CDO and CCO

In a nutshell, what are they?

CDO
CDA
TA
OPD
CCO
OPC

ICAO

CDO – Continuous Descent Operation(s)

CDA – Continuous Descent Approach

OPD – Optimized Profile Descent

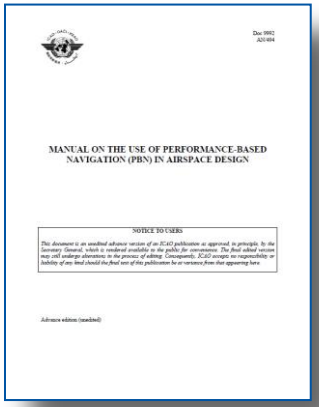
TA – Tailored Arrival

CCO – Continuous Climb Operation(s)

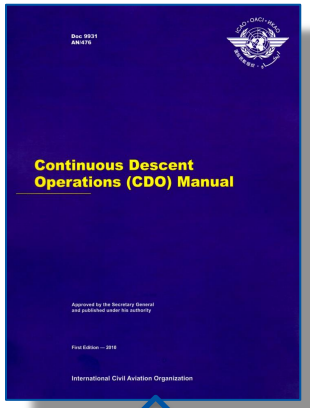
OPC – Optimized Profile Climb

CDO, CCO, and Airspace

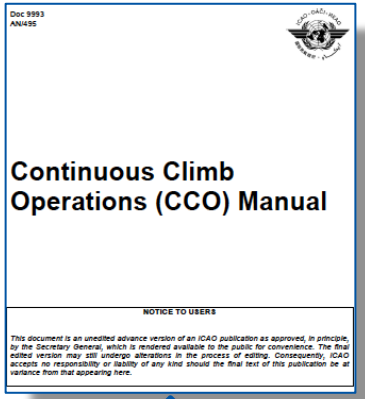
ICAO Doc 9992
PBN Airspace Design



ICAO Doc 9931
CDO



ICAO Doc 9993
CCO



CDO IMPLEMENTATION

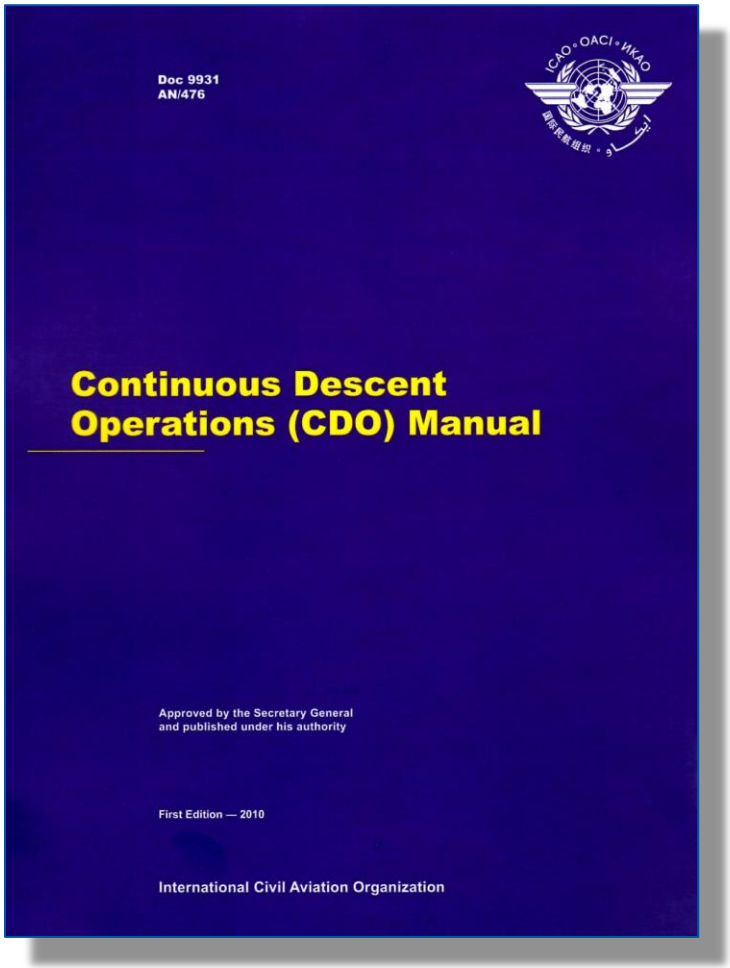
CCO IMPLEMENTATION

Continuous Descent Operations (CDO) Manual

ICAO Doc 9931

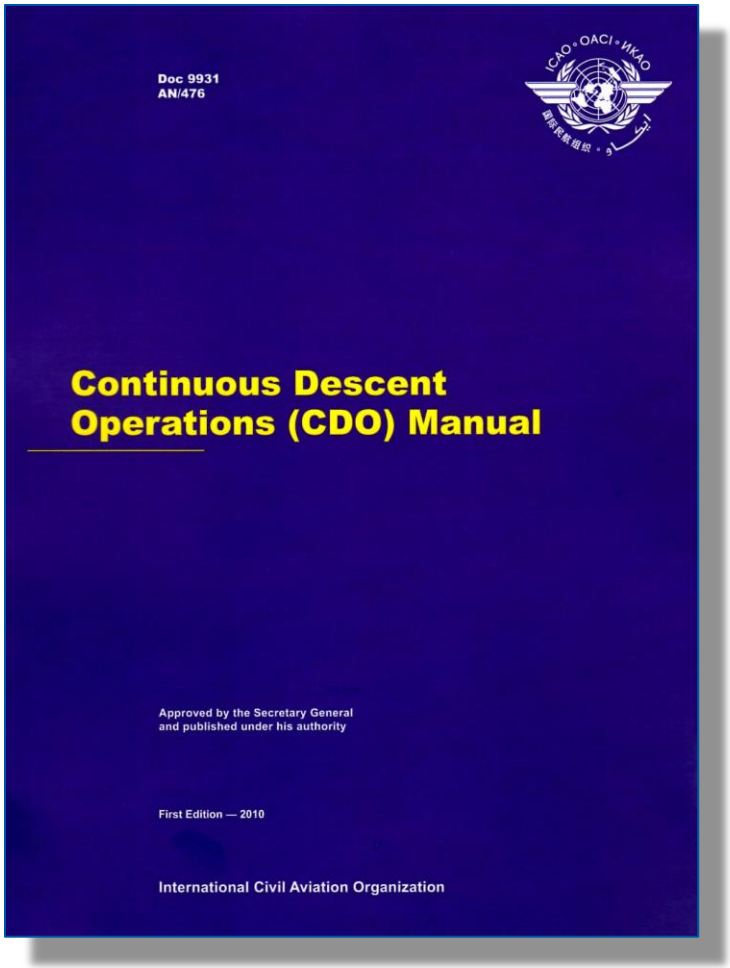
First Edition published 2010

- CDO is an aircraft operating technique
- enabled by airspace design, procedure design and
- facilitated by ATC
- in which an arriving aircraft descends continuously, to the greatest extent possible, using minimum engine thrust and low drag.



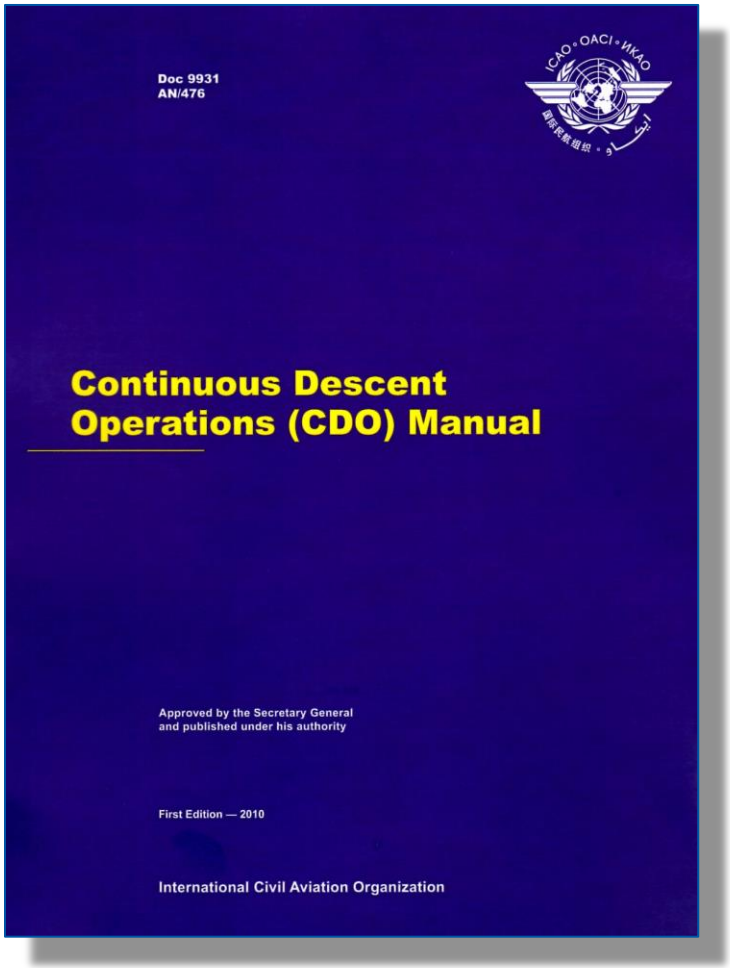
CDO Benefits

- Increase:
  - Flight predictability
  - Airspace efficiency & capacity
  - Safety
- Reduce:
  - Fuel burn
  - Emissions
  - Pilot & controller workload
  - Radio communications
  - CFIT



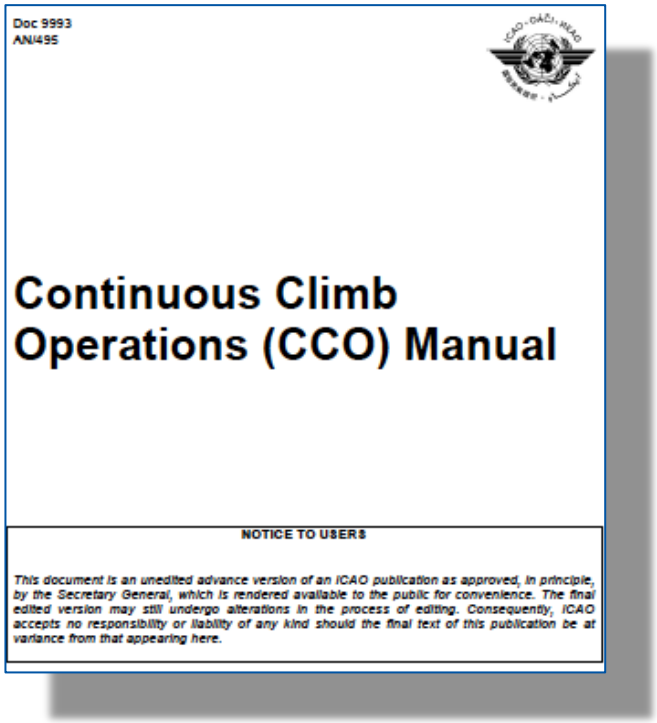
CDO Benefits

- Accurate planning for an optimum descent path is facilitated by the pilot and/or the FMS knowing the flight distance to the runway and the level above the runway at which the CDO is to be initiated.
- Thus a CDO requires planning and communication between the pilot and the air traffic controller.
- A CDO design is integrated within the airspace concept and must balance the needs of departing aircraft with the CDO arrival aircraft.



CCO Defined

ICAO Doc 9993



Doc 9993
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Continuous Climb Operations (CCO) Manual

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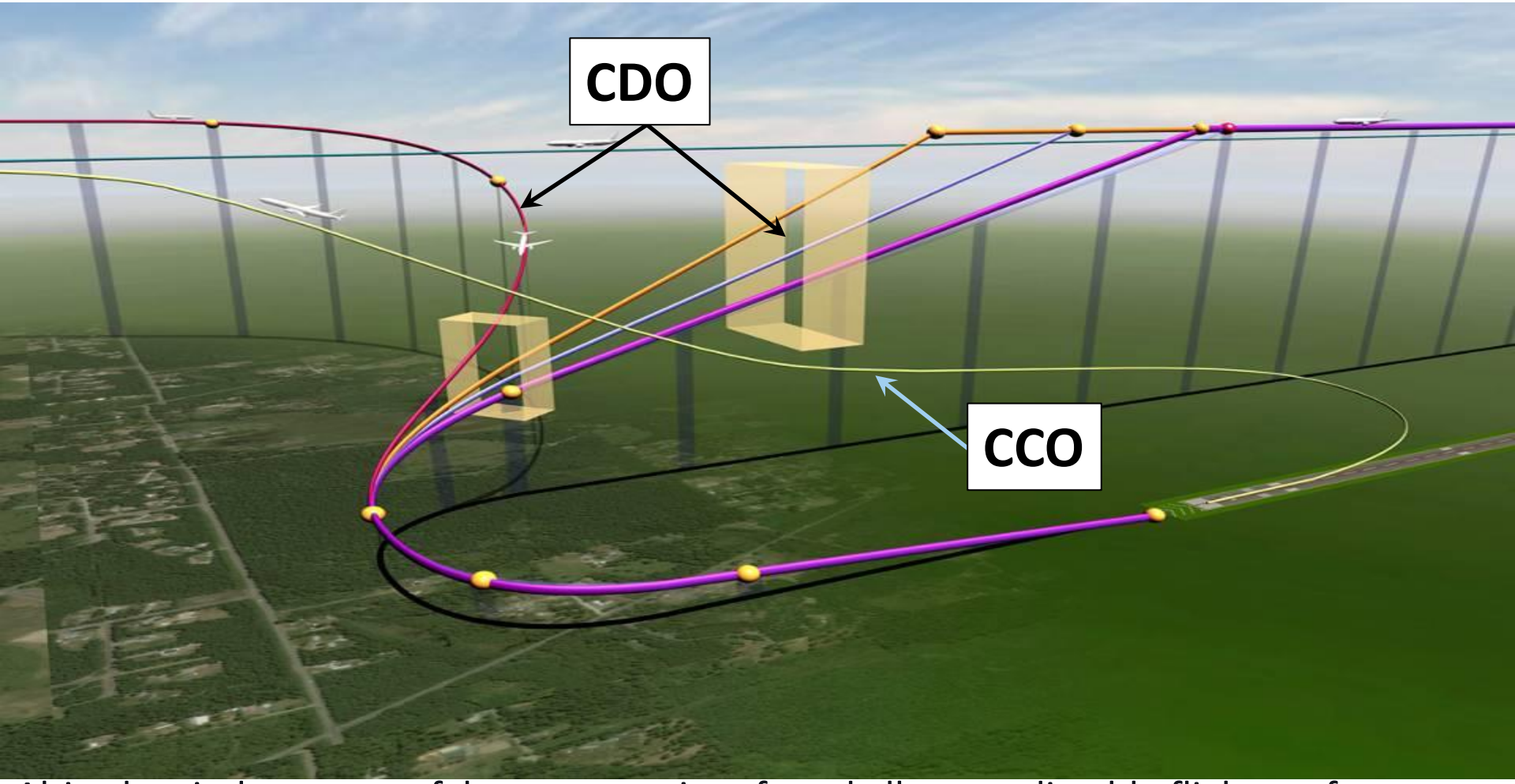
Integrating CCO and CDO Designs

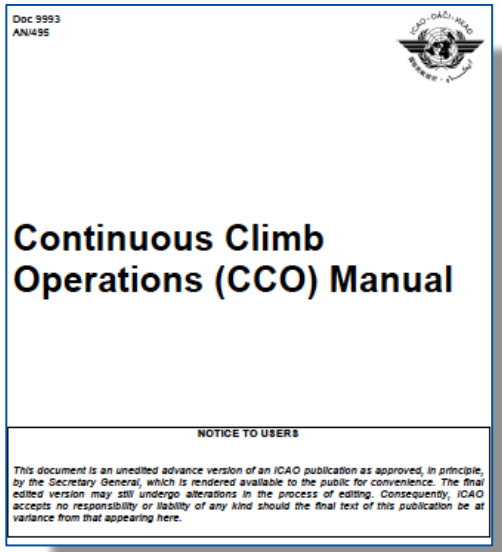


Altitude windows can safely separate aircraft and allow predictable flight performance

CCO & CDO Design Methods

BALANCE:

- Where a trade-off between CCO and CDO is unavoidable, the local analysis and decision making should take into account that a level segment for an aircraft in descent would normally burn less fuel than for the same duration of level segment for an equivalent aircraft in climb.
- Often there is far more unnecessary level flight in the descent phase than in the climb phase.
- The balance will depend on local characteristics such as the extent of level flight in both phases, the significance of noise in the areas affected etc.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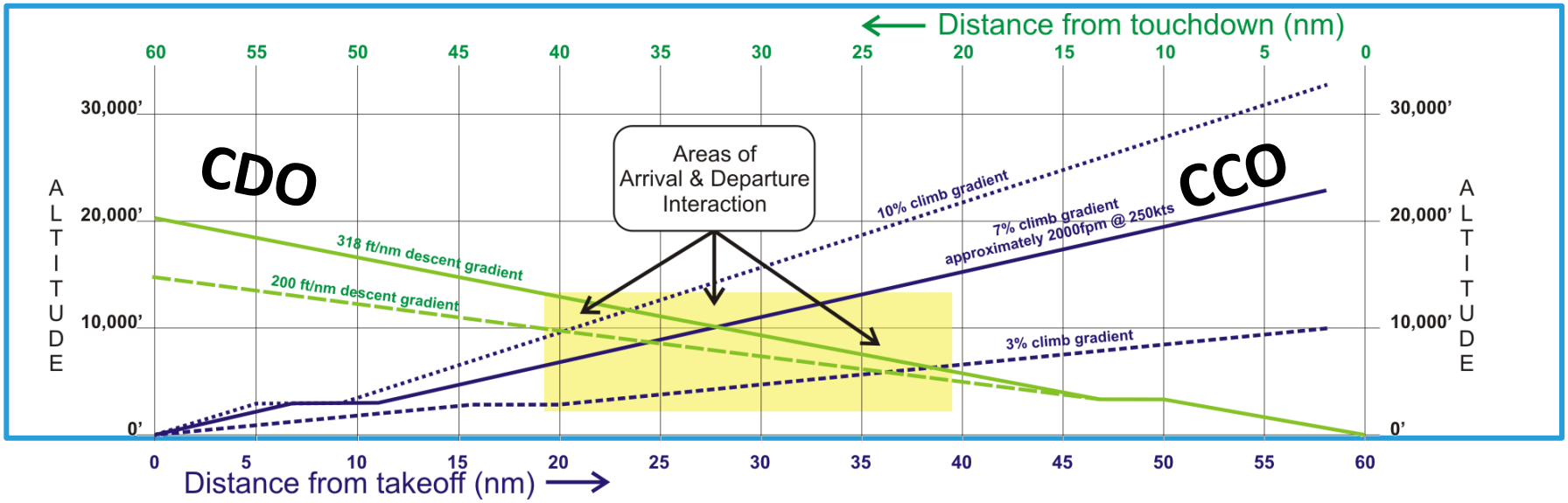
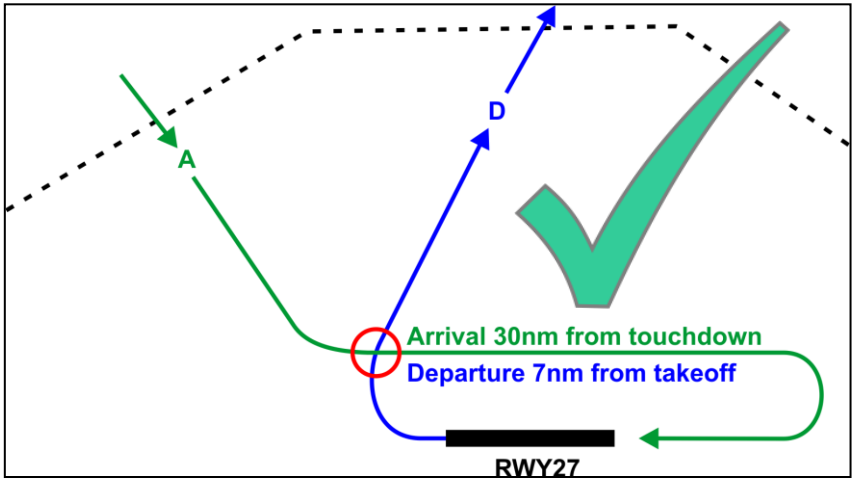
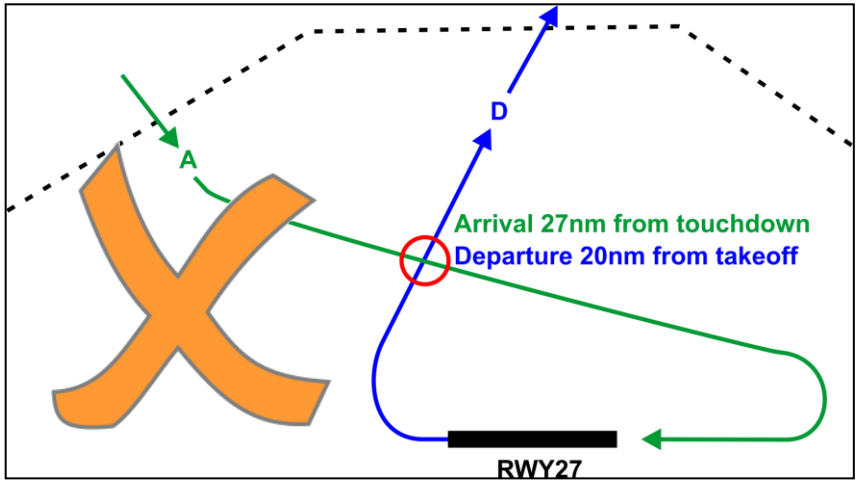
CCO/CDO Integration

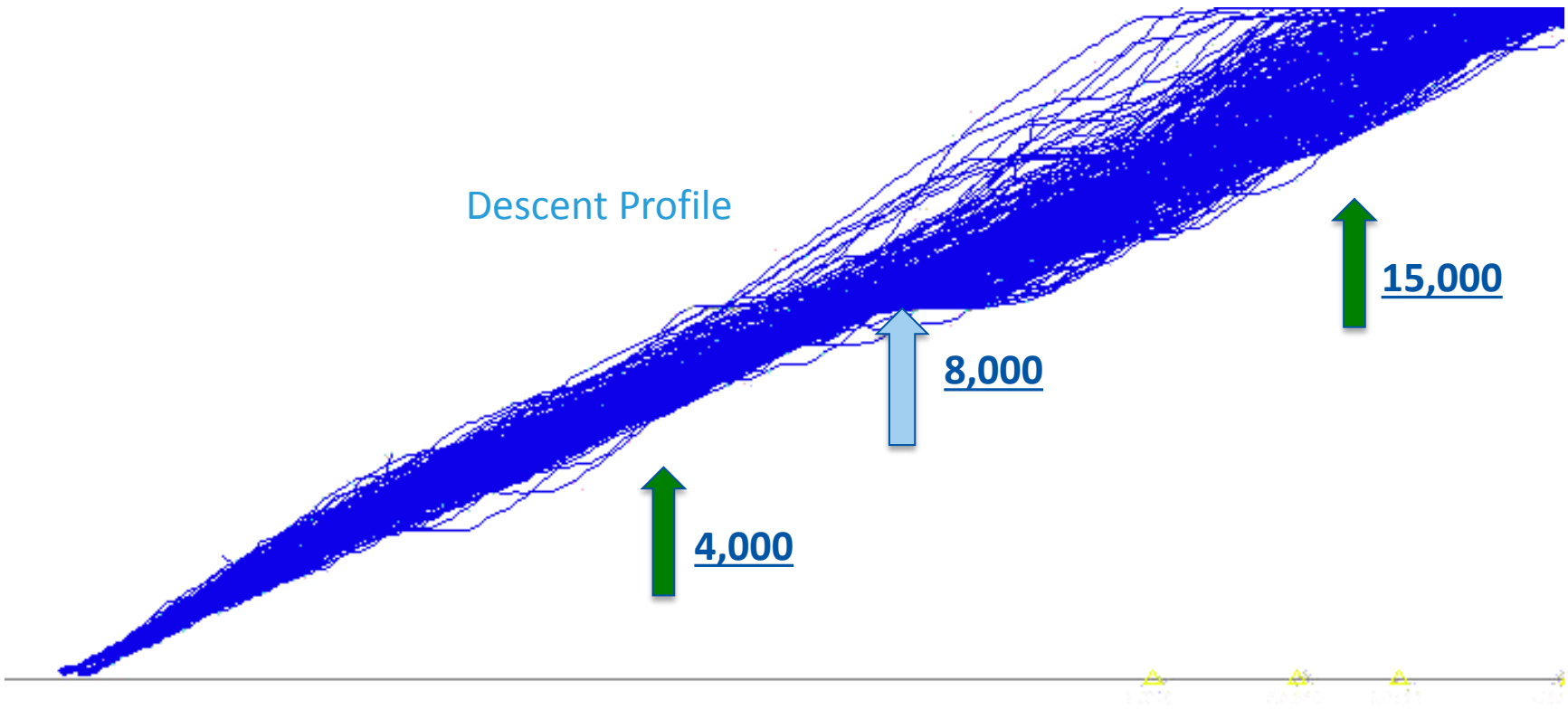






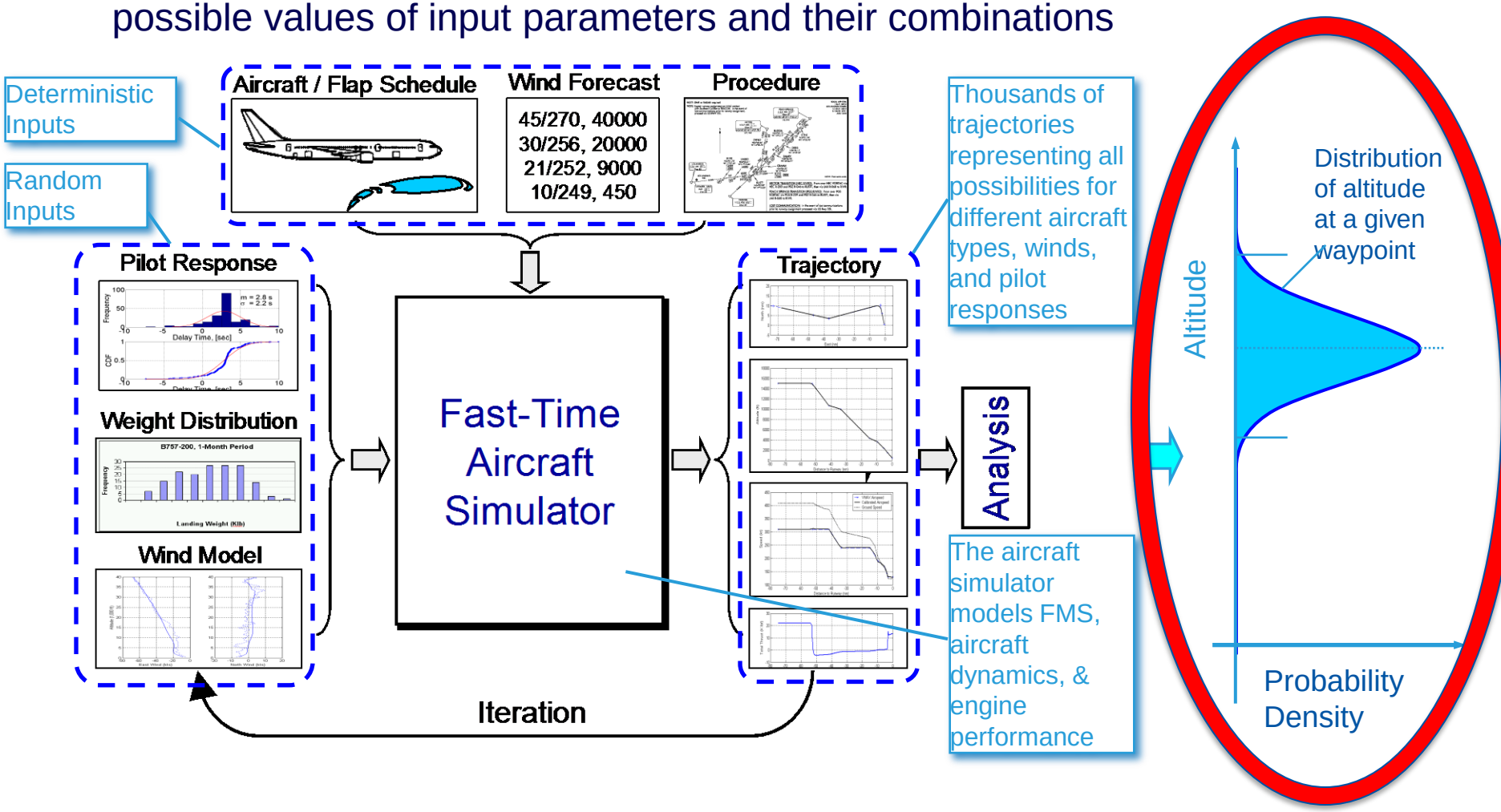
Plan crossover distances for efficient vertical separation

Altitude Limitations and Design Flexibility

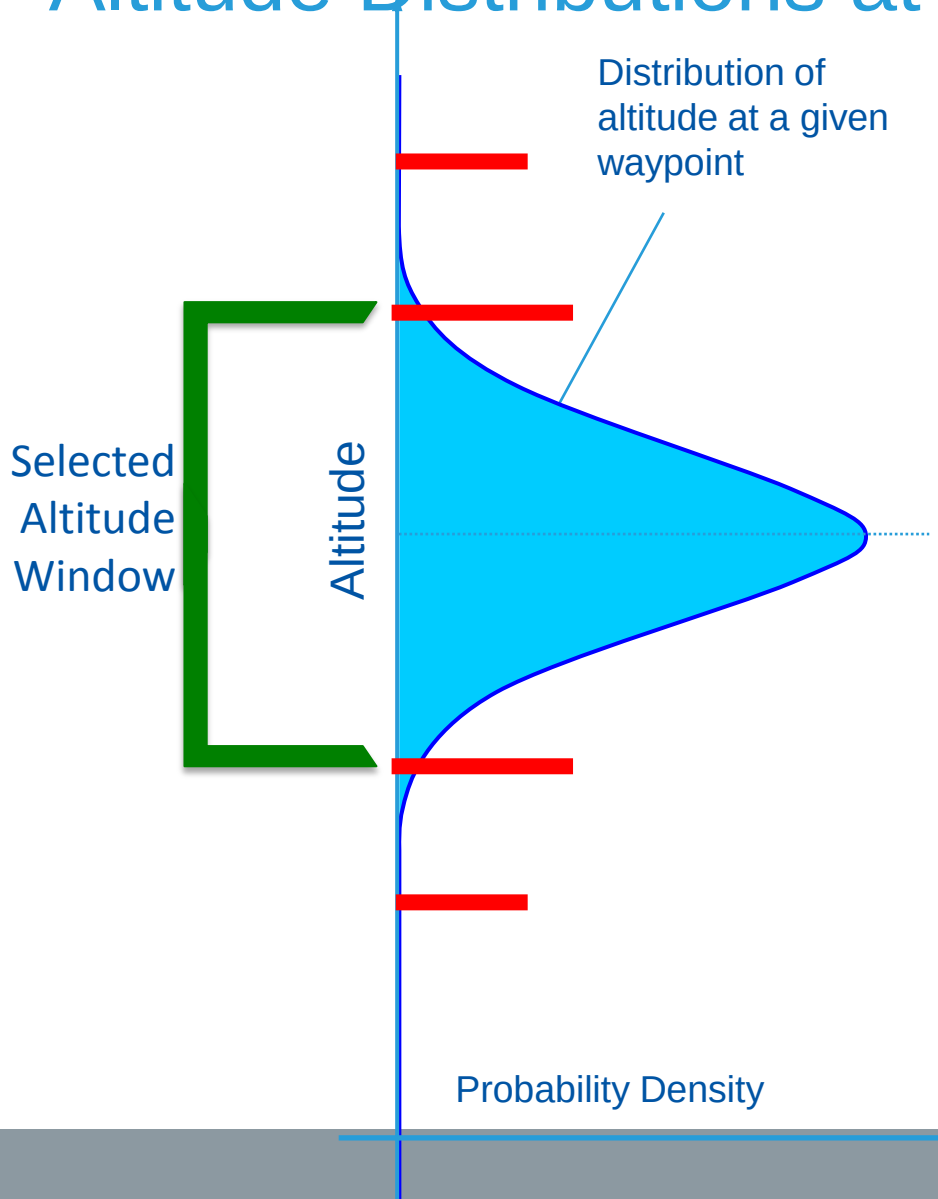


Altitude Distributions at Waypoints

- Monte Carlo: Iteratively simulate the effects of random factors by covering all possible values of input parameters and their combinations



Altitude Distributions at Waypoints



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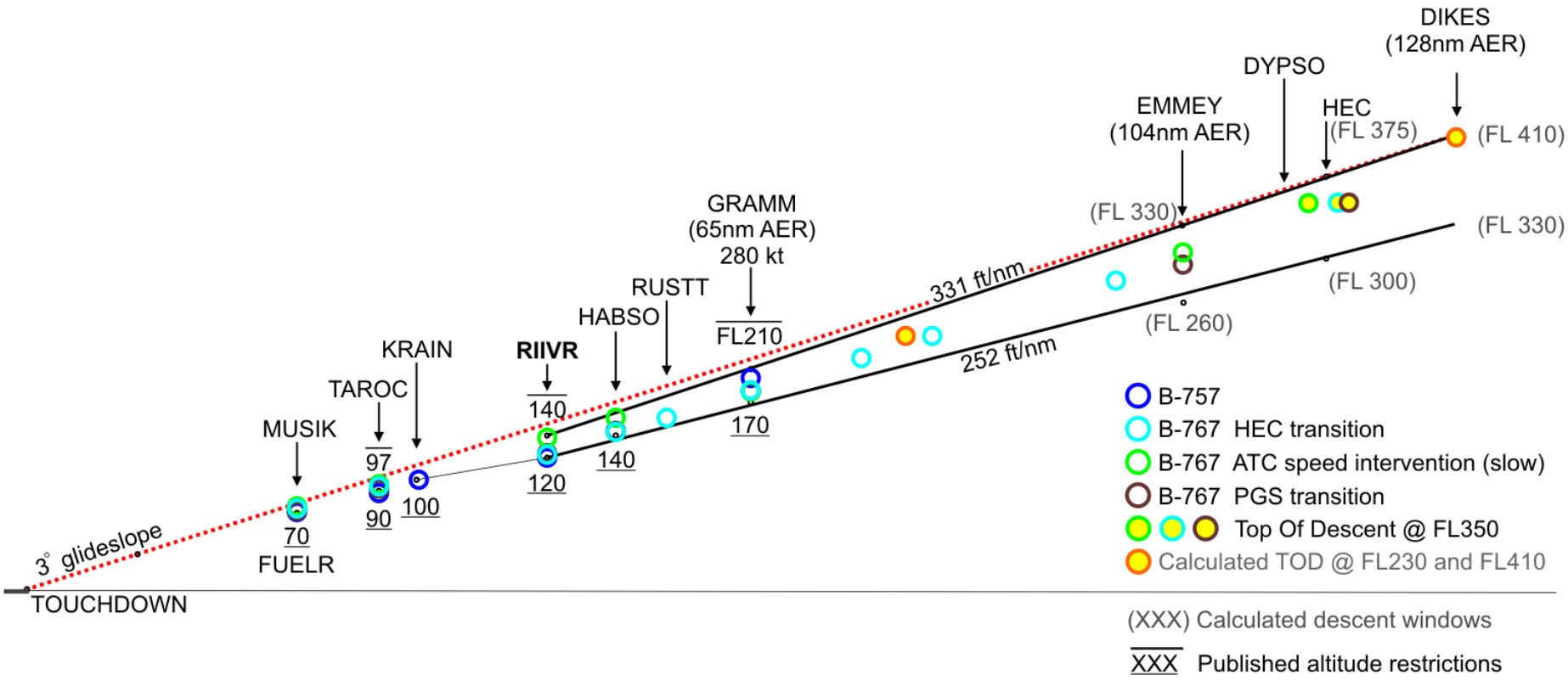
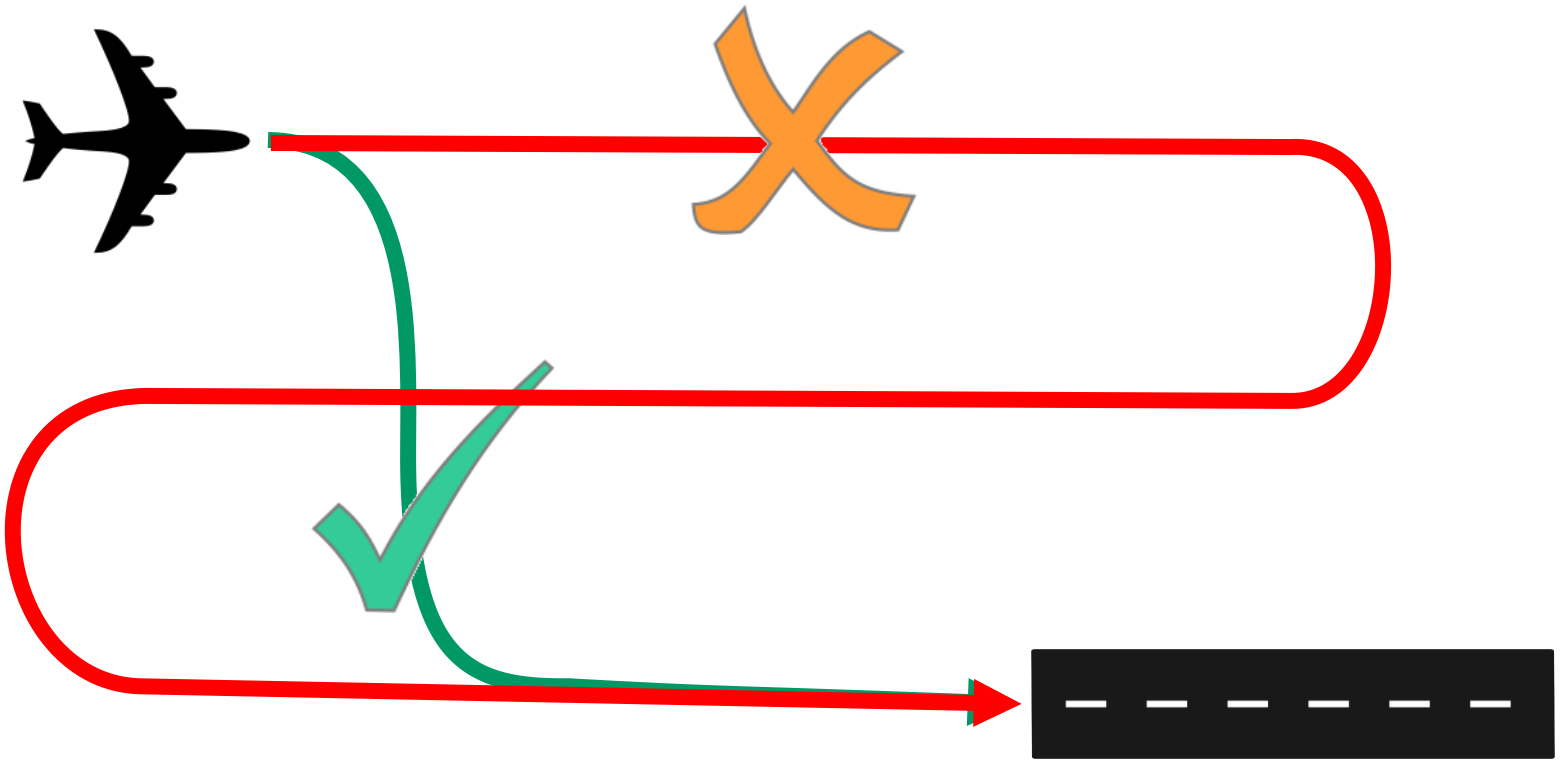


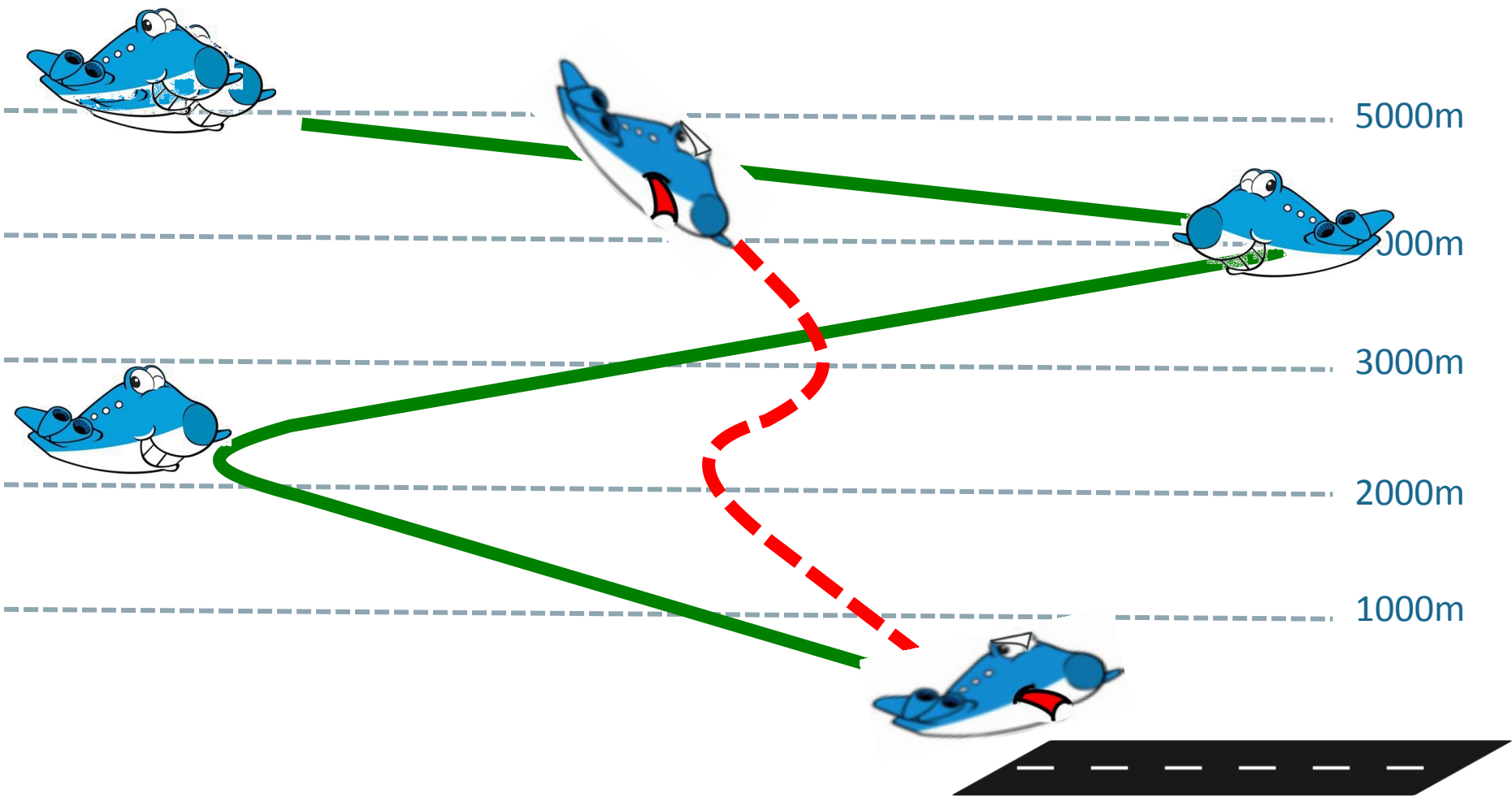
CDO Design Considerations

- ENERGY MANAGEMENT - Design to select the shortest path

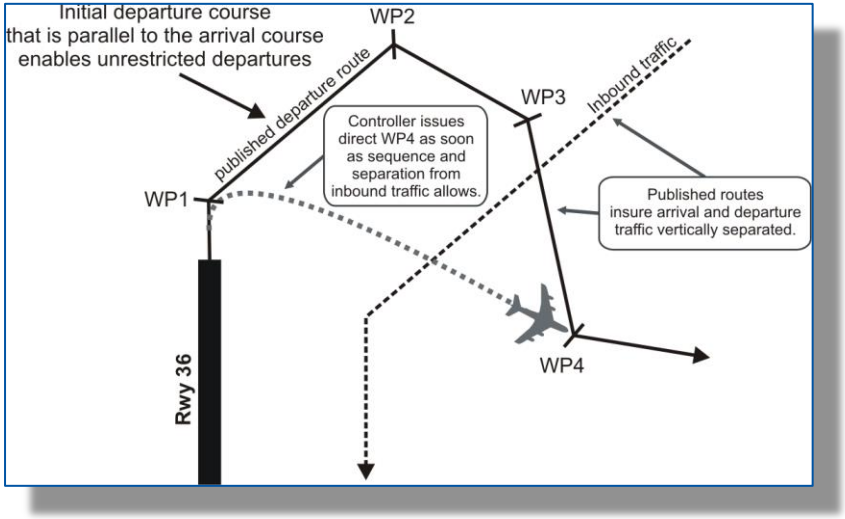


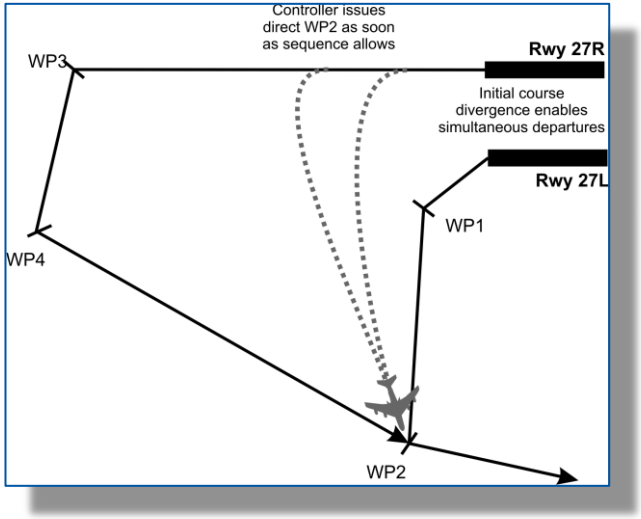
CDO Design Considerations

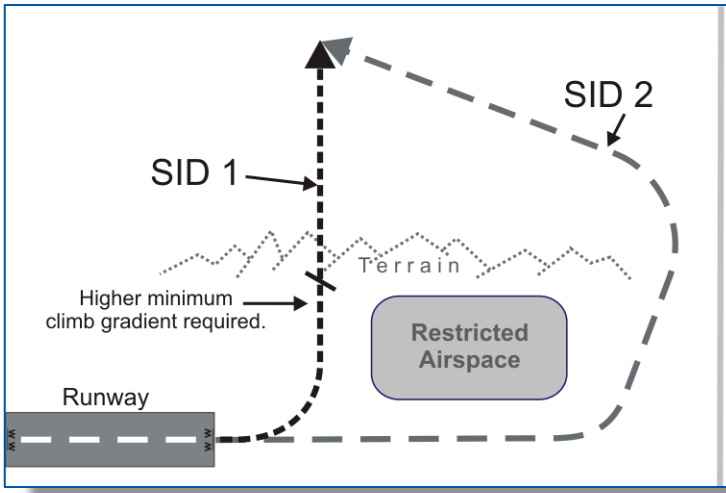
- Long path plus “shortcuts” are inefficient and introduce unstable flight conditions

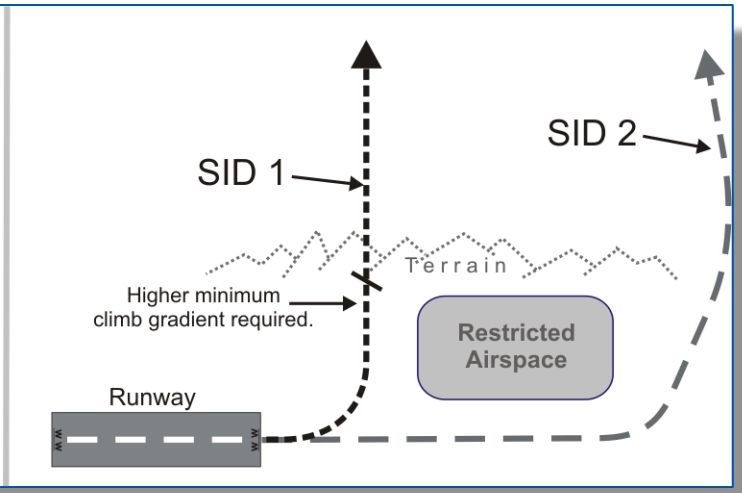


Flexible CCO Design









Balancing CDO, CCO, and Other Aircraft

- Priorities – false choices
- The art of the possible
- CDO and CCO are not absolutes
- Airplane vs. fleet vs. ATC optimization
- Closed Paths enable higher compliance
- Structure increases capacity
- Design for energy management
  - CDO design for shortest path and extend path if required.
  - CCO design for longer path and “shortcut” when able.

Thank You