PASL	**Ballistic launches/space re-entry management -** All States with organisations that conduct ballistic launch or space re-entry activities should ensure: (a) the development of written coordination agreements between the State civil aviation authority and the launch/re-entry agency concerned; (b) that strategic coordination is conducted between the State civil aviation authority and any States affected by the launch/re-entry activity at least 14 days prior to the proposed activity, providing notice of at least: (i) three days for the defined launch window; and (ii) 24 hours for the actual planned launch timing; (c) that consideration of affected airspace users and ANSPs is made after consultation, so that the size of the airspace affected is minimized and the launch window is optimized for the least possible disruption to other users ; and (d) that communication is established with affected ANSPs to provide accurate and timely information on the launch/re-entry activity to manage tactical responses (for example, emergencies and activity completion)	Phase II Priority1

	CNS Technology and Services	
PASL	**ATS surveillance data sharing -** Subject to appropriate filtering, ATS surveillance data, particularly from ADS-B, should be shared with neighbouring ATC units to support ASUR-B0/1 – 2.	Phase II Priority 2
PASL	**Civil-Military integrated systems and facilities -** Civil-Military ATM expectations are as follows: (a) a national Civil-Military body should be formed to coordinatestrategic civil-military activities (military training should be conducted in locations and/or at times that do not adversely affect civilian operations, particularly those associated with major aerodromes); (b) formal civil-military liaison should take place for tactical responses by encouraging military participation at civil ATM meetings and within ATC Centres; (c) integration of civil and military ATM systems using joint procurement, and sharing of ATS surveillance data (especially from ADS-B systems) should be provided as far aspracticable; (d) joint provision of Civil-Military navigation aids and aerodromes; (e) common training should be conducted between civil and military ATM units in areas of common interest; and (f) Civil and military ATM units should utilize common procedures as far as practicable.	Phase II Priority 2
PASL	**Departure Clearance (DCL) -** All ATM systems serving international aerodromes should implement Data-link Departure Clearance (DCL) compliant with EUROCAE WG78/RTCA SC 214 standards.	Phase II Priority 2

Sri Lanka Air Navigation Plan
Version 1.0