Yiannis Papelis, Ph.D.
Chief Scientist, Virginia Modeling Analysis & Simulation Center
Old Dominion University

Organization

- **University-level research center**
  - founded in 1997
  - 20 Researchers: 10 PhDs,10 project scientists
  - 22 engineering service experts
  - 7 administrative staff
  - 2 IT Staff

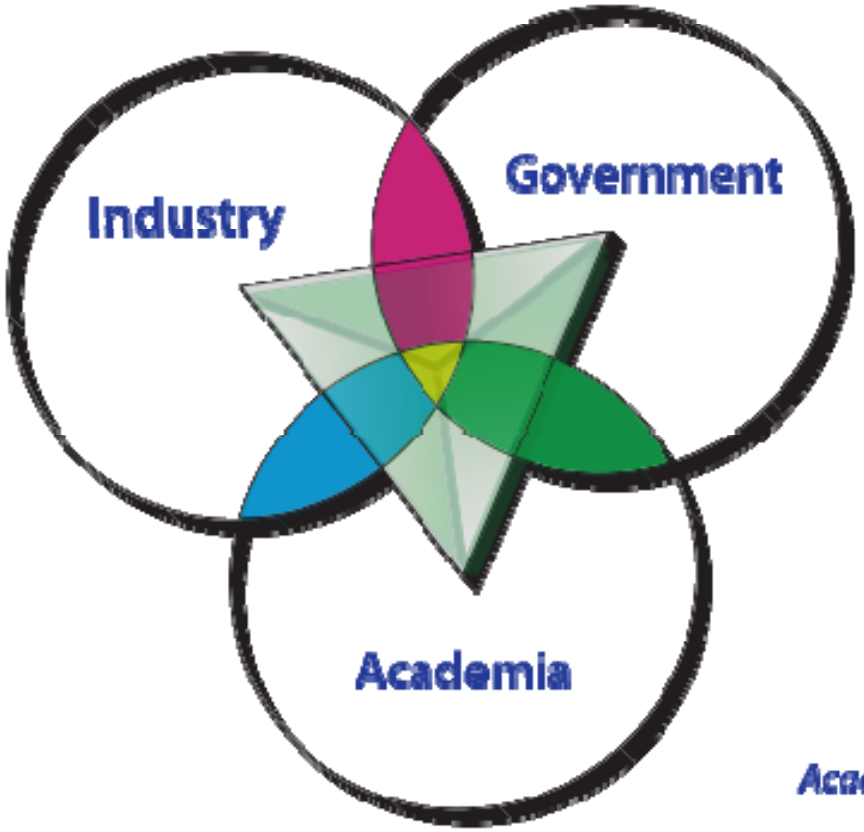
- Research sponsors include
  - U. S. Department of Defense,
  - NASA
  - Commonwealth of Virginia,
  - Private Industry

VMASC Facilities

- **Space Utilization & Labs**
  - GIS-Geospatial Visualization
  - Transportation
  - Medical & Health Care
  - Game-based Learning
  - Visualization
  - Small business incubators

- **Engineering & Computational Sciences Building**
  - Virtual Reality Theater
  - CAVE Facility
  - Modeling & Simulation Lab
  - Visualization Lab
  - Human Factors Lab

VMASC Components

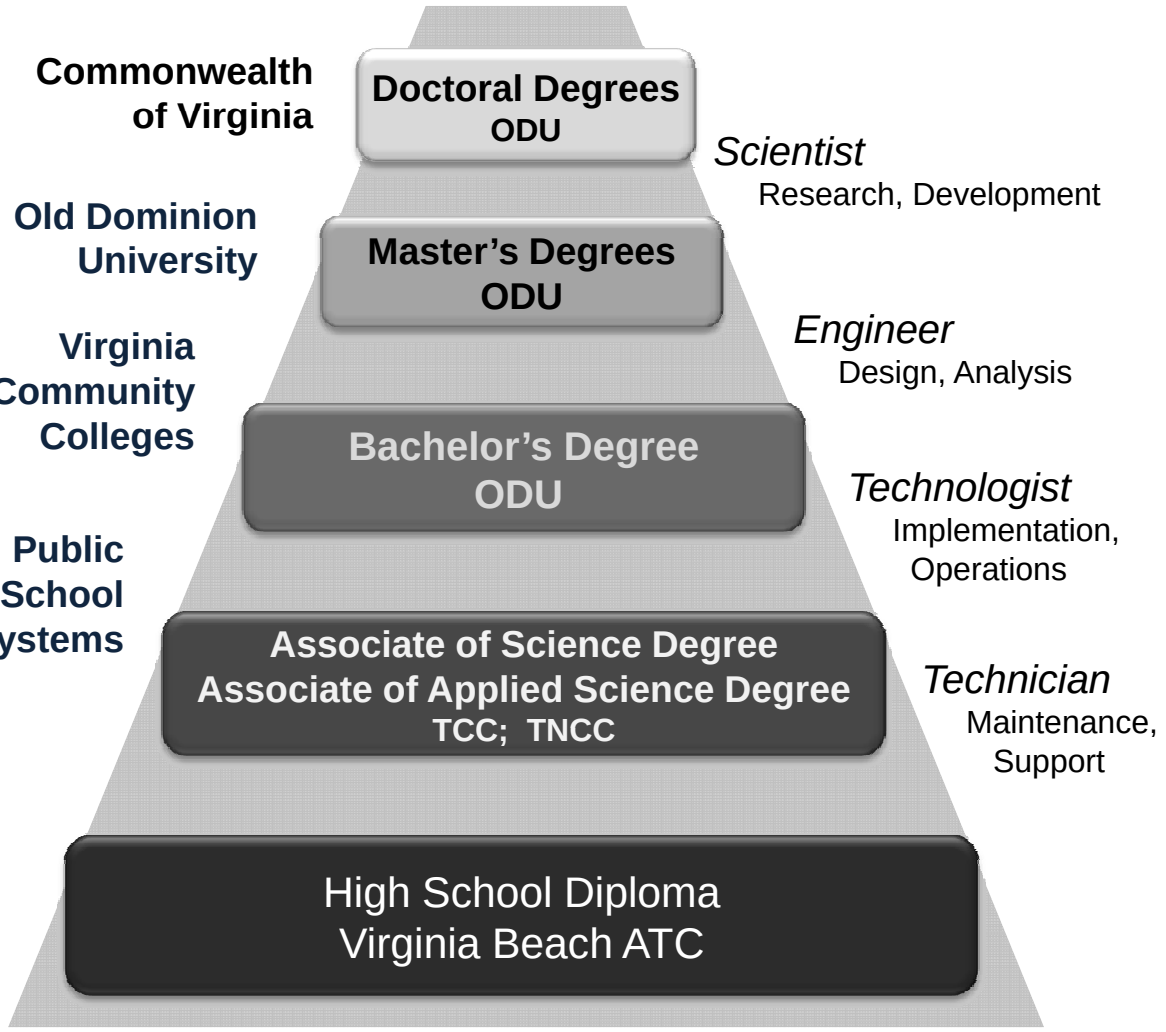


Government — Embrace M&S as a discipline and as a serious problem solving and decision support tool.

Industry — Leverage new developments in M&S to provide solutions to the market place and conduct collaborative research with academia.

Academia — Develop new M&S IP to help solve complex problems for industry and government and to provide industry with the tools for new product development. Provide knowledgeable students to industry and government as part of the workforce development process.

M&S Academic Programs



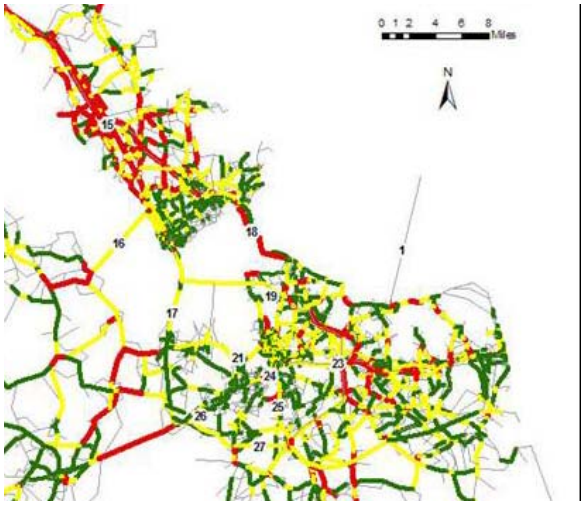
Partners in Providing World-Class M&S Education for Hampton Roads, the Commonwealth, and the World

M&S will be nearly a $1B Enterprise in Hampton Roads By 2010

Transportation M & S

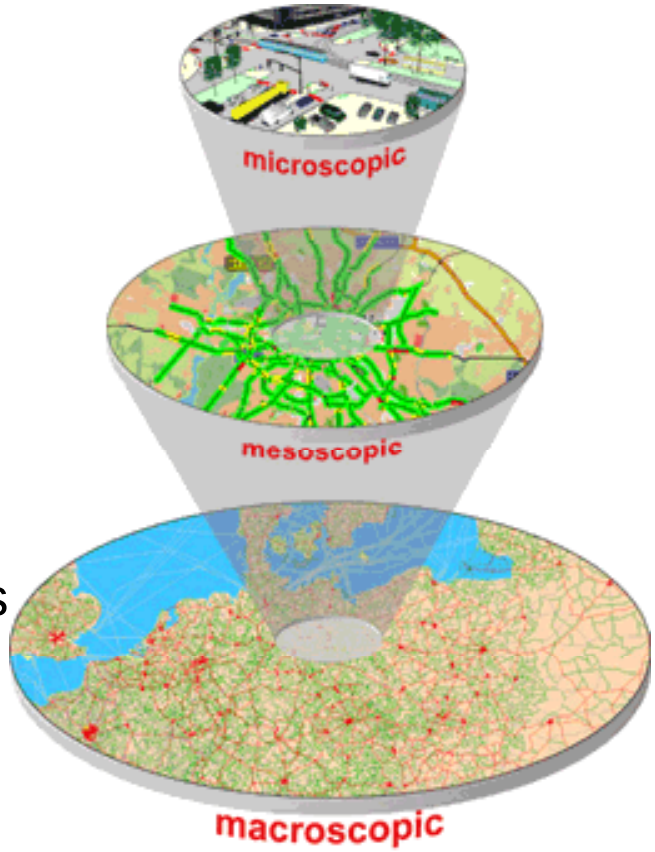
- Planning
  - Land use impacts
  - Alternatives analysis
  - Multimodal planning
  - Community review

- Operations
  - ITS simulation
  - Signal timing
  - ATIS
  - Monitoring and optimization



Simulation Approaches

- Microscopic
  - Simulation model of individual vehicles
- Macroscopic
  - Simulate flow, speed and traffic stream densities
- Mesoscopic
  - Hybrid approach, maintains best benefits micro- and macro-
  - Used in most studies discussed here



Microscopic Simulation Example

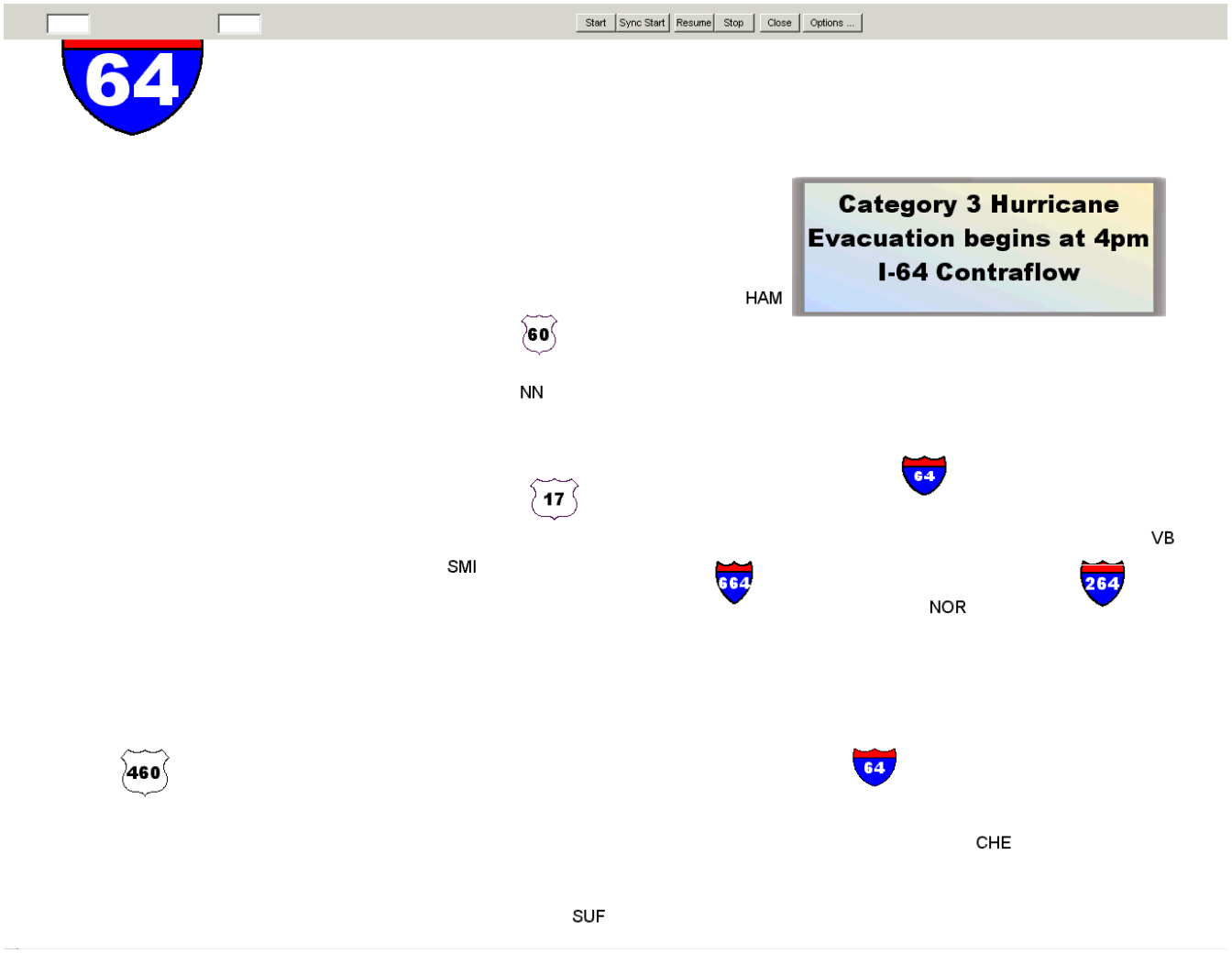
Overview of M&S Projects

- Will present a few M&S transportation projects
- Projects funded by VDEM, VDOT, among others
- Most projects are completed, some are still ongoing
- Final reports are available through VMASC or the contracting organization

HR Hurricane Evacuation

- Assess the feasibility of the Commonwealth's evacuation plan
- Focuses on the six primary routes
- Based on 2000 census updated with 2010 predictions
- Uses flood zone maps from US Army COE
- Assesses impact of accidents and incidents

Simulation Animation



Study Findings

- Category two and stronger storm evacuations require more time than originally planned due to increased impacted populations

- Existing timed phased evacuation improves traffic flow
  - Improvements are enhanced when phases are separated by an overnight period

Study Findings, Continued

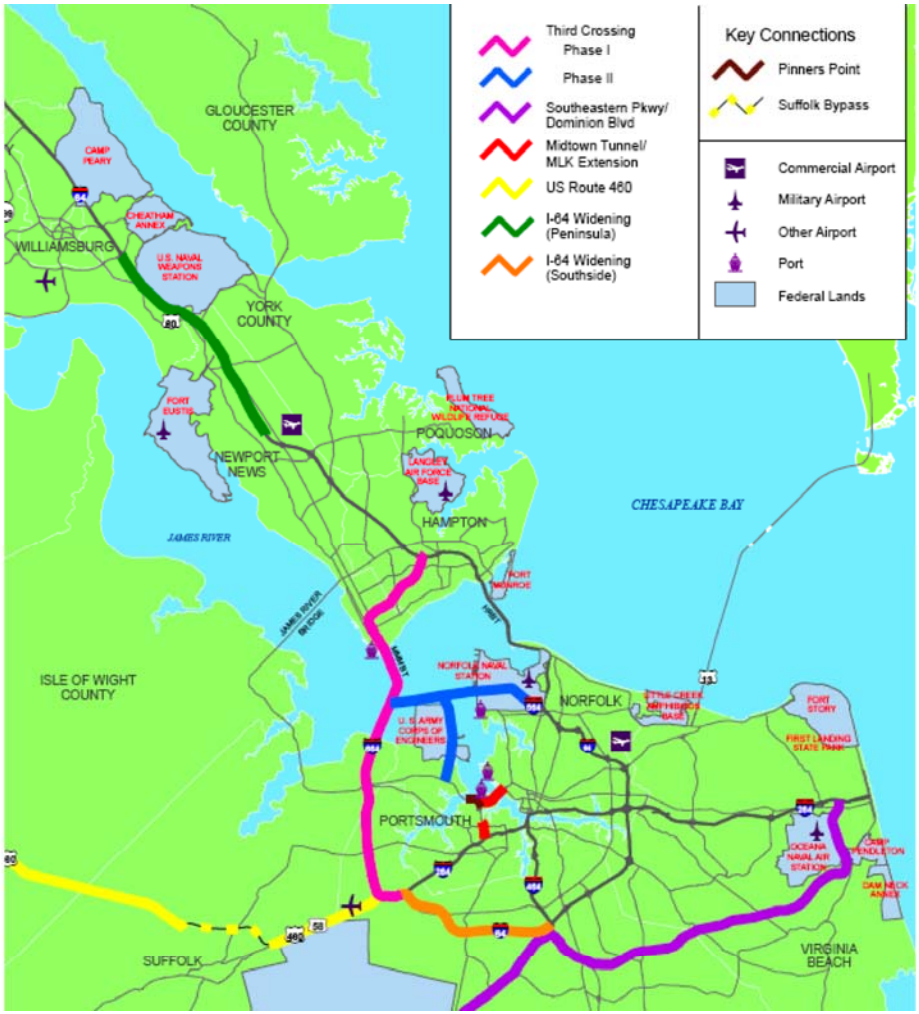
- Accidents and incidents increase travel time for immediately affected groups, but have only minor affect on total evacuation time

- Evacuee compliance with planned evacuation routes and Emergency Managers coordinated use of traffic information systems are critical

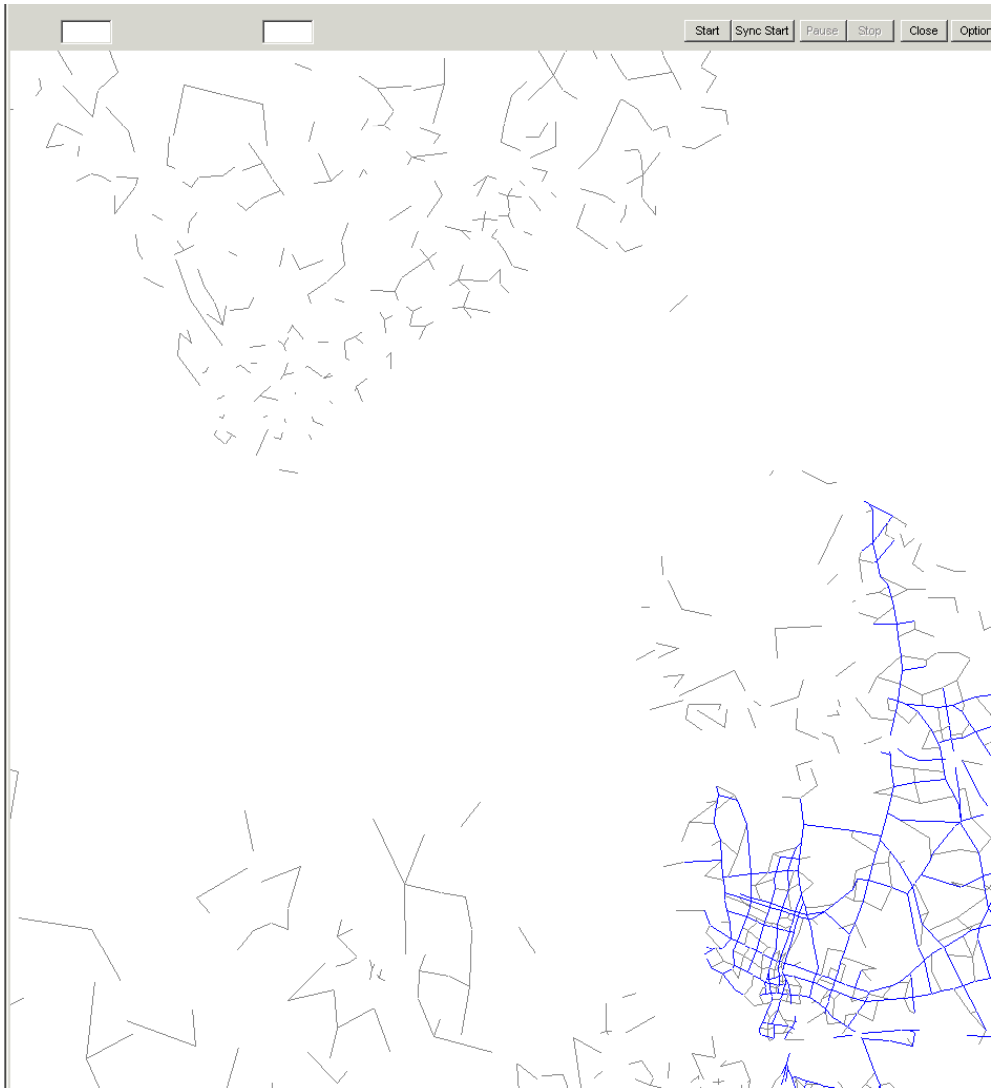
Transportation Alternatives Study

- Assess 6 alternatives for congestion mitigation
  a. 3rd Crossing from Southside to the Northern Peninsula.
     a. Phase 1: Widen I-664 from Bowers Hill to Hampton.
     b. Phase 2: Add a bridge-tunnel between the existing MMMBT and I-564 in Norfolk and a connector across Craney Island from new bridge-tunnel and the Western Freeway.
  b. Southeastern Parkway/Dominion Boulevard from Virginia Beach to Chesapeake.
  c. Widen Midtown Tunnel and extend MLK Freeway to I-264.
  d. Improving Route 460 (eventual construction of a parallel roadway)
  e. Widen I-64 on the Northern Peninsula as far west as Route 199.
  f. Widen I-64 on the Southside (including the High Rise Bridge) from Battlefield Boulevard in Chesapeake to Bowers Hill in Suffolk

Alternatives shown on map



Simulation Example



Study Findings

- **Taking no action is not an option**
  - HRBT traffic demand will be nearly 1.5 times capacity during peak travel hours
- **Of 6 proposed alternatives, only the 3rd Crossing appreciably improves conditions at the HRBT**
- **Only expanding the HRBT can relieve both recurrent and incident-induced congestion at the HRBT**
  - Expanding the HRBT to 6 lanes (or more) and imposition of tolls will relieve some, but not all, of the recurrent congestion
  - Combining an expanded HRBT and the 3rd Crossing (Phase 2) provides significant improvement

Additional Studies

- Effect of Freight Traffic
  - Validate model using current observations
  - Use validated model to make future predictions that include various increases in container-based traffic (APM Container Terminal)
  - Incorporates passenger vehicles and commercial trucking
- Volume-Delay analysis
  - Development of predictive models of delay that depend on volume measurements
  - Fundamental research with practical implications

Summary

- Transportation M&S is a reasonably mature field
- Several tools & scientific approaches can be utilized for planning and optimization
- M&S efforts can produce tangible & actionable results
- The role of VMASC
  - Proven ability to conduct transportation M&S on behalf of the Commonwealth
  - Independent scientific organization, part of ODU


Homeland Security & Defense
Transportation
Virtual Environments
Business & Supply Chain
VMASC
Social Sciences
Medical & Health Care

Questions