Delta Flight Weather Viewer

A Path Forward

Wright Brother PIREPS

- PIREPS are subjective in nature
  - What is “light” for one pilot may be “moderate” for another
  - Pilot tolerance for turbulence varies with phase of flight
- PIREP thresholds are aircraft dependent
  - “Light” for a large aircraft could be “moderate” or even “severe” for smaller planes
- Due to various reasons, turbulence PIREPs are often inaccurate in space and time:
  - A 2012 study by NCAR found*:
    1. PIREPS, on average, have distance errors of 35-45 km
    2. Average PIREP timing errors can be large especially with airline position reports

**Pearson, J. and Sharman, R., 2013: “Calibration of in situ eddy dissipation rate (EDR) severity thresholds based on comparisons to turbulence pilot reports (PIREPs)”, presentation at 93rd American Meteorological Society Annual Meeting, 16th Conference on Aviation, Range, and Aerospace Meteorology, Austin, Texas.*

Automated Turbulence Reporting

- Development began in 1990s under FAA's Aviation Weather Research Program (AWRP)
- Software uses existing sensors and avionics to derive a measure of the turbulent state of the atmosphere
- Aircraft independent, not a direct measurement of g-loads
- Provides atmospheric turbulence metric similar to sea state
- International Civil Aviation Organization (ICAO) standard for turbulence reporting
- Alternative metrics are being used (RTCA standards work)

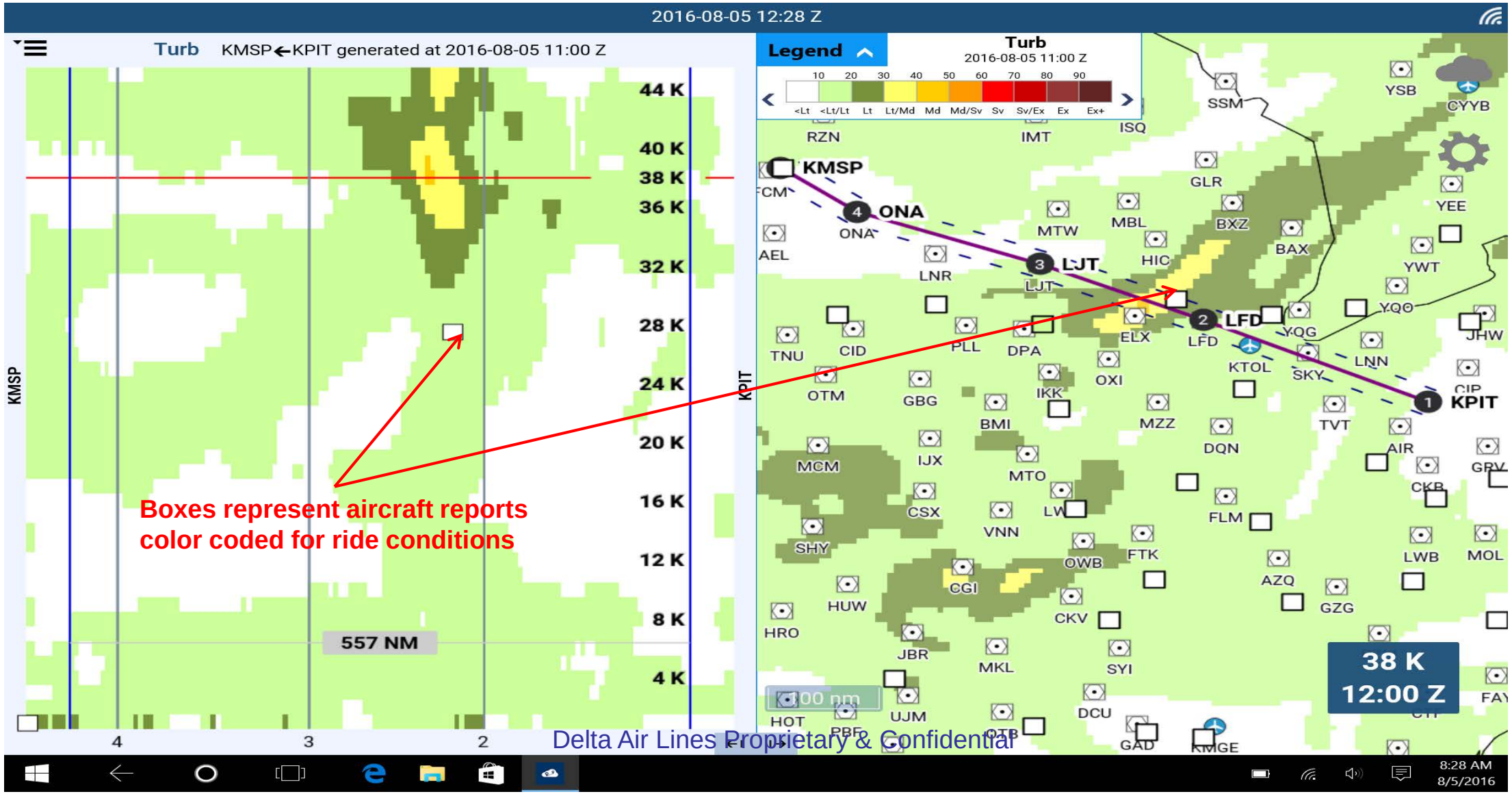
Delta's Flight Weather Viewer

- 12,000+ DAL pilots receiving live data through Gogo WiFi network – Q1 2016
- Depicts graphical views of forecast and actual turbulence reports along route of flight
- Greatly enhances cockpit situational awareness- "Manage the Cabin"
  - Enhances pilot's ability to anticipate and react to possible turbulent conditions
  - Better decisions based on not only cabin safety, but ride comfort and fuel-burn efficiency
- Reduction in ATC workload
  - Less requests for altitude changes
  - Improved NAS capacity
- Very well received

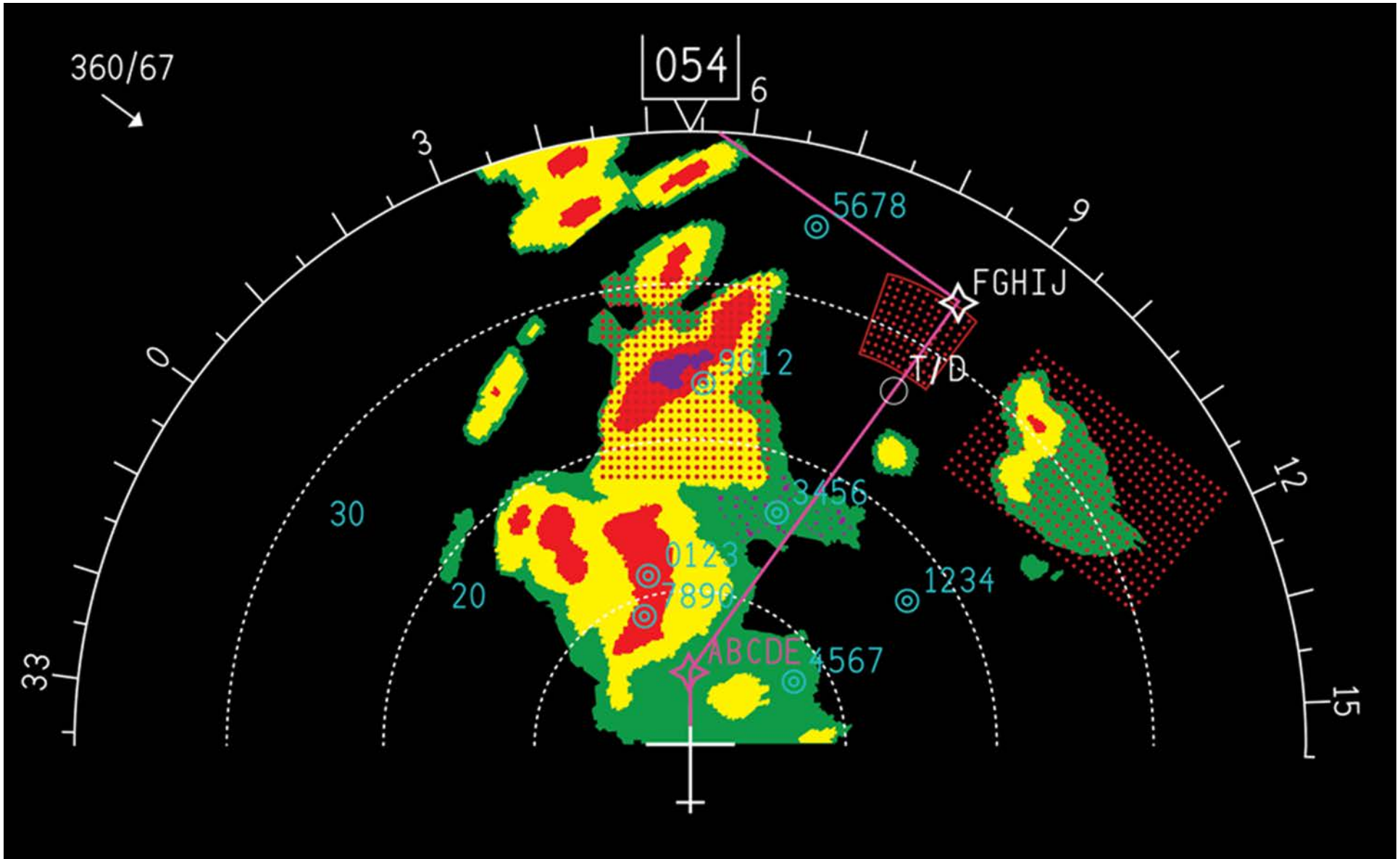
Delta Flight Weather Viewer

- **Available in-flight with Gogo Crew Channel**
- **Allows route entry**
- **Provides turbulence forecast + real-time data**

Reports Validate Forecast

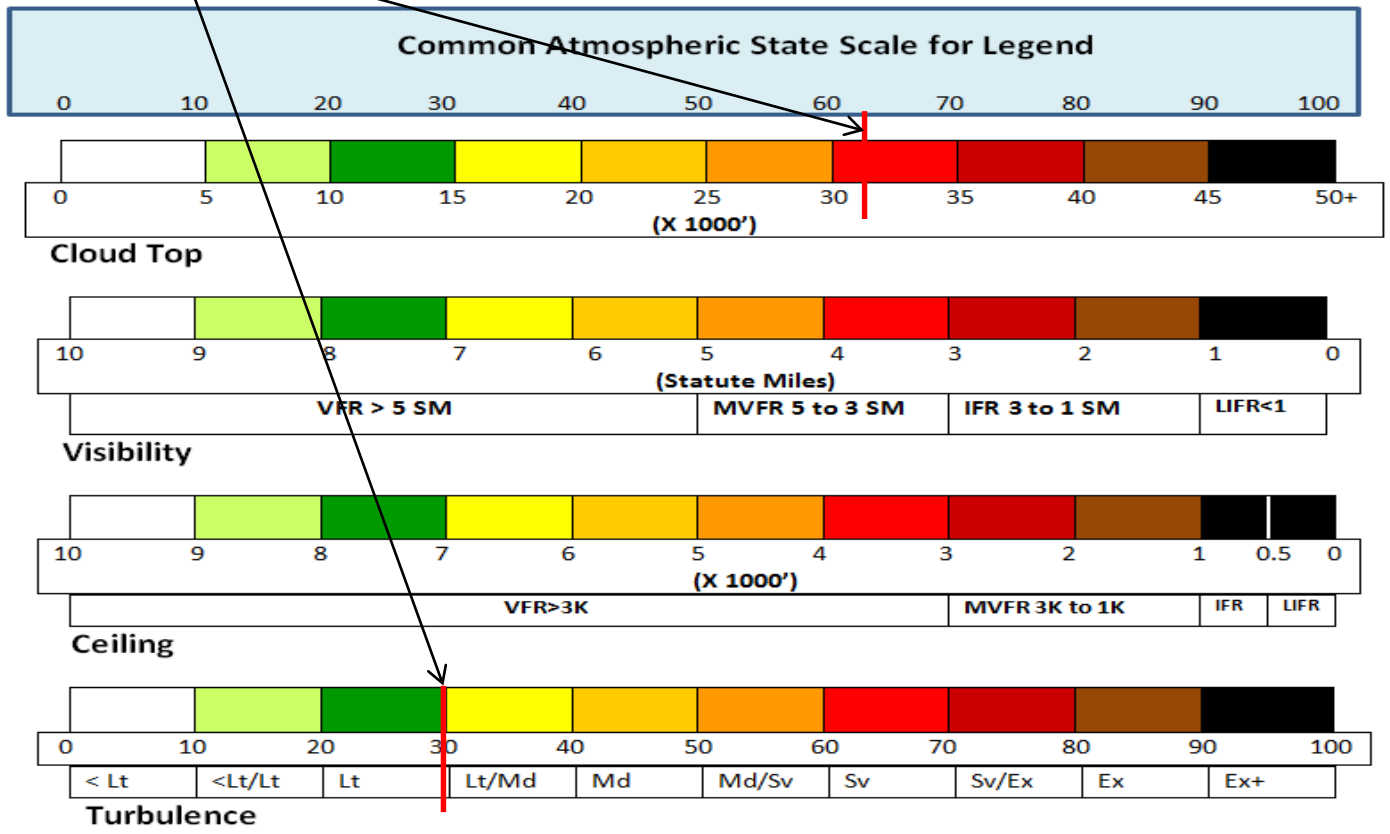


Producer (Storm Reflectivity) vs. Threat
New Sensors Constantly Evolving

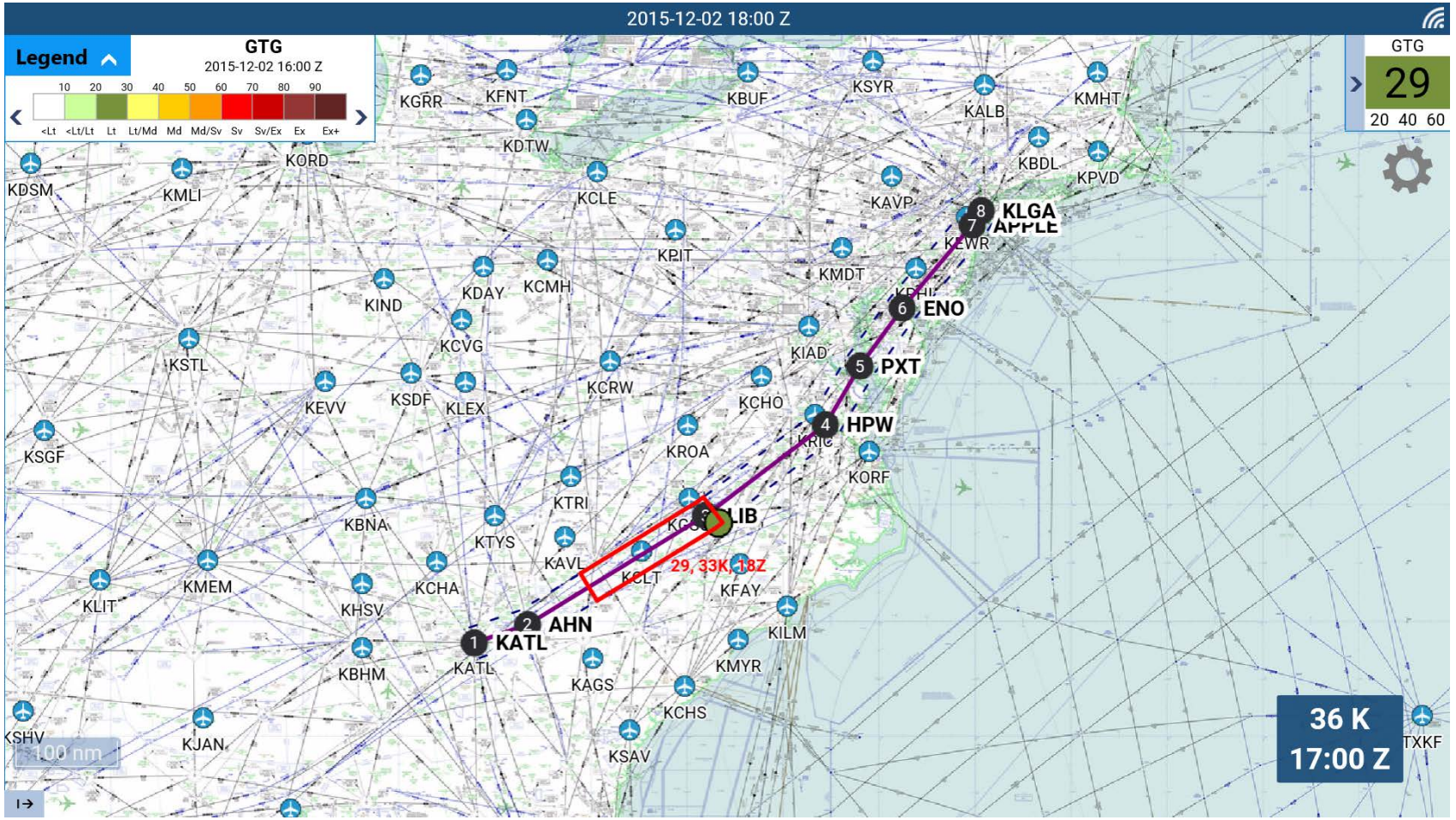


Standardized Presentation of Threats with Alert Thresholds

Key enabler: User defined thresholds which drive operational decisions.



Notification system for Quiet Dark Cockpit



Lessons Learned for Weather Integration

- Pilots are not meteorologists
- Weather compilation is not intuitive
- Information overload is common
- New technologies can work and are cost effective
- Weather viewer launched with turbulence as building block for overall hazard deployment
- Outstanding Feedback from Crews – “GAME CHANGER”

Future Challenges

- Under FAA funding, NCAR is developing a Technical Transfer package that will allow all users to more readily implement standardized EDR reporting.
  - The Package comprises both onboard data processing software and ground-based software to provide tuning and verification
  - Testing is being done in collaboration with Delta Airlines and Boeing