ATC TRAINING & DEVELOPMENT FOR FREE ROUTE AIRSPACE (FRA)

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FREE ROUTE ≠ FREE FLIGHT

Technically all flights continue under control by ATC

UPR | FREE ROUTE AIRSPACE

IMPACT ON ATC

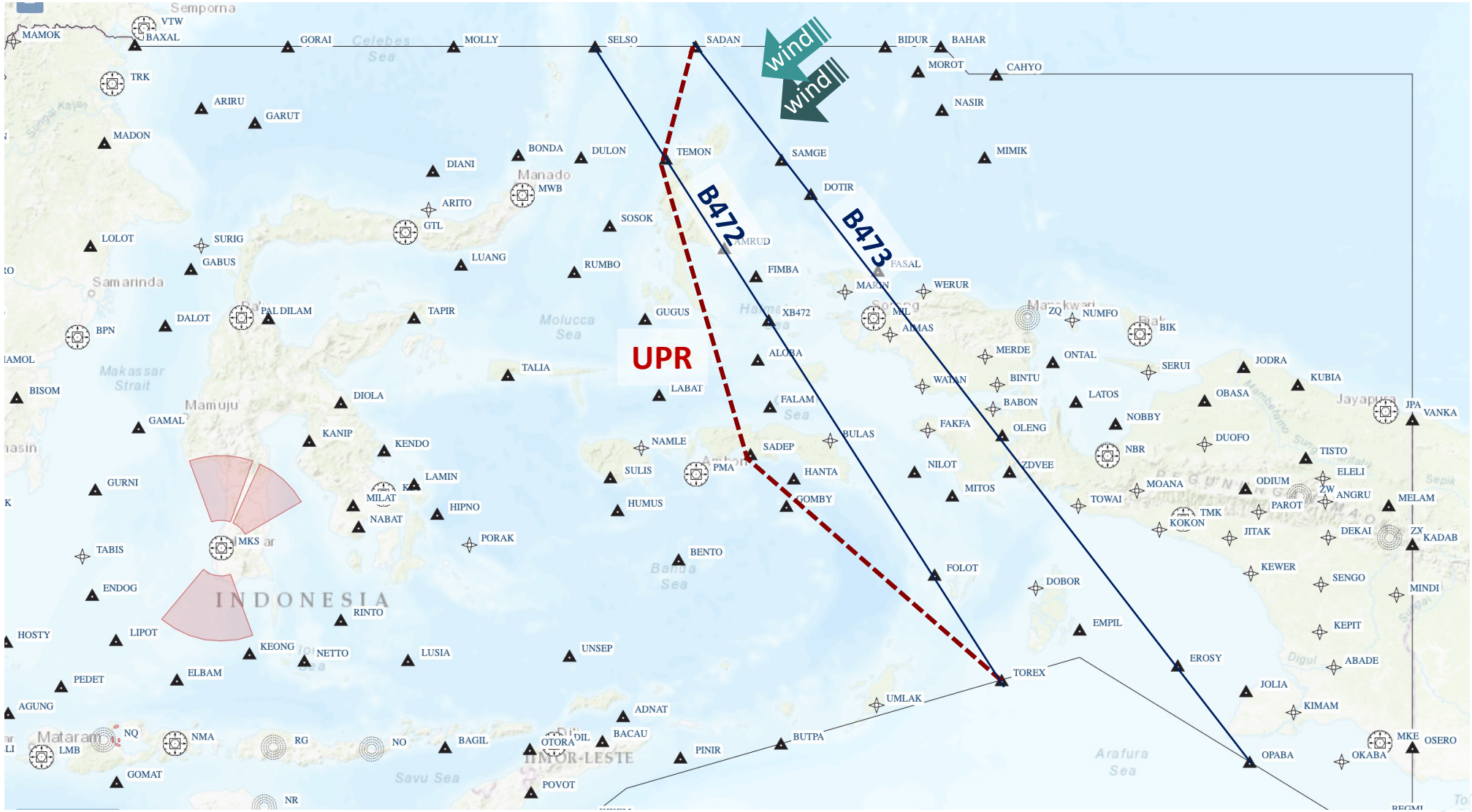
- AIRSPACE USER ORGANISATION
- CONFLICT MANAGEMENT
- SAFETY NETS
- COORDINATION PROCEDURES
- FLIGHT PLANNING

TRAINING NEEDS

- UPR | FRA CONCEPT
- AIRSPACE MANAGEMENT IN FRA
- PBN FOR ATC
- ATC PROCEDURES
- FLIGHT PLANNING
- COORDINATION PROCEDURES
- ATMAS - HUMAN MACHINE INTERFACE
- CONFLICT DETECTION TOOLS
- AIR SITUATION DISPLAY
- TOWARDS TRAJECTORY BASED OPERATION

AIRSPACE USER ORGANISATION

EXAMPLE OF UPR TRAJECTORY

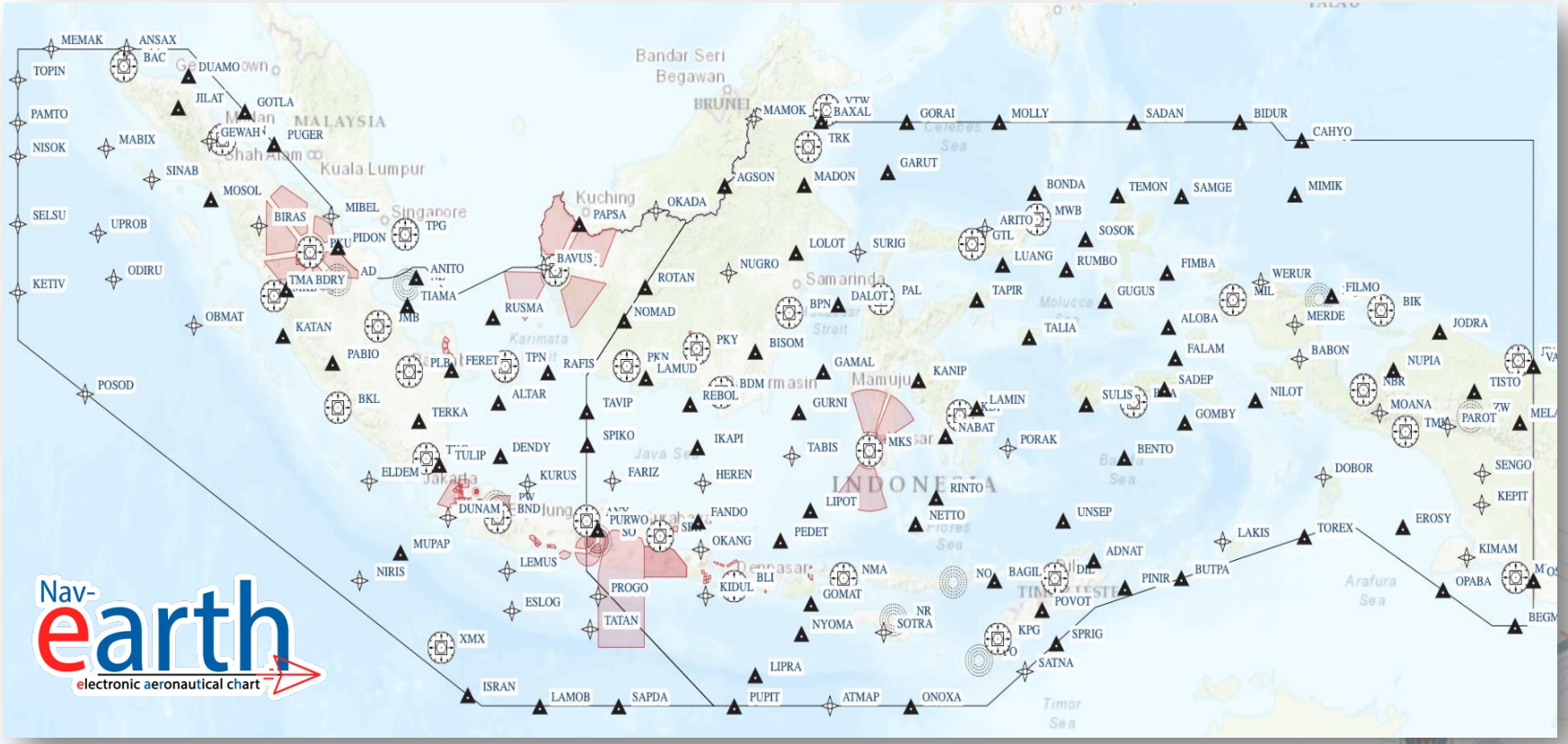


UPR | FRA CONCEPT & AIRSPACE MANAGEMENT

- *See: Airspace Management in FRA presentation*

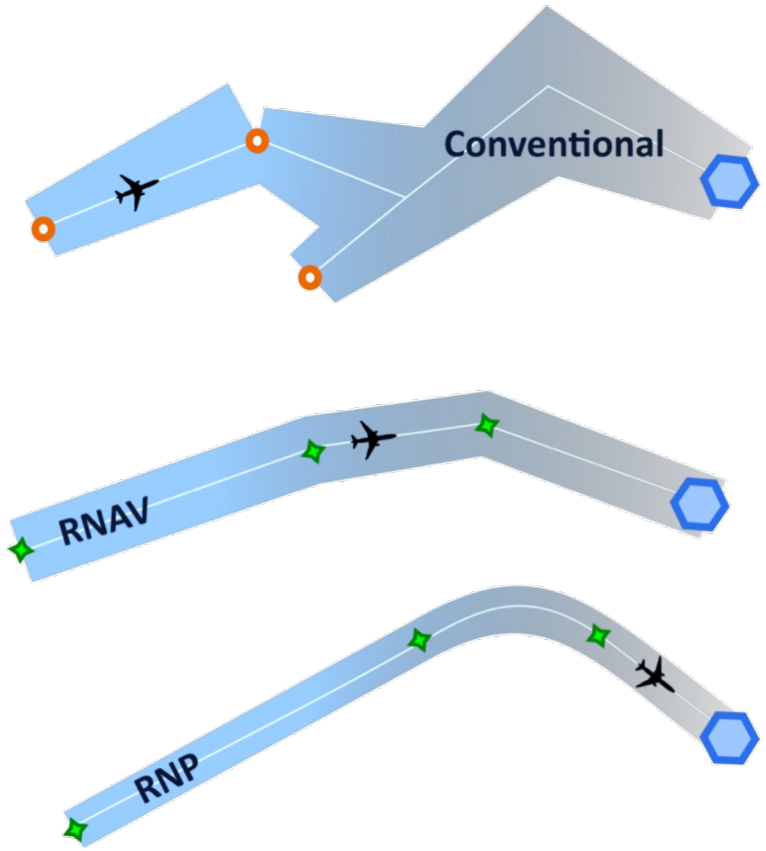
UNDERSTANDING UPR | FRA RULES IMPLEMENTED

- VERTICAL LIMIT
  - F310 - F600?
- HORIZONTAL LIMIT
  - FIR boundary?
- TYPE OF FLIGHT
  - Enroute only?
- UPR RULES:
  - ATS routes
  - DCT Published Entry & Exit boundary point
  - INTERMEDIATE published & designated point
  - CROSS-BORDER?
- FLIGHT PLANNING PROCEDURES
- AREA RESERVATION



PBN IS THE *ENABLER* OF FRA

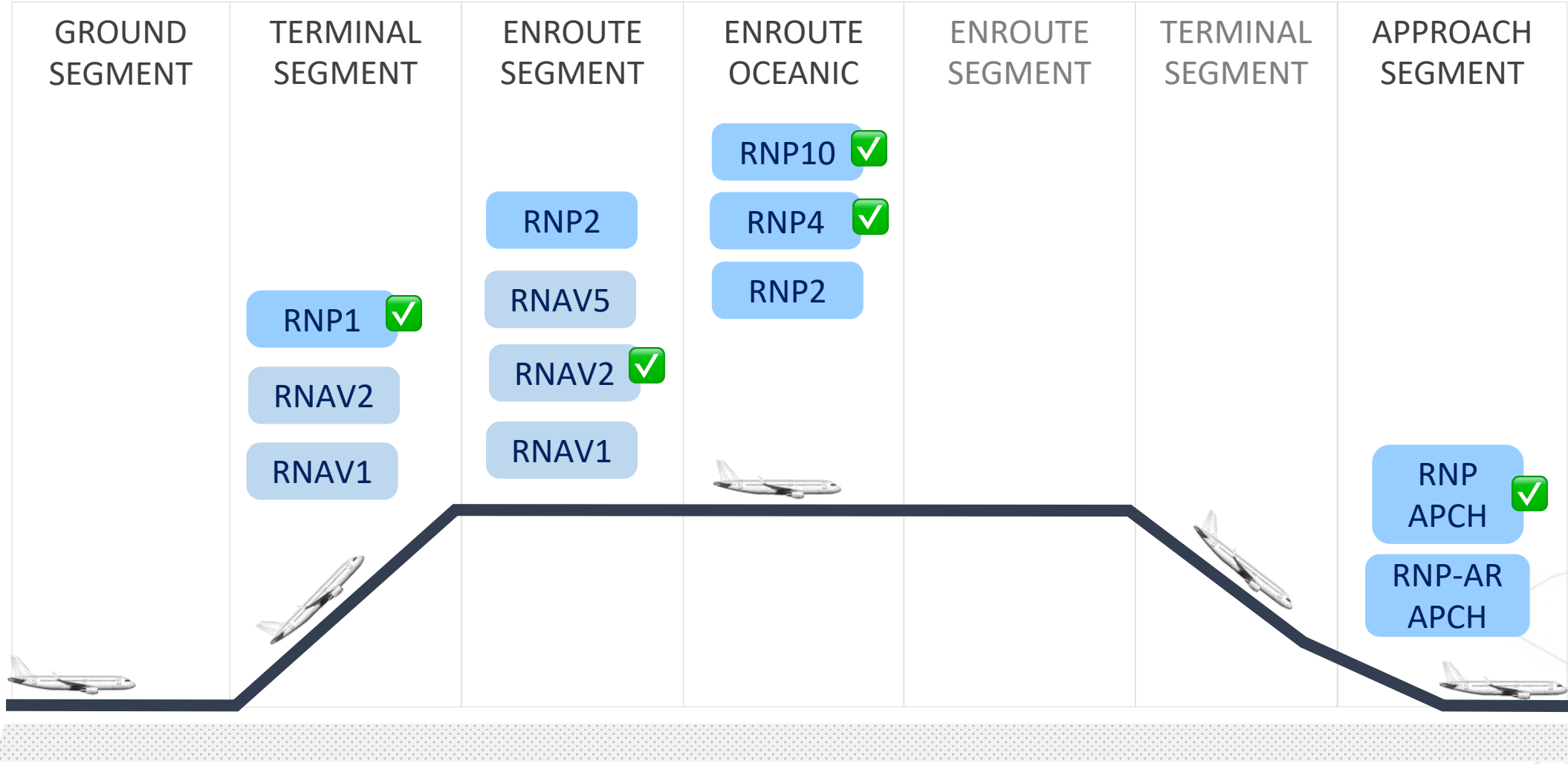
PBN FOR ATC TRAINING



- Based on ICAO PBN Document 9613, PBN training for ATC consist of:
  - Core Training
  - Navigation Specification training

CORE TRAINING	NAVSPEC TRAINING
1. How area navigation system works in this area 2. Flight plan requirements 3. ATC procedures a. ATC Contingency procedures b. Separation minima c. Mixed equipped environment d. Transition between different operating environment e. Phraseology	*[depends on the PBN navigation specification implemented in your airspace]*

NAVIGATION SPECIFICATION APPLICATION



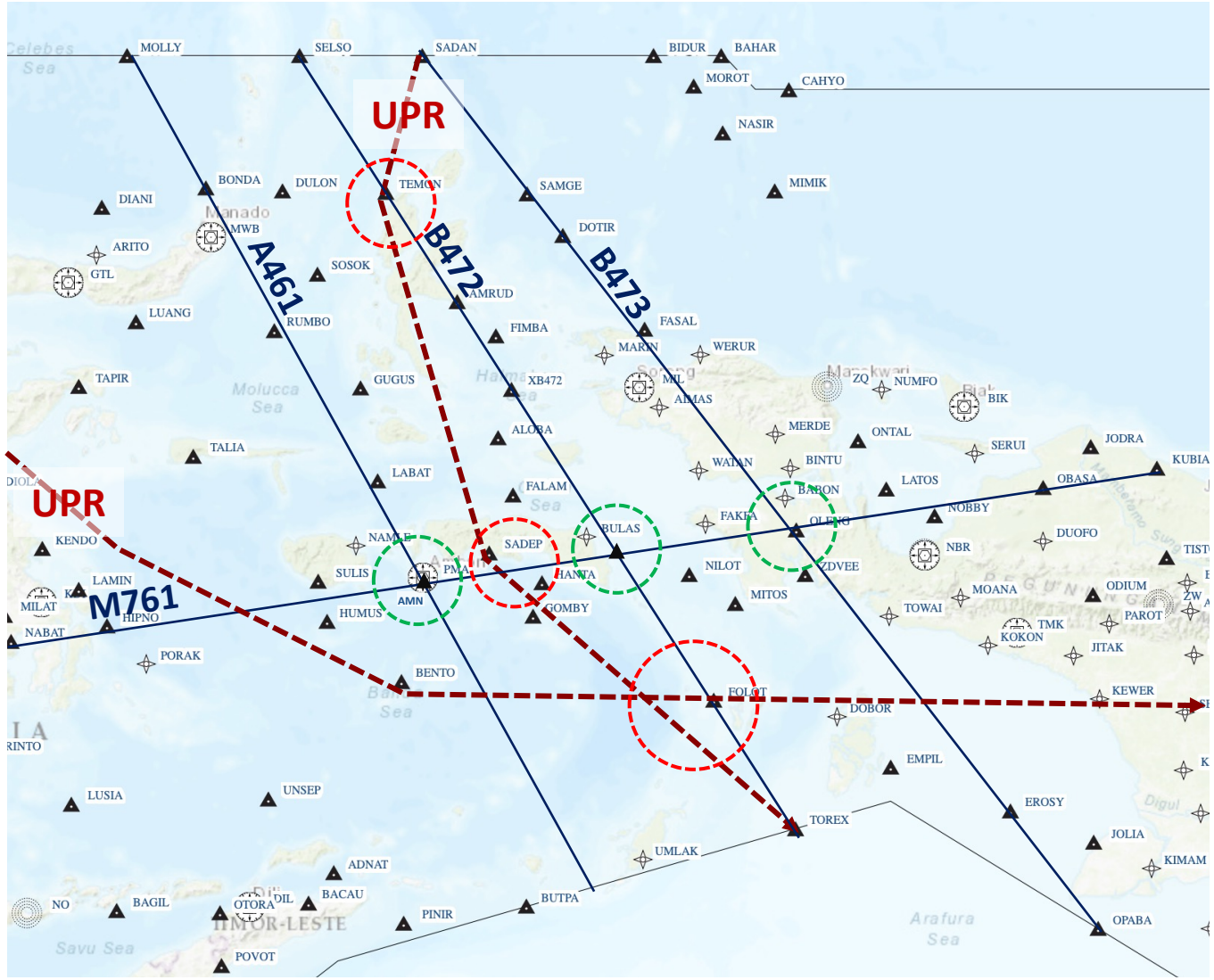
✅ **Implemented = specific training needs**

SPECIFIC NAVIGATION SPECIFICATION TRAINING

RNP/RNAV 10	RNAV2 (ENROUTE)	RNP4
1. Functional capabilities and limitation of RNP/RNAV 10 2. Accuracy, integrity, availability & continuity 3. GPS receiver, RAIM, fault detection and exclusion (FDE) and integrity alerts 4. Reporting of gross navigation error	1. Functional capabilities and limitation of RNAV 2 2. Accuracy, integrity, availability & continuity 3. GPS receiver, RAIM, FDE and integrity alerts 4. Waypoint fly-by versus fly-over concept (and differences in turn performance)	1. Functional capabilities & limitation of RNP 4 2. Accuracy, integrity, availability and continuity including on-board performance monitoring and alerting 3. GPS receiver, RAIM, FDE and integrity alerts 4. Waypoint fly-by versus fly-over 5. For application 30/30 separation minima a. CPDLC communication b. ADS-C system and simulation training c. Effect of periodic reporting delay/failure on longitudinal separation.

CONFLICT MANAGEMENT

EXAMPLE OF HOT SPOTs CHANGES



Routine hot spots

Dynamic hot spot

ATC PROCEDUREs

- Separation Minima
- Phraseology
- Contingency procedures

Implementation of UPR or FRA **DOES NOT CHANGE CURRENT APPLICABLE** ATC procedures!

ATCO need to **increase** SITUATIONAL AWARENESS and **optimizing** ATM Automation System (ATMAS) **prediction & conflict detection tools**

REFRESH TRAINING

HORIZONTAL SEPARATION APPLICATION

SURVEILLANCE ENVIRONMENT

- Apply standard surveillance separation minima: 5NM or 10NM or as applicable
- Control technique: Vectoring

PROCEDURAL ENVIRONMENT

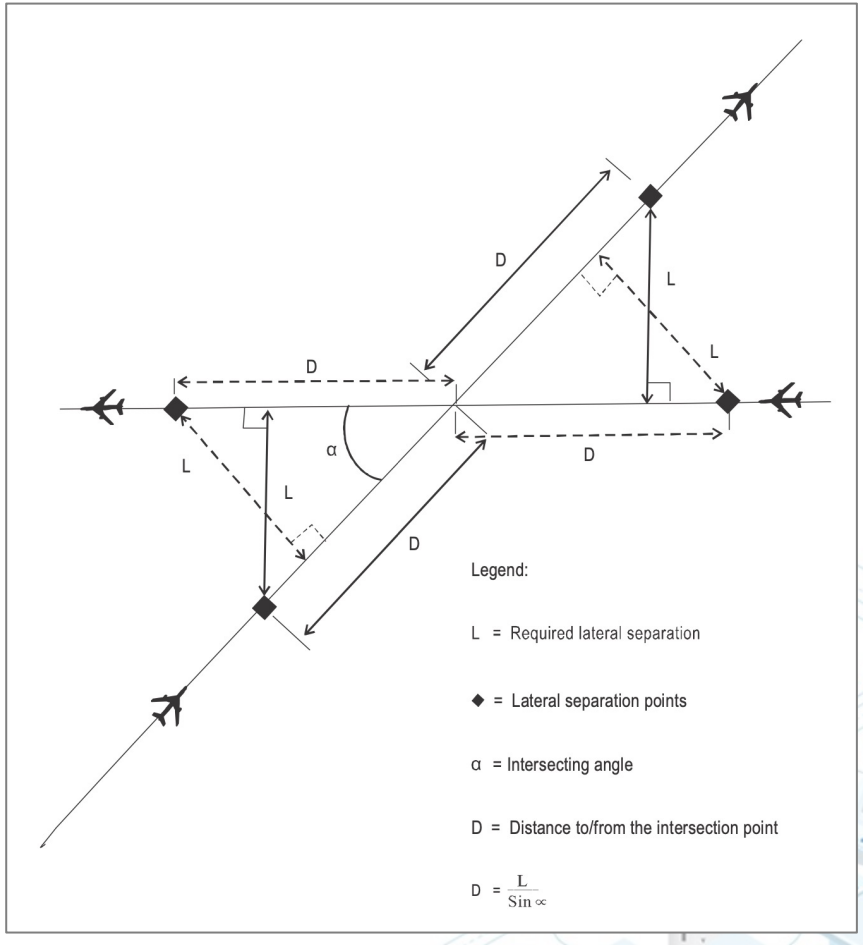
- Apply standard procedural separation minima as applicable
  - Lateral separation
  - Longitudinal
- Control technique: Time restriction

PROCEDURAL SEPARATION (EXAMPLE)

ICAO Doc 4444 PANS-ATM 16th Edition, Chapter V provide application of **PBN separation minima** which are not sensor based (like VOR, VOR/DME) but **performance requirement based** (RNP, RCP, RSP).

- Lateral separation between **aircraft operating on intersecting tracks** or ATS routes shall be established in accordance with the following.
  - an aircraft converging with the track of another aircraft is laterally separated until it reaches a lateral separation point that is located a specified distance measured perpendicularly from the track of the other aircraft; and
  - an aircraft diverging from the track of another aircraft is laterally separated after passing a lateral separation point that is located a specified distance measured perpendicularly from the track of the other aircraft.

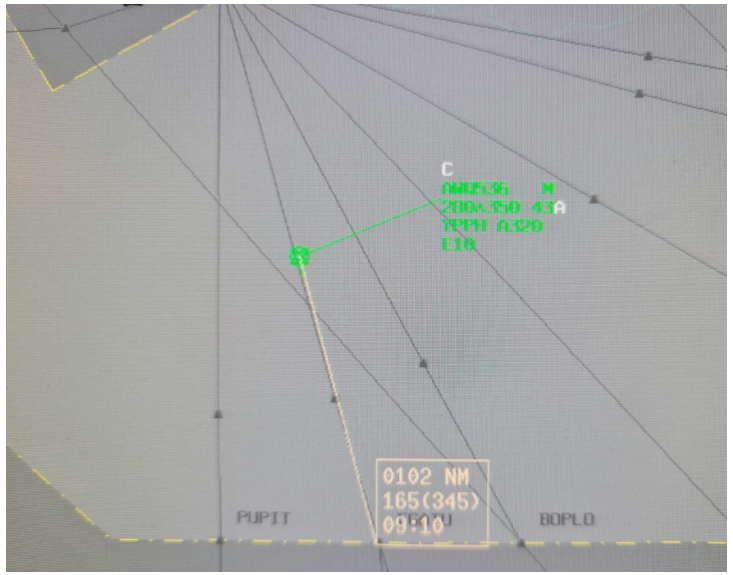
Navigation	Separation
RNAV 10 (RNP 10)	93 km (50 NM)
RNP 4	42.6 km (23 NM)
RNP 2	27.8 km (15 NM)



ATMAS PREDICTION & CONFLICT DETECTION TOOLS (2)

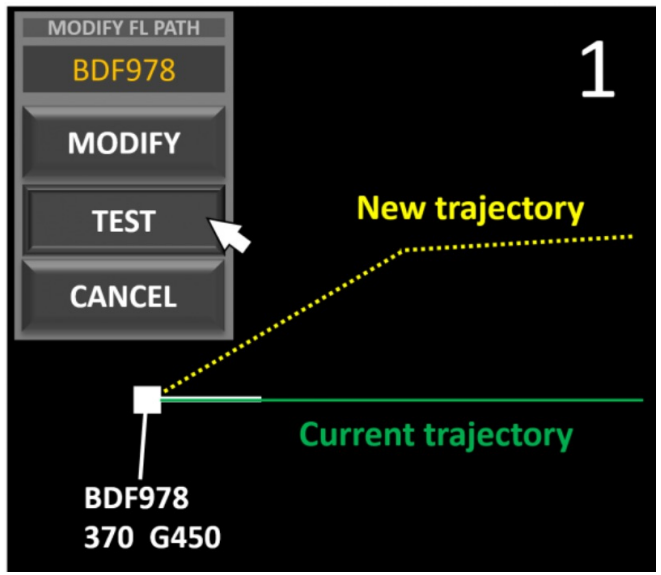
BEARING AND RANGE LINE (BRL)

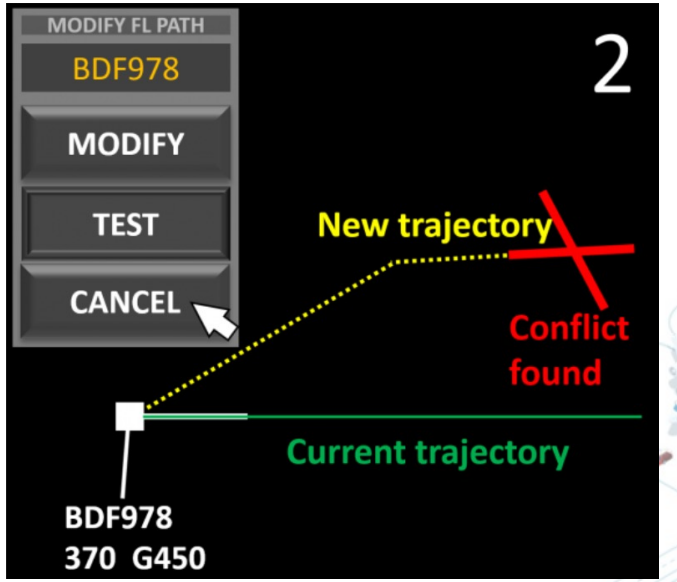
It provides a means of measuring the bearing (direction) and distance between map locations and aircraft. It also provides a time estimate for an aircraft at a point.



FLIGHT PLAN CONFLICT PROBE (FPCP)

It provides data for a display to air traffic controllers whenever any two aircraft are predicted to approach each other within certain separation criteria in the horizontal and vertical dimensions

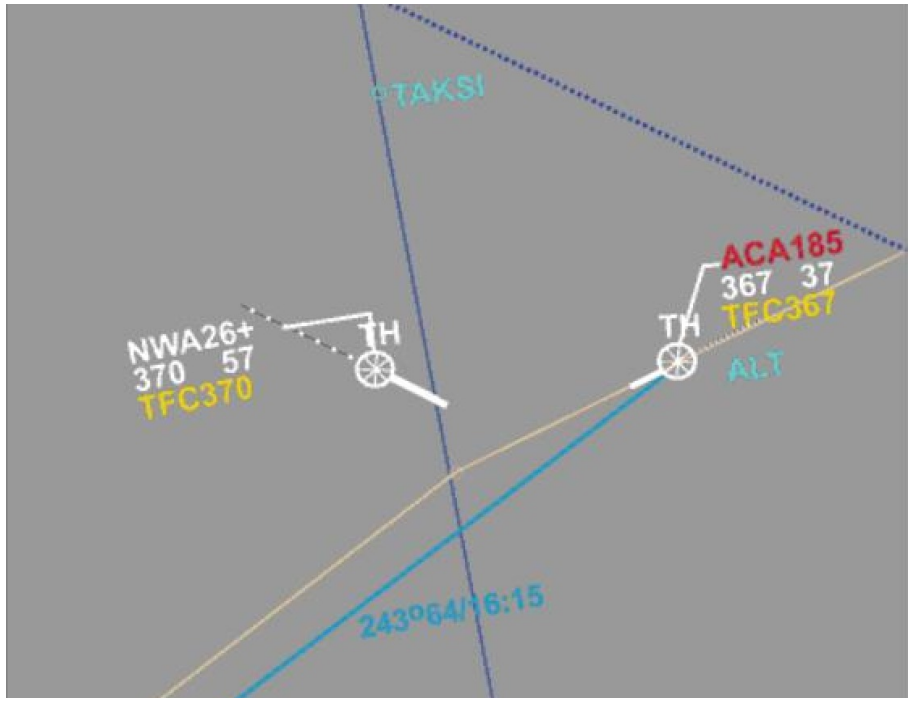




ATMAS PREDICTION & CONFLICT DETECTION TOOLS (2)

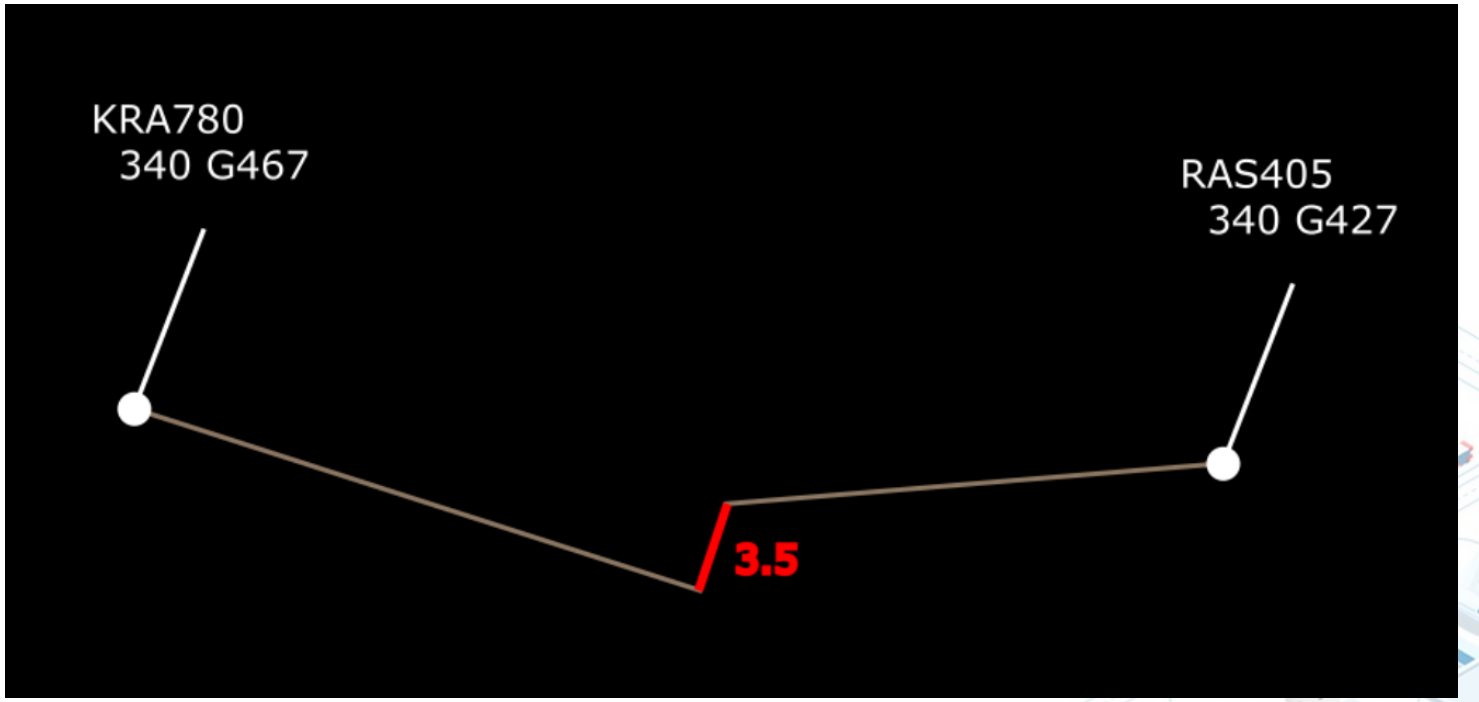
MEDIUM TERM CONFLICT DETECTION (MTCD)

MTCD is a flight data processing system added functionality designed to warn the controller of potential conflict between flights in his area of responsibility in a time horizon extending up to 20 minutes ahead.



TACTICAL CONTROLLER TOOL (TCT)

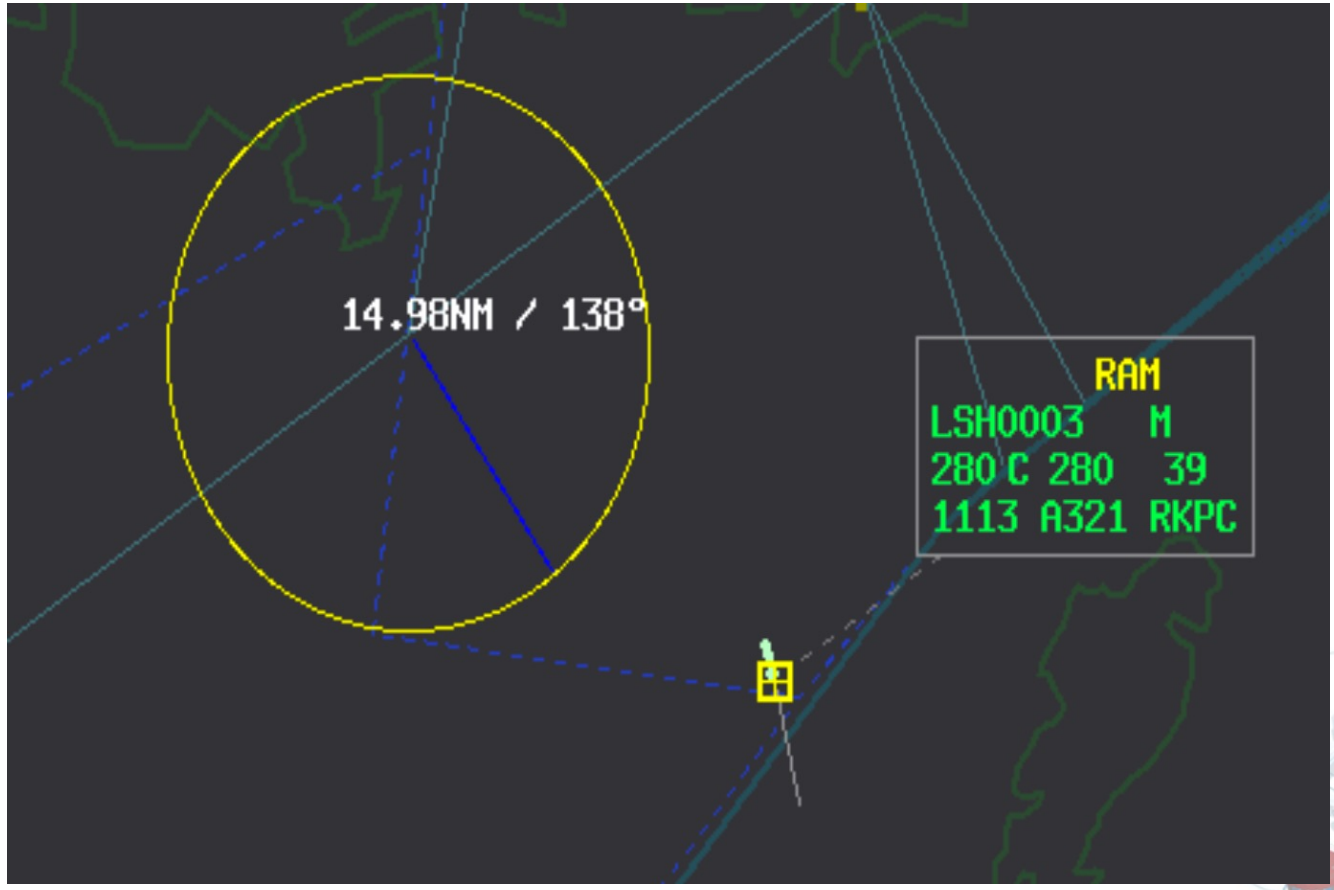
TCT warns the executive (tactical) controller of potential conflicts within the sector. To do this it usually combines current aircraft tracks with an accurate tactical trajectory that reflects the aircraft's current behaviour.



SAFETY NET: ROUTE ADHERENCE MONITORING (RAM)

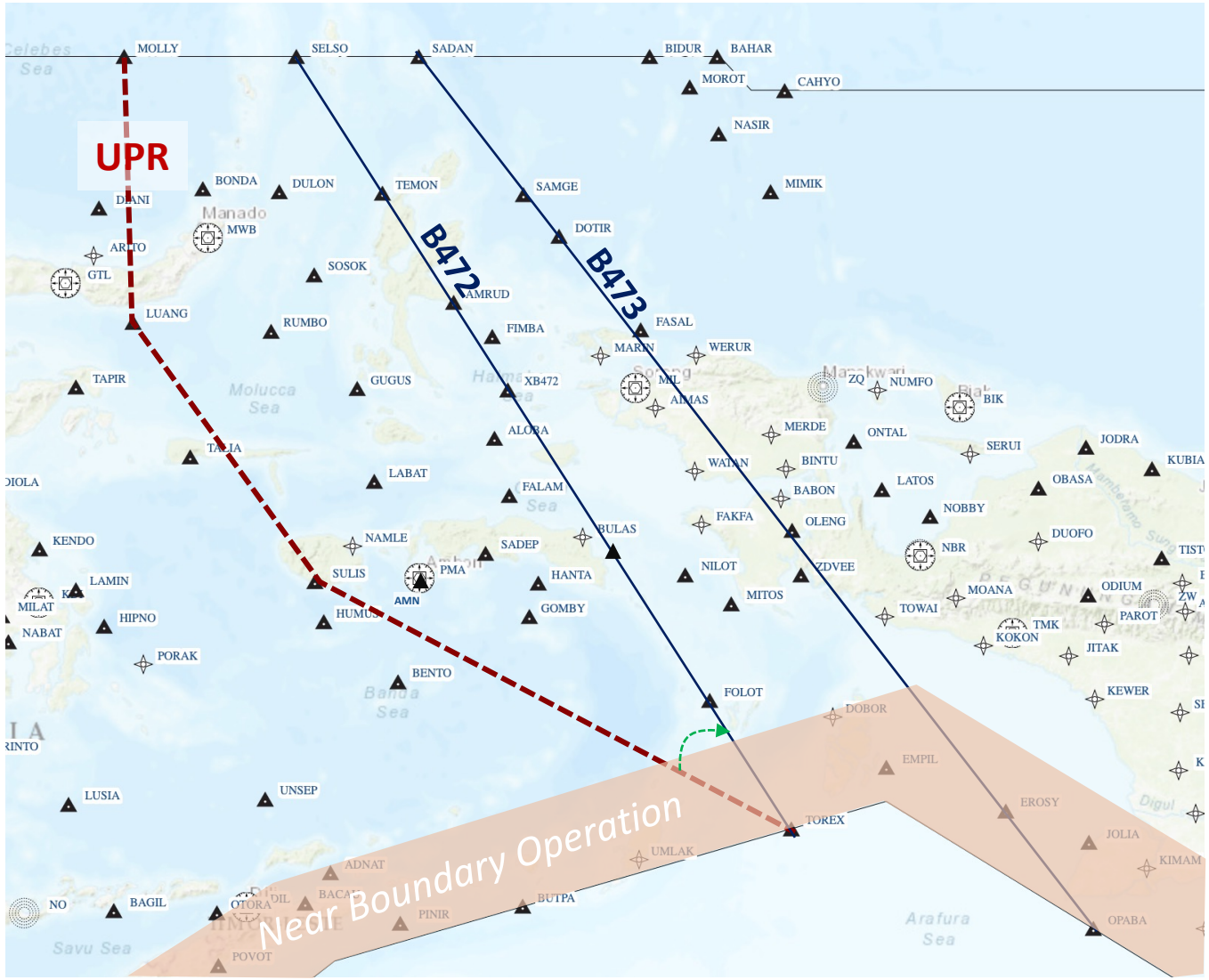
Route Adherence Monitoring (RAM) is a controller advisory tool designed to assist in the early identification of a **variation between the actual and the expected trajectory.**

In FRA where the trajectory of aircraft may not align with ATS route, RAM provides advance warning for controllers, in case of lateral deviation which **COULD LEAD TO LOSS OF SEPARATION** (the aircraft turns towards another one) or **AIRSPACE INFRINGEMENT** (the aircraft turns towards an **area reservation** or a volume of controlled airspace).



COORDINATION PROCEDURES

NEAR COMMON BOUNDARY OPERATION



Implementation of UPR or FRA **DOES NOT CHANGE COORDINATION PROCEDURES**, but amended coordination may required for aircraft flying UPR, especially when **cross-border FRA is not yet implemented.**

DEVIATION ON NEAR BOUNDARY OPERATION

Depends on the horizontal limit of FRA, be mindful of track deviation on near boundary operation that potentially required approval from adjacent ATS Unit

SEPARATION ASSURANCE

Ensure separation minima applied, as describe in Letter of Coordination Agreement, for UPR aircraft prior crossing common boundary or near boundary operation.

FLIGHT PLANNING

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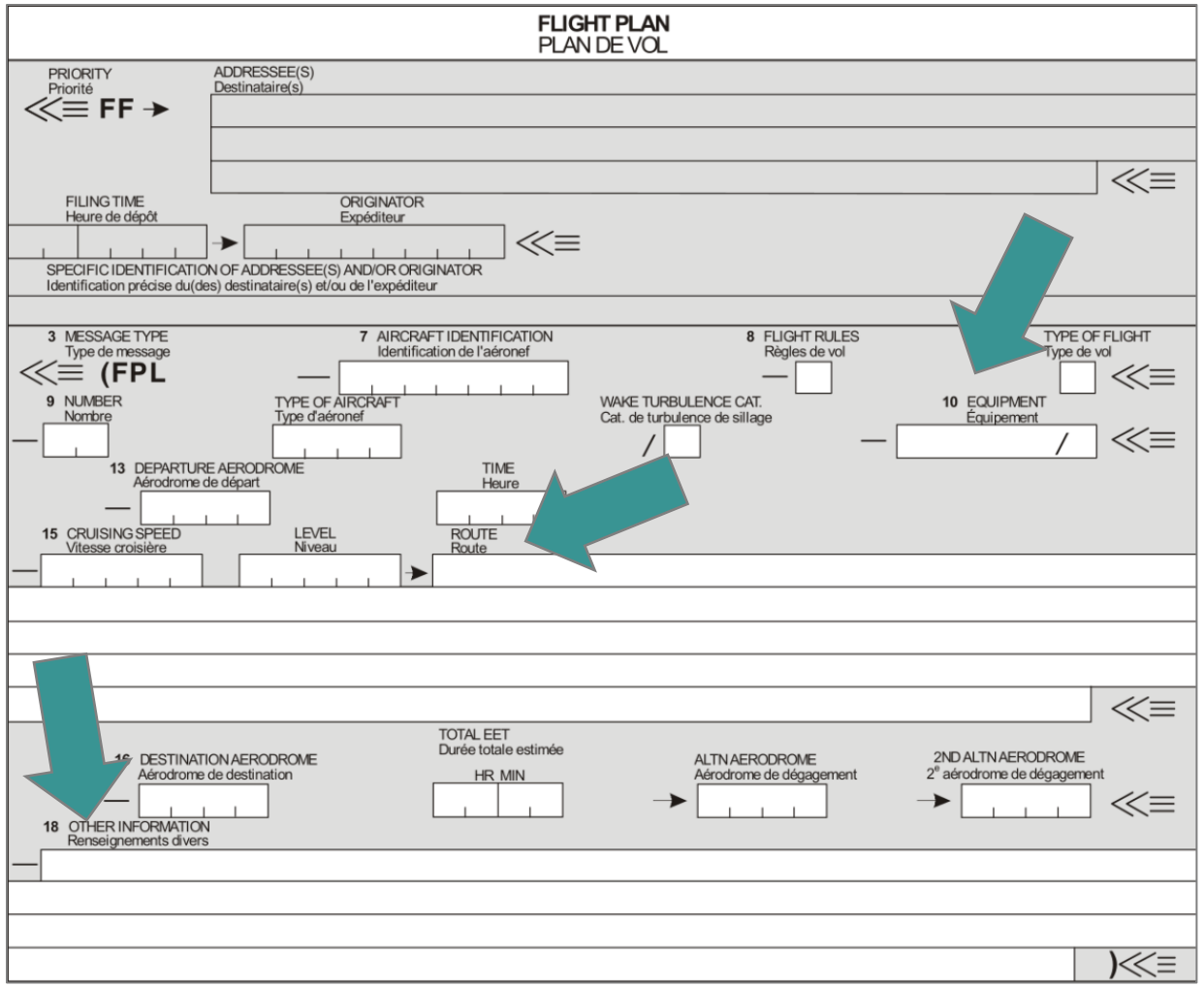


Flight planning will be depending on UPR/FRA regulation:

- Equipment requirement (item 10): PBN, ADS-C, CPDLC, etc.
- FRA ASM rules (item 15)
  - Entry/Exit point
  - Intermediate point
  - Designated point
- Others
  - Remark for flying UPR (item 18), example: RMK/UPRINA

Ensure that Flight Planning System or Flight Filing System and ATMAS can accommodate UPR | FRA flight planning

TOWARD TRAJECTORY BASED OPERATION

FRA IS ONE OF TBO ENABLERS

- Trajectory based operations (TBO) is an air traffic management (ATM) concept intended to enhance strategic planning of aircraft flows to reduce capacity-to-demand imbalance in the airspace System and provide tools to ATM personnel and controls to expedite aircraft movement between origin and destination airports.

- Aircraft trajectory is the core tenant of TBO. Defined in four dimensions – latitude, longitude, altitude and time – the trajectory represents a common reference for where an aircraft is expected to be – and when – at key points along its route.

(FAA definition on TBO)

TBO is a collection of systems, capabilities, processes, and people working together to achieve operational objectives

Time-Based Management (TBM)

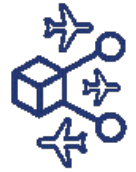
Arrival Metering
Surface Metering
Terminal Metering
Departure Scheduling
... and more

Helps Manage Trajectories by Scheduling and Metering Aircraft through Constraint Points

Performance Based Navigation (PBN)

Area Navigation (RNAV)
Required Navigation Performance (RNP)
Flight Management System (FMS)
STARs, SIDs, IAP and routes
...and more

Enables Aircraft to Accurately Navigate along their Trajectories



Enterprise Enablers

DataComm
System-Wide Information Management (SWIM)
Enhanced Data Exchange
Advanced Weather Products
Airborne Rerouting
...and more

Expands and Automates Sharing of Common Information about Aircraft Trajectories

KEY TAKEAWAYS

KEY TAKEAWAYS

- Free Route is not a free flight. (Currently), aircraft flying UPR is still under control of ATC;
- FRA implementation does not change most ATC related procedure, but ATC need to increase their situational awareness;
- Build training syllabus fit with FRA rules that are implemented
- Optimize ATM automation system capabilities to support ATC operation
- Introduce simple rules, gradually to more complex FRA rules that supporting TBO

Question?

Further question and discussion:

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