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DECISION-MAKING TRAINING ALTERNATIVES
FOR MARINE SPILL RESPONSE
COMMAND POST PERSONNEL



U.S. Coast Guard
Research and Development Center
1082 Shennecossett Road
Groton, Connecticut 06340-6096

MarineSafety
international

Computer Aided Operations Research Facility (CAORF)
National Maritime Research Center
Kings Point, New York 11024

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16. Abstract As a result of the Exxon Valdez and other recent oil spills, the decision-making process within the United States Coast Guard (USCG) directed, multi-agency response team has been identified as an important area for improvement. The Oil Pollution Act of 1990 (OPA 90) has outlined the need for improved spill response training. The USCG believes that improving marine spill training would do much to enhance the capability of the multi-agency response. The methodology involved identifying unanticipated, spill response decision-making tasks to be made by the local Port of New York multi-agency spill response organization, in the event of a significant discharge of oil in the port. These decision-making tasks, along with other information collected from the Port of New York personnel, were then systematically analyzed in order to develop a preliminary set of training objectives for the multi-agency, spill response command post team. These training objectives were then further analyzed to identify the most promising training media for achieving these objectives. As a result of the present effort, it is recommended that a prototype training program be designed for the USCG directed, multi-agency response organization, and that a pilot program be conducted and evaluated in conjunction with the Port of New York.					
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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	* 2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (WEIGHT)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (EXACT)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

* 1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.25. SD Catalog No. C13.10.286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	
MASS (WEIGHT)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	0.125	cups	c
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (EXACT)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

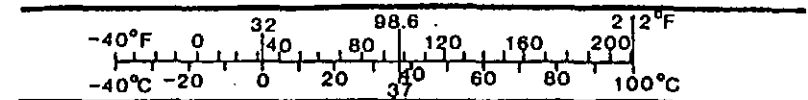


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1.0 INTRODUCTION

1.1 PURPOSE

As a result of the *Exxon Valdez* and other recent oil spills, the decision-making process within the United States Coast Guard (USCG) directed, multi-agency response team has been identified as an important area for improvement. In many cases, decisions about critical response actions, such as the use of chemical dispersants, in-situ burning, or other actions which can result in sacrificing one natural resource for another, must be made quickly. Often, the details of the actual spill scenario, which can impact such response-action decisions, are not adequately foreseen during the contingency planning process. As a result, the multi-agency response team must quickly assess the situation, identify, and implement the most appropriate response actions within a very short period of time. The first few hours after an oil spill are critical; making the right decisions at this time can drastically limit the consequences of a spill, and a lack of experience during this critical time can often lead to poor decision-making. Failure to quickly implement response-actions can result in the loss of response-actions as options, as well as in considerable difficulty and cost in containment and recovery of oil, and restoration of natural resources.

The effectiveness of a response depends on how well the various team members have been trained. The Oil Pollution Act of 1990 (OPA 90) has outlined the need for improved spill response training. The USCG believes that improving marine spill training would do much to enhance the capability of the multi-agency response and is actively engaged in many realistic spill exercises. These exercises often involve using the actual equipment and involving the people who would be called upon to respond in the event of an actual spill.

1.2 BACKGROUND

The degree to which crisis managers are able to anticipate the nature of the crisis event and the decisions that must be made in its wake, will determine the timeliness and effectiveness of response actions (Belardo and Harrald, 1992). Even in crisis situations that result from agents where there is some history (i.e. oil spills), response to disasters often fail to account for all the stakeholders at risk. Planners are unable to define the "decision environment" through the study of historical records and existing procedures, since each occurrence of a rare disaster differs in significant ways from prior events. By nature, natural and technological disasters are low probability / high consequence events that differ qualitatively from more routine disasters or

emergencies. Since these events are extremely rare, there are no experts in their management, as traditionally defined (i.e., someone with deep knowledge and extensive actual experience). This is not to say that there are not people with considerable expertise in almost every element required in the management of a disaster; expertise exists, but it is almost impossible to identify and to integrate valid and relevant expert knowledge during an actual disaster operation (Belardo and Harrauld, 1992).

In emergencies such as oil spills, one of the most fundamental needs for a successful response is the ability to make "correct" decisions, judgments, and inferences in complex, time-pressured, and hazardous environments (Tuler, 1988). In emergency responses, mental workload in the response organization is high, primarily because of the complexity of the environment. Much of the complexity results because decisions are "dynamic" (Tuler, 1988). "Dynamic decision environments" refer to problem situations where a series of interdependent decisions are required, task specifications and the environment are dynamic, available information may be dependent on prior decision outcomes, and those decisions modify the environment. In addition, mental workload may be increased by information load and complexity, emotional stress and fatigue, the social environment created by interacting participants, the rate of task inputs, the degree to which tasks are deferrable, and information feedback characteristics (Hart and Sheridan, 1984).

The USCG has commenced a systematic program to upgrade the effectiveness of the marine spill response decision-making process, involving the On-Scene Coordinator (OSC), the OSC staff (including responsible parties and state representatives), and the Regional Response Team (RRT). This decision-making process encompasses not just USCG personnel, but a mix of federal, state, local, and private individuals who normally participate in the decision-making process during a major spill. This particular analysis focuses on training issues. Other efforts have and will continue to address response team organization, decision support systems, and contingency planning. This analysis identifies a number of key decision-making training objectives and candidate training media for upgrading local command post decision-making skills. Several research issues are also investigated, such as organizational and procedural decision-making issues, training objectives to support the evolution of appropriate organizational forms in response to crises, and the use of decision-support systems to assist decision makers during the response. It is anticipated that subsequent studies will develop and evaluate, in more depth, the candidate training media identified during this study as having the greatest potential for upgrading these skills. At this time, however, the present analysis is focused on the Port of New York, identified under OPA 90 as a "demonstration port" for trial applications of new,

promising marine spill response technology systems. The underlying assumption is that if a new training technology has potential in the Port of New York, it will probably have potential in other local areas.

1.3 OBJECTIVES

There are three specific objectives of this initial, USCG-sponsored, research effort into marine spill response decision-making training. They are listed in descending order of priority:

1. Identify and assess high-potential training tools/technology, which can be utilized at the local port level on a continuing basis, to upgrade the effectiveness and timeliness of the decision-making process of the USCG directed, multi-agency spill response team.
2. Begin to develop a logical and cost-effective strategy for developing and implementing, on a trial basis, one training system/medium, which has a high potential for upgrading the multi-agency response team decision-making process previously identified.
3. Clearly define potential high-priority research projects in complimentary areas, which may be identified during this effort, that significantly impact the decision-making process. These might include command post organization, staffing, decision-support systems, etc.

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2.0 METHODOLOGY

2.1 GENERAL METHODOLOGY

The present study was coordinated by the USCG and the Computer Aided Operations Research Facility (CAORF), which is operated and managed for the U.S. Maritime Administration by MarineSafety International (MSI), as part of the National Maritime Research Center, Kings Point, New York. As noted in Section 1, the present project focuses on the attainment of its objectives within one specific port area (New York) prior to an attempt to extrapolate the findings to other port areas. As a result, a close working relationship during the project was established, and is being maintained, with the local Port of New York personnel.

The general methodology used during this analysis was based on the overall approach used for identifying U.S. Navy training system requirements, modified for specific spill response problems and project resource constraints. The methodology involved identifying unanticipated, spill response decision-making tasks to be made by the local Port of New York multi-agency spill response organization, in the event of a significant discharge of oil in the port. These decision-making tasks, along with other information collected from the Port of New York personnel, were then systematically analyzed in order to develop a preliminary set of training objectives for the multi-agency, spill response command post team. These training objectives were then further analyzed to identify the most promising training media for achieving these objectives.

The present effort was conducted as a series of three tasks, each building on the findings and analyses of the task preceding it. The study team consisted of three principle investigators, each selected for their experience and background in their assigned task area. Task A, conducted by Dr. John R. Harrauld of George Washington University, developed a scenario for a major spill in the Port of New York. Using the scenario, organizational roles were defined and the structure, nature and time sequence of critical response tasks were modeled and analyzed. Task B, conducted by Dr. Martha Grabowski of Rensselaer Polytechnic Institute, determined training objectives aimed at increasing the effectiveness of the multi-agency, spill response organization. Skill, knowledge, and decision-base requirements were defined and validated for the response organization. Task C, conducted by Dr. Thomas Hammell of Paradigm, Inc., then identified decision-making training strategies and media. Approaches and methods of training the multi-agency response personnel were assessed and prioritized based on their cost-effectiveness. The

study was coordinated by Dr. Steven Siegel of MarineSafety International. Study team meetings were held at the conclusion of each task, and in order to ensure continuity of the analyses, each task was "front and back" coordinated by the other members of the study team.

2.2 TASK A - CRITICAL DECISION-MAKING TASKS

2.2.1 Design Scenario

The objective of this first task was to use a scenario based exercise to identify the decisions and issues that must be resolved in order to successfully execute a spill response operation. This task began with a review of the existing Captain of the Port of New York oil spill response scenarios, and a "design scenario" was then developed for this task analysis. The purpose of the design scenario was to establish a solid starting point from which relevant spill response issues could be identified. The design scenario used involved a collision between a Norwegian container vessel and a Bahamian tanker in the Stapleton anchorage (see Appendix A). The scenario represented a "realistic possibility", and in fact, was similar on an actual event: the ESSO BRUSSELS/SEA WITCH collision, which occurred several years ago in the Port of New York. The methodology used to extract expert opinion from Coast Guard and Local Area Committee members was an emerging, emergency-management planning technique known as "hindcasting". During a hindcasting experiment, experts are given the end point of an operation (in this case a failed pollution response) and challenged to determine WHAT went wrong, and WHY these failures occurred. The results of the exercise are used to develop planning and problem solving strategies. A second scenario was used to ensure that all critical issues had been captured, and the results of the exercise were used as the basis for the initial identification of decision-making tasks. The hindcasting scenario generated a number of Critical Success Factors (CSF), and enabled the definition of the factors critical to the success of a response and any potential response problem areas. Appendix B describes the hindcasting exercise and the validation scenario developed for the Port of New York.

2.2.2 Anticipated Command Post Organization

During this task, the anticipated multi-agency organizational structure defined in Group New York draft Instruction 16465: *Crisis Action Planning for Initial Response to Report of Maritime Incidents*, was assumed. This instruction envisions the evolution of a response organization based on the Unified-Command based, Incident-Command System (ICS) functional model (Fire Protection Publications, 1983). The ICS is a cooperative, interagency (federal, state, and local)

organizational structure designed to be applicable to any emergency or incident. The USCG Port of New York has implemented a variation of the ICS framework, focused on marine response to oil spills in the Port of New York. This multi-agency organization has five major functional areas: Command, Operations, Planning, Logistics, and Finance. Each of the functional elements, or cells, will have appropriate representatives from the federal, state, and local governments, as well as the responsible party. In addition, within the Port of New York, the roles of information officer, safety officer, and liaison officer are also identified; these roles may be separate functions reporting to the Command cell, or may be embodied within the Command cell, depending on the type of incident and the agencies involved. Appendix C contains a brief description of the anticipated Port of New York, multi-agency spill response organizational structure.

2.3 TASK B - TRAINING OBJECTIVES

During this second task, the Critical Decision-Making Tasks and other information developed and identified under Task A, were synthesized into a set of preliminary training objectives that could be used to up-grade local multi-agency, marine spill response decision-making. These training objectives address both skill and knowledge requirements for the key individuals and groups involved. The process used to develop these preliminary training objectives was based on Simon's (1960) three-phase model of decision-making (see Appendix D). While primarily addressing individual and team skills, the training objectives primarily focus on the team and sub-team skills required within the anticipated unified-command organization. Since there are many difficulties inherent in assembling the entire multi-agency command post team for training (with its substantial number of personnel...potentially as many as 100 people), the objectives would be better served by assembling the smaller sub-teams several times over the course of the year. Then, at least once a year, assemble the entire command post team for more comprehensive "management team" or triennial "full-scale" exercise, which are presently being considered within the draft National Preparedness for Response Exercise Program (NPREP). This approach to training (sub-team/cell training prior to complete team training) is consistent with currently accepted team training practices (Fitts, 1965; Hammell and Mara, 1970).

2.4 TASK C - TRAINING MEDIA

The training requirements identified under Tasks A and B served as the input characteristics for Task C, in which training issues were identified that were especially relevant to the command post sub-team training. These were then related to available training media, evaluating the

potential effectiveness of media/strategies for the requisite training objectives, and recommending training media for the command post sub-team training.

The Task C analysis was conducted in two distinct parts. The first part assembled information pertaining to the training of teams similar to the Unified Command Structure. This included review of the research literature, covering areas such as decision-making, team training, and stress, and discussion with organizations engaged in emergency training and/or research. These included the Federal Emergency Management Association (FEMA), the American Red Cross, and the U.S. Navy. These sources provided a baseline of information from which many instructional/training issues were identified for consideration in potential command post sub-team training strategies, including issues relevant to learning, training strategy, human perception, decision-making, and cost of implementation.

The second part of Task C analyzed the combination of training issues and available instructional media, with regard to cost effective implementation for command post sub-team training -- that is, achievement of the specified training objectives. The purpose was to pare-down the list of media to those feasible for near-future implementation of training. Criteria of cost and training effectiveness were used, including consideration of training efficiency and logistics factors. It should be expected, however, that training system elements (i.e., media and strategy, etc.) will evolve as experience with local training is gained, as trainee skills improve, and as the training needs evolve.

2.4.1 Training Strategy

Command Post Team training strategy should incorporate specific learning principles derived from the literature (e.g., general learning, decision-making, team training, etc.) to achieve an effective *training process* (the activity and achievement of learning/training). The purpose of the training system, focusing on the trainee, is the *acquisition, improvement* and/or *retention* of knowledge and skills. To this end the training system should provide a carefully crafted process that achieves the greatest gain at acceptable cost. This is the *training strategy*, the detailed process that achieves the training objectives. The strategy typically relies on a variety of *training media* (overhead slides, simulation, etc.) for effective implementation and to aid the training process.

The wide variety of theoretical training issues should be carefully considered in arriving at the specification and design of the specific training strategy to be used for sub-team training, that is,

exactly how the training would take place. The training strategy will be developed at a later time, in correspondence with the other elements of the training system (such as the specific media), to create a highly integrated and effective training process. Since the strategy and media are interdependent, the important consideration for this analysis is that the recommended media have sufficient capabilities to accommodate the range of training strategies that may be used for sub-team training, within reasonable cost limits.

2.4.2 Training Techniques

Training techniques are the applied methods of conducting the training process, such as the technique of *role playing*, or *case study*. The training strategy uses one or more training techniques during a session or course, for the conduct of training. Many of these, although recognized as distinct techniques, overlap with each other, and are often used jointly. Appendix H identifies several training technique examples relevant to Command Post training.

The choice of training techniques, as part of the instructional strategy, is dependent on many factors of the training process, such as student proficiency level, training objectives, time available, and media available. This analysis considered the application of a variety of techniques to Command Post training, affecting the assessment of potential training media. Although the specific techniques to be used for Command Post training will be determined later as part of the strategy development, and are likely to change during the life span of the training, the media selection considered their potential use with the various media.

2.4.3 Media Assessment and Selection

The media selection process analyzed each of the media listed in Section 3, considering the range of learning/training issues (such as, strategy, techniques and other issues) potentially applicable to sub-team training, and with regard to achieving the set of identified training objectives.

The assessment analysis was conducted in two stages. In the first stage, each medium was assessed on a relative basis with regard to specific criteria, as part of evaluating the potential overall acceptability of the medium for sub-team training. Training objectives were considered as a set. The purpose was to identify those media having realistic potential for near-term implementation in applied sub-team training. A pragmatic approach to this assessment was followed: the emphasis was to select proven media that could be feasibly implemented today, and which would support an effective training process.

This assessment relied on four criteria (training effectiveness, training efficiency, logistics, and cost), each composed of three levels of relative assessment (low, medium and high). The assessments of each medium were made relative to the other media under consideration, as well as with regard to absolute standards.

Those media successfully passing the first analysis stage became the candidates that were transformed into the media recommended for further development in support of command post sub-team training. The further assessment leading to the recommended media configurations comprised the second stage of analysis. This required the functional integration of media candidates into cohesive media groups and were further evaluated with regard to command post training objectives. The recommended media characteristics are presented in Section 3.

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3.0 RESULTS AND DISCUSSION

3.1 GENERAL

This section documents and discusses the results developed by the project team, as a result of implementing the methods of analysis described in Section 2. The conclusions and recommendations drawn from further analysis of these results (individually or collectively) are described in Section 4.

3.2 TASK A - CRITICAL DECISION-MAKING TASKS

3.2.1 Critical Response Success Factors

As a result of the hindcasting exercise conducted under Task A, a number of Critical Success Factors were identified by Port of New York personnel. A Critical Success Factor is defined as something that must go right if the response operation, such as the "design scenario" developed under Task A, is to succeed and be perceived as a success. The Critical Success Factors identified by the analysis are shown in Table 3-1.

It is believed that these Critical Success Factors should be important considerations during subsequent planning and training activities within the Port of New York. As such, they were considered, along with other factors such as the critical decision-making tasks, during the development of the training objectives described in Section 3.3.

3.2.2 Potential Response Problems

The hindcasting exercise conducted under Task A also resulted in a number of potential problem areas identified by Port of New York personnel. These are causal problems or issues that could prevent the response team from attaining one or more of the Critical Success Factors. The potential response problem areas identified by the analysis are shown in Table 3-2.

As with the Critical Success Factors, these potential problem areas should also be important considerations during subsequent planning and training activities within the Port of New York. Therefore, they were also considered during the development of the training objectives described in Section 3.3.

TABLE 3-1

Port of New York Pollution Response Critical Success Factors

**Things that must go right if the response operation
is to succeed and be perceived as a success**

1. Adequate response resources (equipment and people) must be mobilized
2. Oil spillage from the source must be minimized
3. The OSC must be able to realize when response strategy is inappropriate and must be able to quickly adjust strategy to actual situation
4. Response organizations must be able to communicate effectively with each other and must transfer information between/within response organizations
5. Response organizations must communicate accurate and timely description of response efforts to public and media
6. Oil must be contained at or near the source
7. The pre-planned command/organizational structure must be cohesive (without public conflict) and work effectively from the start
8. Significant contamination of beaches and sensitive shorelines must not occur
9. Stakeholders must be identified and their interests accounted for
10. Planning for federal, state, and local organizations must be coordinated and without conflict
11. Response equipment must work as designed (e.g. work without failure and be correctly used
12. The immediate response initiated by owners according to pre-approved response plans must meet Coast Guard requirements
13. The public's expectations prior to a spill must be realistic
14. Rescue and salvage operations must not impede pollution response operations

TABLE 3-2

Port of New York Response Causal Factors

**Problems or issues that could prevent attaining
one or more critical success factor**

1. CG OSC does not have the ability or status required to exhibit personal leadership during spill response.
2. The response organization does not have the capability of communicating accurate, timely, and consistent information to the public during response.
3. The resources required to execute the response strategy cannot be mobilized in the time frame required.
4. Capabilities and limitations of response organizations and equipment have not been communicated to stakeholders, media, and public.
5. The response organization specified in the plan will not work in practice to integrate all responsible organizations in a way that ensures the ability to make decisions and take action.
6. The CG does not have the ability to communicate with the owner and rapidly ascertain and influence owner's actions.
7. Key jurisdictional authorities and stakeholders are not participating in the planning process; inter-organizational issues are not resolved, resulting in lack of ownership of the product.
8. Adequate inter-organizational communications could not be established and maintained.
9. The CG does not have the ability to control simultaneous operations (fire, salvage, multiple spills, etc.)
10. Public information strategies and media access sites are not defined or could not be implemented.
11. Response strategies and tactics are not based on realistic scenarios.
12. The technology available for containing and removing oil from open water is inadequate.
13. The vessel response plan review and evaluation process does not ensure viable and valid operator response.

3.2.3 Critical Decision-Making Tasks

Next under Task A, Critical Decision-Making tasks were identified for the first twelve (12) hours of the "design scenario" response. These Critical Decision-Making tasks, which are organized according the sub-team/cell in which they would probably occur, are described in Table 3-3. From this table, it can be seen that until the Planning cell is staffed, its tasks are primarily carried out by those in the Operations cell. Similarly, until the Public Affairs cell is staffed, its tasks are carried out by the Command cell. Tasks designated with an * in Table 3-3 are repetitive tasks, and are listed only at the time they first occur.

As with the Critical Success Factors and the potential problem areas, these Critical Decision-Making Tasks were an important input into the development of the training objectives.

3.2.4 Trainee Input Characteristics

The final result of the Task A analysis was a listing of the minimum Input Characteristics for the multi-agency members within each organizational sub-team/cell, and are described in Table 3-4. The input characteristics are the skills and knowledge that these individuals are expected to possess prior to their participation in the local sub-team/cell exercises. This is consistent with well-accepted training practice, namely that individuals possess certain levels of individual skill and knowledge prior to participating in team training (Hammell and Mara, 1970). Lack of these minimum skills and knowledge can adversely affect the efficiency of the training process, and ultimately the performance of the overall team.

3.3 TASK B - TRAINING OBJECTIVES

Traditionally, training objectives have been described in terms of who is being trained, the specific training objectives, sample conditions, sample tasks, and standards. Appendix E provides a detailed breakdown of both terminal and enabling training objectives for local, multi-agency command post team training, broken into categories describing who is to be trained, what the training objectives are, the priority of the training objective, the different conditions and tasks to be trained, and standards for evaluating performance. Below each training objective are notes indicating knowledge and skill sets, as well as links to past and future research, which may also be considered for that particular training objective. The Appendix E training objectives are also broken down by ICS functional cells (command, operations, planning, logistics, and finance) for

TABLE 3-3

Critical Decision-Making Tasks Classified According to Function and Time

TIME	COMMAND	PUBLIC AFFAIRS	PLANNING/ INFORMATION	OPERATIONS	LOGISTICS	FINANCE
Notification	* Initiate call up of personnel from cplan * Initiate dispatch of available resources * Notify MIO * Verify authority and jurisdiction * Assess amount, type extent of spill * Assess weather & current			* Complete incident report * Draft and transmit safety broadcast * Coordinate communications with VTS		
1/2 Hour	* Coordinate emergency response (SAR, Fire) * Develop, communicate, & implement initial response strategy based on initial info & preplans * Allocate available resources to highest priority areas * Prepare fact briefs * Notify stakeholders identified in CP, schedule meeting * Assign responsibilities & authority to make decisions * Incorporate primary response members into decision process * Evaluate responsible party's initial actions * Assess/Request need for special forces * Evaluate/Approve use of dispersants * Determine location of Command Post * Establish safety zone and issue COTP order	* Draft initial press release	* Project spill trajectory * Determine areas to be protected * Determine contain, removal, recovery capacities required * Determine dispersant capability required * Verify areas for dispersant use	* Evaluate equip needed based on need and planning factors * Implement communication plan * Compare equipment hired by resp party to total amount req'd * Evaluate time req'd for RP equipment to arrive on scene * Determine additional resources required * Determine protective clothing needs * Acquire initial CAMEO data * Determine need for salvage resources * Determine need for firefighting resources * Deploy protective booming to area at risk * Deploy boom to contain at source (if not done by RP) * Deploy available recovery resources	* Initiate procedures to contract for additional resources * Initiate chrono. log	* Request polfund authorization * Assemble documentation for cost recovery * Establish cost responsibilities * Ensure completion of cost recovery documents

TABLE 3-3 (cont.)

TIME	COMMAND	PUBLIC AFFAIRS	PLANNING/ INFORMATION	OPERATIONS	LOGISTICS	FINANCE
3 HRS	* Direct functions of command post * Provide frequent command post briefings * Monitor response mobilization timelines * Authorize use of pollution funds * Determine need for federal direction of response * Evaluate need for liaison personnel * Monitor salvage effort * Brief RRT on status	* Establish Press conference sites/ times * Provide media updates * Assign persons to manage press conference * Ensure all spokes-persons have same information	* Manage communication * Provide feedback info on mobilization to OSC * Evaluate status and extent of spill * Evaluate status and effectiveness of response * Provide situation assessment to OPS/ OSC * Re-assess sensitive areas at risk * Maintain information on status and location of forces and equipment * Project future resource requirements	* Evaluate recovery rate & storage, disposal capacity of resources * Re-Assess extent of spill and deployment of resources * Conduct on site assessment of source and spill * Determine disposal method & requirements * Evaluate defensive booming tactics * Monitor containment and recovery * Initiate investigation * Coordinate overflights	* Establish staging areas. * Coordinate staging areas for resources * Coordinate the transportation of response resources to response area * Coordinate and control the distribution of supplies * Provide for on site feeding for responders * Provide for on site sanitation facilities	
6 HRS	* Hold joint press conf w/rp & state * Modify strategy and tactics as required, * Evaluate response options * Assess and establish response priorities * Negotiate compliance of RP with OSC requirements * Evaluate need for in situ burning, bio-remediation	* Coordinate joint press conference	* Evaluate information * Evaluate threat * Evaluate current strategy and tactics * Develop initial daily tactical plans	* Conduct joint survey of affected area (RP, State, & Fed) * Deploy boom and recovery devices mobilized	* Track material allocation and status * Determine requirements for storage and disposal of oil and oily wastes	* Initiate contracts for storage and disposal of oil and oily wastes.
12 HRS			* Review effectiveness of initial tactical plan * Develop next day tactical plan		* Repair/replace equipment as required * Prepare daily logistics plan * Support dispersant and bio-remediation activities	

TABLE 3-4

Trainee Input Characteristics

The following are suggested minimum input characteristics of persons assigned to ICS response cells in Port of New York pollution responses:

General characteristics required of all personnel:

1. Working knowledge of oil spill response operations.
2. Working knowledge of National Contingency Plan and COTP New York Contingency Plan.
3. Working knowledge of own agency oil spill response role and responsibilities.
4. Working knowledge of assigned role in pollution response organization
5. Authority to execute responsibilities assigned in pollution response organization.

Additional characteristics required for specific response cells:

Command Cell:

1. Detailed knowledge of pollution response operations, techniques, and technologies.
2. Authority to act and to make operational decisions with the authority of their agency or organization.
3. Possess personal leadership characteristics.
4. Detailed knowledge of National Contingency Plan and COTP New York Contingency Plan.

Operations Cell:

1. Detailed knowledge of pollution response operations, techniques, and technologies.
2. Detailed knowledge of National Contingency Plan and COTP New York Contingency Plan.
3. Working knowledge of location and capabilities of local response resources.

TABLE 3-4 (cont.)

Logistics Cell:

1. Detailed knowledge of own organization's supply and logistic system.
2. Detailed knowledge of how to mobilize own organization's pollution response equipment.
3. Working knowledge of location and capabilities of local response resources.

Planning/Information Cell:

1. Detailed knowledge of National Contingency Plan and COTP New York Contingency Plan.
2. Detailed knowledge of own agency's responsibilities.
3. General knowledge of CAMEO system, pollution trajectory models.
4. Detailed knowledge of reporting requirements and report formats applicable to assigned role.

Finance Cell:

1. Detailed knowledge of own agency's financial system and procedures.
2. Working knowledge of federal spill response documentation requirements.
3. Working knowledge of federal spill response funding mechanisms.
4. Working knowledge of contracting procedures used during pollution responses.

Public Affairs Cell:

1. Working knowledge of local media.
2. Ability to prepare press releases.
3. Ability to prepare press conferences.

clarity. *Terminal training objectives* are defined as specific training objectives leading to development of proficiency or skill for oil spill response. *Enabling training objectives* are more generic in nature, and are supportive of the development of specific oil spill response proficiency or skills.

3.4 TASK C - TRAINING MEDIA

A variety of training media are available for local, multi-agency command post sub-team training. Table 3-5 lists the generic media potentially available for training. They represent the range of potential media that can be integrated and configured to support local sub-team training. The potential media were then transformed into a reduced set of several integrated media realistically applicable to the support of local, multi-agency sub-team training. These represent media that can be feasibly implemented today in various parts around the country, would be of reasonable cost, and could provide effective support to enhance achievement of the training objectives. The selected potential media are outlined in Section 4, while the media not selected are outlined in Appendix F.

3.5 LOCAL COMMAND POST TRAINING SYSTEM DEVELOPMENT

Command Post training should be conducted in separate sub-teams; this was an important input assumption to Task C, stemming from the findings of Tasks A and B.

3.5.1 Sub-team Unique Requirements

The training process, including strategy and media, should be tailored to the needs of each sub-team/cell. The training objectives indicate that the training process will differ for each sub-team, due to the members' characteristics, operations functions and tasks, and training objectives.

Although the training process may differ for each sub-team, a single set of training media should be developed for Command Post Sub-team training. It is important, therefore, that the recommended media have sufficient capabilities to enable flexible adaptation to meet the needs of the different sub-teams.

3.5.2 Sub-team Training Setting

Sub-team training should be conducted in a group/team context, such as in a conference room,

TABLE 3-5

List of Potential Training Media

Desk Top Computer/Display System

- Characteristics - Computer/display system
Simulated problem, data, events, etc.
Actual & simulated team members -- communications & coordination
- Variations - Part Task Individual
Part-Task Team/Sub-team

Whole-Task Full Team Trainer

- Characteristics - Multi-station computer/display system
Simulated problem, data, events, etc.
Actual & simulated team members -- communications & coordination

Interactive courseware - ICW

- Characteristics - Multi-station computer/display system
Simulated problem, data, events, etc.
CGI, IVD, etc.
- Level 1 - Essentially video or computer graphic presentation, including minor text.
- Level 2 - Medium Level simulation with video and computer graphics.
- Level 3 - High fidelity presentation with mathematical model simulation or extensive interaction.

Interactive Video Disk - IVD

- Individualized or group instruction

Distance Learning, Distributed Learning, Teleconferencing

- Interconnected individuals in a sub-team
 - Simulated problem, data, events
 - Actual team members -- communications & coordination
 - Simulated other sub-teams
- Interconnected sub-teams
 - Simulated problem, data, events
 - Actual & simulated team members -- communications & coordination
- Individual(s) interconnected with a sub-team
 - Simulated problem, data, events
 - Actual & simulated team members -- communications & coordination

Compact Disk

- Variants - CD-ROM
Compact Disk Interactive

Information Displays, Visualization Imagery

- Characteristics - Individual viewing
Team/Group viewing
Static, dynamic information

TABLE 3-5 (cont.)

Examples - TV, CGI, etc. images
Graphics, alphanumerics
Classroom large screen
Briefing, Debriefing
Individual team member monitor.
Automated status boards, charts, etc.

Group Training

Conference Room, Part-Task Team/Sub-team
Computer assisted, computer/display system
Large screen displays - multiple
Simulation - Problem scenario - data, events, etc.
Action implementation
Other team members
Actual & simulated team members -- communications & coordination

Simulation

Use of actual personnel to play roles, vs. simulated sub-teams, members, etc.
Problem simulation

Visual Slides

Status Boards, Maps, Charts, Tables - manual

Films, Video Tape

VCR tapes of actual incidents, simulated case studies;
Tapes of the sub-team at work, for debriefing and critique.

Portable Trainers

At-home, office
Computer-display system

Books, Paper & Pencil

Blackboard, greenboard, whiteboard
Textbooks, workbooks
Programmed Instruction texts
Charts, diagrams & other handouts

Job Performance Aids

Flowcharts, templates, cards, etc.
Computer-based information processing and presentation tools

Virtual Reality

Considered as an advanced form of simulation (exceptional high fidelity), usually providing realistic stimulation to multiple senses
Would be most appropriate for operations personnel, vice command post teams

Resource Individuals

Highly experienced individuals
Provide guidance, model

at Port of New York Group Headquarters (Governor's Island), as opposed to a remote location. This approach is the most feasible for conducting frequent training sessions, and can be supported by advanced training media. The training media should be designed to support a variety of training strategies for group and small team training in a stand-alone conference room configuration.

3.5.3 Training Process Structure

The training process should be designed to initially attend to the building of core team skills while achieving the respective sub-team training objectives. As training evolves for each sub-team, and each emerges as a cohesive unit, the training attention should smoothly shift to decision-making, problem solving and stress exposure emphasis while addressing the respective sub-team training objectives. Although the attention of training should continually shift in response to sub-team proficiency and needs, as well as oil spill response technology and methodology evolution, it should also continually maintain attention on the improvement and retention of already-acquired skills and knowledge.

The training process should be configured at the outset with highly flexible structure, strategy and media that will enable and facilitate its evolution in correspondence with the expected substantial changes in training objectives and needs. Training, with supporting media, should be implemented in the near term as the initial phase of a structured development process, including development and evaluation of media features, to tailor and refine the training system's effectiveness as a result of on-site training experience.

The evolution of the training process should be paralleled with the development of the training media (i.e., and training strategy). Media development should include change in correspondence with the Command Post Sub-team training needs, as well as progressive development of media capabilities into a robust training system sensitive to each port's training needs. These factors require media characteristics that are flexible enough for continued development, and which can readily add capacity and other elements as required.

3.5.4 Training Strategy

The training strategy should include a mix of proven traditional emergency group/team training techniques (e.g., case studies in a group setting), and techniques specifically developed for sub-team oil spill response training (e.g., abbreviated real- and fast-time simulation exercises). The

recommended media should support both. The sub-team training strategy should be developed at the time of media specification, enabling a tailoring of the strategy to optimally use media features in achieving the training objectives.

As experience in conducting sub-team training is gained, modifications to the training system should be made on a regular basis to improve its effectiveness. This should be substantial in the early years as the port moves up the steep part of learning curve for this training program. Development of the training media (i.e., and hence the strategy and process) should be implemented as a structured multi-phase growth process, with development and introduction of media capabilities and their training evaluation over a carefully planned period. This phased approach should have several benefits, including careful evaluation/modification of media features to assure their effectiveness and feasibility; it will also assure timely implementation of initial training media to fill the present gap in the local, multi-agency response training system.

Command Post sub-team training should concentrate on team-related skills and knowledge, rather than individual. This concentration should be on the sub-team, rather than the full team. Some amount of individual training may be necessary, particularly for the non-USCG personnel; however, this training should be addressed separately from the team training objectives, and at a later date. The sub-team training should have the highest priority at this time, since it is where the greatest immediate performance gains can be achieved. It should be noted that the media recommended for Command Post sub-team training may also be effective for many individual training objectives.

Sub-team training should also concentrate on the improvement and retention of already-learned skills and knowledge, rather than the acquisition of new skills and knowledge. Training should, however, address the acquisition of new skills and knowledge in concert with technology and methodology evolution and improvements (lessons learned from other spill incidents). This may be accomplished as part of the sub-team training. The recommended media will accommodate this individual/sub-team training to a large extent.

It is assumed that all Command Post Team members have already received initial training to acquire the necessary oil spill response and ICS/UCC skills and knowledge to function as part of the team. These are considered as trainee input characteristics to the sub-team training system. If this assumption proves false, which some evidence suggests it may, additional steps should be taken to improve the initial training, without adversely affecting the command post sub-team training.

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4.0 CONCLUSIONS

4.1 MENTAL MODELS

A central theme emerged across the diverse literature, pertaining to Command Post Team training. Each of the major areas of human functioning identify the importance of mental models to the types of tasks performed by Command Post staff. Important characteristics of the models, their use, etc. differ for each area of functioning (decision-making, team functioning), although their central importance is well documented. Hence, the development of mental models, including careful attention to their important aspects regarding each human functional area, is recommended as the unifying framework for the strategy for training. The following paragraphs provide a brief summary of the relationship of mental models to the human functioning areas important to command post sub-team training.

4.1.1 Perception and Mental Models

Human perception literature shows that individuals possess internal cognitive representations (mental models) of objects, events and time-sequenced processes. These mental models can have various forms, such as a mental image of an object (such as a 3-dimensional view of a skimmer, similar to a photograph); or a mental image of the initial oil spill response process as outlined in the port's Contingency Plan, in the form of a template; or a mental image of a time-line sequence of events for obtaining and moving boom into place on a particular cove to head-off the moving oil, in the form of a script. Individuals are believed to have many overlapping mental models, learned from and corresponding to their many and varied experiences through life. All individuals in the Unified Command team, as well as all other individuals involved with oil spill response operations (including the general public), have multiple mental models relating to the many objects, events and processes associated with oil spill response operations.

4.1.2 Shared Mental Models Within a Team

One key aspect of up-grading the marine spill response decision-making process, within the multi-agency command post, is the improvement, via appropriate training, of the shared mental models possessed by the diverse personnel within the command post. These shared mental models should cover a wide variety of spill response issues and procedures, ranging from appropriate response strategies within the port to specific procedures for passing relevant information within the command post.

The mental models developed by each individual, and their association and overlap with the individual's other mental models, are dependent on that person's learning/training and experiences through life. Obviously, these models will differ for each individual. Unfortunately, each of the individuals comprising a team, such as the multi-agency command post, could have different mental models of important aspects of the oil spill incident (causal factors, response goals, situation status and projected dynamic change, priority areas, response process steps and responsibilities, Contingency Plan requirements, equipment capabilities, effectiveness of alternative actions, etc.). These differences are particularly obvious during NPREP exercise debriefings, with individuals expressing viewpoints about a wide variety of issues, interpretations, concerns, and action alternatives. The diverse mental models can lead to differences, discrepancies, and conflicts. Intra-team problems and inefficiencies can be due to differences in how members perceive the incident and related issues, rather than substantive differences of opinion.

A contemporary major tenet of team training is to emphasize the development of shared mental models. That is, each member of the team should have mental models that overlap substantially with those of the other team members, thus providing a common cognitive baseline for interaction, decision-making, etc. Although the individual members of the Unified Command team are expected to have independent concerns and goals, they are also expected to have common concerns and goals to the extent they can work together for common achievement. The shared mental models would greatly facilitate this unified process. It would assist, for example, in shared knowledge and common interpretation of the problem and situation status, and the development of common expectancies and predictions which have been identified as important to team performance.

4.2 JOINT PROBLEM SOLVING EXERCISES

An important training strategy for developing these shared mental models is the conduct of ongoing, multi-agency training sessions. Of particular importance is conducting and evaluating problem solving exercises for members of the "unified" command post team. These problem solving exercises should be presented in the form of problems/issues that the team, or sub-elements of the team, could potentially be faced with solving during and actual response effort.

4.2.1 Expert vs. Novice Problem Solving

Command Post team training, similar to many training situations, should focus on the development of expert decision makers, often beginning with novices, or intermediate level skills. Differences between experts and novices in problem solving behavior are rapidly emerging from the literature (Larkin, et al, 1980). Although many differences have been identified and are relevant to command post team training, (such as novices often solve problems from the solution backwards while experts usually solve them in a forward manner), a major set of findings relates to mental models. These once again coincide with the above summarized findings in perception and team functioning. Experts have been identified as having a much larger and more familiar set of situation/problem templates (mental model variants) in their domain of expertise than novices. Many of these templates are subtly different from others, representing seemingly minor, but yet important, differences in the situations. Furthermore, experts also have many more alternative actions sets available, and readily associated with the templates, from which to select the appropriate course of action. Their much greater experience provides the experts with increased information regarding the success of the alternative actions per each template.

Following Klein's (1989) theory, experts can rapidly obtain a match between the current situation/problem and a stored template which is sensitive to seemingly minor nuances, and have a proven course of action readily associated for implementation. Novices spend considerable time analyzing the situation/problem, while experts quickly size it up and act. Novices are also constrained to follow all leads, while experts rapidly focus on only those likely to have a high payoff. The experts rich repertoire of templates and associated actions have been gained from their extensive experience. A goal of multi-agency, command post training should be to quickly and efficiently develop an increased set of templates and associated actions for the less experienced team members, regarding the Unified Command team structure and its functioning.

4.2.2 Stress

Much of the current team and decision-making research is focusing on performance under conditions of stress, which is of concern to Command Post team training. This situation includes various sources of stress, such as limited problem solving time and information overload. Earlier research has suggested that overlearning (practice well beyond the point of attaining the criterion level of performance), and stress preparation training (training under conditions of high stress) will assist in preparing the team member to cope successfully with the high stress of the

emergency response situation (Fitts, 1965; Kranhenbuhl, Marett, and Reid, 1978). A more recent and related concept is to train individuals on selected tasks to the point that they become almost automatic, much like driving a car (Means, Salas, Crandall, and Jacobs, 1993). Little cognitive workload would be associated with these decisions, thus reducing the overall workload and assisting in controlling stress. These tasks would be carefully selected during pre-planning, and would be those that would have relatively straight forward action choices, such as the initial steps of the incident response process outlined in the port's contingency plan.

This training strategy would address the templates and associated actions of selected decisions, more or less in accordance with Klein's decision-making process theory summarized above. The automatic tasks would be those of an expert, in accordance with the problem solving summary above, with readily recognized situation/problem templates and quickly associated high success actions.

A common theme is emerging from the above-summarized literature relevant to Command Post Sub-team training strategy, centered on the development of mental models. The importance of well developed cognitive structures and representations (mental models of various forms) is central to positive performance in each of these areas of functioning. Although this is only a small part of the literature guidance relevant to Command Post training, it provides a cohesive linkage between the several major categories of training issues and hence direction for development of training strategy around a common framework.

4.3 ICS SUB-TEAM/CELL TRAINING

Due to the difficulty of assembling command post teams, consisting of potentially over 100 people for a major response effort, the focus for such on-going, multi-agency training should be the ICS sub-teams (or cells). These smaller units are the groups in which many of the various problems and issues, which have the potential to slow down the response effort, are addressed. The term "on-going, multi-agency training" as used here is viewed as an eight-hour training session for each individual ICS cell, composed of the various agency representatives, to occur at least twice per year.

4.4 TRAINING MEDIA

Several training media appear to be promising candidates for use during the multi-agency, ICS cell training sessions envisioned. These represent media that can be feasibly implemented today,

in various ports around the country, would be of reasonable cost, and could provide effective support to enhance the achievement of the training objectives outlined in Section 3.3. For purposes of the ICS cell training sessions, these potential media can probably be effectively combined within a common, relatively inexpensive, PC-based delivery system. These training media are:

4.4.1 Desk Top Computer/Display System

A desk-top computer/display system would provide substantial capability to support many of the potential Command Post Sub-team training techniques and probable strategies, in achievement of most training objectives. It is also capable of flexible adaptation to enhance the training system's responsiveness to many of the relevant training issues. When appropriately configured, this medium can provide a wide range of instructional assistance features, supporting workshop/classroom type of activities, fast-time and real-time simulation scenarios, and incident reconstruction. It can also incorporate advanced features of several selected media, such as provide high quality visualization imagery and simulation.

Its flexibility would enable long-term growth/modification to keep pace with evolving training needs. Logistics are of minor concern, since this type of device is readily transportable. Cost of hardware is low; cost of software is dependent on the sophistication of features, such as simulation. The extremes of software cost range from purchase of commercial-off-the-shelf (COTS) applications, such as an oil spill projection model, to development of complex tailored simulation capabilities. However, once developed, the software is essentially no-cost to other ports. Hence, the per-port cost of development, assuming eventual use in many ports, would be small (i.e., primarily low cost hardware).

4.4.2 Information Displays, Visualization Imagery

Visual media are relevant to many of the learning/training issues and the potential strategies, in addressing many Command Post training objectives. They are considered to potentially enhance sub-team training as much as any media. They could include desk top and large screen displays, with a variety of static and dynamic visual information, to be used at various times throughout the training process.

4.4.3 Group Training

Group training media represents the setting (i.e., conference room) and aids (e.g., blackboard or large screen display, documentation of case studies, subgroup tabletop exercises, etc.) in which groups of individuals have traditionally been trained. This is a proven effective technique/media combination for team decision-making training today (e.g., FEMA, Red Cross, Navy War College, USCG Marine Environmental Response School, commercial training organizations in the oil response field). It is typically of low cost, and often combines with other individual media (e.g., visual slides, simulation) to enhance the training process. It remains valuable for Command Post Sub-team training, and represents one of the major media recommendations.

4.4.4 Simulation

This real-time or fast-time capability is important for the conduct of exercise scenarios, in support of many relevant training issues. Although simulation can be effectively accomplished at a paper and pencil level, it is assumed that in the context of this analysis simulation addresses a semi- or fully -automated capability. This type of simulation requires computer-based support, and hence this medium was combined with the desk top computer/display system.

4.4.5 Visual Slides

These are traditional media typically used to support classroom/group training activities. They can be of several types, such as overhead transparencies, 35mm graphics and photographs, and computer-generated. They are generally of low cost and slides of the computer-generated type can introduce animation/dynamics. These would overlap with the visualization imagery media, and would require computer-based support.

4.4.6 Status Boards, Maps, Charts, Tables

These comprise assorted training aids traditionally used to support classroom/group training activities. They are of low cost, if mimic boards and other computer-supported capabilities are not included (these latter media would fall under the simulation, visualization imagery, and desk top computer/display media for Command Post training). Although they may be used in any sub-team training context, their primary use would be in support of the group training media and context.

4.4.7 Films, Video Tape

Films and video tape would be used during Command Post Sub-team training during classroom/group training activities. They would be most useful in providing supplementary information to the team, providing models of team functioning during emergency response situations, and in recording/viewing/discussing Command Post Sub-team/Team performance (e.g., during post scenario exercise critique). The cost was evaluated as low, assuming use of available films and tapes, and the use of relatively low cost video recording and playback equipment for team monitoring.

4.4.8 Books, Paper & Pencil

These traditional media are of low cost, if available materials are used, and generally of high flexibility but limited effectiveness in comparison with other media. This medium was not separately considered any further, since it is typically combined with most other media, at least to some extent.

4.4.9 Resource Individuals

Resource individuals are subject matter experts that can be brought into specific training sessions, to assist the training process. They are typically used to provide guidance, and/or to act as a model. They can be used together with other media in various ways, in accordance with the training strategy -- such as providing a lecture, acting as part of the sub-team in responding to a scenario, demonstrating expert response skills, observing and critiquing the team and its members, discussing pertinent issues with team members. This medium would be of relatively low cost. Resource individuals would usually be applied in a specific training sessions, rather than during all training sessions.

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5.0 RECOMMENDATIONS

Two primary recommendations are made as a result of the present effort:

5.1 CONCEPT DEMONSTRATION/EVALUATION

The multi-agency, ICS sub-team/cell training, which utilize the various training media identified during this phase of the project, should be demonstrated and evaluated within a prototype training program. This prototype training program should be conducted for, ideally, all of the ICS sub-teams/cells within one major response area. Since the project team has been working with the Port of New York personnel, and the Port of New York has been identified under OPA 90 as a demonstration port, it is recommended that the demonstration and evaluation of such a prototype training program occur within the Port of New York.

5.2 NATION-WIDE IMPLEMENTATION ALTERNATIVES

Presuming that the ICS sub-team/cell training concept demonstration described above is successful, an appropriate analysis of alternatives for its nation-wide implementation by the USCG should be conducted. This analysis should examine implementation concepts ranging from USCG ownership of training devices and USCG conduct of training, to USCG procurement of a training services from a commercial source.

5.3 COMPLIMENTARY RESEARCH AREAS

In addition to the above mentioned primary recommendations, several complimentary research area have also been identified. In order to up-grade the decision making process within the marine spill response command posts during major response efforts, the USCG should consider conducting research in the following areas in addition to the training research presently being conducted:

5.3.1 Organizational Research Issues

5.3.1.1 Command Post Organization/Staffing

An organizational chart of a "unified command" can be very misleading if each participant has a different view of the functions and responsibilities of the organizational elements and procedures, or if one or more parties intends to establish a parallel organizational chain.

Historical experience under both the National Contingency Plan and the Federal Response Plan indicate that organizations with different cultures and procedures have a difficult time integrating into a unified organization during a time of crisis, and revert to loosely coupled independent operations (Harrald, et al, 1991; Carley and Harrald, 1993).

The proposed response organizations for major Coast Guard pre-designated OSC's, major oil companies, shipping companies, and national contractors should be documented and compared. Inconsistencies and conflicts should be identified. Conflicts could be resolved within the Coast Guard through the establishment and implementation of standard organizational protocols. External conflicts and inconsistencies (i.e., with oil companies, contractors) must be negotiated. A series of facilitated workshops could help explore and resolve these potential organizational conflicts before they become major issues during a pollution response.

A valuable interim deliverable in this area could be a comparison and analysis of a set of organizational structures and mobilization procedures established by major Coast Guard COTP offices, states, pollution contractors, and major oil companies. A good cross section could be provided by 6-10 CG COTP offices, two major contractors such as Marine Spill Response Corporation (MSRC) or National Response Corporation (NRC), 2-4 states, and 2-4 oil companies. This analysis would reveal similarities and differences in structure and procedure. This would enable the identification of: 1) potential conflicts between the CG and potential response partners, 2) innovative ideas that could be distributed to response community, 3) inconsistencies in CG organization, 4) the degree of implementation and acceptance of unified command and ICS procedures. A final deliverable would be organizational and procedural recommendations based on the analysis of existing plans, and facilitated meetings or interviews with response experts.

5.3.1.2 Transition to Spill of National Significance (SONS)Organization

After a spill event the OSC is faced with three critical functions: (1) mobilizing resources, (2) creating the response organization, and (3) directing the initial response actions. If they are successful, the response quickly passes through three stages: the mobilization/initial response phase, the integration phase, and the production phase. The mobilization and initial response phase is marked by the execution of tasks that are pre-defined by the contingency plan and will, even during a Spill of National Significance (SONS), be directed by the Coast Guard OSC. The success or failure of the mobilization effort depends upon the adequacy of the plan and the ability of the unit to immediately execute the plan.

The second stage, the integration phase, is the period required for the responding forces to arrive on scene and to form an effective operating unit. It is during this phase that the SONS organization will be created. The Coast Guard's goal should be to get through this integration phase and into the production phase as quickly as possible, but this transition will be difficult. The OSC unified command organization will be expanding and forming at the same time the SONS organization is forming. The implementation of relationships within and between these organizations could potentially slow down the response effort during a critical time. Organizational elements will have to establish themselves, create linkages within and between the OSC and SONS organizations, and create linkages with external stakeholders. For example, during the *Exxon Valdez* response, this integration phase lasted for almost a week (Harrald et al, 1993).

This problem could be analyzed in three steps: 1) an analysis of the two organizational structures (OSC and SONS), 2) a determination of the requirements for transition from one organizational structure to the other, and 3) an analysis of the organizational process required to affect this transition. Steps 2 and 3 are critical steps, but are not yet addressed by the Coast Guard. In a model of organizational change, Schein (1972) points out that any organizational transition involves three states: the original state, the transition state, and the final state. Too often, it is claimed, organizations define change by the end state, and ignore the vital transition state. Processes and responsibilities (particularly who is in charge during the transition) must be defined, or control will be lost during the transition state and the desired final state will not be reached. Future work could focus on this transition and will, through interviews and meetings, develop recommended processes, procedures, and responsibility assignments for the transition stage. These recommendations should be tested through the use of gaming exercises or simulation.

Before this project can be undertaken, the Coast Guard must converge on a relatively standardized OSC organizational structure. There would be two products: 1) a multi-dimensional analysis of the transition, based on a timeline. The organizational evolution would be described, and assignment of decisions, actions, and responsibilities identified. A model of the transition plan would then be developed. 2) This transition will be tested using a computer-based simulation model that will demonstrate the organizational evolution (both structure and function) over time.

5.3.1.3 Organizational Effectiveness Assessments

The assessment of the effectiveness of a response organization must follow from a determination of what is meant by a "successful" pollution response. The development of measures of effectiveness for pollution prevention and response was attempted by the Coast Guard during the 1970's (Harrald, et al, 1979; Harrald and Leotta, 1975). The issues identified during these early efforts remain valid: the need to define success, the requirement for appropriate measures of efficiency and effectiveness, and the need to establish the information management capabilities to provide the data required to compute and monitor these measures.

The Critical Success Factor approach developed under Task A provides a potential point of departure. The next step is to develop measures of efficiency and effectiveness. Efficiency measures are necessary to determine how well an organization carries out its assigned tasks. An example of an efficiency measure could be how long it actually takes the organization to mobilize the resources specified by its contingency plan, compared to the time specified by the plan. Effectiveness measures are necessary to determine if an organization is carrying out the correct tasks. An example of an effectiveness measure is the comparison of the resources mobilized to the resources required by the actual spill. If efficiency and effectiveness measures are properly defined, they are measurable using observed data and can be used to determine performance levels. Procedures must be established to ensure that the data required to calculate these measures are collected during spill response exercises and actual events. The determination of inadequate, adequate, and superior performance based on these measures could be based on facilitated workshops with senior Coast Guard officials. The literature on high performing and high reliability organizations (Roberts, 1989, 1990) should be explored and applied to pollution response organizations. The inter-relationships between organizational design, task, and performance could be explored through simulation. Organizational performance simulation models for crisis response organizations have been developed and are discussed by Carley (1991) and Lin and Carley (1992). These models should be explored for possible application to pollution response organizations.

This project would have three distinct deliverables: 1) The attributes of a high performing, high reliability response organization will be developed based on existing research, 2) Measures of efficiency and measures of effectiveness will be developed based on models of high performing organizations, and information requirements to monitor these measures will be identified, and 3) The use of measures of efficiency and effectiveness will be demonstrated using a computer-based simulation model.

5.3.1.4 Improvement of the Contingency Planning Process

The traditional contingency planning process is the creation of a plan by a planning staff or contractor. Experts are consulted by the planners during the planning process and senior managers approve the plan when it is completed. This process, however, has a number of serious deficiencies. First, the opinions and creativity of the experts and senior managers are not captured. Constraining their role to reacting to information provided by planners limits their creativity and input. Secondly, a useful plan should be driven by realistic scenarios and provide support for operational decisions. Planners and contractors are not likely to understand these dimensions. Third, external stakeholders find it difficult to participate in the planning process and their concerns are not incorporated into the final plan. Finally, the contingency planning process does not promote resolution of differences of opinion and the promotion of consensus. The result of these deficiencies is that the planning process hides divergent opinion rather than to resolve them, and parties or persons critical to the response may feel no ownership of the resulting plan.

The use of technology to promote the creativity and consensus building requirements of contingency planning is discussed in Harrald (1990, 1991) and Berlardo and Harrald (1992). The technology of Group Decision Support Systems is proposed as a tool to enhance the problem definition, problem solving, and consensus building aspects of contingency planning. Electronic meeting rooms coupled with GDSS software, such as the system installed at the George Washington University Management Decision Center, could be used to integrate the knowledge and opinions of response experts and external stakeholders. If measures of effectiveness and efficiency are developed for pollution response, then contingency plans could be tested, and meaningful standards for contingency plan review and approval could be developed.

The deliverables for this project would be the output of a series of strategic planning meetings, facilitated by electronic group support systems. The success, however, would depend on the ability to assemble appropriate experts. These meetings should include response experts from the Coast Guard and other response organizations and agencies. Critical problems and issues could be identified, and potential solutions generated and evaluated, by using group decision support technology.

5.3.2 Command Post Information/Display Issues

The development of new technologies has increased the use of highly complex and automated technological systems. Highly integrated systems often require control and coordination by individuals distributed in space with less than perfect communication channels. Oil spill response organizations could be characterized as one of these type of systems. At the same time, advances in information technology have helped to reduce the number of activities that human "components" must perform and allow personnel to focus on more cognitive tasks.

5.3.2.1 Decision Support Systems (DSS)

Decision support systems are one form of information technology which has been designed to assist decision makers in each phase of decision making. These systems are often termed "distributed decision systems" (Fischhoff and Johnson, 1986; Slovic, 1988; Tuler, 1987), and are generally controlled centrally by a small group, and consequently are, by definition, group decision-making systems. The clear benefit of the use of such decision support systems lies in the development of (technologically-assisted) shared mental models of appropriate actions, responses, and replanning efforts during a response. Rather than relying on the individuals involved in the response effort, the use of decision support systems focuses the response organization's formation, evolution, and decision making in accepted, appropriate models. The use of large screen displays, incorporating real-time information relating to spill trajectory, natural resource damage and threat assessments, available resources and their siting, etc., is of obvious benefit to spill response decision makers, who are presently assisted in decision making in the command cells by charts, acetate maps, and the occasional microcomputer. No networked decision making resource, incorporating real-time spill, spiller, and environmental information, is presently utilized, although the benefits of its use are clear.

Thus, decision support systems can offer oil spill response decision makers the opportunity to be assisted by an automated, consistent, knowledgeable decision maker in the command cell, able to access electronically and assimilate real-time situation information, as well as the wide variety of information available electronically in other forms (i.e., data, knowledge, and multimedia information bases). These decision support systems thus allow the human decision maker to surmount their cognitive processing limitations, as well as to assimilate new and different sources of information in support of the decision making task.

5.3.2.2 Expert Systems

With these systems, the institutional or corporate memory of effective (and ineffective) response experiences could be embodied in electronic form, and available to spill response decision makers in the form of recommendations and actions which "learned" from past organizational response experiences. Expert systems, for instance, go beyond the decision support provided with traditional decision support systems, and "clone" experts in electronic form, so that the knowledge, expertise, and decision-making heuristics of expert decision makers is available, portable, and distributable throughout the response organization, in order to provide effective and efficient expert-level decision support.

Rather than relying on the cognitive and information processing resources of the individuals in the response organization, the spill response decision makers (and the training process) could be assisted (or led) by expert electronic systems incorporating the organization's or response efforts' "best practices," implemented in an expert system which recommended, in real-time, appropriate actions and reactions to the events at hand. The benefits of such a system are obvious: consistent, appropriate, and real-time decisions can be made, effectively utilizing the corporate and institutional response experiences of the response organization, in a manner consonant with the overall response effort's goals. Further, these systems embody playback, simulation, and intelligent tutoring capabilities, which widen the training opportunities for members of the multi-agency response organization.

5.3.2.3 Interactive Networking

The use of teleconferencing, interactive networked simulation capabilities, and virtual reality technologies offers additional opportunities for effective spill response decision making training. These systems, which run the gamut from simple teleconferencing and networking facilities, to real-time and faster than real-time experiential training efforts, offer the following possibilities spill response training:

- *the ability to entice senior officials to participate training exercises which they normally might not participate in--whether because of the lure of new technology, or because effective use of the technology allows the senior official to participate without leaving their office, in a manner conducive to effective learning on both sides of the technology:

In the words of Coast Guard Captain of the Port of New York personnel:
"...we would rather have two hours [via teleconference or network] with the right high level person in a training exercise than two days with the wrong people."

*a cost-effective opportunity for all levels of the response organization to participate --more often, in order to solidify "lessons learned," and

*the ability to explore the benefits of real-time training for networked participants, particularly as the costs of these technologies decrease.

5.3.2.4 Software Capabilities

The software capabilities of decision support systems, expert systems, learning systems, networked systems, and virtual reality systems has been enhanced by the use of integrated, multimedia data and knowledge bases. These software suites should be utilized with the enhanced technology solutions identified above.

Integrated, multimedia databases, which incorporate text, graphics, animation, sound, video, and a variety of other information in electronic format, provide effective means of communicating information in advanced technology systems. The use of these data and knowledge bases can assist decision makers with sorting out the vast array of relevant response information (i.e., assisting with information overload), but can also assist in sifting through the rich, "deeper" information which defines how elements and tasks in a domain are related to each other, and the implications of those associations. These are the types of associations and relationships which human information processors have the most difficulty identifying and assimilating; ironically, these are the associations and relationships which can provide the greatest assist in effective oil spill responses. Thus, both the hardware architecture choices (i.e., decision support system, expert system, networked system, virtual reality system) and the software chosen to run on the system (i.e., traditional databases, knowledge bases, integrated data and knowledge bases, multimedia data and knowledge bases) define the capabilities and opportunities for effective spill response decision making training.

5.3.2.5 Developing an Organizational Research Base

The development of organizational theory, and an oil spill response organizational development research base, would greatly assist the development and articulation of appropriate and inappropriate organizational forms for oil spill response.

Developing effective organizational forms for oil spill response is a difficult task. As mentioned earlier, response to any type of emergency is a difficult prospect, often complicated by the absence of individual or corporate memory or history with the spill or the spill response

organization. Other industries (aviation, rail transportation, space and aerospace operations, nuclear power plant operations, etc.) have developed an organizational development and theory research base which permits the systematic development of response models based on empirical research. Unfortunately, the maritime community and the spill response community have a sparse human factors, information technology, psychological and behavioral research base; clearly, both communities could benefit from such a research base, which would inform the development of appropriate organizational forms and mental models of effective response. In the development of such a research base, the maritime community and the spill response community could benefit from the literature and research associated with "high reliability" organizations, which have focused on the interplay and relationships between decision-making, communication, organizational structures, person-machine interfaces, and organizational cultures and values in a domain in order to define effective organizations and effective organizational processes.

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APPENDICES

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APPENDIX A TASK A - SCENARIO DEVELOPMENT

DESCRIPTION OF SCENARIO DEVELOPMENT

Four structured meetings were held with the Captain of the Port of New York and with his key staff members, in which Port of New York spill scenarios and several actual spill histories were reviewed in order to develop spill scenarios for this task. The COTP New York response organization envisioned by its Contingency Plan and a draft Group New York crisis action plan were examined to determine the probable organizational structure of the response organization. Two spill scenarios were developed using this material.

COTP New York staff and the members of the steering committee for the Port of New York Local Area Committee participated in a scenario generation exercise. Captain Larrabee, COTP New York, and his staff, provided extensive support, cooperation, and materials during this task. They committed a great deal of time to the project meetings, in spite of very busy schedules, and their participation was the key factor in the creation of the materials presented in this report.

The objective of the preliminary analysis was to use a scenario based exercise to identify the issues and problems that must be resolved in order to successfully execute a spill response operation. The scenario event used was a collision between a Norwegian container vessel and Bahamian tanker in the Stapleton anchorage.

OIL SPILL CLEAN UP SYSTEM "FAILED MISERABLY" IN NEW YORK CONGRESSMAN CLAIMS. Congressman William O'Riordan (R-N.J.), chairman of the House Environment Committee, today called for Congressional hearings to determine why the oil spill caused by last Thursday's collision between a container vessel and an anchored tanker in New York harbor has resulted in such extensive contamination of environmentally sensitive areas. O'Riordan declared at a press conference that, "nothing has changed since the EXXON VALDEZ fiasco. The Coast Guard and the oil industry have been promising a lot to the Congress and to the public for the last few years, but when the chips were down, they failed just as miserably as they did the last time". Congressman O'Riordan asserted that the contamination of the shoreline of two states, including Rockaway Inlet, Sandy Hook Bay, and Raritan Bay is clear evidence of the "incompetence, collusion, and corruption" of the oil and shipping industries and the Coast Guard.

One of the worst oil spills in the history of the Port of New York occurred in the fog and rain at 3 a.m., August 18. The Norwegian container vessel LUTEFISK was outbound from Newark when it suddenly lost power, its emergency steering failed, and it rammed the Bahamian tanker UNIVERSAL PEACE anchored in Stapleton Anchorage, rupturing two of its cargo tanks and releasing millions of gallons of oil. The momentum of the collision caused the UNIVERSAL PEACE's anchor to break free and the ships drifted with the outgoing tide toward the Verrazano Bridge as the UNIVERSAL PEACE's cargo of heavy number 6 oil gushed into the upper bay. Although hampered by the fog, commercial tugs were able to secure the vessels and to retrieve several containers that fell from the LUTEFISK's deck due to the impact of the collision. The Coast Guard ordered the crews of the vessels to abandon ship due to the potential fire hazard on the UNIVERSAL PEACE and the fear that containers of hazardous cargoes on the LUTEFISK may have been ruptured during the collision. An estimated 3,000,000 gallons of oil from the tanks of the UNIVERSAL PEACE and approximately 5,000 gallons of fuel from the bunkers of the LUTEFISK were pushed by the North winds and ebb tides as far as the beaches of Sandy Hook and Rockaway; the shift of the tides and winds then pushed the oil back into Rockaway Inlet, Raritan Bay, and Sandy Hook Bay.

The Coast Guard Captain of the Port, Captain Rick Larrabee, presided over a hostile press conference at Coast Guard headquarters on Governor's Island yesterday. Larrabee ensured the public that federal, state, and local forces were working well together and that reports of dissention and organizational confusion were unfounded. The Coast Guard and the tanker owner had mobilized all the resources he needed to combat the spill, Larrabee stated, in response to an assertion that the oil industry's Marine Spill Response Corporation's multi million dollar stockpile of equipment in New Jersey was not effectively used. "The owners of the UNIVERSAL PEACE initially employed Clean Water, Inc., a local clean up contractor as specified in their approved vessel contingency plan", said Larrabee, "MSRC and the New York Clean Harbors Cooperative were called when it became apparent that the spill was beyond the local contractor's capability". Mr. Steve Dorrlor, the Regional General Manager of the Marine Spill Response Corporation said that responders were impeded by the poor visibility on scene, but that the performance of the company's new response vessel, the NEW JERSEY RESPONDER, had met expectations. However, according to observers, by the time the vessel arrived on scene much of the oil was either ashore or in shallow close shore areas. "Clean up in these areas is a slow process", admitted Dorrlor.

The Times has learned that the tanker's owners are a group of Canadian investors and, although their local representative was at Capt Larrabee's side during the press conference, the owners have not made themselves available to the press. Larrabee also stated that the Coast Guard was investigating allegations that the UNIVERSAL PEACE had been anchored outside of the designated anchorage area. Observers said that uncertainty over the vessel owner's actions, friction between federal, state, and local officials, confusion over contractual arrangements and the initial focus on the safety threat posed by the drifting vessels hampered early response efforts. Press conferences have been scheduled by the State of New Jersey Department of Environmental Protection and the New York Department of Environmental Conservation. Mayor Dinkins stated in an interview last night with channel 7 news, that he "was not pleased with the progress of the clean up and had serious questions about the Coast Guard, State, and City oil spill plans".

CHRONOLOGY OF SIGNIFICANT EVENTS AND ACTIONS
DURING FIRST 12 HOURS OF SPILL RESPONSE

<u>TIME</u>	<u>EVENT/ACTION</u>
0300	Collision between UNIVERSAL PEACE/LUTEFISK
0301	NY VTS reports collision to COTP NY
0303	Group NY commences contingency plan notifications
0304	Group NY operations center establishes communications with UNIVERSAL PEACE
0305	Group NY operations center establishes communications with LUTEFISK. Transmits safety broadcast.
0310	Group NY receives initial estimate of pollution: "several tanks containing # 6 oil have ruptured, ship is drifting toward Verrazano Bridge"
0320	Group New York completes contingency plan notifications.
0330	41'UTB from Station Rockaway on scene, reports on scene weather: 1/2 mile visibility in fog and rain. Wind from NW at 10 kts, current ebbing at 1.5 kts
0335	Capt Larrabee arrives at COTP NY, assumes OSC, closes port to commercial traffic and establishes safety zone around vessels.
0340	NOAA SSC reports to CG operations center
0342	Report received from LUTEFISK that containers containing hazardous materials were ruptured by collision. Materials confined on deck, but two containers lost over the side. Crews on both vessels determined to be at risk; COTP NY advises masters of both ships to abandon ship.
0345	Capt Larrabee contacted by Mr. Robert Smith, designated agent of the owners of the UNIVERSAL PEACE and the designated Qualified Individual under the vessel's contingency plan. Mr. Smith informs Capt Larrabee that the vessel contingency plan is being implemented and that Clean Water Inc. has been retained as a clean up contractor, that Murphy Pacific has been retained as a salvage contractor, and that his operations center is in the World Trade center. Capt Larrabee requests that Mr. Smith or his representative come to Governor's Island operations center. Mr. Smith elects to stay in the World Trade Center where he is in touch with the owners and send his assistant, Mr. Papapoulos to Governor's Island.
0345	Capt Larrabee requests Coast Guard Strike Force Assistance
0350	COTP NY transmits first POLREP
0400	Coast Guard makes initial press release
0415	NY fireboats, CG and commercial tugs on scene. Initial on scene assessment by COTP NY Port Operations Officer indicates that oil escaping from Universal Peace from at least three tanks. Two containers from LUTEFISK in water. Both crews abandoning ship in orderly manner.
0420	Crews from both ships safely off vessel
0430	SSC provide initial spill trajectory to CG OSC
0440	Tugs recover two containers from water.

0445 NY DEC and NJ DEP representatives report to CG operations center on Governor's Island

0510 Murphy Pacific Salvage tugs on scene. Helicopter overflight requested for first light cancelled due to poor visibility

0600 Clean Water Inc establishes operation center at Great Kills Harbor on Staten Island and commences skimming operation in lower bay

0630 Tug reports large quantity of oil 2 miles south of Verrazano Narrows Bridge. Reports received of oil coming ashore at Coney Island

0630 CG directs responsible party to execute protective booming plan in Rockaway Inlet.

0730 Murphy-Pacific salvage tugs report vessels secured south of Verrazano Bridge. HAZMAT party boards LUTEFISK to secure hazardous materials on deck.

0740 Salvage party board UNIVERSAL PEACE to attempt to pump out damaged cargo tanks. Cargo to be pumped over the top into commercial barges

0745 Coast Guard makes second press release

0800 Clean Water Inc. reports that ships have been boomed to attempt to contain oil at source. However, oil still escaping from UNIVERSAL PEACE and some oil is escaping under the containment barrier.

0800 Regional Response team meets via telephone conference call.

0805 Strong smell of oil reported at Sandy Hook and on Rockaway Point

0815 NY DEC, NJ DEP, state and local officials accompany CG on survey of area via 41' UTB. Helicopter overflight still not possible due to restricted visibility.

0830 Slack Water. Wind on scene report to be SSE at 10 kts, sea 1-2 ft

0835 SSC provides revised spill trajectory to OSC, indicating oil will drift into Raritan Bay, Sandy Hook Bay and Rockaway Inlet on incoming tide.

0840. CG directs Responsible Party to implement protective booming of sensitive areas in Raritan Bay. Clean Water Inc. unable to provide adequate resources in Lower Bay, Rockaway Inlet and in Raritan Bay according to CG assessment.

0845 Capt Larrabee directs responsible party to mobilize additional resources. MSRC and Clean Harbors Cooperative contracted by Mr. Smith.

0900 Hazardous cargoes on LUTEFISK reported secure and no further threat to responders by CG Port Operations Officer on scene.

0930 Coast Guard makes press release.

0945 NY State Department of Environmental Conservation Commissioner makes press release from office in World Trade Center

1000 Coast Guard Strike force advisors on scene.

1100 Marine Spill Response Corporation Response Vessel NEW JERSEY RESPONDER on scene. Resources deployed on by Clean Water, Clean Harbors, and MSRC include skimmers, containment barriers, storage barges, and storage bladders. Response operations still hampered by poor visibility.

1130 NJ State Department of Environmental Protection makes press release.

1210 Oil reported coming on shore at Comfort Pt NJ, Raritan Bay, Gateway National Recreation Area on Staten Island, Coney Island Beach, Sandy Hook and Rockaway inlet.

1215 Revised spill trajectory provided by NOAA SSC. SSC recommends increased protective booming of sensitive areas.

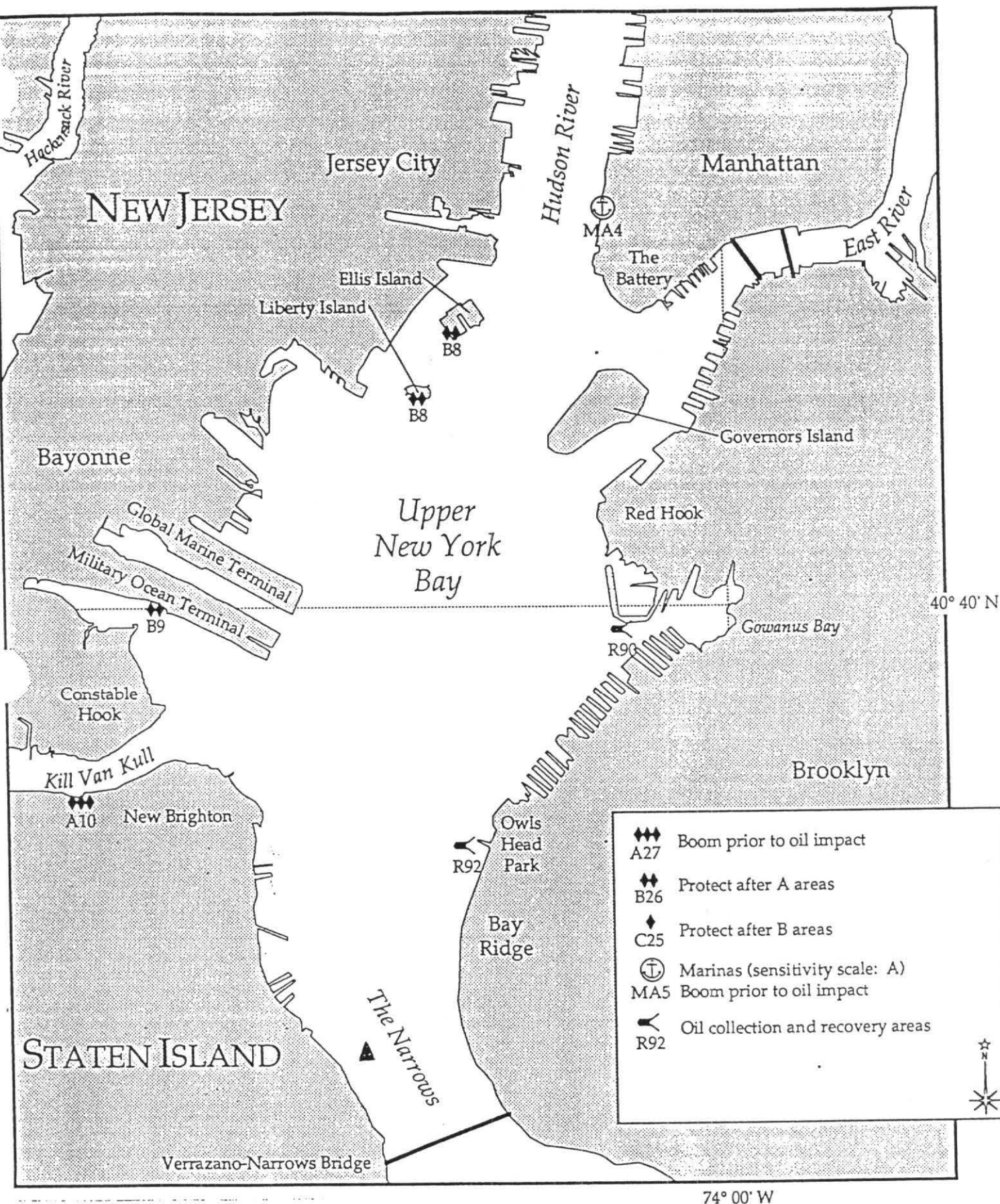
1230 Coast Guard, NY DEP, NY DEC, responsible party, and clean up contractors meet to discuss response priorities and to clarify organizational issues.

1300 Environmental activists demonstrate at Governor's Island ferry terminal

1400 Weather clears enough for overflight. Traffic control has to be established to coordinate media helicopters in response area. Heavy sheen observed in Lower Bay, Raritan Bay, Sandy Hook Bay and Rockaway Inlet. Significant amounts of oil observed on beach. Several areas designated as environmentally sensitive by COTP. NY contingency plan observed without protective booming in place.

1420 Bird cleaning station established on Staten Island. Responsible party agrees to fund activity.

1500 Coast Guard holds press conference on Governor's Island.



Map of Upper New York Bay
Showing Site of Collision (▲)

Port of New York Pollution Response

Alternative Scenario

Location: South end of Prall's Island, Arthur Kill

Event: Grounding of Tank Barge at 0200, 7 Feb

Owner of T/B: Local Barge operator

Owner of Oil: Light and Power Co.

Weather: wind NW 20 kts, Temp 24°

Current: ebbing, max ebb is 1.4 kts at 0500

Impact: Two tanks rupture (#2, #4 starboard), 2.2 Million gallons (52,000bbls) of number 6 oil released into Arthur Kill

Result: By first light oil has been driven by wind and current down Arthur Kill to Port Mobil and threatens to escape into Raritan Bay.

OSC: COTP New York

Owner's approved response: Local Co-op

APPENDIX B

HINDCASTING EXERCISE PORT OF NEW YORK

B.1 OBJECTIVE OF THE EXERCISE

The objective of the hindcasting exercise is to "define the problem"; to specify and refine the Coast Guard's obligation under the National Contingency Plan and to identify preparation critical to the fulfillment of these obligations.

B.2 METHODOLOGY OF THE EXERCISE

The methodology used to extract expert opinion from Coast Guard and Local Area Committee members was the technique of hindcasting. During a hindcasting experiment, experts are given the end point of an operation (in this case a failed pollution response) and challenged to determine WHAT went wrong, and WHY these failures occurred. The results of the exercise can be used to develop planning and problem solving strategies. Since the WHAT and WHY of success are the inverse of the WHAT and WHY of failure, the exercise enables the definition of the factors critical to the success of an oil spill response and identification of priority problem solving activities.

The COTP New York staff was then asked to rank the critical success factors (CSF) and causal factors on a 1 to 10 scale on the dimensions described below.

Critical success factors:

Criticality--How critical is achieving this CSF to the success of the pollution response? (1=least, 10=most critical)

Likelihood--Assess the likelihood that the critical success factor would be achieved if the scenario spill occurred today.
(1= least likely, 10=most likely)

Causal problems/issues:

Criticality--How critical is solving this problem or resolving this issue to the attainment of the critical factors necessary for a successful pollution response?

Difficulty--How difficult would it be to solve this problem, considering economic, political, and technical aspects?

Likelihood--Assess the likelihood that each casual factor exists in New York.

HINDCASTING SCENARIO EXERCISE

PORT OF NEW YORK

DIRECTIONS FOR EXERCISE

1. IDENTIFY four things that went wrong during the spill response that led to the failure described in the NEW YORK TIMES article. (e.g. responsible party took no action, equipment did not arrive until after oil hit the shoreline).

- RECORD EACH ITEM on the upper portion of the exercise form.
- Duplicate forms will be consolidated, the remaining unique forms are distributed to participants

2. SELECT A FORM AND IDENTIFY A WEAKNESS OR PROBLEM in the National Response System that contributed to the spill response failure identified on the form.

- RECORD the causal problem or factor is recorded on the bottom portion of the exercise form
- REPEAT THE PROCESS until all each form has five causal problems or factors.

3. Comments will be collected and transcribed. The entries in the upper portion of the form will be converted into CRITICAL FACTORS FOR SUCCESS. The critical factors will be prioritized by participants.

4. Causal problems are transcribed and displayed. Causal problems will be ranked on the dimensions of CRITICALITY and DIFFICULTY.

HINDCASTING EXERCISE

PORT OF NEW YORK

WHAT WENT WRONG?

WHAT OCCURRED THAT LED TO THE PERCEPTION OF FAILURE DESCRIBED IN THE CASE?

PRIORITY _____

WHY DID THIS OCCUR?

WHAT CAUSED THE FAILURE DESCRIBED ABOVE?

1.

2.

3.

4.

5.

Port of New York Pollution Response

Critical Factors Ranking

Evaluate each critical success factor on a scale of 1 to 10 as it pertains to a pollution response effort in New York using the following criteria.

Criticality: How critical is achieving this critical success factor to the success of the pollution response?

1 = least critical

10 = most critical

Critical Success Factor	Criticality
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Port of New York Pollution Response

Critical Factor Assessment

Assess the likelihood that each critical factor would be achieved using a scale of 1 to 10 if the scenario spill occurred today in New York Harbor.

1 = Least likely

10 = Most likely

Critical Success Factor	Likelihood
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

<u>CRITICAL SUCCESS FACTORS</u>	<u>CRITICALITY OF FACTOR</u>	<u>LIKELIHOOD OF ACHIEVING IN P.O.N.Y.</u>
1. Adequate response resources must be mobilized	9.5	4.8
2. Oil spillage from the source must be minimized	9.0	3.0
3. The OSC must be able to realize when response strategy is inappropriate and must be able to quickly adjust strategy to actual situation.	9.0	8.0
4. Response organizations must be able to communicate effectively with each other and must transfer information between and within response organizations.	8.8	7.8
5. Response organizations must communicate accurate and timely description of response efforts to public and media.	8.5	7.8
6. Oil must be contained at or near the source.	8.5	2.0
7. The pre-planned command/organizational structure must be cohesive and work effectively from the start.	8.5	6.8
8. Significant contamination of beaches and sensitive shorelines must not occur.	8.2	2.6
9. Stakeholders must be identified and their interests accounted for.	7.5	7.2
10. Planning of federal, state, and local organizations must be coordinated and without conflict.	7.5	7.4
11. Response equipment must work as designed.	6.8	5.8
12. The immediate response initiated by owners according to pre-approved response plans must meet CG expectations.	6.5	5.0
13. The public's expectations prior to the spill must be realistic.	6.3	2.6
14. Rescue and salvage operations must not impede pollution response operations.	5.3	6.8

**TABLE 1- CRITICAL SUCCESS FACTORS
OIL SPILL RESPONSE**

Port of New York Pollution Response

Causal Factor Ranking

Evaluate each causal factor on a scale of 1 to 10 as it pertains to a pollution response effort in New York using the following criteria:

Criticality: How critical is solving this problem or resolving this issue to the attainment of the critical factors necessary for a successful pollution response?

Difficulty: How difficult would it be to solve this problem? Consider economic, political, and technical aspects.

1 = least critical/difficult

10 = most critical/difficult

Causal Factor	Criticality	Difficulty
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Port of New York Pollution Response

Causal Factor Assessment

Assess the likelihood that each causal factor exists in the Port of New York today on a scale of 1 to 10.

1 = Statement does not apply

10

= Statement applies completely

Causal Factor	Likelihood
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

<u>CAUSAL PROBLEMS/ISSUES</u>	<u>CRITICALITY OF PROBLEM</u>	<u>DIFFICULTY TO SOLVE</u>	<u>LIKELIHOOD PROBLEM EXISTS IN P.O.N.Y.</u>
1. CG OSC does not have the ability or status required to exhibit personal leadership during spill response.	10.0	6.8	1.4
2. The response organization does not have the capability of communicating accurate, timely, and consistent information to the public during a response.	9.6	5.8	4.8
3. The resources required to execute the response strategy cannot be mobilized in the time frame required.	9.4	9.0	5.2
4. Capabilities and limitations of response organizations and equipment have not been communicated to stakeholders, media, and public.	8.8	5.8	6.6
5. The response organization specified in the plan will not work in practice to integrate all responsible organizations in a way that ensures the ability to make decisions and take actions.	8.8	8.2	4.8
6. The CG does not have the ability to communicate with the owner and rapidly ascertain and influence owner's behavior.	8.8	6.2	3.4
7. Key jurisdictional authorities and stakeholders are not participating in planning process; inter-organizational issues are not resolved resulting in lack of ownership of the product.	8.6	6.8	3.8
8. Adequate inter-organizational communications could not be established and maintained.	8.6	6.8	3.8
9. The CG does not have the ability to control simultaneously operations (fire, salvage, multiple spills, etc).	8.4	6.6	2.4
10. Public information strategies and media access sites are not defined and maintained.	8.4	4.8	6.2
11. Response strategies and tactics are not based on realistic scenarios.	7.6	5.2	3.0
12. The technology available for containing and removing oil from open water is inadequate.	7.4	10	9.8
13. The vessel response plan review and evaluation process does not ensure viable and valid operator response.	7.2	6.6	7.5

TABLE 2- CAUSAL FACTORS

APPENDIX C

KEY TO ABBREVIATIONS AND ORGANIZATIONAL CHARTS FOR PORT OF NY POLLUTION RESPONSE

APPENDIX C.1

KEY TO ABBREVIATIONS USED IN ORGANIZATION CHARTS FOR COTP NY POLLUTION RESPONSE

OSC	On-Scene Coordinator
FOSC	Federal On-Scene Coordinator
COTP	Captain of the Port
ACOTP	Assistant Captain of the Port
RP	Responsible Party
SSC	Scientific Support Coordinator
CAMEO	CAMEO System Operator
ADO	Assistant Duty Officer
RMOW	Radioman of the Watch
GDO	Group Duty Officer
RDO	Response Duty Officer
WC	Watch Captain
PA	Public Affairs Officer
POLREP	Pollution Report Writer
CHRONO	Chronological Log Keeper (Duty Yeoman)
NSF	National Strike Force Representative(s)
SUPSALV	USN Supervisor of Salvage Representative
EPA	Environmental Protection Agency
ERT	EPA Emergency Response Team Representative
MSC	USCG Marine Safety Center Representative

APPENDIX C.2 ORGANIZATION CHARTS FOR PORT OF NY POLLUTION RESPONSE

The organizational structure used as a departure point was the structure specified by the Group New York draft Instruction *Crisis Action Planning for Initial Response to Report of Maritime Incidents*. This instruction envisions the evolution of a response organization based on the Incident Command System functional model. Discussions were held with the COTP New York staff to determine how and when this structure would evolve into an integrated command structure. The resulting hypothesized organizational evolution is shown in the following organization charts which show the response organization at :

- the time of notification
- at 30 minutes after notification
- at 3 hours after notification
- at 6 hours after notification
- at 12 hours after notification

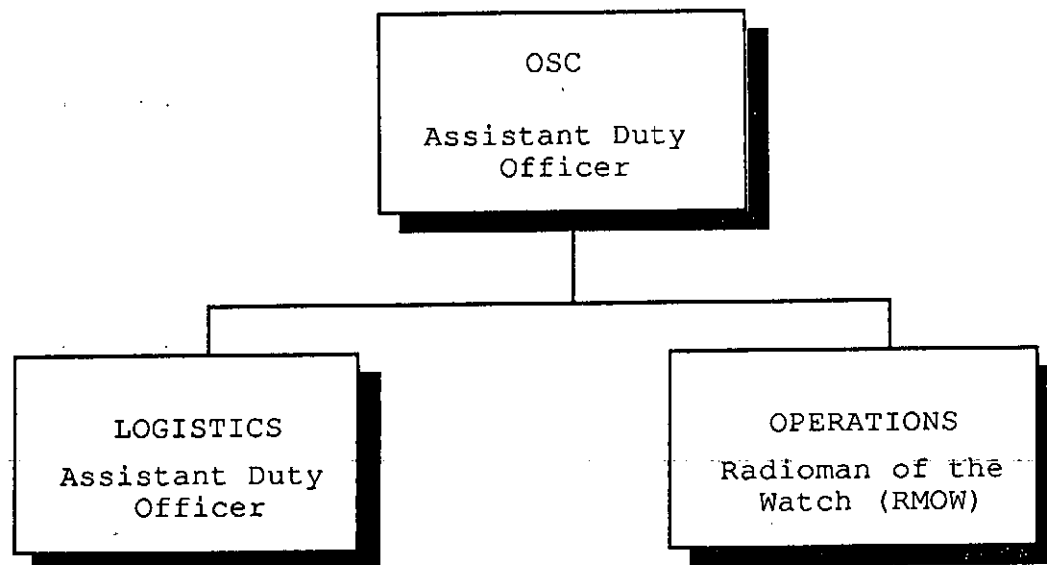
The organizational descriptions through $t = 6$ hours are based on Group New York Instruction 16465. The organization for $t = 12$ hours was developed based on discussions with COTP New York staff, an examination of USCG proposed Spill of National Significance organization (National Strike Force Coordination Center, 1992), and organizational guidance for the Incident Command System.

The critical organizational assumptions presented in these diagrams include:

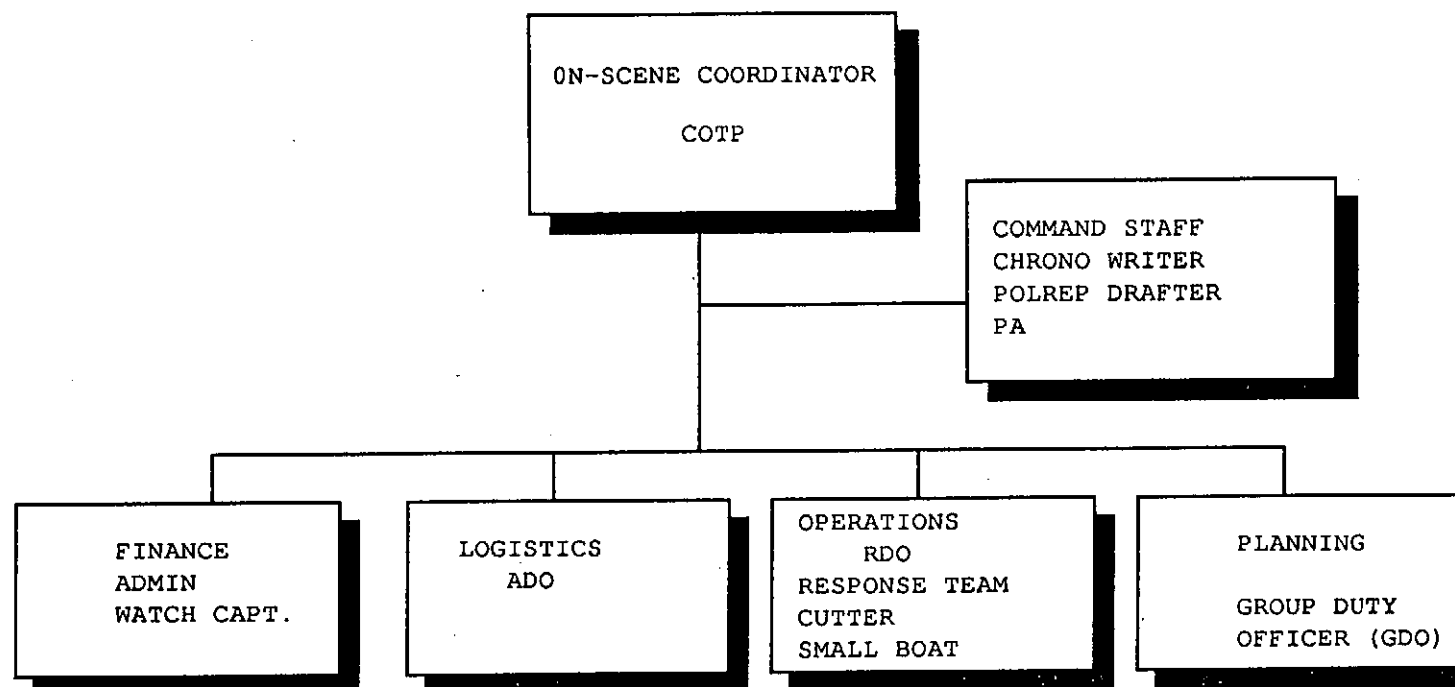
- The COTP will be on scene at $t = 30$ minutes.
- The command element, the planning element, and the public affairs element will be jointly staffed by CG, State, and responsible party officials by $t = 6$ hours.
- All response elements except the finance and logistics elements will be jointly staffed prior to $t = 12$ hours.

The mobilization phase for a spill of the type used in the exercise scenario should be concluded by COTP New York within three hours. During this time period, the actions taken are predominantly those pre-determined in the contingency plan. The integration phase will be completed, according to COTP New York's plan, by time $t=12$ hours.

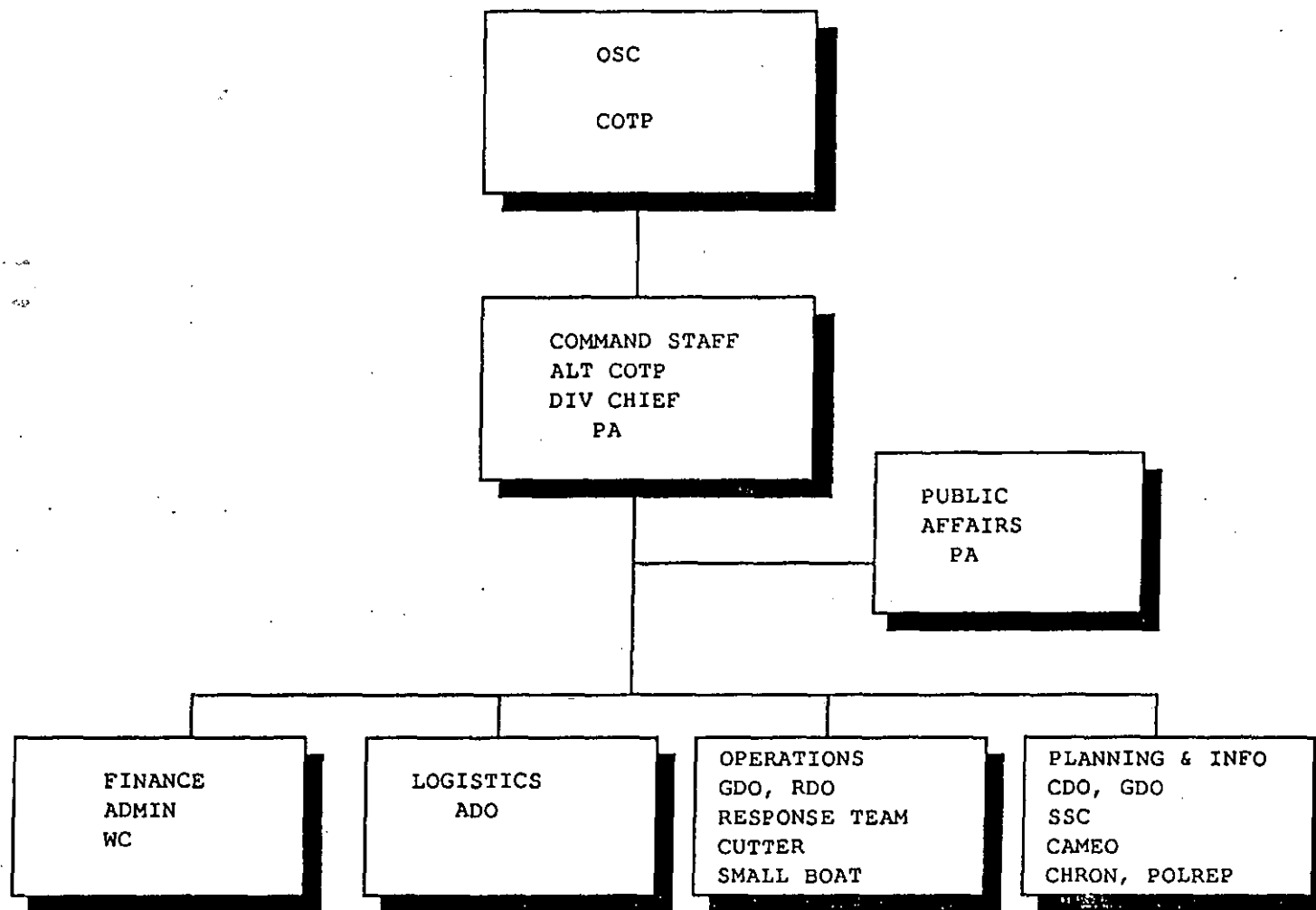
NOTIFICATION



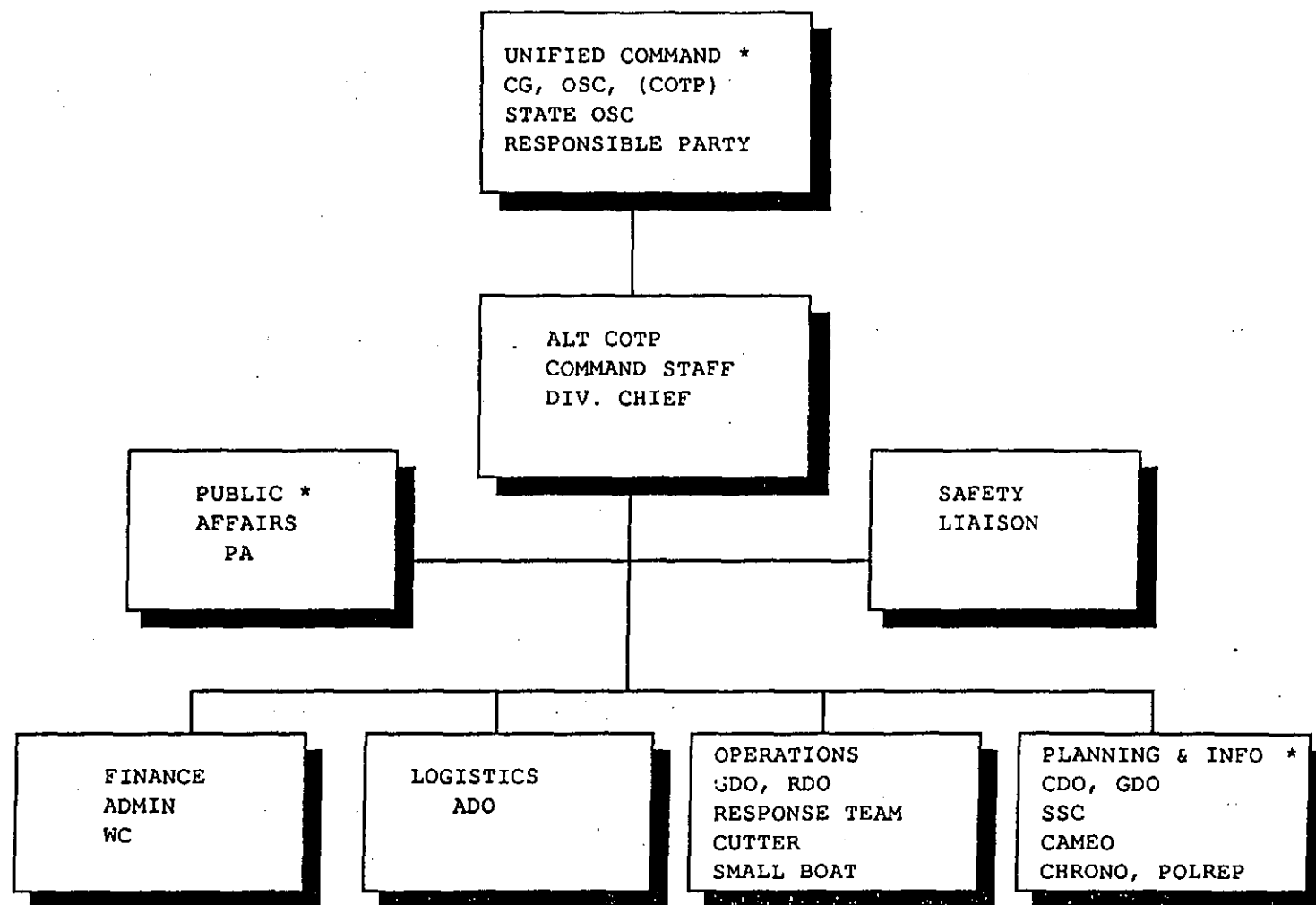
INCIDENT + 30 MINUTES



INCIDENT + 3 HOURS

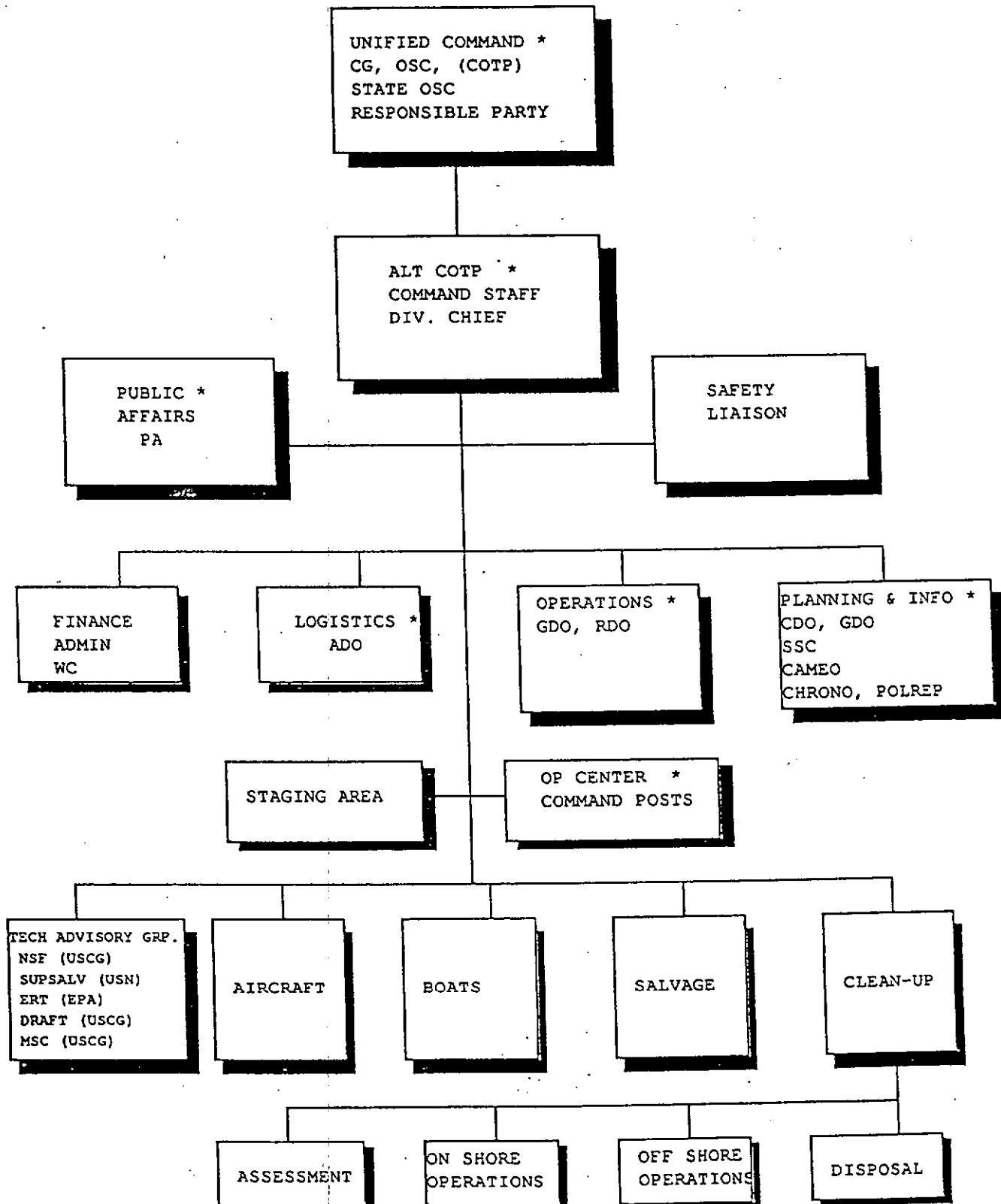


INCIDENT + 6 HOURS



* Staffed by CG, State, and Responsible Party

INCIDENT + 12 HOURS



* Staffed by CG, State, and Responsible Party

APPENDIX D DETERMINANTS OF TRAINING OBJECTIVES FOR OIL SPILL RESPONSE

D.1 THE SUCCESS OF A RESPONSE EFFORT WILL BE JUDGED ON A COMBINATION OF INTERNAL MANAGEMENT, EXTERNAL MANAGEMENT, AND PUBLIC PERCEPTION FACTORS.

Traditionally, organizations who have responded successfully to disasters have been those who have embraced the opportunity and managed the situation well, particularly in the eyes of the public. The Task A requirements determination effort identified that successful oil spill response efforts have been characterized by the following attributes:

- the spill impact is *reasonably* mitigated, contained, and handled,
- someone takes responsibility for spill clean up quickly--and maintains an effective leadership role,
- the response team is buffered from the immediate requirement to respond to political and other pressures, allowing the response organization to establish expectations, meet those expectations, communicate effectively, follow through on published plans, and perform on-going real-time assessments of the response effort,
- the response team is allowed to establish expectations, meet those expectations, communicate effectively, and perform real-time assessments of their performance during the response,
- the press has a preconceived notion of the response plan, players, and responsibilities. This knowledge creates a set of preconceived expectations of what the response team is capable of achieving, and provides a context within which the actions of the response team will be judged, and
- the public perceives that:
 - the response is quick and effective,
 - response team leadership is effective, empathetic, and knowledgeable,
 - the response team is running like a well-oiled machine(i.e.,therefore, less scrutiny is required to focus the team's attention on "important matters"), and
 - team internal and external communications are effective, familial, responsive, and consistent.

Effective training for oil spill response must address the response team's need to produce an effective, successful response.

D.2 JOINT OPERATIONS (I.E., OPERATIONS BETWEEN DIFFERENT FUNCTIONAL ELEMENTS IN THE ICS ORGANIZATIONAL STRUCTURE, AS WELL AS BETWEEN FEDERAL, STATE, AND RESPONSIBLE PARTY ELEMENTS) ARE AN INCREASINGLY IMPORTANT ELEMENT IN SUCCESSFUL SPILL RESPONSE.

...A lesson learned from the Exxon Valdez was the need for representatives from the state(s), spiller, and the [federal government, in order] to reach consensus on clean-up strategy. The members of this "strategic response team" must have absolute decision making authority and are envisioned to be senior state and corporate representatives. This team would come together daily, or more often, and decide resource issues, site clean up issues, etc. By participating in the decision it was felt that these representatives would support the clean up priorities resulting in more efficient political agendas (US Coast Guard National Strike Force Coordination Center, 1993; p. 7).

Joint operations have been identified as necessary in several areas in spills of national significance (SONS): joint operations centers, joint information bureaus, joint legal centers, and joint transportation centers (US Coast Guard National Strike Force Coordination Center, 1993; p. 8). These centers have been identified as important to realize "efficiencies from shared resources and personnel, as well as to enhance the intangible benefits of commonality of purpose" (p. 8). The USCG COTP NY ICS-based organization, in fact, identifies the need for a separate joint information center to coordinate information flows and communications for the response effort.

D.3 DECISION MAKING TRAINING OBJECTIVES FOR OIL SPILL RESPONSE SHOULD BE INFORMED BY AN UNDERSTANDING OF EFFECTIVE INDIVIDUAL AND GROUP DECISION MAKING MODELS

Decision making is often treated as a task that is triggered by the existence of a problem or an opportunity which presumes a need for action. Simon's three-phase model of decision-making (1960), which includes intelligence, design, and choice phases, provides a fairly broad view of decision making and is probably the most widely utilized in information systems research.

In Simon's intelligence phase of decision making, the decision maker specifies the nature of the task by gathering all relevant information. Here, the challenge is in gathering information related to goals and in defining the problem space. The information gathered through the intelligence phase is then used to generate alternate courses of action using the inherent relationships among input variables and constraints in the design phase. The challenge for the design phase is the generation and management of solution alternatives.

Finally, using a set of criteria that are considered appropriate in the design environment, the "best" course of action is chosen by the decision maker for implementation in the choice phase. The governing decision making models determining the nature of the choices made can vary from attempts to develop 'optimal' decisions, to decisions which satisfice, or which make incremental changes to the current decision situation. Much psychological and management science research has focused on identifying different individual's and group's risk profiles in order to assess the likelihood of various actions. In the event that feedback from the Choice to the Intelligence and Design stages occurs, individuals and organizations learn from their decision-making experiences, thus institutionalizing individual and corporate "lessons learned."

In responding to disasters, the various constituents must engage in a uniquely divergent process, encouraging the generation of multiple perspectives; thus group decision making is an important component of disaster response. The generation of multiple perspectives is essential to understanding and describing problems in complex decision settings. Each participant must share with the others their knowledge and experience so that learning will occur and that the group knowledge base will exceed the sum of the individual knowledge bases (Belardo and Harrauld, 1992).

Group decision making is fundamentally an interactive process, however, and patterns of interaction may affect acceptable, actual, and potential levels of performance and coordination. To cooperate effectively, members of a decision group must create and share common understandings, perceptions, and objectives. Yet the creation and maintenance of common meanings depend ultimately on the cognitive processes used by individuals at a particular time. To complete the circle, these cognitive processes, upon which an emergency response system is so dependent, affect the information processing characteristics and behavioral phenomena of the system (Tuler, 1988; p. 112).

Effective decision making, whether individual or group, is thus characterized by the pursuit of a wide variety of information, the logical and rational assessment of the gathered information, a prioritization of the available options and recommendations, the choice of an acceptable solution, and feedback from the process to the affected members, as well as to the members of the decision making body. Decision making training objectives should reflect and nurture this process, and should vary for each stage of decision making being supported and strengthened.

APPENDIX E TRAINING OBJECTIVES

Appendix E provides a detailed breakdown of both terminal and enabling training objectives for the multi-agency, command post training, broken into categories describing who is to be trained, what the training objective is, the priority for the training objective, the different conditions and tasks to be trained, and standards for evaluating performance. Below each training objective are notes indicating knowledge and skills sets, and links to past and future research, which may also be considered for that particular training objective. The Appendix E training objectives are also broken down by ICS functional cells (command, operations, planning, logistics, and finance) for clarity.

Terminal training objectives are defined as specific training objectives leading to the development of proficiency or skills for oil spill response. *Enabling training objectives* are more generic in nature, and are supportive of the development of specific oil spill response proficiency or skills.

Terminal Training Objectives

Priority*	Who?	Training Objective	Sample Conditions	Sample Tasks	
1	Command C1	Determine Incident-specific objectives under various conditions	• Alternate spill sites • Alternate spill types/materials • Alternate weather, wind, environmental factors • Alternate command post sites • COTP/ADMIN orders in effect • RP responds with appropriate/inappropriate resources, plans • Political problems between state, fed, and local agencies • Role clarification needed • Need to establish who's in charge • Command post sites predetermined • Need for backup command post site location	• Gather requisite data, info, judgment, opinions • Prioritize required tasks, concerns, needs appropriately • Allocate available resources to highest priority areas • Make effective use of decision support technology • Develop, communicate, & implement initial response strategy based on initial info/preplans • Negotiate RP compliance with OSC requirements	• Provide feedback and performance assessment in real time to cell, and reporting cells • Insure safety of all responders
* Priority 1 = High 3 = Low				Potential Standard(s)	
				• In a timely manner • Within ____ minutes	

Notes: Simultaneous real-time evaluation of alternatives
Parallel hypothetical reasoning

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	
1	Command C2	Establish Incident-specific organization and staffing under various conditions	• Single RP/single state • Single RP/multiple states • Multiple RP's/ multiple states • Multiple RP's/multiple states • Political problems between state, fed, and local agencies • Role clarification needed in response community • Need to establish who's in charge	• Incorporate primary response group members into decision process • Build initial response organization as specified in contingency plan • Assign responsibility and authorities to make decisions • Determine need for federal direction of response • Evaluate need for liaison personnel • Assess need for, & request as needed, use of special forces • Determine location of command post	• Provide feedback & performance assessment in real-time to cell and reporting cells • Provide improvement suggestions for cells and reporting cells
					Potential Standard(s) • In a timely manner • Within ____ minutes
Notes: Evolving effective response organization in 3-10x's real time Foster organizational culture of high reliability					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
3	Command C3	Prepare and implement incident-specific safety plan	- Oil discharge - Hazmat discharge - Use of local response teams or mini RRT's	- Coordinate response - Evaluate, approve use of dispersants - Direct functions of command post - Authorize use of funds - Assess & establish response priorities - Modify strategy & tactics as required	- In a timely manner - Within ____ minutes
Knowledge and Skills:					
2	Command C4	Establish and implement OSC briefing/organizational reporting procedures	- Non-imminent danger to critical resources - Imminent danger to critical resources - Imminent danger to population center - No electrical/electronic commun, documentation support	- Prepare fact briefs - Provide frequent, scheduled command post briefings - Schedule command post and reporting cell briefings - Hold joint RP/state/fed briefing at t = 2 hrs, t = 6 hrs, etc. - Brief RRT on status - Notify stakeholders ID's in C.P; schedule meeting	- In a timely manner - Within ____ minutes
Notes: Use briefings, organizational reporting as opportunities to establish (and meet) expectations Use as drivers for performing real-time performance assessments					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Command C5	Debrief, critique, develop "lessons learned," institute organizational memory/learning	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Contingency plan not adequate, updated...	- Evaluate RP's Initial and subsequent response effort - Monitor response mobilization timeliness - Modify strategy & tactics as required - Provide feedback to cell, and reporting cells, as well as guidance on how to improve - Develop corporate memory, and capitalize on "lessons learned" from earlier experiences - Effectively utilize electronic and decision support capability available - Negotiate compliance of RP with OSC requirements	- In a timely manner - Within ____ minutes

Notes: Inter- and Intra-team coordination, Integration, communication, organizational memory, Development of shared mental models of appropriate/inappropriate decision-making, "learning" organization

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Command C6	Prepare and conduct media/VIP briefings under various conditions	- Local news organizatns/ local VIP's - State news organizatns/ state VIP's - National news organiztns national VIP's	- Prepare scheduled news briefing - Respond to ad hoc VIP briefing request - Conduct PBS-like media interview	- In a timely manner - Within ____ minutes

Notes: Multiple, simultaneous goals--Information communication, shaping expectations, confidence building

2	Command C7	Resolve all Incident response Issues, not resolved at lower levels, with the unified organizatn under various conditions	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states	- Evaluate need for In situ burning - Negotiate RP compliance with OSC requirements - Modify strategy and tactics as required	- In a timely manner - Within ____ minutes
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Notes:

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Command C8	Effectively document spill history, response, planning, re-planning, and "lessons learned"	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states	- Insure RP billed accurately, fairly, in a timely fashion - Insure spill history recorded, accurate - Document plans, re-plans, evolutions to plans - Insure logkeeping present, accurate - Document lessons learned	- In a timely manner - Within ____ minutes

Notes: Inter- and Intra-team coordination, communication, integration

3	Command C9	Determine location of command post	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Multiple spill sites	Determine location of command post	- In a timely manner - Within ____ minutes
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Notes:

Enabling Training Objectives

Priority*	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standards
1	Command C10	Efficiently gather salient decision-making information, in support of various decisions, under a variety of conditions	- Individual and team fatigue, stress, surprise, uncertainty - Incomplete, time-varying information - Data/Information overload	- Determine adequacy of RPI response - Determine spill history of spiller - Determine extent of spill; resources at risk * Establish QI history	- In a timely manner - Within ____ minutes
* Priority 1 = High 3 = Low					
Notes: • Recognition of impact of various factors impacting effective human decision-making • Effective info gathering approaches/techniques					
1	Command C11	Effectively and efficiently analyze relevant and appropriate data, knowledge, models, opinions, and judgments under various conditions	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Contingency plan N/A	- Assess & establish response priorities - Evaluate response options - Monitor response timeliness - Assess, diagnose, and direct effort as required - Modify strategy and tactics as required	- In a timely manner - Within ____ minutes
Notes: • Development of appropriate team shared mental models • Appropriate analysis techniques • Avoidance of indiv and group d-making limitations/difficulties (groupthink, slouching, etc.)					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standards
1	Command C12	Perform on-going situation assessment, re-assessmt, and direction/redirection of response effort	- Individual and team fatigue, stress, surprise, uncertainty - Incomplete, time-varying information - Data/information overload	- Evaluate response options - Monitor response timeliness - Assess, diagnose, direct and redirect response effort - Modify strategy and tactics as required - Assess & establish response priorities	- In a timely manner - Within ____ minutes
<i>Notes :</i> - Limits to human decision-making - Assessment, reassessmt loop model development - Iterative situation assessment - Team building, delegation					
2	Command C13	Interface effectively, and utilize effectively, external sources, community & local response personnel, volunteers	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Human service orgs (Red Cross) - Public works, mutual aid organizations - Volunteer groups - Heavy equipmt operators	- Determine effective mix of internal/ external resources - Delegate appropriate mix of tasks - Capitalize on resources talents, energies of external sources, w/out compromising response effort	- Negotiate RP compliance with OSC requiremts - Modify strategy and tactics as required - Evaluate response options - Monitor response timeliness - Assess, diagnose, and direct effort as required - In a timely manner - Within ____ minutes
<i>Notes :</i> - Liaison skills--recognition of team contributions, strengths, weaknesses - Delegation skills - Developmt of appropriate models of tight vs. loose coupling					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	
1	Command C14	Develop timely, correct, and consistent decisions appropriate to the decision-making and response phase, supportive of the criteria for success for different phases, conditions	• Response Initiation, integration, production phases • Transition phases bet. response stages • Individual and team fatigue, stress, surprise, uncertainty • Incomplete, time-varying information • Data/information overload • Single RP/single state • Single RP/multiple states • Multiple RP's/ multiple states • Multiple RP's/multiple states • Human service orgs (Red Cross) • Public works, mutual aid organizations • Volunteer groups • Heavy equipmt operators	• Evaluate response options • Monitor response timeliness • Assess, diagnose, direct and redirect response effort • Modify strategy and tactics as required • Determine effective mix of internal/ external resources • Delegate appropriate mix of tasks • Capitalize on resources talents, energies of external sources, w/out compromising response effort • Determine optimal organizational size & composition, and act expeditiously to promulgate & effect it.	• Determine relevant criteria for success for each phase • Assess performance • Make appropriate use of decision support technology to overcome human limits • Determine approp resources to be deployed, and deploy • Determine when to call stakeholders in different phases • Determine level of threat, risk, and response requierd Potential Standards • In a timely manner • Within ____ minutes
Notes: • Liaison skills—recognition of team contributions, strengths, weaknesses					
• Delegation skills • Developmt of appropriate models of tight vs. loose coupling					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Command C15	Develop effective and efficient communication and leadership style	- Local, state, national news organizations/VIP's - Public Information/ community relations - Public and private communication key to response success - News media impacting response operations	- Establish protocols for VIP's - Modify strategy & tactics as required - Schedule briefings, communications - Establish press conference - Provide media updates - Insure all spokespeople have same information	- In a timely manner - Within ____ minutes
Notes: Inter- and Intra-team coordination, communication, integration					
2	Command C16	Communicate effectively within team, with public, with media, with external personnel, under various conditions	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states	- Prepare fact briefs - Provide frequent, scheduled command post briefings - Schedule command post and reporting cell briefings - Hold joint RP/state/ fed briefing at t= 2 hrs, t = 6 hrs, etc. - Brief RRT on status - Notify stakeholders ID's in C.P; schedule meeting	- In a timely manner - Within ____ minutes
Notes:					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Operations O1	Order and control all response resources under various conditions	- Low, medium, high response resource requirements - Beach clean-up - Surf washing - Fish, bird, wildlife migration & clean-up - Air, water, land clean up monitoring	- Compare equipment hired vs. equipment required - Evaluate time required for RP equipment to arrive - Determine additional resources required - Use of local response teams or mini RRT's - Use of warning systems & public emergency notifications - Oil/hazardous waste permits required; waivers possible?	- In a timely manner - Within ____ minutes
Notes: - Technical skills (domain k) - Link to planning - Execution - Link to financial skills - Communication					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Operations O2	Establish and operate resource staging areas under various conditions.	- Low, medium, high response resource requirements - Beach clean-up - Surf washing - Fish, bird, wildlife migration & clean-up - Air, water, land clean up monitoring - Protective booming at source, in area, or in predefined pre-staging areas, collection points - Protective booming not deployed by RP	- Test containment & removal techniques for hazardous conditions - Evaluate salvage requirements—land and water use of SUPSAL - Sensitive area cleanup - Evaluate need for dispersant/chemical use - Review & approve/dis in situ burning—test procedures, preapproval, monitoring protocol, timing - Deploy protective booming as required, where needed - Make effective use of CAMEO data	- In a timely manner - Within ____ minutes
Notes: - Technical skills (domain k) - Link to planning - Execution - Link to financial skills - Communication					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Operations O3	Establish and Implement the Initial Tactical Action Plan, with personnel assignments, and resource allocations, under various conditions	- Contingency plan requires only minor modifications - Contingency plan not applicable to spill, not current, not updated, not reviewed	- Establish personnel assignments - Determine Initial resource allocations - Establish and Implement Initial planning framework	- In a timely manner - Within ____ minutes

*Notes: : Establish (and meet) Initial expectations
Use briefings, organizational reporting to further achievement of Tactical Action Plan*

1	Operations O4	Implement daily Tactical Action Plan, after its development by Planning & approval by Command, under various operat'nl conditions	- Low response resource requirements - Medium response resource requirements - High response resource requirements	- Compare equipment hired vs. equipment req'd - Evaluate time required for RP equipment to arrive - Determine additional resources required - Evaluate recovery rate & storage, disposal capacity of committed resources	- In a timely manner - Within ____ minutes
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*Notes: : Establish (and meet) Initial expectations
Use briefings, organizational reporting to further achievement of Tactical Action Plan*

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Operations O5	Establish and control tactical communications networks under various conditions	- Single RP/single state - Single RP/multiple states - Multiple RP's/single states - Multiple RP's/multiple states - T1 lines available; not	- Implement communications plan - Establish command and emergency frequencies - Determine watch schedule, guard freq's - Establish anti terrorist, sabotage plans	- In a timely manner - Within ____ minutes

Notes: Establish communication networks and supporting organizational structure simultaneously

2	Operations O6	Establish and control vessel/aircraft safety zones and procedures under various conditions	- Low vessel /aircraft traffic density - Moderate vessel/ aircraft traffic density - Heavy vessel/aircraft traffic density	- Determine who prohibit entry into zones - COTP orders, ADMIN orders	- In a timely manner - Within ____ minutes
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Notes: Dual use traffic monitoring, spill surveillance, oversight.

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Operations O7	Determine whether or not response operations should commence, or be continued, under specific operational conditions	• High winds • High sea states • Reduced visibility • Night operations • Weekend/holiday ops	• Conduct on-site assessment of source and spill • Reassess extent of spill and deployment of resources	• In a timely manner • Within ____ minutes
Notes: Multiple goal satisfaction Political vs. technical decisions: 'how much is enough'					
2	Operations O8	Determine whether or not a damaged vessel should be moored to a new locatn under specific operational conditions	• Increasing wind/ sea state • Inability to control flooding • Inability to control fire	• Perform stability calculations • Establish base, loaded, and light conditions • Establish and implement appropriate salvage plan • Determine alternate mooring config's • Determine alternate sites	• In a timely manner • Within ____ minutes
Notes: Vessel-environment safety tradeoffs					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Operations O9	Resolve all normal operat'nl response issues under various conditions	- Single RP/single state - Single RP/multiple states - Multiple RP's/single states - Multiple RP's/multiple states	- Conduct on-site assessmt of source and spill - Determine disposal method & requirements - Evaluate defensive booming - Monitor containmt/recovery - Coordinate overflights - Conduct joint survey of affected area (RP, state,..) - Deploy boom & mobilize recovery devices	- In a timely manner - Within ____ minutes
Notes:					
2	Operations O10	Communicate effectively within team, with public, with media, and with external personnel, under various conditions	- Local, state, national media, VIP's, public - News media impacting response operations - Protocols for VIP's not established	- Implement communicatn plan - Develop OSC/RRT policy on release of information - Prepare, support ad hoc VIP briefings	- In a timely manner - Within ____ minutes
Notes: Dual communication purposes--information transmission, shape expectations, confidence building					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Operations O11	Debrief, critique, develop "lessons learned," Institute organizational memory/learning	- Facility (tank, pipeline) Incident - Contingency plans inadequate for spill— not current, not update not reviewed	- Develop knowledge of hazardous materials stored - Make effective use of regional dbase - Develop team and individual models of appropriate/inappropriate behavior & actions	- In a timely manner - Within ____ minutes

Notes: Facilitate organizational learning; Foster culture of high reliability

2	Operations O12	Conduct investigations into spills, spillers, contributory causes, "lessons learned"	- Single RP/single state - Single RP/multiple states - Multiple RP's/single states - Multiple RP's/multiple states	- Determine penalty action - Locate/prove/identify pollution source - Develop suggestions to prevent similar incidents	- In a timely manner - Within ____ minutes
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*Notes: Begin institutionalization of corporate memory, spiller history; database
Transmission of history, experience to follow on ports*

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
3	Operations O13	Establish and implement a medical tactical action plan	- Immediate, short term, long term health threats from spill - Exposed, injured, decontaminated citizens, bldgs, plants, pets - ATSDR to be notified - Emerg rooms will not take contaminated people - No disaster triage system	Provide emergency medical services for people required	- In a timely manner - Within ____ minutes
<i>Notes:</i>					
3	Operations O14	Evaluate response personnel safety issues	- Personnel protective equipment n. available - Toxic substance sampling required - Divers in toxic environment - Decontamination procedures not established - OSC responsibilities under 40 CFR 300.38 met - contracts specify comply with OSHA regs; CG personnel not familiar	- Determine best achievable protection level for response personnel; assess threat - Determine best response strategy based on threat - Evacuate contaminated areas - Assess whether evacuation vs. indoor protection req'd - Communicate evacuation, indoor protection orders - Determine best time to return to site	- In a timely manner - Within ____ minutes
<i>Notes:</i>					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
3	Operations O15	Establish and implement an effective and efficient law enforcement plan	- Evacuation of contaminated areas - Evacuation vs. Indoor protection - Communication of evacuation, Indoor protection - Decision to return - Looting in evacuated areas	- Determine who prohibits entry into zones (hot, exclusion, safety, etc.) - Determine who pays for lost property - Determine need for special forces	- In a timely manner - Within ____ minutes
<i>Notes:</i>					
3	Operations O16	Establish and implement an effective and efficient fire and rescue plan	- Personnel protective equipment - Toxic substance sampling required - Divers in toxic environment - Hazmat removal required - Non CG resources not available - Jurisdictional conflicts	- Conduct evacuation training for hazmat (vehicles used; PPE for operators) - Determine need for firefighting resources	- In a timely manner - Within ____ minutes
<i>Notes:</i>					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Operations O17	Effectively document spill history, planning, replanning, and "lessons learned"	- Logkeeping in command post - Electronic document services available - Volunteer groups - Nighttime availability, operations * Air, water, land surveillance	- Determine what constitutes timely notification * Document violations	- In a timely manner - Within ____ minutes
<i>Notes: Institutionalize 'lessons learned'</i> <i>Codify organization's 'best practices'</i>					
<i>Notes:</i>					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standards
1	Operations O18	Efficiently gather salient decision-making information, in support of various decisions, under a variety of conditions	- Individual and team fatigue, stress, surprise, uncertainty - Incomplete, time-varying information - Data/information overload	- Gather and evaluate RP, available resources, environment information - Determine use of local response teams or RRT's - Determine containment/removal techniques	- In a timely manner - Within ____ minutes
<i>Notes: · Recognition of impact of various factors impacting effective human decision-making · Effective info gathering approaches techniques</i>					
1	Operations O19	Effectively and efficiently analyze relevant and appropriate data, knowledge, models, opinions, and judgments under various conditions	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Contingency plan N/A	- Evaluate response options - Monitor response timeliness - Assess, diagnose, and direct effort as required - Modify strategy and tactics as required	- In a timely manner - Within ____ minutes
<i>Notes: · Development of appropriate team shared mental models · Appropriate analysis techniques · Avoidance of indiv and group decision-making limitations/difficulties (groupthink, slouching, etc.)</i>					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standards
1	Operations O20	Perform on-going situation assessment, re-assessmt, and direction/redirection of response effort	Fatigue, stress, surprise, uncertainty Incomplete, time-varying information Data/information overload Use of SSC policy, weather forecasting, portable met Air, water, land surveillance Trajectory and plume modeling Effects on fish, birds, wildlife	- Develop & use chem action plans - Analyze samples--where, how fast, contract exist? - Evaluate response options & timeliness - Modify strategy and tactics as required - Develop & use chem action plans	- In a timely manner - Within ____ minutes
<i>Notes: Limits to human decision-making Assessment, reassessmt loop model development</i>					
1	Operations O21	Interface effectively, and utilize effectively, external sources, community & local response personnel, volunteers	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Human service orgs (Red Cross) - Public works, mutual aid organizations - Volunteer groups - Heavy equipmt operators	- Determine what constitutes timely notification - Determine compensatn required - Determine effective mix of internal/ external resources - Delegate appropriate mix of tasks - Capitalize on resources talents, energies of external sources, w/out compromising response	- Evaluate response options - Monitor response timeliness - Assess, diagnose, and direct effort as required - Modify strategy and tactics as required - In a timely manner - Within ____ minutes
<i>Notes: Liaison skills--recognition of team contributions, strengths, weaknesses Delegation skills Developmt of appropriate models of tight vs. loose coupling</i>					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	
1	Operations O22	Develop timely, correct, and consistent decisions appropriate to the decision-making and response phase, supportive of the criteria for success for different phases, conditions	- Response Initiation, Integration, production phases - Transition phases bet. response stages - Individual and team fatigue, stress, surprise, uncertainty - Incomplete, time-varying information - Data/information overload - Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Human service orgs (Red Cross) - Public works, mutual aid organizations - Volunteer groups - Heavy equipmt operators	- Evaluate response options - Monitor response timeliness - Assess, diagnose, direct and redirect response effort - Modify strategy and tactics as required - Determine effective mix of Internal/ external resources - Delegate appropriate mix of tasks - Capitalize on resources talents, energies of external sources, w/ou compromising response effort - Determine optimal organizational size & composition, and act expeditiously to promulgate & effect it.	- Determine relevant criteria for success for each phase - Assess performance - Make appropriate use of decision support technology to overcome human limits - Determine approp resources to be deployed, and deploy - Determine when to call stakeholders in different phases - Determine level of threat, risk, and response required
				Potential Standards - In a timely manner - Within ____ minutes	

Notes: · Liaison skills—recognition of team contributions, strengths, weaknesses
 · Delegation skills · Developmt of appropriate models of tight vs. loose coupling

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Planning P1	Prioritize/reprioritize environmentally sensitive areas for effective utilization of limited protective booming resources	- Contingency plan requires only minor modifications - Contingency plan not applicable to spill	- Project spill trajectory - Determine areas to be protected/reassess - Determine containment, removal, recovery capacities required - Determine dispersant capability required - Verify areas for dispersant use	- In a timely manner - Within ____ minutes
<i>Notes:</i>					
1	Planning P2	Recommend tactical response strategies under various operational conditions	- Alternative spill type/material - Alternative spill location - Alternative spill site weather	- Project spill trajectory - Determine areas to be protected - Determine containment, removal, recovery capacities required - Determine dispersant capability required - Verify areas for dispersant use - Reassess sensitive areas at risk	- In a timely manner - Within ____ minutes
<i>Notes:</i>					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Planning P3	Prepare Daily Tactical Action Plan, with personnel assignments and resource allocations, under various conditions	- Low response resource requirements - Medium response resource requirements - High response resource requirements	- Evaluate information - Evaluate threat - Evaluate current strategy & tactics - Develop daily tactical action plan in response to above findings	- In a timely manner - Within ____ minutes
Notes:					
1	Planning P4	Determine if sufficient response resources have been mobilized to effectively respond to the spill under various conditions.	- RP has assumed financial responsibility and believes that sufficient resources have been mobilized - States want to mobilize additional response resources	- Provide feedback info on mobilization to OSC - Evaluate status & extent of spill - Evaluate status & effectiveness of response - Provide situation assessment to OSC	- In a timely manner - Within ____ minutes
Notes:					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Planning P5	Debrief, critique, develop "lessons learned," Institute organizational memory/learning	- Facility (tank, pipeline) Incident - Contingency plans inadequate for spill— not current, not update not reviewed	- Develop knowledge of hazardous materials stored - Make effective use of regional dbase - Develop team and individual models of appropriate/inapprop behavior & actions	- In a timely manner - Within ____ minutes
<i>Notes:</i>					
1	Planning P6	Conduct Investigations into spills, spillers, contributory causes, "lessons learned"	- Single RP/single state - Single RP/multiple states - Multiple RP's/single states - Multiple RP's/multiple states	- Determine penalty action - Locate/prove/identify pollution source - Develop suggestions to prevent similar incidents	- In a timely manner - Within ____ minutes
<i>Notes:</i>					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Planning P7	Prepare/modify appropriate Dispersant Use Request, under various conditions	• No pre-approval exists; conditions appear appropriate for dispersant use • Spill conditions outside pre-approval parameters	• Determine areas to be protected • Determine containmt, removal, recovery capacities required • Determine dispersant capability required • Verify areas for dispersant use	• In a timely manner • Within ____ minutes
<i>Notes:</i>					
2	Planning P8	Compile and display Incident Status Information under various conditions	• Low response resource requirements • Medium response resource requirements • High response resource requirements	• Manage communications • Maintain historical record file • Maintain information on status & location of forces and equipment • Project future resource requirements (personnel and equipment)	• In a timely manner • Within ____ minutes
<i>Notes:</i>					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Planning P7	Prepare/modify appropriate Dispersant Use Request, under various conditions	- No pre-approval exists; conditions appear appropriate for dispersant use - Spill conditions outside pre-approval parameters	- Determine areas to be protected - Determine containment, removal, recovery capacities required - Determine dispersant capability required - Verify areas for dispersant use	- In a timely manner - Within ____ minutes

Notes:

2	Planning P8	Compile and display Incident Status Information under various conditions	- Low response resource requirements - Medium response resource requirements - High response resource requirements	- Manage communications - Maintain historical record file - Maintain information on status & location of forces and equipment - Project future resource requirements (personnel and equipment)	- In a timely manner - Within ____ minutes
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Notes:

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
2	Planning P7	Prepare/modify appropriate Dispersant Use Request, under various conditions	- No pre-approval exists; conditions appear appropriate for dispersant use - Spill conditions outside pre-approval parameters	- Determine areas to be protected - Determine containment, removal, recovery capabilities required - Determine dispersant capability required - Verify areas for dispersant use	- In a timely manner - Within ____ minutes

Notes:

2	Planning P8	Compile and display Incident Status Information under various conditions	- Low response resource requirements - Medium response resource requirements - High response resource requirements	- Manage communications - Maintain historical record file - Maintain information on status & location of forces and equipment - Project future resource requirements (personnel and equipment)	- In a timely manner - Within ____ minutes
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Notes:

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standards
1	Planning P11	Perform on-going situation assessment, re-assessmt, and direction/redirection of response effort	Fatigue, stress, surprise, uncertainty Incomplete, time-varying Information Data/Information overload Use of SSC policy, weather forecasting, portable met Air, water, land surveillance Trajectory and plume modeling Effects on fish, birds, wildlife	- Review effectiveness of Initial tactical plan - Develop next day tactical plan - Evaluate response options & timeliness - Modify strategy and tactics as required	- In a timely manner - Within ____ minutes
<i>Notes:</i> Limits to human decision-making Assessment, reassessmt loop model development Iterative situation assessment Team building, delegation					
1	Planning P12	Interface effectively, and utilize effectively, external sources, community & local response personnel, volunteers	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Human service orgs (Red Cross) - Public works, mutual aid organizations - Volunteer groups - Heavy equipmt operators	- Determine what constitutes timely notification - Determine effective mix of internal/ external resources - Delegate appropriate mix of tasks - Capitalize on resources talents, energies of external sources, w/out compromising response	- Evaluate response options - Monitor response timeliness - Assess, diagnose, and direct effort as required - Modify strategy and tactics as required - In a timely manner - Within ____ minutes
<i>Notes:</i> Liaison skills—recognition of team contributions, strengths, weaknesses Delegation skills Developmt of appropriate models of tight vs. loose coupling					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	
1	Planning P13	Develop timely, correct, and consistent decisions appropriate to the decision-making and response phase, supportive of the criteria for success for different phases, conditions	- Response Initiation, Integration, production phases - Transition phases bet. response stages - Individual and team fatigue, stress, surprise, uncertainty - Incomplete, time-varying information - Data/information overload - Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Human service orgs (Red Cross) - Public works, mutual aid organizations - Volunteer groups - Heavy equipmt operators	- Evaluate response options - Monitor response timeliness - Assess, diagnose, direct and redirect response effort - Modify strategy and tactics as required - Determine effective mix of internal/ external resources - Delegate appropriate mix of tasks - Capitalize on resources talents, energies of external sources, w/out compromising response effort - Determine optimal organizational size & composition, and act expeditiously to promulgate & effect it.	- Determine relevant criteria for success for each phase - Assess performance - Make appropriate use of decision support technology to overcome human limits - Determine approp resources to be deployed, and deploy - Determine when to call stakeholders in different phases - Determine level of threat, risk, and response required
				Potential Standards - In a timely manner - Within ____ minutes	

*Notes: Liaison skills--recognition of team contributions, strengths, weaknesses
Delegation skills Developmt of appropriate models of tight vs. loose coupling*

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Logistics L1	Establish and operate the following Incident-specific support units as required: -Supply unit -Facilities unit -Maintenance unit -Food Unit -Medical unit	- Low response resource requirements - Medium response resource requirements - High response resource requirements	Initiate procedures to contract for additional resources	- In a timely manner - Within ____ hours
Notes:					
1	Logistics L2	Locate and contract for critical/valuable response resources when various conditions exist	- RP and states disagree on an acceptable response resource cost - RP and states disagree on delivery or transportation details\ - CG/non CG resources essential to response - CG vs. CERCLA funded equipment - Indian lands, Alaskan tribal corps, jurisdictional limits	- Initiate chronological log - Initiate procedures to contract for additional personnel - Legal problems: entry to private/posted land - Initiate contract for additional resources	- In a timely manner - Within ____ hours
Notes:					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Logistics L3	Prepare Daily Tactical Action Plan, with personnel assignments and resource allocations, under various conditions	- Low response resource requirements - Medium response resource requirements - High response resource requirements	- Evaluate information - Evaluate threat - Prepare daily logistics plan - Track material allocation & status	- In a timely manner - Within ____ minutes
<i>Notes:</i>					
1	Logistics L4	Determine if sufficient response resources have been mobilized to effectively respond to the spill under various conditions.	- RP has assumed financial responsibility and believes that sufficient resources have been mobilized - States want to mobilize additional response resources	- Support dispersant and bio-remediation activities - Evaluate status & effectiveness of response - Provide situation assessment to OSC	- In a timely manner - Within ____ minutes
<i>Notes:</i>					

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Logistics L5	Debrief, critique, develop "lessons learned," Institute organizational memory/learning	· Low response resource requirements · Medium response resource requirements · High response resource requirements	· Initiate chronological log · Track material allocation & status · Prepare daily logistics plan	· In a timely manner · Within ____ hours
<i>Notes:</i>					
<i>Notes:</i>					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standards
1	Logistics L6	Efficiently gather salient decision-making information, in support of various decisions, under a variety of conditions	- Individual and team fatigue, stress, surprise, uncertainty - Incomplete, time-varying information - Data/information overload	- Evaluate information - Evaluate threat - Evaluate current strategy and tactics - Develop initial daily tactical action plan	- In a timely manner - Within ____ minutes
<i>Notes: • Recognition of impact of various factors impacting effective human decision-making • Effective info gathering approaches techniques</i>					
1	Logistics L7	Effectively and efficiently analyze relevant and appropriate data, knowledge, models, opinions, and judgments under various conditions	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Contingency plan N/A	- Evaluate response options - Monitor response timeliness - Assess, diagnose, and direct effort as required - Modify strategy and tactics as required	- In a timely manner - Within ____ minutes
<i>Notes: • Development of appropriate team shared mental models • Appropriate analysis techniques • Avoidance of indiv and group d-making limitations/difficulties (groupthink, slouching, etc.)</i>					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standards
1	Logistics L8	Perform on-going situation assessment, re-assessmt, and direction/redirection of response effort	Fatigue, stress, surprise, uncertainty Incomplete, time-varying Information Data/Information overload Use of SSC policy, weather forecasting, portable met Air, water, land surveillance Trajectory and plume modeling Effects on fish, birds, wildlife	- Initiate procedures to contract for additional resources - Review effectiveness of initial plan - Evaluate response options & timeliness - Modify strategy and tactics as required	- In a timely manner - Within ____ minutes
<i>Notes: Limits to human decision-making Assessment, reassessmt loop model development</i>					
1	Logistics L9	Interface effectively, and utilize effectively, external sources, community & local response personnel, volunteers	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Human service orgs (Red Cross) - Public works, mutual aid organizations - Volunteer groups - Heavy equipmt operators	- Initiate procedures to contract for additional resources - Determine effective mix of internal/ external resources - Delegate appropriate mix of tasks - Capitalize on resources talents, energies of external sources, w/out compromising response	- Evaluate response options - Monitor response timeliness - Assess, diagnose, and direct effort as required - Modify strategy and tactics as required - In a timely manner - Within ____ minutes
<i>Notes: Liaison skills--recognition of team contributions, strengths, weaknesses Delegation skills Developmt of appropriate models of tight vs. loose coupling</i>					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks
1	Logistics L10	Develop timely, correct, and consistent decisions appropriate to the decision-making and response phase, supportive of the criteria for success for different phases, conditions	- Response Initiation, Integration, production phases - Transition phases bet. response stages - Individual and team fatigue, stress, surprise, uncertainty - Incomplete, time-varying information - Data/information overload - Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Human service orgs (Red Cross) - Public works, mutual aid organizations - Volunteer groups - Heavy equipmt operators	- Evaluate response options - Monitor response timeliness - Assess, diagnose, direct and redirect response effort - Modify strategy and tactics as required - Determine effective mix of internal/ external resources - Delegate appropriate mix of tasks - Capitalize on resources talents, energies of external sources, w/out compromising response effort - Determine optimal organizational size & composition, and act expeditiously to promulgate & effect it.
				- Determine requirements for storage & disposal of oil and oily wastes - Establish staging areas - Coordinate staging areas for resources - Coordinate transport of response resources to response area - Coordinate and control the distribution of supplies - Provide for on-site feeding for responders - Provide for on-site sanitation facilities * Repair/replace equipment as req'd
				Potential Standards - In a timely manner - Within ____ minutes
Notes: • Liaison skills--recognition of team contributions, strengths, weaknesses • Delegation skills • Developmt of appropriate models of tight vs. loose coupling				

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
1	Finance F1	Establish and operate the following Incident-specific support units as required: -Time Recording unit -Procurement unit -Compensations/claim unit -Cost unit	• RP and states disagree on which units are required • RP has/has not necessary resources to man required units • Time delays unacceptable • Single RP (assumes responsibility) • Single RP (does not assume responsibility) • Multiple RP's • Multiple states • Declaration of state of emergency by mayor, governor, President • Funds available/not available from other sources • Partially federalized • Federal salvage assistance required • Other funds (TAPS,...) • Decontamination req'd • Procedures for FWPCA or CERCLA	• Determine evacuation costs for short, med, long term clean up • Procure required equipment, resources, material to support clean up • Establish and implement compensation schedule • Track human, material, & equipment costs	• In a timely manner • Within ____ minutes

Notes:

Terminal Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standard(s)
	Finance F2	Establish and implement an appropriate cost allocation strategy when various conditions exist.	• RP and states disagree on which units are required • RP has/has not necessary resources to man required units • Time delays unacceptable • Single RP (assumes responsibility) • Single RP (does not assume responsibility) • Multiple RP's • Multiple states • Declaration of state of emergency by mayor, governor, President • Funds available/not available from other sources • Partially federalized • Federal salvage assistance required • Other funds (TAPS,...) • Decontamination req'd • Procedures for FWPCA or CERCLA	• Request polfund authorization • Assemble documentatn for const recovery • Establish cost responsibilities • Insure completion of cost recovery documents • Determine alternate cost allocation strategies • Determine adequacy of strategies for current spill • Evaluate cost allocation strategies • Perform on-going assessment of cost allocation choices for spill at hand	• In a timely manner • Within ____ minutes

Notes:

Terminal Training Objectives

Priority	Who?	Training Objective	Conditions	Tasks	Potential Standard(s)
1	Finance F3	Develop effective and efficient communication and leadership style	- Local, state, national news organizations/VIP's - Public Information/ community relations - Public and private communication key to response success - News media impacting response operations	- Develop OSC/RRT policy on information response - Establish protocols for VIP's - Modify strategy & tactics as required - Schedule briefings, communications	- In a timely manner - Within ____ minutes

Notes: Inter- and Intra-team coordination, communication, integration

1	Finance F4	Effectively document spill history, response, planning, re-planning, and "lessons learned"	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states	- Violation documentatn - Request polfund authorization - Assemble documentatn for cost recovery - Establish cost responsibilities - Insure completion of cost recovery documents	- In a timely manner - Within ____ minutes
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Notes:

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standards
1	Finance F5	Efficiently gather salient decision-making information, in support of various decisions, under a variety of conditions	- Individual and team fatigue, stress, surprise, uncertainty - Incomplete, time-varying information - Data/information overload	- Evaluate information - Evaluate threat - Evaluate current strategy and tactics - Develop initial daily tactical action plan	- In a timely manner - Within ____ minutes
<i>Notes: Recognition of impact of various factors impacting effective human decision-making</i>					
1	Finance F6	Effectively and efficiently analyze relevant and appropriate data, knowledge, models, opinions, and judgments under various conditions	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Contingency plan N/A	- Evaluate response options - Monitor response timeliness - Assess, diagnose, and direct effort as required - Modify strategy and tactics as required	- In a timely manner - Within ____ minutes
<i>Notes: Development of appropriate team shared mental models</i>					
<i>Avoidance of indiv and group d-making limitations/difficulties (groupthink, slouching, etc.)</i>					
<i>Effective info gathering approaches techniques</i>					
<i>Appropriate analysis techniques</i>					

Enabling Training Objectives

Priority	Who?	Training Objective	Sample Conditions	Sample Tasks	Potential Standards
1	Finance F7	Perform on-going situation assessment, re-assessmt, and direction/redirection of response effort	Fatigue, stress, surprise, uncertainty Incomplete, time-varying Information Data/Information overload Use of SSC policy, weather forecasting, portable met Air, water, land surveillance Trajectory and plume modeling Effects on fish, birds, wildlife	- Initiate procedures to contract for additional resources - Review effectiveness of initial plan - Evaluate response options & timeliness - Modify strategy and tactics as required	- In a timely manner - Within ____ minutes
<i>Notes:</i> Limits to human decision-making Assessment, reassessmt loop model development Iterative situation assessment Team building, delegation					
1	Finance F8	Interface effectively, and utilize effectively, external sources, community & local response personnel, volunteers	- Single RP/single state - Single RP/multiple states - Multiple RP's/ multiple states - Multiple RP's/multiple states - Human service orgs (Red Cross) - Public works, mutual aid organizations - Volunteer groups - Heavy equipmt operators	- Initiate contracts for additional resources - Initiate contracts for storage and disposal of oil and oily waste - Determine effective mix of internal/ external resources - Delegate appropriate mix of tasks - Capitalize on resources talents, energies of external sources, w/out compromising response	- Evaluate response options - Monitor response timeliness - Assess, diagnose, and direct effort as required - Modify strategy and tactics as required - In a timely manner - Within ____ minutes
<i>Notes:</i> Liaison skills--recognition of team contributions, strengths, weaknesses Delegation skills Developmt of appropriate models of tight vs. loose coupling					

APPENDIX F REJECTED MEDIA

The following paragraphs summarize the rationale for rejecting each medium at this time. The major factors leading to this assessment are printed in bold regarding each criterion. Each of the rejected media do have potential applicability to Command Post training. However, their pragmatic near-term application to address the most pressing training issues and objectives, within the defined boundaries and constraints of the target training, is substantively less than the selected media according to the criteria used. As the Command Post training evolves, technology improves, etc., one or more of these media may become of high relative value and should be implemented at that time.

F.1 WHOLE-TASK FULL-TEAM TRAINER

The whole-task full-team trainer would be a sophisticated large-scale device capable of simultaneously supporting the major components of the Unified Command organization. This type of trainer would be capable of providing training for the full team, perhaps 50 to 100 or more trainees simultaneously engaged in an exercise. This full-team training context comes under the Management Team Training stage, as defined in Section I.A. Although the Management Team Training stage is important, this study is focused on the Command Post Sub-Team Training stage, which does not require the full training capacity of the Whole-Task Full-Team Trainer.

The oil spill response trainer at the Massachusetts Maritime Academy is one such example of a Whole-Task Full-Team Trainer. This trainer could be capable of supporting the range of training objectives, and thus capable of achieving highly effective training. Its effectiveness would be moderate to high, moderate for those training objectives ideally achieved in a sub-team context due to the full-team constraints of this device. For example, full-team training would of necessity (e.g., cost of detaining many people for training, complexity of the exercise, relative importance of responding to directives and requests from superiors, etc.) focus on issues of relevance to the overall team, rather than focus on a particular sub-team. If the trainer were adapted for use to train only one sub-team, aside from the cost impact, it should enable achievement of the sub-team training objectives; hence the effectiveness assessment of moderate to high.

This large trainer would be relatively expensive to implement in each port, including hardware, software, and building/real estate space, particularly in view of the expected utilization rate which would be relatively low for a single port (i.e., at most estimated to be less than 15% of first-shift time per year). Hence, it would not be economically feasible to develop this type of trainer at each port.

Three trainers operating two shifts could most likely accommodate the training needs of 50 ports. If the sub-team training were to be conducted at a remote location servicing several ports, however, the logistics factors become a major concern for the conduct of regular periodic training. Where-as local port sub-team training might require about a half-days time for each session, one to two days time may be required for the same amount of training (4 to 8 hours per session) due to travel to the remote site. The multi-agency nature of the requisite training, including persons from one or more state government agencies, exacerbates this problem of a remote training location for periodic

sub-team training. The eventual practicality of conducting the regular/periodic training required for the sub-teams would become relatively low due to the logistic factors, seriously compromising the potential for achieving the requisite training.

The cost to conduct regular/periodic sub-team training at a remote location would also be medium to high (i.e., including per diem and transportation costs for multiple sessions, trainer rent, and lost time due to transportation).

The assessment of the Whole-Task Full-Team Trainer in comparison with other available media for the conduct of regular/periodic sub-team training is relatively low. Evaluation summary of the four criteria is:

- Training effectiveness - medium to high
- Training efficiency - high for local port location, for sub-team training objectives
medium for remote location
- Logistics/feasibility - high if local to the port
low, and potentially not feasible, for frequent sub-team training if location is remote from the port
- Cost - high if local to the port and USCG owned
medium to high if in location remote from the port, and not USCG owned
potentially highest cost, depending on configuration and implementation

It should be noted that rejection does not imply the whole-task team trainer is not cost-effective for Command Post Team training, but rather for Sub-Team training as addressed by this effort.

F.2 INTERACTIVE COURSE WARE (ICW)

Interactive courseware is a highly effective training medium, applicable to a wide range of training objectives, if implemented properly. Its capabilities, and hence its effectiveness and cost of development, can vary substantially. The rejection of ICW was based on its primary use for individual training, as opposed to team training, and its inability to pragmatically address the bulk of Command Post Sub-team training objectives. Although some amount of individual training may be required, this study is focused on sub-team training.

Evaluation summary of the four criteria is:

- Training effectiveness - low to medium for sub-team training
- Training efficiency - medium for sub-team training
- Logistics/feasibility - high
- Cost - medium

The hardware recommended later in this report is capable of supporting the three levels of ICW. Although it was rejected, it can be implemented at a later date if desired.

F.3 INTERACTIVE VIDEO DISK - IVD

IVD is a medium somewhat similar to ICW, in that it is most useful for individual training. Its cost is approximately equivalent to the low and intermediate range of ICW. It was rejected for its inability to pragmatically address the bulk of Command Post Sub-team training objectives, similar to ICW.

Evaluation summary of the four criteria is:

Training effectiveness - **low to medium** for sub-team training
Training efficiency - **medium** for sub-team training
Logistics/feasibility - **high**
Cost - **low to medium**

F.4 DISTANCE LEARNING, DISTRIBUTED LEARNING, TELECONFERENCING

This medium in its various configurations is growing in popularity today. Distance learning is most cost-effective when used on a regular basis, and when it is not economically feasible to bring relevant individuals and/or groups into a training session. Its effectiveness for Command Post Sub-team depends on how it is used; many different modes of use are possible.

As a lecture or inter classroom tool it would have limited value in addressing the Command Post Sub-team training objectives; remote individuals or information sources would not be expected to add significantly to the effectiveness of the required training that might be addressed in a lecture format.

As a medium to bring distant participants into the training exercise it has more value. For example, a simulation exercise could use actual high-ranking individuals (e.g., the USCG district admiral) for interfacing with the sub-team undergoing training via remote TV link, without requiring their actual presence at the training site. Although this can be readily accomplished without a TV link, via telephone/speakerphone as desired, the interactive visual image of the relevant person would add to the realism and atmosphere of the training. However, this potential benefit to the effectiveness of the sub-team training would be offset by the logistical effort to setup and operate this link for the occasional training session. With today's technology, one or two persons would be necessary at the remote site to setup and operate the equipment. The desired regular/periodic schedule of sub-team training would reduce the impact of this type of link, and likely render regular participation by non-sub-team persons impractical. As this technology moves into the mainstream (e.g., videophone located at the remote site for other use), however, it will become more feasible for ready integration into the Command Post Sub-Team training.

Another potential use would be for remotely located sub-team members, who are unable to travel to the training site, to participate for all or part of the training session via remote TV link. Although this may help in one or two instances, its regular practice would likely have a detrimental affect on the sub-team training. The absence of sub-team members, even if remotely linked, would be counter-productive to team formation and functioning.

The distance learning medium was concluded to have occasional value for the conduct of sub-team training. Its use in these circumstances, today, would constitute an exception to the regular training situation, rather than the norm. Hence, it was rejected for further consideration. Nevertheless, a remote TV link can be established by the training team if, and when, desired for a particular training exercise, without substantial effort beyond that which would be required if selected as a primary medium at this time. That is, a distance learning hookup could be effected on an as-needed basis, when desired for a particular exercise, without incurring the effort/costs to integrate it into most training sessions.

Evaluation summary of the four criteria is:

- Training effectiveness - **limited value** for overall sub-team training
(**medium** value for exercise fidelity)
- Training efficiency - **low to medium** for sub-team training objectives; it is not likely to improve on the efficiency of training in comparison with other media
- Logistics/feasibility - **medium** for instruction and exercises
- Cost - **medium**

Although not selected, the teleconferencing capability is being rapidly developed across the US, to the extent that it could be readily brought into a sub-team training session if, and when, desired. The cost for teleconferencing is relatively high today for a single port (e.g., about \$1M per year for a dedicated satellite line), but expected to drop substantially over the next several years as its use becomes more widespread.

F.5 COMPACT DISK

Compact disk media is somewhat similar to IVD, with similar limitations.

Evaluation summary of the four criteria is:

- Training effectiveness - **low to medium** for sub-team training
- Training efficiency - **medium** for sub-team training
- Logistics/feasibility - **high**
- Cost - **low to medium**

F.6 PORTABLE TRAINERS

A wide variety of portable trainers could be developed, such as an individual device carry-home trainer. The strategy of use would differ for each type, as would the costs and benefits. The carry-home trainer would be for individual training, having limited use for Command Post Sub-Team training. A van-type trainer traveling between ports, on the other hand, could be used for the Command Post Sub-Team training. It is discussed below as an example of portable trainers.

A van-type trainer would consist of a van housing other selected training media that could be driven to several ports in a regional area for conduct of their training sessions. This approach would have one set of hardware/software serve the Command Post Sub-Team training needs of several ports, estimated as 7 or 8. Two major van variations would be available for this purpose: 1) a van only for carrying the equipment, all of which would be moved to a building for the local port training; and 2) a van that would transport equipment and would provide a van-based control center for exercise control and conduct of training.

Each of the van alternatives would place some constraints on the scheduling and logistical flexibility for local port training, although this would not be a major factor. However, the primary advantage of van-type trainers, spreading the cost of the trainer across several ports, would be offset by the relatively low hardware costs of other equivalent media (e.g., desk top computer display system) and the added costs of van adaptation/installation. This would be true for either van alternative (e.g., cost of

containers, built-in equipment, and added personnel costs). The costs for the second alternative could be considerably higher than the purchase price of equivalent port-specific desk top computer display system hardware. Hence, the van alternative was not selected due to no real training advantages over other similarly, or lessor priced, hardware.

Evaluation summary of the four criteria is:

- Training effectiveness - high
- Training efficiency - medium to high
- Logistics/feasibility - high
- Cost - **medium** for sub-team variant

It should be noted that this analysis does not address the cost-effectiveness of a van-type trainer for full-team training, in support of the Management Team Training stage. Due to the more substantial media requirements for this training, coupled with the much lower frequency of training sessions per port, the van-type trainer may prove a cost-effective alternative.

F.7 JOB PERFORMANCE AIDS

This medium is dependent on the availability and use of performance aids during job performance. At this point in time, no relevant job performance aids exist for use by the Command Post staff (i.e., with the possible exception of charts and manual lists). Hence, job performance aids are not relevant to Command Post training at this time. At a later date, after technology is introduced into the Unified Command organization and the Incident Command System, this medium may take on much greater importance.

Evaluation summary of the four criteria is:

- Training effectiveness - **low**, since few job performance aids in use
- Training efficiency - n.a.
- Logistics/feasibility - high
- Cost - n.a.

F.8 VIRTUAL REALITY

Virtual reality may be defined in various ways. For the purposes of this study, it is defined as an exceptionally high level of simulation fidelity, in which most human senses are stimulated as would be in the real environment. In some instances, virtual reality may be nothing more than traditional simulation, such as aviation training that takes place in sophisticated trainers. In other instances, such as for training snow skiing, virtual reality has come to represent a simulated environment in which the student can ski, receiving the range of stimuli he/she normally would on an actual slope; the student wears a head-mounted display to see the ski terrain, holds and uses ski poles, and stands in ski boots; the ski boots are mounted on individual-foot platforms sensitive to the simulated terrain and student actions; appropriate visual and force stimuli are provided in coordination with the slope scenario and in response to student actions. The virtual reality level of multi-sensory simulation/stimulation is not needed for Command Post training, since the real environment for the sub-teams would be in a conference room. Traditional

simulation, if implemented in a reasonably high fidelity manner, would provide the stimuli necessary for effective training.

Virtual reality level of simulation/stimulation may enhance the training of field operations personnel, if such training was needed. However, this type of media is not needed for Command Post Sub-Team training. Virtual reality technology is developed to only a limited extent today, and not practical for immediate implementation in Command Post training. Simulation, a close relative of virtual reality, is feasible and has been selected.

Evaluation summary of the four criteria is:

- Training effectiveness - potentially high, although not necessary
- Training efficiency - potentially high for sub-team training objectives
- Logistics/feasibility - **not currently feasible as enhancement to simulation**
- Cost - medium to high if local to the port and USCG owned
medium if in location remote from the port, and not USCG owned
potentially high cost, depending on configuration and implementation

APPENDIX G LEARNING/TRAINING ISSUES

This section identifies selected examples of learning/training issues relevant to the training of Command Post Sub-teams. These often diverse issues, and many others, should be carefully considered in the development of the specific training strategy used for Command Post Sub-team training at the time of training system development.

G.1 BROAD REQUIREMENTS

Overall Training Program Structure. The Command Post Team training addressed by this study is only one part of the overall USCG oil spill response training system. The design of the Command Post Team training program component must consider, and appropriately integrate with, the other elements of the overall training system. Individual training (skills and knowledge) for all sub-team members should precede the Command Post Team training. Full team training for each port, such as the PREP exercises and/or other training, should follow the Command Post Team training to integrate the sub-team elements into a cohesive whole team. Each of these aligned training system components must be carefully designed to effectively compliment each other in achieving the overall training program goals; a hand-off process between components is implied.

Training Assistance Technology. Computer-based training media, such as a simulator, possess a wide range of information processing and presentation capabilities. As such, these media are usually the repository of automated and semi-automated assistance to the instructional process. Research has shown that the instructor and his/her tools (e.g., graphical feedback displays) are the elements of the training system that have the greatest impact on the effectiveness of training (i.e., usually much more than fidelity characteristics of a simulator) (Hammell, Gynther, Grasso, and Gaffney, 1981). Hence, the training system's media should be adapted to specifically assist the instructor and instructional process in implementing training principles. Computer-based tools to assist the instructional process are collectively termed Training Assistance Technology (TAT) (Hammell and Crosby, 1980). Careful selection, design and inclusion of TAT features should be accomplished, tailored to the oil spill response training application. Examples of TAT features include:

- Performance Measures -- content, form, methods of use.
- Pre and post briefing displays; feedback displays
- Feedback strategies -- timing, content, presentation, interactivity.
- Demonstration -- media, timing/sequencing, method of use.

Transfer of Training. The bottom-line of the instructional process is effective transfer of the skills and knowledge gained during training to attack the oil spill response problem in the real-world -- i.e., transfer of training. A high degree of transfer will depend on many training program factors. These factors pertain to 1) design of the training system, including the Command Post Sub-Team training component, as well as the other system components (e.g., PREP exercises) and their interaction; 2) conduct of training (which may be much more important than the design), which relies heavily on the instructor; and 3) command direction, which will have a strong and direct bearing on the approach taken in the conduct of training, as well as the application of learned skills and knowledge in the operational environment.

G.2 GENERAL LEARNING/TRAINING ISSUES

The following are example general learning/training issues relevant to the Command Post Sub-Team Training context. They would/should be considered in the design of the training strategy and media.

Active Learner. The effectiveness of the learning/training process improves dramatically with active learners -- rather than passive learners. The instructional process should be designed to require active participation of all trainees.

Generalization. Learned skills and knowledge must transfer to the real-world, and then to the range of spill situations that might be encountered in the port. Generalization occurs when the team's learned skills and knowledge can be effectively applied to a variety of problem situations, not just the specific problems addressed during training. Emergency situations will always differ to some degree from those studied, due to unique characteristics (e.g., environment, vessel cargo, resources available, accident factors, etc.). To achieve generalization, training must address generic underlying concepts and a representative range of situations. Furthermore, trainees must receive practice in addressing the representative range of situations, each with diverse requirements. Generalization is likely linked with development of expert template sets (i.e., mental model sets).

Information. A key element of cognitive tasks is information processing, during the task performance (e.g., collection of information, analysis, etc.) and during the learning process (e.g., guidance, feedback). The training system, and media, therefore, must be designed to facilitate the various types of information processing that will occur during the instructional process. This includes, for example, problem related information (e.g., simulated accident information in a scenario), as well as instructional information (e.g., feedback). The characteristics of information, such as its fidelity, are of particular importance when relevant to the particular tasks (and skills) being addressed during training.

Overlearning. Overlearning is the concept in which training continues well beyond the criterion level of performance, to assure the skills and knowledge become fundamental to the individual's repertoire when in the oil spill emergency situation. The oil spill response training should aim to provide a level of overtraining. Although this may not be possible for some time due to the amount of training possible in any given period, it should be a goal of training.

Practice. Repeated application of learned skills and knowledge is well recognized as positively affecting the acquisition, improvement, and retention of skills and knowledge. Furthermore, a major purpose of training with practice is to extinguish the incorrect behavior, and replace it with correct behavior. The instructional process should assure trainees have acquired the requisite skills and knowledge prior to extensive practice, so as to avoid practicing incorrect responses.

Simulation. Simulation has been found to often facilitate training effectiveness and transfer of training. Fidelity of simulation characteristics should be adequate for the specific training objective's tasks, which means fidelity may be high, moderate, or low. High fidelity is suggested as most important with regard to information rather than hardware.

Stress. Performance under stress is an area of research concern today, including training to achieve high performance under stressful conditions. It is generally accepted that

stress during the instructional process is counterproductive to training effectiveness, and thought to interfere with the acquisition of skills and knowledge. On the other hand, research has shown that training to perform under stress should improve real-world performance under stressful conditions, providing some degree of inoculation to stress. Therefore, it is suggested that early training, focusing on the learning of skills and knowledge, be conducted under low stress conditions. After the requisite skills and knowledge have been adequately attained, training should continue under high stress conditions to prepare the individual to perform in the stressful atmosphere.

Visual Information. Visual information should be used to the extent possible, for briefing and debriefing (e.g., guidance, feedback, etc.).

G.3 TEAM TRAINING

Communication. Prioritize and focus on tasks requiring frequent communication. Focus training on specific aspects of communication, including tasks, methods of communication, terminology, communicative interaction between members, impediments to successful communication, timing of communication, and relationship to coordination.

Coordination. Team coordination training should be a primary focus, integrated with communication training emphasis. Complex tasks that require coordinated teamwork should be developed, particularly in a simulation context. Multiphased sequential coordination exercises, where the subsequent phase depends on the precedent phase, are desired.

Cross Training. Individuals should be trained to perform activities of other team members, so that they can assist or replace other team members as necessary.

Expectations and Predictions. Team members need to develop accurate mutual expectations, regarding individual and team activities, performance, contributions of other members to overall performance, and emergence of solutions. Shared mental models assist this learning process.

Leadership Training. Leadership training should be provided to key individuals of the Unified Command organization.

Problem Solving Strategies. Training that focuses on techniques of problem solving.

Role Refinement. The individual and team role of each member should be defined and refined through training.

Shared Mental Models. Recent research has found that team members in the most successful teams have similar cognitive models -- of relevant systems, the problem situation, etc. The strong suggestion from the literature is that training should focus on developing similar cognitive models across team members, and thereby greatly facilitate the interaction between team members. The shared mental models include knowledge, skill, anticipated behavior (when and how to interact), tasks, problem, and needs.

Unit Training. Teams should be trained as an entire unit, although individual training may also be required for more complex skills. This suggests emphasis on both Command Post Sub-team and Full Team training.

G.4 DECISION MAKING TRAINING

Although a variety of findings are available in the literature regarding the decision making process, few directly address the training of decision making behavior. Substantial research is currently underway addressing decision making and its training, primarily sponsored by the Navy (Cannon-Bowers, et al, 1993). The major results of this work are several years away.

The following issues are a sample of those relevant to decision making and instructional strategy development.

Assessment and Response Selection. Team decision making training should focus on situation assessment and response selection. These have been found as skills of expert decision makers. They link with the template selection concepts of cognitive schemata (i.e., mental models). The first step is to understand the situation -- assessment. Experts then do well in response selection; novices need to learn the response selection process as well. Most experts use a feature matching strategy (cognitive template). (Klein, 1989).

Automatic Performance. Tasks become learned to the extent they no longer require substantive cognitive processing -- in essence, they become a reaction, more procedural, and require less cognitive processing load. Certain emergency response sub-team tasks may be trained to this level of performance. Performance becomes more automatic and less affected by stress. Furthermore, the overall task loading on individuals becomes lessened. The training focus would be to train the constant-mapping tasks (i.e., those that have somewhat rote decision responses). (Means, et al, 1993)

Behavioral Deficiencies. Behavioral deficiencies are undesirable aspects of behavior observed to occur during a decision making process, such as biases. Training to reduce the extent of behavioral deficiencies of sub-team members should improve the decision making performance. Behavioral deficiencies include the following (Sidorsky and Houseman, 1964; Hammell and Mara, 1970):

Stereotypy - Over-generalization of a particular response to a number of situations, such that it is both highly predictable and inappropriate.

Perseveration - Tendency to persist with a source of action after it is reasonable to make a new response or interpretation.

Incompleteness - The degree to which the decision maker avails him/herself of all relevant information in the situation.

Untimeliness - Tendency to take premature action, or delay too long in taking action.

Series Inconsistency - Performance of inconsistent responses based on poor logic, rather than over generalization, in a series of sequentially dependent or interrelated actions.

Behavioral Proficiencies. Behavioral proficiencies are laudable aspects of behavior observed to occur during a decision making process (i.e., the opposite of behavioral deficiencies). Training to acquire/improve the behavioral proficiencies of sub-team members should improve the decision making performance. Behavioral proficiencies include the following (Pesch and Hammell, 1974):

Problem Visualization - Ability to assemble data, including abstract data, to define the problem, and extrapolate trends to form new solutions on the basis of past experience.

Adaptability - Ability to develop new rules, guidelines, and structure to the solution of a problem.

Individual Autonomy - Ability to react in opportune instances to capitalize on a unique series of events.

Decision Making Process - Normative and Naturalistic. The *normative models* focus on a detailed process in which decisions are made as a result of weighing utility values for alternative choices, and selecting the choice with the highest utility value. In the *naturalistic models*, the decision making process is one of recognizing the situation as similar to a previous experience, in the form of relating to a cognitive schemata that the decision maker had already developed, and then selecting actions in accordance with success/failure experiences of the past. Both model classes should be considered during the sub-team training. The normative models identify process steps that will help to assure an adequately structured analysis process during the emergency situation (e.g., collection of data, identification of alternative courses of action, evaluation of the alternatives). To the extent that the decisions can be identified and proceduralized under the Contingency Plan, the team's ability to rapidly respond will be improved, the potential affects of stress will be reduced, and the ability to focus on unanticipated problem aspects will be improved.

On the other hand, the *naturalistic models* appear to identify the process we use in actually making decisions. Hence, addressing elements of this process during training, to improve functioning, will act to improve the team's decision making process. These theories further link with literature on the unique aspects of experts versus novices in problem solving. The naturalistic decision making theories suggest that decisions are made on the basis of identifying a cognitive schemata (i.e., mental model) of the problem situation, most similar to one encountered in the past, and then selecting appropriate action(s) based on the past successes and failures in similar situations. Experts are believed to have many more, and more representative, schemata available for the problem situations, compared with novices. Hence, training should address these issues, such as the development of cognitive schemata for less experienced Command Post Team members.

Problem Recognition and Representation. Training should focus on many trials in problem recognition and representation, using a variety of problem types across the waterfront of likely situations/problems. This is important for the development of cognitive schemata, a basis for superior expert recognition performance.

Stress Training. Provide team training under conditions of time, information load, and problem complexity stress. Focus on speed/accuracy tradeoffs.

Situational Teaching. Situational teaching focuses on incident and accident scenarios showing how other individuals have been influenced by hazardous attitudes. It is believed that awareness of the identified hazardous attitudes will help to improve decision making performance. The training addresses how to break the sequence of poor decisions that ultimately lead to problems. (Jensen, 1992).

Structured Problems. Carefully structured problems should be used, often with the complexities of the real-world situation. This implies simulation.

G.5 INSTRUCTIONAL TECHNIQUES

The instructional technique represents a cohesive set of instructional activities, which embody a variety of integrated instructional principles into a methodology. Often, an applied instructional strategy will combine several instructional techniques, and with uniquely tailored features, to achieve a highly effective instructional strategy. These may be combined at any time, as well as change across the period of the instructional program. Unfortunately, the dimensions of instructional techniques are not cleanly separated, resulting in considerable overlap between techniques. The following list identifies selected examples of instructional techniques, each of which may have applicability to Command Post Sub-team training, and have been considered in this analysis:

Abbreviated Scenarios. These are scenarios that address the time period of an event/action etc., isolated from the longer and more encompassing complete scenario sequence. They should be designed to illustrate specific points, and to provide guidance and models. They should be used early in training, giving way to the longer more complex scenarios later in the training process.

Accelerated Time. A simulation technique used to speed-up a scenario, such that the events occur faster than they normally would in the real-world. Sometimes this technique is used to increase the complexity and/or stress level of the scenario. Other times it is an expedient means of moving through a scenario to efficiently focus on periods or events of importance.

Brief, Debrief, Critique. Instructional and other exercise-related information (e.g., regarding a scenario situation under simulation) is provided to trainees in a briefing. The briefing may occur prior to, during, and/or following a scenario or other activity. The briefing usually provides guidance, a demonstration, explanation, etc. The debrief, also called a critique, usually follows completion of all or part of a scenario; it is the principle context for providing delayed feedback and other post-problem information to the trainees. Several other techniques and issues address briefings also. (Hammell, 1983)

Case study. A descriptive narrative of a situation/problem (actual or hypothetical) presented to a trainee class/group for study. The class/group studies and discusses the case details, commenting on many aspects of the case (e.g., information considered, timeliness of actions, etc.), and offering alternative insights, recommended actions, etc.

Class Discussion. An open discussion is conducted in the class, addressing an issue, a problem, a case, etc.

Class Exercises. The class is given a problem to solve, as a single unit; or divided into groups each addressing a different element, and then integrating the various elements into a single solution.

Contingency Plan Analysis and Development. The port oil spill contingency plan would be studied and improved as appropriate. Alternatively, a contingency plan development process would be conducted, focusing on one or more parts of the plan to provide insight into the requirements, structure, procedures, etc.

Critical Incident. Suggests focusing of training on those incidents during an emergency that are critical to success (i.e., on the critical path). Furthermore, to the extent possible, it is suggested that this focus emphasize procedural aspects of assessment and action.

Demonstration, Guidance, Explanation. Providing positive guidance, in several forms, to the trainees, addressing how they should perform. This would be accomplished prior to the trainees being asked to perform. In some cases, the guidance would address the specific situation, and their respective actions, that the trainees will encounter. This methodology avoids the situation in which trainees may practice incorrect behavior. It also provides good models for learning. Although it is appropriate at all levels of training, depending on the material and other aspects of the instructional strategy, it is most valuable during the basic level of training.

Distance Learning, Distributed Learning. Different learning centers are connected by technological means, such as closed circuit TV connecting rooms, lectures and class discussions conducted between multiple locations via satellite TV links, etc. This may be of use to Command Post training if it is desirable to bring key individuals to the classroom who cannot otherwise be present. It should be noted that the learning literature views distributed learning in another context, in which the learning process is distributed in multiple sessions over time, rather than condensed into a single session.

Exercises. A problem solving activity, usually in an applied context. An exercise may have a variety of elements, including a scenario (see Scenarios).

Gaming. A time-dependent scenario problem involving two or more opposing teams, at least one of which is comprised of trainees. The opposing team(s) may be actual students and/or simulated. The trainee team(s) works to solve the problem, with associated performance measures, data collection, feedback, etc. Simulator exercises are often configured around a scenario game. The PREP exercises would be considered as a gaming format.

Group Problem Solving. Individuals in a group each attack a part, or whole, of the problem, discussing their and other approaches in a group setting. This type of open discussion facilitates exploration of alternative considerations and approaches. Additionally, members of one group should have to interface and work with members of another group to jointly work toward achieving the whole sub-team's goals, addressing coordination training.

Group - Observers. Trainees are divided into two groups: one group performs, while the other observes and takes notes on interaction patterns. Observers then inform team of observations, and suggest improved interaction patterns.

Hands-On. Training using actual equipment, providing hands-on experience. This is often used to augment theory training for individuals who will not have to operate the equipment, but who can benefit from familiarization with the equipment. Certain organizations in the marine field provide this type of training to commercial command center personnel, to familiarize them with the operations, so they can better understand the operations personnel concerns. This is somewhat akin to role playing (see Role Playing).

Learn-By-Example. Using multiple example problems to illustrate principles, alternative actions, etc. that may be associated with the problem. This is a powerful teaching method, as class problems, homework, etc. aptly demonstrates. In addition to basic learning, the generalization of skills and knowledge to other problems and conditions is essential to effective transfer of training to the real-world. Learn-by-example can greatly assist generalization, by enabling trainees to relate the practiced situation (and its details) to other related situations. Computer assisted media can

facilitate this type of training by providing fast-time simulation to rapidly provide alternative problems, sets of actions, and evaluation of their outcomes. This would provide important information enabling trainees to compare and contrast situations, information, actions, performance, etc. across a variety of problems -- thus assisting generalization. (Hammell, Gasteyer and Pesch, 1973; Hammell et al 1980).

Lecture. Classroom lecture.

Modeling. Viewing a movie/tape or skit of a successful oil spill response, and the actions taken by the various individuals and sub-teams involved. The movie would provide a good model for trainee emulation. Another application for modeling would be presentation of a good model Contingency Plan.

Peer Critique. Members review and critique each other's behavior and performance, and individually assess the overall team's performance. Focus should be positive, on how to improve both individual and team performance. It should be noted that this would usually be a normal practice during team operations, to monitor team performance.

Positive Guidance. Positive guidance is an instructional technique in which the trainees are carefully guided in their performance. The correct behaviors are explicitly shown to the trainees, with their subsequent performance guided using cues, directions, etc.. Often, detailed explanation of the rationale behind actions, etc. is provided to accompany the suggested behavior, and with the guidance provided by experts. Immediate feedback often accompanies the guidance. This technique will usually result in trainees who can rapidly acquire the guided skills. Positive guidance has the potential drawback of encouraging trainees to rely on the guidance for performance, as a crutch. Hence, positive guidance is suggested for the early stages of training in which fundamental skills and knowledge are to be learned, and removed in the later stages of training in favor of techniques that require independent functioning by the trainees.

Practice. Practice of learned behaviors and tasks. Practice should be guided to assure errors are identified early, and corrected. Reinforcement should also be provided periodically, on a somewhat random schedule for the more advanced levels of training.

Role Playing. Individuals (i.e., team members) participate in a series of scenarios in which they act in the role of another team member during each scenario to experience the tasks, decisions, communications, etc. from the viewpoint of the other team member. This should be accomplished to focus on coordination training. The rotation to other team member positions should occur in the later stages of training.

Rule Learning. Experts often have well-developed heuristics (i.e., rules of thumb), developed from experience, that can be rapidly applied to interpret and solve a problem. Training the rules employed by experts can improve the rate of learning.

Scenarios. A detailed description of an emergency problem, such as an oil spill, with a time-line script of events. These can be performed on a table top, or implemented on a computer-based simulation.

Self Evaluation. A feedback/reinforcement technique in which trainees evaluate their own performance. Its use develops a requirement for tools to provide information to the trainees to assist them in their self evaluation. This technique is most appropriate for advanced level students.

Self-Paced Instruction (Interactive CourseWare (ICW)). Self-paced instruction is a technique in which the trainee progresses through the instructional process at his/her own rate, rather than at a predetermined rate. This can be appropriate for team training, although it is most directly used for individual training. Today, self-paced instructional media is typically presented via a computer-display system, and requires some degree of activity by the trainee. As such, it is termed interactive courseware. It may be configured for one trainee, or for a small group/team of trainees. ICW can be configured for a range of interactivity, from none (passive viewing) to highly interactive in which the trainee(s) questions and responds (interacts) to the computer.

Simulation. The creation, in an educational laboratory-like setting, of an apparent real-world situation and environment (e.g., PREP exercises). Simulations can be of various levels of fidelity, including hardware, persons, and information. The intent is to place the trainees in situations very similar to those likely to be encountered during the emergency, which require similar decisions and actions, thus providing highly detailed and specific practice in performing the functions of an actual emergency. Studies have shown that, generally, the degree of transfer of skills and knowledge to actual real-world situations is related to the degree of task similarity between the training and real-world situations. It should be cautioned, however, that task fidelity can be counterproductive to training also. Hence, high simulation fidelity, although desirable, will not always achieve the most effective training.

Stress Exposure Training. Training under conditions of stress. This is particularly important for oil spill response sub-teams.

Structured Instructional Process. A highly structured instructional process is generally believed to be the most effective, as opposed to a loosely structure process. The high degree of structure insures that the prescribed instructional process is conducted as appropriate. It does not mean that only procedural training is provided. Rather, free play exercises, etc. may be a part of the structured instructional process. However, their use is carefully orchestrated within the instructional process, as appropriate in correspondence with the many other instructional considerations (e.g., student related, instructor related, training objectives, etc.).

Trial and Error. Trial and error learning is well known, and often incorrectly viewed as the best way to learn. The trainee(s) is placed in a situation in which he/she performs (i.e., trial), makes mistakes (i.e., error), presumably corrects the mistakes (somewhat) and tries again, repeating the trial and error process until the skills are mastered. This iterative trial, error, and correction process can be effective. However, imagine the consequences if aviation pilot training were exclusively a trial and error process -- we may have no living pilots! Trial and error is generally counterproductive during the early stages of training, during which direct guidance of the trainees would usually produce the most rapid acquisition of skills. Later in the instructional process, after the skills have been acquired, trial and error learning may be very effective in assisting the generalization of skills, etc. Hence, trial and error is not suggested for the early stages of the instructional process, but rather for the later stages.

Tutorial. Individual self-paced lessons, presented in a book or via computer-based media.

Video Critique. Videotaping the team in action, with subsequent replay and critique.

Video Presentation. Movie or video tape presentation of a simulated or actual oil spill emergency. This can be used in conjunction with case studies, modeling, and other

techniques. It can illustrate importance of team skills, identify errors that interfere with task accomplishment and team performance, and alternative actions that result in success.

Visual Imagery. Development of instructional information into graphical visual imagery for presentation, as opposed to other methods of presentation (e.g., verbal, written). The visual imagery may be static or animated, as appropriate within training objective, time, and cost considerations.

Workshops. Group problem solving, where the group focuses on one or more aspects of an emergency response problem. The group members, together with the facilitator, address relevant issues and formulate a solution to the problem. The workshop may use techniques such as lecture, slides, videos, case studies, etc. Workshops may be appropriate to address selected topics of training, such as the Contingency Plan, and media notification.

APPENDIX H APPLICATION EXAMPLES

The examples of this section illustrate how the desk top computer/display system could be used for Command Post Sub-team training. The actual use would be dependent on many factors, as discussed in other parts of this report. Several points should be remembered in reviewing these examples:

Each sub-team has unique training requirements, which will require a training strategy tailored to its particular needs.

The recommended media, including the general conference room media, will likely be used in different ways for each sub-team. For example, the Command Sub-team should receive practice in giving press conference briefings; the computer/display system may support this by providing information from which the members develop the briefing; the system may provide corresponding questions to ask of the members; and it may provide information to assist in assessing the responses. But, the primary training will consist of developing and verbally presenting the briefing.

The desk top computer/display system has a broad range of support capabilities applicable to support training for each sub-team, in addition to the narrow range of examples presented in this section.

The examples address potential use of the computer/display system medium only.

H.1 GENERAL LONG-TERM TRAINING PROCESS

A cohesive training process for each sub-team should be planned over several years, assuming one or two 4-hour sessions per month for each sub-team, to achieve the set of training objectives (i.e., the time period of the training process is arbitrarily assumed at this time, but should be determined in accordance with the detailed training system design). As an example, the training process may:

H.1.1. Initial/early part of training program

Positively guide the trainees initially, to establish/improve the fundamental skills and knowledge (e.g., shared mental models, decision making process, team communication skills) to an acceptable minimal level;

Train under low stress conditions;

Address overall problem situation issues, as well as issues specific to the sub-team; the issues should be varied, so as to address the range of relevant applied issues in a reasonable period of training;

Use traditional group/team training techniques, such as case studies; supplement these with simulation-based problems;

Use less complex problems, often focusing on particular aspects of an incident.

Use immediate feedback as appropriate, moving to delayed feedback for the longer and more complex problems as proficiency is increased;

Make substantial use of visual information displays to graphically depict the relevant information, problem conditions, etc. to the extent possible;

H.1.2. Middle Portion Of Training Program

Some positive guidance, but generally phasing out in favor of trial and error types of practice;

Increased problem content of training; increased use of simulated problem scenarios;

Use a mix of fast- and real-time exercise scenarios;

Vary scenario content (i.e., conditions, locations, oil type, etc.) to address the complete range of incident issues; problem complexity should increase with training;

Introduce stress (e.g., time, information overload, conflicting goals)

Use advanced techniques, such as role playing for team training emphasis;

Some immediate feedback, but generally moving toward delayed feedback following scenario completion;

H.1.3. Advanced Portion Of Training Program

Mostly simulated problem scenarios

Use mix of fast- and real-time exercise scenarios, with emphasis on real-time;

Substantial stress content of problems;

Trial and error techniques with delayed feedback (debriefing);

Address wide range of situations for generalization;

Repeat similar difficult problem situations that address issues of particular importance;

H.2 OPERATIONS SUB-TEAM INITIAL TRAINING.

Operations and other sub-team training should initially focus on global issues of the incident, later moving toward the more sub-team-specific issues. Initial focus might address the following decisions using a positive guidance technique:

Training Setting: Sub-team group presentation and discussion; low stress.

Initial decisions: Where is oil?
How much oil?
Where is oil going?
What may be impacted by oil movement? (in path, down stream, etc.)?

What tactics are available, and their likely effectiveness?
What is the equipment response time, including alternatives?
What action should be taken?

- Information presentation: Incident Area Chart display -- showing oil slick, environmental conditions, sensitive areas and their priorities; projected on large screen display.
- Computer-generated oil slick trajectory -- overlaid on the incident area chart as needed.
- Other relevant information presented, such as procedures of the local Contingency Plan, performance measures -- presented on the second large screen display.
- Computational support: Conditions modification by the facilitator, with calculated situation updates and corresponding display modifications.
- Trainee suggested alternatives, with calculated situation updates and corresponding display modifications.
- Calculation and display of performance measures and other relevant situational data, under control of facilitator.

Various training objectives may be supported by this example use of training resources, including providing the trainees an overview understanding of the response process. This would also support, for example, the Command Sub-team training objective of "Determine incident-specific objectives under various conditions", and the Operations Sub-team training objective of "Establish and implement the initial Tactical Action Plan".

This approach would provide specific guidance to the trainees on how to perform, prior to having them perform in a problem scenario, thus avoiding the practicing of poor or incorrect behavior. After this discussion, the trainees may individually, or in subgroups, solve a problem applying the previously refreshed (or learned) principles. Upon problem completion by all, presentations could be made by individuals or subgroups, with ensuing discussion led by the facilitator and supported by the computer-generated problem simulation and displays. This would allow team members to see how their associates view and approach the problem, and encourage discussion about alternative views and actions. This session would thus achieve some amount of team building, in addition to operationally oriented training objectives.

H.3 OPERATIONS SUB-TEAM IN MIDDLE OF TRAINING PROGRAM.

Training focus may be on the generalization skills and knowledge to the complete range of possible conditions, and on the overlearning of critical decision making response skills. Hence, the training process may seek expose the trainees to many different scenario problems and conditions, with particular emphasis on those exercising critical skills, and yet in the context of team interaction and performance. One example approach to achieve this type of training situation would be to use abbreviated real-time scenarios, as follows:

Summary: Place the sub-team at a particular time-slice in a scenario, in which a time-critical decision is needed. Give them a short time (i.e., under real-time

conditions) to resolve the problem, reaching a consensus decision. Enter the sub-team's solution actions into the scenario, and move the scenario ahead to the next time-slice, at which the results of their decision can be observed (i.e., via generated performance measures and situation parameters). Discuss the conditions, decision options and actions with display aiding. Address alternative actions with the help of the fast-time simulation to generate the alternative outcomes. Then move on to the next sub-team decision problem in this scenario, at this time or a later time.

Training setting: High fidelity Unified Command Operations room

Oil spill has occurred, status information is presented (large screen displays) bringing the trainees up to the current time, which is the start of the problem for them.

The current time can be any time in the scenario, it does not have to be at the start of the oil spill response effort. When at a later time, the scenario evolution to the current time is explained (with visual aids), including events and actions taken from the start to the present time.

The large screen displays would be used to present the information, including dynamic fast-time scenario generation (e.g., showing dynamic oil spill slick movement as a function of wind and current at 25x real time), and other relevant information (e.g., weather forecast for the next 8 hours).

Problem requirements: The intent is to present a problem to the sub-team that is time-critical, allowing them a short time for resolution.

The particular problem to be addressed is presented; this may consist of saying nothing and letting the Operations Sub-team identify the immediate problem(s) of concern, or the problem may require them to address a particular aspect of the spill scenario.

The problem may require the sub-team to address a particular decision, such as the distribution of limited labor resources in accordance with the booming directives from the Command cell.

A time limit would be established within which the consensus decision must be given, and entered into the simulation.

One alternative would be to allow the sub-team to exceed the time window, but at a penalty of allowing the scenario to evolve. Hence, if they wish to wait for additional information, such as a more recent overflight survey of the spill, the scenario would generate the additional information, but also proceed to the time at which that information is supplied without action by the Operations Sub-team.

Another alternative would be to increase stress by decreasing the time available for making the decision.

Real-Time Problem Solving: The sub-team begins, at the designated time, a real-time exercise to address the next step of the scenario, as defined by the problem requirements. Their intra-sub-team interactive process would be in real-time, within the constraints imposed. At the time the consensus decision is made, the real-time aspect would be paused for feedback and discussion.

Inter-sub-team (e.g., with Command cell) and external communications could initially be handled by individuals located remotely from the Operational Sub-team. In later versions of the media, consideration of computer-interface communications may prove feasible (i.e., voice and/or display communications).

Scenario Calculation: The simulation would rapidly update the spill scenario (in fast-time) to the next time slice, based on the actions resulting from the sub-team's decision, to enable discussion of the decision results, and/or confronting the next problem in this scenario.

Feedback Discussion: The sub-team, with assistance from the facilitator, would review the results of their decision at the advanced-to time-slice, with the aid of simulation calculations and displayed information.

Discussion of the conditions, alternatives available and their expected outcomes, and the actions taken and resulting outcome should be addressed with the assistance of computer/display aids. Automatic generation and display of performance measures would assist this process.

The fast-time simulation and appropriate display formats could present comparative information regarding potential alternative actions available.

Next Real-Time Problem: The facilitator would introduce the next problem of this scenario, in sequence, to be addresses in real-time by the sub-team. The training process would thus repeat itself until completion of the designated problems associated with this scenario, at which time an overall debriefing would be conducted.

An alternative to providing feedback/discussion following the sub-team decision action, is to bypass the feedback session at the advanced-to time-slice, and instead go on to the next problem in the scenario at that time slice. The feedback would thus be delayed until several, or all, time-slice problems have been addressed in sequence.

H.4 COMMAND SUB-TEAM.

A training session similar to the above may be appropriate for the Command Sub-team, excepting the problem emphasis would be appropriate to their functions. For example, the problem may require the Command Sub-team to evaluate and approve

Planning/Operations recommendations for allocation of limited boom resources to protect sensitive areas, in a situation where the high priority coastline exceeds immediately available boom resources. This may be accomplished with planning for later equipment arrival, changing weather conditions, etc. The training could be conducted in the same context as suggested in Example #3 above, but configured explicitly for the Command Sub-team.

H.5 COMMAND SUB-TEAM AUTOMATIC DECISION TASKS.

Certain time-critical decisions early in a spill incident, such as the allocation of available resources to the highest priority areas, are clearly identified in the port's Contingency Plan and may be trained to a level of near automatic performance. To achieve this, the Command Sub-team can be trained with many abbreviated real- and fast-time scenarios, following a process similar to Example #3. The emphasis would be on making rapid assessments and moving to rapid decisions in accordance with options available. The simulation and display capabilities would directly support this process as suggested above, by generating scenario problem conditions at the required times in response to sub-team actions, presenting scenario-related information, and presenting feedback/discussion information for assessing performance.

H.6 PLANNING.

The Planning Sub-team could be trained in a manner similar to that of Example #3 above, with emphasis on longer-term problems, with fast-time simulation calculation of the likely results of the recommended actions at much later advanced-to time-slices in correspondence with planning time windows, and with the feedback/discussion centered around the likely effects of these longer-term recommendations. For example, the problem could require calculation of containment, removal and recovery capacities, and their time-sequenced plan for acquisition and application. This may address a scenario of several days or even weeks. The simulation could calculate scenario changes over the planned period in response to planned actions, and show the effect of using the planned requirements in terms of cost and effectiveness at various time-slices through the period.

H.7 LOGISTICS.

The Logistics Sub-team could be trained in a manner similar to that of Example #3 above, with the scenario focus and simulation support addressing logistical issues rather than tactical. For example, a training objective of the Logistics Sub-team is to "Determine if sufficient response resources have been mobilized to effectively respond to the spill under various conditions". The scenario could be presented as described above, with the logistics sub-team required to assess the situation and resources, and report to the OSC. The report results could be entered into the computer along with the identified key factors, and compared with the actual scenario calculations for feedback/discussion.

As another example, the simulation models should address food consumption, medical needs, etc. over the course of the scenario in correspondence with the oil spill and response team dynamics. The sub-team could be presented with problems such as preparation of the daily logistics plan. The simulation could implement the plan, and generate performance related information in response for conduct of the feedback/discussion.

H.8 FINANCE.

One training strategy approach for the Finance Sub-team may be similar to Example #3, but the scenario content would likely be substantially different -- i.e., oriented to financial issues. Hence, financial problem scenarios would be structured around the real- and fast-time elements of the suggested training strategy, using computer simulation and display capabilities to assist. For example, the training objective "Establish and implement an appropriate cost allocation strategy when various conditions exist", may present the Finance Sub-team with a spill scenario that requires the development and implementation of a cost allocation strategy between two responsible parties. The strategy could be developed and assessed for completeness and validity with the help of appropriate cost simulation models sensitive to spill issues. The descriptive information associated with the spill may be used to configure the problem, and the later assessment.