Wake Vortex Research in the USA (WakeNet-USA)

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FAA initiatives can not be completed without a revision of the separation standards (FAA Research and Development Advisory Committee, Subcommittee on Separation Standards)

<table>
<thead>
<tr>
<th>Critical Standard*</th>
<th>Controlling Factors</th>
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<tbody>
<tr>
<td>Oceanic</td>
<td>Nav/Altimeter Accuracy</td>
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<tr>
<td>Enroute</td>
<td>Radar resolution/Altimeter Accuracy</td>
</tr>
<tr>
<td>Landing</td>
<td>Blunder/ Wake/Runway Occupancy</td>
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<tr>
<td>Successive Departures</td>
<td>Nav Accuracy/Radar resolution/ Wake</td>
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<tr>
<td>Simultaneous Departures</td>
<td>Radar resolution/Wake</td>
</tr>
<tr>
<td>Departure/Arrival</td>
<td>Nav Accuracy/Radar resolution/ Wake</td>
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*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

Timeline

2004  2006  2009  2020

Near-Term CSPR Procedures: SOIA, 2500 ft rule (FAA)

Mid-term: Wind-Dependent CSPR Departures/Arrivals (FAA/NASA)

Long-term: Active Wake Avoidance Solution (Primarily NASA)

International Coordination: European/FAA/NASA Action Plan/CREDOS
STL CSPR Waiver Proposal
(Phase I – Near Term)

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

- 5 or 6-NM to Lead Aircraft in Next Group for Departures or After a Heavy/757
- 1300 Feet Separation
- Within-Group Spacing is at least 1.5 NM
- Stagger 3500 Feet
CSPR Departures
(Phase II – Mid Term)

STL Example

- Under current rules a Large departing 30L has to wait 3 minutes after Heavy departs 30R since it is considered an intersection takeoff
- In this situation, the wake is obviously not a factor and no waiting should be required
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.
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

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Length of meeting/Number of attendees</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 2002</td>
<td>Washington, DC</td>
<td>½ Day/10 People</td>
<td>• WV leaders discuss a means to focus on implementing RMP</td>
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<tr>
<td></td>
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<td>• Called “RMP Focus Group”</td>
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<tr>
<td>May 2002</td>
<td>NASA Ames, Moffett Field, CA</td>
<td>½ Day/25 People</td>
<td>• Continue discussing way of operating</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Not enough time allowed to discuss topics</td>
</tr>
<tr>
<td>July 2002</td>
<td>Boeing Commercial, Seattle, WA</td>
<td>2 Days/30 People</td>
<td>• WV leaders/users/contributors discuss plans, progress, strategy</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Focus on successfully executing joint RMP</td>
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<tr>
<td>August 2002</td>
<td></td>
<td></td>
<td>• Initiated discussion with WakeNet2 Coordinator about forming parallel organizations across Atlantic with similar names</td>
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<tr>
<td>October 2002</td>
<td>LMI, Washington, DC</td>
<td>2 Days/35 People</td>
<td>• ALPA and NATCA Began Participating</td>
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<td></td>
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<td>• Developed 3-level organization: Executive, Key Stakeholder, General Membership</td>
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<td></td>
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<td>• Began calling group “WakeNet-USA”</td>
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| November 2002 |                                               |                                        | • WakeNet2 Coordinator supported idea of parallel wake vortex interest groups  
                                    |                                               |                                        | • Selected names: WakeNet-USA & WakeNet2-Europe                                                                                          |
| March 2003    | St. Louis, MO                                 | 2 Days/50 People                       | • Participants include airline management reps  
                                    |                                               |                                        | • IFALPA presents wake policy                                                                                                           |
| October 2003  | United Airlines Training Center, Denver, CO   | 2 Days/48 People                       | • Status of each program phase presented to group and feedback requested on content/progress  
                                    |                                               |                                        | • Eurocontrol presents European work                                                                                                    |
| April 2004    | New Orleans, LA                               | 3 Days/28 People                       | • WakeNet-USA/WakeNet2-Europe Co-Sponsored specialist workshop on wake behavior In Ground Effect  
                                    |                                               |                                        | • Determined that quality data sets to allow benchmarking three major wake predictors is necessary                                          |
| April 2004    | Boeing Commercial, Seattle Washington         | 2 Days/48 People                       | • Detailed discussions on multi-phase and European WV work presented  
                                    |                                               |                                        | • Airlines, Safety Organizations discuss requirements for WV implementation                                                             |
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| October 2004 | Volpe National Transportation Center. Cambridge, MA | 2 Days/50 People                      | • Requirements from Boston Logan airport presented by airport authorities  
• US Concepts of Operations team presents findings |
| March 2005  | Boca Raton, FL                        | 2 Days/50 People                      | • WakeNet2-Europe Coordinator presented status of WV research in Europe  
• Presentation give more detail Several European presentations given |
| October 2005 | Boeing Commercial, Seattle, WA         | 2 Days/50 People                      | • Additional participation by Europeans includes Airbus, Eurocontrol     |
| March 2006  | DFW Airport, Dallas, TX               | 2 Days/48 People                      | • European participation includes Eurocontrol, Airbus, NATS-UK  
• Panel on wake separation requirements conducted |
| April 2006  | Berlin, Germany                       | 2 Days/22 People                      | • WakeNet-USA/WakeNet2-Europe Co-Sponsored specialist workshop on Wake Vortex Encounter Metrics  
• Established international working group to develop requirements and plan for accepted wake encounter def. |
Comments from our Customers

• United, Rocky Stone: “I’m happy that FAA and NASA are focused in getting an operational change.”

• UPS, Bob Hilb: “The joint FAA/NASA wake vortex plan is an exemplary case of how the agencies can effectively join forces to modernize the NAS.”

• Boeing Commercial, Paul Wagner: “Echo the comment by United—the program has operational focus. We need a success now and the 2500ft rule has the best chance of success in the near term.”
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 safe wake encounter is being addressed through newly formed working group