

WakeNet3-Europe

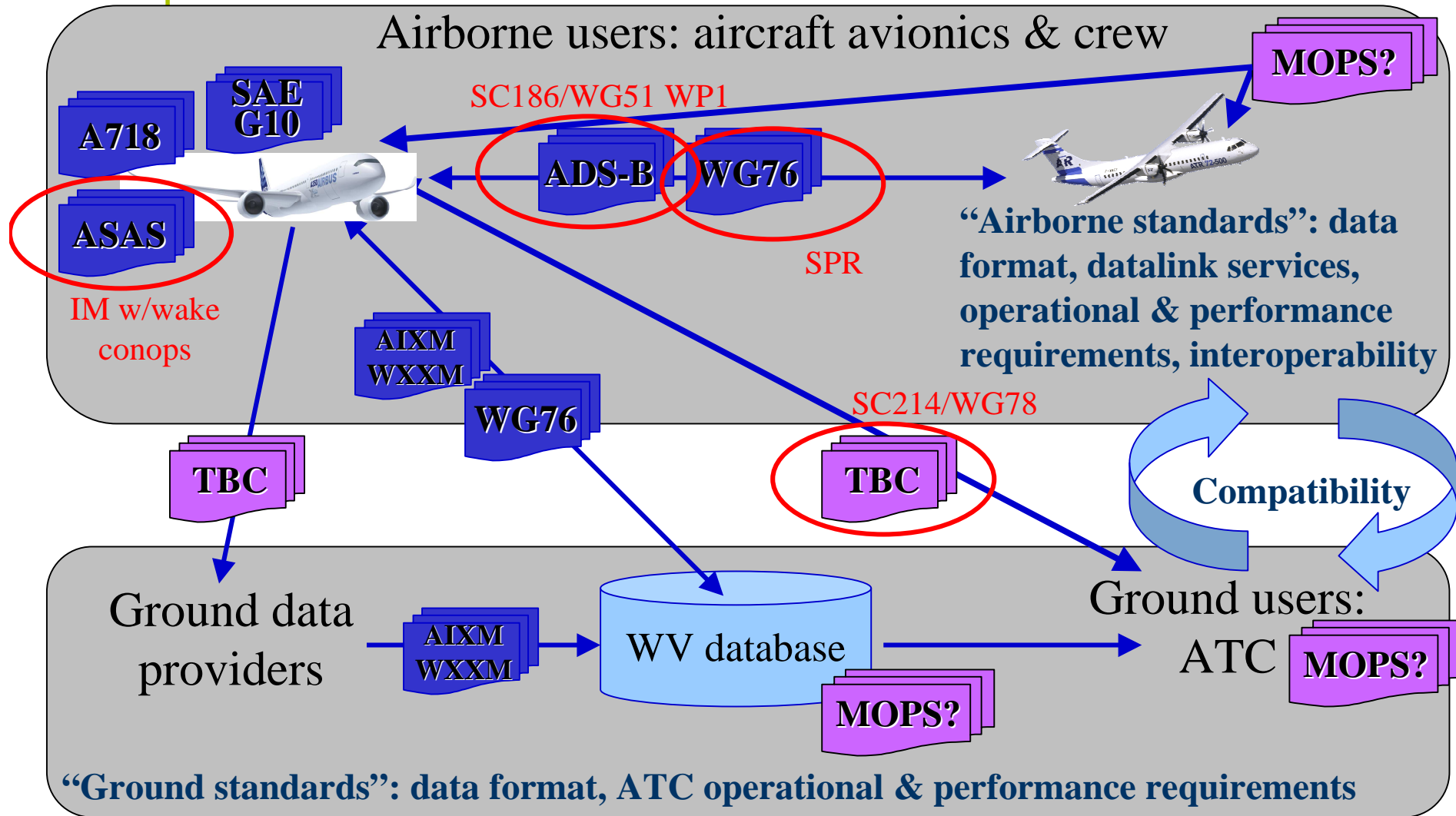


Update on Standardization Activities

WakeNet3 – Europe 2nd Workshop
28-29 June 2010
AIRBUS, Toulouse, France



Recall from Workshop 1 presentation (1^{1/2} year ago...)



RTCA SC206 / Eurocae WG76 AIS/MET Datalink Services

» D-FIS application supporting MET services defined with respect to crew decision time:

- Planning services: decision required beyond next 20min
- Near-term services: decision required between next 3min and 20min
- Immediate: decision required in less than 3min
- Considering: broadcast, demand and contract communication modes
- Operational use beyond advisory

» Wake information considered

- Uplink of wind and temperatures to support wake hazard estimation onboard the aircraft
- Operations considered include RVSM, ASAS (Interval Management)

» Environments

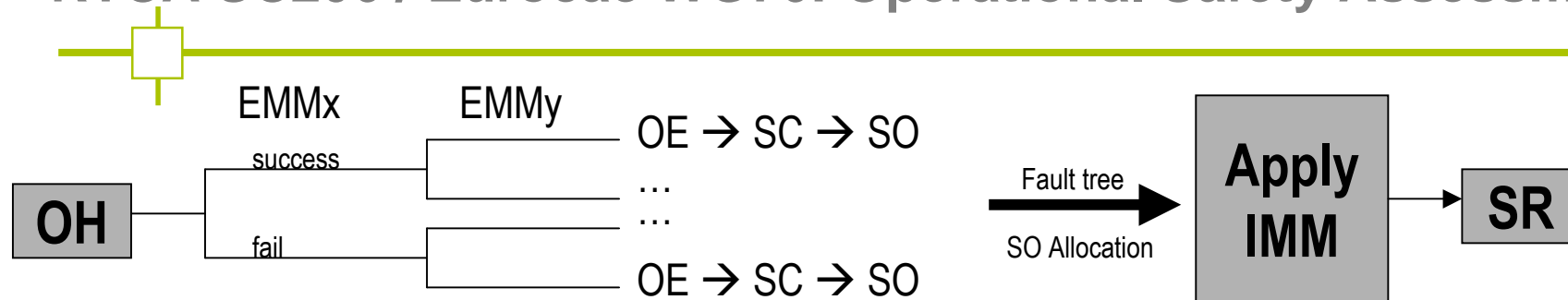
- SESAR IP2 / NextGen mid-term
- SESAR IP3 / NextGen far-term

» Status

- Operational Services Environment Description (ED-151)
- Safety & Performance Requirements (FRAC in August - September)



RTCA SC206 / Eurocae WG76: Operational Safety Assessment



» Operational Hazards

- Unavailable MET information (e.g. MET datalink service is lost)
- Incorrect MET information (e.g. MET service provides incorrect or corrupted info)
- Delayed MET information
- MET information not applicable (e.g. MET service provides non relevant or mis-directed info)
- Incomplete MET information

» Worst case scenarios were considered

- Wake Avoidance with worst credible effect

» External Mitigation Means applied

- ATS communications (voice or data)
- Alternative ATS voice/data link services (reporting information on MET phenomena)
- Onboard sensors
- Operator voice/data link services (AOC/dispatch, flight following, 3rd party)
- VMC operations
- Aircrew awareness

SC = 3
SO = 10⁻⁵

» Internal Mitigation Means

- Inform of malfunction (grd / air)
- Inform no info received in interval
- Keep alive message
- Integrity checks
- Time validity checks
- Applicability in space checks
- Applicability/coherence to request
- Reject incomplete transmissions



» Defined Required Communication Performance

- Transaction time (time after which crew should revert to alternative procedure)
- Continuity (probability of transaction completion without errors in time)
- Availability (for use and from service provision)
- Integrity (acceptable rate of undetected erroneous transactions)
- Update interval (periodicity of broadcast new cycle)

» Determination by analogy

- D-OTIS & CPDLC (as upper limit)
- Exclusion of Human Performance
- Highly dependent on data transmitted
- Dependent on implementation

$TT_{95} = 10-30s$ for immediate service

CRP parameters = 10^{-5}

Values provided as guidelines, shall be refined (esp. allocation) upon implementation.

RTCA SC214 / Eurocae WG78 ATS Datalink Services



» D-FIS application supporting:

- D-OTIS (Operational Terminal Information Service): ATIS, Volmet, Notam, AIB
 - D-RVR (Runway Visual Range)
 - D-HZWX (Hazardous Weather)
 - D-SAR (Special Air Report)
 - D-SIGMET (Significant Meteorological information)
 - D-WVR (Wake Vortex report)
- } • Weather info which may affect the safety of aircraft ops
• En route/terminal highly dynamic weather information
• Non time sensitive information
• Alpha-numeric
• Possible graphic rendering

» Wake information considered

- Uplink of wake vortex information equivalent to aural alerts and/or allowing graphical depiction of wake-in-trail information
- Targeting EFB-like avionics

» Environments

- SESAR IP2 / NextGen mid-term

» Status

- Operational Services Description
- Safety & Performance Requirements (Safety analysis ongoing)
- Validation objectives (in support of validation projects in SESAR & NextGen)



» Operational Service Description (D-WVR)

En-Route	Terminal	Airport	Format
Flight crew awareness (RVSM, RHSM)	Text report with wake information supporting graphic rendering of wake trail Flight crew awareness (CSPA, TBS)	Flight crew awareness of wake conditions during taxi & pre-departure	XML Adapted for datalink Integrated in WXXM

» Voice Wake Vortex Report

- en route might include ATC alerts of potential moderate or greater turbulence that is the result of crossing or preceding traffic, and the flight level of that traffic.
- for arrivals and departures will include the potential for wake vortices and reason (e.g., “caution, wake turbulence, departing B-757, cleared for takeoff.”).

» Digital Wake Vortex Report

- will extend the digital equivalent of the alerting provided by the V-WVR by providing additional alpha-numeric elements that will enable the graphical display of the wake-in-trail from the preceding aircraft.
- Report adjusted according to flight phase, ground capability
- Report content = alerting information + support to wake-in-trail graphic rendering information



RTCA SC186 / Eurocae WG51 WP1 wake-met information

» Floor to Ed Johnson, chair of SC186 WP1 wake-met information



» SC206 / WG76 AIS / MET Datalink Services

- SPR document proposed to FRAC mid-August till mid-September
 - Comments welcome
- RTCA SC206 will continue activities, not Eurocae
 - DO-267A update (UAT ground uplink)
 - Concepts of use for applications of higher criticality than advisory/supplemental
 - MASPS

» SC214 / WG78 ATS Datalink Services – D-HZWX

- SPR work started with Operational Safety Analysis
- Tiger team meets via Telcon
 - Subject Matter Experts contributions to SPR work
 - Contribution to validation objectives from SESAR and NextGen associated projects
- Next meeting: 27 September 2010, Honeywell Bellevue (Seattle), USA

» SC186 / WG51 Wake-Met information – ADS-B

- OSED work ongoing
 - Contribution to example implementations
- Next Meeting: 14-16 July 2010, RTCA, Washington DC, USA



RTCA SC186, WG1 ADS-B Aircraft Derived MET Data Subgroup Progress and Status

Co-chairs:
Edward Johnson (FAA)
Clark Lunsford (MITRE)

WakeNet3-Europe Toulouse, France

June 29th 2010

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Federal Aviation
Administration



Outline

- **Background**
- **Subgroup formation and meeting schedule**
- **Membership and leadership**
- **Activities to date**
 - Background briefs and level setting
 - Discussion of potential applications (pacing, additional, future)
 - OSED approach and preliminary draft
 - Terms of Reference
- **Status and Issues**



Aircraft as Weather Sensor Platforms

- **Discussion on potential use of aircraft as weather sensor platforms ongoing for approximately 20 years**
- **ADS-B equipped aircraft have the potential to measure and report meteorological data at a high resolution, under all weather conditions, over regions of operational interest**
 - Aircraft fly where observations are needed
 - Data availability potentially meets temporal and spatial needs
 - Much of required infrastructure already available onboard
 - Existing message sets include most of the required data elements



Broadcast Data Link Requirement

- **Broadcast link of relevant atmospheric and aircraft data is required to accommodate the wide range of temporal and spatial scales associated with hazardous wake turbulence.**
- **To provide data when wake vortices are short-lived and during ascent and descent flight operations, a data broadcast frequency on the order of 15 seconds is desired.**
 - Terminal environment, 15 second update frequency provides a high likelihood of receiving broadcast data:
 - Every 1-2 miles traveled by the generating aircraft
 - Every 1000 ft or less during departure and arrival phases of flight
 - Less than 1000 ft vertically on approach where wake turbulence encounters can be most hazardous
 - Represents a report once every 2 miles typical at cruise speeds
 - High likelihood of receiving broadcast data on temporal and spatial scales consistent with the current separation en route separation standards (5 miles and +/- 1000 ft)
- **Request-reply and other addressed data links may be inappropriate for transmission of data to multiple aircraft and ground stations at this frequency**
- **Previous RTCA and FAA studies produced recommendations for a broadcast data link of meteorological and aircraft data**



Background

- **Informative appendix to DO-260B/EUROCAE ED-102A and DO-282B developed in 2009**
 - Enables manufacturers to provision for parameters needed in the future
 - Informs the broader community that more is coming
 - Lays the groundwork for inclusion in future MOPS
- **Work started in April and the appendix was delivered to RTCA in August 2009**
- **Team:**
 - Robert Grappel
 - Ed Johnson
 - George Ligler
 - Clark Lunsford
 - Robert Semar
 - Fred Proctor
 - Rocky Stone
 - Chris Swider
 - Tony Warren



Background: Provisioning of Met and ARV Data

- **Examined the feasibility and potential for provisioning for required data elements**
- **Identified which data elements are currently available on standard avionics buses**
- **Feasible for provisioning on standard data buses**
 - Wind speed and direction, static temperature and pressure
- **Wind speed and direction also possible using Air Reference Vector**
- **Current ADS-B output**
 - Aircraft emitter category, position, and pressure altitude
- **Currently provisioned**
 - Aircraft speed and heading
- **Needs further development**
 - Aircraft weight and configuration, atmospheric turbulence



Background: Conclusion

- **Informative appendix contains**
 - Justification of need for Met data for two primary applications
 - Initial estimates of desired data elements, message formats, update rates, and signal provisioning
- **Is providing useful information for developing OSED for ADS-B aircraft derived MET data**
- **Should help identify what additional NextGen capabilities may be enabled with these same data elements and update rates**



ADS-B Wake Subgroup Formation

- **SC186 formed a subgroup under WG1 to develop an OSED for this Met data broadcast capability (November 2009)**
- **Identified Edward Johnson (FAA) and Clark Lunsford (MITRE) as co-chairs**
- **Requestors are Rocky Stone (UAL) and Steve Lang (FAA)**
- **75 Members**
 - **Government: FAA (AJP, AIR, AFS, SBS), NASA (Ames, Langley), UK (NATS, MET), Russian Gosnias**
 - **Manufacturers: Garmin, Thales, Boeing, Honeywell, Jeppesen, Airbus, ACSS**
 - **Airlines: United Airlines, US Airways**
 - **ALPA**
 - **Many other technical participants**
- **Meeting schedule: Telcons every two weeks, in person at RTCA every 2-3 months**



Meetings and Telcons

Telcons

- Bi-weekly
- Jan 7, 2010
- Jan 14, 2010
- Feb 19, 2010
- Feb 25, 2010
- Mar 11, 2010
- Mar 25, 2010
- April 8, 2010
- April 22, 2010
- May 16, 2010
- May 30, 2010

Meetings at RTCA

- Nov 19, 2009
- Jan 27-28, 2010
- **July 14-15, 2010**



Activities

→ **Background briefs and level setting**

- Provisioning appendix development and content
- Need to focus so we can achieve a midterm capability

→ **Applications must**

- Have documented benefits
- Not exceed data and bandwidth limitations set forth in informative appendices
- Have defined FAA program to pay for ground infrastructure
- Have identified industry users/supporters willing to equip

→ **Application discussions**

- Pacing applications: Wake Separation, Arrival Management, Weather Forecasting
- Additional SC 206/EUROCAE WG-76 applications supported by same data (10 flight deck centric, 3 Met centric)
- Future applications with and without additional data requirements



Activities (continued)

- **OSED approach discussion**
 - Service layer described in detail
 - Summary of applications that pace the service layer
 - Appendices with more detailed descriptions for specific applications
- **Initial draft OSED distributed to subgroup for comment**
- **Terms of Reference finalized, ready for approval process (next slide)**



Activities: Terms of Reference (1 of 2)

- **Establish the Operational Service and Environment Definition (OSD) for providing meteorological data over 1090ES and UAT ADS-B links (as described in DO-260B and DO-282B provisioning appendices).**
- **The data service will be provided for all regions of flight (e.g., airport, terminal, en route, oceanic, and remote area airspace) and for all type of operations (e.g., arrival, departure, cruise).**
- **Identify the pacing applications that require these data and drive the link bandwidth requirements. Bound by 1090ES bandwidth and data processing constraints. These data may be applied to ground and aircraft-based applications as well as meteorological data collection.**
- **Minimal changes to aircraft buses for data. Standardization activities may be required in order to provide a few of the data elements, such as weight. New sensors will not be required. Data will be obtained from existing-technology onboard sensors.**



Activities: Terms of Reference (2 of 2)

- **Additional sensors to provide specific data (e.g., humidity) are allowed, but are not required. Investigation of potential methods of assessing and indicating the quality of data being reported may be required.**
- **Identify future applications that could be enabled with a higher capacity data link, that are not currently possible within the limited link budget available with 1090ES.**
- **The current subgroup activity is not developing an SPR at this time (OPA, OSA, and INTEROP), but participation from groups that develop these documents will be requested to ensure the OSED will provide what is needed for those future activities.**
- **Investigate developing a standardized method of computing Eddy Dissipation Rate (EDR).**
- **Identify method(s) to standardize aircraft weight and configuration data reported over the ADS-B data link.**



Status and Issues

→ Status

- Terms of Reference reviewed within subgroup, ready for approval
- 1st draft of OSED, with content from provisioning appendix, out for subgroup comment
- Schedule for complete draft of OSED being developed
- Planned submission of OSED to RTCA PMC Feb 2011

→ Issues

- RTCA PMC requesting greater coordination across SC186, SC206, & SC214
 - Formal coordination agreements will be developed
 - Points of contact for inter committee coordination being identified
- Potential perceived competition with existing Met data reporting capabilities

→ Actions

- Subgroup needs participation of FAA and Industry champions for arrival management and weather applications



WG-1 Subgroup Schedule

Meetings at RTCA:

- Dec 2009 - Kickoff meeting Dec
- Jan 2010 – Discuss terms of reference, OSED structure, & capture of potential applications
- Apr 2010 – Finalize terms of reference & OSED structure
- July 2010 – Subgroup meeting at RTCA
- ~ Sep 2010 – Circulate draft OSED externally for comments

Telecons:

- Bi-weekly (2nd & 4th Thursday of each month)

Objective:

- Feb 2011 – Submit OSED document to SC-186 Plenary

Known Issues:

- Standardization work required:
 - o Algorithm for computation of eddy dissipation rate (edr)
 - o Reporting of aircraft weight
 - o Reporting of aircraft configuration
- **Note: Successful applications can be developed if some data elements are missing**
 - Reduction in benefits relative to optimal solutions



Questions?

