What is an Airspace Concept?

Module 4

European Airspace Concept Workshops
for PBN Implementation

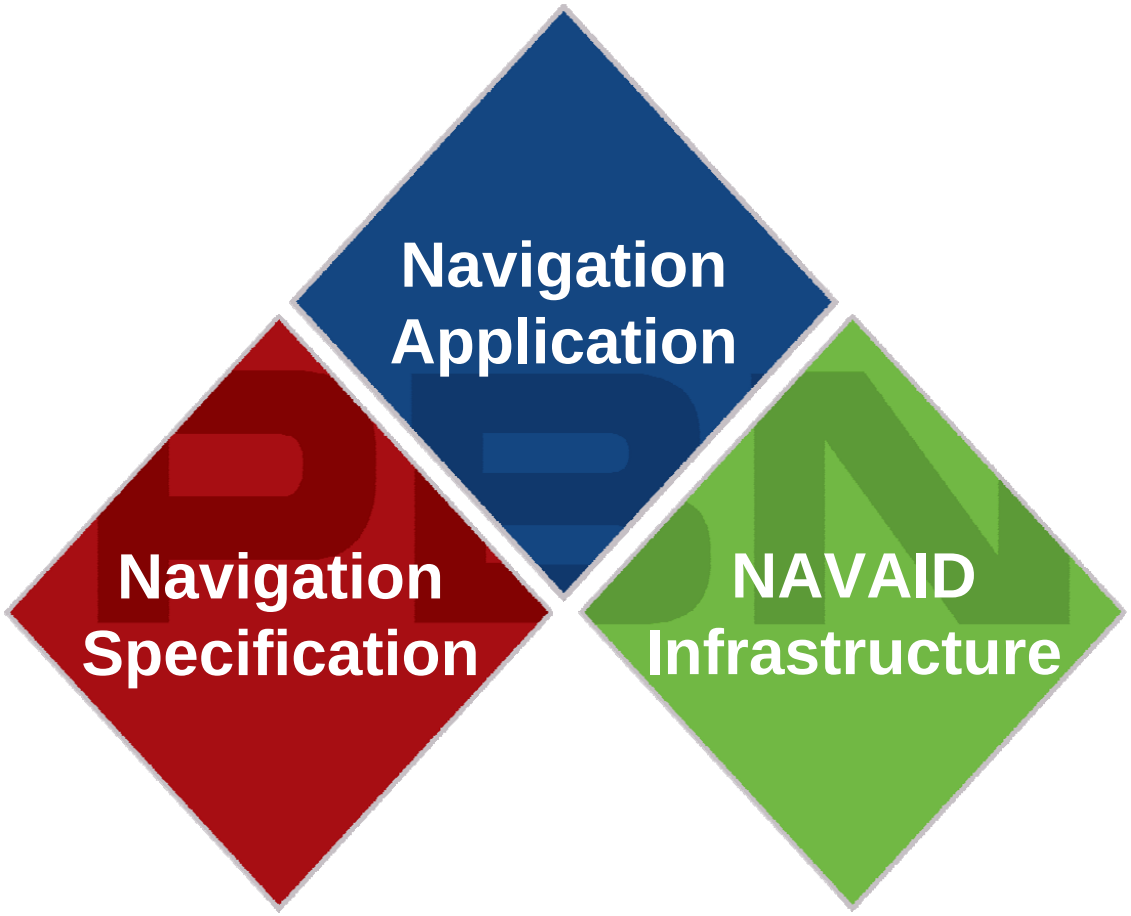
Speaker Name
Speaker title
date

Overview

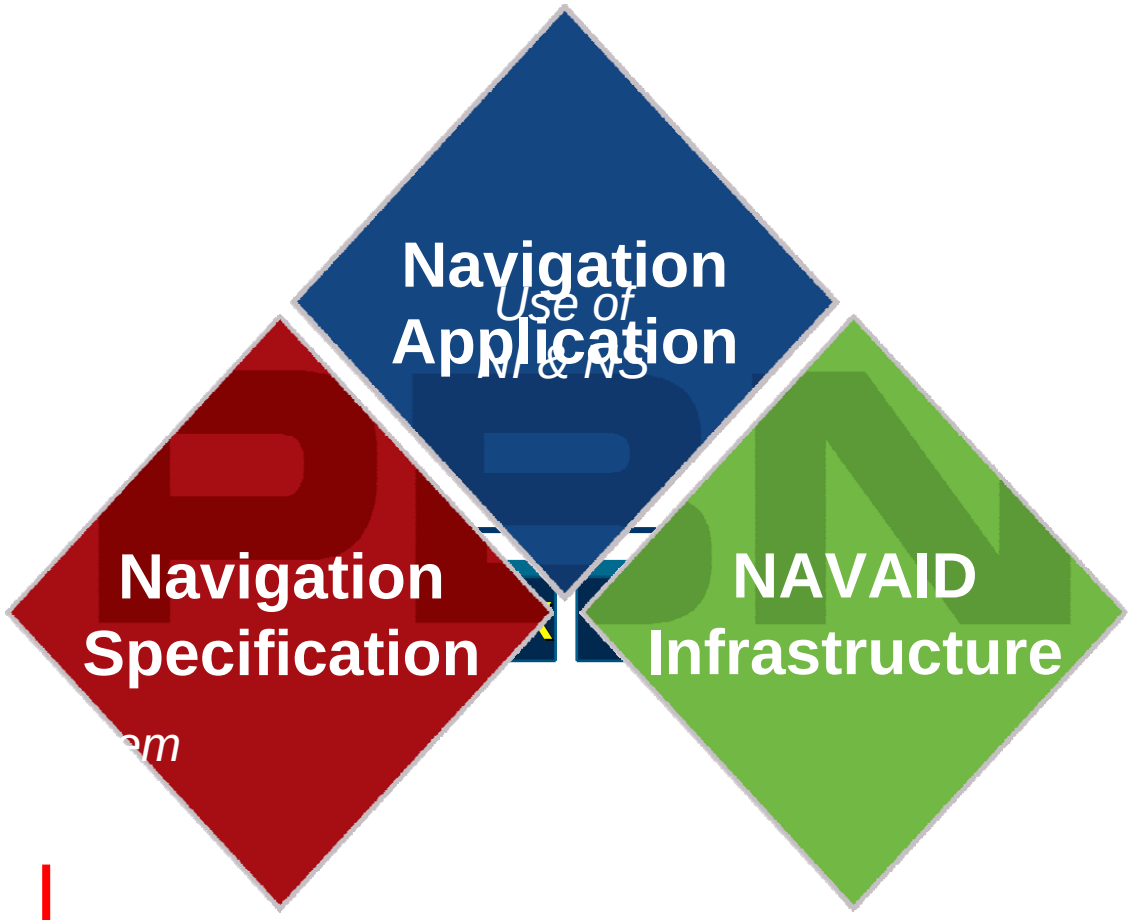
Learning Objectives:

- At the end of this presentation you should:
  - Understand what the purpose of an airspace concept is and how it should drive any successful implementation
- This presentation will discuss:
  - What is an Airspace Concept?
  - Why develop it?
  - Who develops it?
  - What do they need to develop it?
  - What does it look like?
  - After the Airspace Concept is developed, then what?

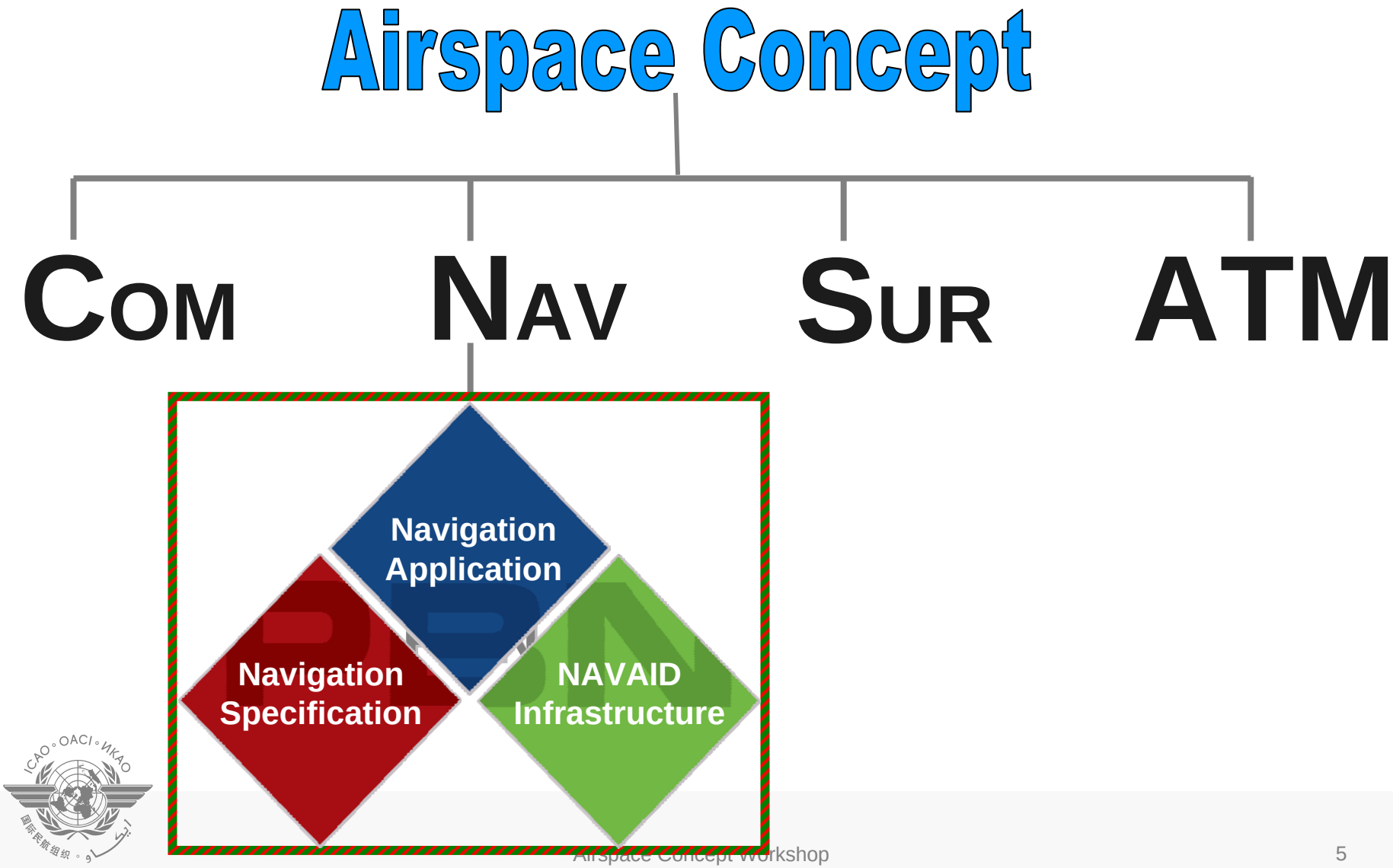
Components of PBN Concept



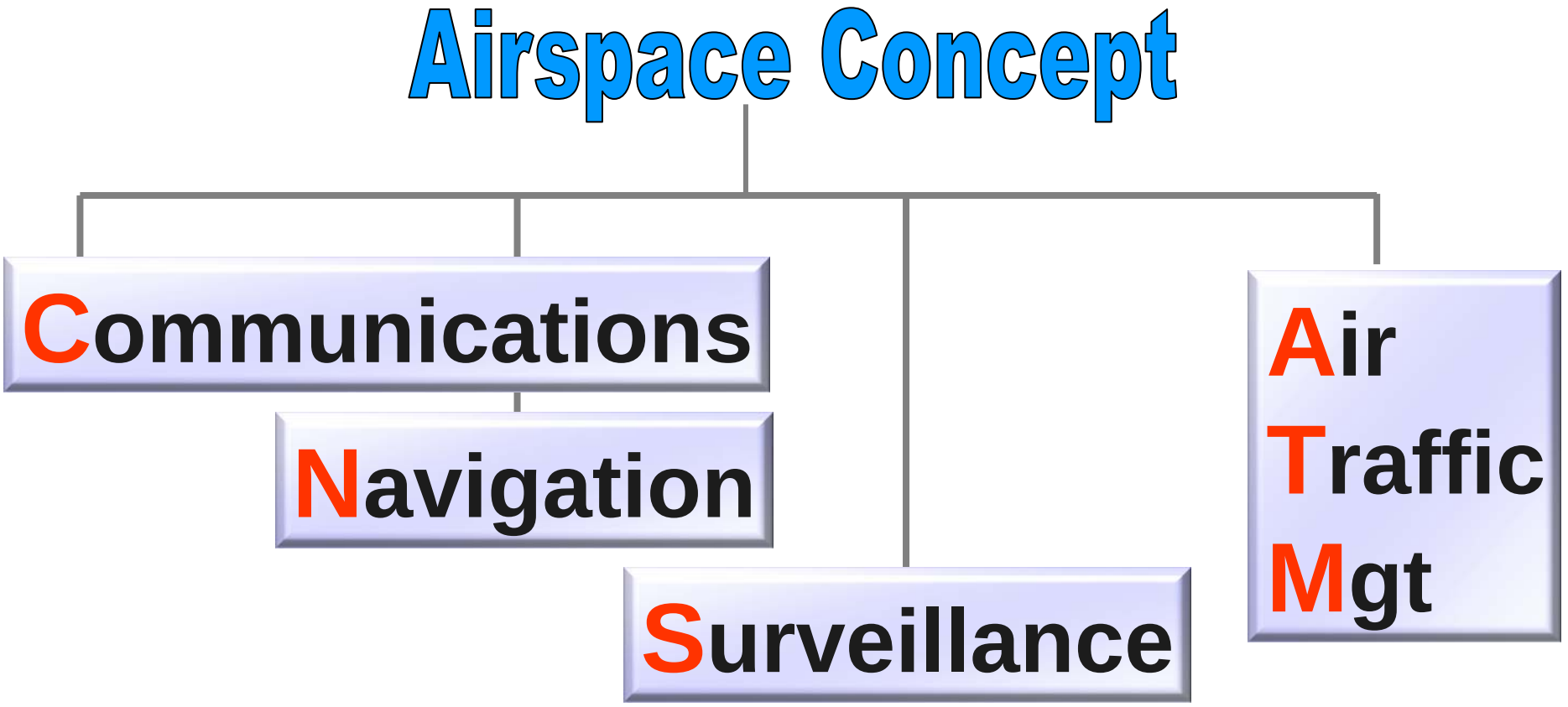
PBN Concept Review



PBN in Context:



Navigation in Context



What is an Airspace Concept?

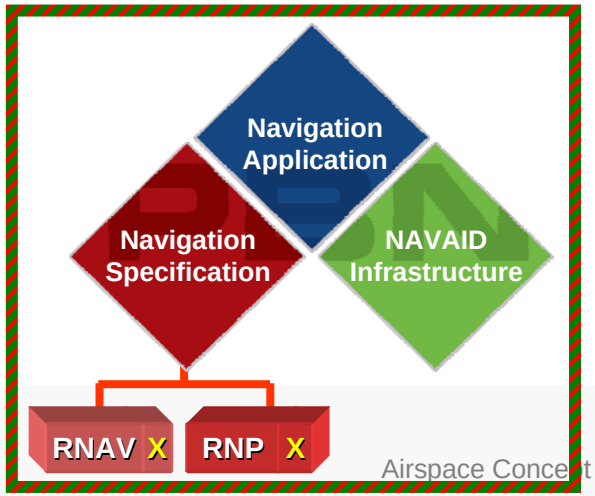
- A master plan or schema of the intended airspace design and its operation
  - Describes the intended operations within an airspace
  - Developed to satisfy explicit and implicit strategic objectives (e.g. improved safety, increased air traffic capacity, improved efficiency, mitigation of environmental impact)
- A fully developed Airspace Concept:
  - Describes in detail the planned airspace organization and its operations
  - Addresses all of the strategic objectives identified for the airspace project
  - Addresses all CNS/ATM enablers
  - Identifies operational and technical assumptions

Context of an Airspace Concept: Strategic Goals (Expected Benefits)

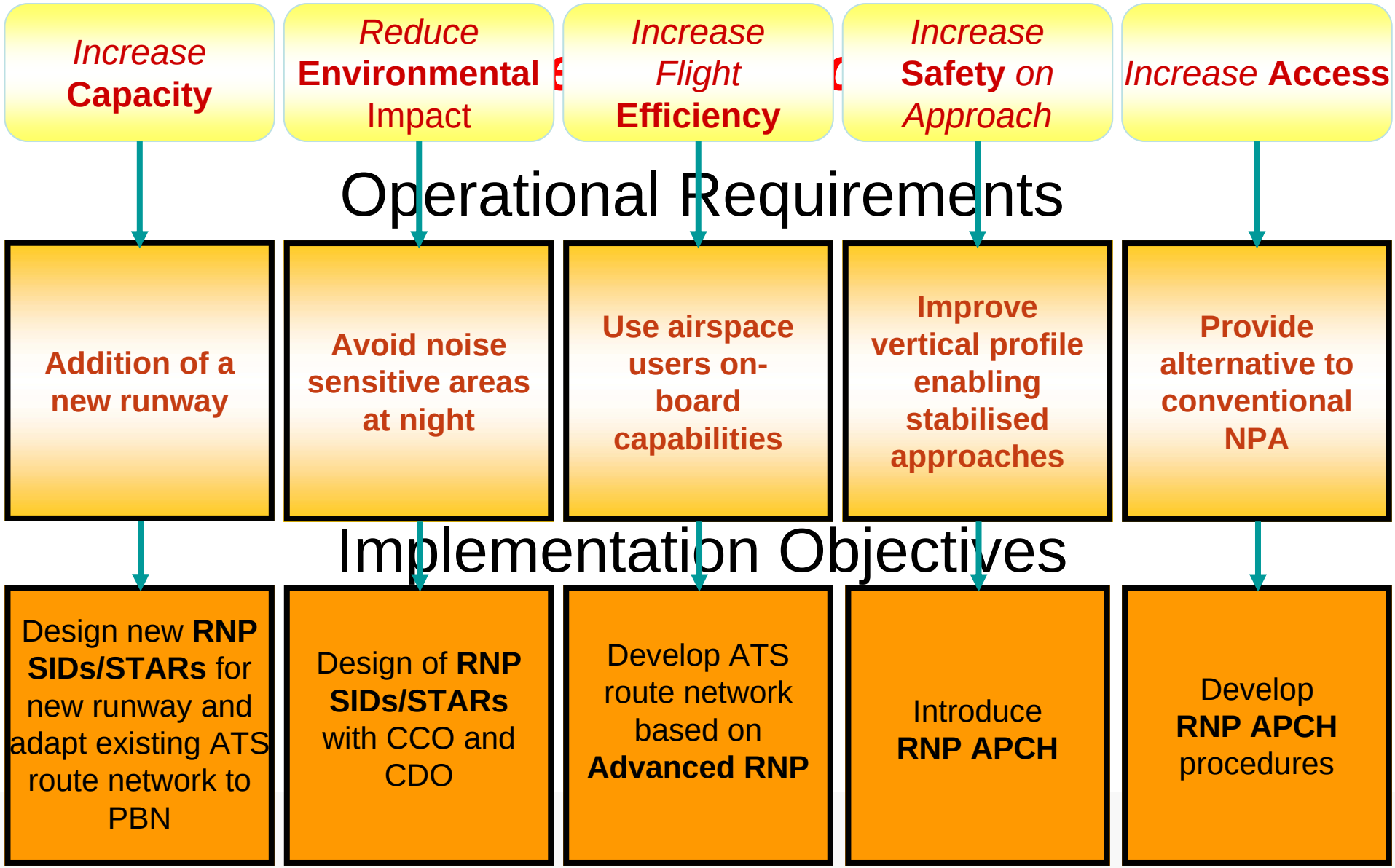
Safety | Capacity | Efficiency | Environment | Access

Airspace Concept

COM | NAV | SUR | ATM



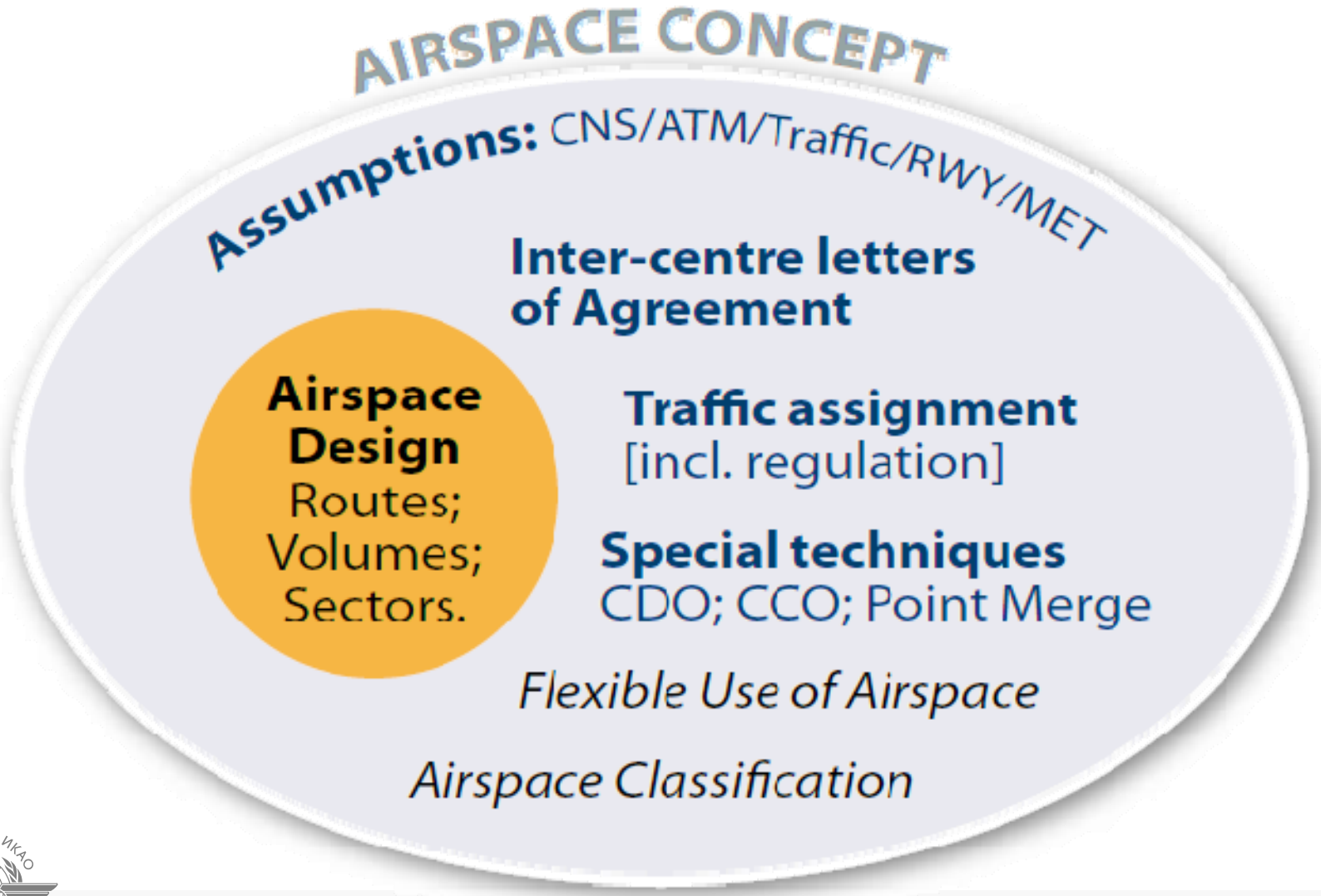
Translation of Strategic Objectives



Why develop an Airspace Concept?

- The development of an Airspace Concept provides a structured and systematic way of determining
  - **What** is to be achieved in an airspace, and
  - **How** it will be achieved
- Development process helps ensure
  - Goals (expected benefits) of planned airspace structure are clearly stated;
  - Objectives of the airspace change are met; and
  - the means chosen to achieve those benefits are appropriate to the goals as well as feasible within the resources available to the particular airspace system

Airspace Concept



Once the Airspace Concept is developed, what's next?

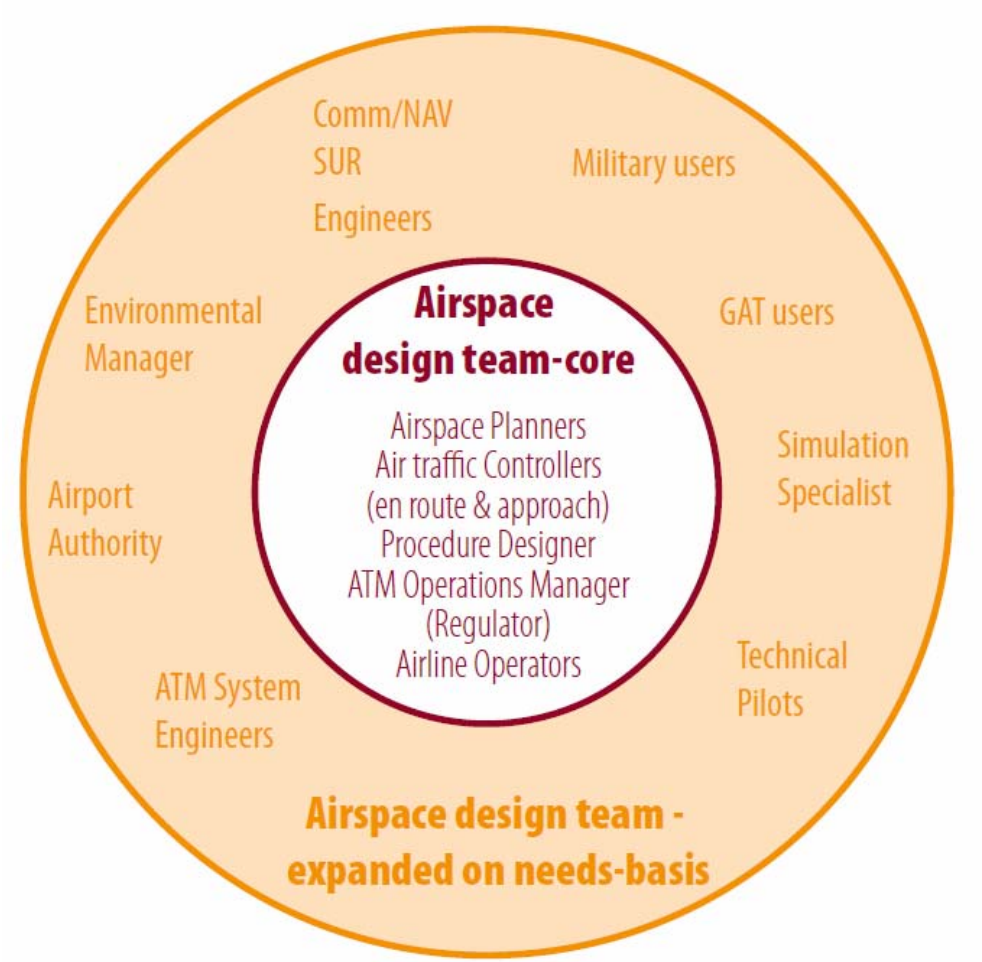
- Lay out a detailed program plan for the specific implementation(s) in the Airspace Concept
- ICAO sample action plans (domain-specific and comprehensive)
  - Consider just as a starting point
  - Adapt as needed to the specific circumstances of a project
  - Steps not always conducted in strict sequence
  - Certain steps may be conducted on a recurring basis as the project progresses
  - Steps and the sequence in which they are performed in the project should be evaluated by the implementation team on the basis of experience and judgment

Who implements the Airspace Concept?

- A ***team effort*** by representatives of various organizations and technical specialties
- Particular composition of the team depends on the scale and nature of the project
  - A simple airspace concept (e.g. a SID, STAR and IAP) would have experts from
    - ANSP (including PANS OPS procedure designer)
    - civil aviation regulator
    - airport operator
    - operators' representative
  - A more extensive Airspace Concept (e.g. new runway, plan for terminal and en route airspace) could also include
    - safety management system experts
    - simulation studies experts
    - additional operator representatives
    - environmental personnel
- ***Team lead*** - usually an airspace planner or knowledgeable ANSP air traffic manager- Not a hard and fast rule. The fundamental requirement is for the task are:

Knowledge, proactive, dedicated, sound understanding of ATM and airspace organization, with support from all participating stakeholders

Airspace Design Team



Airspace Concept development requires the combined efforts of

- Air Navigation Service Providers;
- Regulators; and
- System Users

To Do What?

Implementation Team Initial Tasks

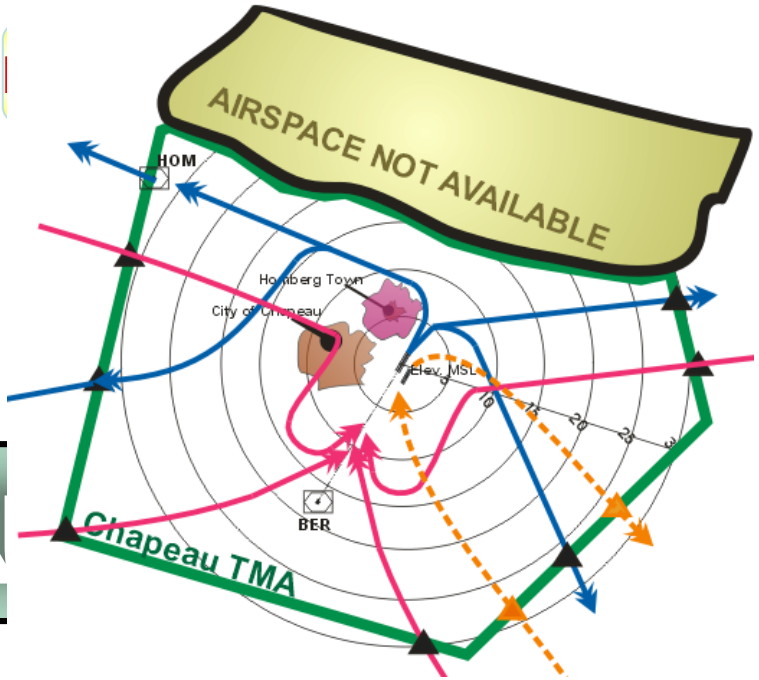
1. **Identify and Prioritise** strategic objectives

Safety? **Efficiency?** **Capacity?**

2. **Develop the target airspace design**

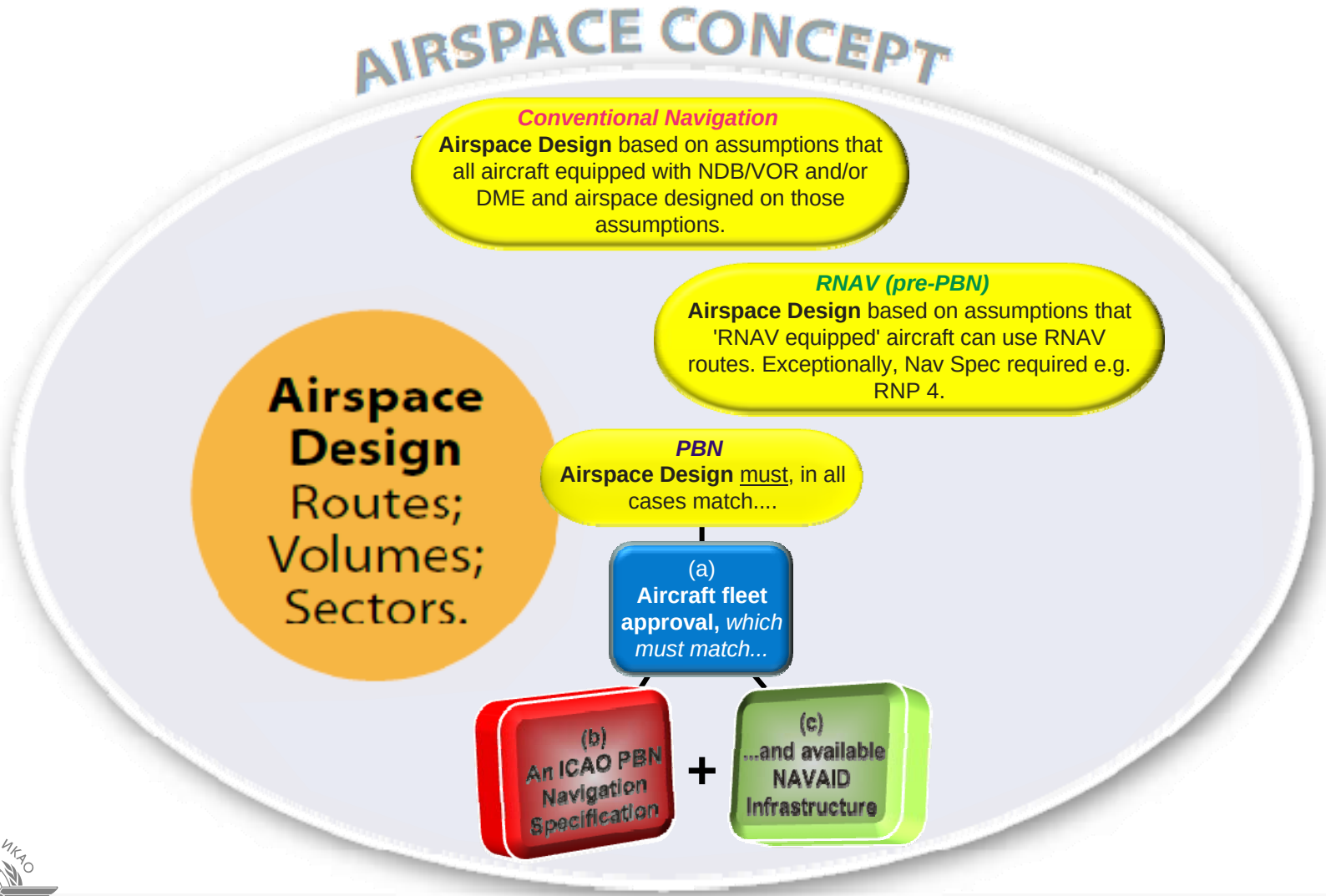
3. **Address enablers**

CN



4. **Identify technical/operational assumptions**

Airspace Concept



What does the team need to implement an Airspace concept (1)?

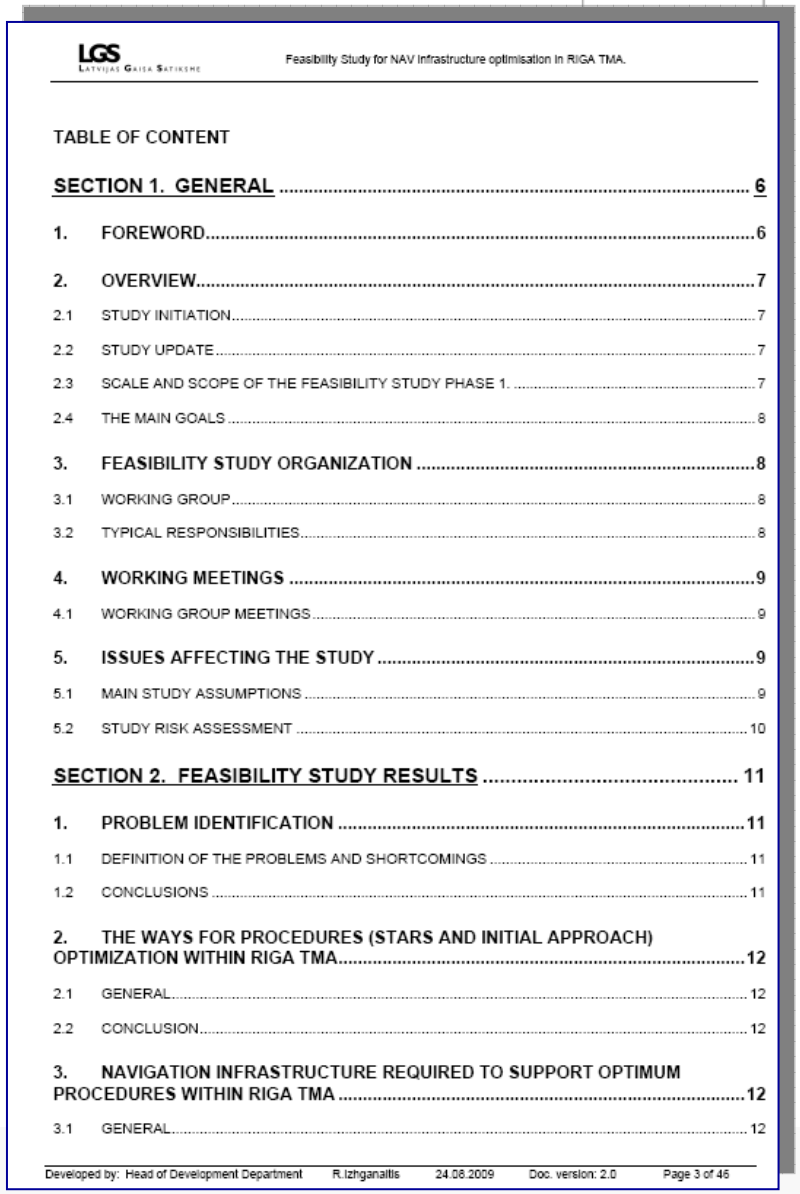
- **TIME** – to explore the needs of the various stakeholders, reach agreement on goals, identify current ground and airborne equipment limitations, conduct traffic flow analyses, etc
- **MONEY** – Costs may include (but are not limited to)
  - education and training (regulators, operators, ATC, procedure designers, etc),
  - establishment and sustainment of robust airworthiness, operations approvals, data quality techniques,
  - changes to ATC automation, flight validation, possibly new NAVAIDS (DMEs), etc
- **TOOLS** - design and modeling tools to support the design, validation and assessment of the present ("reference scenario") and planned Airspace Concept

What does the team need to implement an Airspace Concept (2)?

- **CONOPS**
  - Overarching plan covers:
    - CNS/ATM
    - Supports strategic objectives of airspace concept
    - Ensures buy in from all parties
    - Enables systemization of TMA
  - Strategy on how to handle traffic

What does it look like?

- An Airspace Concept can be in any document format
- Maintain configuration control!



LGS Latvijas Gaisa Satiksme — Feasibility Study for NAV Infrastructure optimisation in RIGA TMA.

TABLE OF CONTENT

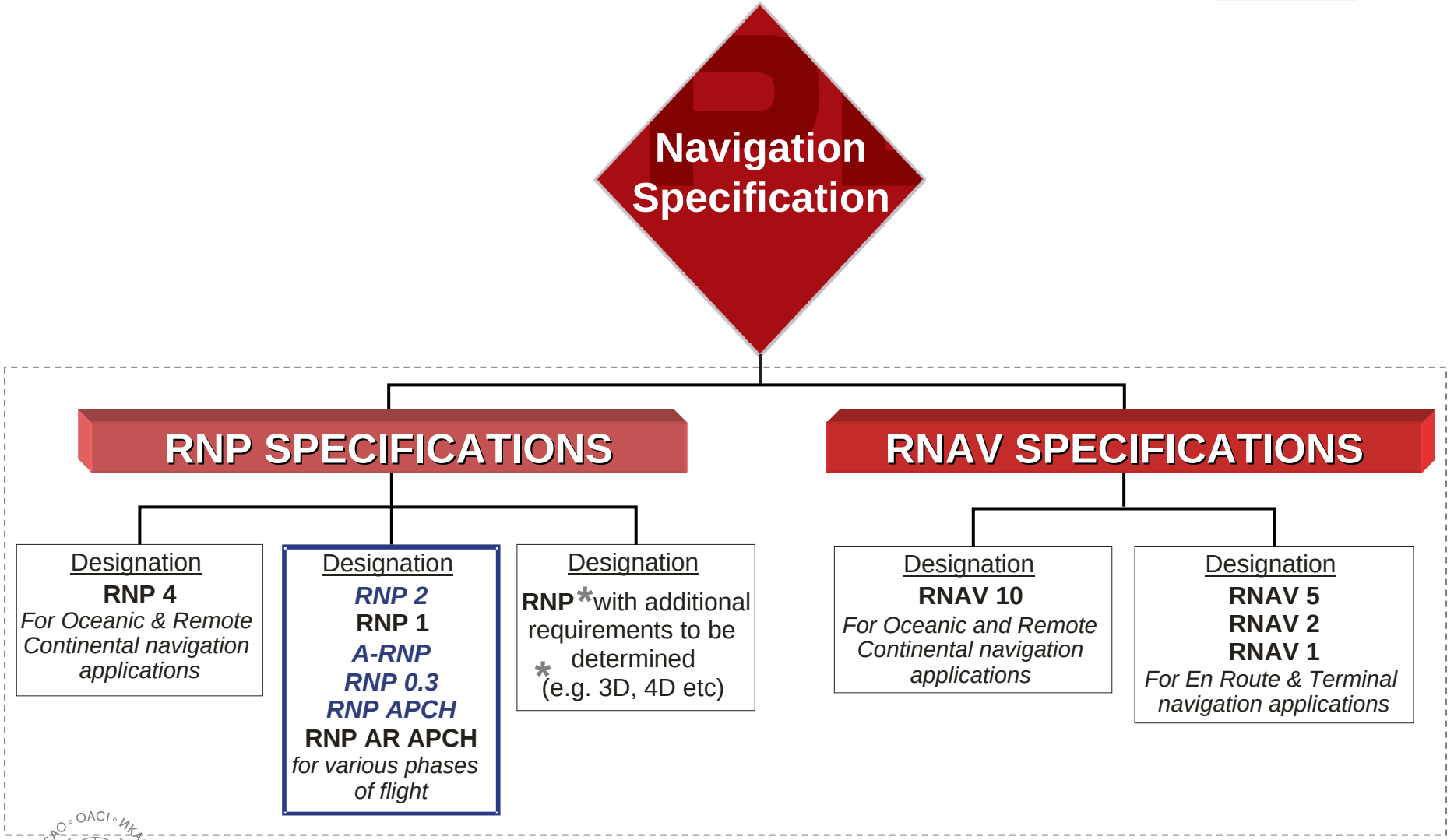
Developed by: Head of Development Department R.Izhganaitis 24.08.2009 Doc. version: 2.0 Page 3 of 46

What is the most critical point in implementing an Airspace Concept?

- The most critical part of developing an airspace concept is *setting the appropriate objectives and scope of the project*
- Enables the project team to remain focused and the budget to be managed within the set time

- Most projects which fail to meet the intended goal do so because of poorly defined scope and objectives.
  - Beware of ***project creep!***

Components of PBN Concept



International NS in Volume II of PBN Manual

What's new with PBN

Conventional Navigation
Airspace Design based on assumptions that all aircraft equipped with NDB/VOR and/or DME and airspace designed on those assumptions.

RNAV (pre-PBN)
Airspace Design based on assumptions that 'RNAV equipped' aircraft can use RNAV routes. Exceptionally, Nav Spec required e.g. RNP 4.

PBN
Airspace Design must, in all cases match....

(a)
Aircraft fleet approval, *which must match...*

(b)
An ICAO PBN Navigation Specification

+

(c)
...and available NAVAID Infrastructure

Address Enablers

Capacity

Increase number of ATS routes to reduce congestion; accommodate projected growth

Communications

VHF? HF? Two Way?

Navigation

NAVAIDs?
– Primary/Reversionary?
Aircraft and Operator Capabilities?

Surveillance

Radar? Non-Radar?

Air Traffic Management

ATC Procedures? Workload? Automation?

Efficiency

Reduce delays that result from excessive "leveling off" flight profiles

Objectives to Implementation

Safety	Capacity	Efficiency	Environment	Access
Reduce Controlled Flight Into Terrain via lateral & vertical course guidance to runway	Increase number of air traffic routes to reduce congestion; accommodate projected growth	Reduce delays that result from excessive “leveling off” flight profiles	Reduce noise over sensitive area	Improve airport and airspace access in all weather conditions
RNP APCH (APV Baro/SBAS) to replace conventional NDB NPA	Parallel **A-RNP** with **FRT** ATS routes between cities	**RNAV-1** SID that allows continuous climb to en-route	**RNP APCH** with **RF** or **RNP (AR) APCH** providing guided curved approach or missed approach segments	**RNP APCH** (APV Baro/SBAS) allowing lower minima

Agree Assumptions

Design the Airspace

Capacity

Increase number of ATS routes to reduce congestion; accommodate projected growth

IDENTIFY KNOWN TRAFFIC FLOWS

DETERMINE PLACEMENT FOR SIDS/STARS

INCLUDE SPECIAL TECHNIQUES e.g. CDO, CCD & POINT MERGE

FIND GOOD CROSSING POINTS

BUILD AIRSPACE VOLUME & SECTORISE

Efficiency

Reduce delays that result from excessive "leveling off" flight profiles

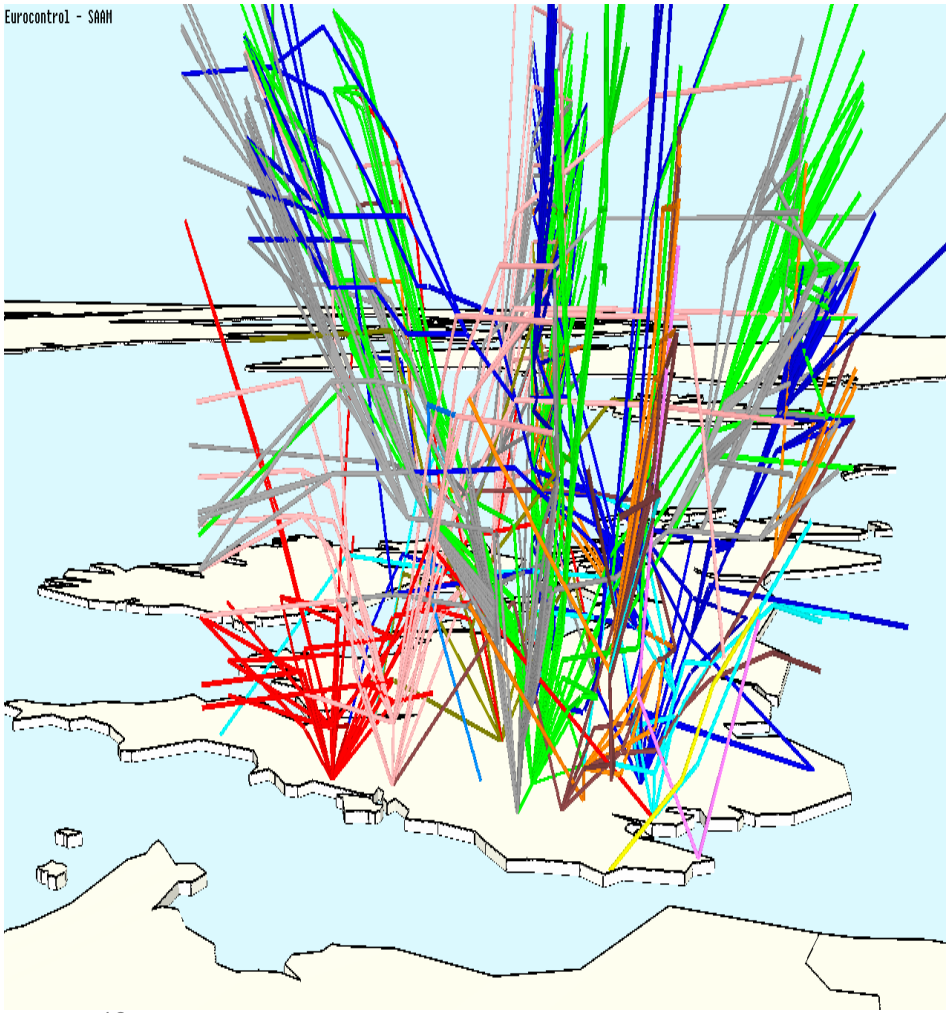
Thank you

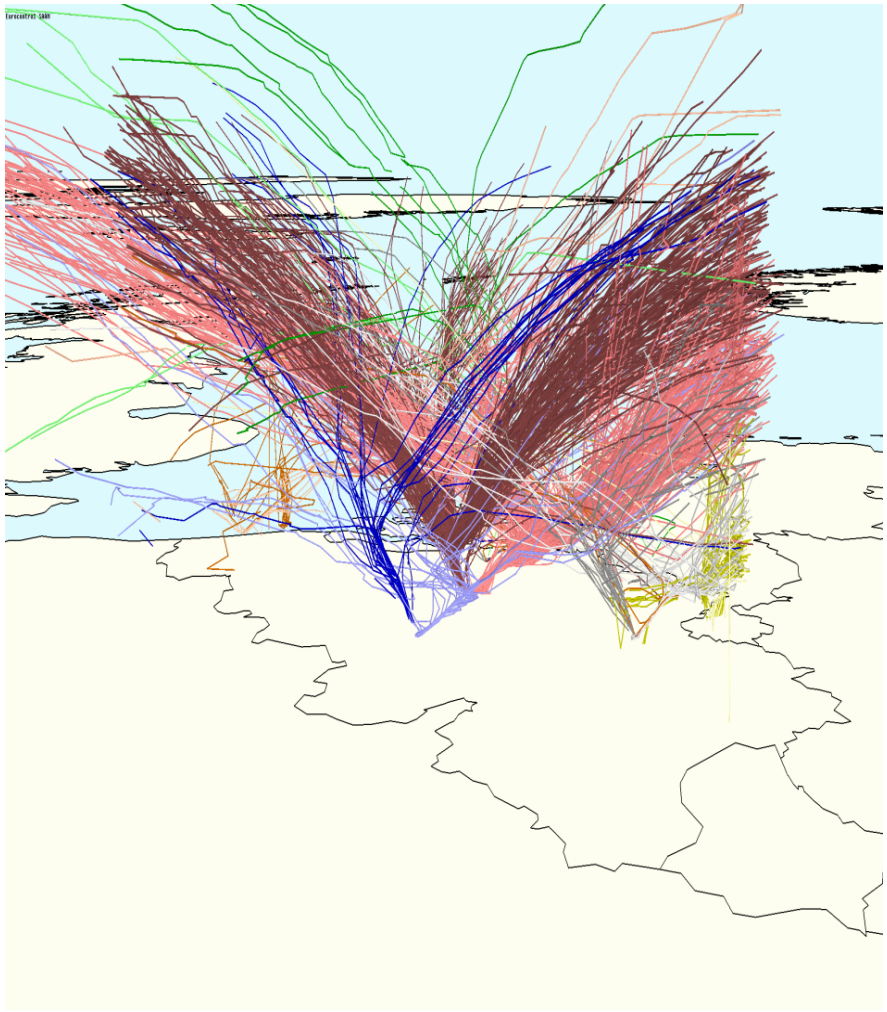
OPS CONCEPTS

OBJECTIVE

- This module will provide an overview of a concept of operations (CONOPS)
- Provide examples of different CONOPS
- Provide generic understanding of the purpose and need to develop a CONOPS in support of a PBN Airspace concept

Current Airspace – Complexity





What is a CONOPS?

- Overarching plan covers:
  - CNS/ATM
  - Supports strategic objectives airspace concept
  - Ensures buy in from all parties
  - Enables systemisation of TMA
- Strategy on how to handle traffic

Why a CONOPS?

- Without CONOPS:
  - Risk to have only a nice airspace design
  - No Predictability
  - No Uniform handling of traffic
  - no planning
  - No benefits from PBN
  - No awareness of developments of trends
  - Less means to analyse trends
    - Traffic spreads
    - New conflict areas
    - Capacity issues

Controllers vs Engineers

- Controllers
  - Conservative
  - Reluctant to change
  - RV ‘rules’
- Engineers
  - Not conservative
  - Embrace change
  - Always in detailed level

Poor Examples

- TMA redesign with AMAN –(US)
- New sectorisation (en route) – (EU)
- Combining tasks – (EU)

Good Examples

- London TMA re-design
- Atlanta RNAV departures

- What about your experiences in this?

Skills and Proficiency

- Pilot
  - System managers
  - Special skills trained on flight sim
- Controller
  - RV mainly
  - Afraid losing skill
  - Is there a resemblance ;-)

TMA 2010+

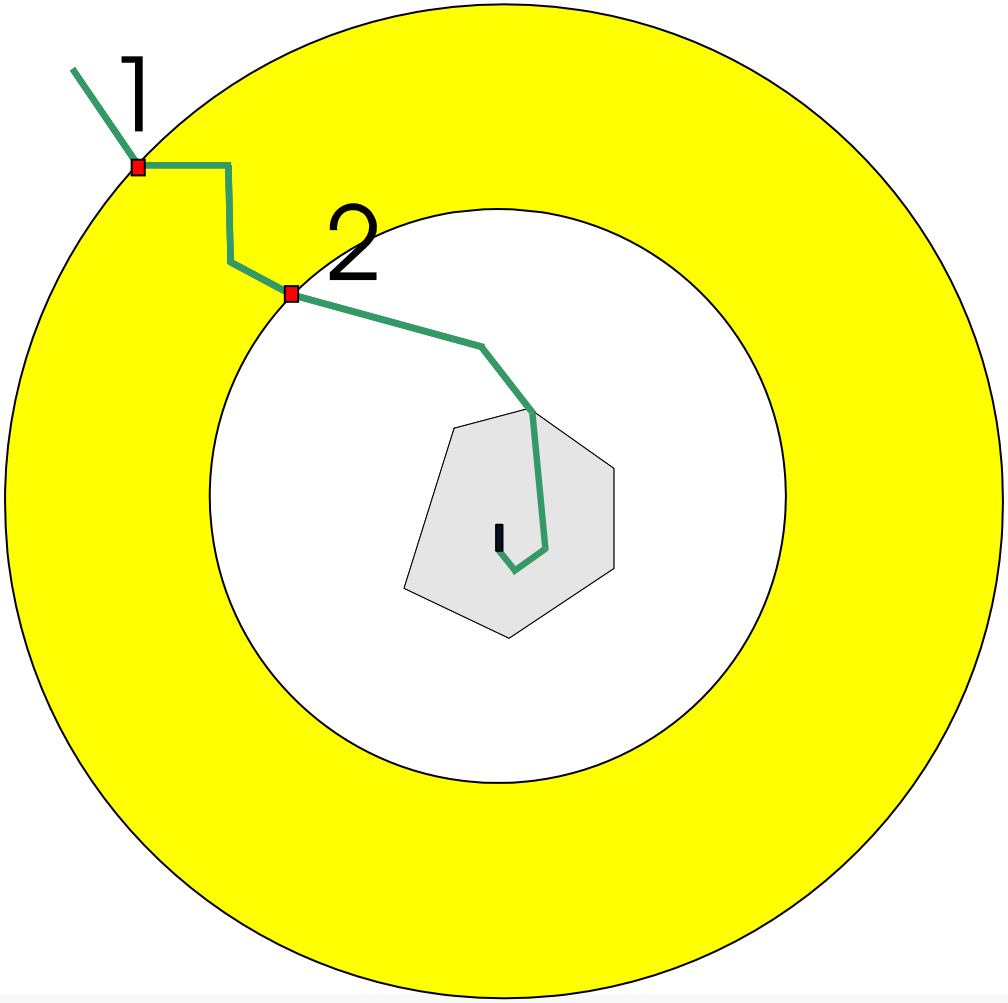
- Advanced arrival manager
- Monitoring tool
- Speed and level advice to controllers
- Allows CDAs in peak hours
- Requires support from ACC

Sequencing and Metering

- Present strategy relies on aircraft stacks to maximise landing rates
- Sequencing and metering is the responsibility of the controller and does not usually take account of AO preferences or priorities
- Future operational concept aims to minimise delay while optimising the available airport resources to the full

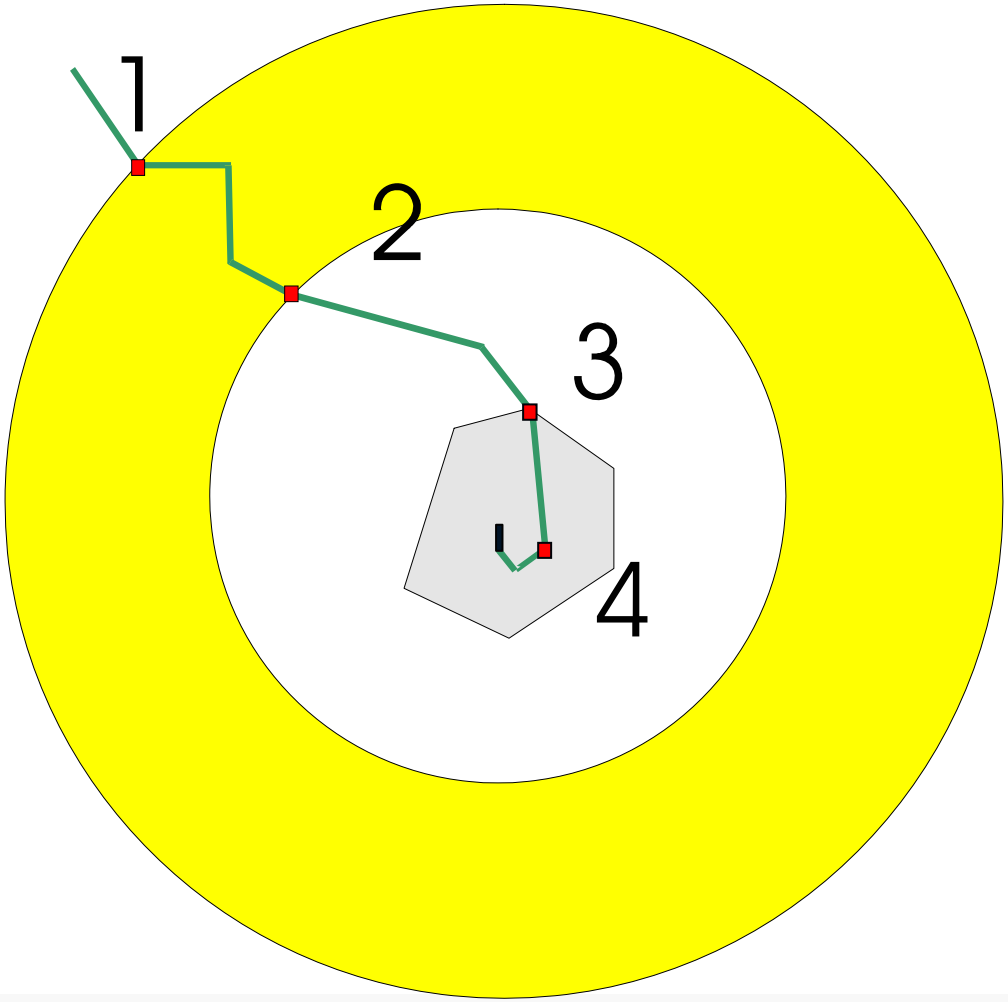
Concept

- At 1:
  - Aircraft becomes eligible for AMAN
- At 2:
  - Controller will be provided with active advisories



Concept (2)

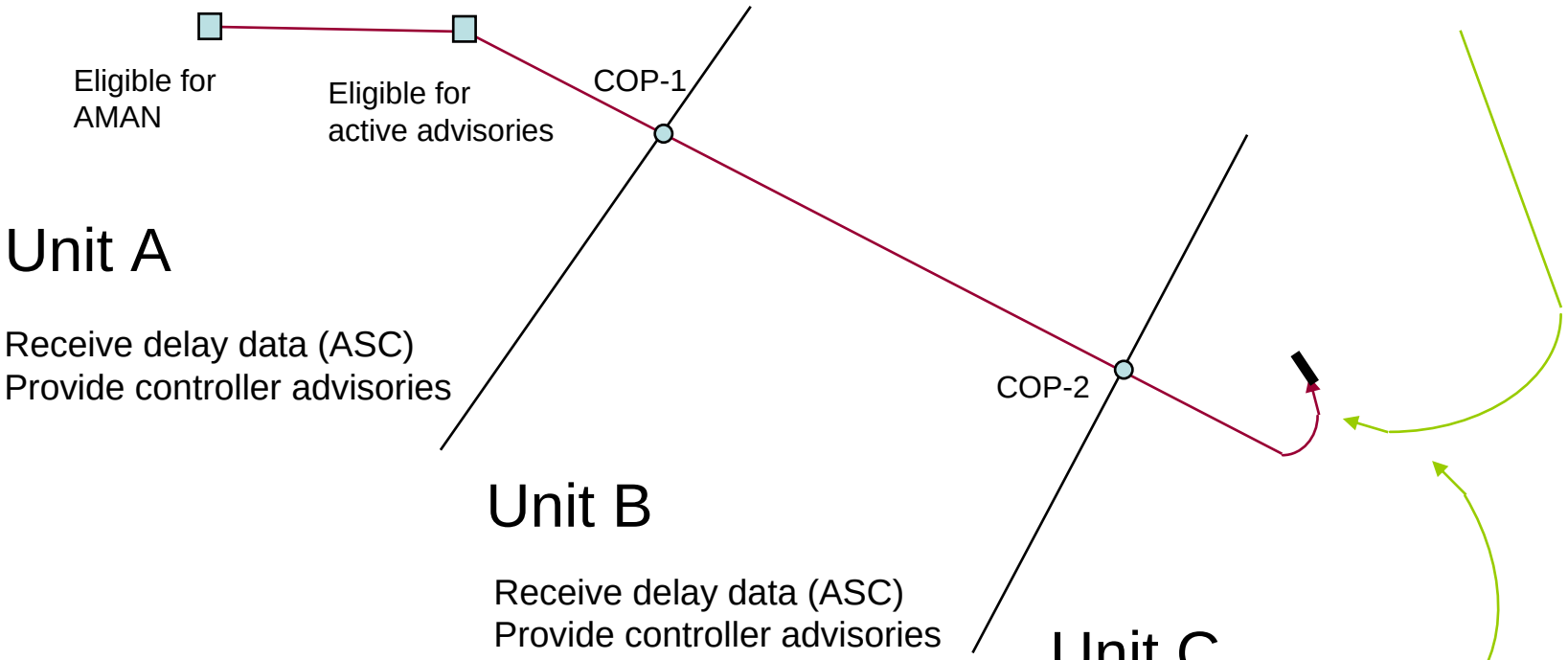
- At 3:
  - Common Path Protection may be provided
- At 4:
  - Common Path Protection will be provided



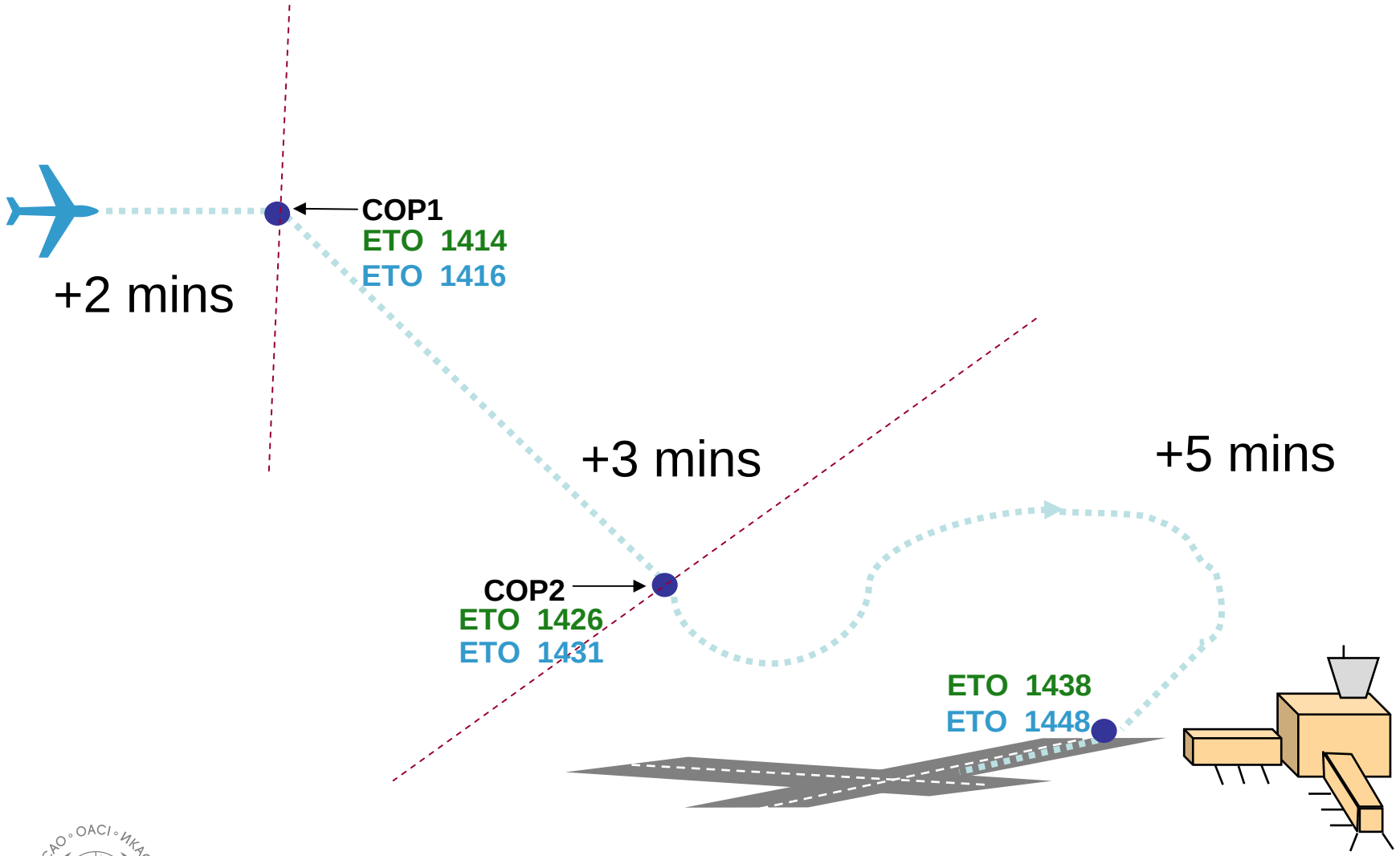
Re-sequencing Criteria

- Re-sequencing adjustment
  - Aircraft cannot meet the scheduled landing time
  - Changed demand for arrival and departure slots

Distributed Processing



Delay Sharing



AMAN-P

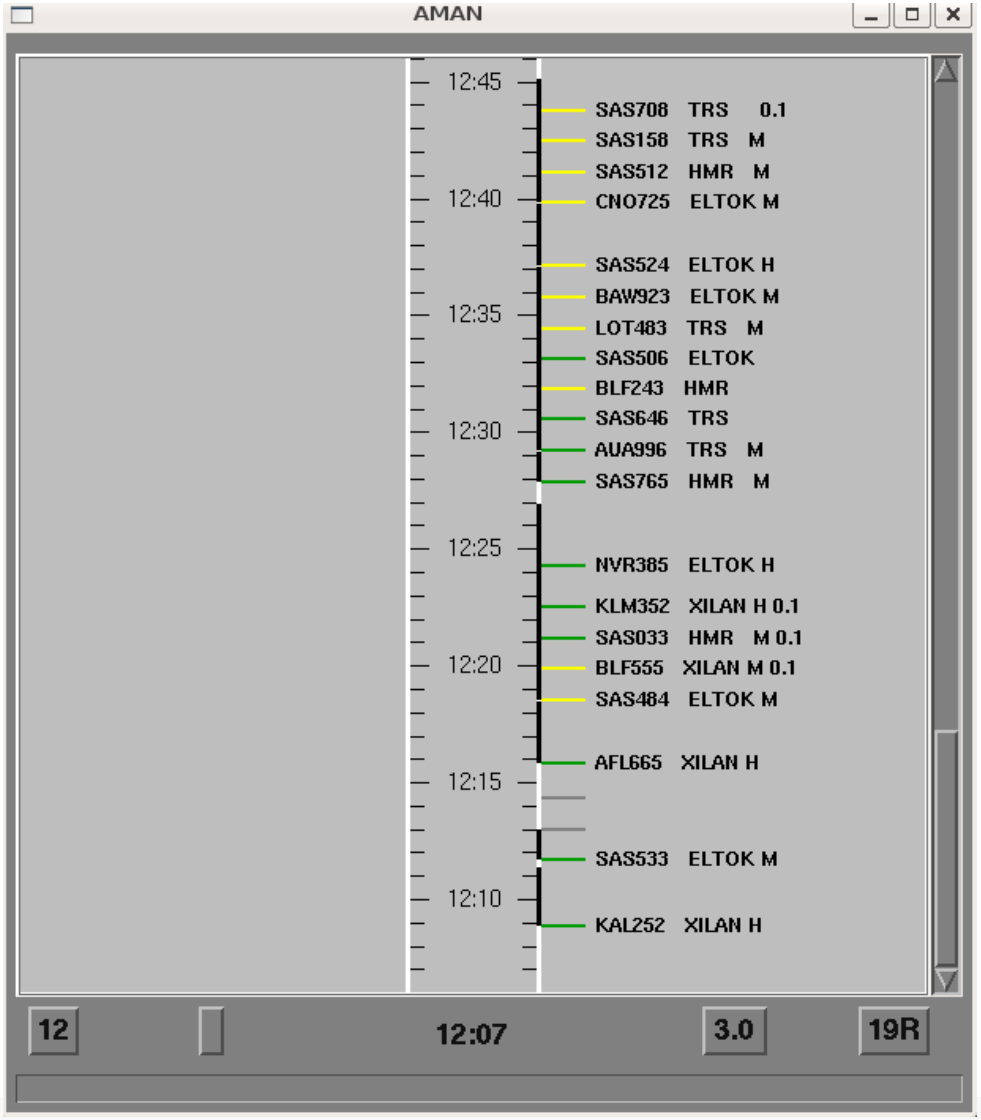
Monitoring functionality (MONA-P)

- Compares the actual progress of the flight against its proposed trajectory
- If discrepancies occur, the system will generate active controller advisories

AMAN-P

- **AMAN-P HMI**

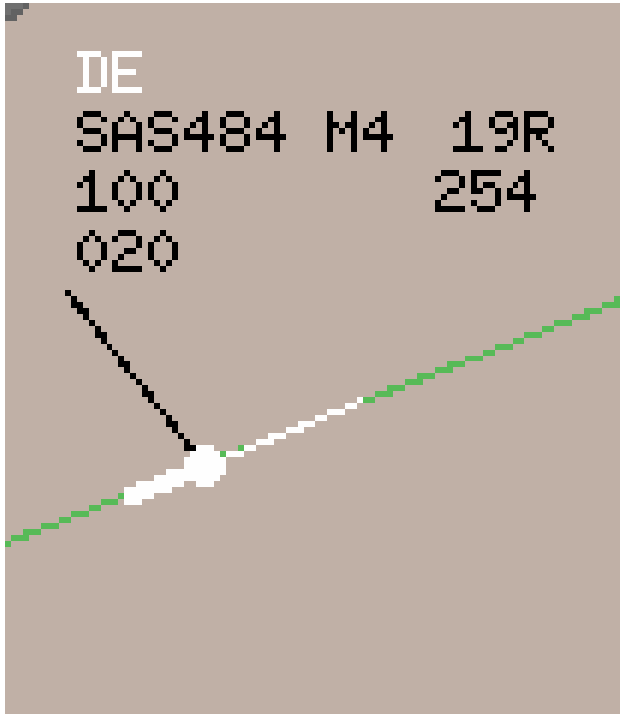
- Landing list



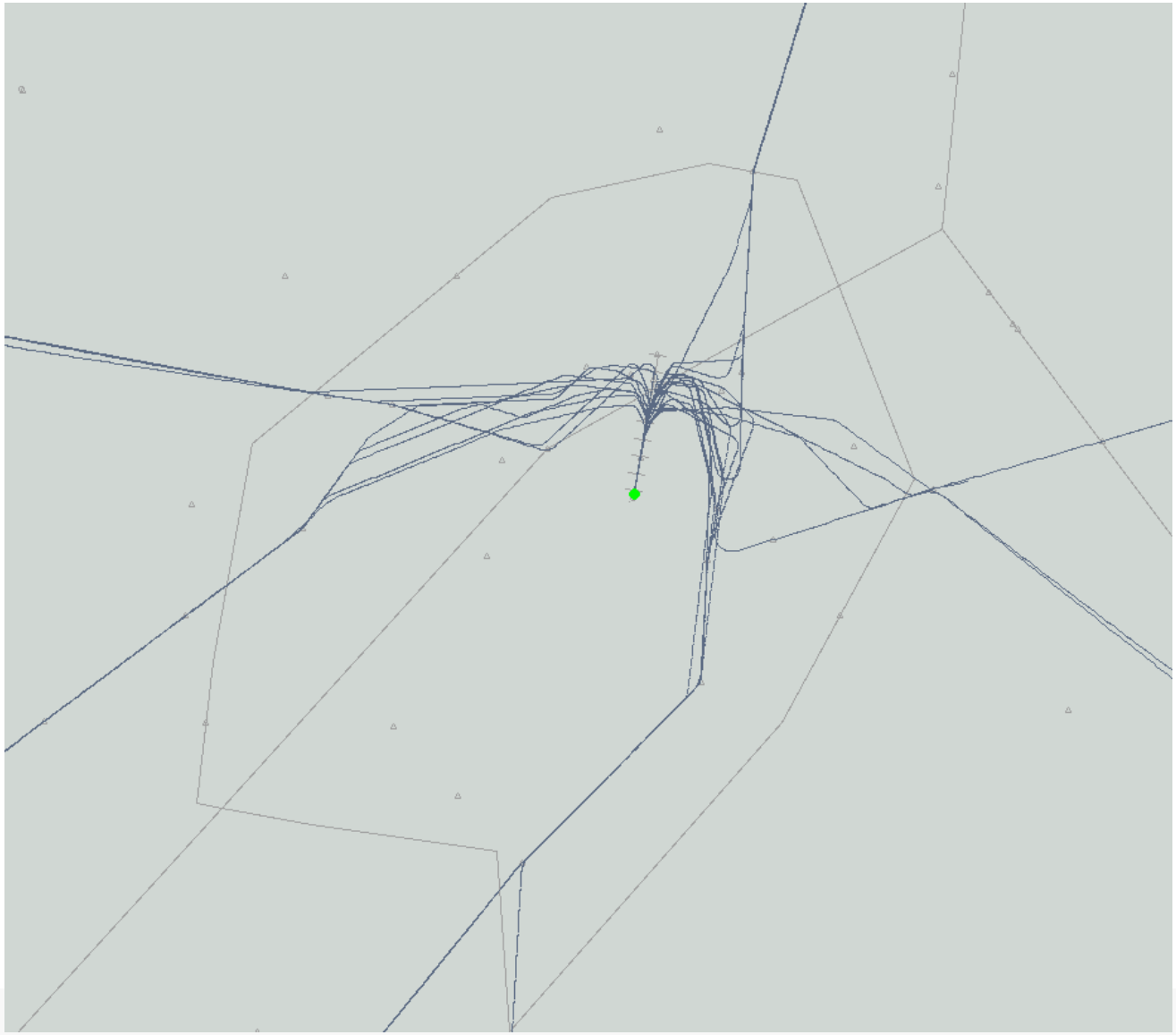
AMAN-P

- **AMAN-P HMI**

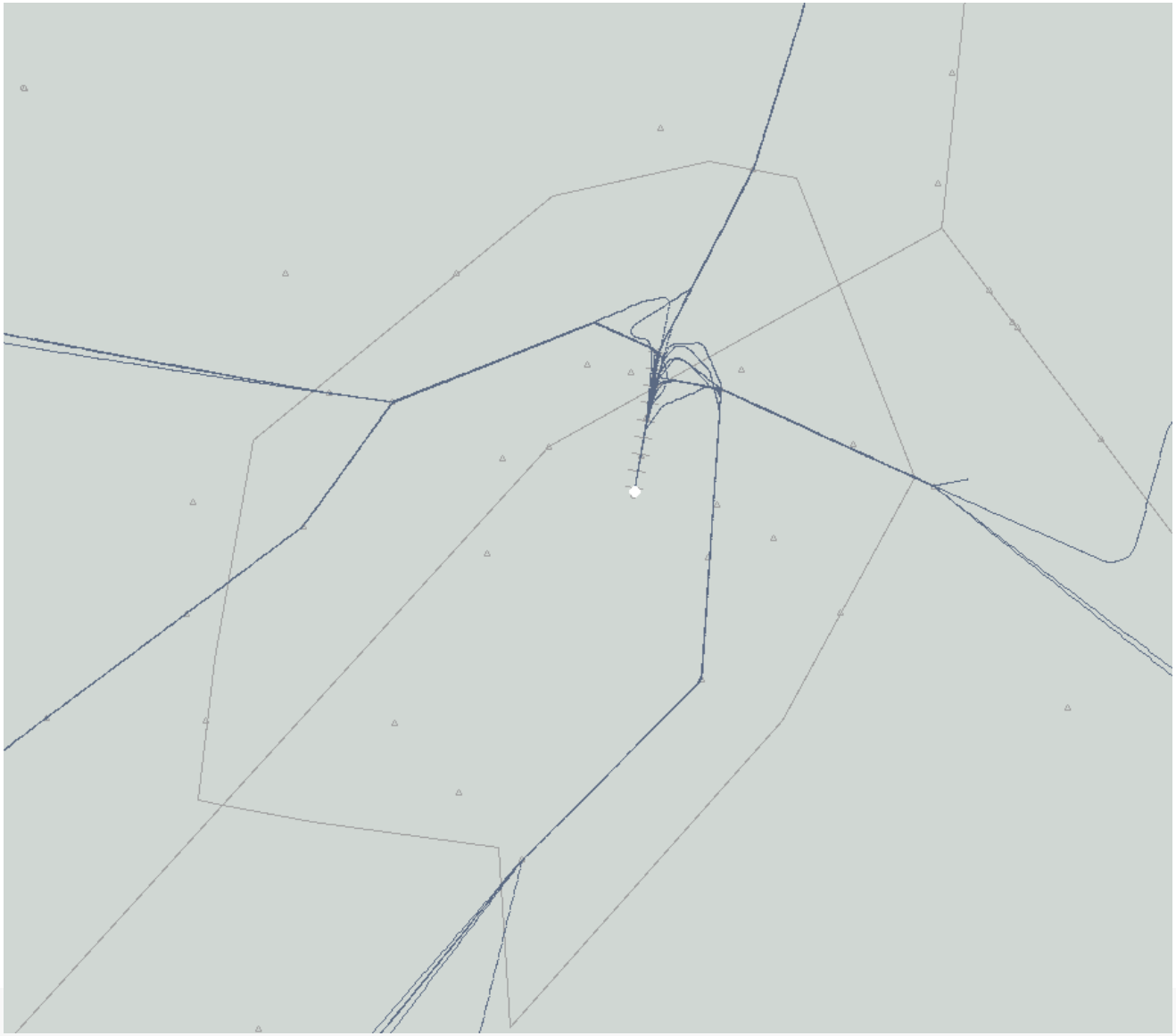
- Controllers advisory in label zero line



Flight Profile (Baseline)

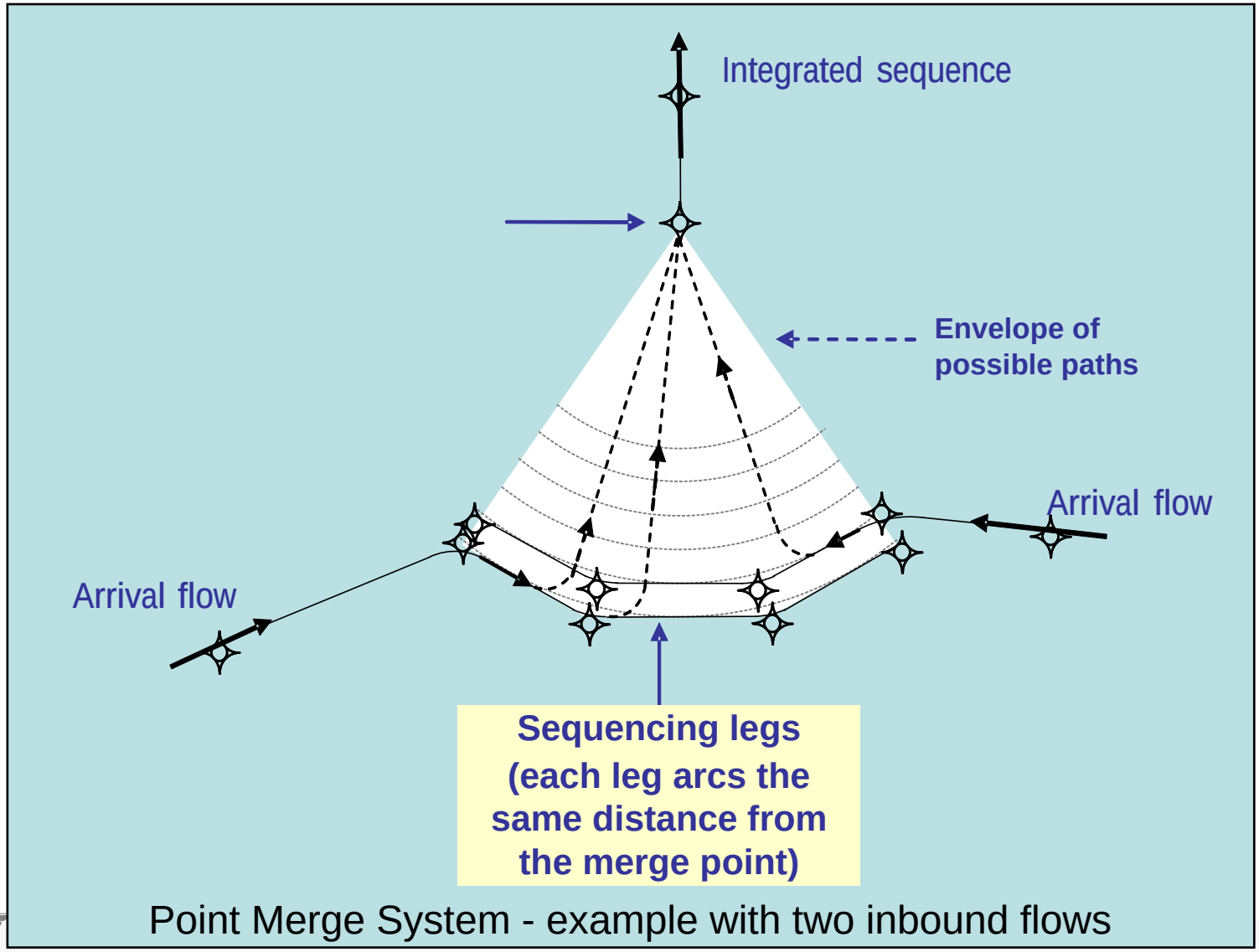


Flight Profile (RNAV1)



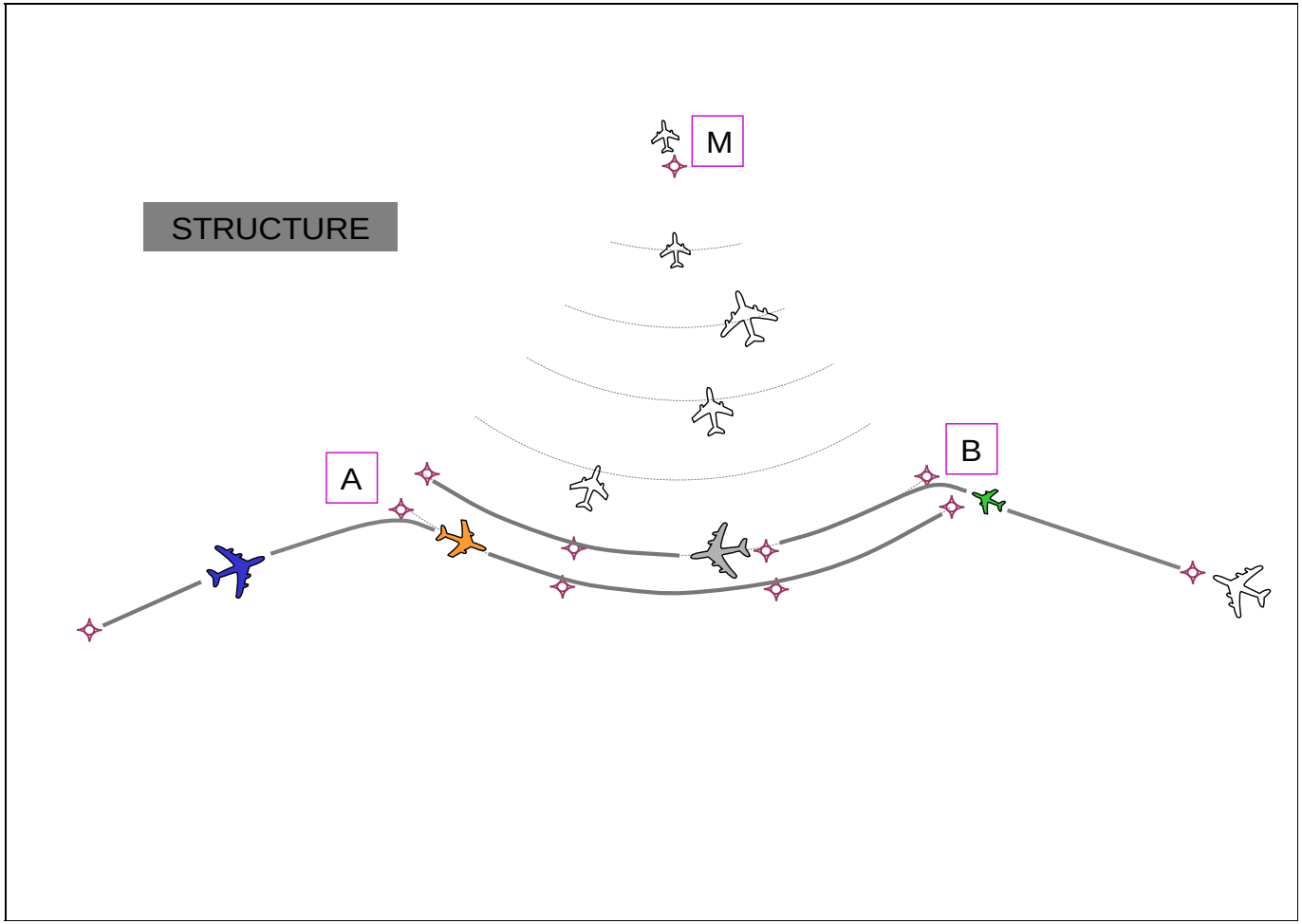
Flight Profile (RNAV1 + AMAN-P)

Point Merge System (PMS)



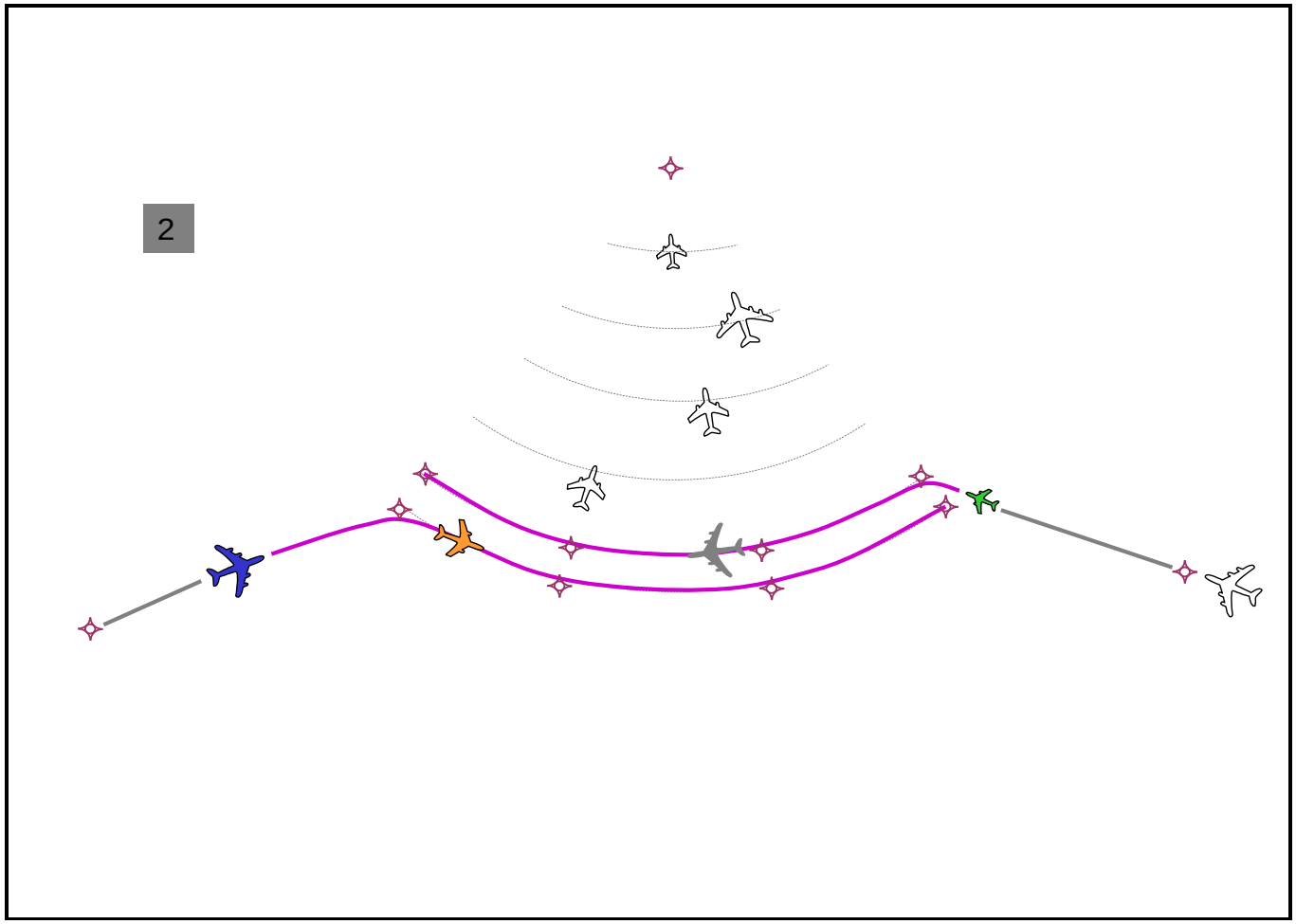
Point Merge System - example with two inbound flows

Scenario “Talk-Through” (1/5)



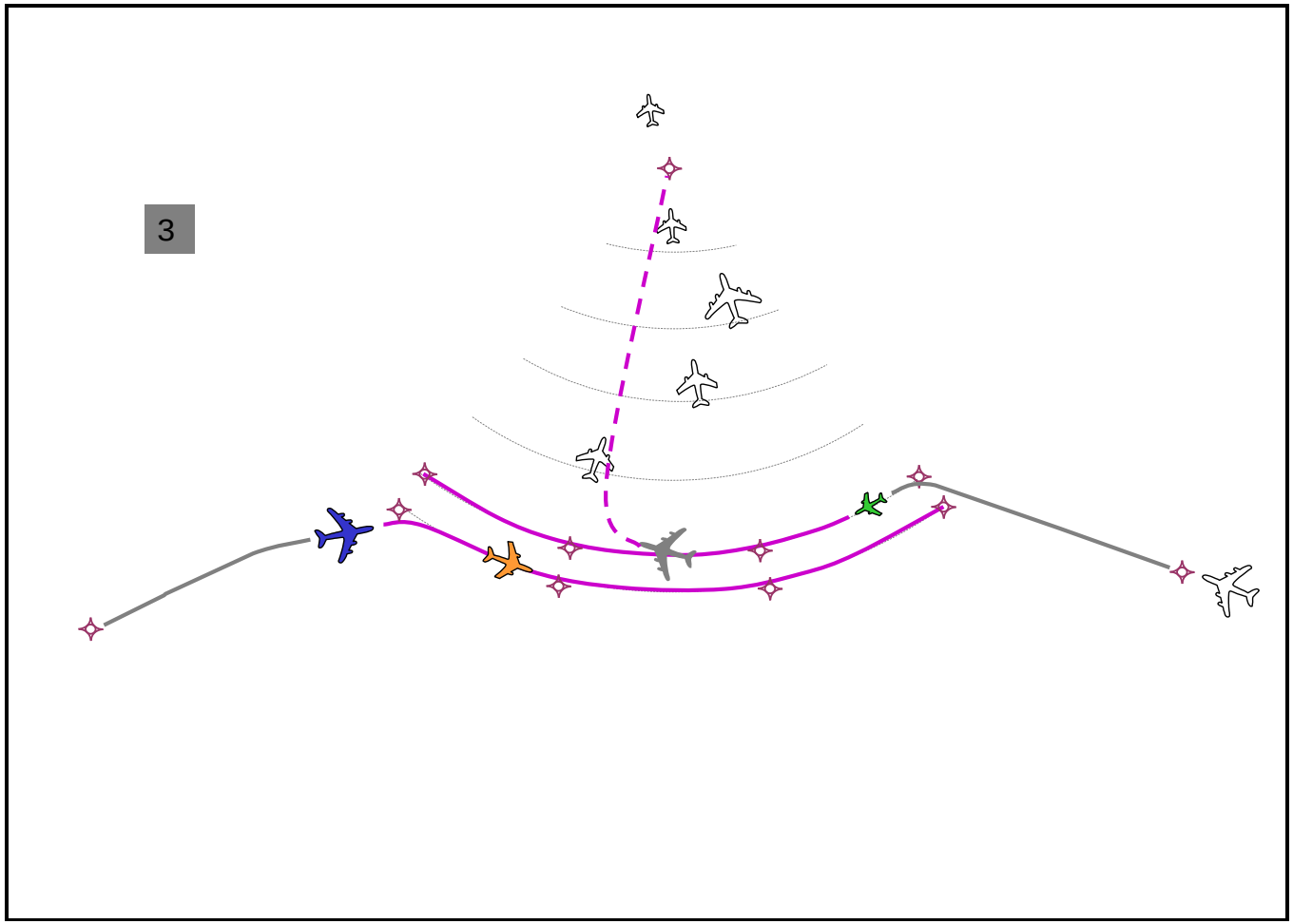
Scenario “talk-through” for Grey, Green, Gold and Blue aircraft

Scenario “Talk-Through” (2/5)



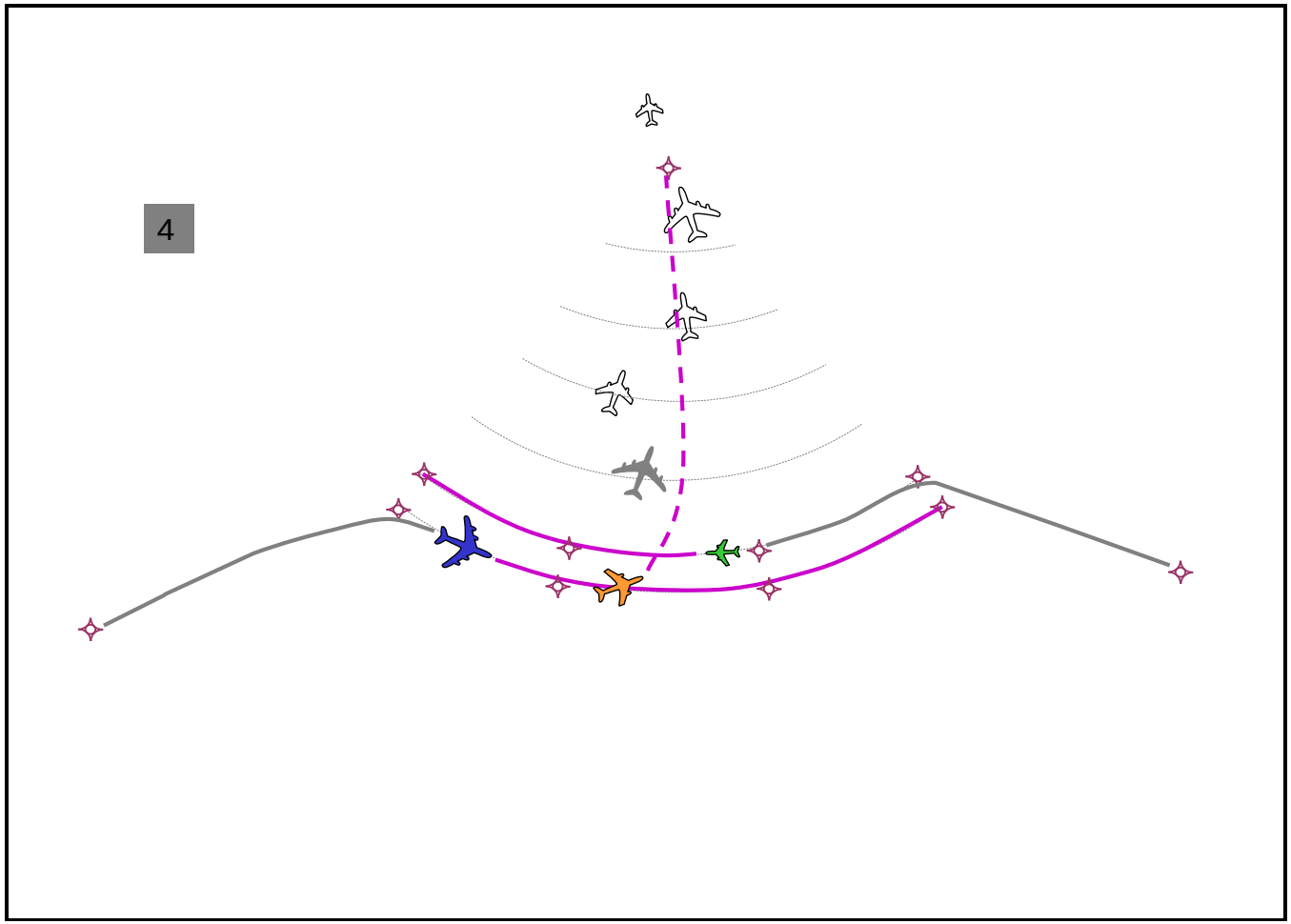
Initial situation with a busy flow of traffic to the merge point

Scenario “talk-through” (3/5)



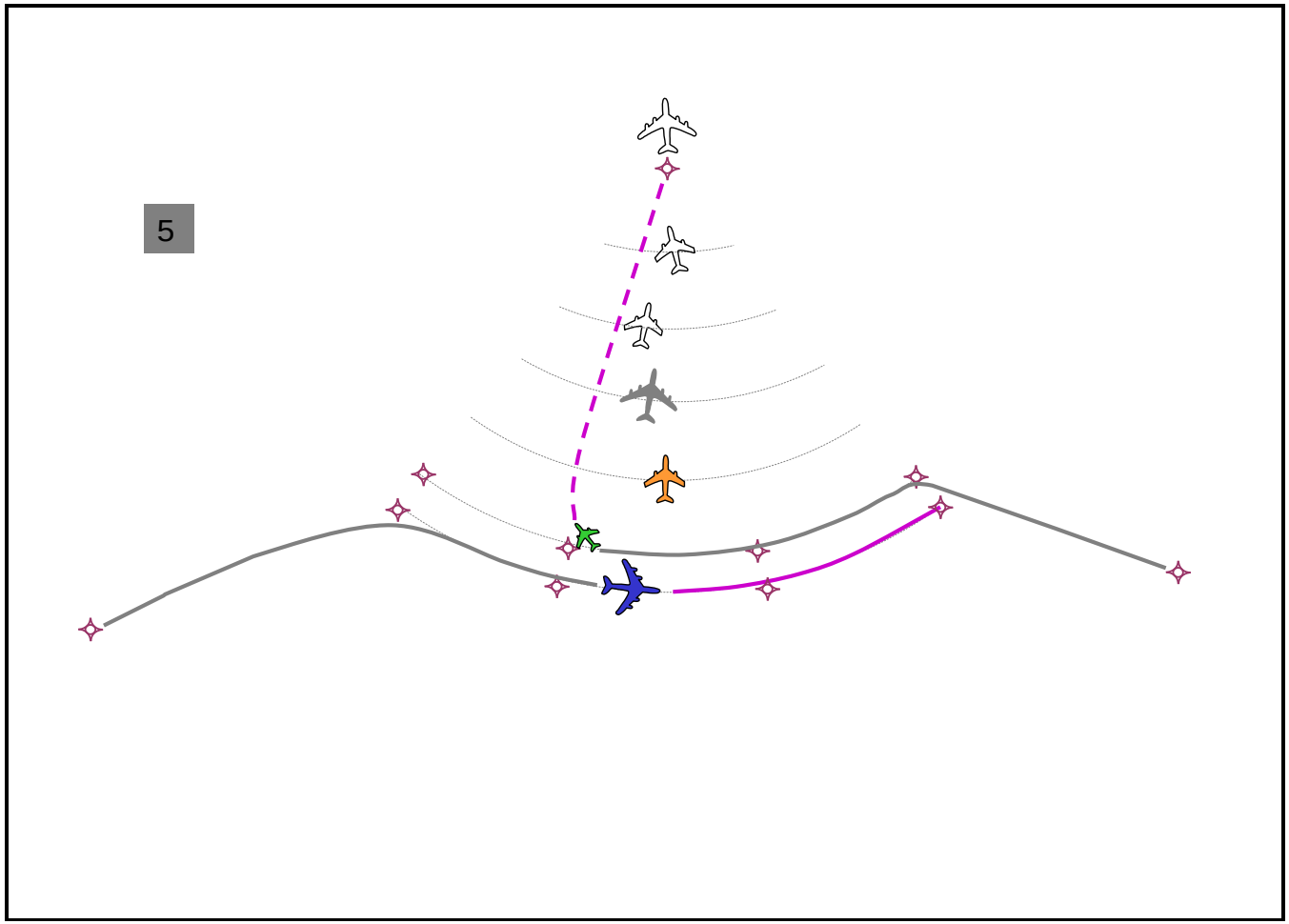
Grey heavy jet cleared direct to the merge point.
Controller determines when to issue the “Direct to merge point” instruction to the Gold aircraft to ensure that the required WTC spacing behind the preceding aircraft will be achieved.

Scenario “Talk-Through” (4/5)



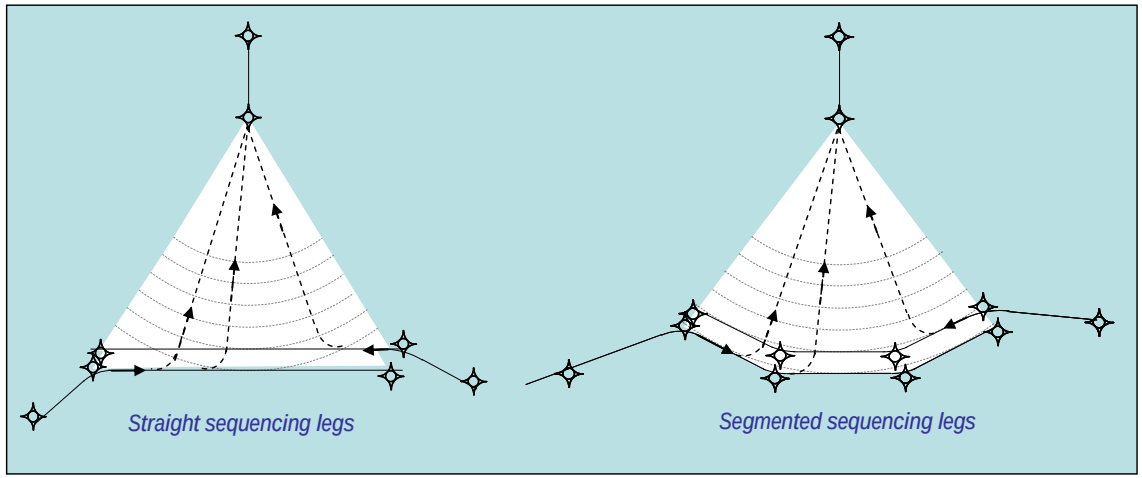
Controller issues the “Turn left direct to merge point” instruction to the Gold aircraft using the range ring arcs to assess the appropriate WTC spacing from the Grey aircraft.

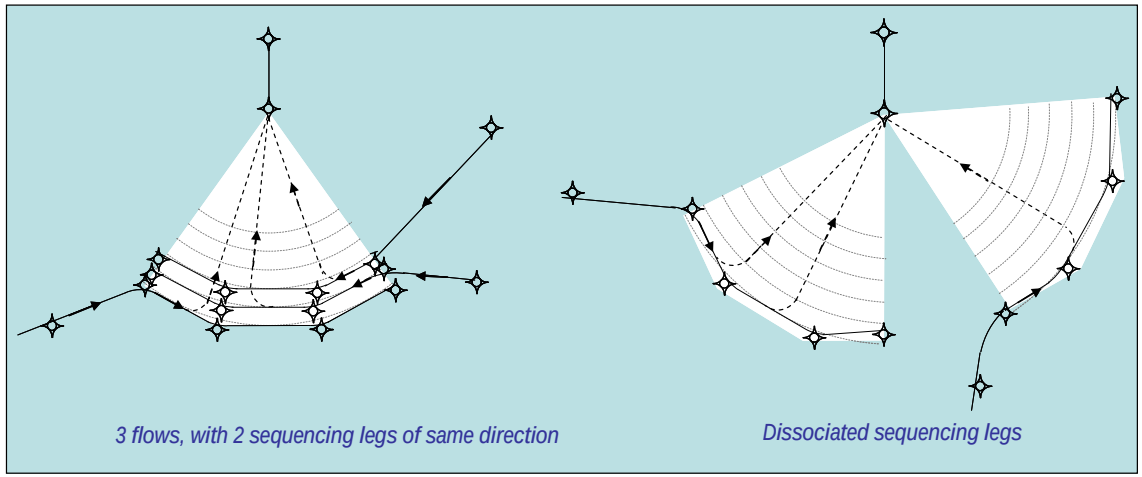
Scenario “Talk-Through” (5/5)

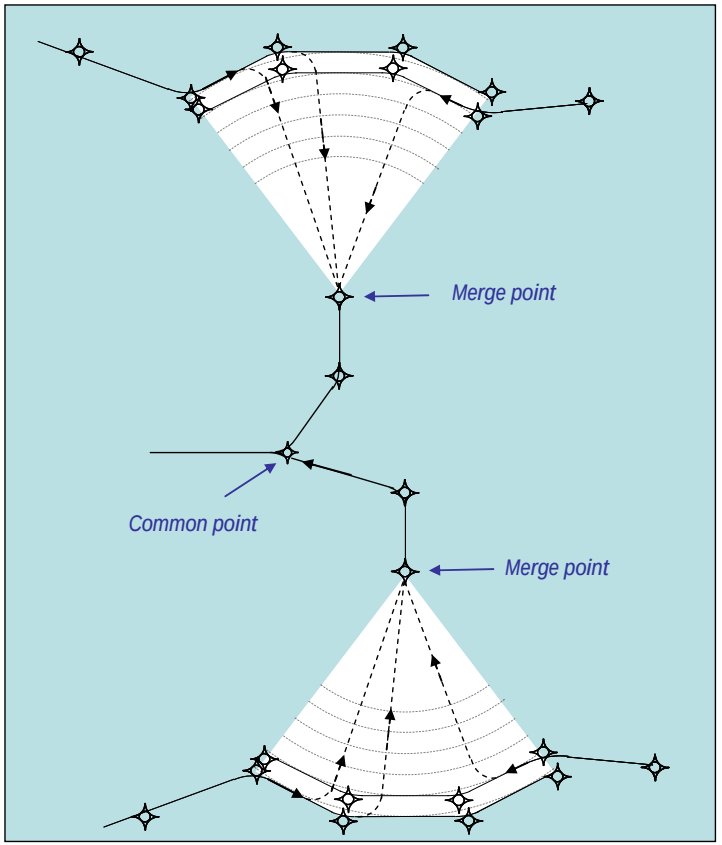


The same technique is repeated for the Green aircraft and subsequently for the Blue aircraft once the Green aircraft passes the next ‘Range Ring’

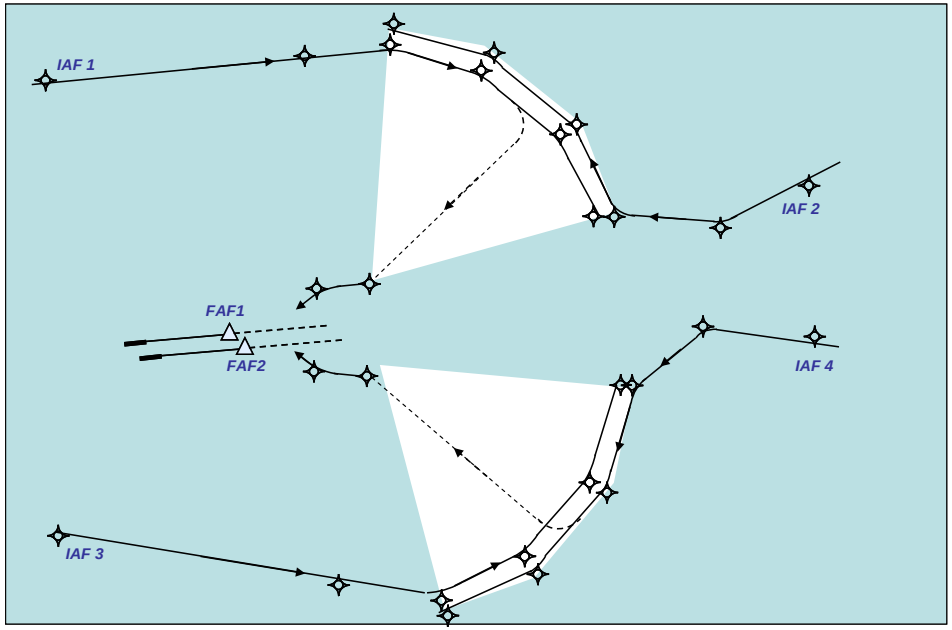
Configurations Tested (1/2)

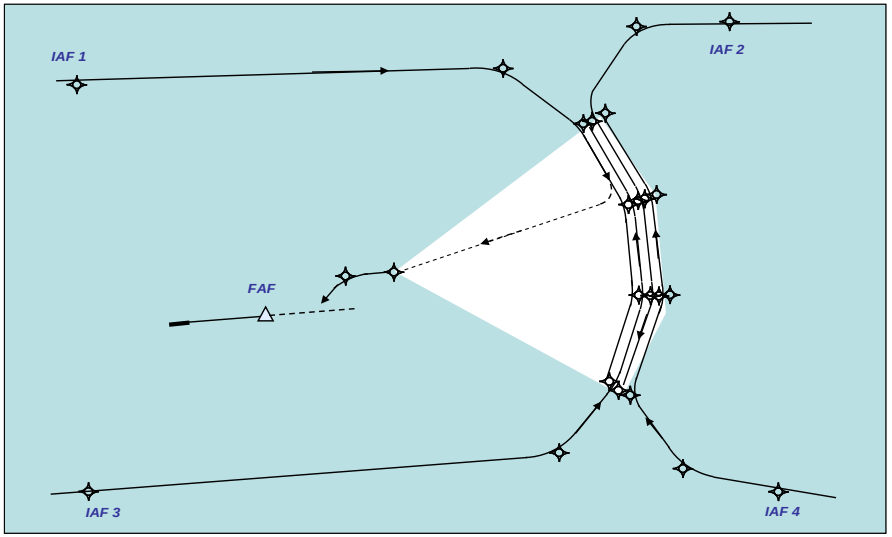


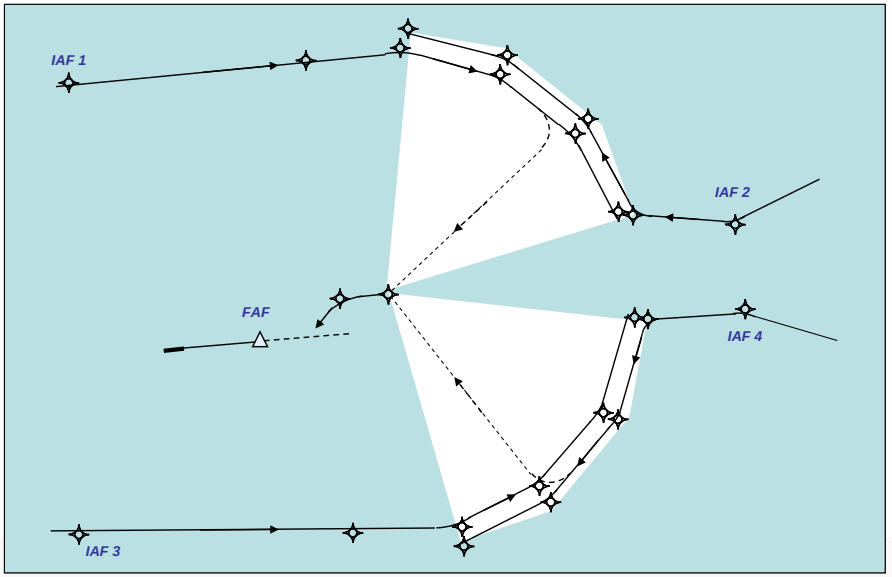


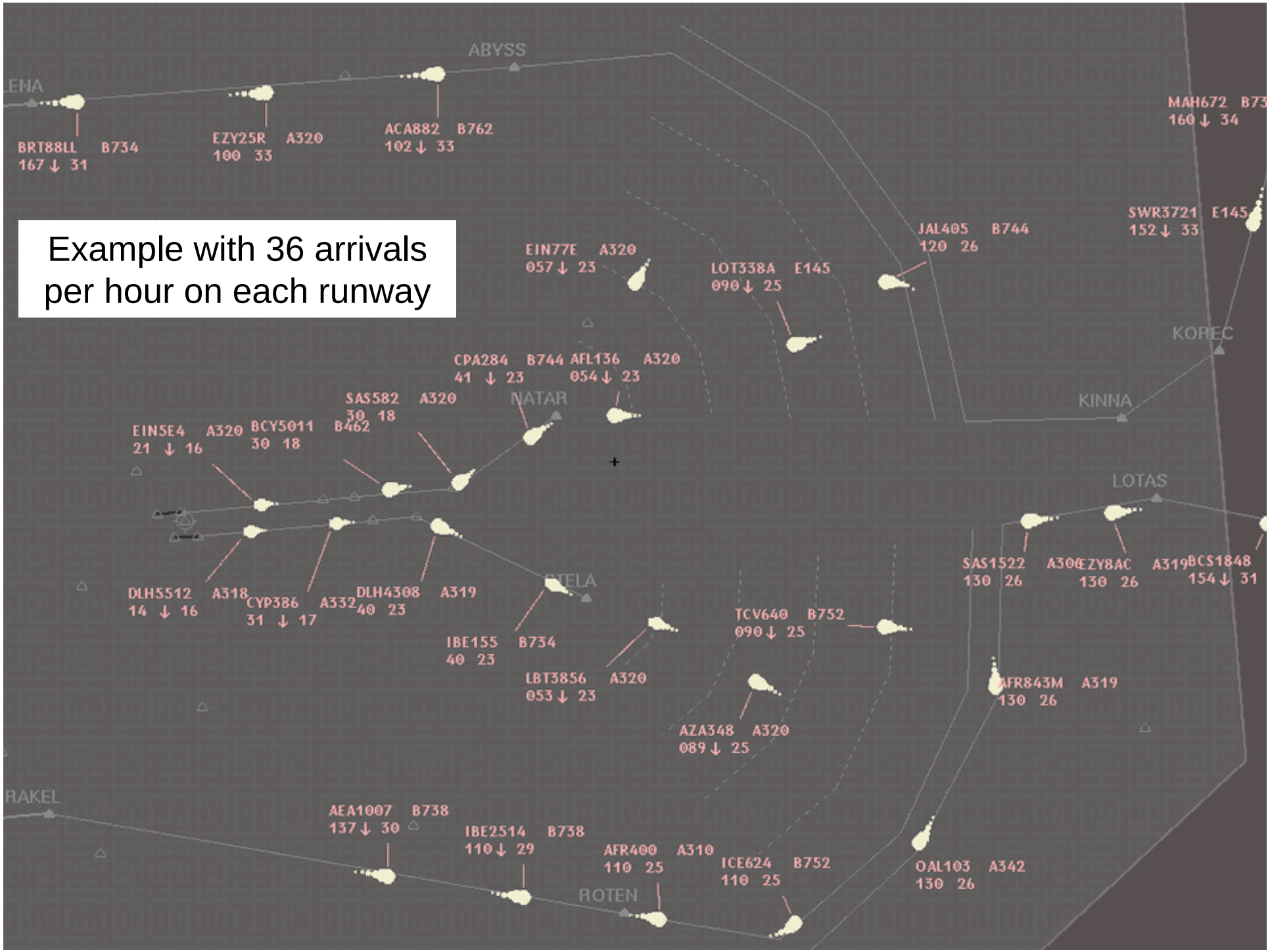


Configurations Tested (2/2)

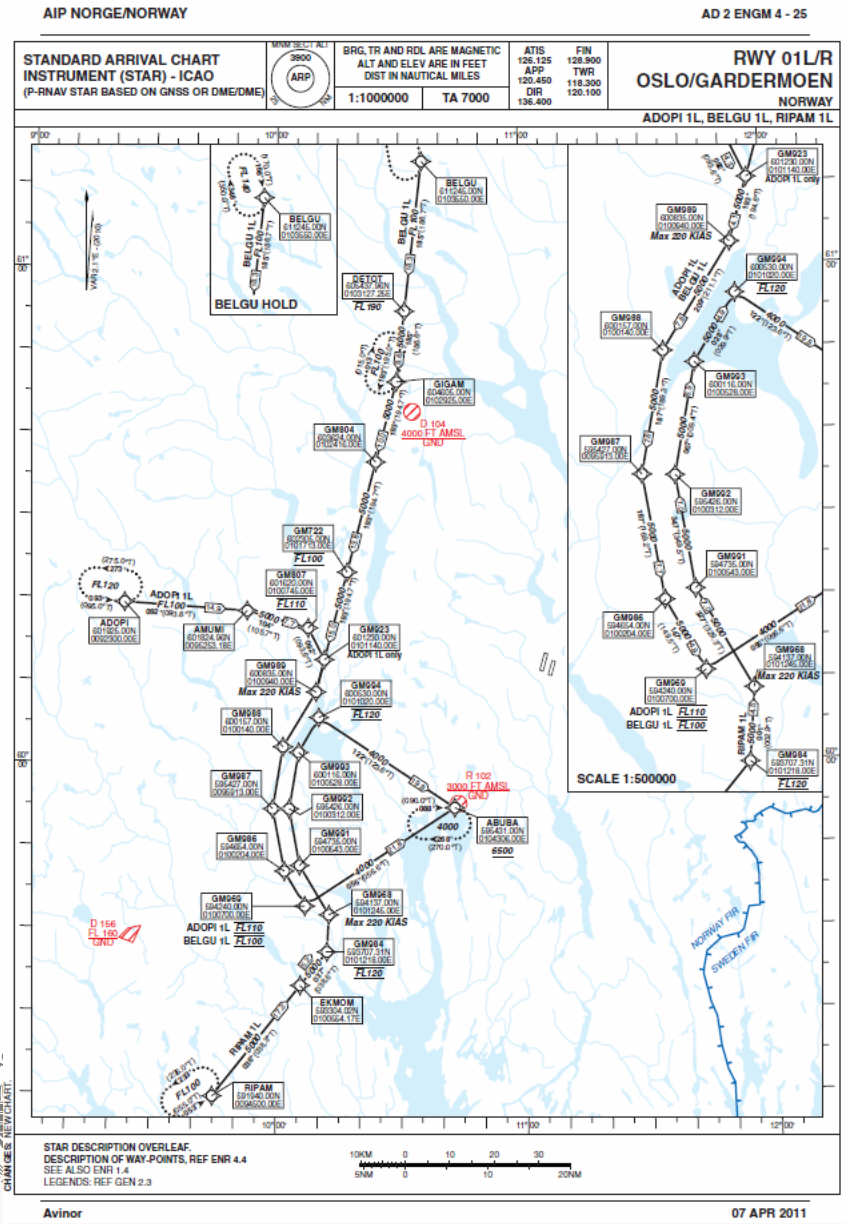


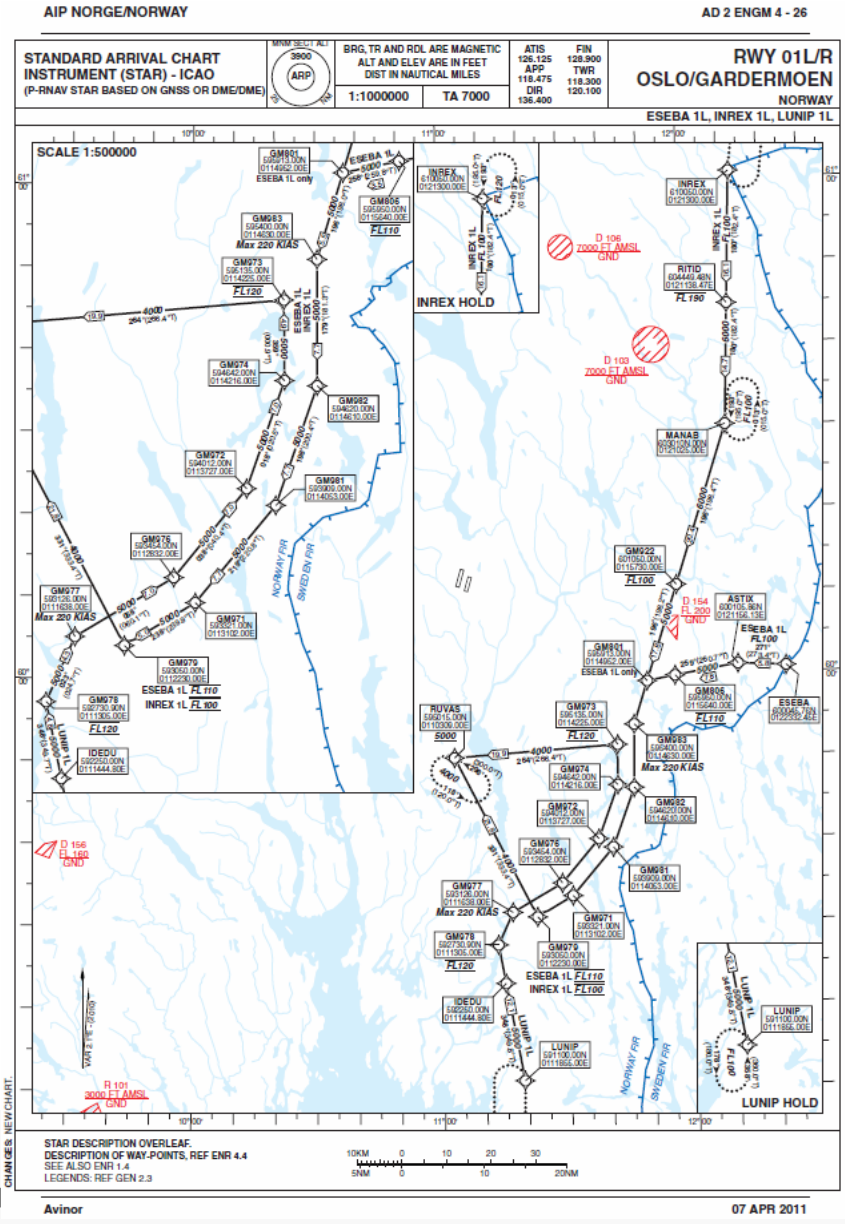





Example with 36 arrivals per hour on each runway
ABYSS
ENA
BRT88LL B734
167 ↓ 31
EZY25R A320
100 33
ACA882 B762
102 ↓ 33
MAH672 B73
160 ↓ 34
SWR3721 E145
152 ↓ 33
JAL405 B744
120 26
EIN77E A320
057 ↓ 23
LOT338A E145
090 ↓ 25
KOREC
CPA284 B744
41 ↓ 23
AFL136 A320
054 ↓ 23
SAS582 A320
30 18
NATAR
KINNA
EIN5E4 A320
21 ↓ 16
BCY5011 B462
30 18
LOTAS
SAS1522 A306
130 26
EZY8AC A319
130 26
BCS1848
154 ↓ 31
DLH5512 A318
14 ↓ 16
CYP3B6 A332
31 ↓ 17
DLH4308 A319
40 23
ETELA
IBE155 B734
40 23
TCV640 B752
090 ↓ 25
LBT3856 A320
053 ↓ 23
AFR843M A319
130 26
AZA348 A320
089 ↓ 25
RAKEL
AEA1007 B738
137 ↓ 30
IBE2514 B738
110 ↓ 29
AFR400 A310
110 25
ROTEN
ICE624 B752
110 25
OAL103 A342
130 26

Point Merge - Norway





THANK YOU