# Establishing a Simulation, Training and Research Center — Achieving the Vision

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**ABSTRACT**

The Institute of Maritime Technology, Research and Analysis (IMTRA) at California Maritime Academy (CMA), under the aegis of the Department of Continuing Education has obtained funding for the acquisition of an Oil Spill Crisis Management Simulator. This simulator will be the core of, and the vehicle for, establishing a Simulation, Training and Research Center in Vallejo. In the effort to realize the vision of establishing a world-class Center which will serve a variety of clients, the Institute has formed a unique team of state and federal agencies directly concerned with both the prevention of, and recovery from, spills. It is also envisioned that the selected simulator manufacturer will be an active, long-term partner on this team. The Center will add to the simulator suite at CMA for undergraduate use, and open avenues for graduate level research in the hydrography and hydrology of the modeled geographic areas as well as in the modeling of the databases themselves. The development of Continuing Education Spill Response training courses, courses in Leadership and Crisis Management, and opportunities for agencies and industry to model and test contingency plans will help support the Center financially. This paper will discuss the model created to establish the center from initial funding through creation of the team and their integration into an Advisory Board for the definition of the simulator and of the functions of the center, the process of defining and acquiring the simulator, and the vision of how the center can grow into the caliber of institution intended. The intent is to provide a model which other Maritime Universities can use to meet their needs and opportunities.

## 1. Introduction

This paper describes the evolution of a model for establishing what is intended to be a world-class simulation, training, and research center built around a spill and crisis management simulator. The evolution of the model, and of the center, is a work in progress. Our experience is not purported to be the ideal way to achieve the goal, but it is hoped that some of what has been accomplished to date may be of use to others who wish to move in a similar direction.

### 1.1 The Vision

The concept of establishing a Simulation and Research Center has been under discussion at California Maritime Academy for a number of years. CMA currently has seven simulators, ranging from full-mission Bridge and Steam simulators, Radar and GMDSS simulators, through part-task diesel and power plant simulators, to an out-dated Liquid Cargo simulator. The construction of an on-campus Simulation Center is an item in the master plan, and is scheduled for funding and construction within the next five years. Appropriately, this Center is intended to support the undergraduate curriculum as its primary customer, with Continuing Education using the simulators as scheduling permits. The on-campus Center is considered essential to providing requisite simulation support to the undergraduate programs as the student body expands to a planned size of 750 cadets.

Vision, however, is not limited to or by planned programs. The ideas and concepts underlying the thoughts and vision of a simulation and research center looked at university growth beyond current parameters to what could be. The concept was that several areas of growth could be addressed in a multi-disciplined package that included the development of a graduate degree program, the establishment and development of a simulation and research center, the development of Professional / Associate of Science / Preparatory programs, and the establishment of a Nautical Center, in conjunction with the siting and development of a Simulation, Training and Research Center. Expansion of the uses of the Simulation Center, partnering with industry / simulator researchers / other California State University system campuses / University of California campuses / local Community Colleges / the United

States Army Reserve, etc., and developing new courses of study and training were and are a part of the vision. Siting the Center off-campus not only addresses a limited availability of space problem, but also takes advantage of the potential availability of land and facilities as a result of the closing of a nearby naval shipyard. With these thoughts in mind, several potential opportunities have been explored over the last few years, none of which have yet to bear fruit.

### 1.2 T/V Neptune Dorado

The Tankship Neptune Dorado is an 813-foot, single hull crude carrier, of 65,000 DWT. She was built in Poland in 1985 and is Singapore flagged. She is owned by Elmhirst Private, Ltd. And operated by Polembos Shipping, Ltd. She was carrying a cargo of 628,000 barrels of Cossack Crude Oil from Dampier, Australia.[i] On 19 September 2000 the U.S, Coast Guard Marine Safety Office, San Francisco Bay (MSO) received a pre-arrival package from the operator of the T/V Neptune Dorado with documents confirming compliance with U.S. regulations that allowed MSO to schedule an examination of the vessel. T/V Neptune Dorado arrived in San Francisco Bay on 23 September, and proceeded to anchor in Anchorage 9. MSO received no notification of any problems or hazardous conditions on the vessel, other than that the autopilot was inoperable (arrangements had been made for its repair).

MSO personnel boarded Neptune Dorado on 24 September to conduct a tank vessel exam and issue a tank vessel exam letter. The exam uncovered serious material problems that endangered the ship, its crew, the cargo, the Port of San Francisco, and the environment of San Francisco Bay, USCG (2000), Enclosure (4), p1. There then followed a series of detentions, expulsion orders, appeals, illegal lightering, and involvement of both the Eleventh Coast Guard District (San Francisco) and the Coast Guard Investigative Service. The further discovery of substantial quantities of oil in Neptune Dorado s segregated ballast tanks in contradiction of representations made by officers and crew about the vessel s condition, indicating the possibility of criminal activity on the part of the master, operator, and/or owner, resulted in the Captain of the Port requesting assistance from both the federal Department of Transportation and the federal Department of Justice on 6 October.[ii] The Investigations Department of the MSO initiated a Marine Violation/civil penalty case against the vessel. An *ad hoc* investigating team was formed on the vessel composed of the Duty Investigation Officer and MSO marine inspectors on scene. The investigating team reviewed and took possession of various vessel logs, many of which exhibited signs of tampering and intentional falsification. The investigating team advised the CGIS agents on scene of the suspected falsifications. Subsequent interviews of the officers and crew led to the arrest of the master on suspicion of violating 18 U.S.C. 1001 (making false official statements).

In a saga that lasted for another two and one half months Neptune Dorado s cargo was successfully off-loaded, the ship was thoroughly inspected and ultimately allowed to depart to Singapore to effect required repairs before being allowed to return to service. On December 19, 2000 a final plea agreement and related compliance agreement were signed by all parties in the interest. At this time, the civil and criminal cases that were pending against the vessel s master and operator, were settled out of court resulting in three felony convictions, a $2.5 million fine, and an enhanced oversight compliance agreement for all the operator s vessels, USCG (2001), Enclosure (4), p17.

## 2. The Stakeholders

Through negotiations with the U.S. Attorney involved in the Neptune Dorado case, funds from the civil penalties in that case, to be administered by the Eleventh Coast Guard District, were set aside for an oil spill simulator. Eleventh Coast Guard District Officers contacted California Maritime Academy to see if CMA was interested in being the site for the oil spill simulator. With an answer in the affirmative, the stage was set for the first steps in the development of a Simulation Training and Research Center with the oil spill / crisis management simulator as the keystone.

### 2.1 The Resource Trustees

The U.S. Coast Guard brought into the equation the concept of including what they referred to as the resource trustees. These trustees were federal and state agencies with a vested interest in spill prevention and response. The trustees were the Coast Guard (Department of Transportation), the Environmental Protection Agency (EPA) (federal), the Department of Commerce, the Department of the Interior, and the State of California Department of Fish and Game s Office of Spill Prevention and Response (OSPR). The inclusion of these entities as trustees with a vested interest in the administration and use of the earmarked funds sets an important conceptual foundation for the development of the organizational structure of the center and the consequent use of the simulator.

### 2.2 The Steering Committee

Eleventh Coast Guard District officers visited the CMA campus in the summer of 2001 to establish initial communications with the Academy and to set the stage for the first meeting on the subject of the oil spill simulator

of what would become the steering committee for defining what the simulator should look like. Represented at this initial meeting in December 2001 were the Coast Guard, California Maritime Academy, the Office of Spill Prevention and Response, the U.S. Environmental Protection Agency, and the National Oceanic and Atmospheric Administration. This working level group set the stage for establishing the technical specifications for the simulator. Perhaps more importantly, it also set the stage for how the stakeholders, those agencies with an interest in how the simulator would be used and how the center would be administered to meet the community s needs, would participate. The group constituted itself as an *ad hoc* steering committee for defining simulator specifications and for addressing which agencies should be included in the community. The inclusiveness and enthusiasm of the participants of this initial meeting were essential elements in establishing how the project would evolve. The decision to consider themselves a steering committee gave everyone an ownership in the project that continues and is, and will be, a key factor in acceptance and use of the simulator and the center.

The funds earmarked for the simulator had by this time been transferred to the National Fish and Wildlife Foundation, San Francisco, pending their release to California Maritime Academy by the Coast Guard. It was decided by CMA that the appropriate repository for the funds when released would be the California Maritime Academy Foundation in order to avoid mingling these funds with the general fund.

### 2.3 The Advisory Board

It is envisioned, and agreed by the participants, that the steering committee will evolve into an advisory board for the Simulation, Training and Research Center. The California State Lands Commission, the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service have also been invited to join the steering committee. State Lands and Fish and Wildlife participated in the most recent meeting where the key points of the Request for Proposals for the simulator were finalized. The format and procedures for the advisory committee have yet to be determined. It is expected that these also will be the product of evolution and will be developed through achieving consensus among those involved.

The participation of the members of the steering committee/advisory board is considered to be a most important factor in the development and success of the center concept. When the steering committee was convened for the first time the meeting included a demonstration of the Coast Guard s *Pisces* system by representatives of Transas USA and Precision Planning and Simulations, Inc. This system was developed for the Coast Guard by Transas Marine in 1997-98. The intent of the demonstration was to establish baseline knowledge of what an oil spill simulator would consist. A significant benefit of the demonstration was that it stimulated participation in defining what the steering committee thought would be needed, and thus a sense of ownership in the project on the part of the stakeholders. As a consequence, the steering committee has evolved into the advisory board by consensus rather than appointment. This is not to say that additional members will not be invited to join the advisory board. Expansion of the board in the future to include others, such as industry and charitable foundation representatives, particularly those with an interest in ecology and environmental protection, is envisioned. But a core of those interested in using the simulator and the resources of the center has been identified and are a part of the development process.

## 3. The Simulator

In Section 1.2 of the Request for Proposals (RFP) (the Tender) for the simulator the purpose of the simulator is described in detail:

> The purpose of the Spill Management Simulator (SMS) is to provide a training, research, planning and outreach **tool** for team management, coordination, and leadership relating to marine spill response and recovery. The SMS will provide a vehicle for management team training to assist the various stakeholders (agencies, trustees) with improving preparedness, communication, coordination and cooperation. The process will provide the ability for the stakeholders to identify shortfalls and tradeoffs of the various plans and strategies.
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> The SMS will be used for the identification, analysis, evaluation and enhancements of curre nt and proposed strategies for resource protection, planning (Area Plans, Contingency Plans, etc.). This includes prevention, preparedness (drills), response and impact analysis. The SMS will aid professionals in the evaluation of their assumptions by providing simulated trial exercises of the existing strategies. Area plans, sea plans and site strategies can be evaluated and different alternatives and options tried on the SMS.
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> The SMS system will integrate all existing information resource databases as best as possible.

The ultimate goal is the protection of natural resources and to reduce the potential damage of a spill. CMA (2002)

The purpose as quoted above represents very specifically the concern and intent of the steering committee that what was to be acquired meet the needs of the various stakeholders as they themselves saw them. Thus it serves not only as a statement to potential bidders as to the desired design and capabilities of the simulator, but also a statement of intent on the part of the stakeholders. The RFP goes on to address technical specifications in detail and also expands on simulation functions, training capability, research and development, etc.

### 3.1 The Partnership

California Maritime Academy brought into the equation the concept of partnering with the successful contractor in order to establish a long-term mutually beneficial relationship where the contractor and CMA participate in the continual development and growth of the SMS system. The Academy intends to actively pursue the involvement of graduate students and researchers in the use of simulator for academic and physical research in ecology related and computer science fields. It is anticipated that the selected contractor will participate in the research programming and development so that the simulator modeling will be continually enhanced as a result of the research into the hydrology and hydrography of the geographic databases. Obviously, the envisioned relationship goes well beyond the traditional contractor-customer model where the buyer gets today s model and then either buys upgrades or watches their simulator be overtaken by the development of new models. To be a true partnership, however, there have to be advantages for the contractor as well. Along with the research and development benefits, and the opportunity to validate models, the structure of the agreements with the contractor will have to provide some financial return to the contractor for participation in the partnership.

This fairly innovative approach to the customer/contractor is of interest also to the steering committee. One of the concerns expressed during that committee s deliberations was that reinventing the wheel should be avoided to the maximum extent possible. This position was expressed specifically in relation to the availability of several mathematical models (some of which have been developed by the agencies represented on the committee) for predicting the movement of water (tides and currents, river flow), oil(s), and atmospheric gases. The committee felt strongly that the software selected for the simulator should be able to take advantage of this modeling and integrate available modeling into the simulator. Thus, the concept of an on-going partnership between the contractor and the center (CMA) was attractive from the point of view of taking advantage of developments in modeling, no matter what the source.

### 3.2 The Phases

Considering that the ultimate spill management simulator desired would exceed the available funding (approximately $300,000.00 U.S.D.), the decision was made to develop the system in three phases. These phases are:

- Phase 1: Basic Spill Simulator
- Phase 1A: Environmental Impact Analysis Module
- Phase 1B: Remote Internet Capability of User Stations
- Phase 2: Expansion of simulator to include additional spill modules
- Phase 3: Expansion to a full crisis management system.

The contractor selected for Phase 1 is expected to be the contractor selected for Phases 2 and 3. A detailed bid proposal and firm fixed price will be required for Phase 1, and budgetary prices will be required for Phases 2 and 3. Phase 1A, the Environmental Impact Analysis Module, and/or Phase 1B, Remote Internet Capability of User Stations will be implemented in either Phase 1 or Phase 2, depending on cost and available funding. In support of this a firm fixed price will be provided for Phases 1A and 1B as options in Phase 1. Moving on, the Phases 2 and 3 will be contingent on the successful completion of Phase 1 and the availability of additional funding.

As stated above, the initial funding for acquisition of the simulator will come from monies received from the T/V Neptune Dorado case. Additional monies for the funding of the remaining phases of the project and the establishment, construction, and administration of the center present an on-going challenge for CMA and the board of advisors. In addition to funding through grants from state and federal agencies, funds from penalties imposed as a result of further civil and criminal cases, and funds from grants from charitable foundation, the business plan for the center calls for it to cover some of its costs through providing services to federal and state agencies and to industry. The use of the simulator to test and verify area and contingency plans, and the development and offering of courses

in incident response and team management, and in academic and physical research as well as in plan development are all potential sources of revenue to help support the center.

**3.3 Phase 1**

The proposals from the contractors bidding on the simulator are due to CMA the beginning of October 2002. Once a selection is made, the basic spill simulator will be housed in existing facilities on campus. Sometime in the winter/spring of 2003 the basic spill simulator should be on-line. The basic simulator will consist of the Instructor/Operator Station (IOS) Module, and the Response Information Management System as diagramed in Figure 1; and the Spill Module as diagramed in Figure 2. Hopefully the basic simulator will include the Phase 1A Environmental Impact Analysis Module as illustrated, and the Phase 1B Remote Internet Capability of User Stations.

The spill movement module in the Spill Module will include sophisticated computer based mathematical models that calculate the behavior of the oil or chemical (the product). The movement (trajectory) and fate of the product over time will be modeled, both on the surface and in the water column. The shape, size thickness, and movement of the product under varying conditions such as currents, water temperature, water salinity, wind and sea state will be calculated and the movement displayed on a two dimensional electronic chart.

The spill cleanup module will include simulation of the effects of booms, skimmers and other equipment or devices. The module will simulate mechanical containment and recovery techniques, including effectiveness and efficiency. It will simulate the configuration of towed and stationary protective booms and performance characteristics such as skimmer recovery rates. The Instructor/Operator will have the ability to alter the performance characteristics of the equipments for specific exercises. The module will include the effects of chemicals, such as dispersants, and of *in-situ* burning.

The shore clean-up module will allow for the analysis and training for the cleanup of the shore when spilled oil reaches coastlines. This module will be able to calculate what will happen to the product over time based on product type, weather conditions and type of shoreline; calculate the change in product mass, volume and thickness over time; and analyzed the amount of product debris that needs to be collected.

The Resource Information Management System Module will include a database of all response resources such as those available from depots. This information can be from actual real world databases that are downloaded to the simulator and can be modified for each training session or contingency plan exercise. The database will be designed to accept electronic file transfers so that information can be downloaded from actual databases, and the simulator databases will be able to be modified without affecting the actual data. This data will be comprised of such elements as personnel, location of airfields, location of depots, land transportation vehicles, vessels, aircraft, booms, skimmers, chemicals (dispersants), absorbents, and other equipment, chemicals or devices.

The Instructor/Operator (IOS) Station Module will be a workstation where instructors and operators predefine, prepare, control and evaluate training scenarios. The station will also allow instructors to set-up, design, modify, control and monitor exercises. They shall be able to set initial conditions, and be able to control throughout the exercise the magnitude of the spill, alter environmental conditions, define the state of available resources to respond to the spill, and control the efficiency and operation of equipments such as skimmers, booms, boats and aircraft.

The Environmental Impact Analysis Module (Phase 1A) will provide sophisticated models for predicting and analyzing the impact to the ecology and shorelines. The models will use habitat-specific information to determine the biological effects of a spilled product, and seasonal estimates of wildlife, including mammals, fish, shellfish, birds, reptiles, plants and other organisms. They will predict the impact on the wildlife to include the predicted percentage killed or injured, basing the mortality probability on existing data that has been collected for the San Francisco Bay area.

The Remote Internet Capability (Phase 1B) will be to provide a web-based interface to the simulator. This will allow each of the module workstations to be operated in remote locations, such as client s offices. There will be full interaction of all users. This effort will include a web site design and a server capability to allow for file transfers and interactive interface to the simulator.

With these specifications the basic simulator will be of sufficient sophistication to meet the immediate needs of the stakeholders for the testing of area and contingency funds and to meet the needs of industry in their design and testing of the required contingency plans, both afloat and ashore.