Cockpit Weather

FPAW Special Session

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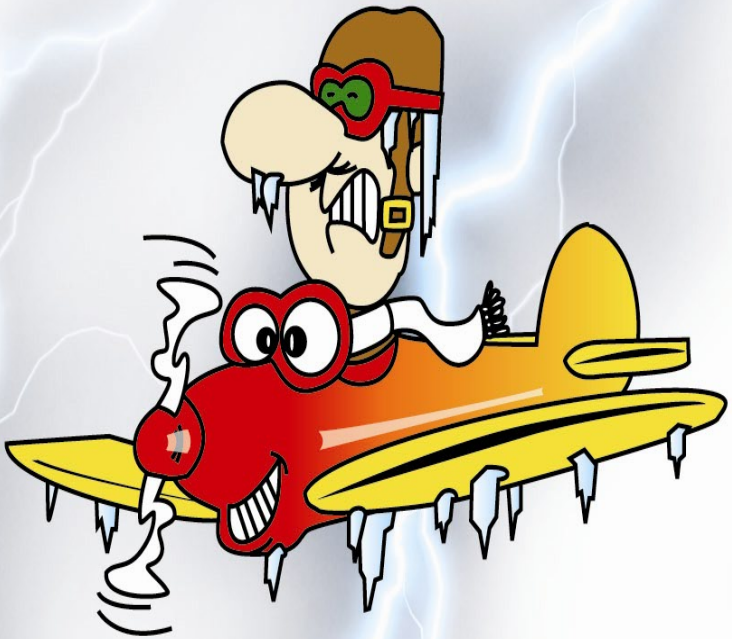
2003 FPAW: Weather in the Cockpit



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?

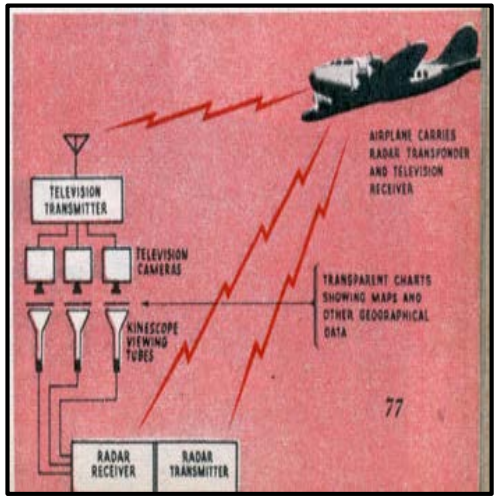
Where's the Link

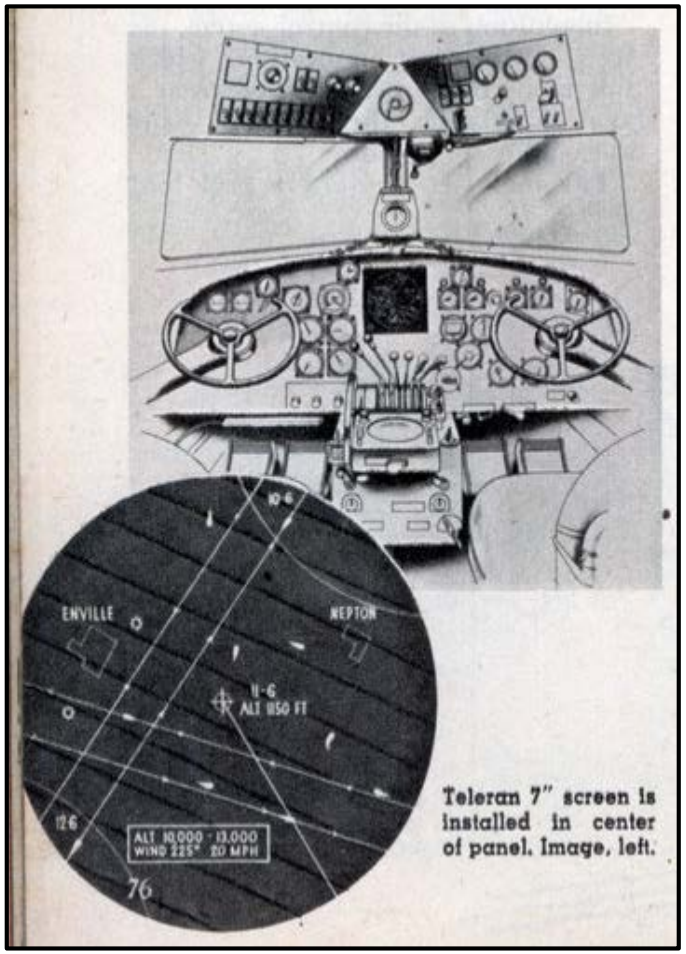
1947: RCA demonstrates Teleran

– 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

1996-97: White House (Gore) Report on Aviation Safety and Security

– 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

<u>Other Impacts – Leading to FAA FIS-B:</u>

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

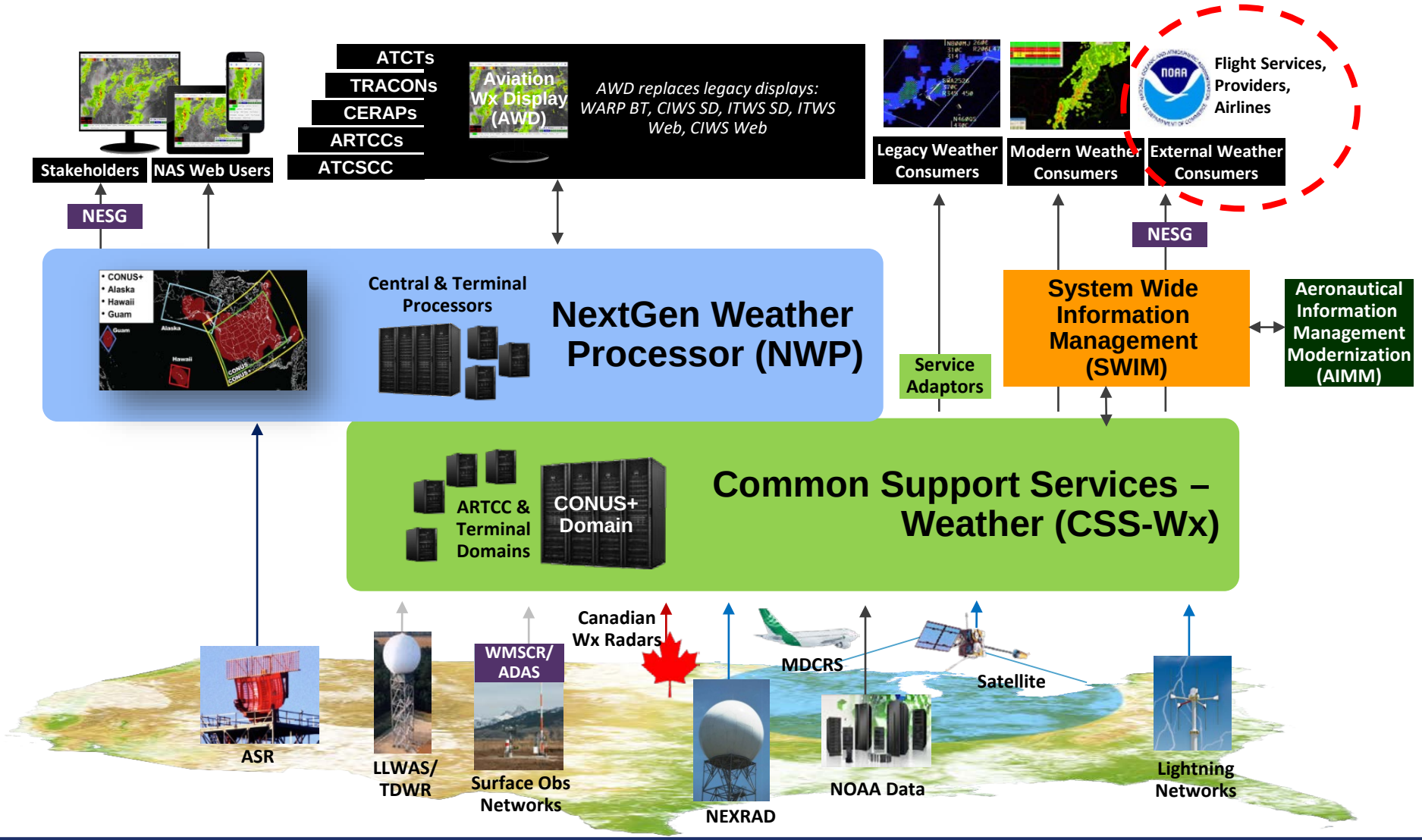
– Deploying uplink services (FIS-B / TIS-B) encourages aircraft to begin equipping with ADS-B and provides near-term benefits at many locations

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

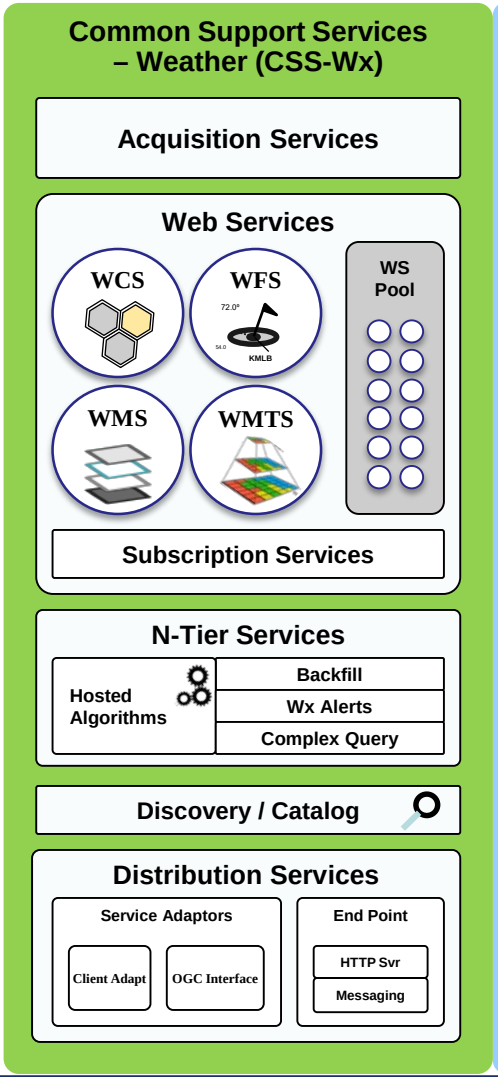
- **RTCA SC-206 / SG 5**
  - Drafting Revision A to the UAT MOPS (DO-358A)

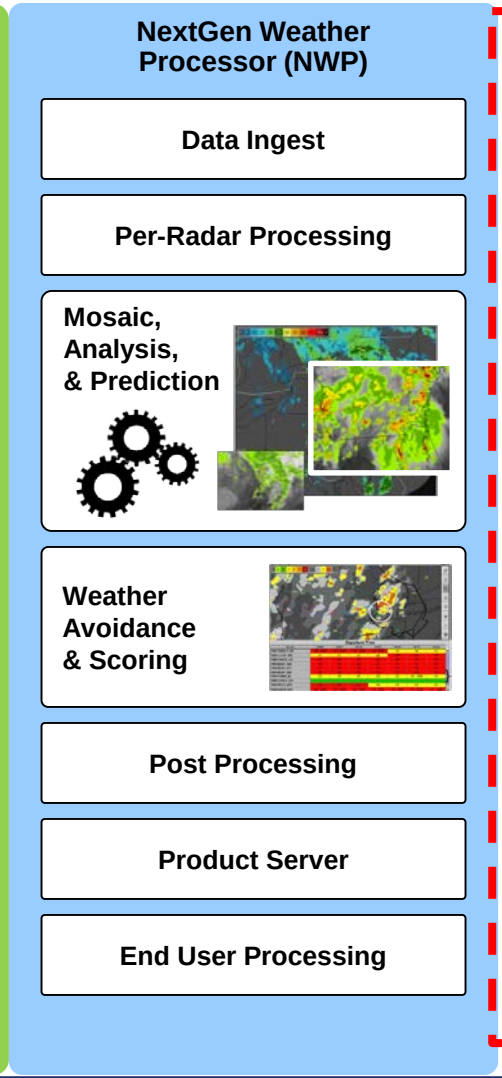
NextGen Wx Systems Architecture



NextGen 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**





- **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)-??

WTIC Research – Follow Segments

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

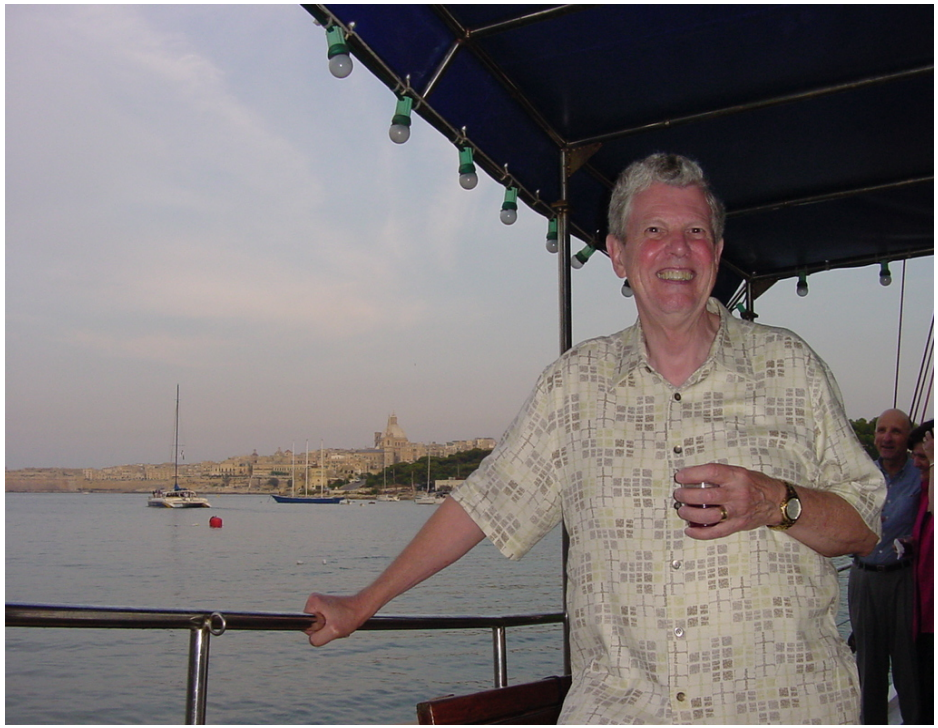
Switch to Stakeholder Panel Briefings

Cockpit Weather Chorus

- Gary Livack – FAA Prophet / Visionary
- Paul Fiducia – Passonate 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 - !!