



Separation Minima Model - How Changes in Contributing Factors Could Affect Current Standards

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EU Framework Programme 6 Project RESET - Reduced Separation Minima

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RESET



BACKGROUND

Many separation minima were defined in 1950s to '70s

Dramatic development of on-board and ground equipment has taken place since then

- What implications do technological developments have for the definition of Separation Minima?
- Where are reductions of Separation Minima needed and feasible in order to enable safe traffic growth in the future?

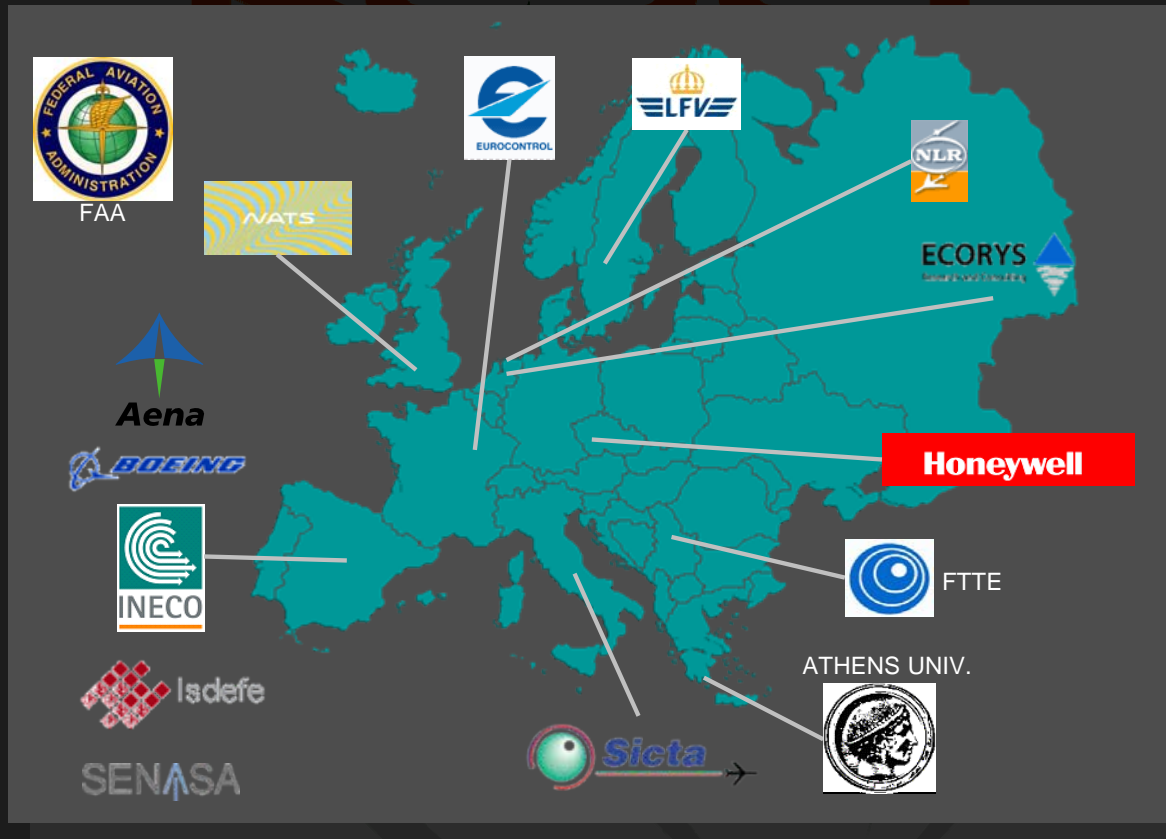


EU Framework Programme 6

RESET Partners around Europe and the U.S.

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14 EUROPEAN PROJECT PARTNERS + FAA



For more information and public deliverables visit: <http://reset.aena.es/>

RESET - Safe Reduction of Separation Minima to Accommodate Future Traffic Growth

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KEY RESET OBJECTIVES

Identify reductions of separation minima to accommodate factor of 2 traffic growth over Europe by 2020 (baseline 2005)

Develop detailed descriptions for reduced Separation Minima operations

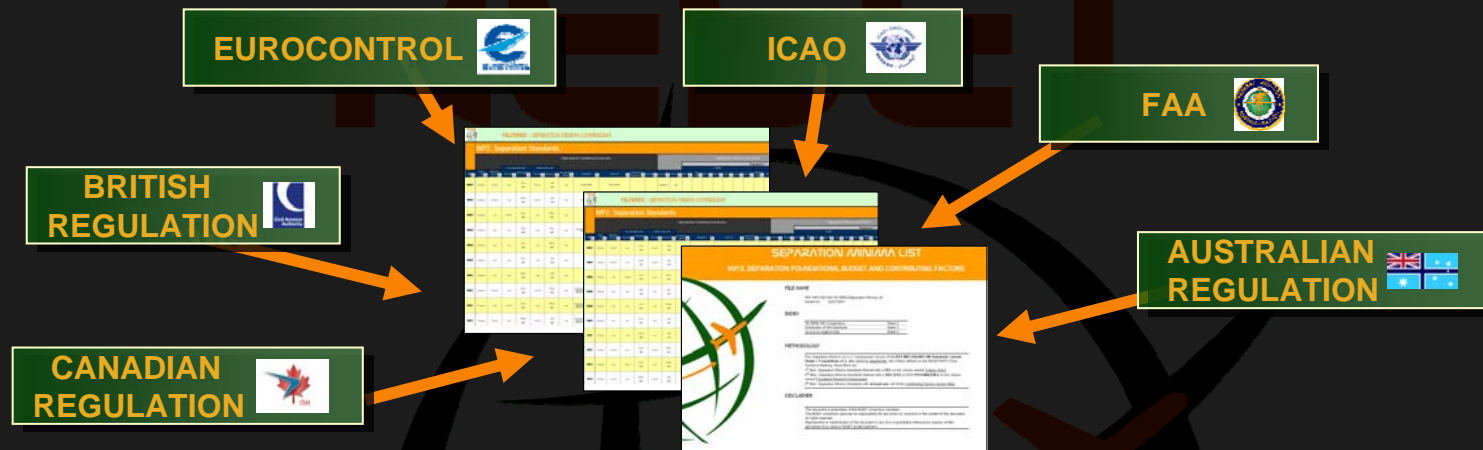
Provide evidence of safe operation

Identify process of change



Separation Minima Database and Foundation Research

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- 680 separation minima standards were collected and organized by phase of flight, type of separation, regulatory body, etc.
- References were recorded and foundations were evaluated

Discovered foundations for only 15% of the standards

Need for Modelized Approach to Separation Minima

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RESET DEVELOPS SEPARATION MINIMUM MODEL to

- Study the influence of new technologies in ATM
- Conduct sensitivity analyses

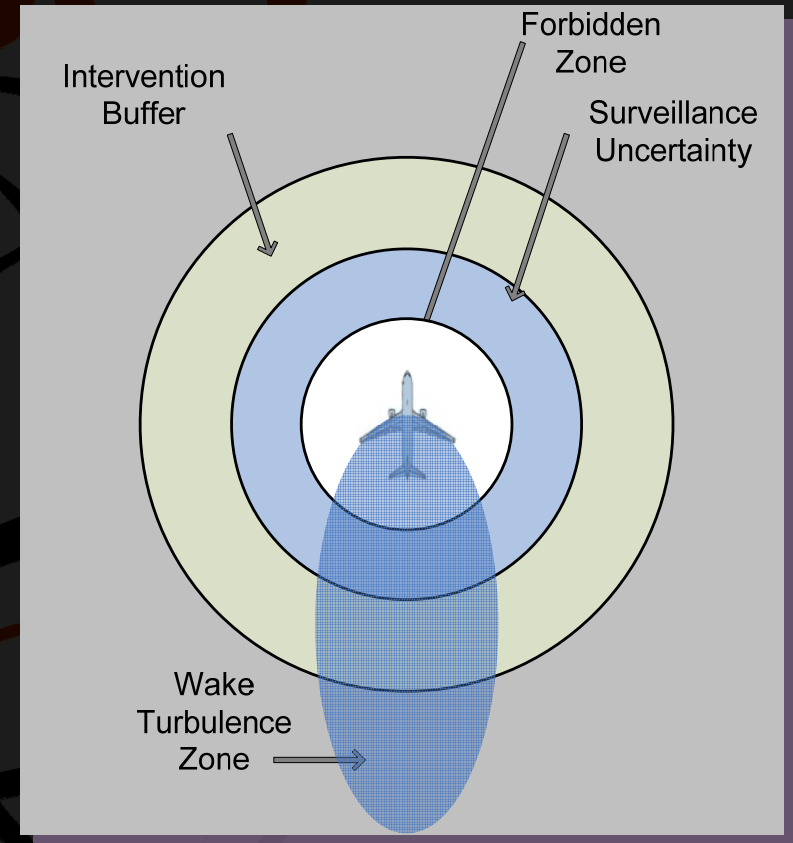
Focus on Horizontal Separation



Separation Minimum Components

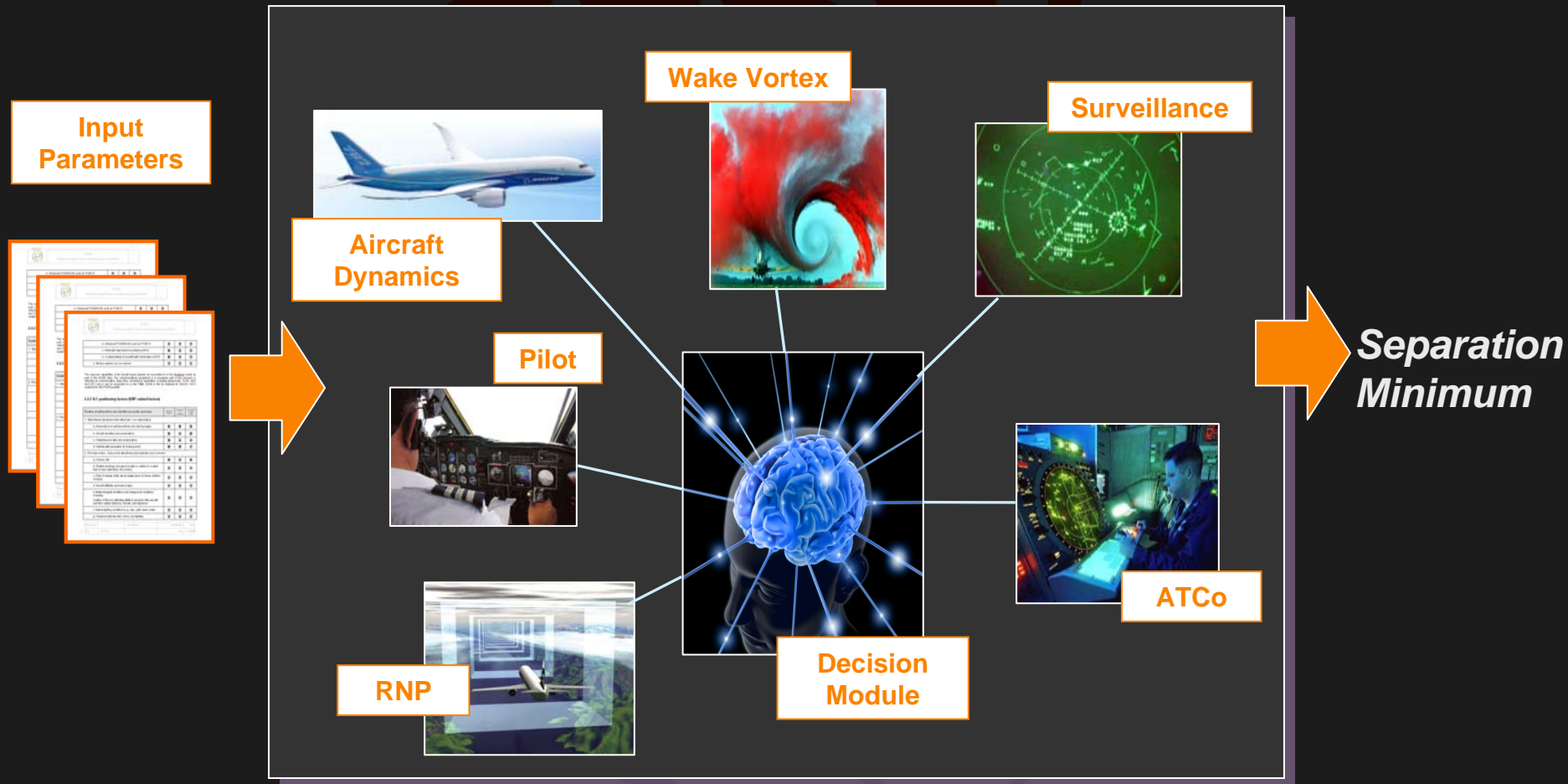
Following approaches of Reynolds & Hansman, Rockman, Ennis & Zhao

- > Forbidden Zone
 - Collision Cross Section
- > Surveillance Uncertainty
 - Aircraft Surveillance
 - Navigation Performance
 - Ground Systems Surveillance
- > Intervention Buffer
 - Detection, Reaction, Communication Time
 - Aircraft Performance
 - Environment
 - Communication Capability
 - ATC Rules and Situation Complexity
- > Wake Turbulence Zone



Separation Model Structure

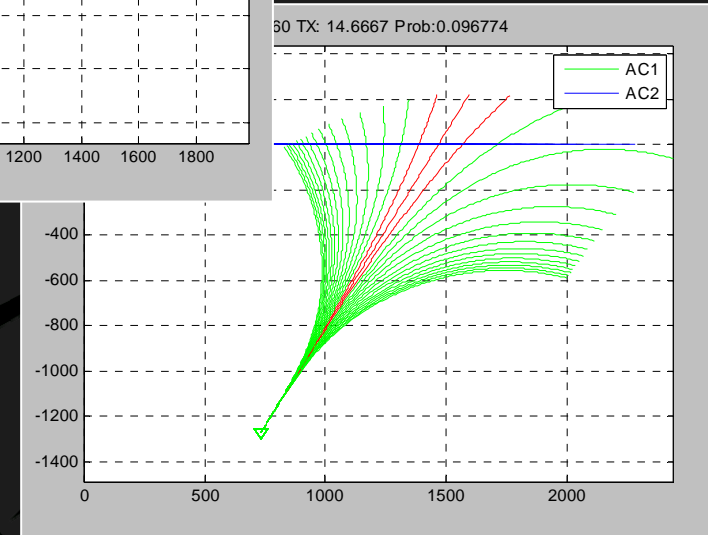
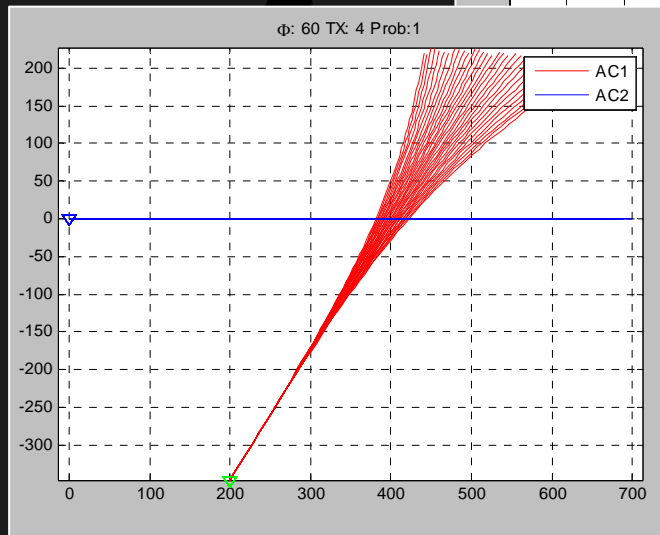
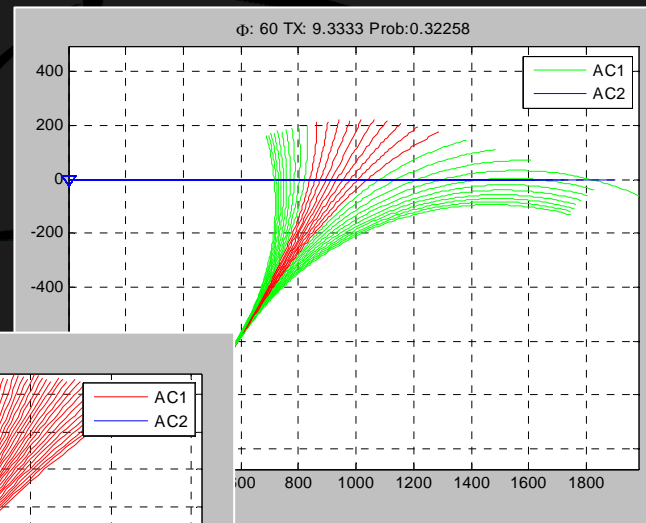
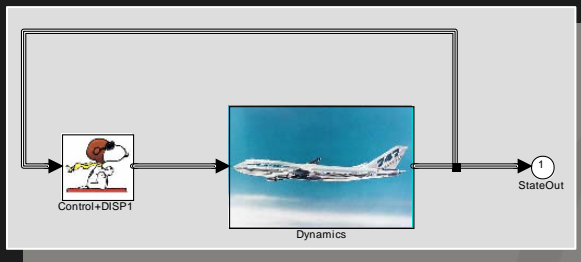
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Aircraft Dynamics Module (Horizontal)

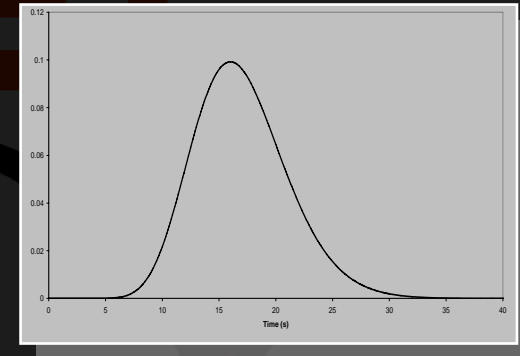
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- Simulate 2 A/C, 1 performing avoidance maneuver
 - Compute % of trajectories avoiding intrusion based on A/C maneuverability
- Distance (time) needed to avoid intrusion for target probability



Detection of a Blunder and Human Intervention

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Surveillance Module

- RADAR surveillance
- ADS-B

Pilot Reaction and Communication Time

- Statistics of UK Airprox events

ATCo Reaction Time

- Cognitive task model

Combination of Separation Components

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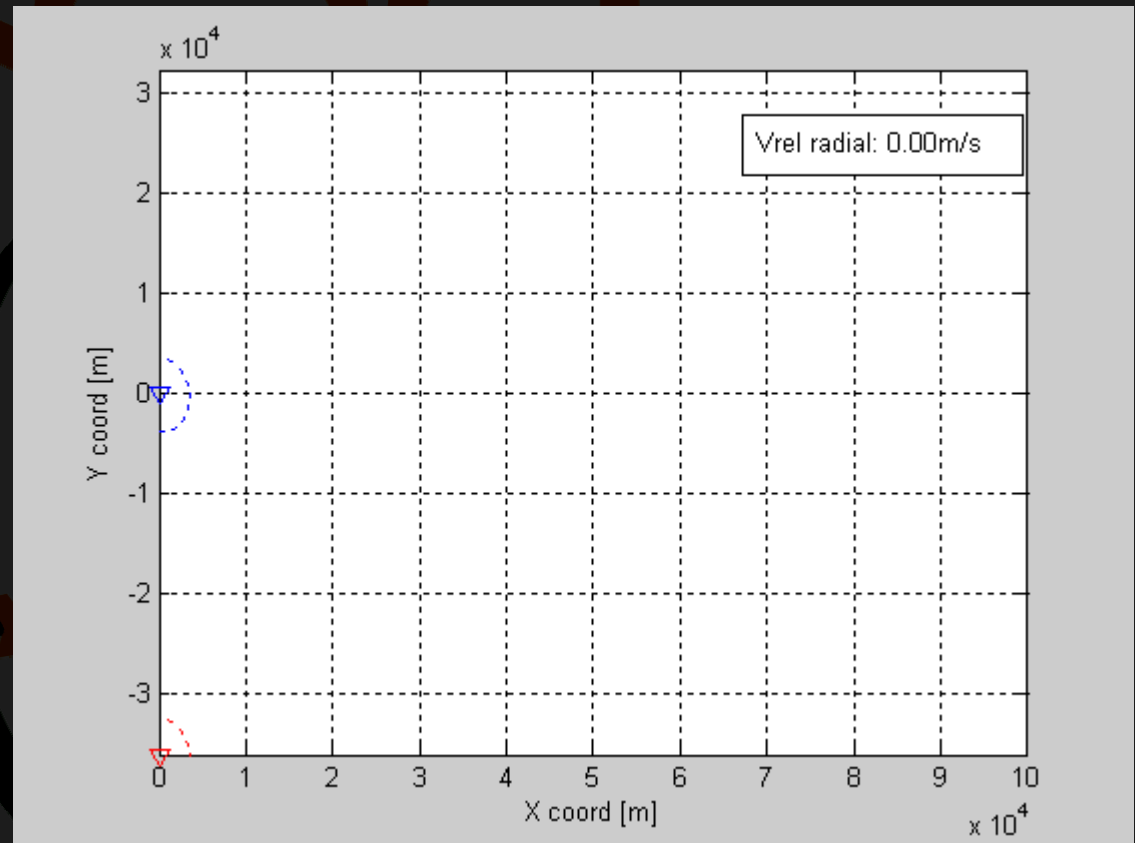
A/C Dynamics



Controller & Pilot Intervention



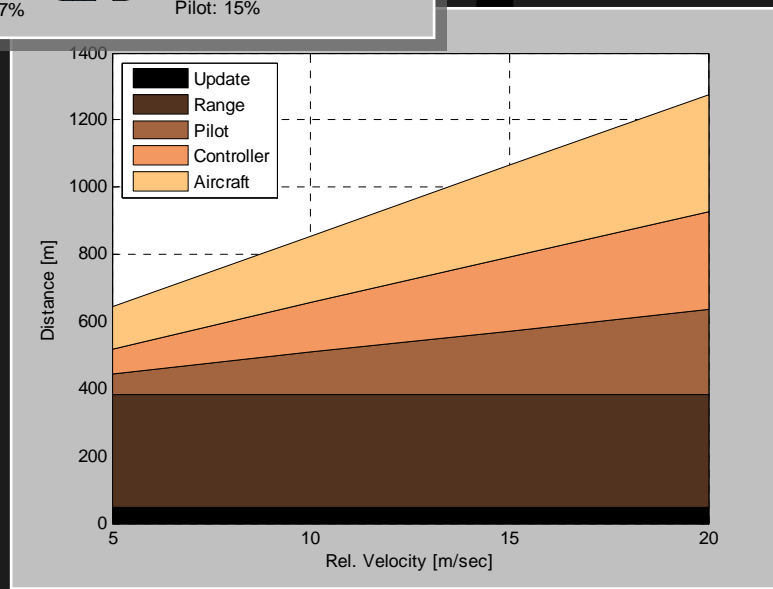
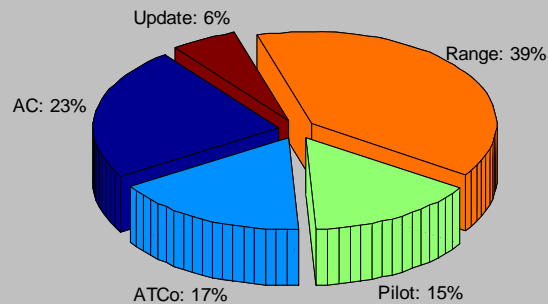
Surveillance Uncertainty



Model Validation Cases

Final Approach / Longitudinal Separation

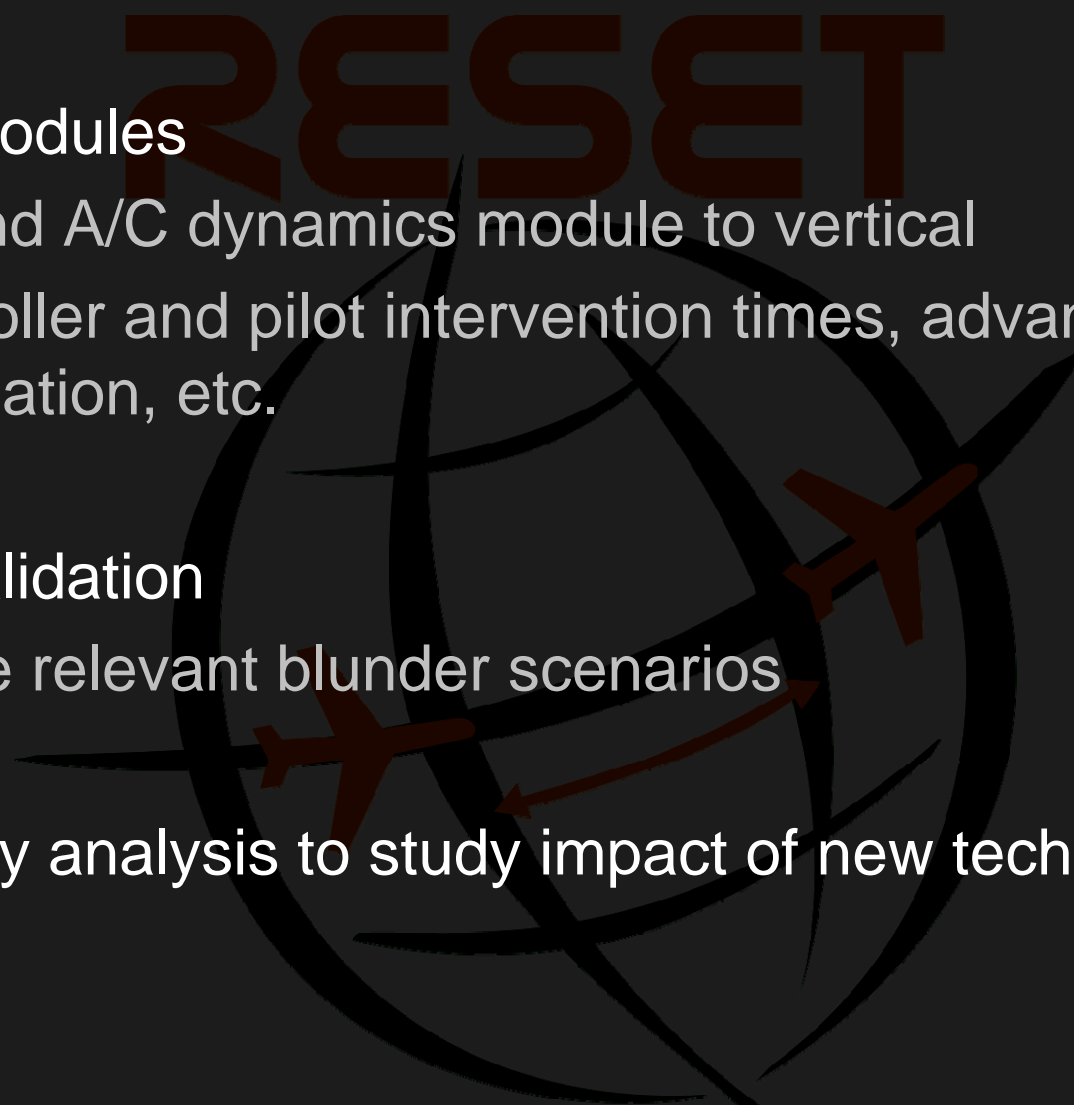
Follow 70m/s, Lead 60m/s, Sensor SSR/in-line Update 5sec, Total Sep. 855.05m



Other Scenarios

- Lateral separation during parallel departure operations
- En-route lateral separation on parallel tracks

Way Ahead

- 
- Refine modules
 - Expand A/C dynamics module to vertical
 - Controller and pilot intervention times, advanced automation, etc.
 - Model validation
 - Define relevant blunder scenarios
 - Sensitivity analysis to study impact of new technologies

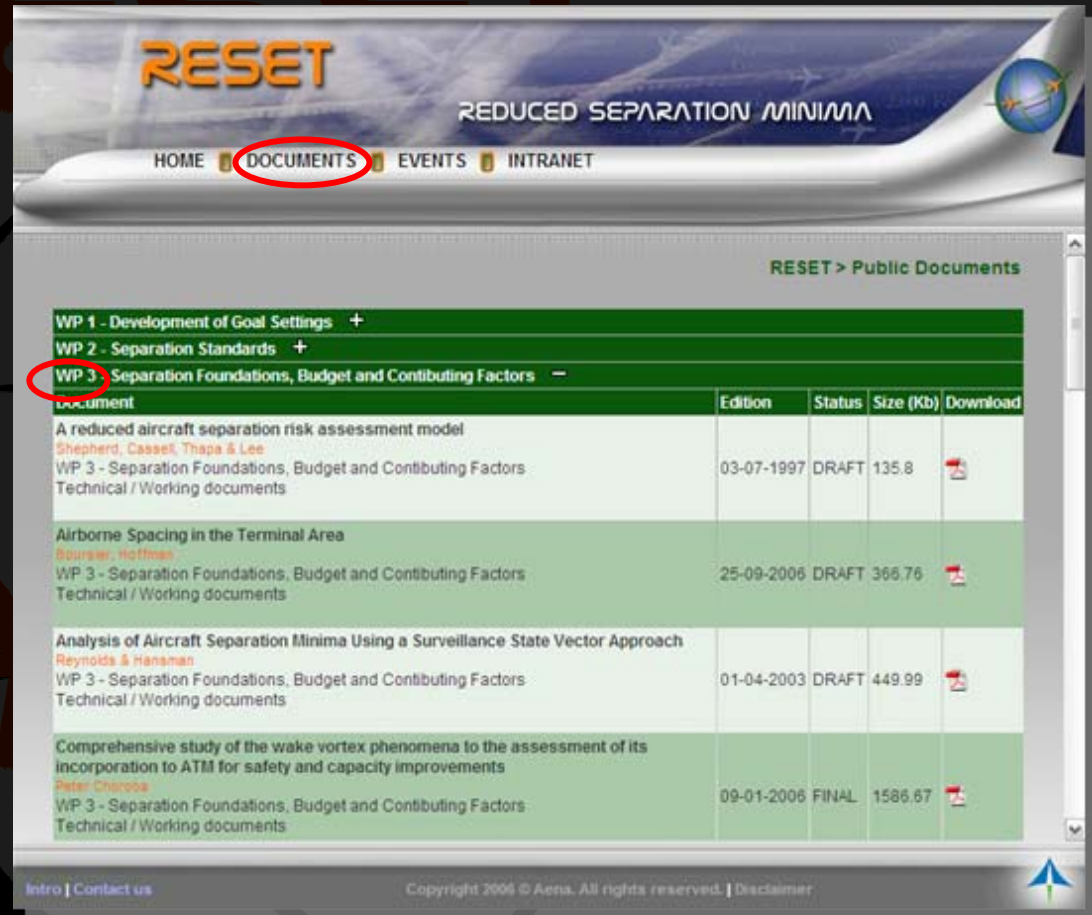
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Separation Minima +
Foundation List

Separation Minima
Model

Documents → WP3



The screenshot shows the RESET website interface. The header features the RESET logo and the text "REDUCED SEPARATION MINIMA". Navigation links include HOME, DOCUMENTS (circled in red), EVENTS, and INTRANET. The main content area is titled "RESET > Public Documents" and displays a list of documents under the heading "WP 3 - Separation Foundations, Budget and Contributing Factors" (also circled in red). The list includes document titles, authors, dates, statuses, sizes, and download icons.

Document	Edition	Status	Size (Kb)	Download
A reduced aircraft separation risk assessment model <i>Shepherd, Cassel, Thapa & Lee</i> WP 3 - Separation Foundations, Budget and Contributing Factors Technical / Working documents	03-07-1997	DRAFT	135.8	
Airborne Spacing in the Terminal Area <i>Boursier, Hoffman</i> WP 3 - Separation Foundations, Budget and Contributing Factors Technical / Working documents	25-09-2006	DRAFT	366.76	
Analysis of Aircraft Separation Minima Using a Surveillance State Vector Approach <i>Reynolds & Hansman</i> WP 3 - Separation Foundations, Budget and Contributing Factors Technical / Working documents	01-04-2003	DRAFT	449.99	
Comprehensive study of the wake vortex phenomena to the assessment of its incorporation to ATM for safety and capacity improvements <i>Peter Charoba</i> WP 3 - Separation Foundations, Budget and Contributing Factors Technical / Working documents	09-01-2006	FINAL	1586.67	

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