Progress in Weather Observations

Friends/Partners in Aviation Weather Forum

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Paul Stough
NASA Langley Research Center

Progress in Weather Observations

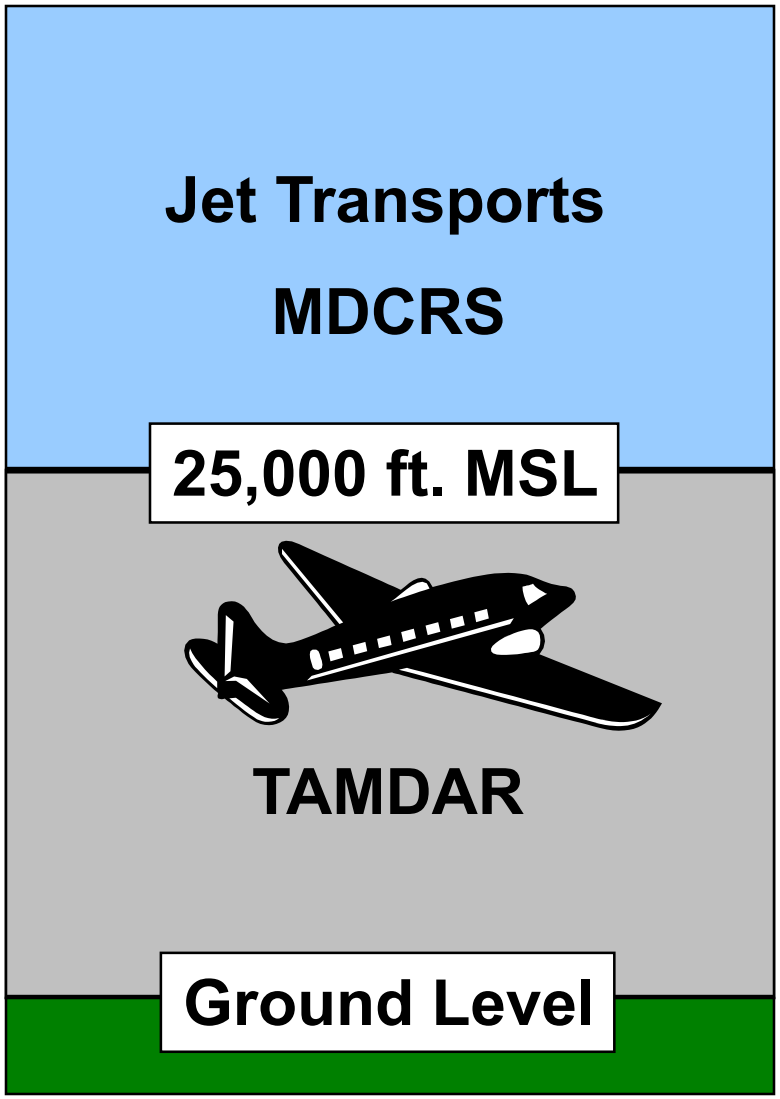
- In-situ weather reporting
- In-flight turbulence detection
- Satellite remote observations

TAMDAR - Tropospheric Airborne Meteorological Data Reporting

Objective:

Sense and report
- **Moisture**
- **Temperature**
- **Winds**
- **Turbulence**
- **Ice**

for use by
- **Forecast models**
- **Weather briefers**
- **Controllers**
- **Other aircraft**



TAMDAR - Tropospheric Airborne Meteorological Data Reporting

Accomplishments:

- ✓ Partnership with FAA & NOAA
- ✓ Concept of Operations
- ✓ Requirements
- ✓ Feasibility Study

Measured

- Pressure
- Temperature
- Humidity
- Ice

Derived

- Altitude
- Airspeed
- Turbulence
- Winds
- Ice Accretion Rate

Developed with Georgia Tech Research Institute and Optical Detection Systems

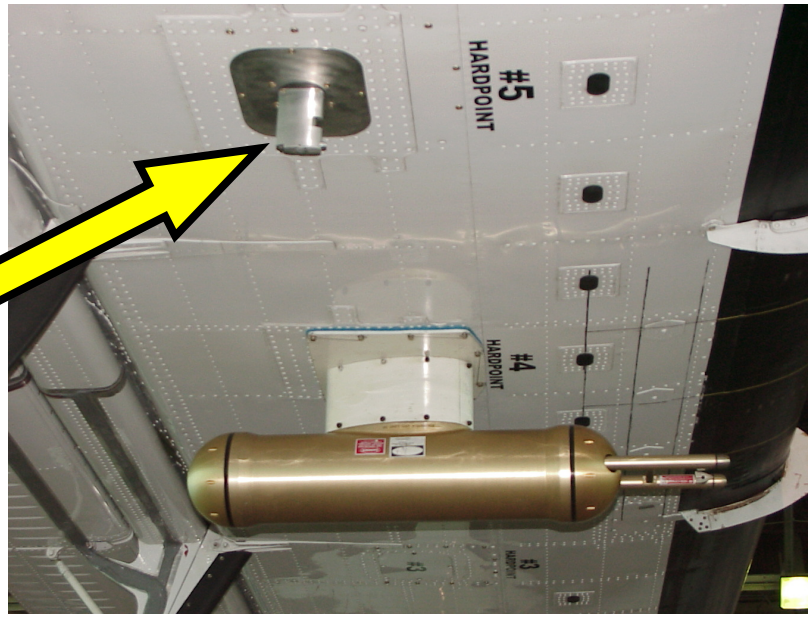
TAMDAR Status

- Humidity sensor technology development
  - Improved capacitive sensor evaluation
  - MEMS hygrometer evaluation
  - MEMS chilled mirror design and testing
  - Long-term validation ongoing in humidity chamber
- Flight tests ongoing
- Final design modifications leading to pre-production sensor fabrication in 2003
- Operational Evaluation in 2004

TAMDAR Flight Tests
NASA Twin Otter Icing Research Airplane

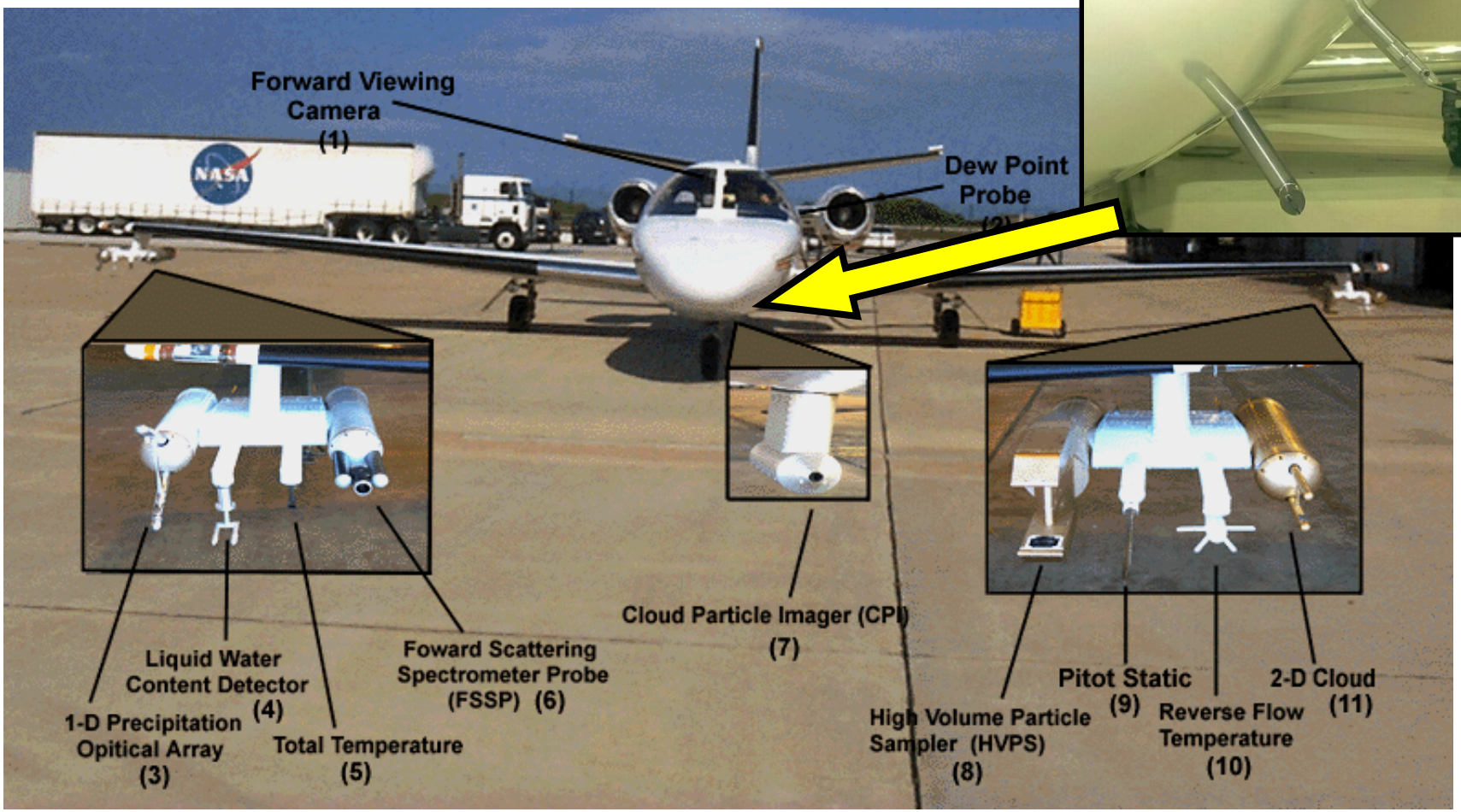
- Initial tests Jan 2002
- Additional flights planned for Nov 2002

TAMDAR Sensor



TAMDAR Flight Tests
UND Cessna Citation II

- Initial flights Jan 2002
- Additional flights Aug-Oct 2002



TAMDAR Flight Tests

ODS Beech Bonanza

Test flights began Oct 2001

- **Long term testing**
- **Still operational**

NASA Cessna 206H

Test flights FY 2003

- **Shakedown**
- **Calibration**
- **Demonstration**
- **Inter-comparison**

Turbulence Detection

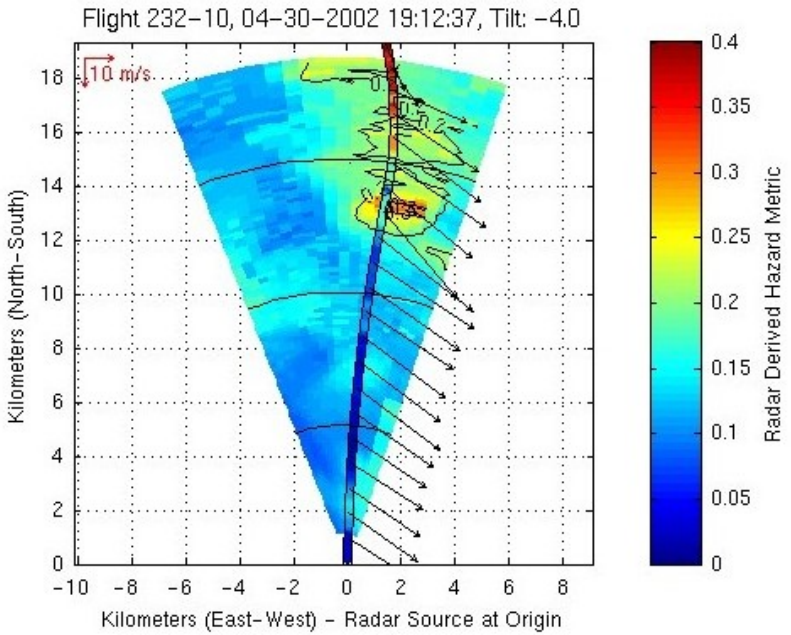
Objective:

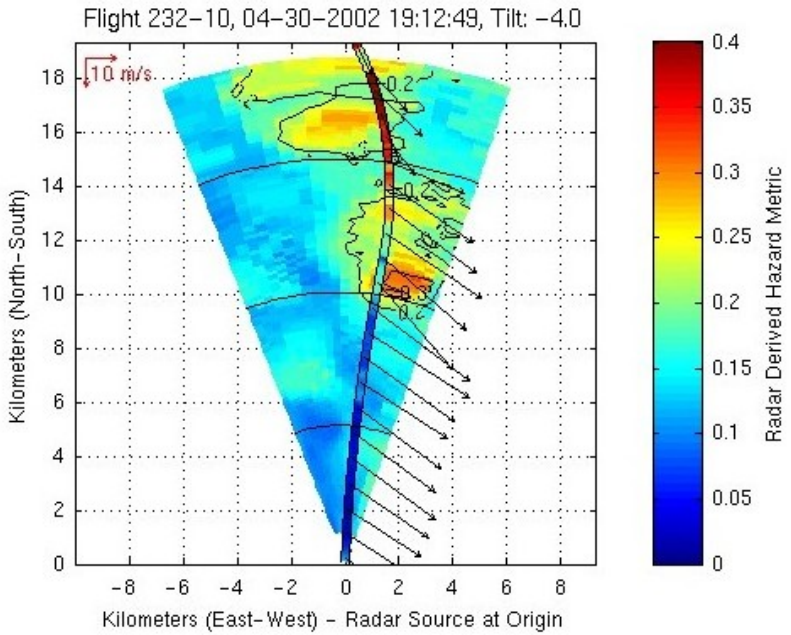
Develop in-flight turbulence detection technologies

Accomplishments:

- ✓**Evaluated Lidar-based system on NASA DC-8**
- ✓**Validated in-situ based algorithms on NASA B-757**
- ✓**Validated radar-based detection algorithm on NASA B-757**
- ✓**Defined technology certification path**

Radar-based Turbulence Warning Display





Display showing radar-predicted hazard metric in background with actual hazard experienced on flight path through turbulent region

Turbulence Detection Status

Complete aircraft turbulence warning experiment at CAMI

- **Determine warning time for wide-body cabin**
- **Focusing on passenger and flight attendant behavior**

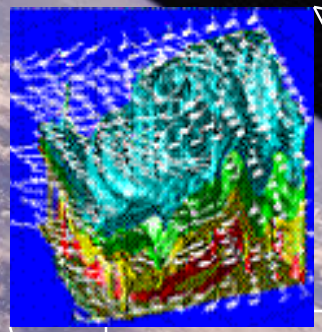
Conduct flight experiments spring 2003 on NASA B-757

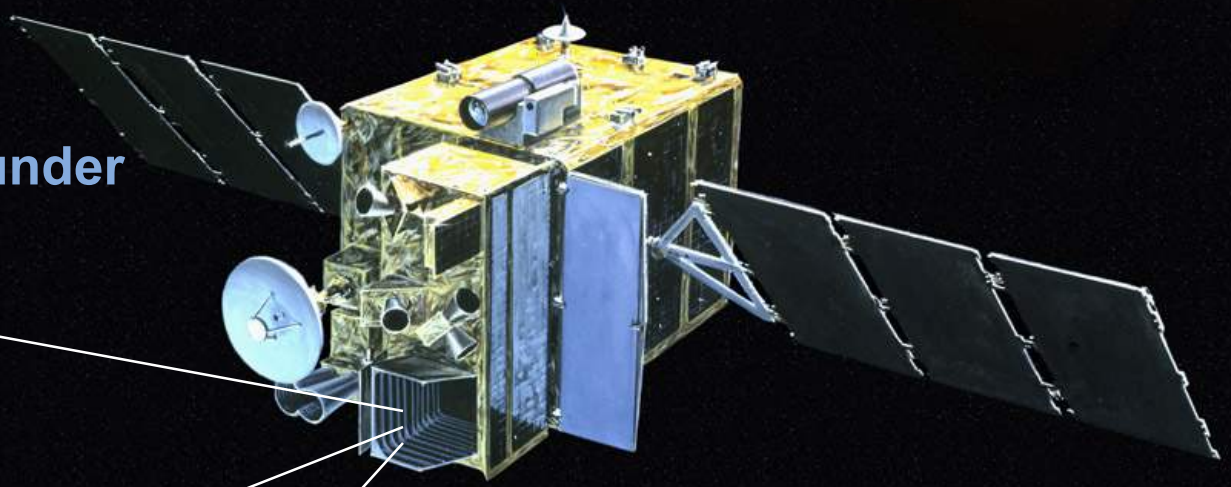
- **Focus on in-situ systems and aircraft-to-aircraft links**
- **Use research radar to predict and record turbulence encounters**

Finalize warning system certification process with FAA

ASAP
Advanced Satellite Aviation-weather Products

GIFTS
Next-Generation Sounder





High resolution
- **1 nm horizontal**
- **3,000 ft vertical**
- **15 min temporal**

Storm detection 2-4 hr before clouds form

ASAP
Advanced Satellite Aviation-weather Products

Objectives:

- **Utilize satellite weather observations and soundings to improve aviation weather reports and forecasts**

- **Prepare for next generation of high resolution weather satellites**

ASAP Status

- ✓ **Accomplishments:**
- ✓ **Funded by both NASA Aviation Safety Program and Earth Sciences Enterprise**
- ✓ **Partnered with FAA Aviation Weather Research Program**
- ✓ **Identified target weather products**
  - **Convective weather**
  - **In-flight icing**
  - **Turbulence**
  - **Oceanic weather**
  - **In-flight winds**
- ✓ **Initiated benefits study**
- **Begin data collection and product development in 2003**