Cockpit Weather

FPAW Special Session

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November 2, 2016
2003 FPAW: Weather in the Cockpit

Is Here & Growing
Why Weather in the Cockpit - ??

• Long Standing Need

• Unchanging Use / Basic Applications

• Changing Technology
Long Standing Need

• Early Air Force Lesson:
  – Pilots plan on my forecast
  – Pilots (and aircraft) fly on the “real/existing” weather

• Axiom:
  – Make my forecast the best possible – and amend promptly when needed
  – Keep pilots (and commanders/supervisors) advised of current/changing weather conditions
Unchanging Use / Applications

1985: OFCM Conference at University of Tennessee (Tullahoma)
1987: FAA Aviation Wx Sys Ops Concept
1991: FAA/NASA PAWSS Requirements
1993: OFCM Aviation Wx Users Forum
1994: FAA Order 7032.15, Air Traffic Wx Needs and Requirements
1996: RTCA DO-232, Ops Concepts for Data Link Applications of FIS

All supported the need for and application of Cockpit Weather
Pilot/Cockpit Applications

• FAR Requirements:
  – IFR vs VFR
  – Alt Airport; Fuel Reserve; Deicing
  – Other

• Safety: Avoid Hazardous & Adverse Wx
  – Aircraft and aircrew capabilities
  – Aircrew/passenger injury and aircraft damage

• Efficiency: Favorable Winds & Wx
  – Aircraft performance

• Quality: Comfort vs Stress
  – Pax & Aircrew
Changing Technology – ??

Where’s the Link?
Where’s the Link

1947: RCA demonstrates Teleran
– Teleran = Television + Radar
– Ground radar gets traffic pics and sends them along with weather to the pilot by television

An early Cockpit Display of Traffic and Weather
Where’s the Link

1981: MITRE/Ohio University VOR Demo
- Ground wx radar images broadcast over VOR and printed on cockpit thermofax printer
- Pilots excited but FAA decides to wait for Mode S data link technology

1980-86: NASA transmits Kavouris NEXRAD Wx Radar to F-106
- NASA Storm Hazards Program intentionally sought inflight lightning strikes
- Successful Kavouris transmission led to joint FAA/NASA Cockpit Weather Program

1990: FAA/NASA establish Cockpit Weather Program

1991: SatCom Demo - NASA Pilot Automated Wx Spt Sys (PAWSS)

1995: Mode S Data Link Demo – AOPA/EAA Supported Flight Tests
- TIS – accepted for service
- GWS/TWS (Graphic/Text Wx Svc) – service denied due to spectrum concerns

- FAA & NASA Aviation Safety Programs
  • NASA AWIN – Langley (Data and Displays)
  • NASA WINCOM – Glen (Data Link Technology)
NASA Cockpit Weather

Switch to Taumi Slides
Where’s the Link

1999: SDARS: NASA Langley demo in Africa
   - Leads to WSI and XMWX commercial services

1999-2011: FAA FIS Data Link (FISDL) Program
   - FAA partners with industry (Honeywell) to provide FISDL broadcast
   - Ground Based VDL 2 Broadcast System – FAA provided the VHF frequencies

2011: Other Impacts – Leading to FAA FIS-B:

   - FAA Capstone launched in Alaska
     - Field demo of adv avionic capabilities – based on MITRE UAT ADS-B concept

1993: RTCA TF 2: No single ADS-B link; AOPA/GA seeks benefits

1995: FAA Free Flight Concept published; AOPA support contingent on benefits

1997: FAA Capstone launched in Alaska
   - Field demo of adv avionic capabilities – based on MITRE UAT ADS-B concept

2002: FAA/EUROCONTROL – Ohio River Valley ADS-B Demo/Test
   - Cockpit Weather Capability: UAT – Yes; 1030/1090 – No

FAA ADS-B Link Decision
   - Deploying uplink services (FIS-B / TIS-B) encourages aircraft to begin equipping with ADS-B and provides near-term benefits at many locations
What Next - FAA

• FIS-B – New Graphic Products
  – Turbulence based on GTG
  – Icing based on CIP/FIP
  – Cloud Tops based on NOAA HRRR
  – Lightning based on NLDN

• RTCA SC-206 / SG 5
  – Drafting Revision A to the UAT MOPS (DO-358A)
NextGen Wx Systems Architecture

NextGen Weather Processor (NWP)

Common Support Services – Weather (CSS-Wx)

ATCTs
TRACONs
CERAPs
ARTCCs

Stakeholders
NAS Web Users

Federal Aviation Administration

ASR
LLWAS/TDWR
WMSCR/ADAS
Surface Obs Networks

CONUS+ Domain

Aeronautical Information Management Modernization (AIMM)

ATCSCC

STAKEHOLDERS

Legacy Weather Consumers

Modern Weather Consumers

External Weather Consumers

Flight Services, Providers, Airlines

System Wide Information Management (SWIM)

Service Adaptors

Federal Aviation Administration

FPAW - Orlando
November 2, 2016

AWD replaces legacy displays: WARP BT, CIWS SD, ITWS SD, ITWS Web, CIWS Web

Canadian Wx Radars

NOAA Data

MDCRS

Satellite

Lightning Networks

Flight Services, Providers, Airlines

Aeronautical Information Management Modernization (AIMM)
NextGen Wx Services and Processes

- Acquisition of weather data
- Subscription Services
- Web Services
  - WCS
  - WFS
  - WMS
  - WMTS
- JMS Messaging backbone infrastructure
- Locally produced Hosted Algorithms products
  - Composite Reflectivity with Flexible Floor
  - Icing And Composite Icing Layer
  - Composite Turbulence and Turbulence Layer
  - Precipitation Altitude Mask
  - CWAM Weather Avoidance Field
- Distribution Services for OGC and legacy consumers
- Discovery Catalog

Common Support Services – Weather (CSS-Wx)

Acquisition Services

Web Services
- WCS
- WFS
- WMS
- WMTS

Subscription Services

N-Tier Services
- Hosted Algorithms
- Backfill
- Wx Alerts
- Complex Query

Discovery / Catalog

Distribution Services
- Service Adaptors
  - Client Adapter
  - OGC Interface
- End Point
  - HTTP Srv
  - Messaging

NextGen Weather Processor (NWP)

Data Ingest

Per-Radar Processing

Mosaic, Analysis, & Prediction

Weather Avoidance & Scoring

Post Processing

Product Server

End User Processing

- Data Ingest
- Radar Pre-processing
- Product Generations
  - Gridded Products
    - Precipitation (VIL)
    - Surface Precipitation Phase
    - Echo Tops
    - Base and Composite Reflectivity
    - Satellite
    - Icing Tops & Bottoms
  - Non-Gridded Products
    - Aggregated Lightning Flashes & Tornado Detections
    - Storm Information Hazard Texts, Leading Edges, & Motion Vectors
    - Radar mosaic Contours
    - Fronts, Trends & Wind Profiles
    - Precipitation (VIL) & Echo Tops (ET) Forecast Accuracy
- Prediction up to 8 hours
- Weather Avoidance products
- Post Processing
Cockpit Weather - Evolution

Questions-??
What Changes

• Technology
  – Data Link
  – Data
    • Fidelity
    • Accuracy
    • Availability

• Procedures
  – Aircraft or ground centric decisions-??
  – Expanded Collaborative Decision Making (CDM)-??
Switch to Gary Pokodner & Following Segments
Stakeholder Panel - Opening

Question:

What key lessons have you learned about Cockpit Weather from your perspective—??

Both the good as well as any concerns or deficiencies.
Stakeholder Panel – Member Briefings

Switch to Stakeholder Panel Briefings
Cockpit Weather Chorus

• Gary Livack – FAA Prophet / Visionary
• Paul Fiducia – Passionate Industry Advocate
• Charlie Scanlon – NASA SDARS Demo
• Norm Crabill – NASA Engineer (Retired) – PAWS Author – Cockpit Wx Pioneer
• Dr David Strahle – Cockpit Wx Pioneer
• Bob Baron – Wx Service Provider / Pioneer
• WSI (The Weather Company) – Wx Service Provider / Pioneer
• MITRE – UAT Concept & Development
• Honeywell – FISDL Development & Operation
• RTCA – FIS Data Link Standards Document
• SAE – Aerospace Recommended Practice (ARP) 5740 [HF Guidelines for Cockpit Displays]
• AOPA – Benefits Advocate & Best Practices Education

Multitude of Others
It’s Happy Hour Time

At least for me - !!