Deploying Counter-terrorism Resources Cost Effectively
Process Description
Problem

- Since 9/11 a very large number of vulnerability analyses have been undertaken.
  - For example, Brookhaven vulnerability analysis of the infrastructure of New York State.
  - Many are based upon probabilistic risk analysis.
- They show that nearly everything is vulnerable.
  - Results are highly uncertain and worst case assumptions used to compensate.
  - Resources for countering these vulnerabilities are limited.
- How can we deploy available resources cost-effectively?
VAST is a new paradigm and data management system for enhancing the usefulness of conventional vulnerability analyses to:

- Set priorities for critical target/threat vulnerabilities,
- Establish priorities for cost-effective counter-measure deployment,
- Determine success/failure outcomes of specified threats to targets from a variety of terrorist groups,
- Measure the attractiveness of targets to these groups.

VAST enables strategic evaluation of assets.
Conventional Vulnerability Analyses

Array of Threats (Open Ended, usually from Al Qaeda)

Array of Targets (Open Ended)

Probabilistic Analysis (Often Worst Case)

Possible Counter-measures

Probable Consequences
- Fatalities & Injuries
- Economic Costs
- Infrastructure & Local Disruption
- Political Influence
- Population Influence

Cost of Counter-Measures
VAST Enhances Existing Analyses

- **Terrorist Matrices (Motivations)**
- **Capabilities & Opportunities**
- **Applicable Threat Scenarios**
- **Potential Targets**
- **VAST Extended Evaluation**
- **Damage Assessment**
- **Threat Reduction (Cost-effective Hardening)**

Note: Rerun for each hardening option.
**Threat Analysis Data Base Structure**

- **Terrorist Types**
  - Transnational
  - National
  - Local, Individuals

- **Motivation (Utilities)**
  - Positive - Achieve Aims
  - Negative - Fear of Retribution

- **Opportunity & Resources**
  - Ability to Reach Targets
  - Capabilities & Technologies

- **Potential Target Types**
  - Threats Matched to Motivations

- **Motivation**
  - Positive - Achieve Aims
  - Negative - Fear of Retribution


Cost-Effective Deployment of Resources
First Level Motivational Profile

Positive Motivational Profile

Motivation

Goals

Negative Motivational Factors

Consequences of Capture

Motivation

Death | Injury | Torture | Incarceration | Retaliation | Group Disfavor | Dissolution | Nat. Disgrace | Isolation | War

Death: 90%  Injury: 80%  Torture: 70%  Incarceration: 60%  Retaliation: 50%  Group Disfavor: 40%  Dissolution: 30%  Nat. Disgrace: 20%  Isolation: 10%  War: 0%

Negative Motivational Factors
Cost-Effective Deployment of Resources

VAST System Process Flow

Motivation Profiles
- Positive Profile
- Negative Profile

Matching Opportunities

Hardening Systems In Place Or Being Tested

Impacts of Threats
- Infrastructure Loss Expectancies

Target (Asset)

Success

Failure

Motivational Translation

Capabilities

Threats

Outcomes
VAST is:
- An anticipatory rather than an imminent threat warning system,
- A defensive threat evaluation system that prioritizes defensive countermeasures,
- Dynamic only in so far as terrorist motivations and capabilities change and imminence information in the form of a single activity index from outside sources.

Imminent threat data from terrorist groups or for types of assets is:
- Directly available from government and police sources,
- Discerned from defensive measures uncovering salient activity,
- Used by VAST to validate high priority attractiveness ratings.

Expert judgments for motivational and capability profiles can come from many sources:
- In-house experts familiar with domestic and international terrorist groups
- Client experts,
- Government intelligence experts.

VAST provides means to merge estimates while providing value diversity when appropriate.
Threat Consequence Structure

Financial
- Robbery
- Extortion
- Kidnapping
- Record Destruction

Population Threats
- Incapacitate
- Terrorize
- Paralyze
- Injure
- Kill Citizens
- Kill Military

Destruction Of Assets
- Structures
- Energy Systems
- Water Supply
- Food Supply
- Communication
- Transportation
- Land Use

Cripple Infrastructure
- Energy Systems
- Water
- Food Supply
- Communication
- Electronic Postal
- Transportation People Cargo
- Financial & Markets
Structured Threat Lists

Generic Threats
- Single Action Threats
- Compound Action Threats
- Asset Particular Threats
  - Single Action Threats
  - Compound Action Threats
Profile Pattern Matching

Group or Individual Profiles

Positive Factors

Negative Factors

Multiple Matching of Profiles

Asset/Threat Profiles

Damage

Population

Disruption

Infrastructure
Further Profile Matching

Group or Individual Profiles

Threat Profiles

Opportunity Profiles

Threat Achievement Filters – Success/Failure

Resource Profiles
Vulnerability Analysis

Evaluate all Terrorist Positive Motivational Profiles Against All Asset Profiles and Score Each

Match the Resource and Opportunity Profiles as Scoring Filters

Order the Threat/Asset Scores by Value
### Resultant Indices

- **Attractiveness Index**
  - Measures how well the positive motivations of a terrorist group matches the likely outcome of a threat to a target.
  - Low value = High Match
  - Open ended at high end

- **Negative Motivation Index**
  - Measures the fear factor involved in attacking a target for a given threat
  - Low Value = Low Fear
  - Open ended at high end

- **Degree of Success**
  - Measures how successful the terrorist may be in carrying out an attack
  - + 1 = High Success
  - 0 = Success/Failure Even
  - - 1 = High Failure

- **Aggregate (Composite) Index**
  - Measures the combination of attractiveness, negative motivation and degree of success
  - Low = High Potential Target Value
  - Open ended at high end
## Target Attractiveness (Only Top 10 Shown)

### in Order by Aggregate Index (Low number is more susceptible to attack)

<table>
<thead>
<tr>
<th>Target and Conf. Level</th>
<th>Group and Conf. Level</th>
<th>Threat and Conf. Level</th>
<th>Pos Motivation Index</th>
<th>Neg Motivation Index</th>
<th>Degree of Success</th>
<th>Aggregate Index</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courthouse 99.0% W</td>
<td>Deranged Small Grps</td>
<td>Bomb: Truck or Box Van, Outside 60.0% B</td>
<td>0.09</td>
<td>0.19</td>
<td>0.06</td>
<td>0.28</td>
<td>98.2%</td>
</tr>
<tr>
<td>Courthouse 81.0% C</td>
<td>Al Qaeda</td>
<td>Gasoline Tanker Truck   99.5% W</td>
<td>0.18</td>
<td>0.17</td>
<td>0.02</td>
<td>0.35</td>
<td>99.8%</td>
</tr>
<tr>
<td>Courthouse 98.0% W</td>
<td>Al Fatah</td>
<td>Bomb: Truck or Box Van, Outside 81.0% C</td>
<td>0.35</td>
<td>0.01</td>
<td>0.01</td>
<td>0.36</td>
<td>99.1%</td>
</tr>
<tr>
<td>Courthouse 99.5% W</td>
<td>Al Qaeda</td>
<td>Bomb: Truck or Box Van, Outside 60.0% B</td>
<td>0.43</td>
<td>0.17</td>
<td>0.02</td>
<td>0.60</td>
<td>98.4%</td>
</tr>
<tr>
<td>Courthouse 98.0% W</td>
<td>Deranged Individuals</td>
<td>Bomb: Truck or Box Van, Outside 60.0% B</td>
<td>0.52</td>
<td>0.15</td>
<td>0.42</td>
<td>0.67</td>
<td>98.3%</td>
</tr>
<tr>
<td>Courthouse 60.0% B</td>
<td>Militia</td>
<td>Bomb: Truck or Box Van, Inside 83.0% C</td>
<td>0.29</td>
<td>0.52</td>
<td>0.14</td>
<td>0.81</td>
<td>96.5%</td>
</tr>
<tr>
<td>Courthouse 99.5% W</td>
<td>Al Qaeda</td>
<td>LP Tanker Truck         99.0% W</td>
<td>0.02</td>
<td>0.89</td>
<td>0.01</td>
<td>0.91</td>
<td>99.9%</td>
</tr>
<tr>
<td>Courthouse 83.0% C</td>
<td>Al Qaeda</td>
<td>Bomb: Truck or Box Van, Inside 98.0% W</td>
<td>0.42</td>
<td>0.51</td>
<td>0.32</td>
<td>0.93</td>
<td>99.1%</td>
</tr>
<tr>
<td>Courthouse 98.0% W</td>
<td>Al Fatah</td>
<td>Bomb: Small Box Van, Inside 99.0% W</td>
<td>0.50</td>
<td>0.63</td>
<td>-0.01</td>
<td>1.13</td>
<td>99.8%</td>
</tr>
<tr>
<td>Courthouse 99.5% W</td>
<td>Hamas</td>
<td>Bomb: Truck or Box Van, Outside 98.0% W</td>
<td>0.25</td>
<td>0.91</td>
<td>0.01</td>
<td>1.16</td>
<td>99.8%</td>
</tr>
</tbody>
</table>

100s of more entries with higher index values not shown
Using The Indices

- If a target is high on the aggregate index (closer to zero), it means that it is likely target to the specified terrorist groups.
- A detailed review (built in) provides insight on the critical parameters for protection.
- Based on the critical parameters, alternative hardening solutions are defined, and new resulting indices are obtained and compared with the originals.
- The lowering of the target on the indices along with costs of the hardening alternatives provides a cost-effective evaluation of target protection.
Index Values

- **Cardinality**
- **Relative Valuation**
  - Discrimination among threats and hardening options
  - Relative Distance
- **Absolute Valuation**
  - Establish by trials on past events
  - Establish by repeated use and pegging
Structure for Methods of Hardening

Hardening - Reducing the Vulnerability of Assets and Sites to Terrorist Attacks

Profile Minimization
- Masking
- Avoiding Publicity
- Secrecy
- Confidentiality

Introduce Redundancy
- Networks
  - Sites
  - Storage
  - Supplies

Access Protection
- Barriers
  - Perimeters
  - Asset Portability
- Access Control
  - Physical Protection

Personnel Vetting
- Security Checks
  - Profiling
  - Access Control
  - Internal & External Checks

Process Changes
- New Processes
  - Eliminate Bottlenecks
- Find Win-win Solutions
  - Capital Investment Needs

Cost-Effective Deployment of Resources
Intervention with hardening systems and technology reduces the ability to achieve the threat:
- impacts the *opportunity and resource profiles* of the terrorists
- impacts the *negative motivational profiles*,
- Reduces the extent of damage to the target

Analysis is run for variety of hardening conditions:
- current level of hardening,
- maximal hardening,
- good judgment levels,
- Several cost-effective levels,
- Less hardening (removal of cost-ineffective operations)
### Sample Hardening Report

<table>
<thead>
<tr>
<th>Hardening Option</th>
<th>Change in Aggregate Index</th>
<th>Capital Cost</th>
<th>Operating and Maintenance Costs/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jersey Barriers</td>
<td>+ 0.48</td>
<td>$6,000</td>
<td>$500</td>
</tr>
<tr>
<td>Portal Controls</td>
<td>+ 0.13</td>
<td>$15,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Gate Controls</td>
<td>+ 0.09</td>
<td>$20,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Street Access Limit</td>
<td>+ 1.50</td>
<td>$5,000 + Loss of Use</td>
<td>$10,000</td>
</tr>
</tbody>
</table>
## Target Attractiveness in Order by Aggregate Index

(Low number is more susceptible to attack)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Target</th>
<th>Terrorist Group</th>
<th>Threat</th>
<th>Aggregate Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Courthouse</td>
<td>Deranged Small Grps</td>
<td>Bomb: Truck or Box Van, Outside</td>
<td>0.76</td>
</tr>
<tr>
<td>6.</td>
<td>Courthouse</td>
<td>Militia</td>
<td>Bomb: Truck or Box Van, Inside</td>
<td>0.81</td>
</tr>
<tr>
<td>2.</td>
<td>Courthouse</td>
<td>Al Qaeda</td>
<td>Gasoline Tanker Truck</td>
<td>0.83</td>
</tr>
<tr>
<td>3.</td>
<td>Courthouse</td>
<td>Al Fatah</td>
<td>Bomb: Truck or Box Van, Outside</td>
<td>0.84</td>
</tr>
<tr>
<td>8.</td>
<td>Courthouse</td>
<td>Al Qaeda</td>
<td>Bomb: Truck or Box Van, Inside</td>
<td>0.93</td>
</tr>
<tr>
<td>4.</td>
<td>Courthouse</td>
<td>Al Qaeda</td>
<td>Bomb: Truck or Box Van, Outside</td>
<td>1.08</td>
</tr>
<tr>
<td>5.</td>
<td>Courthouse</td>
<td>Deranged Individuals</td>
<td>Bomb: Truck or Box Van, Outside</td>
<td>1.15</td>
</tr>
<tr>
<td>9.</td>
<td>Courthouse</td>
<td>Al Fatah</td>
<td>Bomb: Small Box Van, Inside</td>
<td>1.13</td>
</tr>
<tr>
<td>7.</td>
<td>Courthouse</td>
<td>Al Qaeda</td>
<td>LP Tanker Truck</td>
<td>1.38</td>
</tr>
<tr>
<td>10.</td>
<td>Courthouse</td>
<td>Hamas</td>
<td>Bomb: Truck or Box Van, Outside</td>
<td>1.64</td>
</tr>
</tbody>
</table>

100s of more entries with higher index values not shown
Applying Results

- Use the compiled list of likely threats to specific facilities in ordered manner to identify the critical vulnerabilities.
- Develop cost-effective programs to reduce the threat potential to various levels.
- Apply to different applications
  - One to One – Threat by a specific terrorist group to specific assets.
  - One to Many – Likely targets for a terrorist group.
  - Many to One – Vulnerability of specific assets to all threats
  - Many to Many – Identification of global target vulnerability
- Provide the basis for cost-effective deployment of resources for:
  - Hardening,
  - Coping,
  - Emergency response, and
  - Crisis management preparation.