Resilience: Modeling for Conditions of Uncertainty and Change

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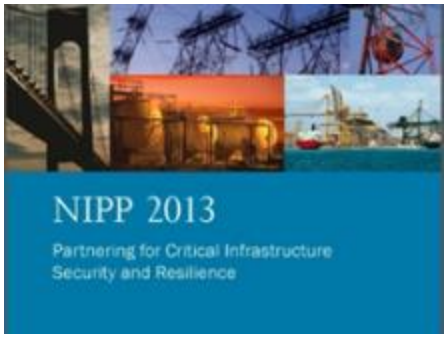
Denver, CO• August, 2014

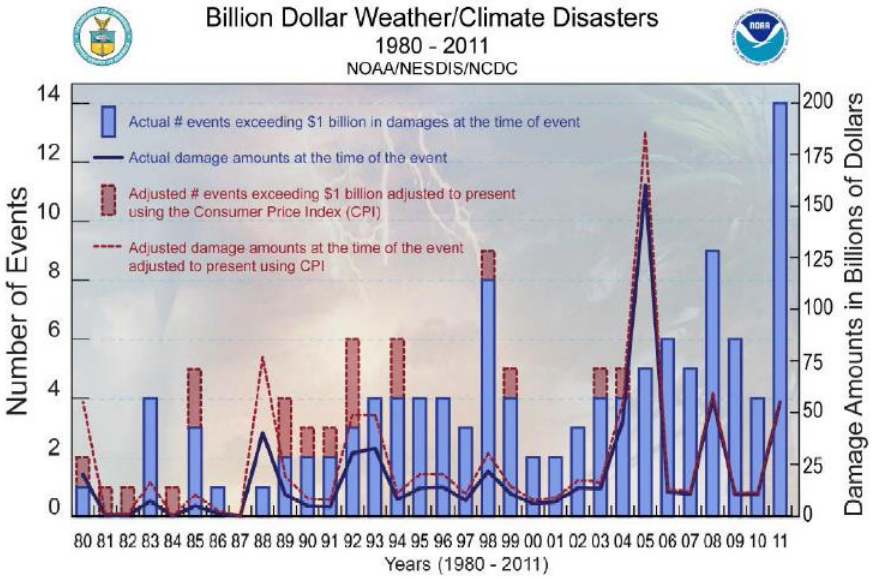
Dealing with fuzz

- Resilience is the new community risk management concept
- Demands analytical techniques conducive to
  - collaboration,
  - complexity, and
  - uncertainty.



- Solutions may leverage existing civilian and military techniques, but require additional synthesis

Risks are evolving

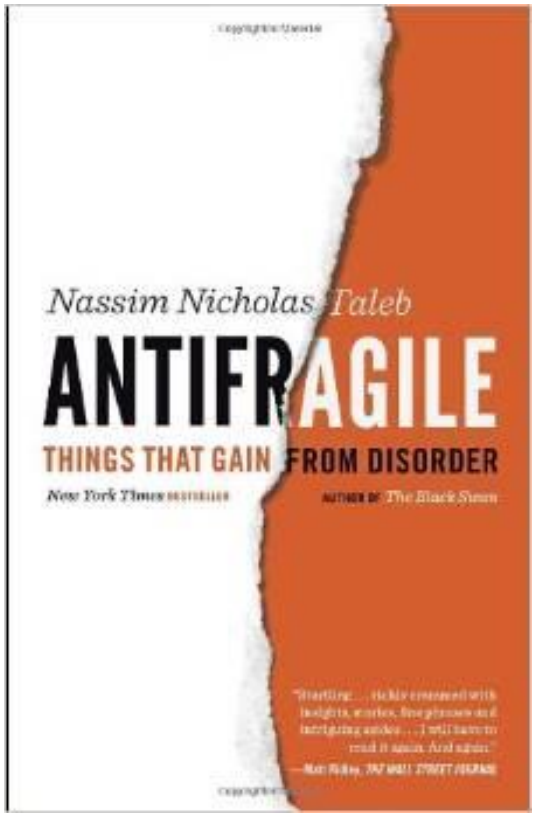


- Natural events increasing in frequency, severity, and impacts
- Human threats (e.g., cyber) proliferating and diversifying
- Long-term changes apparent but complex and unpredictable

Graph source: NOAA National Climatic Data Center, http://www.ncdc.noaa.gov/billions/

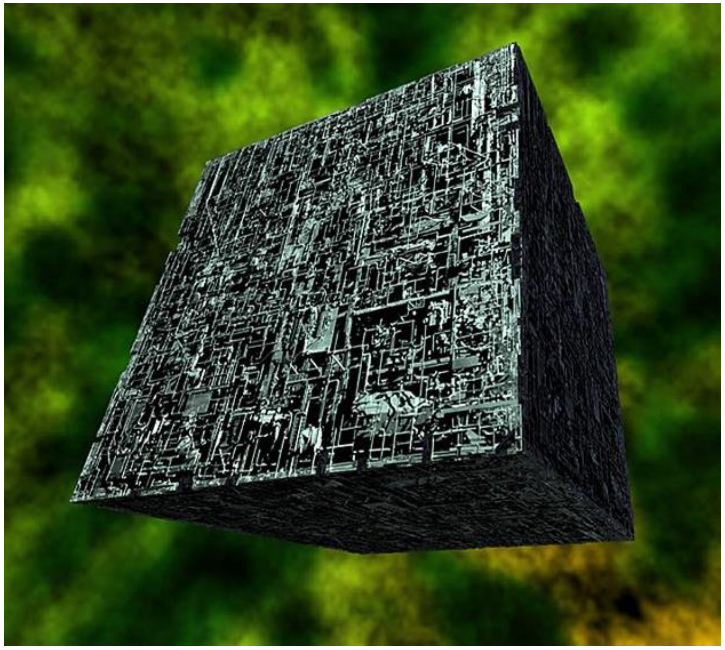
Existing response inadequate

- Systems increasingly optimized for design point performance
- Actuarial methods do not address unknown risks
- Targeted protection vulnerable to evolving threats



Analyzing Resilience

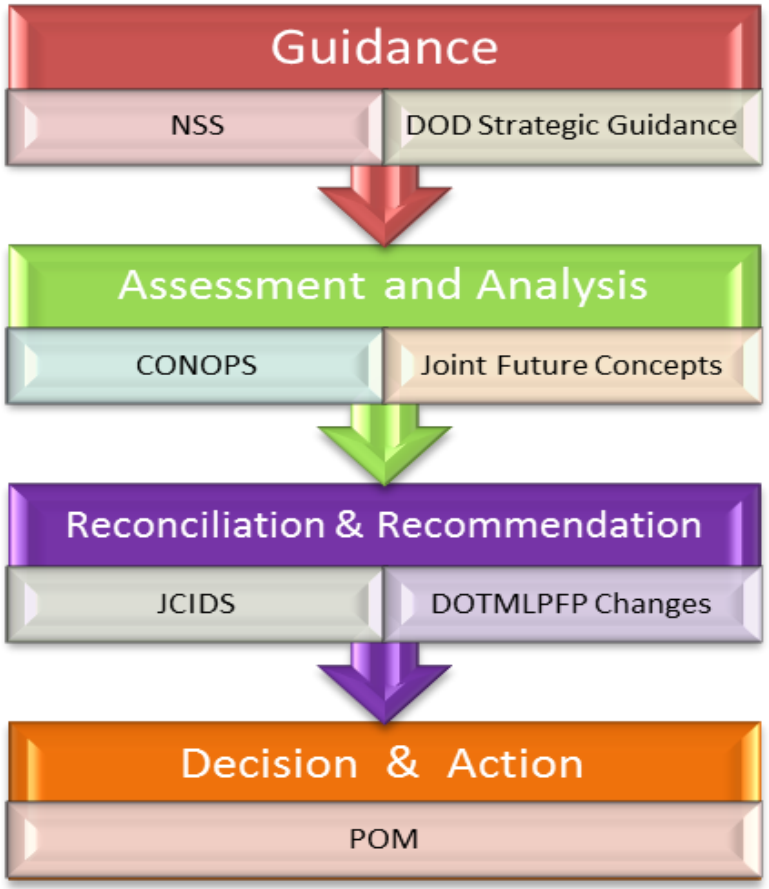
- Holistic orientation
  - Outcome focus regardless of event evolution
  - Interaction among physical, information, human domains
  - Balance robustness, protection, flexibility and readiness
- New analytical techniques required
  - Increased degrees of freedom
  - Interactive systems too complex for deterministic modeling
  - Must integrate qualitative, experimental methods



Star Trek "Borg"

Department of Defense Capabilities Development Process

- Requirements driven by national security responsibilities
- Highly structured process
  - Roles & Responsibilities
  - Logic
  - Standards
  - Analytical methods
- Linked to DoD Resource and Acquisition processes



NSS – National Security Strategy
CONOPS – Concept of Operations
JCIDS – Joint Capabilities Integration & Development System
DOTMLPFP – Doctrine, Organization, Training, Materiel, Leadership & Education, Personnel, Facilities, Policy
POM – Program Objective Memorandum

Evolution in Military Energy Resilience Guidance

- Existing guidance addresses Critical Infrastructure Protection
  - DODM, DODI, ASA IE&E, IMCOM
- Deputy Under SECDEF directed 'power resilience review' (2014)
  - Adherence to resilience policies, determine gaps, develop remediation plans
- Army ACSIM / CG, IMCOM interview
  - Challenged to address the complexity, enormity and interdependencies of installation energy resilience

Department of Defense
MANUAL

OFFICE OF THE UNDER SECRETARY OF DEFENSE

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, DC 20301-8000

DEFENSE ENERGY PROGRAM POLICY MEMORANDUM (DEPPM) 92-1

MEMORANDUM FOR DESIGNATED ENERGY OFFICIALS OF THE OFFICE OF THE SECRETARY OF DEFENSE, MILITARY SERVICES, THE JOINT STAFF, AND THE DEFENSE AGENCIES

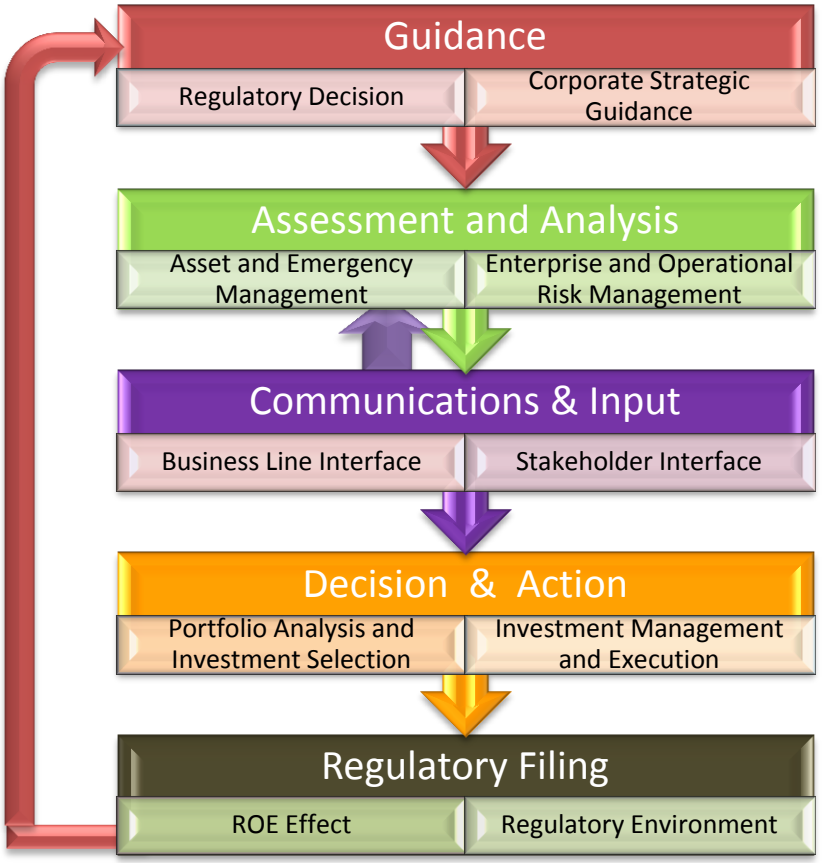
SUBJECT: Department of Defense Energy Security Policy

IMCOM

DODM – DOD Memorandum
DODI – DOD Instruction
ASA IE&E – Assistant Secretary of the Army, Installations , Energy and Environment
ACSIM – Assistant Chief of Staff, Installation Management
CG, IMCOM - Commanding General, Installation Management Command

Commercial Utility Capabilities Development Process

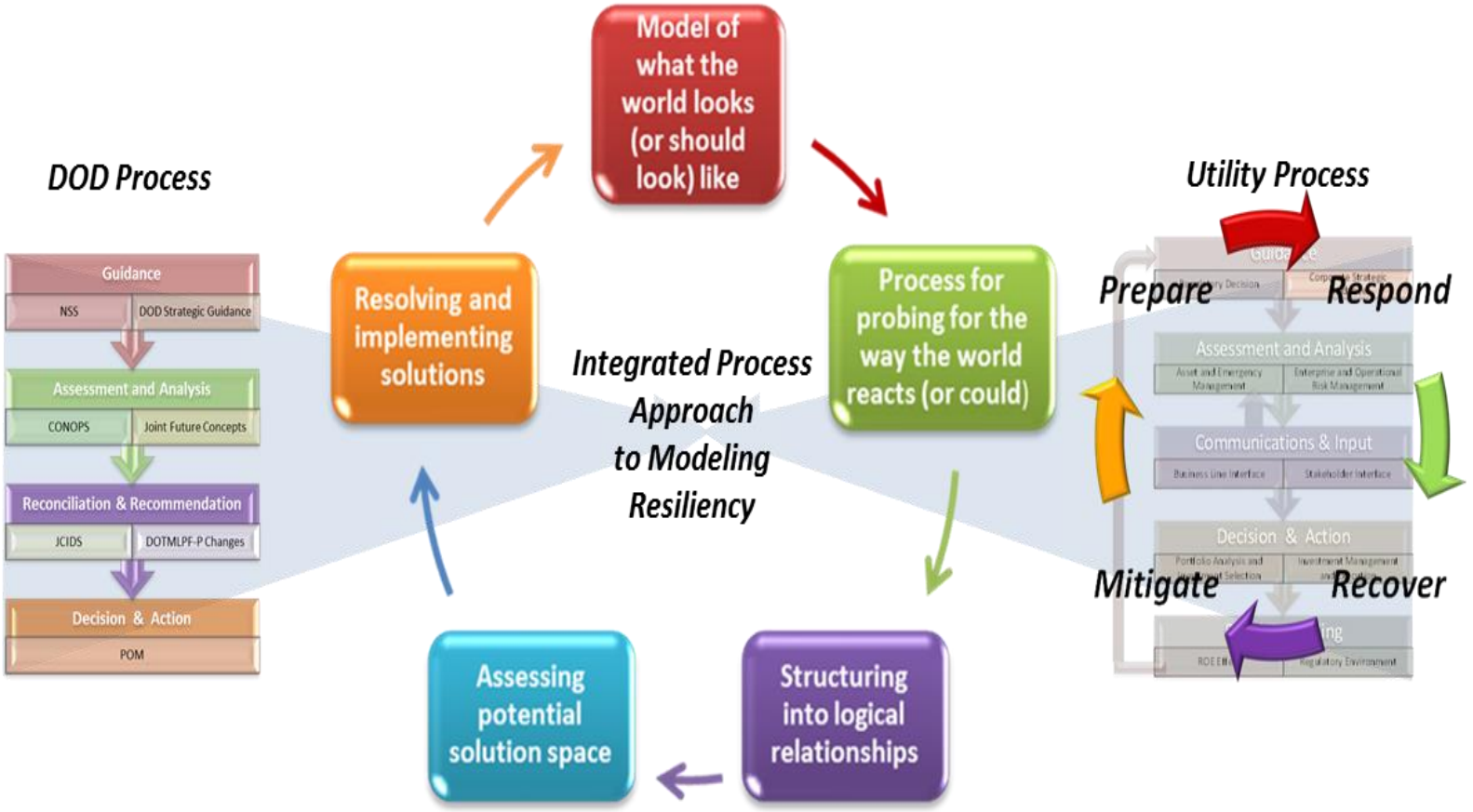
- Predominantly regulated industry
- Process evolution usually driven by actual or anticipated regulatory action
- Competing priorities
  - Shareholder desires for profitability
  - Rate payer desire for 100% safe, reliable, and resilient service
  - Regulator political implications and compliance issues
  - Constrained resources



Commercial Utility Temporal Framework

- **Prepare** - Asset management decisions and investment in response capabilities
- **Respond** – Processes, procedures and methods to respond to unplanned events
- **Recover** – Leadership and coordination to reestablishing service as quickly as possible
- **Mitigate** – System improvements, procedure changes, coordination and communication based upon lessons learned

Integrated Approach to Energy Resilience M&S



Step 1: Elicit World View

Sources

- Interviews
- Expert models
- Workshops
- Plans
- Studies

Step 2: Characterize System Response

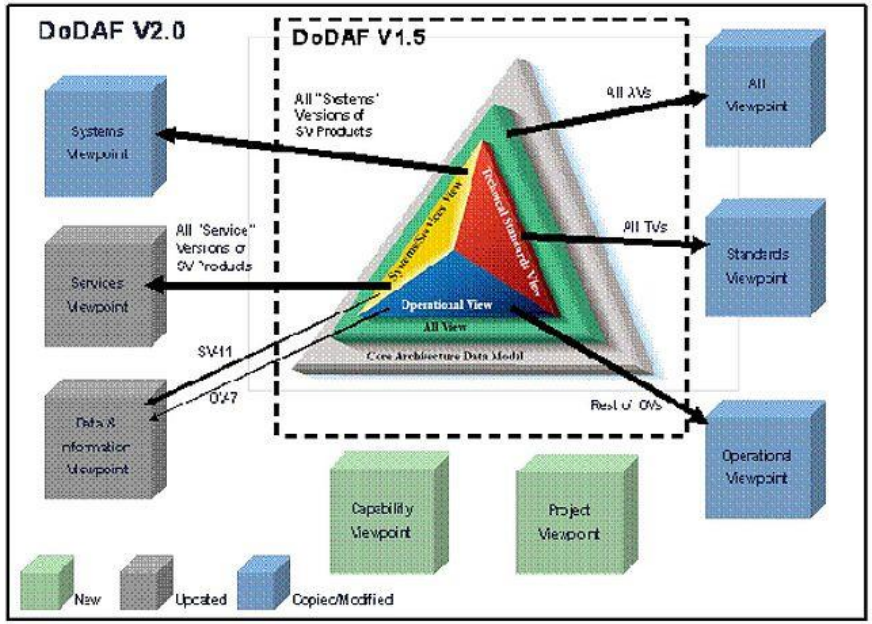
Techniques

- Experiments
- Tabletop Drills
- Community Exercises
- Wargames

Step 3: Map System Taxonomy

Templates

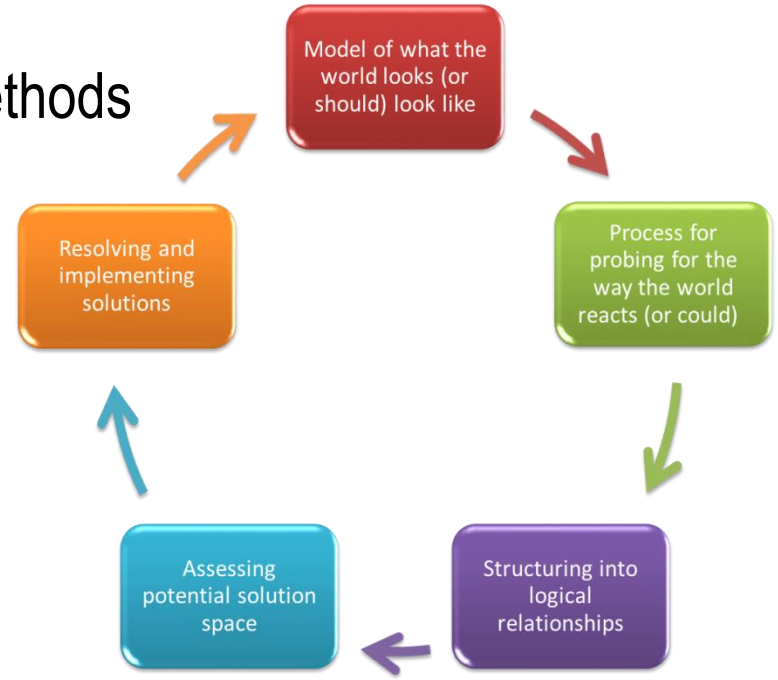
- National Planning Frameworks
- DoD Architectural Framework
- Temporal Framework
  - ✓ Prepare
  - ✓ Respond
  - ✓ Recover
  - ✓ Mitigate



Steps 4/5: Identify/Select Solutions

Tools

- Emergency planning process
- DOTMLPFP
- Collaborative portfolio comparison

Conclusions

- Resilience demands conceptual changes
  - System versus protective focus
  - Outcome-oriented metrics
- Expert insights can inform structured methods
  - Characterize complex interactions
  - Examine response to change
  - Test multi-domain portfolio solutions
- Useful structures / techniques available
  - National Planning Frameworks
  - DoD Architectural Framework
  - Scenario-based exercises/games