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In-Service Evaluation of a Prototype Turbulence Auto-PIREP System (TAPS)

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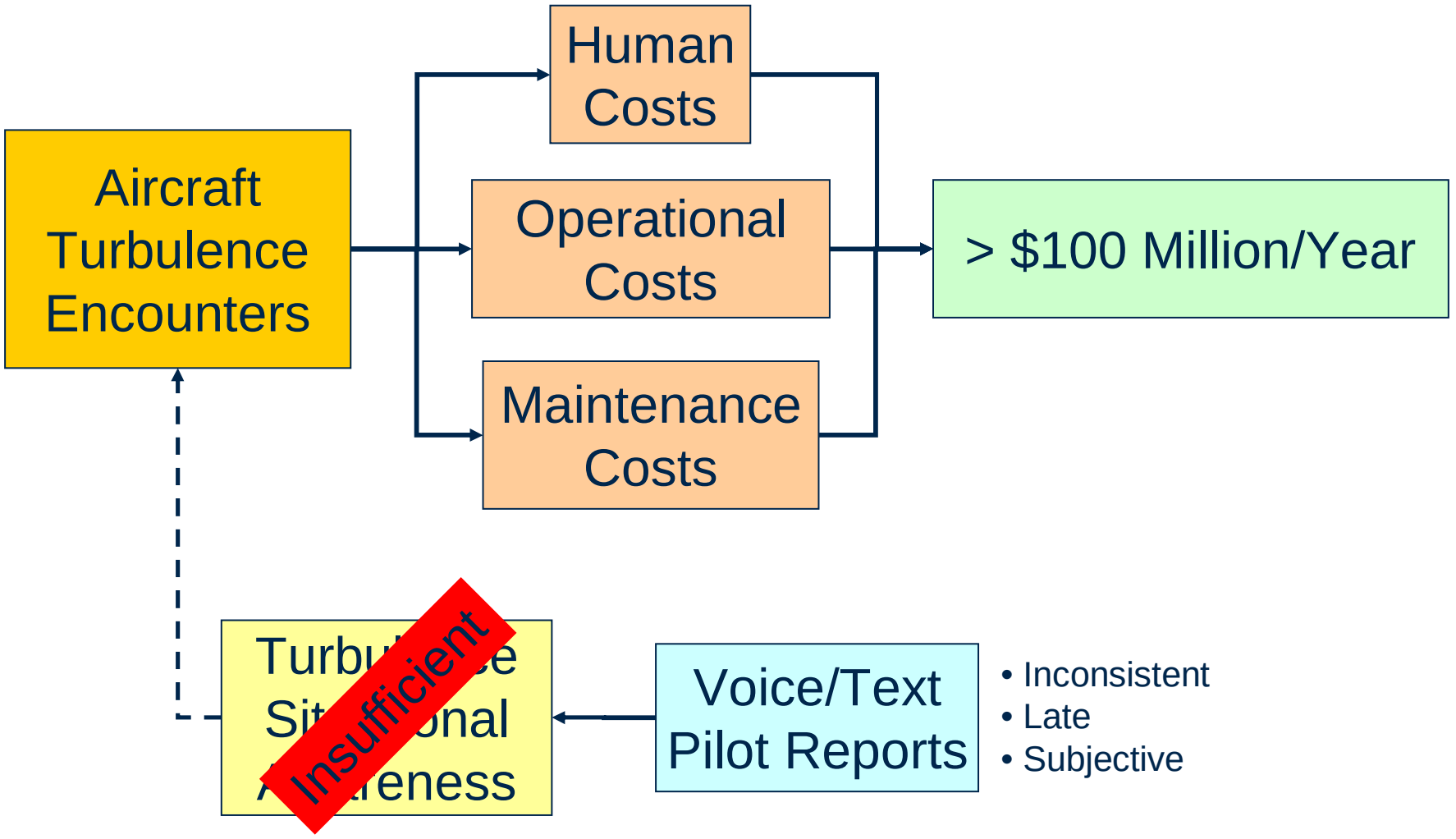
Delta

ARINC YOU WON'T BELIEVE WHAT WE CAN DO.®

The Turbulence Problem



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ATR Solution

NASA's Aviation Safety and Security Program (AvSSP)

- Develop technologies to reduce turbulence accidents by 25-50% by 2007

Turbulence Prediction and Warning System (TPAWS)

AeroTech Research (ATR)

Turbulence Auto-PIREP System (TAPS)

- Event-driven
- Real-time
- Objective
- Improve the situational awareness of potential turbulence hazards

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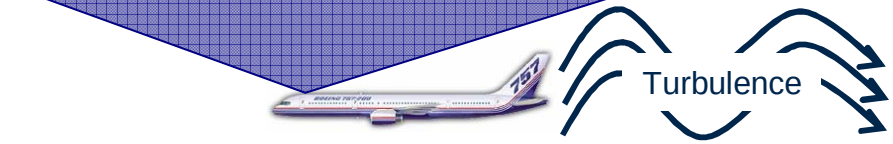
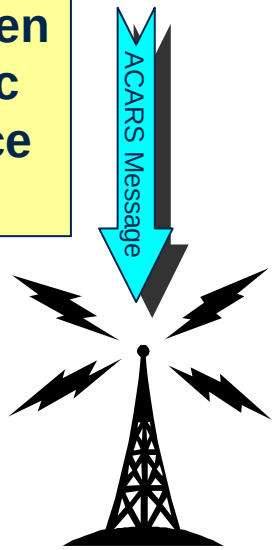
TAPS Architecture

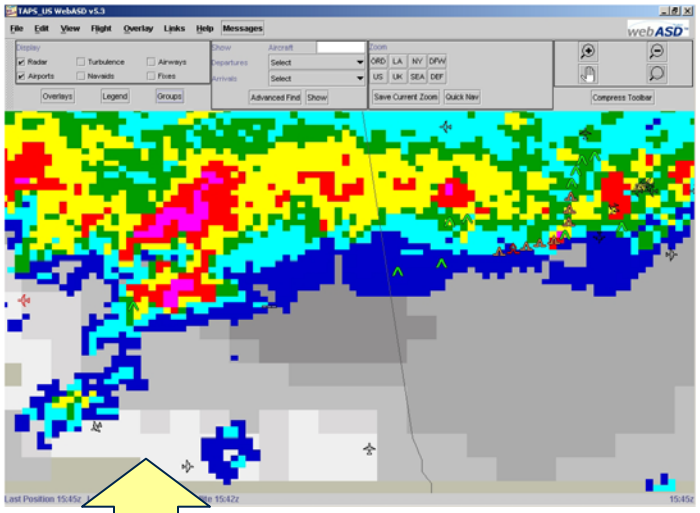
Reporting Algorithms



Event-Driven Automatic Turbulence Report



ARINCs WebASD



Ground Station Network
Flight Following & Flight Planning

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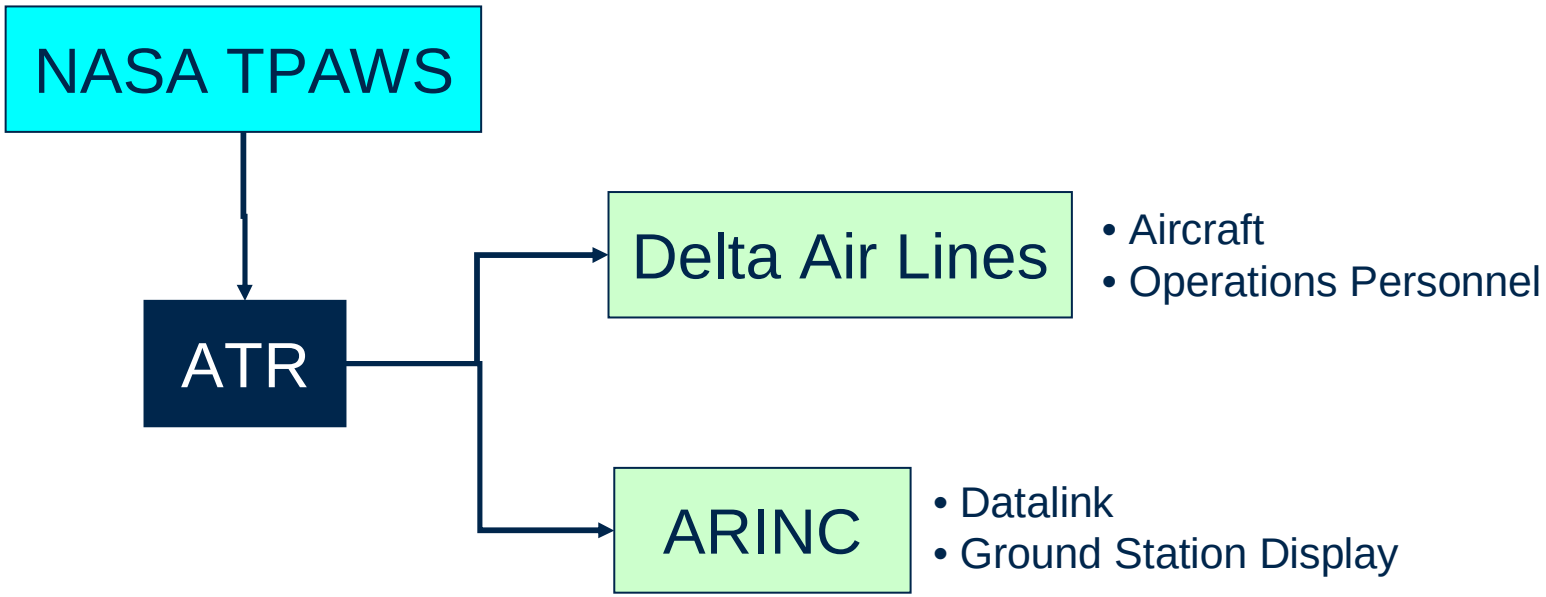
TAPS In-Service Evaluation

- **The goals of this evaluation are:**
  1. **To evaluate the system under realistic operational conditions.**
  2. **To understand the user requirements for the TAPS information.**



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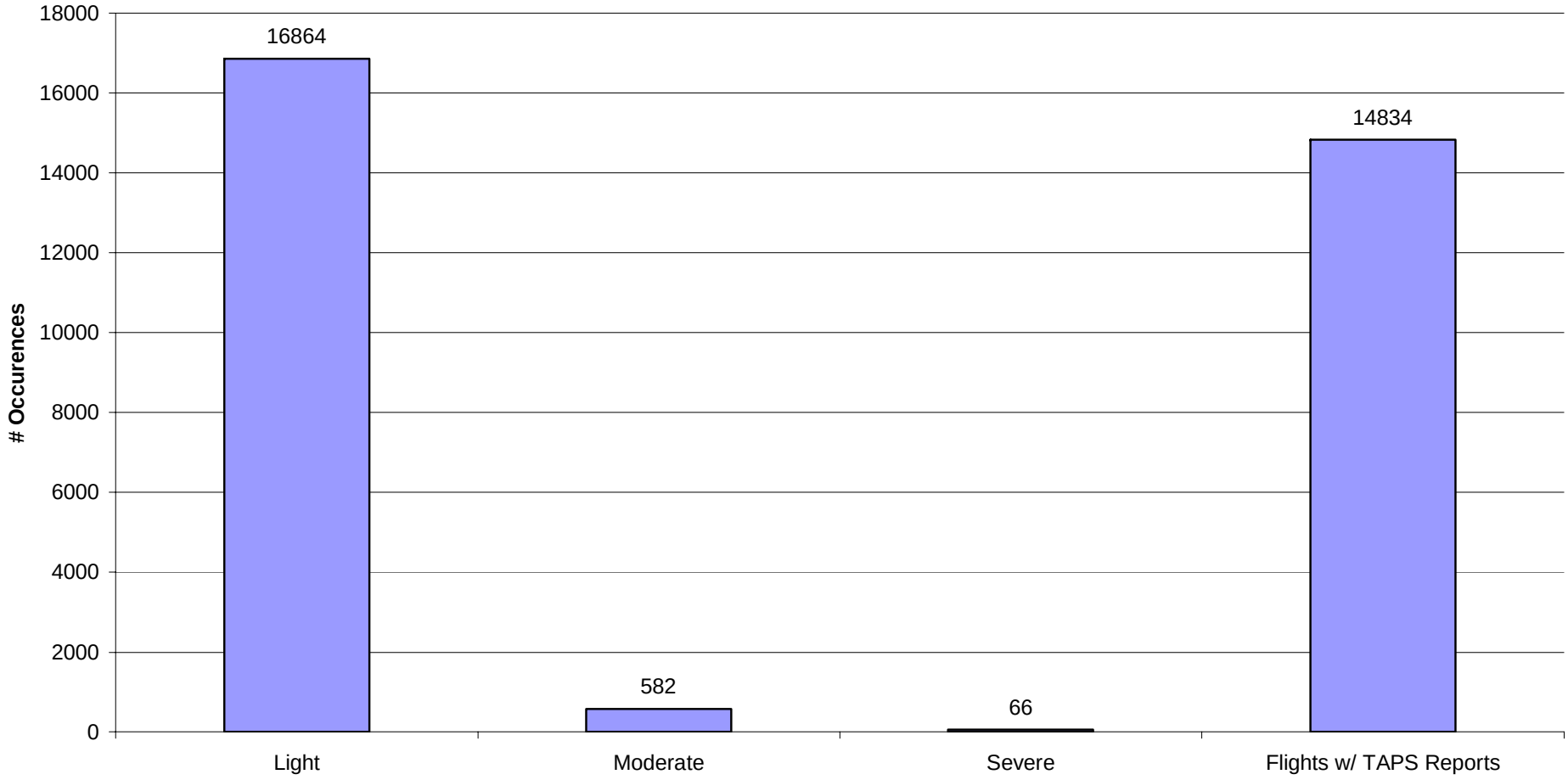
Goal #1: Evaluation Results

- **TAPS Report Analysis**
  - **More than 24,000 reports since Summer 2004**
- **Comparative Analysis**
  - **Under-reporting of turbulence**
  - **Turbulence reporting examination**
  - **Subjectivity of traditional PIREPs**

TAPS Report Analysis

Jun 10, 2004 – May 1, 2005



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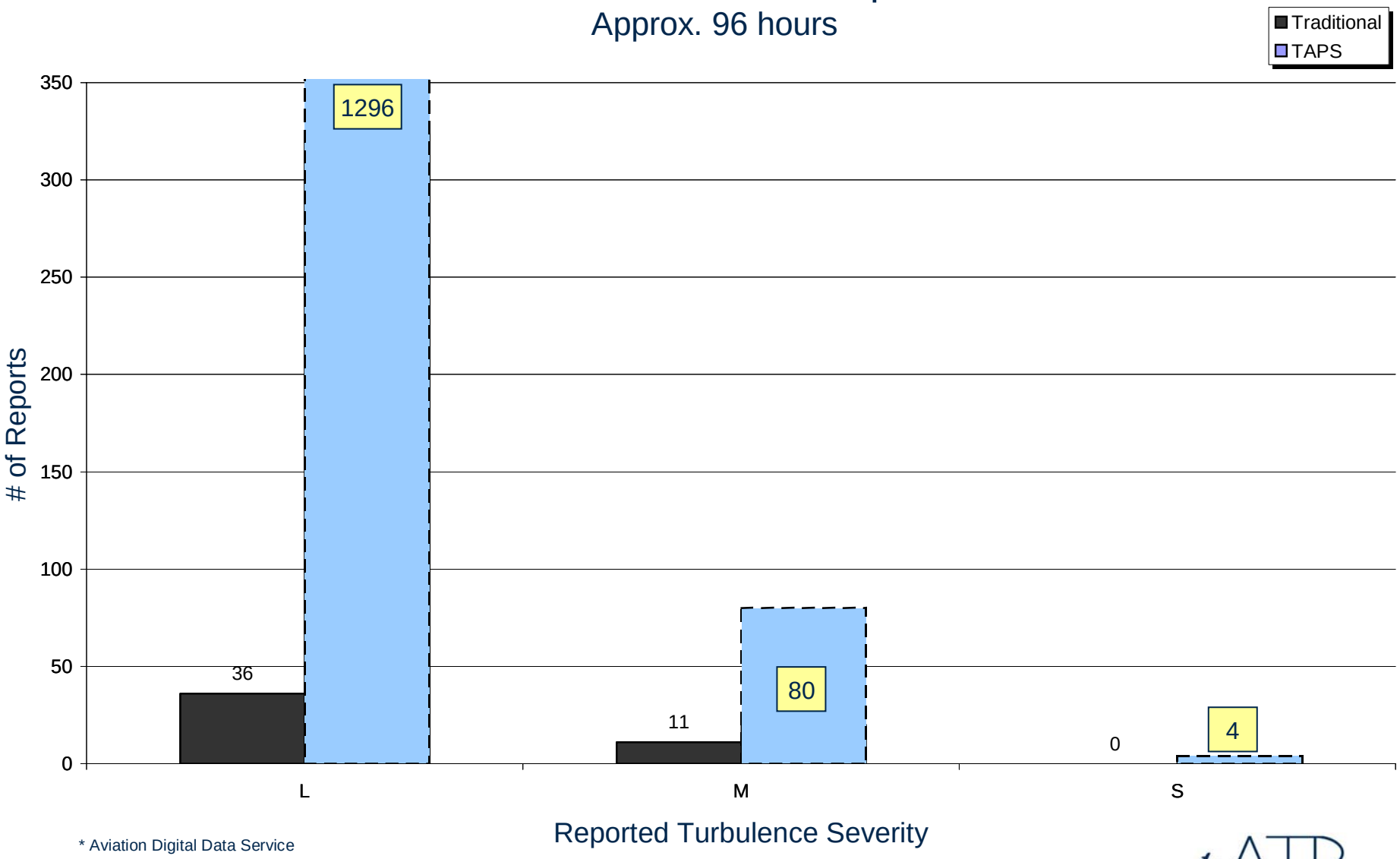
Turbulence Under-Reporting

PIREPs* vs. TAPS Reports

Approx. 96 hours



* Aviation Digital Data Service

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Turbulence Reporting

- **Scarcity of traditional PIREPs.**

- **Near convection or convective regions**
  - Traditional PIREPs usually non-existent
  - When reported, turbulence tends to be underestimated

- **In CAT or unexpected turbulence**
  - Turbulence tends to be overestimated.

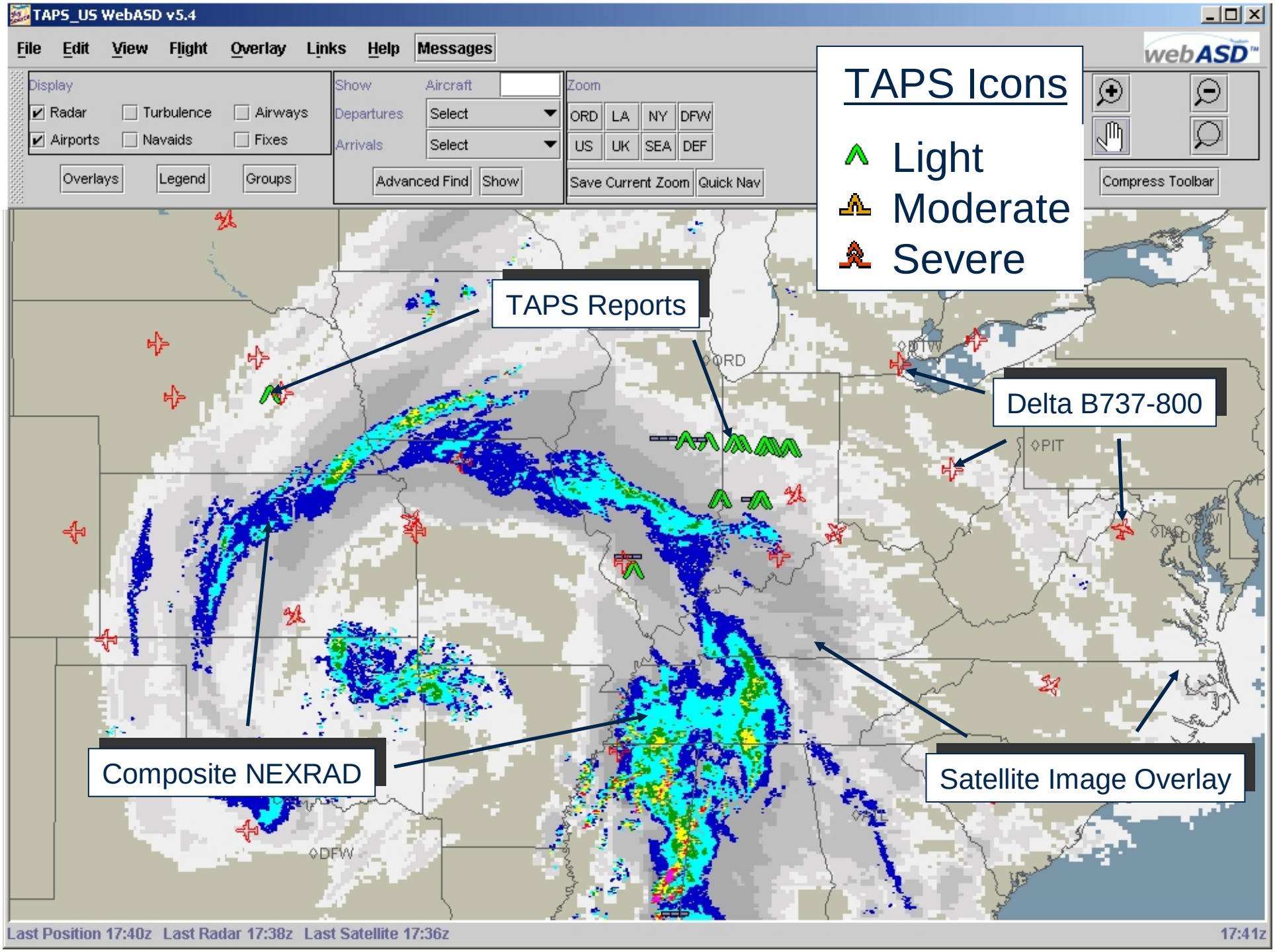
PIREP Subjectivity Analysis

Flight Crew Bulletin (FCB) was issued soliciting feedback on encounters with turbulence that pilots would deem as moderate or greater. Responses from 58 flights have been collected.

PIREP/Feedback	# Flights	Description
Match	16	• Reported turbulence severity agree.
Did Not Match	34	• Reported turbulence severity underestimated • Reported turbulence severity overestimated • PIREP with no TAPS report.
None	8	• TAPS report with no PIREP (near convection) • Turbulence confirmed with follow up conversations with pilot(s)

Goal #2: TAPS Information Usage

Delta User	TAPS Report Information
Flight Safety	• Additional information about aircraft turbulence encounters ✓
Flight Ops/Dispatch	• Enhanced awareness of location and severity of potential turbulence hazards ✓
Maintenance	• Determine necessity of aircraft inspection ✓
Meteorology	• Validate forecast models


TAPS_US WebASD v5.4
File Edit View Flight Overlay Links Help Messages
webASD
Display
Radar Turbulence Airways
Airports Navaids Fixes
Overlays Legend Groups
Show Aircraft
Departures Select
Arrivals Select
Advanced Find Show
Zoom
ORD LA NY DFW
US UK SEA DEF
Save Current Zoom Quick Nav
Compress Toolbar
TAPS Icons
Light
Moderate
Severe
TAPS Reports
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Last Position 17:40z Last Radar 17:38z Last Satellite 17:36z
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Summary

In-Service Evaluation of TAPS

- Provided insight into the system under realistic operational conditions
- Better understanding of the methodology of turbulence reporting
- Relevance of TAPS information to multiple users within the airline
- Demonstrated how TAPS is already being used as an additional source of turbulence information

The Next Step!

- **Install TAPS algorithms on additional aircraft types**
  - **Increase density of TAPS report information available**
  - **Access to turbulence information in different geographical regions**

- **Cockpit Display Development**
  - **CONOPS and Requirements for the display**