Cockpit Communication of Weather Information

Weather Data Delivery and Display in the Cockpit

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Date: October 21, 2010
Presentation Outline

• Background
• Program Overview
• Program Accomplishments
• HOTL ITCZ Demonstration
Background

• 1994 to 2003 – While the annual number of weather-related accidents has declined, weather accidents as a proportion of total accidents remains roughly the same

• Average of 400 weather-related accidents (general aviation, air taxi, & air carrier) per year, over the 10-year period ending in 2006
  – $1.46B (fatalities, injuries, aircraft damages)
  – 42,000 air carrier delay hours in 2008, resulting in $200M in delay costs.

• 257 weather-related accidents involved Part 135 Commuter/Air Taxi operations
  – 6.2% of total weather-related accidents
  – Visibility/Ceiling (39.1% of weather-related )
  – Wind (26.6% of weather-related )
WTIC Program Overview

Spiral I
- Spiral IA
  - NextGen Concept of Operations
  - NextGen Needs/Benefits
  - Current Capabilities
  - Planned Capabilities
- Spiral IB
  - Pre-Spiral II Preparatory Activities
    - Datalink Assessments
    - Airline EFB Evaluations
      - EDR
    - Uplinked Cloud Tops
    - Mid-Term Concepts for WTIC
    - TBO Concepts
    - MET Symbology Definition
    - Integrated Air/Ground Decision Making Model
- Unsatisfied Needs
- Capability Gaps / Requirements
- Responsibility to Industry & Government

Spiral II
- NextGen/SESAR Requirements
- Develop Concept of Use
- Develop HF Interfaces
- Human in the Loop Evaluation
- Flight Evaluations
- Future MET DataLink Standards
  - RTCA SC206/Eurocae WG76
  - RTCA SC214/Eurocae WG78
  - RTCA SC186/Eurocae WG51
  - RTCA SC223/Eurocae WG-82
  - RTCA SC222
- Beginning FY 09

Spiral III
- Proposed Deliverables
  - Functional & Performance Requirements for Integrated Air/Ground Operations
    - Human-Machine Interface
    - Weather Products
    - Weather Info Presentations
  - AC’s & Orders
    - Training
    - Weather Symbology
    - Information Standards
  - Aircraft Certification Standards
    - MASPS
    - MOPS
    - TSO’s/e-TSO’s
    - Orders
    - ARP’s
  - Government Provided Services
    - Graphical Database (from Textual)
    - Graphical Weather Presentations Suitable for Cockpit
    - Datalink Communications Management

FY 09 – FY 11
- Cross-Cutting Activities
  - JPDO NextGen WGs
  - SESAR Efforts
  - NBAA
- Programmatic
  - OTA’s
  - Interagency Agreements
  - University Grants
  - MOA’s
  - Partnership Initiatives
  - Contracts

FY 11 – FY 13
- Functional & Performance Requirements for Integrated Air/Ground Operations
- AC’s & Orders
- Aircraft Certification Standards
- Government Provided Services

FY 14 – FY 15
- Future MET DataLink Standards
- Proposed Deliverables
- Functional & Performance Requirements for Integrated Air/Ground Operations
- AC’s & Orders
- Aircraft Certification Standards
- Government Provided Services
Information Management Standards

• Assess needs to sustain MET “Situational Awareness” between the cockpit and ground systems

• Aircraft
  – Display
    • EFB
    • MFD
    • Stand-alone
  – MET Processor

• Ground
  – Service adaptor
  – Processor

• Develop standards for MET information suitable for airborne architectures to support NextGen Concepts for Parts 91, 135, and 121 operators
Information Exchange and Management Requirements

- Identify MET downlink requirements
- Develop MET data link safety performance requirements
- Develop MET data link minimum aviation safety performance standards
- Verify and validate MET information bandwidth demand, data latency, quality of service, and coverage requirements for transmission and receipt via data link services
- Identify standards to render data linked MET information
Rendering MET in Cockpit

• **Identify MET to support operational decisions**
  – Replanning, tactical avoidance, and tactical control
    • Broken down by user category (GA vs 121 etc)
    • Environmental Description (ED-1, etc)

• **Develop Standards for MET Presentation**
  – visual presentation, e.g., color, overlaid on other information, track up
  – information latency, data aging, reliability, accessibility, accuracy in order to be fit for purpose (advisory, safety critical, non-misleading)
  – system latency, data integrity, reliability, data storage
FY10 Accomplishments

- Based on capabilities described in the NextGen ConOps, developed initial, comprehensive, weather-information user-needs statement for the cockpit environment in different types of operation (e.g., Part 121, Part 135, etc.) for each phase of flight (pre-flight, departure, en route, etc.) in the near-, mid-, and far-term NextGen operating environments.
- Assessed currently available onboard weather-information-processing technology.
- Identified the specific types of weather information being integrated into cockpit FMS and the decisions supported by the information.
- Assessed currently available and emerging ground and cockpit communications interface technologies.
- Assessed currently available options for communications systems (air-ground, ground-air, and air-air).
- Analyzed the bandwidth requirements to datalink graphical icing and turbulence products to the flight deck using an automated network simulation model.
- Supported the development of AIS/MET datalinks Safety Performance Requirements, with commercial industry through RTCA Special Committee and EUROCAE 206/WG-76.
- Supported the development of ARP 5740, Cockpit Display of Data Linked Weather Information (Standards for MET Symbology) with industry and government led SAE G10 committee.
MET in the Cockpit

- Pilots currently have little information as they fly over remote stretches of the ocean, which is where some of the worst turbulence occurs.
- Providing pilots with at least an approximate picture of developing storms could help guide them safely around potentially severe weather.
HOTL Research

• Understand pilot decision-making adverse when presented with MET situational awareness during transoceanic flights
  – Train flight crews on the capabilities and limitations of uplink weather and representations presented on the flight deck
  – Identify those decisions pilots make in the current environment without weather updates, and propose decisions that can be facilitated with frequent weather hazard updates while en route in oceanic/remote regions.
  – Obtain initial flight crew feedback on weather hazard needs and display presentation concepts.
Questions ???