Exploring NextGEN Aviation Technology for Efficient Approaches

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Defining the Problem

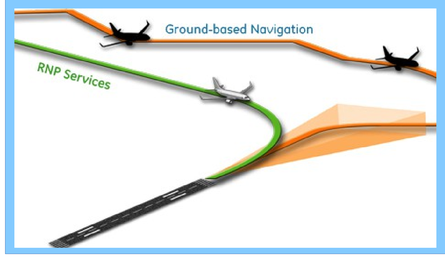
NextGEN includes many benefits, but at what cost and strain do they add to current aviation policies? We focus on one aspect of NextGEN that involves air traffic management – Required Navigation Performance (RNP). With a simulation that integrates RNP policies with current traffic control systems, our aim is to identify and provide analysis to any arising critical issues.

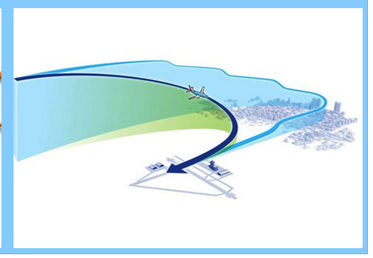
Of importance are objectives such as minimizing number of false (conflict) alerts and minimizing aircraft separation distance. As air traffic increases, can we ensure safety and maintain effectiveness in high-capacity airspace and in extreme cases such as severe weather, pilot error or equipment malfunction?

RNAV / RNP

Required Navigation Performance (RNP) is RNAV (Area Navigation) with onboard navigation support, monitors and alerts. RNP provides extraordinary satellite positioning (±3m) capabilities which allow aircraft and airlines to apply procedures that potentially cut back massively on costs, fuel consumption and delays in the air, as well as noise and emissions.

Largely pioneered by Alaska Airlines (1995 to 2010), RNP allows for more-direct routes through airspace. Alaska Airlines is at near 100% RNP capabilities and Southwest Airlines at 70%.

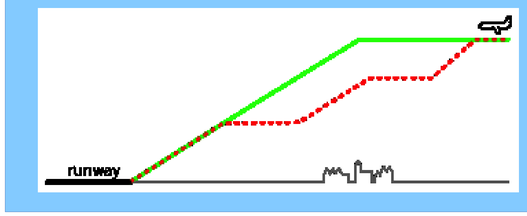




CDA & NextGEN

Continuous Descent Approach improves from traditional landing procedures that typically apply a “stepped” descent process. Benefits of CDA include reduced noise and emissions, allowing aircraft to descend at a smooth, constant angle of descent without the need to request clearance to descend each “stair”.

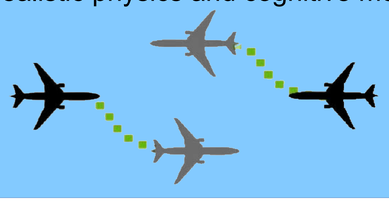
RNP & CDA together contribute in part to the NextGEN aviation plan in the near 5-10 year future. Increasing demands on air traffic and reduced emissions are driving goals. Costs will exponentially rise without, and NextGEN is the required solution.



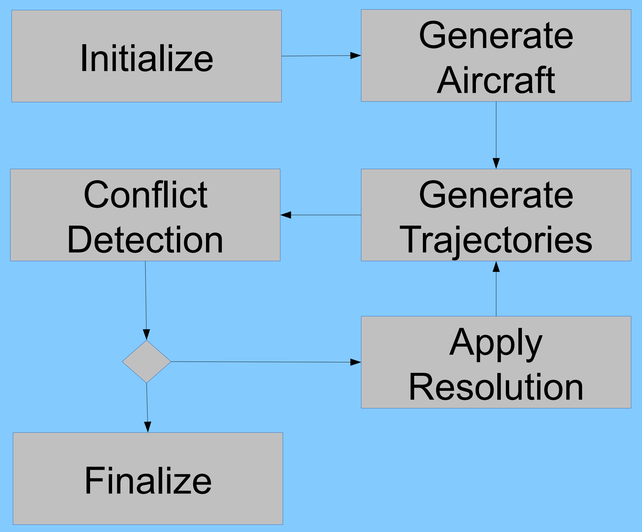
TTSAFE & WMC

Terminal TSAFE (Tactical Separation Assured Flight Environment) is developed by NASA Ames' Flight Dynamics, Trajectory and Controls Branch to detect Loss of Separation (LOS) events between aircraft, and to provide resolutions to such conflicts. TTSAFE aims to replace the current FAA aviation management system, Conflict Probe, for terminal operations.

Work Models that Compute (WMC) is a project built by Georgia Tech that allows for the simulation of both aircraft and pilots for traditional and CDA approaches. It provides information on descent trajectories at efficient levels of fidelity and granularity using realistic physics and cognitive models.



Experiment Framework



Goals & Plans

Our experimental framework integrates TTSAFE and WMC to simulate NextGEN aircraft approaches. We will use this integrated tool to explore the transition from traditional to NextGEN approach operations. For instance, what happens if the number of RNP-guided aircraft increases to 90%? Will conflict detection prove to be too difficult as air traffic increases?

In assessment of each test case, we examine metrics such as time to land, miles-in-trail, conflicts, false alerts, missed calls (undetected LOS) and minimal aircraft separation distances, for both RNP and conventionally routed aircraft, as well as CPU usage of the system in detecting conflicts.