AN APPROACH FOR IMPROVING FLEET TRAINING THROUGH TELECOMMUNICATIONS SUPPORTED SIMULATION

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SUMMARY

Maintaining fleet readiness in light of today's resource constraints and approaches to operational training is extremely difficult. *Time spent at sea is minimal, individual* ship training is not well structured or integrated and joint ship training exercises are few relative to need. Continuation *of this condition may not be necessary, if* the U.S. Navy takes advantage of telecommunication and computer technologies. With these technologies and a common centralized data base most U.S. ship crews located in port could train as if at sea. Individuals could be trained to operate their respective equipment; train as a team; and train as a weapon system.* Further, ships in port throughout the U.S. could be aggregated as a task force and trained as if in a fleet exercise. In addition, ships at sea or a combination of ships at sea or in port could be pooled to train together. Such a system has the potential for saving millions in operating, maintenance and munitions costs, but still produce a fleet trained and ready to neutralize any attack by an adversary.

INTRODUCTION

A constant requirement that must be met by the U.S. Navy is maintaining a high-level of operational readiness so that all possible eventuality can be properly addressed. Meeting this requirement has always been difficult, but today the problem is compounded by limited resources, the constant introduction of new equipment and ships, and the rapid modernization and challenge of the Soviet Navy.

Looking at the essence of operational readiness, the backbone has been the training provided on and by the individual ships. Each is expected to follow basic training guidelines, but operationalize as they see fit. Each individual is expected to reach a level of proficiency relative to assigned tasks and to operate as a member of a team. Each team is trained to function as an efficient and effective entity interfacing with other teams, aggregating to the total weapon system -- the ship. Unfortunately, this training autonomy concept does not always produce the desired results; consequently, *there is a spectrum of readiness within a* ship and among the ships in the fleet.

The other key component of operational *readiness is the fleet exercise. While each* ship is responsible for its own operational readiness, they must eventually come together to function as a member of a team. Fleet *exercises are the basic means used to train* and test the capability of the ships to perform their individual and team roles in varying conflict scenarios. While fleet exercise training is desirable because it is as close to reality that is possible, few are being conducted due to fuel constraints and the operational and maintenance costs.

Because of the above problems, the operational readiness of the U.S. fleet may not be what it should be. However, it may be possible to rectify this situation and save a considerable amount of money over the long run, if the U.S. Navy takes advantage of existing technologies to improve operational training.

THE TECHNOLOGIES

Two basic technologies which may permit the U.S. Navy to improve their operational readiness posture are telecommunications and computer technologies. Advances in the computer field over the past two decades are now being capitalized on to provide computer support to meet almost any need. Similarly, advances in telecommunications now permit reliable communication links to nearly any location on the earth. By combining these technologies it becomes possible to develop a large network of interrelated data communications and data processing devices. Consequently, integrating computers with today's telecommunication can provide a flexible, accurate, and high-speed transmission along with a central location for the accumulation, processing and the evaluation of data.

These technologies are not foreign to the U.S. Navy. They are in daily use. Literally hundreds of computers are in use in the U.S. Navy to include "minis" on board ships and "macros" in various CONUS command centers. Every conceivable telecommunications means is used to include communications satellites, to transmit data and information. Therefore, the technologies that might contribute to the improvement of operational readiness training already are in use. What

*"Weapon system" refers to a ship, submarine or aircraft and is synonymous with "unit."

is needed is a reorientation of thinking towards using them for operational readiness training.

THE OPERATIONAL READINESS TRAINING (ORT) CONCEPT

Basically, the heart of the ORT system would be a centrally located computer which would be programmed to simulate a range of problems that would be induced into the instrumentation of weapon systems to include surface and subsurface vessels and airborne vehicles. The system would be flexible enough to stimulate a single piece of equipment on one or multiple weapon systems. Further, it would be able to aggregate equipment stimulation to effect specialized team training. Moreover, it also would be able to address task force type training, stimulating multiple pieces of equipment in a large number of weapon systems according to a range of scenarios. With the aggregating feature individual equipment operators, combat teams, a ship or a task force would be able to be trained and evaluated.

Another feature of the system would permit ships that are in port, or a combination of port and sea vessels to work as if they were at sea in fleet exercises. The system would have sufficient coverage to include CONUS, the Atlantic and Pacific Oceans and the Mediterranean Sea. Consequently, ships in port throughout the U.S. could participate in ORT, as could ships at sea or in port throughout the world. The ORT system would be able to tie the ships together in any combination from any place in the world and treat them as if they were working together at one geographic location. Figure 1 delineates how weapon systems in the CONUS vicinity might be brought together under the ORT system.

ORT SYSTEM COMPONENTS

The ORT system would have three basic components:

1. Shore Training Control Center
2. Communications System(s)
3. Unit Training Mode Control and Interface System

Shore Training Control Center

The Training Control Center would provide for the initiation, control and evaluation of selected training exercises. It would require a large facility; a staff of training experts and support personnel; and the hardware and software needed to provide operational scenarios to units for training purposes. The training facility concept would be very similar to existing facilities such as the Fleet Combat Direction Systems Training Center, except the problems would be much broader in scope. For example, a single facility may incorporate the features of many existing training systems [i.e., Device 2F87, Weapons Systems Trainer; Device 14A2, Surface Ship ASW Early Attack Weapons System Trainer; Tactical Advanced Combat Direction and Electronic Warfare System (TACDEW) etc.]. In addition, new features may be provided for engineering drills, navigation exercises, etc.

While the discussion thus far has eluded to a broad range of training that could be provided to the fleet, the major emphasis in the remainder of the paper will be placed on training in ASW/AAW. Accordingly, the Training Control Center would provide simulated training problems similar to those currently operational at the various facilities.* The difference lies in the degree of sophistication in simulating the "real world" and the "place of training." As with other training exercises, in ASW the general problem parameters such as ocean environment; target class, its course, speed, depth, etc.; and similar data for friendly vehicles (LAMPS, S-3As, submarines and surface vessels) would be initiated and controlled at the Center. However, the signal inputs for Sonar, Radar, ECM, etc. would be simulated on each unit.

The advantage of this concept over the current system is that, while the training would be controlled from shore the actual training would be conducted at the unit level. This would allow several units to participate in coordinated training exercises, whether in port or at sea. Also, each unit's performance can be evaluated by experts located at the Center as well as by personnel on the ship. The primary purpose of the Training Control Center would be to provide the fleet with operational training scenarios and evaluate their readiness.

*The range of training provided could include Naval War Gaming provided at the Naval War College in Newport, Rhode Island, LAMPS and S-3A pilot training (i.e., Device 2F92, S-3A Weapons System Trainer) sonar classification and operator training (i.e., Device 14E19, Basic Operator/Team Trainer, AN/SQS26 CX Sonar) and anti-air warfare training such as provided by the Tactical Advanced Combat Direction and Electronic Warfare System (TACDEW) at Dam Neck, Virginia and San Diego, California.

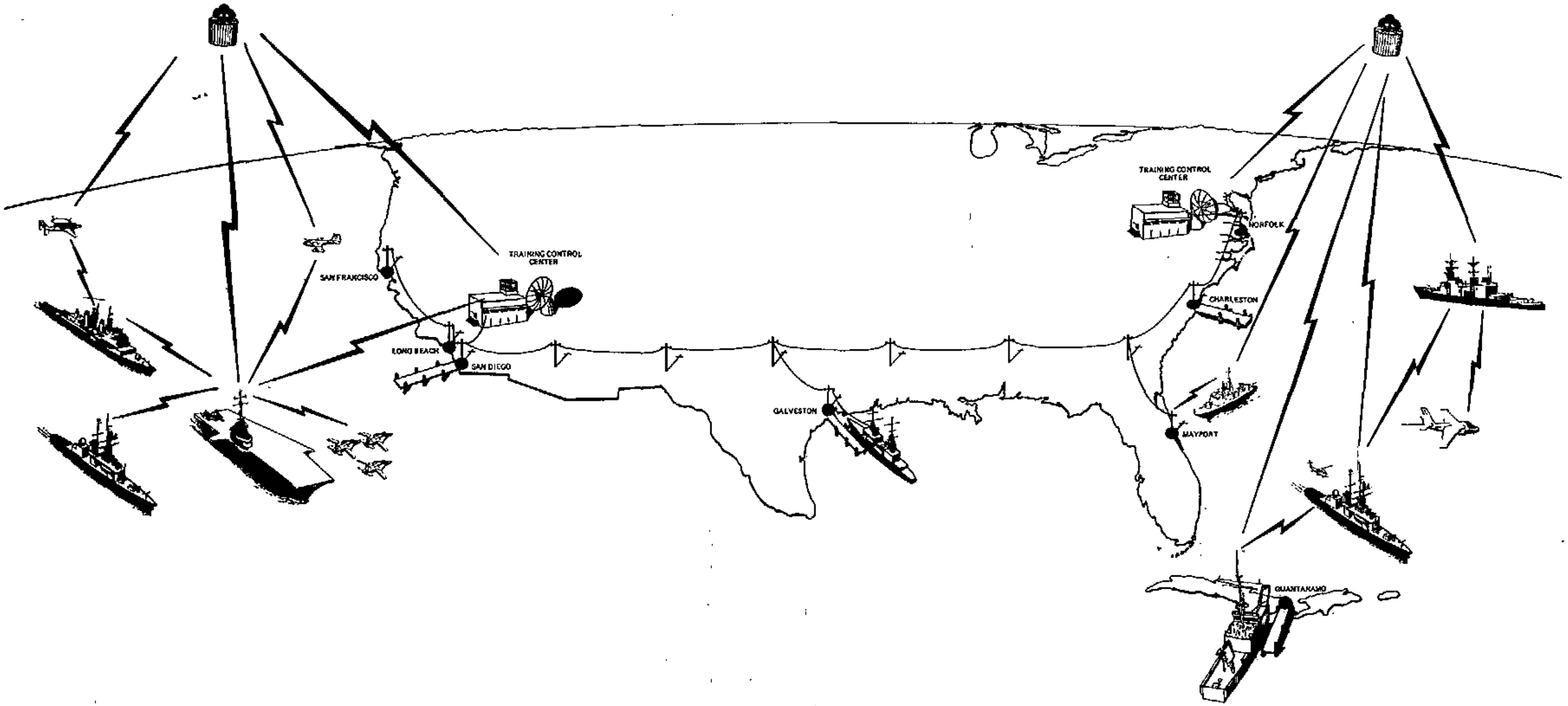

Figure 1. Fleet Training Operational Schenario

Communications System

A variety of communication modes could be used to deliver and receive problem data from Navy units. For example, the Naval Tactical Data System (NTDS) Link 11 and 14 features should be considered in the design of the communications system especially for surface warfare training. For units that are on shore or temporarily in port, a direct line link may serve as the most efficient channel for Training Control Center to unit communication. This might include the AAW Mobile Training Van or MISTER concept.* A variety of communications approaches should be studied, such as AUTODIN and FleetSatComm. The actual communication network would most likely consist of a combination of systems with the determining factors being their availability; the need for a real-time system capability; the types, volume and rates of data transfer; and the costs associated with the operation and/or design of a completely new communications system.

Unit Training Mode Interface and Control System (UTMICS)

The UTMICS would be the final component of the fleet training system. The UTMICS would be physically installed on board each appropriate unit to: 1) provide an alternate mode of operation (training mode); 2) control, process and distribute problem data received from shore thus furnishing simulated inputs to tactical subsystems and components on board the unit; and 3) receive and transmit key feedback data to the Training Control Center for the purposes of critiquing and evaluating the training problem. Units receiving the UTMICS would be provided with a complete training mode capability without sacrificing the tactical mission of the unit or safety of the crew. For example, on a destroyer the training mode would provide a capability of switching radar, sonar, intercommunication switchboards, propulsion systems, etc., either jointly or independently to the training mode. This would allow the injection of simulated control and signal data for conducting individual and/or team training. Specific functions which could be simulated include the own ships' course and speed; radar, ECM and sonar contracts; and the firing and tracking of delivered weapons. The degree of simulation and the physical design of the UTMICS would depend on the type of unit, the fidelity desired, and several other factors which must be further analyzed but not within the scope of this paper.

Figure 2 presents a general functional description of a UTMICS. Again, the primary function of the system is to provide a decentralized equipment and subsystem simulation capability on board the operating unit but under the control of a training problem delivered from shore.

A Standard UTMICS System

It would be advantageous to build a standardized UTMICS configuration that could be tailored to the unique interface requirements of each type of unit. With a microprocessor, such a system can be built. The basic elements are shown in Figure 3, which are:

1. External Interface Processor
2. Main Computer
3. Problem Data Storage Unit
4. Demand Driven Multiple Access Bus
5. Equipment Interface Ports
6. Signal/Data Converters

The problem data from shore would be received, controlled and transferred to the Demand Driven Multiple Access Bus (DDMAB) via the External Interface Processor(s). One or several processors could be used depending on the volume of data to be transferred. Problem data would be read into and stored at the Problem Data Storage Unit. The data would then be further processed and routed to the appropriate destination via the DDMAB which would be controlled by the main computer. The equipment input ports, consisting of one

*This concept deals with providing shipboard training and system testing capabilities by physically interconnecting a shore based simulator (Mobile Van) to systems on board the unit. Recent projects sponsored by the Navy in this area include the Digital Accoustic Sensor Simulator (DASS) and MISTER. The Naval Surface Weapons Center is investigating DASS as a test bed for ASW/AAW aircraft training. The MISTER was to be a surface shipboard combat system pierside trainer. However, apparently the Navy has decided to discontinue the project primarily from cost rather than technological problems. In another effort the Navy is studying the feasibility of a Surface Operator Tactical Training System (SOTTS) for a prototype system to support the FFG-7 Class Frigate.

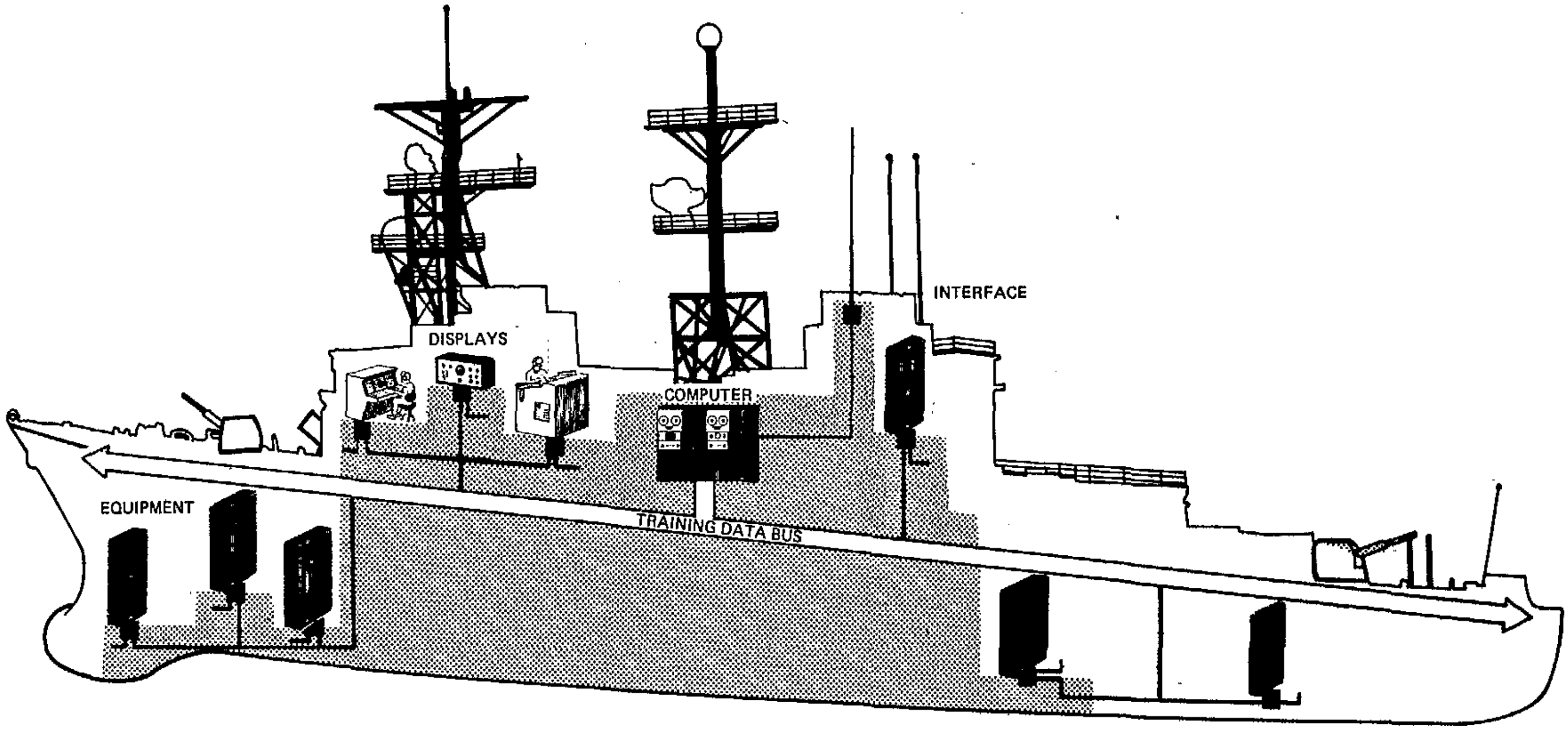

Figure 2. Functional Overview of Shipboard UTMICS

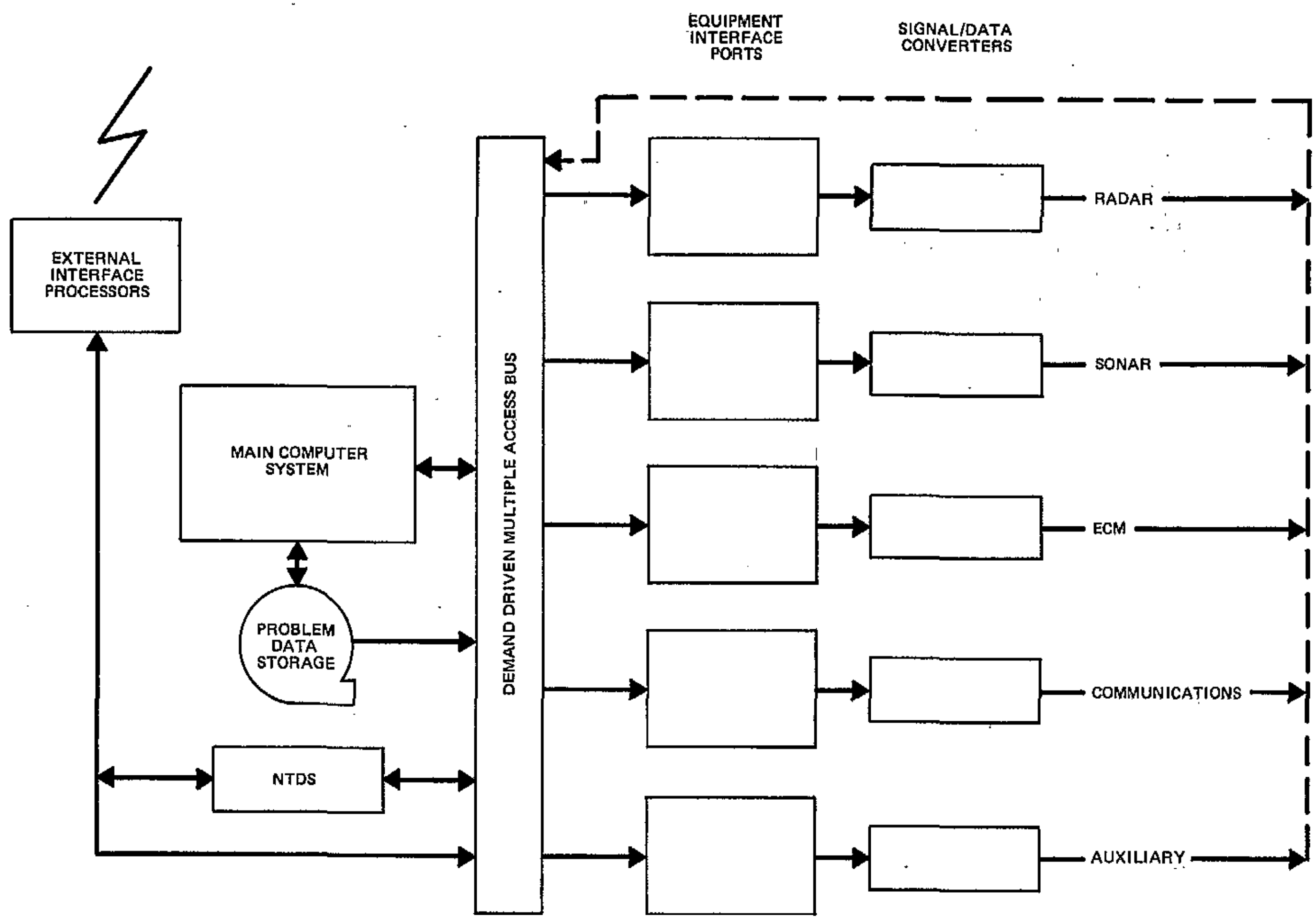

Figure 3. Standard UTMICS Configuration

or several microprocessors, would convert the parameter data to front end system signal data. Then depending upon the nature of the data, it would be formatted and injected into the system via a multiplexer or signal generator. This basic system could be expanded simply by adding ports (microprocessors) and interface equipment/software. Feedback data would be routed back to the control center using the same system by simply monitoring system control settings and unit communication circuits.

APPROACHES FOR PURSUING AN ORT SYSTEM

There are several approaches which might be followed to study, design, develop and implement a fleet training system concept. One approach would be to look at a specific requirement for fleet training and not attempt to solve the problems of the entire fleet at one time. For instance, the Navy could study, design and demonstrate a fleet training capability for ASW on board a specific class of destroyers. If this proved successful, the concept could be expanded to include AAW, engineering and navigation training. A second approach could be to investigate the requirements for a specific type of training but which may include several types of Naval units (i.e., air and surface ASW fleet training). Then based on the requirements and existing fleet training capabilities, a training system concept would be designed and tested on board selected (pilot) units.

The above approaches would apply to both current and future fleet training requirements. However, a third approach would be to investigate the training requirements for only future operating units. The concepts would be designed and tested to the extent practicable on existing vessels. Then, future procurement efforts would have detailed specifications built into the system design requirements of all applicable Naval vessels.

Regardless of the approach followed, it must be consistent with the Navy's objectives for providing improved training through simulation at an affordable cost. In addition, the concept must be totally supported by the fleet.

CONCLUSION

Because of the limitation on resources and time at sea, there is a need to explore cost effective approaches for improving operational readiness training. The ORT system is only one of several alternatives that can be pursued; however, it has considerable merit since it could establish a centralized frame-of-reference to train and evaluate individual crew members, the combat team and the ship as a whole in the performance of its mission. Further, ships on all coasts can remain in port and still train as if at sea. Finally, the system can be implemented using a number of approaches. Nevertheless, a more detailed analysis of the concept is needed before a true appraisal of the merit can be determined.

ABOUT THE AUTHORS

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