# RAMCAP® Plus℠

Risk Analysis and Management for Critical Asset Protection

# "Reduce Risk, Increase Resilience"

**February 26, 2009**

ASME INNOVATIVE TECHNOLOGIES INSTITUTE, LLC

# What We'll Cover

- Quick background on ASME and ASME-ITI
- Purpose and design specs for RAMCAP Plus
- Rundown on the seven-step process
- Maturation to "all" hazards, resilience, dual economics, benefit analysis
- Accomplishments and current initiatives

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# Who is ASME?

- Founded in 1880, the American Society of Mechanical Engineers (ASME) now numbers nearly 130,000 members
  - Technical, educational and research focus
  - One of the world's largest Standard Developing Organizations; sets internationally recognized codes and standards
  - One of the world's largest technical publishers
  - Numerous annual technical conferences worldwide
  - Hundreds of professional development courses annually
- ASME has always been committed to *reducing risks and increasing resilience* of the Nation's *infrastructure*
  - Supporting numerous standards, conferences & fellowships in the White House, Congress and DHS
  - Published book on RAMCAP Plus in February 2009
  - Initiating and coordinating three + formal voluntary American National Standards based on RAMCAP Plus

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# Who is ASME-ITI?

- An ASME-convened 2002 White House-industry conference on homeland security recommended risk management methods consistent and comparable across sectors
- ASME founded the *Innovative Technologies Institute (ITI),* a wholly owned, non-profit subsidiary, to conduct sponsored and self-funded RD&D in engineering-based risk & resilience management, including:
  - Completed the RAMCAP Framework, now in 3rd updated general version
  - Prepared seven sector-specific guidances, plus a special one for campuses
  - Completed RAMCAP Plus – all-hazards, dependencies, dual economics & benefit/cost analysis – now published as book from ASME Press
  - Developing RAMCAP for Regional Resilience to manage dependencies, cascading failures & large-scale solutions
  - Developing software for RAMCAP Campus and RAMCAP Plus
  - Developing American National Standards for water/wastewater utilities & campuses; supporting ASME Standard based on RAMCAP Plus
  - Developing concepts for extending the consistency and comparability of RAMCAP to renewal and re-investment program of Obama Administration

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# Purposes & Design Features RAMCAP Plus

- Purpose: Rational allocation of resources to enhance security & resilience of critical infrastructures
- Provides
  - Common terminology
  - Common process
  - Common metrics
  - Common threat scenarios
    - Terrorist attacks
    - Natural disasters
    - Supply chain disruptions

Tailored to the specific technologies and cultures of the individual sectors

Can be executed well in 3-5 days/site by on-site personnel, w/o experts

for *COMPARING RISKS WITHIN AND ACROSS SECTORS at asset, system, region, state and national levels* *– across time*

- Provides information to support private decision-making to reduce risks and increase resilience and continuity
- Provides information to government decision-makers about risks in the private AND public sectors

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# RAMCAP *Plus* (& NIPP) Risk Definition

**R = C x V x T in current RAMCAP *Plus***

R = Risk or "absolute risk"

C = Consequences, measured in losses ($), fatalities, injuries, etc.

V = Vulnerability, or the likelihood that a predefined terrorist attack or natural hazard will succeed against a particular target

T = Threat frequency, or likelihood that the target will be attacked over a given time span

## Benefit Definition

*Risk reduction* and *resilience enhancement* due to specific preparedness program, measured in:

- Fatalities and injuries avoided
- Financial and economic losses avoided

} Weighted by V and T

- Acceleration of recovery of acceptable level of function
- Other benefits, e.g., governmental readiness, public confidence

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# RAMCAP *Plus* Expands Scope

## Original RAMCAP: Terrorism Risk Management

- Terrorist threat vulnerability & risk assessment
- Consistent across economic sectors
- Consistent metrics

## RAMCAP *Plus*: *Comprehensive Risk/Resilience Management*

- Risk AND resilience goals & objectives
- "All hazards" (natural, man-made, dependency,& proximity)
- Product contamination threat (water, food, pharmaceutical)
- Threat likelihood estimation
- Economic losses to all levels – owners, communities, region, states, nation
- Cost/benefit analysis for all threats to all levels
- Business preparedness, continuity & resilience
- "Secure by Design" and "Resilient by Design" – new concepts
- Dissemination as American National Standards (ANS)

***The result - clearer focus on decision-makers' requirements***

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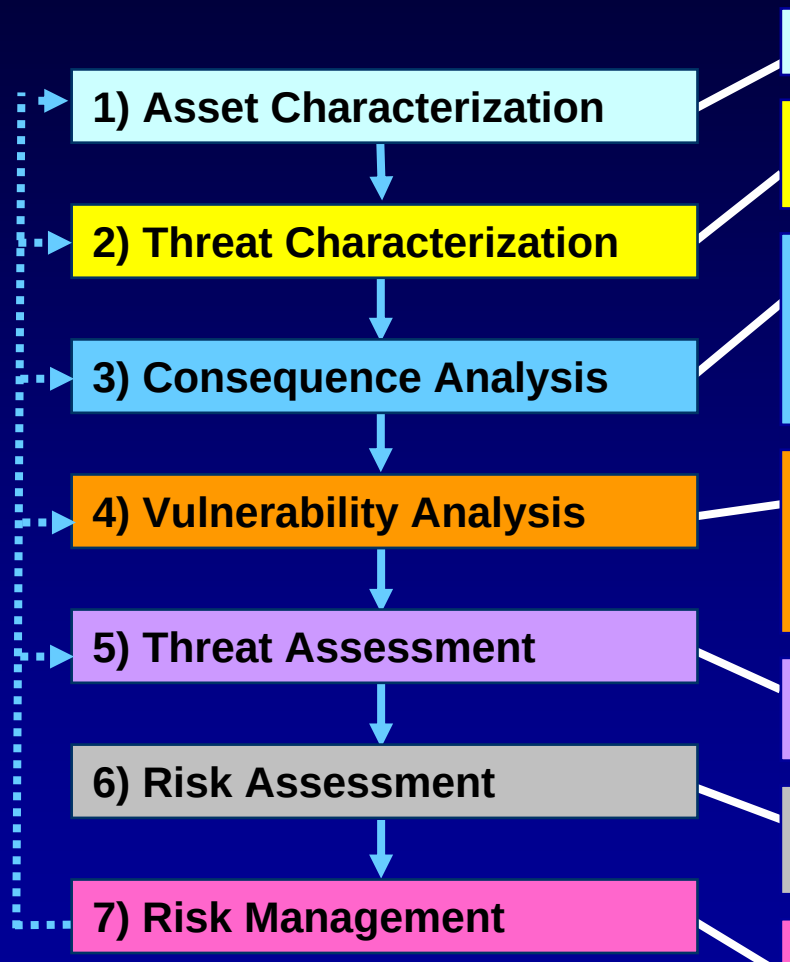
# The RAMCAP Plus Process




What assets do I have that are critical to my operations?

What reasonable worst case threat, natural hazard & supply chain scenarios should I consider?

What happens to my assets & operations if attacked by terrorists, natural hazards or supply chain disruption? How much money lost, to me? fatalities? injuries? How much economic loss to the Community ?

What vulnerabilities would allow a terrorist, natural disaster or supply chain problems to cause these consequences? Given the scenario, what is the likelihood it will result in these consequences?

What is the likelihood that a terrorist natural disaster or supply chain disruption will strike my operations?

**Risk = Consequences *x* (Vulnerability *x* Threat)**
**Resilience = Service Outage *x* (Vulnerability *x* Threat)**

What options do I have to reduce risks & increase resilience and continuity? How much will each benefit my organization? How much will it cost? What is benefit/cost ratio of my options? How can I manage the chosen options?

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# RAMCAP Plus Reference Hazards

| Hazard Type | Hazard Description | | | |
|---|---|---|---|---|
| **Natural** | **N(H)** Hurricanes | **N(E)** Earthquakes | **N(T)** Tornadoes | **N(F)** Floods |
| **Dependency & Proximity** | **D(U)** Loss of Utilities | **D(S)** Loss of Suppliers | **D(S)** Loss of Employees | **DI**Loss of Customers |
| | **D(T)** Loss of Transportation | | **D(P)** Proximity to other targets | |
| **Product Contamination** | **C(C)** Chemical | **C(R)** Radionuclide | **C(B)** Biotoxin | **C(P)** Pathogen |
| | **C(W)** – Weaponization of waste disposal system | | | |
| **Attack: Marine** | **M1** Small boat | **M2** Fast Boat | **M3** Barge | **M4** Ocean Ship |
| **Attack: Aircraft** | **A1** Helicopter | **A2** Small Plane | **A3** Medium, Regional Jet | **A4** Long-Flight Jet |
| **Attack: Automotive** | **V1** **C**ar | **V2** Van | **V3** Mid-size Truck | **V4** 18 Wheeler |
| **Attack: Assault Team** | **AT1** 1 Assailant | **AT2** 2-4 Assailants | **AT3** 5-8 Assailants | **AT4** 9-16 Assailants |
| **Sabotage** | **S(PI)** Physical-Insider | **S(PU)** Physical-Outsider | **S(CI)** Cyber-Insider | **S(CU)** Cyber-Outsider |
| **Theft or Diversion** | **T(PI)** Physical-Insider | **T(PU)** Physical- Outsider | **T(CI)** Cyber-Insider | **T(CU)** Cyber- Outsider |

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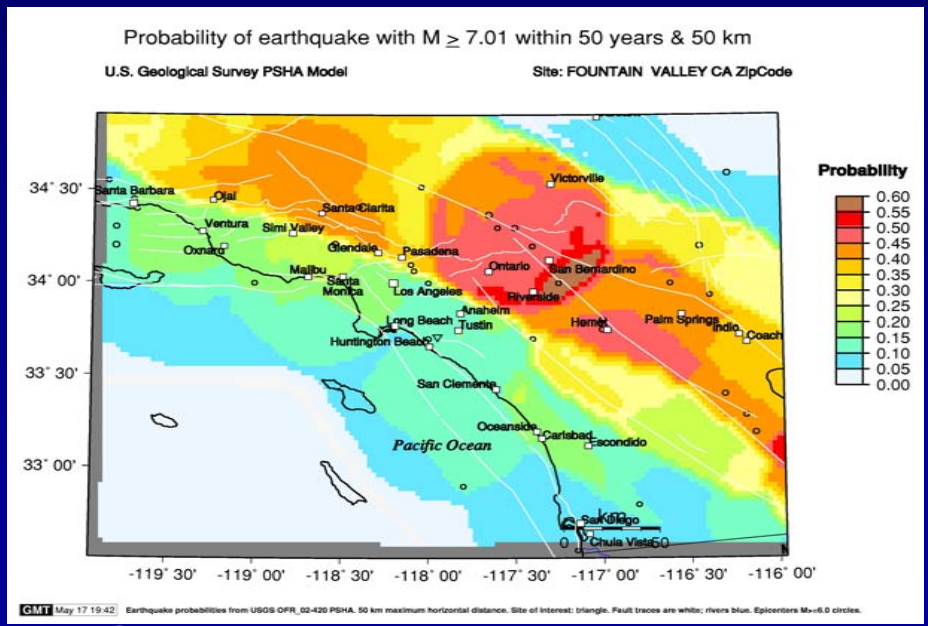
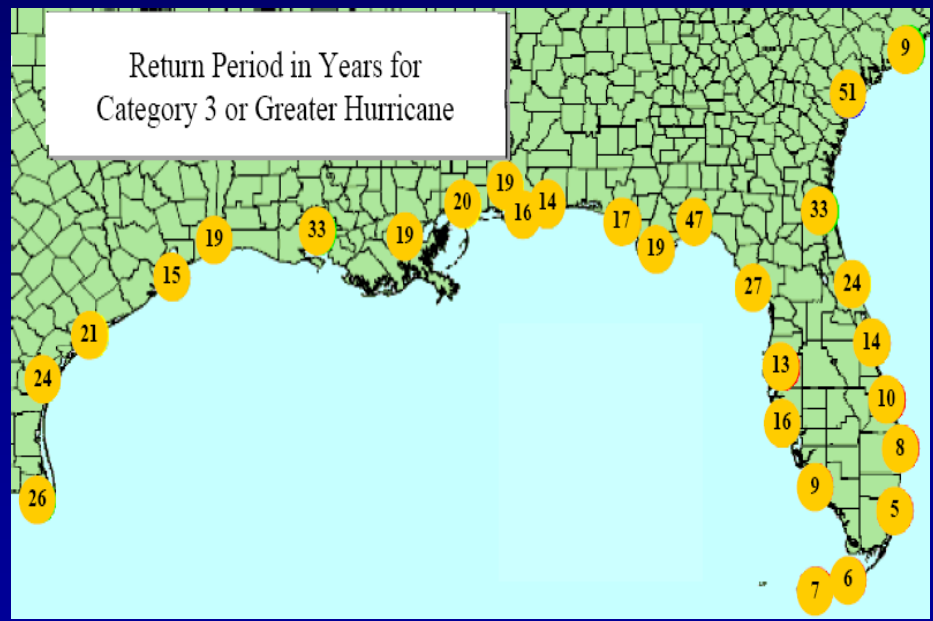
# Natural Hazards Analysis

- Uses building codes as basis
- Damage caused by events that exceed design requirements
- Likelihood based upon historical data
- Damage factors used to calculate cost basis
- Uses full risk equation: R = T * V * C
- Results compare directly with terrorism risk

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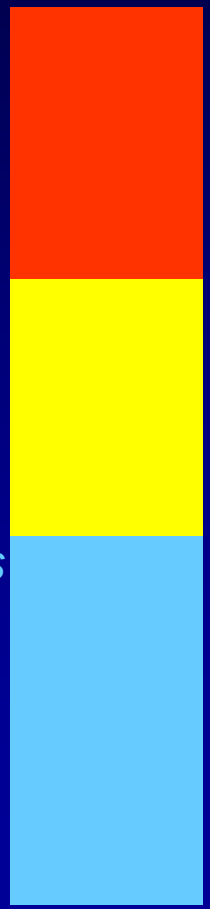
# Optimal Expenditure on Risk/Resilience Management Requires Analysis from Two+ Perspectives

| Level of Expenditure on Critical Infrastructure | Owner's Perspective | Community's Perspective |
|---|---|---|
| *Socially Optimal* | B/C < 1; owner cannot invest | B/C > 1; "public goods" – Gov't or Partnership invests directly or compensates owner |
| *Induced Owner's Outlay* | B/C ~ 1; owner invests | B/C > 1; Gov't or Partnership provides incentives directly – regulations, tax breaks – or through the market – standards, insurance costs, accreditation, credit ratings, eligibility |
| *Voluntary Owner's Outlay* | B/C > 1; owner invests | B/C > 1; Gov't or Partnership verifies private investment; *provides risk and resilience management processes,* like the RAMCAP suite |
| $ 0 | | |



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# RAMCAP *Plus* Comparability Supports Risk-Reduction Resource Allocation Decision-Making

( All dollar amounts in $ millions)

| Target | Bridge | Tank Farm | | Substation | | Water Plant | |
|---|---|---|---|---|---|---|---|
| **Perspective** | **Comm** | **Owner** | **Comm** | **Owner** | **Comm** | **Owner** | **Comm** |
| Risk without option, $ | 15.93 | 8.50 | 0.77 | 0.86-7.5 | 9.0-151.2 | 0.029 | 0.861 |
| Risk with option, $ | 5.13 | 0.056 | 0.00012 | 0.03 | 0.23 | 0.008 | 0.024 |
| Benefit of option, $ | 10.80 | 8.44 | 0.77 | 0.03-7.45 | 8.77-151 | 0.21 | 0.84 |
| Option cost, $ | 0.70 | 2.55 | | 7.0 | | 6.0 | |
| Benefit/cost ratio | 15.43 | 3.31 | 0.03 | 0.12-1.07 | 1.25-21.57 | 0.018 | 0.14 |
| **Invest?** | **Yes** | **Yes** | **No** | **No** | **Yes** | **No** | **No** |

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# RAMCAP & RAMCAP Plus Accomplishments

- Completed Sector-Specific Guidance documents for:
  1. Chemical manufacturing plants (basis for DHS chemical security regulations)
  2. Petroleum refineries (included in chemical security regulations)
  3. Liquefied natural gas terminals
  4. Nuclear power plants (all U.S. nuclear power plants have completed RAMCAP assessments)
  5. Nuclear spent fuel storage and transportation (part of nuclear ANS)
  6. Dams and locks
  7. Water and wastewater systems (basis for developing ANS with AWWA)
  8. Campuses of higher education (basis for developing ANS)
- Cited in 2006 DHS National Infrastructure Protection Plan
- Defense Science Board recommends DoD coordinate with RAMCAP
- RAMCAP Plus published as book February 2009
- RAMCAP Plus is a chapter in Wiley Handbook of Science and Technology for Homeland Security

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# RAMCAP *Plus* Current Initiatives

- RAMCAP *Plus* Campus
  - Partnership with AIG and numerous universities
  - Being tested at numerous, diverse campuses
  - Software package – *in beta testing*
- RAMCAP *Plus* Standards – American National Standards in development
  - RAMCAP Plus Framework Standard
  - RAMCAP Plus Campus Standard
  - RAMCAP Plus Water/Wastewater Standard (jointly with AWWA)
  - ASME nuclear power and petroleum refining standards considering incorporating RAMCAP Plus
- RAMCAP *Plus* for Regional Resilience – continuing refinement; seeking test site
- RAMCAP Plus training & certification – updating to new standards
- Infrastructure Investment Working Group – extending RAMCAP Plus for objective, comparative evaluations for new and renewal infrastructure investments

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# National Implementation & Maintenance Strategy

- American National Standards (ANSs) *must be used* in all Federal regulation, procurement specification, etc., if they exist – or the agency *head* must seek an OMB waiver
  - The National Technology Transfer and Advancement Act of 1995 PL 104-113
  - OMB Circular 119
- Title IX of the "9/11 Commission Recommendations Act" directs the use of ANSs and complementary activities in the national pursuit of preparedness – protection, response and resilience
- RAMCAP Plus was conceived from the very beginning to be developed, implemented and maintained as ANSs and related activities
  - Five ASME and ASME-ITI RAMCAP Plus ANSs are in development
  - These will be published and maintained by ASME, alone or in concert with other SDOs, for as long as there is demand for them
- Use of ANSs is growing in the private sector and the Federal government
- Standards are self-supporting, so will cost tax-payers nothing

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# Benefits & Incentives Using RAMCAP *Plus*

- For *asset owners & operators*, use of RAMCAP
  - Is efficient and cost-effective in application, taking five days or less on-site effort by on-site staff, limiting cost of application
  - Is intuitive, encouraging wide-spread, voluntary use
  - Provides insights into vulnerabilities, consequences and risks as support for internal preparedness, security and continuity decisions
  - Permits direct comparisons across like and unlike assets for risk and resilience resource allocation decision-making
  - Improves reliability of service, enhancing future revenue prospects
  - Improves ability to communicate risk, risk reduction and resilience enhancement
  - Assists in rational utility rate and fee setting to pay for reliability
  - Repeated applications assure accountability measure progress, & changing security environment
  - Reduces insurance costs and/or improves credit ratings, etc.
  - Reduces liability and regulation if linked to an American National Standard
  - *Lowers risks and increases resilience* to attack and natural hazards

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# Benefits and Incentives (Continued)

- For *public sector decision-makers*, RAMCAP Plus provides consistent, directly comparable risk-reduction and resilience-enhancement information
  - Identify areas of potential market failure that can be remedied by concerted action by customers and/or government
  - Establish budgets needed to restore American infrastructure to effectiveness
  - Prioritize public investments in risk reduction and resilience enhancement
  - Incentivize private investment decision-making
  - Rationalize utility rate setting to accommodate security and reliability investments
- Use of RAMCAP Plus data may be an eligibility requirement for certain targeted State and Federal grants
- RAMCAP Plus can serve as basis for a voluntary consensus-based standard (VCS) for self-regulation or as industry's mechanism for shaping regulation
- All this produces a more secure, resilient American Infrastructure for the future

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# Thank You

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# Brief History of RAMCAP Plus

- ***9/02:*** ASME convenes White House-industry workshop on homeland security; industry recommends risk management methods consistent and comparable across sectors
- ***9/03:*** ASME develops initial RAMCAP and writes "Introduction to Risk Analysis and Management for Critical Asset Protection"
- ***2/04:*** ASME workshop on risk analysis and communication with key academic experts for solid theoretical foundation
- ***4/04:*** ASME industry workshop for professional societies, trade associations, National Labs, DHS & other Federal Agencies reviews RAMCAP; advise: "KEEP IT SIMPLE"
- ***8/04:*** RAMCAP Framework© incorporates results from all meetings into the peer review version and distributed; updated based on comments as Version 2.0
- ***3-4/05:*** ASME sponsors major conference on "Regional Resilience"
- ***1/06:*** First five Sector-Specific Guidance documents are completed

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# Brief History of RAMCAP Plus (Cont'd)

- ***6/06:*** DHS issues NIPP, designates RAMCAP as the key CIP tool
- ***1/07:*** Defense Science Board recommends DoD coordinate with RAMCAP on tools
- ***9/07:*** Work completed on Dams & Water Sectors and Regional Resilience conceptual design
- ***1/08:*** RAMCAP Campus method & software developed; testing continues
- ***8/08:*** RAMCAP Plus completed – all hazards, dependencies, dual economics, benefit-cost analysis; publishing as book 2/09
- ***7/08:*** ASME initiates American National Standards for RAMCAP Plus, Water and Campuses
- ***7/08:*** ASME initiates Infrastructure Investment Working Group to develop methods to offer Obama's re-investment and renewal program; work continues for near and longer term processes

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