Wind Needs for NextGen Applications

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Objective: Establish relationship of wind information accuracy to 4D-TBO and IM performance and hence identify wind needs to support them

- Many NextGen applications depend on access to high accuracy wind data
  - Required Time of Arrival (RTA) at a meter fix under 4D-Trajectory Based Ops
  - Assigned Spacing Goal (ASG) between aircraft under Interval Management (IM)
Wind Information Analysis Framework

- Allows analysis of wind information impacts on range of NextGen applications
- Designed to be scalable wrt scope/fidelity & flexible wrt application

Wind Scenario
- Truth
- Forecast

ATC Scenario
- 4D-TBO
- IM

Performance Assessment

Stakeholder needs

Wind Requirement Recommendations
- Identify combinations of wind data, forecast models & data age which meet required wind info quality goals

Wind Information Quality

- Benign
- Moderate
- Severe
- Extreme

Aircraft/Automation Simulation

- Sample target performance
- Automation Capability
- Average forecast error
- Data age

Perf Metric
- Low
- Med
- High

- Model A
- B
- C
Application of Framework to Inform Concepts of Operation and/or Datalink Needs

1. Define scenarios of interest
2. Identify performance trade-space
3. Select target performance level
4. Do feasible combinations of performance drivers meet target level of performance?
   - Yes
   - No
5. Do feasible combinations of wind forecast model and ages meet error limit?
   - Yes
   - No
6. Define procedure/ConOps/datalink needs to get required wind info accuracy to aircraft

Identified need for enhanced automation and/or wind model

“or”
1. Define application of interest
   - 4D-TBO from FL290-FL390 to meter fix at 12,000 ft
2. Identify relevant trade-space
3. Select target performance level
   - +/- 10 secs 95% of time
4. Identify combinations of performance drivers which meet target level of performance
   - Any FMS/cruise altitude feasible if wind error <5 kts RMS
   - Only A-FMS, any cruise level if wind error up to 15 kts RMS
   - Only A-FMS from low cruise alts if wind error up to 25 kts RMS
5. Identify wind models and data ages which achieve maximum allowable wind forecast error
   - HRRR data less than 2.5 hours old
   - RAP model data less than 1.5 hours old
   - GFS data: infeasible

6. Create procedures/ConOps to get required winds into aircraft
   - For trans-continental flights, require fresh wind updates based on RAP model within 1.5 hours or RTA time, or HRRR model within 2.5 hours of RTA time
   - Bandwidth needs for update depends on #WPs and amount of info at each WP
Key Takeaways

• Need to understand wind info accuracy impacts on NextGen to inform
  – Concepts of operation
  – Procedure performance targets
  – Datalink bandwidth needs

• Wind forecast model performance and aircraft automation capability are key drivers

• Future work
  – Validate findings
  – Explore FMS wind-handling and wind forecast enhancements
  – Address evolving RTCA/other stakeholder wind information needs