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## **DECONFLICTING TRAVEL OF AIRCRAFT AND SPACECRAFT THROUGH THE US NATIONAL AIRSPACE SYSTEM**

*DECONFLICTION DES DEPLACEMENTS D'AERONEFS ET D'ENGINS SPATIAUX DANS LE SYSTEME DE L'ESPACE AERIEN NATIONAL*

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Introduction: Launching or reentering spacecraft have involved closing large swaths of the US National Airspace System (NAS) for extended periods of time to aviation traffic throughout the history of space flight. With the increasing frequency of space flights there has been high interest in finding ways to minimize the amount and duration of airspace restriction that is needed to allow for safe passage of aircraft and spacecraft. With funding support from the FAA's Center of Excellence for Commercial Space transportation, research has been conducted over the past eight years to examine this issue. Novel approaches have been proposed to reduce the negative impact to aviation and spaceflight through the same areas of the NAS.

Background: Approaches to address this concern have been undertaken by researchers at Stanford University and by a team at the MITRE Corporation. In both cases, research studies using existing data from routine aircraft pathways and spacecraft trajectories followed by simulations of options to reduce or eliminate aircraft hazard areas (AHA) have been undertaken. These approaches studied the ability to create dynamically changing compact envelopes of the NAS and the ability of the Air Traffic Control (ATC) system to respond quickly to the need to evacuate AHAs. Multiple simulations were run using data from four different spaceport locations across the country.

The simulations using compact envelopes that change dynamically during the time of a space flight launch or reentry showed the near elimination of airspace disruption from commercial space traffic. Further, simulations using the realistic speed with which ATC could reroute aircraft only when necessary for a launching or reentering spacecraft showed this approach is entirely achievable.

Summary: Research conducted under the FAA Center of Excellence for Commercial Space Transportation has demonstrated approaches that almost entirely eliminate the need for prolonged closure of extensive segments of the US NAS.