Implementing CDO and CCO

Use in a constrained environment

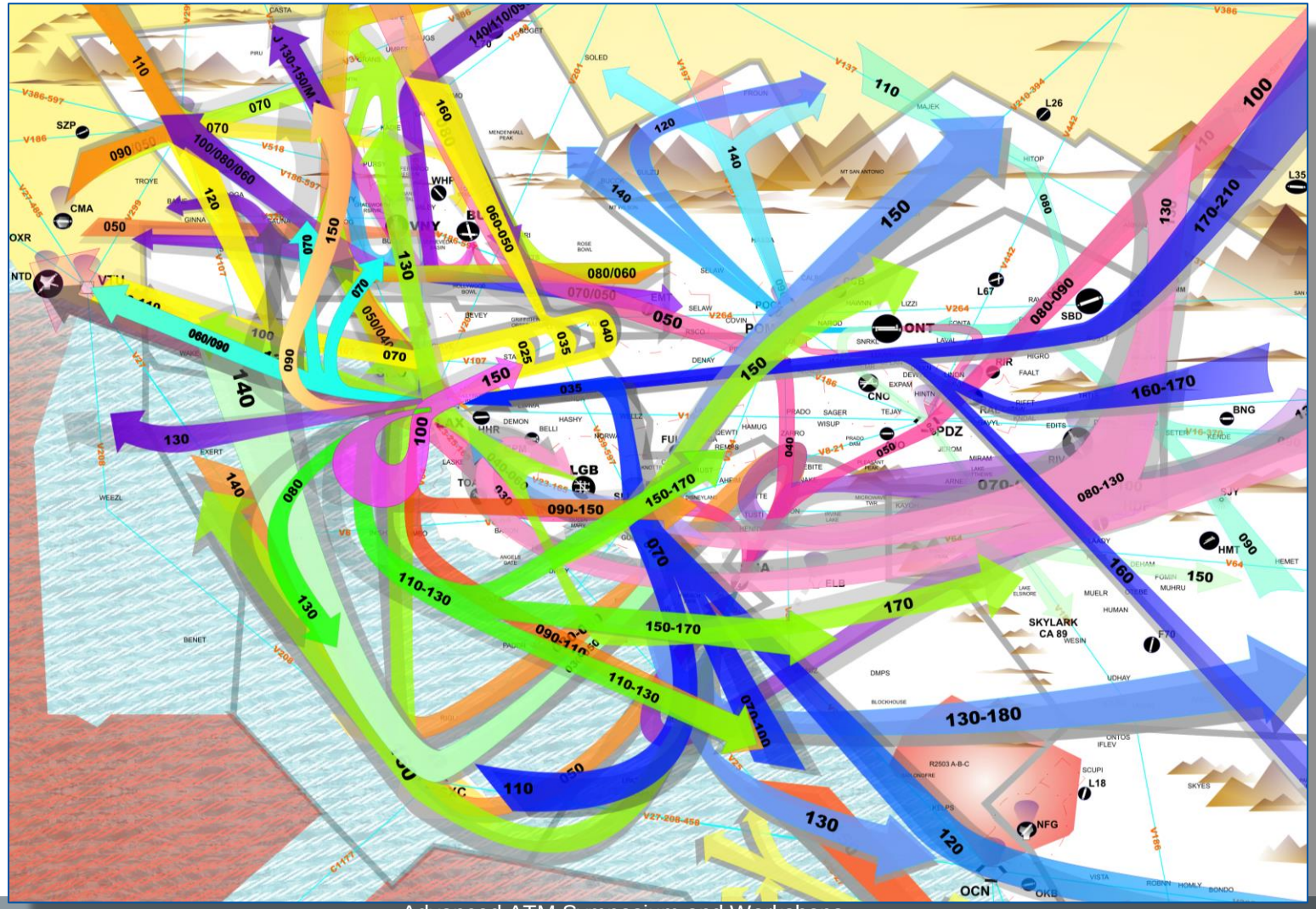
CDO/CCO in a Constrained Environment

- Design system for energy management.
- Update practices to take advantage of technology.
- Leverage FMS capabilities.
- Accept partial success.
- PBN and conventional integration. What choice?
- Request vs. assign – transition period.

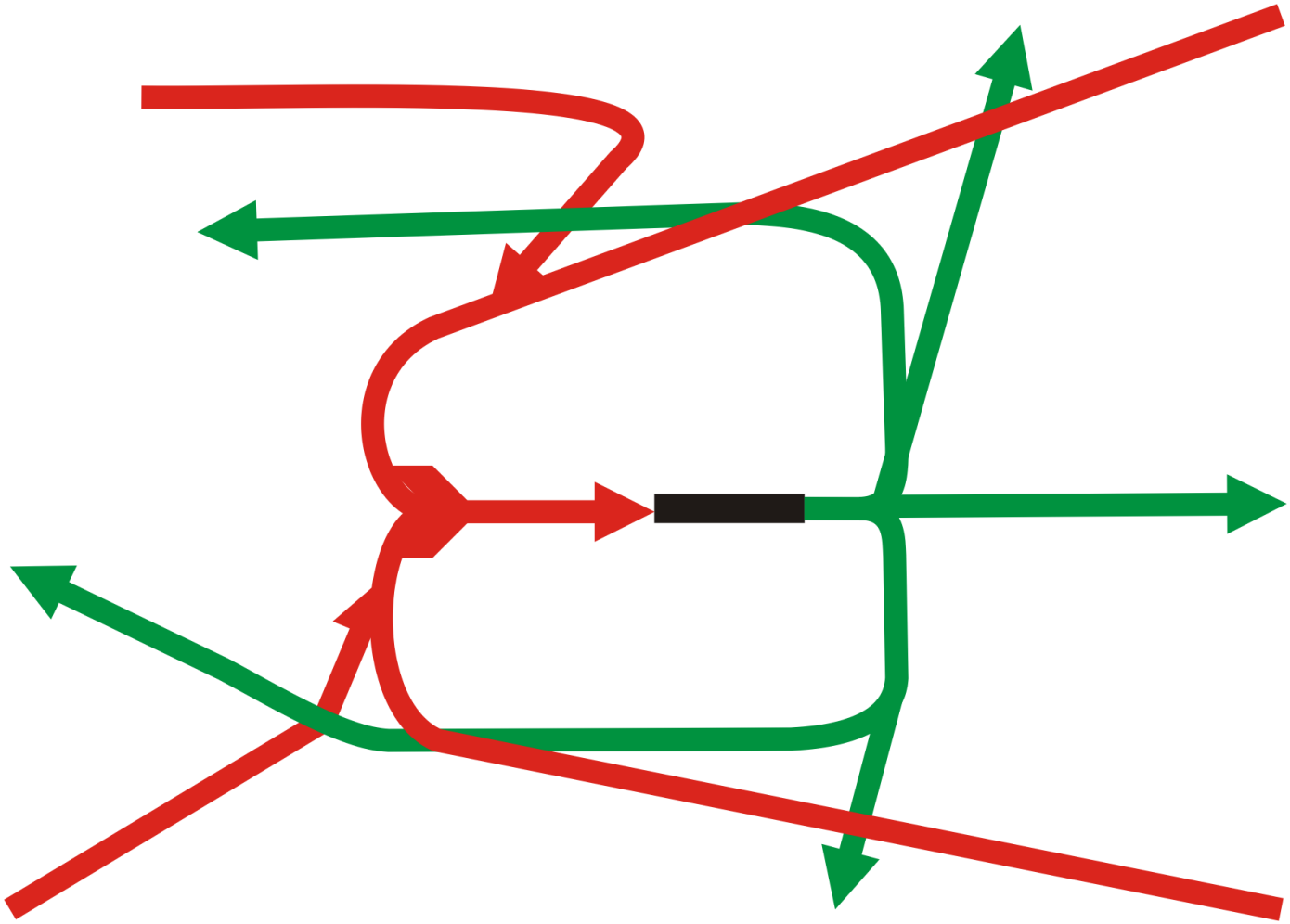
Enabling Acceptance

- Benefits in terms of ATC
  - Safety culture
  - Fewer radio transmissions
  - Less chance of readback/hearback errors
  - Greater predictability
  - Airspace Containment
  - Lost Comm
  - Fewer go-arounds
  - Less transit occupancy time in airspace

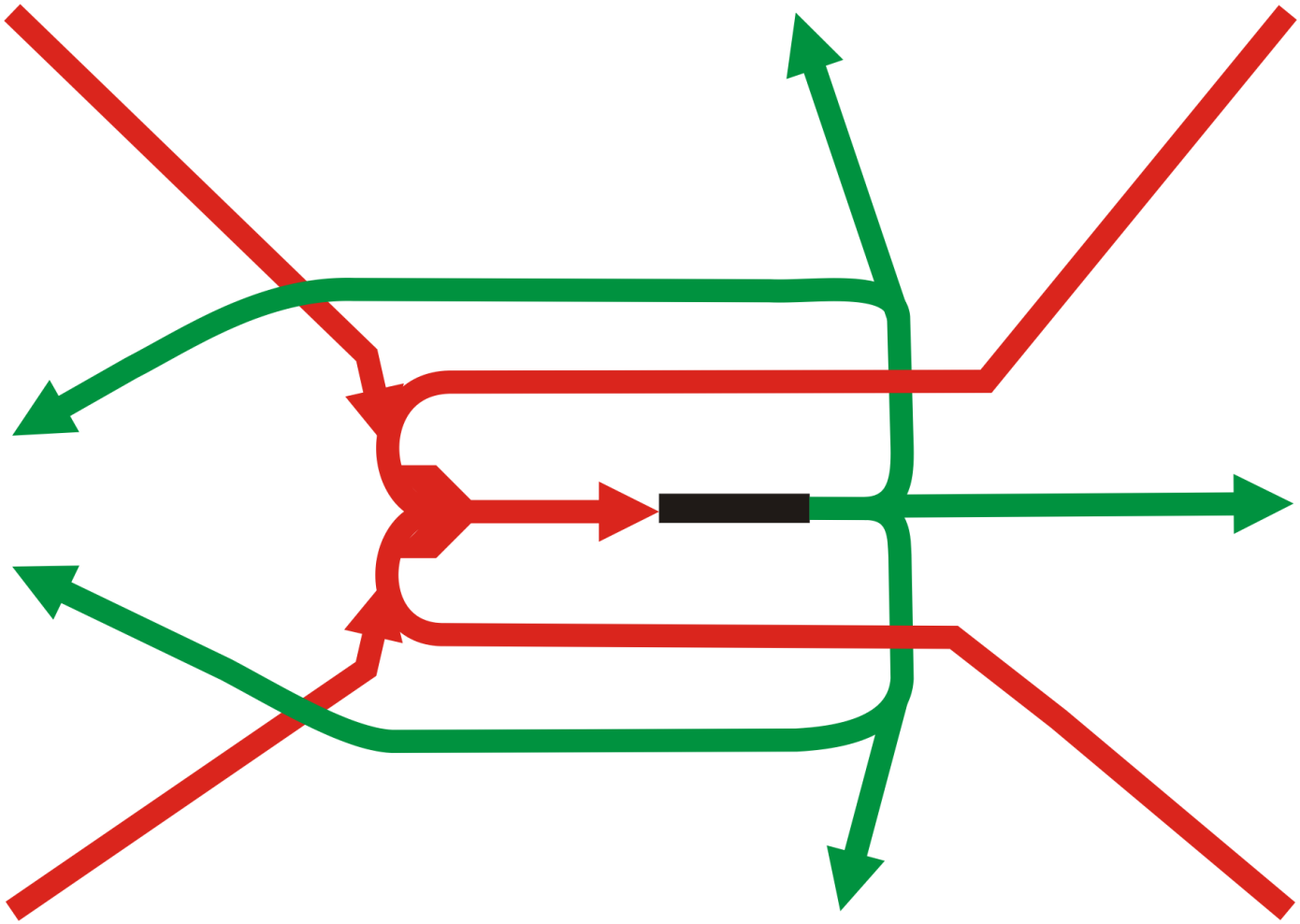
Structure Enables Complexity



Design System for Correct Profile Interaction

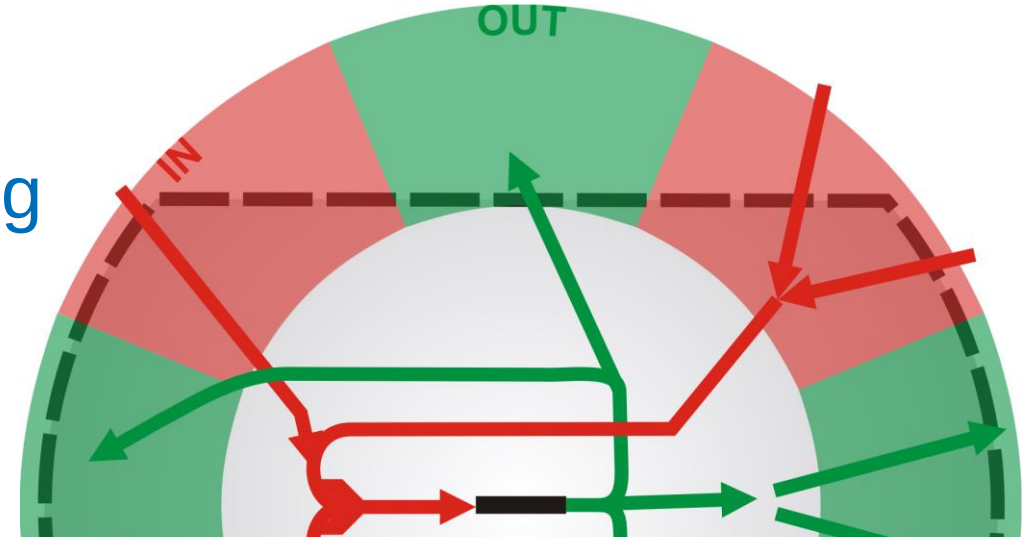


Design System for Correct Profile Interaction



Corner Post – Partial or Full

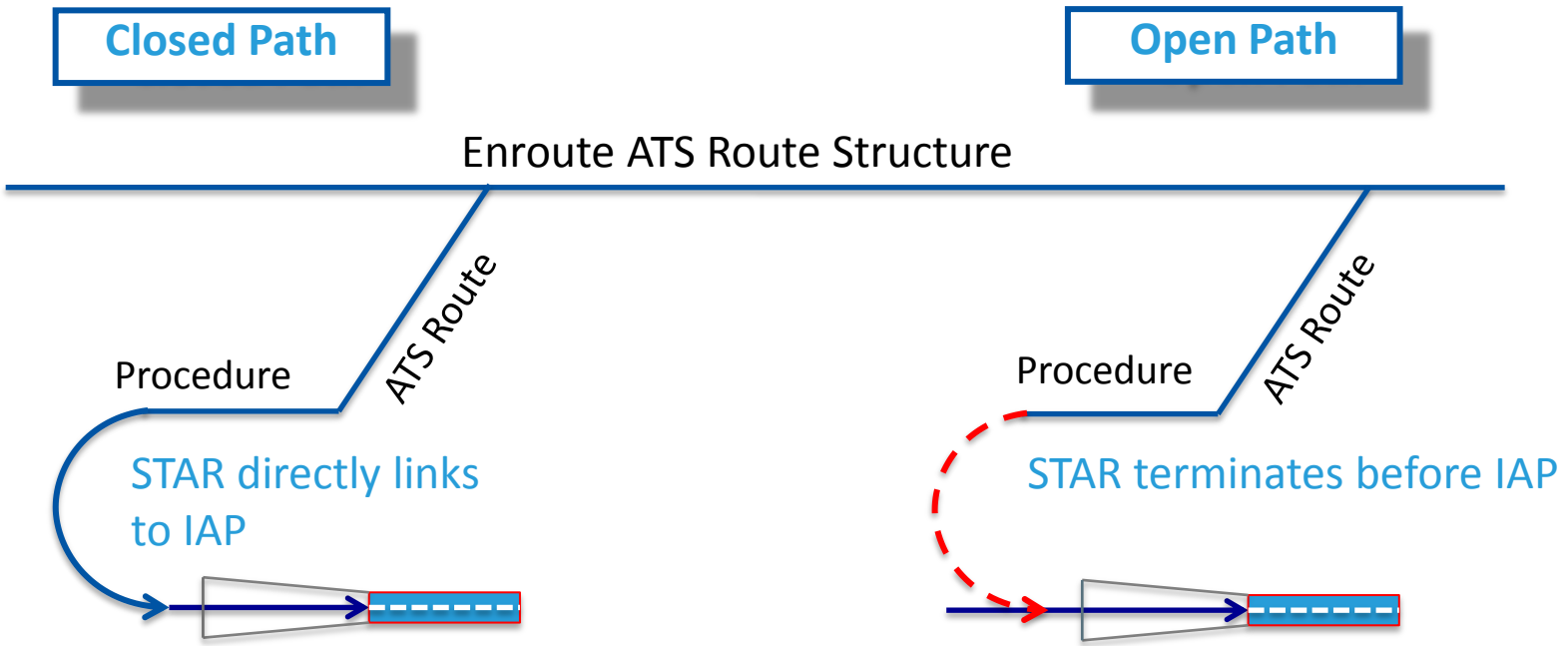
- Flows arranged by quadrant, segregating Arrivals laterally and vertically from Departures



Mixed Mode Operations

- Merging RNAV/RNP aircraft and aircraft using conventional navigation requires design and techniques adjusted to take advantage of PBN.

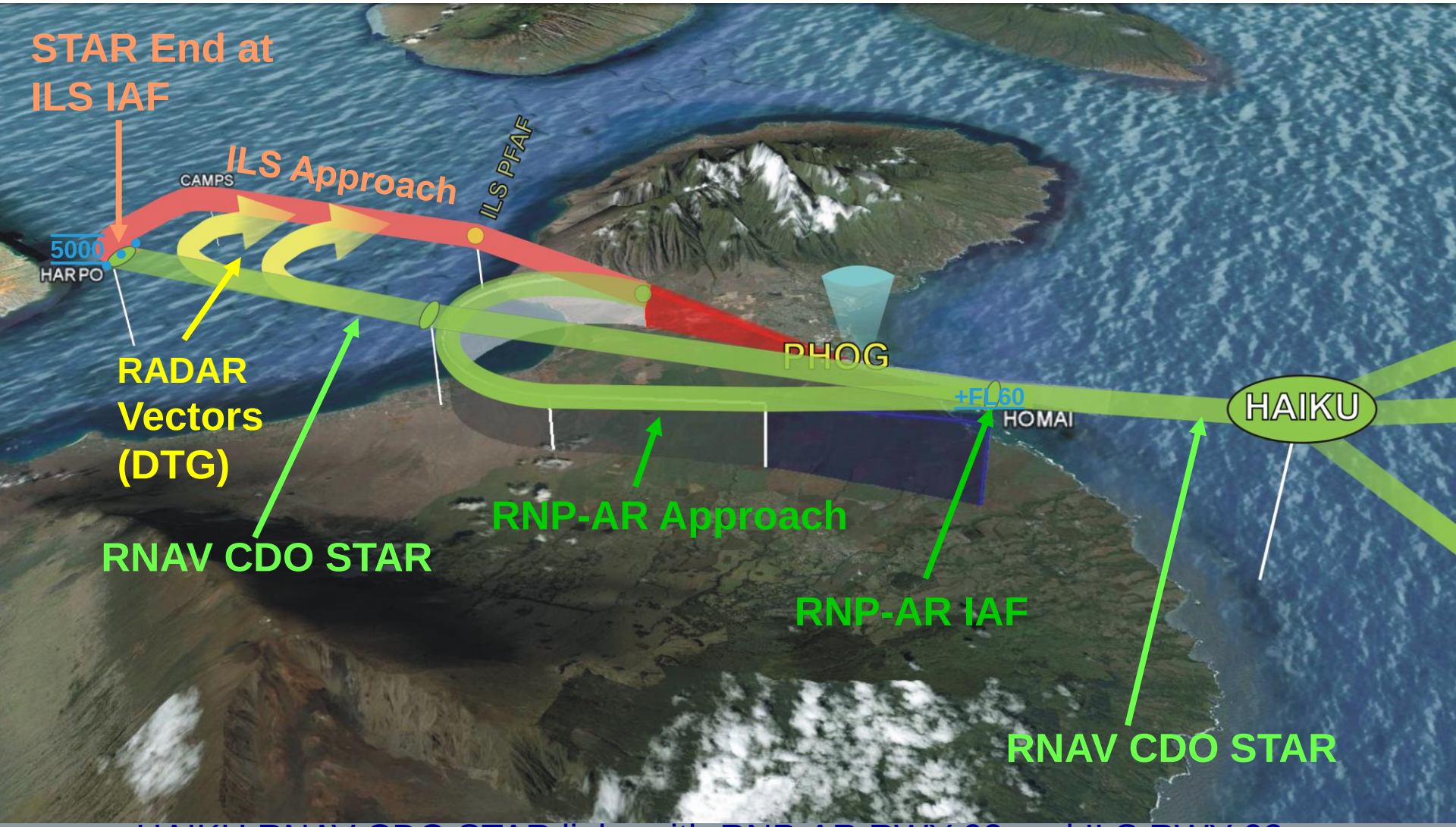
CDO - Different Types of Arrivals



Linked route
- known distance
- FMS advantage

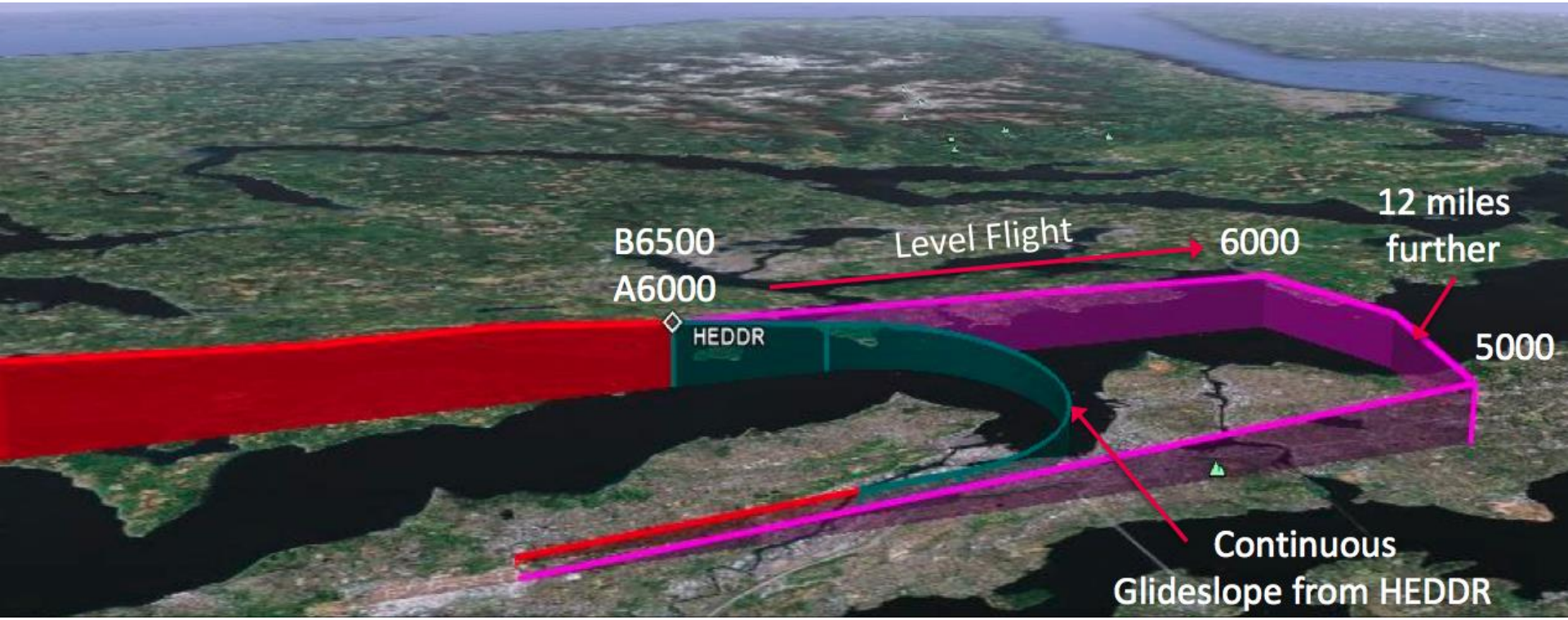
Tactical vectors provided by ATC
- unknown distance
- DTG estimate may be provided by ATC

Integrating RNAV, RNP, and Conventional Aircraft



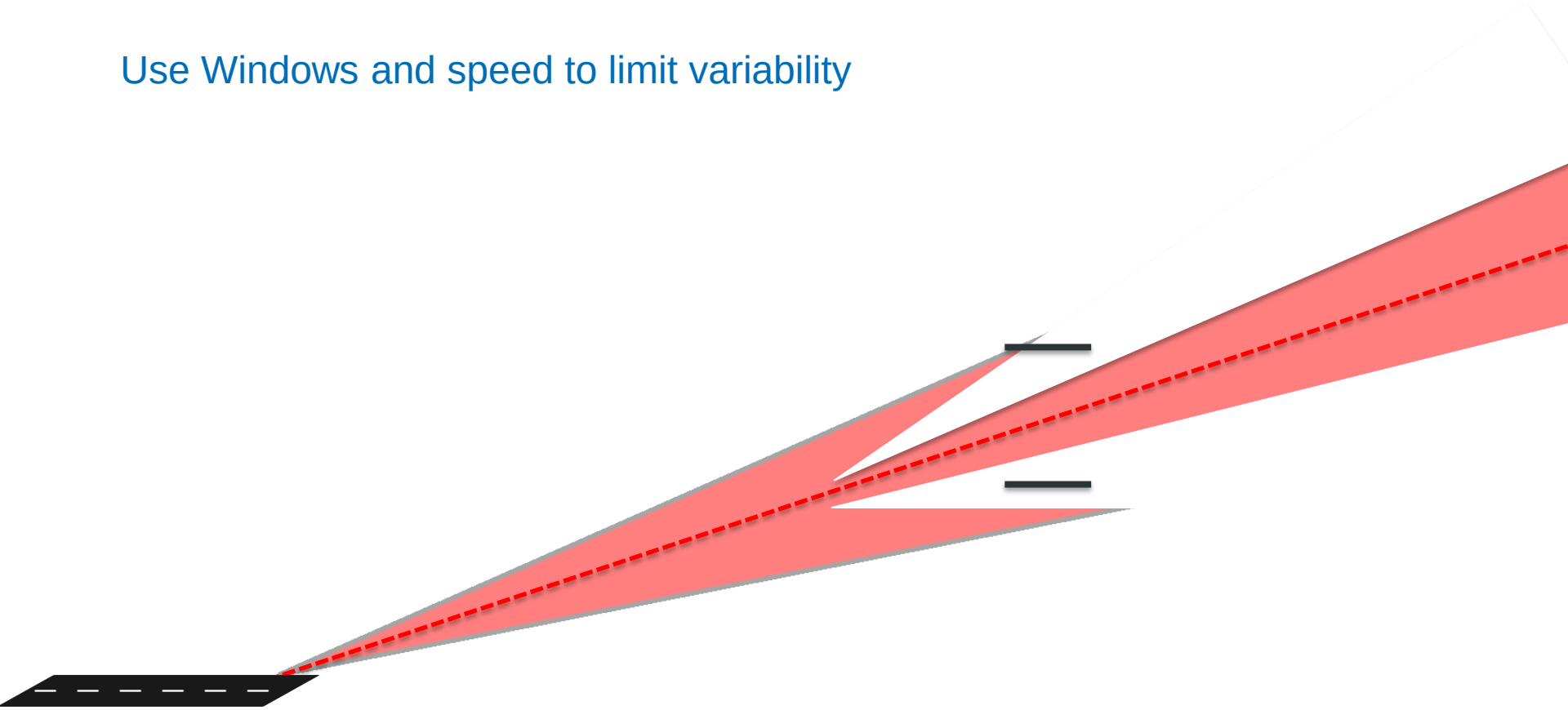
HAIKU RNAV CDO STAR links with RNP-AR RWY 02 and ILS RWY 02

One STAR to Multiple IAP's



Descent Profile Control Techniques

Use Windows and speed to limit variability

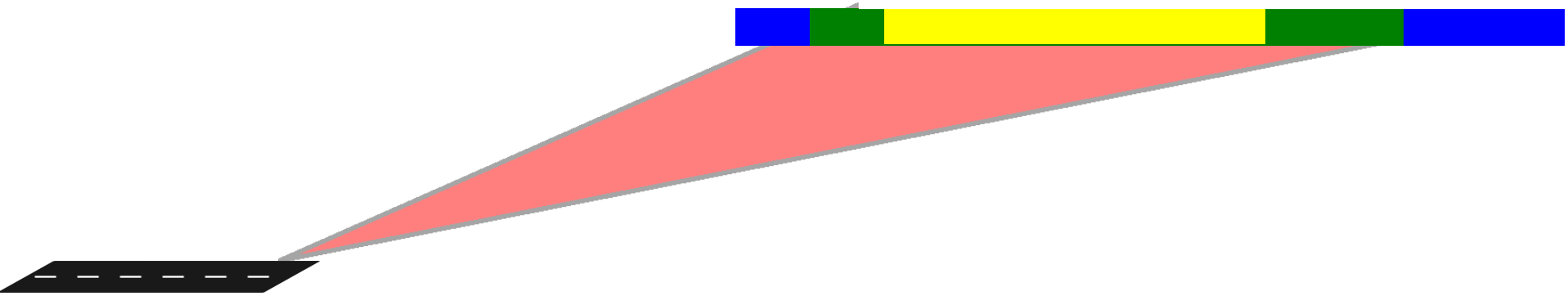


Descent Profile Control Techniques

Unconstrained descent

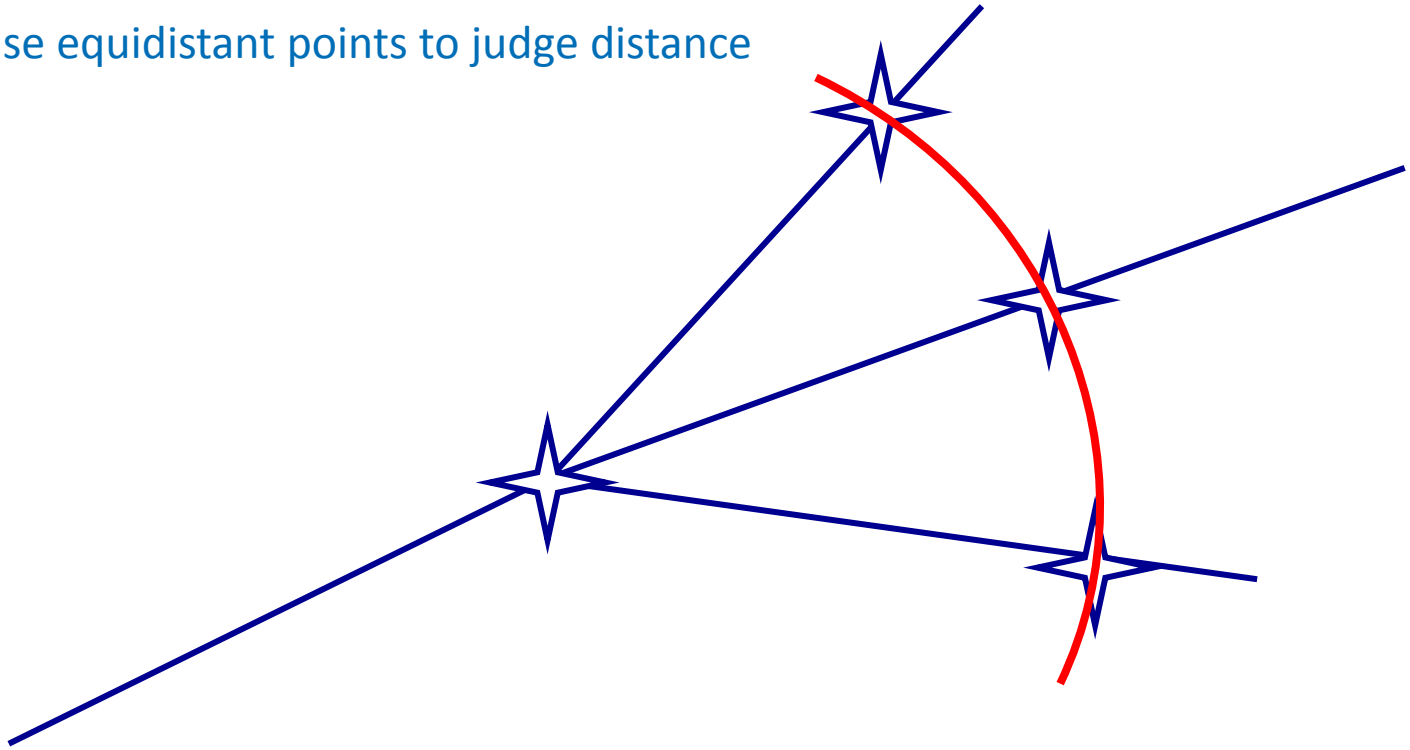
Window altitudes added

Window altitudes and speeds added



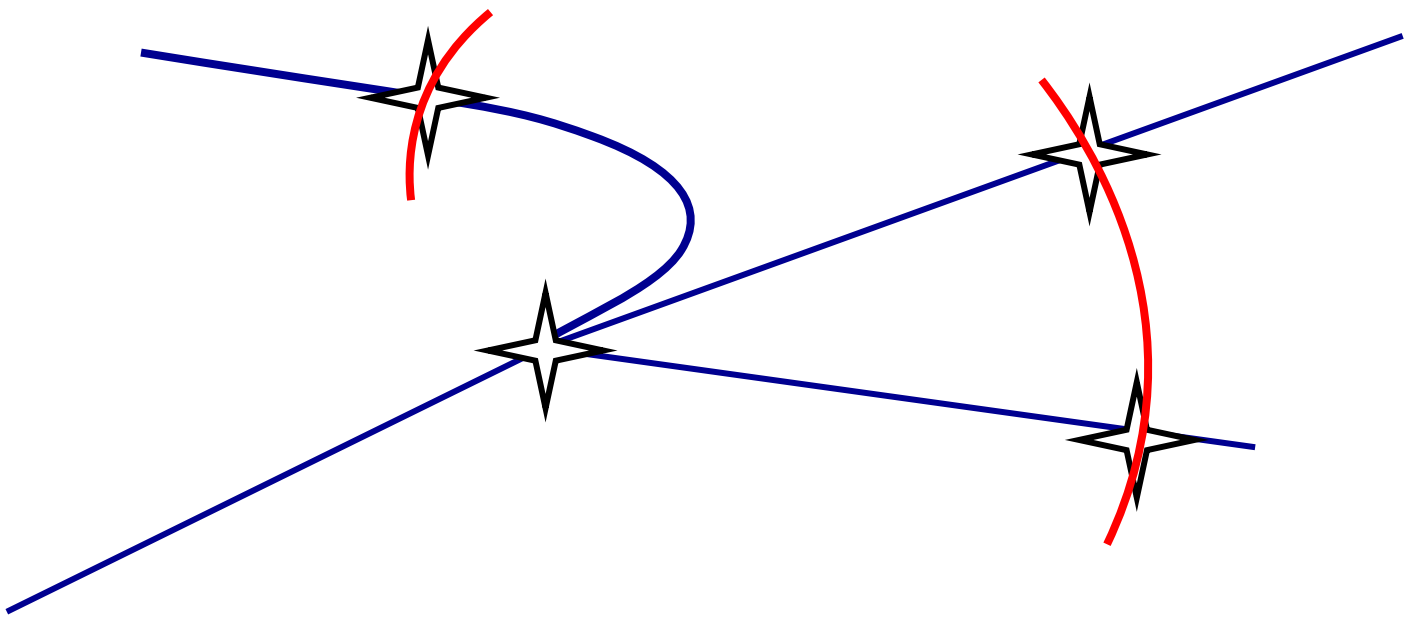
Sequencing Using Structured Decision Points

Use equidistant points to judge distance

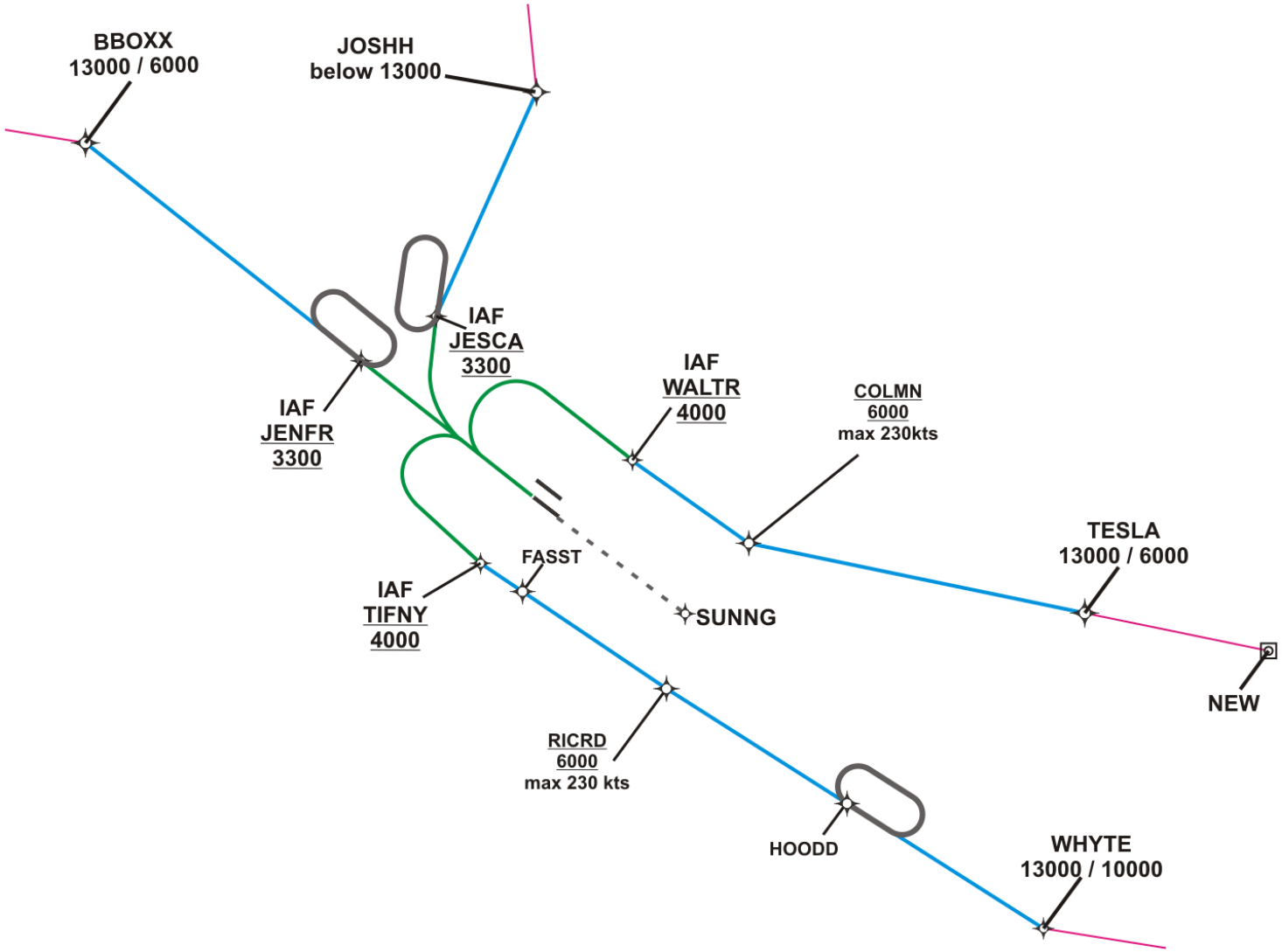


Sequencing Using Structured Decision Points

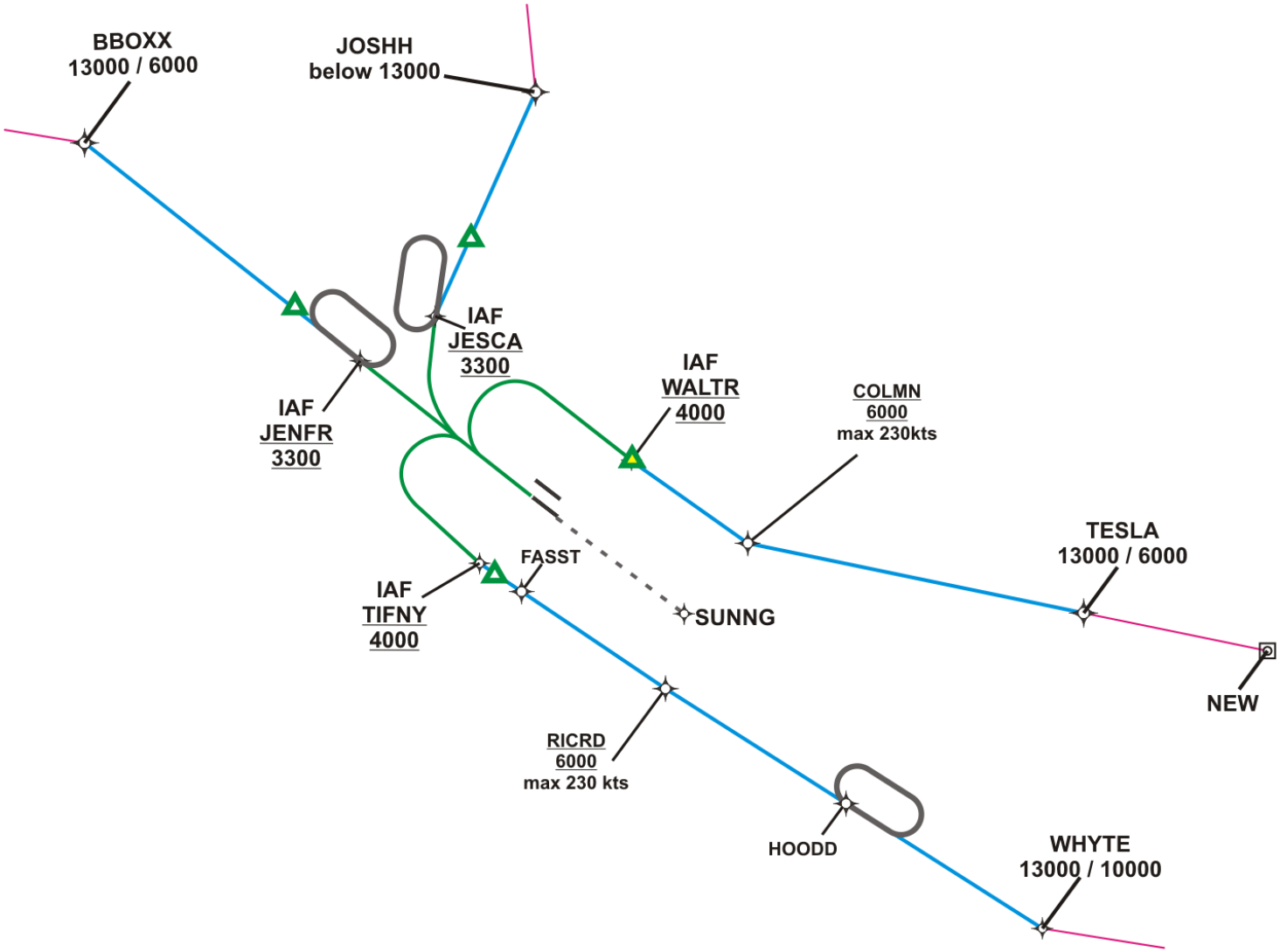
Closed Path PBN consistency allows equidistance for non linear paths



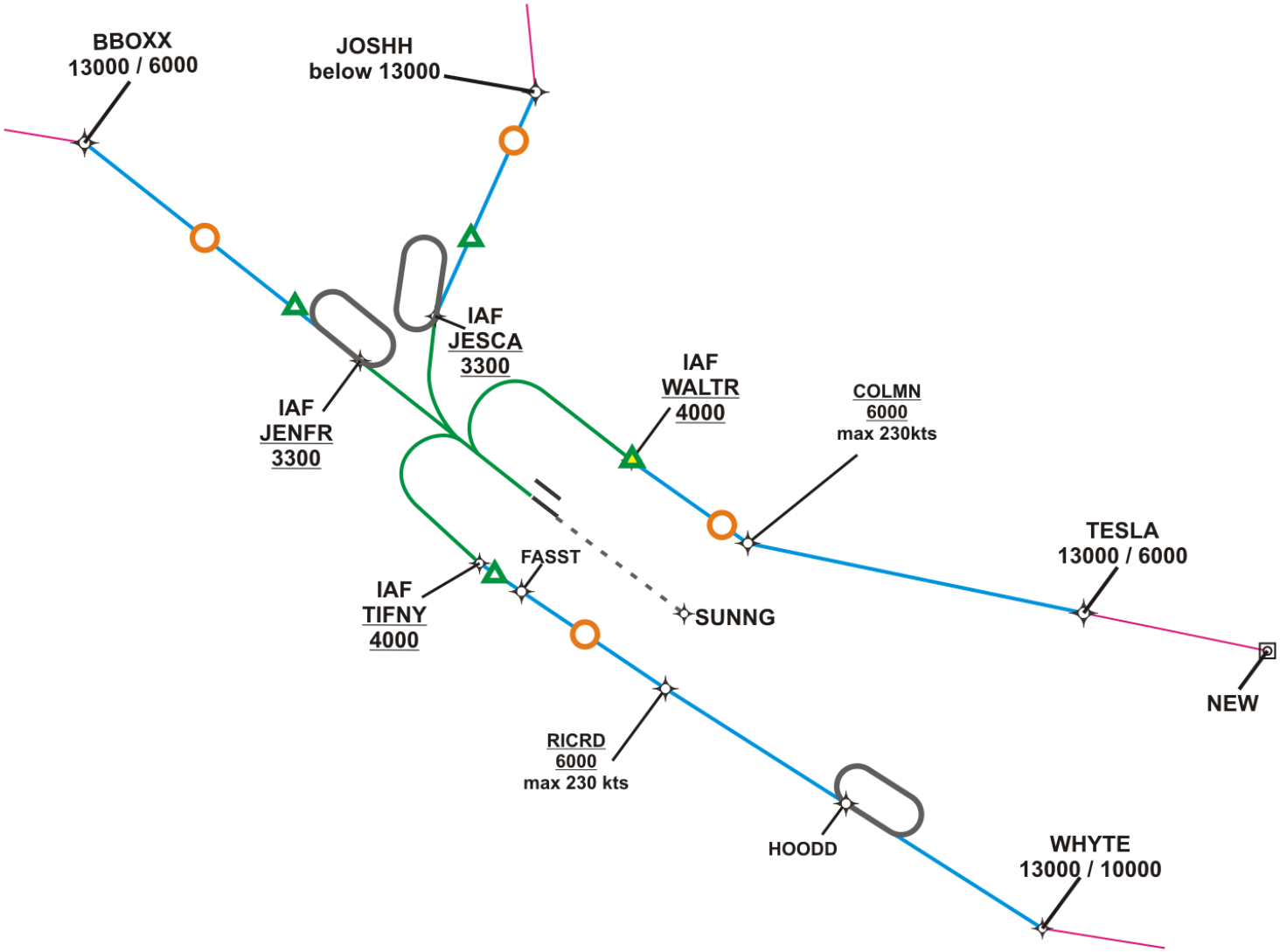
Structured Decision Points – Control by the Numbers



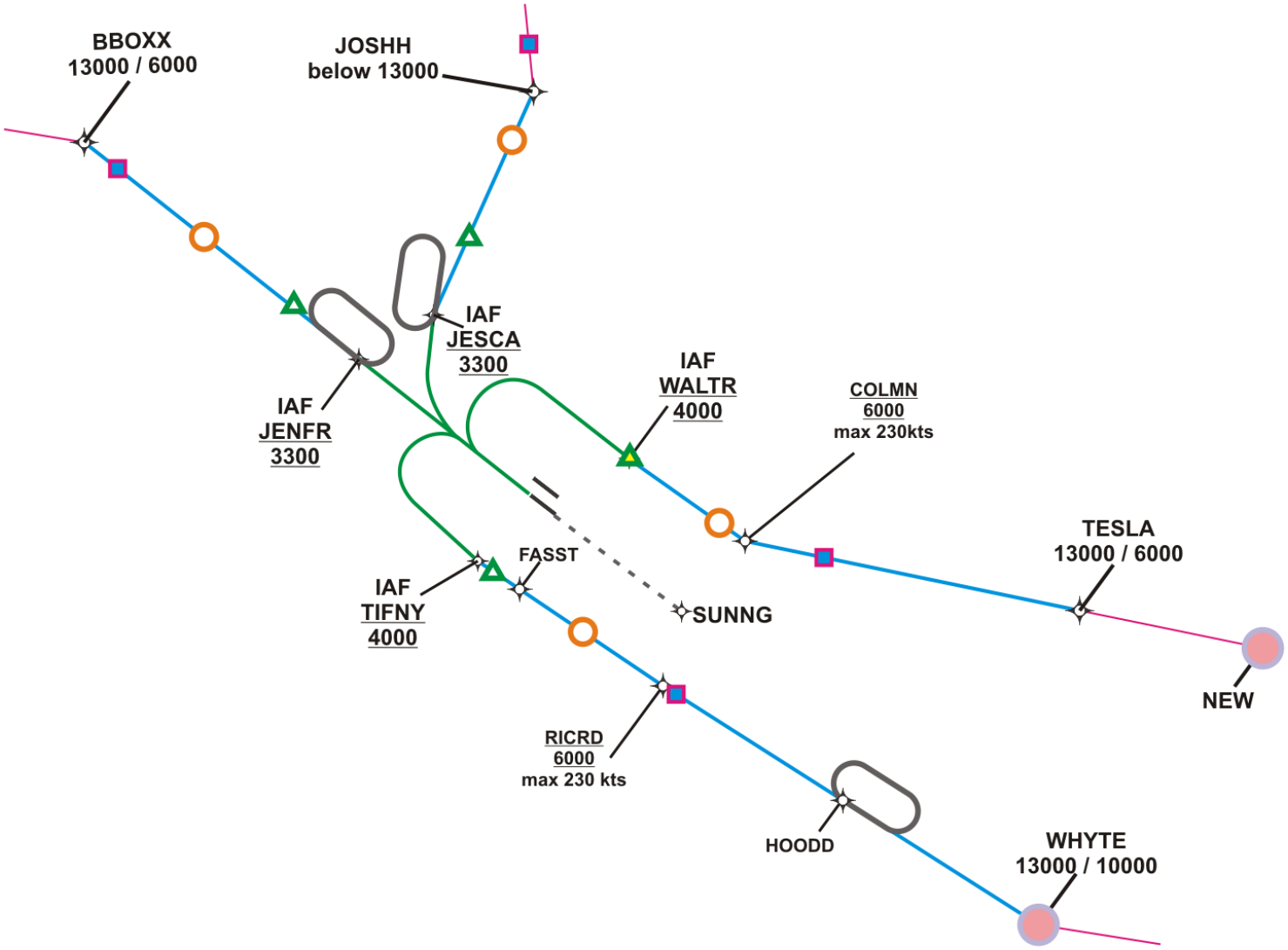
Structured Decision Points – Control by the Numbers



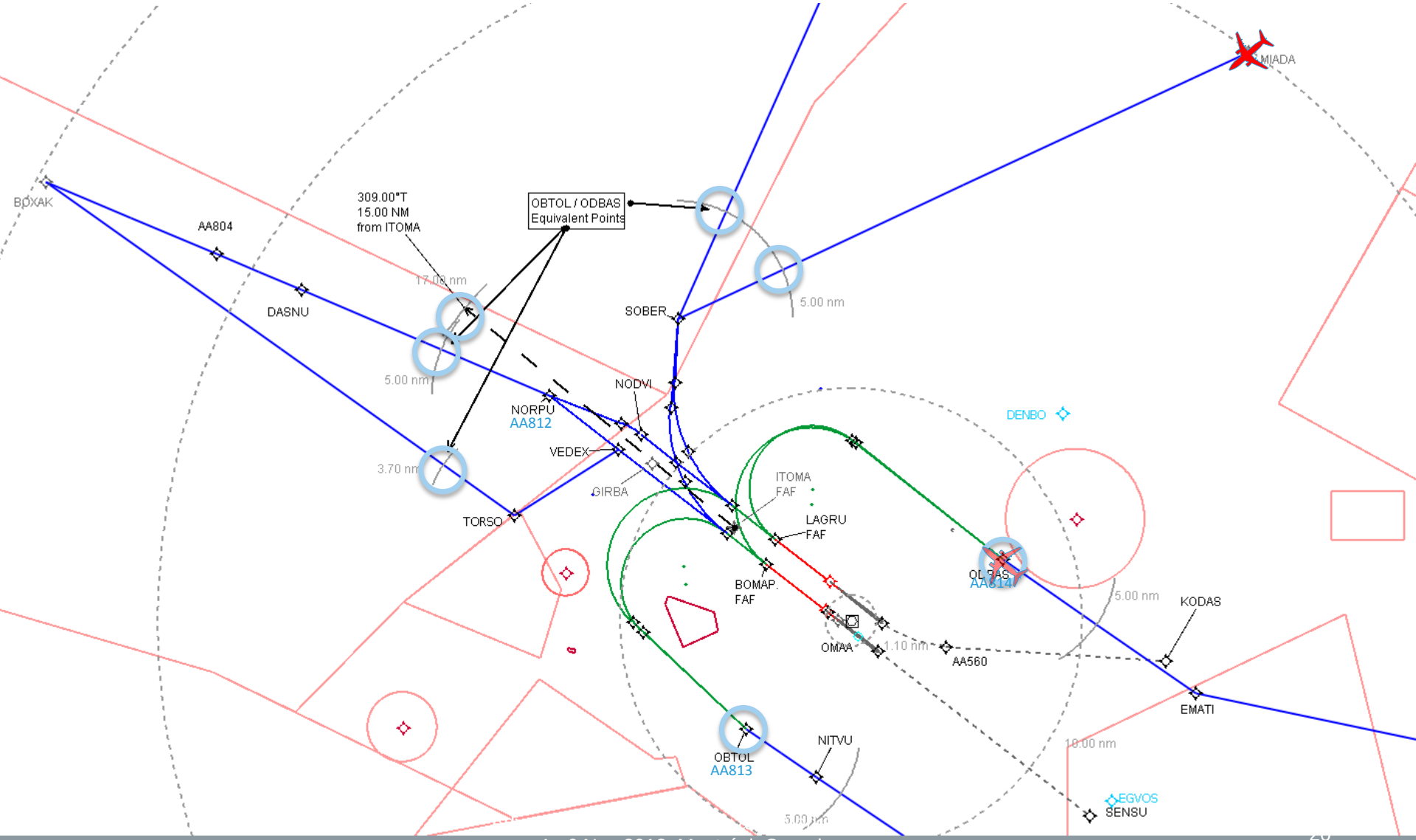
Structured Decision Points – Control by the Numbers



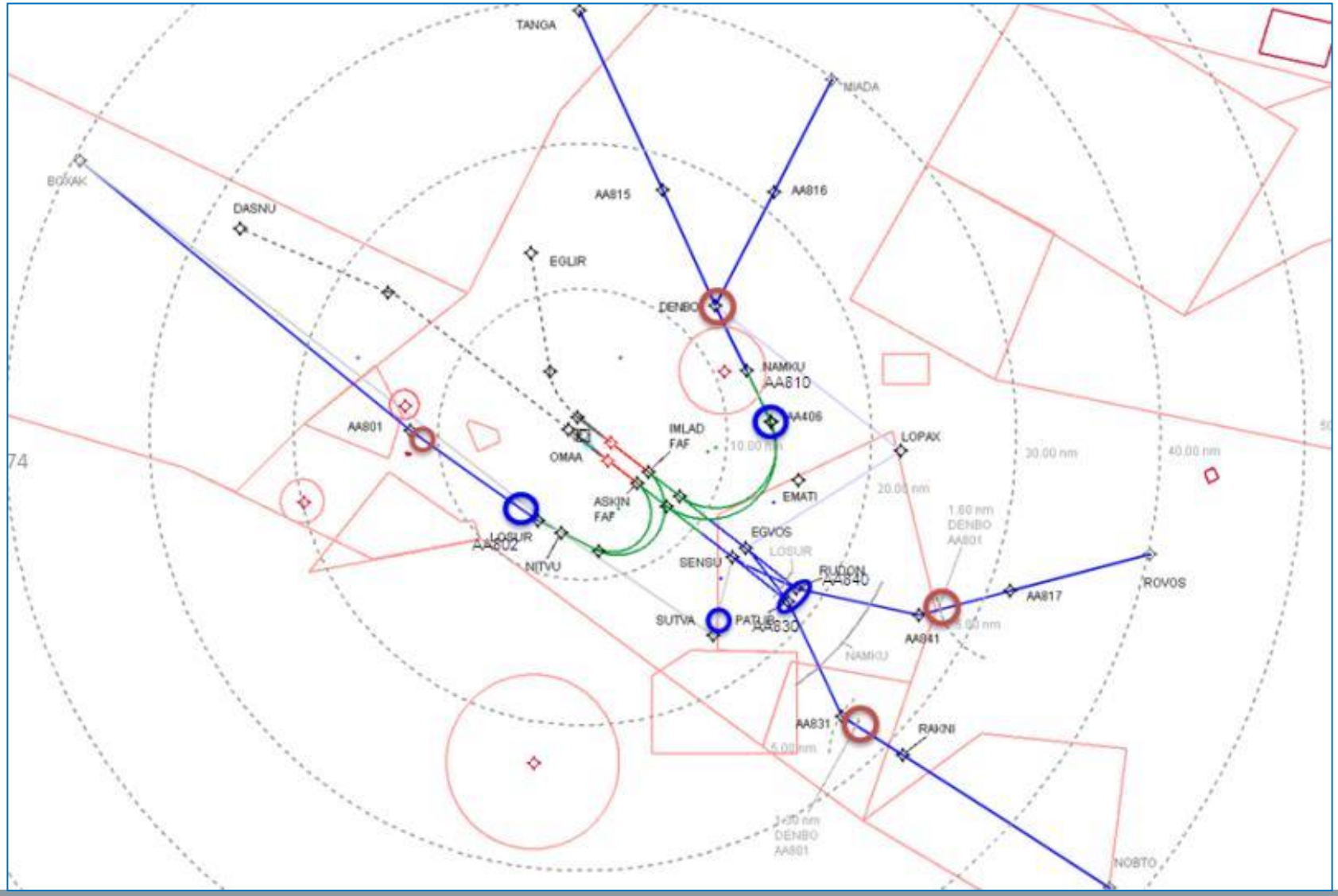
Structured Decision Points – Control by the Numbers



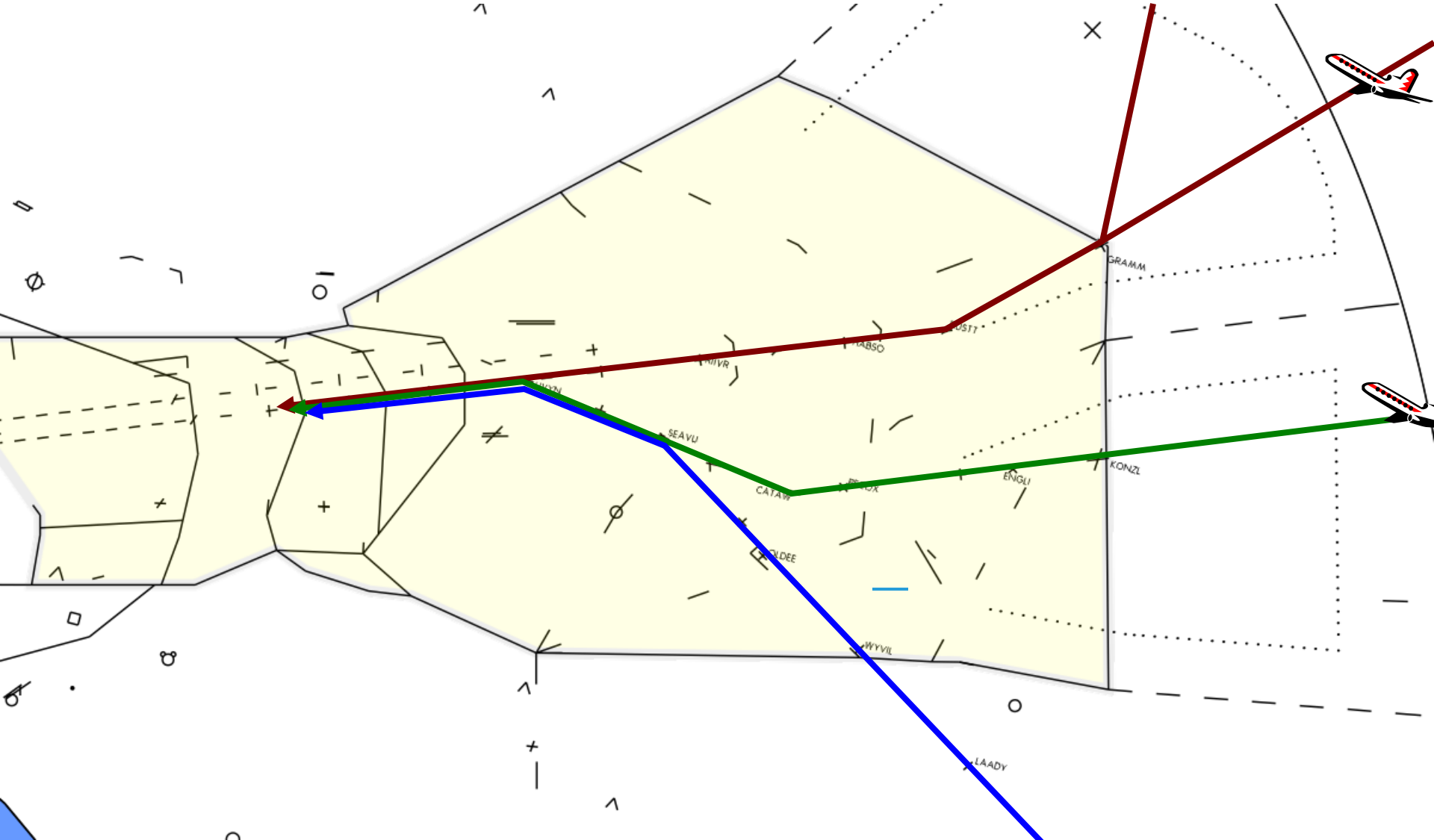
Structured Decision Points – Control by the Numbers



Structured Decision Points – UAE



Closed Path CDO – Priority?



Challenges in Development

- Education
- Design - One airplane vs many
- Limit restrictions
- Commitment and revisions

Thank You