

NASA Simulation Capabilities

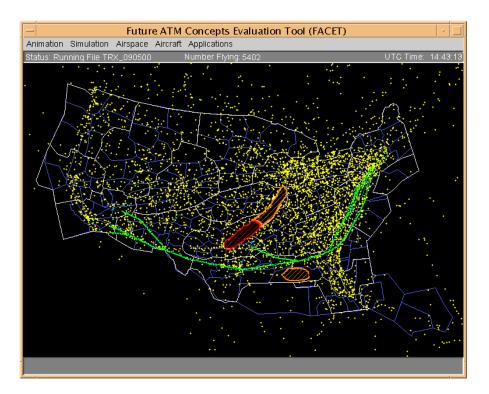
Aug 7, 2017 ver. 072517b





Simulation Tool Overview

 The Future ATM (Air Traffic Management) Concepts
Evaluation Tool (FACET) has
provided a core capability to
conduct air traffic management
research for NASA's Aeronautics
Research Mission Directorate
(ARMD) since 2000

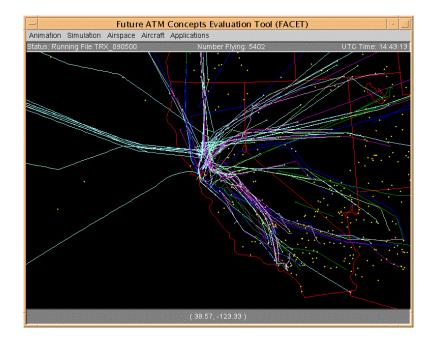


 Under the NASA-CAE agreement, FACET will be adapted to support simulations and analyses of Shanghai Pudong International Airport (IATA: PVG, ICAO: ZSPD) arrival and departure operations



FACET Overview

- National Airspace System (NAS) wide simulations and planning on a laptop computer
- Ability to model airspace operations at U.S. national level (~50,000 aircraft per day)
- Alternative navigation modes available
 - Flight Plan Routing
 - Great Circle Routing
 - Wind Optimal Routing
- Software written in 'C' and 'Java' programming languages
- Can be used for both off-line analyses and real-time applications

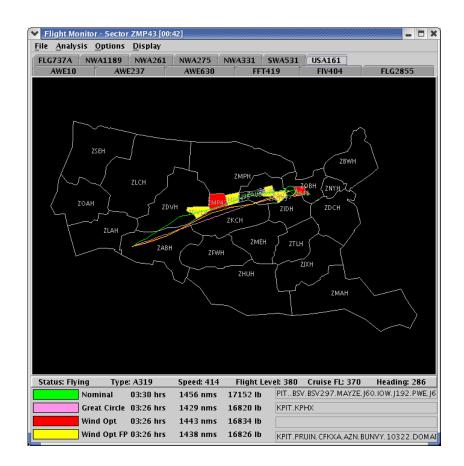


San Francisco Bay Area Arrivals and Departures



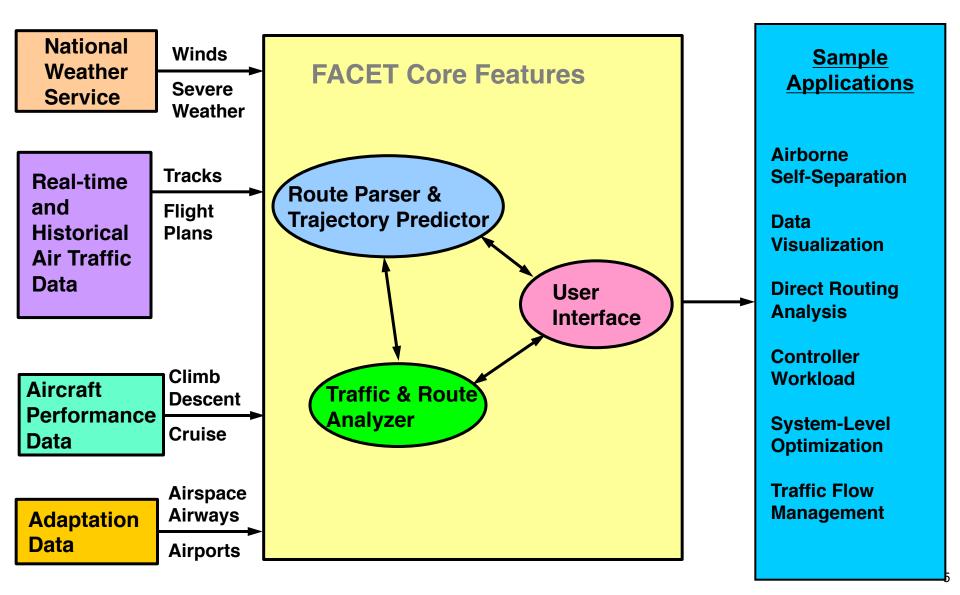
Sample of FACET Supported Studies

- "What-if" capabilities for evaluating traffic flow options to avoid bad weather and airspace congestion while minimizing air traffic delays
- Airspace performance metrics using operations data
 - Relationships between traffic, weather and delay
 - Techniques for clustering and data mining to identify similar types of days/operations
- U.S. domestic and Pacific wind optimal routing studies
- Aggregate air traffic flow models
 - Transform collections of similar trajectories into flow streams
 - Linear models with 100-fold order reduction



Sample "what-if" evaluation display

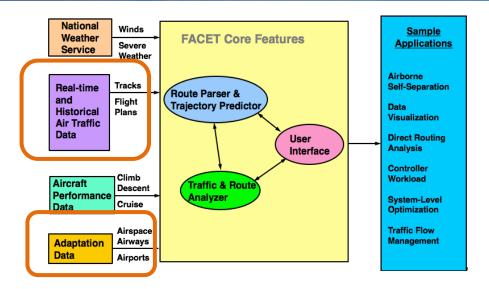






FACET Inputs

 FACET Interface Control Document (ICD) provides a comprehensive description of the system's airspace adaptation and air traffic data requirements

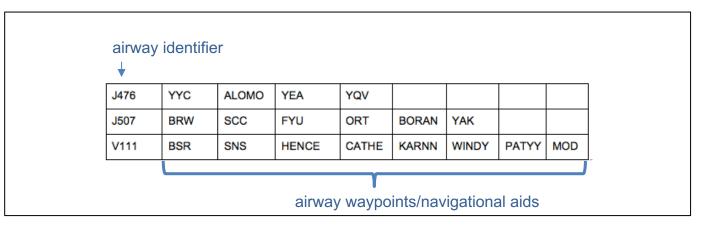


 Airspace adaptation requirements included for navigational aids, waypoints, airways, airport locations, Flight Information Regions (FIRs), sectors, Special Use Airspace (SUA), standard arrival and departure routes and airspace capacities

 FACET formatted ASCII air traffic data format derived from the FAA's System Wide Information Management (SWIM) data provided

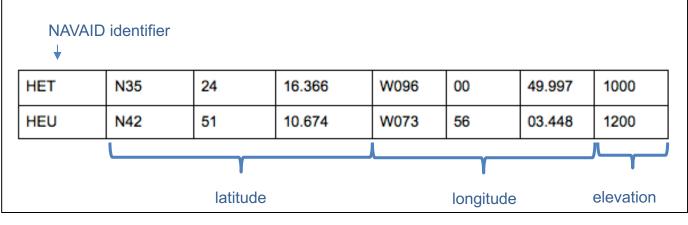


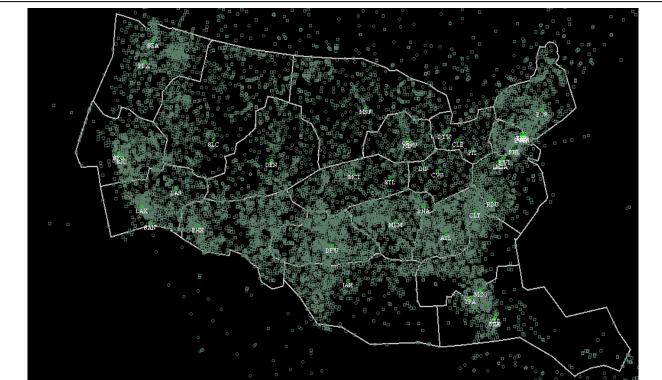
FACET Inputs :: Airways Example





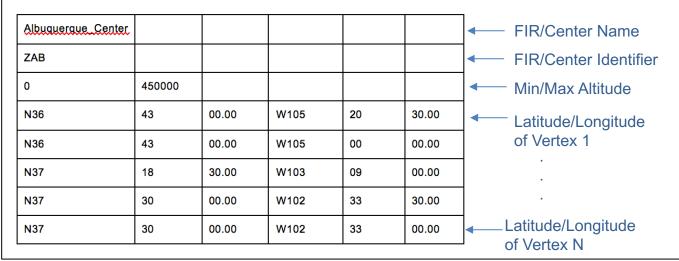
FACET Inputs :: Navigational Aids (NAVAIDS) Example

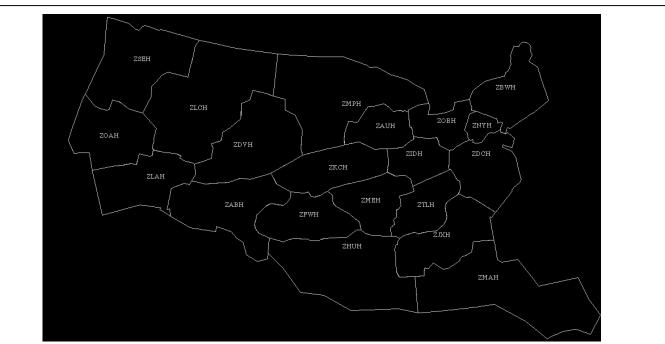




FACET Inputs :: Flight Information Region (FIR) / Center Boundary Example

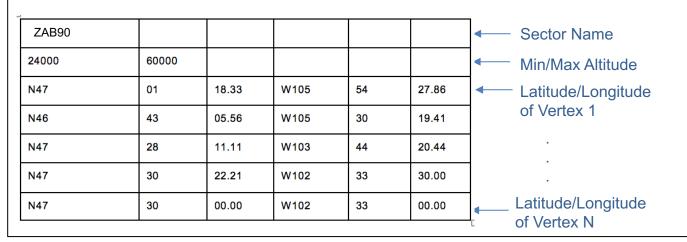


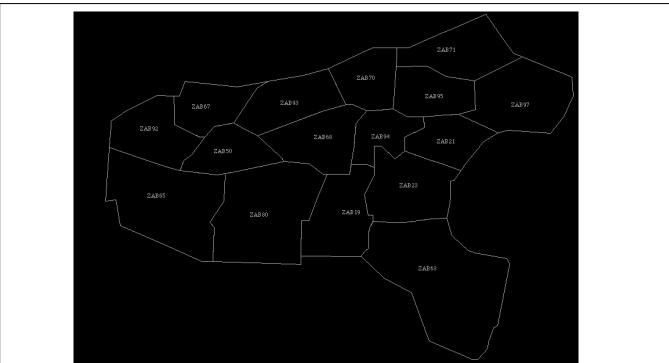




FACET Inputs :: Sector Example

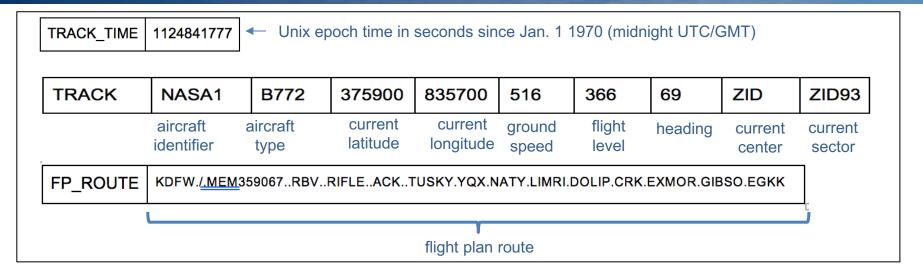


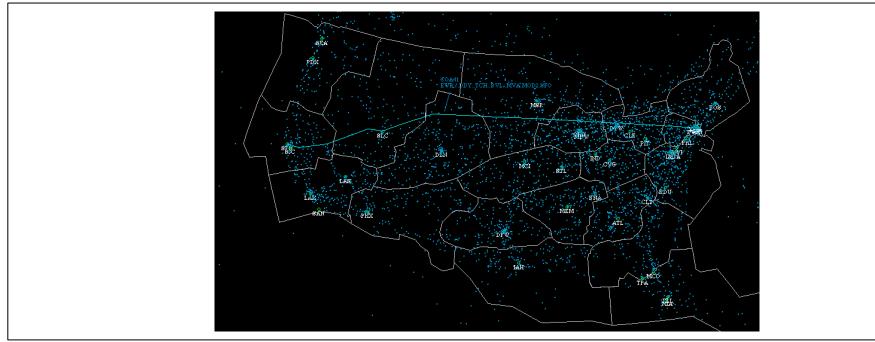






FACET Inputs :: Air Traffic Example

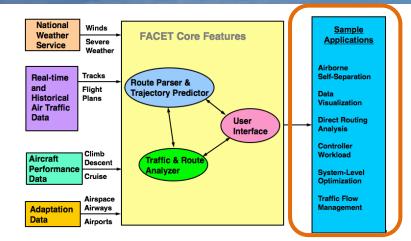


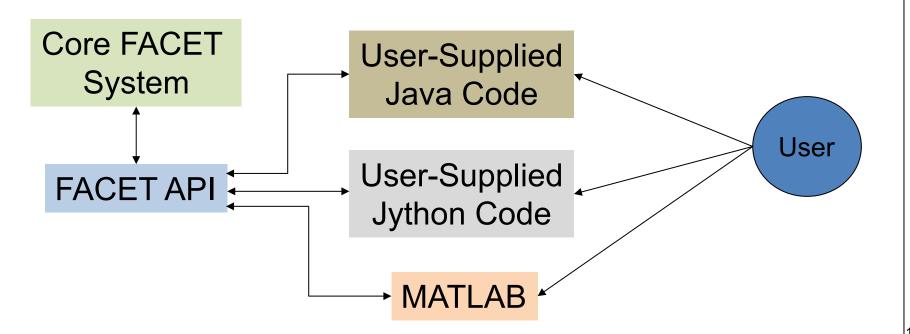




FACET Application Programming Interface

- FACET Application Programming Interface (API) enables scripting of FACET functionality from Java, Jython, Matlab, etc.
- Over 600 methods for accessing FACET functionality

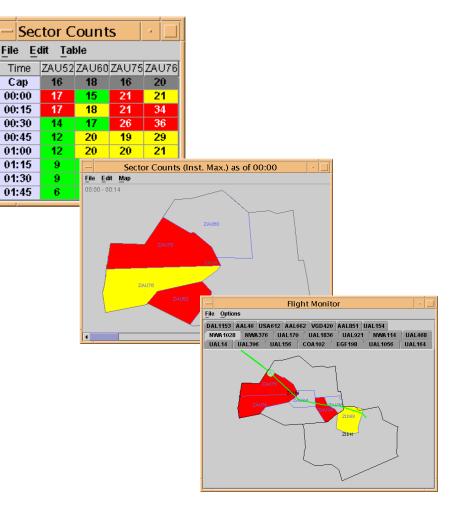






FACET Outputs

- Predefined FACET output capabilities provide:
 - Aggregate aircraft counts in FIRs/Centers/Sectors, arrivals, departures and user defined traffic streams
 - Aircraft-level statistics available for displaying aircraft state information (e.g., heading, speed, altitude, etc.) versus time, fuel burn, path distance and length, etc.
- FACET Application Programming Interface (API) provides complete access to all aircraft state information for user defined metrics calculations



Sample Sector Count and Alert Displays