Drivers of Future Weather Research

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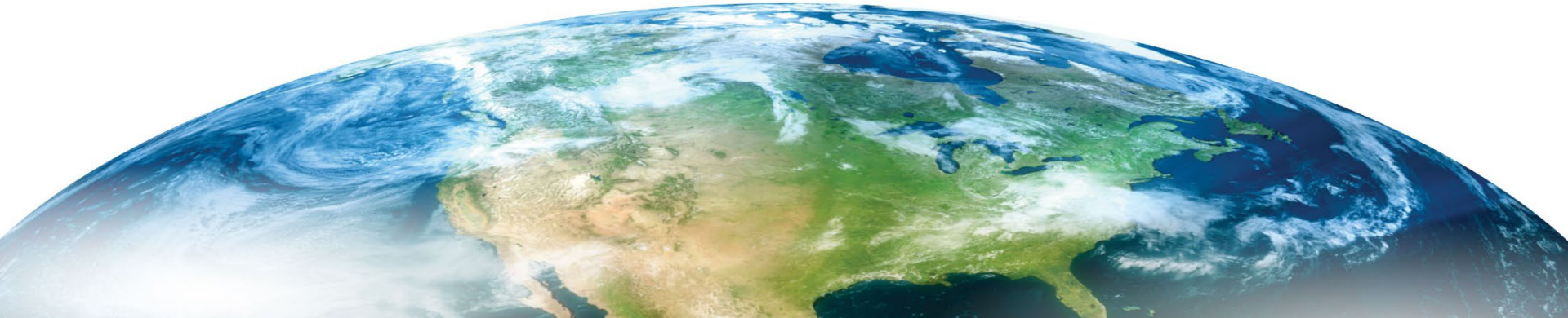
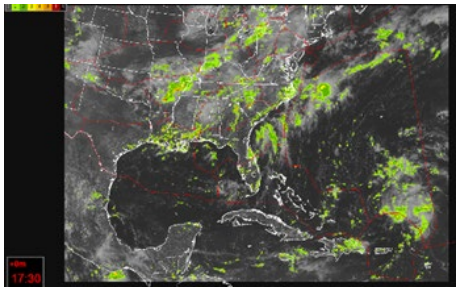
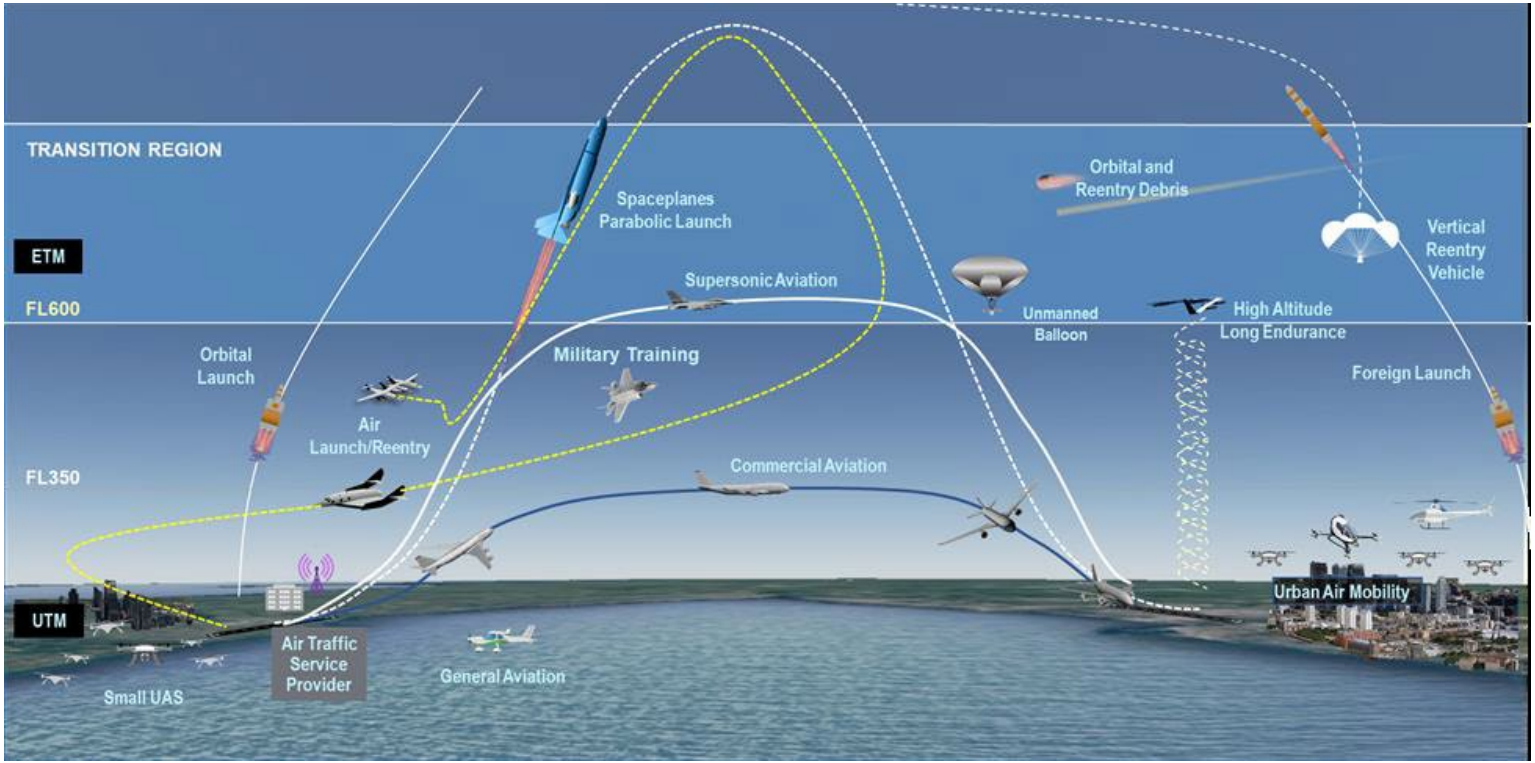


Weather Research Branch



- Conducts research to mitigate the impact of weather on aviation and transitions successful research capabilities to operations
- Aviation Weather Research Program (AWRP) – Performs applied research to enhance the science of weather and weather information/products
  - Leverages advances in meteorological science to enhance observation methods, improve weather prediction models, and produce increasingly accurate forecasts of convective weather, turbulence, icing, and low ceiling and visibility conditions
  - Enables traffic flow managers, controllers, pilots and airline operations personnel to implement tactical and strategic traffic management initiatives to avoid encounters with severe weather, reduce delays and mitigate safety risks
- Weather Technology in the Cockpit (WTIC) – Develops, verifies, and validates recommendations for incorporation into Minimum Weather Service (MinWxSvc) standards and guidance documents
  - Performs research on all part-type aircraft to identify causal factors in weather-related safety hazards/risks and NAS operational inefficiencies; conducts applied research to resolve the identified causal factors and gaps, including gaps in pilot weather training materials and courseware
  - Enhances safety, reduces pilot workloads, and increases fuel efficiency to lower gas emissions for commercial, business, and general aviation operations

Diversity in Future NAS Operations



Courtesy of The MITRE Corporation

Weather Research Drivers

- UAS weather requirements and standards
  - Lack of observations in the boundary layer
  - Micro-weather and ultra-high resolution models
  - How can we expect UAS/UAM operators to meet flight standards if there's no way to verify the weather conditions?
  - Operator education similar to what WTIC is doing for pilots

- Commercial space terrestrial weather needs
  - What new weather requirements will come from Commercial Space as that industry takes off (pun intended)
  - There are already weather standards for launch (commit criteria), but what about landing or for recovery of rockets, etc.?

- Supersonic/hypersonic/trans-orbital passenger flight
  - Will these new modes of transportation, and the composite material and engines they use, produce new weather requirements?

Weather Research Drivers

- TBFM requirements for convective weather
  - 4 hour forecast accurate to within 3 NM and 15 minutes
    - Previously beyond our capabilities, but now within reach?
    - Satellite data exploitation for convective initiation
    - Model-based research?

- Standardized turbulence intensity values
  - EDR is the “standard” but there are different ways it is computed; which way is right, or is there a right way?
  - Calibration of reported turbulence conditions so everyone is on the same page

- Certifications and technologies to meet certification
  - TAIWIN and HIWC completion
  - UAS/UAM certification
  - What’s next?

Weather Research Drivers

- Space weather needs for aviation
  - New hire to develop our new space weather research program (Samantha Carlson)
  - Radiation dosage measurements and standards for commercial aviation
  - Communication and GPS impact mitigation
  - Other aviation, UAS/UAM and commercial space needs

- Integration of new data sources into capabilities
  - Weather satellite imagery into icing, turbulence, convective weather, and C&V capabilities
    - Other channels besides visible and IR
  - Weather satellite data into hazardous weather diagnosis capabilities
    - Sounding/microwave data
    - One man's trash is another man's treasure
  - Radar data assimilated into capabilities
    - New radar data sets (TDWR, commercial, etc., into MRMS and/or NWP?)
    - Severe weather algorithm upgrades, aviation icing algorithms, and other enhancements to NWP radar capabilities
  - LIDAR

Weather Research Drivers

- Use of non-traditional weather data sources
  - Weather cameras
  - UAS/UAM data
  - ADS-B derived data (beyond turbulence)
  - Cell phones
  - Personal observing stations
  - Vehicles
  - Can we exploit/leverage weather research being conducted for renewable energy, fire weather, etc.?
  - Use of this data for aviation operations, but also assimilated into weather models

- Numerical weather models
  - Nested
  - High resolution
  - Super high resolution
  - Data decimation
  - At what point do we hit diminishing returns?

Weather Research Drivers

- Pilot education
  - Continued education of traditional pilots
  - Virtual reality and other new ways to train pilots
  - Education of UAS/UAM pilots
    - Even if these modes are machine-to-machine, the people writing computer code for their operations will need to know thresholds and standards

Weather Research Drivers

- PIREPS (ugh)
  - Accurate and relevant
  - Is there really a way to fix the current system?
  - Complete overhaul and start from scratch?
  - Voice to text
  - Totally automated, taking the pilot out of the equation?

Questions?

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