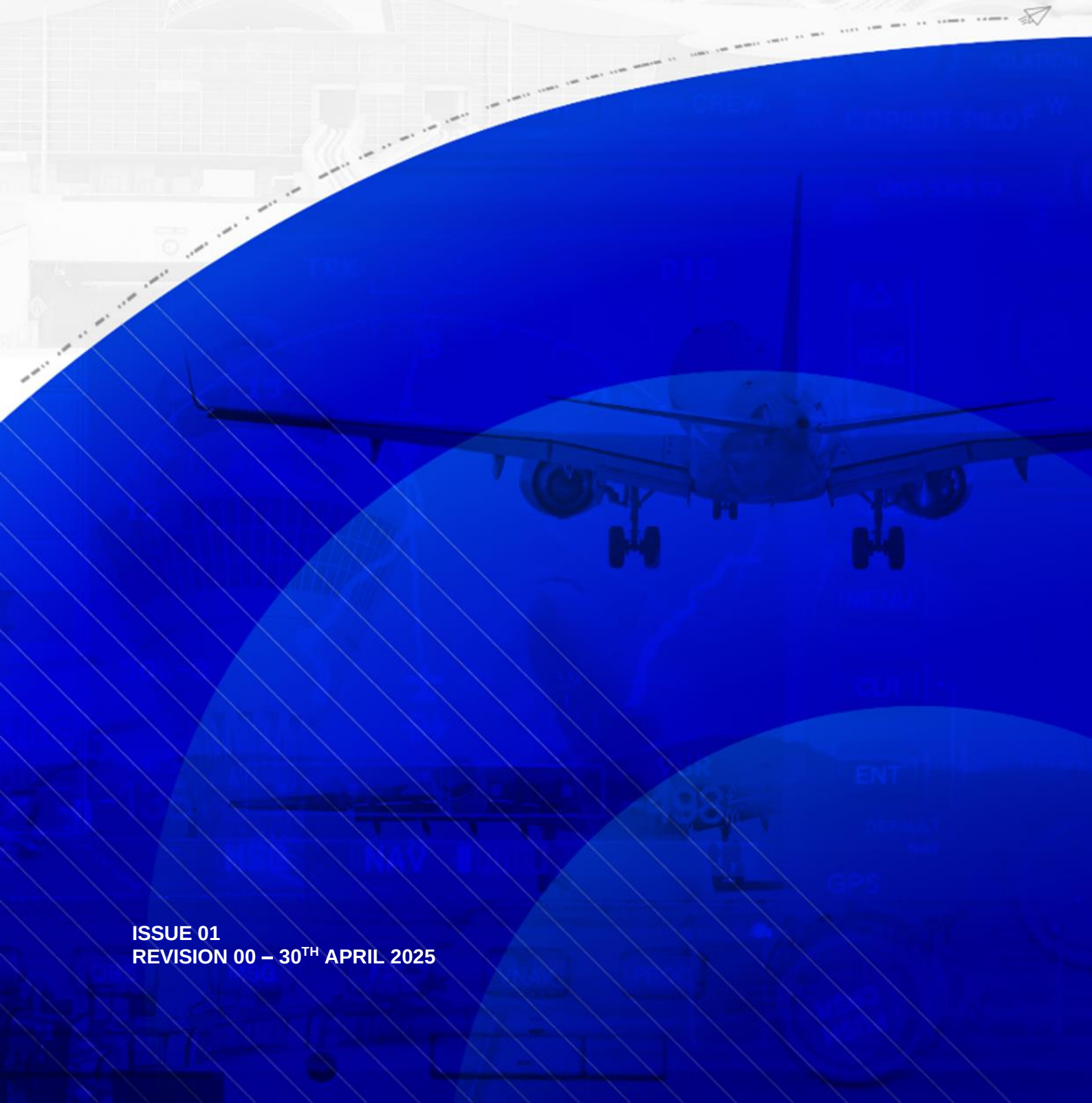
AIR NAVIGATION SERVICES IMPLEMENTATION PLAN – 2

IMPLEMENTATION OF FREE-ROUTE OPERATION (FRTO) IN KUALA LUMPUR FIR AND KOTA KINABALU FIR FRAMEWORK

CIVIL AVIATION AUTHORITY OF MALAYSIA



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Introduction

This "Implementation of Free-Route Operation (FRTO) in Kuala Lumpur FIR and Kota Kinabalu FIR Framework" document presents a detailed implementation plan designed to facilitate the integration of FRTO within the Kuala Lumpur (KL) and Kota Kinabalu (KK) Flight Information Regions (FIR).

This framework outlines essential guidelines and procedures necessary for executing FRTO effectively, ensuring that such implementation is in accordance with the standards set forth by the Aviation System Block Upgrades (ASBU). These standards are part of the broader Global Air Navigation Plan (GANP), which aims to enhance the efficiency and safety of air navigation systems globally.

This document is specifically devised to align with the Asia-Pacific (APAC) Seamless Air Navigation Services (ANS) Plan, a strategic framework aimed at enhancing aviation safety and efficiency across the Asia-Pacific region, which has identified FRTO as a critical priority.

This document serves as a comprehensive guide for the implementation plan, outlining key objectives and strategies. It will be updated regularly to reflect changes in organisational, national and regional contexts, ensuring that it remains relevant and effective.

This document remains the responsibility of ANSTED. Amendments, if any, will be integrated into the relevant sections of the document at the earliest possible opportunity.

(Dato' Captain Norazman Bin Mahmud)
Chief Executive Officer
Civil Aviation Authority of Malaysia

Record of Revisions

Revisions to this ANSIP 2 - FRTO shall be made by authorised personnel only. After inserting the revision, enter the required data in the revision sheet below. The “Initials” must be signed off by the personnel responsible for the change.

Iss/Rev No.	Revision Date	Revision Details	Initials

Summary of Changes

Iss/Rev No.	Item No.	Revision Details

1 General

1.1 Introduction

1.1.1 The International Civil Aviation Organization (ICAO) has developed a comprehensive strategy to achieve carbon-neutral growth from 2020 onwards. This strategic framework encompasses the implementation of a "basket of measures" consisting of technical, operational, and infrastructure enhancements, the promotion of sustainable alternative fuels, the establishment of a CO^2 standard for aircraft, and the development of a global market-based measure known as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

1.1.2 The Aviation System Block Upgrades (ASBU) framework was developed under the Global Air Navigation Plan (GANP) to create a roadmap for implementing essential Air Traffic Management (ATM) operational concepts. It aims to ensure global interoperability and harmonise regional air traffic management improvement programs while maximising safety, capacity, efficiency, and environmental benefits.

1.1.3 The APAC Seamless Air Navigation Services (ANS) Plan underscores the significance of ATM modernisation and initiatives in addressing the escalating traffic volume and complexity. The Plan delineates priorities pertaining to operational enhancements for fostering seamless ANS, with Free Route Operations (FRTO) B0/1-4 identified as “Priority 1”.

1.1.4 The development of this CONOPS took reference from ICAO documentation such as Annex 11, PANS-ATM (Doc 4444), GANP documents, APAC Seamless ANS Plan, and EUROCONTROL European Route Network Improvement Plan (ERNIP) - Part 1: European Airspace Design Methodology – Guidelines.

1.1.5 Prior to the implementation, comprehensive safety risk assessments and tailored implementation plans will be conducted to address each stage of the process.

1.2 Definition

AMET is the “Aeronautical Meteorological Information” provided to support operational efficiency and safety and is an element under the Information Thread of Aviation System Block Upgrades (ASBU).

APTA is the “Improve arrival and departure operations” and is an element under the Operational Thread of Aviation System Block Upgrades (ASBU).

Cross-Border Area (CBA) is a portion of airspace subject to reservation, established for specific operational requirements over international borders.

Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is the first global market-based measure for any sector and represents a cooperative approach that moves away from a “patchwork” of national or regional regulatory initiatives. It offers a harmonized way to reduce emissions from international aviation,

minimizing market distortion while respecting the special circumstances and respective capabilities of ICAO Member States.

Digital Aeronautical Information Management (DAIM) is Aeronautical Information Service that focuses on making available the following products: Aeronautical Information publication (AIP), Aeronautical Information Circular (AIC), Aeronautical charts, AIP supplements and NOTAMs. It is an element under the Information Thread of Aviation System Block Upgrades (ASBU)

European Route Network Improvement Plan (ERNIP) is a document by EUROCONTROL that provides general principles, detailed technical specifications and methods of application for a common airspace design and airspace change process in Europe.

Flight and Flow Information for a Collaborative Environment (FICE) is a systematic collaboration or negotiation procedure between operators and ATM, which facilitates the determination of an optimal route and trajectory

SNET is Ground Based Safety Nets and an integral part of the ATM system using primarily ATS surveillance data with warning times of up to two minutes. SNET goal is collision avoidance, or the avoidance of collision with terrain or obstacles, or to warn the controllers of the unauthorized penetration of an airspace. is an element under the Operational Thread of Aviation System Block Upgrades (ASBU)

Special Use of Airspace (SUA) is a generic term used for airspace volumes designated for specific operations, such as military training, exercises and operations, of a nature such that required limitations on airspace access may be imposed on other aircraft not participating in those activities.

Temporary Reserved Area (TRA) is an airspace that is temporarily reserved and allocated for the specific use of a particular user during a determined period of time and through which other traffic may or may not be allowed to transit under air traffic control clearance.

Temporary Segregated Airspace (TSA) is a temporarily reserved airspace that is exclusively used by a specific user during a set period, and no other flights are allowed to pass through.

1.3 Acronyms and Abbreviation

AIP = Aeronautical Information Publication

APAC = Asia and Pacific

ASBU = Aviation System Block Upgrades

ASM = Air Space Management

ATC = Air Traffic Control

ATCO = Air Traffic Control Officer

ATM = Air Traffic management

ATS = Air Traffic Services

CAAM = Civil Aviation Authority Malaysia

CAD = Civil Aviation Directives

CCO	= Continuous climb operations
CDO	= Continuous descent operations
CDR	= Coded Departure Routes
DCT	= Direct Routings
DRO	= Direct Route Operation
FIR	= Flight Information Regions
FRTO	= Free Route Operations
FUA	= Flexible Use of Airspace
GANP	= Global Air Navigation Plan
ICAO	= International Civil Aviation Organization
MONA	= Monitoring Aids
MTCD	= Medium Term Conflict Detection Tool
NOPS	= Network Operations
NOTAM	= Notice to Airmen
PBN	= Performance-Based Navigation
PR	= Playbook Routes
RNAV	= Area Navigation
RNP	= Required Navigation Performance
RPA	= Remotely Piloted Aircraft
UA	= Unmanned Aircraft
UPR	= User-Preferred Route
UTC	= Coordinated Universal Time

2 Free Route Operation (FRTO) Framework

2.1 FRTO concept is designed to optimise flight efficiency, with the goal of improving the aviation sector's operational efficiency, capacity, and environmental impact. By providing operational flexibility and empowering airspace users to select their preferred routes, this concept creates opportunities for advancements in airspace design and ATM concepts. FRTO concept also would facilitate closer civil-military cooperation through the flexible utilisation of airspace.

2.2 FRTO Framework are as follows:

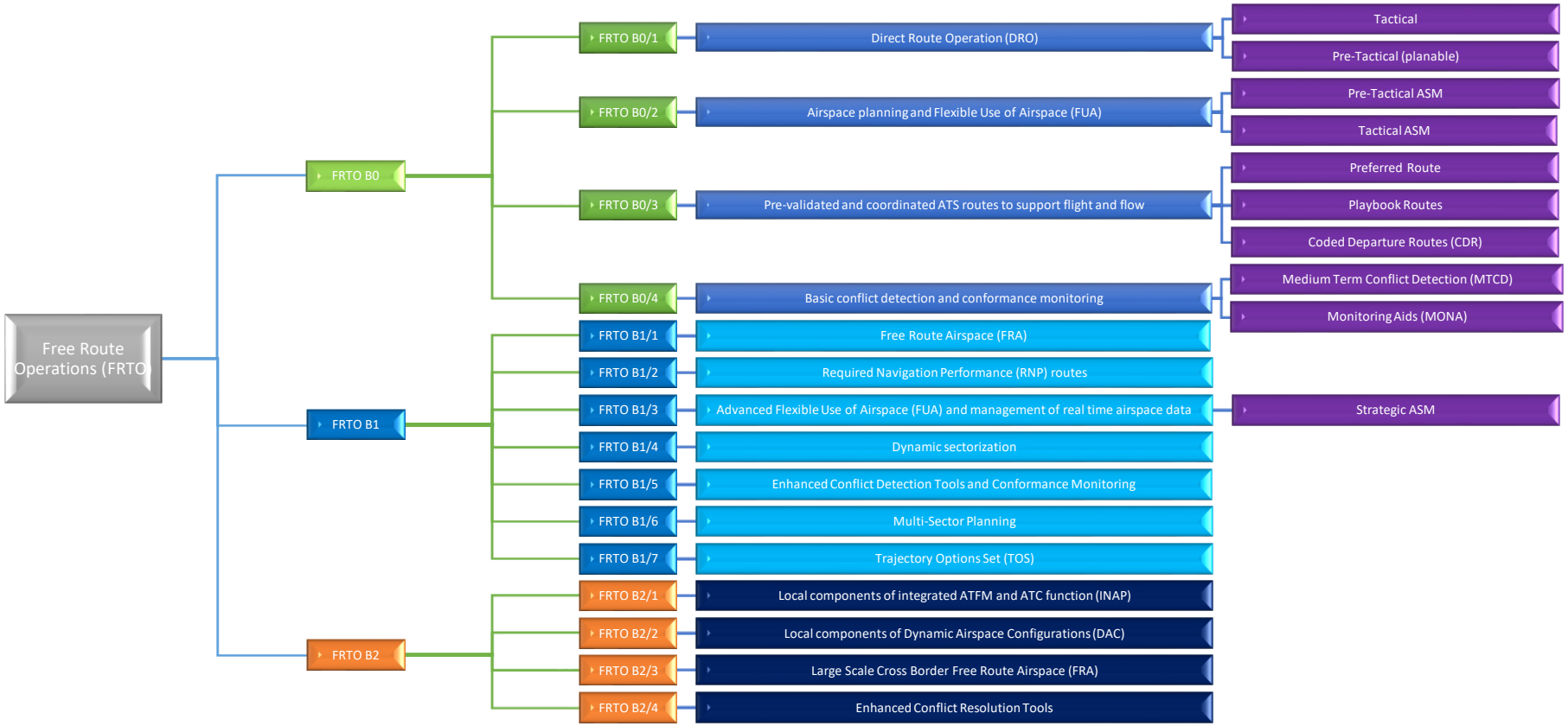

Figure 2-1. FRTO Framework

3 Malaysia's Current Status and Progress

3.1 Recognising the significance of underscores in FRTO B0/1-4 is vital, as these particular components have been earmarked as "Priority 1". Malaysia is dedicated to advancing the completion of this crucial task. To date, Malaysia has partially completed a few components from Block 0.

3.2 Block 0

a) FRTO B0/1 (Direct Route Operation - DRO):

1) Direct routings are established with the aim of providing airspace users with additional flight planning route options on a larger scale across Flight Information Regions (FIRs) such that overall planned leg distances are reduced in comparison with the fixed route network.

2) While the application of direct routing for traffic resolution and track shortening is commonly practised by Air Traffic Control Officers (ATCO) during daily operations, there were no pre-tactical/strategic arrangements designed and recorded for statistical purposes.

b) FRTO B0/2 (Airspace planning and Flexible Use of Airspace (FUA):

1) Flexible Use of Airspace (FUA) is a conceptual framework wherein the traditional demarcation of airspace into "civil" or "military" categories is replaced by a unified continuum. Allocation of airspace is based on the specific requirements of users, with any necessary segregation being temporary and dictated by real-time usage within specific time periods.

2) Currently, the FUA concept used in Malaysian airspace is Pre-tactical Air Space Management (ASM) and Tactical ASM, which is mainly used to cater to airspace activities consisting of unmanned aircraft (UA) or remotely piloted aircraft (RPA), military and sports aviation activities.

c) FRTO B0/4 (Basic conflict detection and conformance monitoring):

1) This element aims to decrease the workload of ATCO by implementing early and systematic conflict detection and conformance monitoring.

2) Medium Term Conflict Detection Tool (MTCD) serves as a basic conflict detection tool and conformance monitoring warning, while the monitoring aids (MONA) function is to provide the controller with warnings if the aircraft deviates from a clearance or planned trajectory.

3) These two functions are available for use in the Controller Working Position (CWP)

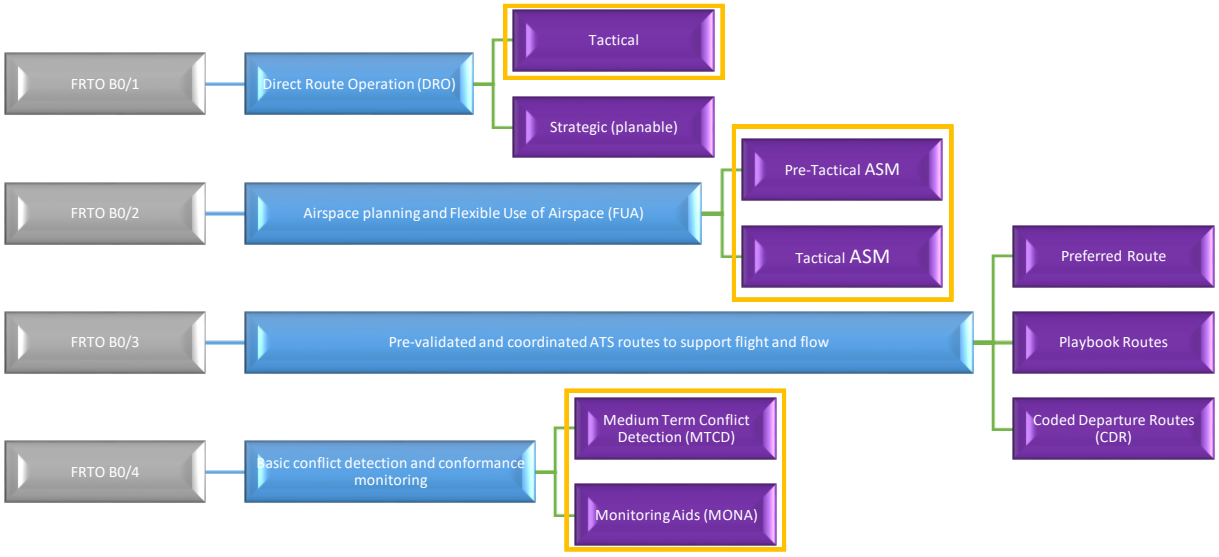

Figure 3-1. Block 0 Framework

3.3 Block 1

a) FRTO B1/2 – Required Navigation Performance (RNP) routes

1) Despite the incomplete implementation of Block 0 elements, transition of enroute airspace from conventional ATS route to PBN routes is ongoing. This implementation and enhancements, focusing on two FIRs - Kuala Lumpur and Kota Kinabalu, indicate that Malaysia has commenced the initial phase of airspace enhancement. This strategic initiative aims to accommodate the anticipated increase in air traffic and passenger movement

2) In the Kuala Lumpur FIR, a total of 85 ATS routes are operational, comprising 49 Performance-Based Navigation (PBN) routes that have been successfully implemented. The remaining 36 routes are conventional and are designated to accommodate conventional aircraft operations, including those of the Malaysia Flying Academy for navigation flying activities.

3) Within the Kota Kinabalu FIR, there are a total of 45 ATS routes. Among these, 15 PBN routes have been established, while the remaining routes serve conventional aircraft operations. This allocation aligns with the overarching objective of facilitating conventional aircraft operations within the region.

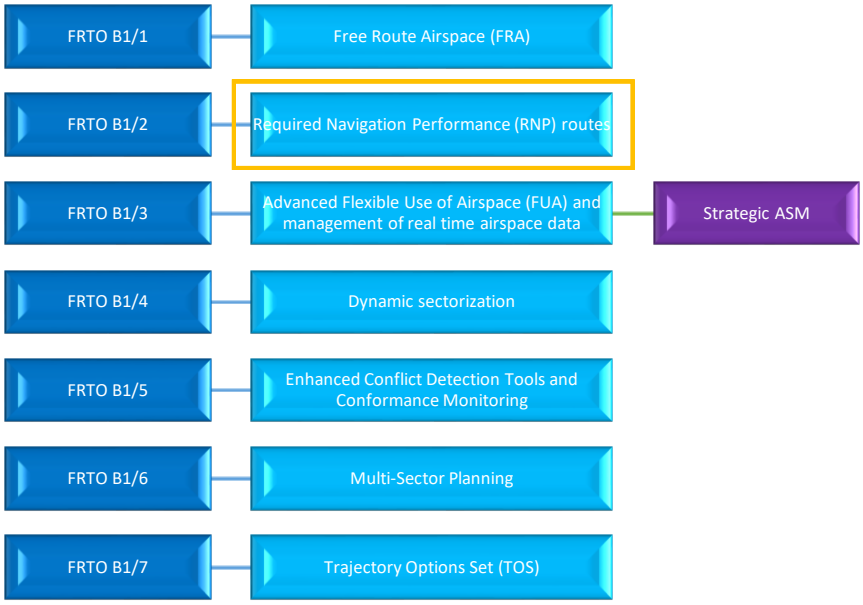

Figure 3-2. Block 1 Framework

3.4 Block 2

a) As of the current publication date, the completion of FRTO Block 0 and Block 1 is pending. Consequently, no updates are available for Block 2 at this time.

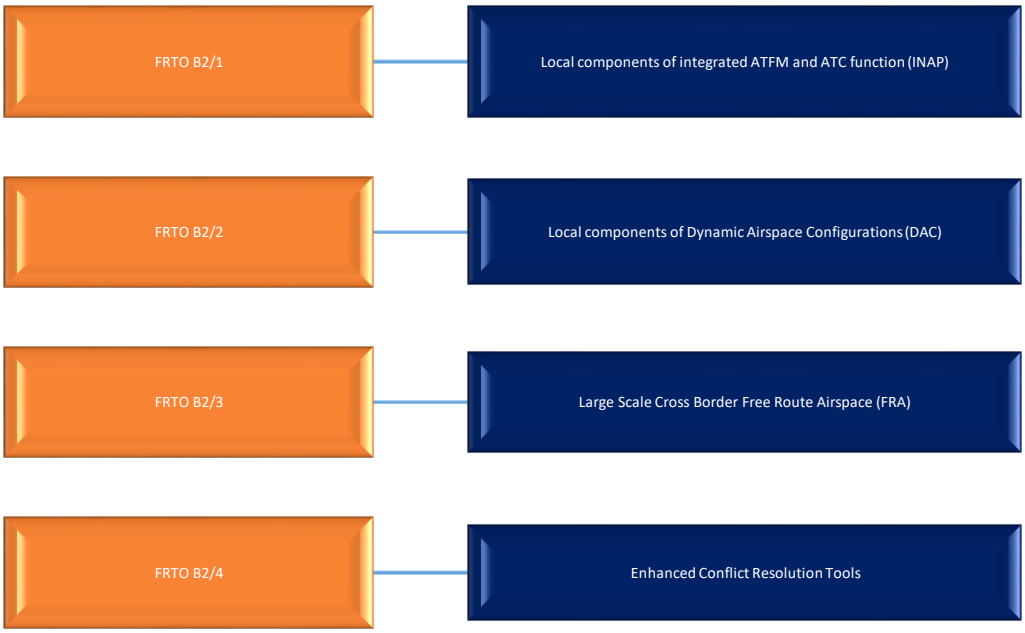

Figure 3-3. Block 2 Framework

4 Strategic Frameworks

Note. - To efficiently address the outstanding FRTO B0/1-4 tasks, the following details outline the planning for this strategic framework:

4.1 FRTO B0/1 (DRO)

a) Strategic Objective:

Increase existing capacity, reduce environmental impact and meet the target level of safety. Documented procedure. Maturity process of existing application.

b) Design Objective

1) Provide a plannable direct track to optimise fuel efficiency.

2) The expected prime beneficiaries of the airspace design process are airspace users, civil and military. The benefits will be evident through the availability of more route options, potentially aligning with preferred trajectories, accompanied by minimal en-route extensions. This is anticipated to result in reduced fuel consumption stemming from optimised CCO/CDO, improved flight economy, and enhanced reliability in fleet planning.

c) Methodology

1) Airspace Structure

i) En-Route.
ii) The utilisation of DRO is presently confined to surveillance airspace. A comprehensive assessment of its suitability in remote airspace is underway.

2) Routes Connectivity

i) Not applicable for traffic on routes that require conventional spacing

3) Traffic Demand

i) Applicable for a specific period of time (i.e., 1600 UTC – 2000 UTC daily)
ii) Applicable for specified flight level until it is fully developed for complete implementation

4) Flight Planning

i) Submission timeframe requirement
ii) Item 18 indication - RMK/DRO

5) ATC Tools

i) Conflict detection tools (i.e., MTCD) and
ii) Monitoring Aids (MONA)

6) Communication and Surveillance – Refer to AIP Malaysia GEN 1.5

7) Navigation Specification

   i) RNP2 / RNAV4

8) Safety Criteria

   i) Safety Risk Assessment

9) Regulatory Consideration

   i) CAD 2 – Rules of The Air
   ii) CAD 11 – Air Traffic Services
   iii) CAD 15 – Aeronautical Information Services

10) Validation/Performance Criteria

   i) Qualitative Assessment (textual/ diagrammatic reasoning, argument, justification)
   ii) Quantitative Assessment – Numerical data (fuel saving, reduction of trackmiles, carbon offset)

4.2 FRTO B0/2 (FUA)

a) Strategic Objective:

1) Increase existing capacity, reduce environmental impact and meet the target level of safety. Maturity process of existing FUA application.

b) Design Objective

1) Design a conditional route track utilizing Special Use of Airspace (SUA) area to optimise fuel efficiency.

2) The expected prime beneficiaries of the airspace design process are commercial civil airspace users.

3) The benefits will be evident through the availability of more route options, potentially aligning with preferred trajectories, accompanied by minimal en-route extensions. This is anticipated to result in reduced fuel consumption stemming from optimised CCO/CDO, improved flight economy, and enhanced reliability in fleet planning.

c) Methodology

1) Airspace Structure

   i) En-Route.
   ii) Flexible and adaptable airspace structures and procedures that are especially suited to temporary allocation and utilization like conditional routes, temporary reserved area (TRA), temporary segregated airspace (TSA) and cross-border area (CBA).

2) Routes Connectivity

   i) Not Applicable

3) Traffic Demand

i) Applicable for all traffic. Routes availability as per NOTAM.

4) Flight Planning

i) Submission timeframe requirement
ii) Item 18 indication - RMK/FUA OPERATION

5) Military Coordination

i) NOTAM

6) ATC Tools

i) Conflict detection tools (i.e., MTCD) and
ii) Monitoring Aids (MONA)

7) Communication and Surveillance – Refer to AIP Malaysia GEN 1.5

8) Navigation Specification

i) RNP2 / RNAV4

d) Safety Criteria

1) Safety Risk Assessment

e) Regulatory Consideration

1) CAD 2 – Rules of The Air

2) CAD 11 – Air Traffic Services

3) CAD 15 – Aeronautical Information Services

f) Validation/Performance Criteria

1) Qualitative Assessment (textual/ diagrammatic reasoning, argument, justification)

2) Quantitative Assessment – Numerical data (fuel saving, reduction of track miles, carbon offset)

4.3 FRTO B0/3 (Pre-validated and coordinated ATS routes to support flight and flow)

a) Strategic Objective:

1) Increase existing capacity, reduce environmental impact and meet the target level of safety.

2) Maturity process of DRO application.

b) Design Objective

The expected prime beneficiaries of the airspace design process are airspace users, civil and military. The benefits will be evident through the availability of

more route options, potentially aligning with preferred trajectories, accompanied by minimal en-route extensions. This is anticipated to result in reduced fuel consumption stemming from optimised CCO/CDO, improved flight economy, and enhanced reliability in fleet planning.

1) Provide a plannable User-Preferred Route (UPR) to optimise fuel efficiency.

   Preferred routes are the normal, everyday routes that were developed to increase system efficiency and capacity by having balanced traffic flows among high-density airports, as well as de-conflicting traffic flows where possible. Preferred routes are those that operators will most commonly file.

2) Provide a plannable Playbook Routes (PR)

   While UPR is used, circumstances may cause UPR to be unavailable. A set of standard routes that ATC can utilize to fit a particular set of circumstances when the UPR routes are not available to be developed. These routes were created to allow for rapid implementation as needed.

3) Coded Departure Routes (CDR)

   CDR is preplanned, alternative routes between a specified city pair that can be quickly activated when traffic constraints exist, such as thunderstorms, turbulence or periods of excessive demand. These routes are pre-coded within the ATC system, and they quickly and easily can be issued as a revised clearance to the flight crew of a CDR-capable aircraft, allowing it to depart the point of origin, often without undue delay, via an alternate route.

c) Methodology

1) Airspace Structure

   i) En-Route.
   ii) The utilisation is confined to surveillance airspace. A comprehensive assessment of its suitability in remote airspace is underway.

2) Routes Connectivity

   i) Regional application is subject to its maturity.

3) Traffic Demand

   i) Applicable for all traffic.
   ii) Flight Level restriction is subject to the feasibility study.

4) Flight Planning

   i) Submission timeframe requirement
   ii) Item 18 indication - RMK/UPR OPERATION

5) ATC Tools

   i) Conflict detection tools (i.e., MTCD)
   ii) Monitoring Aids (MONA) and

iii) Tools to facilitate CDR (enabling revised clearance)

6) Communication and Surveillance – Refer to AIP Malaysia GEN 1.5

7) Navigation Specification

i) RNP2 / RNAV4

d) Safety Criteria

1) Safety Risk Assessment

e) Regulatory Consideration

1) CAD 2 – Rules of The Air

2) CAD 11 – Air Traffic Services

3) CAD 15 – Aeronautical Information Services

f) Validation/Performance Criteria

1) Qualitative Assessment (textual/ diagrammatic reasoning, argument, justification)

2) Quantitative Assessment – Numerical data (fuel saving, reduction of track miles, carbon offset)

4.4 FRTO B1/1-7

Note. - To be developed

4.5 FRTO B2/1-4

Note. - To be developed

5 Strategic Roadmap

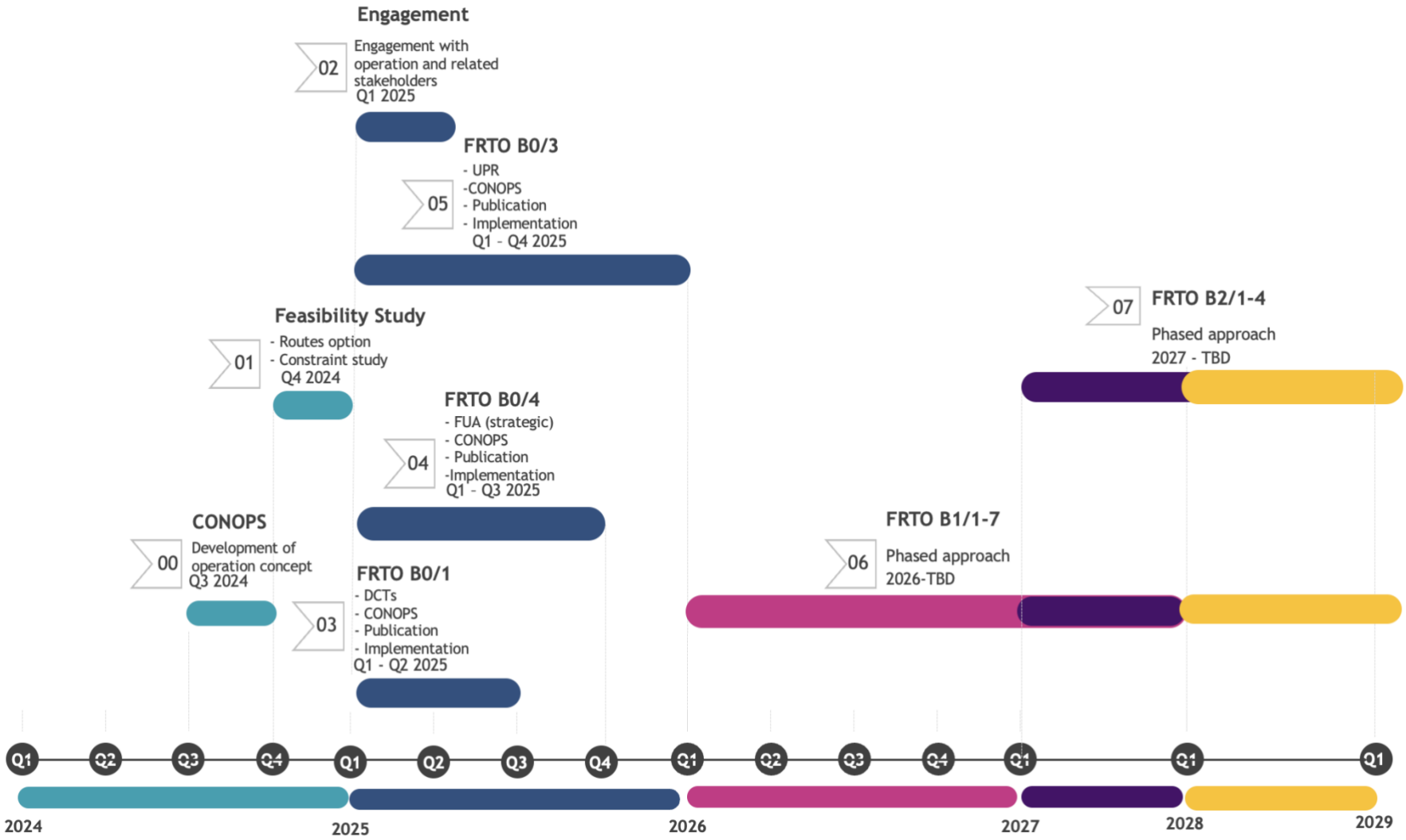

Figure 5-1. Strategic Roadmap

6 Implementation Considerations

6.1 Strategic collaboration with stakeholders:

a) A comprehensive engagement and collaboration between CAAM and its stakeholders are required to ensure a thorough and well-rounded approach to address the FRTO concept that would benefit airspace users.

b) Advanced implementation of FRTO is co-related with ASBU elements such as Meteorological information (AMET), Flight and Flow Information for a Collaborative Environment (FF-ICE), Network Operations (NOPS), Digital Aeronautical Information Management (DAIM), Improved arrival and departure operations (APTA) and Ground-based Safety Nets (SNET). This co-dependency requires comprehensive engagement and coordination with all units, divisions, and stakeholders involved to ensure the smooth implementation of FRTO.

6.2 Data Analysis

6.2.1 Data collection is a pivotal element in ensuring the viability and effectiveness of FRTO implementation. A data-driven approach is imperative in ensuring FRTO addresses the issue of airspace management, with the overarching objective of enhancing operational efficiency, capacity, and environmental impact within the aviation sector.

a) Descriptive and diagnostic analytics

Descriptive and diagnostic analytics would assist CAAM in analysing information based on existing operations.

b) Predictive and Prescriptive analytics

Predictive models and analytics play a crucial role in enabling the CAAM to analyse emerging trends and make informed predictions. This empowers CAAM to develop tailored solutions for airspace management, with a specific focus on the FRTO concept.

Note. - For the purpose at hand, having appropriate tools for data analysis is crucial, along with the assistance of personnel who specialise and are well-versed in data analysis.