Unified 4D Trajectory Approach for Integrated Traffic Management
by
Thomas Colvin

In the face of dramatically rising space-traffic volume (sub-orbital, launch, and re-entry), the National Airspace System (NAS) needs to have a well-defined Concept of Operations to keep launch vehicles and traditional air traffic separate and safe. Special Use Airspaces and Notices to Airmen establish “no-fly zones” that are currently used by the FAA to ensure the safe use of the airspace by all parties, but these methods are overly conservative and thus expensive and unfair to traditional air traffic. We propose a new method that removes unnecessary conservatism by being quantitatively safe and dynamic in space and time. This method, called Compact Envelopes, treats the evolution of a launch vehicle’s nominal trajectory and failure modes probabilistically, allowing the resulting Compact Envelope (a no-fly zone) to be safe to a dialed-in level of safety.

We also leverage elements of NextGen to allow the created envelopes to be dynamic in space and time. In order to assess the benefits of Compact Envelopes over traditional methods, we are developing an analysis environment in collaboration with NASA Ames using their FACET (Future Air-Traffic-Management Concept Evaluation Tool) software. We are also collaborating with the FAA to run similar comparison studies with their preferred air traffic analysis software AirTOp. This talk will outline the Compact Envelope method and the analysis environment we are creating in collaboration with NASA Ames. It will also graphically demonstrate the Compact Envelope method for a Falcon 9 launch from Cape Canaveral, as well as discuss the collaborative study with the FAA.