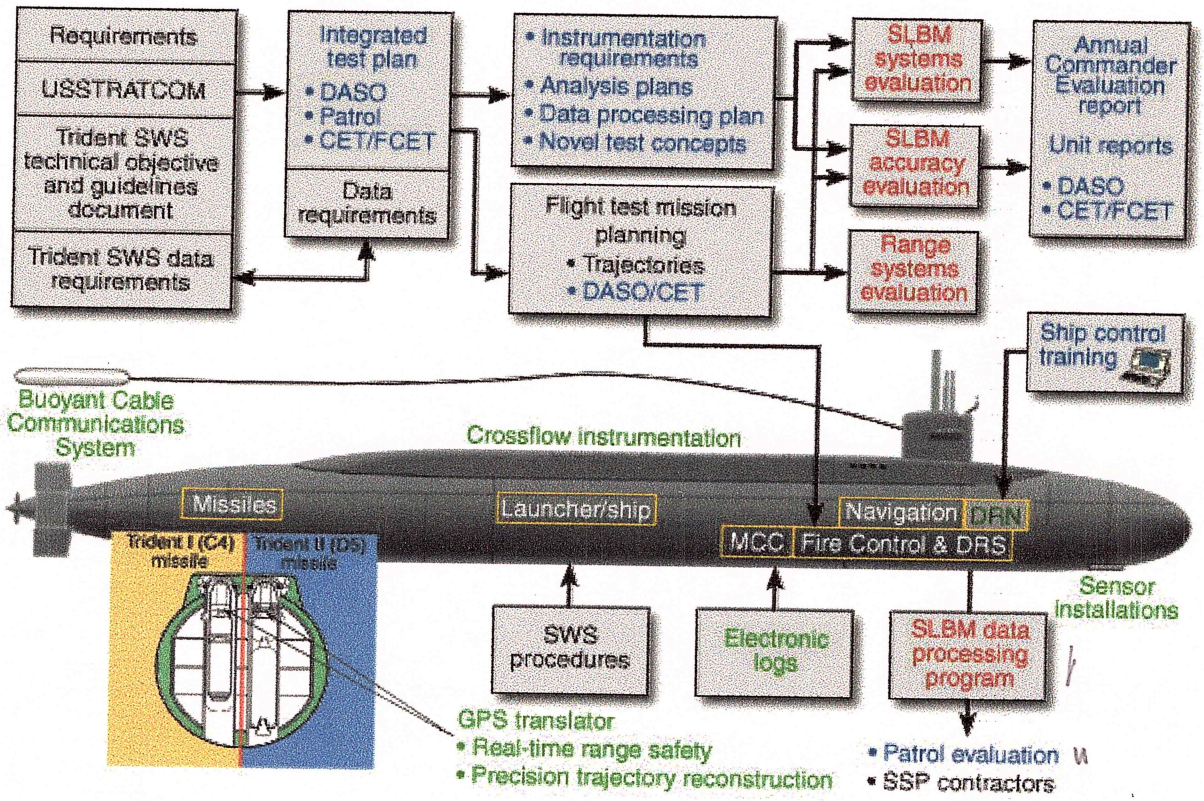
APL JHU Applied Physics Laboratory

Strategic Systems

Introduction - Operational Assessment - Accuracy - Underwater Launch Range Systems - MMIII Guidance - **Training** - SSGN - Nuclear Surety

Operational Assessment

APL's Strategic Systems Program Area provides assurance that the Trident I and II weapon systems are reliable and accurate, using a rigorous test and evaluation program, which includes evaluation of performance during routine operations at sea, all the way to evaluation of periodic test launches (for which the Program Area also provides support). Trident missile accuracy is measured using extensive instrumentation and specialized processing facilities in the Strategic Systems Department (SSD). Those results are used to develop and refine high-confidence predictive submarine-launched ballistic missile accuracy models. APL continues to plan and evaluate Trident Strategic Weapons Systems tests in order to develop the detailed system understanding to not only predict operational system performance but also provide the first indicators of the effects of aging to determine which system elements need to be replaced.



SSD contributes to the continuing Navy Fleet Ballistic Missile Strategic Weapon System test and evaluation programs. (SSD-developed hardware, green; documents/reports, blue; programs, red. MCC = missile control center, DRS = Data Recording System, DRN = DASO Reference Navigator.)

The three primary Trident Weapon System test programs are (1) Demonstration and Shakedown Operations (DASOs), (2) Patrol Evaluation, and (3) Commander Evaluation Tests (CETs) or Follow-on CETs (FCETs).

DASO

Strategic Systems Department personnel provide support for system certification, via the Demonstration and Shakedown Operation (DASO) program. DASO consists of a series of exercises conducted by both crews of the SSBN over several weeks, both in-port and at-sea, intended to verify the readiness of the SWS and crew to begin patrol. DASOs are generally

conducted after an SSBN is first built and after an SSBN receives a major upgrade and often culminate in a test missile launch. Strategic Systems participates throughout DASO by providing independent evaluation of the readiness of the SWS to begin patrol, supporting the naval personnel that issue the system's certification, developing special tests, and providing crew **Training**.

Patrol Evaluation

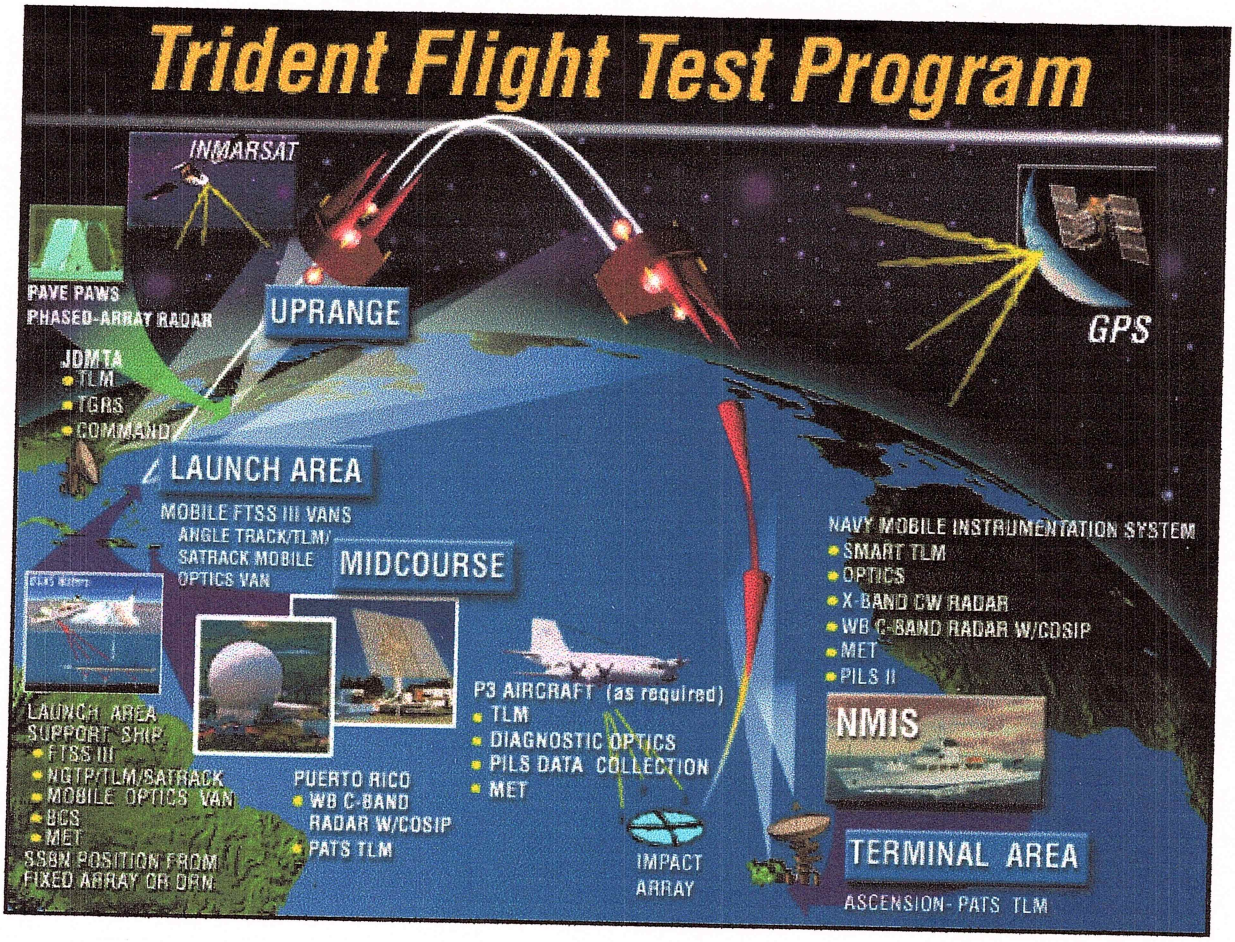
Each SSBN and weapon system may be deployed for a decade or more. The continuous monitoring of each SSBN identifies hull-unique problems as well as fleet trends that may evolve or change with time and affords a current, cumulative weapon system performance estimate, which is critical to maintaining the credibility of this strategic deterrent system. The objectives of patrol evaluations are to (1) provide weapon system performance information in the actual patrol environment for use in deriving performance planning factors, (2) provide Navy Fleet Operational Commanders and Strategic Systems Programs (SSP) with an independent system evaluation of each SSBN and its weapon system strategic deterrent patrol, and (3) provide individual SSBN crews with an analysis of the performance of their weapon system during patrol.

CET/FCET

The Commander Evaluation Tests (CETs) or Follow-on CETs (FCETs) are continuing operational tests that involve random selection of Trident II ships and missiles for test launches. The results of these tests provide annual performance estimates of the Trident II Weapon System. The objectives of this test program are to (1) determine operationally representative weapon system performance characteristics for targeting purposes, (2) ensure that planning factors do not significantly change with time, (3) determine the adequacy of tactical procedures, and (4) provide diagnostic information that may lead to system improvements.

Without advance notice, a selected SSBN is recalled from patrol for a CET. Missiles are selected randomly from the onboard complement of tactical missiles and are converted to a test configuration after returning to port. Following the conversion, the submarine proceeds to a launch area and resumes operations as if on a strategic deterrent patrol. A launch message is transmitted via strategic communications links and the submarine conducts a launch of the selected missiles.

Data is obtained from instrumentation onboard the SSBN, from a launch area support ship, and from downrange support sites (on ship, aircraft, and land) that provide the information necessary for strategic systems analysts to assess total weapon system performance.


Trident Flight Test Program
INMARSAT
PAVE PAWS
PHASED-ARRAY RADAR
UPRANGE
GPS
JDMTA
• TLM
• TGRS
• COMMAND
LAUNCH AREA
MOBILE FTSS III VANS
ANGLE TRACK/TLM/
SATRACK MOBILE
OPTICS VAN
MIDCOURSE
NAVY MOBILE INSTRUMENTATION SYSTEM
• SMART TLM
• OPTICS
• X-BAND CW RADAR
• WB C-BAND RADAR W/COSIP
• MET
• PILS II
NMIS
LAUNCH AREA
SUPPORT SHIP
• FTSS III
• NGTP/TLM/SATRACK
• MOBILE OPTICS VAN
• BCS
• MET
SSBN POSITION FROM
FIXED ARRAY OR ORM
PUERTO RICO
• WB C-BAND
RADAR W/COSIP
• PATS TLM
P3 AIRCRAFT (as required)
• TLM
• DIAGNOSTIC OPTICS
• PILS DATA COLLECTION
• MET
IMPACT
ARRAY
TERMINAL AREA
ASCENSION - PATS TLM

SPIE Proceedings Vol. 3069 Automatic Target Recognition VII
Editor(s): Firooz A. Sadjadi, Lockheed Martin Corp., St. Anthony, MN, USA.

ISBN: 0-8194-2484-6, 554 pages Published 1997

Paper #: 3069-32
Theater targets plume edge extraction and hardbody aimpoint selection using morphological image processing, pp.294-311
Author(s): Clifford A. Paiva, Naval Surface Warfare Ctr., Dahlgren, VA, USA.

Abstract: (U) Future successful ballistic missile booster intercepts will require advanced automatic target detection, tracking, classification and identification (ADTCI) image processing techniques. Two such techniques are presented in this classified SECRET paper using the synthetic scene generator model (SSGM) in combination with the advanced systems (AVS) image processing package. Two challenging multispectral cases are treated: (1) missile hardbody occultation by the missile exhaust plume, and (2) variable plume/hardbody system (PHS) gradient intensities generated by missile tumbling due to exiting the sensible atmosphere. The target detection, tracking and edge extraction methods selected for this study include morphological, open-close operations within decision- level fusion for the obscuration case and pixel-level fusion for variable edge intensities. Other investigators have approached this issue on similar image processing techniques. The multispectral (2.69 - 2.95 micrometer SWIR; 4.17 - 4.2, 4.35 - 4.50 micrometer MWIR; and 8.0 - 12.0 micrometer LWIR) target/background imagery includes SWIRM/MWIR boost phase track (with occlusion problem) and LWIR aimpoint selection (with tumbling problem). The two classified missile systems are: (1) a depressed-angle submarine launched ballistic missile (SLBM) and (2) a medium range ballistic missile (MRBM). The results indicate that for 6 degrees of freedom (6 DOF) hardbodies, ATDCI geometrical pattern reference libraries should be optimized to accommodate the extreme variable gradient geometries for tumbling midcourse targets. For boost- phase missile hardbody occultation by missile exhaust plumes, segmentation and feature extraction should be implemented in each bandpass before processing to the ATDCI classifier. This study demonstrates that although the plume/hardbody system edges were extracted, the geometry of the target edge often deviated from symmetry. !21