Wind Needs for NextGen Applications

Tom G. Reynolds

Sponsor:
Gary Pokodner, FAA Weather Technology in the Cockpit (WTIC)

LINCOLN LABORATORY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Air Traffic Control Systems Group

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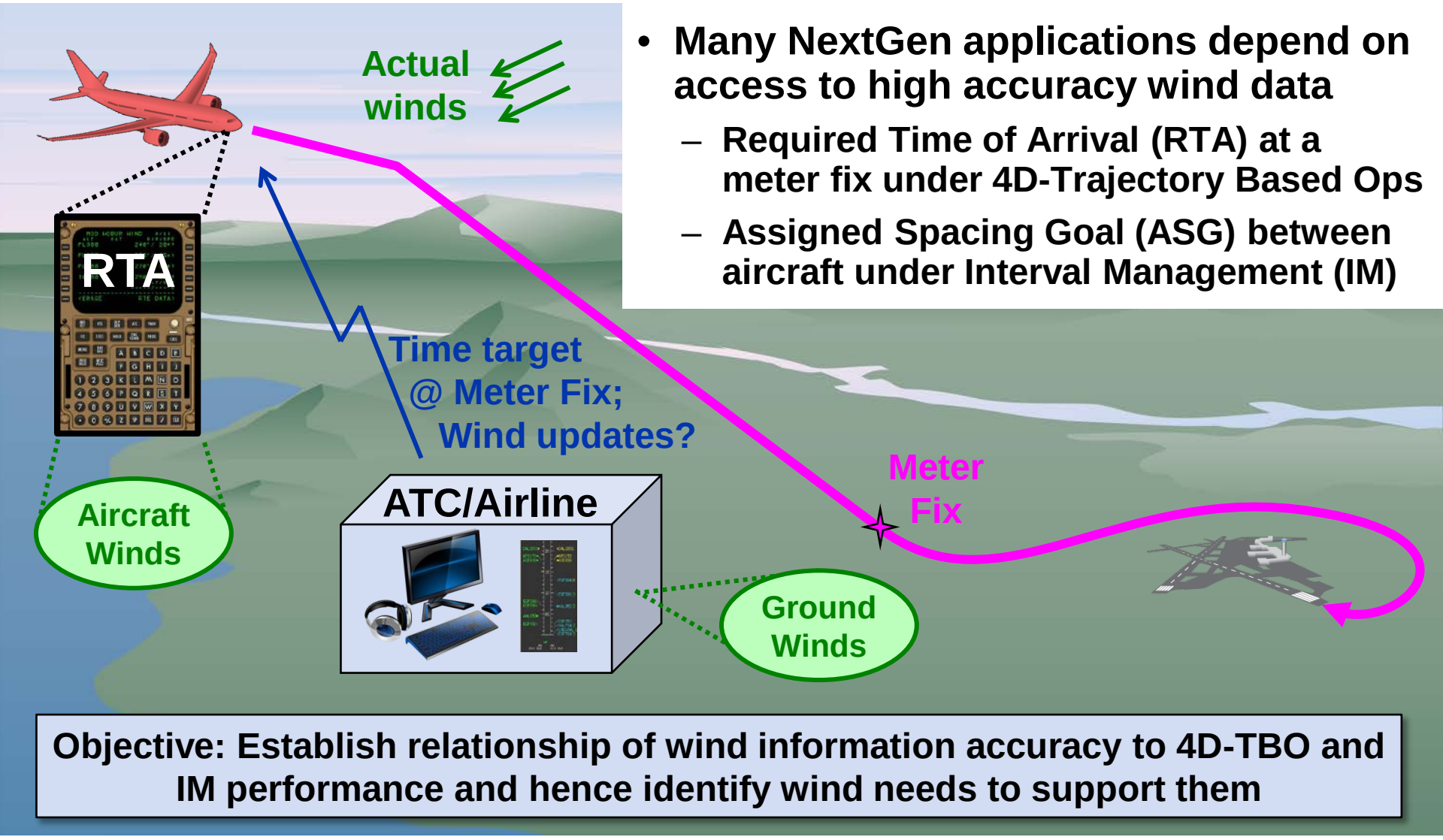

- **Many NextGen applications depend on access to high accuracy wind data**
  - **Required Time of Arrival (RTA) at a meter fix under 4D-Trajectory Based Ops**
  - **Assigned Spacing Goal (ASG) between aircraft under Interval Management (IM)**

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

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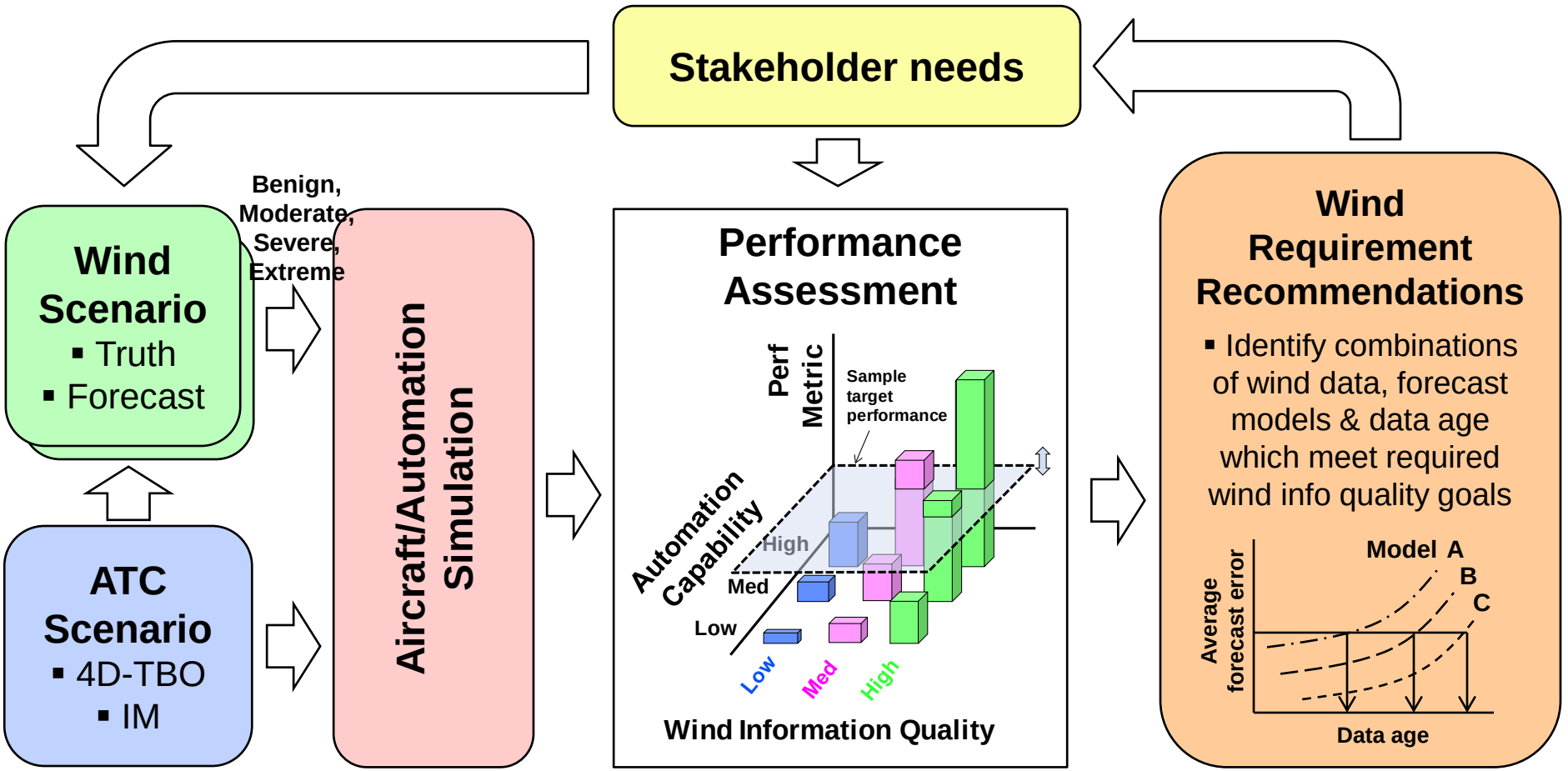
Wind Information Analysis Framework



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

Application of Framework to Inform Concepts of Operation and/or Datalink Needs

Identified need for enhanced automation and/or wind model

"or"

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?

No

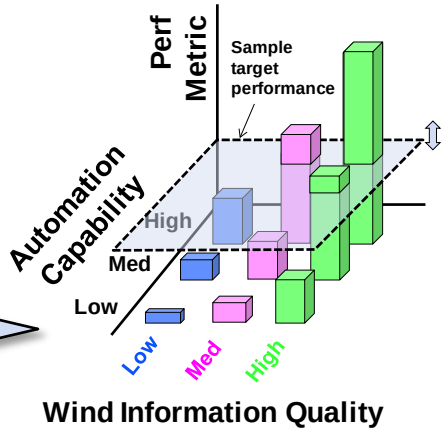
Yes

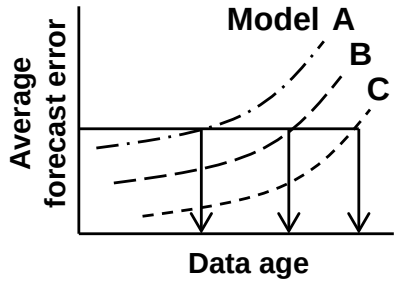
5. Do feasible combinations of wind forecast model and ages meet error limit?

No

Yes

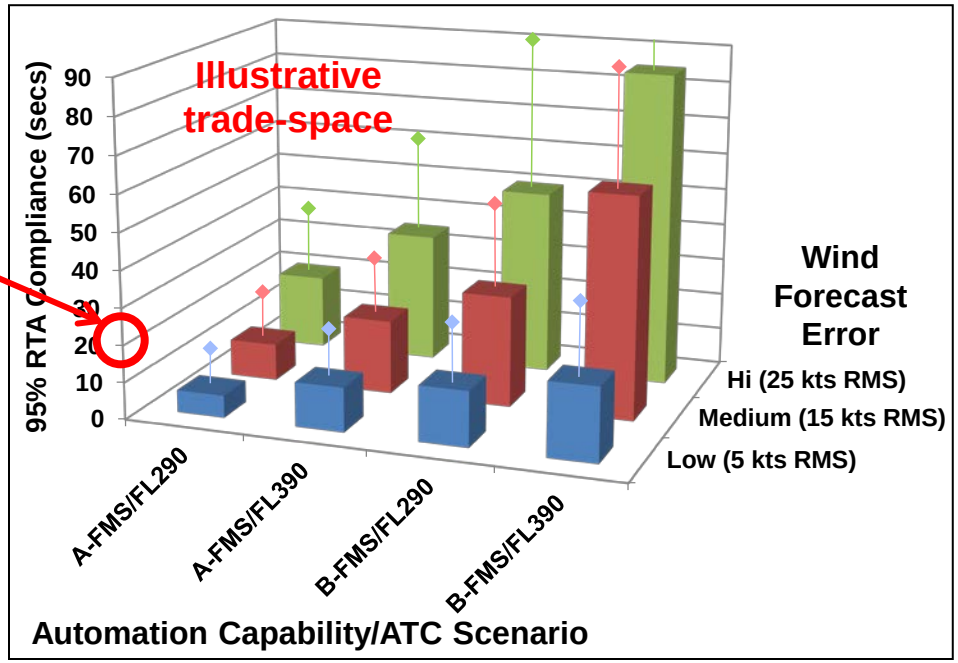
6. Define procedure/ConOps/datalink needs to get required wind info accuracy to aircraft





Sample Application of Results

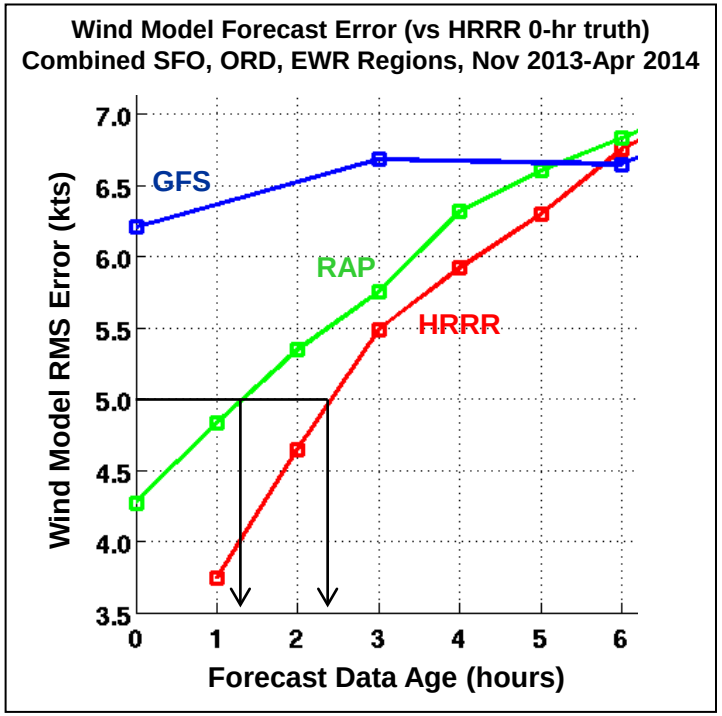
1. Define application of interest
   - 4D-TBO from FL290-FL390 to meter fix at 12,000 ft
2. Identify relevant trade-space
3. Select target performance level
   - +/- 10 secs 95% of time
4. Identify combinations of performance drivers which meet target level of performance
   - Any FMS/cruise altitude 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



A-FMS = Advanced FMS, B-FMS = Basic FMS

Sample Application of Results

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**