



## Ship Trials (T&E Part III)

TOPIC LEARNING OBJECTIVES

- Upon successful completion of this topic, the student will be able to:
1. Recognize the reason(s) why the Navy conducts ship trials.
  2. Identify the types of major ship trials.
  3. Identify the purpose of the major ship trials.
  4. Identify the roles and responsibilities of the organizations involved in conducting each of the major ship trials.
  5. Recognize the process for post-sea trials certification of ships.
  6. Recognize the differences between submarine new construction and overhaul and repair certification of submarines.
  7. Identify the timing of each type of major ship trial and test event.

STUDENT PREPARATION

Student Support Material

1. None

Primary References

1. OPNAVINST 4700.8 series; Trials, Acceptance, Commissioning, Fitting Out, Shakedown, and Post Shakedown Availability of U.S. Naval Ships Undergoing Construction or Conversion
2. NAVSEA S0300-B2-MAN-010; Supervisor of Shipbuilding, Conversion and Repair Operations Manual

Additional References

1. OPNAVINST 4730.5 series; Trials and Material Inspections of Ships
2. OPNAVINST 4730.7 series; Material Inspection of Submarines by the Board of Inspection And Survey
3. OPNAVINST 9080.3 series; Procedures for Tests and Trials of Navy Nuclear Powered Ships Under Construction, Modernization, Conversion, Refueling and Overhaul
4. INSURVINST 4730.1 series; Material Inspections of Surface Ships
5. INSURVINST 4730.2 series; Material Inspections of Submarines
6. INSURVINST 4730.11 series; Preparation of Deficiency Forms
7. NAVSEA PUB 0900-lp-09; 5-4010 Ship Test and Evaluation Planning Guide
8. Joint Fleet Maintenance Manual (JFMM)



# Overview

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- Ship Trial Requirements
- Ship Construction Trials
  - Builder's Trials (BT)
  - Acceptance Trials (AT)
  - Integrated (Acceptance) Trials (IAT)
- Post Delivery Test & Trials (PDT&T) (Surface)
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- Special Trials
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# Ship Trial Requirements

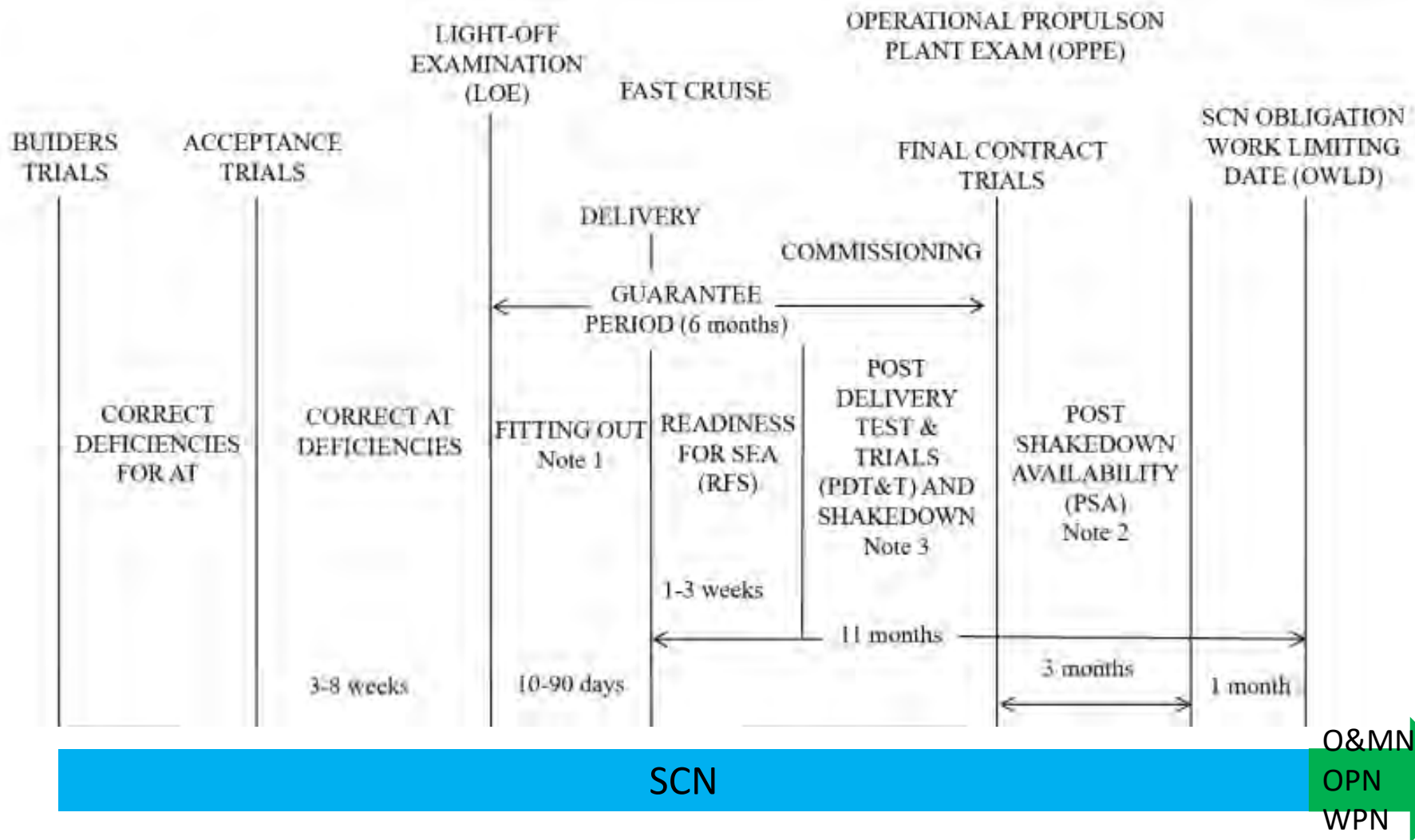
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- 10 USC 7304 (Title 10)
  - “The SECNAV shall designate a board of officers to examine vessels of the Navy.... The president of this board shall report to the CNO the status and material condition.”
- OPNAV Instruction (OPNAVINST 4700.8 series)
  - Trials, Acceptance, Commissioning, Fitting Out, Shakedown, and Post Shakedown Availability of U.S. Naval Ships undergoing construction or conversion
  - ***“Ships and Submarines will be fully mission capable, in the sense that all contractual and governmental responsibilities shall be resolved, prior to delivery, except for crew certification, outfitting, or special Navy range requirements which cannot be met until after delivery.”***
  - Augmented by other OPNAV policy for Aircraft Carriers and Submarines



# Notional Major Milestones

## Ship Trials and Availabilities







# Key Terms

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- **Accepting Authority:**
  - The Officer designated by the CNO to accept a vessel for the Navy, normally the cognizant PEO
  
- **Presenting Authority:**
  - The Officer designated to present the ship to the trial board certifying that it is ready for trials
    - SUPSHIP for Acceptance Trial (AT), Integrated Trials (IT) and Combined Trials (CT)
    - Shipbuilding Program Manager for Final Contract Trial (FCT)
    - Shipbuilder for Builder's Dock Trials (BDT) and Builder's Sea Trials (BST)
  
- **Obligation Work Limiting Date (OWLD):**
  - Established as 11 months following completion of Fitting Out (CFO) prior to fleet introduction of ship
  - Obligations for efforts associated with construction, conversion, outfitting and post-delivery must occur prior to OWLD



# Key Terms

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- Fitting Out Period:
  - Starts the day after the date of delivery for surface ships (prior to delivery for submarines)
  - Industrial work during this period limited to items generated by PREINSURV which affect safety or operational readiness
  
- Delivery:
  - The date the Navy accepts the ship from the shipbuilder
  
- Guarantee Period:
  - The period immediately following delivery of the ship
  - The shipbuilder retains responsibility for correction of defects in any supply or service under which the ship or material was constructed



# Key Players

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- INSURV – Independent verification of readiness of ships and submarines for acceptance and recommendation for Fleet introduction
- OPNAV – Final determination of readiness for service
- Cognizant PEO – Accepting authority new construction and conversion vessels
- NAVSEA – Provides formal recommendation to CNO via ASN(RD&A) for ship deliveries
- Fleet Commanders – Provide services for trials
- TYCOM – Monitors and represents the Warfighter
- SUPSHIP – Provides contractor oversight, prepares/presents ship, and certifies readiness for trials
- Prospective Commanding Officer (PCO)/Ship's Force – Conducts Post Delivery Test & Trials (PDT&T), including Final Contract Trials (FCT)
- Naval Supervising Authority – Assume custody of the ship for its material condition from the Shipbuilder





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# Builders Dock Trials (BDT) (Surface Ships)

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- When
  - Completed major systems are ready for light-off, need to demonstrate system interoperability
- Purpose
  - Consists of pier side tests conducted to determine the ability of the ship from a material standpoint to safely conduct sea trials
  - BDT is conducted during a 24-hour period sufficiently in advance of sea trials to correct deficiencies which would prevent the ship from safely conducting sea trials
  - Used to rehearse execution of the Acceptance Trial (AT) Schedule of Events (SOE) and individual event demonstrations
- Responsibility
  - **Presented by shipbuilder to SUPSHIP**
  - Operated by Shipbuilding crew & licensed Master
  - Also observed by PCO, NAVSEA reps
- Other
  - Specific agenda
  - SUPSHIP documents discrepancies (trial cards)



# Builders Sea Trials (BST) (Surface Ships)

- When
  - Post BDT and determination that vessel can safely conduct sea trials
- Purpose
  - Required to demonstrate that the ship is seaworthy and that the equipment and systems are operational and **ready for Acceptance Trials (AT)**
  - Simulated INSURV also conducted
- Responsibility
  - **Presented by shipbuilder to SUPSHIP**
  - Operated by Shipbuilding crew & licensed Master
  - Also observed by SUPSHIP, PCO, NAVSEA reps
- Other
  - Specific trial agenda\*
  - SUPSHIP documents discrepancies
- \*Specific structure and content of trials may differ by platform per JFMM. Actual order and number of sea trials may vary for individual ships



# Acceptance Trials (AT) (Surface Ships)

- When
  - Upon successful completion of BST and correction of significant construction deficiencies
- Purpose
  - To determine whether the vessel has been completed in accordance with the contract specifications and is operationally ready
  - Trials and material inspections **conducted underway by the INSURV** Board for ships constructed in a private industrial activity to determine suitability for acceptance of a ship by the Navy
- Responsibility
  - **Presented by SUPSHIP to INSURV**
  - Operated by Shipbuilding crew & licensed Master (For nuclear powered surface ships, AT is conducted by ship's force personnel)
  - Also observed by NAVSEA, Ship's Force, TYCOM
- Other
  - Discrepancies documented by INSURV
  - INSURV will either recommend acceptance of the ship or require additional trials at a later date depending on the trial results
  - Board may recommend to not accept delivery unless starred deficiencies are fixed or waived by CNO



# Integrated Acceptance Trials (IAT) (Surface Ships)

- When
  - Upon successful completion of BDT and prior to acceptance and delivery
- Purpose
  - **Consolidated BST and AT**
  - To determine whether the vessel has been completed in accordance with the contract specifications and is operationally ready
- Responsibility
  - **Presented by SUPSHIP to INSURV**
  - Operated by Shipbuilding crew & licensed Master
  - Also observed by NAVSEA, Ship's Force, TYCOM
- Other
  - Discrepancies documented by INSURV
  - “Quick-look” message sent to CNO
  - Conserves resources/accelerates delivery

*For ships with mature production lines; for example: DDG-51 Flight IIA, TA-Os, and TAK-Rs*



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# Post Delivery Test & Trials (PDT&T)

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- When
  - Prior to shakedown period
- Purpose
  - To conduct selected trials and tests peculiar to anti-air warfare, strike warfare, amphibious warfare, anti-surface warfare and anti-submarine warfare. Typical trial and tests include:
    - Acoustic Trials
    - Operational propulsion plant examination
    - Combat System Ship Qualification Trials (Surface Ships) / Weapons System Accuracy Trials (Subs)
    - Antisubmarine warfare and weapon system accuracy trials
- Responsibility
  - **Ship CO**
    - Operated by Ship's Force
    - A special assistance team may be embarked to assist the CO



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# Final Contract Trials (FCT)

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- When
  - After correction of deficiencies noted during AT and prior to Post Shakedown Availability (PSA)
  - Conducted before expiration of the contract guarantee period
- Purpose
  - Final chance to determine if there are any defects, failures, or deterioration directly related to shipbuilder fault
  - Operationally demonstrate ship systems and to satisfy material readiness conditions
- Responsibility
  - **Shipbuilding Program Manager presents to INSURV**
    - Operated by Ship's Force
    - Ship fully equipped and armed, made complete and ready for service
  - Also observed by NAVSEA, SUPSHIP, Shipbuilder
- Other
  - These trials are witnessed by INSURV and are the same in scope as AT, except that these trials are run entirely by Navy personnel



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# Shock Trials (ST)

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- When
  - Prior to PSA (for first of a class only)
- Purpose
  - Demo capability to “fight the ship”
  - CNO designates ship, based on NAVSEA’s recommendation
  - Satisfies Congressional Live Fire Test and Evaluation (LFT&E) requirements
- Responsibility
  - Shipbuilding Program Manager manages trial – significant environmental coordination required
    - NSWC Carderock – designs and instruments shock trial
    - Ship’s CO is Officer in Tactical Command (OTC)
    - SUPSHIP observes
- Other
  - Depth of charge and distance from ship closely monitored
  - Ship highly instrumented (cameras, strain gages)



# What Shock Trials Look Like

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# Post Shakedown Availability (PSA)

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- When
  - After shakedown period and prior to expiration of SCN (OWLD)
- Purpose
  - Correction of new construction deficiencies found during the shakedown period and to accomplish authorized improvements
- Responsibility
  - Supervising Authority and CO are responsible for determining type and extent of post-repair dockside and at-sea tests and trials
    - Reports to TYCOM the completion of Fast Cruise and correction of all mandatory deficiencies
    - Reports to Shipbuilding PM and/or TYCOM the completion of Sea Trials
- Other
  - Ship's Force is operating boat/systems & demonstrates all tests
  - Shipyard is still responsible for successful completion of all tests



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# Special Trials

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- NAVSEA trials conducted on representative ship from a class to determine various class characteristics and as required for any other reason (ship specific, case-by-case basis)
- Conducted after ship delivery
- Examples:
  - Standardization Trials
  - Tactical Trials
  - Acoustical Trials
  - Vibration Trials
  - Fuel Economy, Heat Balance
  - Emergency Recovery (Subs)
  - Stability and Control (Subs)



# Overview

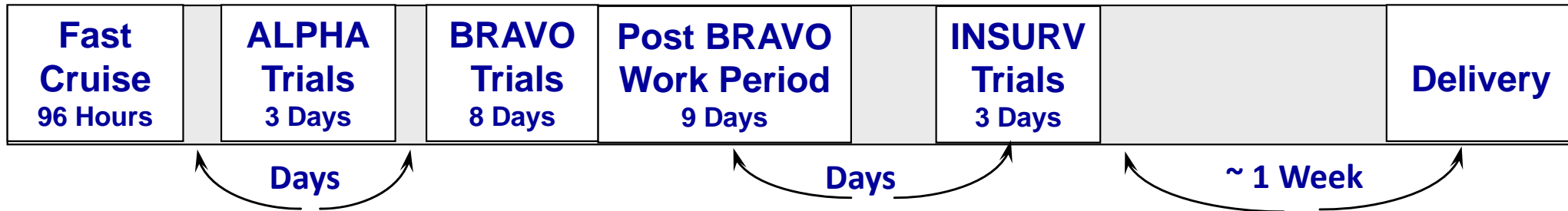
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# Submarine Trials Timeline

## New Construction



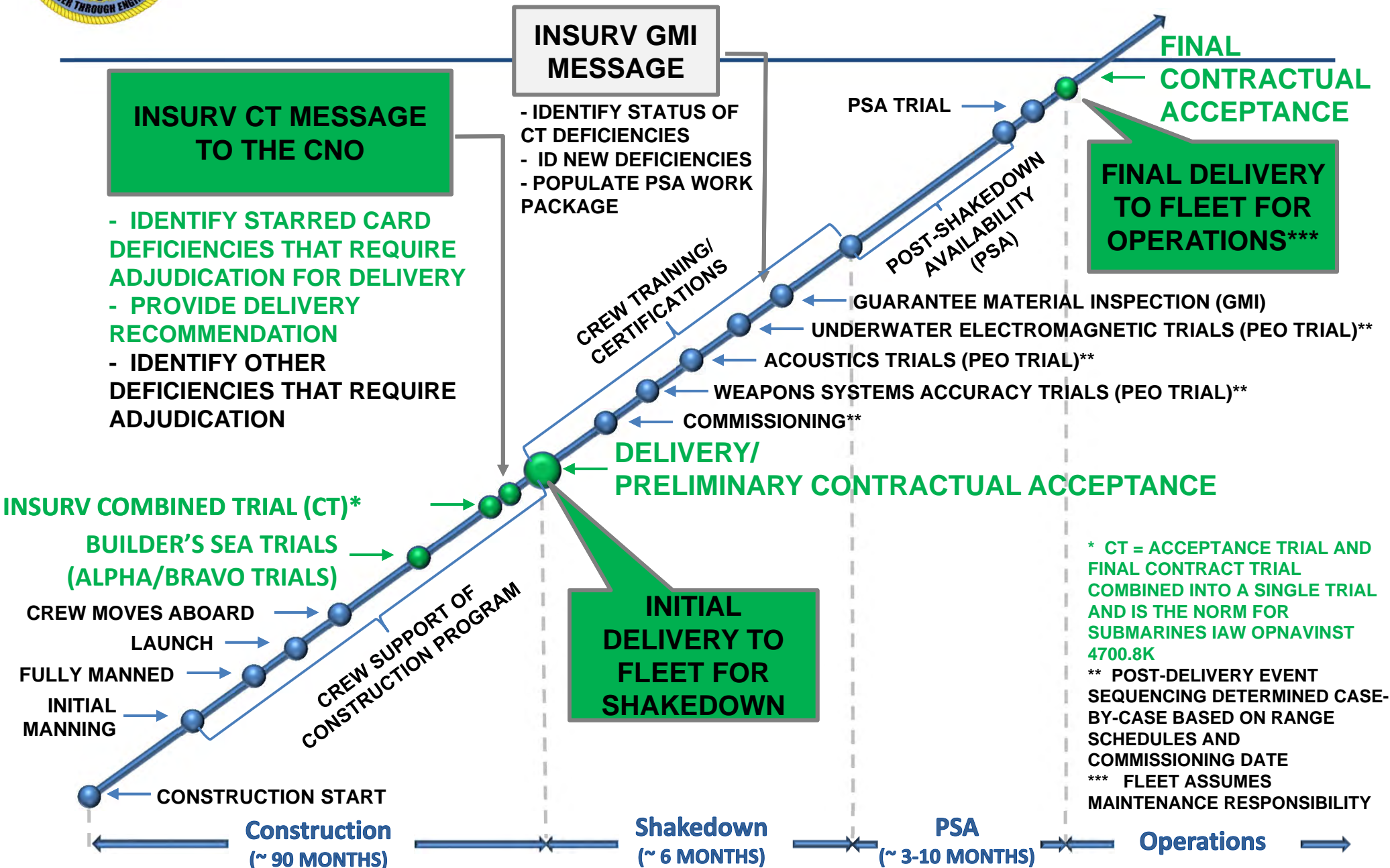
- Fast Cruise – TYCOM directed evolutions for 96 hours with at least 24-hour rest period (crew certification)
- ALPHA Sea Trials – Propulsion plant trials (full power), test depth, ship control, check initial ship tightness [NR - 4 Star rides the submarine]
- BRAVO Sea Trials – Combat Systems, navigation, communications testing, acoustic performance [preps for INSURV]
- BRAVO Work Period – Correct discrepancies, post-dive insulation resistance checks, missile and torpedo tube inspections
- INSURV Trials – Combined AT and FCT by INSURV
- Delivery which is followed by Guarantee Material Inspection

*Ship's force operates submarine/all equipment*



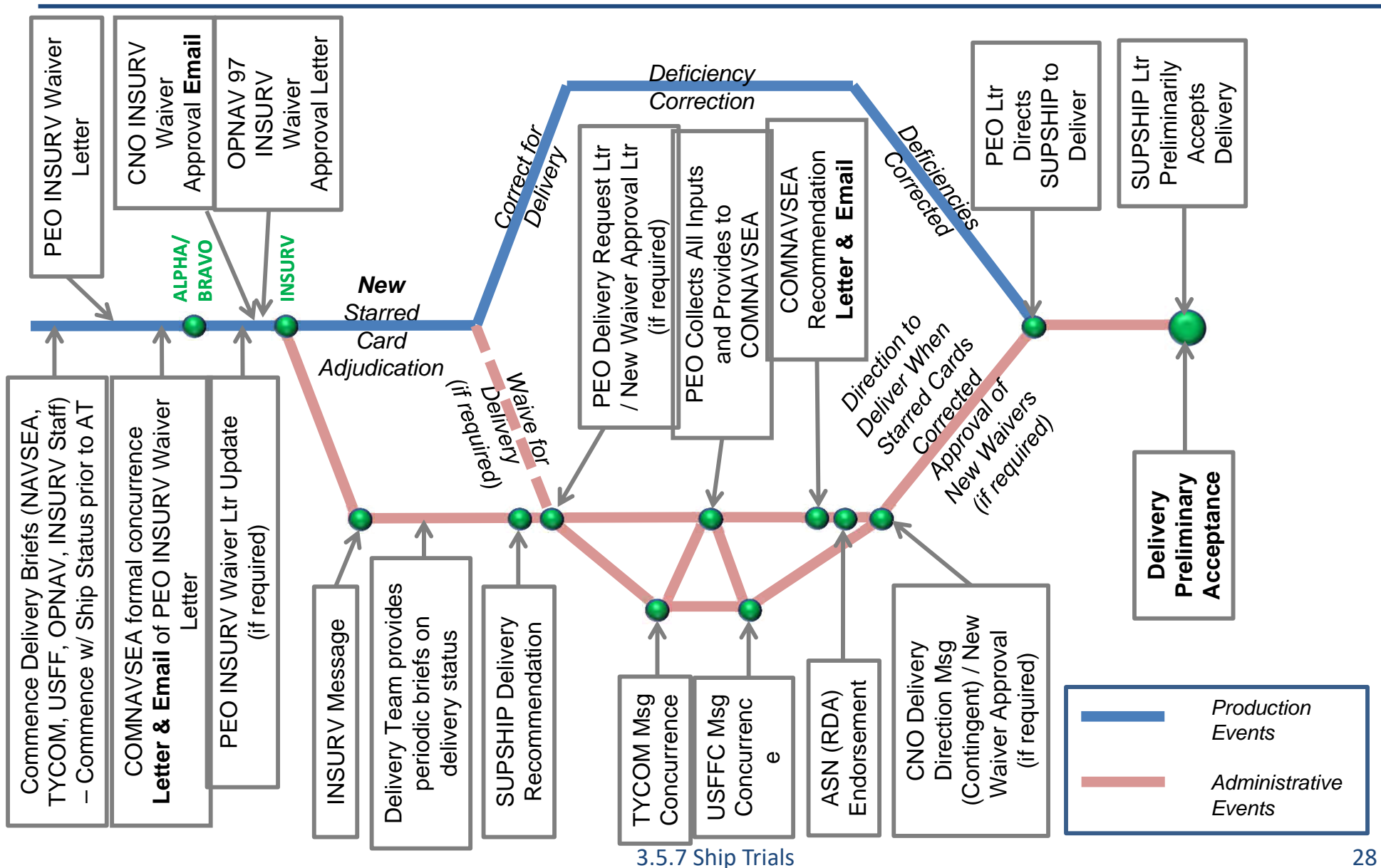


# Fleet Delivery Continuum (Submarines)





# Delivery Sequence per OPNAV 4700.8L (Submarines)





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# Post-Industrial Availability Trials

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- Conducted following test program repairs
- Trial agenda depends on extent and nature of work package
- Objective is to determine if repairs were completed in a manner that finds ship ready for service
- Full power required after each regular overhaul
- Scope of trial agreed upon by Government oversight and ship CO for other repairs\*
- Trial report required only when Government oversight or ship CO determines necessary\*

\*applies to trials following Post Shakedown Availability (PSA) only



# Post-Sea Trials Certification (CNO Availabilities)

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- Naval Supervising Authority, Lead Maintenance Activity, and Ship's Force will conduct a departure conference to finalize the status of all work
- Availability Completion Message will be sent covering:
  - Unresolved maintenance issues and guarantee work items
  - Report of configuration changes resulting from alterations installed during the availability
  - Summarize the NAVSEA waivers issued during the availability
  - Identify those work candidates that will be deferred until the next industrial availability



# Post-Sea Trials Certification (Submarine Special Requirements)

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- Naval Supervisory Authority shall report by message to NAVSEA, satisfactory completion of all Sea Trials
- **NAVSEA certifies** by message to the TYCOM **the SUBSAFE material condition** of the systems on the ship worked on by the industrial activity and **recommends authorization for Unrestricted Operations (URO)** to design test depth
- TYCOM shall report by message to the ship, with copies to CNO and NAVSEA, status of SUBSAFE certification and authorizing URO to test depth





# Submarine New Construction vs. CNO Availability

	New Construction	Repair
What does NAVSEA certify?	NAVSEA certifies SUBSAFE material condition of <u>entire</u> submarine then TYCOM issues URO authorization	NAVSEA certifies SUBSAFE material condition of <u>only the work performed by shipyard</u> then TYCOM issues URO authorization
When is it ready?	INSURV Board inspects and makes delivery (Navy preliminary acceptance from shipbuilder) recommendation to the CNO	NSA and Ship determine when work is complete
How is it tested?	Multiple at-sea trial periods with each trial having a different emphasis	Typically, only one at-sea trial period to complete all testing



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# Ship Program OT&E

## COMOPTEVFORINST 3980.2

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- Five general dedicated operational test periods:
  - Early Operational Assessment (EOA)
    - Conducted during material solution analysis and technology development phases to identify risks or needed enhancements to successful complete IOT&E
  - Operational Assessment (OA)
    - Conducted during the EMD phase, the number of OAs depends on the program/system requirements
    - Goal is the same as EOA
  - Initial Operational Test & Evaluation (IOT&E)
    - Conducted during PD phase, on a production representative test article
    - COMOPTEVFOR makes an assessment regarding the operational suitability/effectiveness and the commander makes a recommendation to the CNO on Fleet integration
    - Results of IOT&E are a prerequisite to the Full Rate Production Decision Review (FRP-DR)
    - IOT&E shall not begin until completion of DT and Design Authority certifies readiness
    - Must allow 90 days between IOT&E and FRP decision



# Ship Program OT&E

## COMOPTEVFORINST 3980.2

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- Five general dedicated operational test periods (continued):
  - Verification of Correction of Deficiency (VCD)
    - Typically, not assigned to a preplanned phase of testing but rather inserted into the test program after a formal phase of operational testing to verify certain deficiencies have been corrected
  - Follow-on Operational Test & Evaluation (FOT&E)
    - Also known as OT III, all operational testing after IOT&E and may include deferred or incomplete testing from IOT&E
    - Conducted with lead ship or designated follow-on ship
    - Example
      - OT III (H) - Self Defense Test Ship test of LHA-6 CS
      - OT III (I) - Lead ship test of CS



# Ship Program OT&E

- MDA and DOT&E will come to an agreement on how much testing is required and then program office will request funds through PPBE process
  - Scheduled after ship is delivered
  - Portions of DT&E and OT&E may be combined with SECNAV concurrence
  - TECHEVAL and IOT&E will not be combined
  - DT&E and OT&E prior to M/S B shall address T&E of individual, new, or modified shipboard systems
    - For lead ship acquisition, T&E conducted on LRIP ship
    - For individual weapons systems, T&E conducted at land-based training sites (best case scenario), use of M&S authorized if not able
    - For system prototypes on lead ship, T&E conducted on LRIP ship and as well as on individual systems

*Ships are complex and require integrated testing of many systems, possibly in various stages of DT and/or OT*



# Summary

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- What is the purpose of dock trials (BDT or ADT)?
- What is the purpose of BT and who presents to whom?
- What is the purpose of AT who presents to whom?
- What is the difference between Submarine SUBSAFE certification during new construction and overhaul/repair?