TRAC Overview

Todd Callantine & Michael Kupfer
What is TRAC?

- “TCSim Route Analyzer/Constructor” or “Trajectory-based Route Analysis/Control” tool
- Graphical airspace/ route design, simulation, and data analysis tool
- Standalone Java application; executable is publically available
Capabilities and Assumptions

- **Airspace/Route Design:**
  - NFDC ‘56-day update’
  - Tools for graphical route/sector construction and analysis

- **Fast-Time Simulation**
  - BADA model
  - Trajectory-based operations ONLY
  - Tools for constructing traffic scenarios, schedules, and visualizing and trial-planning trajectories

- **Data Visualization and Analysis**
  - Loads variety of traffic data formats
  - ‘Pure’ data presentation
  - Tools for organizing and visualizing data, conducting analyses, constructing simulations from data
TRAC Support for MACS

• Read/write MACS airspace/route formats
• Read and analyze MACS/ADRS data
  – Output typical metrics
  – Adjust ‘open-loop’ MACS traffic scenarios
• Present actual/simulated track data in MACS tabular format to support scenario development
TRAC/MACS Workflow Examples

- MACS Data Analysis
- Route/Airspace Design
- Data Visualization
- Scenario Design
MACS Data Analysis

• Data Visualization

• Compute metrics and output
MACS Data Analysis

- Create Data Library
- FlightState
- Traj_plan_b
- Atc
- Macs_Pilot
- TimelineMeterList

Select MACS data log files using data library search strings
- full MACS data except ATC states (including confederates):
- full MACS data including ATC states (including confederates)
- full MACS data except ATC States (no confederates, no slot markers, no timelines)
- ...
MACS Data Analysis

• **Data Visualization**
  - Replay, plot tracks and profiles, fms-trajectories, slot markers, timeline information, events, custom plots
  - Apply filters, cycle through selected subset
## MACS Data Analysis

### Metrics:
- Known waypoint crossing times
- Waypoint Crossing Details (incl. schedule conformance)
- Overall Separation Violations
- Sequence Data
- Average Interarrival Data
- Interarrival Data
- Control Gate Flux
- Level Segment Data
- Sel. Route Conformance
- Control Gate Schedule Conformance
- Schedule Adjustment Data
- ETA-STA error
- Try time-to-fly-tool
- Script (schedule conformance)

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### Diagram

[Graph showing flight path and timing data]
Route/Airspace Design

- Draw a sector in TRAC and export to MACS format
- Draw a route in TRAC and export it to MACS format
Data Visualization

- Add a data set, select a data file, load it
- Various supported formats: CM-Sim, Adrs, TRAC tds, ... (for large files use preprocess data)
Data Visualization

- Plot tracks or replay them using the time slider
- Color code the tracks according to various criteria
- Filter the data set according to various criteria
- Lateral or vertical plots
Scenarios Design

- **Usage of actual traffic recordings (CM-Sim)**
  - Load traffic file and filter flights (flight type, destination runway, etc.)
  - Using the Data Set Flight Table save the aircraft information in the MACS format
  - Use the MACS a/c table editor, MS Excel, or any text editor to edit the file to build a MACS traffic scenario
  - The route, filed route, etc. usually need tweaking; other parameters such as cruise speed or cruise altitude often need to be filled in
  - Python scripts are available that use the TRAC output file and cm-sim data to populate missing data (see question 27 in the MACS Questions and Answers)

1) [https://aol1.arc.nasa.gov:8443/display/macs/MACS+Questions+and+Answers](https://aol1.arc.nasa.gov:8443/display/macs/MACS+Questions+and+Answers)
References


Additional Information

• Contacts:
  – Todd Callantine: todd.callantine@nasa.gov (650) 604-2631
  – Michael Kupfer: michael.kupfer@nasa.gov (650) 604-6424

• URL: http://humansystems.arc.nasa.gov/groups/AOL/technologies/trac.html

• Other documentation available:
  – Basic TRAC tutorial slides
  – TRAC shortcuts and keyboard functions
  – Documentation of MACS log file output options using python scripts in TRAC
  – Documentation of BADA calculations using python scripts in TRAC
Questions and Answers