Exploration of Algorithms for the NextGen Collision Avoidance System

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Problem

- Future airborne applications and Air Traffic Control (ATC) procedures may interact with Traffic Alert and Collision Avoidance System (TCAS) with the undesired effect of generating nuisance Resolution Advisories (RA).
- TCAS is limited to supporting only vertical Ras.
- TCAS RA vertical maneuvers are limited to standard rates of climb/descent (+/-1500 fpm).
- The TCAS surveillance function uses 1090 MHz to actively interrogate other aircraft transponders. The 1090 MHz spectrum is used by many systems and is becoming saturated.

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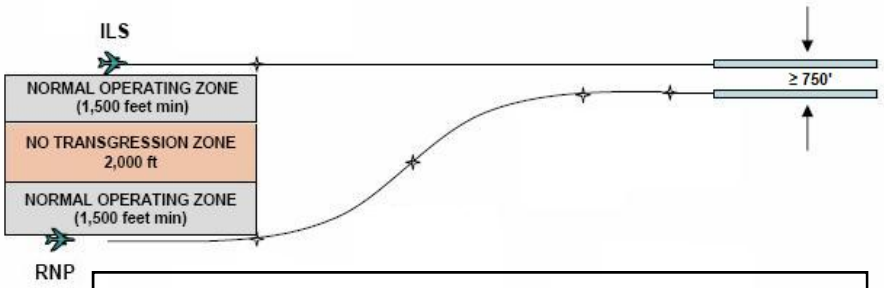
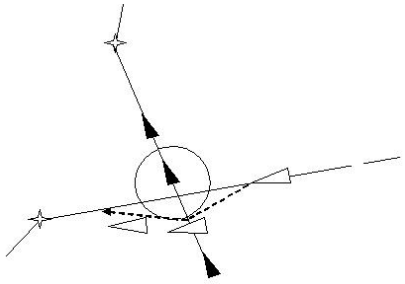
Background

- The Next Generation Air Transportation System (NextGen) is the Federal Aviation Administration's (FAA) initiative to modernize the National Airspace System (NAS) through 2025.
- New procedures will reduce spacing and separation requirements, and better manage the overall flows to provide maximum use of the highest demand airports
  - New approach, arrival, and departure procedures based on area navigation (RNAV), required navigation performance (RNP)
  - New airborne surveillance applications based on Automatic Dependent Surveillance-Broadcast (ADS-B).



RNP Parallel Approach Transition (RPAT)



Aircraft-based Lateral Crossing

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Objective

- **Assess the impact of TCAS limitations on new applications and operational procedures.**
- **Establish performance enhancements that can be achieved with new technologies.**
- **Propose a set of functional capabilities for an airborne collision alerting and avoidance system.**
- **Develop new algorithms for future collision avoidance systems.**

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Activities

- Explore potential enhancements to current TCAS to accommodate evolving NAS.
- Identify potential incompatibilities of TCAS with future ATC Procedures/Airborne Applications.
- Explore a range of options for future NextGen Collision Avoidance System (NextCAS).
- Explore new collision avoidance system (CAS) design principles and incorporate enhanced input data.
- Identify key issues with ADS-B as the surveillance input.
- Develop ways of using ADS-B for CAS.
- Devise an analysis plan for evaluation of alternative CAS algorithms and functional architectures.
- Develop and evaluate alternative CAS algorithms.

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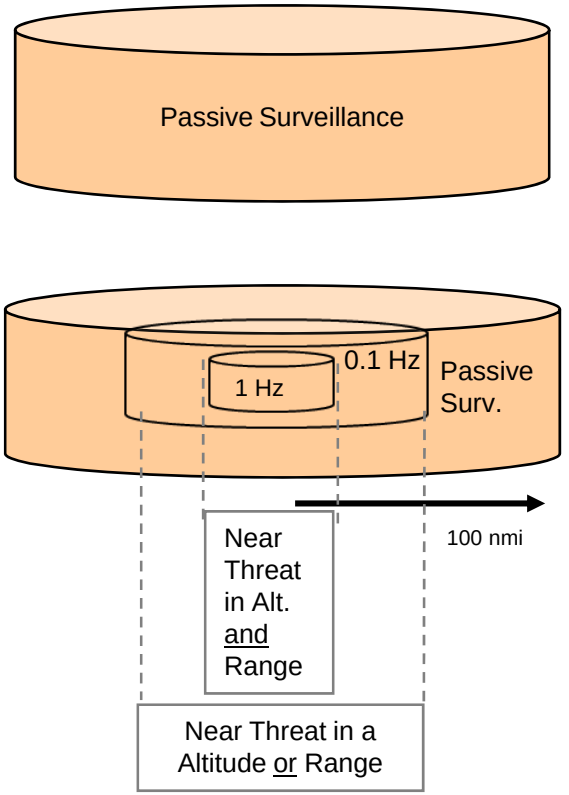
Enabling Technologies with ADS-B

1. **Passive Approach – ADS-B Only**
   - **Collision alerting and avoidance logic is solely based on ADS-B.**
2. **Hybrid Surveillance with Desensitization Capability**
   - **Collision alerting and avoidance logic is solely based on active interrogation.**
3. **"Fused" Hybrid Surveillance**
   - **Conflict Detection uses both ADS-B and active interrogation.**



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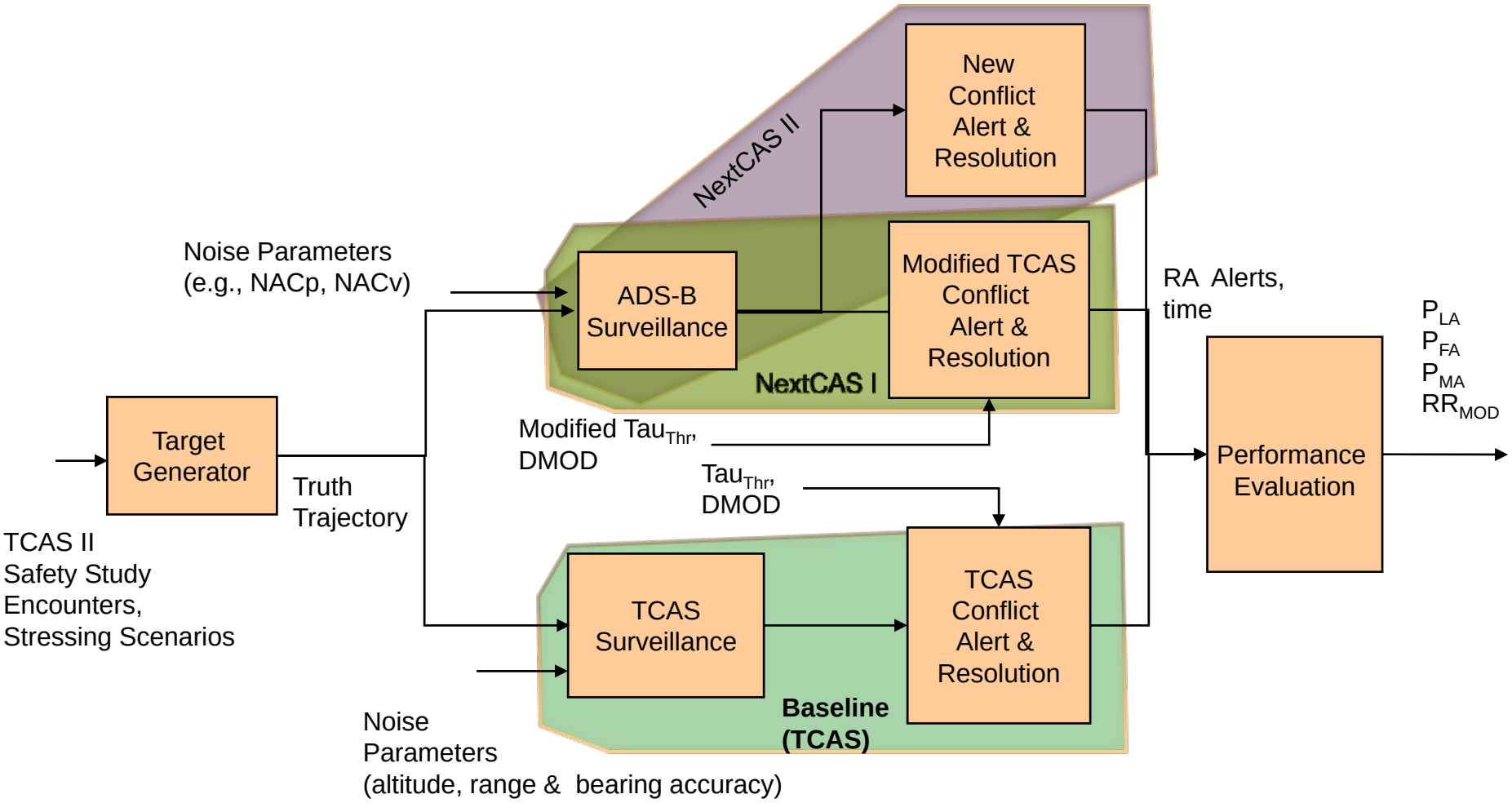
Testbed for Performance Evaluation



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Impacts

- **The aviation community's existing collision avoidance system (TCAS) can trace its origins to MITRE's Technology Program.**
- **MITRE has the opportunity to make a similar impact on the future of aviation by taking the initiative to explore an integrated airborne collision alerting and avoidance system that accommodates**
  - **New applications and procedures envisioned for NextGen**
  - **New types of cooperative aircraft (manned, unmanned).**

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