Tactical Tomahawk Missile

Tomahawk is a long-range cruise missile designed to be launched from submarines and surface ships against land targets. Three primary variants are currently operational: Tomahawk Land Attack Nuclear (TLAM-N) (not deployed); Tomahawk Land Attack Missile-conventional (TLAM-C); and Tomahawk Land Attack Missile-conventional submunition (TLAM-D). Engagement planning, missile initialization, and launch control functions are performed aboard the launch platform by a Combat Control System (submarines) or Tomahawk Weapon Control System (TWCS) (surface ships). Targeting, mission planning, and distribution of Tomahawk tactical data are supported by the Tomahawk Command and Control System (TC2S).

The Tactical Tomahawk program began in FY98 as a restructure of the earlier (FY94-98) Tomahawk Baseline Improvement Program. Tactical Tomahawk represents a considerable leap forward in technology compared with Block III Tomahawk. Designated C^3 nodes will be able to communicate with the missile in-flight and direct it to pre-planned alternate targets or change its mission plan to attack new targets. While in flight, the missile will be able to transmit its health, status, and limited imagery to the C^3 nodes.

The Tactical Tomahawk retains the same WDU-36/B warhead as the Block III Tomahawk. Differences between Tomahawk Block III and the Tactical Tomahawk Baseline IV including significant structural modifications to the missile airframe and engine as well as modified terminal engagement parameters that could significantly affect system lethality. Therefore, live fire testing is required. The Tactical Tomahawk Test and Evaluation Master Plan (TEMP) was approved in FY02.

The fielded Baseline III Tomahawk Weapon System continues to receive incremental upgrades. The principal improvements are fire-control system (Advanced Tomahawk Weapon Control System (ATWCS)) and mission planning system (TC2S) software. These upgrades are undergoing Follow-on Test and Evaluation before release to the Fleet.

TEST & EVALUATION ACTIVITIES

There were two completed test phases in FY02. TC2S software release TMPC 3.2 was tested during Operational Test-IIIF. Software version TMPC 3.2 introduced the capability to plan operational missions using a steep terminal dive maneuver. This release also added software tools to aid the user in designing and planning missions. TMPC 3.2 is an evolutionary improvement on predecessor versions.

ATWCS software release 1.7.1 was evaluated during Operation Test-IIIL. This software version incorporated a new operating system, a new inter-network coordination and management capabilities, interfaces with the Global Command and Control System – Maritime (GCCS-M) and the Battle Force Tactical Trainer (BFTT). There were also new features to assist operators in planning launch and over-water flight operations more efficiently.
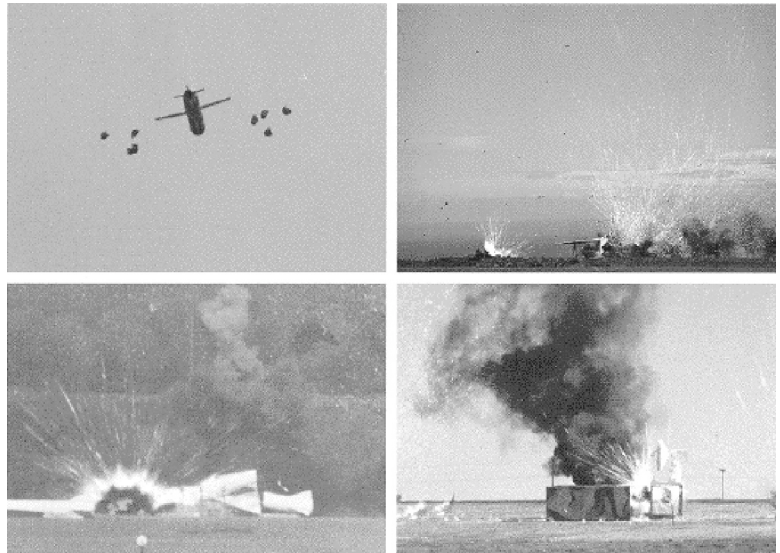
Designated C^3 nodes will be able to communicate with the Tactical Tomahawk in-flight and direct it to pre-planned alternate targets or change its mission plan to attack new targets.

Test event Operational Test-IIIG, evaluating TC2S software release 3.3, was begun in FY02 but has not yet been completed. This software introduces client-server architecture to the Precision Targeting Workstation (PTW) and re-hosts the Mission Distribution System to personal computers (PC-MDS). The PTW changes support improved image display and manipulation, access to integrated mission databases, access to GCCS-M, and improved accuracy in measuring geographical coordinates. The addition of PC-MDS enables more flexible command and control, and in particular, allows launch platforms to distribute mission plans to other launch platforms and to command-and-control nodes.

Test event Operational Test-IIA, an Operational Assessment (OA) of Tactical Tomahawk, was begun in FY02 but has not yet been completed. Key test events include a Functional Ground Test (FGT), completed on May 17, 2002. The FGT exercised most facets of missile operation while the missile was confined to a test stand. The OA will also use data derived from the first two missile flight tests (DT-0 and DT-1). Both flights are launched from fixed sites with the prime contractor assuming primary responsibility for test conduct. DT-0 was completed on August 23, 2002. DT-1 was completed on November 10, 2002. The OA will also utilize data collected during developmental testing of the TTWCS and TC2S.

No testing supporting Live Fire Test & Evaluation (LFT&E) was conducted during FY02.

TEST & EVALUATION ASSESSMENT

The testing conducted during phase Operational Test-IIIF resulted in findings that TC2S software version TMPC 3.2 is operationally effective and operationally suitable. Testing was extensive, with 19 operational missions and three flight test missions planned and validated using accredited simulations. One of the flight test missions was exercised in Operational Test Launch 262, which successfully demonstrated the steep dive capability. The TMPC 3.3 software did not meet certain mission-planning timeline requirements, but the user community found the software acceptable despite this shortcoming.

There is a discontinuity between the Operational Requirements Document (ORD) requirements and the capabilities of operational environment. This discrepancy has little-to-no operational impact. Revision of the ORD would remove the apparent discrepancy. DOT&E has requested a revision or a formal clarification of the ORD from the Navy.

The Operational Test-IIIL test resulted in the ATWCS software version 1.7.1 being declared operationally effective and operationally suitable. Only minor discrepancies were observed and can be avoided with specific procedures and training. Corrections are scheduled for incorporation in upcoming software releases.

Tactical Tomahawk began testing in FY02 with the FGT. The FGT event proved to be extremely beneficial as it uncovered a number of anomalies that would otherwise have been discovered only in flight tests. In the first FGT attempt, the missile's wings and fins did not deploy and the cruise engine shut down almost immediately after start. In the second attempt, a timing issue unique to the test stand caused a Built-In Test (BIT) failure in the missile guidance set. This BIT failure prevented the booster from firing. In the third attempt, these problems were overcome and a useful end-to-end test event was conducted. There were, however, anomalies that required resolution before the program could proceed to flight test. Specifically, the Global Positioning System receiver failed to acquire satellites and the missile failed to log on to Tomahawk Strike Network (TSN). The TSN is the satellite communication network used by the firing platform and command and control nodes to communicate with Tactical Tomahawk all-up-rounds. After correction of discrepancies and thorough internal review, a readiness review panel determined that the missile was ready for flight-testing. Ground tests such as the FGT prove invaluable at discovering and correcting problems prior to actual flight-testing. DOT&E strongly encourages programs to conduct of this type of testing.

The test configuration proposed by the Program Executive Officer (PEO) for the Initial Operational Test and Evaluation, the test phase that supports the initial operational capability and Beyond Low-Rate Initial Production decisions, is inadequate. The current plan does not offer a realistic level of operationally representative stress for the TSN. The PEO has proposed limited live communications with the TSN (one flight all-up-round plus three hardware-in-the loop all-up-round simulators), to be supplemented with more extensive scenario work in a laboratory, where the communications paths would be simulated and the all-up-rounds would be represented by all-software simulations. The laboratory does not adequately replicate the operational environments aboard the launch platforms and other participating C2 nodes (battle group staff and higher commands). Options for satisfying these concerns are currently under discussion.

The live fire testing outlined in the approved Tactical Tomahawk TEMP is sufficient to reveal any significant changes in system lethality from that predicted for the Block III Tomahawk missile. The focus of the Tactical Tomahawk LFT&E is on the potential effects on lethality of different warhead-airframe-target interactions due to changes between Tactical Tomahawk and Block III missile airframes and different terminal engagement envelopes in the diving attack mode. The programmed detonation live warhead flight test will not contribute to this evaluation objective. Since the dive attack mode is the more important of the two terminal attack modes, this test should be conducted first, allowing for the second live warhead flight test to be flown in this mode if necessary.