



# Wake Vortex Research in the USA (WakeNet-USA)

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**FAA initiatives will not be fully realized without a revision of the separation standards (FAA Research and Development Advisory Committee, Subcommittee on Separation Standards)**

Critical Standard*	Controlling Factors
Oceanic	Nav/Altimeter Accuracy
Enroute	Radar resolution/Altimeter Accuracy/ <b>Wake</b>
Landing	Blunder/ <b>Wake</b> /Runway Occupancy
Successive Departures	Nav Accuracy/Radar resolution/ <b>Wake</b>
Simultaneous Departures	Radar resolution/ <b>Wake</b>
Departure/Arrival	Nav Accuracy/Radar resolution/ <b>Wake</b>

**\*Standards that have the greatest impact on system capacity**

# FAA REDAC Separation Standards Working Group Finding

- Wake vortex avoidance is a limiting factor in defining separation standards in the terminal area
- Wake vortex avoidance could become a limiting factor in reducing separation standards in en route airspace

# **FAA/NASA Wake Vortex Research**

## **Wake Vortex Research Goal**

- **Enable an increase in terminal area capacity at an agreed-upon level of safety for the National Airspace System through new standards for wake vortex operations (modify FAA wake vortex separation standards)**

## **Develop the Field Test Data and Analyses to:**

- **Safely Change the FAA Definitions for WV Separations Standards**
- **Provide the Systems Engineering Data Necessary to support an FAA Joint Resource Council Investment (JRC-2B level) for a Full Scale Development of an Aircraft Wake Vortex Avoidance System**

# The US Wake program uses a Phased Approach to Reduce Risk

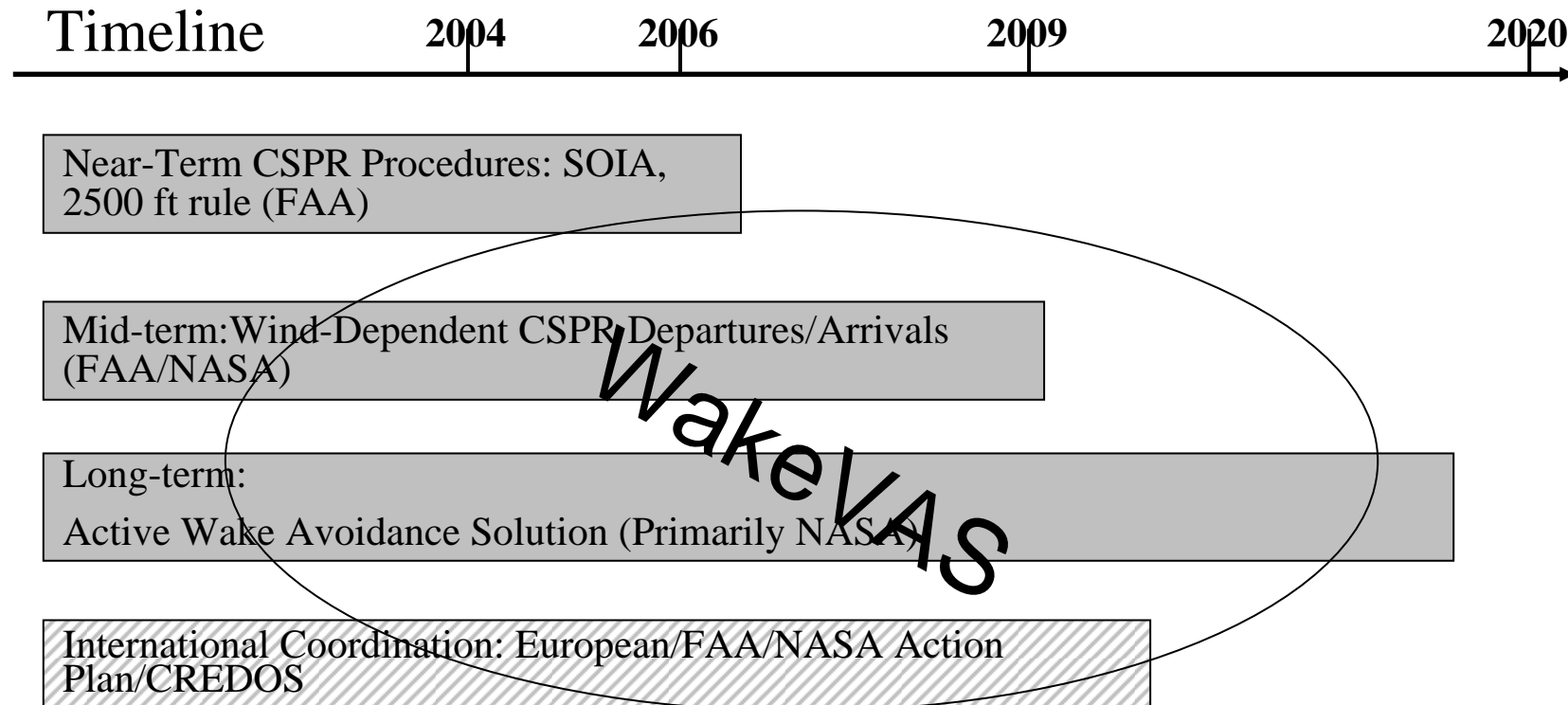
- ATC Data Driven Procedural Changes (Near-Term Solutions)
  - FAA led Phase I program with NASA support for data analysis. NASA is using FAA collected data for Initial CONOPS Development, Initial Safety Analysis, and Wake Predictor Evolution for Phase II and III concepts.
- Weather Dependent Procedures (Mid-Term Solutions) Concepts rely on Cross Wind Transport of Vortices (Joint FAA/NASA)
  - Phase II Departures; Phase II Arrivals
  - Both CSPR and Single Runway Operations
- Operational Separation Based upon Safe Time Separation Predictions (NASA led – Far Term Solutions)
  - Phase III Departures; Phase III Arrivals
  - Incorporates all dimensions of wake behavior – transport, sink, demise
  - Requires an agreed-upon level of safe wake encounter

# FAA/NASA Integrated Research “Creative Tension”



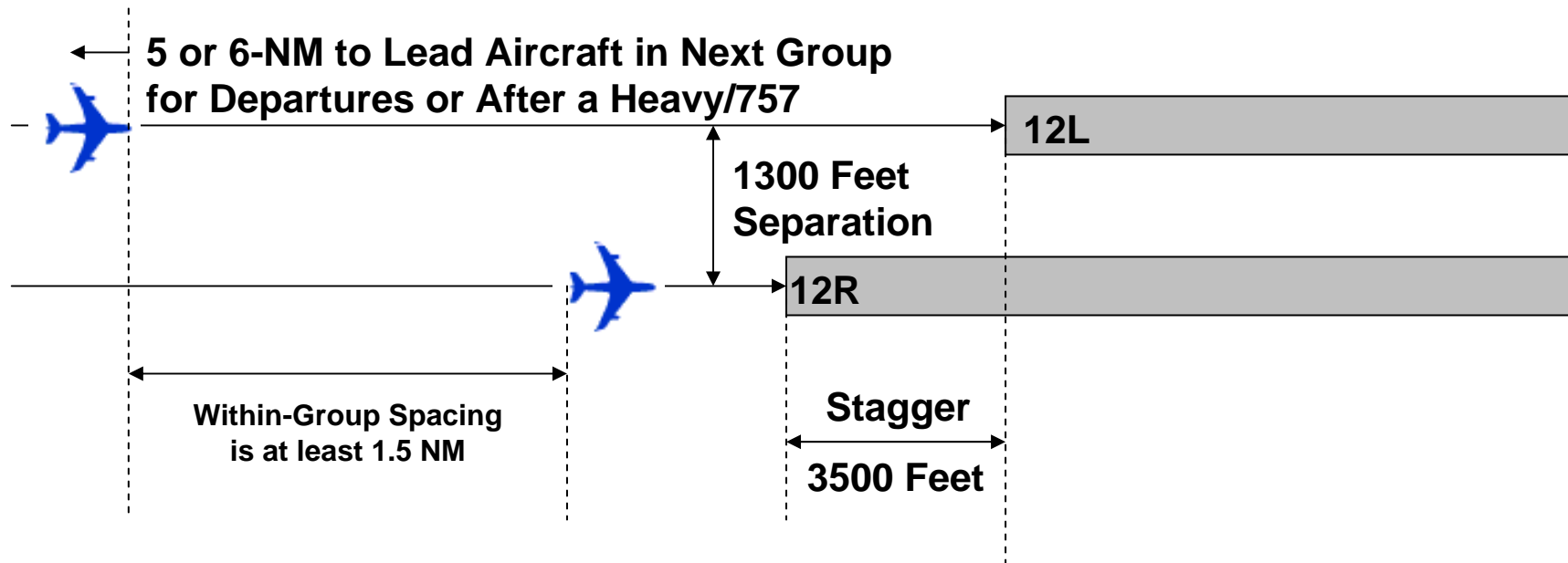
Corporate knowledge shared and maintained by  
both FAA and NASA

# FAA/NASA Program Schedule



# STL CSPR Waiver Proposal (Phase I – Near Term)

Staggered CSPRs at STL  
Proposed IMC  $\geq 1.5$ -NM Grouped Arrivals



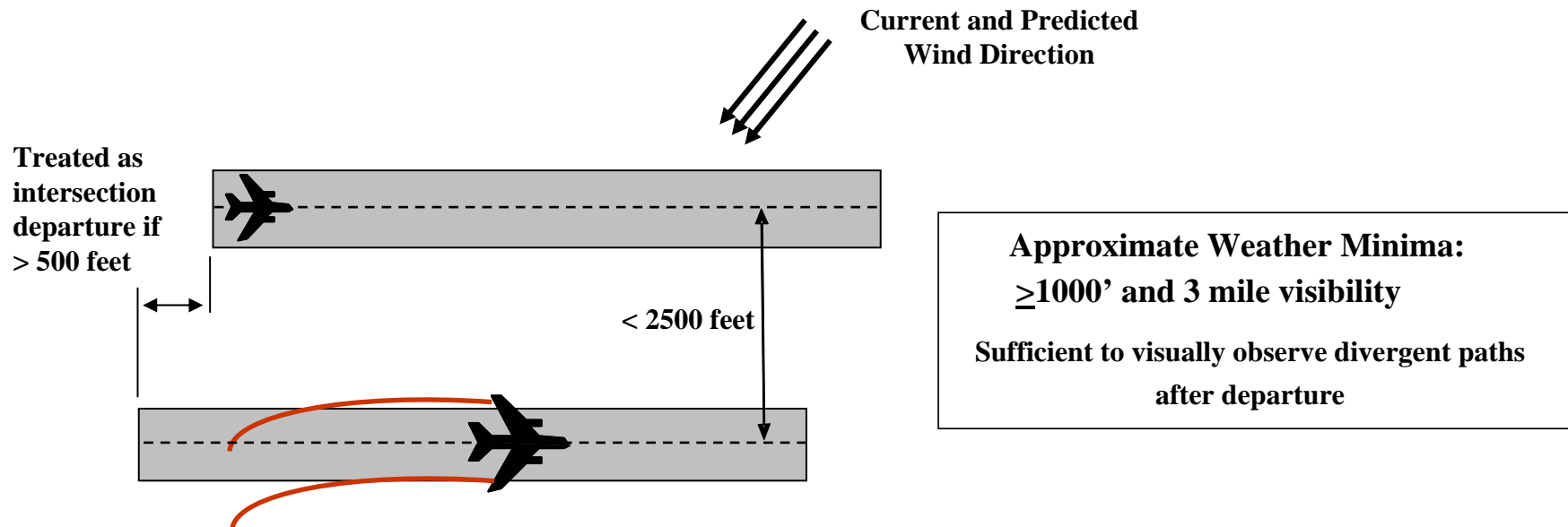
# CSPR Departures ( Phase II – Mid Term)

Under current rules, a Large departing the left runway has to be spaced 3 minutes behind a Heavy departing the right runway due to wake considerations (runway offset as depicted treats parallels as intersection departure). A 2 minute wait (or 5 miles) is required otherwise.

Under certain wind conditions, like these depicted in this situation, the wake is obviously not a factor and closer spacing could be allowed

An operational solution requires:

- Tactical Wind Prediction and Monitor function (for next departure)
- Strategic Weather function (for planning horizon)
- Stability of operation to ensure usability/reliability



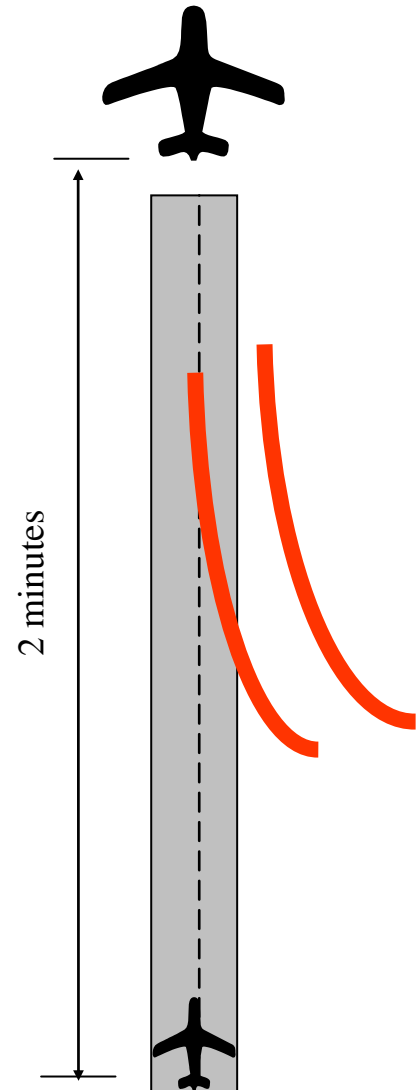
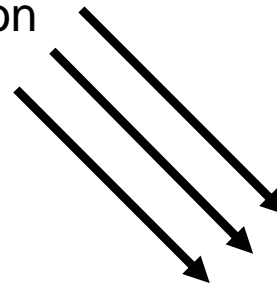
# Single Runway DEPARTURES (Phase II – Mid Term)

## FRA/LHR Example

Under current rules a Large departing has to wait two minutes after Heavy departs.

Under certain wind conditions, like those depicted here, the wake is obviously not a factor and no waiting for mitigation should be required

Wind Direction



# WakeNet-USA Purposes

- Coordinate, focus, and provide direction for US activities aimed at FAA/NASA Plan
- Collaborate with international partners working in the WV area through data and knowledge sharing
- Coordinate the development and modification of WV spacing standards across as broad a venue as possible
- Create a forum for the sharing of WV results from a broad spectrum of activities

# WakeNet-USA Characteristics

- Government/Industry Working Group
- Involves program managers, solution providers, regulators, system users, international representatives, other benefactors
- No specific funding supports WakeNet-USA meeting activities other than wake program execution activities
- Meets every 6 months at a site provided by a WakeNet-USA member

# WakeNet-USA History

Date	Location	Length of meeting/Number of attendees	Outcome
March 2002	Washington, DC	½ Day/10 People	<ul style="list-style-type: none"> <li>• WV leaders discuss a means to focus on implementing RMP</li> <li>• Called “RMP Focus Group”</li> </ul>
May 2002	NASA Ames, Moffett Field, CA	½ Day/25 People	<ul style="list-style-type: none"> <li>• Continue discussing way of operating</li> <li>• Not enough time allowed to discuss topics</li> </ul>
July 2002	Boeing Commercial, Seattle, WA	2 Days/30 People	<ul style="list-style-type: none"> <li>• WV leaders/users/ contributors discuss plans, progress, strategy</li> <li>• Focus on successfully executing joint RMP</li> </ul>
August 2002			<ul style="list-style-type: none"> <li>• Initiated discussion with WakeNet2 Coordinator about forming parallel organizations across Atlantic with similar names</li> </ul>
October 2002	LMI, Washington, DC	2 Days/35 People	<ul style="list-style-type: none"> <li>• ALPA and NATCA Began Participating</li> <li>• Developed 3-level organization: Executive, Key Stakeholder, General Membership</li> <li>• Began calling group “WakeNet-USA”</li> </ul>

# WakeNet-USA History

Date	Location	Length of meeting/Number of attendees	Outcome
November 2002			<ul style="list-style-type: none"> <li>• WakeNet2 Coordinator supported idea of parallel wake vortex interest groups</li> <li>• Selected names: WakeNet-USA &amp; WakeNet2-Europe</li> </ul>
March 2003	St. Louis, MO	2 Days/50 People	<ul style="list-style-type: none"> <li>• Participants include airline management reps</li> <li>• IFALPA presents wake policy</li> </ul>
October 2003	United Airlines Training Center, Denver, CO	2 Days/48 People	<ul style="list-style-type: none"> <li>• Status of each program phase presented to group and feedback requested on content/progress</li> <li>• Eurocontrol presents European work</li> </ul>
April 2004	New Orleans, LA	3 Days/28 People	<ul style="list-style-type: none"> <li>• WakeNet-USA/WakeNet2-Europe Co-Sponsored specialist workshop on wake behavior In Ground Effect</li> <li>• Determined that quality data sets to allow benchmarking three major wake predictors is necessary</li> </ul>
April 2004	Boeing Commercial, Seattle Washington	2 Days/48 People	<ul style="list-style-type: none"> <li>• Detailed discussions on multi-phase and European WV work presented</li> <li>• Airlines, Safety Organizations discuss requirements for WV implementation</li> </ul>

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Date	Location	Length of meeting/Number of attendees	Outcome
October 2004	Volpe National Transportation Center. Cambridge, MA	2 Days/50 People	<ul style="list-style-type: none"> <li>• Requirements from Boston Logan airport presented by airport authorities</li> <li>• US Concepts of Operations team presents findings</li> </ul>
March 2005	Boca Raton, FL	2 Days/50 People	<ul style="list-style-type: none"> <li>• WakeNet2-Europe Coordinator presented status of WV research in Europe</li> <li>• Presentation give more detail Several European presentations given</li> </ul>
October 2005	Boeing Commercial, Seattle, WA	2 Days/50 People	<ul style="list-style-type: none"> <li>• Additional participation by Europeans includes Airbus, Eurocontrol</li> </ul>
March 2006	DFW Airport, Dallas, TX	2 Days/48 People	<ul style="list-style-type: none"> <li>• European participation includes Eurocontrol, Airbus, NATS-UK</li> <li>• Panel on wake separation requirements conducted</li> </ul>
April 2006	Berlin, Germany	2 Days/22 People	<ul style="list-style-type: none"> <li>• WakeNet-USA/WakeNet2-Europe Co-Sponsored specialist workshop on Wake Vortex Encounter Metrics</li> <li>• Established international working group to develop requirements and plan for accepted wake encounter def.</li> </ul>

# Concluding Remarks

- FAA and NASA are executing a joint wake turbulence program targeted at safely increasing capacity
  - This partnership uses the strengths of the two organizations
- Significant international collaboration is involved (e.g., CREDOS Project...)
- WakeNet-USA was created to focus stakeholder interest on making the joint wake vortex plan successful
- WakeNet-USA is serving the purpose well.
  - Phase I results are expected September 2006
  - Phase II field tests are planned for November 2006
  - Phase III key issue on acceptable wake encounter is being addressed through newly formed working group