



# Surface CNS Performance Impacts Analysis Using ACES Uncertainty Modeling

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NASA's Airspace System Program,  
Virtual Airspace Modeling and Simulation (VAMS) Project  
is developing the:

Airspace Concept Evaluation System (ACES)

ACES is being developed under ATMSDI Contract Task Order CTO-7 (COTR: Karlin Roth);  
Raytheon Prime, Seagull Technology is Technical Lead



# Airspace Concepts Evaluation System (ACES) is a fast-time, nationwide simulation of ATM-FD-AOC ops

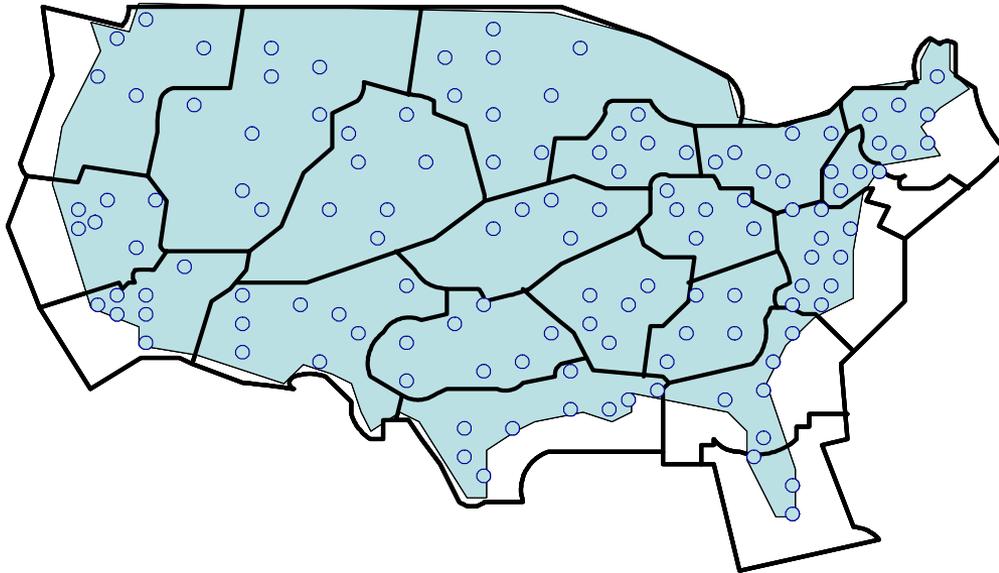
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## ACES Simulates:

- Hundreds of airports with TRACONs
- All centers & sectors
- 10,000's of individual flights
- Gate-to-gate
- Full multi-day flight schedule w/flight plans
- 4-D gridded winds

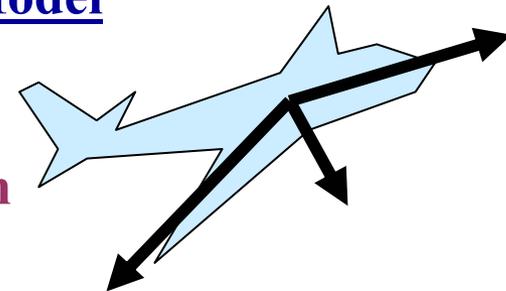
## ACES Provides:

- Dynamic visualization
- Data recording/analysis tools



## ACES has a high-fidelity 4-DOF Trajectory Model

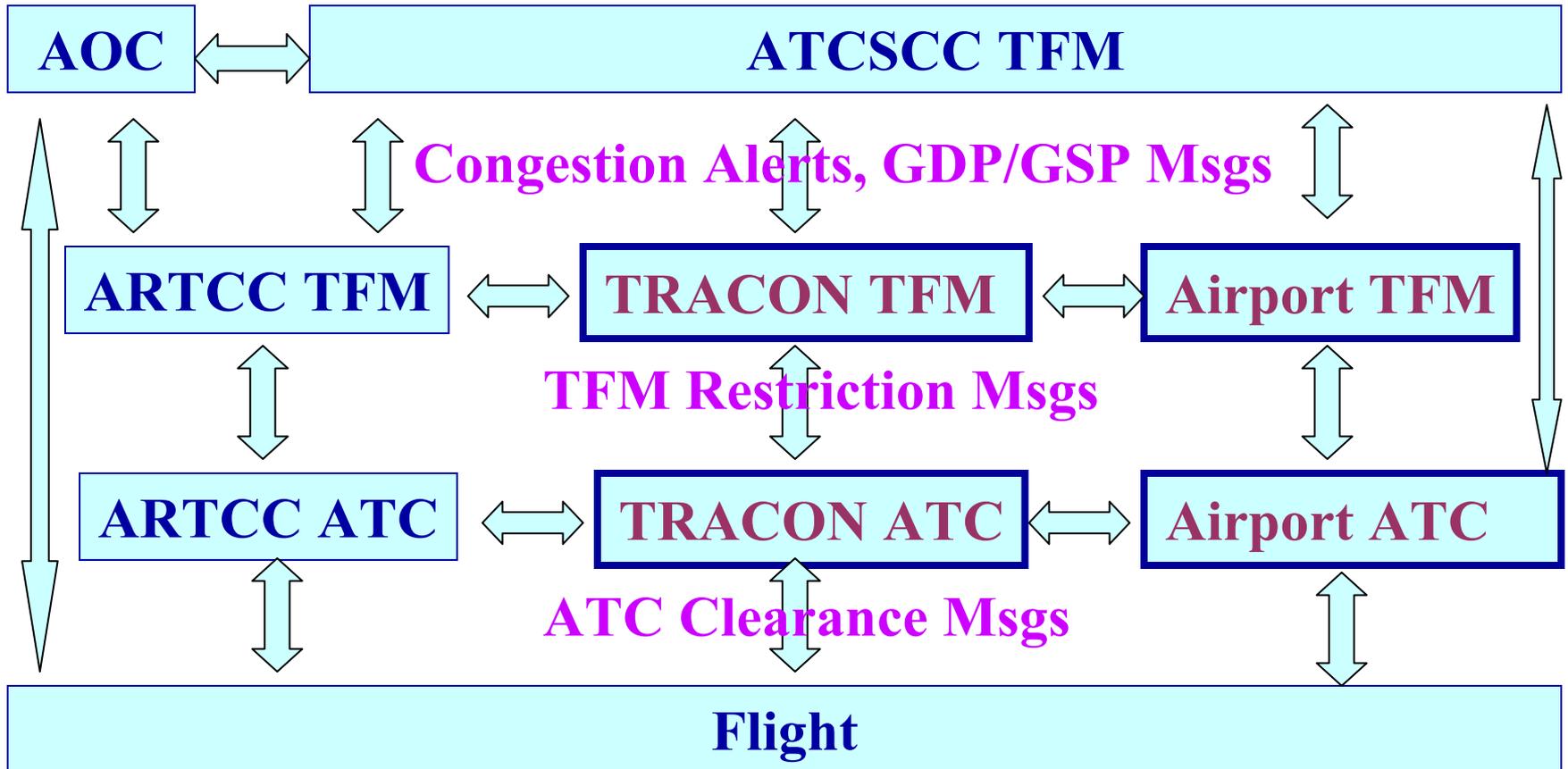
- Based on laws of physics and aerodynamics
- Realistic pilot-based control laws
- Includes elliptic-Earth trajectory propagation





# Agent-based processes modularly simulate airspace/airport/aircraft operations

Agents dynamically exchange operational information



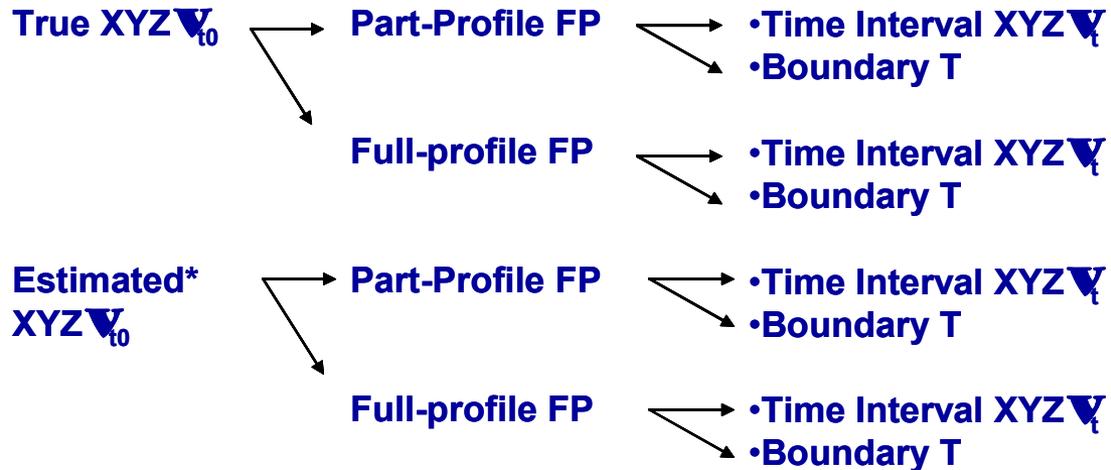


# ACES Uncertainty Architecture Supports Modeling of Information Distribution Among ATM/FD/AOC Agents

ACES represents relative capabilities of air-ground and ground-ground COM system design alternatives to provide timely and accurate data



EG:



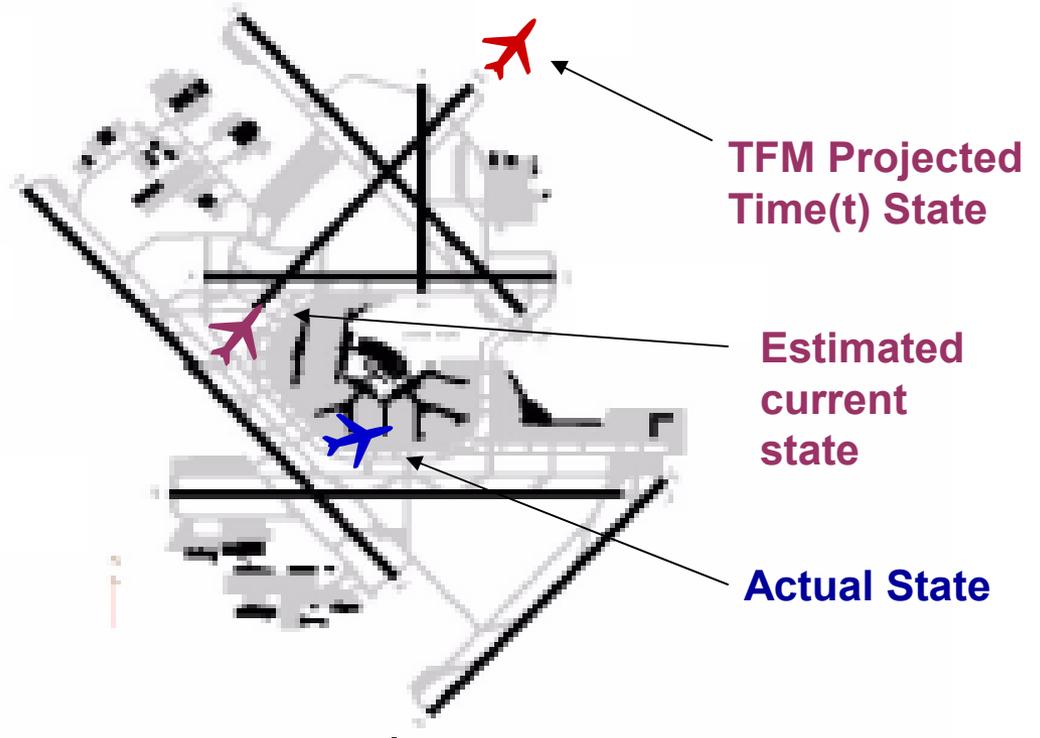


# ACES Agents Can Model CNS Error Sources Relevant to DST Trajectory Tracking and Prediction

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## Communication & Surveillance

Air Ground Data Link and Multi-Sensor Tracker Fusion/Surveillance Data Networking enhances knowledge of State and Intent Information and Improves Trajectory Prediction Accuracy for ATM DSTs





# ACES Can Analyze CNS System Design Impacts on ATM/FMS/AOC DST Performance

TFM Restrictions are dynamically defined and systematically propagated over planning horizon

