Global Weather Notification

A real-time, ground-based, weather notification system for pilots

Developed at NCAR as part of the FAA's Weather Technology in the Cockpit (WTIC) Program

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Global Weather Notification System

- Attempts to anticipate whether aircraft will encounter or be in close proximity to predicted or observed adverse weather conditions.
- Projects each aircraft's position forward in time (based on the aircraft’s flight plan, speed and heading) and calculate a qualitative categorical severity (examples: ‘light’, ‘moderate’, ‘severe’), based on a given weather grid and parameterized thresholds, along the aircraft’s path.
- Runs on the ground ensuring that a large number of aircraft can be processed in a timely manner frequently and large weather grids are not a strain for cockpit bandwidth
- Creates a notification that is designed to give pilots a quick “heads up” message that allows them to seek out additional information, such as an updated weather map or ensuring seat belts are fully fastened for passengers, and is not to replace In-Flight Weather Advisories from official sources.

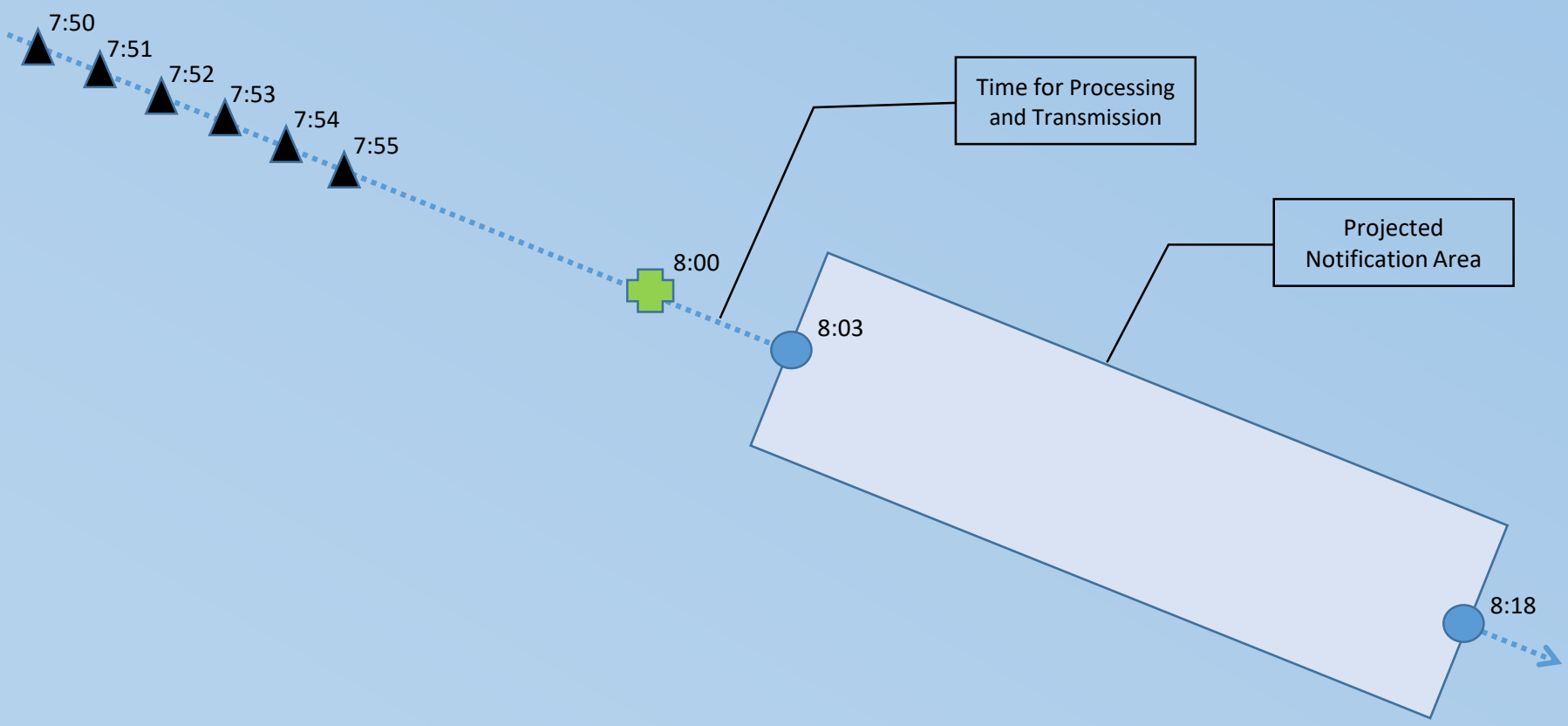
Tactical Turbulence Project

- Developed a method for presenting frequently updated turbulence information to the cockpit
- Developed the system for frequently updating turbulence information
- Demonstrated the feasibility to implement real-time notifications with the necessary latency to the cockpit.

Global Weather Project

- Evaluated running the Tactical Turbulence algorithm in the oceanic region.
- Modified the system for effectiveness and accuracy in oceanic regions and tuned for CTH/CDO based on prior ROMIO evaluations.
- Developed documentation and technology transfer package
- (No longer only for Turbulence, thus new name needed)

Notification Schematic

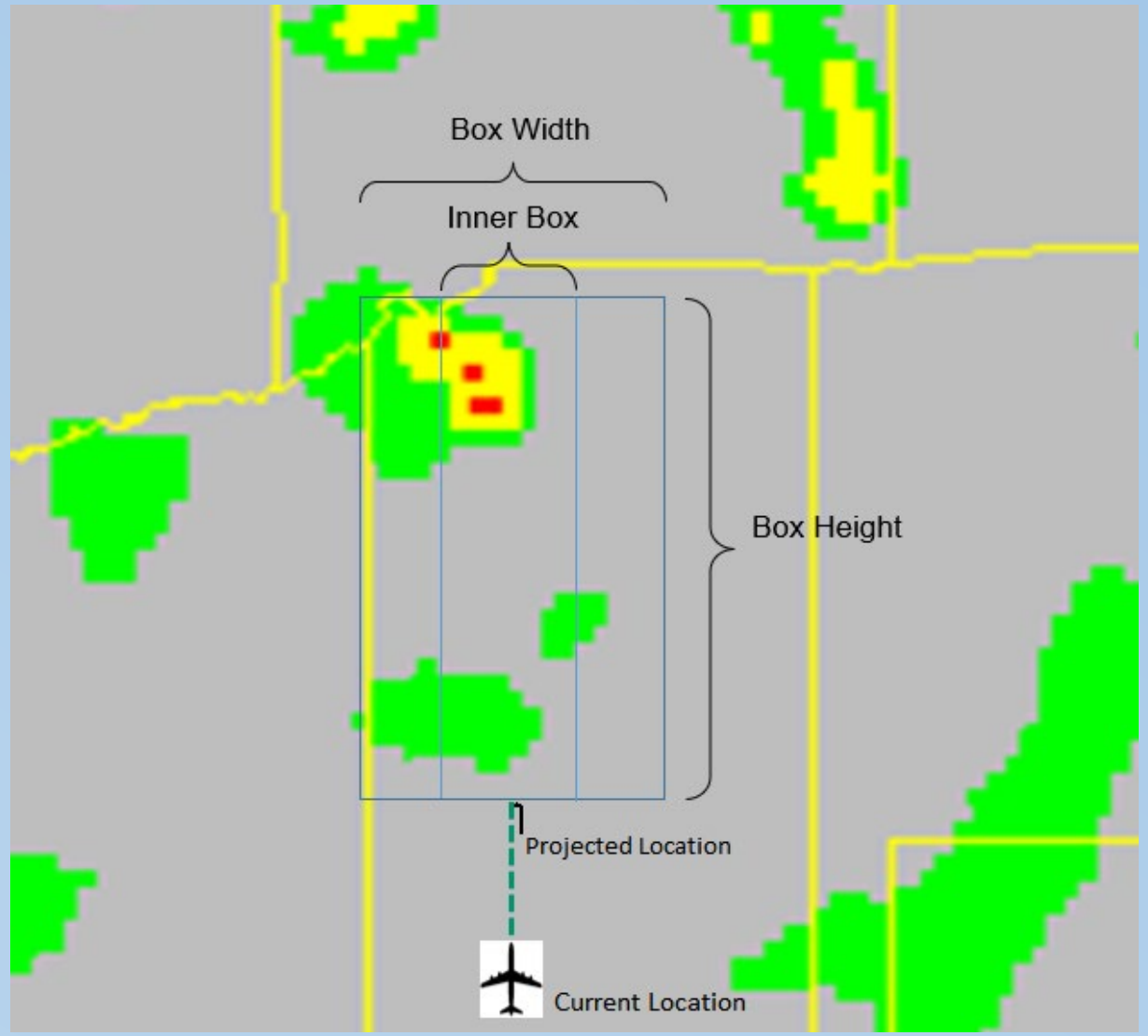


Current Time When Notification is Triggered

Reported Aircraft Position

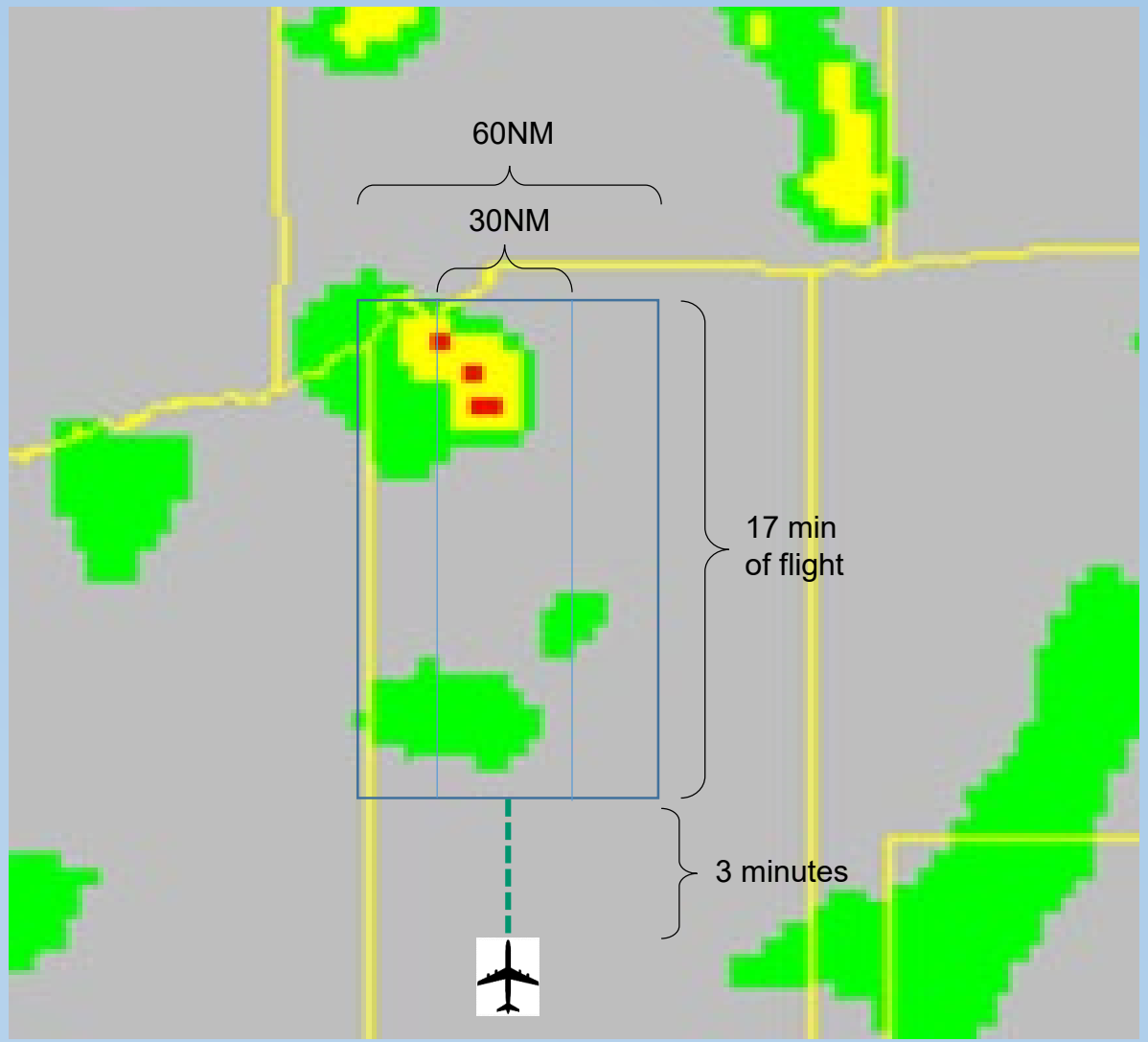
Projected Aircraft Position

Determination of the notification



Determination of the notification

Calculate number of GTGN pixels in box(s) to determine notification type



Types:
NULL
Light
Moderate
Severe

Logic for Position Projection and Notification

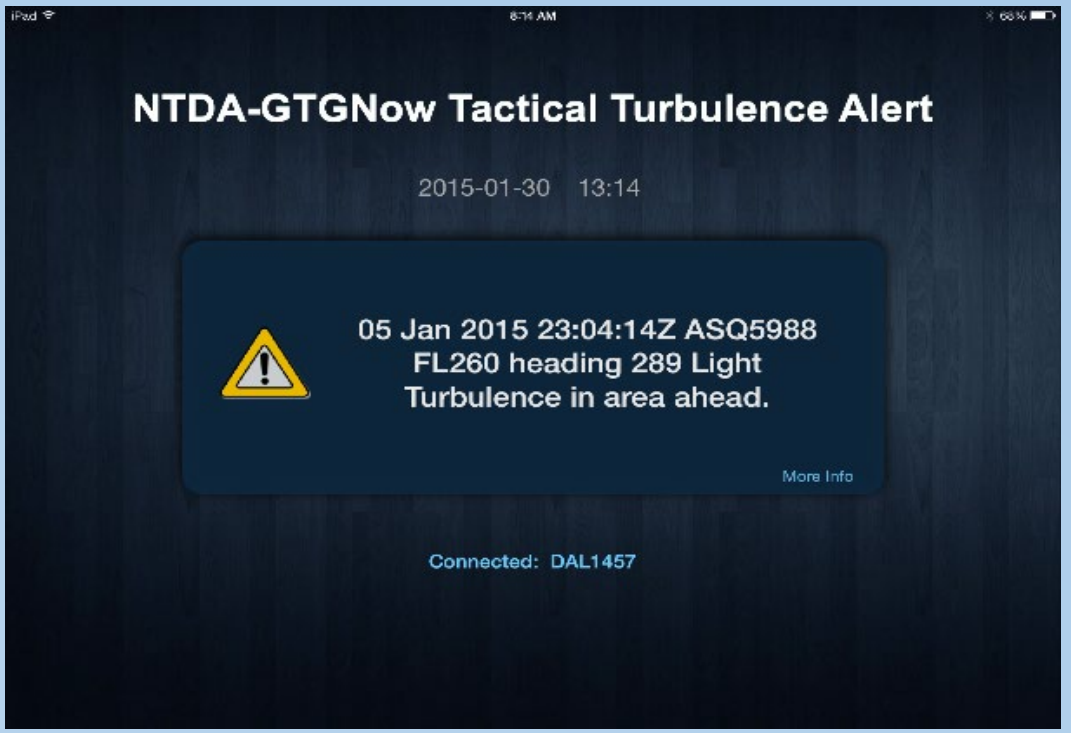
- Gathers all aircraft that have a position report within 3 minutes.
  - Aircraft below minimum altitude (20kft) are skipped.
  - Find a valid departure message to obtain the Departure and Destination airports.
    - No Departure message use simple heading/speed projection.
  - Aircraft within 50nm of departure and 100nm of destination are skipped.
  - Find the most recent route for flight with Departure and Destination airports, eliminates future and past flights with same callsign.
    - No route available use simple heading/speed projection.
  - Aircraft must be within 10nm of route to be considered valid.
    - Aircraft off route use simple heading/speed projection.
  - Using most recent position and valid route, project the aircraft forward along the route 3 minutes into future.
  - Using projected position and valid route create a box 30nm wide (15 to either side of route) and 17 minutes long (using aircraft speed).
  - Gather turbulence information within box and create a NULL, Light, Moderate or Severe notification text.

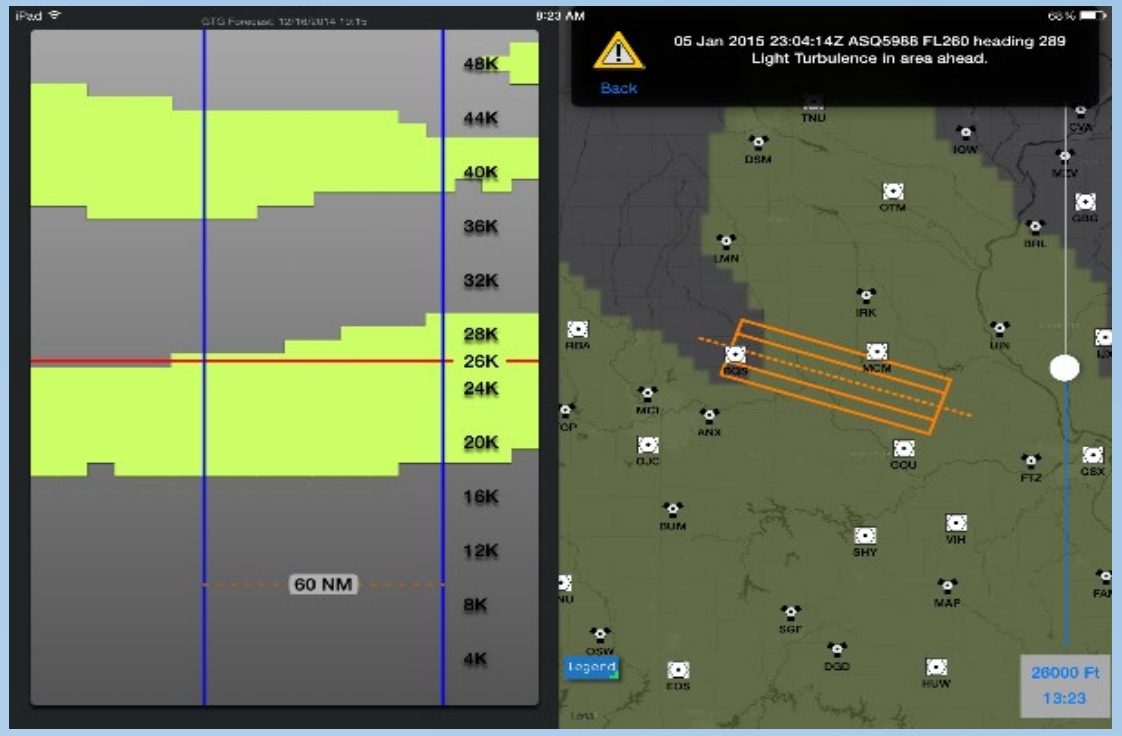
Human Over The Loop Demos (HOTL)

The purposes of the HOTL uplink using the FAA NIEC RCS included:

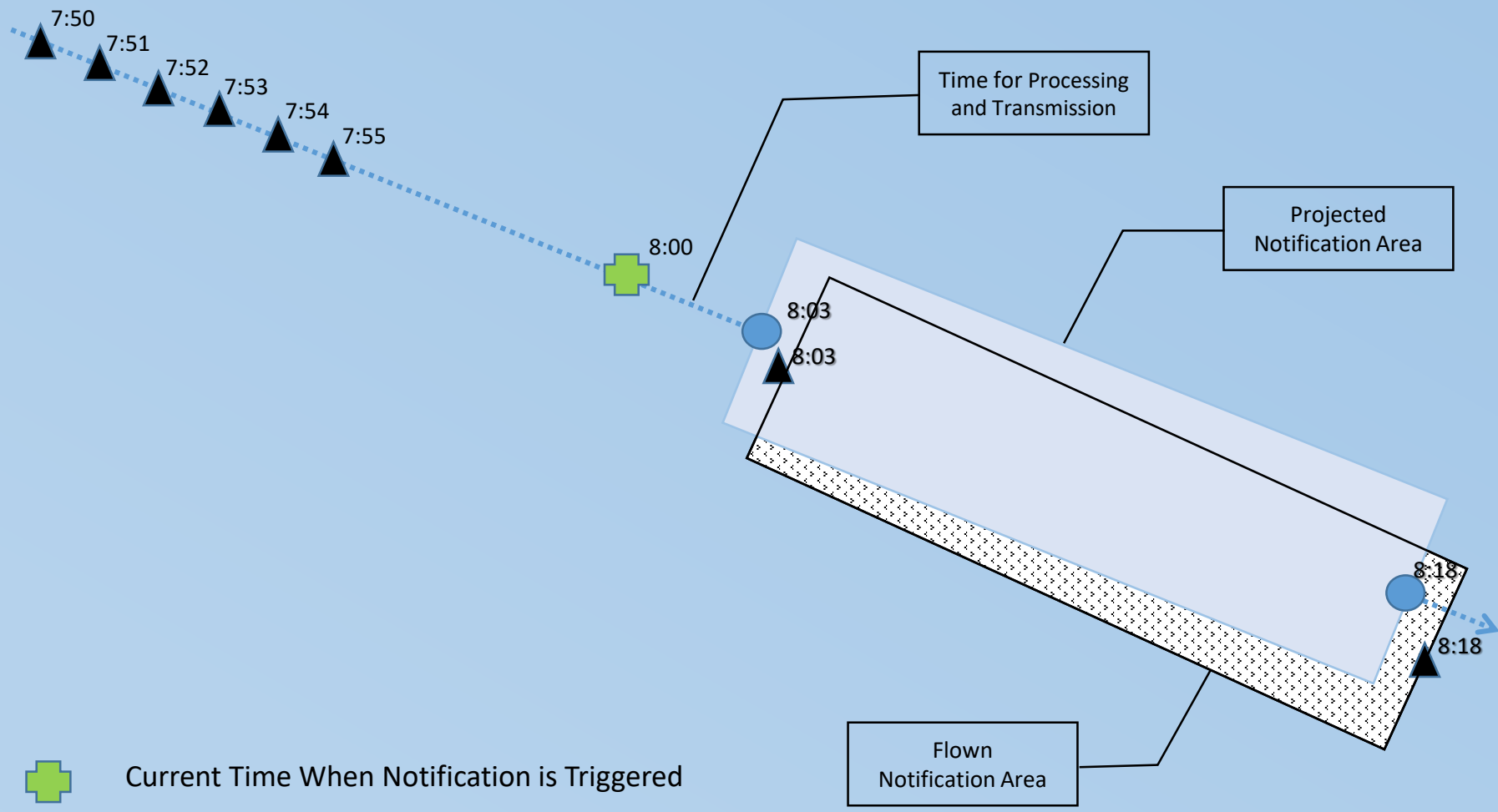
- Identifying flight risks (if any) associated with providing frequently updated turbulence information to the pilots.
- Increasing our understanding of impacts to pilot, dispatch, and air traffic management (ATM) decision making in a collaborative environment when frequently updated turbulence information is provided to the flight deck.
- Identifying demonstration objectives that are best accomplished with an expanded demonstration of frequently uplinked turbulence information to operational airline flights.
- Validating and demonstrating the use of a connection similar to Aircraft Access to System-wide Information Management (SWIM) (AAtS) connection, and data link formats in the turbulence notification role.
- Developing a better understanding of turbulence notification latency requirements, and the ability of AAtS to satisfy them.

HOTL Demonstration Display





Projected vs. Flown Notification Arenas



Turbulence severity from system Vs turbulence severity from actual flown area

Overall

Projected Notification Classification

	NULL	LIGHT	MOD	SEVERE
NULL	17803	317	309	78
LIGHT	176	3538	210	32
MOD	211	132	4424	312
SEVERE	38	15	171	1590

Actual Notification Classification

False Positives

Missed

Turbulence severity from system Vs turbulence severity from actual flown area

Overall

Projected Notification Classification

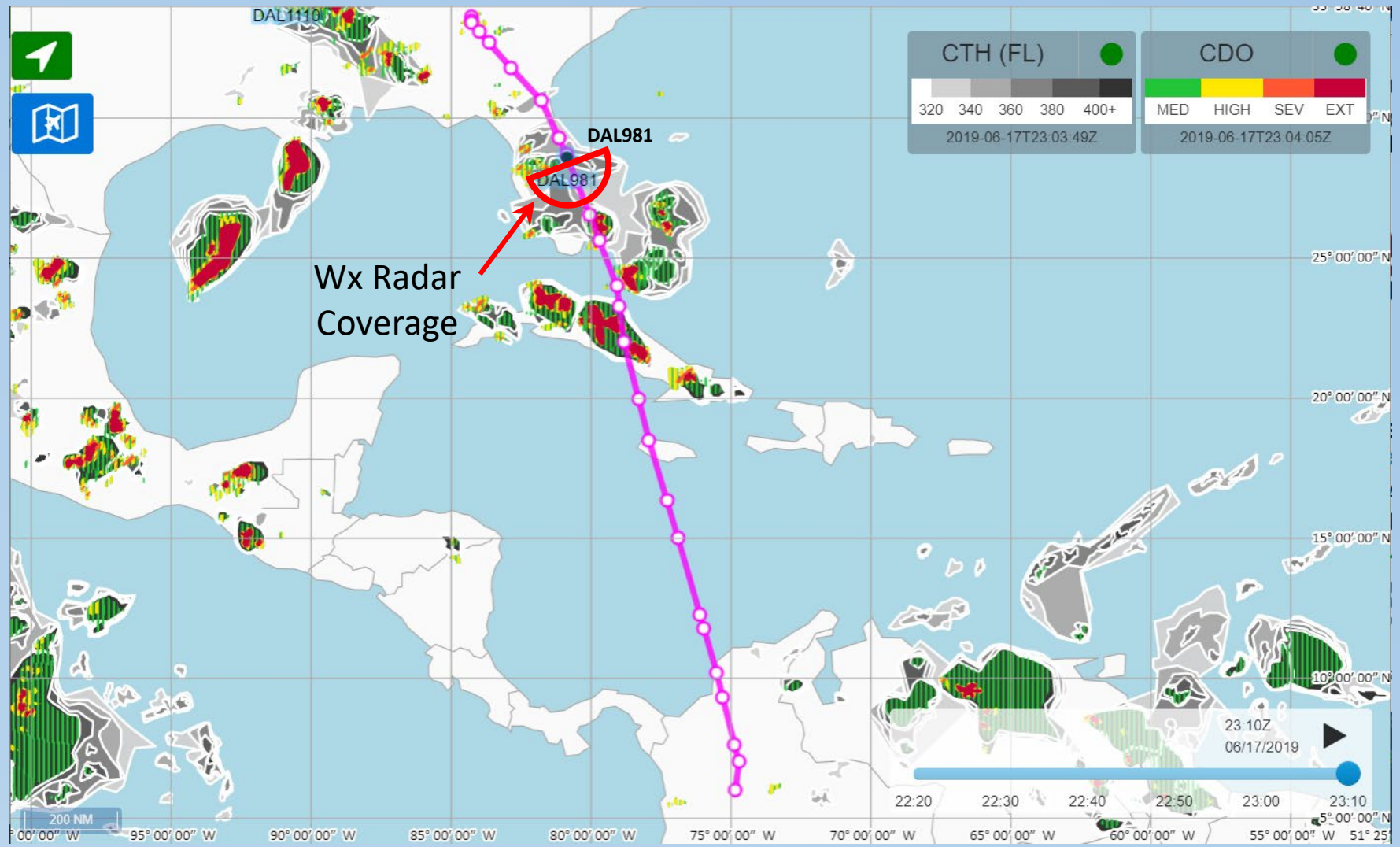
	NULL	LIGHT	MOD	SEVERE
NULL	96.2	1.7	1.7	0.4
LIGHT	4.5	89.4	5.3	0.8
MOD	4.2	2.6	87.1	6.1
SEVERE	2.1	0.8	9.4	87.7

Actual Notification Classification

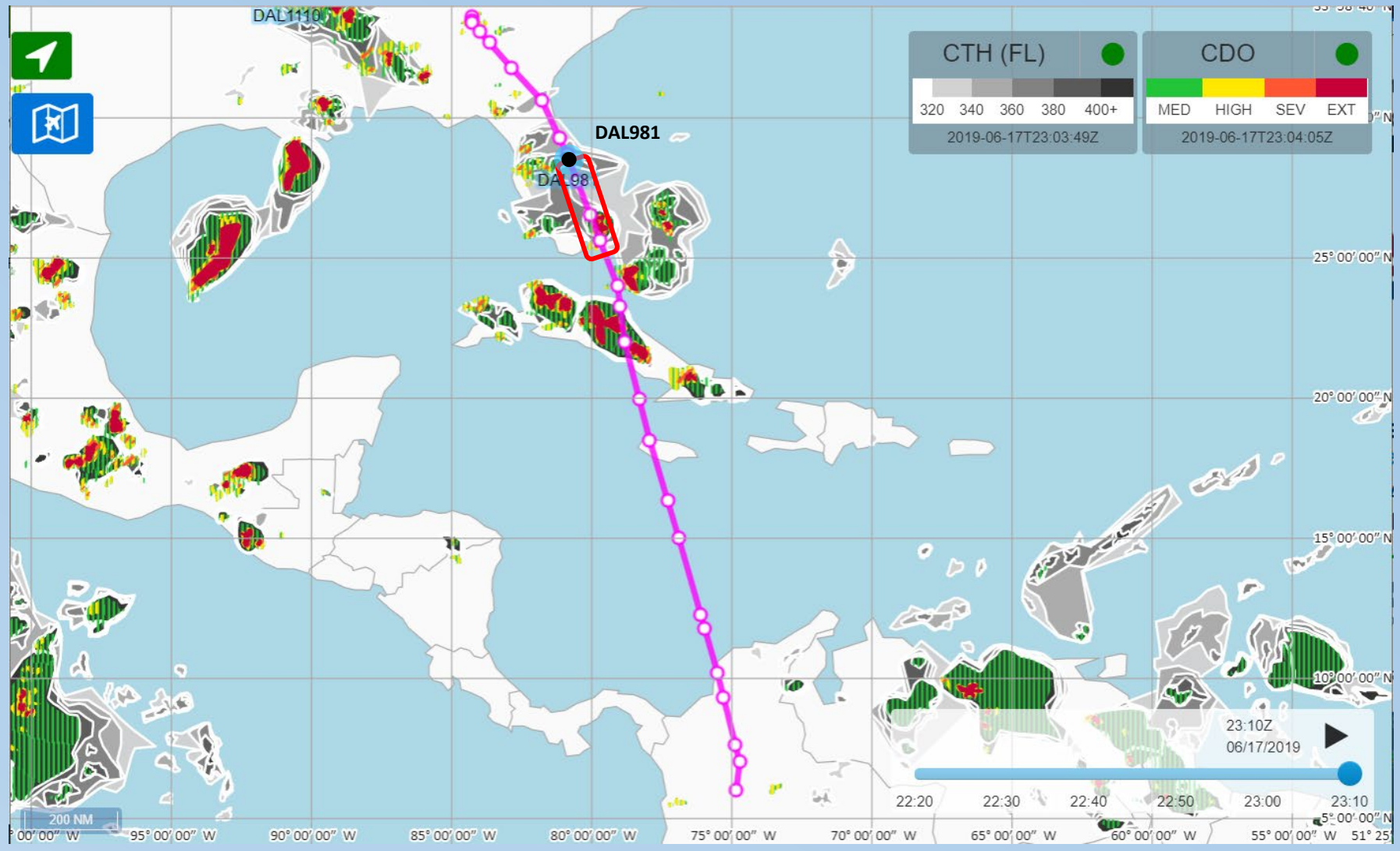
False Positives

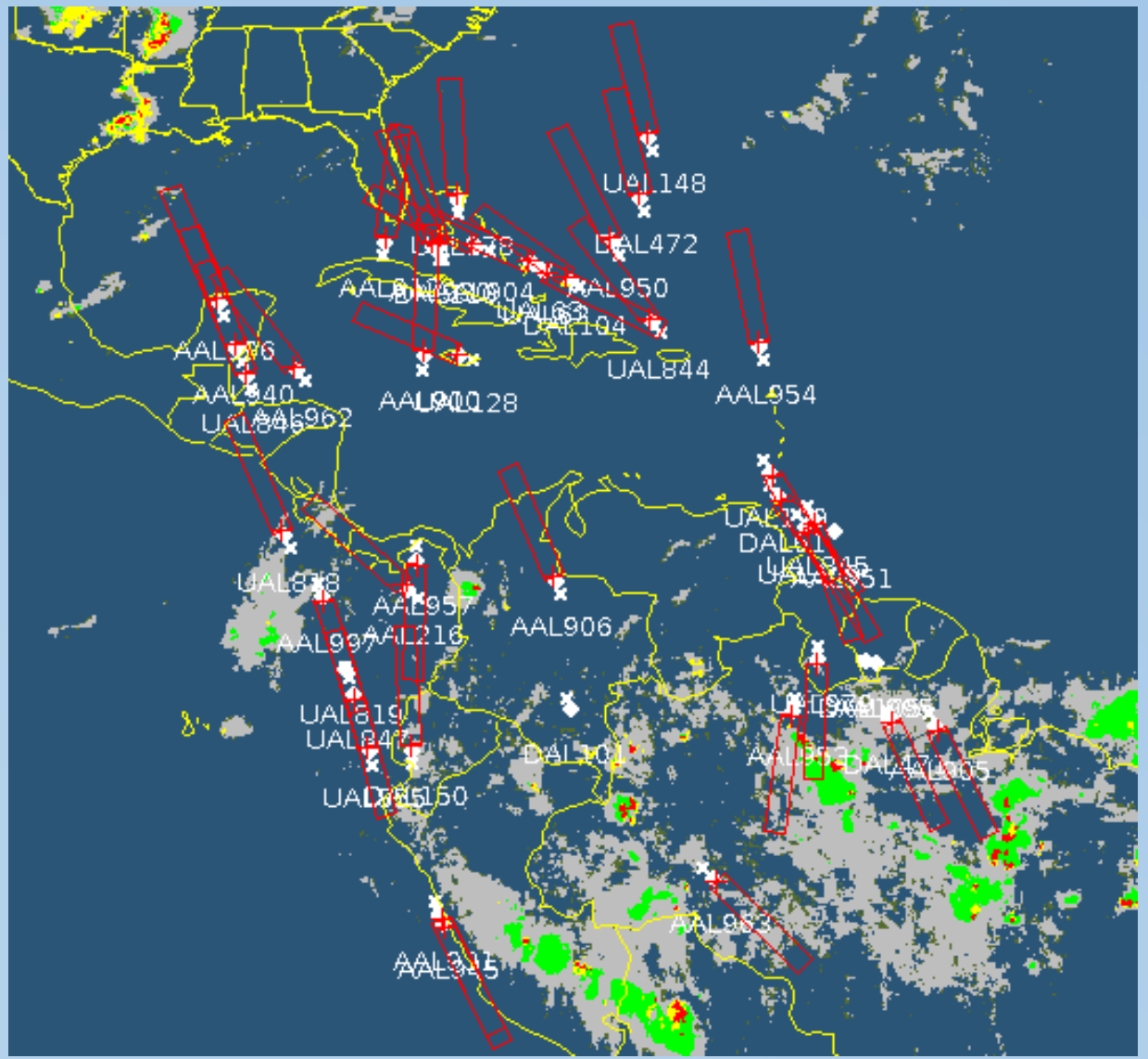
Missed

Onboard Radar look-ahead horizon 20min (~160nm)



Projection window 32min (~240nm) and 60nm wide



17 Jun 2019 23:02Z DAL981 FL328 heading 159, Moderate Convection ahead at 27.33 -80.82, Cloud Top Height at FL358.

GlobalWeatherNote running with CTH/CDO