A Comparison in Quantifying Asset Value, Threat, Vulnerability and Risk

Doug Haines
Haines Security Solutions
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The Broad Picture

- **Learning Objectives**
  - Know the differences between Quantitative and Qualitative Analysis
  - Assess and select the right methodology that serves you best
- **Quantitative versus Qualitative**
- **Comparing MSHARPP, CARVER and RAVA**
Quantitative v. Qualitative

• Qualitative analysis
  – Relies on the individual’s expertise
  – Differs between individuals
  – Not consistent over time
  – Can work one-time or on an isolated basis
Quantitative v. Qualitative

• Quantitative analysis
  – Doesn’t rely on the individual’s expertise
  – Doesn’t differ significantly between individuals
  – Consistent over time
  – Works especially well for multiple assets
Risk Management

- Is not
  - Complete risk avoidance
  - Developing the bunker or Ft Knox mentality
- Is
  - Identifying all potential threat scenarios
  - Accepting some level of risk

IS IT OVER, YET?

CAN WE COME OUT NOW?
Risk Analysis

• Why is identifying and understanding risk so important?
  – Maybe it’s cheaper to replace than to repair
  – Maybe a loss isn’t so bad
  – Maybe there really is no threat
Risk Analysis Results

• What am I protecting (Asset)
• Protecting from what? (Threat)
• Am I in trouble? (Vulnerability)
• How much? (Risk)
  – What can I do? (Countermeasures)
  – At what costs? (Cost benefit)
  – What should I do first (Priorities)
Risk Analysis Team

• Stakeholder “Buy-in”
  – Must agree on asset value and priority
  – Design Basis Threat (DBT)
    • Weapons characteristics
    • Levels of protection
  – Vulnerabilities
MSHARPP

• Background
  – Primarily developed as a tool to assist asset owners on how to mitigate terrorist attacks
• Very adaptable
• Takes the perspective of the asset owner
M-S-H-A-R-P-P

- Mission
  - Is the asset perceived to be essential to the mission?
    - Importance to the mission
    - The effect of its loss
    - The ability to recover from its loss
  - Mission essential components
    - Equipment or people
    - Information
    - Building/Facility
    - Operations/Activity
M-S-H-A-R-P-P

• Symbolism
  – Does the asset have symbolic significance?
  – Does it represent the government - local, state or federal?
  – How about our way of life?
M-S-H-A-R-P-P

- History
  - Threat in the area
    - Demonstrated tactics/methods
  - Generic Threat if no specific threat
    - Design Basis Threat (DBT)
    - Don’t forget the transnational elements
M-S-H-A-R-P-P

• Accessibility
  – Is the asset located near modes of communication
  – Is access restricted/how easy is it to approach
  – Does the asset have an on-site security force/guard service
    • Are they vigilant
    • Is there a low chance of getting caught?
• Recognizable
  – How easy is the asset to recognize?
    • Flags, signs, logos
    • Daylight/nighttime operations
  – Can it be easily located
    • Maps
    • Internet
M-S-H-A-R-P-P

- Population
  - The higher the population the more attractive it is
  - Proximity to other assets
  - “Who” might be just as important as “how many”
M-S-H-A-R-P-P

• Proximity
  – Asset rich environment
  – Unwanted collateral
    • Closeness to schools, churches, other priority buildings could be a deterrent
  – Effects on population “no longer” a primary consideration
<table>
<thead>
<tr>
<th>TARGET</th>
<th>M</th>
<th>S</th>
<th>H</th>
<th>A</th>
<th>R</th>
<th>P</th>
<th>P</th>
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<td>23</td>
<td>4,000 Truck IED</td>
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<table>
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<tr>
<th>ASSET</th>
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<th>A</th>
<th>R</th>
<th>P</th>
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<td>2</td>
<td>3</td>
<td>21</td>
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<td>cashier</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>20</td>
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</table>
Why it’s important to have a different perspective
CARVER

• Background
  – Developed as a tool for US Special Forces
    • Vietnam era
  – Used to assess and determine value to military attackers
  – From outside looking in

Why does he get to be inside? His fur is longer. It just doesn’t seem fair.
C-A-R-V-E-R

• Criticality
  – Assess mission validity
    • It is going to be worth it?
  – Valuable in prioritizing targeting
    • Mission critical asset or critical infrastructure
      – Attack the asset or its support system?
C-A-R-V-E-R

• Accessibility
  – How easy is it to get to?
  – Will I reach the asset without detection?
  – Once I get there can I target the critical portion or does it have additional security countermeasures?
  – Is there a chance to get away?
C-A-R-V-E-R

• Recoverability
  – Time it takes to replace the loss and return to normal operations
    • Availability of additional assets or spare parts
    • Function during restoration
    • Redundancy somewhere else
C-A-R-V-E-R

- Vulnerability
  - Asset is vulnerable if the “bad guy” has the equipment and expertise to carry-out the attack
  - Nature and construction of asset
  - Amount of damage to impact mission
  - On-site security
C-A-R-V-E-R

- Effect on population
  - Cause reprisals or impact on local populace
  - Unemployment
  - Collateral damage to other areas
- Recognizability
  - Degree of recognizability by attackers either through direct surveillance or “soft” intelligence gathering
  - Weather/Visibility
  - Size and complexity of target
  - Distance to travel
  - Technical sophistication of attackers
CARVER MATRIX

<table>
<thead>
<tr>
<th>Fossil Fuel Bulk Power Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Target Component</td>
</tr>
<tr>
<td>Fuel Tanks</td>
</tr>
<tr>
<td>Fuel Pumps</td>
</tr>
<tr>
<td>Boilers</td>
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</table>

<table>
<thead>
<tr>
<th>ASSET</th>
<th>C</th>
<th>A</th>
<th>R</th>
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<th>E</th>
<th>R</th>
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<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>17</td>
</tr>
</tbody>
</table>

LOW - 1
AVERAGE - 5
HIGH - 10
MSHARPP or CARVER

INSIDE LOOKING OUT vs OUTSIDE LOOKING IN
Risk Analysis Vulnerability Assessment (RAVA)

- How about both?
- Plus a cost benefit tool, too!
- Prioritization list
  - Implement countermeasures that will have the biggest risk reduction on the largest amount of people first
RAVA

• Developed by US Navy Naval Facilities Engineering Command (NAVFAC)
  – As part of overall FAA project
    • Several other contractors
    • Antiterrorism Services Branch (ASB)
  – Success likelihood validated on-site
Threat Analysis

• Not all threats are created equal
• Assumes attack will be successful
• Takes in to account likelihood of attack
Asset Analysis

• What are we protecting?
  – Facilities
  – People
  – Money
  – Processes/systems
Vulnerability Analysis

• Baseline
  – Where you are today
  – Defense in depth
    • Level 1 (boundary perimeter)
    • Level 2 (internal boundary)
    • Level 3 (asset façade)
    • Level 4 (interior area)
# Comparing MSHARPP & CARVER

## ASSET

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<td>3</td>
<td>1</td>
<td>5</td>
<td>17</td>
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</table>
## Threat Value

<table>
<thead>
<tr>
<th>Within the past year</th>
<th>Score</th>
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<tbody>
<tr>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is there a high concentration of gangs in the area?</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Yes - within 250 miles of the asset</td>
<td>5</td>
</tr>
<tr>
<td>Yes - within 50 miles of the asset</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial Threat Likelihood (IT) (without adjustment)</th>
<th>0.55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Threat Likelihood (FT) (with adjustment)</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Threat likelihood and effectiveness can be characterized as follows:

- **0.00 - 0.20** Very Low
- **0.21 - 0.40** Low
- **0.41 - 0.50** Moderate
- **0.51 - 0.80** Elevated
- **0.81 - 0.90** Significant
- **0.91 - 1.00** Critical
## Asset Value

<table>
<thead>
<tr>
<th>Asset Value to the Organization (A_o)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 - 5,000 people</td>
<td>75</td>
</tr>
<tr>
<td>&gt;5,000 people</td>
<td>150</td>
</tr>
<tr>
<td><strong>Target Analysis - 2</strong></td>
<td></td>
</tr>
<tr>
<td>Asset visibility to the general public:</td>
<td></td>
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<tr>
<td>probably unknown</td>
<td></td>
</tr>
<tr>
<td>probably known</td>
<td></td>
</tr>
<tr>
<td>well known</td>
<td></td>
</tr>
<tr>
<td><strong>Score</strong></td>
<td>10</td>
</tr>
<tr>
<td>Asset redundancy:</td>
<td></td>
</tr>
<tr>
<td>replacement within the company readily available</td>
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</tbody>
</table>

### Asset Value to the Threat (A_T) = 0.55

**Target Analysis - 3**

<table>
<thead>
<tr>
<th>Asset Value to the Organization</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combatant, ordnance, weapons, law enforcement, or intelligence</td>
<td>50</td>
</tr>
<tr>
<td>High profile or prominent organization or Eschelon 1 or 2 headquarters element or a Class A or B asset.</td>
<td>100</td>
</tr>
<tr>
<td><strong>Score</strong></td>
<td>10</td>
</tr>
</tbody>
</table>

\[
\text{Total Asset Value (A_v) = 0.71}
\]

The total asset value is the average of A_o and A_T. It can be characterized as follows:

- 0.00 - 0.20: Very Low Importance
- 0.21 - 0.40: Low Importance
- 0.41 - 0.50: Moderate Importance
- 0.51 - 0.80: High Importance
- 0.81 - 1.00: Very High Importance
Vulnerability

• Optimized
  – Where you can be after implementing countermeasures
  – Module is intuitive enough to discount countermeasures that won’t affect a risk change
## Vulnerability Value

### IF THERE IS NO INTERIOR LAYER (I.E., A STAND-ALONE ASSET), THEN SELECT THE HIGHEST BASELINE VALUE ON ALL LAYER 4 QUESTIONS.

<table>
<thead>
<tr>
<th>Ref#</th>
<th>Question</th>
<th>ARMED ROBBERY</th>
<th>ROBBERY</th>
<th>THEFT</th>
<th>VALUABLE TAKING</th>
<th>Value</th>
<th>Optimized Value</th>
<th>Improvement Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Is the asset interior layer equipped with an intrusion detection system?</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>ES</td>
</tr>
<tr>
<td></td>
<td>1. Interior volumetric, point sensors on portals and connected to central station (1.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Point sensors on portals and connected to central station (5.0)</td>
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<td></td>
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<tr>
<td></td>
<td>3. Volumetric and/or point sensors on portals but with local alarm only (7.0)</td>
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<tr>
<td></td>
<td>4. No intrusion detection system or no interior layer associated with this asset (10.0)</td>
<td></td>
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</tr>
<tr>
<td>38</td>
<td>Is the interior layer of the asset equipped with duress alarms or well established duress code system?</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>ES</td>
</tr>
<tr>
<td></td>
<td>1. YES (1.0)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>2. NO or no interior layer associated with this asset (5.0)</td>
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<tr>
<td>40</td>
<td>Are critical assets within the interior layer situated away from the exterior shell of the structure or facility?</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
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<td>PS</td>
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<td></td>
<td>1. YES (1.0)</td>
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<td></td>
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<td></td>
<td>2. NO or no interior layer associated with this asset (5.0)</td>
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<td>41</td>
<td>How are critical areas inside the interior layer of the asset secured?</td>
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<td>6</td>
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</tr>
<tr>
<td></td>
<td>1. Electronic Access Control System (1.0)</td>
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<td></td>
<td>2. Around-the-clock guard when operational, locked when non-operational (3.0)</td>
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<tr>
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<td>3. Standard lock and key (4.0)</td>
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<tr>
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<td>4. Areas not secured or no interior layer associated with this asset (6.0)</td>
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<tr>
<td>42</td>
<td>Is there a personnel safe haven designated inside the interior layer of the asset?</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td></td>
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<td>6</td>
<td>PRO</td>
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<tr>
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<td>1. Yes (1.0)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>2. NO or no interior layer associated with this asset (6.0)</td>
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### Maximum Point Total for asset Interior

<table>
<thead>
<tr>
<th>Category</th>
<th>BOBBERY</th>
<th>ROBBERY</th>
<th>THEFT</th>
<th>VALUABLE TAKING</th>
<th>OPTIMIZED</th>
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</thead>
<tbody>
<tr>
<td>Baseline Calculation</td>
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<td>11</td>
<td>24</td>
<td>31</td>
<td>24</td>
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<tr>
<td>Optimized Calculation</td>
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<td>11</td>
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<td>14</td>
<td>4</td>
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</table>
# Vulnerability Value

## IF THERE IS NO INTERIOR LAYER (I.E., A STAND-ALONE ASSET), THEN SELECT THE HIGHEST BASELINE VALUE ON ALL LAYER 4 QUESTIONS.

<table>
<thead>
<tr>
<th>Ref#</th>
<th>Question</th>
<th>ARMED</th>
<th>ROBBERY</th>
<th>THEFT</th>
<th>VANDALISM</th>
<th>HOSTAGE TAKING</th>
<th>Value</th>
<th>Optimized Value</th>
<th>Improvement Category</th>
</tr>
</thead>
</table>
| 37   | Is the asset interior layer equipped with an intrusion detection system?  
   1. Interior volumetric, point sensors on portals and connected to central station (1.0)  
   2. Point sensors on portals and connected to central station (5.0)  
   3. Volumetric and/or point sensors on portals but with local alarm only (7.0)  
   4. No intrusion detection system or no interior layer associated with this asset (10.0) | 10 | 10 | 10 | 10 | | 10 | 1 | ES |
| 38   | Is the interior layer of the asset equipped with duress alarms or well established duress code system?  
   1. YES (1.0)  
   2. NO or no interior layer associated with this asset (5.0) | | | 5 | 5 | 5 | 5 | | 5 | ES |
| 40   | Are critical assets within the interior layer situated away from the exterior shell of the structure or facility?  
   1. YES (1.0)  
   2. NO or no interior layer associated with this asset (5.0) | 5 | 5 | 5 | | | 5 | 5 | PS |
| 41   | How are critical areas inside the interior layer of the asset secured?  
   1. Electronic Access Control System (1.0)  
   2. Around-the-clock guard when operational, locked when non-operational (3.0)  
   3. Standard lock and key (4.0)  
   4. Areas not secured or no interior layer associated with this asset (6.0) | | | | | | 6 | 4 | ES |
| 42   | Is there a personnel safe haven designated inside the interior layer of the asset?  
   1. Yes (1.0)  
   2. NO or no interior layer associated with this asset (6.0) | | | 6 | 6 | 6 | | 6 | PRO |

**Maximum Point Total for asset Interior**

<table>
<thead>
<tr>
<th></th>
<th>ARMED</th>
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<th>VANDALISM</th>
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<tr>
<td>Optimized Calculation</td>
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</tr>
</tbody>
</table>
## Value – Risk Calculations

### Analysis of Risk Reduction

<table>
<thead>
<tr>
<th>Threat</th>
<th>Baseline Risk</th>
<th>Optimized Risk</th>
<th>Decrease in Risk</th>
<th>Overall Point Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armed Robbery</td>
<td>0.73</td>
<td>0.12</td>
<td>83%</td>
<td>0.61</td>
</tr>
<tr>
<td>Robbery</td>
<td>0.73</td>
<td>0.22</td>
<td>69%</td>
<td>0.51</td>
</tr>
<tr>
<td>Kidnapping</td>
<td>0.55</td>
<td>0.04</td>
<td>93%</td>
<td>0.51</td>
</tr>
<tr>
<td>Theft</td>
<td>0.56</td>
<td>0.04</td>
<td>93%</td>
<td>0.52</td>
</tr>
<tr>
<td>Vandalism</td>
<td>0.67</td>
<td>0.06</td>
<td>91%</td>
<td>0.61</td>
</tr>
<tr>
<td>Averages</td>
<td>0.64</td>
<td>0.11</td>
<td>85%</td>
<td>0.53</td>
</tr>
</tbody>
</table>

### Analysis of Vulnerability Reduction

<table>
<thead>
<tr>
<th>Threat</th>
<th>Baseline Vulnerability</th>
<th>Optimized Vulnerability</th>
<th>Decrease in Vulnerability</th>
<th>Overall Point Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armed Robbery</td>
<td>0.95</td>
<td>0.17</td>
<td>83%</td>
<td>0.78</td>
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<tr>
<td>Robbery</td>
<td>0.90</td>
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<tr>
<td>Kidnapping</td>
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<tr>
<td>Theft</td>
<td>0.76</td>
<td>0.05</td>
<td>93%</td>
<td>0.71</td>
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<tr>
<td>Vandalism</td>
<td>0.92</td>
<td>0.09</td>
<td>91%</td>
<td>0.84</td>
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<tr>
<td>Averages</td>
<td>0.88</td>
<td>0.15</td>
<td>85%</td>
<td>0.73</td>
</tr>
</tbody>
</table>
Risk Analysis

• Culmination of threat, asset & vulnerability (optimized)
  – Determines calculated value of risk to a specific target (asset) by a specific threat

\[ \text{Threat} \times \text{Asset Value} \times \text{Vulnerability} = \text{RISK} \]
Cost Benefit Analysis

- Provides Cost Benefit Analysis (CBA)
  - Is based on cost versus reduction in vulnerability and risk
  - Helps determine if the countermeasure is worth spending the money on
- Allows decision makers to prioritize funding
  - Address countermeasures that provide the greatest amount of risk reduction to the greatest number of personnel first
Summary

• Quantitative is better than Qualitative
• Don’t do it alone/get help
• Variety of methods out there
• Choose the one that works best for you
Questions
Contact Information

• Tel: (805) 509-8655
• Email: doug@hainessecuritysolutions.com
• Website: www.hainessecuritysolutions.com