



Aviation Visualization and Analysis

Center for Transportation Analysis
(CTA) Research Areas

- Aviation Visualization and Analysis
- Data, Statistical Analysis
- Geo-Spatial Information Tools
- Defense Transportation
- Energy Policy Analysis
- Environmental Policy Analysis
- Highway Safety
- Intelligent Transportation Systems
- Logistics Management
- Supply Chain Management
- Modeling and Simulation
- Transportation Operations
- Planning and Systems Analysis
- Transportation Security

Understanding Flight Interactions

An ORNL team is supporting the Federal Aviation Administration Flight Standards Certification and Surveillance Division to identify safety-related aviation events using an integrated visualization and analysis tool.



The Austin Digital Inc. Flight Operations Quality Assurance (FOQA) tool, Event Measurement System (EMS), was developed to allow user-configured analysis of data from digital flight data recorders. An enhanced EMS, with highly efficient processing of visualization and analysis functions, is used to study radar tracks and airline data to identify flight interactions and so help identify precursors of safety significance.

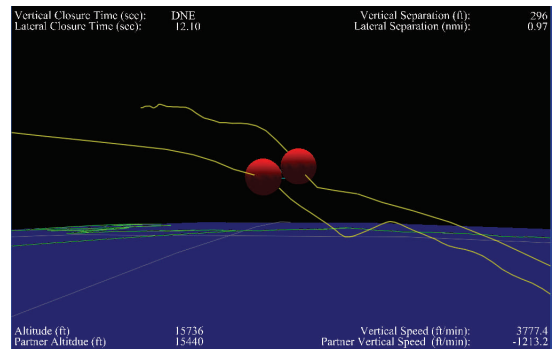
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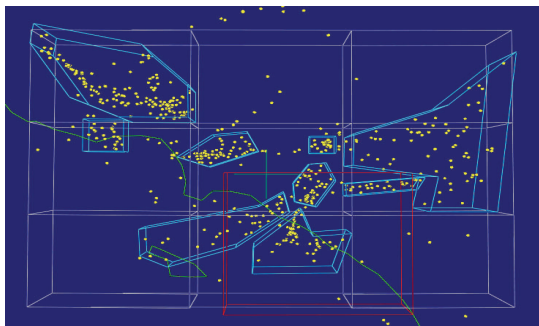
Radar Approach Control (TRACON) and Los Angeles Center (ZLA) facilities is used. The radar analysis complements analysis from airline partner's Flight Data Analysis (FDA) programs. *(Airline partners are users of the EMS FOQA tool).*



Analysis of radar data provides additional information for in-flight interactions of partner aircraft, including coordinated maneuvers and Traffic Alert and Collision Avoidance System Resolution Advisories (TCAS RAs).

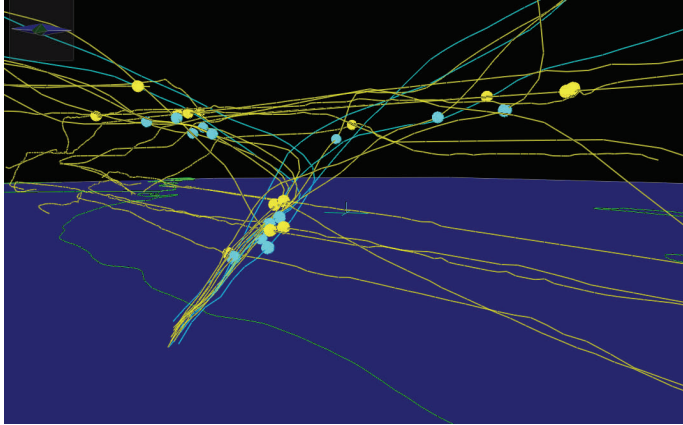
Identifying a Partner Aircraft in SNA Traffic Interactions

Departures from Santa Ana/John Wayne Airport (SNA) shown as blue tracks, and General Aviation traffic (yellow tracks) are displayed at an altitude of ~3,000 feet traveling level between the San Diego, Los Angeles, and Burbank regions. TCAS events occur ~8,000 feet. Some events are not apparent in radar data, but are identified in airline partner data.



A 3-month period (July to Sep 2004) of radar data for the Southern California Consolidated Terminal

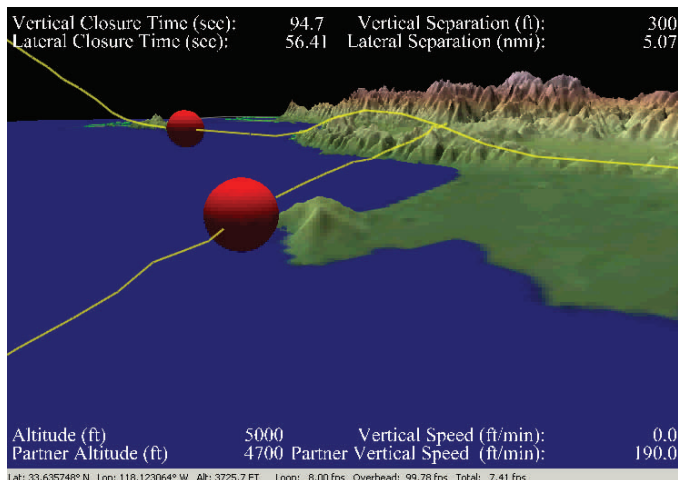
SNA Traffic Interactions



Demonstrate Measure

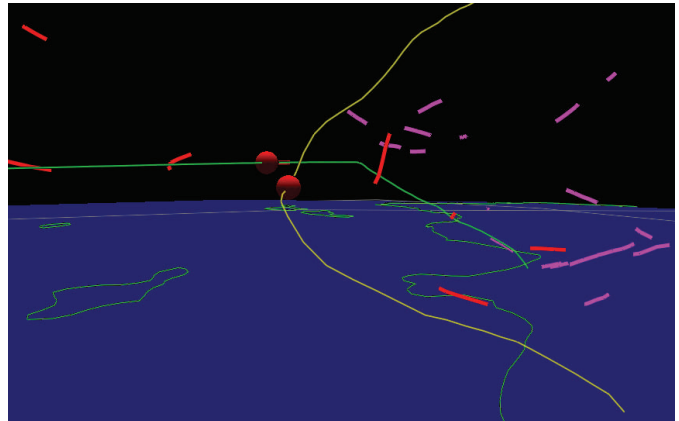
Two interacting aircraft are shown below: an E135 (Embraer Regional Jet 135) and a PA30 (Piper Twin Comanche PA-30) near Tandy Three arrival fix into in Santa Ana/John Wayne Airport (SNA). The aircraft on left responds to a TCAS RA with a climb to increase its separation from the other aircraft. At the shortest duration in separation for these aircraft ~12.2 s is the lateral closure time. (Minimum vertical separation for aircraft ~300 feet and Minimum Lateral Separation ~0.5 nm. These events occur at different times in the sequence).

Tandy Three Arrival into SNA: E135 Interacting with a PA30



Visualization of Flight Pairs

SNA departures are used to show visualization of flight pairs. Flights (with tails) shown in pink are SNA departures, and flights shown in red are close flights that approach closeness in separation.



Summary

- Radar data from Southern California are used to study flight interactions including coordinated maneuvers and Traffic Alert and Collision Avoidance System Resolution Advisories (TCAS RAs).
- The visualization and analysis tool can identify where mid-air collisions are possible in order to determine what preventive measures may be taken to avoid these low-frequency events.
- The ability to dynamically measure flight interactions is applicable to a variety of initiatives, including risk assessment, airspace characterization/management, and interaction analysis of airline data.
- The tool offers benefits for airspace management as well as safety analysis.



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