# G&C Research at Optimal Synthesis Inc.


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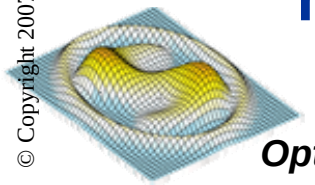

# Research Projects and Software

- **Research Projects:**
  - Air Traffic Management (Surface & En Route)
  - Vehicle Control using Internal Actuators
  - Data Mining on Store Separation Trajectories
  - Speech Recognition in the Presence of Nonstationary Noise
  - Hardware Acceleration for ATM Trajectory Prediction
- **Software Products**
  - Genetic Search Toolbox™ (for use with MATLAB®)
  - Nonlinear Synthesis Tools™ (for use with MATLAB)

**Software Under Development**

Surface Traffic Control (GO-SAFE)

Flight-Deck Automation for Surface Operations (FARGO)

Air and Space Interaction Studies (CARAT)

Air Traffic Flow Modeling & Control (MAESTRO)

Rapid Prototyping Environment for ATM Research (CARAT#)

Software for Designing Nonlinear Estimation & Control Systems (NST+)

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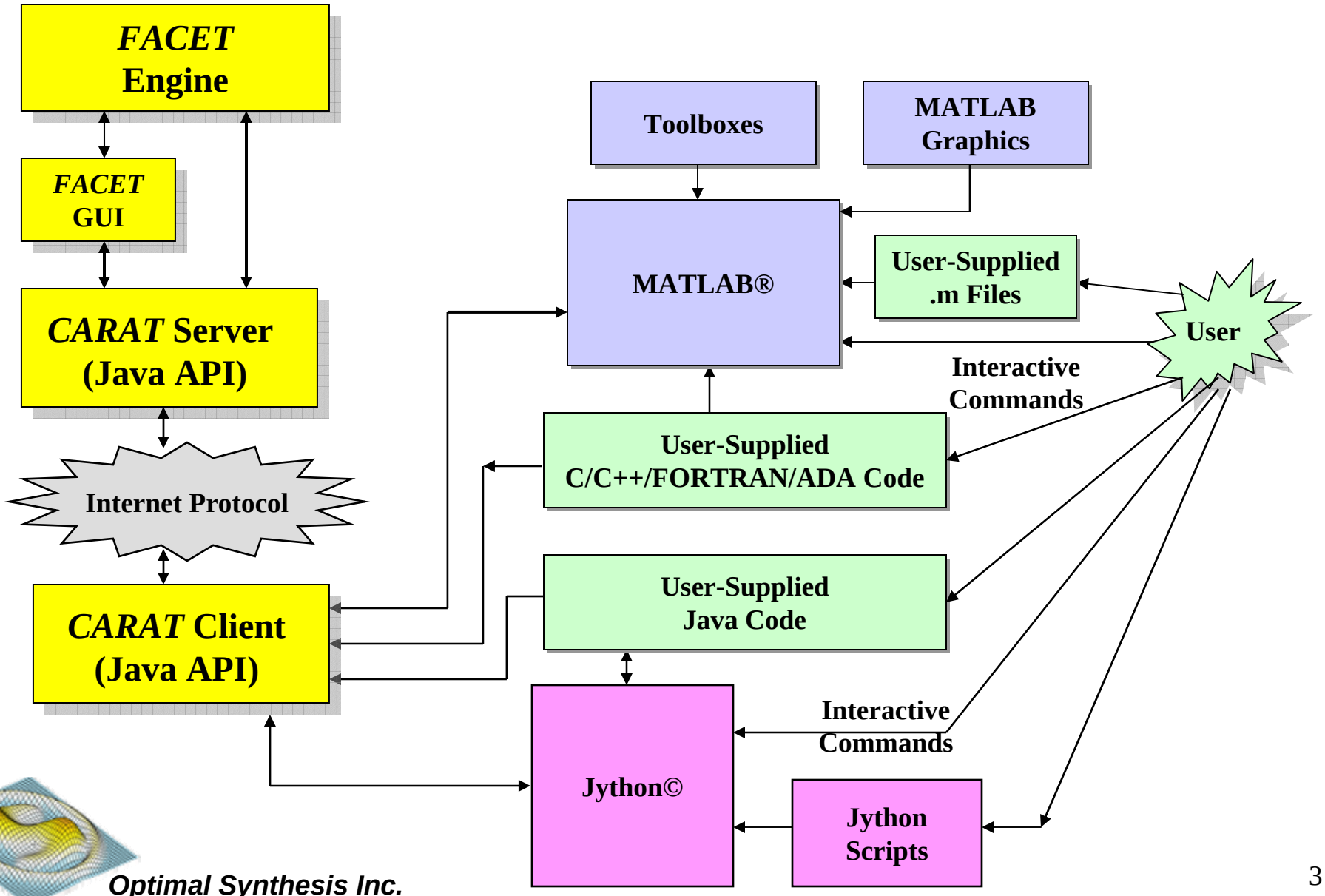
# Interactive Software for ATM Research

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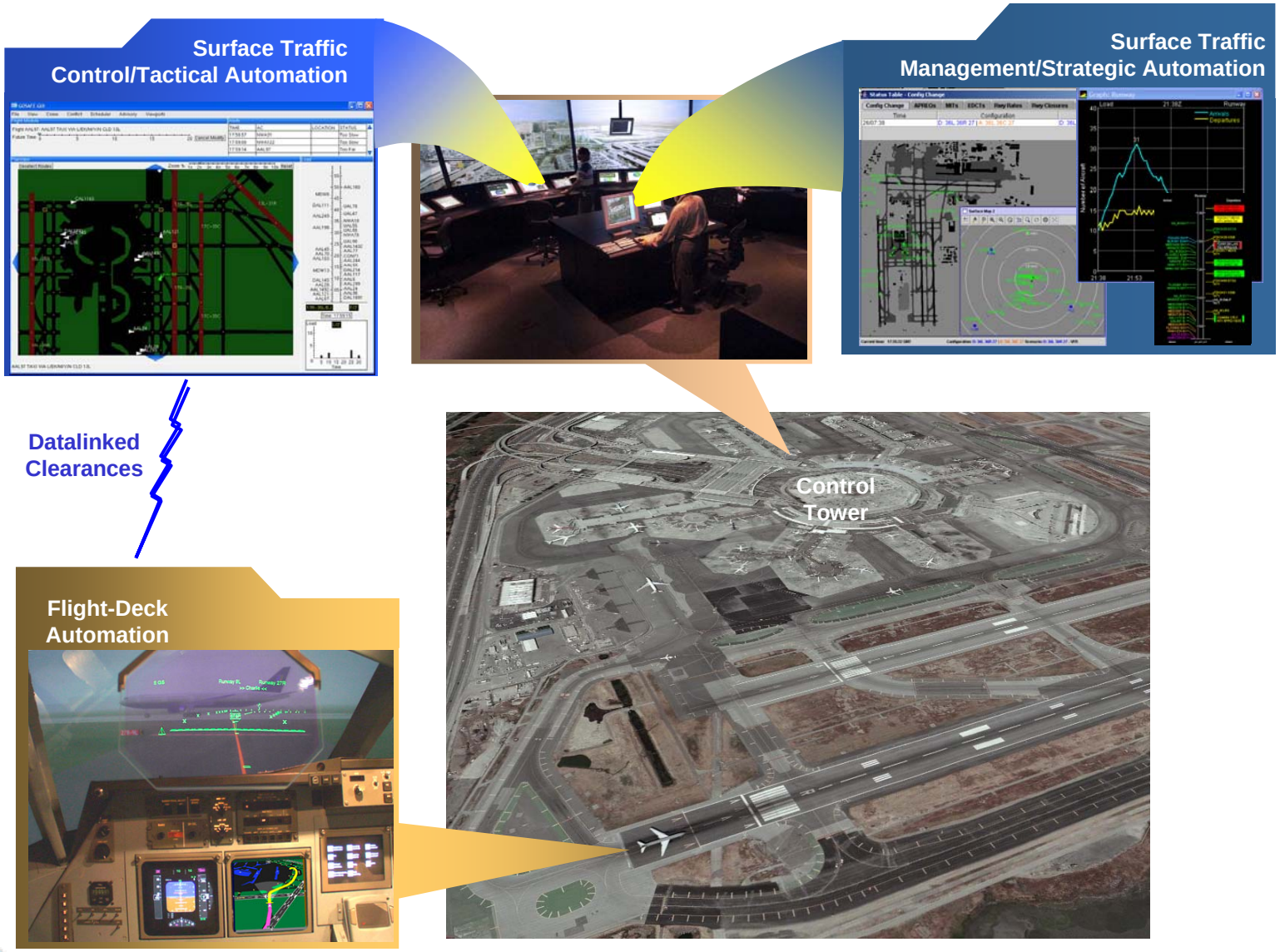
# Surface Operation Automation Research
# — SOAR —

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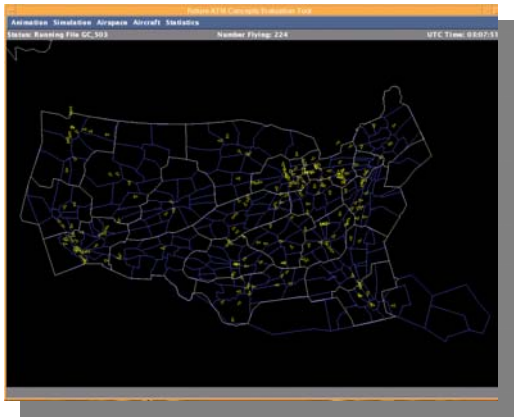
# Air and Space Traffic Interaction Research (ASTIR)

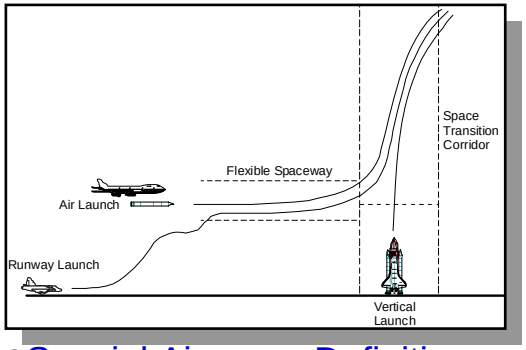
Launch/Return Vehicle Models



Future ATM Concepts Evaluation Tool (FACET)

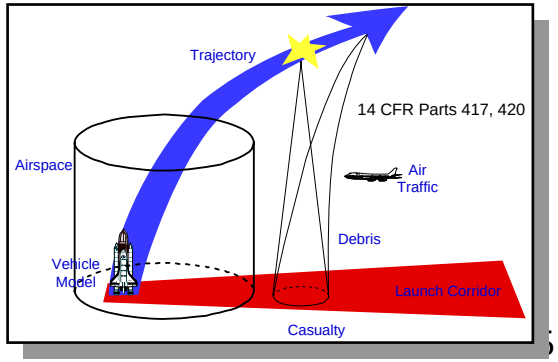
Configurable Airspace Research and Analysis Tool (CARAT)

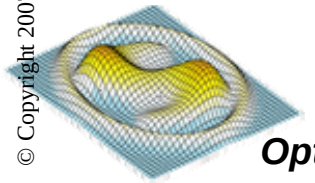
3D Graphics




Special Airspace Definitions

Flight Safety Analysis



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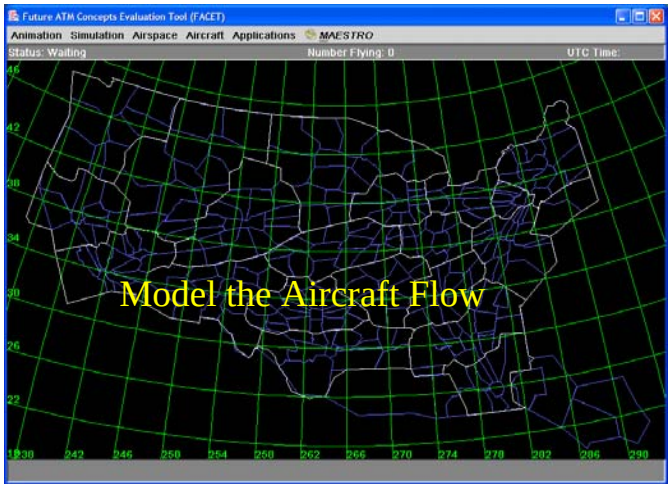
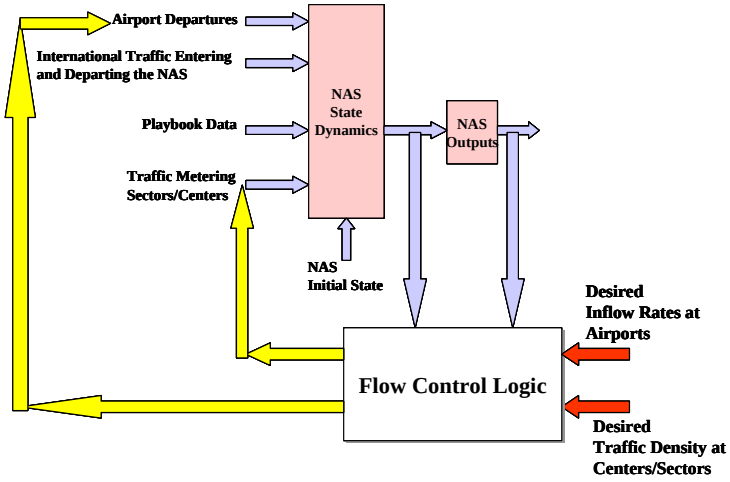
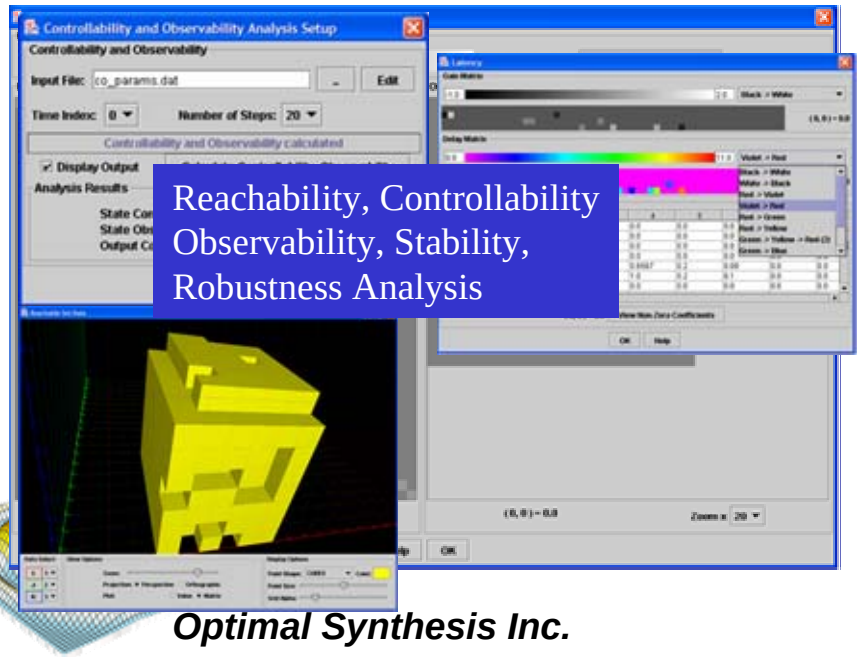
# Algorithms for Strategic Air Traffic Flow Control

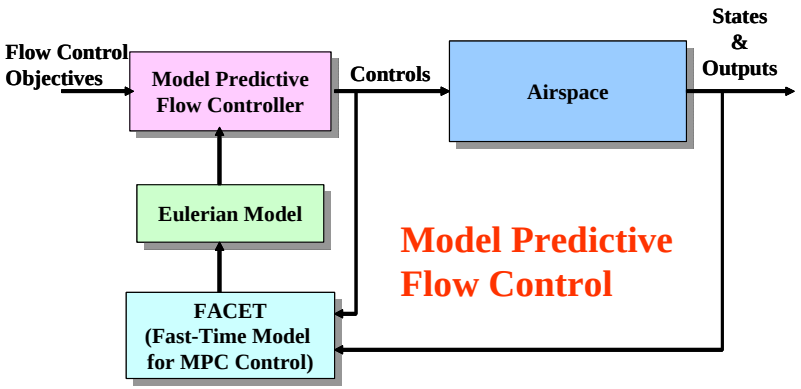



$$x(k+1) = A(k)x(k) + Bu(k) + B_d u^{depart}(k) + \pi q^{depart}(k) + \pi q^{exo}(k)$$

$$z(k) = C(k)x(k) + D_u u(k)$$

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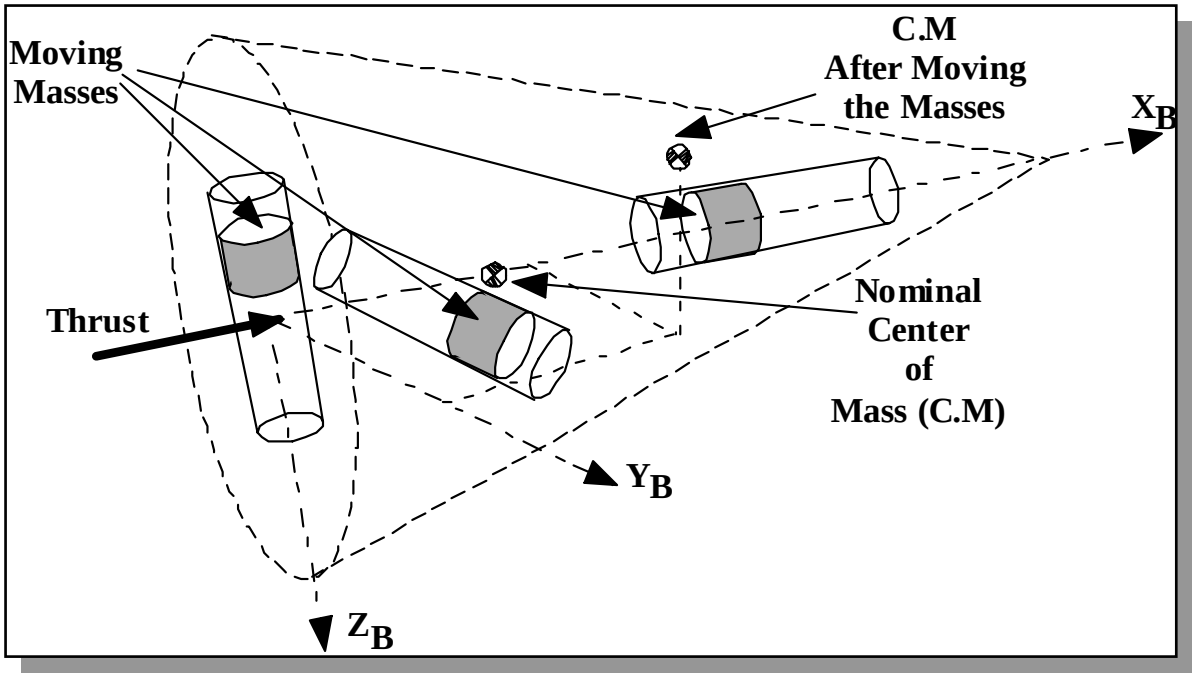
# Moving-Mass Actuated Control of Hyper-Velocity Flight Vehicles




**Moving Masses Alter the CM Location of the Vehicle, thereby Create Control Moments from External Forces**

**Integrated Guidance and Control Methods, Nonlinear Estimation**

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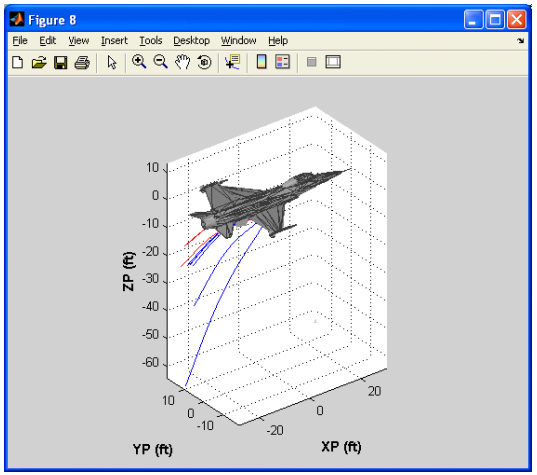
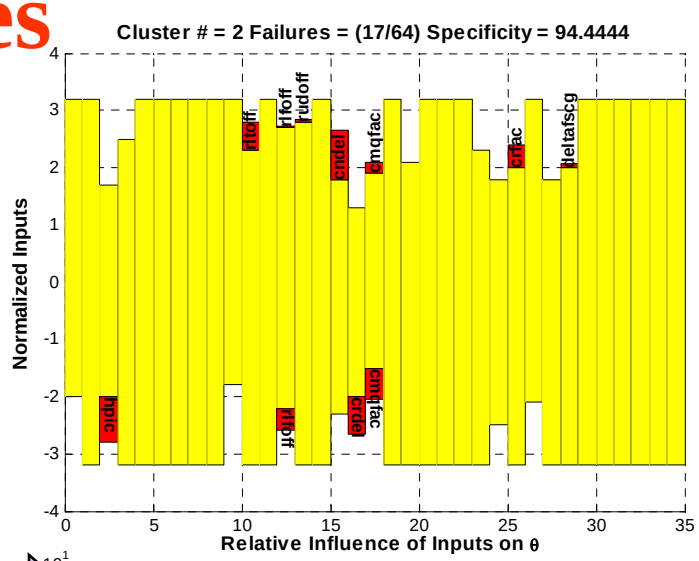
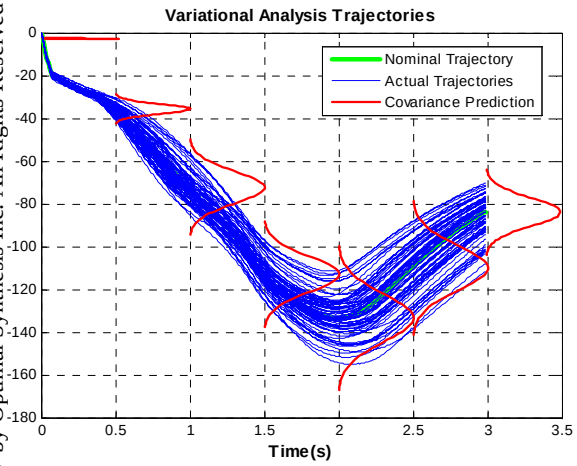
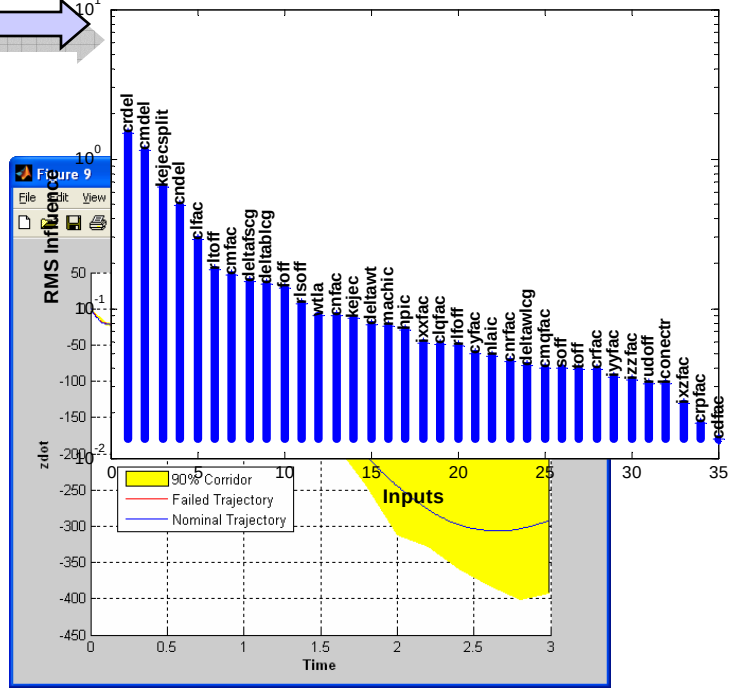
# Data Mining on Store Separation Trajectories

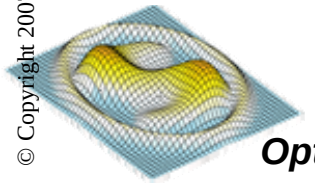



Data Mining Algorithms



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# Speech Recognition in the Presence of Nonstationary Noise

- Mixed UAV/Manned Aircraft Operations
- ATM Using Voice Commands
- Nonstationary Noise Sources

- New Technology Headsets
- Advanced Signal Processing
- Grammar-Based Speech Recognition

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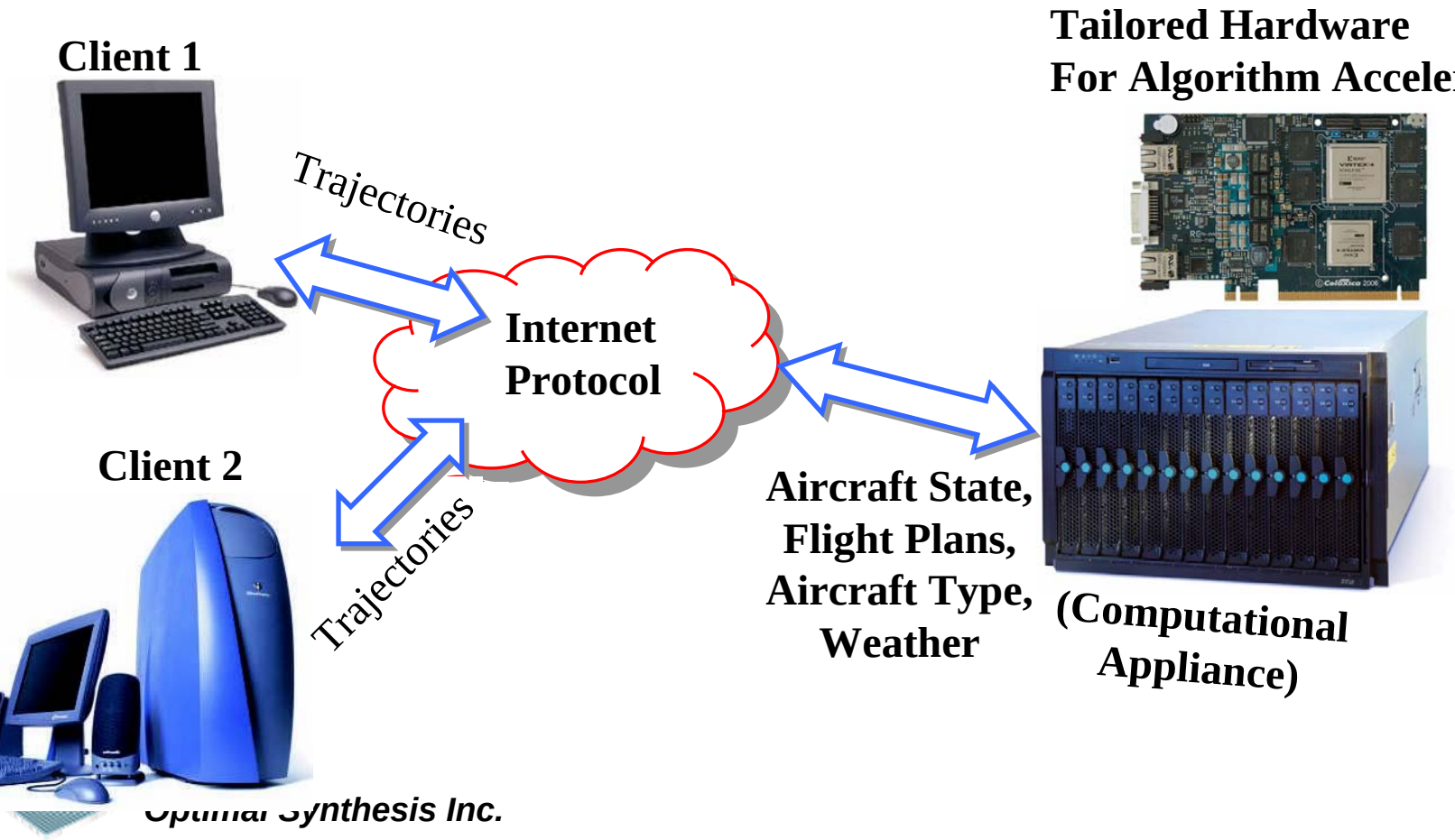
# Hardware Acceleration of Trajectory Prediction

- **Next-Generation ATM will Employ Trajectory-Based Operations**
- **High-Speed Trajectory Predictions will be Central to the Success of this Concept**
- **Special-Purpose Hardware for Accelerating Trajectory Prediction**

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