Verification & Validation of the VIRGINIA (SSN774) Class Submarine Simulation/Stimulation (SIM/STIM) system and On Board Team Trainer (OBTT)

Presented by:
NUWC DIVNPT

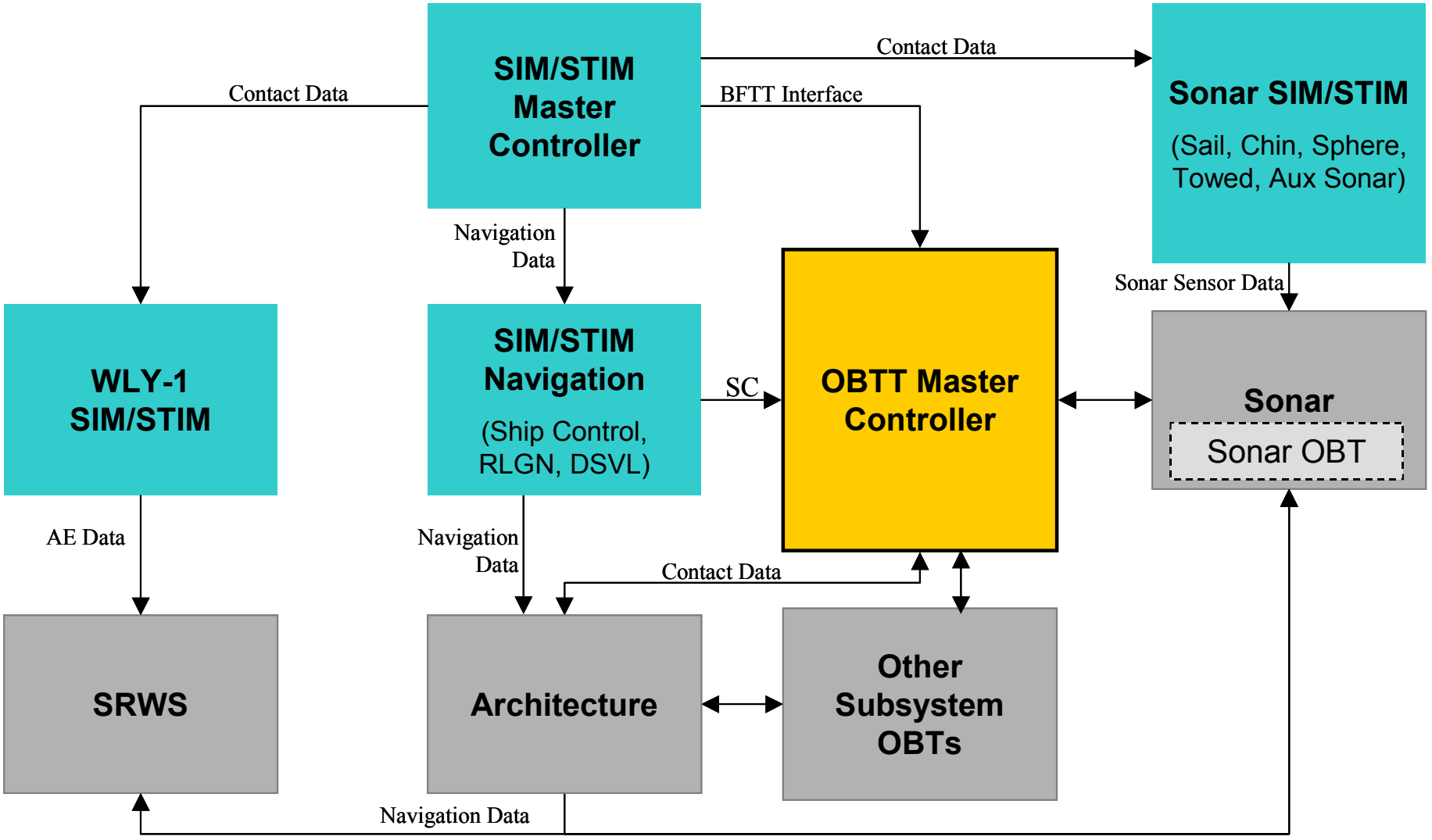
Background

- The VIRGINIA (SSN774) Class Simulation/Stimulation (SIM/STIM) system and On Board Team Trainer (OBTT) support land-based testing conducted at the C^3I Command and Control System Module (CCSM) Off-Hull Assembly and Test Site (COATS).

- During Operational Test IIB (OT-IIB) Commander Operational Test and Evaluation (COMOPTEVFOR) will utilize the SIM/STIM and OBTT to assess the potential operational effectiveness and potential operational suitability of the VIRGINIA (SSN 774) Class combat system.

- The Virginia Class Test and Evaluation Master Plan (TEMP) rev C, dated 8 May 2001 invokes that OT-IIB will be conducted using an accredited SIM/STIM and OBTT.

System Architecture



Simulation Capabilities

- The following simulation capabilities provide an integrated simulation and present a consistent view of the world outside the submarine to an operator of the C^3I System. These SIM/STIM System capabilities include:

- Target Motion simulation
- Ownship Motion simulation
- Environmental simulation
- Sea/Ocean simulation
- Sonar Sensor simulation
- Atmosphere simulation
- TB-16 Towed Array
- TB-29 Towed Array
- Spherical Array (passive only, dissipation of active transmit is not provided)
- HF Chin Receive Array
- HF Sail Receive Array
- Bottom Sounder
- Top Sounder
- Local Conductivity, Temperature, Depth Device

Simulation Capabilities

- Additional SIM/STIM System capabilities include:

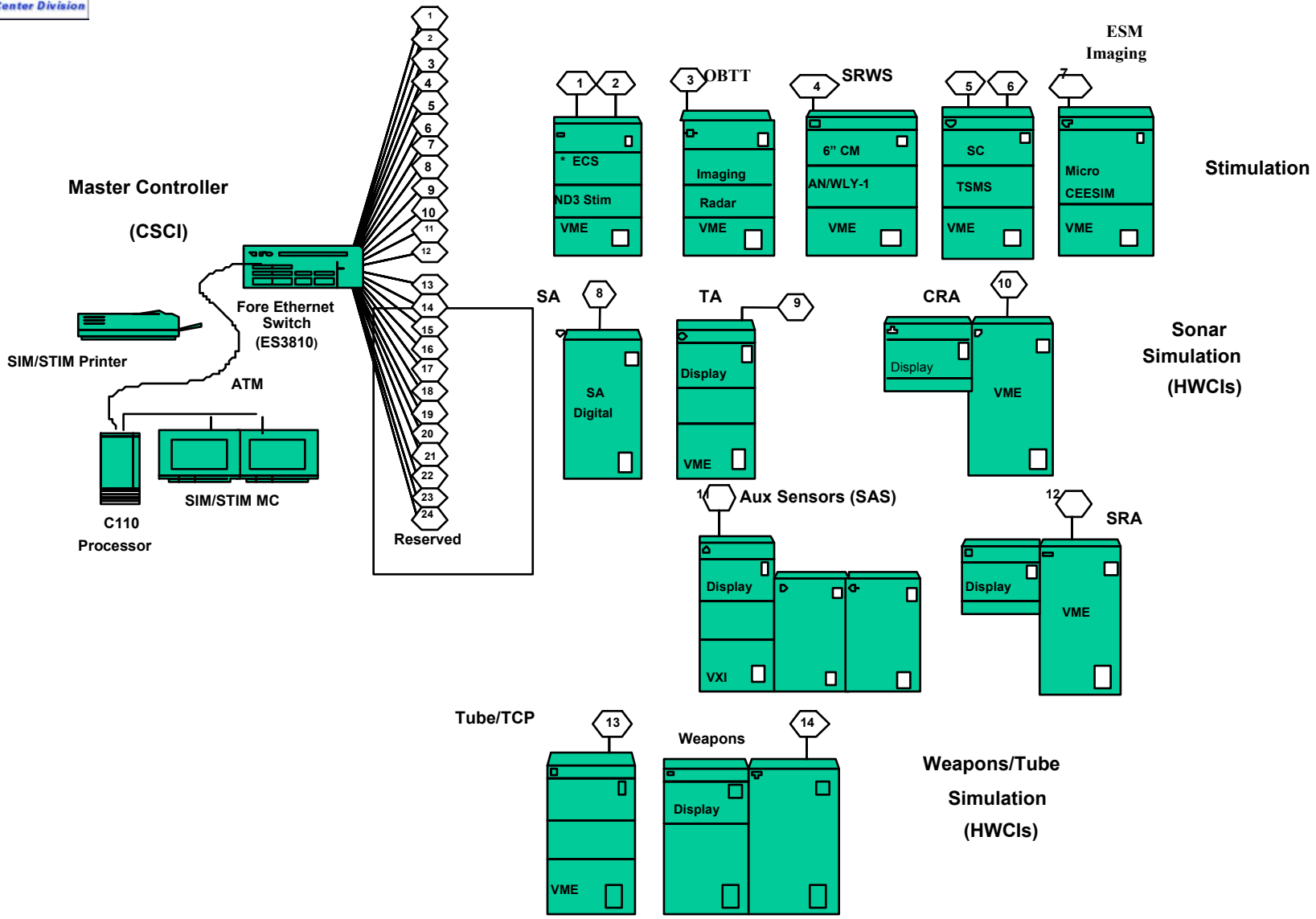
- UI/SSXBT, UI/SSXSV
- Local Sound Velocity Profile Device
- TR-233B HF and TR-232B LF Acoustic Communication Transducer
- DT-369 Calibration Reference Hydrophones/DT-513D Noise Monitoring Hydrophones
- Dummy loads are provided to dissipate/transmit power for active transducers for the Bottom Sounder; Top Sounder; TR-233B HF Acoustic Communication Transducers, TR-232B LF Acoustic Communication Transducer
- Ship Control simulation
- Navigation simulation
  - Ring Laser Gyro Navigator (RLGN) simulation
  - Doppler sonar velocity log simulation
  - Global positioning system simulation

Simulation Capabilities

- Additional SIM/STIM capabilities include:

- TSMS Total Ship Monitoring Subsystem simulation
  - Hull Mounted Accelerometer simulation
  - Accelerometer data simulation
  - Machine status simulation
- Imaging sensor simulation, Support sensor simulation, and Ship Control (Photonics Mast) simulation.
- ESM simulation, ESM stimulation, and Ship Control (IEM) simulation.
- SRWS simulation
  - AN/WLY-1 Active Emission (AE) Sensor simulation
  - External six-inch Countermeasure simulation.
- Weapon simulation
  - Tube/Tube Control
  - Tube/Tube Control Panel simulation

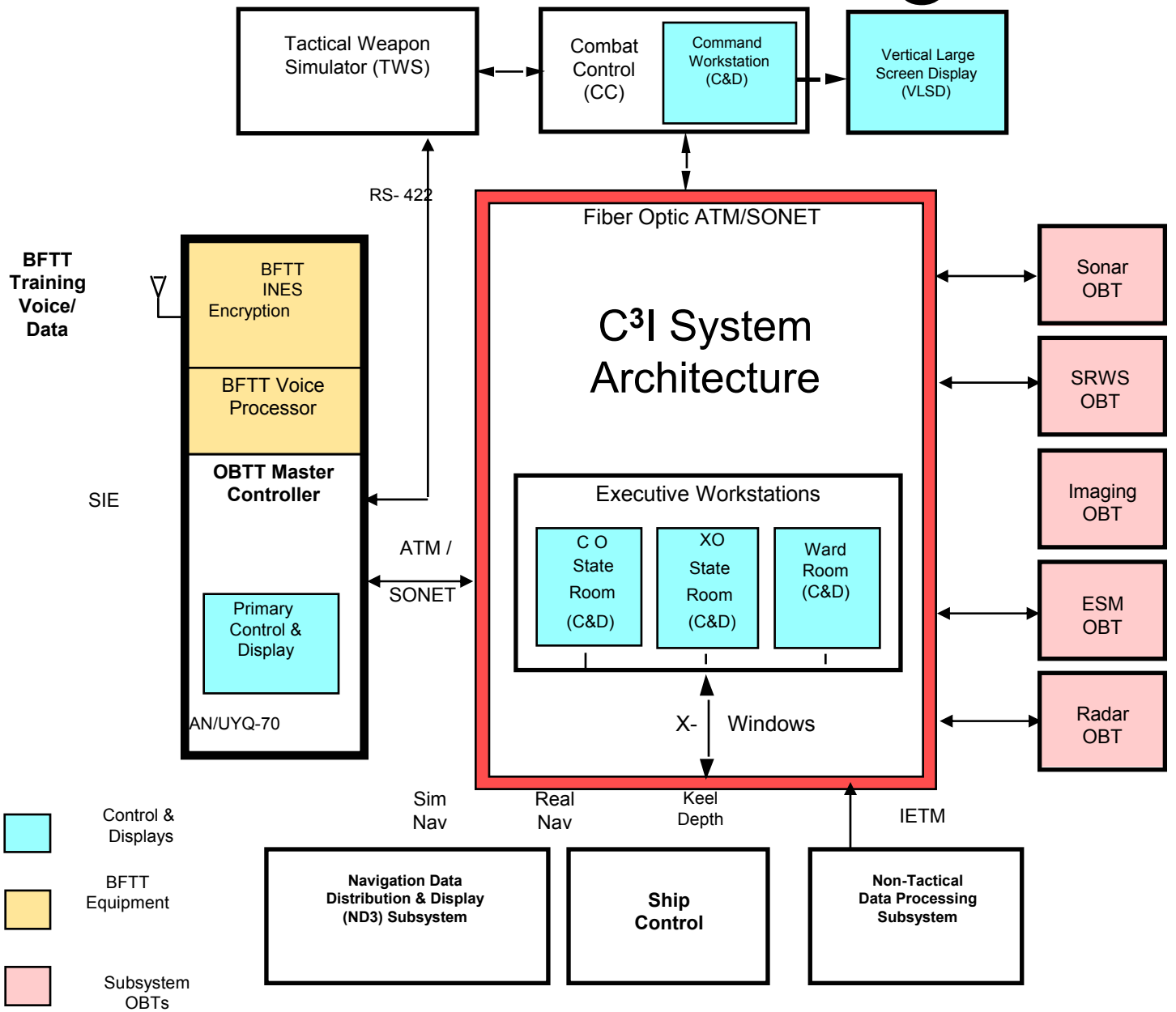
SIM/STIM and OBTT Overall Configuration



OBTT Capabilities

- The OBTT provides the capability for Combined Team Training, Full Combat Team Training and the Battle Force Tactical Training (BFTT) by utilizing the OBTT Master Controller (MC) which interfaces with the following C^3IS Subsystem OBTs:
  - Sonar
  - Electronic Warfare Support Measures (ESM)
  - Radar
  - Imaging
  - Submarine Regional Warfare System (SRWS)

OBTT Overall Configuration



V&V Activities

- The V&V activities leveraged the processes, products and events that were conducted during the course of the development of the SIM/STIM system, OBTT MC and the subsystem OBTs.

- The overall VV&A process was formulated and documented in the Accreditation Process Plan that was prepared by PMS450C2 and COMOPTEVFOR.

- One of the first steps in the process was the formation of the VV&A Integrated Process Team (IPT). The VV&A IPT facilitated the overall coordination, communication and planning of all VV&A activities for OT-IIB. The IPT was composed of PMS450E, NUWC, EB and COMOPTEVFOR representatives. This group met in a working level forum on at least a monthly basis to discuss the status and issues related to the VV&A process. In addition the IPT meeting minutes were used to detail discussion on the technical and implementation issues of SIM/STIM and OBTT to support OT-IIB.

V&V Activities

- Initial SIM/STIM and OBTT V&V activities included the review of requirements specifications and design documents. Submittals from the SIM/STIM and OBTT Participated Managers (PARMs) for the Operational Test Readiness Review (OTRR) for OT-IIB were reviewed in support of the Functional Verification of SIM/STIM and OBTT.

- The formal V&V activity began with the review of test plans and reports provided as a result of the conduct of Factory Acceptance Tests (FATs) System Qualification Tests (SQTs) and Performance Verification Tests (PVTs) conducted at contractors' facilities prior to delivery to COATS.

- Activities at COATS which were leveraged for this V&V effort included the NPES System Integration Interface Test (SIIT), System Integration Operability Test (SIOT) and the 240-Hour Longevity Test. A qualitative assessment of SIM/STIM and OBTT performance in support of Non-Propulsion Electronic System (NPES) testing was prepared at the conclusion of the conduct of the System Integration Operability Test (SIOT), and the 240-Hour Longevity Test.

V&V Activities

- The final and most critical V&V events were the Center for Naval Analyses (CNA) scenario based testing conducted on 2/4/02 and 2/25/02. This event was designed to support the evaluation of critical capabilities required by the SIM/STIM and OBTT systems to support operational testing during OT-IIB.

- For the activities conducted at the contractors facilities, the Participated Managers (PARMs) submittals for the Operational Test Readiness Review (OTRR) for OT-IIB were used. For the NPES tests (SIIT and SIOT), the information was obtained by reviewing test procedures and reports. For the CNA scenarios the information was obtained by participation and witnessing the system performance during those events.

V&V Activities

- Conceptual Model Validation for SIM/STIM was conduct by reviewing the Virginia Class Test & Evaluation Master Plan (TEMP), SIM/STIM System Design Specification and System Specification. Conceptual Model Validation for OBTTMC and the subsystem OBTs was conducted by reviewing the Virginia Class Functional Requirements Document (FRD) and subsystem design specifications.

- Functional verification of the subsystem OBTs was derived primarily from the PARM submittals in support of the OTRR for OT-IIB. For SIM/STIM and OBTTMC the functional verification consisted of reviewing detailed test plans, reports and traceability matrices provided by the SIM/STIM System Integration Team (SIT) and the OBTTMC (SIT).

- System verification was supported by the pertinent results reported from the NPES 240 hour longevity test and the CNA scenario tests on 2/4 and 2/25.

- Results validation was accomplished by reviewing the quantitative results which were used to answer the questions which were prepared and used by CNA during the scenario testing on 2/25.