FLIP Aids Fleet Training

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Tactical development and evaluation (TACD&E) is receiving increased emphasis in the Navy as commanders strive to attain the capabilities needed to accomplish their mission at sea. TACD&E is a significant part of major exercises, providing a means for evaluating new tactical ideas and new Fleet equipment in realistic environments, under actual Fleet operating conditions. The importance of environmental effects on these evaluations has been recognized at high levels in the Navy, and by special study groups such as the recent Morse-Andrews-Munk study for the Naval Research Advisory Council (NRAC). Indeed, sizeable Navy efforts have been applied to this problem for many years, resulting in large quantities of environmental data, and the development of procedures and organizations to apply the data to Fleet problems. There remains, however, considerable room for increasing the understanding and use of environmental information at the operating levels of the Fleet.

Years of research and development have been devoted to the advancement of the capabilities of antisubmarine warfare (ASW) equipment in order to exploit our increased knowledge of the environment. Modern underwater acoustic systems are capable of using various propagation paths, and can be adjusted to optimize signal-to-noise ratios and recognition differentials under different environmental conditions. The key to the successful use of these new capabilities lies in the Fleet operators' recognition of these conditions, and understanding of how to get the best performance from ASW systems as they change.

In the field of underwater acoustics, the Marine Physical Laboratory (MPL) is seeking ways to contribute to these efforts. The key to effective interaction is first-hand contact between operational and scientific personnel in order to acquaint each other with their particular insights as well as problems. Since Fleet operations are now limited by force reduction, fuel costs, and personnel and material readiness requirements, the opportunities for scientific involvement

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on a "supercargo" basis are few indeed. However, the concept of direct participation in the achievement of Fleet exercise objectives is much more likely to be acceptable to Fleet personnel and provide the desired interaction between the operational and scientific communities.

To test this concept and assess prospects for greater interaction in the future, MPL offered the services of FLIP (Figure 1) in conjunction with an equipment checkout operation to RADM Myers, Commander, Cruiser Destroyer Group 3 for a June 1974 Pacific Fleet exercise.

FLIP (1,2,3) is an unusual vessel developed under the sponsorship of the U. S. Navy's Office of Naval Research to fulfill a need for an extremely stable and yet mobile platform from which accurate acoustical measurements could be made at sea.

FLIP, which has an overall length of 355 feet, is towed in the horizontal position to the area where scientific operations are to be carried out. Upon arrival on station, the tow line is cast off and ballast tanks distributed throughout the aft 255 feet of the vessel are

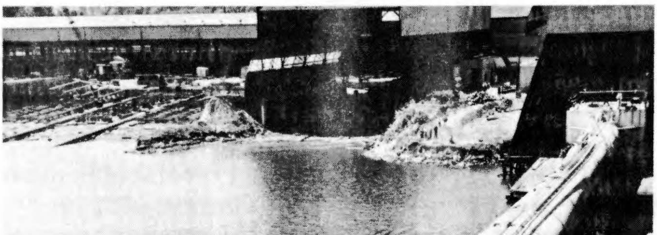

Figure 1 – FLIP showing the aft 225 feet of the vessel where the ballast tanks are distributed

flooded. In about 20 minutes the vessel is completely vertical with approximately 55 feet of prow pointed skyward and the remaining 300 feet of vessel under water.

The diameter of the hull, which is 20 feet between 300- to 150-foot depth, tapers down to 12-1/2 feet at the 60-foot depth. This change in diameter gives FLIP a natural period of 27 seconds for vertical motion compared to an 18-second period for a cylinder of the same depth. The longer period reduces FLIP's response to wave motion since wave energy in the ocean usually occurs at periods below 18 seconds; for a 30-foot wave, FLIP's vertical motion is less than 3 feet.

FLIP's stability, 300-foot draft, and low acoustic noise level have made it uniquely suitable for a wide variety of research experiments: hydrophones can be positioned at a variety of depths for listening to acoustic signals; the same applies for other instrumentation such as pressure sensors for measuring wave heights, tilt and depth of FLIP, or temperature sensors for measuring thermal structure in the ocean. In order to study the horizontal extent of thermal variations in the ocean, three booms can be extended so that temperature sensors can be lowered simultaneously at known distances from one another. Meteorological instruments mounted on a vertical mast that can move up and down at the end of a boom make it possible to make measurements immediately above the sea surface. Its deep sea winch can lower instrumentation packages to a depth of 4000 meters. Booms below the waterline can also be mounted on the hull for obtaining horizontal separation of sensors. In the vertical position FLIP either drifts freely or is held in position by using up to a 3-point moor in any depth.

Liaison with COMCRUDESGRU THREE developed the following objectives for FLIP's participation:

a) A submerged target in deep water to train sonar operators in all modes of operation.

b) A sound source in deep water environment to enhance passive training for sonar operators.

c) A sound source in deep water environment to train Light Airborne Multi-Purpose System (LAMPS) and Ship Towed Underwater Detector (STUD) teams in classifying and localizing underwater sound sources.

d) A navigational aid to assist in reconstruction of exercises.

The operations with FLIP covered two days of the Fleet Exercise and involved three hull mounted sonar ships, two with the LAMPS system, and one with the STUD passive array. FLIP was positioned in 2000 fathom water, 150 miles west of San Diego in a drifting mode. Her position plot was maintained to a high degree of accuracy using satellite navigation as she drifted at 0.3–0.7 knot in 20–25 knot winds.

Training was conducted in all phases of long range sonar operations. Firm sonar contact was established in each mode of sonar operations, providing several hours of training in each of the modes.

FLIP lowered a transducer and transmitted a variety of taped submarine radiated noise signals as requested by the destroyers (DE's), This permitted training of sonar operators on the LAMPS sonobuoy system, and the towed array in both detection and classification of sounds from different submarines. Ships' ASW officers and sonar supervisors were able to evaluate their operators' performances in a realistic, at-sea situation, using their own sonar equipment.

In addition, the entire LAMPS system, including command and control, was exercised in a multi-ship, multi-helo situation, with real operating conditions in a deep-ocean environment. This type of training is essential to the development of LAMPS tactics, and the molding of LAMPS into a coordinated part of the DE's ASW attack team.

Since FLIP projects 55 feet above the sea surface when in the vertical position, she provided an excellent visual and radar target, particularly for the helos. This eliminated the problem of target location, and contributed significantly to the long hours of contact time.

The satellite navigation data acquired by FLIP provided a highly accurate track of her position while drifting on station. This capability of acting essentially as a "mid-ocean lighthouse" offers considerable promise for exercises in which positional reconstruction is important to the analysis of tactics and their results.

The success of this initial Fleet training operation with FLIP is measured not only by the valuable sonar and ASW system training received by the participants, but also by the interest and involvement of ship and helo crews and commanders, Flag officers and their staff officers in the problems associated with optimizing the performance of their ASW equipment in the real ocean environment.

Wherever and whenever the Navy's R&D community can help the Fleet advance its readiness to perform its missions, the opportunity should not be missed. In particular, stimulating the thinking of Fleet personnel on the most effective use of the highly capable ASW equipment which past R&D efforts have provided is not only productive but enjoyable. This can be done best by personal involvement in the continuing tactical and training evolutions of Fleet units. FLIP provides one valuable tool to achieve this purpose. Other research platforms and vessels may offer other useful approaches.

References

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Simultaneous Two-Wavelength Operation in Infrared Lasers

Scientists at the Naval Research Laboratory (NRL) have developed a laser system which provides simultaneous operation of any two laser transitions occurring in an infrared laser.

A chemically active element in combination with a germanium flat polarizes and spatially separates the two laser beams so that their polarizations are perpendicular to each other, and directs the laser beams to separate gratings.

Each grating is rotated to select and reflect a laser beam of a particular wavelength back through the system so that two particular beams are directed from the output.

New Class of Resinous Materials as High-Temperature Adhesives

Naval Research Laboratory chemists have developed a new and improved class of resinous materials which can be used as strong adhesives where temperatures exceed 200 degrees centigrade.

Epoxy resins are broadly useful as adhesives and matrix plastics for fiber-reinforced composites. However, the high-temperature continuous service limit for epoxies of any type is about 200°C, because of the intrinsic characteristics of their molecular structure. Consequently, there has been a requirement in high-temperature epoxy applications for resins capable of performing at temperatures above 200°C.

The new improved class of resinous materials is called "polyphthalocyanine resins," because of the significance of the phthalocyanine nucleus to their high-temperature performance capabilities.

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