
21-23 June 2005, at US Military Academy, West Point, NY

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Modeling the Impacts on National Security from Disruptions in CONUS Critical Infrastructures

John R. Hummel, James F. Burke, Jr., and William B. Cunningham
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21 June 2005

72nd Military Operations Research Society Symposium
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Argonne National Laboratory



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Outline

- Why are CONUS Infrastructure Disruptions Important to the Military Environmental Factors Community?
- How do Disruptions in CONUS Infrastructures Impact National Security?
- How Can these Processes be Modeled to Provide Decision Support Tools to the Planning Community?
- Examples of Impacts on National Security Missions from CONUS Infrastructure Disruptions
- Summary and Future Directions

Why are CONUS Infrastructure Disruptions Important to Military Environmental Factors WG?

- **Reason #1:**

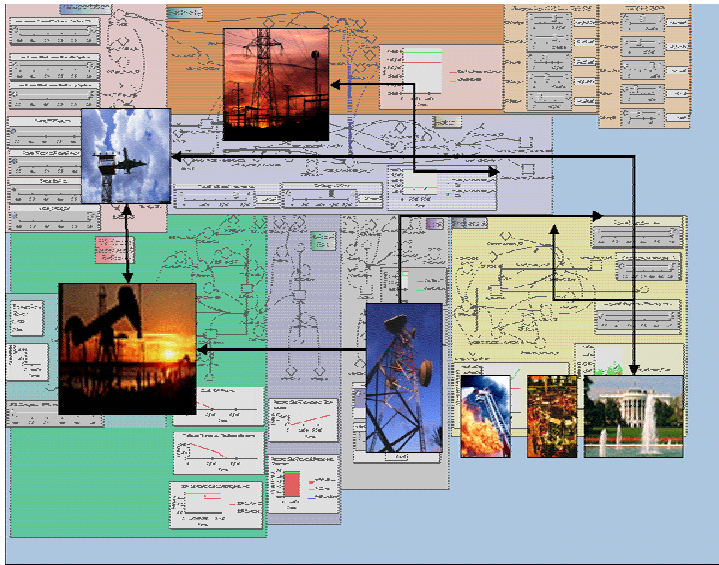
Any National Security Mission Can Involving Sourcing or Force Projection Activities from CONUS and Disruptions in the CONUS Infrastructure, from any Source, can Impact the Execution and Outcome of the Mission

Why are CONUS Infrastructure Disruptions Important to Military Environmental Factors WG?

- Reason #2:
In the DoD Modeling and Simulation Community, Authoritative Data About Infrastructures, and the Environmental Factors that can Impact them, are the Purview of the Natural Environment Executive Agents

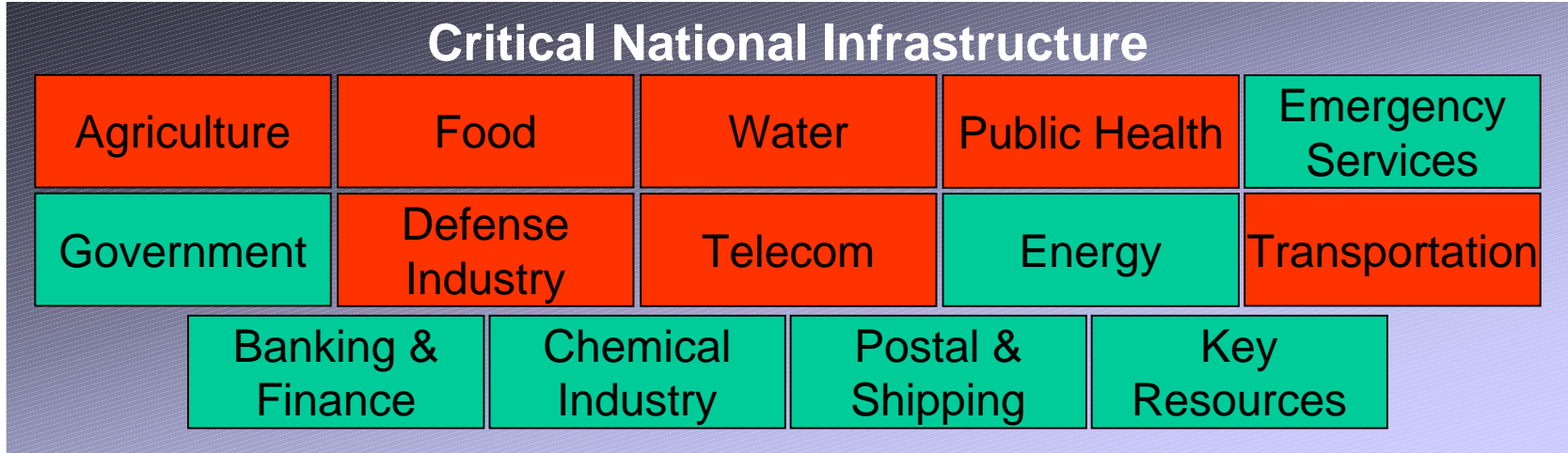
The Critical Infrastructure Protection Decision Support System Program (CIP DSS)

- The DHS-Funded CIP-DSS Program is a Tri-National Laboratory Effort that is Developing:
 - A set of interdependent CONUS infrastructure models used to assess consequences of disruptions initiated in any of the infrastructures
 - A risk-informed decision support tool to help identify investment strategies and other options that best reduce overall risk



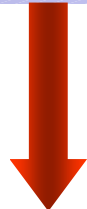
- CIP-DSS will be Used to Provide Insights into:
 - Consequences of attack
 - Choke points
 - Risks and uncertainties
 - Investment and mitigation strategies
 - Impacts on National Security

How Do Disruptions in CONUS Critical Infrastructures Impact National Security?



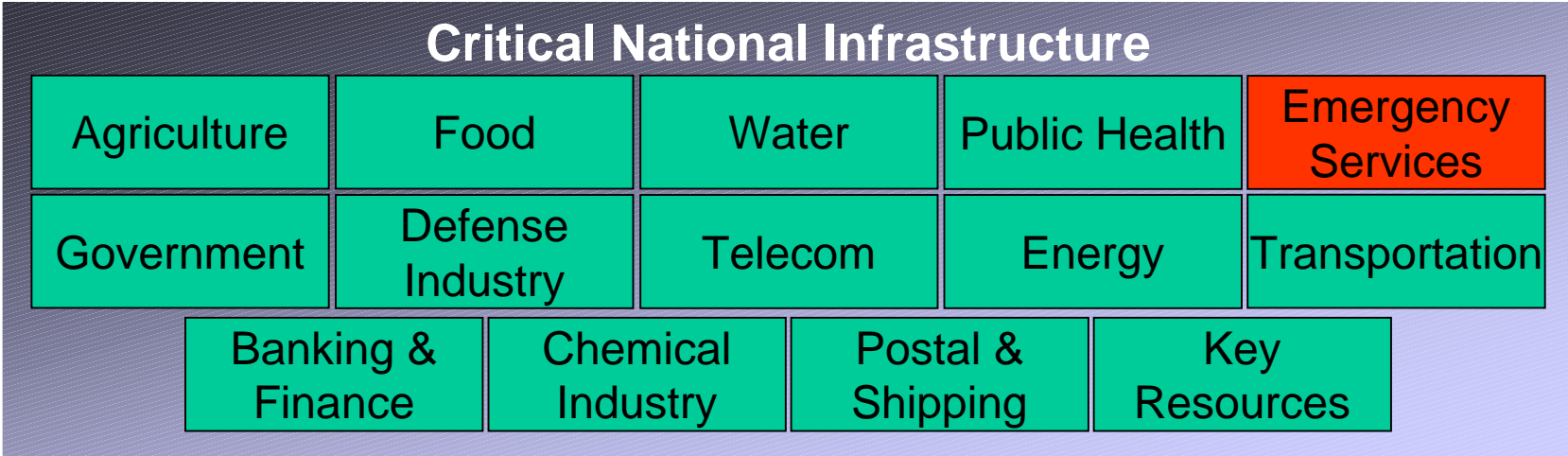
Impacts from Critical Infrastructures

- Longer movement times
- Effective loss of assets
- Shortfall in critical skills
- Shortfall in critical materiel
- Delays in completing specified functions



National Security Infrastructures

How Do National Security Missions Create Impacts on CONUS Critical Infrastructures?



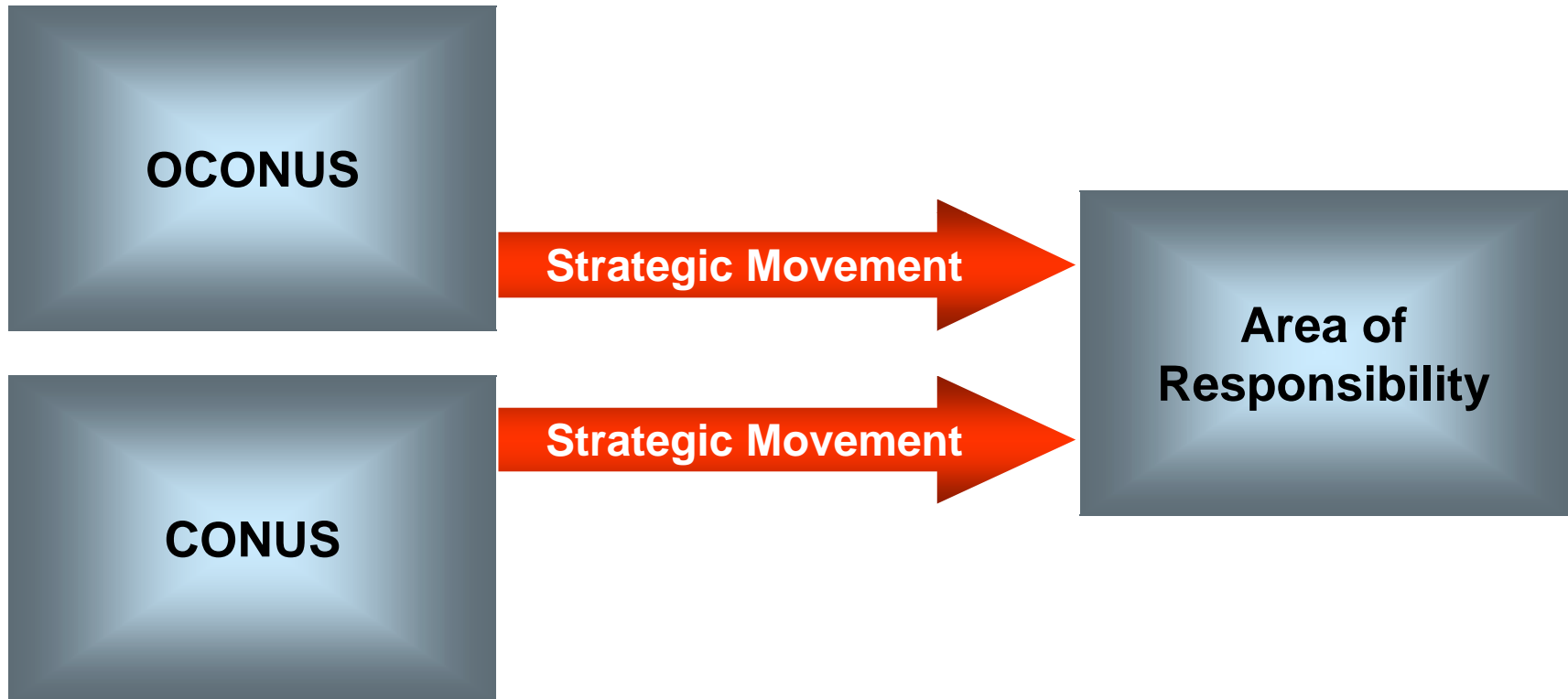
National Security Infrastructures

Impacts on Critical Infrastructures

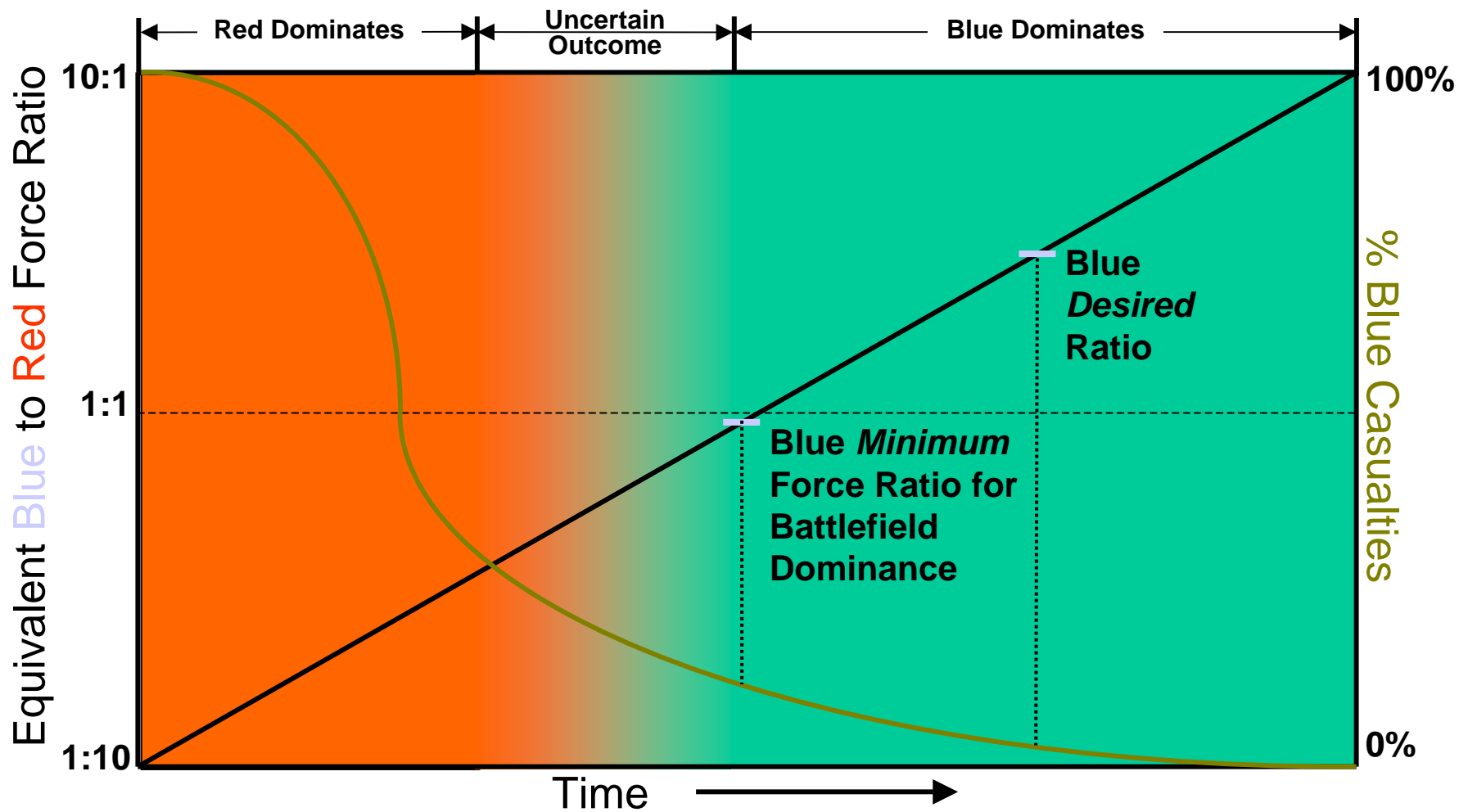
- Shortfall in critical skills

How can we Model CONUS Infrastructure Disruptions on National Security Missions?

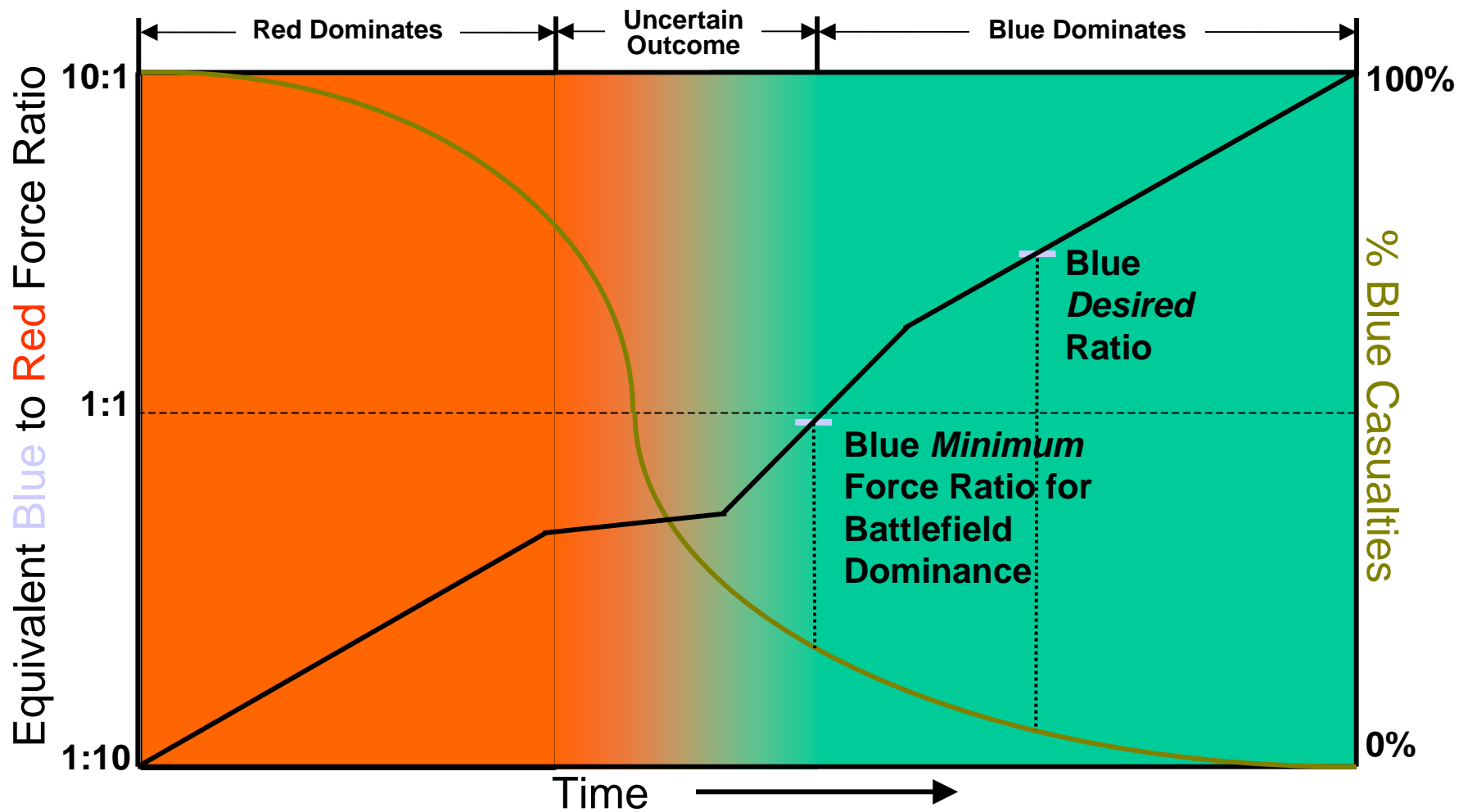
Any National Security Mission will Involve Commonalities



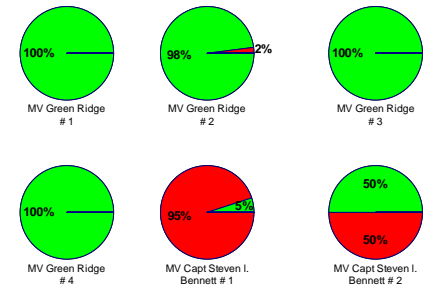
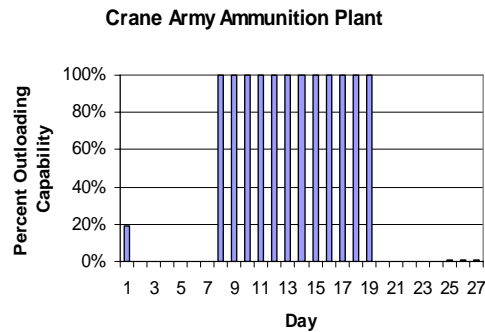
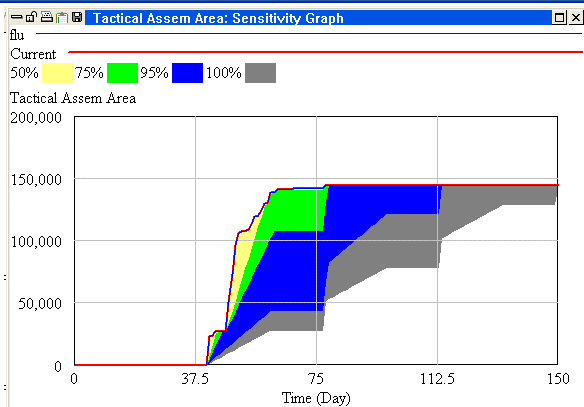
Commonalities of National Security Missions – Commanders will Have an Execution Plan



Commonalities of National Security Missions – Commander's Plans will be Adjustable



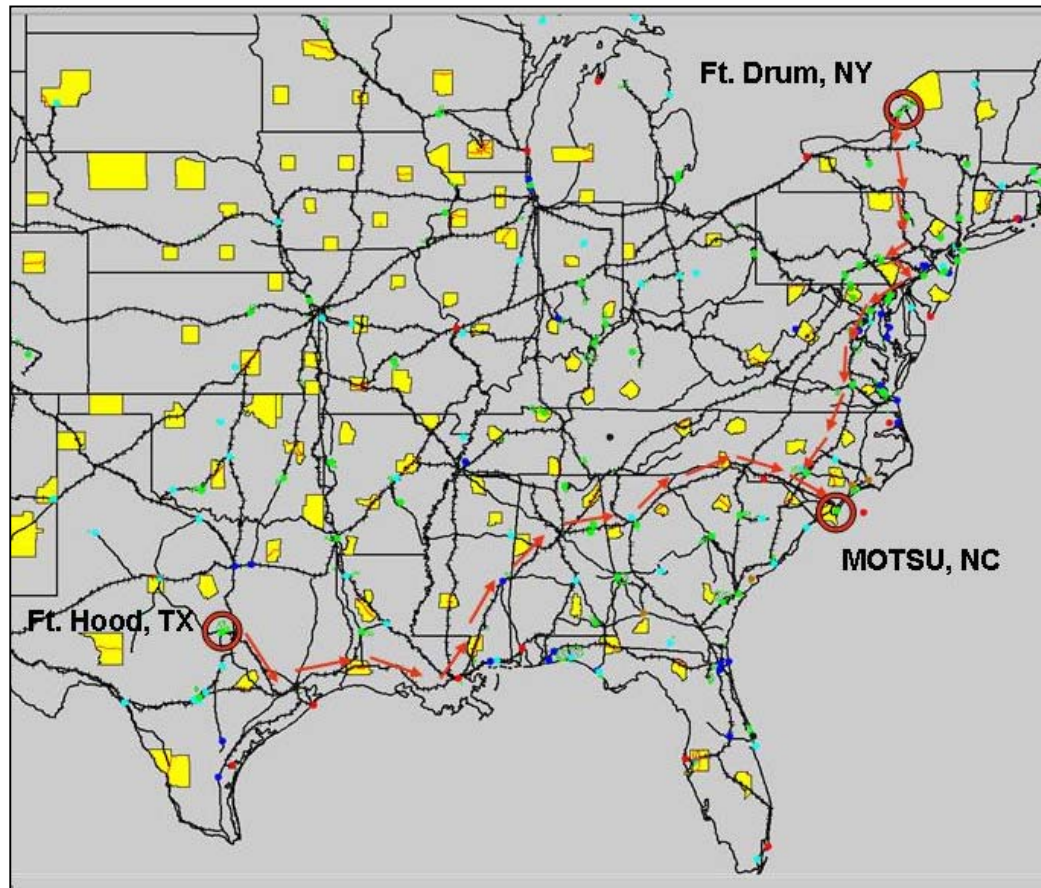
What Tools can be Used to Assess CONUS Infrastructure Impacts on National Security?



Examples of Impacts on National Security from Disrupted CONUS Infrastructures

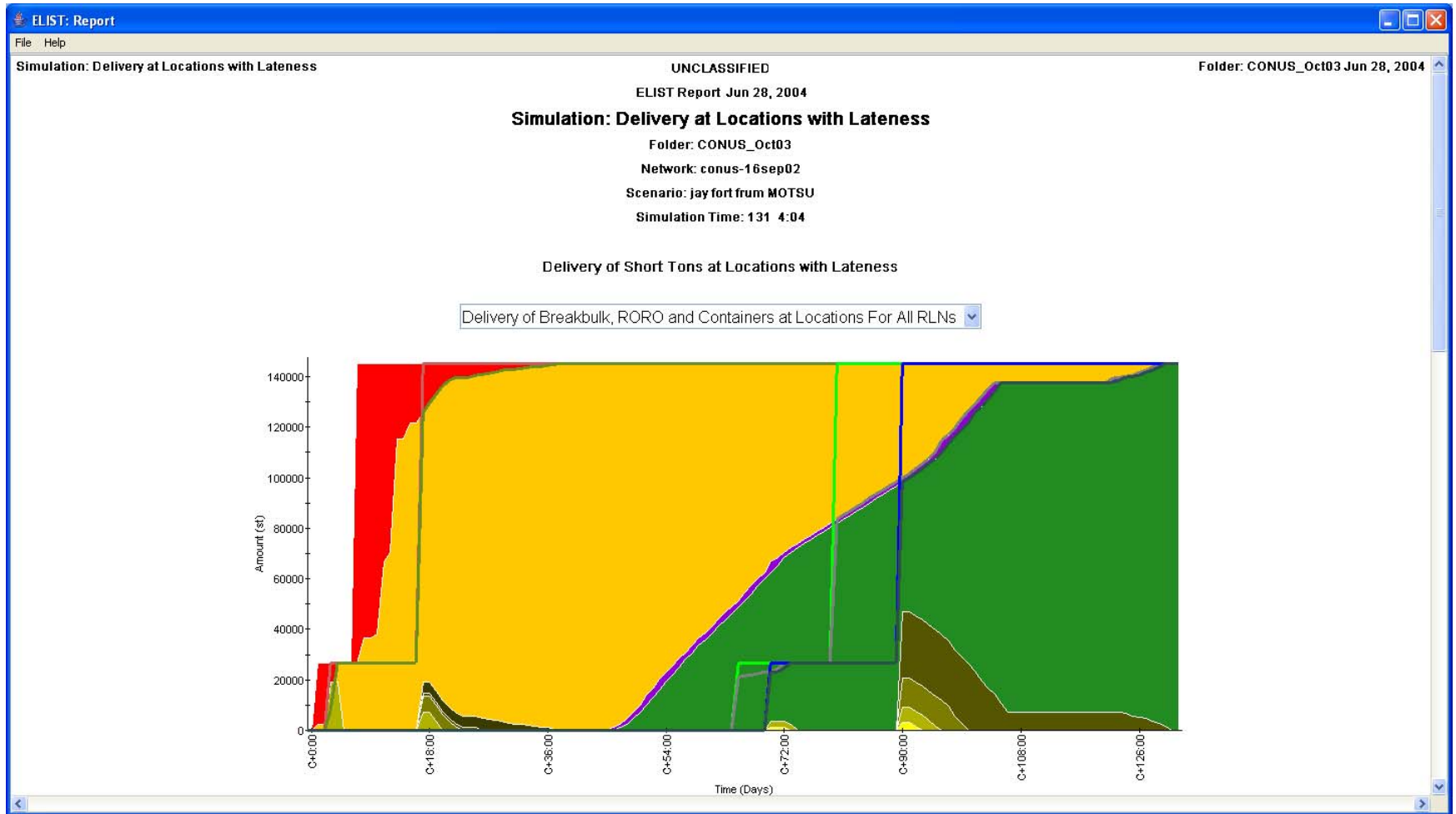
- Example # 1 – CONUS Transportation Network Disrupted While a Deployment of Forces was Occurring
- Example # 2 – A Critical Seaport was Disabled While a Major Class V (Ammunition) Sustainment Operation was Occurring

Example # 1: Disrupted CONUS Transportation Network

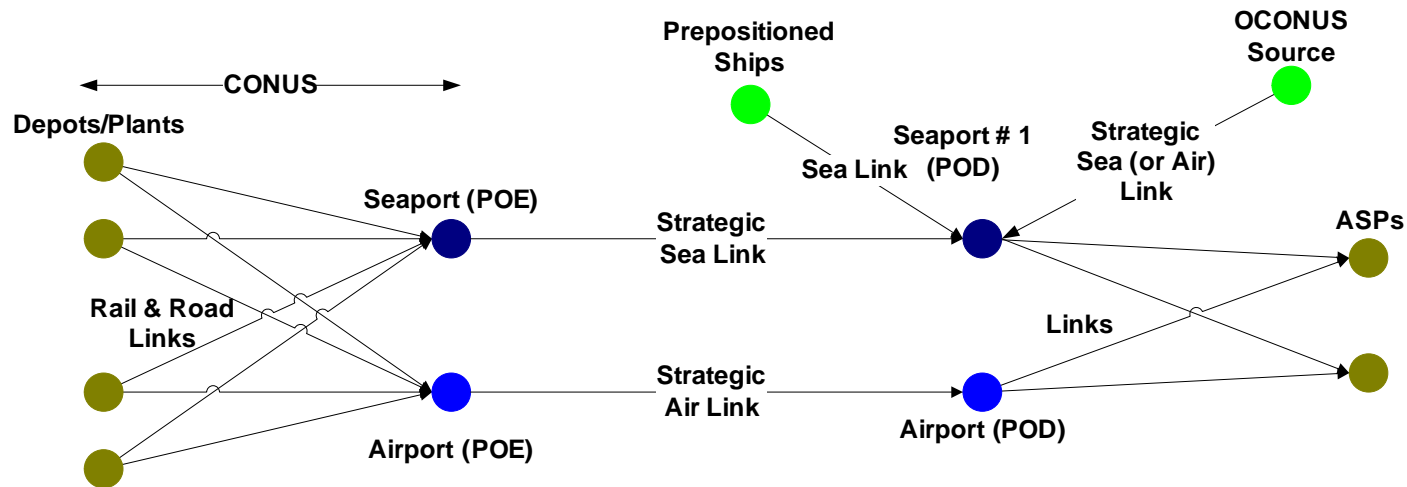


- The Normal Ports of Embarkation (POE) for Two Units were Assumed to be Unavailable and the Units were sent to a more Distant POE
- The Time to Process Through the OCONUS Port of Debarkation was Assumed to be Greater than Normal

Example # 1: Disrupted CONUS Transportation Network (Cont.)



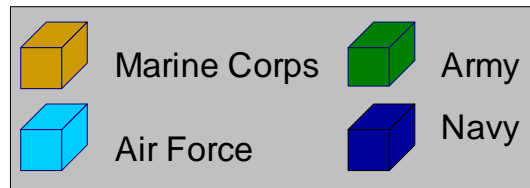
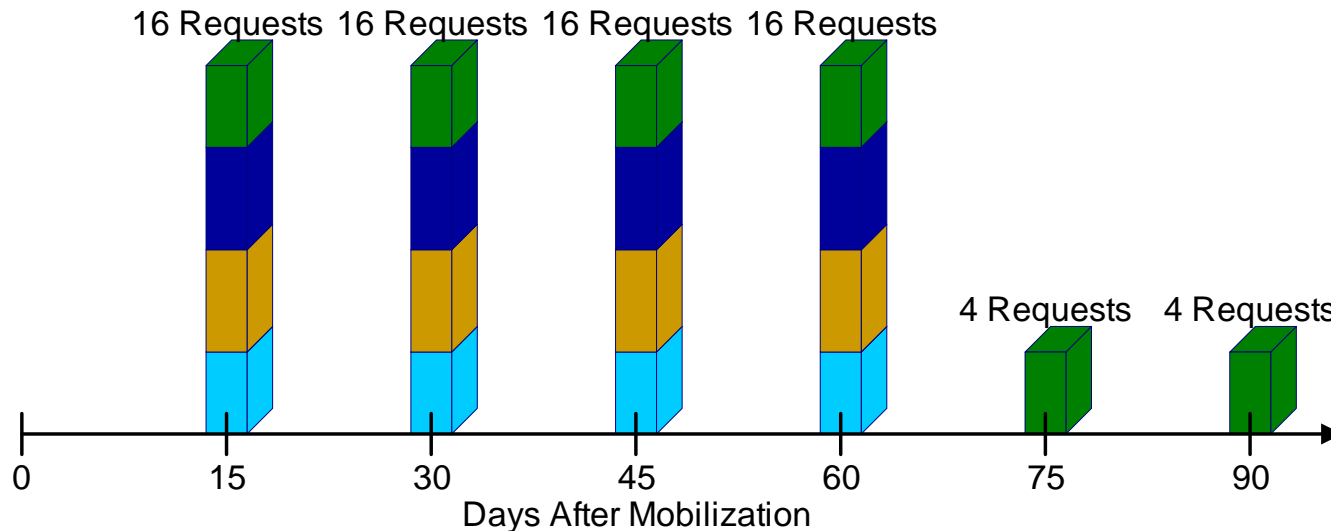
Example # 2: Loss of a Seaport During a Class V Sustainment



- Class V Sourcing and Movement can be Modeled Using the Joint Munitions Planning System (JMPS)
 - Can source from CONUS and OCONUS locations
 - Shipments descriptions based on actual item data
 - Prepositioned ships can be treated as “floating source nodes”

Example # 2: Loss of a Seaport During a Class V Sustainment

- The Scenario Assumed a Major Regional Conflict Involving a Large 90-Day Sustainment of Ammunition with Deliveries Occurring at 15-day Increments



Example # 2: Loss of a Seaport During a Class V Sustainment – Base Case

- Analysis Results:

- A 30-day air bridge with 1 C-17 flight per day delivered items in the first 15-day increment 1 to 18 days late
- Prepositioned ships delivered items for the 15-day increment on time
- The sea bridge used 8 ships and resulted in many shipments arriving on time and others with lateness of 2 to 27 days
- Repositioning from other OCONUS theaters not considered



3,180,335 lbs



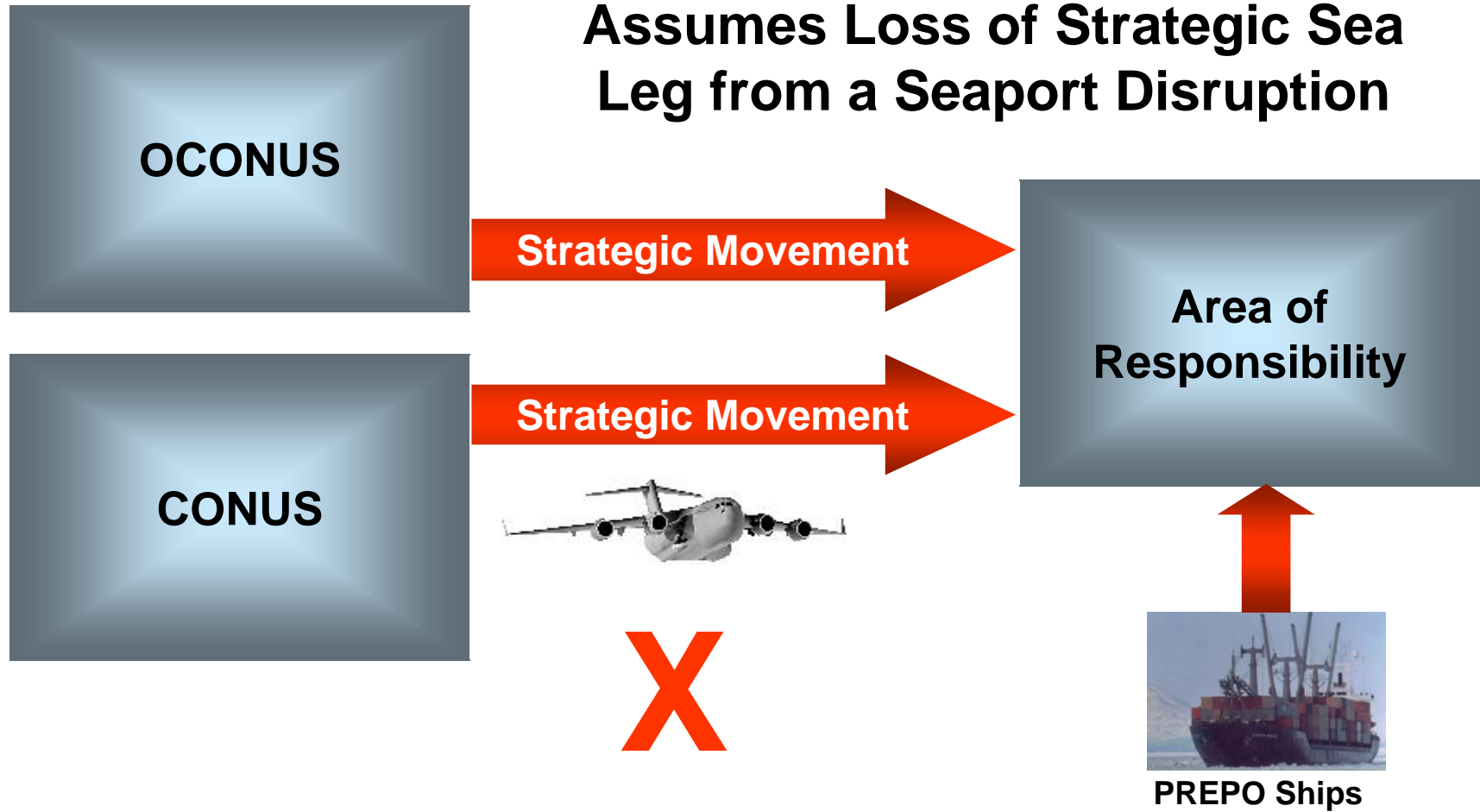
5,8730,280 lbs



**140,770,884 lbs
in 4,322 containers**

Example # 2: Loss of a Seaport During a Class V Sustainment – Disrupted Case

The Disrupted Case Model – Assumes Loss of Strategic Sea Leg from a Seaport Disruption



Example # 2: Loss of a Seaport During a Class V Sustainment – Disrupted Case

- Analysis Results:
 - A 90-day air bridge with 2 C-17 and 1 C-5 flights per day could only deliver items in the first two 15-day increments, but the deliveries were from 1 – 63 days late
 - Items from the PREPO ships arrived on time
 - Only about 1/3 of the requests could be sourced and moved



2 per day



1 per day

48,833,976 lbs



5,8730,280 lbs

Example # 2: Loss of a Seaport During a Class V Sustainment – Disrupted Case

- The Limiting Factors in the Disrupted Case:
 - The number of air assets required to carry all of the required items is available in the military and commercial fleets, **but** the number made available to carry ammunition is generally limited
 - The real throughput capability of airports is reduced by limits put on the amount of explosive material allowed to **be at an** airport at any one moment, not how much cargo can be physically handled
- The “Bottom Line” is that Infrastructure Networks (CONUS and OCONUS) have both Physical and Human-Induced Limits that will Impact their Throughput Capacities and Ability to Respond in Times of Crisis and the Human-Induced Limits can be Much Harder to Modify

Summary and Future Directions

Summary

- A High Level Analysis has Identified the Relationships between CONUS Infrastructures and National Security (and the Reverse Relationship!)
- General Relationships between Mission Execution Plans and Potential Outcomes have been Identified
- Using the Existing ELIST and JMPS Models, Demonstrations have been Given on how CONUS Infrastructure Disruptions can Result in Deployment and Sustainment Delays

Summary and Future Directions

Future Directions

- Generalizing a Deployment Model and Coupling it to the Full Set of CIP DSS Models and Databases
- Couple the National Security Mission Relationships to the Above Models and Databases
- Examine the Relationships Between OCONUS Factors and CONUS Infrastructure Impacts