

**Two Case Studies  
in  
Collaborative Public-Private Risk Assessment  
in  
Vessel Traffic Safety**

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# Two Case Studies

- The Ports and Waterways Safety Assessment Process (PAWSA)
- Offshore Vessel Routing Schemes along the California Coast and Monterey Bay National Marine Sanctuary

**The Ports and Waterways**  
**Safety Assessment Process**  
**(PAWSA)**

# PAWSA Background

- EXXON VALDEZ oil spill
- Oil Pollution Act of 1990 (OPA '90)
- Assess need for VTS in “high volume oil ports”
- Port Needs Studies already in process
- Volpe Transportation Systems Center
- Classical probabilistic/OR approach
- Results widely rejected
  - Congress
  - Stakeholders
  - Internal Coast Guard

# Criticisms of Volpe Port Needs Studies

- “Little stakeholder involvement”
- “Input data questionable and/or incomplete”
- “Focus on single solution to varied problems”
- “Not reflective of new technologies”
- “Inadequate attention to mariner needs”
- “Wrong answers”
- “Answers pre-determined”
- “Bloated federal program”

# “The Rest of the Story”

- All Politics is Local
  - Every port in the nation is the **MOST UNIQUE** port in the nation
  - Every port in the nation is the **MOST IMPORTANT** port in the nation
- Clinton Administration User Fee Proposal
  - Broad industry opposition to any fee
  - Concerns over User Fee impact on port competitiveness
- VTS as port “status symbol”
  - “not important enough to rate a VTS”
  - “not safe because it has no VTS”
  - “so safe it doesn’t need a VTS”

# **National Dialogue Group Guidance**

- **Not every port needs a VTS**
- **VTS is only one of many available VTM tools**
- **Solution may not be a VTS**
- **Appropriate tools to be used in coordination**
- **Local users can provide best insight on risk drivers in a given port**
- **Issue isn't "Where do we build the next VTS?"**
- **Issue is "What is needed where, to mitigate identified risks?"**

# Finding a Balance

- Stakeholder Needs
- Risk Drivers
  - Probability
  - Consequences
- Effectiveness
- Budget

# **Ports and Waterways Safety** **Assessments**

- Vessel traffic risks
- National approach / broadly applicable
- Low cost / widely deployed
- Locally focused
- Expert & stakeholder involvement
- Select locally appropriate risk mitigation
- Structured analytical process

# Key Features

- 2-Day Process Involving 10-30 Participants
- Local Expert Opinion
- Flexible and Easy to Use
- Systematic Evaluation
- Broad Risk Driver Coverage

# **PAWSA Methods & Techniques**

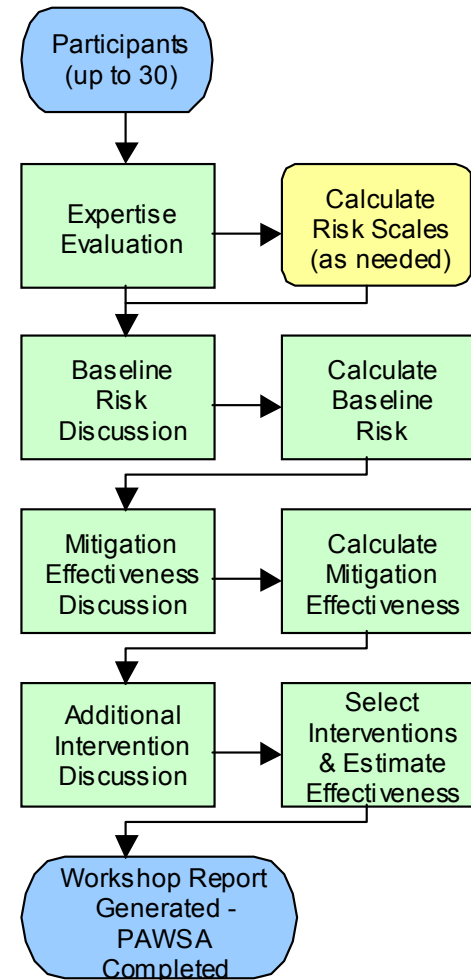
- Anchored Rating Scales
- Expert Opinion Solicitation
- Analytic Hierarchy Process
- Neutral Facilitators
- Structured Process and Product

# Using Experts

- Requires Cross Section of Users, Planners, and Stakeholders
- Promotes Participant Buy-In of Results
- Answers Correlate with Known Quantitative Values
- Not Reliant on Available Data (i.e., user knowledge of “near misses” vs. CG data limited to actual accidents)

# Systematic Process

- Steps Build on Each Other
  - Expertise Evaluation
  - Baseline Risk
  - Mitigation Effectiveness
  - Additional Interventions
- Transparent Calculations
- Results Traceable to Participant Input



Process Flowchart

# Risk Categories and Factors

| Vessel Conditions                 | Traffic Conditions            | Navigational Conditions | Waterway Conditions    | Immediate Consequences      | Subsequent Consequences |
|-----------------------------------|-------------------------------|-------------------------|------------------------|-----------------------------|-------------------------|
| Vessel Quality                    | Volume of Commercial Traffic  | Winds                   | Visibility Impediments | Personal Injuries           | Health and Safety       |
| Deep Draft Mariner Proficiency    | Volume of Small Craft Traffic | Currents                | Dimensions             | Petroleum Discharge         | Environmental           |
| Shallow Draft Mariner Proficiency | Traffic Mix                   | Visibility Restrictions | Bottom Type            | Hazardous Materials Release | Aquatic Resources       |
| Small Craft Operator Proficiency  | Congestion                    | Obstructions            | Configuration          | Mobility                    | Economic                |

# Output – Baseline Risk

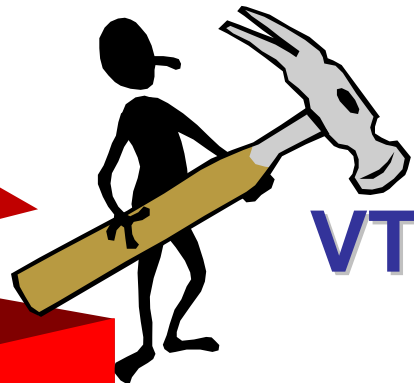
| Vessel Conditions                 | Traffic Conditions                    | Navigational Conditions | Waterway Conditions    | Immediate Consequences     | Subsequent Consequences |
|-----------------------------------|---------------------------------------|-------------------------|------------------------|----------------------------|-------------------------|
| Vessel Quality                    | Volume of Commercial Traffic          | Winds                   | Visibility Impediments | Personal Injuries          | Health and Safety       |
| 4.5                               | 1.9                                   | 4.5                     | 1.0                    | 5.7                        | 3.0                     |
| Deep Draft Mariner Proficiency    | Volume of Traditional Fishery Traffic | Currents                | Dimensions             | Petroleum Discharge        | Environmental           |
| 5.5                               | 3.4                                   | 7.9                     | 5.3 *                  | 9.0                        | 9.0                     |
| Shallow Draft Mariner Proficiency | Traffic Mix                           | Visibility Restrictions | Bottom Type            | Hazardous Material Release | Aquatic Resources       |
| 7.0                               | 3.3                                   | 3.2                     | 8.5                    | 6.5                        | 7.2                     |
| Traditional Fisher Proficiency    | Congestion                            | Obstructions            | Configuration          | Mobility                   | Economic                |
| 5.6                               | 2.6                                   | 2.6                     | 5.1                    | 4.3                        | 7.6                     |



# Vessel Traffic Management - Tool Kit -



 Rules of the Road



VTS



RNA



TSS

Pilotage



ATON



# Output – Mitigation Effectiveness

|                          |                           |                                |                            |                               |                                |
|--------------------------|---------------------------|--------------------------------|----------------------------|-------------------------------|--------------------------------|
| <b>Vessel Conditions</b> | <b>Traffic Conditions</b> | <b>Navigational Conditions</b> | <b>Waterway Conditions</b> | <b>Immediate Consequences</b> | <b>Subsequent Consequences</b> |
|--------------------------|---------------------------|--------------------------------|----------------------------|-------------------------------|--------------------------------|

|                                       |     |  |     |                 |     |                               |     |                            |     |                          |     |
|---------------------------------------|-----|--|-----|-----------------|-----|-------------------------------|-----|----------------------------|-----|--------------------------|-----|
| <b>Vessel Quality</b>                 |     | <b>Volume of Commercial Traffic</b>          |     | <b>Winds</b>    |     | <b>Visibility Impediments</b> |     | <b>Personal Injuries</b>   |     | <b>Health and Safety</b> |     |
| 4.5                                   | 3.9 | 1.9  | 2.2 | 4.5             | 3.6 | 1.0                           | 1.0 | 5.7                        | 5.3 | 3.0                      | 3.1 |
| <b>NO</b>                             |     | <b>RISING</b>                                |     | <b>Balanced</b> |     | <b>Balanced</b>               |     | <b>Maybe</b>               |     | <b>RISING</b>            |     |
| <b>Deep Draft Mariner Proficiency</b> |     | <b>Volume of Traditional Fishery Traffic</b> |     | <b>Currents</b> |     | <b>Dimensions</b>             |     | <b>Petroleum Discharge</b> |     | <b>Environmental</b>     |     |
| 5.5                                   | 4.5 | 3.4  | 3.4 | 7.9             | 6.2 | 5.3                           | 5.5 | 9.0                        | 7.3 | 9.0                      | 7.9 |
| <b>NO</b>                             |     | <b>Balanced</b>                              |     | <b>Maybe</b>    |     | <b>RISING</b>                 |     | <b>Maybe</b>               |     | <b>Maybe</b>             |     |

|                    |        |                 |   |
|--------------------|--------|-----------------|---|
| <b>KEY</b>         |        | Book 3          | Absolute level of risk  |
| <b>Risk Factor</b> |        | Book 4          | Level of risk taking into account existing mitigations                          |
|                    |        | <b>Balanced</b> | Consensus that risks are well balanced by existing mitigations                  |
| Book 3             | Book 4 | <b>Maybe</b>    | No consensus that risks are adequately balanced by existing mitigations         |
| <b>Consensus</b>   |        | <b>NO</b>       | Consensus that existing mitigations do NOT adequately balance risk              |
|                    |        | <b>RISING</b>   | Existing mitigations or future projections are causing /will cause risk to rise |

# Output – Interventions

| Vessel Conditions              | Traffic Conditions                    | Navigational Conditions | Waterway Conditions    | Immediate Consequences  | Subsequent Consequences |
|--------------------------------|---------------------------------------|-------------------------|------------------------|-------------------------|-------------------------|
| Vessel Quality                 | Volume of Commercial Traffic          | Winds                   | Visibility Impediments | Personal Injuries       | Health and Safety       |
| Enforcement                    | Rules & Procedures                    | Balanced                | Balanced               | Coordination / Planning | Coordination / Planning |
| 1.9 <b>Caution</b>             | 1.0                                   |                         |                        | 3.3                     | 0.9 <b>Caution</b>      |
| Deep Draft Mariner Proficiency | Volume of Traditional Fishery Traffic | Currents                | Dimensions             | Petroleum Discharge     | Environmental           |
| Rules & Procedures             | Balanced                              | Nav / Hydro Info        | Rules & Procedures     | Coordination / Planning | Coordination / Planning |
| 2.7                            |                                       | 2.5                     | 2.9                    | 3.3                     | 2.8                     |

## KEY

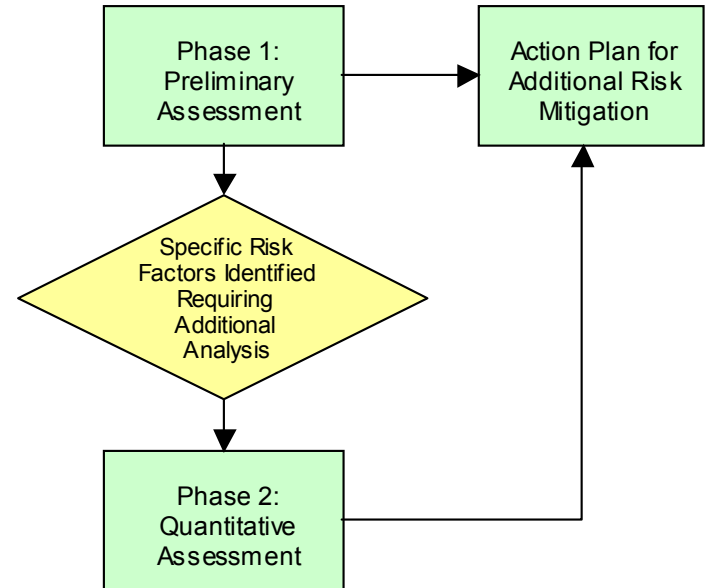
|                    |                  |  |
|--------------------|------------------|--|
| <b>Risk Factor</b> | Intervention     | Intervention category which was judged most effective in further mitigating risk |
| Intervention       | Risk Improvement | Expected improvement in risk level if new mitigation measures were implemented   |
| Risk Improvement   | <b>Caution</b>   | No consensus alert   |

# PAWSA Results

- Assessment of current measures vs identified risks
- Projected effectiveness of alternatives
- Strategic Plan  
Identifies risk / Mitigation measure / Process owner
- Stakeholder buy-in
- Focuses future Harbor Safety Committee discussions / efforts
- Support for investment decisions

# Moving Forward

- IALA\* Generic Risk Model (GRM)
  - PAWSA (Phase 1)
  - IALA Waterway Risk Assessment Program (IWRAP) (Phase 2)
- Continued Refinement



Generic Port Risk Model Structure

\*IALA – International Association of Marine Aids to Navigation and Lighthouse Authorities

**California Coast & Monterey Bay**  
**National Marine Sanctuary**

**Offshore Vessel Routing Schemes**

# Background

- Extreme Environmental Sensitivities
- Grounding & Oil Spill Risk Perceived as High
- Previous Effort followed traditional Port Access Route Study & Public Rule-making Processes
- Traditional Processes Proved Inadequate
- Highly Polarized Positions
  - Industry Viewed as Irresponsible & Greedy
  - Environmental Advocates Viewed as Unreasonable & Irrational

# Finding a Balance

- Stakeholder Needs
- Risk Drivers
  - Probability
  - Consequences
- Effectiveness
- Budget

# Developing a Win-Win Solution

- Facilitated sessions in neutral setting
- Ground Rules
  - All legitimate stakeholders represented
  - Respect for others' concerns
  - Objective Evaluation of Concerns (i.e., based on Science & Engineering)
  - Decisions based on Fact, not Emotion
- Start with Outcome/End-State **ALL** Agreed On
  - **NO** Oil Spills
  - **NO** Unnecessary Costs Incurred by Industry
- Reverse Engineer from desired end-state via scenarios incompatible with desired end-state

# Example Scenario

- Loss of Power
  - Ship drifting aground
  - Winds and Currents
- Feasibility
  - Historical Weather and Current Data
  - Drift characteristics of ships
- Interventions
  - Available Response Resources
  - Response Times vs. drift predictions
- Analysis – minor change to offshore routing schemes provides sufficient response times under worst case conditions

# Outcome

- Changes recommended
  - Coastal “Recommended Routes” moved slightly further offshore
  - Traffic Separation Schemes in Santa Barbara Channel and San Francisco entrance adjusted
- Transit Time and Fuel Cost increases
  - Minimal
  - Readily Accepted by Industry
- US and International Regulatory Changes Easily Approved due to Stakeholder Support

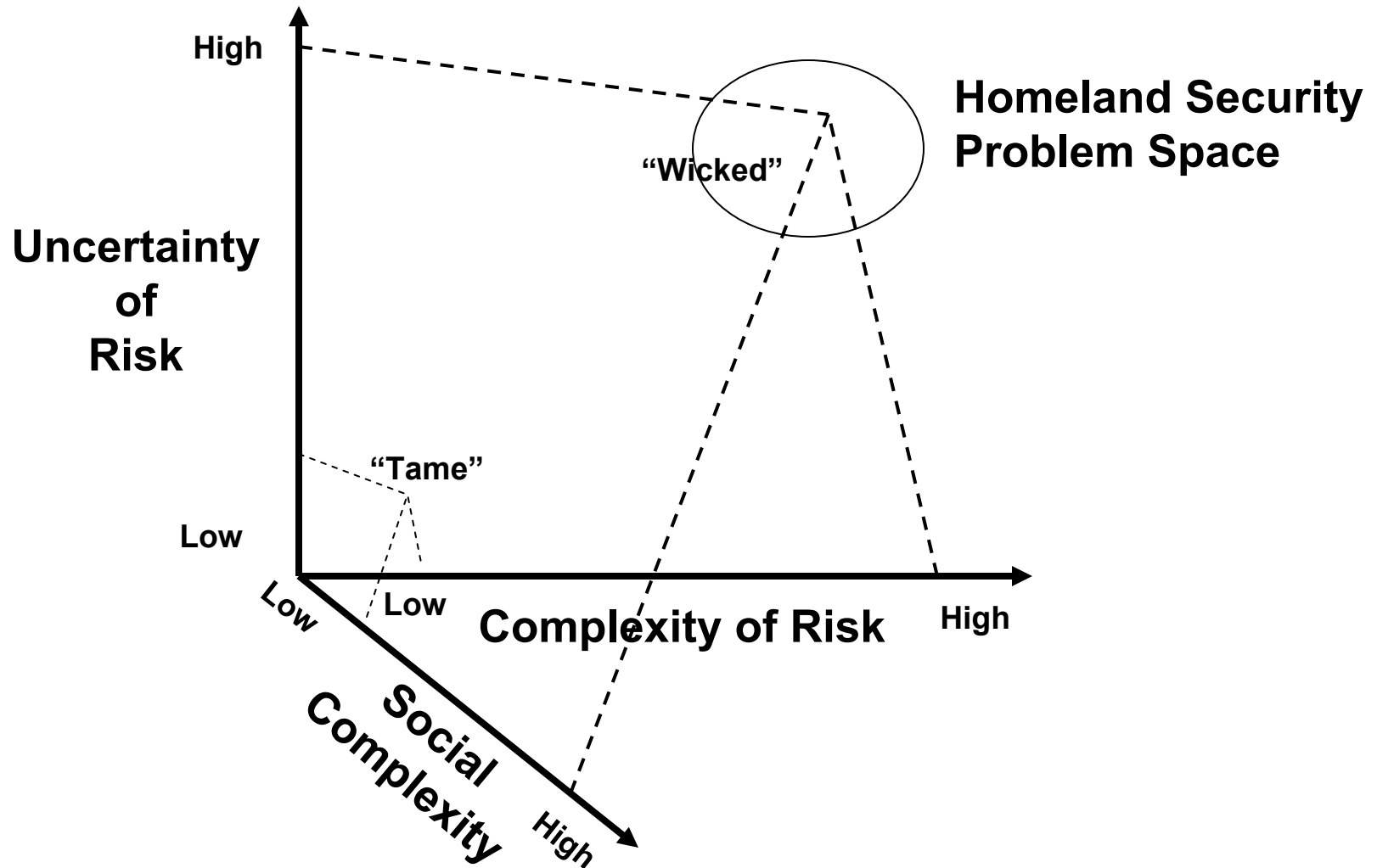
# Lessons Learned

- **Include Stakeholders**
  - Legitimate stakeholders will fight if excluded
- **Respect** legitimacy of stakeholder concerns
  - Stakeholders will support decisions if meaningfully involved/heard in decision-making process
- Provide a **Structured & Transparent Process**
- **Neutral** facilitation and venue help
- Work backwards from an **Outcome** all parties agree to
- Identify **Risk Drivers** and appropriate **Interventions**
- Work from **Facts**, not Emotion
- **Experts** add immeasurably (but get the *right* experts)
- ***All of us*** is smarter than ***one of us***.

# A Note of Caution

- Fundamental Differences - Security vs. Safety Risks
- Levels of Uncertainty
  - Vessel Traffic Safety
    - where? when? how? which vessel or vessels? how bad?
    - the *sine qua non* for vessel traffic safety is the vessel but vessels don't hide – if there is a vessel, there is a risk
  - Terrorism
    - where? when? how? which target or targets? how bad?
    - the *sine qua non* for terrorism is the terrorist and terrorists DO hide – if there is no terrorist visible is a terrorist even there?
- Nature of Risk Drivers
  - Safety Risks arise from normal daily life
  - Security Risks driven by actions of an adaptive, reactive and strategically-driven adversary

# The Homeland Security Decision-Making Environment



# Wicked Problems

- You don't understand the problem until you have developed a solution.
- Wicked problems have no stopping rule.
- Solutions to wicked problems are not right-or-wrong, but good-or-bad, better-or-worse.
- Every wicked problem is essentially unique and novel.
- Every solution to a wicked problem is a "one-shot" operation."
- Wicked problems have no given alternative solution
- Every wicked problem can be considered to be a symptom of another problem.
- Every solution to a wicked problem can generate more problems.

# Questions?

[http://www.navcen.uscg.gov/mwv/projects/pawsa/PAWSA\\_Back.htm](http://www.navcen.uscg.gov/mwv/projects/pawsa/PAWSA_Back.htm)