Performance-Based Navigation

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Misconceptions on PBN

- PBN, may ***look*** complicated but it is not:
  - It does ***not*** add new navigation philosophy,
  - It ***is*** a pragmatic tool to implement navigation procedures using aircraft capabilities that have existed for more than 30 years!
  - It does ***not*** require States to:
    - Completely overhaul navigation infrastructure,
      - It can be implemented step-by-step
    - Implement the most advanced NavSpec
      - It only needs to accommodate operational needs

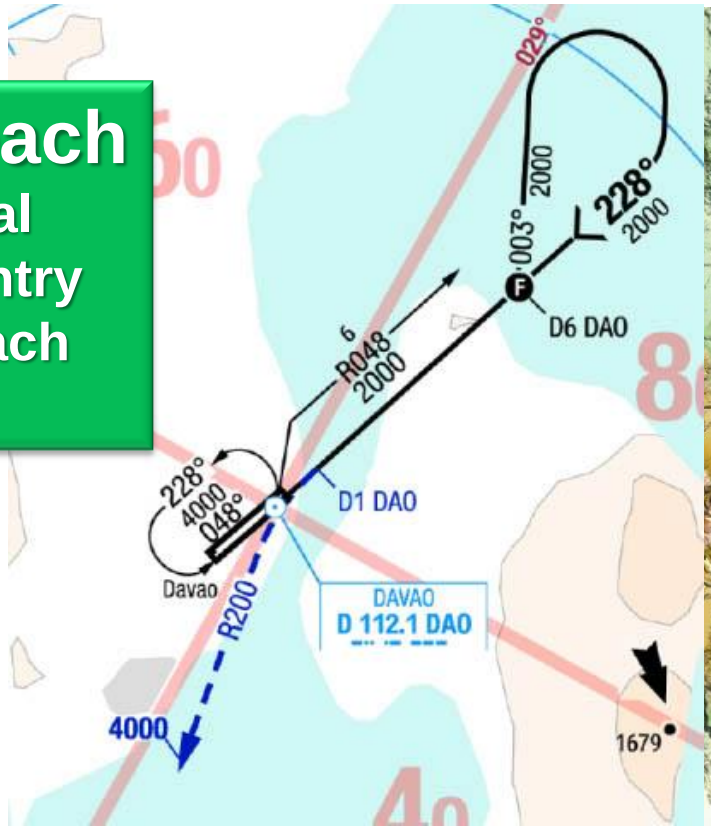
Need for PBN

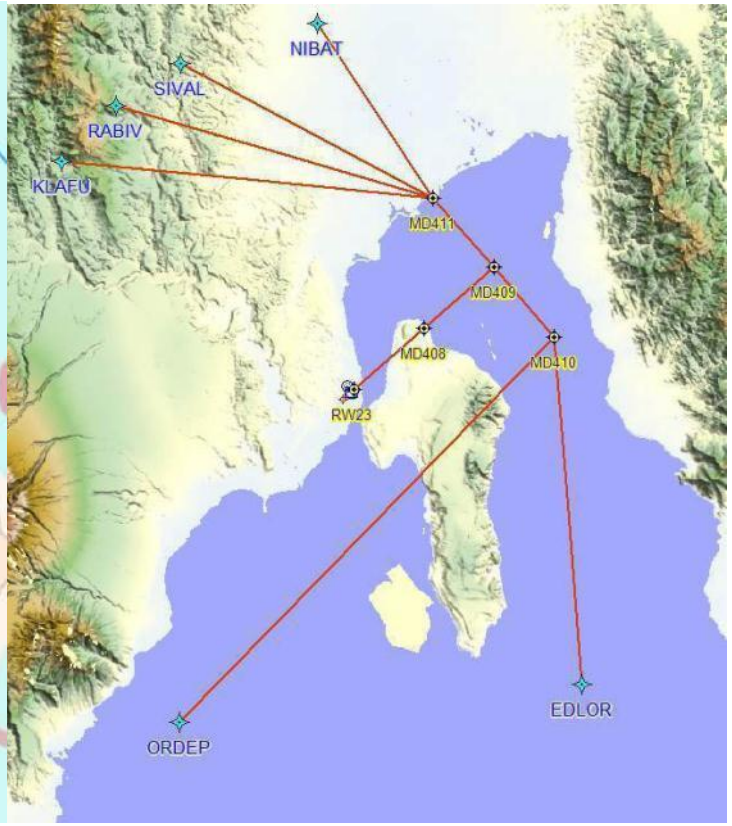
- Benefits all phases of flight
- Safety
  - Include vertical guidance
- Route flexibility
  - Not constrained to NAVAIDs-based routes
- Reduction of fuel, noise and CO2 emissions
  - Efficient arrival and departure procedures
- Airport and airspace access increased
  - In all weather conditions


Capacity / Efficiency

PBN Benefits vs. Legacy Approach

VOR Approach
20 NM Arrival
17 NM Hold entry
33 NM approach
= 70 NM

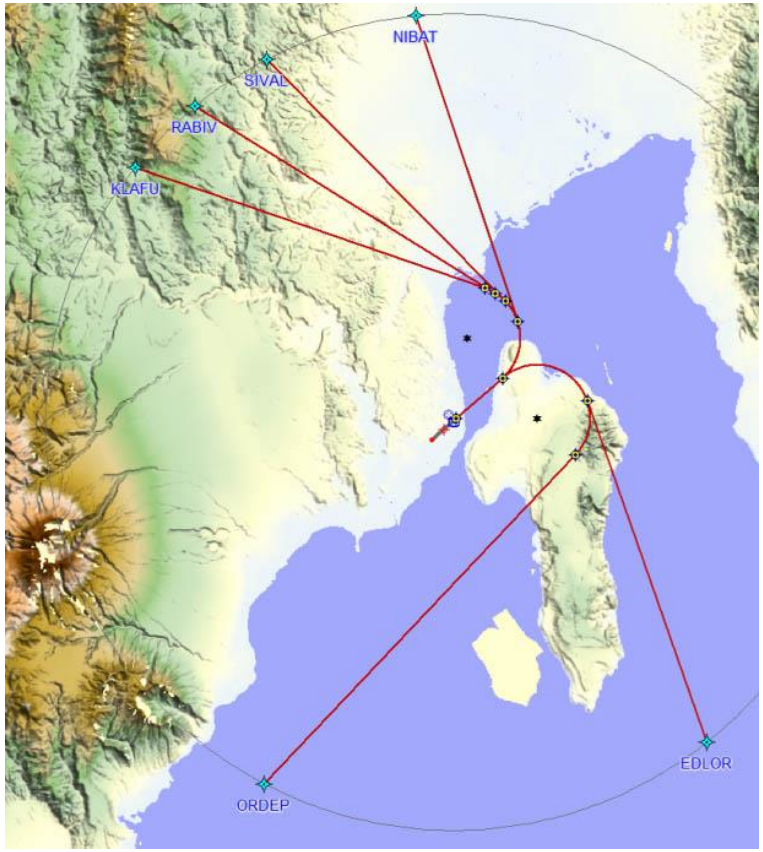


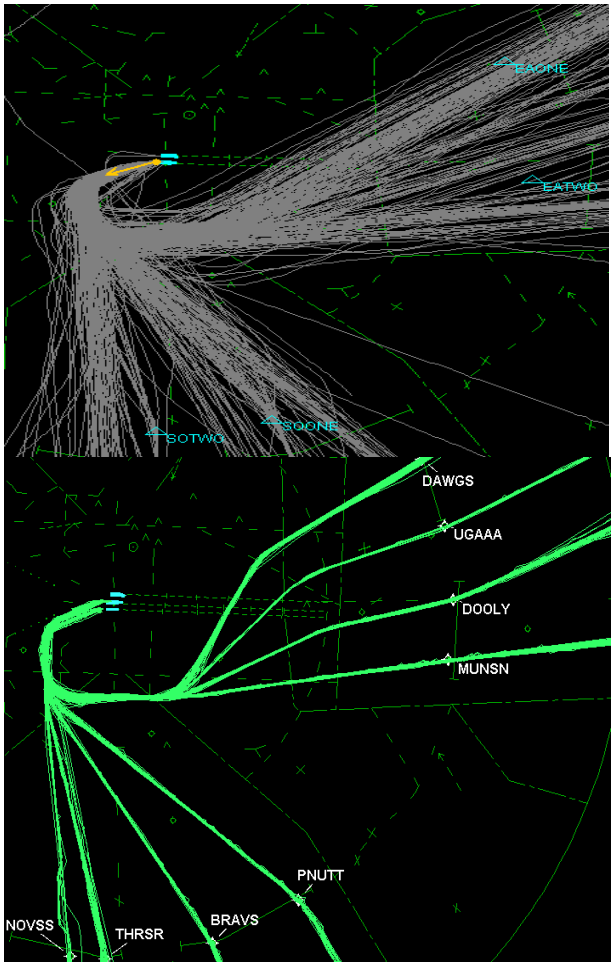


PBN Optimized Tracks

RNP AR Optimized Tracks
Savings via:

NIBAT – 3.8 NM
EDLOR – 7.2 NM
ORDEP – 10.3 NM
KLAFU – 7.7 NM
RABIV – 7 NM
SIVAL – 5.7 NM
≈ 7 NM

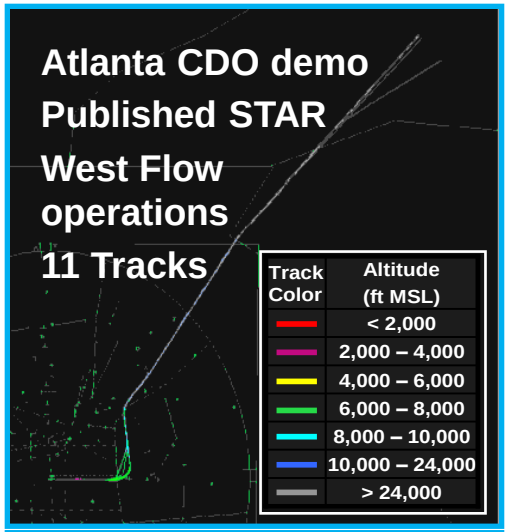


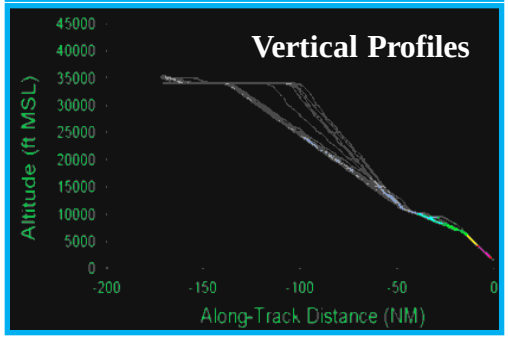


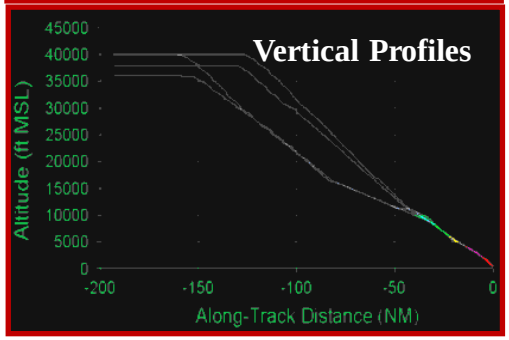
Improving Runway Utilization at Atlanta (ATL)

- Approximately 94% of daily departures are RNAV-capable
- More departure lanes and exit points to the enroute airspace
  - Capacity gain of 9-12 departures per hour
- Repeatable and predictable paths
- Benefits
  - Increased throughput
  - Reduced departure delays
  - 40-50% reduction in communications

Fuel Savings/Emission Reduction







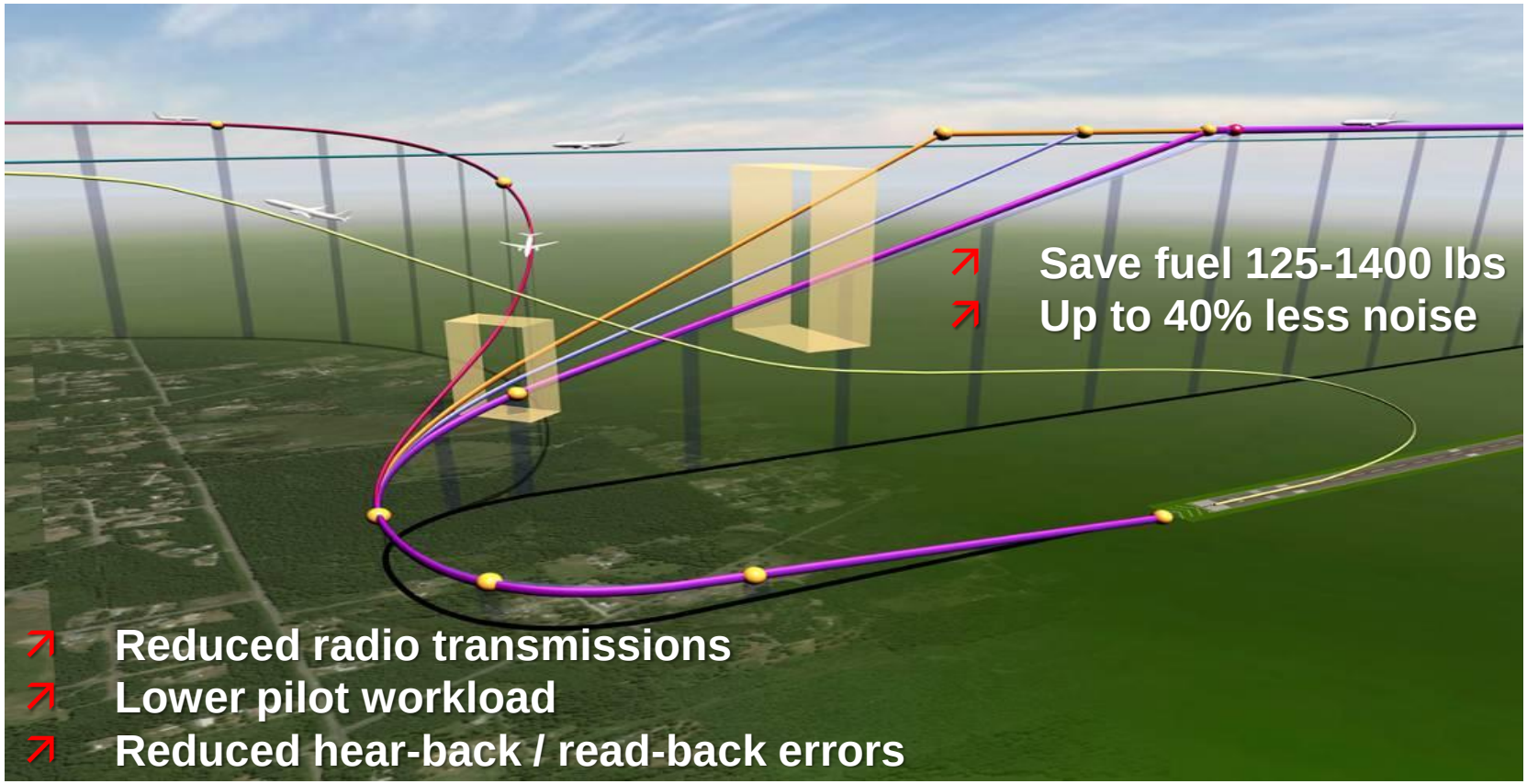
Continuous Descent Ops provide large benefits in fuel, emissions, and flight time.

- North Arrival STAR at Atlanta (ATL)
  - ***144 liters*** of fuel savings and ***360kg*** reduction in CO_2 emissions per flight
- North Arrival STAR at Miami (MIA)
  - ***182-197 liters*** of fuel savings and ***460-500kg*** reduction in CO2 emissions per flight

600 CDO night demos at ATL
Two North Arrival STARs

- ***151-227 liters*** of fuel savings / ***380kg*** reduction in CO2 emissions per flight

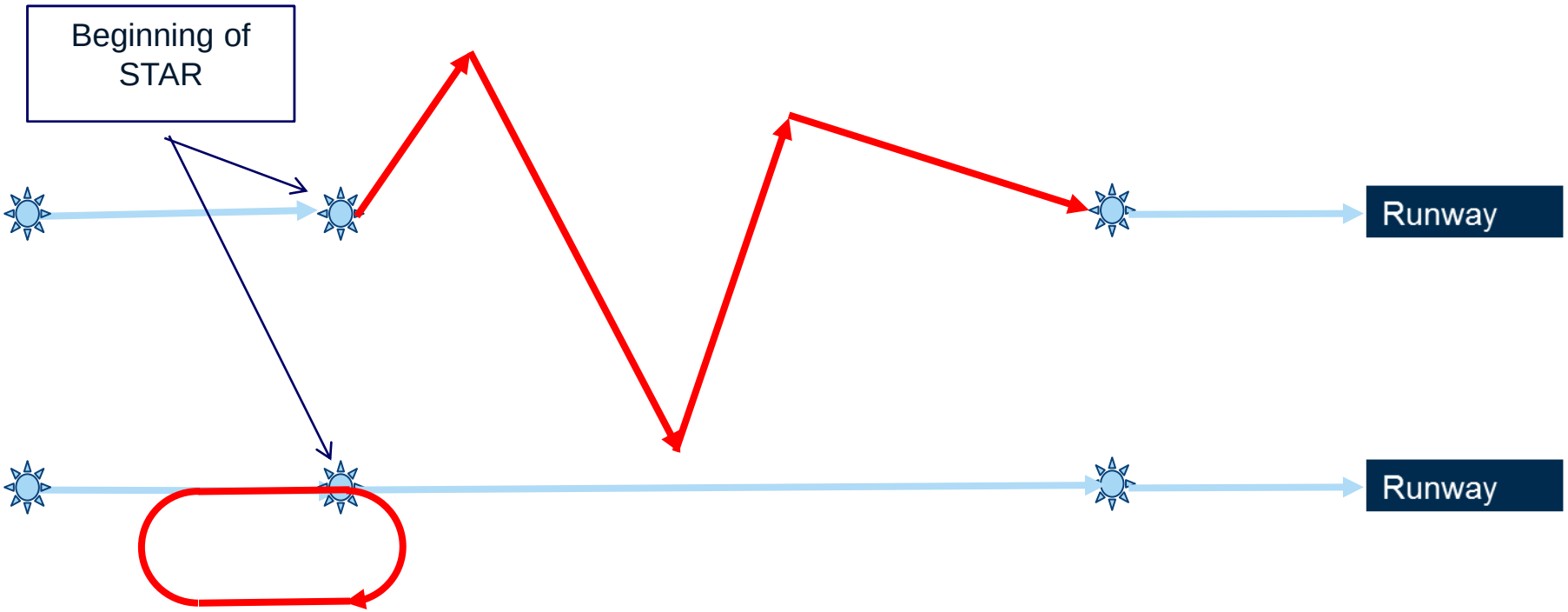
Continuous Descent Operations (CDOs)



Sequencing - metering

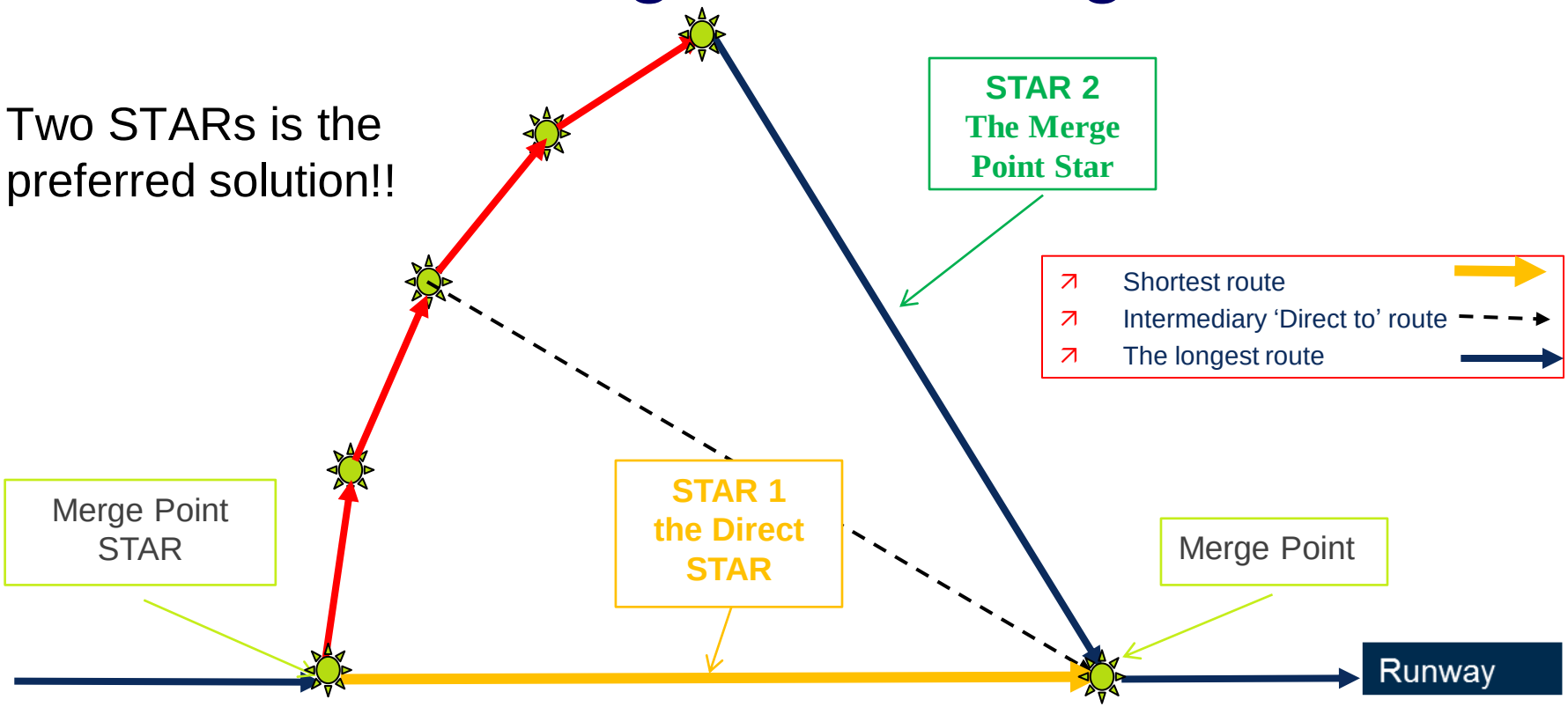
- Traffic sequencing could be achieved by small speed interventions during the cruise or early phases of descent.
- Reduce sequencing maneuvers at lower altitudes with the consequent benefit on fuel burn and noise.
- With merge points technique Holding patterns are rarely used under these conditions
- Available technology nowadays

Merging Points



Merge point procedure, an other form of Holding or vectoring

- Two STARs is the preferred solution!!



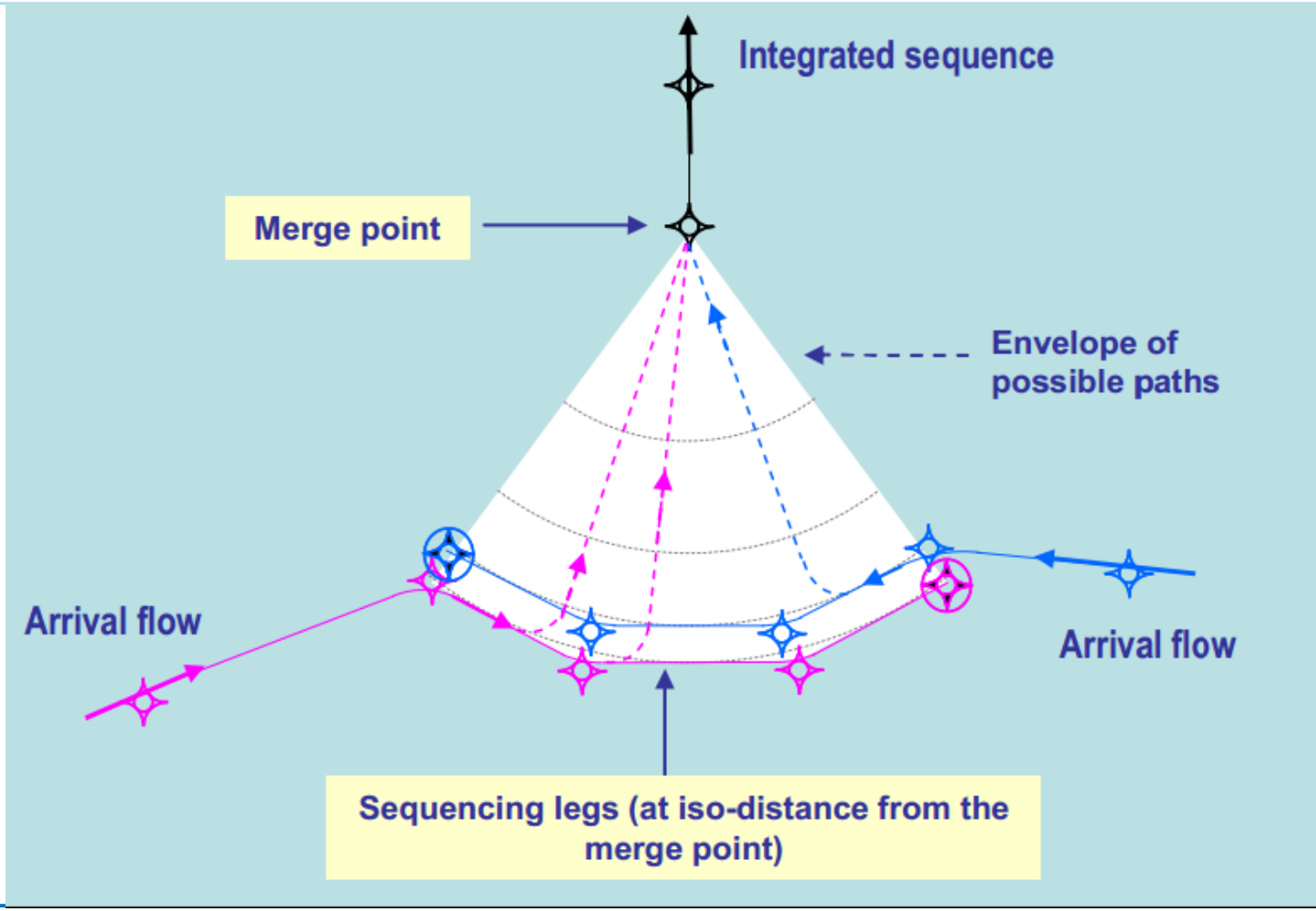
- Clue word:

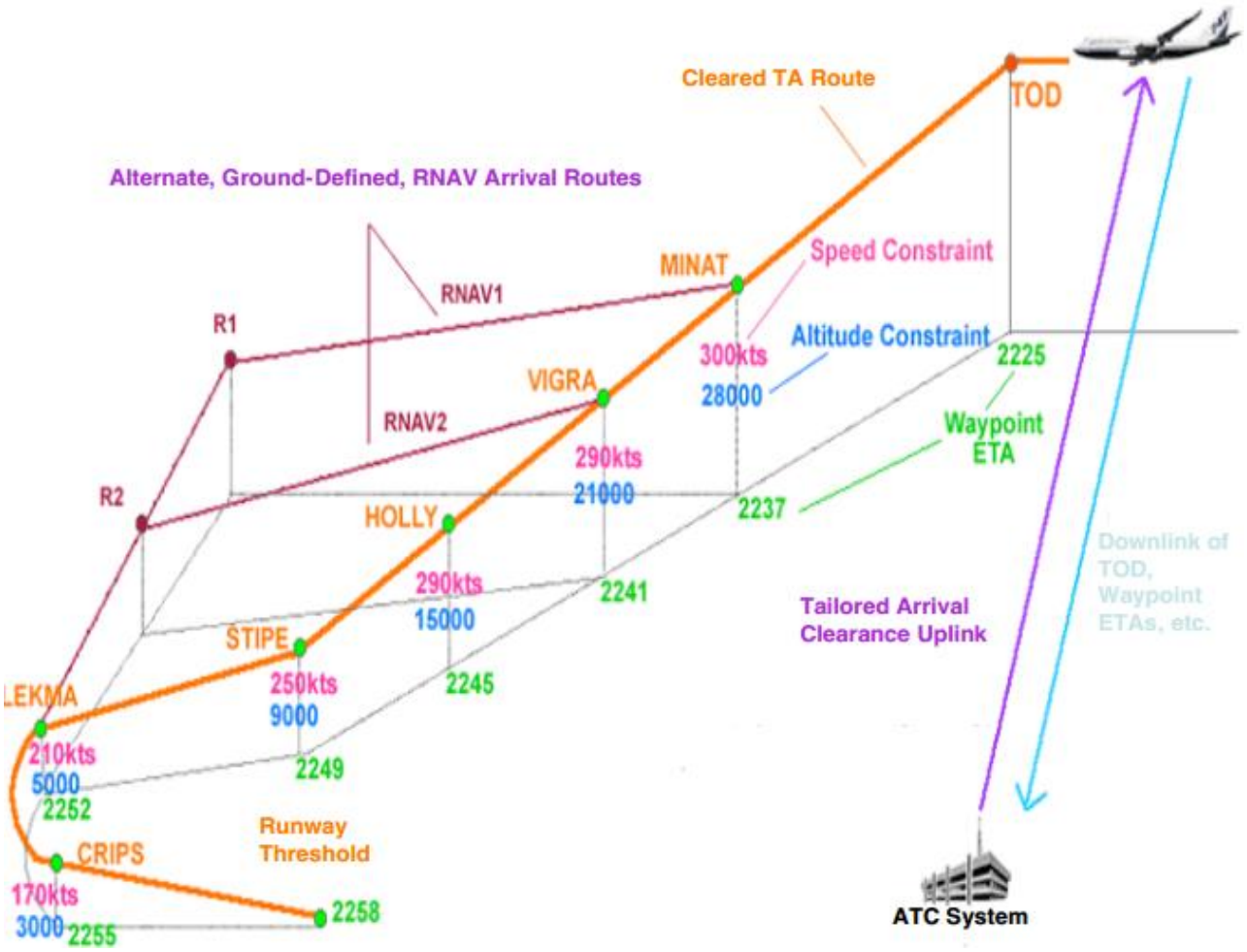
"equidistant reference points"

Vectoring

vs

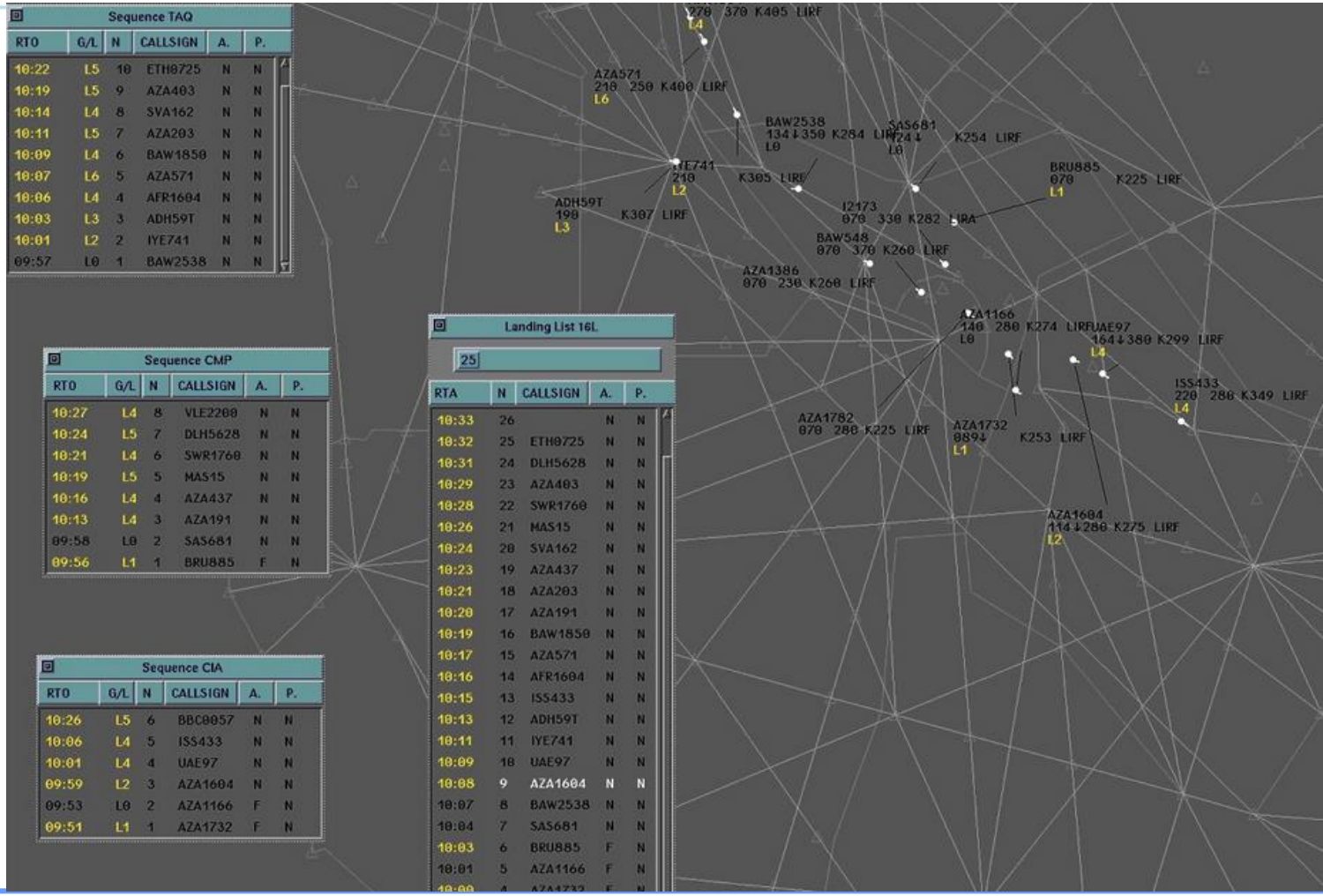
STAR - DCT TO (merge point)



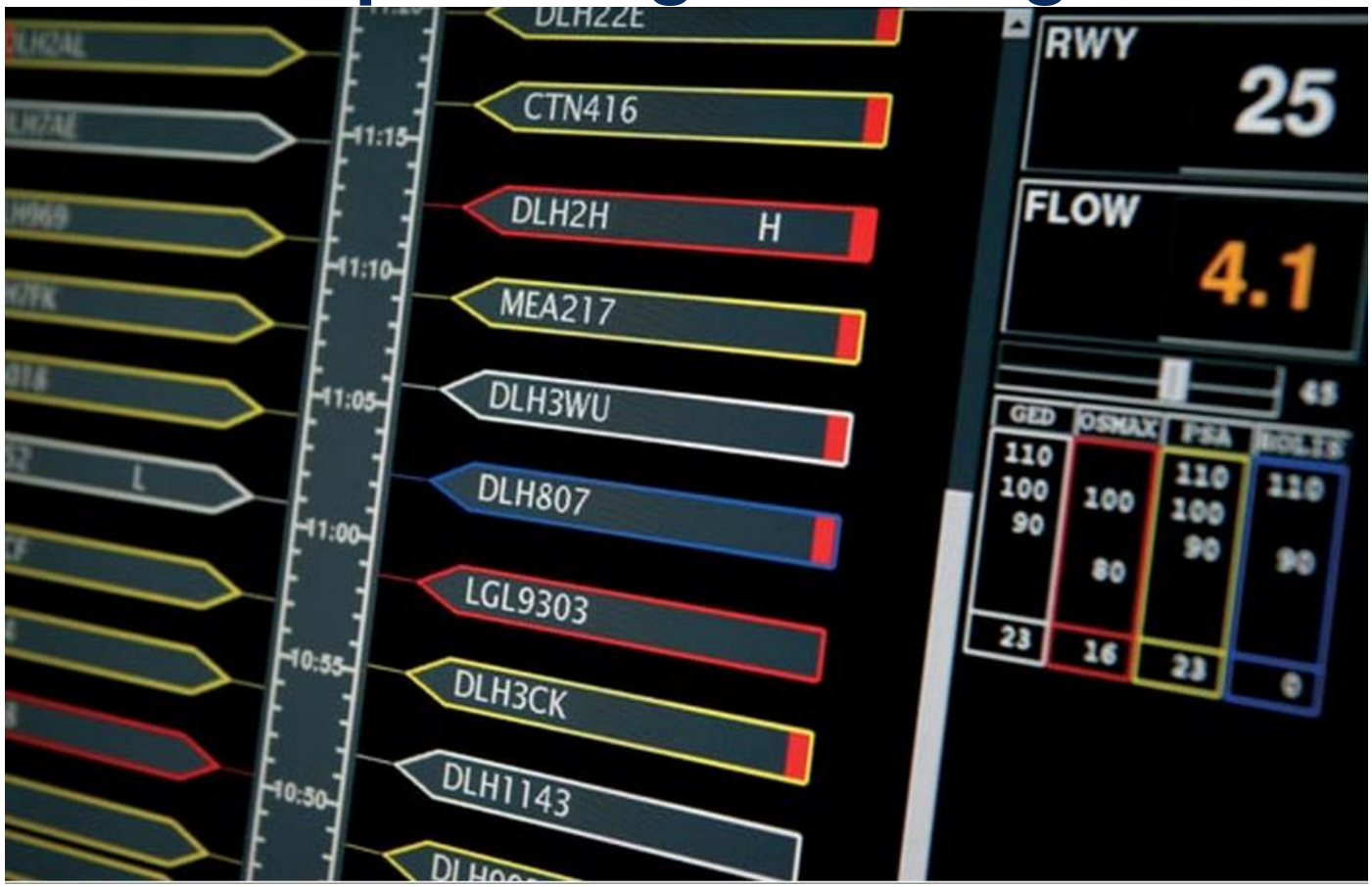

Cleared TA Route
TOD
Alternate, Ground-Defined, RNAV Arrival Routes
MINAT
Speed Constraint
RNAV1
R1
300kts
28000
Altitude Constraint
2225
VIGRA
RNAV2
Waypoint
ETA
290kts
21000
R2
HOLLY
2237
290kts
15000
2241
Downlink of
TOD,
Waypoint
ETAs, etc.
Tailored Arrival
Clearance Uplink
STIPE
250kts
9000
2245
LEKMA
210kts
5000
2252
2249
Runway
Threshold
CRIPS
170kts
3000
2255
2258
ATC System

Merge points CDG

- Secuencing & Metering (SDP+FDP)

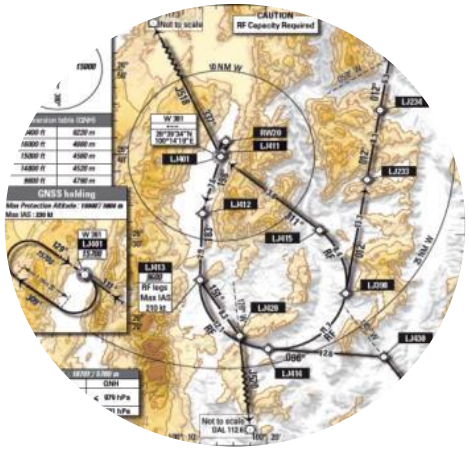


Sequencing/metering



Stakeholders must work together…

…to realize the benefits



PBN True / False Quiz

- PBN is an ATC issue… they are responsible for implementation

- PBN is only about procedure design – publish and done

- PBN can provide benefits such as safety, efficiency, capacity all by itself

Questions?

Thank you!

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