



National Guard Bureau

Application of System Dynamics Model for

Capabilities Assessment and Development

Process (CADP)

NGB-J8

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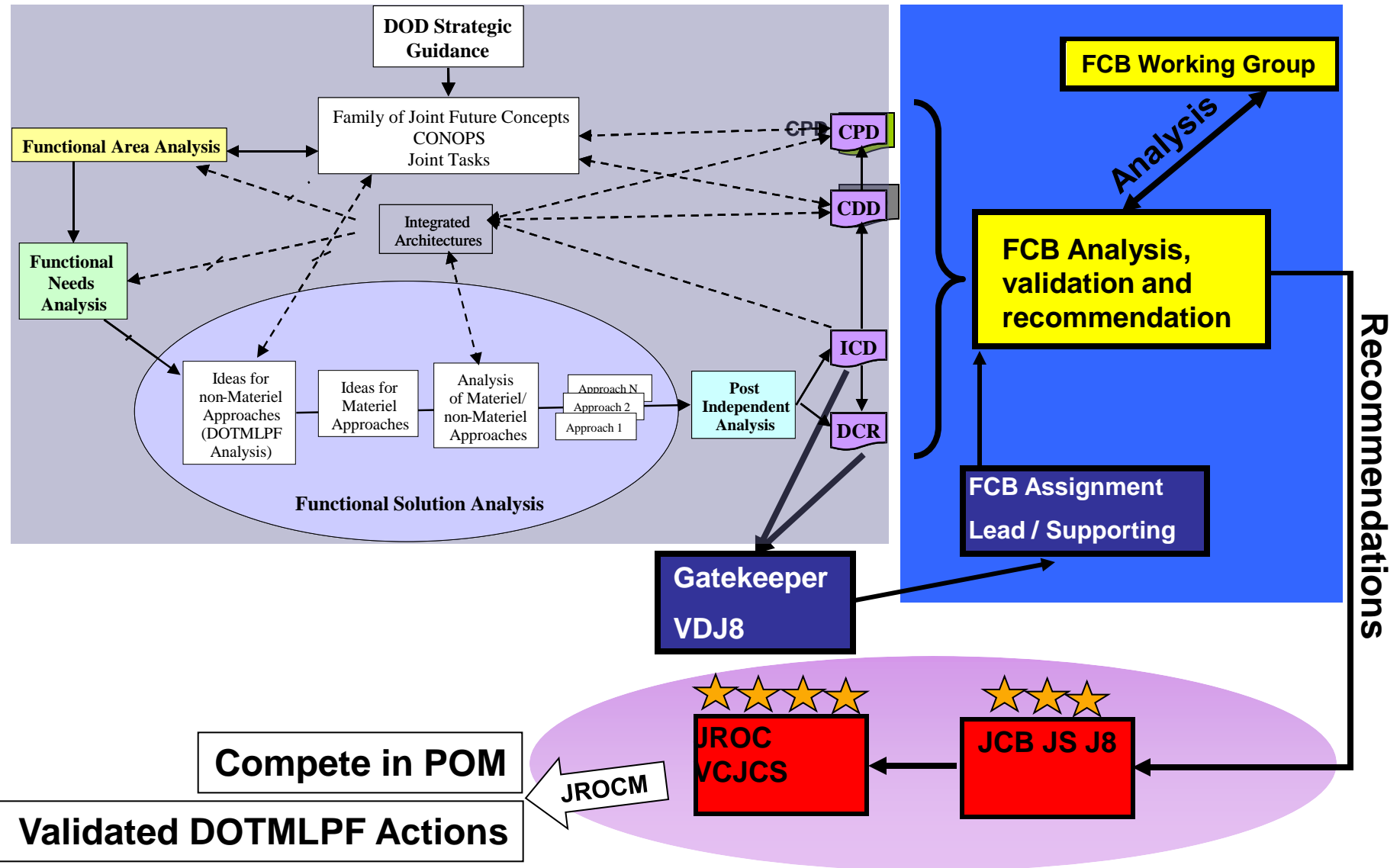
Asymmetric Solutions, LLC

James "Jim" Engolia

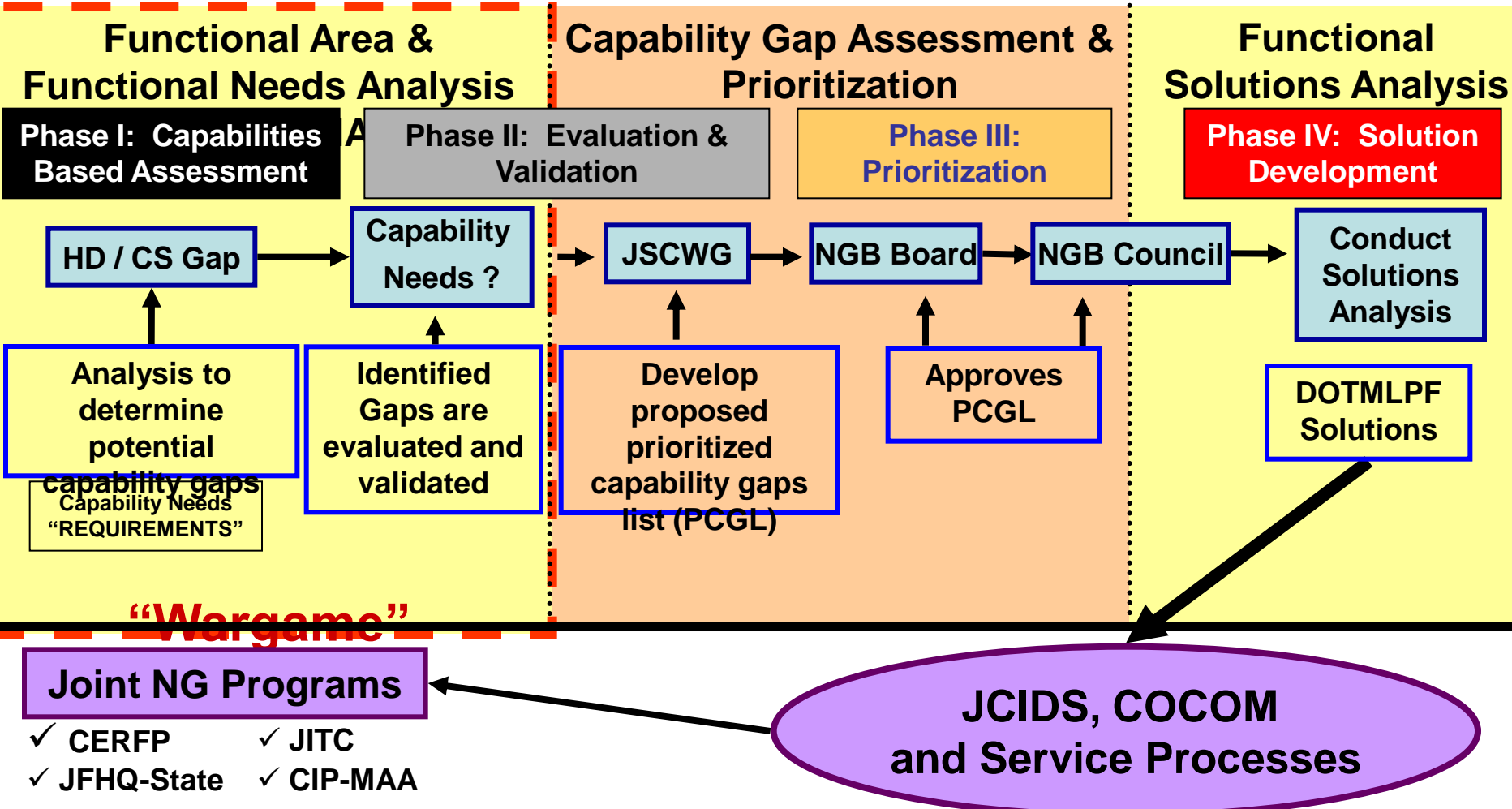


- Overview – Study Framework
- Operational View / Model
- Example of Detailed Modeling Results
- Summary of Results / Endstate

Joint Capabilities Integration and Development System (JCIDS)

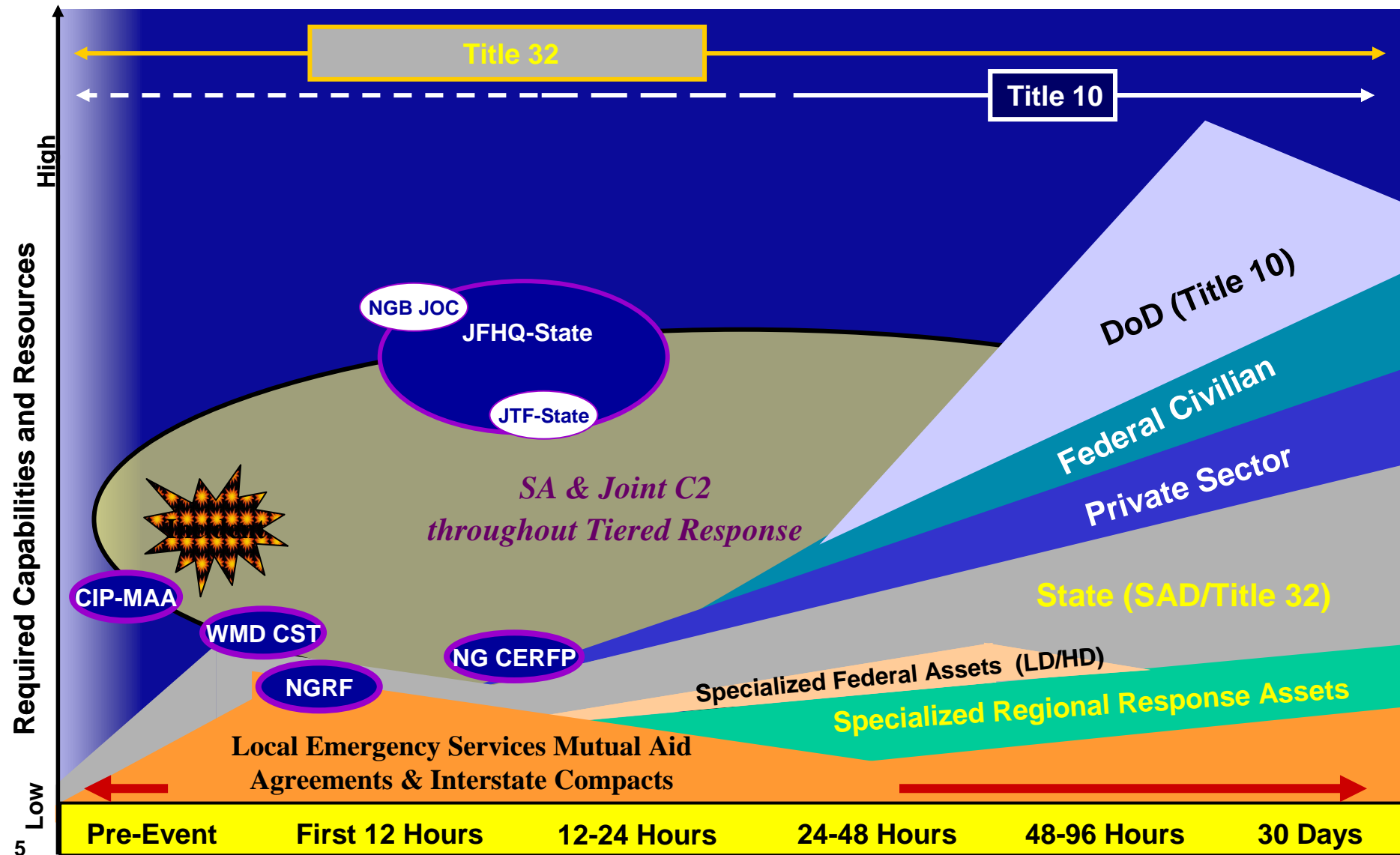


NGB Joint Capability Assessment & Development Process (24 Month Cycle Synchronized with Service POM Development)





Employment Model for Unanticipated Event





- Mission/Task/Capability Lists for each NPS delineated by Major Scenario Event List or MSEL (CS focused)
 - Hurricane or Earthquake (region specific)
 - 10 KT NUDET
 - Pandemic Influenza
- 2014 force model applied as “regional forces” to accomplish specified or implied NG missions for each major event
- Results of Wargame (Capability Gaps):
 - Determine sufficiency of projected (2014) NG capabilities (forces)
 - Identify other non-force related capability gaps in terms of Doctrine, Organization, Training, Materiel, Leadership, Personnel and/or Facilities (DOTMLPF)

2008 NGB CADP Wargames



2-6 Jun
Pentagon
Host: NGB



14-18 Jul
Atlanta
Host: GA



4-8 Aug
Kansas City
Host: KS



8-12 Sep
Seattle
Host: WA



Wargame Objectives

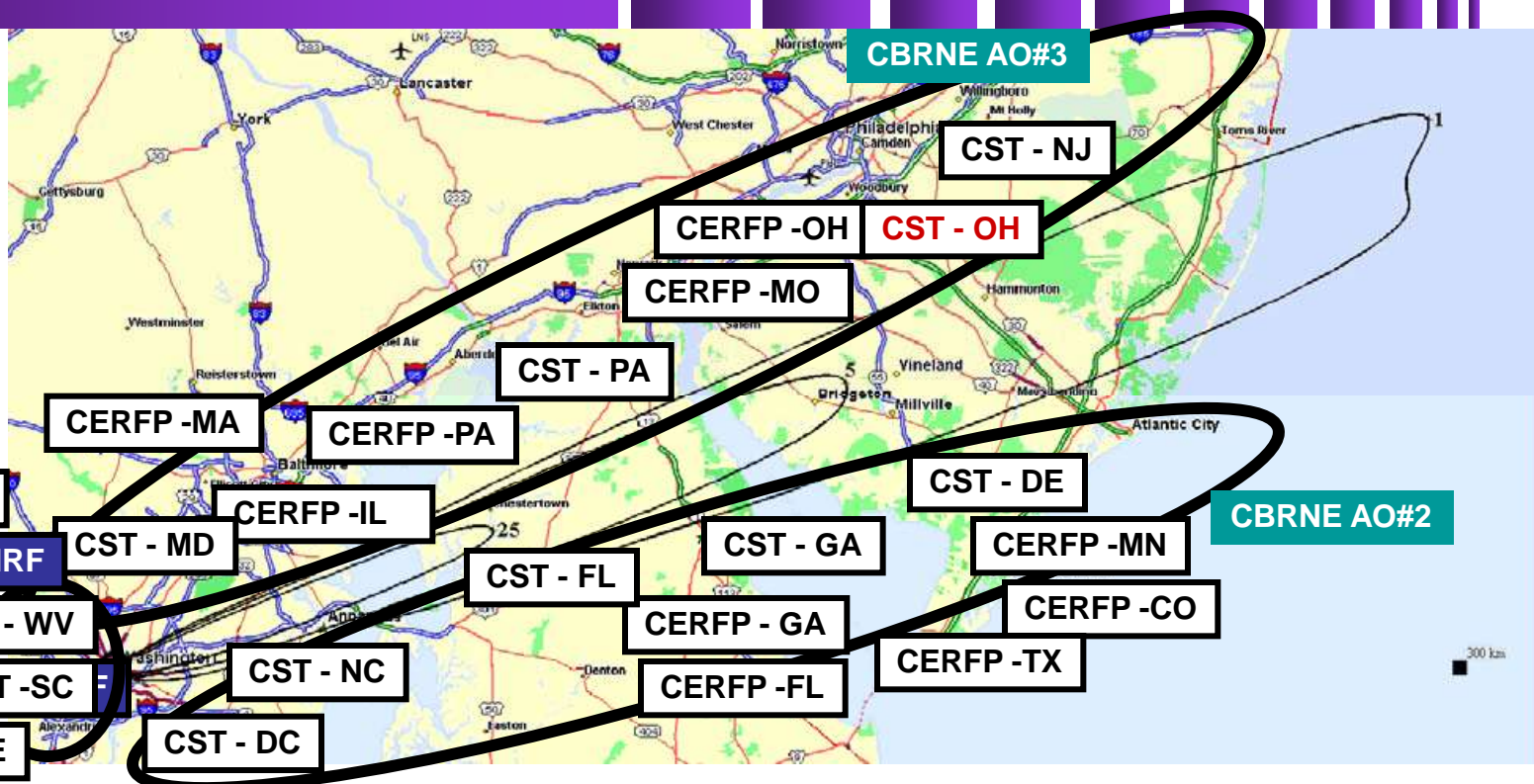
- Examine key response challenges associated with each NPS scenario
- In concert with state NG CADP participants, refine assumptions, state agency capabilities and level of effort for HD/CS missions and tasks.
- Systematically evaluate programmed NG HD/CS capabilities.
- Identify and prioritize projected capability shortfalls and recommend to CNGB approaches for developing solutions.



Scenario Overview (National Planning Scenario 1)

Casualties	Hundreds of thousands
Infrastructure Damage	Total within radius of 0.5 to 3 miles
Evacuations/Displaced Persons	<p>100,000 in affected area seek shelter in safe areas (decontamination required for all before entering shelters)</p> <p>250,000 instructed to shelter in place as plume moves across region(s)</p> <p>1 million+ self-evacuate from major urban areas</p>
Contamination	Various levels up to approximately 3,000 square miles
Economic Impact	Hundreds of billions of dollars
Potential for Multiple Events	No
Recovery Timeline	Years

Event # 4: (72-96 Hours): 10 KT



- JTF-VA, MD and DE define and coordinate specific areas of responsibility for NG CERFPs.
- WMD CSTs continue to deploy (CST KY; CST NJ; CST NC; and CST SC- 13 Total) arrive :
 - Detect suspected WMD agents/substances/Determine the current contaminated area.....
 - Advise civil authorities as to casualty medical management
- CERFPs from MN, CO, TX, MA and NE arrive- **13 Total (NY, WA, CA, HI)** remain in place because of continued threat to large metropolitan areas). CERFPs begin to extraction operations in areas originally “too hot” for search and rescue. Continue decon and triage along major roads.
- Additional JTF-CS CBRNE response elements are integrated in CBRNE CM operations.



← WMD-CST monitoring →

Hot Zone

Warm Zone

Cold Zone
Incident Command Post

WMD-CST
Survey Team

CERFP Search & Extraction
With Integrated Medical Personnel



Casualties Collection

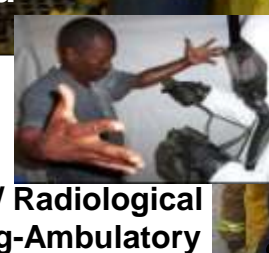


Non-Ambulatory
transport

CERFP Decon



Medical Monitoring
as needed



Chemical / Radiological
Monitoring-Ambulatory



Medical Treatment



**Civilian Patient
Evacuation**

← WMD-CST monitoring →

← Wind Direction →



Build a model to identify and measure NGB civil support capability gaps (over a 96 hour period) related to operational requirements of extraction, decontamination, and triage/medical stabilization in response to a 10k explosion

Capability gap defined as requirements exceeding resources over time



Why we used a dynamic modeling approach?

Requirements (REQ) are sequentially derived over different timelines

- Medical REQ in part a f (DECON REQ)
which are in part a f (Extraction REQ)

Diverse resources arrive and are depleted over different timelines



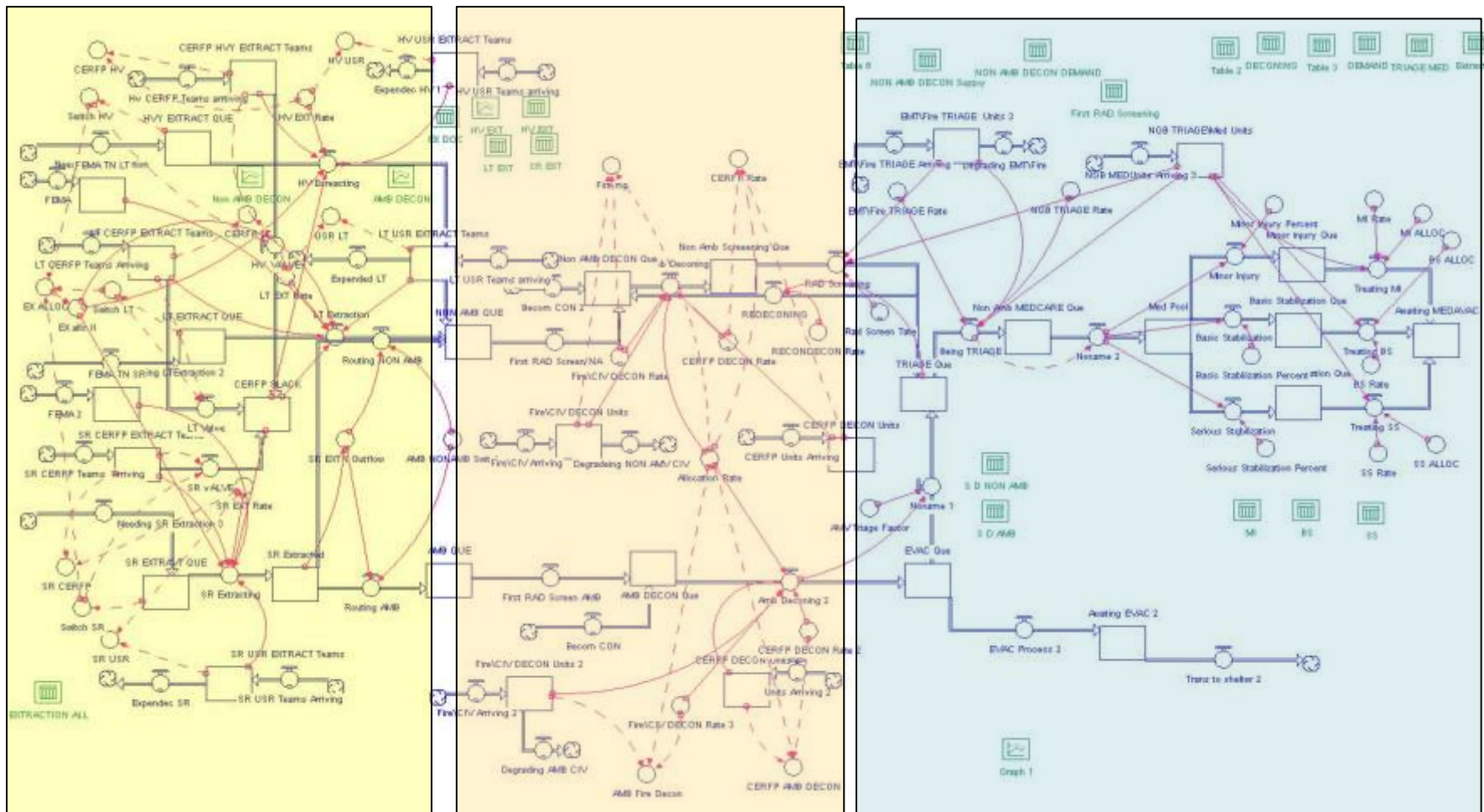
Model consists of three sequential capability workflows

- Extraction
- DECON
- Triage/Medical Stabilization

Each capability work flow has a set of requirement components and resource components

Both requirement components and resource components are built with a set of stocks and flows

Model Work Flow Components



EXTRACTION

DECONTAMINATION

TRIAGE AND STABILIZATION



Key Variables of Model Components

Requirement Component Variables

- Requirements inflow
- Requirement Stock
- Requirement Outflow

Resource Component Variables

- Resource Inflow
- Resource Stock
- Resource Outflow

Processing Rate Converter

Action Connectors

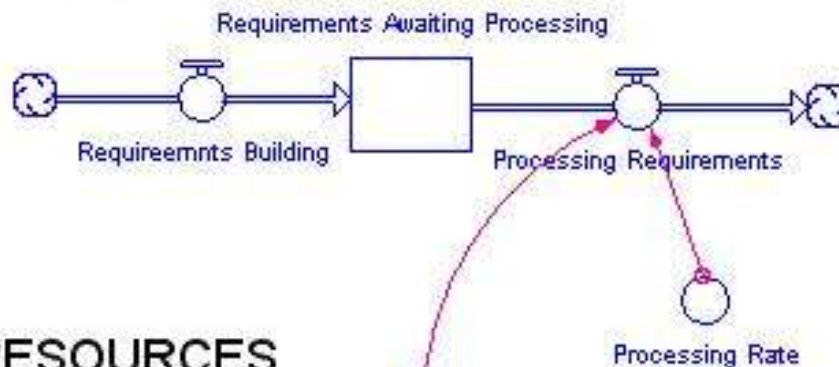
- Connects Resource Stock and Processing Rate Converter to Compute Rate of Requirement Outflow over time



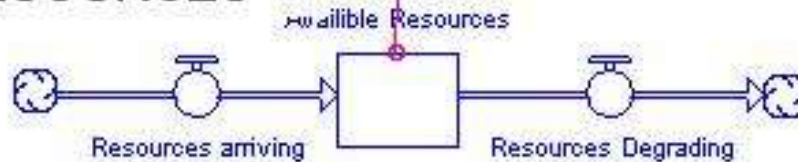
Key Variables of Model Components II

EXTERNAL RESOURCE TEMPLAT

REQUIREMENTS



RESOURCES





Search and Extraction (S&E)



Defining throughput, categories of Victims:

- Heavy: Rope Rescue and Confined Space Rescue : 4 to 8 hours of extensive work
- Light: Light Framed Collapse Structure: 1 hour or less of work
- Simple Recovery: No specialized work required



Level I Technical Rescue Tasks

NFPA 1006 (2008) Standard for Technical Rescuer Professional

Rescue Discipline	JPR Tasks	JPR
Rope Rescue (Chapter 6)	Construct - multiple-point anchor systems, compound rope mechanical advantage systems, fixed (load barring) rope system; direct the operation in a high-angle environment a rope rescue system and a load to be moved; Ascend / descend a fixed rope system	6.1.1 – 6.1.6
Confined Space S&R (Chapter 7)	Conduct- (air) monitoring of the environment; given monitoring equipment, PPE, size up information; Prepare for entry into the confined space; Enter a confined space, package the victim for removal; Remove all entrants from a confined space	7.1.1 – 7.1.5
Structural Collapse (Chapter 9)	Conduct a size-up of a light frame collapsed structure, so existing and potential conditions within the structure and immediate periphery are evaluated; resources and hazards are identified and the need for rescue is assessed; determine victim location; search a collapsed structure; stabilize a collapsed light framed structure; implement collapse support operations (lighting, personnel rehabilitation); release a victim from entrapment of a light frame collapse structure	9.1.1 - 9.1.8

Other Rescue Disciplines	Vehicle S&R	Surface Water S&R	Wilderness S&R	Trench Evacuation S&R	Vehicle Machinery S&R	Cave S&R	Mine / Tunnel S&R	Surf S&R
	Chapter 10	Chapter 11	Chapter 16	Chapter 8	Chapter 10	Chapter 18	Chapter 17	Chapter 15

Extraction Capability work Flow



Types of Extraction Modeled

- Heavy
- Light
- Simple recovery

Requirements

- Quantity needing extraction obtain DTRA model
- Inflow modeled using onetime pulse expression

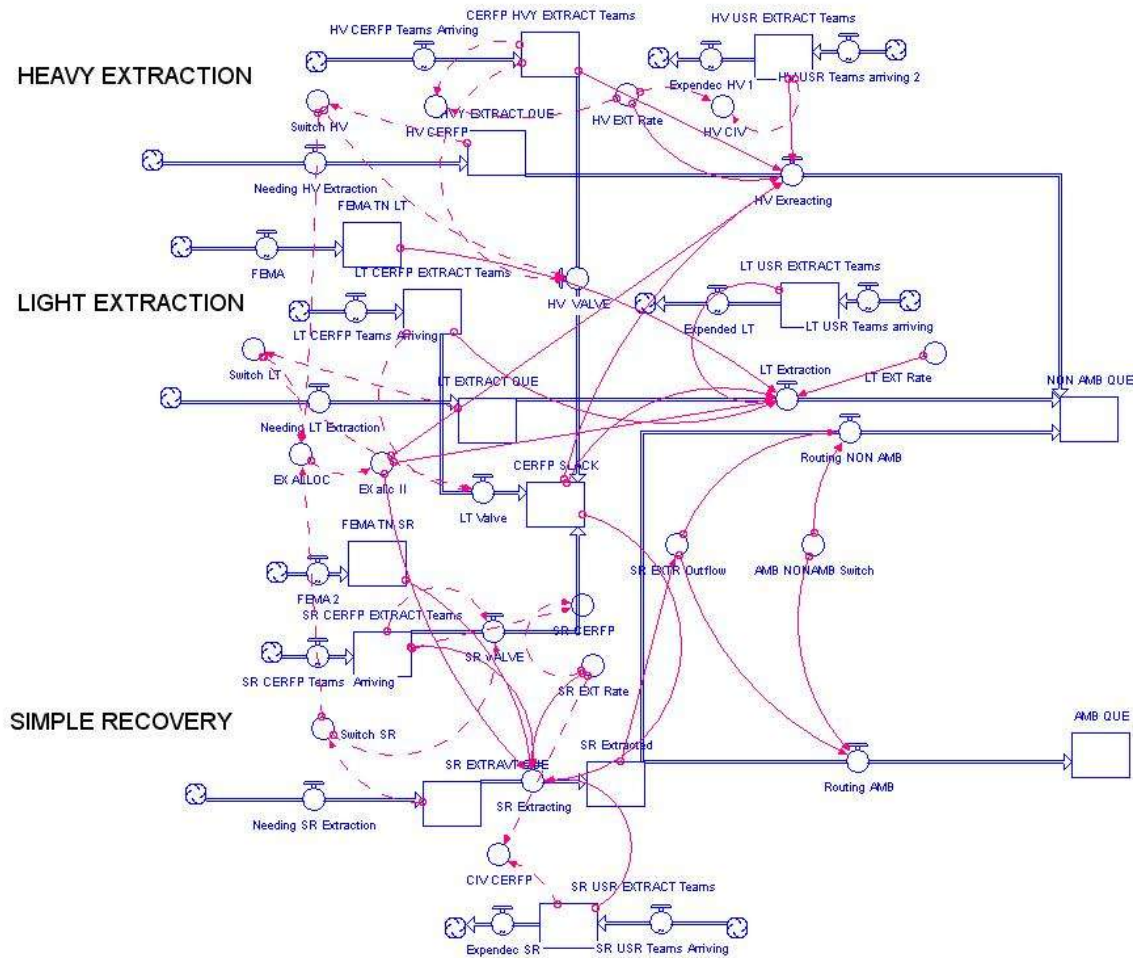
Resources

- Supply: First-responders, FEMA Teams, & NGB CERFPs
- Inflows & outflow for each modeled using graph function
- Arrival and depletion times for each derived from war games conducted in four FEMA Regions (III, IV, VII, & X)

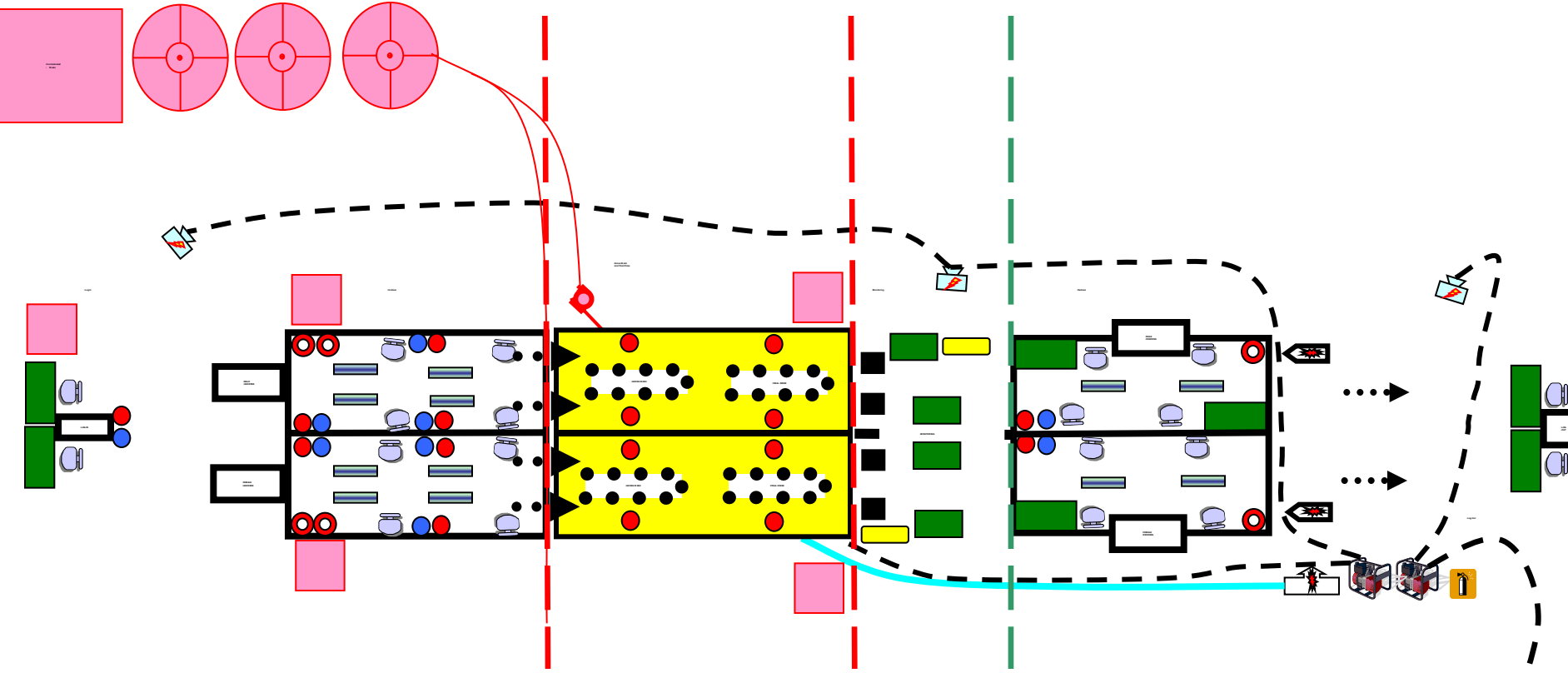
Converters

- Different processing rate converters for each obtained from OSD CAP study and State/FEMA SMEs
- Logic statements in transfer converters used to shift resources based on relative workload requirements

Extraction Overview

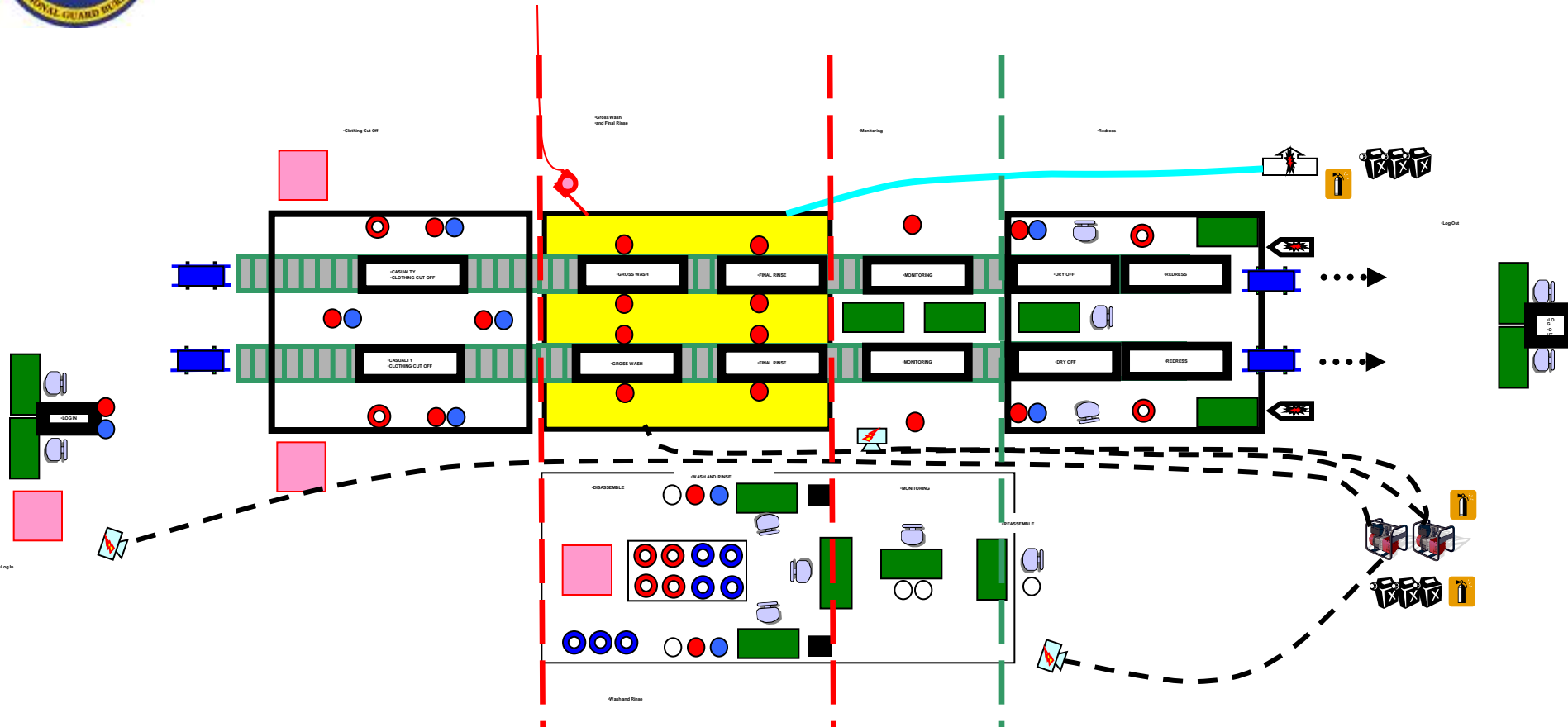


Ambulatory Casualties Decontamination (DECON)



- | | | | | | | | |
|--|------------------------|--|------------------|--|----------------------|--|----------------------|
| | •Trash Can Clean Water | | •Table | | •Rinse Bucket | | •Jet Heater |
| | •Trash Can Decon | | •Litter on Stand | | •Kill Bucket | | •Rollers |
| | •Plastic Bag | | •Light | | •Trash | | •Runoff Hose |
| | •Sump Pump | | •Light Set | | •Hand Rail | | •Blivet (Waste) |
| | •Chair | | •Water Heater | | •Electrical Line | | •Solid Waste Storage |
| | •Back Board | | •Extension Cord | | •Rinse Water Hose | | •Tarp |
| | | | •Floor Tray | | •Decon Solution Hose | | |

Non-Ambulatory DECON



	•Trash Can Clean Water		•Table		•Rinse Bucket		•Jet Heater
	•Trash Can Decon		•Litter on Stand		•Kill Bucket		•Rollers
	•Plastic Bag		•Light		•Trash		•Runoff Hose
	•Sump Pump		•Light Set		•Hand Rail		•Blivet (Waste)
	•Chair		•Water Heater		•Electrical Line		•Solid Waste Storage
	•Back Board		•Extension Cord		•Rinse Water Hose		•Tarp
			•Floor Tray		•Decon Solution Hose		



Types of DECON Modeled

- Non-ambulatory
- Ambulatory

Requirements

- Quantity needing DECON obtained from DTRA model
- Inflows from extraction outflows and additional DECON requirements over time

Resources

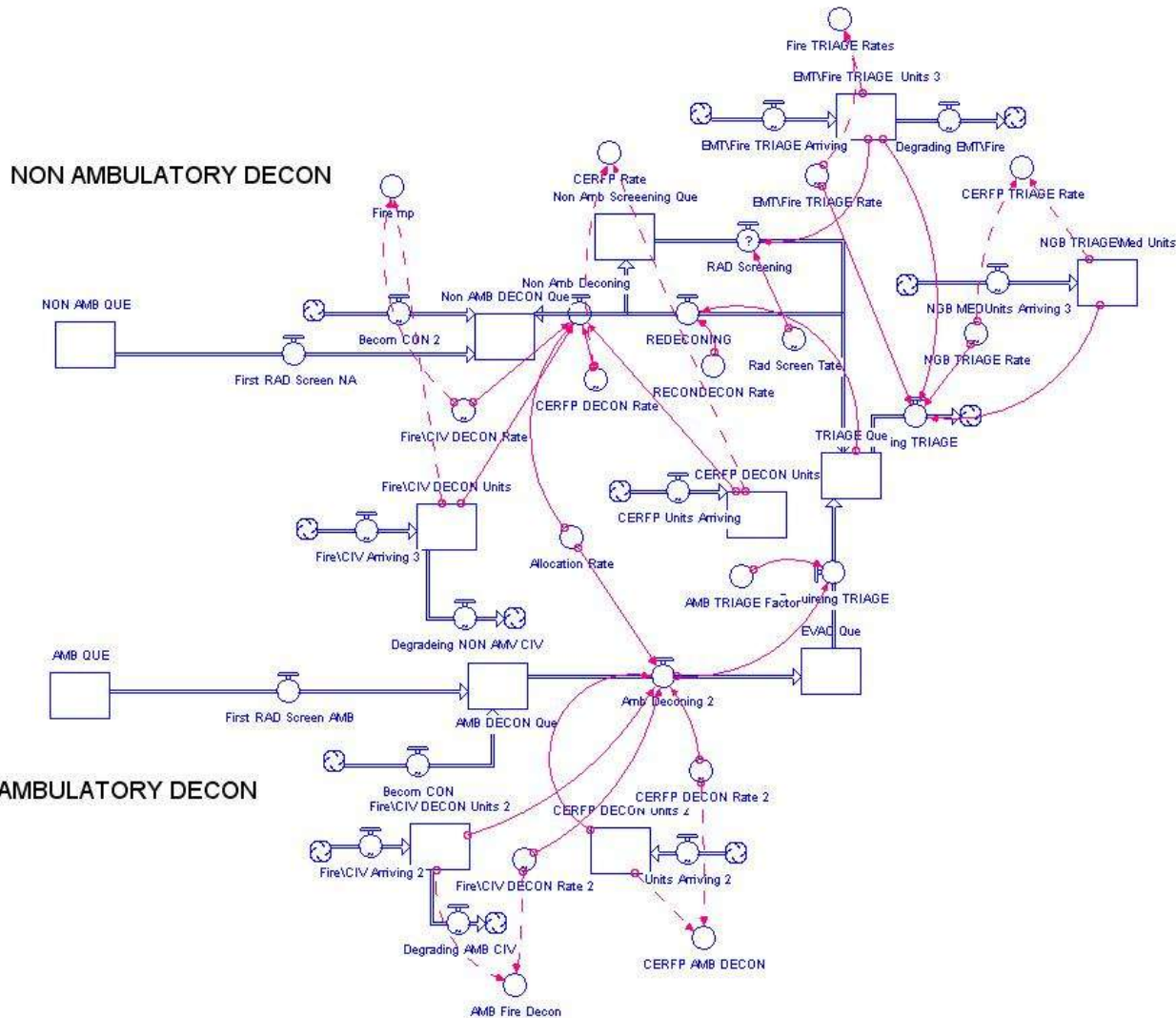
- Supply: First-responders, & NGB CERFPs DECON teams
- Inflows & outflow for each modeled using graph function
- Arrival and depletion times for each derived from war games conducted in four FEMA Regions (III, IV, VII, & X)

Converters

- Different processing rate converters for each resource obtained from OSD CAP study and State/FEMA SMEs



DECON Overview





Shelter and Roller Systems



Categories:

- Minor Injury
- Basic Stabilization
- Serious Stabilization



Types of Modeled

- Minor Injury
- Basic Stabilization
- Serious Stabilization

Requirements

- Quantity needing medical treatment obtained from DTRA model
- Inflows from non-ambulatory outflows

Resources

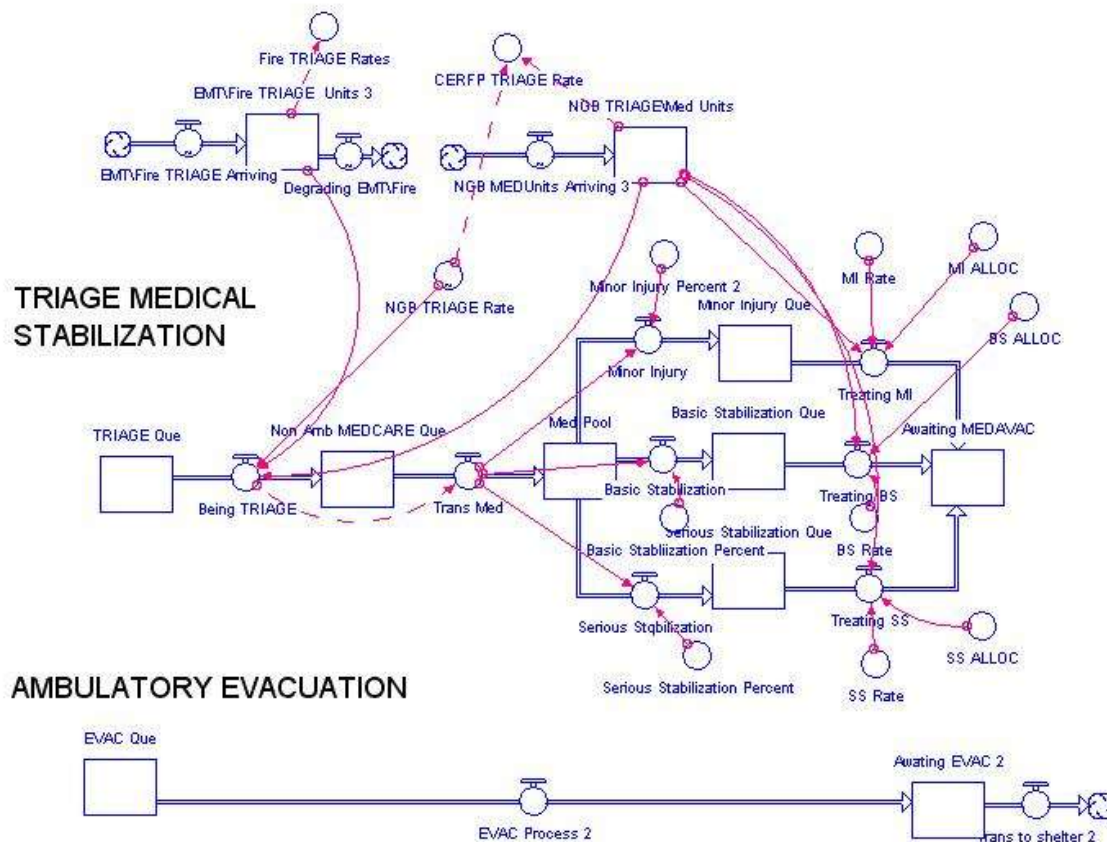
- Supply: First-responders, & NGB CERFPs medical teams
- Inflows & outflow for each modeled using graph function
- Arrival and depletion times for each derived from war games conducted in four FEMA Regions (III, IV, VII, & X)

Converters

- Different processing rate converters for each resource obtained from medical SMEs



Triage/Medical Stabilization Overview





Final Stage of Model

Awaiting MEDAVAC stock— Number of patients that received medical treatment over 96 hour period

Awaiting evacuation stock – Number of people that received ambulatory DECON over a 96 hour period



The Civil Support Analytic Baseline Study was used to validate output of model

- Study conducted by Simulation & Analysis Center, Under Secretary Defense) Program Analysis and Evaluation (PA&E)

- Purpose of study to determine sufficiency of Department of Defense support to civil authorities during large catastrophic events in Continental United States

- Study used same 10k Security Council's National Planning Scenario and DITRA models to determine Extraction, DECON, Triage/Medical Stabilization requirements.



Assumptions and Rates Validated :

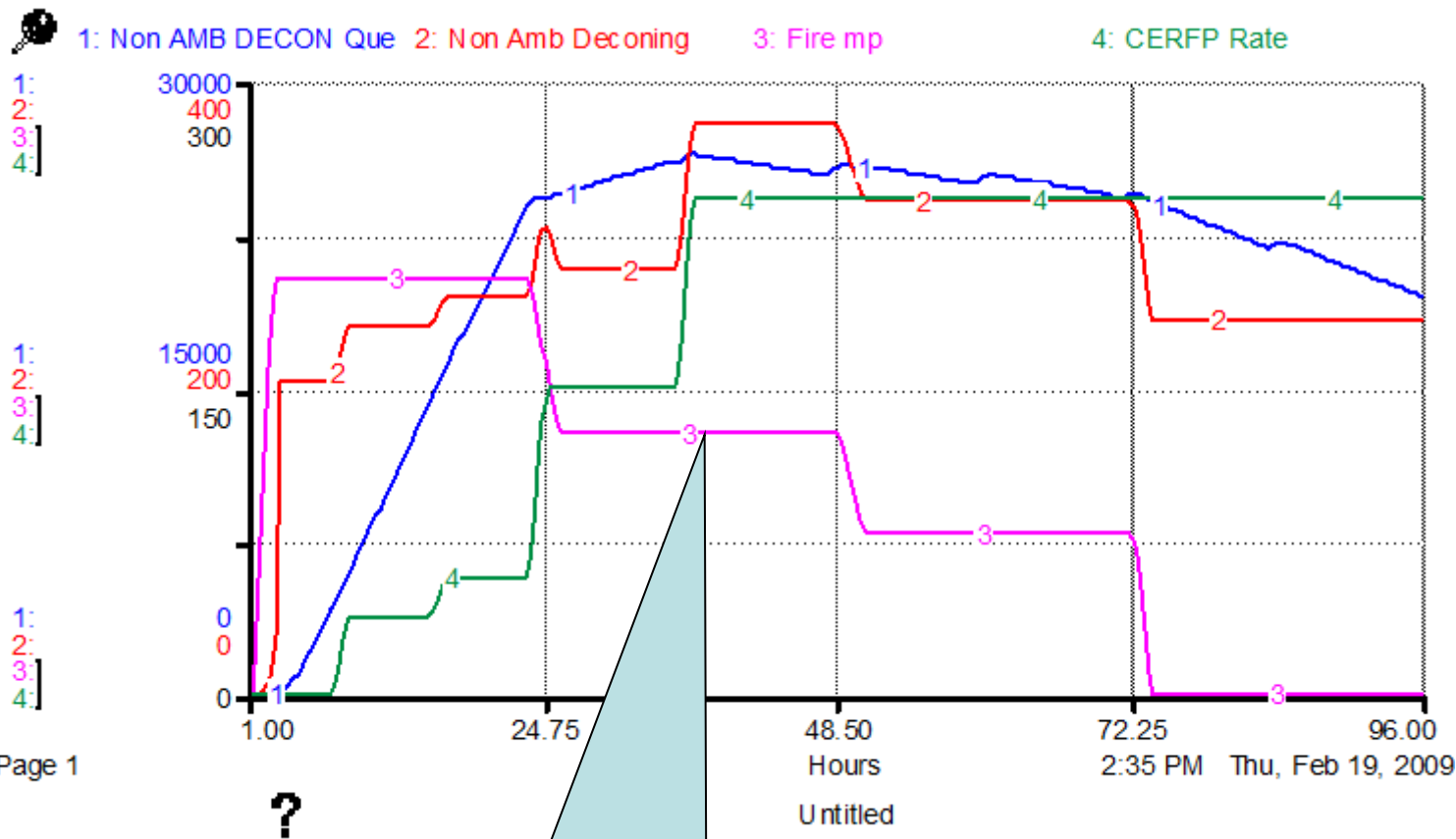
- Timeline
- Force Structure
- Processing Rates
- Burnout
- Closure rates
- Causal Relationships

Results of Validation

- OSD PA&E gave consent to assumptions and rates contributing to model results
- OSD PA&E took issue with our assessment that no capability gaps appear for extraction requirements
- Both studies agreed on significant capability gaps for DECON and Triage/Medical Stabilization



Model Results – Non Ambulatory DECON

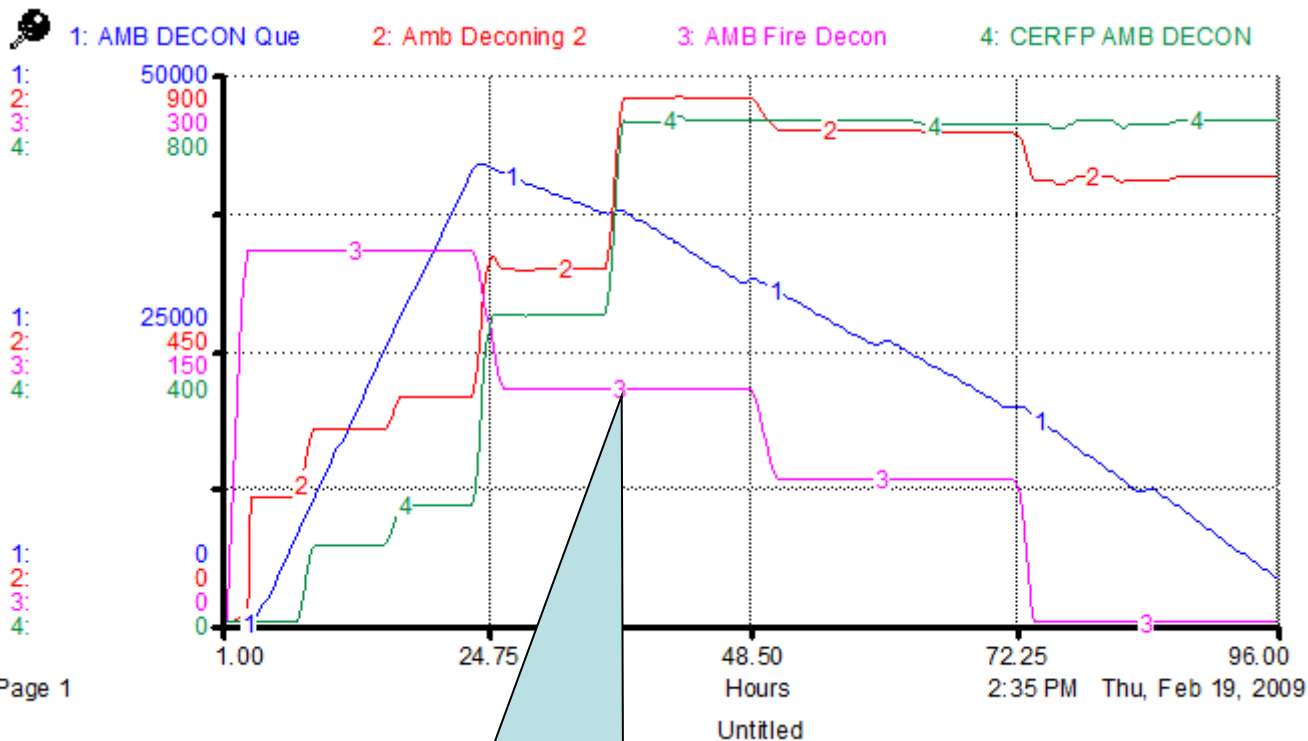


Page 1

Accounts for degradation of local HAZMAT Team decontamination capacity because of lack of personnel/equipment sustainment capability



Model Results - Ambulatory DECON



Accounts for degradation of local HAZMAT Team decontamination capacity because of lack of personnel/equipment sustainment capability



10Kt Analysis Summary - Gaps

- SEARCH AND EXTRACTION
 - Avg Demand: 53,182
 - Avg Supply (96hrs): 48,055
 - Avg GAP: 5,127

- NON-AMBULATORY DECON
 - Avg Demand: 72,604
 - Avg Supply (96hrs): 24,265
 - Avg GAP: 48,339

- AMBULATORY DECON
 - Avg Demand: 106,569
 - Avg Supply (96hrs): 61,005
 - Avg GAP: 45,564

- TRIAGE AND STABILIZATION
 - Avg Demand: 29,811
 - Avg Supply (96hrs): 3751
 - Avg GAP: 26,060

With 11 additional CERFPs

- **SEARCH AND EXTRACTION**
 - Avg GAP: 0

- **NON-AMBULATORY DECON**
 - Avg GAP: 36,568

- **AMBULATORY DECON**
 - Avg GAP: 20,820



- In the 2010 Quadrennial Defense Review, the Secretary of Defense directed the restructuring of the Department's CBRNE Consequence Management Response Forces; and directed the Chief, National Guard Bureau to stand-up 10 Homeland Response Forces (HRFs)
- Each HRF includes one CBRNE Enhanced Response Force Package (CERFP)



- Obtaining Data
 - Grinding down subjectivity – limits of objectivity
- Working with Functional Experts
 - Asking the right questions
 - Gaining consensus



Questions