Enhancing the FAA's Airport Safety Analysis Capability

As new operational procedures, equipment, and aircraft capabilities become available, the need for a more robust, efficient, and easier way of conducting complex safety analyses has been identified by the Federal Aviation Administration (FAA). Such a capability is needed to address the demand for safety analyses as the FAA transitions to new types of operations in all phases of flight.

The MITRE Corporation's Center for Advanced Aviation System Development (MITRE/CAASD) has developed a research platform for requirements elicitation called the Safety Assessment Toolset Prototype (SAT-P). The SAT-P builds upon the existing Collision Risk Model (CRM) and focuses on data integration, modeling complex obstacles, and providing a higher fidelity representation of air traffic and airport operational constraints needed to support safety assessment analyses. The prototype has helped the FAA define requirements for software tools to automate some of the labor intensive processes in setting up a safety analysis. It will also help the FAA prepare to incorporate new technologies and operations into their safety analyses and will support the transformation to a performance based National Airspace System (NAS).

Data Integration. The SAT-P provides the airport safety analyst with easy access to critical data and photo imagery, all geo-referenced for display and analysis within a geographic information system graphical user interface. The National Airspace System Repository database, integrated with the SAT-P, provides data on airports, runways, Instrument Landing System (ILS) approaches, Navigational Aids, and fixes. The Flight System Standards Information Service, a Web service linked to the SAT-P, provides data on obstacles in and around the airport environment. Obstacles can also be imported from the Digital Obstacle File database. Additionally, the SAT-P can display video maps, airport layout diagrams, ESRI Shapefiles, GeoTIFF files, satellite photo imagery of airports, and terrain data from the Digital Elevation Model and Digital Terrain Elevation Data.

Complex Obstacle Modeling. Often a safety analysis problem demands a more complex obstacle representation to account for the width and depth of the obstacle's "footprint." To address that need, the SAT-P demonstrates a capability to outline buildings and other elements requiring complex representation and enables the analyst to assign key properties, such as precise location and dimensions. The SAT-P then automatically generates a series of wall obstacles suitable for CRM analysis. A similar capability enables terrain features to be modeled as complex obstacles. Terrain contours are generated for areas of interest and represented as a series of point obstacles along the contours for CRM analysis.

Grid Obstacles. The SAT-P demonstrates a useful capability for analyzing candidate locations for proposed obstacles. The analyst can construct rectangular grids to represent multiple locations and height options for proposed obstacles. The SAT-P can then assess each cell location to determine its collision risk safety. This allows the analyst to run the CRM thousands of times to assess each cell together with other obstacles for various combinations of aircraft landing speeds and minimum obstacle clearance heights. Results are displayed graphically, making it easy for the analyst to view optimal locations for obstacle placement at an airport.

CRM Case Analysis for Multiple Runways/Airports. The CRM, originally designed to assess one runway/ILS at a time, has been integrated with the SAT-P to facilitate analysis of multiple runways at one or several airports as part of a single assessment case. The analyst can now construct one case to determine how changes in the CRM engine (e.g., visual segment risk calculation capability) or changes in an obstacle database may affect risk across several airports. The analyst is freed from the burden of setting up individual cases for each runway allowing them to promptly complete complex multi-airport analysis cases.

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