



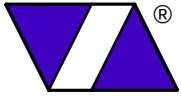
Via Technology

Geometric Separation

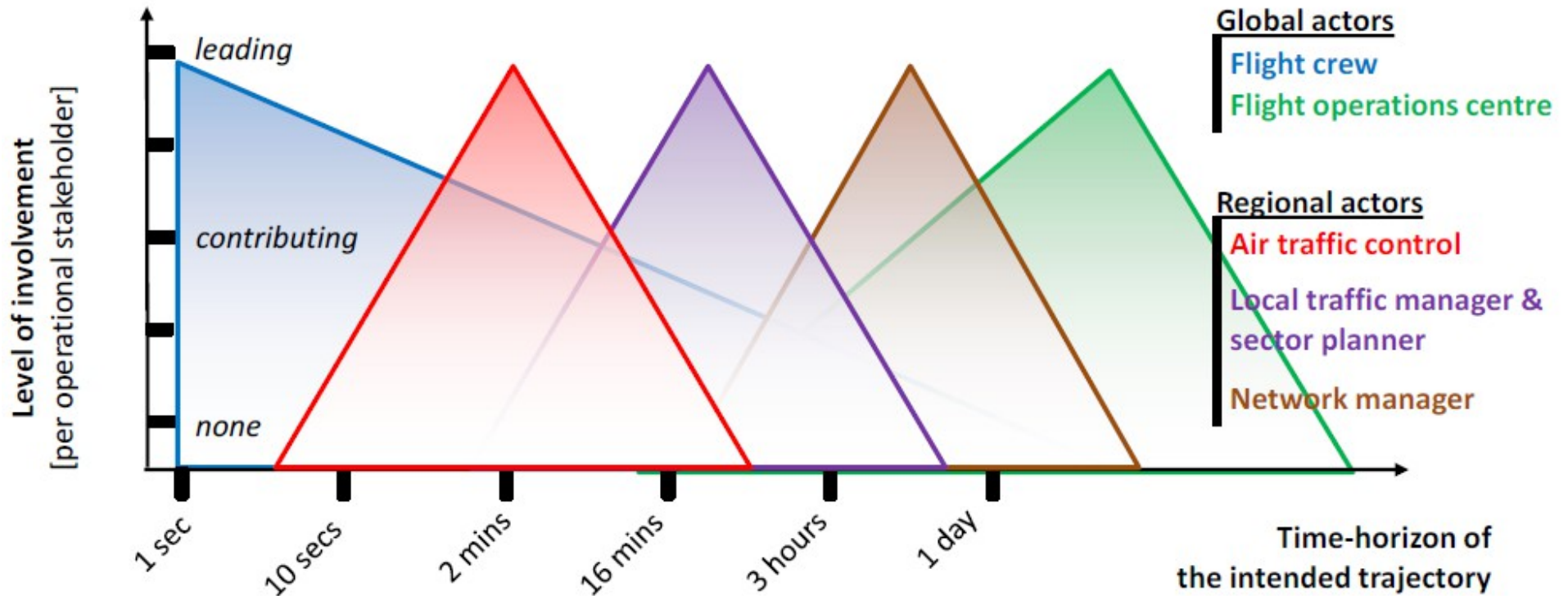


Geometric Separation

- Conflict Horizon
- Conflict Detection
- Combinatorial Complexity
- Geometric Separation
- Summary



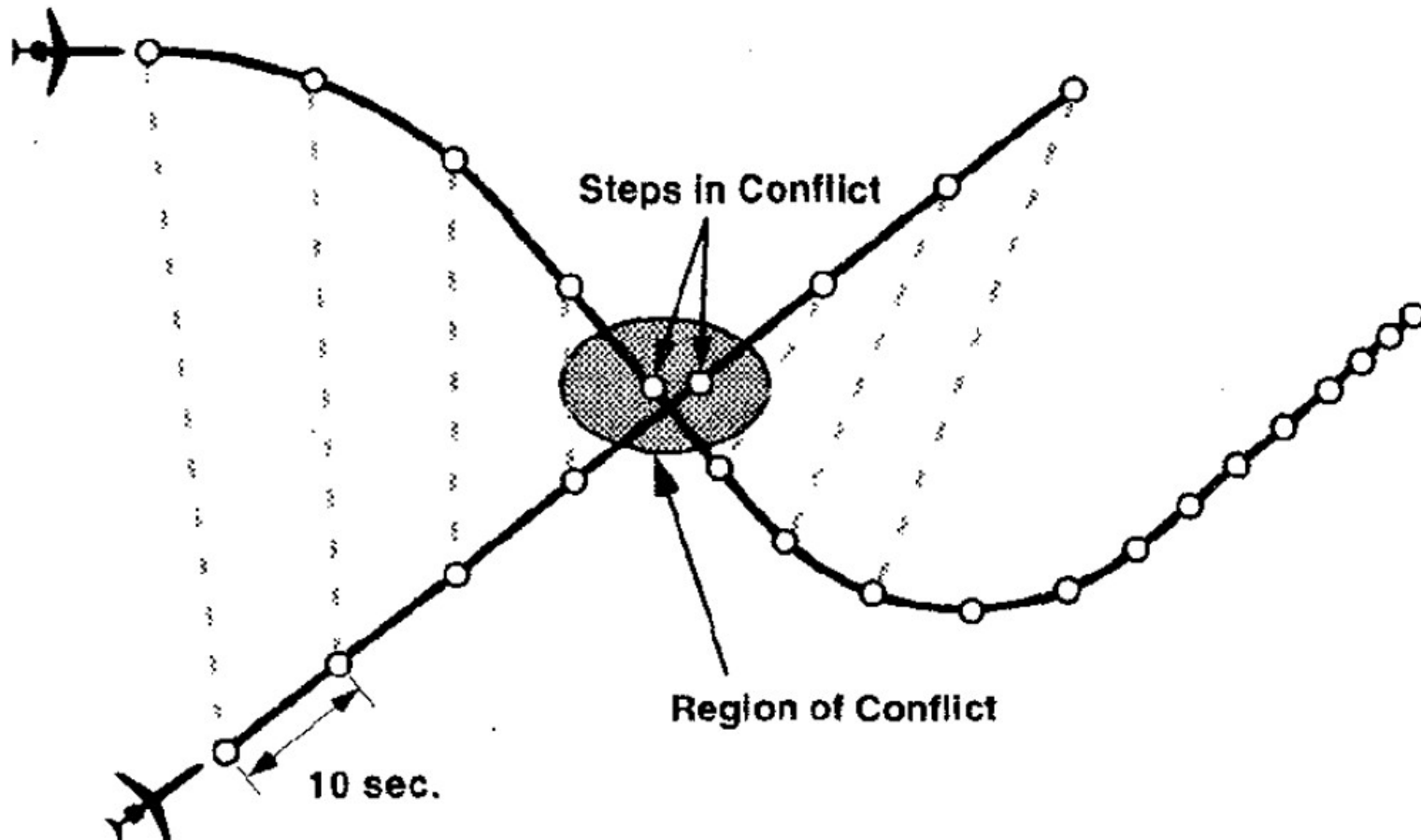
Conflict Horizon



Operational Stakeholder Involvement, ATMRPP WG/25-WP/601 Fig 4



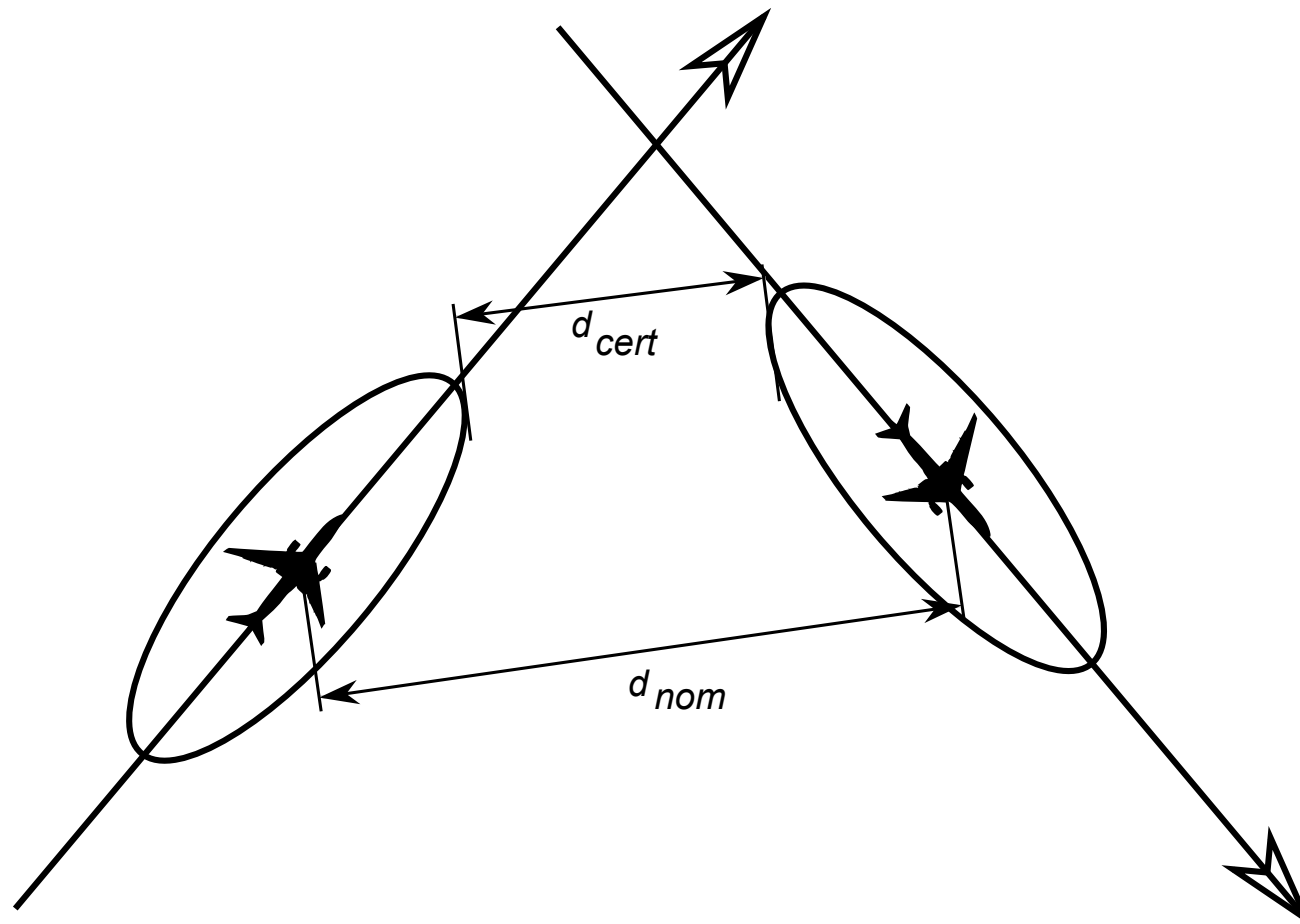
Distance Separation



NASA Design of a Conflict Detection Algorithm for CTAS, Fig 4



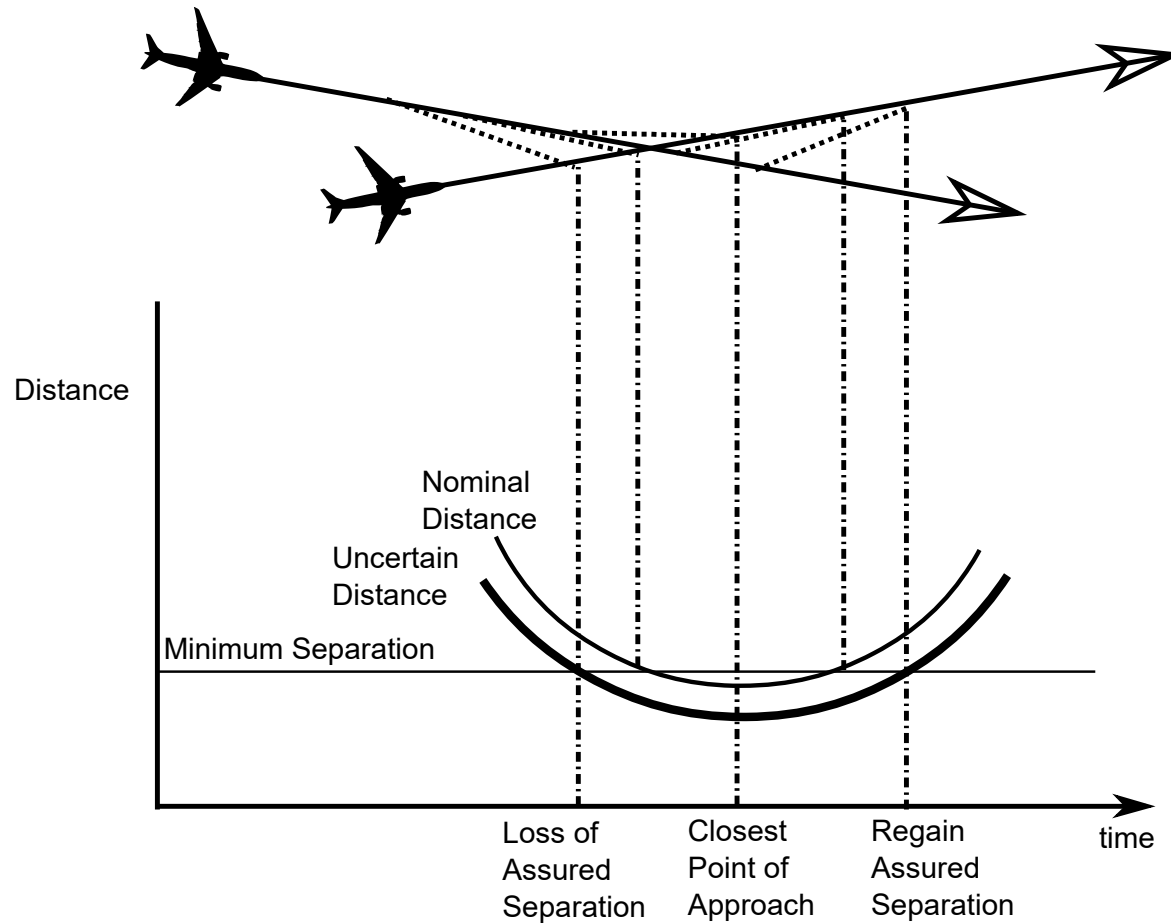
Position Uncertainty



NATS iFACTS Patent EP 2 372 672 A2 Fig 7



Separation Distance



NATS iFACTS Patent EP 2 372 672 A2 Fig 9



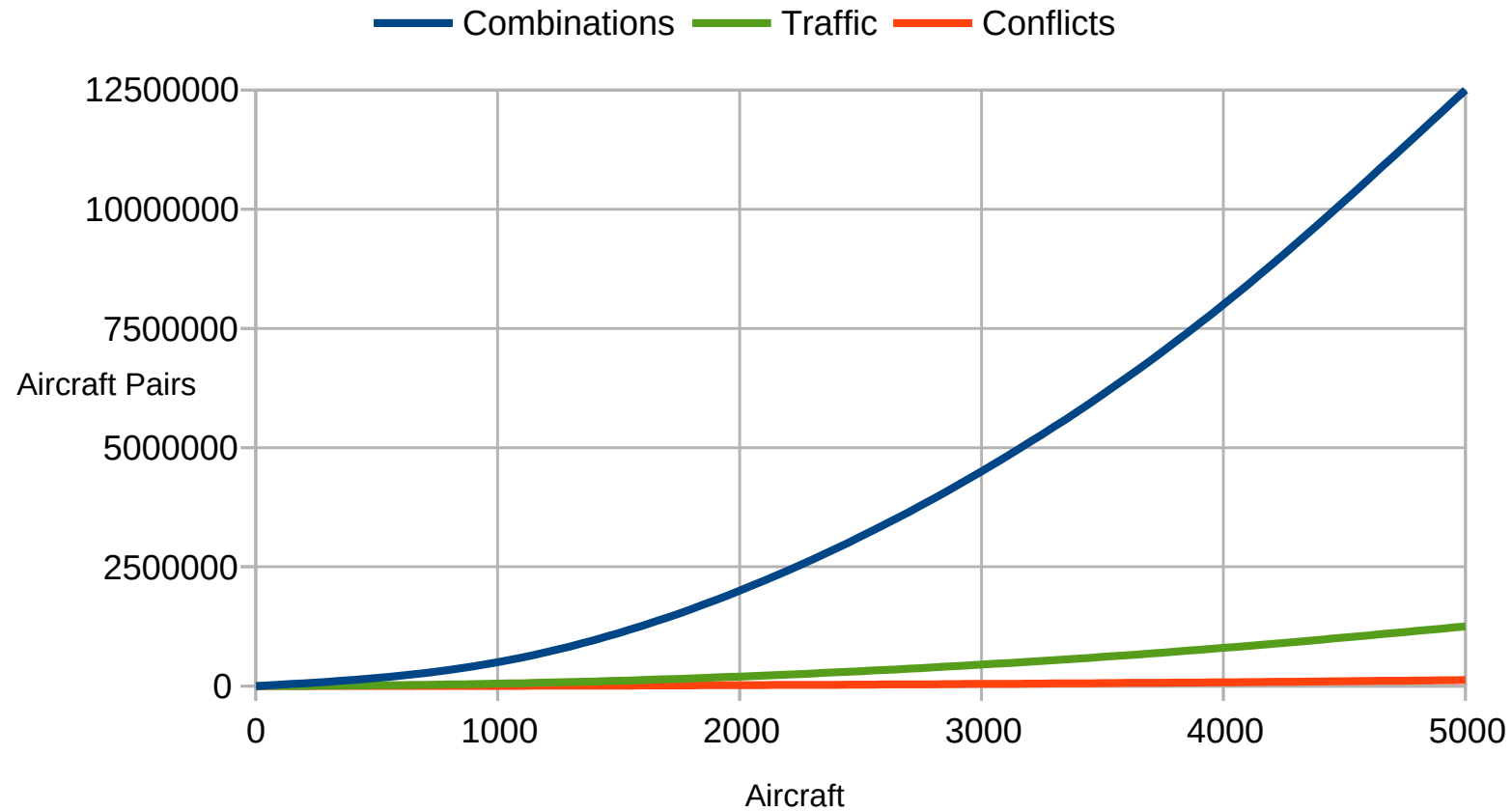
Conflict Detection

- Calculates separation distance at given times
- Uncertainty is modelled in position at given time
- Minimum separation is: minimum uncertain distance at time of closest approach
- **Detection Area:** slightly larger than a sector
- **Conflict Horizon:** less than 20 minutes



Combinatorial Complexity

$${}_n C_2 = n \frac{(n-1)}{2} \approx \frac{n^2}{2}$$



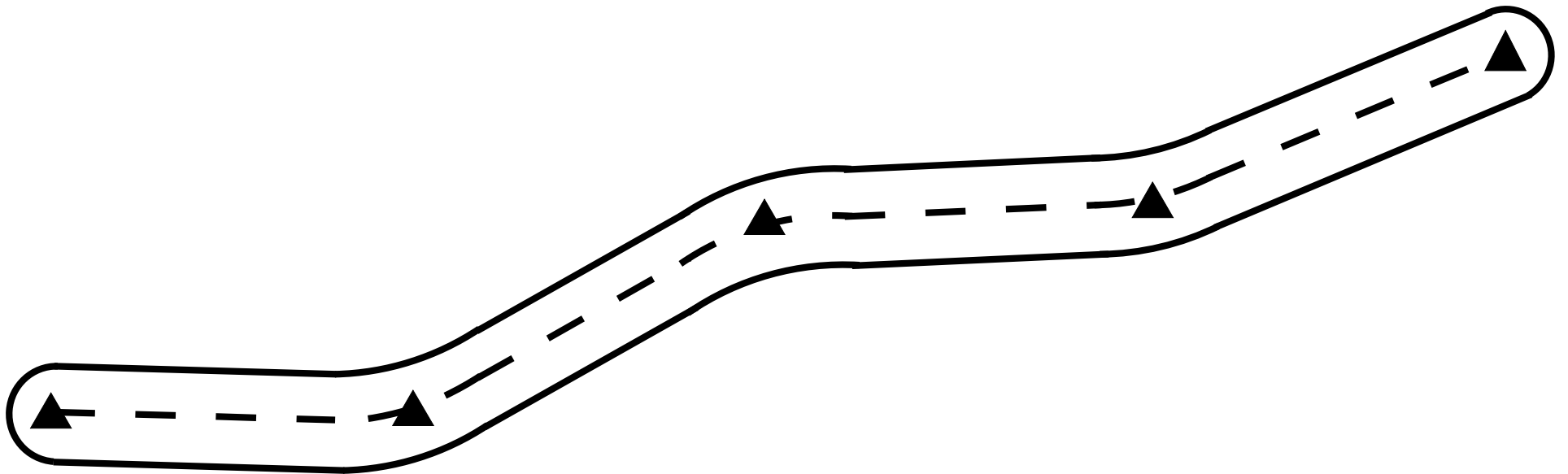


Separated Routes





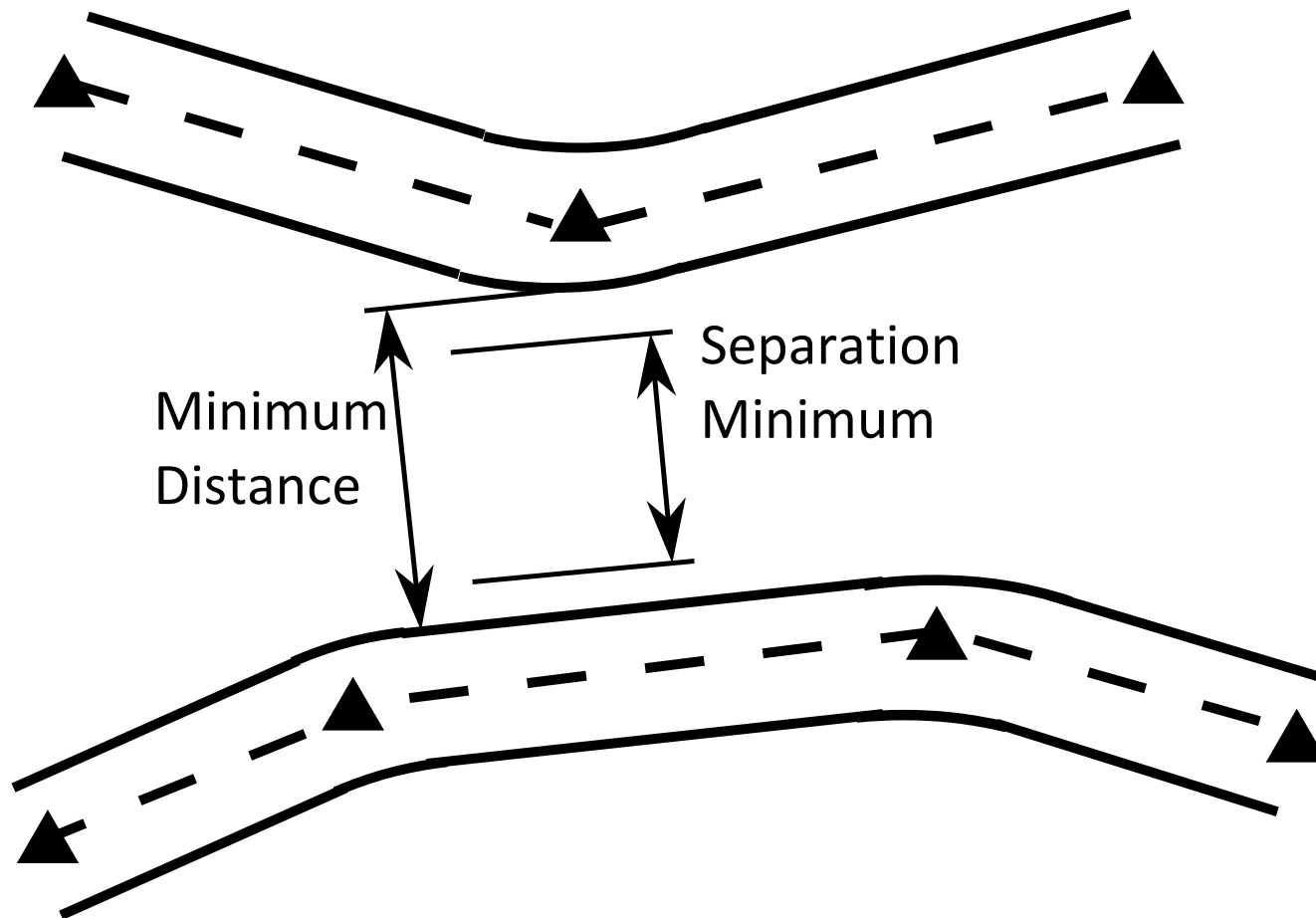
Flight Path



2D Route swept by navigation tolerance

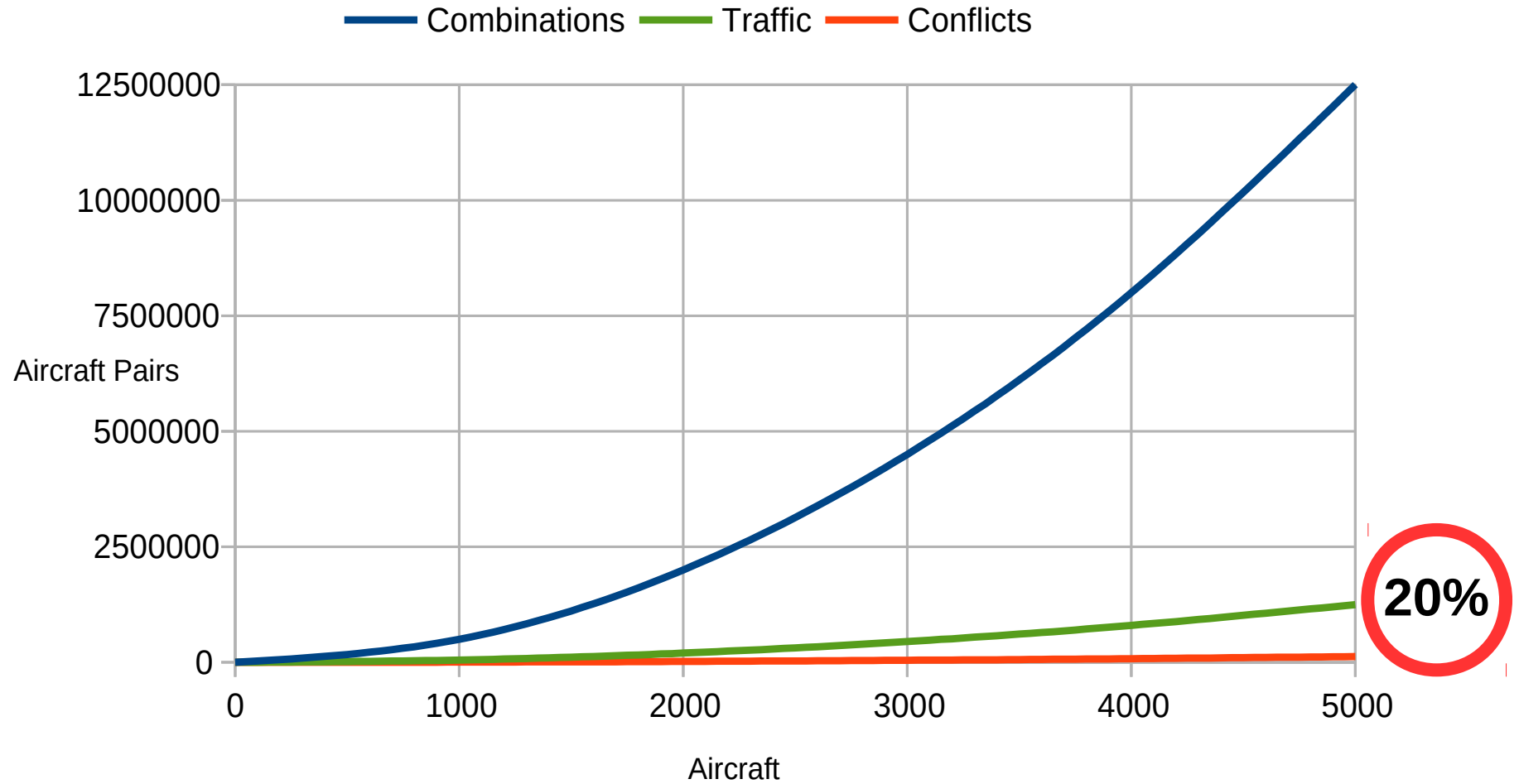


Separated Flight Paths



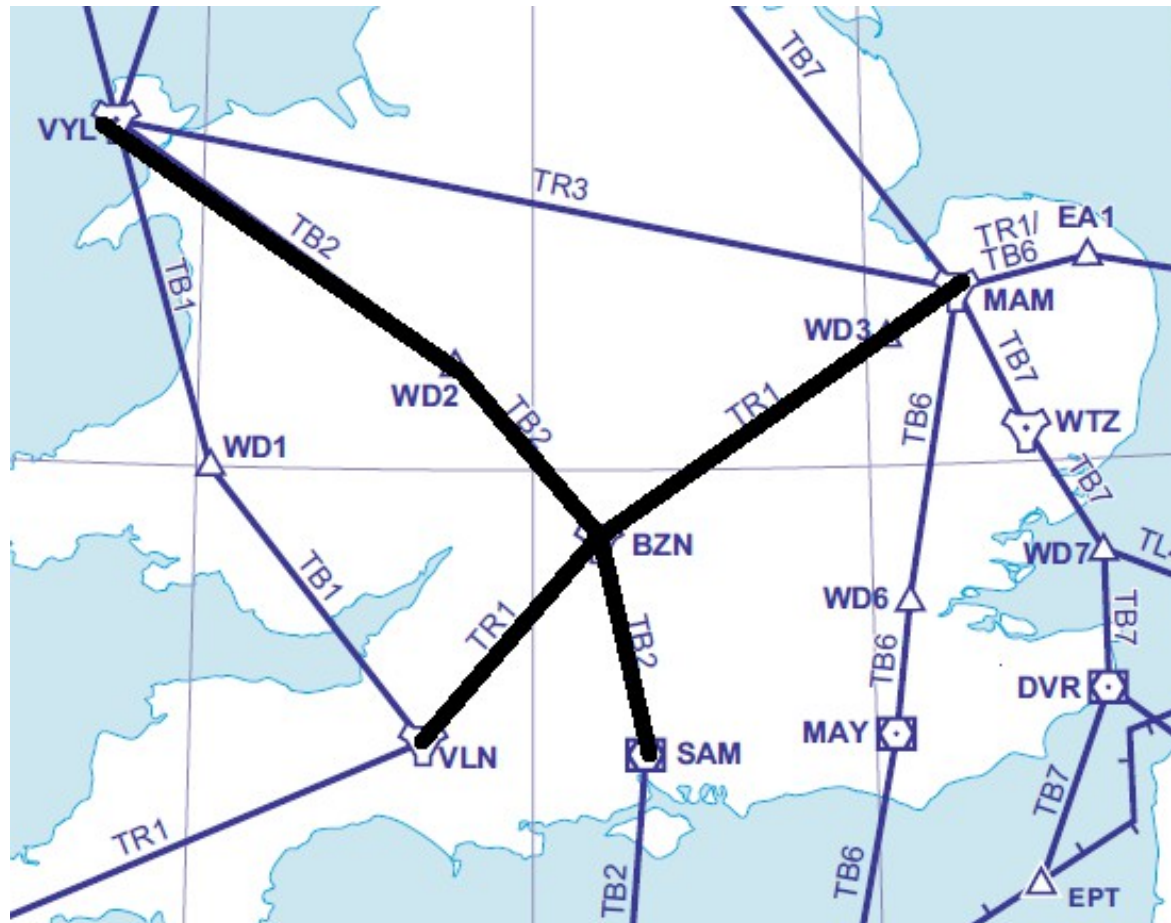


Route Separation





Airway Intersection

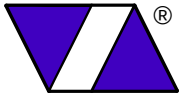




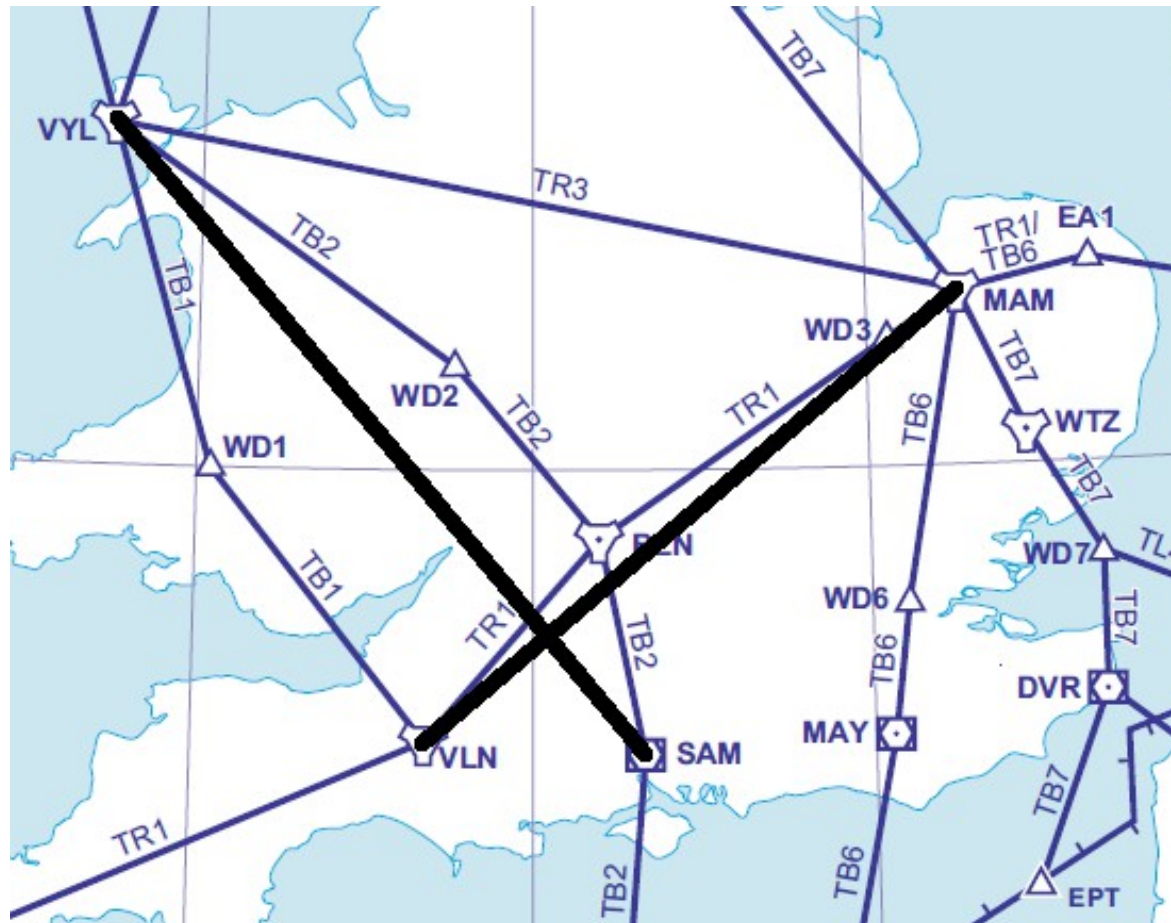
Procedural Separation



Flight Strip Board, Wikipedia © Fred775

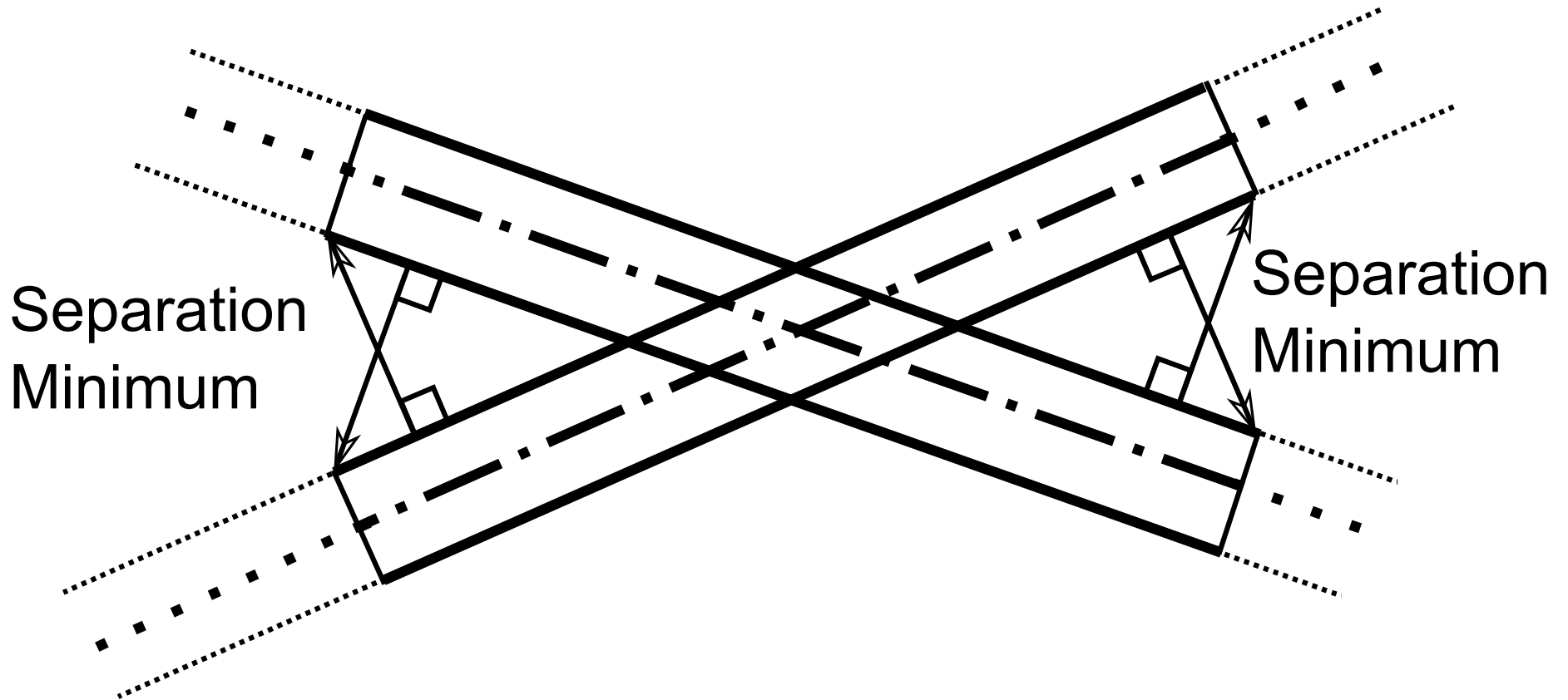


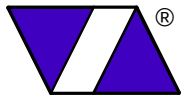
Direct Route Intersection





Conflict Paths



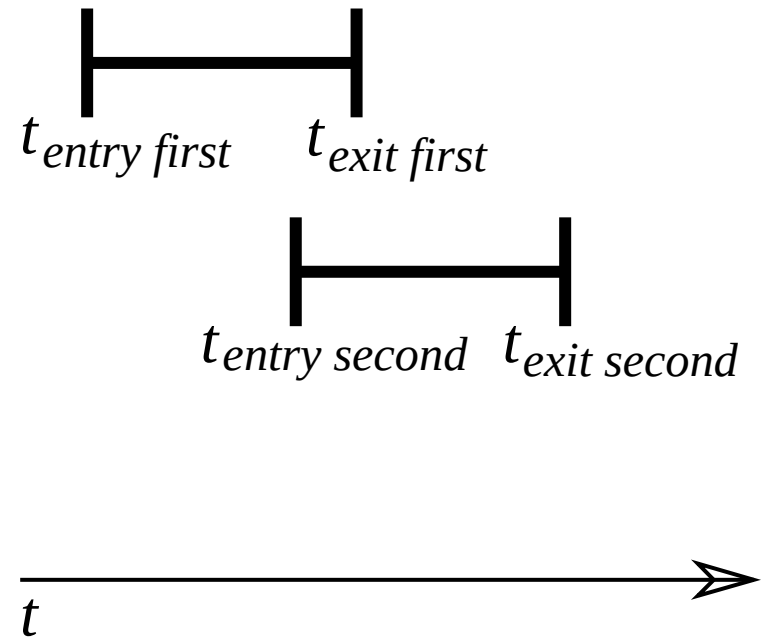
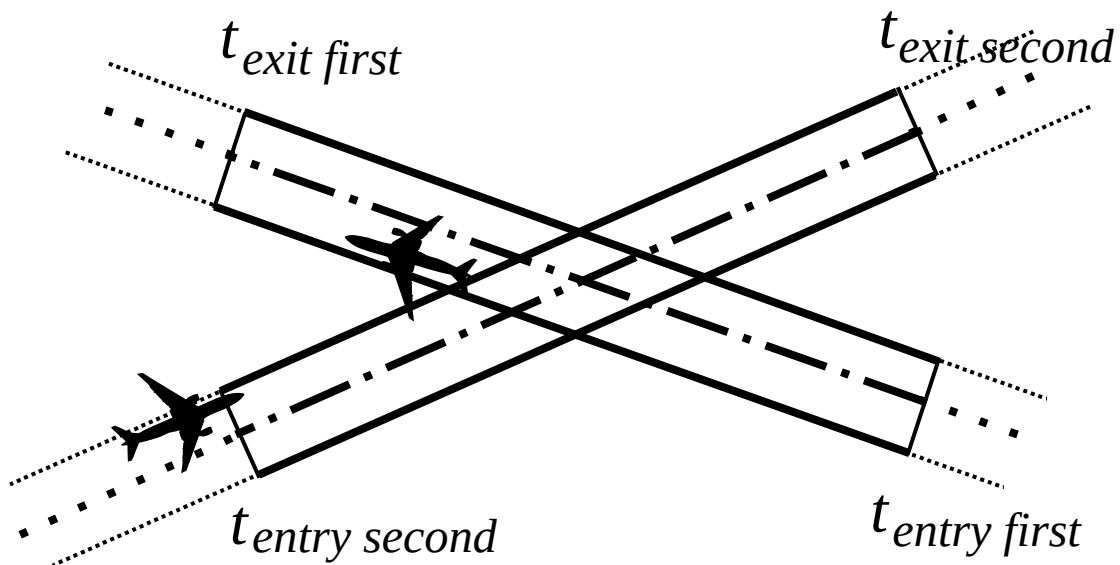


Direct Route Conflict Paths



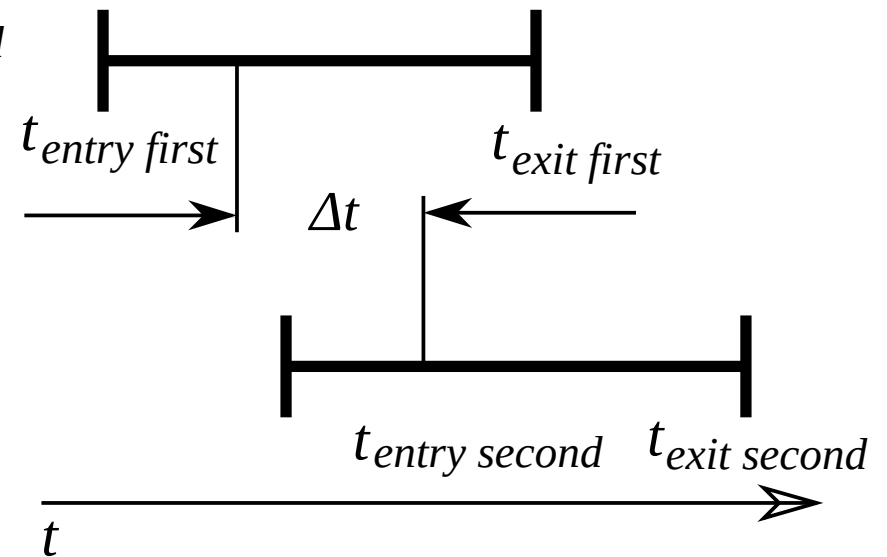
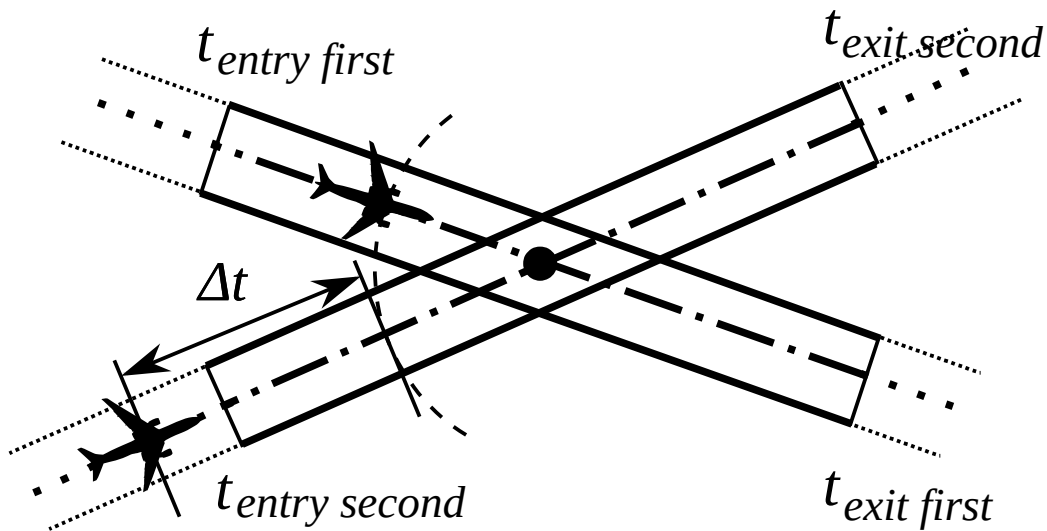


Reciprocal Interaction





Non-Reciprocal Interaction





Geometric Separation

- Finds if (and where) routes can lose separation
- Uncertainty is modelled in time at given position
- Minimum separation is: minimum time difference before distance separation may be lost
- **Detection Area:** larger than an FIR
- **Conflict Horizon:** could be hours ahead, depending on trajectory accuracy...



Summary

	Conflict Detection	Geometric Separation
Finds	Min Distance at Closest Time	Min Distance between Paths
Horizontal Uncertainty	Position at given time	Time at given position
Reported Separation	Minimum Distance	Minimum Time
Number of Aircraft	< 100	> 1000
Detection Area	> Sector	> FIR
Conflict Horizon	< 20 minutes	hours, trajectory dependant
Stakeholders	ATC	Sector Planner+
Status	Operational	Requires validation...