Cockpit Communication of Weather Information

Weather Data Delivery and Display in the Cockpit

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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 III Spiral II **Proposed Deliverables** Spiral IA NextGen/SESAR Functional & Performance NextGen Concept of Operations Requirements Requirements for Integrated Air/Ground Operations NextGen Develop Concept Human-Machine Interface Needs/Benefits of Use Weather Products Weather Info Presentations Current Planned Develop HF Capabilities Capabilities AC's & Orders Interfaces Training **Unsatisfied Needs** Weather Symbology Human in the Information Standards Loop Evaluation Capability Gaps / Requirements Aircraft Certification Standards Responsibility to Flight Evaluations **MASPS** Industry & Government MOPS TSO's/e-TSO's Spiral IB Orders Pre-Spiral II Preparatory Activities Future MET DataLink Standards ARP's **Datalink Assessments** RTCA SC206/Eurocae WG76 Airline EFB Evaluations RTCA SC214/Eurocae WG78 Government Provided Services EDR RTCA SC186/Eurocae WG51 Graphical Database (from Textual) Uplinked Cloud Tops RTCA SC223/Eurocae WG-82 **Graphical Weather Presentations** Mid-Term Conops for WTIC RTCA SC222 Suitable for Cockpit **TBO Concepts** Datalink Communications MET Symbology Definition Beginning FY 09 Integrated Air/Ground Decision Management Making Model

FY 09 – FY 11 FY 13 FY 14 – FY 15

Cross-Cutting Activities

- JPDO NextGen WGs
- SESAR Efforts
- NBAA

- NASA
- RTCA Committees
- SAE Committees

Programmatics

- OTA's
- Interagency Agreements
- University Grants

- MOA's
- Partnership Initiatives
- Contracts



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 a 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.

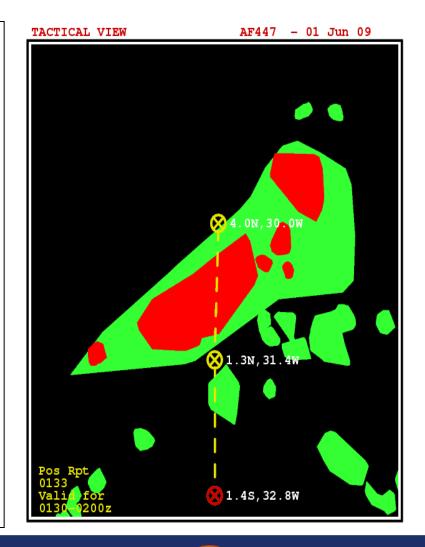


MET in the Cockpit

- 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

GOES-East Cloud Top Heights

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01 Jun 09 TOP
                    FI AF447/AN NXXXAF
-- '/' Cloud tops 30,000 to 40,000 ft/////CCC/////
  'C' Cloud tops above 40,000 ft///////CC////
                          *4.0N,30.0W///////
                          *//////C/////////
                        //*//CC///CCC////////
                        ///*CCCC/C/CC/////////
                       ////*CCCCCC//C////////
                      ///CC*CCCC///CC///////
                     ////CCCCCCCCC*CCC/////
                //CCCCCCCCC*CC///// //
               //CCCCCCCCC*C/////// //////
              /////CCCCCCCCC*C// // // //////
             /////ccccccc//*/
            */\/00000000cc//*
           CCC////////// *
                                  /////////
                          *1.3N,31.4W ////
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Pos Rpt
0133
                          X 1.4S,32.8W
                                            //
Valid for //
0130-0200z //
Pilot feedback at url:
http://www.rap.ucar.edu/projects/owpdt/feedback.html
CCC///
```



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???

