Training Session Objectives

- Educate symposium on DDES B roles, functions, resident expertise, and support capabilities
- Provide insight into current DoD Explosives Safety Munitions Risk Management (ESMR M) policy
- Educate participants on the ESMRM Assessment process
- Gain forum participants perspective on explosives safety and risk management
- Serve as exchange venue for explosives safety best practices; trends; procedures; and lessons learned for applicability within and across forum participants
Training Session Agenda

- Intro Brief
- ESMRM Policy
- Technical Paper 23 Overview
- ESMRM Assessment Process
- ESMRM Assessment Examples
- ESS risk based capabilities in ESS 6.1.4
ESMRM Assessment Process Agenda

- ESMRM Assessment Purpose
- ESMRM Assessment Tools
- Munitions Risk Assessment System (MRAS)
- Munitions Risk Assessment System Example
ESMRM Assessment Purpose

- To identify, analyze, and reduce munitions-related risks in support of DoD explosives safety policy tenets:
  - To protect personnel and property from the potentially-damaging effects of DoD military munitions
  - To expose the minimum number of people for the minimum time to the minimum amount of DoD military munitions required to safely and effectively execute the mission
- Explosives safety is a critical function where the Combatant Commander (CCDR) can influence decisions relating to identifying and reducing munitions-related risks
- Planning for risks and potential consequences from the unintended initiation of DoD military munitions, procedures, and processes provides commanders the necessary information needed to make informed risk decisions based on ESMRM principles and contributes to mission success

The foundational premise of ESMRM involves upfront identification and clear communication, to the appropriate level of command, of the risks and consequences to and from DoD military munitions during all phases of military planning, training, and operations.
ESMRM Assessment Purpose

- ESMRM analysis involves evaluating potential consequences of an incident...estimates:
  - Personnel exposure, including potential fatalities and injuries
  - Infrastructure exposures and associated costs
  - Operational impact due to loss/damaged equipment/infrastructure

- ESMRM Assessment analyzes risks **to and from** explosives and munitions and their related operations.

- Assessment and the qualitative measure used to identify the hazard severity will be coordinated for approval as a single package to:
  - Risk decision authority
  - Responsible Combatant Commander (CCDR)
  - Service
  - DDESB

*Primary: Inform leaders/decision authorities of the risk associated with explosives and/or munitions based on the potential consequence associated with an explosives incident...when DoD explosives safety requirements cannot be met.*
The DDESB has developed and evaluated several risk analysis tools to facilitate risk based siting and munitions risk assessments.

DDESB’s TP 23 *Assessing Explosives Safety Risks, Deviations, And Consequences* provides an overview of tools available to perform munitions risk assessments.
The Automated Safety Assessment Protocol – Explosives (ASAP-X) and the Consequence & Risk Identification (C&RI) tool:

- Tier one tool:
  - Analyzes Potential Explosion Site (PES) (ECM, Open, Other) to Exposed Sites (ESs)
  - Analyzes consequences based on overpressure and fragmentation based on K-factors (K-6, K-9, K-11, K-18, K-24, K-40/K-50)
  - Estimates fatalities, injuries, and infrastructure losses
  - This is a consequence tool that doesn’t take into consideration the probability of event
  - Excel Spreadsheet based

- Currently the primary tool used to conduct ESMRM Assessments

ASAP-X was developed to assist in the risk assessment process, the derived information may be presented to leadership for review with the deviation package. It provides the information necessary to assist leaders in making informed risk decisions.
Consequence & Risk Identification (C&RI) tool (Cont.)

- Estimates the potential number of fatalities, injuries, and infrastructure damage
- The C&RI tool doesn’t take into consideration the probability of event nor PES orientation when calculating risks
- The tool is currently Excel spreadsheet based and is being integrated into the DoD’s Explosives Safety Siting (ESS) Software program in 2018/2019

<table>
<thead>
<tr>
<th>Zone US = NATO</th>
<th>Facility Damage %</th>
<th>Fatality %</th>
<th>Injury %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (K6) = Q2.4</td>
<td>100%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>2 (K9) = Q3.6</td>
<td>100%</td>
<td>90%</td>
<td>10%</td>
</tr>
<tr>
<td>3 (K11) = Q4.7</td>
<td>100%</td>
<td>80%</td>
<td>20%</td>
</tr>
<tr>
<td>4 (K18) = Q7.1</td>
<td>50%</td>
<td>20%</td>
<td>40%</td>
</tr>
<tr>
<td>5 (K24/30) = Q9.5/Q12</td>
<td>20%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>6 (K40/50) = Q15.9/Q19.8</td>
<td>5%</td>
<td>1%</td>
<td>2%</td>
</tr>
</tbody>
</table>
A NATO version of the tool “NATO Automated Safety Assessment Protocol – Explosives (NASAP-X)” is available.

- NASAP-X tool analyzes potential risks based on the distance between Potential Explosion Sites (PESs) (ECM, Open, Other) to Exposed Sites (ESs).
ESMRM Assessment Tools

- **NATO Automated Safety Assessment Protocol - Explosives (NASAP-X)** (Cont.)
  - Estimates the potential number of fatalities and infrastructure damage (not injuries)
  - The NASAP-X tool doesn’t take into consideration the probability of event nor PES orientation when calculating risks
  - Excel spreadsheet based

<table>
<thead>
<tr>
<th>Zone NATO = US</th>
<th>Facility Damage %</th>
<th>Fatality %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Q2.4) = K6</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>2 (Q3.6) = K9</td>
<td>100%</td>
<td>91%</td>
</tr>
<tr>
<td>3 (Q7.2) = K18</td>
<td>50%</td>
<td>21%</td>
</tr>
<tr>
<td>4 (Q9.6) = K24</td>
<td>20%</td>
<td>3%</td>
</tr>
<tr>
<td>5 (Q14.8/PTRD) = K37</td>
<td>10%</td>
<td>2%</td>
</tr>
<tr>
<td>6 (Q22.2/IBD) = K56</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>7 (Q44.4/2IBD) = K112</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>
The C&RI Tool is currently automated within the MRAS

Trimble Yuma-2 GPS/GIS enabled tablets
Conduct Field Assessment
• Validate ArcGIS data
  • Add/Remove Facilities
  • Collect & validate ES data
  • Collect GPS data (PES/ES)
  • Collect images

Pre-assessment planning products:
• ArcGIS area Maps & Construction Cost
• Integrated Shape file overlays (i.e. Installation boundaries, ESQD arcs, Groupings, etc…)

Load ArcGIS & Construction Cost Data on devices

Internal data validation process

C&RI / ASAP-X
Infrastructure (ES) data processed
Consequence data processed

Report / Output Data

Infrastructure ES - Output Data
• Tabular data
  • Exposed personnel
  • Infrastructure by type data
  • Infrastructure cost data
  • Location GPS Data
• Summary tabular data
• Exposure data (personnel & infrastructure cost data)
• Image data
  • Base boundary & IBD arc
  • Grouping data

Consequence - Output Data
• Consequences summary:
  • Infrastructure damage est.
  • Personnel fatality & injury est.
• Color-coded tabular ES Output data by zone:
  • On-base by zone
  • Off-base by zone
  • Total by zone
• Total Exposures & consequences
• Fact sheet
• Image data
Munitions Risk Assessment System Example

- **Pre-planning**
  
  1. Define scope of operation?
     
     ✓ Location of potential explosion site (PES)
     
     - Small boat pier at Naval Mine and Anti-Submarine Warfare Center, Point Loma Naval Base
     
     ✓ Define operation:
     
     - 500 lbs. Net Explosives Weight (NEW) munitions transfer

  2. Enter PES information in C&RI/ASAP-X tool on the Input Worksheet

---

<table>
<thead>
<tr>
<th>POTENTIAL EXPLOSIVE SITE (PES)</th>
<th>PES GPS COORDINATES</th>
<th>HAZARD DIVISION</th>
<th>NEW (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GPS WAY-POINT</td>
<td>LATITUDE</td>
<td>LONGITUDE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIR</td>
<td>DEG</td>
</tr>
<tr>
<td>PES Name: Point Loma</td>
<td></td>
<td>1</td>
<td>North</td>
</tr>
<tr>
<td>Is the PES an open pad, ECM, or Other?</td>
<td>Other</td>
<td>2</td>
<td>North</td>
</tr>
<tr>
<td>If an ECM, is it 26 ft x 60 ft or larger and a loading density less than 0.028 lbs/cubic ft?</td>
<td></td>
<td>3</td>
<td>North</td>
</tr>
<tr>
<td>If an ECM, is it Undefined?</td>
<td></td>
<td>4</td>
<td>North</td>
</tr>
<tr>
<td>If Other, can it stop primary fragments?</td>
<td>No</td>
<td></td>
<td>GPS Unit#:</td>
</tr>
</tbody>
</table>

---
2. This will populate Zone distances in the Output Page of the C&RI tool

<table>
<thead>
<tr>
<th>Distance</th>
<th>ZONE</th>
<th>FATAL</th>
<th>BUILDING DAMAGE LOSS</th>
<th>INJURIES</th>
<th>% FATAL</th>
<th>% BLDG DAMAGE</th>
<th>% INJURIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>1 (K6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>2 (K9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>3 (K11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>143</td>
<td>4 (K18)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>750</td>
<td>5 (K24/PTRD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,250</td>
<td>6 (K40/IBD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Same data can be pulled from any DDESB approved Quantity Distance Calculator

3. Download high quality image that is rectified/georeferenced from sites like Digital Globe™

4. Use program like ArcGIS™ to draw shape files representing:
   1) The PES
   2) Each of the ESQD zones (1 through 6)
   3) Groupings within the ESQD arcs
- Groupings should not cross ESQD zones

1) Try to Group like facilities

2) Grouping help ensure complete area coverage when multiple team are collecting data

3) Groupings reduce overall data entry requirements and are particularly helpful in densely populated areas

Fictitious Example - ESMRM Assessment to conduct munitions on-load operations

Munitions Risk Assessment System Example

Example ESQD Arcs and Groupings

Point Loma, San Diego
ESQD Arcs for 500 lbs NEW

Legend:
- Red: 1 AEC
- Yellow: 2 AEC
- Green: 3 AEC
- Blue: 4 AEC
- Purple: 5 AEC
- Pink: 6 AEC
- Brown: 7 AEC

Projection: Transverse Mercator
Datum: WGS 1984 UTM Zone 11N

5. Load infrastructure cost data into MRAS

- Construction costs are used to calculate infrastructure value and damage estimates exposures – Cost per Square Foot
- Six Infrastructure exposures types are used in the C&RI tool
  - **Residential** properties include single detached homes, apartments, duplex, and condominiums – $337.50
  - **Commercial** properties include office buildings, banks, retail outlets, malls, hotel, resorts, etc. – $266.00
  - **Industrial** properties include factories, repair/machine shops, manufacturing facilities, refineries, warehouses, etc. – $165.00
  - **Institutional** properties include schools, post office, stadiums, hospitals, government facilities, etc. – $550.00
  - **Agricultural** properties include farms, feedlots, ranches, slaughter houses, etc. – N/A
  - **Other** to capture miscellaneous infrastructure & equipment (e.g., large gantry type cranes at ports) – Various
Further sub-divide maps into grids to provide backup map for assessment teams.
Munitions Risk Assessment System Example
Munitions Risk Assessment System Example

Munitions Risk Assessment System Example

Point Loma, San Diego
ESQD Arcs for 500 lbs NEW

Munitions Risk Assessment System Example

Point Loma, San Diego
ESQD Arcs for 500 lbs NEW

Munitions Risk Assessment System Example

Munitions Risk Assessment System Example

Conducting the On-site ESMRM Assessment

- Steps 1-4 of the ESMRM Assessment process: Initiation, Scope Development, Pre-Coord/Info gathering and Pre-Assessment Analysis are completed

- On-site Assessment goals include:
  - Validate mission scope and pre-planning assumptions
  - Identifying risks to and from munitions at and around the PES
    - Facilities/equipment/capabilities to support operations, lightening protection, hazardous materials etc…
    - Each assessment is unique and having experienced explosives safety personnel and personnel familiar with the proposed operating location is critical

Collecting ES infrastructure data within ESQD arcs

- Teams collect infrastructure and personnel exposure data within assigned grouping

Collecting ES infrastructure data within ESQD arcs (continued)

- The most accurate method is to physically measure each facility
- Measurements can also be taken from imagery when conducting desktop assessments provided the images are scaled. (Determining the number of stories is very challenging)
- Large numbers of buildings makes physically measuring each building impractical
  - When estimating building sizes the use of “Equivalent Units” helps to scope the issue
  - Equivalent Units are pre-defined square footage sizes that can be used to quickly estimate a buildings size
  - As an example a 40’ x 40’ building is 1600 square feet. When looking at a building simply estimating how many 40’ x 40’ cubes can fit in the building can be used to estimate the total square footage
  - Counting the number of equivalent units, of each property type, in an assessment grouping is an acceptable method for estimating property exposures

Infrastructure Data collected within each group is characterized based on the facility type (Industrial, commercial, instructional, residential, agricultural, and other)
Determining personnel exposures

- There are a number of ways to estimate the populations in a given area
  - Census can be used as a means to help validate data collection efforts
  - Occupancy placards
  - Asking local government officials
  - Asking owners/supervisors at commercial, industrial and government faculties
  - Estimating the number of personnel in various types of properties
  - A combination of methods is often used in an assessment

- Establishing general guidelines for each of the data collection teams helps to maintain data consistency (i.e., the average number of personnel per residence is 3)

<table>
<thead>
<tr>
<th>TEAM #:</th>
<th>ES GROUP #:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Types:</td>
<td>COMMercial, RESidential, INDustrial, INSTitutational, AGRIcultural, OTHER</td>
</tr>
<tr>
<td>Equivalent Unit Size:</td>
<td>__________ ft²</td>
</tr>
<tr>
<td>Personnel Per Unit:</td>
<td>__________ (unless otherwise noted)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROPERTY TYPE</th>
<th>EQUIVALENT UNITS</th>
<th>TOTAL PERSONNEL</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Munitions Risk Assessment System Example

- Analyzing potential Risk
  - Exposed infrastructure and personnel census data is entered into the ASAP-X/C&RI Excel Spreadsheet or into the MRAS
  - Potential consequences are analyzed based on the Net Explosives Weight (NEW) at the Potential Explosion Site (PES) and the distances to the exposed sites (ESs)

### OUTPUT DATA FOR

<table>
<thead>
<tr>
<th>ZONE</th>
<th>DISTANCE</th>
<th>FATAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 (K6)</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2 (K9)</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>3 (K11)</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4 (K18)</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>5 (K24/PTRD)</td>
<td>92</td>
</tr>
<tr>
<td>6</td>
<td>6 (K40/IBD)</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BUILDING DAMAGE LOSS</th>
<th>% FATAL</th>
<th>% BLDG DAMAGE</th>
<th>Total # Personnel</th>
<th>INJURIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>660,000</td>
<td>100%</td>
<td>100%</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>660,000</td>
<td>100%</td>
<td>100%</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>660,000</td>
<td>100%</td>
<td>100%</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>508,866</td>
<td>67%</td>
<td>77%</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>65,046,656</td>
<td>10%</td>
<td>33%</td>
<td>952</td>
<td>184</td>
</tr>
<tr>
<td>47,727,359</td>
<td>2%</td>
<td>14%</td>
<td>1,905</td>
<td>60</td>
</tr>
</tbody>
</table>

| Total Fatalities | 133 |
| Total # Personnel | 2,869 |
| Total Injuries | 245 |

- All non-fatal are injuries
- Sliding scale from "all non-fatal" to 2X fatalities
- Twice the # of fatalities
### Risk Analysis

- Hazard Severity and Probability - Based on the analysis determine the overall risks to and from munitions related processes
- Military Standard 882E, “Department of Defense Standard Practice System Safety,” or the Services’ Safety process can be used to quantify the potential risks.

<table>
<thead>
<tr>
<th>Description</th>
<th>Severity Category</th>
<th>Mishap Result Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catastrophic</td>
<td>1</td>
<td>Could result in one or more of the following: death, permanent total disability, irreversible significant environmental impact, or monetary loss equal to or exceeding $10 million (M).</td>
</tr>
<tr>
<td>Critical</td>
<td>2</td>
<td>Could result in one or more illnesses that may result in hospitalization of at least three personnel, reversible significant environmental impact, or monetary loss equal to or exceeding $1 million but less than $10 million.</td>
</tr>
<tr>
<td>Marginal</td>
<td>3</td>
<td>Could result in one or more lost work day(s), reversible moderate environmental impact, or monetary loss equal to or exceeding $100 thousand (K) but less than $1 million.</td>
</tr>
<tr>
<td>Negligible</td>
<td>4</td>
<td>Could result in one or more lost work day(s), minimal environmental impact, or monetary loss less than $100 thousand (K).</td>
</tr>
</tbody>
</table>

**Probability**

<table>
<thead>
<tr>
<th>Description</th>
<th>Level</th>
<th>Specific Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent</td>
<td>A</td>
<td>Likely to occur often in the life of an item.</td>
</tr>
<tr>
<td>Probable</td>
<td>B</td>
<td>Will occur several times in the life of an item.</td>
</tr>
<tr>
<td>Occasional</td>
<td>C</td>
<td>Likely to occur sometime in the life of an item.</td>
</tr>
<tr>
<td>Remote</td>
<td>D</td>
<td>Unlikely but possible to occur in the life of an item.</td>
</tr>
<tr>
<td>Improbable</td>
<td>E</td>
<td>So unlikely it can be assumed occurrence may not be experienced in the life of an item.</td>
</tr>
<tr>
<td>Eliminated</td>
<td>F</td>
<td>Incapable of occurrence. This level is used when potential hazards are identified and later eliminated.</td>
</tr>
</tbody>
</table>

**Severity**

<table>
<thead>
<tr>
<th>Description</th>
<th>Level</th>
<th>Specific Individual</th>
</tr>
</thead>
<tbody>
<tr>
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<td>A</td>
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</tr>
<tr>
<td>Eliminated</td>
<td>F</td>
<td>Incapable of occurrence. This level is used when potential hazards are identified and later eliminated.</td>
</tr>
</tbody>
</table>

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**Munitions Risk Assessment System Example**

- Description:...
Munitions Risk Assessment System Example

Potential Blast and Fragmentation Effects
Net Explosive Weight: 500 pounds
Personnel Exposure: 2,669 people affected
Total Fatalities: 133 fatalities
Total Injuries: 245 injuries
Total Property Exposure: $551,028,000
Estimated Property Damage: $115,292,884
Munitions Risk Assessment System Example

**Risk Control Plan**

- Develop site specific Risk Reduction Recommendations
- Develop Corrective Action Plans as appropriate

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**PORT/PIER FACT SHEET: Point Loma MITIGATING CONTROL MEASURES**

*Instructions:* These control measures are provided for your use. Modify as needed for this specific site; use the blank space to add any site-specific measures.

| ☐ Require the host nation to provide firefighting support. |
| ☐ Generate a fire map that identifies the HD of all military munitions located at the site and provide it for first responders. |
| ☐ Provide medical support during all on/offloading operations. |
| ☐ Provide access to and maintain standard operating procedures during all on/offloading operations. |
| ☐ Provide the appropriate level of security that is required for the security risk codes of military munitions during on/offloading. |
| ☐ Arrange for explosive ordnance disposal support during on/offloading operations. |
| ☐ Require a safety loading officer is present during all military munitions on/offloading operations. |
| ☐ Establish applicable emergency withdrawal distances based on the highest HD of military munitions being on/offloaded and brief all personnel working on the pier. |
| ☐ Establish notification procedures for impending electrical storms within 15 miles of the pier facility. Evacuate personnel to a minimum public traffic route distance based on the highest HD of military munitions being on/offloaded from the vessel. |
| ☐ Require all vehicles and equipment offered for transporting military munitions are inspected by personnel who are AMMO-51 certified. On a case-by-case basis, the senior qualified inspector onsite will make a determination to use any vehicle or equipment that does not meet U.S. safety standards identified on DD Form 626, "Motor Vehicle Inspection (Transporting Hazardous Materials)." |
| ☐ Enforce hazards of electromagnetic radiation to ordnance (HERO) restrictions to include radios, cell phones, and electronic devices. Set HERO conditions by the vessel. |
| ☐ Require that only qualified/certified personnel handle military munitions with the exception of host nation contracted crane operators and associated stevedores who are responsible for on/offloading explosives-laden International Organization for Standardization (ISO) containers. |
| ☐ During military munitions on/offloading operations, have adjacent berths within established ESQD arcs clear of other vessels. |
| ☐ Establish that material handling equipment, weight handling equipment, and ordnance handling equipment used to handle explosives-laden ISO containers have a current load test. |
| ☐ Require a safety loading officer inspects the port/pier firefighting capabilities prior to on/offloading operations. |
| ☐ Prohibit pier side ISO container break outs. |
| ☐ Prohibit pier side overnight storage operations. |
| ☐ Limit the number of personnel performing on/offloading operations to the minimum required to safely perform the operations. |
| ☐ Obtain host nation concurrence and understanding of U.S. munitions activities and their potential impact on population exposure to the ESQD arc. |
| ☐ Control and secure the port/pier and nearby waterfront area to prevent unauthorized persons from having access to these areas during munitions on/offloading operations. |
| ☐ Coordinate and schedule munitions operations with nearby industrial, commercial, residential, and institutional facilities’ occupants to reduce exposure risk to an acceptable level. |
Port Chicago, California Ship Explosion of 17 July 1944. The explosion of about 3,500,000 pounds of explosives in railroad cars on the pier and in the holds of a ship resulted in the death of 320 people, injuries to 390, and property damage estimated to be $13,000,000. This incident provided empirical data based on the damage relationships by types, magnitude, direction and distance from the pier are recorded in the report by description, charts, tables, maps and in many cases by the determination of a formula for the fitted curve for the amount of damage per locality. Worst explosives incident of WWII
ESMRM Assessment Example - Port

- Pre-planning
  - Define potential explosion site (PES)
  - Define operation:
    - US Army munitions off-load operations at SPOD
    - Maximum Net Explosives Weight (NEW) 12M lbs.
- Based on PES location & NEW, ESQD arcs reflect area encumbered by munitions operations that require analysis
- Pre-planning coordination identified additional planned port usage

Pre-planning

➢ USMC indicated that they were planning to use the port for:

✓ Munitions on/off-load operations at piers 17-21 (7.6M NEW - Staging & Storage)
✓ Ammunitions Holding Area (AHA)
✓ Equipment laydown (LSA 2)
✓ Troop berthing (LSA 1)

Identification of Exposures

➢ In addition to identifying potential risk to infrastructure and personnel the analysis team evaluated the potential risks to Army and USMC operations at the port

Pre-planning analysis

The initial analysis showed that planning assumptions by Army & USMC created untenable risks:

- Army operations at piers 9-12 would jeopardize USMC operations:
  - USMC equipment loss near 50%
  - USMC fatalities near 20%

- USMC operations at piers 17-21 and at the AHA would jeopardize USMC and Army operations:
  - USMC fatalities near 80%
  - Risks to Army off-load operations

Based on data collected during the pre-planning analysis:

- USA/USMC agreed that the ESMRM Assessment Team would collect ESMRM data based on the areas encumbered by the composite ESQD arcs
- Data collected during risk assessment would help identify Courses of Action (COAs)
Once exposure data was collected for encumbered areas

The C&RI tool was used to analyze risks based on 4 different scenarios

- Risks were analyzed with C&RI tool to identify:
  - Potential infrastructure damage
  - Potential number of fatalities
  - Potential number of injuries

<table>
<thead>
<tr>
<th>Potential Explosion Site</th>
<th>Exposures</th>
<th>Potential Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Personnel Within IBD</td>
<td>Infrastructure Cost (USD)²</td>
</tr>
<tr>
<td>Utilization of Berths 9-12 – 12M lbs. NEW</td>
<td>11,004</td>
<td>$5,798,984,291</td>
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<tr>
<td><strong>Utilization of Berths 17-21 – 12M lbs. NEW</strong></td>
<td><strong>3,096</strong></td>
<td><strong>$4,672,214,190</strong></td>
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<tr>
<td>Utilization of Berths 9-21 – 12M lbs. NEW</td>
<td>12,905</td>
<td>$7,185,333,011</td>
</tr>
</tbody>
</table>

ESMRM Assessment Example - Port

- Base on risk analysis piers 17-21 posed the least amount of munitions-related risks
- USMC would not store munitions within pier complex in propose AHA
- USMC would not use Logistics Staging Areas (LSAs) - 1
- Army and USMC agreed to both conduct munitions operations at single location to minimize over all risk