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*).

<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/Wake</td>
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<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>
</tr>
<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

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

2020
STL CSPR Waiver Proposal (Phase I – Near Term)

Staggered CSPRs at STL
Proposed IMC ≥ 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)

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

Approximate Weather Minima:
- ≥1000’ and 3 mile visibility
  Sufficient to visually observe divergent paths after departure
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

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<th>Length of meeting/Number of attendees</th>
<th>Outcome</th>
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| March 2002 | Washington, DC                         | ½ Day/10 People                      | • WV leaders discuss a means to focus on implementing RMP  
  • Called “RMP Focus Group”                                                                                                           |
| May 2002   | NASA Ames, Moffett Field, CA           | ½ Day/25 People                      | • Continue discussing way of operating  
  • Not enough time allowed to discuss topics                                                                                           |
| July 2002  | Boeing Commercial, Seattle, WA         | 2 Days/30 People                     | • WV leaders/users/ contributors discuss plans, progress, strategy  
  • Focus on successfully executing joint RMP                                                                                            |
| August 2002|                                         |                                      | • Initiated discussion with WakeNet2 Coordinator about forming parallel organizations across Atlantic with similar names               |
| October 2002| LMI, Washington, DC                   | 2 Days/35 People                     | • ALPA and NATCA Began Participating  
  • Developed 3-level organization: Executive, Key Stakeholder, General Membership  
  • Began calling group “WakeNet-USA”                                                                                                    |
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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. |
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