



DEPARTMENT OF THE NAVY

NAVAL SEA SYSTEMS COMMAND
WASHINGTON, DC 20362-5101

IN REPLY REFER TO

NAVSEAINST 4790.17A
OPR 06Q
07 Nov 1988

NAVSEA INSTRUCTION 4790.17A

From: Commander, Naval Sea Systems Command

Subj: FLEET TEST AND REPAIR OF SHIPBOARD ELECTRONIC EQUIPMENT

Ref: (a) OPNAVINST 4790.13

Encl: (1) Definitions
(2) Authorized 2M & STEEP ATE Deployments

1. Purpose. To assign responsibilities for implementing the maintenance policy of reference (a) for Fleet test and repair of shipboard electronic equipment. This is a major revision which integrates the Support and Test Equipment Engineering Program (STEPP) with the Surface Miniature/Microminiature (2M) Program.

2. Scope. This instruction applies to using STEEP and 2M to do off-line test and repair of shipboard electronic equipment at the Fleet organizational and intermediate maintenance levels. This instruction does not apply to avionics, to nuclear propulsion systems or to shipboard electronic equipment under the cognizance of SEA 08.

3. Cancellation. NAVSEAINST 4790.17 of 7 May 1980.

4. Definitions. Applicable definitions are in enclosure (1). For this instruction, the term "program manager" is generic and covers all Naval Sea Systems Command (NAVSEA) acquisition and program managers of shipboard electronic equipment.

5. Background

a. The Chief of Naval Operations (CNO) maintenance policy of reference (a) states that maintenance for surface ship electronic equipment is to be done at the lowest practical level. Doing test and repair at the lowest level enhances ship sustainability and helps to ensure optimum economic use of resources in achieving maximum operational readiness.

b. NAVSEA has two programs for supporting Fleet test and repair of shipboard electronic equipment at the organizational and intermediate maintenance levels:

(1) STEEP provides the Fleet with the capability for off-line testing of circuit card assemblies (CCA) and electronic modules (EM). This capability consists of automatic test equipment (ATE) and test program sets (TPS) for screening and fault diagnostics of suspect CCAs and EMs.

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(2) The Surface 2M Program provides the capability for doing high reliability and high quality repairs of electronic assemblies, primarily CCAs and EMs. 2M repair capability consists of the training, tools, techniques and documentation needed for doing repairs in the Fleet.

Using STEEP ATE and 2M repair stations to screen, fault isolate and repair CCAs and EMs enhances the operational availability of shipboard electronic equipment by reducing logistic delays. STEEP and 2M also help to keep good CCAs and EMs on board, thus reducing no failure evidents (NFE) and saving ships' Operational Target (OPTAR) funds.

c. Fleet STEEP ATE operators and 2M technicians are authorized to do test and repair on CCAs and EMs that are source, maintenance and recoverability (SM&R) coded for repair at either the organizational or intermediate maintenance levels. These are called "normal" repairs. In *emergency situations*, Commanding Officers may authorize test and repair of CCAs and EMs not SM&R coded for organizational or intermediate level repair when the repairs are within the ability of available personnel and adequate materials and facilities are at hand.

d. CNO (OP 32) authorizes deployment sites for STEEP ATE and Surface 2M repair stations. Enclosure (2) lists all Fleet sites now authorized STEEP ATE, Surface 2M or both. Deployment to sites other than those listed in enclosure (2) requires OP 32 approval. NAVSEA will deploy STEEP ATE and 2M repair stations only when trained and certified operators or repair technicians are on board.

e. Per reference (a), program managers for shipboard electronic equipment will, when practical, implement Progressive Depot Level Repair (PDLR) for depot repairables. Under PDLR, depot repairables first go to the intermediate level for screening and repair. When an item is beyond the intermediate level capability, it goes to the depot for repair. Both the design and maintenance plan should support progressive repair for depot level repairables. Progressive repair allows rapid turnaround of unserviceable items at the lowest practical level. If the program manager does not employ PDLR, he or she must justify this during the ILS certification process.

6. Policy

a. The maintenance policies of reference (a) will be incorporated for newly developed or redesigned shipboard electronic equipment. As a goal, maintenance concepts for shipboard electronic equipment will be developed such that 80 percent of all of the lowest replaceable units (LRU) are testable

and repairable by the Fleet at either the organizational or intermediate maintenance level. Testing of LRUs is done by Built-in-Test, testability, maintenance assist modules, general or special purpose test equipment, or any combinations thereof.

b. The testability provisions of MIL-STD-2165 will be incorporated into the design of new or redesigned shipboard electronic equipment. Program managers will ensure that CCA or EM designs are optimally testable given the test and repair capability now deployed to or planned for the Fleet.

c. The maintenance policies of reference (a) will be incorporated for existing shipboard electronic equipment when the present maintenance concept and logistic support do not meet the established requirements for operational readiness and the system meets the mission essentiality requirements in OPNAVINST 4700.19E.

7. Responsibilities

a. Reliability, Maintainability, Quality and Logistics Office (SEA 06Q)

(1) Serve as the program manager for STEEP and the Surface 2M Program.

(2) Acquire and direct deployment of STEEP ATE and 2M repair stations. Incorporate new test and repair capability into deployed STEEP ATE and 2M repair.

(3) Develop Fleet training programs for STEEP ATE and 2M repair, coordinating training inputs from the Fleet.

(4) Develop integrated logistic support for STEEP ATE and 2M repair stations.

(5) Coordinate the development of all STEEP TPSS based on Fleet requirements and priorities. Provide funding for developing STEEP TPSS for deployed shipboard electronic equipment; include funding for TPS first article acceptance. Provide program managers with funding requirements for developing STEEP TPS for new systems.

(6) Develop standard Statements of Work (SOW) and TPS development specifications for program managers to use in TPS acquisition when acquired as support for shipboard electronic equipment. Provide program managers with STEEP ATE and 2M equipment specifications and capabilities.

(7) Duplicate and deploy all STEEP TPSS.

(8) Establish quality standards for STEEP and 2M use in the Fleet for test and repair of shipboard electronic equipment.

(9) Review acquisition program maintenance and logistic planning documents for the use of Fleet test and repair capability at the lowest practical level. Provide help to NAVSEA program managers in developing maintenance concepts and documentation.

(10) Coordinate future STEEP development with the Consolidated Automated Support System (CASS) Program, a Navy initiative to standardize automated test equipment in the 1990's.

b. NAVSEA Acquisition and Program Managers

(1) Include STEEP planned TPS development as a program schedule milestone.

(2) Using Level of Repair Analysis and operational readiness as the means for identifying TPS candidates, fund for developing STEEP TPSSs for new systems; include funding for TPS first article acceptance. When TPSSs are to be procured as part of an equipment acquisition, include STEEP TPS development requirements (MIL-STD-2077A) in the SOW and equipment specification. Procure initial and provide interim 2M repair piece parts for organizational and intermediate level maintenance until the Material Support Date is reached.

(3) Provide the designated STEEP TPS developing activity with technical documentation and at least two CCAs or EMs for each TPS under development. One CCA or EM is for use during development and the other is for validation. All CCAs are to be returned upon completing TPS development.

(4) Validate (first article acceptance) all newly developed STEEP TPSSs. Provide the Fleet with a CCA or EM if they choose to conduct an independent review of a new TPS. All CCAs are to be returned upon completing the review.

(5) Serve as life-cycle manager for STEEP TPSSs and keep configuration control of the TPSSs after validation. Provide funding for developing a new TPS whenever an Engineering Change Proposal causes an existing TPS to no longer be valid.

(6) Reprovision logistic support when the Maintenance Plan is revised. Ensure reprovisioning includes repair piece parts. Change the SM&R code to show repair at the organizational or intermediate level once a TPS for a CCA or EM is developed. Change to 3H cognizant symbol when condemnation authority is at the intermediate level.

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(7) Revise maintenance documentation (System MIPs, MRCs and Tech Manuals) to incorporate use of 2M/ATE.

(8) Investigate and resolve problems with STEEP TPSS submitted from the Fleet. Provide investigation results, including planned corrective actions to the reporting activity and SEA 06Q.

(9) Ensure that system level Personnel Qualification Standards (PQS) are revised to indicate familiarization with STEEP ATE and 2M. On board E-3 through E-5 ratings are affected.

c. Fleet Commanders in Chief and Type Commanders

(1) Operationally administer Fleet test and repair capability (STEPP and 2M) for shipboard electronic equipment that follows with the policies of reference (a) and the precepts of this instruction.

(2) Ensure that only certified 2M repair technicians do repairs on shipboard electronic equipment CCAs and EMs SM&R coded for Fleet repair and that the technicians use only approved tools, piece parts and certified 2M repair stations. Ensure that the repair restrictions of paragraph 5c for "normal" and emergency repairs are enforced.

(3) Ensure that trained and certified STEEP ATE operators are on board ships having STEEP ATE.

(4) Maintain at least two certified 2M repair technicians for each 2M repair station. (Certification requirements are two certified 2M technicians for each miniature repair station and two certified *microminiature* technicians for each microminiature repair station.) The Surface 2M Navy Training Plan has a training allowance of two 2M technicians per 2M station for ships and shore sites having multiple 2M stations and three 2M technicians for ships and shore sites having only one 2M repair station.

(5) Ensure that quality assurance (QA) procedures are in place for repairing CCAs and EMs. Use the 2M Technical Manual, NAVSEA TE000-AA-HBK-010/2M, as a guide for workmanship standards.

(6) Allocate certified 2M Fleet personnel to serve as 2M/ATE inspectors to certify STEEP ATE operators and 2M technicians; to audit STEEP ATE and 2M repair sites; to install 2M repair stations, to conduct remedial and building block STEEP ATE and 2M training, and to provide technical help on STEEP and 2M.

(7) Provide follow-on logistic support for STEEP ATE and 2M repair stations (including procuring repair parts, consumables, and replacements for tools and equipment worn, damaged or lost).

d. Naval Weapons Support Center, Crane

(1) Act as the Technical Direction Agent, the Acquisition Engineering Agent and the In-Service Engineering Agent (per NAVSEAINST 5400.57A) for STEEP and the Surface 2M Program.

(2) Deploy STEEP ATE and 2M repair stations per SEA 06Q direction.

(3) Plan logistic support and provide interim support for STEEP ATE and 2M repair stations.

(4) Serve as acceptance agent for STEEP ATE and 2M repair stations.

(5) Act as the 2M/ATE Certification Agent. Certify 2M instructors, inspectors, schools, and STEEP ATE and 2M repair sites as necessary. Update certification criteria as required.

(6) Evaluate emerging test technologies and repair techniques and procedures for inclusion within the scope of authorized test and repair of shipboard electronic equipment.

(7) Evaluate and update the STEEP ATE and 2M training curriculum, as needed.

e. Naval Weapons Station, Seal Beach

(1) Deploy, under the direction of SEA 06Q, STEEP TPSS to the Fleet. Duplicate the TPS documentation and test programs and verify that the duplicated TPSS are correct and suitable for Fleet deployment.

(2) Operate the Configuration Status Accounting System for 2M and STEEP; support common TPS development tools.

(3) As part of the 2M/ATE certification process, provide each Fleet site having STEEP ATE and the applicable 2M/ATE Inspector a listing of STEEP TPSS and interfacing hardware that should be on board.

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f. TPS Developers. Develop STEEP TPSs as directed by SEA 06Q. All TPS development will follow MIL-STD-2077A. Fault detection will be at least 95 percent and fault isolation comprehensiveness will be at least 90 percent unless otherwise authorized by SEA 06Q.

8. Concurrence. The Commander in Chief, U.S. Atlantic Fleet and the Commander in Chief, U.S. Pacific Fleet concur with this instruction.

R. H. Ailes

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Deputy Commander for
Weapons & Combat Systems

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DEFINITIONS

MAINTENANCE LEVELS. The Navy has three levels of maintenance for shipboard electronic equipment:

-- Organizational Level Maintenance. The first level of maintenance is the preventive and corrective maintenance performed by the ships crew. The organizational level consists of equipment operation, inspection, service, replacement of parts and repairs.

-- Intermediate Level Maintenance. The second level of maintenance provides support beyond the capability of the organizational level. The intermediate level is comprised of Navy personnel in tenders, repair ships, and shore intermediate maintenance activities (IMAs). Intermediate maintenance includes calibration, repair or replacement of damaged parts, emergency fabrication of unavailable parts, verification testing, and fault isolation. IMAs provide technical support the organizational level when necessary.

-- Depot Level Maintenance. The third level of maintenance requires skills and facilities beyond the capability of either the organizational or intermediate levels. The depot level consists of naval and private shipyards, the ship repair facilities, and designated overhaul points. Depot maintenance includes major rework, full restoration, manufacturing, large scale repairs, and modernization. Depots provide engineering and technical support to the lower maintenance levels.

MAINTENANCE PLAN. The plan that translates the three level maintenance concept into a set of tasks that will ensure that the equipment meets its requirements for availability. Acquisition managers use the Maintenance Plan to develop and procure the logistics support for the three maintenance levels.

PROGRESSIVE DEPOT LEVEL REPAIR (PDLR). PDLR is the sequential movement of unserviceable depot level repairables (DLRs) from the ship to the depot. DLRs with SM&R codes for removal at the organizational level should go first to the intermediate level for screening and repair. If a DLR is beyond the capability of an IMA, then it should go to depot for repair.

SHIPBOARD ELECTRONIC EQUIPMENT. All shipboard equipment based on, operated by, or otherwise involving the conduction of electrons or charged carriers and such related technologies as RF and fiber optics. Shipboard electronic equipment includes weapons and combat systems (from sensors to launchers); and hull,

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mechanical and electrical equipment (such as internal communication equipment, gas turbine propulsion monitoring systems, and the electronic portion of electro-mechanical equipment). Excluded are avionics, nuclear propulsion, nuclear propulsion support equipment, and weapon expendables (bullets, missiles, torpedoes & mines).

SOURCE, MAINTENANCE AND RECOVERABILITY (SM&R) CODE. The SM&R code identifies the lowest maintenance level that may repair, replace, or condemn an item. The program manager determines the SM&R code when developing the Maintenance Plan.

SUPPORT AND TEST EQUIPMENT ENGINEERING PROGRAM (STEEP). STEEP provides automatic test equipment (ATE) to the Fleet for off-line testing of circuit card assemblies (CCAs) and electronic modules (EMs). STEEP ATE is used to screen and fault diagnose suspect CCAs and EMs. The AN/USM-465 is the only standard ATE deployed to the Fleet. It can screen digital CCAs and diagnose faults. More capable testers are under development for analog and hybrid cards.

SURFACE MINIATURE/MICROMINIATURE (2M) PROGRAM. The Surface 2M Program provides repair capability for circuit card assemblies and electronic modules. Most surface combatants, auxiliaries and amphibious ships have 2M repair stations. Ashore, there are 2M stations at IMAs, Ship Repair Facilities, and other maintenance facilities that directly support surface ships. CNO reviews requests for participation in the Surface 2M Program based on Fleet needs, repair assets, maintenance policy and budget constraints.

-- Miniature Electronic Repair. The repair of electronic assemblies, primarily EMs and single- or double-sided CCAs. Miniature electronic repair includes, and is limited to, the following:

(1) removing and installing discrete components and integrated circuit devices having leads and soldered connections and having through-hole or planar terminations (excluding surface mounted and welded lead devices);

(2) repairing CCA laminate surface and through-board damage and surface conductors (excluding multi-layer, thick film, multi/micro-wire and flex print);

(3) removing and applying conformal coatings (excluding vapor-deposited coatings or other coatings requiring unique environmental safeguards);

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(4) removing and attaching wires to turret, pierced tab, bifurcated, hook and other similar terminals and solderable connector pins;

(5) removing and replacing solderless terminations, including wire wrap, crimp connectors and crimp-lug connections;

(6) handling electronic assemblies with electrostatic discharge (ESD) sensitive devices and circuitry.

-- Microminiature Electronic Repair. The repair of electronic assemblies which require a much greater degree of skill, knowledge, dexterity and repair equipment to repair than that available in miniature electronic repair. Microminiature repair includes all miniature repair and:

(1) removing welded lead planar mounted components and replacing with soldered lead devices (excluding internal repair of sealed package integrated devices);

(2) repairing EMs and CCAs with sub-assemblies and high density packaging;

(3) repairing flex-print and multi-layer laminated CCAs (excluding thick film and multi/micro-wire);

(4) repairing embedded bulb edge-lighted panels and acrylic plastic panels.

Exclusions. Those special components and assemblies that may be critically sensitive to frequency, voltage, temperature, dust, humidity, etc., and repairs which need special calibration equipment.

TESTABILITY. A design characteristic to readily determine the status (operable, inoperable, or degraded) of an item and to facilitate the isolation of faults within the item.

2M/ATE CERTIFICATION. The process to sustain the capability in the Fleet to test and do high reliability repairs of shipboard electronic equipment. *All 2M personnel, STEEP ATE operators, and test and repair facilities and support sites must be certified before doing test and repair on shipboard electronic equipment.* A 2M/ATE inspector (for miniature and microminiature electronic repair technicians, STEEP ATE operators and Fleet test and repair sites) or the 2M/ATE Certification Agent (for 2M/ATE inspectors, instructors and schools) evaluates the technician or audits the facility for conformance to established test and repair standards. The certification process follows the 2M/ATE

Certification Plan developed by the 2M/ATE Certification Agent. The Certification Agent issues the certification when the standards are met. The certification period for 2M personnel and shore-based IMA repair stations is 12 months. The certification period for shipboard repair stations and ATE operators and test sites is not to exceed 24 months (typically 18 months), normally coinciding with Type Commander regularly scheduled combat readiness inspections. For STEEP ATE and 2M support sites (schools and MOTUs), the certification period is 12 months.

2M/ATE PERSONNEL. No added billets are required for Fleet test and repair of shipboard electronic equipment. 2M/ATE is a collateral duty for Fleet technicians. Listed below, in order of skill and training needed, are 2M/ATE operational personnel:

-- STEPP ATE Operators. Fleet personnel trained and certified in the skills to do testing with STEEP ATE on shipboard electronic equipment.

-- Miniature Electronic Repair Technicians. Fleet personnel trained and certified in the skills to do all miniature electronic repair skills.

-- Microminiature Electronic Repair Technicians. Fleet personnel trained and certified in the skills to do all miniature and microminiature electronic repair skills.

-- 2M/ATE Inspectors. Fleet personnel who conduct site audits and make certification recommendations to the 2M/ATE Certification Agent. They also review performance level of 2M technicians and STEEP ATE operators and certify previously trained 2M/ATE personnel when demonstrated performance meets or exceeds Fleet test and repair standards.

-- 2M Instructors. Fleet personnel who train 2M technicians, inspectors and other instructors. 2M instructors provide the first certification of 2M technicians and recommend certification of inspectors and other instructors to the 2M/ATE Certification Agent.

-- 2M/ATE Certification Agent. A NAVSEA agent who certifies 2M inspectors and instructors, Fleet test and repair sites, and 2M/ATE support sites (schools, MOTUs, etc.).

AUTHORIZED 2M & STEEP ATE DEPLOYMENTS
(by ship class or shore site)

Authorized Deployment Sites		Mini Stations	Micro Stations	AN/USM-465
AD	DESTROYER TENDER	2	2	1
AE	AMMUNITION SHIP	1	-	-
AF	STORE SHIP	-	-	-
AFS	COMBAT STORE SHIP	1	-	-
AG	MISCELLANEOUS	-	-	-
AGDS	DEEP SUBMERGENCE SUPPORT SHIP	-	-	-
AGF	MISCELLANEOUS COMMAND SHIP	2	1	1
AGM	MISSILE RANGE INSTRUMENTATION SHIP	-	-	-
AGOR	OCEANOGRAPHIC RESEARCH SHIP	-	-	-
AGOS	OCEAN SURVEILLANCE SHIP	-	-	-
AGS	SURVEYING SHIP	-	-	-
AGSS	AUXILIARY RESEARCH SUBMARINE	-	-	-
AH	HOSPITAL SHIP	-	-	-
AK	CARGO SHIP	-	-	-
AKR	VEHICLE CARGO SHIP	-	-	-
AO	OILER	1	-	-
AOE	FAST COMBAT SUPPORT SHIP	-	1	1
AOR	REPLENISHMENT OILER	-	1	1
AR	REPAIR SHIP	2	2	1
ARC	CABLE REPAIRING SHIP	-	-	-
ARL 24 only	REPAIR SHIP, SMALL	1	-	-
ARS	SALVAGE SHIP	1	-	-
AS	SUBMARINE TENDER	2	2	1
ASR	SUBMARINE RESCUE SHIP	-	-	-
ATF	FLEET OCEAN TUG	-	-	-
ATS	SALVAGE AND RESCUE SHIP	1	-	-
AVT 16 only	AUXILIARY AIRCRAFT LANDING TRAINING SHIP	1	1	-
BB	BATTLESHIP	2	1	1
CG	GUIDED MISSILE CRUISER	2	1	1
CGN	GUIDED MISSILE CRUISER, NUCLEAR	2	1	1
CV	MULTI-PURPOSE AIRCRAFT CARRIER	2	2	1
CVN	MULTI-PURPOSE AIRCRAFT CARRIER, NUCLEAR	2	2	1
DD 946 only	DESTROYER	1	-	-
DD 963 class	DESTROYER	2	1	1
DDG 2,37 classes	GUIDED MISSILE DESTROYER	1	1	1
DDG 51 class	GUIDED MISSILE DESTROYER	2	1	1
DDG 993 class	GUIDED MISSILE DESTROYER	2	1	1
FF	FRIGATE	1	-	1
FFG	GUIDED MISSILE FRIGATE	-	1	1
LCC	AMPHIBIOUS COMMAND SHIP	2	1	1
LHA	AMPHIBIOUS ASSAULT SHIP, GENERAL PURPOSE	1	1	1
LHD	AMPHIBIOUS ASSAULT SHIP, MULTI-PURPOSE	1	1	1

AUTHORIZED 2M & STEEP ATE DEPLOYMENTS
(by ship class or shore site)

Authorized Deployment Sites		Mini Stations	Micro Stations	AN/USM-465
LKA	AMPHIBIOUS CARGO SHIP	1	-	-
LPD	AMPHIBIOUS TRANSPORT DOCK	1	-	1 **
LPH	AMPHIBIOUS ASSAULT SHIP, HELICOPTER	1	1	1
LSD 32,36 classes	DOCK LANDING SHIP	1	-	-
LSD 41 class	DOCK LANDING SHIP	-	1	1
LST	TANK LANDING SHIP	1	-	-
MCM	MINE COUNTERMEASURES	-	-	-
MSO	MINESWEEPER, OCEAN	-	-	-
PHM	GUIDED MISSILE PATROL COMBATANT	-	-	-
SS	SUBMARINE	-	-	-
SSN	SUBMARINE, NUCLEAR	-	-	-
SSBN	BALLISTIC MISSILE SUBMARINE, NUCLEAR	-	-	-
MOBILE LOGISTIC SUPPORT GROUP				
	PHMRON MLSG	1 *	1 *	1
	ASSAULT CRAFT UNIT (ACLC)	- *	1 *	-
SPECIAL WARFARE				
	SEAL TEAMS/DELIVERY UNITS	-	1 *	-
	SPECIAL BOAT UNITS	- *	1 *	-
SIMA		2 *	1 *	1 ***
SRF		1 *	1 *	1
SUBMARINE SUPPORT ACTIVITIES				
	NAVSUBSUPPFAC NEW LONDON	2 *	2 *	1
	SUBBASE NEW LONDON	1 *	1 *	-
	SUBBASE PEARL HARBOR	1 *	1 *	-
	SUBBASE SAN DIEGO	1 *	1 *	-
	TRF BANGOR, KINGS BAY	2 *	2 *	1
	SUBGRU 7 YOKOSUKA	1 *	1 *	-
	SUBMARINE RESCUE UNIT	1 *	1 *	-
MOBILE TECHNICAL UNIT		1 *	1 *	- ****
2M & ATE FLEET TRAINING		1 *	1 *	1
NAVSEA COMBAT SYSTEMS TRAINING ACT		- *	- *	1
GROUND ELECTRONIC MAINTENANCE (NAS)		2 *	1 *	-
OCEAN SYSTEMS COMMAND (NAVFAC)		-	1	-
FLEET DECEPTION GROUP		-	1	-
FLEET ELECTRONIC WARFARE SUPP GROUP		-	1	-

* minimum capability -- additional 2M stations are provided commensurate with repair support or training provided.

** USS Nashville (LPD 13) only.

*** one each additional AN/USM-465 provided to SIMA Norfolk and SIMA San Diego.

**** provided for ATE certification and training as required.