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Encl: (1) Total Ship Test Program: Ship Test and Evaluation Planning Guide, NAVSEA 0900-LP-095-4010, Revision One, dated Jun 1985

1. The Ship Test and Evaluation Planning Guide was first published in February 1977, and portions of it were later updated by Changes 1 and 2. Enclosure (1) is a copy of Revision 1, which replaces those earlier publications. The intended audience for this revision remains the same: i.e., the NAVSEA ship acquisition program managers, ship logistics managers and those directly providing the support in the management of ship test programs. However, the contents of this guide have changed. The original version educated the reader on the then-new ship test management policies and procedures. This revision assumes the reader knows those policies; it provides him with a description of our lessons learned in implementing them during the last ten years.

2. Additional copies of this guide may be obtained from the NAVSEA Test and Evaluation Division (SEA 902), 202-692-0448 and 0411, or Autovon 222-0448 and 0411.

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M. T. Reynolds
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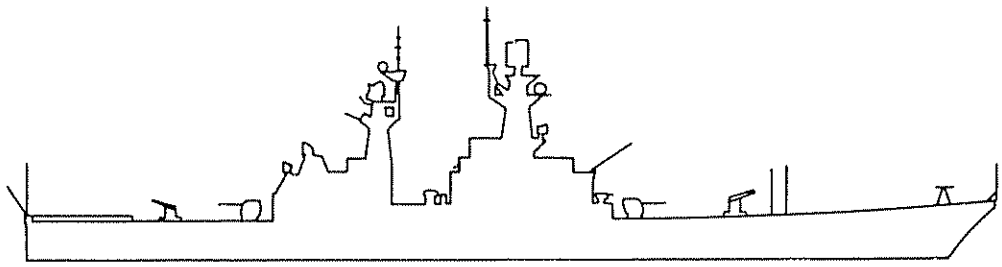

SHIP TEST AND EVALUATION PLANNING GUIDE (TEPG)

JUNE 1985

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NAVAL SEA SYSTEMS COMMAND
DEPARTMENT OF THE NAVY
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SECTION 1

INTRODUCTION

1.1 PURPOSE

This guide has been prepared to provide Naval Sea Systems Command (NAVSEA) personnel with background and guidance information for managing ship test programs. Its primary audience is intended to be NAVSEA ship acquisition program managers, ship logistics managers, and those directly providing them support in the management of ship test programs. It is not intended to provide guidance to managers of system Research and Development programs; those managers should contact SEA 902 to find appropriate documents to meet their needs.

1.2 SCOPE

The focus of this guide is the industrial periods of a ship's life; e.g. construction, modernization, Post-Shakedown Availability, Regular Overhaul and Selected Restricted Availabilities. Other types of testing, such as in-service maintenance testing by ship's force and operational test and evaluation by the Operational Test and Evaluation Force, are also described to fill out the overall picture. This guide assumes the reader has a basic familiarity with the policy directives. While this guide does describe the contents of those directives, it should not be used as substitute for them or as an authoritative source for policy. The key directives and the versions that were current at the time of publication of this guide are listed in Appendix A.

Through the Total Ship Test Program (TSTP), NAVSEA has established a hierarchy of publications to communicate policies and management requirements for ship test programs. See figure 1-1. NAVSEAINST 3960.5 articulates the TSTP policies, and

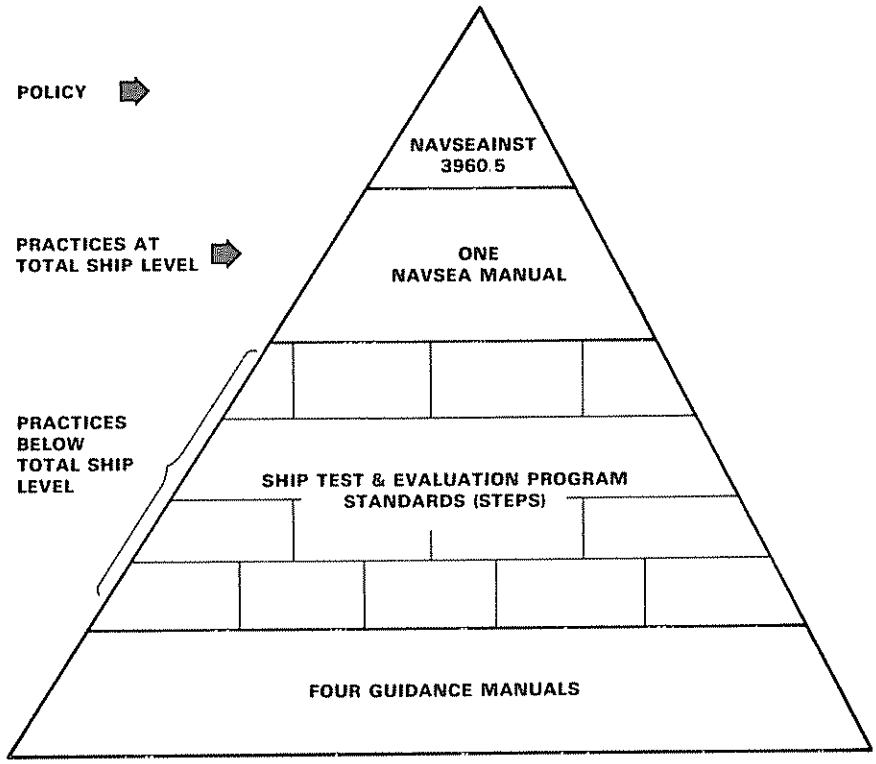

Figure 1-1 Hierarchy of TSTP Publications

will be complemented by a NAVSEA manual which describes the management procedures to be used in implementing those policies. (This manual is under development at the time of publication of this Ship Test and Evaluation Planning Guide. It is anticipated that it will be issued in early 1986 and will incorporate and supercede NAVSEA 0900-LP-095-2010, Ship Construction Tests and Trials Manual, and NAVSEA T9093-AB-TRQ-010/SURF COMB, Combat System Test and Certification Manual for Surface Combatant Ships.) To publish practices that NAVSEA wants followed in the shipboard testing of individual types of systems, Ship Test and Evaluation Program Standards (STEPS) are used. Finally, supporting these three tiers of policy and procedural

publications are four guidance manuals, including this one. The other three are:

Post-Delivery Tests and Trials Guidance Manual	NAVSEA 0900-LP-095-3010
Ship Acquisition Test and Evaluation Budgeting Guide	NAVSEA 0900-LP-095-5010
Ship Land-Based Test Site Planning Guide	NAVSEA 0900-LP-095-6010

1.3 CHANGES

Users are encouraged to submit recommendations for changes to this guide. Such recommendations should be forwarded to SEA 902, with a copy to SEA 61X1. Copies of the guide will be distributed to Navy field activities and, upon request, to contractors who provide direct support to NAVSEA offices in the management of ship test programs. Recommendations are solicited from these sources also.

1.4 TSTP ORIENTATION

NAVSEA has developed a series of TSTP orientation courses for introducing personnel to TSTP policy and to the mechanics of test program implementation both in the ship acquisition and active fleet environments. Course material is directed toward personnel involved with test program management and engineering, at headquarters, field activities, shipyards and onboard ships. NAVSEA 61X1 may be contacted for more information regarding course content and schedules.

SECTION 2

GENERAL SHIP ACQUISITION TEST AND EVALUATION POLICY

2.1 INTRODUCTION

There are two different sources that have provided the test and evaluation (T&E) policies and procedures for ship acquisition programs since 1970. First, there has been the Department of Defense (DOD) policies of "try before buy". These policies require that all acquisition programs advance from one phase to another or qualify for major new funding increments by the actual demonstration of technical and operational thresholds. How those policies impact the structure of ship programs will be the subject of this Section of the guide.

The second source of T&E policies for ship programs has been NAVSEA's efforts to improve and standardize the manner in which shipyard test periods are planned and conducted. These NAVSEA efforts are embodied in the Total Ship Test Program (TSTP) and are the subject of the remainder of this guide. (A summary of the TSTP precepts is provided in paragraph 4.1.)

2.2 STRUCTURE OF SHIP ACQUISITION PROGRAMS

If ships were to be procured the way most other Navy systems are, the lead ship of a class would be used as a prototype for the purpose of conducting T&E prior to approving construction of the follow-ships of the class. However, because of the time associated with the design and construction of a ship and the fact that little operational risk is associated with the ship platform itself, it has been agreed that this prototyping approach is not necessary. Instead, development and operational T&E (DT&E and

OT&E) conducted on other installations provide sufficient T&E data to assure the suitability and effectiveness of the overall ship, thus meeting the spirit and intent of the "try-before-buy" policy, DOD Directive 5000.3.* These installations are (1) the surrogate platforms used for DT&E and OT&E of individual unproven shipborne systems and (2) the propulsion and combat system land-based test sites that are frequently constructed for integration of shipborne systems prior to installation in the lead ship of a new class.

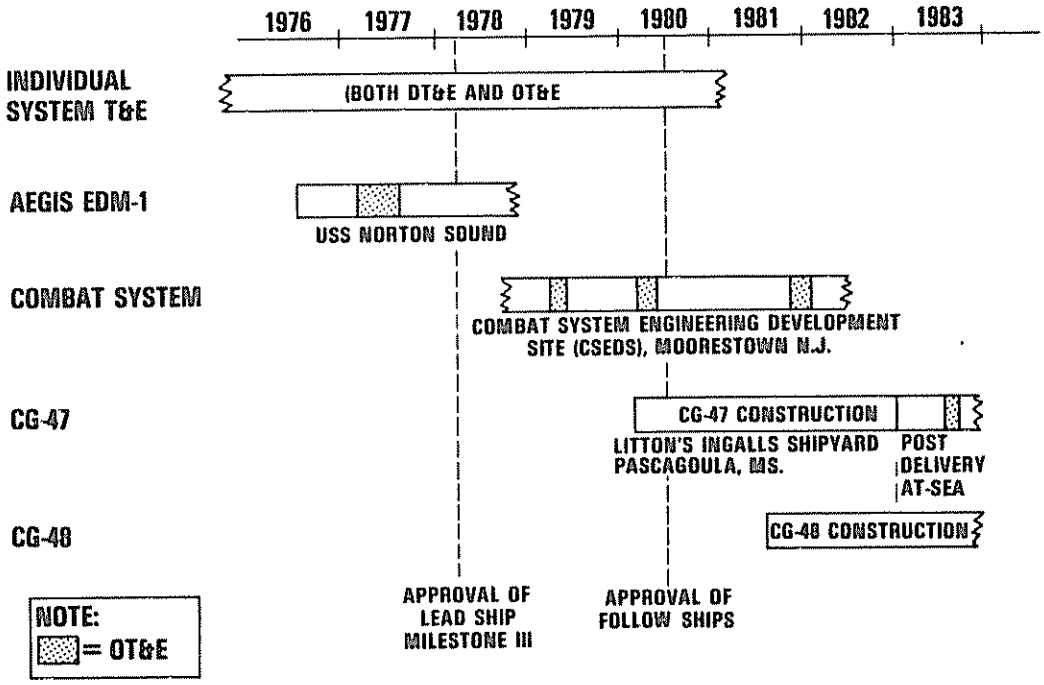

Figure 2-1 Ship acquisition T&E program: CG-47 Class

For example, on the CG-47 class shipbuilding program, note in figure 2-1 that approval of the follow-ships was not dependent on test results from the lead ship itself. Because of the long time required to construct a ship and because most of the technical risks are associated with the shipboard systems

*Note that throughout the text, directives, instructions, and manuals are referenced by their basic numbers only; Appendix A lists the full titles of those publications and the specific revision and date of issue utilized in this manual.

and their integration, such a delay in ship acquisition programs is not considered warranted. Instead, the primary T&E inputs to the approval of lead ship construction come from the results of the individual shipboard system T&E programs to date. In this case, for example, testing of the AEGIS weapon system MK 7, the heart of the combat system in this ship, was a significant input. This testing was conducted on an AEGIS engineering development model (EDM) installed in USS NORTON SOUND (AVM-1).

Primary inputs to a decision approving follow-ship construction also include T&E from land-based test sites (LBTS). LBTSs (some are called land-based engineering facilities) have become very common vehicles for integrating and testing selected shipboard systems before they are installed in the ship. Since the Navy is able to simulate many shipboard conditions at a LBTS, it provides a very convenient opportunity to conduct DT&E and OT&E. Most new combatant ship programs have a LBTS for the integration of combat system equipment; some programs have also had a LBTS for the integration of propulsion system equipment. The CG-47 class program has a LBTS at Moorestown, N.J., the Combat System Engineering Development Site (CSEDS). CSEDS has an engineering development model of the AEGIS weapon system as well as many other elements of the combat system.

There is one exception to this program structure. When a ship design involves a major technological advance in the hull or propulsion design, the lead ship is designed, constructed and tested in its entirety as a research and development (R&D) effort. This is sometimes referred to as a ship development or prototype program. Such ships undergo extensive DT&E and OT&E prior to the commitment to the production of follow ships. Two examples of ship programs that followed this program structure are the Patrol Combatant Hydrofoil Ship, PHM-1 Class, and the air cushion landing craft, LCAC.

2.3 SHIP PROGRAM PHASES

For conventional ship programs, the design phases and the program approval milestones that precede them are as follows:

Milestone *I-Start of preliminary design and initial part of contract design

Milestone II-Completion of contract design and start of lead ship design and construction

Milestone III-Start of construction of follow-ships

For ship development programs, the milestones are:

Milestone I-Start of preliminary design

Milestone II-Start of contract design, lead ship design, construction, technical evaluation (TECHEVAL) and operational evaluation (OPEVAL)

Milestone III-Start of construction of follow-ships

The primary difference in the two program structures is that in the conventional program, Milestone III approval to build the follow-ships takes place while the lead ship is still under construction. In the ship development program, Milestone III is delayed until the lead ship has completed construction and goes through a Technical Evaluation (TECHEVAL) and Operational Evaluation (OPEVAL). The procedures for Milestone reviews vary

*For Acquisition Category (ACAT) I programs, those which must be presented to the Secretary of Defense for approval to proceed into each phase, the milestones are called "DSARC" I, II and III. DSARC is the Defense Systems Acquisition Review Council which reviews those programs for the Secretary of Defense. Similarly, for ACAT IIS programs, those for which the Secretary of the Navy approves proceeding into each phase, the milestones are called "DNSARC" I, II and III for the Department of the Navy Systems Acquisition Review Council.

according to which of the four Acquisition Categories (ACATs) the CNO assigns to the ship acquisition program. These procedures will not be covered in this guide. OPNAVINST 5000.42 is the key reference that describes them.

2.4 TYPES OF T&E

Three types of T&E are conducted in acquisition programs:

- Development T&E (DT&E) is conducted as part of the engineering design and development process and to verify attainment of technical performance specifications and objectives. It is sponsored by the System Command (SYSCOM) program manager and is conducted by the contractors, subcontractors, Navy engineering activities and Navy labs.

- Operational T&E (OT&E) is conducted to estimate a system's operational effectiveness and operational suitability, identify the need for modifications and provide information on tactics. OT&E has four distinguishing characteristics: it is conducted in the actual operational environment; it is conducted using typical fleet-type personnel for operation and maintenance; it is conducted against a simulated enemy, employing countermeasures; and it is conducted solely by the Operational Test and Evaluation Force.

- Production Acceptance T&E (PAT&E) is conducted on production units to ensure that they meet contract specifications. Trials of new ships conducted by the Board of Inspection and Survey (INSURV) are considered PAT&E. Shipyard industrial testing is also considered PAT&E.

For most combatant ship programs, the following apply:

- The CNO determines when a ship program will be structured as a ship development program requiring a TECHEVAL and OPEVAL of the lead ship before approval of construction of the follow-ships.

- The CNO also determines when the complexity of the combat system or propulsion system warrants construction of a Land-Based Test Site (LBTS) for design and integration testing (and possibly operational testing) prior to final design of the lead ship.

- DT&E and OT&E prior to Milestone II of a ship program usually address individual T&E events to date on the new systems and system upgrade that are planned for installation in this ship class.

- For conventionally structured combatant ship acquisition programs, DT&E and OT&E between Milestones II and III consist of additional T&E of individual systems as well as T&E at the LBTSs, if constructed. For ship development programs, this T&E includes TECHEVAL (which is DT&E) and OPEVAL (which is OT&E) on the lead ship itself.

- After Milestone III, Follow-on OT&E is usually conducted on the lead ship during the period between delivery and expiration of Ship Construction Navy (SCN) funding authority. For conventional ship programs, this is the first opportunity OPTEVFOR gets to evaluate the integrated systems in an at-sea environment. For a development program, this gives OPTEVFOR an opportunity to evaluate corrections and other changes made since they evaluated the ship during OPEVAL.

Amphibious ships, auxiliary ships and all non-combatants in general do not require OT&E.

Because there is little developmental or operational risk in the ship platform itself (most of the risk is in new shipboard systems and the integration of those systems), there is not much DT&E and OT&E in a ship program. The more significant testing is that associated with the ship construction contract itself; i.e., PAT&E. Two phases of ship PAT&E are defined:

- Ship Construction Tests and Trials (refer to NAVSEA 0900-LP-095-2010) consist of all testing conducted on the ship during construction, including PRESINSURV's Acceptance Trials. This period may also include some earlier equipment PAT&E (such as Factory Acceptance Tests) if imposed by the Ship Acquisition Program Manager (SHAPM) as prerequisites to shipboard installation.

- Ship Post-Delivery Tests and Trials (refer to NAVSEA 0900-LP-095-3010) are the conventional tests and trials, including PRESINSURV's final contract trials, that commence after ship delivery and continue to the end of the SCN obligation or Work Limiting Date.

2.5 TEST AND EVALUATION MASTER PLAN (TEMP)

For ship acquisition programs that include OT&E, a Test and Evaluation Master Plan (TEMP) must be prepared by the Ship Acquisition Program Manager (SHAPM) and OPTEVFOR to identify when the OT&E will be conducted, what preparatory DT&E will be conducted, what fleet resources are needed, what program approval decisions (if any) the DT&E and OT&E results will impact, and what evaluation criteria will be used. The TEMP is a summary document (usually not more than 20 pages) whose format is prescribed in OPNAV Instruction 3960.10. The procedures for processing a TEMP for review and approval are described in NAVSEAINST 3960.2. For ship acquisition programs that do not require OT&E, a TEMP is not required.

2.6 SHIP T&E PROGRAM PHASES

Regardless of the overall ship program structure and the points of the lead-ship design that program approval milestones are imposed, the overall T&E program should be thought of as a progression through several phases. Refer to figure 2-2. Individual equipments proceed from testing at the factory to testing in the shipyard. Some of the newer systems or system upgrades that have not yet been approved for fleet use will have to go through technical and operational testing, probably on another Navy ship that is already in service. Also, some of the systems that are closely integrated with other systems may be tested in a combat system or propulsion system land based test site, if established for this ship class. After construction tests and trials, and delivery of the ship to the Navy, each ship proceeds through a 6 to 9 month post-delivery test period, in conjunction with shakedown training and crew qualification training. After a post-shakedown shipyard availability, each ship proceeds to regular fleet operations. It is important

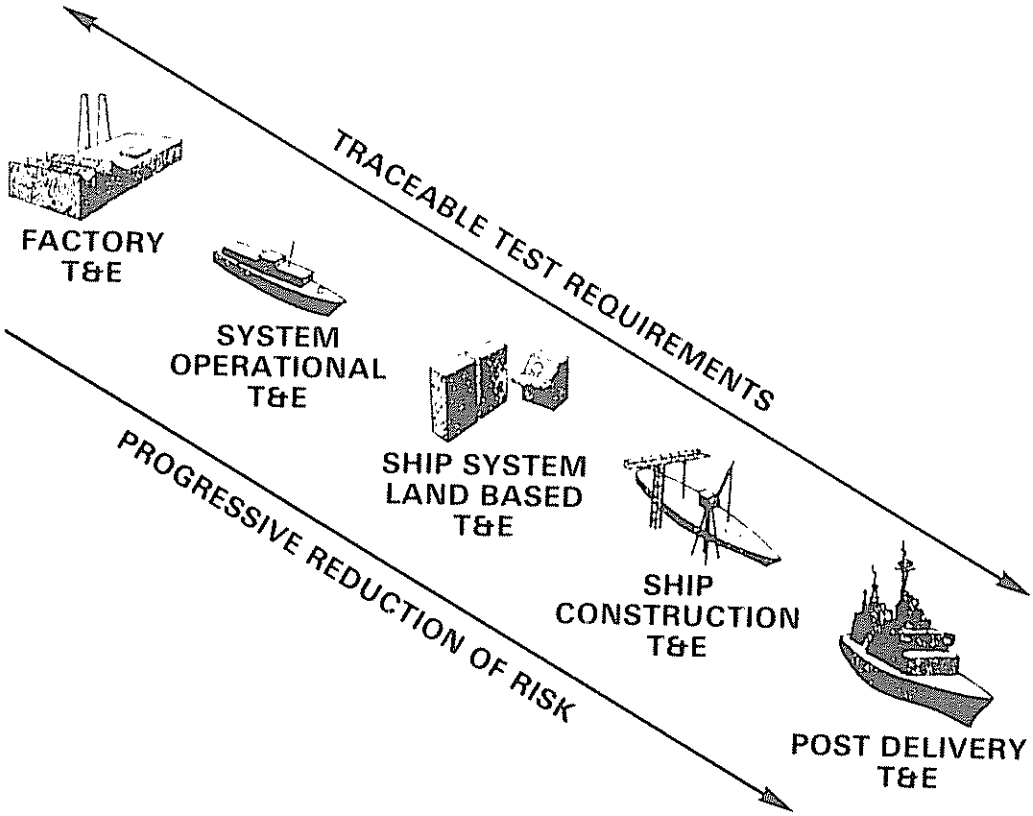

Figure 2-2 Ship Acquisition T&E Phases: The "Reynolds Model"

that each ship T&E program be viewed as encompassing all of these phases. Until the late 1960's, the Navy generally tended to equate ship acquisition T&E to the ship construction test program and treat the rest as appendages. But the engineering complexity of ship designs since that time has fostered this expanded view. In general NAVSEA is working on the overall management and engineering process to improve the transition between these types of events. This is a major effort because they involve testing at different locations, under the management of different organizations, and with a different mix and priority of test objectives. In addition, the participants in each ship program need to take special efforts to ensure the traceability between phases and a well engineered reduction of risk and uncertainty as the testing proceeds to higher levels and later phases. Only then will the value of and return of the investment in the testing be optimized.

SECTION 3

PRELIMINARY AND CONTRACT DESIGN PHASES

3.1 INTRODUCTION

Development of the test requirements to be met during the ship construction period takes place during the preliminary and contract design phases. Major efforts include:

- o Establishing a Land-Based Test Site, if necessary, and conducting the associated engineering and testing efforts
- o Building necessary models and mock-ups
- o Preparing the test documentation for use in the Request for Proposal (RFP) and in the contract itself for lead ship detail design and construction
  - oo RFP requirements
  - oo Contract clauses
  - oo Sections 092, 094 and 095 of the Shipbuilding Specifications
  - oo Test Documentation Booklet (including Test Index, Test Outlines, selected Test Procedures and Test Sequence Networks)

3.2 LAND-BASED TEST SITE (LBTS) PROGRAM

The Ship Acquisition Program Manager (SHAPM) must be sensitive to the high risk areas in the ship design and pursue means of reducing the risks. Early T&E is one means of identifying potential problems and reducing high risk areas. LBTSs may be used to accomplish the following objectives:

- o Equipment and subsystem checkout and integration
- o Debug, proof and demonstrate operational and diagnostic computer programs
- o Validation of installation procedures
- o Validation of operational, maintenance and support procedures
- o Validation of test procedures
- o Evaluation of equipment design changes and modifications to the systems
- o System level training of the crew

Schedules for LBTS testing must allow sufficient time to assure satisfactory test results prior to critical program decision points. The overall test period should be of adequate length and should be properly sequenced to accommodate the identification of deficiencies and the proper verification of the corrections. Every effort should be made to prevent the test schedule from becoming success oriented; that is, allow enough cushion in the schedule to accommodate corrective action. Maximum system-level performance should be tested to uncover problems that might otherwise go undetected until shipboard testing. Land-based testing may also include a period of Operational T&E by OPTEVFOR to allow OPTEVFOR an opportunity to report test results at a Milestone decision review (refer to Section 2).

The Ship Land-Based Test Site Planning Guide (NAVSEA 0900-LP-095-6010) provides guidance for use in evaluating the need for LBTSs and as an aid in developing and utilizing them. Selection criteria governing LBTS establishment and location are discussed in NAVMAT Instruction 3960.8. The SHAPM should also consider utilizing a production LBTS for the interface testing and grooming of suites of selected production hardware prior to shipboard installation. Specific efforts that can be undertaken at such a site include: checkout of equipment received from the manufacturer, equipment alterations and field changes, cutting exact lengths of connectorized cables, conducting intra- and intersystem operability tests and installing computer programs.

Whenever practicable, actual hardware should be used instead of simulations for interface and integration testing at LBTSs. This will ensure more valid test results and reduce the time and cost associated with producing simulation programs.

For most ship programs, NAVSEA has found it useful to publish a LBTS Management Plan, covering topics such as:

- o Objectives of the test site
- o Facility design and construction
- o Site management procedures
- o Test schedule and objectives
- o Configuration control
- o Logistics support
- o Safety
- o Funding

3.3 MODELS AND MOCK-UPS

Models and mock-ups are utilized to evalute arrangement, access, human factors, safety, etc. Models and mock-ups are also used by ship designers as design tools to eliminate interference and by shipbuilders for templating, layout, prefabrication, and preliminary equipment checkout. Examples of space mock-ups required by the Chief of Naval Operations (CNO) include: pilot house and bridge wings, Combat Information Center, Primary Flight Control, Flag Command and other operational control centers, weapon control, main communications spaces, main machinery and main machinery control spaces and Submarine Attack and Control Centers (refer to NAVSEA Instruction 9098.1). The ship design team must select models and mock-ups required in the Detailed Design and Construction Phase of the ship acquisition program. Considerations in selecting models and mock-ups include:

- o Is the system in question unique enough to warrant mocking up?
- o Is the model or mock-up cost-effective in verifying significant characteristics?
- o Does the model or mock-up provide early man-machine interface evaluation?
- o Can the model be utilized for crew training? Operator training? Team training?

- o What is the foreseeable utilization life of the model or mock-up?
- o Is there an existing model or mock-up that can be utilized for the purposes of this particular ship program?
- o Does the schedule of mock-ups permit time for feedback and modification of the design?

3.4 T&E IN THE REQUEST FOR PROPOSAL (RFP)

The T&E information provided to industry in the RFP consists of: test requirements in sections 092, 094 and 095* of the ship specifications, the Test Documentation Booklet, and T&E in the Contract Data Requirements List, CDRL. (For those ships built to commercial specifications for the Maritime Administration (MARAD), NAVSEA invokes the Total Ship Test Requirements Development Guide (NAVSEA S9070-AB-SBS-010) as a substitute for what would appear in the government specifications.)

3.4.1 Specification Section 092. Section 092 of the General Specifications for Ships of the U.S. Navy (GEN SPECs), entitled "Shipboard Tests", contains general requirements for the shipboard test program and describes the shipbuilding contractor's responsibilities to:

- o Conduct tests of installed Government Furnished Equipment (GFE), using test procedures provided by the Navy
- o Prepare and conduct test procedures for Contractor Furnished Equipment (CFE)
- o Maintain and regularly publish a detailed test schedule
- o Implement a test notification system
- o Participate in the overall ship Test Task Group (TTG) and Test Problem Reporting and Resolution System administered by the Supervisor of Shipbuilding (SUPSHIP)
- o Allow for government personnel to conduct special tests and certifications identified in the ITP
- o Submit a final report consisting of a complete set of test procedures, with data points filled in, and signed by Navy witnesses

*Section 093 is usually not used, but is available for special test program requirements. In the LHD-1 specifications, for example, section 093 covers requirements for a combat system test facility to be established by the shipbuilder.

The tests required by the GEN SPECs should be considered a minimum. Many shipboard installations may require additional testing beyond these requirements. During ship design, the specific shipyard test requirements for this ship must be developed, using the GEN SPECs as a point of departure, and inserted into the detailed specs for this ship and into the supplementary Test Doumentation Booklet (TDB).

3.4.2 Specification Section 094. Section 094, Ship Trials, of the GEN SPECs contains the general requirements for ship trials: Builders Trials, Acceptance Trials, and Final Contract Trials. It provides the responsibilities for various trials, scheduling and reporting requirements. Major factors that will affect the specific trial requirements to be included in the detailed ships specs are:

- Board of Inspection and Survey interests
- Lead, follow or prototype ship
- Ship mission requirements
- Safety requirements
- Navy experience with each of the shipboard systems
- The verification requirements of the Top Level Requirements
- Fleet support requirements
- Who will operate the ship during trials; i.e., contractor or ship's force

3.4.3 Specification Section 095. Section 095 contains specific test requirements in narrative form, including the tests to be conducted during trials. These test narratives are cross-referenced to the associated technical requirements in other sections of the specifications. This section is the core around which all contractor prepared tests are based and is the final reference used to define test requirements. Its accuracy is of paramount importance.

3.4.4 Test Documentation Booklet (TDB). The TDB is provided as part of the contract bid package to inform the prospective contractors of the scope of the test program. It contains:

- o Test Index
- o Selected Test Procedures for government furnished equipment (GFE)
- o Test Outlines (for GFE with test procedures not yet available)
- o Test Sequence Networks for GFE
- o Test Numbering System description

In the development of the TDB, test requirements should "flow-down" from higher level documents, such as the TLRs/Top Level Specifications, Combat System Operational Design, Combat System Design Requirements. In other words, the shipyard test program requirements should be traceable back to higher level documentation.

a. Test Outlines (TOs). TOs are normally provided to supplement narratives in section 095 of the ship specification. They are general descriptions (in outline format) of the testing necessary to comply with section 095 test requirements; they include information such as test objectives, test equipment, personnel involved, and services, facilities and estimated time required to conduct each test. TOs are used as part of the shipbuilding contract bid package to give the shipbuilder information upon which to make a realistic bid and to provide advance planning information for testing GFE for which detailed test procedures will be provided later. They are also used in preparing TPs, TSNs and test schedules. The format and content of TOs are described in DOD-STD-2106 (Navy), which is a specification for system contractors to use in developing TOs and TPs.

b. Test Procedures (TPs). A TP is the detailed step-by-step document which describes how a specific test is to be performed. Test procedures are discussed in greater detail in DOD-STD-2106 (Navy). If available at time of TDB publication, they are usually provided instead of test outlines.

The T&E Automated Management Information System (TEAMIS) provides the capability to search and retrieve previously used TPs, which in many cases can be utilized directly or can be slightly modified for the new ship program. These previously-used TPs can also be used as an aid to develop TOs for inclusion in the contract bid package (refer to paragraph 3.7).

c. Test Index (TI). The TI is a list, by test number and title, of the tests to be conducted. The index may also list, in the case of government furnished tests, the agency responsible for developing the TO or TP and, in a case where some tests are to be conducted by the government (vice the shipbuilder), it may identify these tests.

d. Test Sequence Network (TSN). The TSN is a flow chart of the sequence in which the shipboard tests should be performed and indicates the interdependence of tests by showing which tests are prerequisite to others. TSNs do not show time or date requirements. (The scheduling of testing is primarily the responsibility of the shipbuilder.) However, since some tests, particularly of electronics equipment, can produce invalid results if taken out of sequence, some prerequisites will be mandatory. TSNs can be a useful tool for documenting and communicating such prerequisites. TEAMIS has a graphic generation capability that can be used for preparing TSNs.

3.4.5 Shipbuilding Contract Data. All data required of the contractor during the contract period must be specified in the Contract Data Requirement List (CDRL), DD Form 1423. For each data entry in the CDRL, the appropriate specification number or contract article number is referenced. Dates of submission and distribution requirements are also shown.

Associated with each CDRL line item is a Data Item Description (DID), DD Form 1664. The DID describes the data to be furnished to the government by the contractor. A list of typical T&E data to be generated by the shipbuilder and submitted to the government is shown in Table 3-1. Table 3-1 also includes the identifying numbers of the standardized T&E DIDs which have been established for NAVSEA. Table 3-2 shows recommended submittal schedules and approval requirements. Note that many of the items do not include approval action by the government. Normally, the contractor's test plan, test schedule and test procedures for most CFE are not subject to government approval to preclude any government accountability for errors in the contractor's planning of the test program. However, technical data, such as test procedures and test reports, sometimes require government approval. Note that even without specific approval authority the government has the option to review all documentation and to point out items which violate the terms of the specifications or contract, as well as to recommend improvements.

Table 3-1. Typical T&E Related Data Required of the Shipbuilder

	Title	Description
1.	Ship Acceptance Test Index *(DID No. DI-T-23039A)	Provides a complete listing of all tests to be conducted during the ship acceptance test program.
2.	Ship Test Problem Report *(DID No. DI-T-23044B)	Used to document discrepancies and problems in documentation, equipment, or performance of test procedures encountered during the conduct of a ship test.
3.	Ship Acceptance Test Report *(DID No. DI-T-23190A)	Used to document the overall test results and findings in relation to the technical specification requirements for each test. Provides the details of analysis and the final results of analyses of raw data records taken at test time.
4.	Notification of Tests *(DID No. DI-T-23731A)	Used to identify tests to be performed and their scheduled time and location to allow the government to plan for witnessing the tests. May also be used as a notification of trial dates.
5.	Ship Acceptance Test Procedure *(DID No. DI-T-23769A)	Provides the detailed description of actions to be performed during a specific test. Serves to demonstrate compliance with related technical specification requirements.
6.	Booklet of Ship Test Reports *(DID No. DI-T-23794A)	Provides a complete, bound set of test reports for all tests conducted during a ship acceptance test program.
7.	Comprehensive Test Plan *(DID No. DI-T-23802A)	Used to detail the contractor's approach to satisfying the test program requirements of the contract specifications.

*NOTE: The number of Standardized T&E Data Item Description (DID) that covers this Data.

Table 3-1. Typical T&E Related Data Required of the Shipbuilder (Continued)

Title	Description
8. Ship Acceptance Test Schedule *(DID No. DI-T-23959B)	Schedule dates for conduct of each test from stage 2 through Stage 7, subsidiary data for test performance, and an analysis of test problem areas.
9. Ship Test Outline *(DID No. DI-T-26251A)	Used to define a specific test requirement and method. Allows scoping of test effort and provides guidance for development of the test procedure. (Not normally required of the shipbuilder unless follow-ships will be built in different yards and lead-ship test procedures will not be applicable.)
10. Ship Test Status Report *(DID No. DI-T-26388A)	Provides periodic status reports of test performance or test documentation development to assist in assessing test progress and identifying potential problem areas. Specific reports are: a. Test Documentation Status Report. b. Test Performance Status Report. c. Test Program Quarterly Report.
11. Test Change Proposal *(DID No. DI-T-26391B)	Used to document proposed changes to approved test documentation (e.g., test outlines, test procedures, test sequence networks) prior to the actual conduct of the test. (Not required for tests not approved by the government.)
12. Ship Trial Agenda DI-T-26393B	Used for Builder's Trials and Acceptance Trials to provide the general and detailed methods of operation of the ship and scheduling of at-sea tests with details of personnel participating, security, and a complete set of test procedures to be performed.

*NOTE: The number of the Standardized T&E Data Item Description (DID) that covers this Data.

Table 3-1. Typical T&E Related Data Required of the Shipbuilder (Continued)

	Title	Description
13.	Ship Trial Report *(DID No. DI-T-26457A)	Used to document the results of tests, inspections, and operations conducted during Builder's Trials or Acceptance Trials.
14.	Ship Test Sequence Network *(DID No. DI-T-26465A)	Used to depict graphically the sequence of test conduct for a test by displaying all prerequisite tests and initial support service requirements as shown on appropriate prerequisite listings and test outlines or test procedures. Does not include dates or time frames.

Table 3-2. Test Documentation Delivery Requirements for CDRL

	Title	Recommended Submittal Schedule
1.	Ship Acceptance Test Schedule DID No. DI-T-23959B	Specify in days after contract award; (e.g., 180, DAC). Quarterly updates until start of testing; monthly updates thereafter.
2.	Comprehensive Test Plan DID No. DI-T-23802A	Specify in days after contract award (e.g., 180 DAC). Revisions as necessary due to personnel, organizational or procedural changes.
3.	Ship Acceptance Test Procedure DID No. DI-T-23769A	90 days prior to scheduled test start date in Ship Acceptance Test Schedule. Approval by SUPSHIP for GFE tests; review and comment by SUPSHIP for CFE tests. For surface ship contracts, distribution must include the NAVSEA Test Documentation Repository located at and maintained by the Naval Ship Weapon Systems Engineering Station (NSWSES), Port Hueneme, Ca, Code 4J00.

Table 3-2. Test Documentation Delivery Requirements for CDRL (Continued)

Title	Recommended Submittal Schedule
4. Ship Test Problem Report DID No. DI-T-23044B	Not later than 48 hours after problem is discovered.
5. Ship Acceptance Test Report DID No. DI-T-23190A	14 days after test conduct, but not later than ship delivery. Approval by SUPSHIP.
6. Ship Test Status Report DID No. DI-T-26388A	Weekly - start 1 week after scheduled start of test program.
7. Test Program Quarterly Report P/O DID No. DI-T-26388A	Each 3 month period - start 3 months after scheduled start of test program.
8. Notification of Tests DID No. DI-T-23731A	48 hours prior to scheduled start of test. May require to be 72 hours or more if extensive travel time is required by government test witnesses. Test schedule or Test Program Quarterly Report and Test Performance Status Report can be used for scheduling witnesses; this notification confirms or alters the plan.
9. Notification of Trials Dates P/O DID No. DI-T-23731A	For notification of Builders Trials (BT) and Acceptance Trials (AT) dates, use 70 - 90 days prior to scheduled trial start date. AT date subject to INSURV approval.
10. Ship Trial Agenda DID No. DI-T-26393B	For BT, 70 - 90 days prior to start of BT. Approval by SUPSHIP. For AT, 70 - 90 days prior to start of AT. Approval by SUPSHIP. Approval of AT and BT agenda is for technical content and adequacy of tests.
11. Ship Trial Report DID No. DI-T-26457A	BT Report: Not later than (NLT) 2 days prior to AT AT Report: NLT 30 days after completion of AT.
12. Certification of Readiness for Sea Trials	NLT 24 hours prior to start of BT.

Table 3-2. Test Documentation Delivery Requirements for CDRL (Continued)

Title	Recommended Submittal Schedule
13. Certification of Satisfactory Builder Trials	NLT 48 hours prior to start of AT.
14. Test Change Proposals DID No. DI-T-2639B	As required to document proposed changes to test procedures.
15. Ship Test Sequence Network DID No. DI-T-26465A	As required to provide to follow-ship contractors.
16. Ship Test Outline DID No. DI-T-26251A	As required to provide to follow-ship contractors in different yards.
17. Booklet of Ship Test Reports DID No. DI-T-23794A	90 days after ship delivery. Delivery in microfiche media is recommended.

3.4.6 Government-Furnished Test Support. In addition to the test and trial requirements in the ship specification, the shipbuilding contract commits the government to furnish test support, such as:

- o Tactical, test, maintenance and diagnostic computer programs
- o Test hardware
  - oo Selected test equipment
  - oo Weapons shapes
  - oo Special tools used in testing
  - oo Sufficient spares for GFE to permit maintenance during shipboard testing
- o Test facilities
  - oo Targets
  - oo Support ships, boats, and aircraft
  - oo Ranges
  - oo Communication services
  - oo Office space for government test team members
- o Personnel
  - oo Test directors
  - oo Test conductors
  - oo Test witnesses
  - oo GFE Engineering Service personnel

The ship design team determines the government furnished test support needed for the ship program.

3.5 T&E IN THE SOURCE SELECTION PROCESS

The Request for Proposal should require that each offeror describe his approach to structuring the testing in accordance with the Total Ship Test Program for Ship Production: Ship Construction Tests and Trials Manual, NAVSEA 0900-LP-095-2010. The proposal should include a technical discussion of the type of testing to be conducted at each stage of the shipbuilding process and the integration of test documentation provided by the Navy with that provided by the shipbuilder. An overall test schedule showing key test

milestones integrated with construction events should also be required. Where specific requirements are included in the shipbuilding specification for an In-Plant Acceptance Test (IPAT) Program for Contractor Furnished Equipment, the RFP should also require that the proposal address the IPAT program.

The factors included in the Source Selection Plan for evaluating the proposals should include:

- The degree to which the offeror demonstrates technical competence in his T&E approach and schedule
- His understanding of the requirements of the TSTP Ship Construction Tests and Trials Manual
- The capability shown by his organization and his management procedures

These requirements for the proposals should be stated so as to recognize that detailed and more definitive test program planning will be required later in the shipbuilder's Comprehensive Test Plan.

3.6 CONTRACT CLAUSES

The T&E tasks to be undertaken by the shipbuilder during the contract are included in the specifications or in the contract articles. Shipbuilding contracts usually include the following requirements:

- Reliability and Maintainability tasks including demonstration tests on Contractor Furnished Equipment where the applicable equipment procurement specifications do not contain reliability and maintainability or quality assurance testing requirements and the equipment does not have prior extensive Fleet service.
- Test equipment intended to to be provided to the ship, and furnished to the contractor for storage aboard the ship, shall not be used by the contractor for any purpose except for those tests required by Section 095 of the specification.

The most prominent treatment of the tests and trials program appears in the 'Delivery of Completed Ship' clause which requires that:

(a) ". . . vessel shall not be presented for acceptance trials until . . . (the) contractor has satisfactorily carried out those parts . . . for which . . . (he) is responsible . . . and contractor has corrected (certain) . . . contractor responsible deficiencies . . ."

(b) " . . . contractor shall make (an) interval available . . . between . . . trials and delivery . . . to correct contractor responsible deficiencies . . . necessary to avoid an adverse effect on the operational capability of the vessel . . ."

Other paragraphs of the clause require that the shipbuilder make the ship available to the Navy for inspection, tests, and trials to the extent necessary, providing only (as also set forth in the Inspection clause) that they will be performed so as not to delay the shipbuilder's work unduly.

3.7 TEST DOCUMENTATION MANAGEMENT SYSTEM

NAVSEA has established a Test Documentation Management System (TDMS) to provide a repository of test documentation used in new ship construction and shipyard availabilities. It also includes an automated management information system which can serve a wide variety of users such as NAVSEA program engineers, shipbuilders, SUPSHIPs, Navy engineering organizations and contractors. The TDMS is administered by SEA 61X1 and is operated by the Naval Ship Weapon Systems Engineering Station, Code 4J00.

The repository provides for the storage, retrieval and distribution of test documents for surface ship systems. The documents in storage include test outlines, test procedures, test summaries, test narratives, test reports, test problem reports, and test change proposals. These documents are used by

NSWSES and NAVSSES in their roles as Combat System TDD and Ship Systems TDD respectively, and are available to any other organizations upon request. In several ship programs, provisions have been made for the electronic transmission of documents and document changes.

The management information system, called the Test and Evaluation Automated Management Information System (TEAMIS), includes among other things (1) a Master File, which is an inventory of available documentation, with information on the applicability and past usage of each document; and (2) a Project File capability for users as a management tool to track test documentation development and conduct.

SEA 61X1 or NSWSES 4J00 should be contacted for more information on these services.

SECTION 4

DETAILED DESIGN AND CONSTRUCTION PHASE

4.1 THE "TOTAL SHIP TEST PROGRAM" (TSTP) POLICIES

In the early 1970's, as ship designs became more complex and shipboard systems more interdependent, NAVSEA found that the government would have to participate more actively in some parts of the shipyard test program, particularly for government furnished equipment (GFE). Historically, the Navy had given the shipbuilder the installation test procedures that had been developed as part of each equipment contract and had given the shipbuilder the responsibility of integrating these tests among themselves and with the tests of the equipment he was procuring. When the tests were conducted, it was generally the shipbuilder's responsibility to plan and schedule the testing with little formal Navy participation. It might be said the focus of Navy attention was on Builder's and Acceptance Trials. As the equipment, systems and systems integration became more complex, it was necessary for the Navy to be more formally involved earlier in the testing. This resulted in the NAVSEA policy, issued in 1974, that ship construction testing must involve the conduct of a total ship Integrated Test Package (ITP). The ITP consists of a mix of government and shipbuilder prepared tests, tailored to the mix of government and shipbuilder design responsibilities in the contract. The government furnished tests are to be contractually invoked in the contract, and the shipbuilder must get prior approval to deviate from them. To implement this policy, NAVSEA has defined seven stages of testing, standardized the test formats and developed a test numbering system. NAVSEA also identified organizational responsibilities to be used during the planning

and execution of each ship test program. Procedures were also established for implementing a closed loop test problem reporting and resolution system in each ship program. These standards and practices are described in this Section. In 1974, NAVSEA established the Total Ship Test Program (TSTP) to develop and maintain these standards, and to capture lessons learned as they are used in ship acquisition programs.

The shipbuilding programs for the CGN-36, CGN-38 and FFG-7 Classes were the first ones to implement the TSTP, and did so with very successful results. At that time, it was realized that the involvement in ship testing by more Navy organizations and at an earlier time than previously brought a risk of more disruption than it would be worth. In practice, however, it was shown that with proper attention the desired benefits are achieved. Several shipyards and the President of the Board of Inspection and Survey have said that the additional regimen that TSTP brings to the testing efforts results in a more ready ship at the time of trials and delivery. While the TSTP requires additional resources to be applied to the test program, the objectives of the overall shipbuilding program are strengthened. NAVSEA believes the payoff has since been proven on every type of ship program and that the implementation of the policies is well worth the investment.

In 1984, NAVSEA codified the basic precepts of the TSTP and published them in NAVSEA Instruction 3960.5 on "Policy on Ship Testing", making them applicable to all ship industrial availabilities. (Their implementation in shipyard periods other than ship construction is described in Section 6.) The TSTP precepts are summarized as follows:

a. The test requirements must be developed with the objective of confirming that the ship is materially capable of performing its mission during the next operating cycle without recourse to an unplanned industrial availability.

b. Although the test procedures themselves are developed by many separate government and industry organizations, NAVSEA must provide the direction to ensure tests conducted on a ship form an Integrated Test Package (ITP). In evaluating test problems that arise as well as in assessing the readiness for and the success of sea trials, test results must be analyzed and reported from the perspective of the total ship's ability to perform its mission, and not solely on an individual system's ability to support the next testing evolution such as propulsion system light-off examination or combat system ship qualification trials.

c. Special certification requirements must be minimized. When possible, the responsibility for conducting certification testing will be assigned to the shipyard or local Supervisor of Shipbuilding (SUPSHIP). Certification test procedures are to be developed and treated as part of the ship's ITP, even if some tests are conducted by organizations outside of the shipyard or they are scheduled separately from tests conducted by shipyard personnel. The continuity of the test program must be maintained if it is to remain integrated and is to be both efficient and effective. To help control the proliferation of certification requirements for surface ship systems NAVSEA has instituted a special review process (refer to paragraph 4.6). A special review process is not necessary for submarines because the unique performance requirements of their systems has already fostered the necessary degree of control.

d. Testing performed immediately after the construction period must be planned and conducted as an extension of the prior testing to support bringing the ship and its systems from a state of material completion to one of operational readiness. While the construction period is complete for schedule purposes after the ship leaves the shipyard, it must be recognized that the ship's performance is not fully verified until it has completed the operability tests that must be done at sea. NAVSEA must maintain continuity and traceability between the test requirements it imposes during the construction period and those conducted during the post delivery period.

4.2 INTEGRATED TEST PACKAGE

Test program activity during the detailed design and construction phase of the lead ship of a class includes the development and conduct of the ITP. The ITP is the final assembly of tests to be run during construction, Builder's Trials and Acceptance Trials. As described in Section 3, the tests for government furnished equipment (GFE) are provided by the Navy and for contractor furnished equipment (CFE) by the shipbuilder. The terms "total ship testing" and "Integrated Test Package" acknowledge that dealing with these tests as both individual entities and an organized, engineered and structured whole is critical to the success of the test program. There is rarely a need to physically treat the ITP as a single document. (The 800 or so tests for a destroyer size ship would fill many large binders.) However, to enable them to be developed, reviewed, validated, conducted and reported in a cohesive, effective and efficient manner, they are categorized into seven stages of testing. A standard numbering system has been established, to aid in tracking tests during a given shipyard test period, and interfacing with

the NAVSEA Test Procedure Repository for later use on other ships and programs. There are also provisions for control of test documentation changes.

4.2.1 Test Stages. Test stages are used to stratify testing into discrete levels, each level representing a higher level of operability than the preceding one. The obvious objective in this stratification is to promote a building block approach to testing, an approach that has become critically important in the last decade as shipboard systems have become more complex and interdependent. The stratification has also eased the integration of tests of newly developed systems into individual ship ITPs. A brief description of the 7 stages follows. For a detailed description, with more examples, refer to the TSTP Ship Construction Tests and Trials Manual. (The following definitions describe usage of the 7 stages not only in new construction ships, but also in other shipyard availabilities.)

Stage 1. Material Receipt Inspection and Shop Tests. Stage 1 encompasses those tests and inspections that provide for physical inspection of new material, equipment and associated documentation. Stage 1 also encompasses any preinstallation tests conducted in the shipyard. For work planning and cost accounting purposes, this stage is considered a part of the quality assurance program and is not in the test program. The shipyard is normally responsible for the preparation of all Stage 1 tests.

Stage 2. Shipboard Installation Inspections and Tests. Stage 2 includes those tests and inspections of equipment, cabling, waveguide, piping, ventilation, etc., to ensure that each installation has been accomplished in accordance with established standards (drawings and specifications). The shipyard is normally responsible for the preparation of Stage 2 test procedures.

Stage 3. Equipment Level Operational Tests. Stage 3 includes those operational tests which demonstrate that the individual equipment performs within the tolerances after shipboard installation. They are conducted independently of the system (i.e., the equipment may be isolated from the system).

Stage 4. Intrasystem Tests. Stage 4 tests are those that demonstrate that all equipment entirely within one independent system, perform required functions within prescribed limits and tolerances. Stage 4 testing normally consists of the verification of proper intrasystem signals

within a single major subelement of the combat, mobility, support or containment areas of a ship. Some examples of tests in this category are:

- o All light-off examination prior to propulsion plant tests
- o Measurements of operational parameters of external communications transmit and receive networks
- o Guided missile fire control system to launching system interfaces

Stage 5. Intersystem Tests. Stage 5 tests are those that demonstrate two or more independent systems interface to perform a specific function or functions within established standards. The exchange of intersystem signals, commands, functions and all associated computer interfaces are included. Some examples included within Stage 5 testing are:

- o All propulsion plant tests after light-off examination
- o Underwater Battery Fire Control (UBFC) transmission tests to sonar
- o External communications system on-the-air tests
- o Command and Control System Interface Tests (C&CSIT)

Stage 6. Special Tests. Stage 6 tests are those that require special simulation facilities external to the immediate test activity, but as part of the work package for the shipyard industrial effort. Some examples are: waterborne noise surveys, antenna radiation pattern tests, active electronic countermeasure (ECM) range tests, electromagnetic interference (EMI) tests, and System Integration Tests (SIT).

Stage 7. Trials Tests. Stage 7 tests are those that must be conducted during sea trials, viz., Builders Trials (BT), Acceptance Trials (AT), Underway Trials (UT), and Post Repair Trials (PRT). Examples of stage 7 tests are surface search radar system tracking and full power underway trial.

4.2.2 Test Numbering System. At the time of publication of this guide, NAVSEA is transitioning from the numbering system that has been tailored to and used in new ship construction programs (described in the Ship Construction Tests and Trials Manual) to a new system which will better serve the test include tests for other types of industrial periods. Appendix D describes this system. Ship acquisition programs already underway when the new system was established are not required to change to it.

4.2.3 Test Documentation Control. To ensure technical validity, tests are written in a format that identifies the system's configuration down to the actual field change/ordnance alteration (ORDALT) level. When the tests are conducted, they must correspond exactly to the configuration of the hardware.

Past experiences with "generic" test procedures often left a question about the validity of the test itself that sometimes could not be answered without re-conducting the test a second time. During a ship acquisition program, the primary source of test documentation changes are configuration changes to the hardware and computer software. Such changes are frequently made to most major systems both before and after delivery to the shipyard. Quite frequently, if the modification is a newly developed one (as is often the case in weapons or electronics), the availability of good, approved documentation will lag the availability of the hardware. It must be a major concern of all involved in the program to track these changes, evaluate their impact on test documentation, and ensure that the test documentation changes are available at the time of testing. The approach necessary to do this will vary on each program. Documentation control is relatively simple on an aircraft carrier program with only one shipyard involved or on a fleet oiler program with few new electronics equipment. It is quite different on a program like the FFG-7 Class of frigates with three different shipyards building 50 ships and several combat system upgrades taking place during the 10 year construction program. In that case, equipment changes had to be negotiated with each shipyard to determine which ships and at what stage of their construction or post-delivery phase the changes could most economically be incorporated. Of course, a given equipment change can impact several tests, and even affect prospective test revisions associated with other equipment changes. The FFG-7 SHAPM decided that tests were not to be modified until it was determined what changes would apply to a specific ship and shipboard equipment configuration. In this case the SHAPM tasked his total ship test program organization, vice relying solely on the Navy system program managers and their equipment suppliers, in order to ensure maximum responsiveness to the needs of his ships. As a result, they were able to process major test revisions in an average of 90 days.

4.3 ORGANIZATIONAL RESPONSIBILITIES

To be able to bring the necessary attention to bear during critical times in a test program, NAVSEA has superimposed special TSTP assignments on the regular organizational structure that support ship programs. The two types of responsibilities are discussed below.

4.3.1 The Regular Organization.

a. The SHAPM has overall responsibility for ensuring that the ships are built in accordance with the requirements of the contract. With regards to testing, he:

- o Ensures that the appropriate test requirements are developed
- o Ensures that the test support to be provided by the government is identified & provided on time
- o Establishes and manages the test organization necessary for his TSTP

b. Each Systems Command shipborne system program manager must, for the system he is managing:

- o Prepare test requirements
- o Ensure the preparation and delivery of test procedures for GFE to support the ship test program needs
- o Review test procedures for CFE that the SHAPM requires be reviewed by headquarters (verses only by SUPSHIP)
- o Provide support, as necessary, during testing
- o Review proposed test changes and selected test reports

c. The SUPSHIP, as the Navy's on-site contract administrator, must assure that the shipyard accomplishes the test program requirements in the contract. He:

- o Reviews the shipbuilder's test documentation as required, and distributes those identified for review by other Navy activities
- o Provides the government portions of the ITP to the shipbuilder and passes changes proposed by the shipbuilder to appropriate Navy activities for considerations
- o Maintains a test procedure master file
- o Witnesses shipyard testing

- o Chairs the Test Task Group and administers the Test Problem Reporting and Resolution System
- o Coordinates the government provisions of test support on-site

d. The shipbuilder is responsible for ship construction. He:

- o Develops test plans, procedures, and schedules and submits them to the government for review and approval, as required by the contract
- o Reviews government test requirements in the shipbuilding specification and the government furnished test procedures, and provides comments as necessary
- o Conducts all of the tests, with the exception of special tests and certifications for which the government will provide test personnel
- o Makes provisions and provides support for the special tests and certifications which the government will conduct
- o Participates in the SUPSHIP-chaired Test Task Group and in the Test Problem Reporting and Resolution process

4.3.2 The special Total Ship Test organization. Supporting the "regular" organization, in each individual ship program, is a Total Ship Test Program organization (refer to figure 4-1). Elements are put in place to ensure

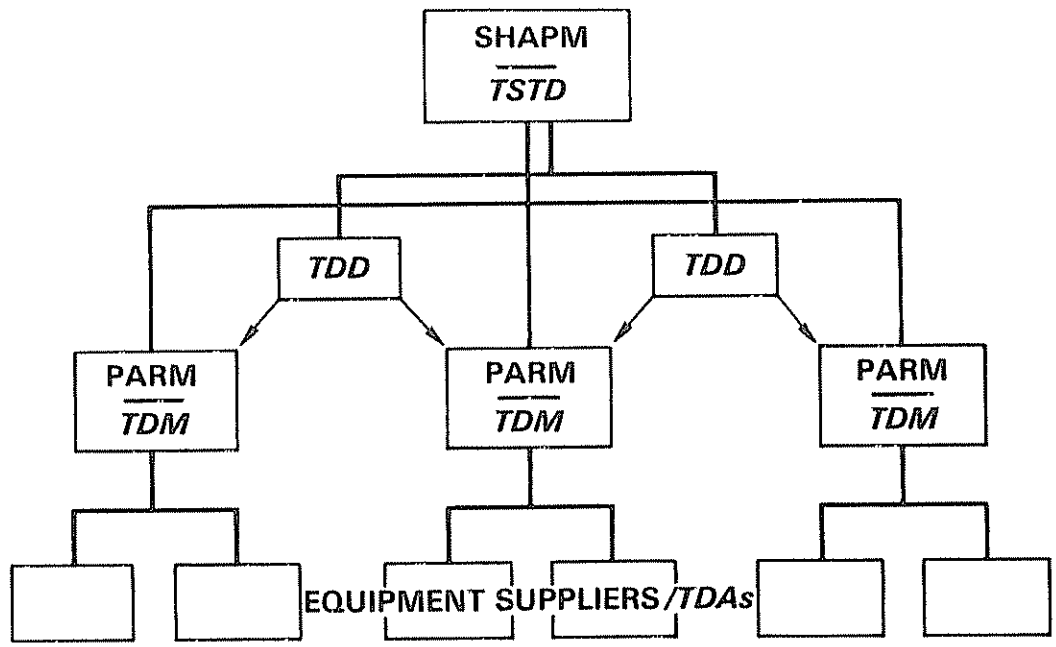

Figure 4-1 Typical SHAPM TSTP Organization

continuity of attention to the testing effort and to provide continuing support to the regular organization that, during periods of heavy workload, would otherwise not be able to adequately manage the testing. For the test program to work properly; i.e., to progressively provide assurance that the ship and ship systems are achieving the proper level of operability, there is a need for continuous and direct communications among all of the parties involved. The "special" organization provides that communication.

a. Total Ship Test Director (TSTD). The TSTD is responsible to the SHAPM for organizing, planning, managing and controlling the development and implementation of an ITP for a specific ship or ship class. He assigns, directs and coordinates the efforts of the test development organization. Included is the direction of the program Test Development Directors (TDDs) and the overall analysis and evaluation of ship test program progress and effectiveness. The ship test program implementation will be accomplished by the TSTD utilizing the SUPSHIP organization and other test groups established to test and certify the systems. The TSTD will usually be a member of the SHAPM's staff or of a Navy organization directly tasked by the SHAPM. In some cases a member of the cognizant SUPSHIP organization is tasked as the on-site or Local TSTD. This approach has been successfully employed on several programs and is recommended as a means of making the test development organization more responsive.

b. Test Development Director (TDD). The TDD is responsible for organizing, planning, managing, and maintaining the test documentation for combat systems (Combat System TDD) or for ship (HM&E) systems (Ship Systems TDD). The responsibilities of the TDD include:

- Developing, or directing the development of, system level tests which verify that the systems are properly integrated among themselves and with the other major systems
- Directing the participants in the test program to develop adequate, accurate, and non-redundant tests by:
  - oo Ensuring that suitable existing test documentation is integrated into an ITP
  - oo Expediting the resolution of deficiencies in existing documentation
  - oo Ensuring that new documentation is being developed where needed
- Ensuring that test documentation is delivered on time
- Developing the system TSNs
- Providing test engineers on-site in the shipyard during testing

To increase the standardization of tests, as well as to effect improvements in test engineering, NAVSEA has designated specific field activities for certain TDD assignments. For surface ship programs, the Naval Ship Weapon Systems Engineering Station (NSWSES Code C-4JOO), Port Huemene, California, has been designated to fulfill the Combat System TDD assignments and the Naval Ship Systems Engineering Station, Philadelphia, Pennsylvania, has been designated for Ship Systems TDD assignments. (There are two exceptions. One is that the Naval Coastal Systems Center, Panama City, Florida, has been assigned as CSTDD for the MCM-1 Class mine countermeasures ship new construction program. The second is that the CG-47 program has four TDDs: three for portions of the combat system and one for the ship system - reporting to the AEGIS Project TDD, the NAVSEA Technical Representative in Moorestown, N.J.) Since most combat system tests are government-furnished, the CSTDD's primary job is one of coordinating government organizations' development of tests. However, since most ship system tests are provided by the shipbuilder, the SSTDD's job is primarily one of coordinating the review of the tests by government organizations.

c. Test Development Manager. The TDM is someone on the staff of, or in an activity directly tasked by, the Systems Command manager having technical cognizance of a particular shipboard system. Unlike the TSTD and the TDD, the TDM is usually not assigned full time to a single ship program, and also probably not to the test program. His dutes are:

- Directing the development of the test documentation for his system and its delivery to the land based test sites (if appropriate) and the shipyard
- Providing for a review of tests on interfacing systems, as directed by the TDD
- Providing test support as necessary
- Participating in (or providing for the system's in-service engineering agent or manufacturer's participation in) the resolution of test problems

d. Test Development Agent. The TDA is the organization responsible for preparing, validating the individual test procedures for equipment and systems under and maintaining cognizance. It is usually the equipment manufacturer or the In-Service Engineering Agent. It should be tasked by the SYSCOM manager to prepare and proof the tests, work with TDA's of interfacing systems to ensure effective and efficient testing, develop test documentation changes to support approved equipment changes, respond to test change proposals and test problem reports, and provide, when necessary, assistance to the shipbuilder and SUPSHIP in the shipyard.

In establishing a ship program's test organization, it is important to ensure that titles are given to the individuals who will actually be performing the work and not to their supervisors, organizational unit leaders or parent organizations. The TDDs, TDMs and TDAs are principal points-of-contact for

the SHAPM. Experience has shown that when persons other than the individual actually performing the task are assigned as TDD, TDM or TDA, it creates unnecessary levels of management that detract from the efficiency of communications. This is counter to the primary goal of streamlining reporting procedures to ensure quick response to test program needs and should be avoided.

Some SHAPMs have funded these Navy organization on a strict incremental basis, and have even allowed funds to lapse. This approach is very disruptive to the organizations and is frequently interpreted as a lack of long term commitment. In some cases, personnel who previously had been dedicated to a particular test program were assigned to other projects when funding lapsed and were not available when it continued. SHAPMs should seriously plan their long term needs and fund accordingly. In particular, they should realize that the work of the test development personnel (TDDs, TDMs, TDAs) will need to continue even after the initial ITP is delivered and for the entire construction program. Some of these continuing tasks are described throughout this chapter.

4.4 PLANNING AND CONDUCT OF STAGE 3, 4, 5 AND 6 TESTING

The primary test program activity during ship construction involves completing the development of the ITP, planning the schedule of testing in conjunction with production milestones, identifying who will be available to support testing, conducting the ITP and reporting the results.

4.4.1 Completing the ITP. Early in the construction period, the test organization should develop and publish a plan describing any new tests to be developed, their development and validation schedule, the review process

(which should vary depending on the maturity of the test procedure), the test sequences and the dates by which test procedures are needed for actual testing. The SHAPMs for the CGN-38, LSD-41, FFG-7 and MCM-1 Classes, among others, have published excellent plans, called in most cases a Ship Test Management Plan (STMP). NAVSEA 61X1 has copies of these documents for reference use.

The objective goal in developing the ITP is a quality product that can readily be used to effectively verify proper system installation and operation and expose discrepancies. The shipbuilder's quality assurance program should cover the preparation of his portion of the ITP. For the Navy's portion, the ship test organization must ensure that the objective is met. Test documentation review criteria such as the following should be specified:

- Prerequisite conditions are specified
- The equipment addressed in the test is the exact equipment being installed aboard the ship, including applicable Field Changes, Shipalts, and/or Ordalts
- The applicable specification requirements will be satisfactorily demonstrated
- The test method is an effective and efficient way of acquiring the required data
- The test method demonstrates the desired equipment and interface parameters including the various modes of operation
- The data sheets show specified values and/or acceptable tolerance limits for each data point or measured value
- The parameters tested are the right ones
- The requirements are consistent with the applicable test outline and test narrative
- Any redundancy between stage 7 and lower level tests is necessary and cannot be eliminated
- The documents are in the proper format and each test procedure is a stand-alone document

Each new test must be validated through actual performance. This validation should entail step-by-step performance of the test on actual hardware which has as close a configuration as possible to the ship. Land-based test sites (LBTS), if available, are excellent facilities for this

validation. In a few cases, arrangements were made for the shipyard people to conduct new ITP tests at the LBTS. This provided them training with the tests they must use later and it provided for a truly independent conduct of the test, not influenced by the hardware manufacturer's field engineers' familiarity with the tests and equipment.

The FFG-7 Class combat and propulsion system LBTSs and the Production Test Centers of the CG-47 Class program were used for such validation with much success. Another alternative is to use actual fleet ships. USS FIDELITY (MSO-443) was used to validate test procedures for new systems (and their integration) planned for the MCM-1 mine countermeasures ship program. FIDELITY is a minesweeper that was used for the Technical Evaluation (TECHEVAL) and Operational Evaluation (OPEVAL) of these systems, and therefore had prototype hardware installed.

When validation of a new test prior to delivery to the shipbuilder is not possible, the conduct of these tests on the lead ship becomes the validation. If a substantial amount of such effort is anticipated, provisions should be made in the shipbuilding contract to schedule specific access to the equipment for the development and proofing of corrections to the tests as necessary.

4.4.2 Shipbuilder Planning. A standard contract data requirement is to have the shipbuilder submit, about 6 months after contract award, a Comprehensive Test Plan (CTP) for approval by the SHAPM to demonstrate that he understands the governments requirements for a test program. Data Item Description (DID) DI-T-23802A provides format and content requirements. The CTP includes as a minimum the following elements:

- o A description of the shipbuilder's test organization showing how it will interface with the SHAPM's test organization
- o The schedule for the shipbuilder's development, review, validation and approval of the test documentation for which he is responsible. (It is important that the shipbuilder have identifiable test review and approval procedures not only to ensure they are adequately controlled, but also so that SUPSHIP make meaningful judgments on when to review the tests.)
- o A schedule of all testing in sequence of planned conduct, thus indicating the interrelationship between events. (For ship programs utilizing commercial specifications, the plan must describe the planned testing in sufficient depth for the SHAPM to judge its adequacy.)
- o A description of the shipyard's part of the test problem reporting and resolution system, and how it will interact with the overall system for this ship program

SEA 61X1, reviews CTPs and provides comments to the cognizant SHAPM. SEA 61X1 also has copies of past CTPs on file.

In the same timeframe as the CTP, the shipbuilder is usually required to submit his first test schedule showing the planned start and completion date for each stage 2 through 7 test (DID No DI-T-23959B). He is usually required to update this schedule quarterly thereafter until the start of testing, after which it is updated monthly.

One item that test program personnel need to pay special attention to when reviewing such plans and schedules is the potential interference between production and testing. The physical protection of equipment, particularly sensitive electronic equipment, after it is first installed in a ship is always a concern, particularly as work on deck tiles, overhead sheathing, cable pulling and other work related to compartment close-out continues. Test program personnel must be particularly concerned when such work continues after testing begins. The shipbuilder will have some requirement to describe ahead of time his plans to protect the equipment and they should include the

use of temporary metal or rigid wood coverings. Many combatant ship programs include special approaches to minimize the risk of such schedule interference, such as providing for installation of the equipment as late as possible. The Rapid Installation Plans used on the SSN-688 Class submarine are an example. But the interference can never be fully eliminated, and the test program personnel need to be aware of this potential source of equipment damage. Production planning personnel will generally be much less sensitive to the test program requirements than they are to meeting production schedules. Likewise, test personnel can be so intent on conducting a risk-free successful test on the first try that they ignore the reasonable requirements of efficient production planning. Both perspectives need to be accommodated to ensure a successful program. A continuing dialogue is needed at all levels; make sure it takes place.

4.4.3 Personnel Support during Testing. On a major ship program, about halfway through the detailed design/construction period, final personnel assignments must be formalized for the manpower-intensive and schedule-intensive testing program that will begin months later. In particular, the Navy (and Navy-sponsored) personnel should be identified by name who will be available to assist SUPSHIP in witnessing the tests, will assist in the resolution of technical problems that arise (including traveling to the shipyard if necessary), and will review/approve test procedure changes on a quick turnaround basis. For GFE, the SHAPM and SUPSHIP should maintain a list of these people in the Navy engineering organization and the system contractors who have been assigned to provide this support. Usually they will not be dedicated to the ship test program, so they should be kept informed of the ship test schedule and be aware that they may be called upon for assistance on short notice.

For complex ships, the SHAPM should charter, in addition to those who will be on an "on-call" basis, a core of people prepositioned during testing at the shipbuilding site to augment SUPSHIP personnel. This group, or a portion of it, should be organized with their counterparts in the shipbuilder's organization into a Test Task Group (TTG), chaired by SUPSHIP, to ensure adequate and timely communication on a day-by-day basis. The Navy members of the TTG are under the administrative control of SUPSHIP. The composition of the group will vary with the test schedule. Its membership can include system technical representatives who can help resolve problems locally, when possible. The Combat System and Ship System TDDs usually provide on-site representatives to the TTG who can provide valuable expertise in the overall engineering of the ITP and sequencing of the tests. These representatives are called the Local Combat System Test Development Director (LCSTDD) and the Local Ship Systems Test Development Director (LSSTDD). In the CG-47 cruiser program, where a relatively significant amount of combat system testing was conducted by the Navy's AEGIS combat system engineering contractor (instead of by the shipbuilder), an AEGIS Test Team was formed. It consisted of dedicated personnel from the shipbuilder, the combat system engineering contractor, SUPSHIP and selected other Navy activities. Combined with a disciplined program of earlier development and production testing of these systems at AEGIS land-based test sites, this significantly contributed to reducing combat systems testing on the ship to about six months. This is several months shorter than most comparable lead ship testing. It also contributed to the achievement of another objective of the program: to deliver the ship to the Navy in a more combat ready condition than previous surface ships.

In addition to the general coordination that is done through a TTG, on submarine programs NAVSEA requires that special Joint Test Groups (JTGs) be established to oversee the planning and conduct of tests that could affect

safety or watertight integrity. The JTGs (usually one for ship systems and one for combat systems) are composed of the shipyard Chief Test Engineer, representatives of the shipyard departments responsible for preparing test documents, SUPSHIP and system contractors (on a case basis). The JTGs have authority and responsibility to review and approve all tests that could impact these ship conditions, approve the daily test schedule, and stop test operations when unsafe or potentially unsafe conditions occur (refer to NAVSEA 0905-485-6010, Manual for the Control of Testing and Ship Conditions).

Several versions of a TSTP Training Course are conducted by NSWSES on a regular basis. Organizations involved in ship test programs should ensure that their personnel newly supporting such programs avail themselves of this opportunity (refer to paragraph 1.4).

4.4.4 Test Problem Reporting and Resolution System. For each ship program, a test problem reporting and resolution process must be established for (1) the timely identification and resolution of problems that occur during testing in the shipyard and (2) the closed loop reporting of corrective action to prevent recurrence on other ships. Problems to be covered under such a process are those which prevent the completion of any portion of a test procedure because of procedural discrepancies, tolerance deviations, design shortfalls, equipment malfunctions or computer program discrepancies. Judgments are necessary to determine both what to identify as a "test problem" and which problems to report and track. So that the process does not become overburdened beyond its usefulness, problems that are obvious, readily correctable on the spot, and not likely to occur again should not be reported. Likewise, problems induced by the test conductor not properly

following the procedure should not be reported. To reduce the number of these types of occurrences, some shipbuilders routinely "dry-run" the test procedure before formally conducting it for the record.

The test problem reporting and resolution process must be tailored to, and defined for, each ship program. Decisions must be made as to whether a single reporting system is to be used for tests of both GFE and CFE. It may be decided that the government need only automatically receive test problem reports dealing with GFE and, for CFE, receive the assurance that the shipyard has some type of reporting system to suit its own purposes. However, in a program involving several shipyards - and particularly where the lead shipbuilder is the purchasing agent for some CFE for the follow shipbuilders - the process should also cover that CFE, to ensure that each shipyard is apprised of the test problems in this equipment uncovered by the others.

Whatever is included in Navy's part of the process, its day-to-day operation must be controlled by the local SUPSHIP. To avoid undue delay in the ongoing production/testing efforts, the SUPSHIP should make every effort to resolve problems locally. The SHAPM should provide SUPSHIP with a reasonable amount of on-site expertise to do so, in the form of a well staffed Test Task Group, personnel supplementing the local Combat System and Ship System TDDs, and the general engineering services provided with new GFE. If problems cannot be resolved by the on-site personnel, they should attempt to take care of them by phone. If formal assistance is required, the SUPSHIP should refer the problem in writing to the cognizant engineering organizations who will have previously been identified and tasked (refer to paragraph 4.4.3). NAVSEA form 4730/1 has been developed for this type of correspondence. SUPSHIP should assign a response time based on the severity

and impact of the problem. The process should permit interim approval of problem solutions, when appropriate. This can allow testing to proceed with the interim resolution approved by SUPSHIP, while remote organizations are given an opportunity to review and validate it.. If the interim resolution is not approved, a decision would have to be made on what testing needs to be repeated after the proper resolutions are incorporated.

Figure 4-2 shows the number of test problem reports generated by the three shipyards involved in building the first flight of FFG-7 Class ships. Note the decline in reports as experience was gained in the test program. As each shipyard conducted the ITP for the first time, they had their own "learning curve" to experience. Not shown by the chart is the fact that

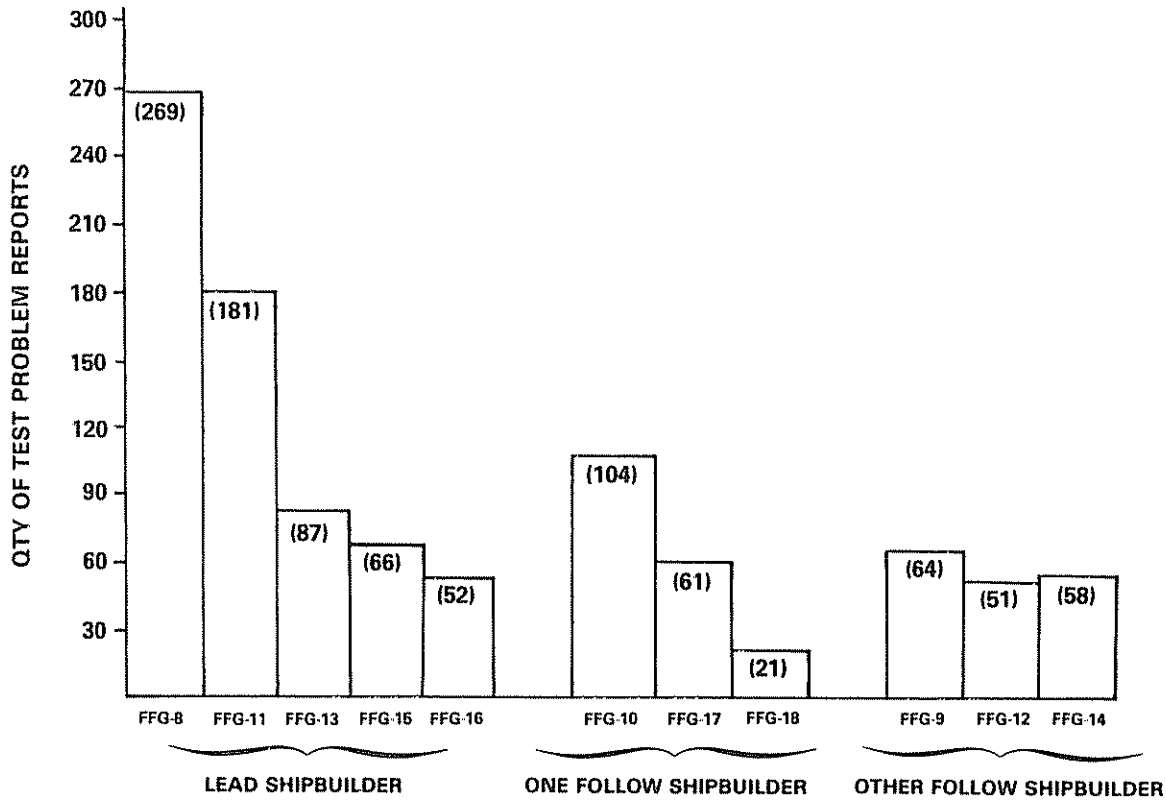

Figure 4-2 Test problem reports on the first flight of FFG-7 Class ships.

as the second flight of ships was built, the numbers rose again, but not to the level of the first flight. This rise was due to changes in equipment (primarily combat system equipment) and the attendant changes in the ITP.

Keep in mind that judgment is required on what the process should cover, and what types of problems to consider reportable. It will be necessary for all involved in the ship test program to make such judgments early in the program, to document them for all to use, and to refine them as experience is gained.

4.4.5 Test Witnessing. The NAVSEA policy is, to the extent possible, all tests should be witnessed. As a minimum, the SHAPM should identify the critical systems entering Navy service for the first time and arrange for 100% witnessing of the tests of those systems. Ship acquisition programs should augment the SUPSHIP staff for test witnessing by utilizing members of the Test Task Group and other government-provided contract engineers. The SHAPM should ensure the contract and specifications prescribe an adequate amount of time to notify the Navy of scheduled tests. Although the shipbuilder must be allowed maximum flexibility in test scheduling, as much as a week's notice in some cases may be necessary to allow for arrangements of the travel of Navy engineers or contractors from remote activities.

4.4.6 Progressing through the Test Program. In recent ship programs that have benefited from the standardization the TSTP fosters, it was found that the results of testing could be used as an indicator of program progress. This was particularly true during the last year of ship construction. During construction of the SSN-688, the SHAPM and SUPSHIP, working with the shipbuilder on an informal basis, reviewed the test package and assigned

weights to the accomplishment of the individual tests (and sometimes portions of the tests) in relation to their significance. All parties found the use of weighting factors gave not only a better measure of the progress of testing, but a close correlation to the degree of ship completion.

4.4.7 Equipment Maintenance During the Test Period. The shipbuilder is responsible, in accordance with the shipbuilding contract, for the condition of the ship's equipment, parts, and material, whether GFE or CFE, from the time of receipt until delivery of the ship to the government. The shipbuilder performs preventive maintenance on equipment, as well as repairing faulty or inoperative equipment. Experience from recent ship acquisitions shows that necessary preventive maintenance of GFE is sometimes not properly performed on equipment in the shipyard environment. Shipbuilding contracts should specify preventive maintenance procedures, performance of which should be monitored throughout the ship construction period. This will help assure that the operability achieved when equipments are initially tested is sustained through the remainder of tests and trials to delivery to the Navy.

In addition to providing for an effective preventive maintenance program, the SHAPM also must pay special attention to spare parts and repair parts support. Lack of adequate spare parts support for the construction tests and trials phase has proven to be a perennial problem. Experience has shown that a lack of installation and checkout parts inevitably results in cannibalization from other ships. Often this cannibalization alters equipment field change configurations and voids previously conducted tests. Additionally, cannibalization results in higher costs for ship construction; i.e., parts removed will have to be reinstalled, resulting in charges for the removal and reinstallation. Cannibalization has sometimes proliferated to the point that some systems in the last ship of a class have been virtual shells

when the time for testing approaches. Three recommendations have emerged from recent ship acquisition program experience with this problem:

- o Establish a priority for ships under construction that will enable the SUPSHIP to obtain rapid response to repair part requests
- o Ensure that equipment managers provide adequate spare parts support during the test period, including some difficult-to-obtain material
- o Stock the supply system with components for new systems early in the procurement process

4.4.8 Crew Participation. The nucleus crew is usually available at the shipbuilding yard for the few months preceding sea trials, and naturally takes a deep interest in the progress of testing. SUPSHIP, with the concurrence of the Prospective Commanding Officer, can sometimes make use of these personnel in assisting in the witnessing of tests. If provided for in the contract or other agreement, these personnel may accomplish some of the testing and maintenance. There is a standard procedure for the "turnover" of equipment from the shipbuilder to the Navy crew in the reactor and propulsion plant areas of nuclear ships. If a SHAPM plans this to any great extent for other areas such as the combat system, he must coordinate with the Naval Military Personnel Command to arrange earlier availability and perhaps special training. The most significant benefit is to allow a smoother transition of the ship from the builder to the Navy. For USS TICONDEROGA (CG-47), the crew was allowed early access to the ship to the extent that live gun and missile firings were able to be conducted during sea trials, before ship delivery to the Navy.

4.5 BUILDER'S AND ACCEPTANCE TRIALS

The policy related to the trials and acceptance of ships is provided in OPNAV Instruction 4700.8. Supplementary policy for nuclear powered ships is contained in OPNAVINST 9080.3.

4.5.1 Builder's Trials. During Builder's Trials (BT), tests and inspections are conducted at sea by the shipbuilder to provide assurance that the ship will be ready for Acceptance Trials (AT), which usually occurs a month later. BT should be treated as much as possible as a rehearsal for AT, including the conduct of the same tests that are anticipated to be conducted during AT. The NAVSEA Ship Acquisition Contract Administration Manual (SACAM), NAVSEA 0900-LP-079-6010, as well as the shipbuilding specifications contain descriptions of the prerequisites for and requirements of BT. The ITP will contain the test procedures to be conducted, categorized as Stage 7 tests.

4.5.2 Simulated INSURV Inspection. Recent ship programs (SSN-688, CVN-68, CGN-38) have expanded the BT to include a simulated INSURV inspection (also known as Mock INSURV or a Pre-INSURV inspection). Section 094, Ship Trials, of the General Specifications for Ships of the United States Navy includes the proposed entry into the ships specifications to invoke this requirement on the shipbuilder. The simulated INSURV inspection is conducted similar to the INSURV inspection to be conducted during the AT, except that the shipbuilder assumes the role of the presenting authority and the SUPSHIP assumes the role of the INSURV. The SUPSHIP designates Navy representatives to act as inspectors and the shipbuilder appoints personnel to accompany the representatives in the inspection. Cards are prepared, as in an INSURV inspection, of each deficiency with the required corrective action. As specified in the ship specification, the SUPSHIP and the shipbuilder will determine whether each deficiency is a government or the contractor responsibility and how each deficiency will be corrected.

When assembling the trial team for Acceptance Trials, PRESINSURV augments the permanent members of the INSURV Board with personnel from Navy engineering activities who are technical experts on selected systems (refer to INSURV

Instruction 4730.18). Since the same personnel are usually selected to support INSURV on ship trials, the SHAPM should try to arrange to have them participate in the simulated inspection of his ship during Builder's Trials. This will provide early orientation for these personnel, as well as provide the SHAPM with insight into their concerns and an opportunity to addresses those concerns before AT.

4.5.3 Pre-Sea Trial Audit (PSTA). A PSTA was successfully used on the CVN-68 Class program to expedite the correction of deficiencies prior to BT and AT. The audit cycle started about 6 months prior to the proposed BT. Due to the size and complexity of the carrier, the systems to be included in the audit were chosen by criticality to the mission of the ship and the history of the item in previous shipboard applications. For each of the selected systems, Navy representatives were designated to conduct an audit cycle which lasted about 5 weeks, with several audits being conducted concurrently. The purpose of the audit was to identify discrepancies typically uncovered during trials and allow their correction earlier.

4.5.4 Acceptance Trials (AT). AT consist of an inspection of a ship by the INSURV Board to determine suitability for acceptance of the ship, including the correction of deficiencies found during BT.

The shipbuilder submits to the SUPSHIP, for approval, the proposed agenda and schedule of the tests to be conducted during AT and the proposed dates for the trials. The contract should require this submittal 90 days prior to the proposed date for AT and should allow 60 days for Navy review and comment. OPNAV Instruction 4700.8 recommends that SUPSHIP propose the applicable trial

date to PRESINSURV at least 60 days in advance. INSURV Instructions 9080.2 and 9080.3 require that the SUPSHIP forward the proposed agenda to INSURV at least 30 days prior to the trials. However, the proposed contractual lead-time requirement of 90 days is desirable. Once the agenda is approved by PRESINSURV, last minute changes should be resisted in order to provide the smooth flow of events necessary during the trials. It should be noted that INSURV reserves the right to, and sometimes will, deviate from the agenda during the course of the trial. This includes requesting lower level tests that were already completed prior to trials.

The SUPSHIP provides written certification to the PRESINSURV that the BT was completed satisfactorily, that deficiencies have been corrected, that all ship systems are operational and that the ship is ready for AT. More information on this certification is provided in Appendix 20B of the Ship Acquisition Contract Administration Manual. The SUPSHIP functions as the presenting authority. The trials are conducted dockside and at-sea utilizing the requirements of INSURV Instructions 9080.2 and 9080.3 to demonstrate to the INSURV compliance with contractual requirements. After the AT is completed, selected equipment (as requested by INSURV and directed by the SUPSHIP) are opened and inspected during a post-trial examination period.

The objective of the entire acquisition process is to provide an operational capability, not simply hardware on a ship platform. Hence, INSURV observes the testing of all elements of the total weapons and support systems. Because of the CNO's emphasis on operational readiness, INSURV takes a close look at the availability of proper technical documentation, installation drawings, reference standards, Allowance Parts Lists, onboard spare parts, tools, test equipment, installation of the Planned Maintenance System (PMS), and space for stowage, maintenance and workshops.

Although the OPNAV and INSURV Instructions on trials do not make a clear distinction, it is understood that for a major combatant ship the combat system capability that can be demonstrated during AT is somewhat less than is expected later when the crew has had an opportunity to operate the combat system and after post-delivery shipboard training exercises have been completed. For example, AT is not expected to include a simultaneous demonstration of several warfare areas or the conduct of a multithreat combat scenario. In addition to problems in training a trials crew for this type of demonstration, it would not be cost effective to include this level of testing within the shipbuilding contract period, because responsibility for the success of such testing would primarily be the government's responsibility if the combat system design and most of the equipment are provided by the government.

The AT trials team consists of the INSURV Board augmented by selected support personnel from other activities. The cost of travel and per diem for support personnel is funded by INSURV. Labor costs (salaries, overtime, and applicable overhead) are not funded by INSURV. The SHAPM funds the labor costs of support personnel from Navy organizations that require such funding i.e., Navy Industrial Funded activities (refer to INSURV Instruction 4730.18).

When INSURV trials are conducted on a ship constructed in a Naval shipyard or one that has undergone a major modernization or conversion, these trials are referred to as Underway Trials (UT), not AT. When AT (or UT) are combined with the Final Contract Trials, the resulting trials are called Combined Trials.

4.5.5 Phased Ship Completion. OPNAV occasionally approves phased ship completion of major combatant ships (particularly the first ship of the class). This deferres some higher level integration testing until a special test period following ship delivery, instead of during the shipyard period.

The CGN-38 program is an example. The complexity of the combat system, the absence of a full combat system LBTS and the parallel development of complex computer programs by government personnel prompted the use of the phased-completion approach to reduce the liability of the government for delays in the intersystem testing of GFE. Stage 1 through Stage 5 and selected Stage 6 tests of the ITP were conducted by the shipbuilder. Other Stage 6 tests, including the Command and Control Operational Program Functional Checkout and Stage 7 tests were conducted by a joint government and contractor integration team. For this program, the phased completion approach is estimated to have lengthened the time from ship delivery to full release for fleet operations by about 3 to 4 months. But, it was considered effective from a contractural, overall costs, schedule and technical standpoint.

The SHAPM, prior to any contractual obligations to the phased-completion approach, must submit a letter to the CNO requesting a waiver of the normal requirements for delivery and acceptance of the ship as required by OPNAV Instruction 4700.8. If approved, OPNAV will issue an instruction (4700 series) on the procedures for trials, acceptance, commissioning, fitting out, shakedown and post-shakedown availability of the particular ship or class. The SHAPM should discuss with PRESINSURV the expected material readiness of the ship at AT so that they have a mutual understanding of the scope of the AT.

4.6 CERTIFICATION REQUIREMENTS

As some shipboard systems became more complex and the handling, installation, testing operation and maintenance required special training, the cognizant Systems Commands have in selected cases invoked requirements for a special certification effort to ensure that the system is working properly when turned over to the ship's crew. The certification requirements frequently involve the use of outside teams who come into the shipyard to conduct some installation checkout tests and perhaps performance tests. These certification requirements tended to proliferate during the 1970's and fell into disfavor with the SUPSHIPs and shipyards due to: incomplete test documentation, inadequate pass/fail criteria and disruptive scheduling requirements. As a first step in addressing the problem, NAVSEA published a Guidance Manual for Shipborne Systems Certification Requirements, NAVSEA S9040-AA-GTP-010-SSCR. This manual contains a data sheet for each major certification requirement for surface ships and describes the source of the requirement, the testing procedure (who tests, where are the tests documented, who certifies to whom) and the prerequisites.

NAVSEA then made it policy that shipboard certification requirements are to be minimized. When possible, the responsibility for conducting testing to support certifications is to be assigned to the shipyard or the local SUPSHIP. Test procedures that support certifications are to be developed and treated as part of the ITP, even if organizations outside the shipyard will be conducting some of the tests and even if the tests are scheduled in a time frame separate from the tests conducted by shipyard personnel. In 1983, NAVSEA established a surface ship Shipboard Certification Requirements Review

Board under the chairmanship of SEA 91 to review all current and future certification requirements to effect this reduction and to provide needed consistency of approach. It is anticipated that by late 1985, the initial work of the Board will be completed, and the Guide mentioned previously will be replaced by an authoritative manual that lists the current certifications approved for continuation.

Ship test program personnel need to be aware of these efforts. SHAPM personnel should ensure that the testing part of certification requirements are incorporated into the development of the ITP so that the SUPSHIP and shipyard can readily see a cohesive and integrated test program. They should also keep apprised of certification requirements that are discontinued, and delete them from the shipbuilding contracts as soon as possible thereafter.

4.7 MAINTENANCE TEST PACKAGE

Each ship must have a maintenance test package, as part of its Planned Maintenance System (PMS) documentation, for ship's force to use in monitoring material readiness after the ship is turned over to the fleet. Refer to MIL-P-24534 (Navy). NAVSEA policy is to use as similar testing as possible in both PMS and ITP testing in order to (1) reduce test development costs and (2) enhance the traceability and repeatability of test results among different events. DOD STD 2106 (Navy) and MIL-P-24534 prescribe the same basic engineering process for developing ITP and PMS tests respectively. When these two standards are invoked on a system manufacturer, similar tests (perhaps formatted differently) can be achieved.

4.8 FOLLOW-SHIP TESTING

The lead ship of the class will usually have more testing in some equipment than may be necessary for the follow-ships, such as in tests to proof new interface design approaches or tests of new hardware and computer programs. In addition to this, some unnecessary redundancy of testing (in spite of the best efforts of all to reduce it beforehand), some better testing approaches to reduce the use of resources such as aircraft services, and some more efficient methods to reduce equipment manning requirements will be found on the first ship. The ship test organization must be attentive to capturing this experience and to changing the follow-ship ITP accordingly. A fairly simple reduction in a test requirement can have a large saving downstream, particularly when multiplied by the number of remaining ships in the class.

SECTION 5

POST-DELIVERY TESTS AND TRIALS

5.1 INTRODUCTION

As ship designs and capabilities have increased in complexity, so have the efforts to bring a ship from contractual completion at the time of its delivery to the Navy to its maximum state of operational readiness prior to initial deployment. The post delivery tests and trials phase encompasses the test program related events that take place while the ship is still under the Ship Construction Navy (SCN) funding envelope; i.e., before the end of the SCN work limiting date, which is usually about 11 months after delivery. During this time, the ship completes fitting out (when that was not done prior to delivery), goes through shakedown tests and trials, and returns to an industrial activity for Post Shakedown Availability.

5.2. OBJECTIVES

Post-delivery tests and trials are structured to achieve four objectives:

- To establish the ship's capabilities and limitations and to provide feedback to the ship design community
- To verify the ship's material readiness in at at-sea environment. This is a continuation of testing begun during construction through the Integrated Test Package
- To verify that the ship achieves what the CNO specified in the class Top Level Requirements
- To enhance the proficiency of ship's force in operating the ship and its systems effectively and efficiently; i.e., to "fight the ship" as a team and exploit her full capabilities

5.3. TEST PLANNING AND CONDUCT

The test program during this phase consists of a series of specialized test and trial events, each one structured to achieve one or more of the four objectives. Many of the tests involve special range and instrumentation facilities, and all involve special scheduling arrangments with the ship and Type Commander. The TSTP Ship Post-Delivery Tests and Trials Guidance Manual, NAVSEA 0900-LP-095-3010, describes the more common events, their individual objectives, resources required, Navy activities involved, scheduling requirements, tips on planning, and both references and points of contact for more information.

Among the test events are Final Contract Trials (FCT) conducted by the Board of Inspection and Survey (INSURV). FCT requires particular attention not only because it is conducted by INSURV but because of its objectives:

- To determine shipbuilder responsible defects prior to the end of the guarantee period
- To determine defects in government furnished equipment, now that they have been operated at-sea
- To determine the operational readiness and performance of ship's force in the operation of the ship. OPNAV Instruction 4700.8 requires that the Type Commander must certify the ship's readiness before trials begin

The coordination of post-delivery tests and trials events is the responsibility of the SHAPM even though each is separately required and authorized (most by CNO direction). The SHAPM should start at least a year in advance scoping and planning the events with the cognizant organizations who will direct them and with the ship. For combatant ships, where planning can be extensive, many SHAPMs have found it necessary to publish and maintain an overall post-delivery tests and trials plan to keep all parties advised.

Samples of such plans are available from SEA 902 and SEA 61X1. For all to gain maximum benefit from these events they must be structured as a logical extension of prior testing. The SHAPM and all involved must ensure that there is traceability between the ship construction and post-delivery phases. There must be deliberate efforts to make this happen. There are so many organizations involved in different events that it is easy for the events to be planned and conducted without reference to the larger test program of which they are a part.

5.4. POST SHAKEDOWN AVAILABILITY (PSA)

PSA is a shipyard availability that occurs after the shakedown period, but prior to the end of the SCN limiting date. During this period, deficiencies uncovered during the shakedown period, including those found on Final Contract Trials, are corrected. In addition, authorized new equipment and system modifications are installed. On a combatant ship, this latter category of work can be significant, since many improvements to the newer combat system equipment can be expected during the course of the ship construction program. As these improvements become available, it can be expected that PSA's will provide attractive opportunities for catching (1) those ships recently delivered but still within the SCN envelope and (2) those hulls which are so far into construction that installation prior to delivery would be prohibitively disruptive and expensive. The SHAPM must ensure that a test program tailored to each individual ship's PSA work package is planned, conducted and reported. Since the tests to be used will be the same as those in portions of the Integrated Test Packages being used on other ships of the class during their construction, the SHAPM will in most cases manage the PSA test programs as extensions to his overall Total Ship Test Program for the class.

SECTION 6

INDUSTRIAL AVAILABILITIES

6.1 INTRODUCTION.

The doctrine of Total Ship Testing applies equally to a ship during industrial availabilities (such as Regular Overhauls and Selected Restricted Availabilities) as it does to new construction. As described in paragraph 4.1, the policies that derive from this doctrine are:

a. A well engineered test effort must be performed prior to the industrial period to accurately determine the material condition of the systems and equipment.

b. The test requirements must be developed to confirm that the ship is materially capable of performing its mission during the next operating cycle, and not necessarily be limited to the equipment being installed, overhauled or repaired.

c. Test procedures must be treated as part of a total ship Integrated Test Package (ITP), both during their preparation and conduct.

d. Test procedures that support special system certification requirements are to be treated as part of the ITP.

e. Testing performed immediately after the industrial period must be planned and conducted as an extension of prior testing to bring the ship and its systems from a state of material readiness to one of operational readiness.

The objective of the test program during an industrial availability is to ensure that the total ship is materially capable of performing its mission, although it is not necessary that every equipment and system be brought through the full 7 stages of testing. (For the definition of the 7 stages, refer to paragraph 4.2.1). The test requirements are developed from the need

to verify proper operability of (1) systems that are new, overhauled or received major repairs, (2) systems where ability to perform properly may have been affected by stand-down during the industrial period and (3) systems where operation may be affected by work done on interfacing systems. The scope of testing is directly proportional to the scope of the work package. Since the work package has two sponsors (the Type Commanders (TYCOM) for repairs and NAVSEA for alterations), the management of an industrial test program has much less NAVSEA involvement than a new construction ship test program where NAVSEA is the sole sponsor. Planning and conduct of the test program is left to the Naval shipyard or SUPSHIP and the Planning and Engineering for Repairs and Alterations (PERA) organizations. In some cases they are assisted by NAVSEA engineering field activities such as the Naval Ship Weapon Systems Engineering Station (NSWSES) for surface ship combat system testing support and the Naval Underwater Systems Center (NUSC), New London, for submarine combat system testing support. \ PERA SS does w/o NUSC

6.2 INTEGRATED TEST PACKAGE

Sections 092 and 094 of NAVSEA S9AA0-AB-GOS-010 contain the general specifications for surface ship overhaul shipboard tests and post-overhaul ship trials. A total ship Integrated Test Package (ITP) is called for under Section 092c.

The ITP is the final assembly of tests to be conducted during the industrial availability. The shipyard, Naval or private, with the assistance from PERA (and SUPSHIP when the shipyard is a private yard), has ultimate

responsibility for ~~prepar~~ing conduct of the overall ITP. Some sections of the ITPs, such as the combat system, are usually provided by other activities. Unlike new construction test programs, the majority of the tests should already be available. NAVSEA policy requires maximum use of Planned Maintenance System (PMS) tests during all major test events of a ship's life (except initial construction). This practice provides consistency and traceability during successive test events on the same ship, particularly those conducted by ship's force. It also allows the comparison of test results between ships. For testing outside of shipyard availabilities (e.g., Pre-Overhaul Tests and Inspections, Combat System Post-Overhaul Examinations, and Underway Material Inspections), PMS tests are used almost exclusively. For shipyard availabilities, PMS tests with data sheets are used only if they support the technical objectives of the test program. However, sometimes this is not the case; for example:

a. The configuration of the equipment has changed to the point that the available PMS tests are inadequate.

b. The equipment is being newly installed or is being re-installed after refurbishment, and either the testing methodology or the depth of testing is not stringent enough to fully verify proper installation and equipment/system operation.

c. The introduction of a significantly revised tactical computer program requires that testing more extensive than the PMS tests be conducted to support final proofing of the program.

Cases such as these require that tests other than or in addition to the PMS tests be used for a particular equipment. Generally, the Systems Command program manager responsible for the new equipment, alteration or computer program is responsible for developing the associated installation checkout tests and making them available to cognizant shipyards.

6.3 ORGANIZATIONAL RESPONSIBILITIES

6.3.1 NAVSEA Ship Logistics Manager is the primary NAVSEA point of contact with the shipyard and the Fleet for each ship industrial period. He is responsible for directing the installation of alterations authorized by OPNAV under the Fleet Modernization Program. In doing so, he integrates the requirements of all of the Systems Commands.

6.3.2 SEA 05 and SEA 06 manage the design, development, integration testing and support of ship systems and combat systems, respectively.

6.3.3 The Type Commander (TYCOM) budgets for and funds the repairs to be included in the work package and screens which tests are to be conducted by ship's force.

6.3.4 PERA is the industrial planning agent for NAVSEA and the TYCOM, who manages the development of the shipyard work package.

6.3.5 The shipyard is responsible for completing the work package, including the conduct of the ITP (and scheduling the ship's force conduct of those portions of the ITP screened to them).

6.3.6 The cognizant SUPSHIP administers the contract and is the primary Navy contact for the shipyard, when the overhaul is industrial availability to a private shipyard.

6.3.7 The Combat System Test Development Director (CSTDD), when assigned, is responsible for coordinating the preparation of the combat system portion of the ITP and providing it to PERA for transmittal, along with the ship system test requirements, to the shipyard. NAVSEA has assigned a CSTDD for the majority of surface ship classes; NSWSES has been given that assignment in all such cases. Tasking to NSWSES for this assignment for specific availabilities frequently includes the requirement to provide on-site engineering support to the shipyard during testing.

6.4 FUNDING

Generally, the development of test procedures is funded as part of the development of the individual repairs and alterations and is done by the cognizant Navy In-Service Engineering Agents. The only significant costs to be funded as part of the shipyard test program are therefore those of the shipyard to conduct the tests. The conduct of tests associated with repairs is funded by the TYCOM; that associated with alterations is funded by NAVSEA. The conduct of system level tests beyond the scope of the individual repairs and alterations is, by mutual agreement, funded by the TYCOM; any engineering work required to assemble the ITP, as well as funding to provide on-site support for the conduct of the ITP, is funded by NAVSEA.

6.5 PRE-INDUSTRIAL PERIOD

During the year prior to the start of the availability, one or more ship inspections are made to determine its material condition for purposes of scoping the work package. Such inspections are made by PERA and, if assigned

at that time, the shipyard. PMS tests are primarily used during this inspection. Soon after, the TYCOM holds a Work Definition Conference (WDC) to make decisions and provide authorization for the work package scope. Among the decisions made are the scope of testing and the screening of responsibility of conducting each test to either shipyard or ship's force. Although it is the TYCOM's prerogative to make these decisions on screening, NAVSEA recommends that Stage 4 and 5 Combat system tests be screened to the shipyard because of their complexity and the difficulty involved in diagnosing problems that can occur. PERA is responsible for providing an initial assessment of test program requirements to the TYCOM prior to the WDC. PERA CRUDES for example provides this in the form of a preliminary Integrated Test Planning Document (ITPD). After the conference, PERA issues the authorized ITPD in conjunction with the Ship Alteration and Repair Package. This document includes a test index (including source and expected date of delivery, for those that will be supplied by other Navy activities; see paragraph 6.6.1), a listing of certification requirements, test sequence networks and Combat System Test Summaries.

Because combat system work has become so specialized and private shipyards sometimes delegate such work to subcontractors, NAVSEA has instituted the Master Ordnance Repair (MOR) Program (NAVSEA Instruction 8000.2). Under this program a NAVSEA team reviews and qualifies private shipyards and contractors who plan to do surface ship combat system work. MOR qualification is now being used as a consideration in selecting private shipyards for ship overhaul work.

6.6 INDUSTRIAL PERIOD

When the shipyard is assigned the overall work package, it is not held responsible for deficiencies that are identified through the conduct of the ITP, except of course those warrantee items that should have been corrected during the normal course of completing the assigned work package. When such deficiencies are identified, the TYCOM must decide which deficiences are to be corrected, who is to make the correction and whether or not the industrial period must be extended for this additional work.

6.6.1 Preparation of the ITP. It is the shipyard's responsibility (whether Navy or private) to prepare the ship Integrated Test Package (ITP). In many cases, portions of the ITP are provided to the shipyard and the shipyard is required to use these as provided, or to obtain approval before deviating from them. The documentation includes stand-alone test procedures, reflecting the proper system configuration, and test sequence networks and an index. Such documentation is provided:

- o Combat system tests for surface ships (developed and maintained under the sponsorship of NAVSEA's Test and Certification Program for Surface Ships)
- o Combat system tests for submarines (developed and maintained under the sponsorship of NAVSEA's Anti Submarine Warfare Systems Test Program, and PM-1's Poseidon and Trident Missile Test Programs)
- o 1200 PSI propulsion plant tests (developed and maintained under the sponsorship of the 1200 PSI Propulsion Plant Test and Certification Program)

There are some additional tests that have been standardized and are retained in the PERAs' repositories, such as those for surface ship combat support systems maintained by PERA CRUDES, that are made available to the shipyards

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for guidance, but which are not controlled to the point that prior approval must be obtained by the shipyard to deviate from them. However, the shipyards are required to provide feedback after use of such tests to the respective PERA so that any improvements can be incorporated into the standard test procedures.

6.6.2 Conduct of the ITP. The shipyard is responsible for scheduling the testing so that it proceeds from the lower to the higher stages, with each successive stage demonstrating higher level operability. The shipyard integrates the testing assigned to ship's force and any outside organizations with its own schedule and does a final review of the ITP before testing starts. It must also integrate the applicable certification requirements into the schedule (refer to paragraph 4.6). Most work packages for combatant ship availabilities include the requirement for the shipyard to develop an overall test plan and to submit it to PERA for review.

The Test Task Group (TTG) coordinates test program matters on-site with ship's force and representatives from outside Navy organizations such as certification teams and system engineering service personnel. When the shipyard is a Navy yard, a shipyard representative chairs the TTG. When it is a private shipyard, SUPSHIP chairs the TTG and the shipyard provides a representative. In addition to the general coordination that is done through a TTG, on submarine programs NAVSEA requires that special Joint Test Groups (JTGs) be established to oversee the planning and conduct of tests that could affect safety or watertight integrity. The JTGs (usually one for ship systems and one for the combat system) are composed of the cognizant Chief Test Engineer, representatives of the shipyard departments responsible for

preparing test documents, system contractors (on a case basis), SUPSHIP and ship's force. The JTGs have authority and responsibility to review and concur in all tests that could impact safety and watertight integrity, approve the daily test schedule, and stop test operations when unsafe or potentially unsafe conditions occur. Refer to NAVSEA 0905-485-6010, Manual for the Control of Testing and Ship Conditions.

For each test program, the shipyard is required to maintain a Test Problem Reporting and Resolution Process for (1) the timely identification and resolution of problems that occur during testing and (2) the closed loop reporting of corrective action to prevent recurrence on other ships. The problems to be reported in this manner are those that prevent completion of a portion of a test because of procedural discrepancies, tolerance deviations, equipment malfunctions or computer program discrepancies. NAVSEA form 4730/1 has been developed for this purpose. The reports are sent to organizations outside the shipyard/SUPSHIP area when they report deficiencies in equipment or documentation that were supplied by such organizations.

6.6.3 Progress Reporting. In regular status reports to NAVSEA (refer to NAVSEA Instruction 4710.8), the Naval Shipyards and SUPSHIPs must report progress against certain key milestones of a major industrial availability of a surface ship. Among these milestones are the following related to the test program:

- o Start of propulsion plant light-off examination (LOE)
- o Commence combat system operability testing (stages 4 and 5)
- o Conduct combat system sea trials
- o Complete combat system portion of the ITP

Test reports are required for most tests. The test report consists of a copy of the test procedure, with the data sheets completed and proper signatures affixed. At the completion of the industrial period, the Naval Shipyard or SUPSHIP must report to the TYCOM, NAVSEA and the ship any major deficiencies identified during testing that would keep the ship from fully performing its mission, in addition to the status of the conduct of the ITP.

6.7. POST-INDUSTRIAL PERIOD

After completion of the industrial period, test events are conducted to complete the demonstration of material and operational readiness that could not be demonstrated earlier. The more common events are :

- o Operational Propulsion Plant Examination (OPPE) conducted by the Fleet Commander's Propulsion Examination Board on conventionally powered ships to verify that the plant, the procedures and the personnel can operate safely and effectively

- o Combat System Post Overhaul Examination for LANTFLT ships and Combat System Overhaul Review for PACFLT ships conducted by the Immediate Unit Commander to evaluate the surface ship's Tactical Training Program and Combat System readiness

- o Combat System Ship Qualification Trial (CSSQT) is a training and qualification effort for surface combatant ships conducted by NSWSES to help the crew groom the system and prepare them for their first post overhaul live firings

- o Weapon System Accuracy Trial (WSAT) determines the accuracy and limitations of the Anti-Submarine Warfare systems of both surface ships and submarines on specially instrumented ranges

6.8. SHIP CONVERSIONS AND MODERNIZATIONS.

The management of shipyard test programs conducted during conversions and modernizations follows the procedures used during new construction (Section 4), instead of those described in this section for ship overhauls.

APPENDIX A

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NAVSEA 0900-1P-095-5010 - TSTP Ship Acquisition Test and Evaluation Budgeting Guide dated September 1982

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APPENDIX B

SUBJECT INDEX

APPENDIX C

LIST OF ABBREVIATIONS AND ACRONYMS

The following list of abbreviations and acronyms includes those used in this Guide. The list also includes those used elsewhere in other Total Ship Test Program (TSTP) publications.

-A-

ACAT	Acquisition Category
APL	Allowance Parts List
ASW	Anti-Submarine Warfare
AT	Acceptance Trials

-B-

BACD	Basic Alteration Class Drawing
BITE	Built-In Test Equipment
BT	Builder Trials

-C-

C&C	Command and Control
CCSQT	Consolidated Combat System Qualification Trials
CDRL	Contract Data Requirements List
CHG	Change
CIWS	Close-In Weapon System
CNO	Chief of Naval Operations
COH	Complex Overhaul
COMNAVSURFLANT	Commander, Naval Surface Forces U.S. Atlantic Fleet
COMNAVSURFPAC	Commander, Naval Surface Forces U.S. Pacific Fleet
CSAT	Combat System Alignment Test
CSE	Combat System Engineer
CSIT	Combat System Interface Test
CSMP	Combat System Management Plan
CSMP	Current Ship Maintenance Project
CSOR	Combat System Overhaul Review
CSOT	Combat System Operability Test
CSPOE	Combat System Post Overhaul Examination
CSRR	Combat System Readiness Review
CSRT	Combat System Readiness Test
CST&C	Combat System Test and Certification
CSTDD	Combat System Test Development Director
CSTEM	Combat System Test and Evaluation Manager
CSTS	Combat System Test Summary
CSTTG	Combat System Test Task Group

-D-

DAC	Days After Contract Award
DAR	Defense Acquisition Regulations
DID	Data Item Description

DOD	Department of Defense
DODISS	Department of Defense, Index of Specifications & Standards
DSOT	Daily System Operability Test
DT&E	Development Test and Evaluation
DX/DR	Data Extraction/Data Reduction

-E-

ECM	Electronic Countermeasures
ECP	Engineering Change Proposal
EDM	Engineering Development Model
EMI	Electromagnetic Interference
ESWBS	Expanded Ship Work Breakdown Structure (5-digits)

-F-

FAR	Federal Acquisition Regulations
FCT	Final Contract Trial
FSCM	Federal Supply Code for Manufacturers

-G-

GENSPEC	General Specifications for Ships
GFE	Government-Furnished Equipment
GFI	Government-Furnished Information
GPO	Government Printing Office

-H-

HM&E	Hull, Mechanical and Electrical

-I-

INSURV	Inspection and Survey, Board of
IMA	Intermediate Maintenance Activity
IPAT	In-Plant Acceptance Test
ISEA	In-Service Engineering Agent
ITP	Integrated Test Package
ITPD	Integrated Test Planning Document

-J-

JTG	Joint Test Group

-K-

-L-

LBEF	Land-Based Engineering Facility
LBTF	Land-Based Test Facility
LBTS	Land-Based Test Site

LCSTDD	Local Combat System Test Development Director
LORAN	Long-Range Navigation
LSSTDD	Local Ship System Test Development Director
LTSTD	Local Total Ship Test Director

-M-

MARAD	Maritime Administration
MCA	Material Condition Assessment
MIL	Military
MIP	Maintenance Index Page
MOR	Master Ordnance Repair
MOTU	Mobile Ordnance Test Unit
MRC	Maintenance Requirement Card
MSB	Maintenance Standard Bulletin

-N-

NAVSEA	Naval Sea Systems Command
NLT	Not Later Than
NOSC	Naval Ocean Systems Center
NSWSES	Naval Ship Weapon Systems Engineering Station
NTDS	Naval Tactical Data System
NUSC	Naval Underwater Systems Center

-O-

OCSOT	Overall Combat System Operability Test
OD	Ordnance Document
O&MN	Operations and Maintenance Navy
OPEVAL	Operational Evaluation
OPNAV	Operation Test and Evaluation Force
OPPE	Operational Propulsion Plant Examination
OPTEVFOR	Operation Test and Evaluation Force
ORDALT	Ordnance Alteration
OT&E	Operational Test and Evaluation

-P-

PARM	Participating Manager
PAT&E	Production Acceptance Test and Evaluation
PDT&T	Post Delivery Tests and Trials
PERA	Planning and Engineering for Repairs and Alterations
POA&M	Plan of Action and Milestones
POFA	Programmed Operational and Functional Analysis
PMS	Planned Maintenance System
PRESINSURV	President, Board of Inspection and Survey
PSA	Post-Shakedown Availability
PSTA	Pre-Sea Trial Audit

-R-

R&D	Research and Development
REV	Revision
RFP	Request for Proposal

RIP	Rapid Installation Plan
ROH	Regular Overhaul
RSB	Reference Standards Book

-S-

SACAM	Ship Acquisition Contract Administration Manual
SAD	Supplemental Alteration Drawing
SAP	Ship Alteration Proposal
SAR	Ship Alteration Record
SARP	Ship Alteration and Repair Package
SCN	Ship Construction Navy
SCRRB	Shipboard Certification Requirements Review Board
SESEF	Shipboard Electronic Systems Evaluation Facility
SFOMS	Ship Force Overhaul Management System
SHAPM	Ship Acquisition Program Manager
SHIPALT	Ship Alteration
SIMA	Ship Intermediate Maintenance Activity
SIT	System Integration Test
SLD	Ship Logistics Director
SLM	Ship Logistics Manager
SOS	Supervisor of Shipbuilding, Conversion and Repair
SOT	System Operability Test
SPEC	Specification
SQT	Ship Qualification Trial
SRF	Ship Repair Facility
SSCI	Ship Systems Configuration Index
SSCR	Ship Systems Certification Requirements
SSR	Ship Selected Records
SSTDD	Ship Systems Test Development Director
STEPS	Ship Test and Evaluation Program Standards
STD	Standard
SUPSHIP	Supervisor of Shipbuilding, Conversion and Repair
SWAB	Ship Work Authorization Boundary
SWBS	Ship Work Breakdown Structure
SWLIN	Ship Work List Item Number
SYSCOM	Systems Command

-T-

T&C	Test and Certification
T&E	Test and Evaluation
TCP	Test Change Proposal
TDA	Test Development Agent
TDB	Test Documentation Booklet
TDD	Test Development Director
TDIS	Test Data Information Base
TDM	Test Development Manager
TDR	Time Domain Reflectometer
TEAMIS	Test and Evaluation Automated Management Information System
TECHEVAL	Technical Evaluation
TEMP	Test and Evaluation Master Plan
TI	Test Index
TLR	Top Level Requirements

TO	Test Outline
TP	Test Procedure
TPR	Test Problem Report
TPRS	Test Problem Reporting and Resolution System
TRS	Technical Repair Standard
TSN	Test Sequence Network
TSTD	Total Ship Test Director
TSTP	Total Ship Test Program
TTG	Test Task Group
TYCOM	Type Commander

-U-

UBFCS	Underwater Battery Fire Control System
UMI	Underway Matrial Inspection
UT	Underway Trial

-V-

VSWR	Voltage Standing Wave Ratio

-W-

WDC	Work Definition Conference
WDS	Weapon Direction System
WSAT	Weapon System Accuracy Trial

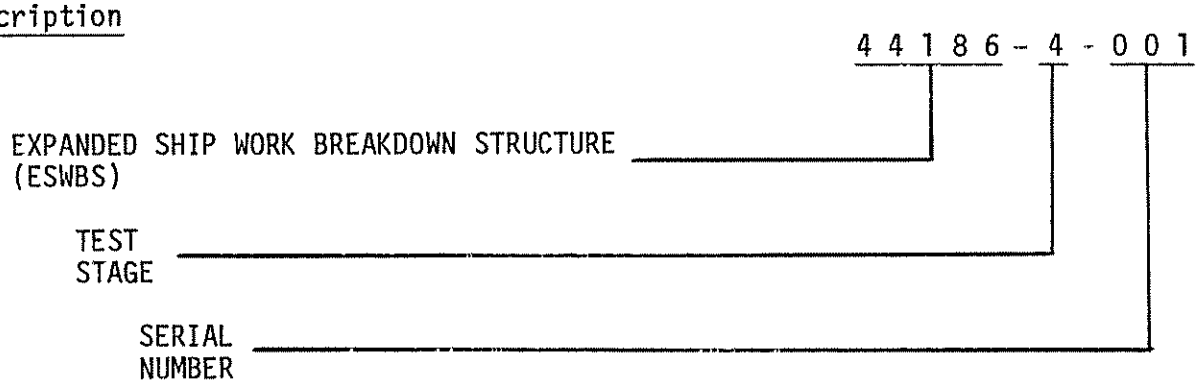
APPENDIX D

STANDARD TEST NUMBERING SYSTEM

Background. - In the past, several different test numbering systems were developed for surface ships to facilitate cataloging and to allow easy storage and retrieval from various repositories. 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 numbering system has been developed. This "standardized" numbering system is applicable to all active fleet ship repair and overhaul programs and to those new ship construction programs contracted for after 1 July 1983 (NAVSEA ltr SEA 902/MTR Ser 50 of 18 March 83 refers). A single number is used on all documents associated with a test, such as test outlines, test procedures, test problem reports and test reports.

Numbers for surface ship tests are assigned by the Naval Ship Weapon Systems Engineering Station (NSWSES), Code (4J00), Port Hueneme, California 93043, to ensure consistency of application and to prevent duplication. The point of contact for coordination of number assignments can be reached by telephone on autovon 360-5701/5549 or commercial (805) 982-5701/5549.

Description



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- Test Stages. A description of test stages for industrial test programs is provided by DOD-STD-2106(Navy). The test stages are:

  Stage 1 - Material Receipt Inspection/Shop tests
  Stage 2 - Shipboard Installation Inspections/tests
  Stage 3 - Equipment tests
  Stage 4 - Intrasystem tests
  Stage 5 - Intersystem tests
  Stage 6 - Special tests
  Stage 7 - Trials tests

- 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 letter and changes by numbers. A revision to a document is a reissuance of the entire document, whereas a change is a modification to selected pages in the document.