Weather Technology in the Cockpit (WTIC) Program—Program Update

Friends/Partners of Aviation Weather (FPAW)

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Presented by

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WTIC Program Overview

- Portfolio of research projects to develop, verify, and validate requirements recommendations to incorporate into Minimum Weather Service (MinWxSvc) standards and guidance documents
- We define MinWxSvc as:
  - Minimum cockpit meteorological (MET) information
  - Minimum performance standards/characteristics of the MET information
  - Minimum information rendering standards
  - Enhanced MET training

WTIC Program Objectives

- Enhance General Aviation (GA) safety by identifying and resolving risks before they become accidents
- Incorporate MinWxSvc recommendations into standards and other guidance documents
  - Enables NextGen operations and benefits, and pilot roles
- Resolve operational (current and NextGen) inefficiencies associated with adverse weather
- Enhance pilot MET-training to enable effective and consistent adverse weather decision-making

WTIC is not building cockpit applications so outreach to industry is necessary for implementing MinWxSvc(s).

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WTIC Program Overview

- MinWxSvc Recommendation Template
  - Detail operational shortfall and associated MET information gap(s)
  - Identify key stakeholders for recommendation (industry, consumers/users, standards writers, guidance and publication writers, etc)
  - Provide clear and compelling case for the recommendation
    - Benefits can only be realized by stakeholder actions
  - Include sufficient detail for stakeholder use/implementation
  - Include summary of overall research process and results, and references to associate reports with brief descriptions

WTIC Program Overview – Current Projects

- GA Pilot Training
  - MET exam test question development and pilot weather knowledge
  - Weather Information Latency Demonstrator (WILD)
  - Immersive (skills based) training programs
- Adverse Weather Notifications (GA and Part 121)
  - Tactical Turbulence Notification
  - Notification rendering
  - Eddy Dissipation Rate (EDR) Uplink – Tech Transfer
  - Active Reminder (convection and visibility)
- Uncertainty Information (GA and Part 121)
  - **Time stamping**
  - Cockpit applications and benefit assessments

WTIC Program Overview – Current Projects

- Wind Accuracy and Applications (Part 121)
- **Oceanic Demonstration (Part 121)**
  - **Cloud Top Height Product (CTH)**
  - **Convective Diagnosis Oceanic (CDO)**
  - Shortfall analyses and magnitude assessment
- Predicting Pilot Behavior Near Convection (Part 121)
  - Classifier development, refinement, and assessment
- **Crowd Sourcing and Cloud Technology Applications**
  - **Visibility**
  - Forward Looking Radar
  - **Forecasting**
- RTCA Support, (RTCA SC-206)
- Mobile MET Application

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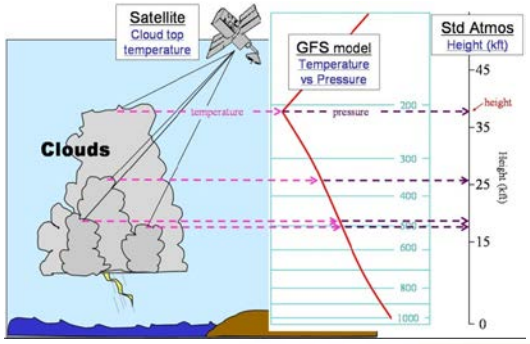
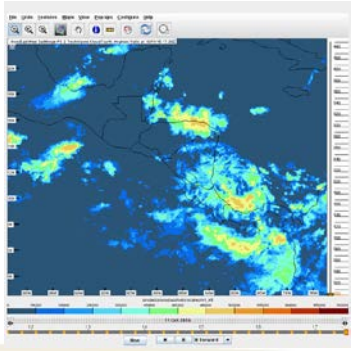
WTIC Project Overview – Oceanic Demonstration

- Perform operational demonstration with commercial airlines of Cloud Top Height (CTH) product and Convective Diagnosis Oceanic (CDO)
- Benefits analysis of providing CTH and CDO
  - Identify pilot decisions that can be improved by these products
  - Impacts on deviation requests
  - Impacts on operational safety and efficiency
  - Impacts on communications with dispatch and ATC





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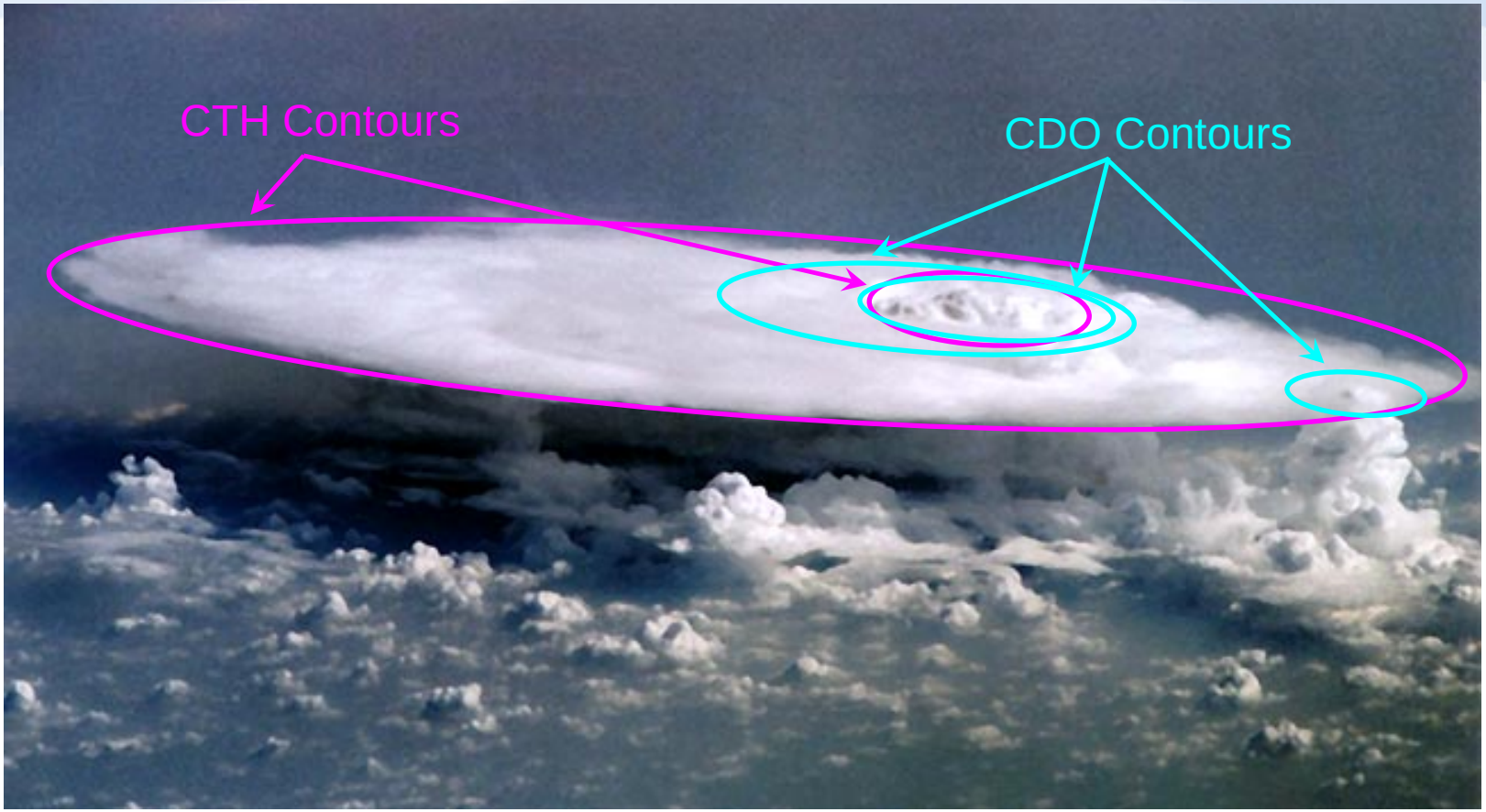
CTH and CDO Product Overview



- Two products better characterize convective storm
- CTH gives full extent of cloud cover and height
- CDO shows location of updraft/lightning hazards

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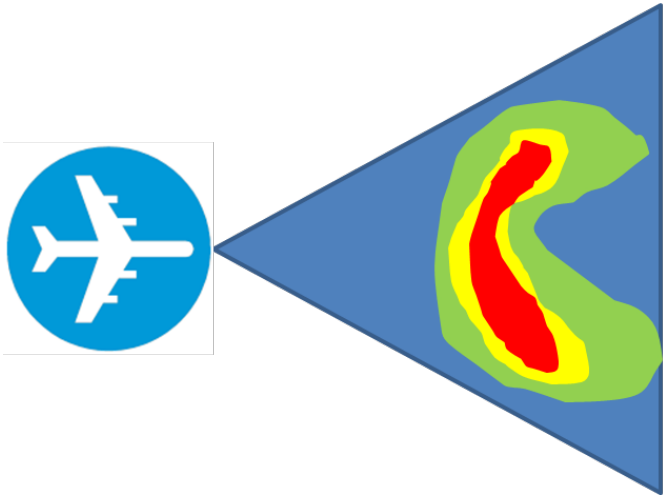
Onboard Radar Versus CTH

- Radar penetrates cloud and sees intensity of precipitation
- Satellites only see the temperature of the top of the cloud, which can be as high as FL600
  - Cloud top height EFB product shows flight level of the cloud top
- Altitude difference between radar and cloud top height means the satellite image likely shows much larger area for the storm
- Echo top from radar is not the same altitude as cloud top height from satellite

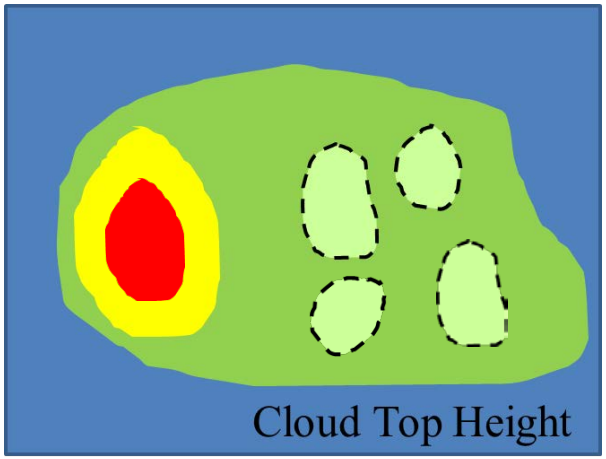
Onboard Radar Versus CTH

- Radar tactical view



Reflectivity can be attenuated

- Satellite strategic view
  - Satellite will see storm behind the leading storm (attenuated by radar)
  - Anvil cloud can hide gaps between storms
  - Anvil cloud can hide growing storms at lower altitudes



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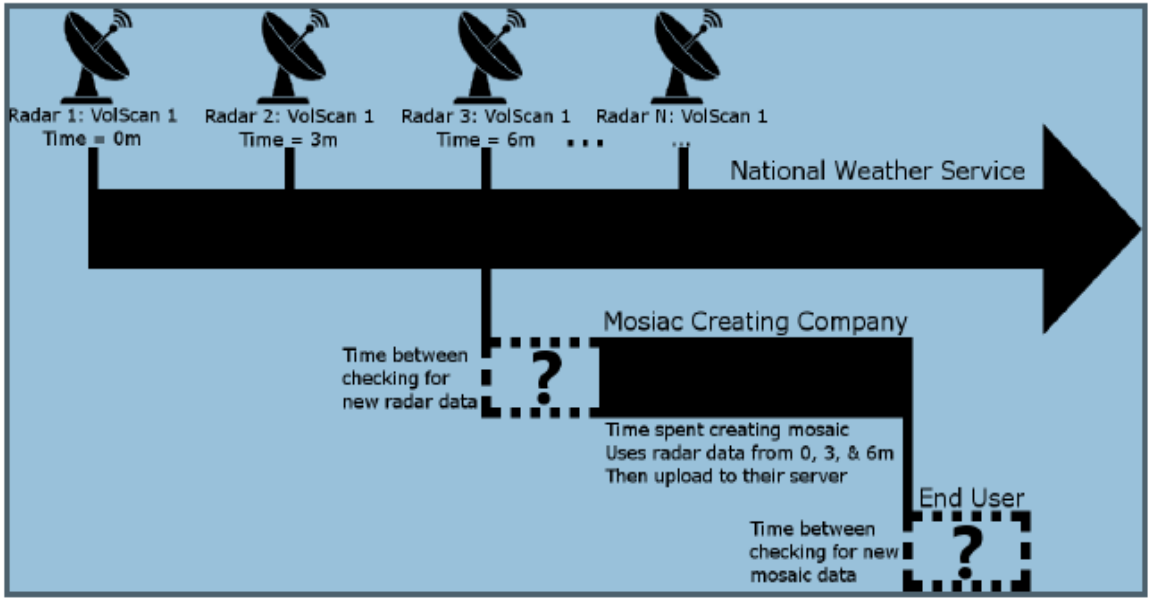
WTIC Project Overview – Timestamping

- Investigate the timeliness/latency of current capabilities across industry providers of NEXRAD weather radar mosaic imagery:
  - Processing
  - Delivery
  - Overall Age
  - Symbology (timestamp, age parameters, or warnings)
  - User cues for old or missing data
- Investigate methods of timestamping
- Investigate communication of mosaics refresh

Time Stamping – Plan

- Standards review
- Interview providers to assess process latency using common definitions of data age, refresh time, capture time



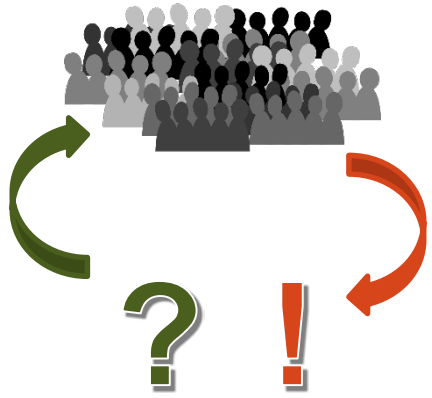
Sample – Regional Mosaic Simulation Model

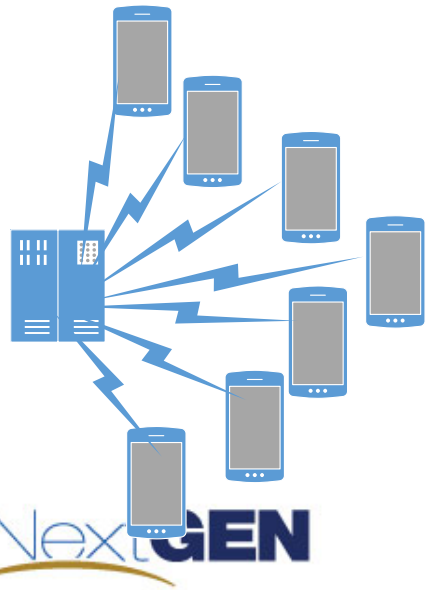
Time Stamping - Plan

- Develop NEXRAD and timestamping model for fast track simulation
  - Use real archived data
  - Produce “truth” value to quantify timestamping delays
- Use Simulation To
  - Provide insight on affects of different radar volume scan start and end times (realistic idea of general age of mosaics)
  - Determine how refresh timing contributes to the timestamping of the NEXRAD data
- Timestamping recommendations based on results

WTIC Project Overview – Crowd Sourcing

- The term is used for 2 broad concepts
  1. Crowd as Processor: Enlisting the contributions of a large number of networked participants in solving problems for which human intelligence performs better than automation
     a) **Volunteers** with an interest in the problem being solved
     b) **Inadvertent "Volunteers"** who perform the desired task for their own purposes (e.g., the "CAPTCHA's" used on web sites to verify that they are being accessed by humans)
     c) **Persons paid** a small amount per decision to perform the task (e.g., the Amazon Mechanical Turk web service)
  2. Crowd as Sensor: Gathering anonymous data from a large number of networked platforms for (e.g., inferring city traffic congestion from cell phone tracking data)





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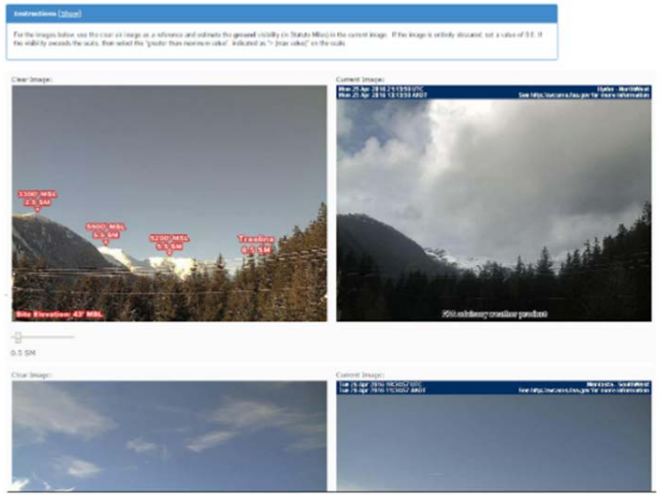
WTIC Project Overview – Crowd Sourcing

- Using crowd source processing to create visibility information from camera images
  - “Crowd” processing confidence level set by various parameters including size of crowd, crowd skill level, and edge detection sensors
- Crowd source sensors for wind



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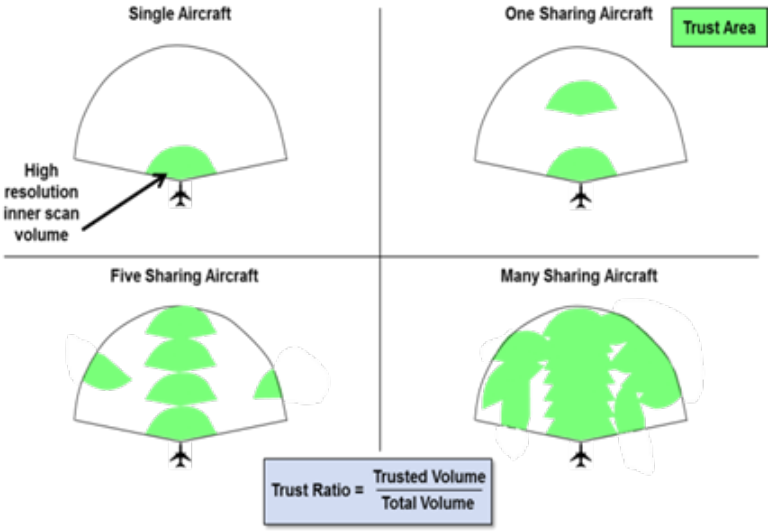
WTIC Project Overview – Crowd Sourcing

- Forward looking radar to as crowd sourced sensors to fill in areas with lack of radar coverage



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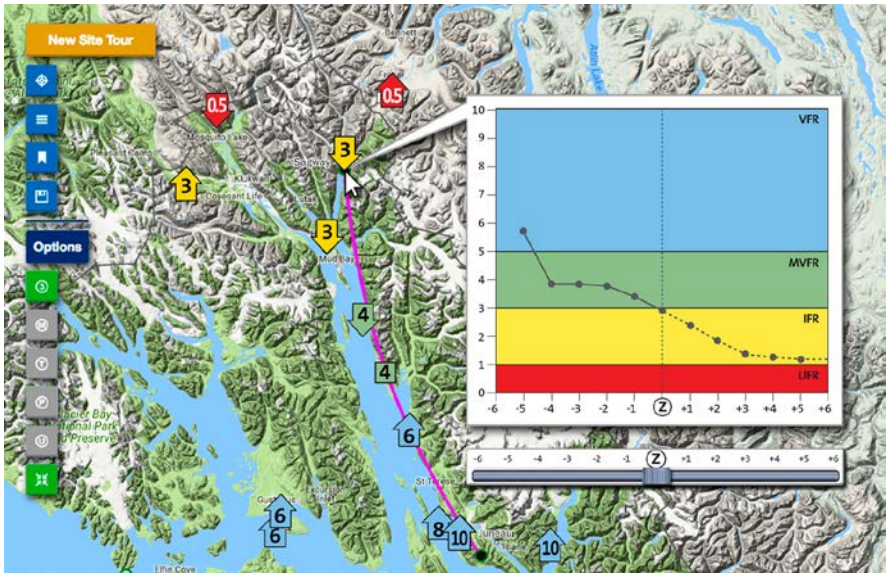
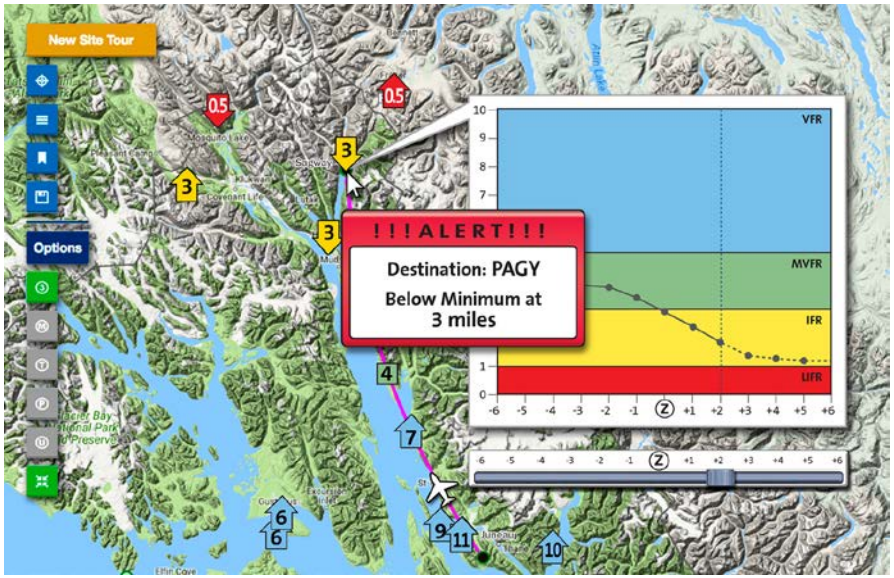
WTIC Project Overview – Crowd Sourcing

- Potential to use crowd source visibility data, wind data, and forward looking radar data to develop forecasts and to show trends along flight routes



Current conditions and trends



Slider set to 2-hour forecast

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