Future of Weather Capabilities in General Aviation Avionics

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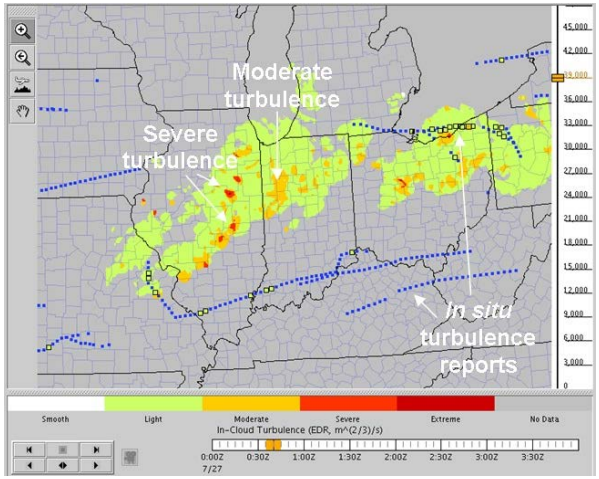
- In the last several years “strategic weather” information in the form of Nexrad has been brought to all levels part 91 General Aviation
- With the widespread adoption of ADS-B weather, glass displays and the iPad, there is really no reason why every General Aviation pilot should not have access to NexRad weather, traffic and terrain data
- The missing link for many General Aviation pilots is the lack of reliable turbulence data
- But do we really know what to do with all that we are looking at?

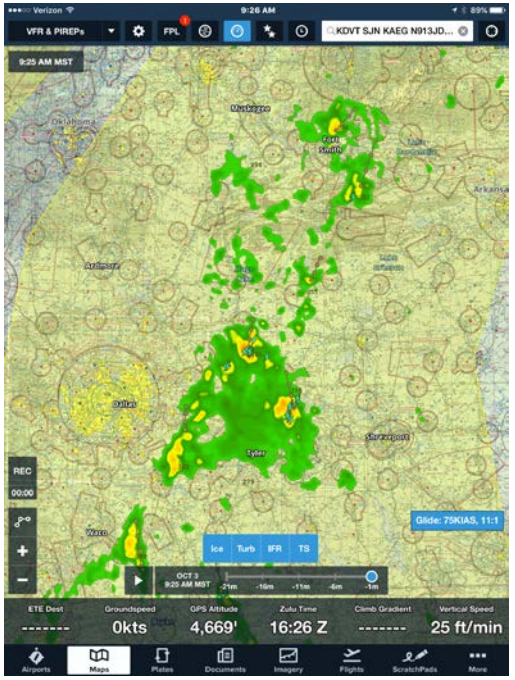


What Does This All Mean?

- It is clear that we are at the early stages weather availability to the General Aviation Pilot
- With the widespread availability on many different display devices the pilot is faced with a multitude of information that is presented to the pilot in many different forms and formats
  - This is only going to increase with the advancement of low cost data communications
- For those that use XM and ADS-B the differences can get even more confusing

What Does This All Mean?

- With the advent of the glass display and iPad in the cockpit and the wide range of applications available what you see on the display is not always consistent with what you see on an iPad or for that matter out the window!
  - This can and will lead to unfortunate misinterpretations and potential tragedies



Driving factors for Display of weather in General Aviation Aircraft

- Key Technology Drivers
  - Communication pipeline and availability of timely data
  - A flexible medium to present the data
  - Tactical and strategic decision making algorithms integrated into the Air Traffic Control (ATC) system
    - Weather, turbulence, terrain and traffic
- Training
  - How do you read the data and what do you do with it?
  - Need for recurrent training to stay abreast of weather technologies

Communication Pipeline and Availability of Data

- Satellite
  - XM is still very reliable remains as the most weather products available
  - The general aviation pilot can not afford expensive satellite installations so much of this out of reach for the lower end General Aviation pilot
- Weather Radar
  - Still the only real source of real-time local “tactical weather” information
- ADS-B Connectivity
  - Transponders and portable devices are giving unprecedented access to weather data
- Airborne Wi-Fi
  - This has the most promise for the future. With many including Google, Facebook and others looking to put Wi-Fi hot spots on balloons and drones this could make access to the internet and incredible weather resources a common place thing

Flexible Medium for Displaying Weather

- Tablet technology in our daily lives has created an expectation of data and application immediacy and choice
- The availability of weather information on the internet and tablet applications has made people very aware of digital weather presentations
- The issue arises when you transition from a strategic view of weather to a tactical view of weather in a cockpit where the room for error tightens and the stress of decision making increases
  - Differences in how each source represents the data digitally can create indecisiveness or a sense of over confidence if the pilot does not truly understand what they are looking at
  - Time lag of ADS-B and XM weather is well documented but still concerning as the digital display of any data often times creates a sense of comfort to settle in when looking at the displays

Flexible Medium for Displaying Weather

- Ipads vs Primary Displays…... Or Both?
- Primary Displays
  - Direct view in front of the pilot make it easy to incoprrporate into the pilots normal scan
  - Integrated with traffic (ADS-B) and terrain data in normal scan increases awareness in mountainous areas
  - Especially important in high stress IMC conditions
- Ipad
  - Flexible display and wide range of applications
  - Able to take advantage of the latest low cost weather applications

Tactical and strategic decision making algorithms

- The next phase of evolution of weather in the cockpit will be the development and integration algorithms to provide the pilot with options in real time
- We now have a lot of data available to the pilot and the need for assimilating the data into decision-making form
- We already see some of this in cycling of weather radar over a period of time to predict the next 30 minutes
- What we need is the next generation of this to not only use radar, but to use updated in real time based on past data and forecast data and present a set of options to the pilot

Importance of Training

- Training can never be enough when it comes to being a pilot
- Each pilot flies with their own minimums
  - Additional weather, traffic and some day turbulence information available to the pilot will naturally create a sense of confidence and potential lowering a pilot's minimums that they are willing to fly in, especially when flying around weather.
- With the proliferation of weather data available on so many sources it is unlikely that we will see standardization in the presentation of weather and therefore it is almost impossible to create any one training course to address all of the variations
- It becomes incumbent on the pilot to seek out the specific training on the specific resources that they need
- But is this enough?

Approach to Weather Training

- Establishment of the key weather vocabulary with definitions is imperative to establish a basis of training

- Once those are known with the same level of understanding as a pilot has about why a plane flies will create a basic level of information that each weather application can publish

- Understand what the key pieces of data are will allow training to be focused on how to use the data instead of so much effort on how to use a particular application

What does the Future Look Like

- Real time exchange of tactical weather information digitized for all to use including ATC
- Weather and turbulence algorithms that provide better short term forecasting integrated with actual conditions along a route for advanced planning before a pilot gets into trouble
- Integration of tablet devices and their application into the installed avionics
- Standardized basic weather products supplemented by specialized applications based on an individuals mission and capability

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