Wake Vortex Safety Technology in the ICAO Aviation System Block Upgrades

Dr. Mikhail Kanevskiy
Scheduled Stages of Alteration of Norms Concerning Wake Vortex Separation

**Stage 1. Expansion of the ICAO separation matrix**

*2009–2012*

Alteration of norms concerning longitudinal separation of aircraft is based on organizational agreements.

(3 wake turbulence categories of aircraft + A-380)  
(6 wake turbulence categories of aircraft)
Scheduled Stages of Alteration of Norms Concerning Wake Vortex Separation

Stage 2. Static pairwise separation for certain types of aircraft

- Limitations on conditions of penetration into wake vortex

2012-2014

Stage 3. Dynamic pairwise separation for current weather affecting decay of wake vortices

2014-2018

Alteration of norms concerning aircraft separation is based on organizational agreements and implementation of Wake Vortex Flight Safety System
National Programmes for Wake Vortex Flight Safety

USA

Wake Vortex Advisory System

NextGen Programme

EUROPE

Vortex Safety and Capacity System

SESAR Programme

RUSSIA

Wake Vortex (WV) Flight Safety System

Russian State Programme
Wake Vortex Flight Safety System

**Milestones**

- **B0-70**: Increased Runway Throughput through Wake Vortex Separations. **2013**
- **B1-70**: Increased Runway Throughput through Pair Wise Static Wake Vortex Separations. **2018**
- **B2-70**: Advanced Wake Vortex Separation Pair Wise Dynamic Wake Vortex Separations. **2023**

GANIS Working Document ICAO AVIATION SYSTEM BLOCK UPGRADES
Wake Vortex Flight Safety System

Benefits

- **B0-70**
  - 2% for the RF aerodromes
  - 7% for the U.S. aerodromes
  - 4% for European aerodromes

- **B1-70**
  - 4% for the RF aerodromes
  - 15% for the U.S. aerodromes
  - 8% for European aerodromes

- **B2-70**
  - 35 to 40% increase for aerodromes worldwide

Capacity gains for airports:
- 2013
- 2018
- 2023
1. Reception of data on generator wake vortices and weather data
2. Prediction of own motion
3. Evaluation of danger areas
4. Weather measurement
5. Calculation of own wake vortices
6. Data transmission

ATC – Ground Facility Tower MET Centre

- Calculation of own wake vortices
- Weather measurement
- Data transmission

ADS-B
Real-time air-to-air data exchange via Universal Access Transceiver (UAT) data link between Piper Saratoga (wake generator) & Cessna Caravan (wake penetrator)
Russian Flight Test of Onboard Wake Prediction and Avoidance System Prototype 2007

Real-time air-to-air data exchange via VDL mode 4 data link between Tupolev -154 (wake generator) & L-39 Albatross (wake penetrator)
Russian Flight Test of Onboard Wake Prediction and Avoidance System Prototype 2007

Wake Vortex Hazard on CDTI
Airbus Flight test of Onboard Wake Prediction and Avoidance System Prototype
2010

Real-time air-to-air data exchange via dedicated FTI VHF data link between A-380 (wake generator) & A-320 (wake penetrator)

SESAR projects 9.11 & 9.30 “Aircraft Systems for Wake Encounter Alleviation
SEBASTIAN KAUERTZ (AIRBUS)
WN3E Workshop on Wake Turbulence Achievements
Airbus Flight test of Onboard Wake Prediction and Avoidance System Prototype 2010

Real-time display on dedicated screen

SESAR projects 9.11 & 9.30 “Aircraft Systems for Wake Encounter Alleviation
SEBASTIAN KAUERTZ (AIRBUS)
WN3E Workshop on Wake Turbulence Achievements
ADS-B Data Link Standards Upgrade


Draft Appendix A
Provisioning For Potential
Wake Vortex And Arrival
Management ADS-B
Applications

Appendix W
Provisioning For Potential
Wake Vortex And Arrival
Management ADS-B
Applications

ES-1090 UAT

Operational Services and Environmental Definition (Draft) 2012

Aircraft Derived Meteorological Data
Via DS-B Data Link for Wake Vortex, Air Traffic Management,
and Weather Applications Operational Services and
Environmental Definition. RTCA SC-206 SG-1 Subgroup for
Wake, ATM, & Weather
Possible Architecture for Wake Turbulence Applications In the Terminal Area

Corrections & Final Approach Data
+Recommended Wake Procedure & Wake Vortex Hazard Information

ADS-C Data for Wake Applications

Wake Vortex

VDL m2 (in)

ES-1090 (out)

Wake Turbulence Ground Based Processor + AMAN/DMAN

ADS-B Data for Wake Applications
Astronautic`s EFB Installations & Future Wake Vortex Application
Surveillance System (ASA)
Wake Vortex Awareness System

Functions of Provision of Information about Air Traffic
- Enhanced Visual Acquisition (EVAcq)
- Conflict Detection (CD)
- Functions of Aircraft Separation
- Approach Spacing for Instrument Approaches (ASIA)
- Independent Closely Parallel Approach (ICSPA)
- Functions of Aircraft Self-separation
- Airborne Conflict Management (ACM)

SMART Aircraft Surveillance Applications
Updated Do-289

Software Type G
- Aircraft Wake Vortex Model
  - Near Wake Model
  - Far Wake Model
- Wake Vortex Hazard Evaluation
  - Prediction of Aircraft Position with Respect of Wake Vortices
  - Danger Area Geometry

Wake Vortex Awareness System
Warning System Preventing Penetration into Wake Vortices

Development of Operational Requirements and Procedures

En-route Flight SWP 10.3

On-board Instruments for Wake Vortex Monitoring and Forecasting SWP 9.11, SWP 9.30

Airport Facilities for Wake Vortex Monitoring and Forecasting SWP 12.2.1, SWP 12.2.2

System Development, Development of Certification Basis

Airport Operations SWP 6.8.1, SWP 12.2.1

Operations in the Terminal Area SWP 10.3

Work Breakdown Structure of Integrated Wake Vortex Flight Safety System Development Process in the SESAR Project
Development of EUROCAE SPR (Safety and Performance Requirement) & IOP (Interoperability) for Integrated Wake Vortex Safety System

Standards for WV Ground Safety Net Alerts Service 2008-2013

Standards for Ground Doppler X-Band Radar for WV Detection 2008-2013

Standards for Ground Doppler Lidar for WV Detection 2008-2013

Standards for advanced ADS-B Application & Technologies 2011-2018

Update of ICAO PANS-ATM for Airborne WV Detection 2011-2018

NEW EUROCAE WGs UNDERWAY

Kick Off shortly for:
- WG-83 Airport Foreign Object Debris (FOD) Detection Systems
- WG-84 Digital Radio Control Interface for Air/Ground Voice Communication
- WG-88 On-Board Weight and Balance Systems

Specific other activities under preparation:
- **WG-86 Wake Vortex Detection and Prediction**
- WG-87 Fire Extinguishing activity (replacement of Halon gas)
- WG-xx ETSO C-16a electrically heated pitot and pitot static tubes
- WG or TF xx on ED-104 (de-icing) revision
Wake Vortex Flight Safety System

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- **B1-70**: 7% for the U.S. aerodromes
- **B2-70**: 4% for European aerodromes
- 35 to 40% increase for aerodromes worldwide

Capacity gains for airports:
- 2013: 4% for European aerodromes
- 2018: 7% for the U.S. aerodromes
- 2023: 2% for the RF aerodromes