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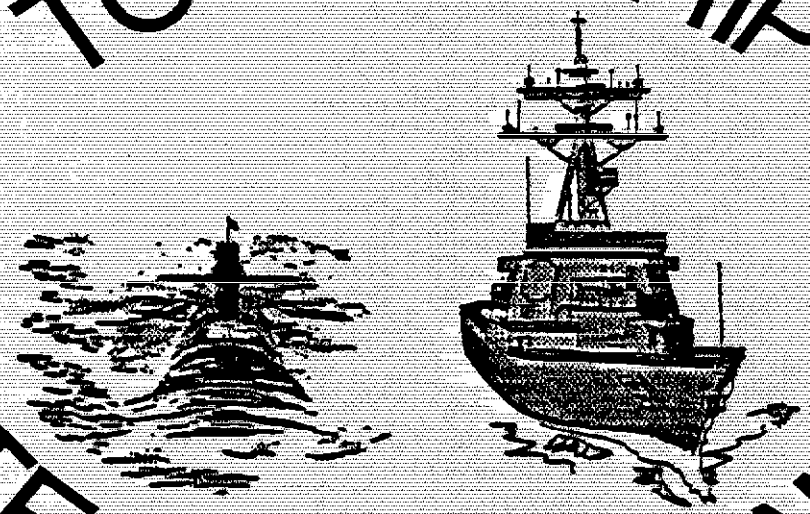
TOTAL SHIP TEST PROGRAM



THE TOTAL SHIP TEST PROGRAM MANUAL

PUBLISHED BY DIRECTION OF THE COMMANDER, NAVAL SEA SYSTEMS COMMAND

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Subj: TOTAL SHIP TEST PROGRAM MANUAL

Ref: (a) NAVSEA Ship Construction Test and Trials Manual (NAVSEA 0900-LP-095-2010)
(b) Combat Systems Test and Certification Manual for Surface Combatant Ships (NASEA T9093-AB-TRQ-010/SURF COMB)
(c) 1200 PSI Propulsion Plant Test and Certification Manual (NAVSEA 0941-LP-053-6010)

Encl: (1) Total Ship Test Program Manual (NAVSEA S9095-AD-TRQ-010/TSTP)

1. Enclosure (1) consolidates the contents of references (a)-(c) on the testing of ships and ship systems during new construction and industrial availabilities. It describes the Navy-wide standards and practices that have proven successful for both effective and efficient ship test programs. Since enclosure (1) is a consolidation of existing publications, any contracts and project orders that reference any of those older publications need not be revised to refer to enclosure (1).

2. Questions should be referred to the NAVSEA Ship Test and Evaluation Branch at 703-602-8176, DSN 332-0137.

M.T. REYNOLDS
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THE TOTAL SHIP TEST PROGRAM MANUAL

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CHAPTER 1

ADMINISTRATION

1.1 **Introduction**. Total ship testing is the systematic planning, organizing, execution and reporting of testing from the total ship perspective. The Total Ship Test Program (TSTP) was instituted in 1974 to establish policies and standard practices for ship testing during industrial periods in order to help assure proper accomplishment of the industrial work and to verify the material readiness of the ship for fleet operations. These policies and procedures pertain to the industrial periods of a ship's life; e.g., Construction, Conversion, Modernization, Post-Shakedown Availability, Regular Overhaul, Selected Restricted Availability, Phased Maintenance Availability, etc.. The Commander, Naval Sea Systems Command (NAVSEA SEA-91T), maintains this manual as part of the responsibility to set technical standards for ship engineering and material integration.

1.2 **Supersession**. This manual supersedes the NAVSEA Ship Construction Tests and Trials Manual (NAVSEA 0900-LP-095-2010), the Combat Systems Test and Certification Manual for Surface Combatant Ships (NAVSEA T9093-AB-TRQ-010/SURF COMB), and the 1200 PSI Propulsion Plant Test and Certification Manuals (NAVSEA 0941-LP-053-6010). The requirements of these manuals, vice this manual, are still applicable for those contracts in which they are invoked.

1.3 **Scope**. This manual applies to testing of surface ships and submarines, being constructed by NAVSEA and affiliated Direct Reporting Program Managers (DRPMs) and Program Executive Officers (PEOs). This includes ships being constructed under Foreign Military Sales (FMS) cases, those being built for research and development, and those being built for operation by the Military Sealift Command. It also applies to any other ship industrial

1.3 Scope (Continued).

period for which NAVSEA, its affiliated DRPMs, and PEOs and its field activities have responsibilities for testing. Specifically excluded is the testing of propulsion plants of nuclear powered ships, the nuclear support facilities of submarine and surface ship tenders, and systems under the cognizance of the Strategic Systems Program Office. The requirements of this manual are the minimum necessary for effectively executing ship test programs; they do not modify or supersede other requirements that are separately imposed for selected components, systems, or classes of ships, such as those in the references of Appendix A, those published in the Submarine Safety Requirements Manual (NAVSEA 0924-062-0010) or the Manual for the Control of Testing and Ship Conditions (NAVSEA 0905-485-6010). This manual describes testing for ships under construction, conversion or modernization (Chapter 2) and testing for active fleet ships during industrial availabilities (Chapter 3).

1.4 Policy. The following forms the basis for the organizational relationships, management procedures, and documentation standards prescribed in this manual.

a. The requirements for testing shall be engineered for two primary objectives: confirming proper accomplishment of contractual requirements (either construction specifications or the authorized work package) and assessing the material readiness of the ship for fleet operations. Work package requirements may change during the industrial period; therefore, test requirements must be maintained current and properly tailored to the work package.

b. Because of the interdependence of shipboard systems, Test Procedures (TPs), both government and contractor furnished, must be formulated into a total ship Integrated Test Package (ITP) to

1.4 Policy (Continued).

optimize effectiveness and efficiency. The ITP shall be structured to clearly identify and differentiate responsibility for TP development and conduct between government (including Alteration Installation Teams (AITs)) and the shipyard. Test results should not solely be analyzed on the individual system's performance and ability to support the next test or operational event. They should be analyzed from the perspective of the ship's ability to perform its mission, and the test program's ability to verify material readiness.

c. Requirements for certification of individual equipments during an industrial period shall be imposed only when the procedures of this manual are not sufficient to assure proper equipment operation, safety or compatibility. Testing required to obtain certification shall be assigned, whenever possible, to the shipyard or to qualified technical agencies (other than testing routinely conducted by ship's force). Test procedures for all certification testing shall be developed in accordance with this manual and be part of the ship's ITP, even if organizations outside of the shipyard will be conducting the tests, or if the tests are scheduled during a time frame separate from related tests conducted by shipyard personnel. This policy will help maintain the continuity of the test program and ensure it is effective and efficient. For surface ship systems, NAVSEA screens candidate certifications and maintains a manual, Shipboard Systems Certification Requirements for Surface Ship Industrial Periods (Non-Nuclear) (NAVSEA S9040-AA-GTP-010/SSCR), listing those certification requirements that are approved for accomplishment during surface ship industrial periods. Certification requirements for submarines are published on a case-by-case basis because of the unique performance requirements.

1.4 **Policy (Continued)**.

d. The test program will be structured so that results of industrial period testing can be used and evaluated during post-industrial period testing. While the industrial period is considered complete upon completion of the industrial work, the ship's total capability may not be fully verified until it has completed post-industrial tests and trials. Figure 1-1 depicts the normal flow of test events commencing with construction and continuing through a ship's lifecycle.

1.5 **Responsibilities**. Appendix B provides a summary of the responsibilities of each organization that is a participant in achieving the objectives of TSTP.

1.6 **Recommended Changes**. Recommended changes to this manual should be submitted to the Director, NAVSEA Test and Evaluation Office (NAVSEA 91T).

SHIP TESTING

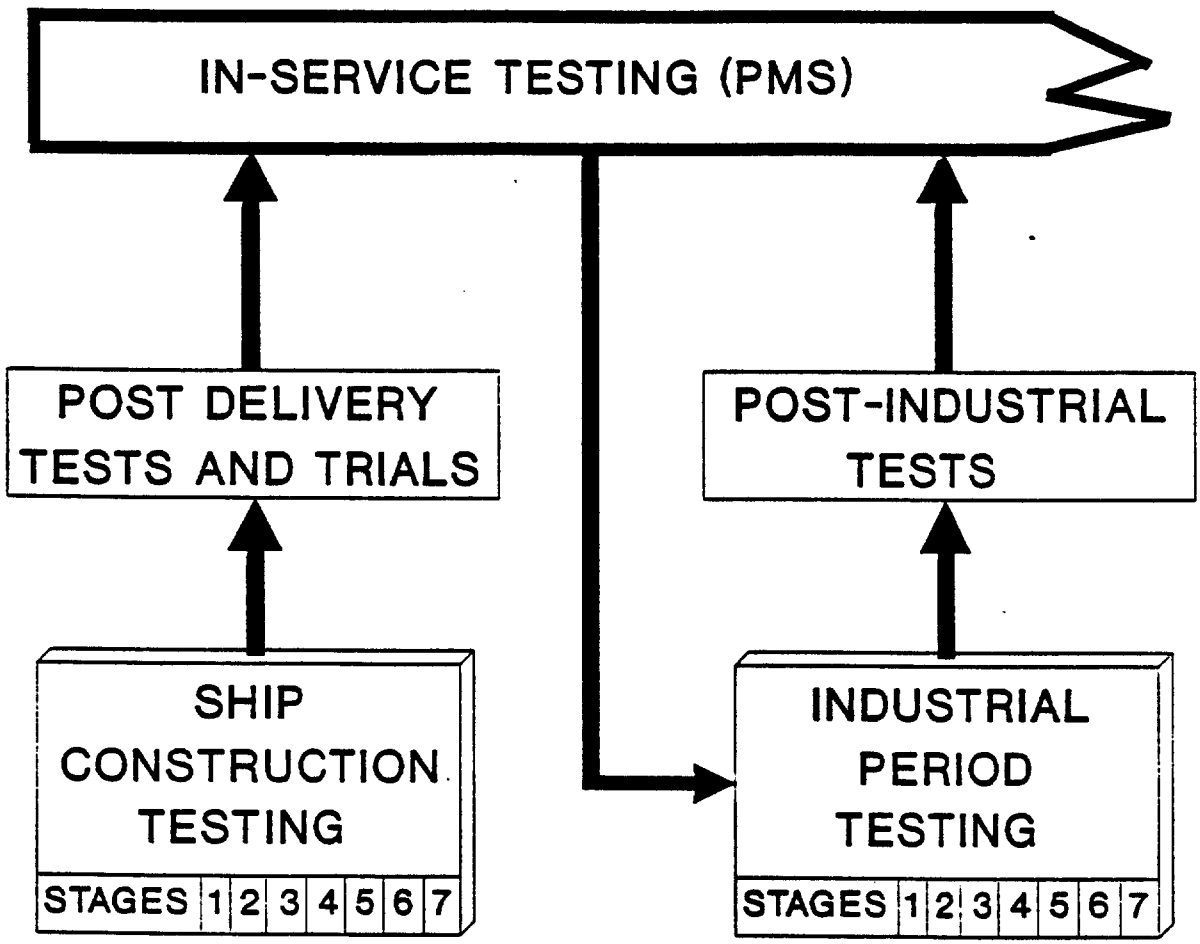

FIGURE 1-1

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CHAPTER 2

TESTS AND TRIALS OF SHIPS DURING CONSTRUCTION

(NOTE: This chapter supersedes NAVSEA 0900-LP-095-2010, Ship Construction Tests and Trials Manual, of April 1977. See paragraph 1.2. Any contracts that invoke provisions of NAVSEA 0900-LP-095-2010 at the time this manual is issued do not need to be modified.)

2.1 **Introduction**. For the construction or conversion[1] (hereafter referred to only as construction, for the sake of brevity) of each class of ships, the Ship Program Manager (SPM) in NAVSEA, Direct Reporting Program Managers (DRPMs) and Program Executive Officers (PEOs), (hereafter referred to only as SPMs for the sake of brevity) establish a ship test program which provides assurance of compliance with hardware/software technical requirements and assesses material readiness for fleet operations. Participating Managers (PARMs) in the SYSCOMs, DRPMs and PEOs shall provide necessary support to the ship test programs.

2.2 **Methodology**. The following is the methodology to be used in each ship class test program:

a. System (hardware and computer program) interfaces not previously tested and verified are tested and verified at other installations if available (either at land-based test sites or on surrogate ships), before the start of testing on a ship. In addition, when deemed cost effective by the cognizant SPM, a production test site is used for integration testing and grooming of hardware and computer programs before installation in each ship.

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[1] i.e., those primarily funded from the Shipbuilding and Conversion, Navy (SCN) appropriation.

2.2 Methodology (Continued).

b. Test requirements in ship construction specifications use a bottom-up building block approach. This approach is reflected in the test stages in Appendix D.

c. Test Procedures (TPs) shall reflect requirements of ship test specifications. DOD-STD-2106 (NAVY) provides excellent guidance for the engineering and formatting of test procedures. Existing Navy-owned TPs are available from the repositories listed in paragraph 2.5.b.(1).

d. The total ship Integrated Test Package (ITP) is engineered and conducted to ensure ship construction is completed in accordance with the contract and the ship is ready for trials by the Board of Inspection and Survey. The ITP consists of a Test Index (TI), TPs, and a Test Sequence Network all of which will be covered in detail in later sections of this chapter. The shipyard and Naval Supervising Authority (NSA) (Supervisor of Shipbuilding for private shipyards, Shipyard Commander for Navy Yards or Commanding Officer for Ship Repair Facilities) will use the conduct of the ITP as a tool for measuring progress during the industrial period.

e. Each SPM, with support of the PARMs, establishes a test organization to: provide continuous support through development of ship test requirements, perform testing when appropriate, review test results, and function as the ship manager's technical agent for systems tests.

2.3 Organization. Before the start of the shipyard test program, the SPM establishes a test development organization to manage the responsibilities described in Appendix D. A Total Ship Test Director (TSTD) and Test Development Directors (TDDs) are assigned. Test Development Managers (TDMs) and Test Development Agents (TDAs) are identified and tasked. The SPM may find it necessary to issue a Ship Test Management Plan (STMP) to identify these participating organizations; to document their authority, responsibilities, and working relationships; and to publish test schedules. The SPM tasks (through Ship Project Directives (SPDs)) each PARM to designate technical support organizations, to identify the points of contact for the development and revision of TPs and to designate individuals with the authority to verify the adequacy of proposed test problem resolutions. Because of the potential disruption of the shipyard's production effort, the technical support organizations are expected to resolve such test problems expeditiously, and should therefore maintain the appropriate expertise readily available to apply to such problems.

2.4 Test Documentation in the Shipbuilding Contract.

a. Government and Shipyard Responsibilities. In general, the government provides the TPs covering the systems it supplies; and the private shipyard, the TPs for the systems it supplies. Specifically:

(1) The government shall provide the TPs to be used by the shipyard for Government Furnished Equipment (GFE), and the interfaces between GFE and Contractor Furnished Equipment (CFE) for which the design has been specified by the government.

2.4 Test Documentation in the Shipbuilding Contract (Continued).

(2) For CFE, the shipyard develops the TPs based on the Test Narratives (TNs) contained in the 095 section of the ship specifications. If the government already has TPs for systems that will be supplied as CFE, the SPM may provide these to the shipyard in lieu of contracting the shipyard to develop new ones. CFE TPs developed by the shipyard shall be written to the same level of detail, specifications and standards as GFE TPs.

(3) For interfaces between GFE and CFE, the government determines which TPs it will provide, and shall task the shipyard to prepare the remainder.

(4) To enable shipyard integration of test documentation into a cohesive ITP, each PARM must ensure the development of ship test documentation that conforms to the standardized requirements of this manual. The shipyard should be prohibited from deviating from the government test requirements, including government furnished test procedures, without prior approval of the NSA and concurrence of the SPM's technical representative.

b. Test Requirements in the Solicitation. To heighten the visibility of test requirements in the solicitation of bids for ship construction contracts and to facilitate development of coordinated and comprehensive test programs, the test requirements to be met by shipyards are consolidated into a centralized part (Sections 092, 094, and 095) of the shipbuilding specifications and a supplemental Test Documentation Booklet. For ships built to commercial standards, the applicable government test requirements are contained in Sections 101 and 101A of the specifications. The test requirements are invoked as follows:

2.4 Test Documentation in the Shipbuilding Contract (Continued).

(1) Section 092 - General Requirements for Test and Evaluation. This section states the general requirements for the execution of the test program to be conducted by the shipyard. Section 092 invokes the applicable requirements of this manual on the shipyard, and commits the government to its related responsibilities.

(2) Section 094 - Ship Trials. This section contains all general requirements for sea trials conducted during the construction period, but does not specify the individual tests to be conducted by the shipyard during trials. The specific test requirements for trials are included in Section 095.

(3) Section 095 - Test Narratives (TNs). This section contains TNs which are prose descriptions of the testing necessary for the shipyard to demonstrate compliance with technical requirements in sections of the ship specifications. The TNs shall be written in enough detail to indicate the performance requirements the government wants demonstrated. Each TN is cross-referenced with the specification section containing the associated technical requirements. The TNs are the basis upon which the shipyard-responsible test procedures are developed. Section 095 also describes any testing to be conducted by the government, and the shipyard support required for those tests. The TSTP Test Narrative Guidance Document, NAVSEA T9095-AA-DOC-010, of 22 May 90, provides detailed guidance for developing TNs.

(4) Test Documentation Booklet (TDB). This document supplements Sections 092, 094, and 095 of the ship specification. It contains the Test Index (TI), Test Outlines (TOs) (for which detailed TPs will be provided later by the government), and TSNs.

2.4 Test Documentation in the Shipbuilding Contract (Continued).

The TDB should not be a contractual document which would require updating throughout the contractual time frame. Each TO, which will eventually become the front matter for the test procedure provides the general description of a test. The TOs are provided to the bidders to allow them to scope the test requirements for GFE, for use in cost estimating, and to accomplish early planning for scheduling of resources.

(5) Contract Data Requirements List (CDRL) and Data Item Descriptions (DIDs). CDRLs and DIDs define the format, content, delivery dates, approval authority and distribution of test documentation which the shipyard must submit to the government. A list of sample test program related DIDs is listed in Appendix B. The DIDs should be tailored to reflect TSTP requirements.

c. Sequence of Tests. When successful completion of any test is a prerequisite for starting another test, that sequence must be clearly reflected in the TOs and TPs to be contractually invoked on the shipyard. The shipyard provides the test schedule reflecting those prerequisites to the NSA for review before the start of testing. TSNs are treated as supplementary to the information on prerequisites specified in TOs and TPs, and are provided to the shipyard for guidance only.

2.5 The Integrated Test Package (ITP). The shipbuilder is responsible for the ITP which consists of the TI, TPs and TSNs that define the test program, including Builder's and Acceptance Trials, to be conducted during construction of each ship. Test documentation for GFE is provided to the shipyard by the government; and test documentation for CFE is normally provided by the shipbuilder. The ITP consists of the following:

a. Test Index (TI). The TI is a list, by test number and title, of shipboard tests to be conducted and the activity responsible for conduct of each test. The TI also indicates test procedures to be furnished by the government and those to be furnished by the shipyard.

b. Test Procedure (TP). A TP is a step-by-step description of the operations to be performed during the conduct of a specific test. It includes: a signature cover page, revision record, outline (objective, estimated test time, references, test support equipment, computer programs required, prerequisites, special conditions, equipment involved, configuration, method, station assignments, additional instructions), set-up conditions, test steps, data recording pages with pass/fail criteria, and special instructions. Each TP shall be a stand-alone document, with the possible exception of a separate appendix which might contain system set-up and securing instructions. TPs should not require reference to other documents while the test is being conducted. TPs shall not contain or depend upon any information that is proprietary to any shipyard or equipment supplier. The standard system for numbering TPs is described in Appendix F.

2.5 **The Integrated Test Package (ITP) (Continued).**

(1) Government Furnished Test Procedures. As described in paragraph 2.4 a., the government provides TPs to the shipyard for use with GFE. The shipyard is contractually required to use these TPs. The test development organization uses or modifies as necessary existing TPs that satisfy the requirements of this manual, if they are available. Existing TPs should be obtained from the following test repositories:

Surface Ships: Naval Surface Warfare Center, Port Hueneme DIV, (NSWC PHD), Port Hueneme, CA (Combat Systems only)

Submarines: Submarine Maintenance Engineering, Planning and Procurement (SUBMEPP), Portsmouth, NH

Newly developed TPs shall be provided to the appropriate repository for future use.

(2) Verification of Government Furnished Test Procedures. When possible, government furnished TPs should be verified through step-by-step performance prior to delivery to the shipyard. The verification process contains the feasibility, safety, accuracy and efficiency of a TP through its conduct on a system known to be properly performing aboard a ship, in a land-based test site, or in an industrial plant. When verification before delivery to the shipyard is not feasible, the conduct of these TPs on the lead ship shall be treated as the verification. The PARMs must keep a record of which TPs for their systems have been verified. Regardless of verification status, the technically responsible government organization shall sign each TP to indicate Navy authorization for the shipyard to use it.

2.5 The Integrated Test Package (ITP) (Continued).

(3) Production Land-Based Test Sites. Land-based test sites (paragraph 2.2 (a)) are used for hardware/software grooming before shipboard installation, and test procedure verification before industrial testing. This verification is generally more cost effective than shipboard verification and can be performed early in the production cycle. Use of land-based test sites reduces the schedule risk associated with conducting testing on the ship during construction and provides early identification of hardware/software and test documentation problems. The same TPs planned for the ITP should be used at the test site.

c. Test Sequence Network (TSN). A TSN is a flow chart depicting the order in which tests should be performed. Test interdependence is shown by indication of which TPs are prerequisites to others. TSNs can indicate ship service requirements e.g., air, HVAC, cooling, water. TSNs do not show dates nor schedules, only test relationships.

2.6 Comprehensive Test Plan. The shipyard submits a Comprehensive Test Plan (CTP) for review and approval before the start of testing. This plan describes the shipyard test program's compliance with the contract and demonstrates that its interface with the government's test program is adequate. The approval authority for this plan is the SPM. The CTP shall include: a description of the shipyard's test organization and its interface with the SPM's test organization, an index of and schedule for the development and verification of test documentation for which the shipyard has responsibility, a preliminary schedule of all testing (including GFE), and a description of the test problem reporting and resolution system. If the schedules for testing or for the development

2.6 Comprehensive Test Plan (Continued).

of tests are included in other documents to be delivered to the government under the terms of the contract, those schedules should be referenced in the CTP rather than actually included, to reduce the impact and potential confusion when revisions must be made.

2.7 Review of Shipyard Furnished Test Documentation. The government test development organization provides assistance to the NSA in reviewing shipyard furnished test documentation for technical adequacy, contract compliance, and compatibility with government furnished test documentation.

2.8 Conduct of the Ship Test Program.

a. Progressing by the Test Program. The shipyard and the NSA should use the test program to measure progress during the construction period. Each TP is intended to be performed on operable equipment. After installation, inspections, set-up and grooming (that are prerequisites to a test) are properly completed, the test completions are the indicators of progress towards a completed ship delivery.

b. Test Documentation Change Control. Test documentation (TIs, TOs, TSNs and TPs) shall be developed to correspond to the configuration of the system (hardware/software) as it will be installed and tested on the ship. The documentation must be controlled to maintain that correlation if the system is modified. The SPM and system managers shall establish formal procedures for controlling changes to test documentation throughout revisions, verifications and use. These procedures shall ensure that proposed changes receive proper reviews and that, when approved, they are distributed to all cognizant organizations. The vehicle for

2.8 Conduct of the Ship Test Program (Continued).

processing changes before a TP is used for testing, is the Test Change Proposal (TCP). The form is provided in Appendix G. The vehicle for processing changes as a result of testing is the Test Problem Reporting and Resolution (TPRR) form which is provided in Appendix H.

c. Government Witnessing of Testing. The shipyard shall notify the NSA of the date and time that tests are to be performed to allow planning for witnessing by a government representative. This notification shall be provided sufficiently in advance to allow planning for travel by personnel from remote organizations that may be required to support witnessing. Although not always possible, the NSA should strive to have a government representative witness 100% of TPs conducted. Problems must be expeditiously resolved and reported, and test results must be properly documented and reported. The NSA should use members of the Test Task Group/Joint Test Group (see paragraph 2.8.e) or get other services to support test witnessing.

d. Test Problem Reporting and Resolution (TPRR) System. For each ship test program, a TPRR system shall be established at the shipyard. The TPRR system shall consist of a formal process for timely identification and resolution of problems that occur during testing and closed-loop reporting of corrective actions to prevent recurrence on future ships. A reportable problem exists when any portion of a TP cannot be satisfactorily completed as scheduled because of procedural discrepancies, tolerance deviations, or hardware/software discrepancies. A TPRR form (Appendix H) shall be used to document such problems.

2.8 Conduct of the Ship Test Program (Continued).

The TPRR process should be reserved primarily for technical problems impacting the TP and not be used to suggest editorial changes to government-furnished documentation or report or obtain waivers from ship or system specifications.

(1) The NSA shall coordinate the local accomplishment of government responsibilities during the operation of the TPRR system. When a reportable problem is uncovered, the NSA shall make every effort to resolve the problem locally using the engineering services provided on-site, and verify correction with the cognizant government technical support organization for that system if applicable. TPRR forms shall be forwarded to the cognizant government technical agent for final resolution and feedback to the appropriate repository even though the problem received a local interim solution. When formal assistance is required from remote organizations, the NSA should refer the problem (by the TPRR form) to cognizant organizations previously identified by the SPM to provide such support, assigning a response time based on the severity and impact of the problem.

(2) The NSA shall ensure that recommended changes to the test documentation are provided to the cognizant TDD, TDM, or TDA. The TDD shall review the recommended changes and the TDA/TDM comments, and upon agreeing with the recommended resolution(s) shall incorporate the revised test procedures into the applicable Navy ship test repository, to be incorporated into the test documentation for other ship programs with the same systems.

(3) PARMs shall plan, budget, and fund their engineering support organizations in advance to respond to the TPRR system for each ship program.

2.8 Conduct of the Ship Test Program (Continued).

e. Test Task Group/Joint Test Group. For ships with a significant amount of GFE, the SPM should establish a requirement in the specifications for a Test Task Group (TTG) or Joint Test Group (JTG) at the shipyard during conduct of the ITP. The primary purpose of either group is to expedite communications among the major participants. The composition of each group will vary with the schedule, but in general should include representatives of the NSA, the Local Test Development Director (LTDD), system contractors, technical agents, the shipyard and ship's force. The government members of the group operate under the administrative control of the NSA and augment the technical expertise of its organization. Their parent organizations may impose tasks, including reporting duties, that do not interfere with the NSA's responsibilities. If the potential for misunderstanding exists, a memorandum of agreement between the NSA and the test group member's parent organization should be developed.

f. Ship's Force Participation in Testing. When provided for in the contract, the nucleus crew shall participate in selected tests and trials to achieve a smoother transition of ship operation and maintenance from the shipyard to the government. If the SPM plans to use this concept, it must be coordinated with the Bureau of Naval Personnel to effect an earlier availability of the nucleus crew and to arrange special training.

g. Test Reports. A test report is the test procedure and test data sheets with the data filled in, signatures affixed, and test data approved by the government (unless additional requirements are specified for a particular test). The shipyard and the NSA shall establish a test report review and sign-off process that ensures traceability for each test report.

2.8 Conduct of the Ship Test Program (Continued).

h. Certification of Readiness for INSURV Trials. Before presenting the ship for Acceptance Trials, Underway Trials or Combined Trials by the Board of Inspection and Survey (INSURV), the NSA must certify that, among other things, the required tests and trials were completed satisfactorily and the ship is ready for INSURV trials. The requirements for this certification are contained in OPNAVINST 4700.8 (series) and Appendix 20B of the Ship Acquisition Contract Administration Manual, NAVSEA 0900-LP-079-6010. The NSA shall get a waiver from the SPM to make such a certification with tests previously identified as prerequisites not yet successfully completed.

2.9 Post-Delivery Tests and Trials (PDT&T). After delivery of the ship, a period of tests and trials is conducted to confirm the design capabilities and limitations of the ship, to bring the ship from a state of contractual completion to one of full material readiness, and to identify latent discrepancies that qualify for correction under the guarantee provisions of the contract. Because of the diversity of testing, the limitations in the availability of fleet services and the extent of resources required, it is essential that the SPM ensure maximum coordination among the PARMs and their agents. Likewise, these tests and trials must be coordinated as early as possible with the Type Commander and the ship so that the most effective and efficient scheduling with shakedown and other operational commitments can be achieved. That portion of these tests and trials that have as their objective the at-sea verification of material readiness supplement the ITP conducted during the industrial period. As such, they are to be treated as a part of the ship test program and they shall build upon and be traceable to the ITP conducted during the industrial period.

2.10 **Follow-on Ship Testing**. The SPM, PARMs, and other support organizations shall assess the test requirements for possible reductions on follow-on ships.

2.11 **Test Documentation for Later Industrial Periods**. As part of each ship acquisition program, the SPM funds the TDA to transfer the new construction test package into the appropriate NAVSEA repositories for active fleet ships. Paragraph 2.5.b.(1) identifies those repositories. In addition to the test procedures in the ITP, this effort includes, for systems and equipment for which they are not already available, the preparation of signature completion pages and data sheets, and the assignment of NAVSEA test numbers (in accordance with Appendix (F)) for PMS-based tests that could later be used in industrial availabilities for that ship class. Paragraph (3.5 b.) discusses the use of PMS-based tests during such availabilities.

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CHAPTER 3

TESTS AND TRIALS OF ACTIVE FLEET SHIPS DURING INDUSTRIAL AVAILABILITIES

3.1 **Introduction**. The scope of testing will vary considerably from one industrial availability to another, depending on its length, the specific items in the authorized work package, and the impact of the work on integrated system operations. The objectives in applying the Total Ship Test Program (TSTP) principles in an industrial availability are to provide a test program that will effectively and efficiently assure that the work performed by all organizations was properly completed and to assess the ship's readiness to perform its mission. Ship Program Managers (SPMs) and Type Commanders (TYCOMs) must closely coordinate both long-term and short-term test planning to ensure the most judicious use of resources.

3.2 **Methodology**.

a. Total Ship Test Requirements (TSTRs) is a complete list of test requirements, including Test Procedures (TPs), by number and title, the number of times the particular test should be conducted as part of each work line item, the organization recommended to conduct it, and a cross-reference to the related item in the work package. After the work package and scope of testing for the industrial availability are defined at the Work Definition Conference, and after any updates are provided by those organizations tasked to provide them (e.g., SYSCOM field organizations or the ship class Planning Yard), Planning Engineering for Repairs and Alterations (PERA) or SUBMEPP publishes the authorized TSTR as part of the authorized work package for the industrial availability.

3.2 Methodology (Continued).

The TSTR should be engineered to assure material readiness of the ship's equipment at the end of the industrial availability. Therefore, it may not necessarily be limited to the systems being installed, overhauled or repaired. Before the start of the availability, the SPM and TYCOM must authorize and fund any testing beyond that needed to verify shipyard work.

b. The TPs used in Integrated Test Packages (ITPs) should be ones which assure compliance with technical requirements, and should have been verified through prior use, when possible. In support of having the test procedures readily available, SYSCOM Program Managers for selected equipment/systems are responsible for development and maintenance of standard TPs and for provided them to the applicable test repositories.

c. Test Development Directors (TDDs) shall develop well engineered and integrated test packages.

d. Tasking, funding, and organizational relationships are maintained to support the development, control, and maintenance of test documentation used during ship availabilities.

e. Although not always possible, the Naval Supervising Authority (NSA) (Supervisor of Shipbuilding for private shipyards, Shipyard Commander for Navy Yards or Commanding Officer for Ship Repair Facilities) should strive to have a government representative witness each TP conducted. Problems must be expeditiously resolved and reported in accordance with TPRR, and test results must be properly documented and reported.

3.2 Methodology (Continued).

f. All tests conducted during the industrial availability must be treated as part of the test program. This includes those tests that are conducted by certification teams, ship's force, and the shipyard (i.e., public or private shipyard or repair facility). Any work accomplished by Alteration Installation Teams (AITs) or Intermediate Maintenance Activities (IMAs) must be well documented so that tests necessitated by such work can be added to the TSTR and test procedures can be included in the ITP.

3.3 Organization. Appendix C summarizes the test execution responsibilities of the major participants in ship availabilities. Appendix E describes the interrelationships of those organizations specifically tasked in selected cases to support the preparation of the related test documentation. SYSCOMs and other sponsors must provide tasking and funding for the participants to provide the necessary test documentation, to engineer the test program requirements, to conduct testing when required, and to expedite test problem resolution.

3.4 Development of Industrial Test Requirements.

a. Scope of Testing. For an availability which includes alterations of shipboard systems, PERAs and SUBMEPP will develop a systems-engineered preliminary TSTR (or equivalent) document, forwarded as part of the preliminary availability work package. For surface ships, NAVSEA tasks NSWC PHD to provide the combat systems portion of the TSTRs; PERA or the Planning Yard must obtain the concurrence of NSWC PHD to revise their inputs. The preliminary TSTR is NAVSEA's recommended scope of testing based on

3.4 Development of Industrial Test Requirements (Continued).

the objectives of verifying proper work completion and assessing material readiness. The following are benchmarks for preparing the preliminary TSTR:

(1) For short industrial availabilities, normally less than 120 days, Stage 3 equipment testing and Stage 4 intrasystem testing are scheduled only for systems being overhauled or repaired, or receiving Ship Alterations (SHIPALTs), Ordnance Alterations (ORDALTs) or Field Changes (FCs). Selected additional Stage 4, Stage 5, Stage 6 and 7 testing may be necessary to check interfaces disconnected or changed, and to determine intersystem operability and ElectroMagnetic Compatibility (EMC).

(2) For longer industrial availabilities, testing requirements increase proportionally with the length and complexity of the work package. In the combat system area, selected Stage 3 through 7 tests are usually necessary. Ship system requirements include Stage 3 through 7 testing which supports the work package, Light-Off Examination, Dock Trials, and Sea Trials.

When the industrial work package does not include Title K ship alterations (K-alts), the TYCOM should consider funding the development of a Combat System ITP (CSITP) to obtain the most current system and equipment test procedures. Without an engineered CSITP, the results of the test program may not necessarily be considered a complete indicator of ship material readiness.

3.5 Conduct of Testing.

a. The Integrated Test Package (ITP). The ITP is the complete set of TPs to be conducted during an industrial availability. The final assembly of the ITP is the shipyard's responsibility, in accordance with the contract or project order. The ITP consists of the Test Index (TI), TPs, and TSNs that defines the test program for the industrial availability.

(1) Test Index (TI). The TI is a list by test number and title of the tests to be conducted and the activity responsible for conduct of each test.

(2) Test Procedure (TP). A TP is a step-by-step description of the operations to be performed during the conduct of a specific test. It includes: the set-up conditions, the pass/fail criteria, signature page and data recording pages and instructions. Each TP shall be a stand-alone document, to the maximum extent practicable. With the possible exception of a separate appendix which should contain system set-up and securing instructions, TPs shall not require reference to other documents while the test is being conducted. A standardized format and engineering process used in developing a TP is contained in DOD-STD-2106 (NAVY). TPs shall not contain or depend upon information that is proprietary to any private shipyard or equipment supplier. The standard system for numbering TPs is described in Appendix F. Separation by test stages (Appendix D) and the standard numbering system shall be used in all availabilities for standardization and traceability.

(3) Test Sequence Network (TSN). A TSN is a flow chart of the order in which tests are recommended for accomplishment. Test interdependence is shown by indications of which tests are prerequisites to others. TSNs do not show dates or schedules.

3.5 Conduct of Testing (Continued).

b. Government-Furnished Portion of the ITP.

The ITP is to be treated by all involved in preparing or conducting portions of it as an integrated entity and any change must be reviewed for possible impact on the whole. The contract or project order may require the conduct of certain TPs by Navy organizations. Usually combat system TPs are furnished by Navy organizations. The responsible Test Development Activity (TDA) maintains the TPs to match the configurations of the systems, and provides them to the appropriate Navy test repository in time to support ship industrial availabilities. The repositories are:

COMBAT SYSTEMS:

Surface Ships:

Naval Surface Warfare Center, Port Hueneme Division, (NSWC PHD), Port Hueneme, CA;

Submarines:

Submarine Maintenance Engineering, Planning and Procurement (SUBMEPP), Portsmouth, NH.

HM&E:

PERA (Surface) Philadelphia

In addition, TPs for selected (HM&E) Systems are available from Carderock Division Naval Surface Warfare Center Philadelphia (surface ships). When new TPs are developed, they should be verified, when authorized, through step-by-step performance in systems installed in land-based test sites and surrogate ships before delivery to a shipyard. The verification process is an evaluation of the feasibility, safety, accuracy and efficiency of a TP through performance aboard ship, in a land-based test site, industrial plant or any appropriate facility. The TPs used at the test site should be the same ones included in the ITP. When

3.5 Conduct of Testing (Continued).

verification before delivery to the shipyard is not feasible, the conduct of these TPs on the lead ship shall be treated as the verification. The Participating Managers (PARMs) in each SYSCOM shall keep a record of which TPs for their systems are verified for use in shipboard testing. Regardless of verification status, the technically responsible government organization shall sign each TP to indicate its adequacy to achieve the test objectives.

NAVSEA policy requires maximum use of tests from the Planned Maintenance System (PMS) during the routine testing events of a ship's life that include ship's force participation. For testing during an industrial availability (other than construction), PMS tests should be used as long as they support the technical objectives of the test program, i.e., they measure performance in a way that provides assurance the ship and systems are materially capable of performing their missions. To use a PMS-based test during an industrial availability, a signature cover page, general information paragraphs, data sheets, test equipment calibration page and comment sheets are added by the cognizant TDA to enable test planning and the recording of actual performance compared to acceptance tolerances; NAVSEA test numbers (Appendix F) should be assigned. PMS tests should be modified to test the scope authorized for the availability. When major changes are made to a system during the availability, the depth of testing typically contained in PMS will usually not be adequate. In this case, tests other than or in addition to the PMS tests should be used. Judgments regarding the adequacy of combat system tests are the responsibility of the cognizant In Service Engineering Agent (ISEA), in consultation with the TDD. For purposes of ship maintenance,

3.5 Conduct of Testing (Continued).

ship's force may take credit for PMS-based tests completed satisfactorily as part of the test program that have a PMS equivalency, even if not conducted by ship's force.

c. Progressing by the Test Program. The private shipyard and the NSA should use the test program as a tool for measuring progress during the latter part of the industrial availability. When the industrial work that is prerequisite to a test has been completed, the start of tests, technical problems encountered, and test completions together are indicators of progress towards the completion of the work package. Such indicators should be used as both quantitative and qualitative measures in status reporting. DOD-STD-2106 (NAVY) was issued in part to enable better measurement of progression through the test program. The ability to use the test program for progressing also necessitates that it be conducted efficiently, with all prerequisites (industrial work, grooming, other tests), completed before formal testing starts. Ship's force is responsible for bringing equipment out of Inactive Equipment Maintenance (IEM) in sufficient time to support Stage 4 and 5 testing.

d. Government Witnessing of Testing. Testing shall be witnessed, on a selective basis, by personnel not responsible for conducting the test. In private shipyards, this witnessing shall be accomplished by a government representative. The shipyard shall provide notification of the date and time testing is to be performed sufficiently in advance to allow planning for travel by personnel from remote organizations that are required to support witnessing.

3.5 Conduct of Testing (Continued).

e. Test Problem Reporting and Resolution (TPRR) System. For each ship availability, a TPRR System should be established, consisting of a formal process for timely identification and resolution of problems with government-furnished TPs that occur during testing, and closed-loop reporting of corrective actions to prevent recurrence on future ships. A TPRR Form (Appendix H) should be used to document such problems. Use of the TPRR System should be reserved for technical problems only and not be used to identify equipment configuration changes or to suggest editorial changes to government furnished documents. The NSA should coordinate accomplishment of the government's responsibilities for operation of the TPRR System. The NSA should make every effort to locally develop interim solutions to problems with TPs and then obtain the applicable TDA's concurrence with those solutions. System managers should clearly designate their TDAs, and regularly identify points of contact therein to the NSA. Because of the potential for disruption of the shipyard's production effort, the TDAs should respond to test problems expeditiously, and shall maintain the appropriate expertise readily available. Responses to routine test problem reports should be as soon as possible, but not later than 30 calendar days; responses to urgent test problem reports should be made within the time frame set by the NSA, in coordination with the TDA and ISEA. System managers must ensure that funding is in place to support such responses. The NSA shall implement a process to track test problem reports and their resolutions.

The NSA shall ensure that any corrections made to government-furnished TPs are provided to the cognizant organizations so they can be incorporated into the documentation for follow ships of the class and for other ship test programs.

3.5 Conduct of Testing (Continued).

f. Test Task Group/Joint Test Group. A Test Task Group (TTG)/Joint Test Group (JTG) may be established at the shipyard during the conduct of the ITP to expedite communications, augment technical expertise and to support local resolution of test problems. The test group may be established for the total ship, or have more limited responsibilities, such as the combat system, depending on the complexity of the industrial availability. Also, there may be two different groups, one for the combat system and one for ship systems. The composition of these test groups will vary with the testing schedule. The primary test group members should be from the organizations of the NSA, the shipyard (and/or its Master Ordnance Repair sub-contractor, if involved), ship's force, the Local Combat Systems Test Development Director (LCSTDD) and Local Ship System Test Development Director (LSSTDD), if assigned. See Appendix E, paragraph 3.e, for a description of LCSTDD and LSSTDD functions. The government members of the group shall function under the administrative control of the NSA or the engineering organization of the Naval shipyard, augmenting its technical expertise. Parent organizations of the individual group members may impose tasks, including reporting duties that do not interfere with the NSA's responsibilities. If the potential for misunderstanding exists in defining responsibilities, a memorandum of agreement between the NSA and the group member's parent organization should be implemented.

g. Ship's Force Participation in Testing. Ship's force conducts the TPs assigned to them by the TYCOM at the Work Definition Conference. For the ship test program to be effective, this conference must take into consideration the capability of ship's force, as well as the expected availability of key members. In general, TPs at the higher stages (7, 6, 5 and some 4) should be

3.5 Conduct of Testing (Continued).

reserved for accomplishment by the shipyard (this does not preclude ship's force operation of the equipment during such shipyard-directed tests). Ship's force should assign a test coordinator to manage ship's force testing, to act as a member of the test group, and to assign personnel to witness tests.

h. Test Reports. A test report is a copy of the test procedure with the data filled in, signatures affixed, and test data approved by the government (unless additional requirements are specified for a particular test). Copies of each test report should be furnished to the ship and the NSA; the report should be retained by the NSA for a minimum of 2 years. The shipyard and the NSA should establish a consistent test report review/sign-off process for all programs in that shipyard to ensure traceability for each test report.

3.6 Test Program Completion Report.

At the completion of the industrial availability, the NSA shall verify by letter to the TYCOM and NAVSEA that the authorized test program has been successfully accomplished. The letter shall also indicate that waivers for tests not accomplished have been obtained from the SPM or the TYCOM, whichever is the source of the test requirement. As a minimum the report shall address the following:

a. Ship hull, type industrial availability, and start and completion dates.

3.6 Test Program Completion Report (Continued).

b. Summary of test procedures attempted:

c. Test Status Categories (see Figure 3-1)

(1) TPs completed satisfactorily.

(2) TPs completed with major discrepancies (TPs completed with discrepancies that impact overall operation of equipment and degrades ship's mission). Planned/recommended corrective action should be included.

(3) TPs completed with minor discrepancies (TPs completed with discrepancies that do not impact overall operation of equipment or degrade ship's mission). Planned/recommended corrective action should be included.

(4) TPs incomplete (TPs which were started but unfinished for reasons not due to fault/failure within the system under test). Planned/recommended corrective action and retest requirements should be included.

(5) TP failures (TPs which were started but were interrupted/terminated due to a fault/failure within the system or subsystem under test). Planned/recommended corrective action and retest requirements should be included.

d. List of unresolved Test Problem Reports.

e. Status of required system certifications.

3.6 Test Program Completion Report (Continued).

	NUMBER COMPLET-ED SAT	NUMBER COMPLETED WITH MAJOR DISCREPAN-CIES	NUMBER COMPLETED WITH MINOR DISCREPAN-CIES	NUMBER INCOMP-LETE	NUMBER OF FAILU-RES
SHIP'S FORCE					
CONTRAC-TOR					
GOVERN-MENT					
TOTALS					

TEST STATUS CATEGORIES

Figure 3-1

3.7 Post-Industrial Testing.

Tests conducted after the industrial availability to retest equipment, verify equipment fixes and complete verification of ship and system operability shall be planned to build upon the ITP. Tests should be accomplished during the availability unless the costs preclude such conduct and the tests can be effectively conducted afterwards. Post-industrial testing should be minimized to lessen the impact on the ship's operational commitments. Tests during this period should use PMS Maintenance Requirement Cards when they are adequate to satisfy the objectives of the test.

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APPENDIX A

REFERENCES

DOD

DOD-STD-2106 (NAVY) - Development of Shipboard Industrial Test Procedures

MIL-P-24534A (NAVY) - Planned Maintenance Documentation Development Specifications

OPNAV

OPNAVINST 4700.8 Series Subj: Trials, Acceptance, Commissioning, Fitting Out, Shakedown and Post Shakedown Availability of U.S. Naval Ships Undergoing Construction/Conversion/Modernization

NAVSEA

NAVSEAINST 3960.2 Series - Test and Evaluation

NAVSEA 0900-LP-079-6010 - Ship Acquisition Contract Administration Manual (SACAM)

NAVSEA 0900-LP-095-3010 - Post Delivery Tests and Trials Guidance Manual

NAVSEA 0900-LP-095-4010 - Ship Test and Evaluation Planning Guide

NAVSEA 0900-LP-095-5010 - Ship Acquisition Test and Evaluation Budgeting Guide

NAVSEA 0900-LP-095-6010 - Land Based Test Site Planning Guide

NAVSEA 0924-062-0010 - Submarine Safety Requirements Manual

APPENDIX A

REFERENCES (Continued)

NAVSEA S9040-AA-GTP-010/SSCR - Shipboard Systems Certification Requirements for Surface Ship Industrial Periods (Non-Nuclear),

NAVSEA S9AA0-AA-SPN-010/GEN SPEC - General Specifications for Ships of the United States Navy

NAVSEA S9AA0-AB-GOS-010/GSO - General Specifications for Overhaul of Surface Ships

NAVSEA T9095-AA-DOC-010 - TSTP Test Narrative Guidance Document

Ship Test and Evaluation Program Standard (STEPS) #1 - Combat System Level Tests for Surface Ships, of 7 May 84

STEPS #2 - Anti-Submarine Warfare (ASW) Systems Test Program, of 15 Jul 86 (also catalogued as NAVSEAINST 3360.1)

STEPS #3 - Sonar Certification Program, of 10 Sep 86 (also catalogued as NAVSEAINST 9460.5A)

STEPS #4 - Responsibility for Active Fleet Surface Ship Combat System Industrial Test Procedures, of 21 Apr 87

STEPS #5 - NAVSEA Policy for Surface Ship Certification Requirements for Industrial Periods, of 12 Aug 88

STEPS #6 - Submarine Weapon Handling and Launcher System Certification, of 3 May 90 (also cataloged as NAVSEAINST 9750.1)

STEPS #7 - NAVSEA 0900-076-7010 Revision C, Standardized Combat System Test Program SSN and SSBN Submarines

APPENDIX B

SAMPLE LISTING OF TEST PROGRAM DATA ITEM DESCRIPTIONS

Ship Acceptance Test Index

Ship Test Problem Report

Ship Acceptance Test Report

Notification Of Tests

Booklet Of Ship Test Reports

Comprehensive Test Plan

Ship Acceptance Test Schedule

Ship Test Status Report

Test Change Proposal

Ship Trial Agenda

Ship Trial Report

Ship Test Sequence Network

Breakdown Diagram

Interface Analysis Record

Test Element List

Ship Test Outline

Shipboard Industrial Test Procedure

Verification Analysis Record

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APPENDIX C

SUMMARY OF RESPONSIBILITIES

1. **Introduction**. The following is a summary of the responsibilities of the major participants in the conduct of a test program in a ship industrial period/availability.

2. **The Ship Program Manager**. (With the assistance of Ship Design Managers, Combat System Engineers and the NAVSEA Test and Evaluation Office).

a. Establish a test program, based on this manual, for each class of ships.

b. Ensure that tasking and funding documents issued to program participants address the support of TSTP.

c. Ensure that the ship contract visibly reflects the proper technical test requirements.

d. Ensure continuity and traceability between the testing required during the construction/availability period and that required during the post-construction/availability period.

3. **NAVSEA, NAVAIR and SPAWAR Shipboard System Managers**.

a. Ensure timely completion of systems engineering, the conduct of development and operational testing, EM compatibility testing and the establishment of a stable product baseline, of systems being developed for shipboard installation and use.

b. Budget, fund and direct the development and maintenance of test documentation identified in this manual for each system.

c. Ensure verification of test procedures at the first opportunity. Each alteration and engineering change approved during the service life of a system must be accompanied by corresponding changes or new ship test documentation.

d. Provide engineering services, including participants in the test development organization (Appendix D) and personnel at the shipyard itself, as necessary to support each ship test program.

Ensure the necessary expertise is maintained and contractor or field organization personnel are identified to directly respond to TPRRs.

e. Develop, procure, distribute and maintain special test equipment and tools necessary to support TSTP.

4. **Naval Supervising Authority (NSA).**

a. Administer each ship test program in accordance with this manual, the Ship Acquisition Contract Administration Manual, and the contract.

b. Deliver the government test documentation to the shipyard, and coordinate government reviews of those documents. Deliver shipyard test documents to other government organizations.

c. Coordinate the interface of all government organizations with the shipyard.

d. Manage the government part of the TPRR System.

e. Chair the TTG/JTG in ship construction programs. The NSA may delegate the chair in individual cases.

f. Report to NAVSEA on the progress and completion of the ship test program.

g. Provide comments to the originators of test documents, as necessary. Obtain waivers in accordance with standard procedures.

h. Provide engineering services to support testing. Establish and administer test groups, as required.

i. Perform the functions of the LCSTDD (Appendix D, paragraph 3) for the industrial availabilities of active fleet surface ships. Maintain the necessary number of qualified people to perform the LCSTDD duties for ship industrial availabilities, or task other organizations to provide certified people as needed.

5. **Private Shipyard.**

Plan, manage, conduct and report on the ship test program in accordance with the contract.

6. **PERAs, SUBMEPP or the Ship Class Planning Yard.**

a. Publicize to the participants in the ship test program appropriate information on the planned work packages and the anticipated post-industrial configuration of the shipboard systems. Ensure, in coordination with those participants, that the TSTR document reflects that configuration.

b. Ensure authorized test requirements are reflected in the work package for the availability.

c. Maintain liaison with the NSA and the shipyard to determine the impact of changes in the work package on planning for the preparation and delivery of test procedures. Notify the cognizant government organizations of these impacts.

d. Manage the pre-availability materiel condition assessment program to define the test package for the TYCOM.

8. **Ship's Force.**

a. Assign a test coordinator to keep ship's force efforts integrated with those of the other government participants and the private shipyard, to manage the testing screened to it by the TYCOM and to participate as a member of the test group.

b. Being cognizant that ship's force is primarily responsible for all equipment in active fleet testing, assign qualified personnel to conduct tests assigned by the TYCOM.

c. Assign personnel to witness the conduct of tests as required.

9. **Type Commander.**

a. Authorize the conduct of the ITP during the industrial availability. Fund testing for TYCOM-assigned repairs and alterations.

b. Identify tests assigned for conduct by ships force.

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APPENDIX D

TEST STAGES

Seven stages separate testing into discrete levels. The definitions, and examples of tests in each stage, are provided in DOD-STD-2106. Each stage represents a higher level of operability than the preceding. The seven stages are:

Stage 1 - Material Receipt Inspection and Shop Tests[2]

Stage 1 provides for inventory management and physical inspection of all equipment and associated documentation; it is intended to ensure satisfactory receipt by the contractor of items such as equipment, components, spare parts, manuals, drawings, etc., and that the aforementioned items are of proper configuration and have not been physically damaged or lost in shipment. (Stage 1 will generally be covered by a quality assurance program.)

Stage 2 - Shipboard Installation Tests and Inspection

Stage 2 inspections and tests demonstrate installation in accordance with the requirements of the ship specification. Inspection and static tests to prove integrity, strength, and continuity are applied to foundations, cabling, sonar domes, piping, ventilation, air conditioning, switchboards, etc. Insulation resistance, VSWR and time domain reflectometer bench tests are included in this stage. The review of the locations of the optical systems, piping systems, etc., are also Stage 2 tests. (Stage 2 will be covered in part by a quality assurance program.)

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[2] Although receipt inspections are identified as Stage 1 of the test program, few of them are performed through the use of test procedures. They are covered by the Quality Assurance (QA) program invoked in the contract. This applies to many Stage 2 requirements also. The shipyard must ensure traceability between the QA program and the TSTP, including well defined instructions for the turnover of equipment from QA personnel to test personnel.

Stage 3 - Equipment Tests

Stage 3 tests demonstrate that the individual equipment and groups of equipment meet their design parameters and perform within the limits and tolerances required by the ship specification after shipboard installation. Included are equipment and safety checks to be conducted prior to equipment operation, as well as initial light-off tests.

Stage 4 - Intrasystem Tests

Stage 4 tests demonstrate that intrasystem (equipment and functions entirely within one independent system) operation and alignment are within the limits and tolerances required by the ship specification. The transmission of intrasystem signals, commands, and functions (including those generated by computer programs integral to the system) is included. (Stage 4 is normally that intrasystem testing within a single sub-element of the combat, mobility, support, or containment areas of the ship.)

Stage 5 - Intersystem Tests

Stage 5 tests demonstrate that intersystem (two or more independent systems that interface) operation and alignment are within the limits and tolerances required by the ship specification. The exchange of intersystem signals, commands, functions, and all associated computer interfaces are included. (Stage 5 is that testing normally conducted between two or more sub-elements within the combat, mobility, support or containment areas of the ship.)

Stage 6 - Special Tests

Stage 6 tests re those tests which require special simulation facilities or significant facilities/resources external to the immediate testing location. Tests for special purposes, such as access to equipment for maintenance, repair or removal, reliability, maintainability and availability demonstrations, radiation hazards (RADHAZ) testing, electromagnetic interference (EMI) testing, and the ship inclining experiment are included. Special tests can apply to equipment, a system or a number of systems, and may require total ship operability.

Stage 7 - Trials Tests

Stage 7 is defined as those tests that are unique to Builder's Trials (BT) and Acceptance Trials (AT), including the associated prerequisite dockside testing prior to getting underway. Lower level tests conducted prior to BT and AT which are required to be reconducted during these trials shall be given a Stage 7 number also. Toward the goal of using BT as a rehearsal for AT, the same test procedures should be used on both trials wherever possible. (Although the ship construction tests and trials ITP does not include coverage of Final Contract Trials (FCT), many of the same tests can be used for the FCT agenda.)

The test stages were established to promote a building block approach to testing and to ease the integration of tests into individual ship ITPs. It is not necessary that each system progress through all stages in each industrial period; the selection of tests must be tailored to the work package. In some cases, a test procedure can satisfy the requirements of more than one stage. Test procedures for the SSN classes up to and including SSN 688 and including SSBN 726 have been separated into six test "phases" similar to the seven stages. It is not planned to reformat these or any other existing procedures.

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APPENDIX E

TEST DEVELOPMENT ORGANIZATION

1. **Introduction**. In new construction programs, personnel involved in preparing test documentation are organized in four tiers as described in the following paragraphs. This tier structure is not used on mature test programs for submarines.

In active fleet industrial availabilities, the titles and functions are used only selectively, in connection with systems for which NAVSEA funds programs to maintain current, standardized tests. The NSA's engineering organization performs the functions identified herein for the remaining systems where standard tests are not available.

Responsibility for approval of test procedures should generally be delegated within an organization to the lowest level, commensurate with authority and technical expertise available. In some cases, concurrence by another organization may be required before approval is granted.

2. **Total Ship Test Director (TSTD)**. The TSTD coordinates the development of an ITP for a specific ship or ship class. If established, a TSTD is usually assigned from within the SPM's organization for new construction ships only. For active fleet ships, the cognizant NSA with the assistance of PERA or SUBMEPP, performs the necessary coordination. If the work package is sufficiently complex, the SYSCOM and/or TYCOM may fund such an assignment.

3. **Test Development Director (TDD)**. The TDD as assigned by the SPM, is responsible for planning and managing the development of test documentation. As such, the TDD:

a. Accomplishes the systems engineering that defines the test requirements and the scope of the ITP for each industrial period or availability, when directed by the TSTD.

b. Directs development of system integration tests which verify that the systems are properly integrated and compatible among themselves and with the other major systems.

c. Assists the NAVSEA SPM and the TSTD in identifying and tasking the Test Development Managers (TDMs) and TDAs for specific systems and equipment under their cognizance.

3. Test Development Director (TDD) (Continued).

d. Coordinates the TDMs' development of adequate tests by:

(1) Ensuring that existing, verified test documentation is used when adequate.
(2) Ensuring that deficiencies in existing documents are resolved by the cognizant TDM.
(3) Ensuring that new documentation is being developed when needed, in accordance with this manual.
(4) Ensuring the test documents are delivered in the necessary time frame.
(5) Developing the necessary system level TSNs not tasked to other organizations.

e. Assigning as necessary, an LCSTDD or LSSTDD.

(1) Acting as the on-site test expert at the shipyard for the TDD's test documents.
(2) Tracking the delivery of government test documents to the shipyard, and of shipyard furnished documents through government reviews.
(3) Coordinating the witnessing of tests.
(4) Acting as a member of the Test Group.
(5) Developing interim solutions to TPRRs and obtaining TDM/TDA concurrence.
(6) Tracking TCPs and the incorporation of approved changes into documents already received.
(7) Capturing and documenting lessons learned.
(8) Providing periodic status reports to the TDD.
(9) Assisting in coordinating development of the ITP for ships in private sector availabilities.

f. Ensuring conduct of a program of formal training and tracking of on-the-job experience of personnel to be assigned as LCSTDDs and LSSTDDs, to ensure the use of qualified personnel.

3. Test Development Director (TDD) (Continued).

Table D-1 provides the NAVSEA TDD assignments. The NAVSEA Deputy Commander having technical cognizance shall review and approve any exceptions to these assignments:

New Construction (NC) ships:

- Surface ship combat systems (less mine warfare ships): Naval Surface Warfare Center, Port Hueneme Division
- Mine warfare ship combat systems: Naval Surface Warfare Center, Coastal Systems Station
- Surface ship systems: Carderock Division Naval Surface Warfare Center, Philadelphia
- Submarine systems: assigned on a case-by-case basis

Active Fleet (AF) ships:

- Surface ship combat systems, less mine warfare ships: Naval Surface Warfare Center, Port Hueneme Division
- Mine warfare ship combat systems: Naval Surface Warfare Center, Mine Warfare Engineering Activity
- Surface ship systems: Carderock Division, Naval Surface Warfare Center, Philadelphia[3]
- Submarine systems: Submarine Maintenance Engineering, Planning and Procurement (SUBMEPP)

NAVSEA TDD ASSIGNMENTS

TABLE E-1

4. **Test Development Manager (TDM)**. The TDM is responsible for organizing, planning, and managing the development of test documentation for a specific system that is a major subset of the combat or ship system. The TDM is the government agent tasked by the SYSCOM system manager having cognizance of the system to accomplish the following:

[3] Assignment made on a case-by-case basis, when the industrial work package is unusually complex.

4. Test Development Manager (TDM) (Continued).

a. Develop, or direct the development of, system tests to verify proper shipboard installation, operation and compatibility.

b. Maintain both industrial and PMS tests for the system, as changes are authorized to it.

c. Make the judgments regarding the technical adequacy of existing tests or the need to develop new ones.

d. Manage cognizant TDAs.

e. Ensure accurate, adequate, and non-redundant testing, by:

(1) Verifying that test documents and test document specifications conform to this manual and specifications.

(2) Identifying deficiencies in existing documents, notifying the appropriate TDAs, and directing the rework of those documents or the development of new ones.

(3) Reviewing other TDMs' test documents impacting the operation or test of the system, and ensure changes are made as necessary.

5. Test Development Agent (TDA). TDAs prepare the equipment and system level test documents. The TDA is usually the government ISEA for in-service systems. For new systems, it is usually the government TDA or the system procurement contractor. TDAs are assigned and tasked by the SYSCOM system manager or assigned by the TDM. For systems where a TDA has not been tasked to support an availability, the shipyard must perform these functions and should be so tasked. The TDA:

5. Test Development Agent (TDA) (Continued)

a. Develops and maintains test documents for testing shipboard systems to ensure proper installation and operation. The TDA also provides reproducible-quality copies to the TDD and to the applicable repository.

b. Provides technical support for verification of tests.

c. Provides technical support for conduct of testing, including resolution of TPRRs that affect the TDA's test documents.

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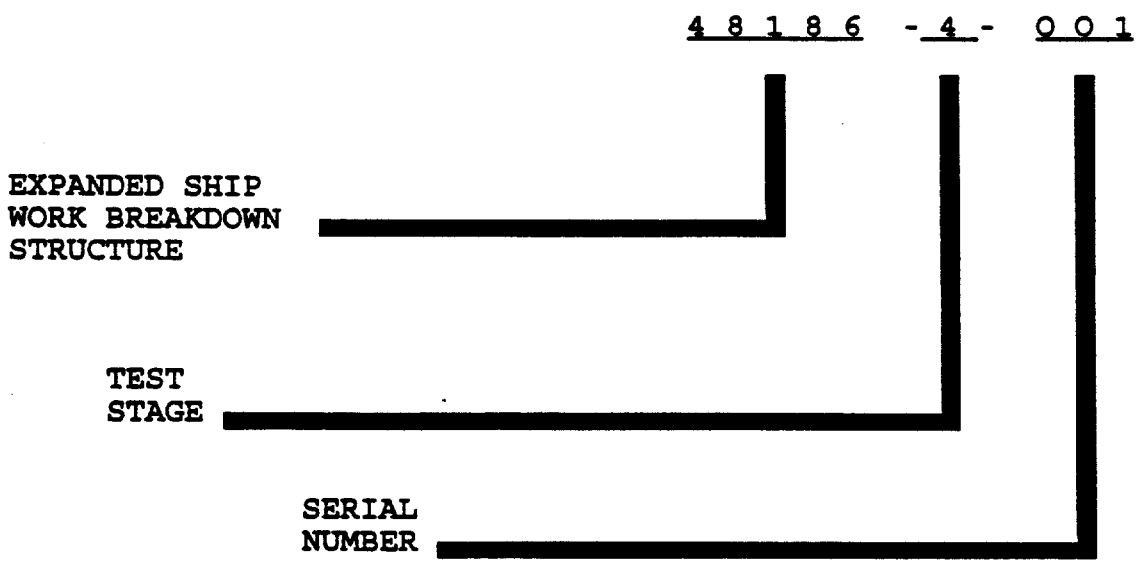
APPENDIX F

THE TEST NUMBERING SYSTEM

1. Background. In the past, different test numbering systems were used to facilitate cataloging and to allow easy storage and retrieval from various repositories. NAVSEA promulgated a common numbering system in 1983 because the variety of numbering systems were found to inhibit the sharing of test documentation among repositories and to hinder direct access by users. A single number from this system is used on all documents associated with a particular test, such as test outlines, test procedures, test problem reports and test reports. Numbers already assigned to tests at the time this manual is published need not be renumbered. Figure F-1 is a graphical representation of the test numbering system.

2. Description.



TEST NUMBERING SYSTEM

Figure F-1

Expanded Ship Work Breakdown Structure (ESWBS). NAVSEA S9040-AS-IDX-010/SWBS SD (Volume 1) is the ESWBS listing and NAVSEA S9040-AA-IDX-020/SWBS SD (Volume 2) is the User's Guide. The ESWBS is available on CD-ROM.

Test Stages. See Appendix C. Definitions of the seven test stages are provided in DOD-STD-2106 (NAVY).

Serial Numbers. The serial number differentiates between tests within a single ESWBS and stage. The serial number has no relationship to the sequence in which the tests are conducted.

Additional Designators. If individual organizations require additional designators with the test number to accommodate internal processes, they may append numbers to the beginning or end of the core number separated by a slash (/).

Revision and Changes. The revision and change status are not part of the test number. Revisions are shown by letters and changes by numbers. A revision is a re-issuance of the entire document, whereas a change is a modification of selected pages.

3. **Assignment of test numbers**. To avoid duplication, the organizations depicted in TABLE F-1 control the test numbers for the ships and systems shown in the following chart. For test procedures not otherwise assigned numbers from these sources, the individual shipyard may assign the numbers.

CATEGORY	ACTIVITY	TELEPHONE
SURFACE SHIP Combat Systems	NSWC PHD 4B10	805-982-6710
SURFACE SHIP (HM&E) Systems	PERA SURFACE 210	215-897-1946
FOR SELECTED HM&E	NSWC CD PHILADELPHIA	215-897-1939
SSN-21	SOS GROTON	203-433-2665
OTHER SUBMARINE CLASSES:		
Combat Systems	SUBMEPP 1823	603-427-2123
Ship Systems	SUBMEPP 1821	603-427-2124

TEST NUMBERING ORGANIZATIONS

TABLE F-1

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APPENDIX G

FORMAT FOR TEST CHANGE PROPOSALS

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TEST CHANGE PROPOSAL

TCP NO. _____
DATE _____

Test Title: _____
Test Number: _____ Revision _____
Submitting Agency: _____
Originator's Name: _____ Code: _____
Originator's Address: _____ Tel: _____
_____
_____

Proposed Test Change:

(Brief description of change. Supporting material such as circuit and block diagrams, and proposed test procedure pages or marked-up page shall be attached to the TCP.)

Reason for Change:

(State the reason for TCP such as equipment, format or content changes; errors in test procedures; or improvements in test procedures which would enable test performance with less personnel, lower cost, less time, greater accuracy or more complete results.)

Final Test Change:

(Brief description provided by the Test Group Chair or the assignee, describing modifications made to the original TCP and reasons therefore, or reason for disapproval of TCP.)

Remarks:

(Comments if needed, bearing on the TCP and final action, covering such items as required changes to technical specifications, changes or corrections required to equipment, further details on disapproval action, potential simultaneous and identical TCPs etc..)

TCP APPROVED _____ TCP REJECTED _____

TSTD SIGNATURE: _____ DATE: _____

TEST CHANGE PROPOSAL FORM

FIGURE G-1

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APPENDIX H

NAVSEA FORM 4730/1

TEST PROBLEM REPORT AND RESOLUTION FORM

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TEST PROBLEM REPORT AND RESOLUTION

(Use blank 8 -1/2" X 11" paper if additional space is required: identify item no.) (See instructions on BACK)

1. FROM	2. SERIAL NUMBER 3. TEST PROBLEM REPORT NUMBER
4. TO	5. DATE 6. DATE DISCOVERED 7. NEED DATE

8. TEST PROCEDURE

NUMBER REVISION/CHANGE TITLE

9. PROBLEM DESCRIPTION		10. SIGNATURE DATE
11. INTERIM PROBLEM SOLUTION		12. ISEA/FMA CONTACT NAME & CODE 13. SIGNATURE - LOCAL TDD/SHIPYD DATE
14. FINAL RESOLUTION		15. AGENCY THAT PROVIDED RESOLUTION 16. SIGNATURE - ISEA/FMA DATE
17. CLOSEOUT ACTION	NEW/REVISED TEST PROCEDURE REV/CHG	PROVIDING AGENCY DATE 18. SIGNATURE - TDD DATE
19. COPY TO		

NAVSEA 4730/1 (Rev. 10-89) (FRONT)

FIGURE H-1

INSTRUCTIONS FOR COMPLETING TEST PROBLEM REPORT AND RESOLUTION FORM

1. FROM - Enter mailing address of originating activity. Any activity in the test community may submit a TPR for consideration.

2. SERIAL NUMBER - Enter originating activity control number, if applicable.

3. TEST PROBLEM REPORT NUMBER - Number will be based on hull number and series number, consecutive 001 through 499; example, DD-967-080.

4. TO - Enter address of cognizant ISEA if known; enter address of cognizant TDD if ISEA is not assigned.

5. DATE - Enter date TPRR is developed.

6. DATE DISCOVERED - Enter date problem was discovered.

7. NEED DATE - Enter date response is needed in order to prevent delay in test schedule (enter URGENT or ROUTINE).

8. TEST PROCEDURE - Enter number, revision and title from affected test procedure.

9. PROBLEM DESCRIPTION - Enter description of the problem. If mark-ups of the test procedure pages are attached, this section should summarize the extent of the changes necessary. If additional space is needed, attached to this form.

10. SIGNATURE - Enter the signature of originating individual and date.

11. INTERIM PROBLEM SOLUTION - This section to be completed by the originating activity if an interim solution has been determined. Interim solutions should be obtained from, or discussed with the ISEA before TPR distribution. Originating activity may enter a recommended solution if the ISEA is not available. In this case, only the TDD may be entered as contact in item 12 and a reason for not contacting ISEA should be noted. If no interim solution is available, this section will be left blank.

12. ISEA/FMA CONTACT NAME & CODE - Enter the name and code of ISEA contacted for solution in item 11.

13. SIGNATURE - LOCAL TDD/SHIPYARD - Enter signature of individual making ISEA contact and date of contact.

14. FINAL RESOLUTION - The ISEA will enter technical content of the final resolution or the reason for rejection of the TPR. If final resolution results in a revised test procedure, this section will so state and revised test procedure will be indicated.

15. AGENCY THAT PROVIDED RESOLUTION - Enter name of organization providing solution.

16. SIGNATURE - ISEA/FMA - Enter signature of individual providing final resolution and date of signature.

17. CLOSEOUT ACTION - Completed by the TDD, states action taken including any extenuating circumstances encountered in developing or applying the final resolution, the distribution made and date of distribution.

18. SIGNATURE - TDD - Enter signature of TDD who took closeout action and date of signature.

19. COPY TO - Copy to cognizant TDD and for additional information activities, as applicable.

TEST PROBLEM REPORT AND RESOLUTION FORM (BACK)
FIGURE H-2

APPENDIX I

LIST OF ACRONYMS

AIT	Alteration Installation Team
CDNSWC	Carderock Division, Naval Surface Warfare Center
CDRL	Contract Data Requirements List
CFE	Contractor Furnished Equipment
CHOP	CHange of OPerational control
CS	Combat System
CTP	Comprehensive Test Plan
DID	Data Item Description
DOD-STD-XX	Department Of Defense Standard-XX
DRPM	Direct Reporting Program Manager
EMC	ElectroMagnetic Compatibility
ESWBS	Expanded Ship Work Breakdown Structure
FMS	Foreign Military Sales
GFE	Government Furnished Equipment
HM&E	Hull, Mechanical & Electrical
IEM	Inactive Equipment Maintenance
IMA	Intermediate Maintenance Activity
INSURV	(Board of) Inspection and Survey
ISEA	In-Service Engineering Agent
ITP	Integrated Test Package
JTG	Joint Test Group
LCSTDD	Local Combat System Test Development Director
LSSTDD	Local Ship System Test Development Director
LTDD	Local Test Development Director
MRC	Maintenance Requirement Card
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NAVSHIPYD	Naval Shipyard
NSA	Naval Supervising Authority (Term includes Supervisor of Shipbuilding, Conversion and Repair (SUPSHIP), Shipyard Commander and Commanding Officer, Ship Repair Facility)
NSWC	Naval Surface Warfare Center
NSWC PHD	Naval Surface Warfare Center, Port Hueneme Division
ORDALT	Ordnance Alteration

APPENDIX H

LIST OF ACRONYMS

(Continued)

PARM	Participating Manager
PDT&T	Post-Delivery Tests and Trials
PEO	Program Executive Officer
PERA	Planning & Engineering for Repairs & Alterations
PMS	Planned Maintenance System
SHIPALT	Ship Alteration
SPAWAR	Space And Naval Warfare Systems Command
SPM	Ship Program Manager
STEPS	Ship Test and Evaluation Program Standard
STMP	Ship Test Management Plan
SUBMEPP	Submarine Maintenance Engineering, Planning and Procurement
SUPSHIP	Supervisor of Shipbuilding, Conversion and Repair
SYSCOM	Systems Command
TCP	Test Change Proposal
TDA	Test Development Agent/Activity
TDD	Test Development Director
TDM	Test Development Manager
TI	Test Index
TN	Test Narrative
TO	Test Outline
TP	Test Procedure
TPRR	Test Problem Report and Resolution
TSN	Test Sequence Network
TSTD	Total Ship Test Director
TSTP	Total Ship Test Program
TSTR	Total Ship Test Requirements
TTG	Test Task Group
TYCOM	Type Commander