FAA/NASA WakeVAS
Conops Evaluation Team

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Conops Evaluation Team Chairman

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Goal

Support the ultimate implementation of the Wake Vortex
Advisory System (WakeVAS) elements of the
FAA/NASA Program to Revise Wake Turbulence
Separation Standards For Airport Capacity
Enhancements in IMC, by focusing its resources to:

• Develop air traffic and flight operations procedures,
  and related ground and/or airborne systems, that are
  likely to meet FAA and stakeholder safety
  requirements at the end of the research program.

• Produce data and analysis to enable all decision
  makers who must approve/accept the new procedures,
  and systems to conclude that safety would be
  maintained or enhanced through this implementation.
Decision Makers

- FAA
  - Flight Standards: AFS 210, 400, 410, 420, 430, 440
  - Air Traffic: ATP 120, 400, 500.
  - Aircraft Certification: AIR 130, TAD, SAD.
  - Airports: AAS 100
  - System Safety: ASY 300
  - Controllers Union: NATCA

- Industry
  - Pilots Unions: ALPA, APA, SWAPA
  - Airlines: ATA, RAA, individual airlines
  - Airport operators: ACI

Objectives

- Create detailed Conops/functional system descriptions
- Create detailed event sequences: normal/non-normal
- Identify changes from current standards & requirements
- Identify the safety research issues of decision makers
- Identify technical (systems & operations) research issues
- Recommend a data collection and analysis program
- Recommend an appropriate risk analysis methodology.
- Rank Conops that appear to meet safety requirements.
- Record transition and implementation issues.
Out-of-Scope “Non-Objectives”

- Capacity Improvements Analysis
- Benefits Analysis
- Cost-Benefit Analysis
- Investment Analysis
- Training Program Design
- System Performance Specifications
- Transition / Implementation Plans
- Assessment of Sensor Capabilities

Wake Conops Evaluation Team
Membership & Expertise

- **Airports** (FAA-AAS, ACI)
- **Air Traffic Control** (NATCA, ATP 120, 200, 500)
- **Flight Operations** (ALPA, ATA, RAA, Boeing ATM, Continental, United, UPS)
- **NAS Systems Integration** (FAA-ATB 20, Boeing, CSC, Raytheon, Lockheed Martin)
- **Regulatory/Certification** (FAA-AIR 130, FAA-AFS 420, 430, 440, FAA-ATP 100, 200, 500)
- **Safety Analysis** (FAA-ASY, GMU, MITRE)
- **Wake Science** (FAA-AAR, GMU, MITLL, MITRE, NASA, Volpe)
Candidate Operational Enhancements

**WakeVAS Elements**

- **Phase I. Near Term: 2003 + 2 – 3 yrs (Expand use of procedures)**
  - A. Arrivals, CSPR, <2500’ (1000’?) static, 1.5 NM diag. dep. Lrg. lead
  - B. Arrivals, Ph. I A with staggered thresholds

- **Phase II. Mid-Term: 3 – 7 yrs (New Procedures & Ground Systems)**
  - A. Departures
    - CSPR, static, <2500’ (1000’?), adjacent or staggered thresholds
    - CSPR, <2500’ (700’?), dynamic separation, cross-wind sense & prediction
    - 1-Rwy, <2-3 min., dynamic separation, cross-wind sense & prediction
  - B. Arrivals
    - CSPR <2500’ (700’?) dynamic separation, cross-wind sense & prediction

- **Phase III. Far-Term: 7 – 10 yrs (New Procedures & Ground and/or Airborne Systems)**
  - A. Departures
  - B. Arrivals
    - CSPR, <2500’, dynamic separation, active weather sense & prediction
    - 1-Rwy, dynamic separation, active weather sense & prediction

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**Phase II (Wind-Dependent) WakeVAS**

**Additional Benefits over Phase I**

- **Arrivals**
  - May be needed for CSPR 1,000’ RCLs for Large and Small.
  - May enable CSPRs < 1,000’ RCL spacing; to the min. 700 feet RCL VFR RCL spacing, for Large and Small
  - May enable the above RCL spacing for heavy/B-757.

- **Departures**
  - CSPR <2,500’; to 700’? For all categories.
  - 1-Rwy: time separation reduced < 2 (or 3) minutes for Large (or Small) behind Heavy/757.
COE Analysis Order

- Baseline CSPR Arrivals
- Phase II - B -1: CSPR < 2,500 feet Arrivals, dynamic separation, active wind sensing and prediction. STL
- Baseline 1-Rwy & CSPR Departures
- Phase II - A - 3: 1-Rwy Departure dynamic, active wind sensing and prediction. SDF
- Phase II – A - 2: CSPR <2,500 feet departures, active wind sensing and prediction. STL
- Phase III – A or B: Dynamic single runway, arrivals, departures, intersections, weather and turbulence sensing and prediction. MEM

Baseline Report Contents

- Current Policies & Requirements
- Current NAS Services & Systems
- Current Operational Configurations
- Current ATC & Flight Ops Procedures: normal and non-normal, with event sequences.
- Planned NAS Services & Systems 2005 – 2010
- Impetus for Change: Government / Industry
- Constraints and Assumptions
- Safety Analysis Methodologies and Reports
- 20 Appendices
Conops Evaluation Report Contents

- Candidate Operational Enhancement: Detailed Conops Description (Procedures & Systems)
- Proposed New Policies & Requirements
- Changes in NAS Services & Systems
- Changes in Operational Configurations
- Changes in ATC & Flight Ops Procedures
- Interaction with Planned 2005 – 2010 NAS
- Assumptions: and verification
- Research Issues: Collision & Wake, Data Acq./Anal...
- Transition and Implementation Issues
- Conops Ranking Analysis
- System Safety Management Plan; Methodology

II – B- 1 Conops

<table>
<thead>
<tr>
<th>WVAS IAP</th>
<th>Wake Independence Configuration</th>
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<tbody>
<tr>
<td></td>
<td>Trailing a/c upwind, min. x-wind</td>
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<tr>
<td>Straight-in</td>
<td>II-B-1-a-1</td>
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<tr>
<td>Angled 3°</td>
<td>II-B-1-b-1</td>
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<tr>
<td>Angle to FAF</td>
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<td>LDA/GS</td>
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<tr>
<td>Angled &amp; SI</td>
<td>II-B-1-e-1</td>
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II-B-1-a-1

Not To Scale

Alternate Separation Zone (ASZ) for Large-Large; Horizontal and vertical dimensions of full scale ILS deflection.

Min Crosswind nominal 3 Kts; Higher for smaller RCL spacing

II-B-1-b-2

Not To Scale

Max Crosswind nominally 2 Kts; Higher for greater RCL spacing

ASZ 1: 3 NM X 1,000' HAT X 2,500' + FTE

Max Crosswind nominally 2 Kts; Higher for greater RCL spacing

ASZ 1: 3 NM X 1,000' HAT X 2,500' + FTE
II-B-1-c-1

Not To Scale

Min Crosswind nominal 3 Kts; Higher for smaller RCL spacing

Max Crosswind nominally 2 Kts; Higher for greater RCL spacing

LDA/Glideslope Approach

ASZ 1: 3NM X 1,000’ HAT X 2,500’ + FTE

> 3° Angle LDA MAP, 400’ MDA

FAF 5NM

180 kts
1,500’ HAT
45 seconds

FAF 5NM

180 kts
1,500’ HAT
45 seconds

II-B-1-d-2 (LDA)

Not To Scale

Max Crosswind nominally 2 Kts; Higher for greater RCL spacing

LDA/Glideslope Approach

ASZ 1: 3NM X 1,000’ HAT X 2,500’ + FTE

> 3° Angle LDA MAP, 400’ MDA

FAF 5NM

180 kts
1,500’ HAT
45 seconds

FAF 5NM

180 kts
1,500’ HAT
45 seconds
Comparison with SOIA SFO/RPAT

**SOIA SFO/RPAT**

- **~1,600/4 Minimum**
  - Collision separation: by pilots on visuals.
  - Wake separation: Max. 10 Kts crosswind, Plus max. 1 NM stagger so leading airplane wake will not transport to the trailing airplane path.

**WakeVAS II-B-1**

- **200’ to 250’/1/2 Min**
  - Collision separation: Min. 1.5 NM at RWT.
  - Wake separation: Min. crosswind for trailing upwind; Max. crosswind for trailing downwind; plus “clusters” for more frequent OK winds.
### Results To Date

- **Conops Definition and Analysis**
  - WakeVAS Instrument Approach Procedures
  - WakeVAS Wake Independent Configurations
  - Event Sequence Analysis
  - Non-Normal Event Analysis

- **Safety Analysis Methodology Selection**
  - Safety Management Plan
  - Safety Risk Management Process

### Results to Date

- **Research Issues Described/Categorized**
  - Wake Vortex Safety Analysis Issues
  - Collision Risk Safety Analysis Issues
  - Data Acquisition Requirements
  - Data Analysis Requirements
  - Technical (Systems / Operations) Issues

- **To Be identified to Decision Makers**