Identification of Wake Vortex Issues in NextGen

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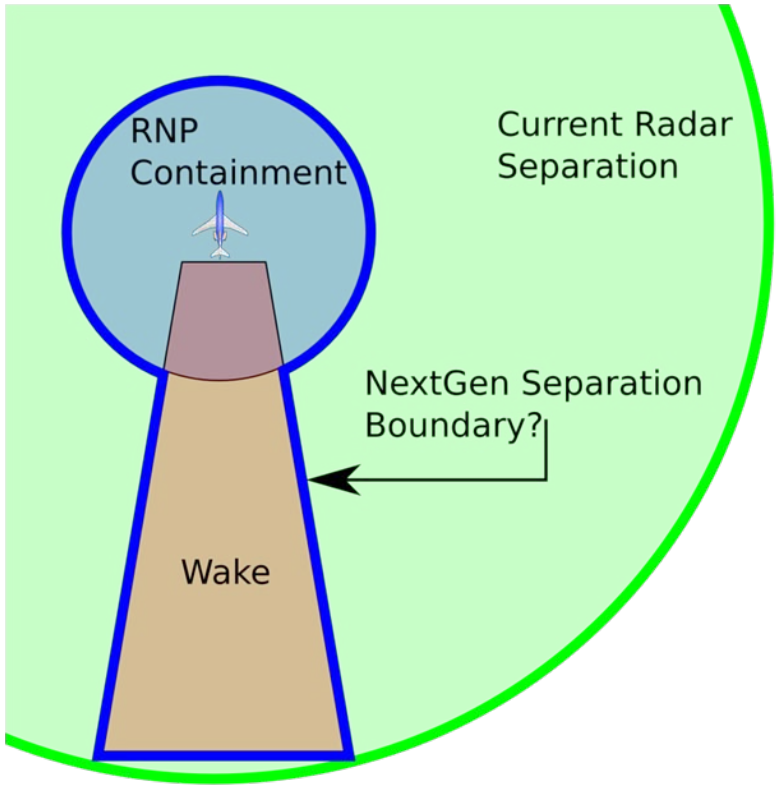
Objective

- Tasked with identifying NextGen operational concepts that may pose an increased risk of an aircraft encountering wake turbulence
- The results of this analysis add to the breadth of work assisting NextGen planners in identifying where wake vortex constrains need to be considered
- The results also feed a more detailed wake modeling effort being undertaken with Virginia Tech and George Mason University

Analysis Method

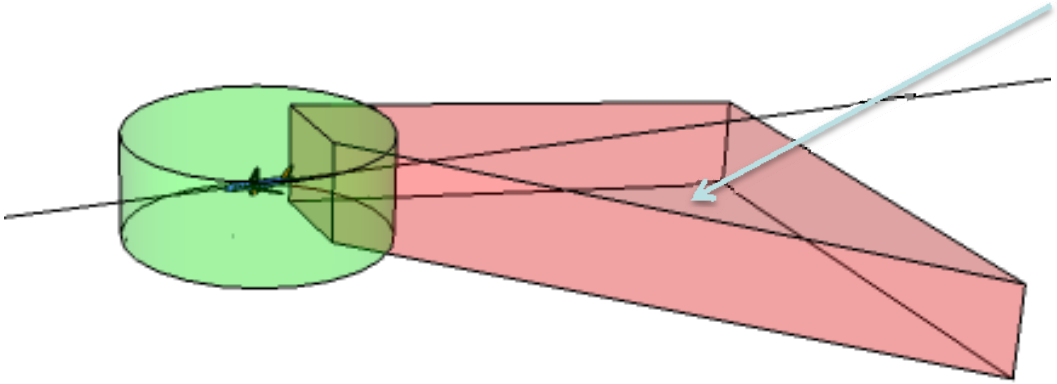
- Reviewed:
  - NextGen Concept of Operations (ConOps) v2.0
  - NextGen Integrated Work Plan (IWP) v1.0
  - NextGen Implementation Plan 2009
- Listed all concepts that cause aircraft proximities or geometries that have the potential for wake vortex interaction
- Interviewed individuals involved in developing NextGen to determine their perception of potential wake vortex hazards or issues
- List has been updated as new information has become available
- Seeking further input

Precision Navigation Separation Requirements



- NextGen will use precision navigation and surveillance technologies (e.g. RNP, ADS-B) which is expected to enable reduced separation
- Current radar separation rules are on a similar scale to the wake hazard
- Aircraft wakes may no longer be buffered by navigational separation requirements
- NextGen separation requirements could look substantially different to those currently in use

Separation Rule Complexity



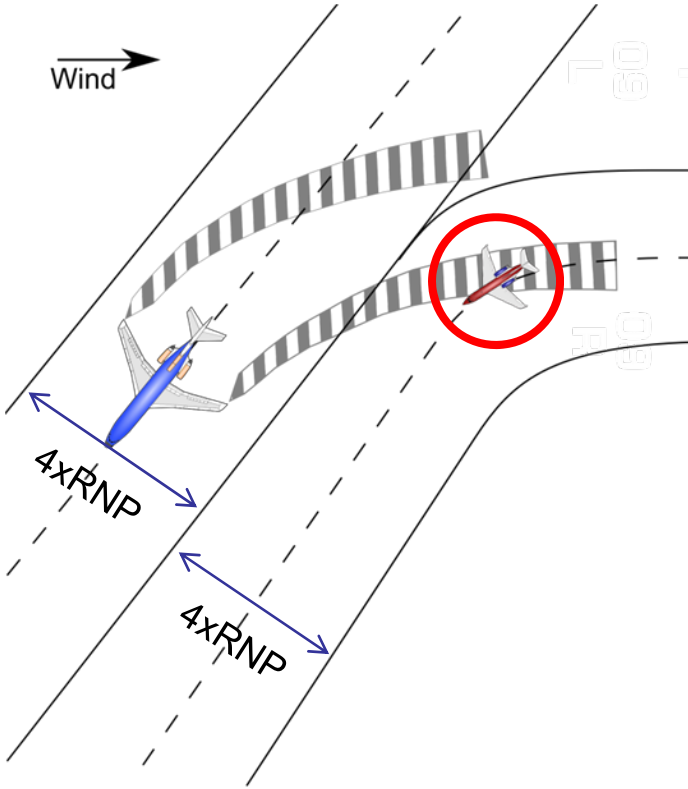
Dynamic wake separation boundary could vary with:

- Wind velocity and/or direction
- Lead aircraft weight/configuration/velocity
- Trailing aircraft weight/configuration/velocity
- Atmospheric conditions (aside from wind)

- Wake separation standards could be complex
- With improved wake models and atmospheric/aircraft data, tightly defined wake hazard boundaries may be possible
- Increased complexity in separation criteria could make controller or pilot workload unacceptably high
- A balance must be found between increasing airspace utilization and managing the complexity of procedures

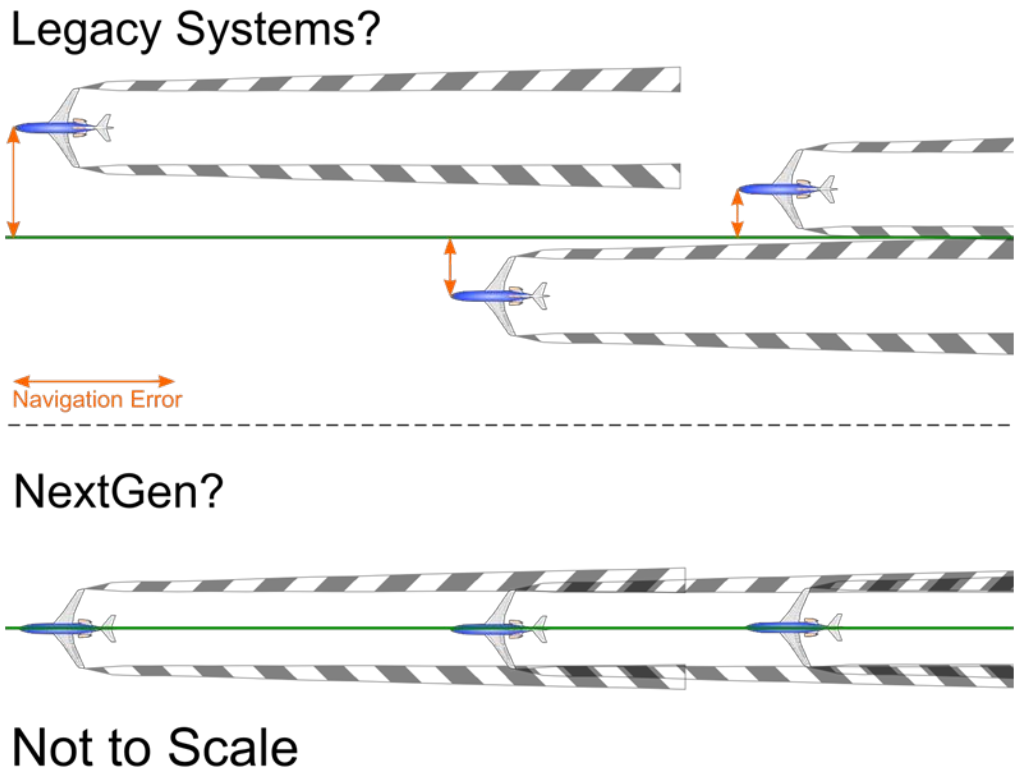
Tight Routes

- NextGen will use precision navigation to improve capacity and will increase airspace utilization by reducing the separation between adjacent routes
- If the current 4xRNP segment width is used, the required separation between routes may be as low as 0.4nm (for RNP0.1)
- Tightly-spaced routes increase the risk of wake vortices from one route propagating into adjacent routes
- Wake vortex separation criteria may become the determining factor in route separation



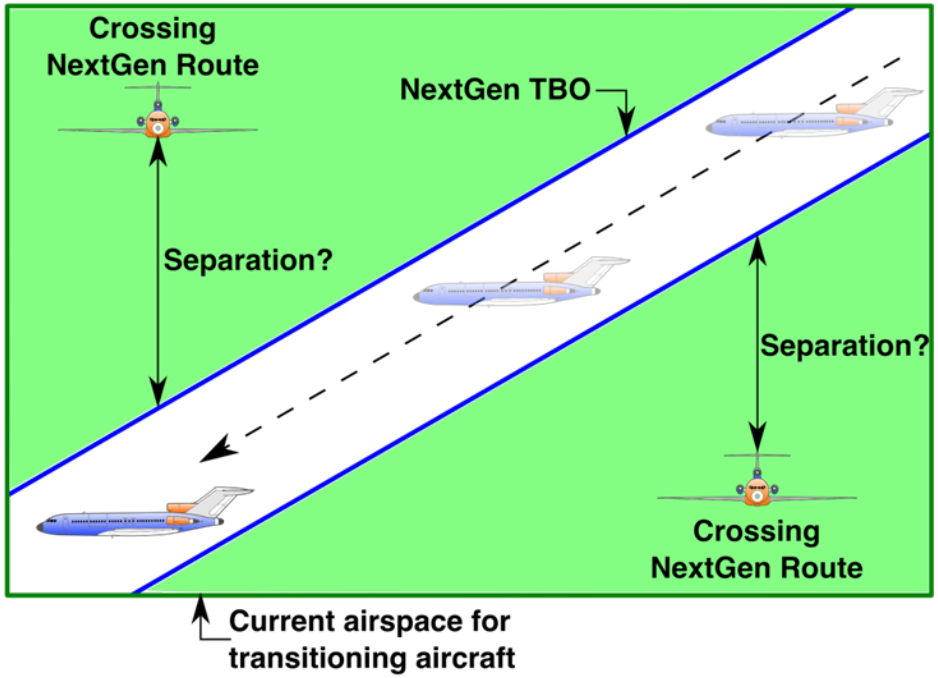
Precision Navigation

- Navigational imprecision may provide some protection from wake vortices
- NextGen aircraft will follow assigned flight tracks more precisely, potentially increasing the risk of a wake encounter for climbing and descending aircraft
- Strategic lateral offset procedures (SLOP) are currently being used in part to move aircraft out of the wake of preceding aircraft



Trajectory-Based Operations

- Many of the aircraft operating in NextGen will be following precisely defined 4-dimensional trajectories (4DT) through transition airspace.
- Transitioning aircraft are currently given a large volume of airspace for maneuvering
- TBOs will require a detailed understanding of wake position and evolution in all three dimensions in order to plan close-proximity safely separated flights



- **Need to define and determine 4-D trajectory separation criteria between trajectories**