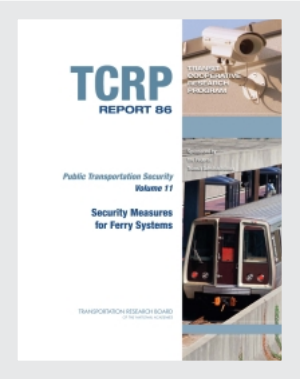

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DETAILS

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TRANSIT COOPERATIVE RESEARCH PROGRAM

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Volume 11
Security Measures for Ferry Systems

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TRANSPORTATION RESEARCH BOARD

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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions,* published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), Transportation 2000, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA, the National Academies, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

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The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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FOREWORD

By S. A. Parker
Staff Officer
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This eleventh volume of *TCRP Report 86: Public Transportation Security* will assist U.S. ferry system operators in evaluating and selecting general security measures (GSMs) for their operations consistent with the National Incident Management System (NIMS). The importance of NIMS is set out in a September 8, 2004, letter to state governors, from Department of Homeland Security Secretary Tom Ridge: "NIMS provides a consistent nationwide approach for Federal, State, territorial, tribal, and local governments to work effectively and efficiently together to prepare for, prevent, respond to, and recover from domestic incidents, regardless of cause, size, or complexity."

The seven-step GSM evaluation process and the description of the characteristics of the U.S. ferry system in this report are supplemented online with a downloadable Excel tool for applying the seven-step GSM evaluation process. The Excel tool is available at http://trb.org/news/blurb_detail.asp?id=6068. Users of the *TCRP Report 86* series will find that the products emphasize mitigation along with prevention, preparation, response, and recovery.

Science Applications International Corporation prepared this volume of *TCRP Report 86* under TCRP Project J-10H.

Emergencies arising from terrorist threats highlight the need for transportation managers to minimize the vulnerability of travelers, employees, and physical assets through incident prevention, preparedness, mitigation, response, and recovery. Managers seek to reduce the chances that transportation vehicles and facilities will be targets or instruments of terrorist attacks and to be prepared to respond to and recover from such possibilities. By being prepared to respond to terrorism, each transportation agency is simultaneously prepared to respond to natural disasters such as hurricanes, floods, and wildfires, as well as human-caused events such as hazardous materials spills and other incidents.

This is the eleventh volume of *TCRP Report 86: Public Transportation Security,* a series in which relevant information is assembled into single, concise volumes—each pertaining to a specific security problem and closely related issues. These volumes focus on the concerns that transportation agencies are addressing when developing programs in response to the terrorist attacks of September 11, 2001, and the anthrax attacks that followed. Future volumes of the reports will be issued as they are completed.

To develop this volume in a comprehensive manner and to ensure inclusion of significant knowledge, available information was assembled from numerous sources, including a number of state departments of transportation. A topic panel of experts in the subject area was established to guide the researchers in organizing and evaluating the collected data and to review the final document.

This volume was prepared to meet an urgent need for information in this area. It records practices that were acceptable within the limitations of the knowledge available at the time

of its preparation. Work in this area is proceeding swiftly, and readers are encouraged to be on the lookout for the most up-to-date information.

Volumes issued under *TCRP Report 86: Public Transportation Security* may be found on the TRB website at http://www.TRB.org/SecurityPubs.

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PART I

Guide for Evaluating Security Measures for the U.S. Ferry System

CHAPTER 1

Introduction

1.1 Background

Part I of this report and an accompanying Excel tool (which is available online at http://trb.org/news/blurb_detail.asp?id=6068) will assist the U.S. Ferry System (USFS) operators in evaluating and selecting security measures for their operations. The Excel tool contains a detailed list of general security measures (GSMs) and five sets of evaluation criteria that are weighted by the user. The evaluation criteria weights are used to calculate the value of each GSM option to the user, thereby enabling the user to compare many alternative options against user-specific criteria. This approach provides the user with a methodology to consider operator-specific requirements using operator-weighted criteria. Part I of this report, "Guide for Evaluating Security Measures for the U.S. Ferry System," is designed to accompany the Excel tool and provide step-by-step guidance for evaluating GSMs.

Evaluation steps and tool use were tested during a series of meetings with representatives from the Washington State Ferry, Washington State Patrol, and Washington-area U.S. Coast Guard. An important outcome of this test was recognition that the most broadly applicable GSMs (e.g., human observations and video monitoring) may rank much higher with this evaluation system than GSMs that are typically applied in only a few specific areas (e.g., screening).

The objective and scope of this guide are described below. The steps of the evaluation process are described in Chapter 2. Chapter 3 provides a more detailed description of the tool layout.

1.2 Objective, Scope, and Limitations

The objective of this project is to provide guidance to the USFS operators in selecting GSMs for their specific operational environment. The GSMs addressed include the following major categories: fencing and barriers, access control, intruder sensors, monitoring, procedural and low-cost measures, screening, waterside security, and human observation. This guide and the accompanying Excel tool are designed to help ferry system operators sift through the many security measures available, not to prescribe security measures or limit security options.

As part of the objective to provide guidance for evaluation of GSMs, sample data are provided on GSMs. The cost data are provided as an example of the type of data to be collected during the GSM evaluation process; they are *not* estimates for use. These values need to be updated by the user to reflect current values for site-specific conditions. The thoroughness of updates should increase as the GSM options are narrowed and as they become more specific.

Although there has been substantial interest in screening measures for ferry operators because of regulatory pressure, this guide and the accompanying Excel tool are for GSMs, of which

screening is just one category. A guide specifically for evaluation of screening measures would likely include comparison of characteristics such as specific substances detected, sensitivity for detected substances, rates of false positives, rates of false negatives, throughput, and so forth. This information can be added to the tool by the user, but is not part of this project because the goal was to address a broad array of security measures, many of which do not have similar statistics for comparison.

CHAPTER 2

The Evaluation Process

2.1 Overview

The GSM evaluation process is presented as a series of seven steps. The steps allow users to weigh their evaluation criteria and then identify and quantitatively contrast candidate security measures for their ferry system operation. In addition to evaluation criteria, other considerations in identifying and contrasting GSMs include applicability, costs, pre- and co-requisites, and strengths and weaknesses.

Table 1 displays the categories and sub-categories of GSMs included in the accompanying tool. These GSM categories are not addressed equally. For example, while lists of "fencing/barriers" and "intruder sensors" are relatively comprehensive in their address of applicable technologies, the list of "screening" measures is much less comprehensive, largely because of the developmental level of many of these technologies. A dozen or so different screening technologies for trace detection are not included because their current use is primarily in laboratories or as prototype or demonstration field units.

The seven steps for evaluation of these GSMs are shown in Figure 1 and summarized below. Further details regarding the tool that accompanies these steps are provided in Chapter 3.

2.2 The Seven Steps

Step 1: Enter weights

GSMs may be evaluated using many different criteria (e.g., achieving regulatory compliance or applicability to a specific threat type). The importance of different groups of criteria depends on the user's objectives. Worksheet 1 of the Excel file provides several different groups of evaluation criteria. The users weigh the importance of these criteria from 0 to 5 based on their needs and vulnerabilities. Zeros can be entered as the weight of evaluation criteria that are of no interest.

Step 2: Sort by value

User-entered weights of evaluation criteria (entered in Step 1) and the relative applicability ranks for each security measure (i.e., provided in Worksheet 2) are used to automatically calculate relative valuation of each security measure. Relative valuations are calculated in value, or "utils," for each evaluation criteria group. To develop a short list of GSMs for further evaluation, the user sorts GSMs based on utils in Worksheet 2. GSMs that have the greatest number of utils are recorded by the user on paper to develop a list for further evaluation.

Step 3: Edit data

The paper list of GSMs with the most utils (obtained in Step 2) is further assessed based on characterization of the GSMs. Listed GSMs are looked up in Worksheet 3, and the characterization

Table 1. Categorization of GSMs.

GSM Categories and Sub-Categories	# of GSMs
Fencing/Barriers	
Retractable vehicle barriers/gates	5
Fixed vehicle deterrent with pedestrian access	4
Fixed, both vehicle and pedestrian deterrent	5
Access Control	
Credentials	13
Locks	3
System Control	3
Intruder Sensors	
Perimeter (doors & windows, walls & fences, and buried)	13
Volume sensors – motion detectors	9
Monitoring	
Lighting	3
CCTV/video	7
Procedural/Low Cost	5
Waterside Security	
Surface	4
Underwater	5
Screening	
Passengers and Cargo	7
Trace Detection	14
Human Observation	
All Areas	3
Waterside	2

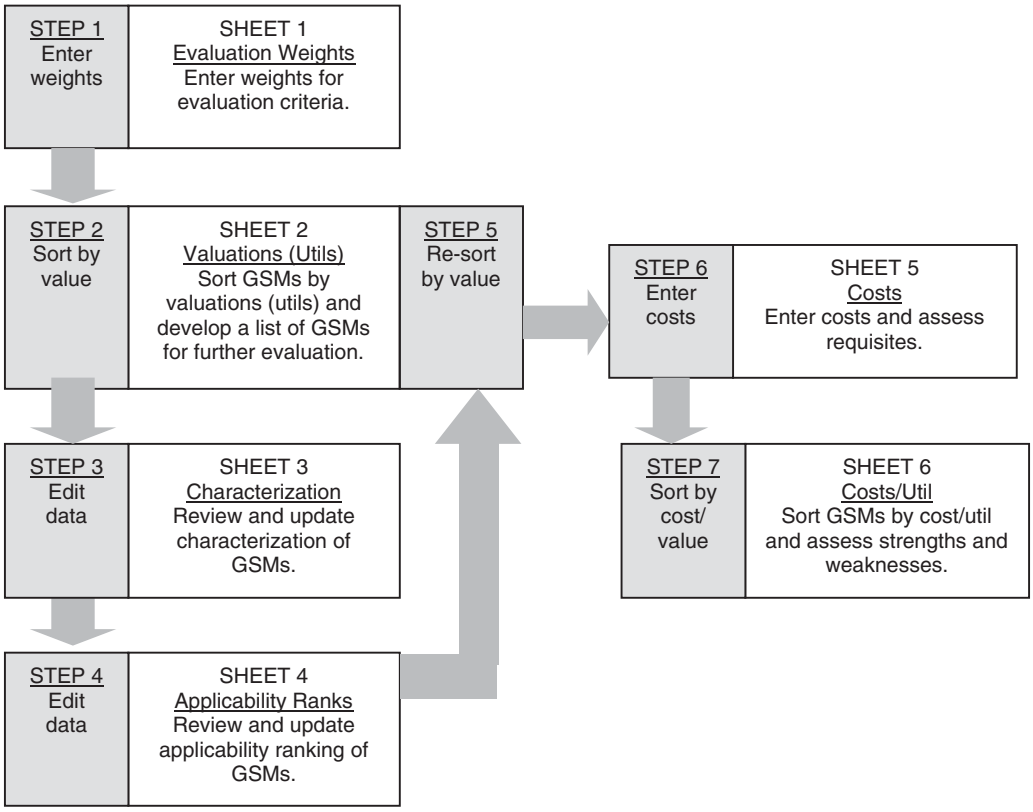


Figure 1. GSM evaluation steps and worksheet pages.

information is reviewed to determine if any GSMs should be removed from the paper list because either the measure has already been implemented or the measure cannot be reasonably implemented for technical reasons. Examples of conditions that may cause removal of some options include ground surfaces entirely covered by asphalt or concrete, which would prevent effective use of buried fiber optic intruder sensors, or limited space, which could prevent construction of efficient earthen barriers. (Note that cost should *not* be considered at this stage of the evaluation.)

Step 4: Edit data

The paper list of GSMs developed in Step 2 and refined in Step 3 is used to identify rows in Worksheet 4 that should be reviewed and adjusted as needed. Applicability ranks from 0 to 3 to indicate how well a specific GSM meets the various evaluation criteria (described in Worksheet 1). These rankings are subjective, but are unlikely to differ from the ranking provided by more than one unit when the evaluation criteria are similarly understood.

Step 5: Re-sort by value

The user returns to Worksheet 2 to sort GSMs again with the adjusted information entered in Steps 3 and 4. Top GSMs based on number of utils are listed on paper for further evaluation.

Step 6: Enter costs

The next step in evaluating the short list is to update the cost-related data in Worksheet 5 to reflect the projected needs with respect to system size and to reflect any pre- or co-requisites that may need to be implemented. Concurrently determine comparable units for cost comparisons between rows (e.g., full implementation at all relevant sites in the facility) and adjust cost data based on updated information. Note that the cost data provided in the worksheet are rough estimates that are often based on a small sampling of costs; thus, they provide only a rough cost range (i.e., within an order of magnitude). In some cases, the cost range represents substantial differences in capability that are shown in one row because they employ the same technology. For example, IMS screening trace detectors have a cost range listed as $7,000 to $34,000, which represents the approximate costs of small hand-held units up through continuous monitoring systems able to detect a greater variety of agents.

In some cases, the user should create new rows to represent variations in measures with the same technology by overwriting rows that are not on the short list for further evaluation. When it is decided to replace a row's contents, changes should be made in Worksheet 3 to describe specific GSM characteristics, in Worksheet 4 to record applicability ranks, and in Worksheet 5 for cost data and requisite information. References provided in Worksheet 5 can be used to begin cost assessments.

Step 7: Sort by cost/value

After cost data have been updated in the short list, cost per util is calculated in Worksheet 6. The user can then sort by cost per util to further prioritize the short list, with the lowest cost per util suggesting the largest security improvement per dollar. The user should carefully assess strengths and weaknesses of the security measures. Further research to expand understanding of strengths, weaknesses, variations, and costs may be needed. Suppliers should be contacted for specific information, product demonstrations, and on-site equipment trials. Other organizations, particularly the U.S. Coast Guard and Captain of the Port, should also be consulted regarding selection of the final options.

CHAPTER 3

The Tool

3.1 Worksheet Integration and Data Flow

When the accompanying Excel file is opened, tabs at the bottom of the screen indicate separate worksheets within the tool. Each worksheet takes up more than a standard-size view screen. The "Page Down" key can be used to view the lower rows. In the worksheets that are wider than the view screen, the right arrow key can be used to view the remaining columns. The worksheet labels shown on the tabs at the bottom of the workbook are listed below with a brief description of their contents.

- **1. Evaluation Weights**—for entry of evaluation criteria weights.
- **2. Valuations**—for sorting of GSMs based on utils.
- **3. Characteristics**—for review and editing of GSM characteristics.
- **4. Applicability Ranks**—for review and editing of GSM applicability ranks according to the evaluation criteria.
- **5. Costs**—for development of GSM costs and assessment of GSM pre- and co-requisites.
- **6. Cost-Util & Strengths**—for sorting of GSMs based on cost per util and for assessing GSM strengths and weaknesses.
- **References**—lists references referred to in Worksheets 3 and 5.
- **Hidden Calculations**—uses entries in Worksheets 1 and 4 to calculate values shown in Worksheets 2 and 6. The user does not need to view this worksheet.

Each worksheet is described in detail below. Figure 2 provides a diagram of the data flow between the worksheets.

3.2 Worksheet 1, Evaluation Weights

The tool uses five sets of evaluation criteria to calculate the utils of various security measures for an operation: security objectives, non-security effects, 33 CFR compliance, locations, and threat type. The completed tables in Worksheet 1 of the tool will be used to weigh the importance of the different evaluation criteria to the operation. The tables from Worksheet 1 are grouped by evaluation criteria and are provided below.

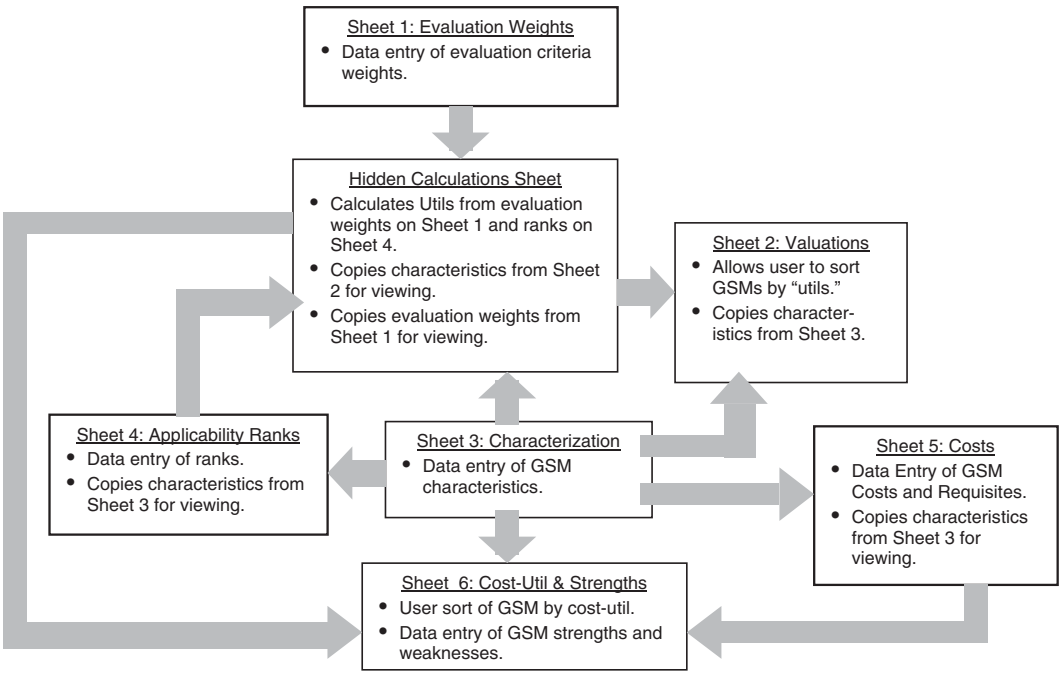


Figure 2. Data flow between worksheets of the GSM evaluation tool.

3.2.1 Criteria Group 1: Security Objectives

Four general security objectives are considered: deter, detect, deny, and mitigate. A security measure can be selected on the basis of how well it contributes to one or more of these security objectives. Each of these objectives is described below. After each description, enter the number weight from 0 to 5 (see definitions below) that best indicates the relative importance of this objective to your security needs.

0 = not important
1 = low importance
2 = low to moderate importance
3 = moderate importance
4 = moderate to high importance
5 = high importance

Security Objectives	Importance (0 – 5)
Deter: To cause an adversary to abandon consideration of this site during their planning stage due to the introduction of certain security measures. Deterrence is due to one or both of the following: (a) the target was devalued, (b) the probability of success was decreased.	
Detect: To discover (a) the planning of a threatening event, such as may be indicated by extensive observation of operations or equipment, or (b) the presence of a threat agent (e.g., weapon or explosive).	
Deny: To deny access to a target by such measures as barrier reinforcement, unexpected relocation of the target, and patterns that differ from those expected.	
Mitigate: To reduce the effects of an event when it occurs by either (a) reducing the magnitude of an event (e.g., reduced target size) or (b) preventing the threat agent from being maximally effective (e.g., because of a sprinkler system or rapid identification of a released toxin).	

3.2.2 Criteria Group 2: Non-Security Effects

Many security measures also have non-security effects that may be either beneficial or detrimental. This group of evaluation criteria allows you to weight the importance of these non-security effects on your selection of security measures. After each description, indicate the relative importance of this described non-security effect in your security measure decision making.

0 = not important
1 = low importance
2 = low to moderate importance
3 = moderate importance
4 = moderate to high importance
5 = high importance

Non-Security Effects	Importance (0 – 5)
Safety – refers to both employee and passenger safety	
Crime – refers to general crime other than fare evasion	
Fare Evasion – refers only to fare evasion	
Service – refers to both possible service delays and service improvements	

3.2.3 Criteria Group 3: 33 CFR Compliance

Facilities and vessels that fall under 33 CFR 104 and 105 must implement security measures that fall under the five general categories listed below. If your operation is in compliance with these regulations, these categories may not be important for you when evaluating additional security measures. Alternatively, you may have interest in further measures within some of these categories regardless of compliance. For each 33 CFR category listed below, indicate the importance of the category for your selection of new security measures.

0 = not important/already in compliance
1 = low importance
2 = low to moderate importance
3 = moderate importance
4 = moderate to high importance
5 = high importance/not in compliance

33 CFR Compliance	Importance (0 – 5)
Access Control *(includes screening measures)*	
Restricted Areas	
Handling Cargo	
Stores and Bunkers	
Monitoring	

3.2.4 Criteria Group 4: Locations

Based on an assessment of your operation's vulnerabilities (i.e., potential consequences and target accessibility), particular locations in or near your operation may be identified as being more or less vulnerable to attack. After each location description below, indicate the relative importance of implementing additional security measures in the location area. Enter "0" for locations listed that are not applicable to your operations.

0 = not important
1 = low importance
2 = low to moderate importance
3 = moderate importance
4 = moderate to high importance
5 = high importance

Locations	Importance (0 – 5)
Beyond Boundary (Shoreside): Access routes to the ferry system, adjacent assets that can be used as means for affecting an event (e.g., stored fuel), tall structures that can be used as observation and planning sites, etc.	
Facility Perimeter: The shoreside property boundary.	
Vehicle Parking: Shoreside areas for vehicle parking, particularly public parking areas near ferry operations.	
Vehicle Holding: Shoreside areas for parking and screening vehicles prior to loading them onto a ferry	
Passenger Waiting: Shoreside areas for passengers, including ticketing and passenger screening areas.	
Terminal Operation: Shoreside areas for operation control that are not for general passengers.	
Adjacent Ferry (Shoreside): Shoreside area within approximately 30 feet of ferry vessels.	
Adjacent Ferry (Waterside): Waterside area within approximately 30 feet of ferry vessels.	
On-Board (Non-Restricted): Passenger areas on-board the ferry.	
On-Board (Restricted): Areas on-board the ferry that are not to have passenger access.	
In Transit: Areas surrounding a ferry while it is operating on a route or otherwise in transit.	

3.2.5 Criteria Group 5: Threat Type

Three general categories of threats are considered: delivery of explosives or incendiaries; acts of force (e.g., hijacking, commandeering, and ramming); and delivery of WMDs (i.e., chemical, biological, or radiological agents). Based on assessments of your operation's vulnerabilities, some threats may be of more concern than others. For each threat type below, indicate the relative importance of additional security measures to address the threat.

0 = not important
1 = low importance
2 = low to moderate importance
3 = moderate importance
4 = moderate to high importance
5 = high importance

Threat Type	Importance (0 – 5)
Delivery of Explosive or Incendiary by	
Person – on a person or within their baggage	
Vehicle – within a car, van, or truck	
Vessel – within a waterside vessel	
Artillery (e.g., RPG) – from a location in range of the facility or ferry routes	
Mine – underwater explosive on piers, vessels, etc.	
Overhead – from anything overhead, e.g., aircraft, bridge over the ferry route, etc.	
Act of Force	
TO: **Facility –** terminal or pier	
Vessel – ferry or ferry patrol vessel	
BY: **Vehicle –** car, van, or truck	
Vessel – waterside vessel, surface or underwater	
Overhead – airplane or bridge	
WMD Delivery of:	
Chem – toxic chemical agent	
Bio – harmful biological agent	
Rad – radioactive agent	

3.2.6 Evaluation Criteria Groups

The weights entered in the tables above are used to assess the operator's priorities within a single evaluation criteria group (i.e., security objectives, non-security effects, 33 CFR compliance, locations, or threat type). The weights provided below will be used to adjust weights between evaluation criteria groups according to the priorities for your operation. After each description, enter the number from 0 to 5 (see definitions below) that best indicates the relative importance of the evaluation criteria group.

0 = not important
1 = low importance
2 = low to moderate importance
3 = moderate importance
4 = moderate to high importance
5 = high importance

Evaluation Criteria Groups	Importance (0 – 5)
Security Objectives	
Non-Security Effects	
33 CFR Compliance	
Locations	
Threat Type	

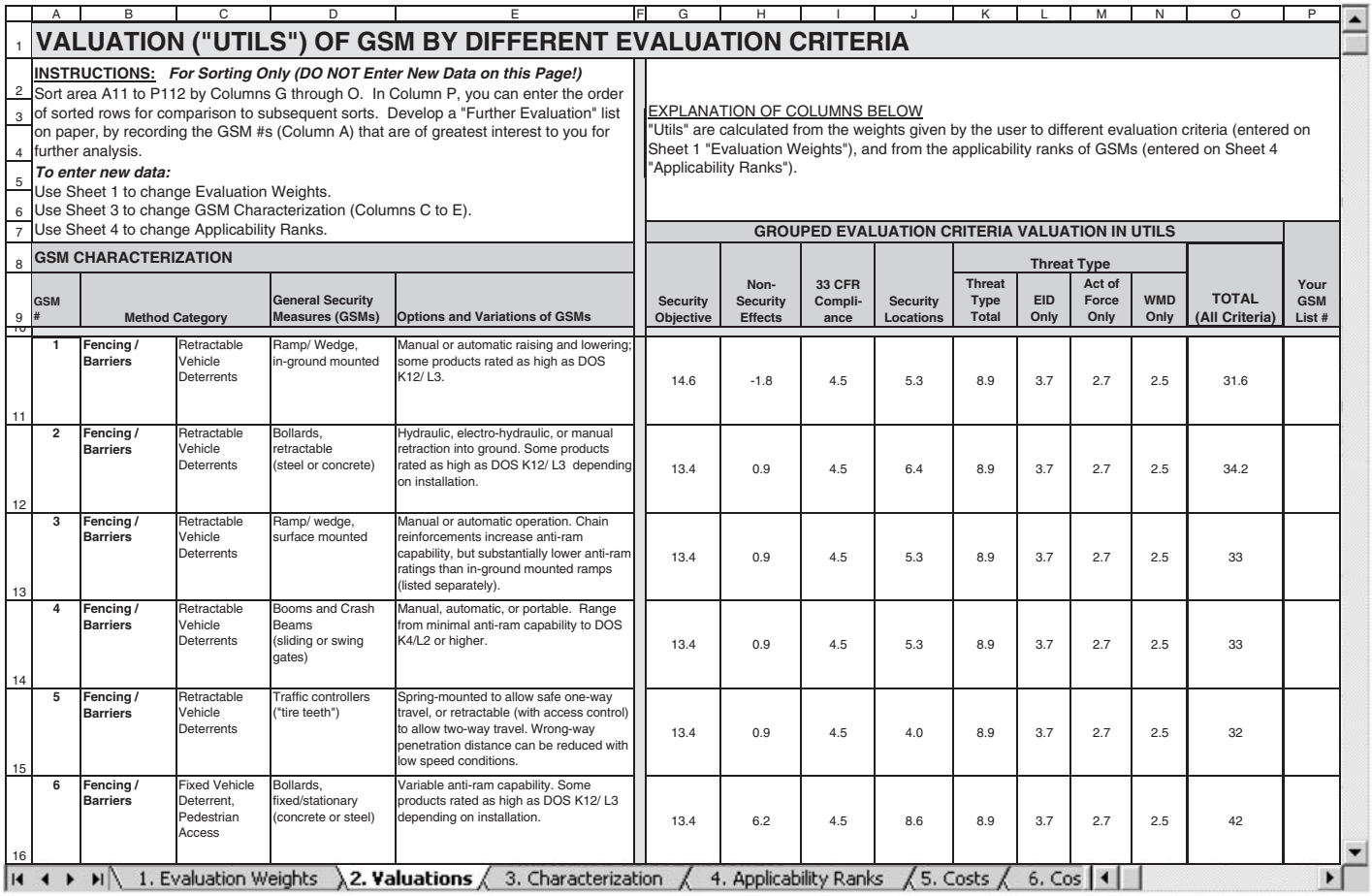
When the information in Worksheet 1 is completed, the tool calculates the value of each GSM in accordance with the user-set weighting factors. These will appear in Worksheet 2, Valuations.

3.3 Worksheet 2, Valuations

Figure 3 shows a view of Worksheet 2, Valuations. This worksheet is used to sort GSMs based on valuations in utils. These valuations are calculated from the weights given by the user to different evaluation criteria (entered in Worksheet 1, Evaluation Weights), and from the applicability rankings of GSMs (entered in Worksheet 4, Applicability Ranks). Step 2 (see Figure 1) requires the following:

- Sort area A11 to P112 by Columns G through O (refer to the box below for instructions on sorting in Excel). This will provide the first prioritizations of GSMs.
- In Column P, enter the order of sorted rows for comparison with subsequent sorts.
- Record (in a separate file or on paper) the GSM numbers (from Column A) that are of greatest interest to you for further analysis.

Any edits made in this worksheet will not be copied to other worksheets. Changes in cell content should be made in Worksheet 3 (Characterization) to change content in Columns A through E, and Worksheets 1 (Evaluation Weights) and 4 (Applicability Ranks) to change the utils shown in Columns G through O.



VALUATION ("UTILS") OF GSM BY DIFFERENT EVALUATION CRITERIA

INSTRUCTIONS: ***For Sorting Only (DO NOT Enter New Data on this Page!)***
Sort area A11 to P112 by Columns G through O. In Column P, you can enter the order of sorted rows for comparison to subsequent sorts. Develop a "Further Evaluation" list on paper, by recording the GSM #s (Column A) that are of greatest interest to you for further analysis.

To enter new data:
Use Sheet 1 to change Evaluation Weights.
Use Sheet 3 to change GSM Characterization (Columns C to E).
Use Sheet 4 to change Applicability Ranks.

EXPLANATION OF COLUMNS BELOW
"Utils" are calculated from the weights given by the user to different evaluation criteria (entered on Sheet 1 "Evaluation Weights"), and from the applicability ranks of GSMs (entered on Sheet 4 "Applicability Ranks").

	GSM CHARACTERIZATION					GROUPED EVALUATION CRITERIA VALUATION IN UTILS									
										Threat Type					
	GSM #	Method Category		General Security Measures (GSMs)	Options and Variations of GSMs	Security Objective	Non-Security Effects	33 CFR Compliance	Security Locations	Threat Type Total	EID Only	Act of Force Only	WMD Only	TOTAL (All Criteria)	Your GSM List #
11	1	Fencing / Barriers	Retractable Vehicle Deterrents	Ramp/ Wedge, in-ground mounted	Manual or automatic raising and lowering; some products rated as high as DOS K12/ L3.	14.6	-1.8	4.5	5.3	8.9	3.7	2.7	2.5	31.6	
12	2	Fencing / Barriers	Retractable Vehicle Deterrents	Bollards, retractable (steel or concrete)	Hydraulic, electro-hydraulic, or manual retraction into ground. Some products rated as high as DOS K12/ L3 depending on installation.	13.4	0.9	4.5	6.4	8.9	3.7	2.7	2.5	34.2	
13	3	Fencing / Barriers	Retractable Vehicle Deterrents	Ramp/ wedge, surface mounted	Manual or automatic operation. Chain reinforcements increase anti-ram capability, but substantially lower anti-ram ratings than in-ground mounted ramps (listed separately).	13.4	0.9	4.5	5.3	8.9	3.7	2.7	2.5	33	
14	4	Fencing / Barriers	Retractable Vehicle Deterrents	Booms and Crash Beams (sliding or swing gates)	Manual, automatic, or portable. Range from minimal anti-ram capability to DOS K4/L2 or higher.	13.4	0.9	4.5	5.3	8.9	3.7	2.7	2.5	33	
15	5	Fencing / Barriers	Retractable Vehicle Deterrents	Traffic controllers ("tire teeth")	Spring-mounted to allow safe one-way travel, or retractable (with access control) to allow two-way travel. Wrong-way penetration distance can be reduced with low speed conditions.	13.4	0.9	4.5	4.0	8.9	3.7	2.7	2.5	32	
16	6	Fencing / Barriers	Fixed Vehicle Deterrent, Pedestrian Access	Bollards, fixed/stationary (concrete or steel)	Variable anti-ram capability. Some products rated as high as DOS K12/ L3 depending on installation.	13.4	6.2	4.5	8.6	8.9	3.7	2.7	2.5	42	

1. Evaluation Weights | 2. Valuations | 3. Characterization | 4. Applicability Ranks | 5. Costs | 6. Cos

Figure 3. View of Worksheet 2, Valuations.

How to Sort in Excel

Highlight the area to be sorted. To do this on Worksheet 2, start with the cursor in Cell A11, hold the "shift" key down while moving the mouse to Cell P11. While still holding the shift key down, press "down page," or "end" followed by down arrow. The entire contents from Cells A11 to P112 should be highlighted. Release the shift key and click on "Data" at the top of the screen, then click on "sort" in the drop-down box. Click on the down arrow to show the drop box under "Sort By," select "Column O" to sort on the "Total Utils" or other columns to sort by a particular evaluation criteria group. Select "Descending" to the right of the drop-box and then click "OK" at the bottom of the "Sort" box. The highlighted area will be re-ordered with the GSMs with the highest number of utils at the top of the page.

3.4 Worksheet 3, Characterization

Figure 4 shows a view of Worksheet 3, Characterization. The columns in this worksheet provide descriptions of each GSM listed in Rows 11 to 112. Column E, "Notes," describes each GSM, and Column F, "Options and Variations of GSM," describes some of the common variations for each GSM. Step 3 (see Figure 1) requires the following:

- Look up (in Column A) the GSM numbers recorded on your short list (in a file or on paper) for further evaluation.
- Review the characterization information to determine if any GSM should be removed from the short list. A GSM should be removed from consideration either because the measure has already been implemented or because the measure cannot be reasonably implemented for technical reasons. Examples of conditions that may cause exclusion of some options include ground surfaces entirely covered by asphalt or concrete, which would prevent effective use of buried fiber optic intruder sensors; or limited space, which could prevent construction of efficient earthen barriers. Note that cost should *not* be considered at this stage of the evaluation.
- You may edit Columns C through F to describe more specific GSMs as needed.

CHARACTERIZATION OF GSM

INSTRUCTIONS: ***For data edits only! DO NOT SORT on this page!!***
The columns below provide descriptions of each GSM listed in rows 11 to 112. For each GSM # on your paper list of GSMs for further evaluation (developed from the sorts performed on Sheet 2 "Valuations"), review the characterization information provided below. You may edit Columns C through F to describe more specific GSMs as needed. Use GSM # (Column A) to quickly find GSMs at the top of your list.

GSM CHARACTERIZATION

GSM #	Method Category		GSM	Notes	Options and Variations of GSM	More Info. (Ref.)
1	**Fencing / Barriers**	Retractable Vehicle Deterrents	Ramp/ Wedge, in-ground mounted	May be certified anti-ram vehicle barriers that have been tested to either Department of State (DOS), U.S. Navy, or U.S. Marshall Service specifications, the later two of which are often converted to DOS ratings. K ratings indicate kinetic energy (determined from speed and weight), L ratings indicate the extent of penetration beyond the barrier. K and L ratings of speed and penetration described below are for a 15,000 lb vehicle with impact perpendicular to the barrier: K4 -- 30 mph L1 -- 20 to 50 feet K8 -- 40 mph L2 -- 3 to 20 feet K12 -- 50 mph L3 -- less than 3 feet	Manual or automatic raising and lowering; some products rated as high as DOS K12/ L3.	5, 6, 54
2	**Fencing / Barriers**	Retractable Vehicle Deterrents	Bollards, retractable (steel or concrete)		Hydraulic, electro-hydraulic, or manual retraction into ground. Some products rated as high as DOS K12/ L3 depending on installation.	5, 6, 54
3	**Fencing / Barriers**	Retractable Vehicle Deterrents	Ramp/ wedge, surface mounted		Manual or automatic operation. Chain reinforcements increase anti-ram capability, but substantially lower anti-ram ratings than in-ground mounted ramps (listed separately).	5, 6, 54
4	**Fencing / Barriers**	Retractable Vehicle Deterrents	Booms and Crash Beams (sliding or swing gates)		Manual, automatic, or portable. Range from minimal anti ram capability to DOS K4/L2 or higher.	6, 54
5	**Fencing / Barriers**	Retractable Vehicle Deterrents	Traffic controllers ("tire teeth")	Traffic controllers are not certified anti-ram barriers. They can be penetrated by vehicles with puncture proof tires. Under some circumstances a vehicle with standard tires may penetrate a significant distance after it's tires are shred.	Spring-mounted to allow safe one-way travel, or retractable (with access control) to allow two-way travel. Wrong-way penetration distance can be reduced with low speed conditions.	5
6	**Fencing / Barriers**	Fixed Vehicle Deterrent, Pedestrian Access	Bollards, fixed/stationary (concrete or steel)	May be certified anti-ram vehicle barriers have been tested to either Department of State (DOS), U.S. Navy, or U.S. Marshall Service specifications, the later two of which are often converted to DOS ratings. K ratings indicate kinetic energy (determined from speed and weight), L ratings indicate the extent of penetration beyond the barrier. K and L ratings of speed and penetration described below are for a 15,000 lb vehicle with impact perpendicular to the barrier: K4 -- 30 mph L1 -- 20 to 50 feet K8 -- 40 mph L2 -- 3 to 20 feet K12 -- 50 mph L3 -- less than 3 feet	Variable anti-ram capability. Some products rated as high as DOS K12/ L3 depending on installation.	5, 6, 59
7	**Fencing / Barriers**	Fixed Vehicle Deterrent, Pedestrian Access	Decorative Crash-Rated Barrier (spheres, benches, bike racks, trees, etc.)	Crash-rated decorative furniture, bike racks, and planters are typically mounted on crash rated bollards or steel posts. Trees are rated based on trunk diameter. Branches and leaves can reduce observation and video monitoring ability.	Wide variety of aesthetic options, metal or concrete. Variable anti-ram capability. Some products rated as high as DOS K12/ L3 depending on installation.	7, 8
8	**Fencing / Barriers**	Fixed Vehicle Deterrent,	Jersey Barriers, portable	Jersey barriers are often used as temporary barriers, They are grouped here as a "fixed vehicle-deterrent" because they typically provide a temporary	Various styles, lengths, shapes, colors, can be arranged end-to-end, or in multiple rows, and anchored to	5, 59

1. Evaluation Weights | 2. Valuations | **3. Characterization** | 4. Applicability Ranks | 5. Costs | 6. Cos

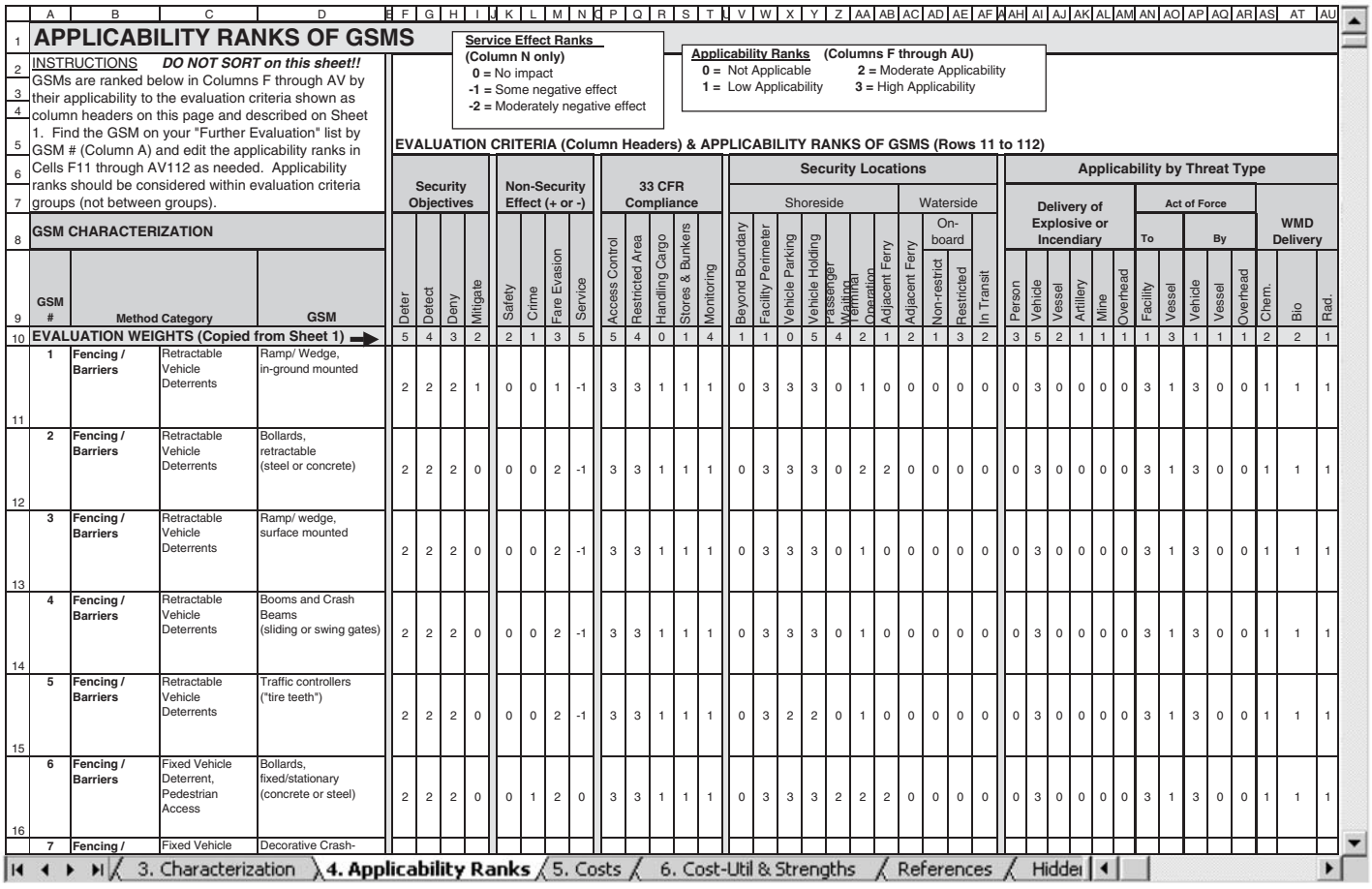
Figure 4. View of Worksheet 3, Characterization.

Do not sort in this worksheet because other worksheets copy information from specified cells in this worksheet, which will be incorrect if this worksheet is sorted. Use GSM # (Column A) to quickly find GSMs on your short list for further evaluation.

3.5 Worksheet 4, Applicability Ranks

Figure 5 shows a view of Worksheet 4, Applicability Ranks. This worksheet is used to adjust applicability rankings of specific GSMs against the evaluation criteria listed in Row 9 (Column F–AV), and described in Worksheet 1. The purpose of this worksheet is to provide the user with the opportunity to review and, if needed, adjust the applicability ranks provided for the short list of GSMs developed from the sorts conducted in Worksheet 2, Valuations.

The worksheet contains relative, generalized rankings for each GSM for each of the evaluation criteria. These rankings are multiplied by the evaluation criteria weights (entered in Worksheet 1, Evaluation Weights) to provide the valuations for each GSM shown in Worksheet 2. The appli-



APPLICABILITY RANKS OF GSMS

INSTRUCTIONS *DO NOT SORT on this sheet!!* GSMs are ranked below in Columns F through AV by their applicability to the evaluation criteria shown as column headers on this page and described on Sheet 1. Find the GSM on your "Further Evaluation" list by GSM # (Column A) and edit the applicability ranks in Cells F11 through AV112 as needed. Applicability ranks should be considered within evaluation criteria groups (not between groups).

Service Effect Ranks (Column N only)
0 = No impact
-1 = Some negative effect
-2 = Moderately negative effect

Applicability Ranks (Columns F through AU)
0 = Not Applicable
1 = Low Applicability
2 = Moderate Applicability
3 = High Applicability

EVALUATION CRITERIA (Column Headers) & APPLICABILITY RANKS OF GSMS (Rows 11 to 112)

	A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
8	GSM CHARACTERIZATION				Security Objectives					Non-Security Effect (+ or -)					33 CFR Compliance						Security Locations														Applicability by Threat Type												
																					Shoreside							Waterside																			
																													On-board				Delivery of Explosive or Incendiary					Act of Force						
9	GSM #	Method Category		GSM	Deter	Detect	Deny	Mitigate		Safety	Crime	Fare Evasion	Service		Access Control	Restricted Area	Handling Cargo	Stores & Bunkers	Monitoring		Beyond Boundary	Facility Perimeter	Vehicle Parking	Vehicle Holding	Passenger Waiting	Terminal Operation	Adjacent Ferry	Adjacent Ferry	Non-restrict	Restricted	In Transit		Person	Vehicle	Vessel	Artillery	Mine	Overhead	To Facility	To Vessel	By Vehicle	By Vessel	By Overhead	WMD Delivery Chem.	Bio	Rad.
10	EVALUATION WEIGHTS (Copied from Sheet 1) →				5	4	3	2		2	1	3	5		5	4	0	1	4		1	1	0	5	4	2	1	2	1	3	2		3	5	2	1	1	1	1	3	1	1	0	1	2	2	1
11	1	Fencing / Barriers	Retractable Vehicle Deterrents	Ramp/ Wedge, in-ground mounted	2	2	2	1		0	0	1	-1		3	3	1	1	1		0	3	3	3	0	1	0	0	0	0	0		0	3	0	0	0	0	3	1	3	0	0	1	1	1
12	2	Fencing / Barriers	Retractable Vehicle Deterrents	Bollards, retractable (steel or concrete)	2	2	2	0		0	0	2	-1		3	3	1	1	1		0	3	3	3	0	2	2	0	0	0	0		0	3	0	0	0	0	3	1	3	0	0	1	1	1
13	3	Fencing / Barriers	Retractable Vehicle Deterrents	Ramp/ wedge, surface mounted	2	2	2	0		0	0	2	-1		3	3	1	1	1		0	3	3	3	0	1	0	0	0	0	0		0	3	0	0	0	0	3	1	3	0	0	1	1	1
14	4	Fencing / Barriers	Retractable Vehicle Deterrents	Booms and Crash Beams (sliding or swing gates)	2	2	2	0		0	0	2	-1		3	3	1	1	1		0	3	3	3	0	1	0	0	0	0	0		0	3	0	0	0	0	3	1	3	0	0	1	1	1
15	5	Fencing / Barriers	Retractable Vehicle Deterrents	Traffic controllers ("tire teeth")	2	2	2	0		0	0	2	-1		3	3	1	1	1		0	3	2	2	0	1	0	0	0	0	0		0	3	0	0	0	0	3	1	3	0	0	1	1	1
16	6	Fencing / Barriers	Fixed Vehicle Deterrent, Pedestrian Access	Bollards, fixed/stationary (concrete or steel)	2	2	2	0		0	1	2	0		3	3	1	1	1		0	3	3	3	2	2	2	0	0	0	0		0	3	0	0	0	0	3	1	3	0	0	1	1	1
	7	Fencing /	Fixed Vehicle	Decorative Crash-																																										

3. Characterization | 4. Applicability Ranks | 5. Costs | 6. Cost-Util & Strengths | References | Hidde

Figure 5. View of Worksheet 4, Applicability Ranks.

cability ranks provided in Cells F11 through AV112 are used to make an initial review and a generalized comparison of measures. The relative rankings are:

0 = none or not applicable
1 = low
2 = moderate
3 = high

A different rank scale is used for service effects in Column H. Service effects ranks are:

0 = no impact
−1 = some negative effect
−2 = moderately negative effect

The user is in a good position to determine the applicability of each GSM to their operations and, as such, is encouraged to make adjustment to the GSMs on their short list. Applicability ranks should be considered within evaluation criteria groups (not between groups). A rank change of more than one may be due to differing considerations of the GSM's characteristics (listed in Worksheet 3, Characterization) or differing understandings of the evaluation criteria as described in Worksheet 1, Evaluation Weights. Thus, careful consideration should be given to applicability ranks that are changed by more than one.

This worksheet should be used only to edit applicability ranks. Use Worksheet 3, Characterization, to change GSM descriptions to make the characteristic changes appear in all worksheets.

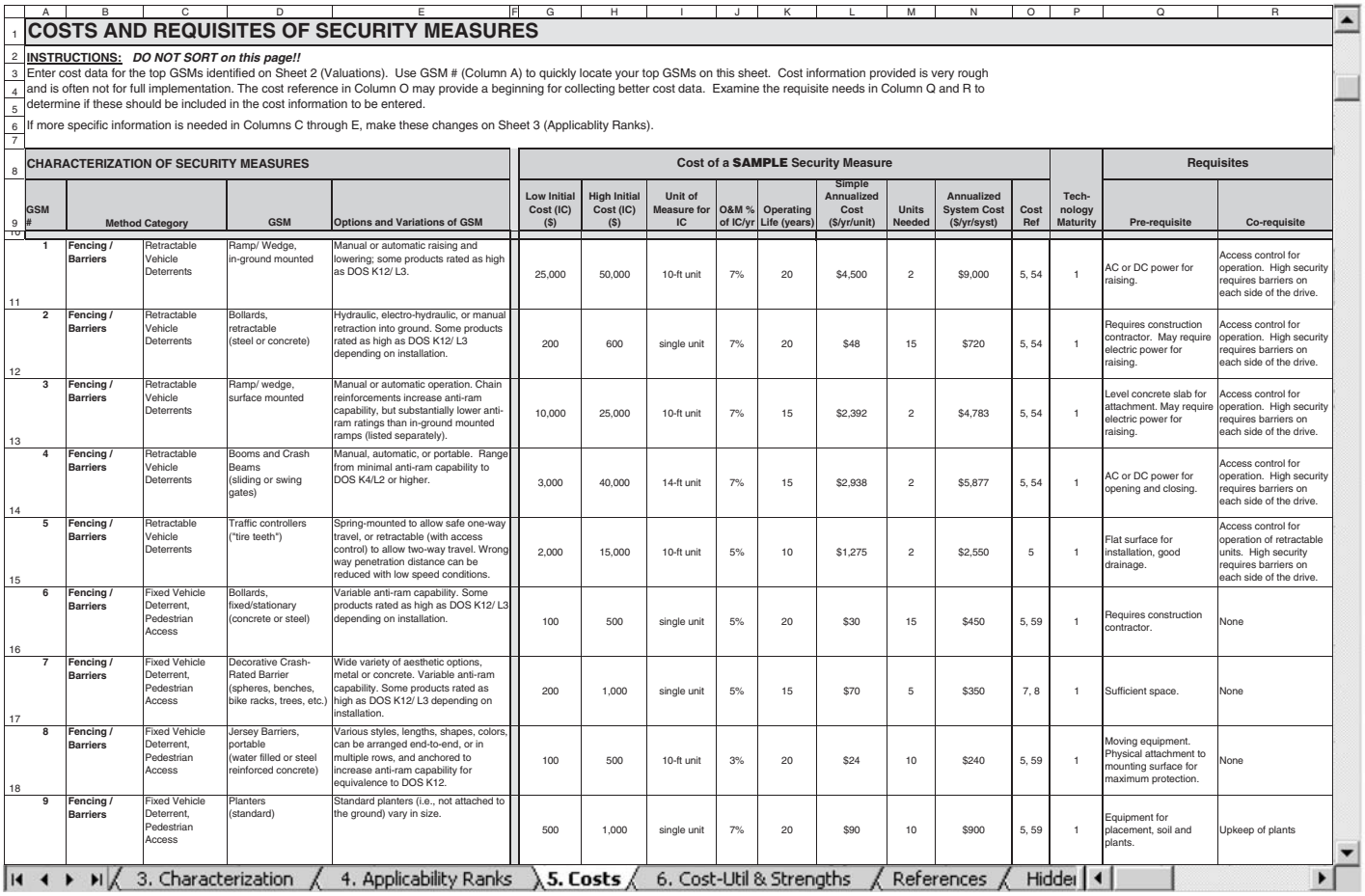
3.6 Worksheet 5, Costs

Figure 6 shows a view of Worksheet 5, Costs. This worksheet provides the user with the opportunity to enter system- and region-specific cost information for the short list of candidate GSMs. This worksheet is Step 6 in Figure 1. The worksheet contains generalized cost information that is based on a small sampling of costs; thus, these cost ranges are rough (i.e., order of magnitude). In some cases, the cost range listed for a GSM is very wide, reflecting the broad range of capabilities. For example, IMS screening trace detectors have a cost range listed as $7,000 to $34,000, which represents the approximate costs of small hand-held units up to continuous monitoring systems able to detect a greater variety of agents. Cost references are provided in Column O, with references details in the References worksheet.

Before making changes to costs, note that the cost information entered by the user in Columns G through K should reflect the projected needs with respect to system size and reflect any pre- or co-requisites that may be needed. Likely pre- and co-requisites are shown in Columns Q and R.

The steps needed for adjusting the costs are:

- Develop a "new" short list of candidate GSMs (Step 5 in Figure 1) after editing applicability ranks in Worksheet 4 (Step 4 in Figure 1).
- Determine comparable units for cost comparisons between the GSMs on the short list (e.g., full implementation at all relevant sites in the facility).
- Make adjustments to low and high initial cost estimates—Columns G and H, respectively. Note the unit of measure in Column I.
- Adjust the operation and maintenance (O&M) costs in terms of percentage of initial cost per year in Column J. These percentages should assume full operability throughout the GSM operating life.



COSTS AND REQUISITES OF SECURITY MEASURES

INSTRUCTIONS: ***DO NOT SORT on this page!!***

Enter cost data for the top GSMs identified on Sheet 2 (Valuations). Use GSM # (Column A) to quickly locate your top GSMs on this sheet. Cost information provided is very rough and is often not for full implementation. The cost reference in Column O may provide a beginning for collecting better cost data. Examine the requisite needs in Column Q and R to determine if these should be included in the cost information to be entered.

If more specific information is needed in Columns C through E, make these changes on Sheet 3 (Applicablity Ranks).

CHARACTERIZATION OF SECURITY MEASURES					Cost of a **SAMPLE** Security Measure										Requisites	
GSM #	Method Category		GSM	Options and Variations of GSM	Low Initial Cost (IC) ($)	High Initial Cost (IC) ($)	Unit of Measure for IC	O&M % of IC/yr	Operating Life (years)	Simple Annualized Cost ($/yr/unit)	Units Needed	Annualized System Cost ($/yr/syst)	Cost Ref	Tech-nology Maturity	Pre-requisite	Co-requisite
1	**Fencing / Barriers**	Retractable Vehicle Deterrents	Ramp/ Wedge, in-ground mounted	Manual or automatic raising and lowering; some products rated as high as DOS K12/ L3.	25,000	50,000	10-ft unit	7%	20	$4,500	2	$9,000	5, 54	1	AC or DC power for raising.	Access control for operation. High security requires barriers on each side of the drive.
2	**Fencing / Barriers**	Retractable Vehicle Deterrents	Bollards, retractable (steel or concrete)	Hydraulic, electro-hydraulic, or manual retraction into ground. Some products rated as high as DOS K12/ L3 depending on installation.	200	600	single unit	7%	20	$48	15	$720	5, 54	1	Requires construction contractor. May require electric power for raising.	Access control for operation. High security requires barriers on each side of the drive.
3	**Fencing / Barriers**	Retractable Vehicle Deterrents	Ramp/ wedge, surface mounted	Manual or automatic operation. Chain reinforcements increase anti-ram capability, but substantially lower anti-ram ratings than in-ground mounted ramps (listed separately).	10,000	25,000	10-ft unit	7%	15	$2,392	2	$4,783	5, 54	1	Level concrete slab for attachment. May require electric power for raising.	Access control for operation. High security requires barriers on each side of the drive.
4	**Fencing / Barriers**	Retractable Vehicle Deterrents	Booms and Crash Beams (sliding or swing gates)	Manual, automatic, or portable. Range from minimal anti-ram capability to DOS K4/L2 or higher.	3,000	40,000	14-ft unit	7%	15	$2,938	2	$5,877	5, 54	1	AC or DC power for opening and closing.	Access control for operation. High security requires barriers on each side of the drive.
5	**Fencing / Barriers**	Retractable Vehicle Deterrents	Traffic controllers ("tire teeth")	Spring-mounted to allow safe one-way travel, or retractable (with access control) to allow two-way travel. Wrong way penetration distance can be reduced with low speed conditions.	2,000	15,000	10-ft unit	5%	10	$1,275	2	$2,550	5	1	Flat surface for installation, good drainage.	Access control for operation of retractable units. High security requires barriers on each side of the drive.
6	**Fencing / Barriers**	Fixed Vehicle Deterrent, Pedestrian Access	Bollards, fixed/stationary (concrete or steel)	Variable anti-ram capability. Some products rated as high as DOS K12/ L3 depending on installation.	100	500	single unit	5%	20	$30	15	$450	5, 59	1	Requires construction contractor.	None
7	**Fencing / Barriers**	Fixed Vehicle Deterrent, Pedestrian Access	Decorative Crash-Rated Barrier (spheres, benches, bike racks, trees, etc.)	Wide variety of aesthetic options, metal or concrete. Variable anti-ram capability. Some products rated as high as DOS K12/ L3 depending on installation.	200	1,000	single unit	5%	15	$70	5	$350	7, 8	1	Sufficient space.	None
8	**Fencing / Barriers**	Fixed Vehicle Deterrent, Pedestrian Access	Jersey Barriers, portable (water filled or steel reinforced concrete)	Various styles, lengths, shapes, colors, can be arranged end-to-end, or in multiple rows, and anchored to increase anti-ram capability for equivalence to DOS K12.	100	500	10-ft unit	3%	20	$24	10	$240	5, 59	1	Moving equipment. Physical attachment to mounting surface for maximum protection.	None
9	**Fencing / Barriers**	Fixed Vehicle Deterrent, Pedestrian Access	Planters (standard)	Standard planters (i.e., not attached to the ground) vary in size.	500	1,000	single unit	7%	20	$90	10	$900	5, 59	1	Equipment for placement, soil and plants.	Upkeep of plants

3. Characterization | 4. Applicability Ranks | **5. Costs** | 6. Cost-Util & Strengths | References | Hidde

Figure 6. View of Worksheet 5, Costs.

- Adjust the expected operating life of the GSM in Column K.
- Update the relative technology maturity of the GSM in Column P, using the number ranking below. Less mature and less available technologies are more likely to undergo significant changes in cost within several years; thus, cost information for these GSMs should be considered tentative.

  1 = Mature, wide commercial availability
  2 = Mature, limited commercial availability
  3 = Developing technology, wide availability
  4 = Developing technology, limited availability

Simple annualized cost as $/year/unit is automatically calculated in Column L based on an average initial cost (average of Columns G and H), operating life (Column K), and O&M percentage of initial cost per year (Column J).

Do not change information in Columns A through E. These columns are copies of GSM description information from Worksheet 2.

3.7 Worksheet 6, Cost-Util & Strengths

After cost data have been updated for GSMs on the short list, cost per util is calculated in Worksheet 6 (shown in Figure 7). The user can sort Cells A11 to M112 in this worksheet in descending order in Column H (cost per util) to further prioritize the short list, with the lowest cost per util suggesting the largest security improvement per dollar.

Selection of candidate security measures should not be based solely on these sorts. The user should carefully assess strengths and weaknesses of the security measures (Columns J and K) and add additional information as needed (Column L). Further consideration of strengths, weaknesses, variations, and costs may be needed. Suppliers should be contacted for specific information, product demonstrations, and on-site equipment trials. Other organizations should also be consulted regarding selection of the final options, particularly the U.S. Coast Guard and Captain of the Port, local law enforcement, and security experts.

Changes should be made to GSM description or characterization (Columns A through E) based on this further research, which can be entered in Worksheet 3, Characterization. This may also cause changes in applicability ranks, which should be edited in Worksheet 4, Applicability Ranks, and changes in costs data should be made in Worksheet 5, Costs.

COST PER "UTIL" AND GSM STRENGTHS AND WEAKNESSES

INSTUCTIONS

Sort Cells A11 to M112 on this sheet in descending order in Column H.
Add more information for comparing GSMs in Columns J, K, and L.
Use Sheet 3 to change characterization information (Columns A through E).
Use Sheet 5 to change cost information (Column G).

	CHARACTERIZATION OF SECURITY MEASURES					Annualized Costs		Other Information		
	GSM #	Method Category		GSM	Options and Variations of GSM	Annulized System Cost ($/yr/syst)	Cost Per "Util"	Strengths	Weaknesses	Additional Information Developed by the User (e.g., sensitivity)
11	1	Fencing / Barriers	Retractable Vehicle Deterrents	Ramp/ Wedge, in-ground mounted	Manual or automatic raising and lowering; some products rated as high as DOS K12/ L3.	$9,000	$285	Effective retractable vehicle barrier, some raise in 2 seconds, often remains operational after vehicle impact.	Ground surface modification for installation. Not very aesthetic. May cause injury to occupant or vehicle fire. Maintenance procedures (i.e., cleaning, lubrication).	
12	2	Fencing / Barriers	Retractable Vehicle Deterrents	Bollards, retractable (steel or concrete)	Hydraulic, electro-hydraulic, or manual retraction into ground. Some products rated as high as DOS K12/ L3 depending on installation.	$720	$21	Effective retractable vehicle barrier. Inexpensive to install and maintain. Can be aesthetically tailored in wide variety of sizes.	Outer aesthetic covering can be damaged and need to be replaced. May need engineering analysis to ensure robust design to meet specific needs.	
13	3	Fencing / Barriers	Retractable Vehicle Deterrents	Ramp/ wedge, surface mounted	Manual or automatic operation. Chain reinforcements increase anti-ram capability, but substantially lower anti-ram ratings than in-ground mounted ramps (listed separately).	$4,783	$144	Easy installation, may be temporary or permanent.	Lower anti-ram ability than in-ground mounted ramps/ wedges.	
14	4	Fencing / Barriers	Retractable Vehicle Deterrents	Booms and Crash Beams (sliding or swing gates)	Manual, automatic, or portable. Range from minimal anti-ram capability to DOS K4/L2 or higher.	$5,877	$177	Best for frequent vehicle access needs.	May damage vehicles with poorly timed closure. Has less anti-ram capability than ramps or bollards	
15	5	Fencing / Barriers	Retractable Vehicle Deterrents	Traffic controllers ("tire teeth")	Spring-mounted to allow safe one-way travel, or retractable (with access control) to allow two-way travel. Wrong-way penetration distance can be reduced with low speed conditions.	$2,550	$80	Common in parking lot applications, easily installed by construction companies.	Inadvertent tire damage from vehicles backing up or traveling in the wrong direction.	
16	6	Fencing / Barriers	Fixed Vehicle Deterrent, Pedestrian Access	Bollards, fixed/stationary (concrete or steel)	Variable anti-ram capability. Some products rated as high as DOS K12/ L3 depending on installation.	$450	$11	Inexpensive to install and maintain. Can be aesthetically tailored in wide variety of sizes.	Outer aesthetic covering can be damaged and need to be replaced. May need engineering analysis to ensure robust design to meet specific needs.	
17	7	Fencing / Barriers	Fixed Vehicle Deterrent, Pedestrian Access	Decorative Crash-Rated Barrier (spheres, benches, bike racks, trees, etc.)	Wide variety of aesthetic options, metal or concrete. Variable anti-ram capability. Some products rated as high as DOS K12/ L3 depending on installation.	$350	$8	Aesthetically tailored, anti-ram rated, without creating a "security" atmosphere.	May promote undesirable loitering. Options such as trees obscure broad view.	
18	8	Fencing / Barriers	Fixed Vehicle Deterrent, Pedestrian Access	Jersey Barriers, portable (water filled or steel reinforced concrete)	Various styles, lengths, shapes, colors, can be arranged end-to-end, or in multiple rows, and anchored to increase anti-ram capability for equivalence to DOS K12.	$240	$6	Highly configurable, low cost and maintenance, empty water-filled units weigh less than 200 lbs and are easy to transport.	Plastic versions require water-filling source and drainage area, and can have freezing problems. Concrete versions require a substantial forklift or	
	9	Fencing / Barriers	Fixed Vehicle Deterrent,	Planters (standard)	Standard planters (i.e., not attached to the ground) vary in size.			Aesthetically tailored vehicle deterrent, planter contents may be	May become a projectile when rammed	

3. Characterization | 4. Applicability Ranks | 5. Costs | 6. Cost-Util & Strengths | References | Hidde

Figure 7. View of Worksheet 6, Cost-Util & Strengths.

3.8 References Worksheet

This worksheet provides full references for Column G of Worksheet 3, Characterization, and Column O of Worksheet 5, Costs. Wherever possible, Internet sites are provided. The sites provided do not always display cost information, but they provide e-mail and telephone contact information through which costs estimates can be obtained.

3.9 Hidden Calculations Worksheet

3.9.1 Overview of Hidden Calculations

The Hidden Calculations worksheet does not need to be viewed by the user. It uses entries in Worksheets 1 and 4 to calculate valuations (utils) and entries in Worksheet 3 to label the viewed GSMs. Valuations calculated in the Hidden Calculations worksheet are copied to Worksheet 2, Valuations. More advanced users may benefit from viewing additional breakdowns shown in the Hidden Calculations worksheet. While valuations in Worksheet 2 are shown only for grouped evaluation criteria, valuations may be viewed for each individual evaluation criterion in the Hidden Calculations worksheet.

Columns A through O of the Hidden Calculations worksheet show the same information that is displayed in Worksheet 2, Valuations. Columns farther to the right (i.e., Columns Q through BK) show the utils (or weight-adjusted rank) of each GSM for each evaluation criterion within each of the evaluation groups. If you sort data in the Hidden Calculations worksheet, the data must be returned to the original order prior to using Worksheets 2 and 6. Alternatively, the Hidden Calculations worksheet can be copied to another worksheet name for sorting.

As previously described, utils are calculated from the weights given by the user to different evaluation criteria (entered in Worksheet 1, Evaluation Weights) and to the relative applicability ranks (entered in Worksheet 4, Applicability Ranks). A more detailed description of the Excel equations used to calculate these weight-adjusted ranks (i.e., utils) in the Hidden Calculations worksheet is provided below. Most users are not likely to need this level of detail.

Columns Q through T of the Hidden Calculations worksheet show GSM characterization information from Worksheet 3, Characterization, to provide easy reference when analyzing the valuations for GSMs in Columns V through BK. For discussion of weight-adjusted ranks (i.e., utils) in Columns V through BK, the following terms are used:

- ***Rank*** refers to the numbers entered in Worksheet 4, Applicability Ranks. These numbers indicate the relative applicability of each GSM to each evaluation criterion. The maximum acceptable applicability rank is 3.
- ***Specific Criteria*** refers to the specific evaluation criteria described in Worksheet 1, Evaluation Weights. For example, in the Security Objective group, the specific criteria are to deter, detect, deny, and mitigate, as described in Rows 9 through 12 of Worksheet 1, Evaluation Weights.
- ***Weight*** refers to the numbers entered in Worksheet 1, Evaluation Weights. These numbers indicate the relative weight given to different evaluation criteria. The maximum weight is five. There are two types of weights: group weights and specific weights (described below).
- ***Group Weight*** refers to the five weights entered in Rows 75 to 79 of Worksheet 1, Evaluation Weights, for the criteria groups of security objectives, non-security effects, 33 CFR Compliance, Security Locations, and Threat Type.
- ***Sub-Group Weight*** refers to the average weight of each of the three sub-groups within the Threat Type group. These sub-groups are Delivery of Explosive/Incendiary, Act of Force, and Deliver WMD.

- ***Specific Weight*** refers to the weights entered in Rows 9 to 69 of Worksheet 1, Evaluation Weights. These weights are for specific criteria listed within each evaluation group. For example, in the Security Objective group, specific criteria are deter, detect, deny, and mitigate.

3.9.2 Calculation of Weight-Adjusted Ranks

The general method for calculation of weight-adjusted ranks is to multiply rank by weight. The *(rank)×(weight)* is expressed as a fraction of the maximum possible rank and average group or sub-group weight and then multiplied by the total possible utils for the specific criteria (i.e., the maximum group or sub-group utils divided by the number of specific criteria in the group or sub-group).

Maximum Group Utils are shown in Row 7 (Cells V7, AA7, AF7, and AL7) and Row 5 (Cell BG5) of the Hidden Calculations worksheet. The Excel equations for these cells are shown in Table 2. Maximum group utils are calculated as the product of the total utils (i.e., 100) and the fraction of the group weight divided by the summation of all group weights. Thus, when all group weights are equal, there are 20 possible utils for each group. When all group weights are not equal (the more common case), some groups will have maximum possible utils above 20, and others below 20.

Maximum Threat Type Sub-Group Utils are shown in Cells AZ7, BH6, and BK7. The Excel equations for these cells are shown in Table 2. The three sub-groups within the Threat Type group

Table 2. Equations for calculations of maximum possible utils.

Cell	Excel Equation	Explanation
V7	=('1. Evaluation Weights'!$H$75/SUM('1. Evaluation Weights'!$H$75:$H$79))*100	Maximum possible utils for the Group, Security Objectives, given the weights provided on Sheet 1, Evaluation Weights.
AA7	=('1. Evaluation Weights'!$H$76/SUM('1. Evaluation Weights'!$H$75:$H$79))*100	Maximum possible utils for the Group, Non-Security Effects, given the weights provided on Sheet 1, Evaluation Weights.
AF7	=('1. Evaluation Weights'!$H$77/SUM('1. Evaluation Weights'!$H$75:$H$79))*100	Maximum possible utils for the Group, 33 CFR Compliance, given the weights provided on Sheet 1, Evaluation Weights.
AL7	=('1. Evaluation Weights'!$H$78/SUM('1. Evaluation Weights'!$H$75:$H$79))*100	Maximum possible utils for the Group, Security Locations, given the weights provided on Sheet 1, Evaluation Weights.
BG5	=('1. Evaluation Weights'!$H$79/SUM('1. Evaluation Weights'!$H$75:$H$79))*100	Maximum possible utils for the Group, Threat Type, given the weights provided on Sheet 1, Evaluation Weights.
AZ7	=(AVERAGE(AX10:BC10))/(AVERAGE(AVERAGE($AX$10:$BC$10),AVERAGE($BD$10:$BH$10),AVERAGE($BI$10:$BK$10)))*($BG$5/3)	Maximum possible utils for the Threat Type sub-group, Deliver Explosive/Incendiary, given the weights provided.
BH6	=(AVERAGE(BD10:BH10))/(AVERAGE(AVERAGE($AX$10:$BC$10),AVERAGE($BD$10:$BH$10),AVERAGE($BI$10:$BK$10)))*($BG$5/3)	Maximum possible utils for the Threat Type sub-group, Act of Force, given the weights provided.
BK7	=(AVERAGE(BI10:BK10))/(AVERAGE(AVERAGE($AX$10:$BC$10),AVERAGE($BD$10:$BH$10),AVERAGE($BI$10:$BK$10)))*($BG$5/3)	Maximum possible utils for the Threat Type sub-group, WMD Delivery, given the weights provided.

Table 3. Equations for weight-adjusted ranks (i.e., util valuations).

Column	Group	Excel Equation *(in upper right cell)*	Explanation
V • • Y	Security Objective	=(('4. Applicability Ranks'!F11*V$10)/ ((AVERAGE($V$10:$Y$10))*3)) *($V$7/4)	For each GSM (row) and each specific criterion (column) GSM rank is: 1. Multiplied by the specific weight, 2. Expressed as a fraction of the average specific weight and maximum rank, 3. Multiplied by the maximum group utils divided by the number of criteria in the group.
AA • • AD	Non-Security Effects	=(('4. Applicability Ranks'!K11*AA$11)/ ((SUM($AA11:$AD11)/4)*3))* ($AA$8/4)	
AF • • AJ	33 CFR Compliance	=(('4. Applicability Ranks'!P11*AF$11)/ ((SUM($AF11:$AJ11)/5)*3))* ($AF$8/5)	
AL • • AV	Locations	=(('4. Applicability Ranks'!V11*AL$11)/ ((SUM($AL11:$AV11)/11)*3))* ($AL$8/11)	
AX • • BC	Threat Type – EID Sub-group	=(('4. Applicability Ranks'!AH11*AX$11)/ ((SUM($AX11:$BC11)/6)*3))* (($AX$8/3)/6)	For each GSM (row) and each specific criterion (column) GSM rank is: 1. Multiplied by the specific weight, 2. Expressed as a fraction of the average specific weight and maximum rank, 3. Multiplied by the maximum sub-group utils divided by the number of criteria in the sub-group.
BD • • BH	Threat Type – Act of Force Sub-group	=(('4. Applicability Ranks'!AN11*BD$11)/ ((SUM($BD11:$BH11)/5)*3))* (($AX$8/3)/5)	
BI BJ BK	Threat Type – WMD Sub-group	=(('4. Applicability Ranks'!AS11*BI$11)/ ((SUM($BI11:$BK11)/3)*3))* (($AX$8/3)/3)	

(i.e., Delivery of Explosives/Incendiaries, Acts of Force, and WMD Delivery) are allotted portions of the maximum group utils (show in Cell BG5) based on the sub-group's average weight. More specifically, the maximum group utils is divided by 3 (i.e., the number of sub-groups), and multiplied by the fraction of the sub-group average weight divided by the average of the average sub-group weights for all three sub-groups. Thus, sub-groups are weighted according to their average sub-group weight and are not affected by varied numbers of specific criteria within each sub-group.

Rows 11 and higher (Columns V through BK) display weight-adjusted ranks for each GSM and specific evaluation criteria. Sample equations in these columns are shown in Table 3. There are three parts to the equation for weight-adjusted ranks:

1. Apply the specific weight to the rank—that is, *(Rank)×(Specific Weight)*.
2. Express *(Rank)×(Specific Weight)* as a fraction of the maximum rank and the average specific weight. This makes it so specific weights are relative within their group—if all specific weights in a group are the same, it makes no difference if the specific weights are all reported as 1 or 5.
3. Multiply the above fraction by the maximum possible utils for the specific criteria. This is the maximum possible utils for the group (as in Row 7) given the evaluation weights provided, divided by the number of specific criteria within the group (e.g., 4 in the Security Objective group). For the Threat Type group, the maximum possible utils for the sub-group is used in place of the group maximum utils.

PART II

Characteristics of the U.S. Ferry System

CHAPTER 1

Introduction to USFS Characteristics

The U.S. Ferry System (USFS) is a vital component of the nation's multimodal transportation network, with the capacity to quickly and efficiently move a large number of people and goods across the nation's waterways. In some parts of the country, the USFS is the only means of transport and, as such, is an indispensable component of the area's infrastructure and economy. The USFS is also depended upon in times of crisis for back-up transportation when other modes of transportation are disrupted, for evacuations, and for the delivery of emergency supplies and personnel. The ferry system in San Francisco Bay performed all of these functions in response to the Loma Prieta earthquake in October 1989, and the New York City ferry system did the same in response to the events of September 11, 2001.

The ferry service system across the United States is extensive. Ferries operate in 43 states and territories, providing service on over 350 different ferry routes. Each year, the nation's ferries carry more than 113 million passengers and 32 million vehicles over numerous waterways.[1] The same characteristics that make the system desirable (i.e., the wide extent of service and the popularity of use) also make it a potential target and a potential instrument of a terrorist act. The appeal of the USFS to terrorists may be both in the potential use of vessels and facilities as original threat sites and in helping to spread a threat in the form of released contaminants. Operational characteristics of the system, such as the need to move large numbers of people on a tight schedule, increase the system's vulnerability and present unique security challenges. The highest-capacity ferry systems rank high in relative risk of attack, partly because of the potential consequences of an attack in a small area with a large number of people. This consideration has been important in the development of related security regulations. Furthermore, one of the guiding principles for the identification of critical national infrastructure is the assurance of public safety, public confidence, and services,[2] all of which are represented in high-capacity ferry systems.

1.1 Objective

The objective of Part II is to present a USFS characterization that will enhance the understanding, effective adoption, and implementation of security measures. In addition, Part II provides security-related statistics that were used in the development of the guide (Part I) and the accompanying Excel tool. Part II represents work completed under Tasks 1, 2, and 3 of TCRP Project J-10H. Part I is the final product, the resulting guide to assist ferry system operators in the evaluation of security measures to meet security and operational goals.

1.2 Organization of Part II

Chapter 1 provides a general background of the USFS. Chapters 2 and 3 characterize vessels and terminals, respectively, by categories that have security implications. Chapter 4 summarizes

the requirements and objectives of security regulations. Chapter 5 discusses common security threats (including terrorist-related threats) to the USFS. Appendices provide further information of regulations, Maritime Security (MARSEC) levels, and glossaries of terms and acronyms.

1.3 Background

Ferry operations begin at the terminal boundary. Depending on the facilities, tickets are sold either near the site boundary or, in some cases, on-board the vessel. For systems that accommodate highway vehicles, vehicles are directed to a cargo loading area and may be driven onto the vessel by the passengers or by ferry personnel, depending on the particular system. Separate passenger waiting areas are often available at the terminal a short distance from the embarking area. After embarking, passengers are often free to move within passenger and vehicle cargo areas while the vessel is underway. Debarking procedures are generally similar to embarking.

Ferry vessels vary greatly in size, design, and capacity. There are three basic types of ferry based on cargo types, as described below. Length and passenger capacity provided in these brief descriptions are based on information in the National Ferry Database.[3]

1. **Passenger-only vessels**—do not carry vehicles, with the possible exception of bicycles. These vessels may be 400 or more feet in length and carry up to 6,000 passengers. Their service is often fixed-route service, and trips are typically of short to moderate lengths. Sometimes "water taxis" are distinguished as a separate group of vessels that are 65 feet or less in length, carry fewer than 150 passengers, and provide fixed-route and on-demand trips of short lengths. However, there is no formal regulatory or construction distinctions between "water taxis" and passenger-only ferries, and they are not distinguished in the National Ferry Database.
2. **Roll-on/roll-off vessels**—transport highway vehicles (i.e., automobile and sometimes semi-truck trailers) and passengers. They may be 400 feet or more in length and may carry up to 3,500 passengers. Their service is often fixed-route service, and trips are typically longer than passenger-only ferries.
3. **Railroad carfloats**—transport railroad cars and have railroad tracks on the deck. They may be 200 feet or more in length and may carry up to 300 passengers.

In general, trips between route destinations can exceed 2 hours, but more often the average travel time for a route is between 11 and 30 minutes. There are typically intermodal transfers at or near ferry terminals, including park-and-ride lots, feeder bus service, roll-on/roll-off bus service (for auto ferries), and terminals located close to passenger rail service (as in New York and San Francisco). Ferries travel on waterways that may be intercoastal (i.e., along the coastline), intracoastal (i.e., lakes, rivers, bays, and sounds), or international (i.e., across international boundaries). Ferries operate in urban, coastal, and rural regions:

- **Urban** services provide trips within a metropolitan commuting area, with fixed or variable schedules. Often fixed frequency varies daily to accommodate commuters. Service includes point-to-point transit (e.g., across a harbor), linear service with multiple stops (e.g., along a waterfront), circulator service (e.g., fixed route but not fixed schedule), and water taxi service (e.g., fixed landings with passenger pickup on demand).
- **Coastal** services provide intercity and interisland trips on salt water and large fresh water lakes. Travel times range from 1 hour to 1 day. Service frequency often ranges from daily to weekly and may vary seasonally.
- **Rural** services provide transportation across rivers and lakes when the construction of bridges is not warranted. Typically, these routes are short, operate on demand, carry a limited number of vehicles, and accommodate pedestrians and bicycles.

By law, ferries are considered fixed guideways. There are three different route designations commonly used within the ferry system. *Fixed routes* (also called closed-loop routes) have a fixed point designating their beginning and end. Each trip may take a slightly different course, but the beginning and end of the route are located at fixed points. *Segmented routes* (also called open-loop routes) are portions of a fixed route with multiple stops. *Metropolitan routes* serve metropolitan areas and carry the majority of the national ferry system passengers.

In addition to the route designations, ferry services may be categorized as regular service or *express service*. Ferry services that generally operate during peak commuter hours by both demand and fixed-route service are considered express services.

Currently, the majority of all ferry routes are considered essential service routes, meaning that there are no other modes of transportation available to the specific destination serviced. Such services are often considered the lifelines of island communities.

Notes

1. U.S. Department of Transportation. Federal Highway Administration, Intermodal and Statewide Programs Division, *National Ferry Study,* National Ferry Database, December, 2000.
2. The National Strategy for the Physical Protection of Critical Infrastructures and Key Assets, February 2003. Available at: http://www.dhs.gov/interweb/assetlibrary/Physical_Strategy.pdf.
3. U.S. Department of Transportation, ibid.

CHAPTER 2

USFS Security-Related Vessel Characteristics

Vessels within the USFS fleet are largely custom made to meet the varied passenger capacity, trip duration, and cargo type demands. This broad variety leads to many logical components or characteristics that can be used to provide an overview of the USFS. This same broad variety also renders the need for the development of security procedures that are system and vessel specific. The primary categories selected for this overview are those that either are currently used for determining the applicability of security regulations or are being considered for possible additional security regulations. Additional categories presented are by commonly distinguished characteristics that may have some security implications, but are not important for identifying applicable current security regulations.

From the perspective of security regulations, there is no difference between ferry vessels and passenger vessels. (Note: this may not be the case for safety regulations.) All vessels in waters under U.S. jurisdiction are subject to U.S. Coast Guard area security plans, as described in 33 CFR 103. Area security plans include vessel identification and navigation requirements. Further requirements vary with the area. Designation of vessel types for which more stringent national security regulations apply is based on determinations of relative risk, which includes both the likelihood of an event and the magnitude of the effects of an event. According to the National Risk Assessment Tool (N-RAT) as described in the Federal Register, Vol. 68, No. 126, pp. 39, 244–39,245, the highest maritime risk involves vessels that have a passenger capacity greater than 2,000. A lesser, but still high risk is associated with vessels that have a passenger capacity greater than 150. Thus, all domestic vessels with passenger capacities in excess of 150 must meet 33 CFR 104, which requires the development of a U.S. Coast Guard–approved vessel security plan (VSP). These plans are to be vessel-specific, living documents that are modified as new issues and methods evolve through experience, including required security drills and exercises. There has been discussion within the U.S. Coast Guard of more stringent security regulations for vessels with passenger capacities of more than 500 and more than 2,000. Thus, these categories of vessels may be of future interest from the standpoint of national security regulations.

According to N-RAT, a relatively high risk has also been associated with all vessels that have a regulation tonnage that is more than 100 gross tons. Thus, these vessels must also meet 33 CFR 104 requirements. The applicability of 33 CFR 104 is broader for vessels undergoing international voyages. All vessels on international voyages with more than 12 passengers and at least one for-hire are required to meet 33 CFR 104 requirements or the equivalent regulations under the International Convention for the Safety of Life at Sea (SOLAS).

Overall, the distinguishing characteristics of the U.S. ferry fleet from a security regulations perspective are as follows:

- International voyages with more than 12 passengers must comply with 33 CFR 104 and SOLAS.
- Voyages with a passenger capacity of more than 150 must comply with 33 CFR 104.

- Voyages with a passenger capacity of more than 500 may in the future comply with more stringent security regulations.
- Voyages with a passenger capacity of more than 2,000 may in the future comply with more stringent security regulations.
- Voyages with more than 100 gross tons must comply with 33 CFR 104.

The numbers of vessels in these categories are presented in Sections 2.1, 2.2, and 2.3. Section 2.4 presents the number of vessels in additional categories based on characteristics that may affect security, but are not important for identifying applicable security regulations. These additional categories include

- High-ridership systems,
- Vessel vehicle capacity, and
- Vessel cruising speed and hull types.

Unless otherwise specified, the statistics in this report are from the National Ferry Database,[1] which is based on a survey of U.S. ferry operators conducted in 1999–2000 by the Volpe National Transportation Systems Center. The survey response rate was 85%. Some respondents did not answer all the survey questions. Returned surveys with incomplete information in a particular information category are referred to as "NULL" in the exhibits below. When assessing these data, it should be recognized that ferry systems in some locations (i.e., New York) have undergone significant growth in the 6 years since survey completion.

The following categories identify the portions of the USFS that must meet the requirements defined in 33 CFR 104.

2.1 International Routes

The National Ferry Database provides information on ferry routes, but this does not include the number of vessels on each route. In some systems, a single vessel operates more than one route. The National Ferry Database lists 352 ferry routes with terminals in the United States. Sixteen of these routes are between the U.S. mainland and another country. Seventeen of these routes are within the Caribbean and have at least one terminal in a U.S. territory or state (most of these terminals are in the Virgin Islands and Puerto Rico).

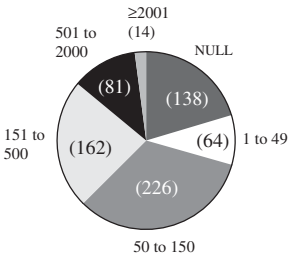
Table 1 summarizes ferry routes with respect to terminal locations. The table does not include routes with operators located outside the United States, or vessels registered outside the United

Table 1. Number of routes and terminal locations in the national ferry database.

Terminal Locations	# Routes
Within the Caribbean*	17
Between the Caribbean and U.S. Mainland	1
Between Canada and the U.S. Mainland	14
Between Mexico and the U.S. Mainland	1
Within the 50 United States	319
TOTAL Routes	352

* These routes include at least one terminal that is in a U.S. Caribbean territory; the second Caribbean terminal may be in either a U.S. or foreign territory.

States. Thus, these data underestimate the actual number of international routes that have terminals in the United States. The passenger capacity of most vessels in the National Ferry Database is greater than 12. Thus, it is likely that most of the vessels that operate on international routes in Table 1 must meet 33 CFR 104 requirements.



Note: Numbers in parentheses indicate the total number of vessels in each category.

Figure 1. Passenger capacity in the U.S. ferry fleet.

2.2 Passenger Capacity and Location of Relatively High-Risk Targets

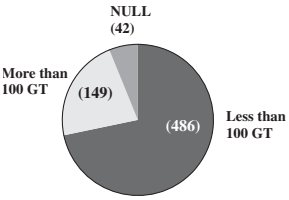
The passenger capacity of the USFS, according to the National Ferry Database, is shown in Figure 1. At least 40% of the national fleet has a passenger capacity that is less than or equal to 150 and, thus, do not need to meet the requirements of 33 CFR 104 (i.e., they do not need to develop a U.S. Coast Guard–approved vessel security plan). Roughly 10% of the entire fleet has a passenger capacity of less than 50, meeting some definitions of water taxis. The "NULL" group in Figure 1, which did not provide their passenger capacity, represents 20% of the national fleet. This group consists of relatively small operators and, thus, is more likely to have vessels that fall in the categories that have passenger capacities of less than 150. Thus, overall, the percentage of the national ferry fleet that does not need to meet 33 CFR 104 requirements based on passenger capacity is estimated to be roughly 60%.

During the time of the National Ferry Survey, nearly 40%, or 257 vessels, met the criteria for 33 CFR 104. While this number of vessels was likely reasonably accurate in the year 2000, it has increased in the 5 years since survey completion. If more stringent security regulations are adopted for vessels with a passenger capacity of 500 to 1,999 and for vessels with a passenger capacity of 2,000 or more, this would affect 81 and 14 vessels, respectively, based on the fleet represented in the National Ferry Survey completed in the year 2000.

As may be expected, all 14 of the ferry vessels in the National Ferry Database with passenger capacities of 2,000 or more are located in the two states with the highest ridership, Washington and New York. Two vessels with a capacity of 6,000 are located in New York, in addition to three vessels with passenger capacities of 3,500. In the state of Washington, there are seven vessels with passenger capacities of 2,500 and two vessels with passenger capacities of 2,000. Thus, in the year 2000, five vessels in New York and seven vessels in the state of Washington fell within the highest relative risk category based on N-RAT.

Table 2 shows the number of ferry vessels in the two highest passenger capacity categories (i.e., synonymous with relative high risk) by state.

The number of vessels in the highest-risk categories is greatest in the state of Washington, although ridership and, presumably, the number of ferries with passenger capacities of less than 500 are greater in New York.



Note: Numbers in parentheses indicate the total number of vessels in each category.

Figure 2. Regulation gross tonnage of the U.S. ferry fleet.

2.3 Vessel Gross Tons

Based on data in the National Ferry Database, 22% of vessels, or 149 vessels, in the year 2000 exceeded the 100 gross ton regulation tonnage. There was a 6% non-response (i.e., NULL) in this category. It is likely that all the vessels in the NULL category are less than 100 gross tons. Thus, about one-fifth of the USFS must meet 33 CFR 104 requirements based upon tonnage alone. (See Figure 2.)

Of the 149 vessels with more than 100 gross tons, 13 listed a passenger capacity that is less than 150, and 12 did not report their passenger capacity. Thus, somewhere between 13 and 25 (9% and

Table 2. Number of vessels in relatively high-risk passenger capacity categories by state.

State	Vessel Passenger Capacity		Total High-Risk Vessels
	500 to 1,999	2,000 or more	
Washington	15	9	24
New York	12	5	17
California	15	0	15
Massachusetts	13	0	13
Connecticut	6	0	6
Alaska	5	0	5
Texas	5	0	5
Delaware	5	0	5
Louisiana	4	0	4
Michigan	4	0	4
Ohio	4	0	4
Virginia	1	0	1
Maine	1	0	1

17%, respectively) of the 149 ferry vessels that have more than 100 gross tons are required to meet 33 CFR 104 requirements based solely on tonnage because their passenger capacity is less than 150.

2.4 Additional Categories That May Affect Security

The following categories do not affect the applicability of federal security regulations. However, they may be considered in vulnerability assessments and security plans developed for vessels under 33 CFR 104, for facilities under 33 CFR 105, and for areas under 33 CFR 103.

2.4.1 High-Ridership Systems

As shown in Table 3, the first, third, and fourth systems with the highest ridership are in the New York City area and together represent one-third of all boardings at U.S. ferry systems. The ferry system with the second-to-highest ridership is located in the state of Washington. Ferry systems with the fifth, sixth, and seventh highest ridership service the cities of Houston-Galveston, San Francisco, and Corpus Christi–Port Aransas, respectively. According to considerations of both annual ridership (Table 3) and capacity of largest vessels (Table 2), the New York City area and the state of Washington ferry systems are the highest-risk systems.

2.4.2 Vessel Vehicle Capacity

Highway vehicle cargo in the USFS presents additional security concerns because vehicles contain a much greater volume to inspect and have the ability to carry and hide large amounts of explosives or other hazardous materials. As shown in Table 4, of the vessels in the National Ferry Database, 341 (50%) are passenger-only vessels. Three hundred and twenty-six vessels (48%) are roll-on/roll-off vessels with the ability to carry highway vehicles. Most roll-on/roll-off vessels also carry passengers. Only 10 of the 677 vessels in the National Ferry Database are railroad carfloats.

Table 3. Annual boardings in the 10 highest-ridership systems.

Service System Operator (Metropolitan Area)	Annual Boardings	Percentage of Total National Boardings
New York City DOT (New York City)	19,270,397	17%
WA State DOT (Seattle)	15,407,548	14%
Circle Line (New York City)	10,856,554	10%
NY Waterway (New York City)	7,244,419	6%
TX DOT (Houston – Galveston)	6,648,007	6%
Blue & Gold Fleet (San Francisco)	3,750,000	3%
TX DOT (Corpus Christi – Port Aransas)	3,000,000	3%
Woods Hole/Martha's Vineyard/Nantucket Steamship Authority *(not a metropolitan area)*	2,970,000	3%
LA DOT (New Orleans)	2,512,504	2%
NC DOT Ferry Division *(not a metropolitan area)*	2,341,280	2%
TOTAL Boardings of the 10 Highest Systems	74,000,709	66%
TOTAL Boardings of All U.S. Ferry Systems	113,332,016	100%

Note: These boardings are based on the National Ferry Database. Other sources indicate substantial differences in boarding estimates. For example, an article in the *Seattle Times,* Oct. 24, 2003, estimates annual Washington State DOT boardings at 26 million (http://seattletimes.nwsource.com/html/localnews/2001773286_webferry23.html).

2.4.3 Vessel Cruising Speed and Hull Type

Ferry vessels are often categorized by their physical and mechanical characteristics. A vessel's configuration establishes its performance, maneuverability, and limitations on the water. For example, monohull vessel stability is more affected by wave action than catamaran hull vessels are, but catamaran vessels require wider berths for docking. Monohull vessels are the most common in the ferry service, as shown in Table 5. The next most common category is catamarans, which have dual hulls and often greater speed and maneuverability. The remaining 2% of the USFS is a variety of other hull types.

Hull shape may affect a vessel's susceptibility to underwater damage, in addition to affecting vessel speed. Both high-speed and maneuverability may reduce a vessel's (a) susceptibility to ramming while underway and (b) hijacking from boarding while underway.

Table 4. Number and type of U.S. ferry vessels in service.

Number of Vessels	Type of Ferry Vessel
341	Passenger Only
326	Roll-On/Roll-Off
10	Railroad Carfloat
677	Total

Table 5. Hull types and service types from the National Ferry Database.

Hull Type	Service Type			Total Vessels	% Total
	Passenger Only	Roll-On/ Roll-Off	Rail Carfloat		
Monohull	271	320	10	601	89%
Catamaran	57	1	0	58	9%
Other multi-hull	0	1	0	1	<1%
Hydrofoil	2	0	0	2	<1%
Other	7	4	0	11	<2%
NULL	4	0	0	4	<1%
TOTAL	341	326	10	677	100%

Note

1. U.S. Department of Transportation. Federal Highway Administration, Intermodal and Statewide Programs Division, *National Ferry Study,* National Ferry Database, December 2000.

CHAPTER 3

USFS Terminal and Area Characteristics

The security at ferry terminals is addressed in 33 CFR 105. Terminal facilities are required to conduct a facility security and vulnerability assessment and develop a facility security plan (FSP) that meets captain of the port (COTP) approval if they receive any of the following:

- Vessels with passenger capacities greater than 150,
- Vessels on international voyages that have more than 12 passengers and one for-hire (i.e., vessels that fall under SOLAS), and
- Cargo vessels that have more than 100 gross register tons.

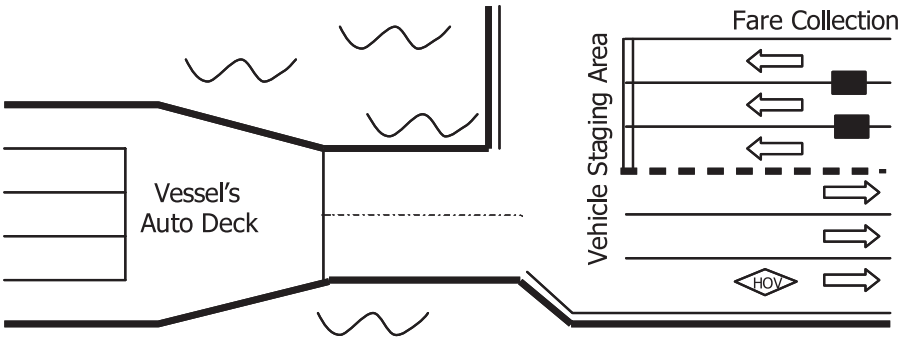
Exemptions are made for facilities that receive vessels with passenger capacities greater than 150 if the vessels are not carrying passengers. Area security plans (ASPs) are required for all waterways under U.S. jurisdiction (33 CFR 103). These plans are developed by the Area Maritime Security (AMS) Committee after completion of an area maritime security assessment (AMSA).

Currently, there are almost 600 terminals in the USFS, and more than half of these terminals are located in 10 states. Nationally, only a small number of these 600 terminals process 1 million or more passengers and vehicles annually. Ferry terminals can be enclosed buildings that support an operator's business functions and may shelter small retail or other waterfront services. In other instances, a small building supporting a fare purchasing window and a dock for boarding and alighting passengers and/or vehicles is considered a ferry terminal. Most ferry terminals are accessible to vehicles. On-site parking is available at 55% of all ferry terminals. Many terminals have public access areas, but often restrict access to boarding and debarking areas to fare-paying customers. Drop-off areas for passengers, luggage, or both are particular security concerns because they increase the hazards of vehicle-borne incendiary and explosive devices (IEDs) by reducing standoff distances and may limit ability to screen passenger luggage.

Some of the considerations in conducting vulnerability assessments and developing security plans under 33 CFR 105 may include docks, moorings, and gangways, which are briefly described in Section 3.1. Other areas with security implications are fare collection, waiting areas, and vessel loading, which are described in Section 3.2. Waterway area effects are briefly discussed in Section 3.3, and types of ownership/operation are discussed in Section 3.4.

3.1 Docks, Moorings, and Gangways

Docking configurations at ferry terminals depend on the type of vessels received. Vehicle ferries are typically end-loaded and, hence, have dock facilities that accommodate this process, as illustrated in Figure 3. Vehicles to be loaded are temporarily stored at landside or dockside vehicle staging areas. Passenger-only ferries are typically side-loaded, although some newer passenger-only



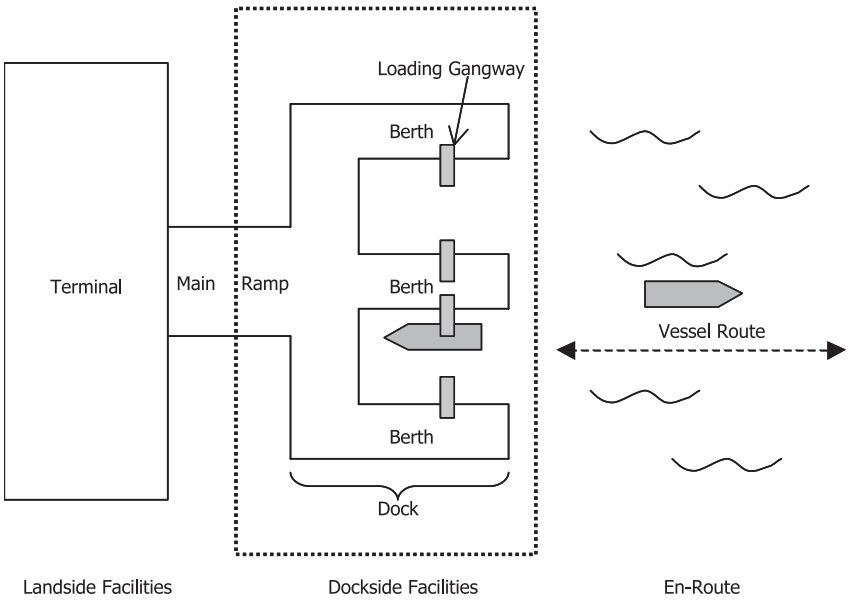
Source: *TCRP Report 100: Transit Capacity and Quality of Service Manual*, 2nd Edition, Transportation Research Board, 2004, page 6-5.

Figure 3. Diagram of vehicle staging area in relation to ferry vessel.

ferries are end-loaded. The most typical dock design has parallel berths, such as the design shown in Figure 4. Some dock facilities may have a variety of berthing arrangements to facilitate a range of vessel types. Many ferries use gangways to provide a temporary ramp from the vessel to a dock-side platform.

Mooring procedures and gangway technology vary considerably from location to location and vessel to vessel. Some examples of mooring procedures include the following:

- Fasten three lines between the vessel and a shoreside platform.
- Fasten one line and place a heavy gangway on the vessel to secure it to a shoreside platform.
- Use a rack system to guide the vessel to the dock, then place the mooring hooks and gangways.



Source: *TCRP Report 100: Transit Capacity and Quality of Service Manual*, 2nd Edition, Transportation Research Board, 2004, page 6-9.

Figure 4. Typical ferry terminal design.

The shoreside platform may be a dock or a barge, the latter of which allows a constant height between the vessel and loading platform. The use of various gangway technologies can affect the time it takes to emplace and remove the gangway. Gangway technologies include manual placement with a hand winch and mechanical placement with electric, hydraulic, and bow loading. The latter technology offers the advantage of faster mooring and loading at properly configured terminals. These mooring and gangway procedures may have different security implications. For example, if it takes longer to moor and place a gangway (e.g., as a result of electrical power loss), embarking and debarking passengers will be required to remain in a confined area for a longer time, thereby extending the period that these areas retain high population densities. When the relative vulnerability of the gangway is high, increases in monitoring, access control, and restricted areas may be considered.

3.2 Fare Collection, Waiting Areas, and Vessel Loading

Methods for passenger fare collection vary among ferry terminals. One method is for boarding passengers to pay their fares at ticket windows or ticket vending machines prior to entering the platform area. Another method is to collect fares by a combination of an on-board cashier (for those paying cash), and an on-board ticket-validating machine (for those holding multiple-ride tickets and passes). There may be enclosed waiting areas for passengers to congregate prior to boarding. Ferry terminals that have waiting areas have the additional security concerns that are associated with these areas. Monitoring for unattended bags and packages are among the security needs for these areas.

The basic layout for loading passengers at terminals follows a general model where walkways lead to the stable approach (landside), the passenger loading platform (dock) is connected to the stable approach (either by mooring or anchorage), and a gangway is deployed to bridge the span from the passenger-loading platform to the vessel. It is often natural for passenger-loading platforms to rise and drop with changing water or tidal levels. Where water levels are more stable, gangways may be deployed from the stable approach to the vessel. On the busiest ferry routes, a terminal building may have multiple boarding levels with multiple gangways deployed.

Cargo handling is identified in 33 CFR 105 as a particular process for which security measures must be developed. For ferry operations that accommodate vehicles, the vehicle-loading facility often accounts for a major portion of a facility's overall footprint. The staging lot design for embarking passengers' vehicles depends on a number of factors, such as the vessel auto-deck capacity and the loading process. While some staging areas are actually part of the road serviced by the ferry system, in other cases, a roadside pull-off has been added to the highway shoulder so that vehicular traffic can queue to await loading. The order of vehicle loading is often carefully managed to maintain vessel balance. In some cases, vehicles are only loaded and unloaded by staff. The unloading process for ferry vessels is generally more straightforward and less time consuming than loading.

Many North American auto-ferry operators request that auto-passengers on long-distance routes make reservations and/or arrive 30 minutes to 3 hours prior to departure. The suggested arrival time is a function of the anticipated demand and may include time for security and/or hazardous material checks. For services between Canada and the United States, the advance time may also include checks by federal authorities such as the U.S. Customs and Border Protection Service.

The number of terminals that serve ferry routes with high-passenger boardings (Table 6) can be used as an indicator of the number of ferry terminals that process large numbers of people.

Table 6. Number of terminals with high annual passenger boardings.

Annual Passenger Boardings	Number of Terminals
500,000 to 999,999	26
1,000,000 to 1,999,999	27
2,000,000 to 4,999,999	13
5,000,000 to 9,999,999	5
10,000,000 or more	2
TOTAL	73

Source: U.S. Department of Transportation, Federal Highway Administration, Intermodal and Statewide Programs Division, *National Ferry Study,* National Ferry Database, December 2000.

Terminals that process high numbers of passengers generally present greater relative risks than terminals that process fewer passengers. High-volume terminals also present a greater challenge with respect to the timely screening of passengers and cargo.

3.3 Waterway Area Effects

The extent and type of water traffic is among the considerations in the development of ASPs. Water traffic affects the extent and type of waterway monitoring that may be employed and the designation of vessel traffic service (VTS) areas (described in Section 4.3.1). Harbor traffic can also impact ferry vessel movements. Small pleasure crafts and windsurfers can cause delays to ferries, particularly on weekends. These conditions may result in congestion, which is synonymous with a higher-risk environment, forcing vessels to reduce travel speeds and perhaps post additional lookout watches on deck. In some cases, local authorities increase the burden by designating specific directions of travel. This means that vessels traveling in a certain direction must yield to vessels traveling in the other direction. Each of these delays is considered part of a vessel's travel time to its destination. The interrelationship between travel time and security is that the longer a vessel is on the water, the more time the crew would have to handle a security incident away from immediate response of local emergency responders.

3.4 Ownership/Operation

A mix of private and public owners and operators run and maintain the USFS. Rules and regulations that apply to ferries make no distinction in ownership, however. Because publicly owned ferry systems are generally larger than private systems, size-based regulations affect more publicly owned services. Ownership may also affect financing for implementation of security requirements. For publicly owned vessels and facilities, the title for the vessel or for the terminal is held by a federal, state, county, town, or other local government. For privately owned vessels or facilities, the title for the vessel or terminal is held by one or more private entities. Regardless of the ownership, operation of the ferry system may be contracted to either a government or private entity. Oftentimes, systems that are both privately owned and operated are under state public utility commission (PUC) oversight.

As shown in Table 7, 68 million passengers, or 65% of the passengers, and 30 million vehicles, or 84% of the vehicles transported annually by ferry, travel on publicly owned and publicly operated

Table 7. U.S. ferry operations by type of ownership and passenger/ vehicle volume.

Type of Ownership	Number of Operations	Annual	
		Passengers (millions)	Vehicles (millions)
Publicly Owned/Publicly Operated	63	68	30.0
Publicly Owned/Privately Operated	17	3	0.5
Privately Owned/Publicly Operated (under contract)	13	3	0.2
Privately Owned/Privately Operated	115	30	5.0

Source: *TCRP Report 100: Transit Capacity and Quality of Service Manual*, 2nd Edition, Transportation Research Board, 2004.

systems. However, these public systems make up only 30%, or 63, of the total number of U.S. ferry operations. Privately owned and operated systems carry 30 million passengers, or 29% of the passengers, and 5 million vehicles, or 14% of the vehicles that travel by ferry, while mixtures of public and private ownership and operation carry just 6% of the passengers, and 2% of the vehicles transported by ferry.

CHAPTER 4

Security Regulations and Guidance

Vessels and facilities may be required to have approved security plans under either international or national law. Guidance and background information for achieving compliance with the national regulations is provided in several different types of publications. This chapter briefly discusses international and national security regulations and federally published guidance for meeting these regulations. The final section of this chapter describes regulations for VTSs and automatic identification systems (AISs), both of which were initiated primarily for safety reasons but have security implications.

4.1 International Vessel and Terminal Security Regulations

Security at sea has long been a concern of governments, shipping lines, port authorities, and importers and exporters as a result of piracy and smuggling. However, the 9/11 terrorist attacks stimulated the International Maritime Organization (IMO) within the United Nations to develop more stringent, international security measures, called the International Ship and Port Facility Security (ISPS) code. In December 2002, this code was incorporated into the existing Safety of Life at Sea (SOLAS) convention as amendments to Chapters V and XI. Thus, the ISPS code applies to vessels and facilities of the 163 signatory nations of the SOLAS convention, including the United States, as well as ships that call on ports of contracting nations. It specifically applies to ships engaged in international voyages, including

- Passenger ships,
- Cargo ships of at least 500 gross tonnage,
- Mobile offshore drilling units, and
- Port facilities serving ships engaged on international voyages.

The ISPS code does not apply to warships, naval auxiliaries, or other ships owned or operated by a SOLAS signatory government and used only on government non-commercial service.

The ISPS code establishes an international framework for cooperation between the signatory nations' government agencies, local administrations, and shipping and port industries on ships and port facilities used in international trade. This co-operation is for the detection of security threats, establishment of preventive measures against security incidents, and establishment of relevant roles and responsibilities at the national and international level. The ISPS code requires the establishment of security levels and compliance of all ships with the security-level requirements of the government that has jurisdiction over the water the vessel is in. In addition, for each ship and port authority affected, the ISPS code requires the following:

- Ship security plan,
- Port facility security plan,
- Ship security officer,
- Company security officer,
- Port facility security officer,
- Ship alarms, and
- Shipboard AISs.

As described in the following sections, the ISPS code is implemented in the United States by a concurrently developed congressional act and its ensuing regulations.

4.2 National Vessel and Terminal Security Regulations and Guidance

A near-equivalent of the ISPS code was enacted in the United States when the U.S. Congress passed the Maritime Transportation Security Act (MTSA) in 2002, which is reenacted every 2 years to facilitate timely amendments. The MTSA is implemented by the U.S. Coast Guard, which publishes its regulations in the Code of Federal Regulations (CFR). Guidance for meeting Coast Guard regulations is published as Maritime Security (MARSEC) directives, and Navigation and Vessel Inspection Circulars (NVICs). Each of these publication types is described below, followed by a brief summary of references for development of U.S. Coast Guard–approved security plans.

4.2.1 The Code of Federal Regulations (CFR)

In 2003, the U.S. Coast Guard published new security plans and security officer regulations in 33 CFR Parts 101 to 106. All regulations published in the CFR are initially published in the *Federal Register.* The preambles of the July 1, 2003, and October 22, 2003, *Federal Register* sections that address 33 CFR contain information that is not in the body of the regulatory text. This information provides further background and explains the new regulation's purpose, thereby maybe assisting in interpretation of the regulations.

Overall security is achieved by applying compartmentalized security processes to terminal and vessel segments. All operations prior to boarding are the responsibility of the facility security officer. Once passengers are on a vessel, they become the responsibility of the vessel security officer and the captain. In addition to requiring approved vessel and facility security plans that are based on security assessments, 33 CFR 104 and 105 call for

- Designation of facility and vessel security officers,
- Training of personnel on the security plan,
- Annual security exercises and security drills,
- Records of security system and equipment maintenance per manufacturer recommendations,
- Security measures that are scalable to MARSEC levels,
- Declarations of security that delineate responsibilities during vessel-to-facility interfaces, and
- Compliance with previously existing regulations.

MARSEC levels are discussed in greater detail in Appendix B. Preexisting security regulations that apply to the USFS are found in

- 33 CFR 26, 162, and 164 (which deal with AIS, addressed in Section 4.3.2 below);
- 33 CFR 161 (which deals with VTS, addressed in Section 4.3.1 below);
- 33 CFR 165 (which deals with regulated navigation and limited access areas);

- 33 CFR 120 and 128 (which deal with security of vessels; CFR 120 is under revision);
- 33 CFR 160 (which deals with administrative procedures, reporting and record-keeping for harbors, notice of arrival rules, hazardous materials, marine safety, and navigation);
- 46 CFR 701 (which deals with port security);
- 46 CFR 2 (which deals with marine safety, security, reporting, and vessels);
- 46 CFR 31 (which deals with cargo vessels, inspection and certification, and security);
- 46 CFR 71 (which deals with passenger vessels, inspection and certification, and security); and
- 46 CFR 91 (which deals with vessel inspection and certification).

For vessel and facility security plans (i.e., 33 CFR 104 and 105), alternative security programs (ASPs) can be approved by the U.S. Coast Guard for facility or vessel associations or large fleets. For example, the Passenger Vessel Association (PVA) has an approved vessel security plan that is used by many of its 300 members, representing over 2,000 vessels. Other ASPs approved by the U.S. Coast Guard have been developed by the American Waterway Organization (an association of inland and coastwise tug/barge operators) and the American Gaming Association (an association for riverboat gaming operators). ASPs are designated as sensitive security information (SSI), as are all vessel and facility security plans developed under these regulations. Regardless of whether an ASP is used, a security assessment must be conducted for all vessels and facilities for which 33 CFR 104, 33 CFR 105, or SOLAS are applicable.

4.2.2 Maritime Security (MARSEC) Directives

MARSEC directives are issued by the commandant of the Coast Guard to provide vessels and facilities with performance standards regarding access control and the secure handling of cargo. These directives do not impose new requirements, but they provide performance standards for meeting the regulations.

MARSEC directive numbering incorporates the applicable CFR subsection topic number and the sequential numbering of the document. For example, 105-2 means the information pertains to 33 CFR 105 (maritime facility security) and that it is the second directive issued for maritime facility security. For ferry owners and operators, the most pertinent directives are MARSEC Directive 104-5, which applies to passenger vessels and ferryboats and supersedes the earlier MARSEC Directive 104-2, and MARSEC Directive 105-2, which applies to facilities that receive foreign passenger vessels and ferryboats. MARSEC Directive 104-6 applies to vessels in high-risk waters and thus may apply to some ferry operations. Other MARSEC directives apply specifically to cruise ships (104-1), cargo and towing vessels (104-3), and mobile offshore drilling units (104-4).

Information within the MARSEC directives is designated as SSI and is not subject to public release. The Captain of the Port (COTP) determines which MARSEC directives are relevant for a particular operation. Designated company, vessel, and facility security officers obtain copies of these directives after contacting their COTP and signing a non-disclosure agreement.

4.2.3 Navigation and Vessel Inspection Circulars (NVICs)

NVICs provide detailed guidance on the enforcement of or compliance with federal marine safety regulations and Coast Guard marine safety programs. NVICs are available to the general public. They do not have the force of law, but they provide important information on how to achieve regulatory and program compliance. NVICs ensure that Coast Guard inspections and other regulatory actions are consistently conducted and are directed primarily to Coast Guard personnel. However, they also assist the marine industry and the general public in understanding how certain regulations will be enforced and how marine safety programs will be conducted.

NVICs address a wide variety of subjects, including vessel construction features, mariner training and licensing requirements, inspection methods and testing techniques, safety and security procedures, requirements for certain Coast Guard regulatory processes, manning requirements, equipment approval methods, and special hazards. NVICs are numbered consecutively by year. For example, NVIC 04-03 would be the fourth NVIC issued in 2003. Table A2 in Appendix A summarizes security-related NVICs that may affect the USFS.

4.2.4 References for the Development of a U.S. Coast Guard–Approved Security Plan

For the development of vessel security plans, NVIC 04-03 should be considered, along with 33 CFR 101 and 104, and the MARSEC directives for CFR 101 and 104. For the development of facility security plans, NVIC 03-03 should be considered, along with 33 CFR 101 and 105 and the MARSEC directives for CFR 101 and 105. In addition, as mentioned above, the preamble of the July 1, 2003, and October 22, 2003, *Federal Register* may be helpful and is recommended by various organizations (e.g., the American Association of Port Authorities) to be considered during security plan development. Vessels and facilities that can adopt an approved association security plan under the alternative security program (ASP) allowance of 33 CFR 104 and 105 may have reduced need for these references, but prudence would suggest knowledge of their contents because even within an ASP, security plans must be individualized for each vessel and facility.

All vessels and facilities that are required to either develop approved security plans or an ASP must first conduct vulnerability assessments. Guidance for these assessments are provided in the preamble to the July 1, 2003, and October 22, 2003, *Federal Register;* in NVIC 10-02; and in documents by various associations, such as the Passenger Vessel Association's "Risk Guide." The Transportation Security Administration (TSA) has also developed a tool for conducting maritime vulnerability assessments, the Vulnerability Identification Self-Assessment Tool (VISAT) for maritime (previously known as the TSA Maritime Self-Assessment Module, or TMSARM). This may be obtained at the request of a company, vessel, or facility security officer at http://www.tsa.gov/public/display?content=09000519800d6843. The approved security plan must address each of the identified vulnerability areas. An annual audit must also be performed to establish that protective measures are working and to identify and mitigate any new vulnerabilities. Any new countermeasures taken must be amended to the existing security plan, and the COTP must be notified of these changes.

4.3 Safety Regulations with Security Implications

The following sections describe vessel traffic services (VTSs) and automatic information systems (AISs). AISs are based on newer technology than was initially employed in VTS areas. AISs are expected to be ultimately implemented throughout all waterways. Both of the sections below are condensed from information on the U.S. Coast Guard websites http://www.navcen.uscg.gov/mwv/vts/vts_home.htm (for VTS) and http://www.navcen.uscg.gov/enav/ais/default.htm (for AIS).

4.3.1 Vessel Traffic Service (VTS)

VTS provides active monitoring, information services, traffic organization, and navigational assistance for vessels in designated areas, similar to air traffic control. U.S. Coast Guard VTS regulations are in 33 CFR 161. There are two main types of VTS, surveilled and non-surveilled. Surveilled systems consist of one or more land-based sensors (i.e., radar, AIS, and closed-circuit television sites) that output their signals to a central location where operators monitor and man-

age vessel traffic movement. Non-surveilled systems consist of one or more reporting points at which ships are required to report their identity, course, speed, and other data to the monitoring authority. The U.S. Coast Guard authority to establish VTS with requirements for electronic devices was initially provided in the Ports and Waterways Safety Act of 1972 (PWSA), Title 33 USC §1221. The PWSA was a response to the collision of the tankers Arizona Standard and Oregon Standard under the Golden Gate Bridge in 1971, with the intent to establish good order and predictability on waterways by implementing fundamental management practices. Subsequently, the U.S. Coast Guard began to establish VTSs in critical congested ports, where ships must report their position, identity, and intentions to the vessel traffic center. A VHF-FM communications network forms the basis of a VTS, in which transiting vessels report to the vessel traffic center (VTC) by radiotelephone and are in turn provided with navigational safety information.

In 1972, the first formal VTSs were established in San Francisco (California) and Puget Sound (Seattle). The VTS of Louisville, Kentucky, which is only activated during high water in the Ohio River (approximately 50 days per year), was started in 1973. Additional systems were established in Houston-Galveston (Texas), Prince William Sound (Alaska); Berwick Bay (Louisiana), and the St. Mary's River at Sault Ste Marie (Michigan). New Orleans and New York provided services on a voluntary basis throughout the 1970s and 1980s, but these operations were curtailed in 1988 because of budgetary restraints. In 1990, however, the Oil Pollution Act, a response to the Exxon Valdez oil spill, mandated participation in all existing and future VTSs. More information on each of the nine U.S. Coast Guard–designated VTS areas can be obtained at http://www.navcen.uscg.gov/mwv/vts/locations.htm#VTS_LALB.

Today, many VTS areas employ a variety of sensors and communications systems, including a network of radars and closed-circuit television cameras for surveillance and computer-assisted tracking. Many of the current technology AIS requirements discussed below began being phased into VTS areas during the 1990s. Each VTS publishes specific AIS requirements, with phased implementation plans. While not a specific criterion for VTS designation, the nine currently designated VTS areas include all ferry systems with an annual ridership of 500,000 or more.

4.3.2 Automatic Identification System (AIS)

An AIS is a shipboard broadcast system that allows vessel operators to more easily identify the position and heading of their vessel in relation to other vessels navigating in the area. It allows shore-based AIS stations to more easily monitor the location and heading of vessels in their area. The adoption of these systems is currently being phased in.

An AIS includes a position-indicating transponder and an electronic charting or situation display for accessing the information made available by the transponder system. It operates in the VHF maritime band and is capable of handling over 4,500 reports per minute and updates as often as every 2 seconds. When fully developed, AIS has the ability to provide a shipboard radar display with overlaid electronic chart data that include a mark for every significant ship within radio range, along with a velocity vector (indicating speed and heading). Each ship "mark" could reflect the actual size and GPS location of the ship. Classification, call sign, registration number, and other information could be displayed by "clicking" on a ship mark, ship name, course, and speed. Maneuvering information, closest point of approach (CPA), time to closest point of approach (TCPA), and other navigation information that is more accurate and timely than information available from an automatic radar plotting aid could also be available. Previously, this type of information has been available only to some VTS operations centers, but it will become available to every AIS-equipped ship. Shore-based AIS stations can provide text messages, time synchronization, meteorological and hydrological information, navigation information, and position of vessels.

The AIS transponder normally works in an autonomous and continuous mode, regardless of whether it is operating in the open seas or coastal or inland areas. AIS stations continuously synchronize themselves to each other to avoid overlap of slot transmissions. The system coverage range is similar to other VHF applications, essentially depending on the height of the antenna. AIS's propagation is slightly better than that of radar because of the longer wavelength, so it is possible to "see" around bends and behind islands if the land masses are not too high. A typical value to be expected at sea is nominally 20 nautical miles. With the help of repeater stations, the coverage for both ship and VTS stations can be improved considerably. In the event of system overload, only vessels or ships farther away will be subject to drop-out in order to give preference to nearer vessels or ships that are a primary concern to ship operators. In practice, the capacity of the system is nearly unlimited, allowing for a great number of ships to be accommodated at the same time.

The U.S. Coast Guard published a final rule in the October 22, 2003, *Federal Register* that harmonized the AIS mandates in SOLAS and the MTSA. AIS requirements of the MTSA are delineated in 33 CFR 162.46. Currently, AIS units are required for the following passenger vessels:

- All passenger vessels of 150 gross tons or more that are on international voyages as of July 1, 2003 (this requirement endorses SOLAS requirements for AIS) and
- All passenger vessels with capacities greater than 150 passengers and navigating in VTS zones designated in 33 FR 161.12 as of December 31, 2004.

Thus, the Coast Guard is initially implementing AIS in VTS areas and for international voyages. However, areas and vessels required to have AIS units are expected to increases over time. NVIC 8-01 describes the certification process for AIS and other navigation equipment described under SOLAS. The Federal Communications Commission is currently developing rules for equipment authorization that, when finalized, will supersede NVIC 8-01.

"Class A" AIS units meet International Maritime Organization (IMO) requirements for specific broadcasts regarding position, navigation, and identification—both while underway and at anchor—to be able to both receive and transmit text messages. Vessels that must meet SOLAS requirements must have Class A equipment. Units that do not meet Class A requirements are able to broadcast position, course, and speed without the input of an external positioning device (e.g., differential global positioning system [DGPS]). Additional external devices (e.g., transmitting heading device, gyro, and rate-of-turn indicator) are recommended for vessels with these units, but are not required except as needed to meet SOLAS requirements for vessels in international voyages.

The International Electrotechnical Commission (IEC) has established a "Class B" certification standard. Class B units provide less extensive navigational information than a Class A unit, only receive (not transmit) text messages, and provide less vessel identification and descriptive information than a Class A unit provides.

CHAPTER 5

Common USFS Threats

5.1 Introduction to Common Threats

The same characteristics that make the USFS desirable (i.e., the wide extent of service and the popularity of use) also make it a potential target and a potential instrument of a terrorist act. The appeal of the USFS to terrorists may be in the potential use of vessels and facilities as a primary target, as a secondary target of a terrorist act committed against another target, and as an instrument of a terrorist act. Operational characteristics of the system, such as the need to move a large number of people on a tight schedule, increase the system's security vulnerability and present unique security requirements and challenges. Because the characteristics and operations of the USFS vary widely, different operations and ferry system components face different levels of threats with different probabilities of occurrence. However, overall, the USFS is regarded as a relatively high-risk and high-probability target facing unspecified threats of unknown intensity and timing. In the words of a New York City ferry system employee, "ferries are perfect targets and perfect security challenges."

The measure of threat "is based on the analysis of the intention and capacity of an adversary to undertake actions that would be detrimental to an asset or population."[1] The potential threat against the USFS is an assumed threat based on expressed but general indications of intent to cause harm to U.S. citizens; circumstantial information that indicates a willingness to attack the USFS (e.g., noted surveillance of the Washington State Ferry System); and other events that indicate both the intent and capacity of the adversary to undertake such actions (e.g., 9/11 and the USS Cole). However, at the time of this writing, the threats to the USFS remain only potential because they are neither clear nor specific.

The purpose of this chapter is to explore, in a summary format, the common threats to the USFS and threats to others that could materialize if the USFS were to be used as an instrument of a terrorist act (ITA).

Security regulations, per 33 CFR 104 and 105, cover vessels and facilities by identifying six specific security measures that a ferry system owner/operator needs to apply to address the potential threat and to maintain an appropriate level of security:

1. **Access control**—to prevent unauthorized entry and the introduction of devices and acts that would damage or injure people or property.
2. **Restricted areas**—to prevent and deter unauthorized persons from accessing sensitive areas of the ferry system.
3. **Handling of cargo**—to ensure the safe and secure handling of cargo.
4. **Delivery of vessel stores and bunkers**—to deter people from tampering, contaminating, and using vessel stores and bunkers as a tool or means of injuring people and damaging property.

5. **Monitoring**—to have the capability to continuously monitor vessels and facilities in accordance with the owner and operator's security plan.
6. **Security incident procedures**—to coordinate incident procedures with local, state, and federal authorities, including procedures for securing and evacuating vessels.

While these six security measures are specifically enumerated by 33 CFR and point to areas of concern, they do not readily lend themselves to identifying specific threat areas or locations within the ferry system. A report produced for the U.S. Coast Guard by Internet Protocol Telephony (IPT) titled, "Scenario Selection for Ferry Special Assessment," identified 10 security locations within ferry systems to help define area-specific threats. Based on discussions with ferry operators, SAIC has edited these locations to create 11 security locations:

- **Location 1: Beyond site boundary**—shore-side areas that may or may not directly relate to the ferry system but are of interest from a security perspective. Examples may include roads, buildings, approaches to the ferry, connections to other modes of transportation (bus, subway, etc.), bridges, tunnels, other points where people congregate, tall structures that can be used for observation and planning, and adjacent assets that can affect an event (e.g., stored fuel).
- **Location 2: Facility perimeter**—the shore-side property boundary, which may or may not be clearly marked (e.g., with a fence).
- **Location 3: Vehicle parking**—shore-side vehicle parking as distinct from vehicle holding prior to loading (i.e., Location 4, below). Vehicle parking includes both restricted parking areas and public parking areas.
- **Location 4: Vehicle holding**—shore-side area for parking and screening vehicles (e.g., cars, trucks, and railcars) prior to loading them onto a ferry. Note that this location is not applicable to passenger-only ferries.
- **Locations 5: Passenger waiting area**—shore-side areas for passenger drop-off and pick-up, bus stop, subway stop, and so forth. This location may also include ticketing and screening areas.
- **Location 6: Terminal operations**—shore-side areas for operation control that are not for general passengers (e.g., fueling, administration, and communications areas).
- **Location 7: Adjacent to ferry (shore-side)**—shore-side areas within approximately 30 feet of ferry vessels or their path. These areas may or may not have restricted access. Depending on the facility, this area may or may not overlap with passenger waiting and vehicle parking or holding areas.
- **Location 8: Adjacent to ferry (water-side)**—water-side areas within approximately 30 feet of ferry vessels or their piers. These areas may or may not have restricted access. In some cases, private boats and commercial boats are located close to ferry terminal facilities and share water-side and shore-side access.
- **Location 9: On-board (non-restricted)**—areas on the ferry designated for passenger access.
- **Location 10: On-board (restricted)**—areas on the ferry designated for access by ferry system personnel. Certain areas are restricted to specific personnel only (e.g., pilot and security personnel).
- **Location 11: In transit**—areas surrounding a ferry while it is operating on a route or otherwise in transit. This location includes areas below the water surface (e.g., diver or mine), from the air (e.g., airplane or plume of gas), and from land (e.g., top of a bridge or building).

The above locations are used to assist in the assessment of specific threat types to the USFS, although it should be recognized that because ferry operations vary within the USFS, not all of the listed locations apply to all operations.

In the assessment of potential threats to the USFS, three general threat categories are examined for each of the 11 security areas:

1. **Incendiary and explosive devices (IEDs)**—for example, planted in a facility or on a suicide bomber, car, truck, underwater mine, or fuel container.
2. **Acts of force**—for example, hijacking or commandeering a vessel or facility. Acts of force may include use of firearms, knives, or other weapons or use of physical impact (e.g., ramming) to inflict injury to persons or damage a vessel or facility.
3. **Chemical, biological, and radiological (CBR) agents**—for example, chlorine, anthrax, and dirty bombs.

The following three sections apply the three threat categories to the 11 security areas to form a summary threat identification and review.

5.2 Explosives and Incendiaries

The use of explosives and incendiaries (e.g., TNT, C-4, and flammable chemicals and gases) to commit acts of terrorism has been relatively common in recent decades. Improvised explosive devices (IEDs) have been particularly common in regions with high levels of terrorism (e.g., the Middle East). In addition to explosives, fuel tanks represent a common incendiary that could be used to create fire or explosion. IEDs may be used to cause physical damage, loss of life, and mass fear. They may be delivered by a variety of means:

- **By person**—including suicide bombers; people setting remotely detonated, time-detonated, or sensor-detonated IEDs; people creating IEDs (e.g., igniting fuel or creating electrical fires); people concealing IEDs in hand baggage, and so forth. (Note: use of IEDs with the intent to commandeer or hijack a facility or vessel is addressed below in Section 5.3, Acts of Force.)
- **By vehicle**—including cars, trucks, or railcars. Vehicles may conceal diesel, fertilizer, liquefied natural gas (LNG), gasoline, and other IEDs. Large cars can accommodate up to about 1,000 pounds of explosives without significant modifications and more with significant modifications of the suspension. Trucks may deliver thousands of pounds of explosive material to destroy buildings, large vessels, and so forth. Delivery by truck (e.g., as in the Oklahoma City bombing, the first World Trade Center bombing, and the Beirut marine barracks) is the most common mode of IED delivery.
- **By vessel**—including boats or other floating vessels (e.g., USS Cole style).
- **As an artillery**—including rocket-propelled grenade (RPG) launchers. While RPGs may be legally obtained in the United States, ammunitions may enter the country only through illegal means. RPGs may be fired from the shore or from passing boats.
- **Underwater**—including IEDs that divers attach to the hull, mines that divers place in the path of a ferry, and so forth.
- **Overhead**—including IEDs that are dropped from bridges or cliffs, light aircrafts, commercial airliners, remotely controlled aircrafts, helicopters, and so forth.

The threat of IEDs differs widely by ferry system and other characteristics. To determine the vulnerability of each security area to each type of threat, the ferry operation needs to conduct a vulnerability assessment that takes into consideration the particular conditions and characteristics of the ferry system, including operational and site-specific security measures.

Table 8 presents hypothetical relative vulnerabilities among security areas for IED delivery. Tables such as this may assist ferry operators in selecting areas for concentration of specific preventive measures.

While an assessment such as that shown in Table 8 will vary among ferry systems, in general, IED carried on people into the system pose a relatively moderate to high threat in more areas

Table 8. Hypothetical relative vulnerability of security areas to IEDs. (Comparisons valid only within each column.)

LOCATION	IED Delivery Mode					
	Person	Vehicle	Vessel	Artillery	Mine	Overhead
1. Beyond Site Boundary	M	M	N/A	L	N/A	**
2. Facility Perimeter	M	H	N/A	L	N/A	**
3. Vehicle Parking	H	H	N/A	M	N/A	**
4. Vehicle Holding	M	H	N/A	L	N/A	**
5. Passenger Waiting Area	H	M	N/A	L	N/A	**
6. Terminal Operations	M	L	N/A	H	N/A	**
7. Adjacent to Ferry (Shore-side)	H	L	N/A	H	N/A	**
8. Adjacent to Ferry (Water-side)	M	L	H	H	H	**
9. On-Board (Non-restricted)	H	L*	N/A	L	N/A	**
10. On-Board (Restricted)	M	H*	N/A	L	N/A	**
11. In Transit	L	L	H	H	M	**

H = high; M = medium; L = low; and N/A = not applicable mode for this security area.
* Assumes that on-board cargo area, including vehicle storage area, is restricted.
** Assumes similar vulnerability among security areas without specification of a particular mode.

than any other mode of IED delivery because, carried as such, IEDs may be precisely placed in the greatest variety of areas to yield the highest consequences. The flexibility in placement of personally carried IEDs should not be confused with the relative probability of placement among delivery modes. Historically, the most common mode of IED delivery in the United States has been on trucks. Hence, the use of an analysis such as that presented in Table 8 should be restricted to assisting in determining the number of preventive measures installed in each area for a specific threat on delivery-mode basis. Such an analysis should *not* be used to assess the extensiveness of preventive measures between threat types or delivery modes.

5.3 Acts of Force

Acts of force are perhaps the oldest type of threat in the maritime industry. These include attacks that may be directed to either shore-side facilities or the vessel itself. There are two general acts of force:

- **Commandeering**—seizing control of a portion or all of a facility or vessel for the purpose of piracy or hijacking. This act is commonly carried out with the use (or threatened use) of firearms; knives; IEDs; chemical, biological, or radiological agents; or other weapons.
- **Ramming**—driving a vehicle, vessel, or aircraft into a vessel or shore-side facility. A ferry may be rammed or commandeered for ramming. This act may involve the use of IEDs or chemical, biological, or radiological agents, but the initial portion of the attack—the ramming itself—is an act of force.

Table 9 presents hypothetical relative vulnerabilities among security areas for acts of force. The delivery mode in the table refers to either the commandeering object (i.e., vessel or facility) or the object used for ramming. An assessment such as that shown in Table 9 will vary among ferry systems. As with Table 8, the use of an analysis such as that presented in Table 9 should be

Table 9. Hypothetical relative vulnerability of security areas to acts of force. (Comparisons valid only within each column.)

LOCATION	Act of Force Delivery Mode				
	To:		By:		
	Facility	Vessel	Vehicle	Vessel	Overhead
1. Beyond Site Boundary	L	N/A	L	N/A	L
2. Facility Perimeter	L	N/A	H	N/A	L
3. Vehicle Parking	M	N/A	H	N/A	L
4. Vehicle Holding	M	N/A	H	N/A	M
5. Passenger Waiting Area	H	N/A	M	N/A	H
6. Terminal Operations	H	N/A	M	N/A	M
7. Adjacent to Ferry (Shore-side)	H	M	M	N/A	M
8. Adjacent to Ferry (Water-side)	M	H	N/A	H	M
9. On-Board (Non-restricted)	N/A	M*	N/A**	N/A	L
10. On-Board (Restricted)	N/A	H*	L**	N/A	L
11. In Transit	N/A	M	N/A	H	L

H = high; M = medium; L = low; and N/A = not applicable mode for this security area.
* Assumes that navigational controls are in restricted areas.
** Assumes that on-board cargo area, including vehicle storage, is restricted.

restricted to assisting in determining the number of preventive measures installed in each area on a specific threat or delivery mode basis. Such an analysis should *not* be used to assess the extensiveness of preventive measures between threat types or delivery modes.

5.4 Chemical, Biological, and Radiological (CBR) Agents

Many forms of CBR agents may be used to threaten the USFS. Although the effects of these agents vary greatly, as do the detection measures, the areas in which they may be released and the relative vulnerability of these areas may be quite similar. CBR agents may be delivered by active or passive modes, as described below.

- **Active delivery**—a release that can be quickly recognized, although the type of agent may not be immediately known. Examples of active delivery include colored or odiferous gases or liquids leaking from a container in a monitored area or from the HVAC system, and a CBR agent released during an explosion. In these examples, tests for CBR agents may be quickly conducted to determine at least the general type of release agent, although detailed identification may take up to several days.
- **Passive delivery**—a release that cannot be quickly recognized, such as the release of a non-odiferous agent through the HVAC system; release of a tasteless, colorless agent in the water supply; or another means of general dispersal of an agent that cannot be detected by sight, taste, or smell.

Table 10 shows hypothetical relative vulnerabilities among security areas for active and passive releases of CBR agents. As with Tables 8 and 9, analyses such as that presented in Table 10 should be used only to assist in determining the number of security measures installed in each area for a specific threat delivery mode. Such analyses should *not* be used to assess the extensiveness of

Table 10. Hypothetical relative vulnerability of security areas to CBR agents. (Comparisons valid only within each column.)

LOCATION	CBR Delivery Modes		
	Chem	Bio	Rad
1. Beyond Site Boundary	L	L	L
2. Facility Perimeter	M	M	M
3. Vehicle Parking	M	M	M
4. Vehicle Holding	H	H	H
5. Passenger Waiting Area	H	H	H
6. Terminal Operations	M	M	M
7. Adjacent to Ferry (Shore-side)	M	M	M
8. Adjacent to Ferry (Water-side)	M	M	M
9. On-Board (Non-restricted)	H	H	H
10. On-Board (Restricted)	H	H	H
11. In Transit	M	M	M

H = high; M = medium; L = low; and N/A = not applicable mode for this security area.

security measures between threat types or delivery modes. The relative vulnerabilities among security areas in Table 10 are for the initial release of a CBR agent within the ferry system. These vulnerabilities may not vary among CBR agents; however, CBR agents have been retained as separate columns for better assessment of particular scenarios that may develop, such as a CBR attack outside the USFS that may be transported through the ferry system.

Notes

1. Guidance on Risk Analysis and Management for Critical Asset Protection: *Asset Application Handbook, Prototype for Chemical Process Industry,* ASME, Draft, Page 42, July 30, 2004.

APPENDIX A

Summary of Regulations and Guidance

Table A1. Summary table of maritime security policy and its impact on the USFS.

Year Enacted	Title of Legislation	Objective of Legislation	Impact on the USFS
2001	International Ships & Port Facility Security (ISPS) Code	Created requirement for certain types of vessel and maritime facilities to have security plans and undertake other security-related activities to prevent maritime terrorism.	Significantly increased international security requirements for vessels and maritime facilities.
2002	Maritime Transportation Security Act (MTSA)	Established security protection measures to enhance the security of vessels, facilities, cargo, and people at U.S. ports.	Mandated numerous security measures to include specific types of passenger vessels and maritime facilities. Also, required the U.S. Coast Guard to implement security programs to evaluate and identify security issues and mitigate vulnerabilities by implementing security protective measures.
2003	33 CFR Navigation and Navigable Waters, Chapter I, Subchapter H—Maritime Security, Parts 101 and 103-106	Established an organizational, operational, and administrative structure for the implementation of security protective measures within the maritime industry.	Obligated passenger vessels and facility owners/operators meeting specified criteria to implement and follow maritime security guidelines. Each part addressed a specific maritime security topic: Part 101: General Security Part 103: The AMS Committee Part 104: Vessel Security Part 105: Facility Security

Sources: Federal Highway Administration. *Transportation Equity Act for the 21st Century* (TEA-21), http://www.fhwa.dot.gov/tea21/, and U.S. Coast Guard, *Maritime Transportation Security Act (MTSA) 2002*, http://www.uscg.mil/hq/g-m/mp/mtsa.shtml.

Table A2. Summary table of security-related NVICs and their impact on the USFS.

NVIC Number	Title of NVIC	Impact on the USFS
02-05	International Port Security (IPS) Programs	Outlines procedures for conducting the International Port Security (IPS) Program, details the process for conducting information exchanges with other countries to learn how they are implementing the ISPS Code.
03-03 Change 1	Implementation Guidance for the Regulations Mandated by the Maritime Transportation Security Act (MTSA) of 2002 for Facilities	Provides guidance detailing the Facility Security Plan review process and compliance inspection information and clarifies MTSA guidance mandated in 33 CFR 105.
04-02	Security for Passenger Vessels and Passenger Terminals	Establishes new guidance for developing security plans and implementing security measures for passenger vessels and terminals.
04-03	Guidance for Verification of Vessel Security Plans on Domestic Vessels in Accordance with the Regulations Mandated by the Maritime Transportation Security Act (MTSA) of 2002 and International Ship & Port Security (ISPS) Code	Provides guidelines for implementing the security regulations mandated by MTSA 2002 and the ISPS Code and guidance for conducting verification inspections of affected U.S. vessels operating in domestic waters.
06-03 Change 1	Coast Guard Port State Control Targeting and Boarding Policy for Vessel Security and Safety	Part 1 provides updated procedures for risk-based vessel targeting, reporting, notification, boarding, and control and enforcement, including revised examination checklists. Part 2 provides updated enclosures to NVIC 06-03.
06-04	Voluntary Screening Guidance for Owners and Operators Regulated under Parts 104, 105, and 106 of Subchapter H of Title 33, Code of Federal Regulations	Provides guidance on the development and implementation of a screening regime for vessels and facilities. An overview of what owners and operators should consider is provided. Other equivalent methods are permitted.
09-02 Ch-1	Guidelines for Development of Area Maritime Security Committees and Area Maritime Security Plans Required for U.S. Ports	Provides guidance on the development of area maritime security (AMS) committees and area maritime security plans, describes responsibilities of the Captain of the Port acting as the Federal Maritime Security Coordinator, provides a template for the AMS plan, and addresses port security issues shared by stakeholders and the AMS committees.
10-02	Security Guidelines for Vessels	Provides recommendations for performing security assessments, developing security plans, and implementing security measures and procedures.
10-04	Guidelines for Handling Sensitive Security Information	Provides maritime industry guidance on the access, safeguarding, and disclosure of information to ensure transportation security.
11-02	Recommended Security Guidelines for Facilities	Provides guidance on developing security plans, procedures, and measures for facilities.
12-04	Maritime Security Compliance and Enforcement for U.S./Canadian Boundary and Coastal Waters	Establishes maritime security procedures for vessels operating in the boundary waters of the United States and Canada.

Source: U.S. Coast Guard, List of Issued NVICs, http://www.uscg.mil/hq/g-m/mp/nvic.html.

Other Sources of Maritime Guidance

Other sources of maritime guidance that may have security implications are described briefly below.

Local Notices to Mariners (LNMs)

LNMs are published by the U.S. Coast Guard and are the primary means for disseminating information concerning navigation issues and other items of interest to mariners on waters under U.S. jurisdiction. The LNMs are essential to all navigators for the purpose of keeping their charts, lists, coast pilots, and other nautical publications up-to-date as well as to inform the maritime community of general security information (e.g., the temporary or permanent extension or reduction of a security zone or naval vessel protective zone [NVPZ]). The LNMs may be used to disseminate maritime security information, encourage the public to report suspicious activities to their local Federal Bureau of Investigation (FBI) Joint Terrorism Task Force (JTTF) office, and so forth. The Department of Homeland Security (DHS) encourages the maritime public to report information concerning suspicious activity to their *local* JTTF office. For more information, visit the U.S. Coast Guard's "LNM Frequently Asked Questions" page at http://www.navcen.uscg.gov/faq/lnmfaq.htm.

Naval Vessel Protection Zones (NVPZs)

As a security precaution in 33 CFR 165, the U.S. Coast Guard designated concentric zones around U.S. Navy warships as NVPZs. Passenger vessels may encounter a naval warship during their travel on or near their route. Vigilance and caution on behalf of the vessel's master while in the area of the warship are necessary to ensure safe passage around or through the zone. The NVPZs surrounding all U.S. Navy ships over 100 feet in length consist of two concentric rings. The outer ring of the zone is a regulated area that encompasses a 500-yard standoff distance of water area around the naval vessel. The inner ring of the zone encompasses a 100-yard standoff distance and area surrounding the naval vessel. Zones are in force whether the vessel is moored or underway (i.e., in motion). Maritime vessels operating within the 500-yard zone, but outside of the 100-yard zone, must operate at minimum speed and proceed as directed by the naval vessel's commanding officer or official patrol. Vessels passing within the 100-yard inner ring must first contact the respective U.S. Navy or U.S. Coast Guard vessel via the designated maritime VHF-FM channel before continuing. This precaution is to ensure safe passage through the zone in accordance with the navigation rules.

APPENDIX B

Maritime Security (MARSEC) Levels

Maritime Security (MARSEC) levels are called for in 33 CFR 101.200 to increase security of facilities and vessels based on an increase in threats that could impact the maritime industry. All vessels and facilities that must meet 33 CFR 104 and 105 or SOLAS requirements must have approved plans for increasing MARSEC levels. MARSEC levels provide guidance to the maritime community and to the public of the level of risk to the maritime elements of the national transportation system. As stated in 33 CFR 101.205, MARSEC levels parallel the Department of Homeland Security (DHS) Homeland Security Advisory System (HSAS), which is designed to target protective measures when specific information to a specific sector or geographic region is received. The relationship between MARSEC and HSAS threat levels is shown in Table B1.

The mandatory requirements of MARSEC level 1 for vessels and terminals are listed in 33 CFR 104 and 105, respectively. MARSEC levels 2 and 3 are considered guidance and only applicable if they are contained in a U.S. Coast Guard–approved vessel or facility security plan. An example of various MARSEC levels and protective measures is shown in Table B2. The system is designed such that MARSEC level 1 protective measures are accomplished at the lowest security levels. Under increased security threat, MARSEC level 2 protective measures are accomplished in addition to those of Level 1, and so forth. Specific MARSEC level security measures annotated in Table B2 are generic. Actual protective measures employed within individual facilities are considered sensitive security information. The Captain of the Port (COTP) has the legal authority to increase or decrease MARSEC levels that may differ from HSAS levels based on intelligence for certain geographic areas and selective targeting of maritime interests. Additionally, when

Table B1. Relationship between MARSEC levels and the HSAS levels (from 33 CFR 101.205).

Maritime Security (MARSEC) Level	Homeland Security Advisory System (HSAS) Threat Condition Level and Corresponding Color	
MARSEC 1	Low	Green
	Guarded	Blue
	Elevated	Yellow
MARSEC 2	High	Orange
MARSEC 3	Severe	Red

Table B2. Example MARSEC levels and corresponding protection measures.

Measure	MARSEC 1	MARSEC 2	MARSEC 3
Declaration of Security	Coordinate security needs and procedures and agree upon contents of the Declaration of Security (DoS). A DoS can be effective for up to 90 days.	Revisit DoS effective period to 30 days.	No action.
Access Control and Screening	Enforce access control procedures. Randomly screen for dangerous substances and devices.	Enforce MARSEC 1 protocols. Increase screening rate and detail for dangerous substances and devices.	Enforce MARSEC 1 and 2 protocols. Screen everyone extensively for dangerous substances and devices.
Restricted Areas	Designate and post restricted areas. Restrict access to areas.	Enforce MARSEC 1 protocols. Increase intensity and frequency of monitoring access controls to areas.	Enforce MARSEC 1 and 2 protocols. Restrict access to additional areas, prohibit access to areas, and search areas.
Additional Passenger Ferry Facility Requirements	Segregate checked persons and personal effects from the unchecked. Pre-screen a percentage of loaded vessels. Deny access to restricted areas. Provide security monitors in public access areas.	Enforce MARSEC 1 protocols. Increase intensity of public area monitoring.	Enforce MARSEC 1 and 2 protocols. Assign additional security force personnel to monitor the public access area.
Cargo Handling	Check cargo and cargo spaces prior to and during handling. Match cargo documentation with shipping information. Screen specified vehicles.	Enforce MARSEC 1 protocols. Increase frequency of cargo and cargo space checks, documents, and specified vehicle screenings.	Enforce MARSEC 1 and 2 protocols. Suspend loading operations. Cooperate with other maritime entities in area. Verify inventory and locations of hazardous materials on board vessel.
Delivery of Stores and Bunkers	Check stores for integrity. Decline accepting stores/bunkers without being pre-ordered or pre-inspected. Deter tampering with stores.	Enforce MARSEC 1 protocols. Check before accepting stores/bunkers immediately upon arrival on-board.	Enforce MARSEC 1 and 2 protocols. Enhance checking of stores. Restrict delivery of stores/bunkers. Refuse to accept stores on-board.

notified of an increase in MARSEC levels by the COTP, the company must notify the COTP, within a reasonable time, that the company's facilities and vessels have attained the specific MARSEC level security.

Alternate security protective measures can be applied, as necessary, to counter a recognized deficiency or a threat. Vessel or facility owners or operators can implement such action immediately; they do not have to wait for approval or written authorization from the COTP when immediate action is necessary. However, the necessary communication between vessel and facility owners or operators should be followed up immediately through the use of administrative requests, justifications, or letters.

APPENDIX C

Glossaries of Terms and Acronyms

Table C1. Glossary of terms.

Term	Definition
Alighting	To land, to depart.
Alternative Security Program	A third-party- or industrial-organization-developed standard that the commandant has determined provides an equivalent level of security to that established by current federal and U.S. Coast Guard regulations.
Area Commander	The U.S. Coast Guard officer designated by the commandant to command a specific Coast Guard area.
Area Maritime Security Committee	The committee established to assist and advise in the development, review, and update of the area maritime security plan for its Captain of the Port zone.
Area of Responsibility	A Coast Guard area, district, marine inspection zone, or Captain of the Port zone.
Audit	An evaluation of a security assessment or security plan—performed by the owner or operator, the owner or operator's designee, or an approved third party—intended to identify deficiencies, non-conformities, and/or inadequacies that would render the assessment or plan insufficient.
Auto Equivalent Units (AEUs)	A commonly used measurement to determine auto-deck capacity to keep the vessel balanced. The measurement is based on the space that a boarding vehicle occupies compared with the space of a standard vehicle to determine weight constraints for vehicle ferries.
Automatic Identification System (AIS)	A shipboard broadcast system that acts like a transponder, operates in the VHF maritime band, is capable of handling thousands of reports per minute, and updates as often as every 2 seconds.
Breach of Security	An incident that has not resulted in a transportation security incident because security measures have been circumvented, eluded, or violated.
Captain of the Port (COTP)	The local officer exercising authority for the Captain of the Port zones. The COTP is the maritime security coordinator and the port facility security officer.
Catamaran	A vessel with twin hulls and usually a deck or superstructure connecting the hulls.
Circulator Service	A ferry service on a fixed route without a fixed schedule.
Coastal	Pertaining to services providing intercity and interisland trips on saltwater and large freshwater lakes. Travel times range from 1 hour to 1 day. Service frequency often ranges from daily to weekly.
Commandant	Commandant (i.e., head) of the U.S. Coast Guard.

Table C1. (Continued).

Term	Definition
Commuter Rail	Urban passenger train service for short-distance travel between a central city and adjacent suburbs. Commuter rail does not include heavy-rail or light-rail service.
Company	A person or entity that owns any facility or vessel subject to 33 CFR, Subchapter H.
Crew	The personnel engaged on-board ship, excluding the master and officers and the passengers on passenger ships.
Deck House	A small superstructure on the top deck of a vessel that contains the helm and other navigational instruments.
Drill	A training event that tests at least one component of the area maritime security, vessel, or facility security plan and is used to maintain a higher level of security readiness.
Equivalent Security Measure	An alternative measure that can take the place of a 33 CFR 104 and 105 required measure. Equivalent security measures must be approved by the commandant (G–MP) as meeting or exceeding the effectiveness of the required measures in 33 CFR 104 and 105.
Essential Service Routes	Routes used when no other modes of transportation are available to the specific destination serviced.
Exercise	A comprehensive training event that involves several of the functional elements of the area maritime security, vessel, or facility security plan.
Express Services	Ferry services that generally operate during peak commuter hours by both demand-based and fixed-route service.
Facility	Any structure that is located in, on, under, or adjacent to any waters subject to the jurisdiction of the United States. A facility may be used, operated, or maintained by a public or private entity, including any contiguous or adjoining property under common ownership or operations.
Facility Security Officer	The person responsible for the development, implementation, revision, and maintenance of the facility security plan. The facility security officer communicates with the COTP and company and vessel security officers.
Facility Security Plan	The plan developed to ensure the application of security measures designed to protect the facility and its servicing vessels or those vessels interfacing with the facility, their cargoes, and persons on-board at the respective MARSEC levels.
Ferry	A vessel that (a) is limited in its use to the carriage of deck passengers or vehicles, or both and (b) operates on a short-run, frequent schedule between two or more points over the most direct water route, other than in ocean or coastwise service. A ferry may also be a hovercraft, hydrofoil, or other high-speed vessel.
Ferry Service Express	Service that may operate in peak hours bypassing intervening islands. Alternatively, some trips may be operated by high-speed or passenger-only ferries as opposed to the regular ferry, which could be considered as express service of a sort.
Ferry Service Transit	A service confined to metropolitan areas and small cities where offshore islands, bays, and wide rivers preclude any other type of service at a reasonable cost. In a few places, service may operate between two points on the same shore.
Ferry Service Urban	Service where at least one terminal is within an urbanized area. Such service excludes international, rural, rural Interstate, island, and urban park ferries.
Fixed Guideways	Service in which the beginning and ending points are fixed. By law, ferryboat services are considered fixed guideways. Though each trip may take a slightly different course due to water conditions, the beginning and ending points are fixed.
Fixed Routes	Routes that have a fixed point for a beginning and end. By law, ferryboats are considered fixed guideways. Each trip may take a slightly different course, but the end and beginning are fixed points.

(continued on next page)

Table C1. (Continued).

Term	Definition
Gangway	A narrow, portable platform used as a passage by persons entering or leaving a vessel moored alongside a pier or quay.
Gross Tons	The internal cubic capacity of all spaces in and on the vessel that are permanently enclosed, with the exception of certain permissible exemptions. It is expressed in tons of 100 cubic feet.
High-Occupancy Vehicle	A highway travel lane reserved for vehicles carrying two or more passengers.
Hovercraft	A vessel used for the transportation of passengers and cargo that rides on a cushion of air formed under it. It is very maneuverable and amphibious.
Hydrofoil	A motorboat that has metal plates or fins attached by struts fore and aft for lifting the hull clear of the water as speed is attained.
Intercity	Connecting two or more cities.
Intercoastal	Describing *external* waterways that run along coasts or gulfs.
Interstate	Connecting two or more states.
Intracoastal	Describing *internal* waterways such as lakes, rivers, and harbors.
Intrastate	Connecting within a state.
Knot	The unit of speed equivalent to one nautical mile, or 6,080.20 feet per hour.
Linear Service	Ferry service with multiple stops (e.g., along a waterfront).
Marine Transportation System	A national network of waterway systems, ports, and their intermodal landside connections that allows the various modes of transportation (i.e., vessels, vehicles, and other system users) to move people and goods on the water. This system includes extensive regional and local passenger ferry systems.
Maritime Security Directive	An instruction issued by the commandant or his/her delegate mandating specific security measures for vessels and facilities that may be involved in a transportation security incident.
Maritime Security Levels	The levels reflecting the prevailing threat environment to the marine elements of the national transportation system, including ports, vessels, facilities, and critical assets and infrastructure located on or adjacent to water subject to the jurisdiction of the United States.
Maritime Transportation Security Act	Legislation passed as public law 107-295 on November 25, 2002, that implements, mandates, and regulates the security for maritime transportation vessels, assets, and facilities.
MARSEC Level 1	The level for which minimum appropriate protective security measures shall be maintained at all times.
MARSEC Level 2	The level for which moderate protective security measures shall be maintained for a period of time as a result of heightened risk of a transportation security incident.
MARSEC Level 3	The level for which maximum protective security measures shall be maintained for a limited period of time as a result of heightened risk of a transportation security incident.
Master	The holder of a license that authorizes the individual to serve as a master, operator, or person in charge of the rated vessel.

Table C1. (Continued).

Term	Definition
Metropolitan Routes	Routes located in and serving areas designated as metropolitan. These routes are used to transport individuals from one point in a metropolitan area to another. For example, New York City is a metropolitan area and the ferry systems support the transportation of the city.
Monohull	A vessel with a single hull.
Mooring Line	A cable or line to tie up a ship.
Naval Vessel Protection Zone	A 500-yard regulated area of water surrounding large U.S. naval vessels that is necessary to provide for the safety or security of these U.S. naval vessels.
Navigation and Vessel Inspection Circular (NVIC)	Detailed guidance about the enforcement of or compliance with certain federal marine safety regulations and Coast Guard marine safety programs. NVICs are non-directive, meaning that they do not have the force of law, but they are important tools for complying with the law. Non-compliance with an NVIC is not a violation of the law in and of itself; however, non-compliance with an NVIC may indicate that a law is being violated. NVICs are used internally by the Coast Guard to ensure that inspections and other regulatory actions conducted by field personnel are adequate, complete, and consistent.
Nonstop Ferry Route Segment	Direct nonstop ferry service between two locations that may or may not make up part of a greater overall multi-stop route or route system.
Owner or Operator	Any person or entity that owns or maintains operational control over any facility subject to 33 CFR Subchapter H.
Passenger Vessel	(1) On an international voyage, a vessel carrying more than 12 passengers, including at least one passenger-for-hire; and (2) on a domestic voyage, (i) a vessel of at least 100 gross register tons carrying more than 12 passengers, including at least one passenger-for-hire; (ii) a vessel of less than 100 gross register tons carrying more than 6 passengers, including at least one passenger-for-hire; (iii) a vessel that is chartered and carrying more than 12 passengers; (iv) a submersible vessel that is carrying at least one passenger-for-hire; or (v) a wing-in-ground craft, regardless of tonnage, that is carrying at least one passenger-for-hire.
Passenger-for-Hire	"A passenger for whom consideration is contributed as a condition of carriage on the vessel, whether directly or indirectly flowing to the owner, charterer, operator, agent, or any other person having an interest in the vessel" (46 CFR 2101.21a). In other words, a passenger-for-hire is a passenger who must give something (e.g., money, fuel, or labor) in exchange for being a passenger. This distinction separates business-type arrangements from friends on a boat ride.
Passenger-Only Ferries	Vessels having only passenger decks, though they may also have space for bicycles. They can range from small boats about 50 feet long holding about 50 people to the 310-foot-long Staten Island ferries in New York, which can accommodate 6,000 people. Because they do not have vehicle decks, they need not be square-ended and may be side-loading and have pointed bows. Catamaran (double hull) and hydrofoil (skimming the surface of the water) styles may be used for high-speed services.
Pilot House	The enclosed space on the navigating bridge from which a ship is controlled when underway.
Point-to-Point Ferry Route Segment/Service	Serving only two locations, in which case the route consists of a single nonstop ferry route segment.

(continued on next page)

Table C1. (Continued).

Term	Definition
Privately Owned and Privately Operated	When the title and operation of the boat and the terminal are vested by a private entity.
Privately Owned and Publicly Operated	When the title for the boat or terminal is vested in a private entity and the operation of the boat or terminal is under contract between the private and public entity.
Public Access Facility	A facility that (1) is used by the public primarily for purposes such as recreation, entertainment, retail, or tourism, and not for receiving vessels subject to part 104; (2) has minimal infrastructure for servicing vessels subject to part 104 of this chapter; and (3) receives only (i) vessels not subject to part 104 of this chapter, or (ii) passenger vessels, except (A) ferries certified to carry vehicles; (B) cruise ships; or (C) passenger vessels subject to SOLAS Chapter XI.
Publicly Owned and Operated	When the title for the boat or terminal is vested in a federal, state, county, town, township, Indian tribe, municipal or other local government and the above operate the boat or terminal.
Publicly Owned and Privately Operated	When the title for the boat or terminal is vested in a federal, state, county, town, township, Indian tribe, municipal or other local government and a private entity operates the boat or terminal.
Railroad Carfloat	A barge equipped with railroad tracks used to move rail cars across water. Typically, a tugboat tows the carfloat.
Restricted Area	The infrastructure or locations identified in an area, vessel, or facility security assessment or by the operator that require limited access and a higher degree of security protection. The entire facility may be designated the restricted area as long as the entire facility is provided the appropriate level of security.
Roll-On/ Roll-Off (RO/RO) Vessel	A vessel with ramps that allows wheeled vehicles to be loaded and discharged without cranes.
Rural Service	Service providing transportation across rivers and lakes when the construction of bridges is not warranted. Typically, these routes are short, operate on demand, carry a limited number of vehicles, and accommodate pedestrians and bicycles.
Screening	A reasonable examination of persons, cargo, vehicles, or baggage for the protection of the vessel, its passengers, and its crew. The purpose of the screening is to secure the vital government interest of protecting vessels, harbors, and waterfront facilities from destruction, loss, or injury due to sabotage or other causes of similar nature. Such screening is intended to ensure that dangerous substances and devices or other items that pose a real danger of violence or a threat to security are not present.
Seasonal Service	Service provided during a limited period each year (e.g., a ferry that runs all year except during the winter).
Security Sweep	A walkthrough to visually inspect unrestricted areas to identify unattended packages, briefcases, or luggage and determine that all restricted areas are secure.
Security System	A device or multiple devices designed, installed, and operated to monitor, detect, observe, or communicate about activity that may pose a security threat in a location or locations on a vessel or facility.
Segmented Routes	Portions of a fixed route. When a ferry stops in between the two fixed points, it has just completed a segment of the overall route.
Sensitive Security Information	A specific category of transportation security information that the Transportation Security Administration has determined must be protected from improper disclosure to ensure transportation security as defined by 49 CFR Part 1520.

Table C1. (Continued).

Term	Definition
Small-Waterplane-Area Twin Hull (SWATH)	An experimental hull configuration similar to the two-hulled catamaran, but with submerged hulls connected to the above-water deck by thin struts. This configuration allows for a wide deck and reduced drag, but is not suitable for heavy loads.
Survey	An on-scene examination and evaluation of the physical characteristics of a vessel or facility and its security systems, processes, procedures, and personnel.
Transit Bus	A bus designed for frequent-stop service with front and center doors, normally with a rear-mounted diesel engine and low-back seating, and without luggage storage compartments or restroom facilities. Transit buses include motorbus and trolley coach.
Transportation Security Incident	A security incident resulting in a significant loss of life, environmental damage, transportation system disruption, or economic disruption in a particular area.
Unaccompanied Baggage	Any baggage, including personal effects, not accompanied by a person who is boarding the vessel.
Urban Services	Services that provide trips into major cities or within their metropolitan commuting areas and experience periods of demand similar to those associated with other transportation services. Operators provide point-to-point transit or stops (e.g., across a harbor), linear service with multiple stops (e.g., along a waterfront), circulator service (e.g., fixed route, not fixed schedule), and water taxi service (e.g., fixed landings, passenger pick-up on demand).
Vehicle Ferries	Vessels having at least one deck for vehicles, with additional decks for passengers. The largest vehicle ferries—which are in the Seattle, Washington, area—are more than 460 feet long and accommodate 2,500 passengers and 218 vehicles. Such ferries are normally square-ended to allow vehicle access and egress.
Vessel Security Officer	The person on-board the vessel, accountable to the master, and designated by the company as responsible for (a) security of the vessel, including implementation and maintenance of the vessel security plan, and (b) liaison with the facility security officer and the vessel's company security officer.
Vessel Security Plan	The plan developed to ensure the application of security measures designed to protect the vessel and the facility that the vessel is servicing or interacting with the vessel's cargoes and persons on-board at the respective MARSEC levels.
Vessel Stores	(1) Materials on-board a vessel for the upkeep, maintenance, safety, operation, or navigation of the vessel and (2) materials on-board for the safety or comfort of the vessel's passengers or crew, including any provisions for the vessel's passengers or crew.
Vessel Traffic Service (VTS)	A national transportation system that collects, processes, and disseminates information on the marine operating environment and maritime vessel traffic in major U.S. ports and waterways.
Vessel-to-Port Interface	The interaction that occurs when a vessel is directly and immediately affected by actions involving the movement of persons, cargo, or vessel stores or the provisions of port services to or from the vessel.
Waivers	Exemptions from requirements. Prior to operating, any facility owner or operator may apply for a waiver for any requirement that the facility owner or operator considers unnecessary in light of the nature or operating conditions of the facility.
Water Taxis	Very small passenger-only ferries (about 50 feet or less in length) that may operate in both fixed-route and on-demand service, depending on the time of day and patronage levels. They can load and unload very quickly and operate very frequently, sometimes to several different points around a harbor or along a river.
Waters Subject to the Jurisdiction of the United States	All waters described in Section 2.36(a) of 33 CFR Subchapter H; the exclusive economic zone, in respect to the living and non-living resources therein, and, in respect to facilities located on the outer continental shelf of the United States, the waters superjacent thereto.

Table C2. Glossary of acronyms.

Acronym	Definition
AIS	Automatic Information System
AMS Committee	Area Maritime Security Committee
AOR	Area of Responsibility
ASP	Alternative Security Program
BTS	Bureau of Transportation Statistics
CFR	Code of Federal Regulations
COTP	Captain of the Port
CSO	Company Security Officer
DOT	Department of Transportation
FSA	Facility Security Assessment
FSO	Facility Security Officer
FSP	Facility Security Plan
GSM	General Security Measure
HOV Lane	High-Occupancy Vehicle Lane
HSAS	Homeland Security Advisory System
IMO	International Maritime Organization
ISPS	International Ship and Port Security
ISTEA	Intermodal Surface Transportation Efficiency Act
LNM	Local Notice to Mariners
LO/LO	Load-On/Load-Off
MARSEC	Maritime Security
MSIS Database	Marine Safety Information System Database
MTSA	Maritime Transportation Security Act
NVIC	Navigation and Vessel Inspection Circular
NVPZ	Naval Vessel Protection Zone
PUC	Public Utility Commission
PVA	Passenger Vessel Association
RO/RO	Roll-On/Roll-Off
SSI	Sensitive Security Information
TEA-21	Transportation Equity Act for the 21st Century
TSA	Transportation Security Administration
TSI	Transportation Security Incident
USCG	U.S. Coast Guard
VHF	Very High Frequency
VMRS	Vessel Movement Reporting System
VSO	Vessel Security Officer
VSP	Vessel Security Plan
VTS	Vessel Traffic Service

Abbreviations and acronyms used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation