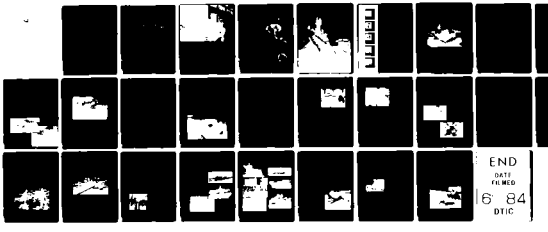
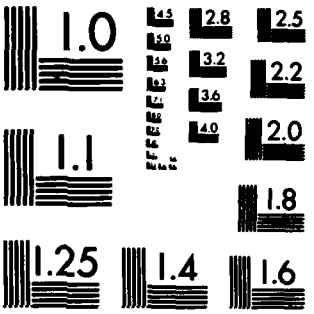
AD-A141 065 FLEET READINESS OFFICE FY 83 ACTIVITY SUMMARY(U) NAVAL 1/1
OCEAN SYSTEMS CENTER SAN DIEGO CA 01 MAR 84
NOSC/TD-650

UNCLASSIFIED F/G 5/1 NL





NOSC TD 650

NOSC TD 650

Technical Document 650

# FLEET READINESS OFFICE FY 83 ACTIVITY SUMMARY

1 March 1984

Summary Report
October 1982 — October 1983





NOSC

NAVAL OCEAN SYSTEMS CENTER
San Diego, California 92152

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA 92152

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

**JM PATTON, CAPT, USN**
*Commander*

**RM HILLYER**
*Technical Director*

# *Foreword*

This abbreviated presentation of representative tasks undertaken in FY 83 on behalf of the Fleet is intended to give an overview of the range of activities managed and supported by the Fleet Readiness Office (FRO).

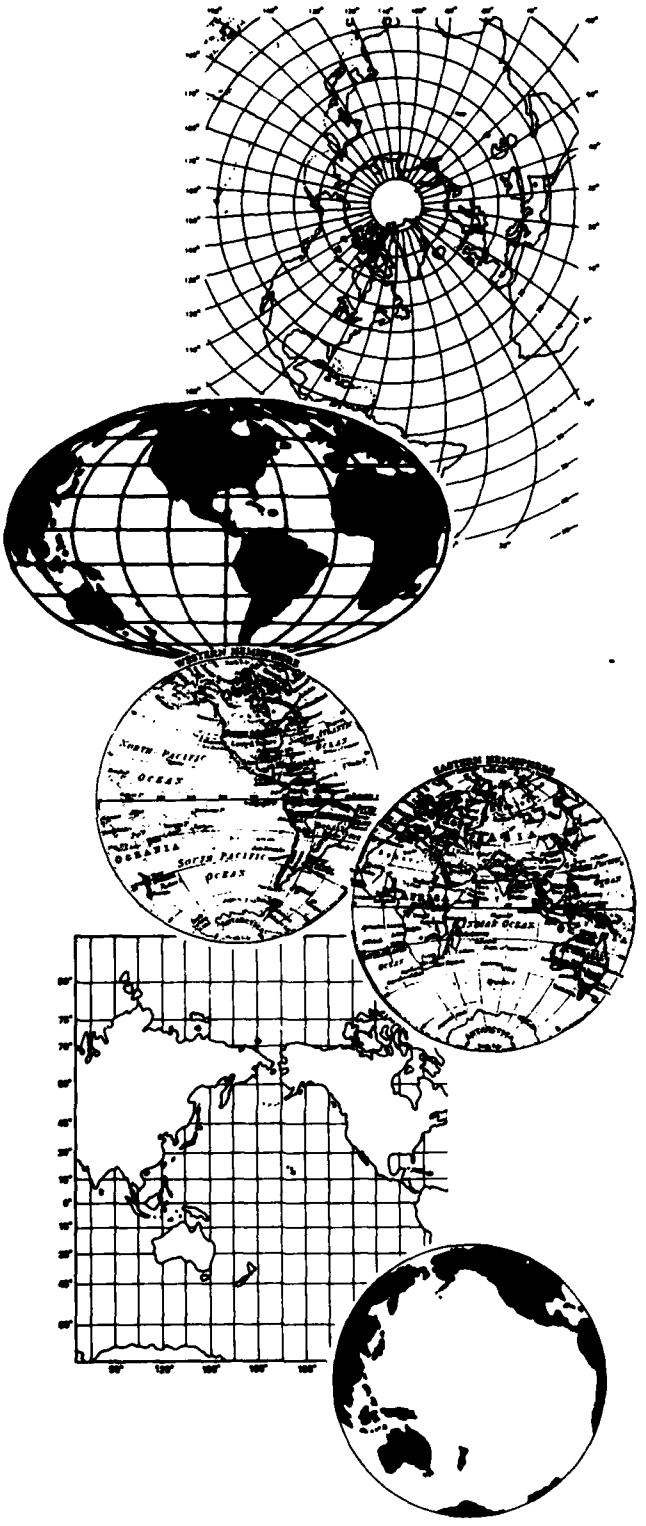
These activities were, for the most part, directed toward the solution of specific Fleet problems. Additionally, this year saw an increased involvement by NOSC in Fleet operations, as evidenced, for example, by the Center's concerted support of a major three-carrier Battle Group exercise, Fleetex 83-1.

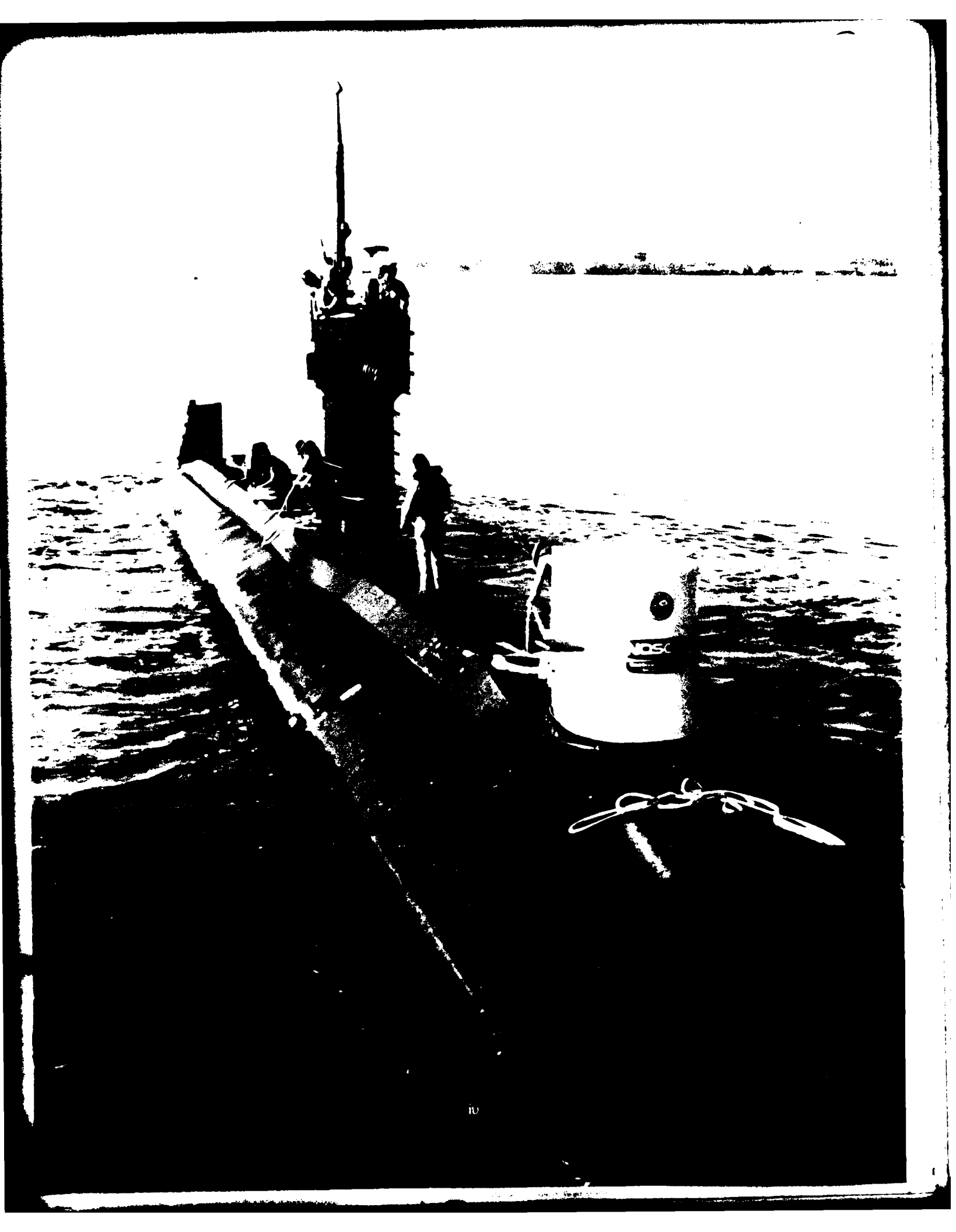
A clear inference to be drawn from the successful application of Center resources to immediate Fleet needs is that some highly effective intercommunication is going on. FRO plays an important role in this information exchange by facilitating, promoting, and stimulating a constant dialogue between NOSC and the Fleet.

**M. M. Baldwin,** Head
Fleet Readiness Office

# Contents







*Marv Baldwin*

**Code 18**
**Fleet Readiness Office**
**Head**

*CDR Larry Peterson*

**Code 183**
**Military Liaison**
**Group**

*Jim Grant*

**Code 181**
**Application Engineering**
**Group**

*Jerry Beauchane*

**Code 1801**
**Tactical Development & Evaluation & Fleet Exercise Program Manager**

*Jim Boyle*

**Code 1802**
**NSAP**
**Program Manager**

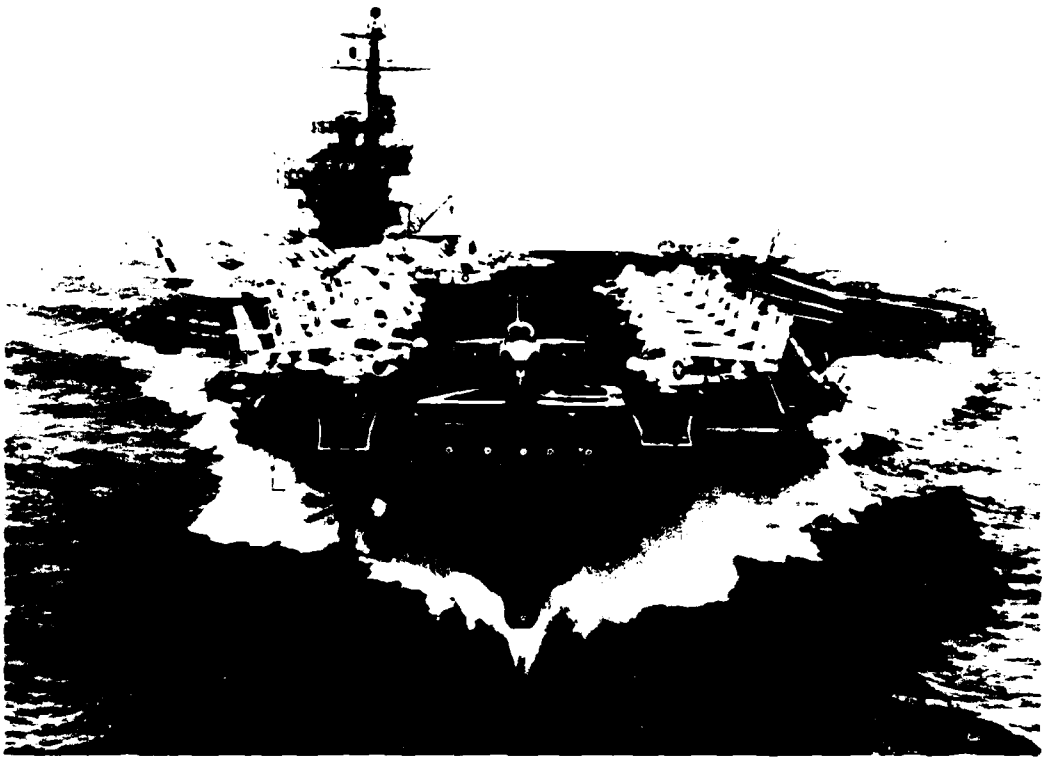
# *Introduction*

The best way to begin to describe the Fleet Readiness Office (FRO) is to define its purpose. FRO's basic objective is to serve as the focal point within NOSC for a network of interactions between the Fleet and NOSC's technical community. FRO helps energize this network by bringing the expertise and resources available at NOSC directly to bear on the solution of current and potential Fleet problems in areas consistent with the Center's mission.

Essential to meeting this objective is the establishment and maintenance of active liaison with Navy and Marine Corps operational commands and with the technical community at NOSC. FRO sees to it that NOSC's scientists and engineers are kept current on Fleet operational problems. FRO encourages participation and involvement in the technical community so that existing Fleet problems can be solved and potential Fleet problems can be anticipated and therefore averted or resolved. At the same time, FRO keeps the operational commands informed of the capabilities and resources available at NOSC. The resulting network can thus be viewed as a reciprocal flow of information that is at once stimulated by and channeled through FRO.

On the organizational level FRO has Center responsibility for: (a) technical management and administration of near-term and quick-reaction technical support for Fleet and Marine Corps operational commands; (b) evaluation and identification of Fleet operational readiness problems through Fleet exercise liaison and participation; (c) technical direction, technical management, and technical support of operationally oriented problems; (d) management of the Tactical Development and Evaluation program, the Navy Science Assistance Program, and the PROCAL Fleet Support program; and (e) participation in Navy-wide high-level committees for naval warfare.

FRO establishes various technical programs, some of a continuing nature and some directed toward specific near-term problems, through which it discharges these responsibilities. Representative projects from some of these programs are presented in this report to illustrate NOSC's major technical achievements in support of the Fleet in FY 83.



# *Navy science assistance program*

## *General*

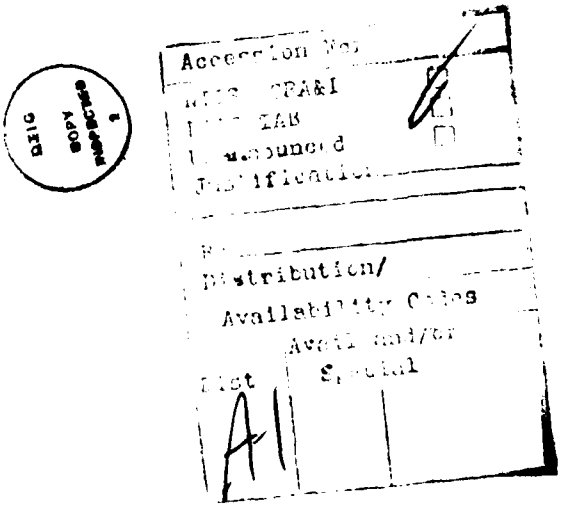
The Navy Science Assistance Program (NSAP) is sponsored and funded by the Director of Navy Laboratories. Its mandate is to provide quick-reaction scientific and technical services to the operational commands. Science advisors and technical consultants, supported by laboratory coordinators and points of contact in OPNAV and NAVMAT, carry out this mandate by effectively matching technical expertise to everyday Fleet readiness problems.

The NSAP field team of advisors and consultants are temporarily assigned to the operating forces, where they assist in identifying, defining, and ultimately solving problems that require immediate action. They also attempt to educate laboratory technical personnel about the problems and operational environment faced by the Fleet.

NSAP's value lies in its ability to bring all the resources of the Navy laboratories and centers directly to bear on all areas of operational readiness on a quick-reaction basis.

In FY 83, under the coordination of the NSAP Program Manager (Code 1802), NOSC provided NSAP science advisors to CINCUSNAVEUR, COMTHIRDFLT, and COMSEVENTHFLT and NSAP consultants to COMSIXTHFLT and COMSEVENTHFLT.

In the table on the following page, the FY 83 NSAP projects conducted at NOSC are listed, along with commands supported and NOSC performing codes. Nearly every NOSC technical directorate was represented as a technical agent for the twenty projects listed. It should be recognized that although not documented in the table, every directorate has given support to NSAP by answering Fleet requests for information received by the Center via the office of the Director of NSAP.



FY 83 NOSC NSAP projects

| Title | Task | Command Supported | NOSC Performing Code |
|---|---|---|---|
| Passive Acoustic Signal Processing | SEV-2-82 | COMSEVENTHFLT | 1606 |
| Soft Kill Defensive Countermeasures | AL-1-82 | COMNAVAIRLANT | 164 |
| High Reliability $C^3$ | SEV-3-83 | COMSEVENTHFLT | 164 |
| Site Survey | SURFP-1-83 | COMNAVSURFPAC | 514 |
| Short Time Marker | SURFP-4-83 | COMNAVSURFPAC | 514 |
| *Prevention of Blocking of PHM Seawater Intakes | SURFL-1-83 | COMNAVSURFLANT | 5143 |
| *Jeep Trailer Dragon Rack | FMFL-1-83 | FMFLANT | 5334 |
| Surface Ship Radiated Noise Measurement | SURFL-1-82 | COMNAVSURFLANT | 6361 |
| SIXTHFLT ASW Support | S-2-82 | COMSIXTHFLT | 713 |
| *HF Adaptive Array | CLF-1-83 | CINCLANTFLT | 8112 |
| *Aircraft HF LRI Modification | SEV-4-81 | COMSEVENTHFLT | 8141 |
| Small Craft Navigation | SURFP-1-82 | COMNAVSURFPAC | 8244 |
| Receive Only Link-11 Terminal | SURFP-2-82 | COMNAVSURFPAC | 8245 |
| AN/ALQ-108 Countermeasure System | AP-1-81 | COMNAVAIRPAC | 8246 |
| Expendable Sinkex Emitter | SEC-1-83 | COMSECONDFLT | 8255 |
| Mediterranean Tactical Logistics Command and Control | CNE-1-83 | CINCUSNAVEUR | 8323 |
| Effective Radiated Power Measurement | Q-4-82 | MCDEC/EMFPAC | 934 |
| Media Sources | CNE-2-83 | CINCUSNAVEUR | 9342 |
| Multichannel UHF Pod Relay | SEC-3-83 | COMSECONDFLT | 9342 |
| Wire Line Adapter for H-189 Handset | Q-3-82 | MCDEC/FMFPAC | 9342 |

*Summarized in this report.

## *Hf adaptive array*

NOSC has done extensive work in the area of HF adaptive antenna arrays for antijam communications. The adaptive array is a receiving concept that provides antijam protection by nulling undesired signals while directing a beam in the direction of the desired communications signal.

Even in an unjammed environment an adaptive array provides communication enhancement by virtue of optimally combining inputs from several antennas. This enhancement arises from several factors. One of these factors, antenna pattern diversity, is especially useful for HF shipboard communications.

Typically shipboard HF antennas have nulls caused by interference with the ship's superstructure and aggravated by tilting from vertical to horizontal for operations. The number and depth of these nulls tend to be more pronounced at the upper end of the HF band. An incoming communication signal is directly affected by the receiving antenna pattern. The effect of non-omni patterns has been analyzed statistically and shown to increase required power by 13 dB to get coverage to 95% of azimuthal angles. Optimally combining four antennas with uncorrelated patterns essentially gains back this loss.

For an adaptive array to work in a hostile environment, it must be provided with a secure reference signal and the array processor must have a relatively fast (possibly changeable) time constant. An expensive processor is thus required to supply a coherent closed loop control system. Even in a nonhostile environment, an adaptive array providing all the types of enhancement desired would be relatively expensive. In addition, such processors are currently not available for HF, nor is the Navy developing one at this time. Consequently, NOSC constructed a special inexpensive adaptive array to realize the gain available from antenna pattern diversity. The device, called an adaptive beam steering array, was tested on board the USS John F. Kennedy, using four existing receiving antennas. The processor uses analog weights on the RF inputs and adjusts them under microprocessor control to maximize the output of an R-1051 receiver. The receiver is modified to bring out the AGC line. The beam former was found to work well in terms of eliminating the effects of antenna pattern nulls.

The type of hardware tested works well when no interfering signals are present, as would be the case for Limited Range Intercept (LRI) operations. Use of such a system throughout a task force could reduce required transmitter power by as much as 15 dB for LRI operations. If this type of power reduction is urgently required, then the inexpensive NOSC system, which could be fielded rapidly, should be developed.

However, given the cost and effort involved with providing the multiple antenna inputs, it was recommended that a complete adaptive array system be developed which can steer nulls at interfering signals as well as a beam in the direction of the desired signal.

## *Aircraft hf lri modifications*

In 1976 the surface elements of the Navy began the test and evaluation of a propagation tactic called Limited Range Intercept. The tactic involves the use of frequency management (selecting the proper frequency) and power control (reducing the power level).

Until NSAP project HF LRI was initiated, the tactic had been used with only surface and subsurface elements of the Battle Group. However, aircraft operating within the Battle Group must also be capable of implementing the LRI propagation tactic.

The technical objective of this NSAP project was to implement power control on S-3A, E-2C, P-3C, and P-3B aircraft and demonstrate the LRI propagation tactic by using these aircraft during EASTPAC and WESTPAC Fleet exercises. The aircraft radios requiring power control modifications are shown in the following table.

Aircraft HF radios

| *Aircraft Type* | *Transceiver* | *Power, Nominal(W)* |
|---|---|---|
| S-3A | AN/ARC-153 | 1000 |
| E-2C | AN/ARC-157 | 1000/500 |
| P-3C | AN/ARC-161 | 1000/500 |
| P-3B | AN/ARC-94 | 100 |

The demonstration was intended to answer the question of whether the LRI propagation tactic will work when both aircraft and surface ships are involved.

The approach taken for implementing power control on the HF radios shown in the table was that the required modification must be external to the radio, must not alter existing aircraft wiring, and must be such that the aircraft system could easily be returned to its original status.

After discussions with the radio manufacturers it was determined that the best approach to power control involved changing the automatic level control (ALC) bias, which enables the power amplifier to reduce the exciter drive level, thereby reducing the output power of the power amplifier.

The power control modifications for the AN/ARC-153 and -157 were similar since both radios are of Rockwell-Collins manufacture. The modification for the AN/ARC-161 (RCA radio) was different. The AN/ARC-94 was not modified because it did not meet the criteria mentioned above. Since the ARC-94 is a 100 W radio, it could be used for the LRI tactic without modification, but would not normally be recommended without the modification.

The modification for power control involved the development of cable adapter for installation between the receiver-transmitter unit and the power amplifier and a transmitter power control (TPC) unit. The cable adapter, consisting of a male and female connector connected pin-for-pin, would allow access to leads required for control. The TPC would connect to the cable adapter and apply the proper ALC bias to the ALC line.

It was concluded that Battle Group aircraft (S-3A, E-2C, and P-3C) can effectively participate in the LRI propagation tactic, and that aircraft radios (ARC-153, -157, -161) can be modified for power control and returned to their original condition.

## *Blockage of seawater intakes*

PHMs (Patrol Combatant Missile Hydrofoils) berthed at the Naval Station at Key West, Florida, encountered a problem with an excessive failure rate of their seawater pumps. Four pumps are installed on each PHM and are used to pressurize the fire main and provide water cooling to auxiliary equipment. The failure of the pumps was attributed to the blockage of seawater intakes by seagrass.

In response to a request by COMNAVSURFLANT, NOSC conducted an on-site survey to determine the nature of the problem. The survey, conducted with the cooperation and support of COMPHMRON TWO, revealed no evidence of live seagrass beds nor significant accumulations of dead seagrass beneath any of the berthing sites. However, significant amounts of floating seagrass were observed throughout the Key West harbor area. The shallow-draft PHMs, permanentiy stationed at Key West, are particularly susceptible to intake blockage because their intakes are only 2 to 3 feet beneath the surface.

Technology originally developed to control oil pollution has been extended to include the control of various types of flotsam (including seagrass). Both turbidity curtains and debris booms have been used successfully in the Key West area by marine construction and service organizations. Indications were that the curtains and booms work quite well and are sufficiently resistant to deterioration and fouling to last for several years in the subtropical environment.

*Turtle grass is effectively excluded from an area protected by a containment boom.*

COMNAVSURFLANT requested NSAP assistance to conduct a pilot program to determine the feasibility of using a boom system to divert drifting seagrass and thus prevent its accumulation in the vicinity of the seawater intakes of the PHMs. The objectives of the program were to (a) identify or design, procure, and test an applicable boom system, (b) determine the most effective boom development for PHMs located at their normal berthing sites, under a variety of wind and tidal conditions, and (c) quantify the utility of the boom system by comparing intake blockage rates for protected versus unprotected PHMs.

The containment boom system purchased for this study (at $9 a lineal foot) was made by Containment Systems Corporation, Cocoa, Florida. It is a GSA item, listed as a modified performance boom, and is composed of —

- a 4-foot curtain made of high-strength nylon, coated with yellow vinyl
- 6-inch-diameter, oil-resistant, closed-cell polypropylene floats
- 1/4-inch galvanized-chain ballast with double-thickness fabric in the bottom of the curtain
- extruded-aluminum, quick-connect end connectors to join the 100-foot sections

Additionally, a 33-inch-diameter mooring buoy and anchoring system was required to position the boom around the ship and hold it away from the ship's hull. This system was comprised of —

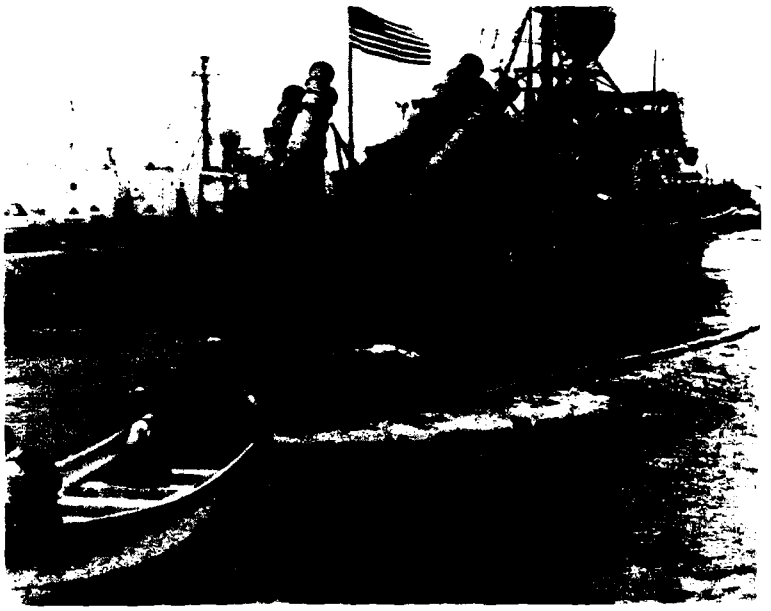
- two 13-inch-diameter, closed-cell, urethane buoys with a high-impact plastic shell, a 1/2-inch-diameter shaft through the center of the buoy which had a 3-inch-diameter galvanized eye bolt on the top, and a 1/2-inch-diameter galvanized swivel on the bottom
- an 18-pound, hot-dipped, galvanized "Danforth style" anchor secured to the buoy with 5/8-inch polypropylene line

Initial deployment of this boom and buoy system included the installation of two 4-foot-long by 4-inch-wide "I" beams and two floating bulkhead connectors to attach the curtain to the seawall. This method of attachment was modified due to the condition of the concrete seawall and was replaced by simply securing the curtain to a

bollard, cleat, or other permanent fixed point on the pier.

The initial anchoring system also required modification. It was necessary to replace the Danforth-style anchors with 200-pound concrete clumps to maintain a solid moor in the very soft muddy bottom. Once installed, the clumps could be moved and positioned while suspended from the anchor line and were not lifted aboard the skiff.

The results of this study are based upon data collected from 4 April to 31 August 1983, at Trumbo Annex, NAVSTA Key West, Florida. During this period the boom was deployed 63 days (50% of the time) around a PHM. Drifting turtle grass was present in the area on 37 days (30% of the time). Grass was reported inside the protected area on 7 days in August when grass was observed outside the boom. During that week the boom was frequently moved to permit service craft access to the USS Aries and the boom integrity was violated. No attempt was made to clear the captured grass before the USS Hercules replaced the USS Aries at the test berth. Other than this 7-day period the boom was effective in preventing drifting turtle grass from entering and accumulating in the test berth. It was therefore recommended that the Containment Systems boom be procured for harbor services at naval facilities where drifting seagrass or debris has created problems with ship seawater intakes.



***Deployment of containment boom around PHM moored at the Naval Station in Key West. It generally takes three or four men 15 to 20 minutes to install a 300-foot boom and 10 minutes to remove it.***

# *Jeep trailer dragon rack*

Currently there is no suitable way to carry Dragon antitank missiles in a standard M-416 jeep trailer. The plywood boxes in which they are packed are so large that only a few missiles can be carried in the trailer, leaving very little room for other supplies. The large packing boxes are difficult to off-load, and uncrating the weapon is time consuming and requires tools. In addition, the wooden boxes offer very little environmental protection, especially against extremely wet conditions.

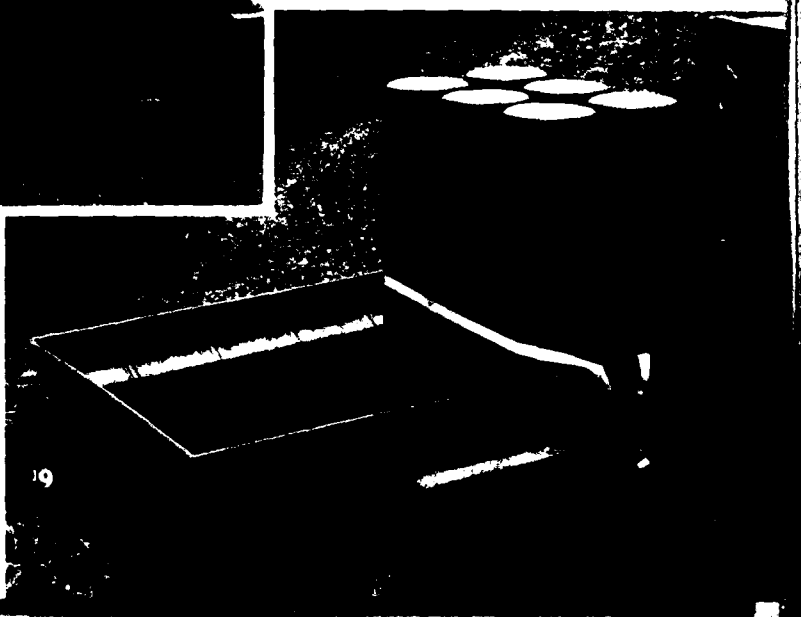
NOSC was tasked to develop a prototype M-416 jeep trailer-mounted rack that would meet or exceed the 2nd Marine Division's requirement of transporting six dragon missiles in an M-416 jeep trailer. The following design parameters were specified:

1. Transport six or more Dragon missiles in an M-416 jeep trailer without making modifications to the trailer.
2. Use no more than two-thirds of the trailer space for carrying the missiles.
3. Require no tools other than rope or nylon webbing to secure the weapons to the trailer.
4. Ensure that the method by which six Dragon weapons are transported provides waterproofing and shock protection.
5. Ensure that carrying space for the weapon does not exceed the width of the trailer and that a low profile is maintained.
6. Apply the principles of simplicity in design and economy in cost to the solution of this problem.
7. Ensure that the rack or container is lightweight, and allow for easy access and removal of the Dragon weapon.

In FY 83 the dragon rack concept was dropped in favor of stackable plastic containers, and 60 prototype plastic stackable containers were designed and built. The containers were tested by the Marines during field exercise at Kahoolawe in Hawaii and successfully met the requirements. Environmental testing was done at NOSC in San Diego, but has not been reported on yet. Future testing will be done at Camp Lejeune and a final report will complete the project.

*Tactical deployment of Dragon weapons in plastic containers stacked horizontally in M-416 jeep trailer.*

*Vertical stacking allows for more cargo area than does horizontal stacking, but presents a larger area of vulnerability.*



# Tactical development and evaluation

## General

The goal of FRO's TACD&E and Fleet Exercise Program (Code 1801) is to improve the involvement of NOSC and the NAVMAT centers in the TACD&E program and Fleet exercises. Code 1801 provides a conduit for information and technology between the Fleet and NOSC personnel, assists in the Center's Fleet-related programs, and participates in and coordinates NOSC's involvement in Fleet exercises.

During FY 83 NOSC increased its participation in the TACD&E program to over 10 man years of effort with more than 10 projects. The mutual undertaking of the Fleet and Center in TACD&E-related efforts has benefited from the active participation of the 06, 07, 08, and 09 directorates and the major staff offices.

## Information and technology transfer

In FY 83 the Center was briefed by THIRDFLT representatives on the Battle Group ASW Readiness and Effectiveness Measuring (BGAREM) program. BGAREM was the first attempt to evaluate a Battle Group ASW exercise on an instrumented range. The briefing dealt with the first efforts of THIRDFLT to use the BARSTUR Range to evaluate the overall ASW Force performance in a realistic attack scenario.

The NSAP Director and NOSC representatives briefed the ONR TACD&E Support Office, Code 230. The briefings and discussions focused on DNL support of the Navy Center's increased involvement in the TACD&E program. As a direct outcome of these briefings a management agreement was concluded between the Director of NSAP and the Director of ONR 230. NOSC also agreed to support a TACD&E ASW project at ONR Washington, D.C.

Codes 164 and 1801 gave presentations on NOSC's concept for $C^3CM$ support to VCNO, CINCPACFLT, CINCUSNAVEUR, all the numbered Fleet Commands, Battle Group Commanders OP 094 and OP 009, the Navy Security Group, and many of the DESGRUs. The concept, primarily developed by NOSC Code 164, dealt with the methodology necessary to present multiple source information in a coherent way, enabling a Battle Group Commander to make $C^3CM$ decisions in a timely manner. These presentations also included at-sea-evaluations made during several Fleet operational exercises. The implementation of the methodology was well received by the Fleet Commands, who endorsed the concept and the proposed automation of the display of that methodology. Because the Fleet is involved in the concept development phase, in testing the decision aids with NOSC personnel during major Fleet exercises, and, finally, in automating the decision aid display process, NOSC should emerge with a product that can be supported and used by the Fleet. The satellite vulnerability charts developed by NOSC are currently being used by most of the CARGRUs in both the Atlantic and Pacific Fleets.

During the year briefings were also given by Center personnel to the Fleet commands on the Shipboard Identification Demonstration Module (SIDM), UHF relay concept, Autonomous Acoustic Array ($A^3$) project, Tactical Flag Command Center (TFCC), Global Positioning System (GPS), and the propagation prediction programs PROPHET, IREPS, and COPS. As a result of these briefings, many of the subject projects were tested during several Fleet exercises.

## *Fleet-related projects*

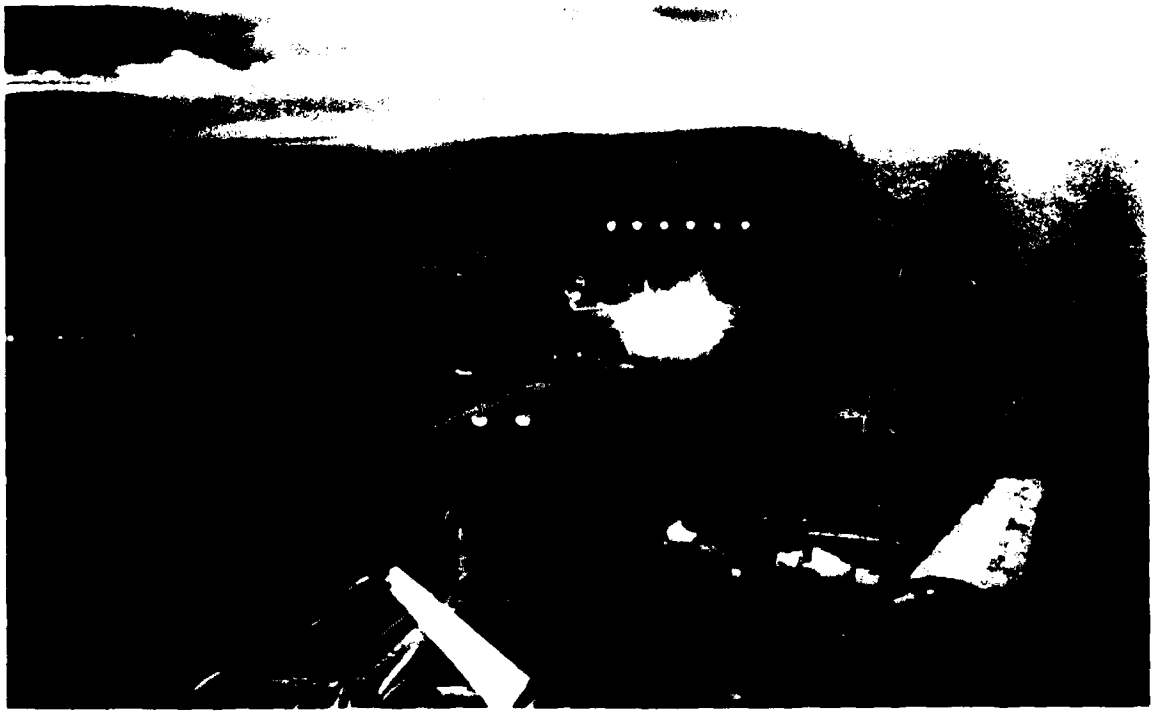
The NOSC C³CM support decision aid concept was developed and demonstrated in FY 83. This concept and decision aid were tested and evaluated in three major exercises in both the Pacific and Atlantic: Fleetex 83-1, United Effort, and Ocean Safari.

The SIDM test and evaluation, conducted during the Balltops exercise, provided the program manager with the opportunity to use the system in a realistic operational environment.

Some of the HF prediction capabilities developed by PROPHET were evaluated during two transits between CONUS and Hawaii. The Army, Air Force, and Navy Security Group are using the PROPHET prediction capability for their HF communication requirements. The tests conducted during the two transits constituted the first at-sea demonstration for this specific prediction module of the HF prediction capability.

Code 1801 coordinated the technical support for the test and evaluation of radar simulators during the Cold Ops 83 exercise. After NOSC employees were trained in the operation and maintenance of three simulators, they operated and maintained the simulators during the exercise. Their operation logs during the exercise and their technical comments were used as the basis to evaluate the system's ability to operate effectively and reliably in a cold at-sea environment.

***Readiness aboard the USS John F. Kennedy during the Ocean Safari exercise.***



## Fleet exercise participation

In FY 83 NOSC provided support for Fleetex 83-1, Cold Winter, United Effort, Ocean Safari, Balltops, Solid Shield, and various Readiex's and Transitex's. Wargame exercises supported were the SACLANT Force Projection and the TRCP-24A at the Naval War College, Newport, Rhode Island, and the SEATAC capability at NWC. NOSC's largest commitment to an exercise was made to Fleetex 83-1. During this exercise NOSC provided seven ship riders and six watch personnel at the THIRDFLT Command Center, in addition to fully manning both the TFCC and Acoustic Research Center (ARC) complexes at NOSC.

NOSC participation in exercises not only assists the Fleet in evaluating the exercise but provides an opportunity to demonstrate and test equipment and concepts in an operational environment. Some of the NOSC systems and concepts used during exercises were SIDM, $A^3$, UHF relay, STADD, $C^3CM$ decision aids, ASW decision aids, TFCC, ARC, GPS, Quick Reaction Surveillance Systems, and PROPHET and IREPS prediction capabilities. NOSC Interim Battle Group Tactical Training, Warfare Environment Simulation, and TFCC facilities were also used before and after exercises, to familiarize Battle Group staffs with the exercise objectives and to evaluate the exercises themselves.

## Additional fy 83 activities

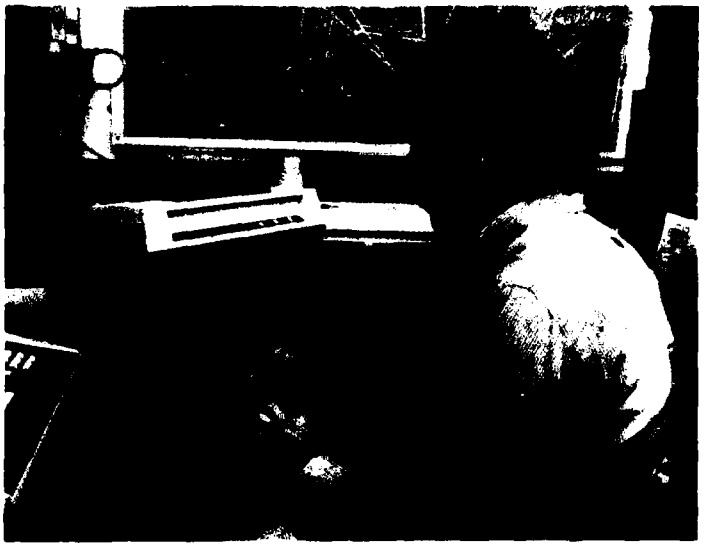
During the past year the TACMEMO Library in the Fleet Readiness Office has increased to 200 documents. The Center Codes have requested 100 TACMEMOs. FRO also maintains and distributes the LANTFLT ASW Improvement documents and summarizes and distributes to NOSC Departments the Fleet CINC's Tactical Deficiencies and R&D Objectives.

As of October 1983 ONR will not have responsibility for the technical evaluation of TACD&E projects. This function will be assumed by the Naval Tactical Support Activity (NTSA). Mr. A. Letow will head the Tactical Library and the technical evaluation contracting support for the entire TACD&E program.

## Programmable calculator fleet support applications

### General

For the last several years, the Navy has used programmable calculators to provide dedicated automated data processing support to various levels of command. The Programmable Calculator (PROCAL) project has been in existence at NOSC since 1974 and was formalized in 1976 as the PROCAL Fleet Support Program when NAVMAT accepted the program as a multi-laboratory effort and designated NOSC as the lead laboratory for PROCAL support work. NOSC has sponsored a series of PROCAL workshops and site visits and is conducting a continuing analysis of Fleet requirements. Application programs tailored for Fleet users are being produced, documented, and included as a reference data base for Fleet activities. The PROCAL Fleet Support Office provides various system configurations, program development facilities, and development support assistance, as well as hands-on expertise and knowledge of Fleet requirements.



*Randy South, a product of NOSC's New Professional Program, is a recent addition to FRO's Application Engineering Group. Here, he is using the Jonos Escort personal computer to develop milestones and costing charts for the COMSEVENTHFLT Computer Command Support System.*

## *Fleet data display system*

The PROCAL Fleet Support Office was requested to provide support to the Fleet Data Display System (FDDS) in the preparation and presentation of a program review and progress demonstration for Rear Admiral Tuttle, Commander Carrier Group Eight. This support consisted of the acquisition of a TEK 4054A, the loan of an HP 9845, and the preparation of several graphic display programs and interface routines between the PROCALs and the FDDS computer (81V).

The system configuration that was attained was to output threat data from the FDDS, over an existing TTY port, to the TEK 4054A. The resulting output was used as input data to the HP 9845 Combat Air Patrol Stationing (CAST) program, which computed, through vector logic, electronic warfare and combat air patrol stations and a launch sequence plan. This latter information was then used as input data to the TEK 4054A and was also used to create a graphic display of the threat, aircraft stations, ship position, radius of action, and keep-out ranges.

In addition to the graphic display, the TEK 4054A created an FDDS overlay message, which was converted from ASCII to BAUDOT five-level code and automatically transmitted to the FDDS computer. This overlay message was then integrated into the FDDS data base and used as required in the FDDS console and on large-screen displays. This entire process took approximately five minutes from the start of of the FDDS threat message to the integration of the return overlay into the FDDS data base.

*A TFCC program manager (left) and an FRO representative review FDDS symbology development displays for use in the TFCC operation.*

## *Data base management systems development*

Two automated support systems, the Resource Management Support System (RMSS) and the PROCAL-Assisted Ship Scheduling System (PASS), were turned over to COMTHIRDFLT and COMNAVSURFPAC for on-site operation and maintenance. These systems are NSAP-funded data base management systems that include the following capabilities.

- Storage, management, display, and manipulation of the employment schedules and services information used by the Fleet and type Commanders and their staffs.
- Direct input of employment schedules and services data received in digitized format and terminal entry of data from hard copy.
- Automatic generation of standard reports, outgoing messages, and other schedule-related documents in hard copy, magnetic tape, and punched paper-tape format.

The hardware configuration for these systems is based on a Wang 2200 MVP programmable calculator. The software is a data base management system that provides user flexibility for modifying and adding data, enables the operator to fill terminal screen formats and to print out reports without reprogramming the system, and has an elegant report and output capability.

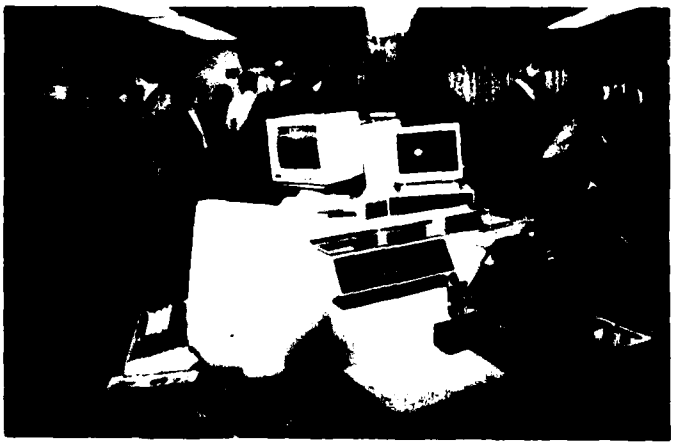
## *Procal workshop program*

In order to accomplish several of the objectives of the PROCAL Fleet Support Program, NAVMAT, through the Fleet Support line item, provided funds for general program support and NOSC provided funds for program development, agency liaison, and sponsorship of the workshop series.

The purpose of the workshop series is to provide a forum for uniformed military personnel, product line vendors, and laboratory-center professionals for general discussions, problem solving, and the continuing examination of the triangular relationships of user requirements, hardware attributes, and application programs and the administrative or logistics and regulatory support requirements.

Because of the continuing success of the PROCAL workshops, they have been scheduled on a regular basis in the early part of each calendar year. To date over 790 people have attended at least one workshop. Twenty-five percent of them have attended two or more workshops. Over 190 commands and activities have been represented at these workshops.

*In opening remarks of PROCAL Workshop 12, Captain Murton, Chief Staff Officer at NOSC, expresses the value of continuing the PROCAL Workshop series.*



*Workshop attendees engage in informal information exchange in the PROCAL hardware demonstration room.*

Summary of PROCAL Workshops

| Work-shop | Date | Theme/Results |
|---|---|---|
| 1 | 3-6 Feb 76 | Established frame of reference for PROCAL bandwidth concept and confirmed need for continuing workshops. |
| 2 | 14-15 Jul 76 | Established user's position vis-a-vis ADP classification, acquisition, reporting need to seek relief from overburdening regulations which were documented in Appendix D, titled "Request for Waiver of the Provisions of Public Law PL89-306 (Brooks Bill) for Certain Microprocessor Based Equipment." |
| 3 | 30 Nov-2 Dec 76 | Issued policy statements on GSA classification, delegated procurement authority, defined "PROCAL," and discussed involvement of the operating forces in the control and guidance of the PROCAL program. |
| 4 | 23-27 May 77 | Prepared a white paper, Appendix E, at the request of CNO/NAVDAC, titled "Summary of Comments at the Fourth Programmable (PROCAL) Workshop on Applications, Management Development and Reporting of Microprocessor Based Systems." |
| 5 | 1-4 Nov 77 | Identified a rightwards shift in the PROCAL bandwidth and the creation of a void in the low-cost stand-alone area; introduced the hand-held calculator group into the workshop arena; and conducted further discussions on documentation standards. |
| 6 | 9-11 May 78 | Accepted a set of documentation standards and discontinued these discussions; introduced the physical and electronic security aspects of PROCAL. |
| 7 | 30 Oct-3 Nov 78 | Introduced a new advance line of PROCAL equipment and capability; commented on the work of the NAVMAT LCCE working group, and discontinued discussions on security aspects. |
| 8 | 11-15 Jun 79 | Identified the need to develop and have approved a general operational requirement for PROCALs. Exhibited the transportability of ECLIPS software from the HP 9831 to the HP 9835, and the urgent requirement to decrease the software costs associated with the development of user-specified application programs. |
| 9 | 4-6 Feb 80 | Made a series of presentations on PROCAL operational, administrative, and tactical applications, including the DNA interactive nuclear display terminals and USA-TRASANA WANG wargaming system; examined SECNAV Inst 5240.6 dated 2 Nov 1979 for the impact of its newly stated policies on delegated procurement authority and acquisition policies. Demonstrated new hardware, i.e., the TEK 4050 series and the HP 85. |
| 10 | 9-12 Feb 81 | Included new product introduction by Tektronix, HP, and DEC; demonstrated the NSAP-funded Resource Management and Employment Scheduling programs and Ship Scheduling System; made presentations of the Tactical Decision Aid programs, and held a panel discussion on a number of PROCAL-related subjects. The workshop included an address by a representative of the Office of the Assistant Secretary of the Navy for Financial Management on "ADP Policy – a SECNAV Viewpoint." |
| 11 | 8-12 Feb 82 | Included a detailed discussion of the dramatic advances in the hand-held calculator field and the impact of the CP/M operating system on the PROCAL field, in particular as regards the introduction of the Xerox 860 WPS (with CP/M) into the Fleet as the CNO-designated standard. There were technological discussions and presentations on the 64K RAM, 32-bit technology and distributed nodal networking. Fleet Lectures About Their Thing (FLATT) were included. |
| 12 | 7-11 Feb 83 | Included a discussion of tactical decision aids, a demonstration of new products, a discussion of baseband and broadband networks, and a hands-on use of an operational ETHERNET. Sessions were held on acquisition policies, the delegation of procurement authority, the use of word processing and optical character reading devices, the technical aspects of microprocessor product development, the continuation of the interactive graphic and device technology seminars, and the dysfunctional consequences of the subjective standardization of PROCALs. Discussions were also held on the need for and the worthiness of the PROCAL workshop series, on the advisability of changing the current workshop format, and on the increase and extended use of desk-top computers in the operational environment. |

# *Surface ship machinery vibration monitoring programs in the pacific*

## *General*

Monitoring the vibration of operating machinery for assessing operational health is an established technique in industry and in the U.S. Navy. Programs have been developed and based on the principle that healthy in-place operating machines possess a characteristic, or baseline, vibration level and that as wear or damage to individual machine components increases there is a corresponding increase in vibration amplitude as measured on the machine.

These programs have had a long history in the submarine community, where interest in machinery condition, as well as in the contributions machinery vibration makes to radiated acoustic signature, is vital.

By comparison, monitoring programs for surface ships are relatively recent. Here, costs for machinery repair and replacement have increased, as has the time interval between ship-scheduled accesses to repair facilities and shipyards.

These increases have resulted in an emphasis on programs that offer a timely means of assessing machine operational condition so that the major costs associated with severe or catastrophic damage may be averted.

## *Technical agent for comnavsurfpac*

In 1976 at the request of CINCPACFLT FRO was tasked to investigate shipboard machinery vibration monitoring for its effectiveness as a maintenance tool. This resulted in a redefined Chapman Number program that provided regularly scheduled shipboard monitoring on Pacific Fleet FF 1040, FF 1052, and FFG 1 class frigates.

The object of the program was to enable each participating ship to perform its own monthly monitoring and, based on trended data, form decisions on shipboard machinery operation or repairs.

To assist this and other programs, COMNAVSURFPAC designated NOSC as its technical agent. In this capacity FRO provided technical assistance, liaison between the Fleet and the civilian technical communities, and other assistance as required for COMNAVSURFPAC's machinery maintenance and ship silencing programs.

Programs that have been developed with NOSC's assistance as technical agent include the following:

- Redefined Chapman Number program
- Hard-mounted machinery vibration monitoring program on FF 1052 class frigates

- Machinery vibration monitoring program on DD 963 class destroyers
- Ship maintenance planning program

The Chapman Number, hard-mounted, and DD 963 programs are based on a determination of vibration trends by using the wide-band frequency analysis of vibration data.

The DD 963 program also uses narrow-band frequency analysis for a better resolution and isolation of machine component malfunction when wide-band data indicate that a machine is troubled.

The program for ship maintenance planning is a program of machine vibration measurement that uses both wide-band and narrow-band analysis. In this program a two- or three-man team boards a ship in WESTPAC or MIDPAC and performs measurements while the ship is en route to the West Coast.

The data obtained assist planners in determining which machinery units will receive repair or replacement attention at the ship's next scheduled shipyard availability.

The technical agent function at NOSC has been updated and is now being performed by Code 636.

## *Surface ship radiated noise measurement*

Related to the programs in machinery vibration is the Surface Ship Radiated Noise Measurement (SSRNM) program now being pursued in both the Pacific and Atlantic. This program was initiated in WESTPAC near Subic Bay under Navy Science Assistance Program tasking, and its feasibility was demonstrated in 1977. Later that same year COMNAVSURFPAC established an operational requirement for the radiated noise measurement of surface ships for maintenance and silencing. To assist and demonstrate an approach to satisfying this requirement, FRO performed a four-ship feasibility test series at San Clemente Island.

From a buoy-moored small craft equipped with an on-deck instrumentation hut, recording equipment, and an over-the-side hydrophone, the SSRNM team recorded and reported each ship's speed-related radiated in-water noise emanations.

In SSRNM testing, a ship may be ranged in 6 to 12 hours. Noise signatures are compared to those of the particular class; nontypical noise is then a signal of possible onboard machinery problems.

Following a successful demonstration of the test series, COMNAVSURFPAC assumed sponsorship of SSRNM and has required all Pacific Fleet ships to be ranged prior to deployment to WESTPAC. Management of the program at NOSC was accepted by the FORACS Division, Code 636, where continued growth has been seen.

In the Pacific, ranging is accomplished at San Clemente Island, at Lualualei on Oahu, at Barking Sands on Kauai, and at the Guam Acoustic Ranging Facility.

In the Atlantic, under the sponsorship of COMSURFLANT, the David Taylor Naval Ship Research and Development Center (DTNSRDC) conducts ranging at the Atlantic Undersea Test and Evaluation Center (AUTEC) on Andros Island in the Bahamas and at St. Croix in the Virgin Islands.

At the outset, a goal was eventual NAVSEA sponsorship of the program and its integration with the FORACS program.

In 1983 NAVSEA funded the development of a permanent system, including a bottom-

moored vertical hydrophone array and a state-of-the-art instrumentation van for data processing, recording, system control, and ship tracking. This system, a prototype for follow-on units to be situated at St. Croix and at Lualualei, has been completed and installed at the San Clemente Island site. Currently ship testing is being performed with this system.

In November 1983 NAVSEA representatives will perform validation testing of the new system. Installation of a similar system at St. Croix is scheduled for the spring of 1984; installation at Lualualei, Oahu, will follow.

NAVSEA is currently sponsoring the SSRNM testing of ASW ships in both the Atlantic and Pacific Fleets; SSRNM testing for other classes of ships is sponsored by the respective force commander. Under NAVSEA auspices, DTNSRDC has the technical direction of the SSRNM program; NOSC's role is responsibility for system design, development, installation, and update.

***SSRNM instrumentation and range control van overlooking Wilson Cove at San Clemente Island.***

***Inside the van an operator (foreground) is at work on the control console.***

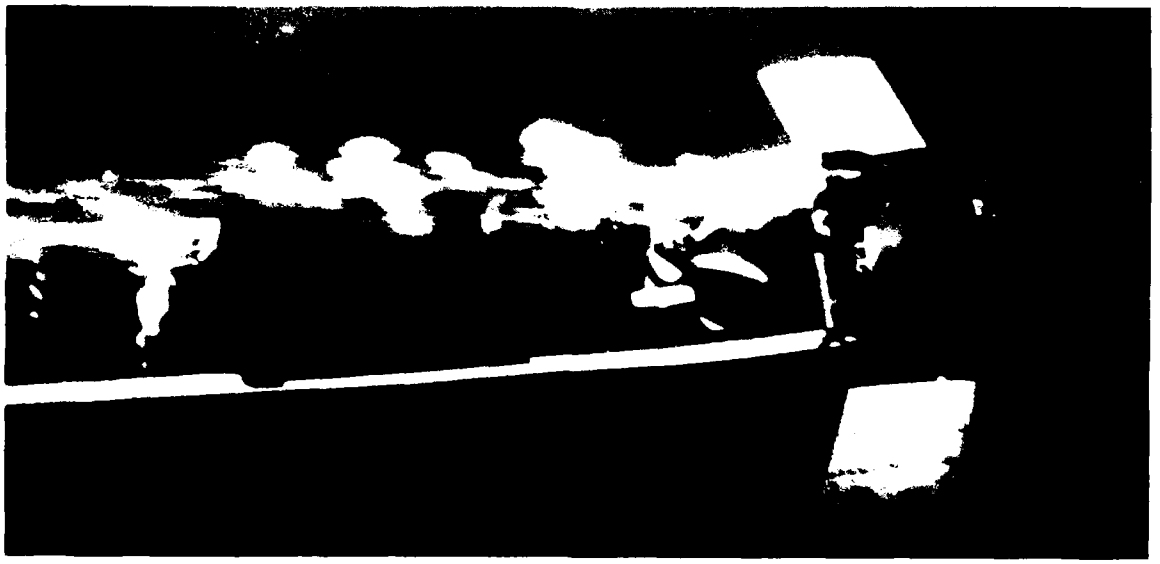
## *Swimmer delivery vehicle noise measurement*

In 1982 FRO sponsored the ambient noise survey of several sites in the San Diego area. The purpose of the survey was to prepare for the eventual selection of a site at which to conduct noise measurements of Swimmer Delivery Vehicles (SDVs). A location near the Naval Amphibious Base in San Diego Bay was selected as the site for making these measurements. An advantage of this site is its convenient location for SDV users.

A need has long existed for a dedicated SDV sound-measuring facility to obtain information for use in threat and vulnerability analyses, subsystem condition analysis, quieting, and the design of new models. Previous testing to obtain such data required that the vehicles be transported long distances to the test site, resulting in many logistics problems.

With the endorsement and support of COMNAVSPECWARGRU ONE, COMNAVSEASYSCOM (NSEA OOC) sponsored the development and assembly of the Swimmer Delivery Vehicle Noise Measurement (SDVENOM) system. Assembly of the instrumentation in a trailer is currently in progress. The SDVENOM data can be used to determine various acoustic characteristics. From this information, routine corrective action may be taken to lessen or eliminate offending noise and thus reduce acoustic detectability.

Installation of the SDVENOM system and on-site check-out are scheduled for early 1984. Design, development, fabrication, assembly, and testing are being managed by the Ocean Engineering Department's Advanced Systems Division, Code 941.



***Mk 7 SDV trainer.***

*SDV noise measurement program manager at work in acoustic monitoring van*

## *Target hulk acoustic augmentation*

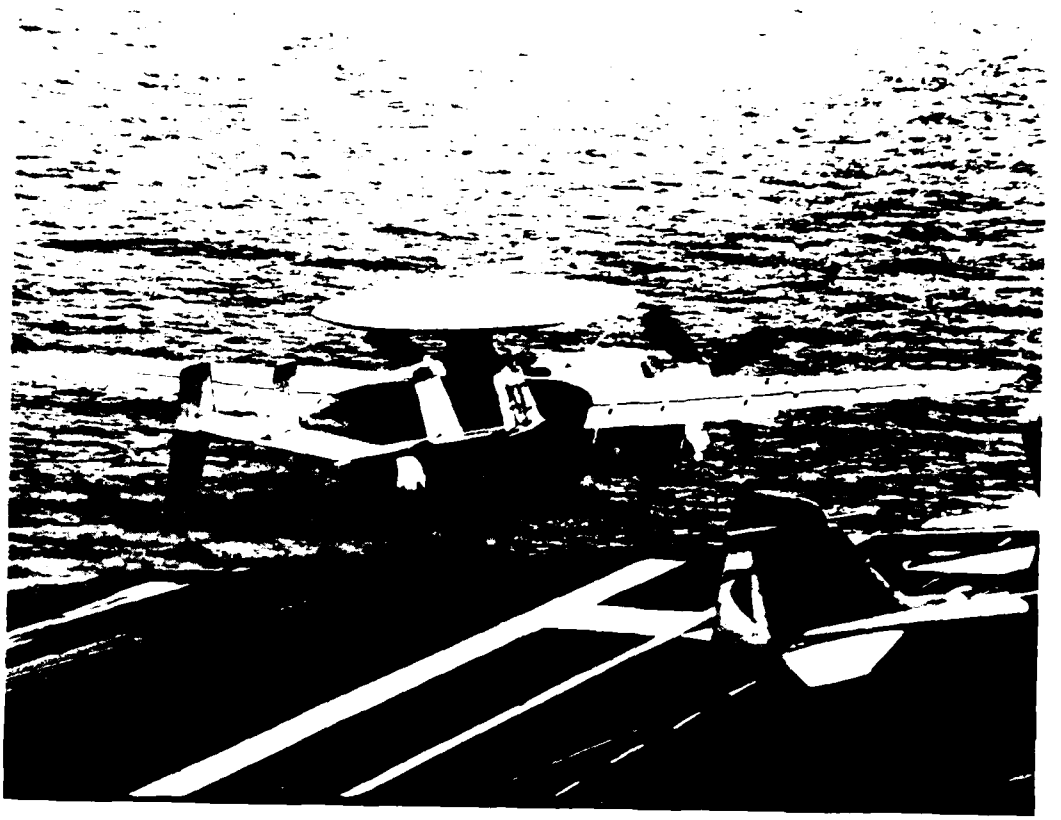
Since 1981 FRO has assisted COMTHIRDFLT and the Pacific Missile Test Center in giving target hulks an in-water noise-making capability. Hulks used in Fleet targeting exercises are towed to sea and placed at the target site. On site, the hulk is ordinarily dead in the water, and during targeting no acoustic emission occurs that could be used by Fleet sonar assets to assist in forming targeting decisions. To remedy this situation, a concept for acoustic augmentation, initially used in NSAP assistance given to COMSEVENTHFLT in 1981, is applied. Seventh Fleet's requirement was for augmentation to be applied to a former covered refrigerated lighter (YFR) located at Subic Bay, Republic of the Philippines. To satisfy the requirement, a motor vibrator, sold commercially as a bin vibrator for grain and flour mills, was internally mounted to the barge's bottom frame structure. The vibrator, operating with a preset imbalance to the motor's shaft, caused sufficient vibration to establish acoustic energy transfer for long range sonar reception

In 1983 the ex-USS Cabildo (LSD-16) received augmentation for Readiex 83-2. Two vibrators were installed internally below the water line, one port side, the other starboard. Additionally, continuous time-controlled frequency shifting was installed to assist signal recognition. Thus the vibrators ran 1 minute at 59 Hz and then were shifted to 57 Hz for 1 minute in a continuous alternating fashion. This "coded" signal was received at a range of approximately 60 miles.

COMTHIRDFLTREP and PMTC are exploring possibilities for the acoustic augmentation of an ex-Army tug boat as well as of SEPTAR Mk 35-type radio-controlled target boats. Augmentation in both cases is seen as providing more realism for training purposes. The 143-foot ex-Army tug is envisioned as nonexpendable, capable of continuous use for training, and amenable to more elaborate augmentation, so as to make it capable, for example, of simulating the known characteristics of other surface craft. The fiberglass-constructed SEPTAR, on the other hand, is most often the target of missile impact, where survivability is low, and therefore elaborate augmentation is not considered to be a cost-effective measure.

A survey has been conducted of practical means for accomplishing these goals, taking into account acoustic capabilities, platform compatibilities, vibroacoustic system types, maintainability and safety, and relative costs. A report has been prepared and forwarded to COMTHIRDFLT and PMTC which describes available systems, their advantages and disadvantages, and their applicability to the two types of platforms. Relative costing figures were also included. With this report PMTC representatives and COMTHIRDFLT can prepare proposals and better argue for NAVAIR and Fleet support.

***The NOSC project manager for acoustic augmentation oversees the measuring of acoustic source levels at rope-measured distances from the acoustically augmented ex-USS Cabildo (LSD 16).***



# Military liaison group

## General

The primary duties of the Military Liaison Group are (a) to provide a direct liaison between the Fleet and NOSC personnel involved in various projects requiring direct coordination with Fleet commands, (b) to manage and allocate Quick-Reaction Capability (QRC) funds, and (c) to assist NOSC civilian employees unfamiliar with the Navy chain of command to become conversant with naval traditions and customs. Engineers, scientists, and technicians employed at NOSC frequently become involved in projects involving command and control, communications, ship design and maintenance, and almost every aspect of military operations. The Military Liaison Group provides those NOSC employees with points of contact who have the military experience and expertise to provide background information on problem areas, answer questions, make recommendations, and give assistance during the conduct of NOSC projects.

*Jim Ruble brings 22 years of Navy experience to his position as Deputy to the Head of the Military Liaison Group.*

## Ship scheduling and class technical information

The Military Liaison Group maintains a readily available library of ship-movement information, exercise schedules, and addresses and phone numbers of points of contact knowledgeable in the multiplicity of issues of interest. This library encompasses long- and short-range employment schedules for all U.S. Navy mobile commands, Fleet exercise scheduling information, and flag officer and major staff personnel listings.

During FY 83, on numerous occasions, the Military Liaison Group provided detailed information on ship and afloat staff scheduling and on maintenance and operational procedures unique to the various ship classes. Additionally, the Group effected liaison between Center engineers and representatives of more than thirty major shore and sea-based commands.

## Nosc face-to-the-fleet program

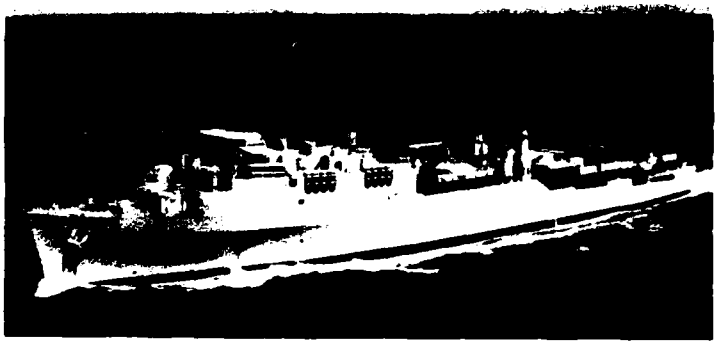
The Military Liaison Group plays an active role in the Center's Face-to-the-Fleet program. The Group promotes the Center's capabilities through personal contact, by compiling and distributing informational material and lists of selected briefing topics, and by sending out, as a matter of routine, frequent invitations for Center tours to all U.S. Navy commands. Once an invitation is accepted by an interested command, the Group arranges and conducts tours and briefings either on Center facilities and programs or on issues of special interest to the visiting command.

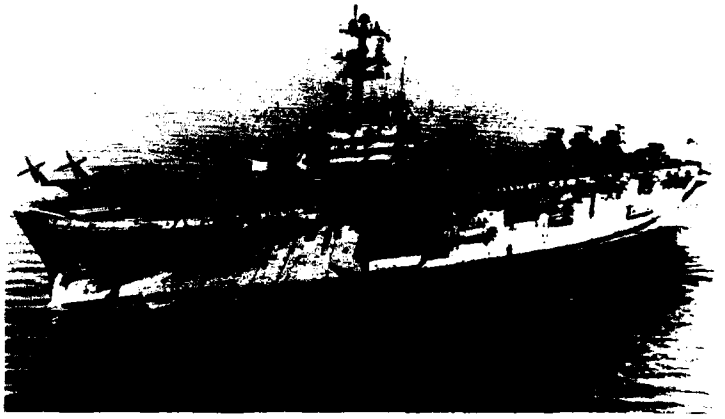
In supporting the Face-to-the-Fleet program during FY 83, the Military Liaison Group arranged and assisted in conducting over twenty tours of the Center for representatives from Fleet commands.

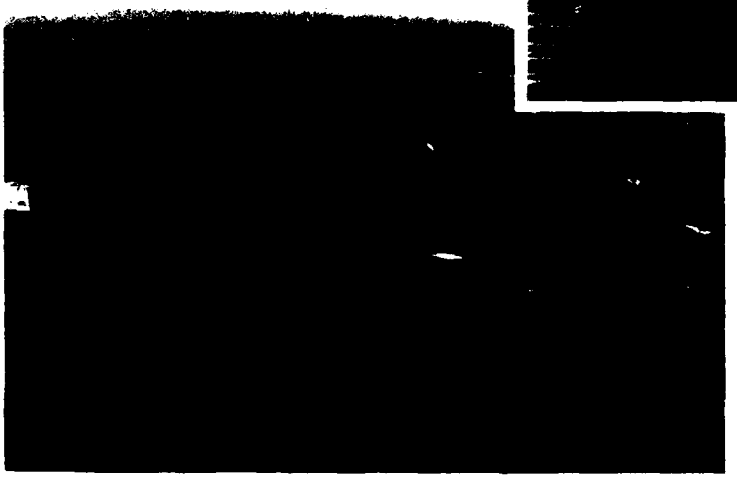
During the fiscal year the Center's new professionals were given tours of ten Fleet commands which included every ship class and such unique platforms as the DSRV-1 and Special Boat Squadron One.

## *New professional tours*

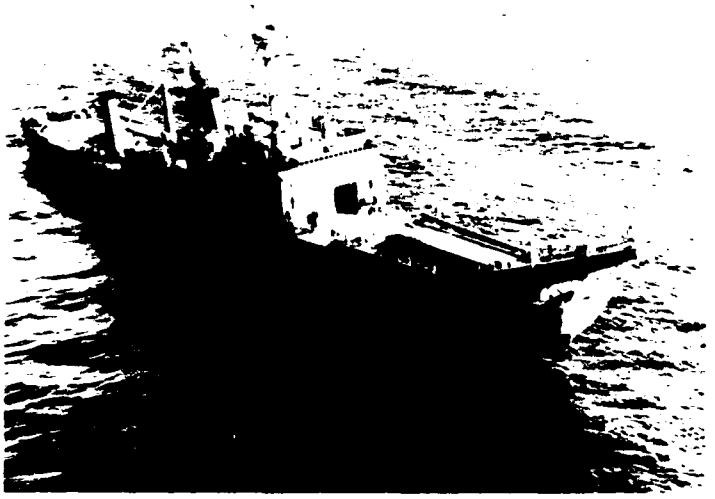
One very important function performed by the Military Liaison Group is the indoctrination of newly reporting NOSC civilian scientists and engineers. The Group's efforts are a part of an overall Center effort to rapidly transform recent college graduates into more effective DOD scientists and engineers. The Military Liaison Group, in coordination with members of the Type Commanders' staffs, schedules, arranges, and conducts shipboard and facility tours for these new professionals. These tours are intended to introduce the new professionals to U.S. Navy air, surface, and subsurface platforms and systems so that they can better accomplish the C³I, ocean surveillance, surface and air-launched undersea weapons systems, and submarine Arctic warfare missions of the Center.



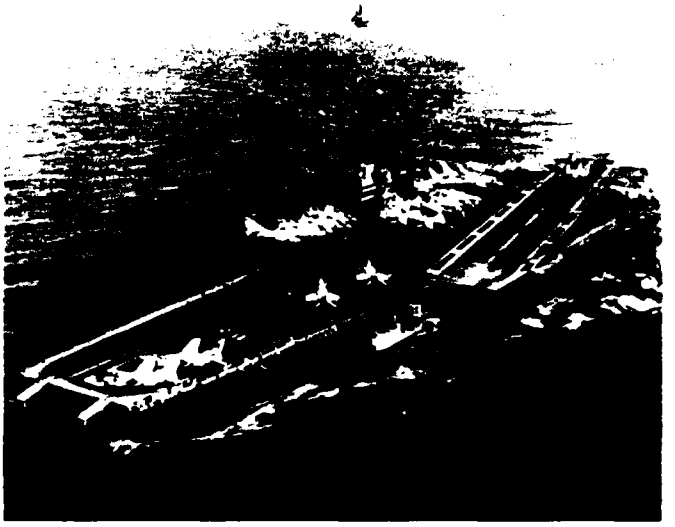




***The 1983 New Professionals aboard the USS Tripoli. Encircling them are Pacific Fleet ships that represent the ship classes they visited during FY 83.***




L P H -X



## *Quick-reaction capability*

The Military Liaison Group is tasked by the Head of FRO with the allocation and management of QRC funds. The QRC program provides a way to respond to emergent Fleet problem areas with rapid and inexpensive investigations. The main thrust of these investigations is first to determine the scope of the problem and then to take a "quick look" at possible solutions. Depending on the size and nature of the problem, the end product of the QRC effort may be as simple as a report detailing the recommended solution or as involved as a proposal to the various sytems' commands detailing the problem, offering possible solutions, and soliciting the funding required to resolve the problem.

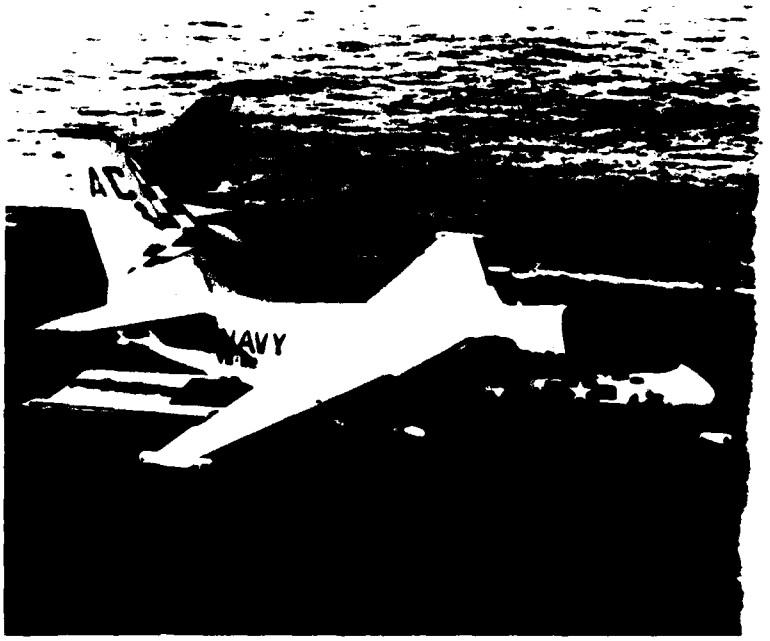
During FY 83 QRC tasks included such projects as SURFLANT Seagrass Investigation, Anti-Surface Warfare Commander Tactical Decision Aid, UHF Relay Pod (SATCAT) Demonstration, HF Prophet System Validation Tests, Optical Guide Light Proposal, USMC Improved Packaging Proposal, Limited Range Intercept Training Media Evaluation, HF Scanning Receiver Investigation, and USMC AN/TPQ-63 Radar Remote Display Investigation.

The majority of these projects involved less than a two man-month effort and have resulted in proposed solutions or follow-on program funding of more than $4 million to permit more active and extensive efforts.

## *Uhf relay pod*

A UHF relay pod was developed through NSAP funding in 1978. The pod-mounted relay was flight tested at the Naval Surface Weapons Center in Dahlgren, Virginia, and during at-sea flight operations. Although the multichannel pod performed its mission, it was not accepted as a required communication link capability and was therefore sent back to NOSC. In 1983 the requirement for the pod was validated and a QRC task was initiated to reinstall the electronics equipment aboard the original pod, test, and deliver an operational multichannel UHF link to COMSECONDFLT.

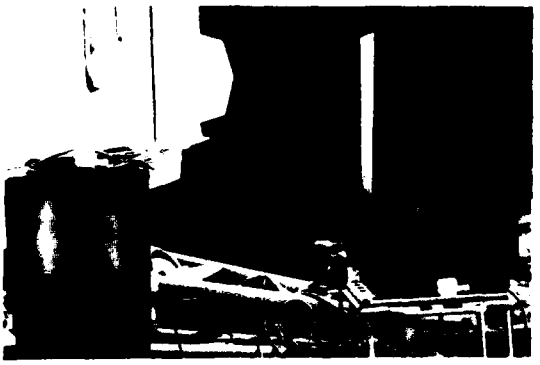
The pod has been extensively tested during at-sea flight operations with great success and has resulted in actions to procure additional pods for Fleet use.



***S-3 aircraft carrying UHF relay pod (SATCAT) under right wing.***

## Optical guidance light

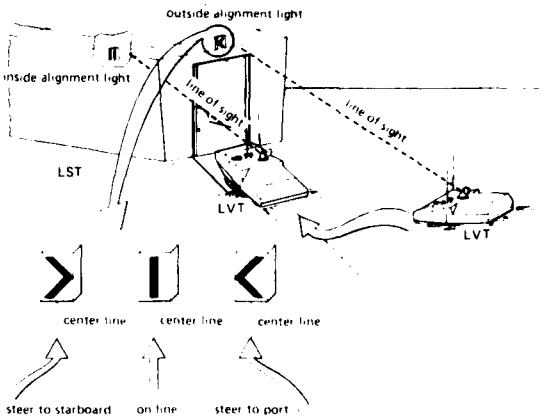
During a NOSC investigation on how to improve well-deck operations aboard LHA-type ships, a unique guide light based on the moire technique was discovered. This device is being used in Europe as a navigational aid for maneuvering in canals and for parking aircraft. It is also suitable for the guidance of vehicles in narrow passages. Code 8232 and FRO saw a direct and immediate use for this system in guiding amphibious craft (LCUs, LCMs, and LVTs) aboard ships and during ship-to-shore movement.



*Optical guidance lights.*

The approach decided upon to effect this use was to design and build a guidance light prototype which would enable the driver of an amphibious craft or vehicle to easily align the unit with the centerline of an amphibious ship's well-deck or with the boat lane to the beach. After the prototype was built, it was demonstrated to amphibious training personnel of Naval Beach Group One at Coronado and was subsequently evaluated in an operational scenario during landing exercises at training beaches near the Naval Amphibious Base at Coronado.

Future efforts include further operational testing and an investigation of the unit's suitability for use in the spotting and landing of helicopters on amphibious air-capable ship platforms.




***LVTs use alignment lights to enter LST.***

## Additional fy 83 activities

Military Liaison Group personnel visited over twenty-five major staff and afloat commands, attended many formal meetings, and participated in *ad hoc* discussions involving over twenty significant Center programs.

Military Liaison Group personnel also coordinated the Center's participation in Fleetex 83-1, a major effort which included over 140 civilian and military Center personnel working at NOSC and at various afloat and ashore commands.

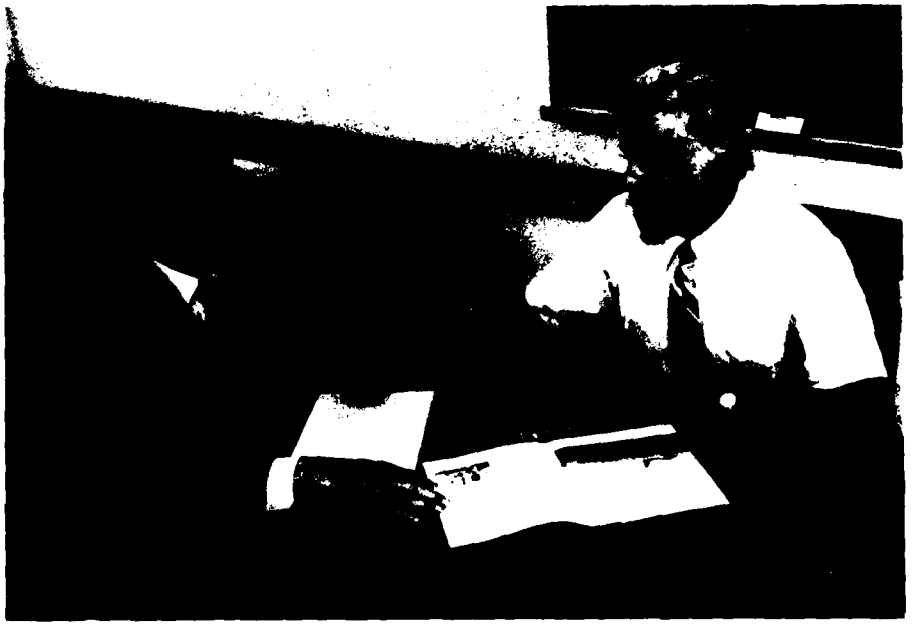
# *Naval warfare advisory group*

The Naval Warfare Advisory Group (NWAG) is a direct descendant of the Advanced Technical Objectives Working Group for Naval Warfare, a group chartered in 1973 by the Director of Navy Laboratories (DNL) to review the offensive capability of ships comprising a surface strike group and to make appropriate recommendations to DNL.

NWAG today identifies and correlates Fleet needs with research and development capabilities. Battle management, $C^3I$, $C^3CM$, and emerging Battle Group level operational problems and deficiencies have been examined and described in recent NWAG meetings and documents.

NWAG representatives from Navy laboratories met at NOSC in February 1983 to discuss $C^3$ and $C^3CM$ concepts, including Fleet experience. In June they met at NUSC to examine problems and prospects in Arctic ASW and to hold discussions with the Wallops Island Battle Group Level Support Facility planning representative from NAVELEX. In August they met with Mr. Hillyer, DNL, to discuss plans for the FY 84 tasking of NWAG.

During this fiscal year Dave Washburn, Head of NOSC's $C^3$ and EW Analysis Group, was named Chairman of NWAG. Jack Stawiski, Head of NOSC's $C^3$ Systems Department, and Marv Baldwin, Head of NOSC's Fleet Readiness Office, were appointed alternate chairman and representative, respectively.



***Dave Washburn (right) and Marv Baldwin discuss FY 84 NWAG plans to describe the system engineering requirements and facilities for oncoming naval combat systems through 1995.***