ELECTRONIC COMBAT T&E CONSOLIDATION MASTER PLAN

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PREPARED BY:

THE T&E BOARD of OPERATING DIRECTORS

THE T&E BOARD of DIRECTORS

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EXECUTIVE SUMMARY

This Electronic Combat Consolidation Master Plan defines the test capabilities required to test current and future Department of Defense (DoD) weapon systems in an electronic combat (EC) environment and provides the roadmap and rationale for consolidation/sustainment of these required capabilities. This Master Plan addresses Congressional direction to the Secretary of Defense to develop a Master Plan for future consolidations of DoD-wide EC test and evaluation (T&E) assets.

This Consolidation Master Plan describes the strategy by which DoD EC T&E resources have been, and continue to be, right-sized to meet Service requirements without unwarranted duplication. This plan considered all facilities within the Services with significant involvement in EC testing. Of those, several major facilities account for the preponderance of EC testing and have been extensively studied during the T&E Reliance and Base Realignment and Closure (BRAC) processes. The plan addresses past, present, and future consolidation actions associated with facilities at 17 separate sites involved in EC T&E. Of these, 11 sites encompass the core EC T&E infrastructure that supports most EC T&E and are the subject of this plan. The remaining six are non-T&E sites with ancillary EC capabilities that exist to support other missions (e.g., Science and Technology (S&T), Training, etc.). They are not part of the core EC T&E infrastructure, and therefore are sites for limited, tightly controlled EC T&E investment (if any). The Consolidation Master Plan outlines plans which will result in a reduction[1] of the core EC T&E infrastructure to five primary test sites (Patuxent River, Edwards AFB, Point Mugu, China Lake, and Aberdeen) and three specialty sites (Holloman AFB, Nellis Range Complex (NRC), and Ft. Huachuca). Reductions have been accomplished via a series of intra- and inter-Service initiatives under T&E Reliance, and continue through active control of future investments by the T&E Board of Directors (BoD), as well as downsizing in place to continue to match resources to workload. The EC T&E Consolidation Master Plan Roadmap shown in Figure 5, Section VI (p. 14) depicts the planned progressive reduction of primary and specialty EC T&E sites.

Although Congress referred to airborne EC and command, control, and communications countermeasures (C^3CM) systems, recent changes in DoD terminology now, more appropriately, encompass these systems under Electronic Warfare (EW).

The criteria used for downsizing of the T&E EC infrastructure has two thrust areas. One is an overarching strategy that is based on the premise that sufficient T&E capabilities must be retained to preclude the following: Single-Node Failure, Loss of Surge Capability, Loss of Quick Response Capability, and Major Impact on Other Mission Areas. The second thrust area includes the following quantitative measures that are typically associated with facility capacity and utilization studies: Workload, Geographical Constraints / Natural Attributes, Costs to Move and/or Realign, Service Uniqueness/Technical Uniqueness, and Multi-Mission Use. The

[1] Capabilities reduced by ceasing T&E investment at specified sites and redirecting the EC T&E workload to other locations.

combination of an overarching strategy and specific quantitative metrics, tailored for each study, will continue to be used in future studies. Workload will be used as a trigger to initiate studies of further downsizing or consolidation opportunities. Weighting factors may also be applied to the metric set to ensure that more important factors are properly considered.

Major consolidations have been planned in the resource categories of digital models and simulations, hardware-in-the-loop test capabilities, and open air ranges, as follows:

> Digital models and computer simulations are inherent within most test resources and significant improvement in EC testing is anticipated via the implementation of a single system level Joint Modeling and Simulation System (J-MASS) architecture. Future J-MASS compliant electronic combat models will be interoperable, will minimize the need for duplicative model development, and will promote data standardization. J-MASS compliance with the DoD Common Technical Framework for modeling and simulation will allow the use of these models to support of a wider range of DoD analytical requirements.
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> EC Hardware-In-The-Loop (HITL) facilities represent a combination of unique roles as well as some excess capacity. Operations and Maintenance (O&M) and Improvement and Modernization (I&M) savings are anticipated by collocating two of the facilities to an Installed System Test Facility (ISTF). Additionally, collocation of HITL capabilities with installed systems test facilities allows a reduction in the overall number of EC T&E sites and a corresponding decrease in excess capacity within both resource categories.
>
> Finally, the capacity of EC open air ranges exceeds requirements by approximately 30%. Thus, a consolidation from three to two is planned, which will provide a monetary savings, development of better T&E capabilities via concentration of available threat simulators (producing greater signal and pulse density with reduced duplication), and better focus for limited investment dollars.

The tri-Service EC T&E infrastructure is currently right-sized to meet today's workload and warfighters' requirements. Criteria are in place to trigger the study and evaluation of further downsizing or consolidation opportunities. Furthermore, through the T&E Executive Agent structure, appropriate controls are in place to ensure that the necessary facilities are improved and modernized, without unwarranted duplication, to meet the technological demands of current and future EC systems, and to ensure that the EC T&E infrastructure remains right-sized in the future.

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I PURPOSE

This Master Plan delineates the strategy by which DoD EC test resources have been and will continue to be "right-sized". The primary goals of this plan are to ensure required T&E capabilities are available to satisfy future requirements, and that the EC T&E infrastructure is sized to support future workload levels and simultaneously minimize impacts upon customers which utilize these resources to support EC T&E. This plan addresses the requirements of the FY95 House Armed Services Committee language, which directed:

> "the Secretary of Defense to develop a master plan for future consolidations of DoD wide electronic combat test and evaluation assets. This Master Plan shall provide a statement of required electronic combat capabilities and a road map for consolidation of these activities".

II SCOPE

This plan addresses the strategy used to guide past, present and future consolidations of EC T&E activities across the three Services. This plan considered all facilities within the Services with significant involvement in EC Testing. Of those, several major facilities account for the preponderance of EC testing and have been extensively studied during the T&E Reliance and BRAC processes. The Consolidation Roadmap in Section VI identifies those major facilities and the consolidation actions taken. The remaining facilities are either service unique or non T&E facilities with ancillary EC testing capability.

In this plan, the term "EC" is used interchangeably with "EW," Electronic Warfare. Although Congress referred to airborne EC and C^3CM systems, recent changes in DoD terminology now, more appropriately, encompass these systems under EW. EC systems span the entire electromagnetic spectrum, are both offensive and defensive in nature, and include subsystems, technologies, and techniques for electronic warfare, and suppression of enemy air defenses. Electronic warfare is defined as: any military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. This includes electronic attack such as jamming; electronic warfare support measures such as threat warning; and electronic protection associated with offensive avionics.

III BACKGROUND

T&E Reliance Process

The DoD T&E community established the T&E Reliance process in 1990 to right-size the T&E infrastructure and eliminate unwarranted duplication of capabilities and facilities. In 1993, the Services established a tri–Service T&E Executive Agent lead by a Board of Directors (BoD) consisting of the Service Vice Chiefs of Staff. The T&E Executive Agent structure is described in Appendix A. The T&E Executive Agent has continued the T&E Reliance process executed

through the Board of Operating Directors (BoOD) and the Test and Evaluation Reliance and Investment Board (TERIB). The TERIB has published a TERIB Handbook approved by the BoOD which governs the details of the T&E Reliance process including development of the annual Test Resource Master Plan (TRMP) and Test Investment Strategy (TIS).

The T&E Reliance process is being used for right-sizing the EC elements of the T&E infrastructure through intra-Service and inter-Service initiatives and control of all investments in the infrastructure. Two key objectives of the T&E Reliance process are to identify critical T&E resources, and establish a strategy for right-sizing the T&E infrastructure through consolidation and eventual reduction/elimination of duplicative capabilities. T&E Reliance will reduce capabilities by ceasing institutional T&E investment at specified sites and directing the T&E workload to other locations.

EC Test Categories

The Final Report on Electronic Warfare Test and Evaluation Capabilities prepared by the Electronic Warfare Test and Evaluation Reliance Study Group of November 1991 (Revised 8 May 1992) determined that "EW (EC) T&E capabilities generally fall into one of the following categories:"

- Digital Modeling and Computer Simulation (M&S)
- Measurement Facilities (MFs)
- Integration Laboratories (ILs)
- Hardware-in-the-loop (HITL) test capabilities
- Installed System Test Facilities (ISTF)
- Open Air Ranges (OARs) (note: This includes ground and airborne assets)

In the annual TRMPs, the T&E Executive Agent has endorsed the broader use of these six test resource categories for all T&E facilities. Appendix B provides definitions of these test resource categories. Integration Laboratories (ILs) are not addressed in this consolidation plan because they are generally system specific, as opposed to general purpose, test and evaluation facilities.

Figure 1 illustrates the relationship of the test resource categories that support EC T&E.

These test capabilities are used through-out the life cycle of an EC system. Current and future EC T&E requirements call for modern EC T&E capability in each of these test categories. Complicated testing of the developmental EC systems is progressively conducted in each test resource category. As system development progresses from brassboard through prototype to production systems, both hardware and embedded software undergo a sequence of tests at various facilities. The purpose of these tests is to reduce risk by establishing demonstrated values for system performance and technical parameters before progressing to the more expensive, yet more realistic or credible, category of testing.

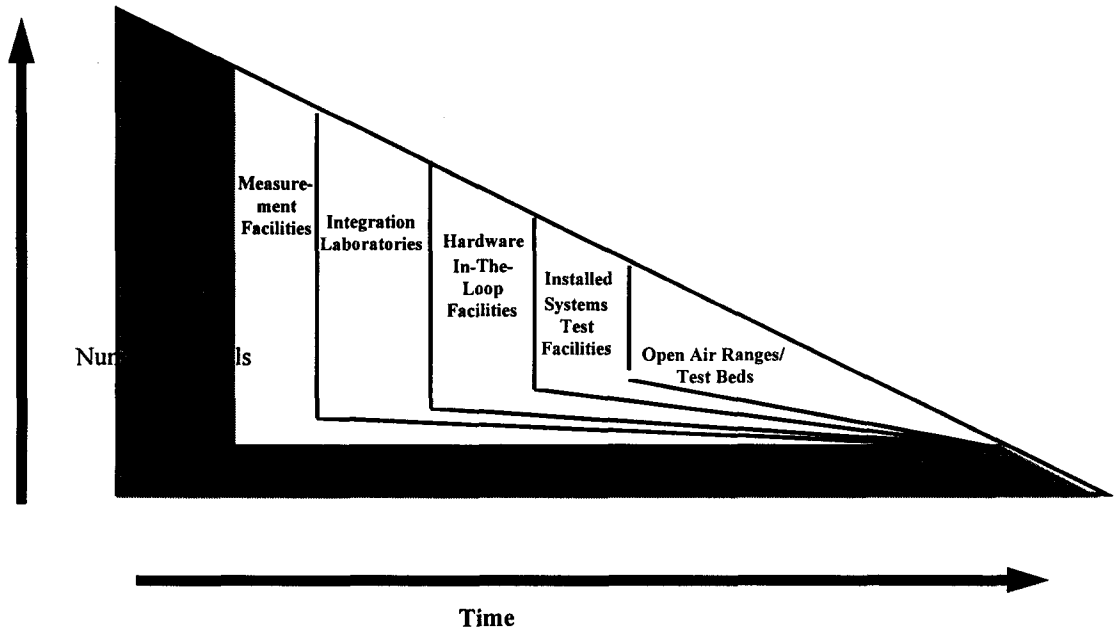

Figure 1
Resource Utilization to Support EC T&E

Baseline Capability

The EC T&E activities included in the analysis for development of this master plan are shown below. Seventeen Service T&E and other activities (each defined as a single location under one managing organization) were considered, each of which typically has multiple test facilities and capabilities spanning one or more test resource categories. The activities included were:

Army	Aberdeen Test Center (ATC), Aberdeen Proving Ground, MD
	Electronic Proving Ground (EPG), Ft Huachuca, AZ
	Operational Test Support Agency (OTSA), Ft Bliss, TX *
	White Sands Missile Range (WSMR), NM and its Big Crow Capabilities *
Navy	NAWC-AD Patuxent River, MD
	NAWC-WD China Lake, CA
	NAWC-WD Pt Mugu, CA
	NSWC Carderock Laboratory, MD *
	Naval Research Laboratory, Washington, DC *
	Naval Surface Warfare Center, Dahlgren, VA *
Air Force	AFFTC Edwards AFB, CA
	Nellis Range Complex, NV

AFDTC Eglin AFB, FL
AFDTC (Real-Time Electromagnetic Digitally Controlled Analyzer Processor (REDCAP)), Buffalo, NY
AFDTC (Air Force Electronic Warfare Evaluation Simulator (AFEWES)), Ft Worth, TX
AFDTC Holloman AFB, NM
ASC Wright-Patterson AFB, OH *

* = Single Service, non-duplicative, not subject to consolidation. Therefore, not analyzed further in this plan.

IV ELECTRONIC COMBAT T&E REQUIREMENTS

In order to adequately support developmental and operational testing, the EC test community must replicate, as closely as possible the EC battlefield, including all systems that could potentially represent threats to our forces and systems. This replication would include worst case numbers of threat systems that would permit full testing against the threat densities and C^3 aspects of the adversary forces. The threat system simulators must also include significant variability to allow "what if" testing to demonstrate and evaluate the robustness of systems to handle potential upgrades and changes to the threat. This fully replicated EC battlefield would be implemented in M&S, HITL, ISTF, and OAR facilities.

Fiscal constraints limit the ability to replicate the full EC battlefield at any given facility. Past test requirements were met using a single point design copying the threat at HITL, ISTF, and OAR facilities. The ground test facilities supplement these simulators with open loop signal simulators used to create more realistic threat densities.

Open air ranges are shifting from the use of costly threat simulators to actual foreign threat systems as they become available and are cost effective. Current technology supplements these threat simulations by allowing for the creation of more realistic densities at the open air facilities using advanced waveform generators linked to wideband high power microwave sources. Modern technology may allow for the linking of facilities creating a virtual battlefield made up of digital models, computer simulations, laboratory systems from the HITL and ISTF facilities, and the open air ranges. Successful demonstrations of such facility linkages have been performed by all three Services. An Office of the Secretary of Defense (OSD) initiative to link the Navy's Air Combat Environment Test and Evaluation Facility (ACETEF) at Patuxent River, MD with the Air Force's REDCAP facility in Buffalo, NY will include a battery of developmental and operational tests to determine the utility of such links. The OSD initiative to develop, test and integrate a High Level Architecture (HLA) for modeling and simulation will facilitate the interoperability and reuse a wide range of models including those that are J-MASS compliant. The HLA will specify only the minimum definition required to facilitate interoperability and reuse. Further definition and detailed implementation of specific simulation system architectures will remain the responsibility of the developing Component.

Technology Trends and Program Requirements

The EC test community is faced with the challenge of meeting U.S. Defense technological advances in the following areas:

- Global surveillance and communications;
- All-weather day/night precision strike;
- All-weather defense against very low observable cruise missiles;
- All-weather day/night survivable mobile enhanced lethality ground combat vehicles; and,
- Surface and undersea superiority against open ocean and confined/coastal threats posed by advanced, stealthy nuclear and non-nuclear submarines, remotely operated underwater vehicles, and mines.

The realities of reduced budgets and force structure do not eliminate the need for future T&E of new technologies. Major platform development or upgrade programs and EW programs will continue to present challenges to the EC T&E community. These programs include:

- Platform development or upgrade programs:

  - F-22
  - CV-22
  - AH-64/Longbow
  - B-1 Defensive Systems Upgrade
  - F/A-18E/F
  - EH-60
  - Surface ship EW upgrades.
  - V-22
  - RAH-66/Comanche
  - B-2
  - Joint Advanced Strike Technology (JAST)
  - F-15 Tactical Electronic Warfare System
  - EP-3E Sensor System Improvement Program
  - Unmanned Air Vehicles/payloads

- Electronic warfare programs/improvements:

  - Integrated Defensive Electronic Countermeasures (IDECM)
  - Joint Advanced SIGINT Architecture
  - Advanced Technology Radar Jammer (ATRJ)
  - Advanced Tactical Infrared Countermeasures (ATIRCM)
  - Common Missile Warning System (CMWS)
  - Advanced Strategic and Tactical Expendable (ASTE)
  - ALR-67 V(3)
  - ALE-47
  - Quick Fix
  - ALE-50
  - Guard Rail

These programs and the associated integration efforts show the need for a robust and technically capable EW T&E infrastructure (reference DoD FY96 Electronic Warfare Plan, April 1995).

Threat Technology Requirements

Additionally, foreign threat technology improvements and diversity will continue to be a challenge to the EW T&E community. The need to test against a realistic and representative threat will continue to drive the focus of EW test capability development. This is complicated by the increasing multi-polarity of world military power. Weapons are now a major hard currency export item for Russia, China, several Western European nations, and a growing group of newly industrialized states such as Israel, India, and Brazil. Weapons systems from any of these states, or from the U.S. itself, may be used by a host of potential adversaries U.S. forces may face in non-combatant evacuation operations (NEO), peace-making/peace-keeping operations, contingency/limited objective warfare (CALOW) operations, or major crises such as the liberation of Kuwait. Examples from open sources include:

- Combat aircraft including:
  - Russian MiG-29/FULCRUM
  - French Mirage 2000
  - French Mirage F-1
  - Italo-Brazilian AMX
- Air-to-Air missiles including:
  - U.S. AIM-7/SPARROW
  - French MICA
  - French Super 530
  - U.S. AIM-9/SIDEWINDER
  - French MAGIC II
  - Russian AA-11/ARCHER
- Surface-to-Air weapon systems including:
  - British Rapier
  - Swedish Giraffe/RBS 70/80
  - U.S. Hawk/I-Hawk
  - French Crotale NG
  - Russian SA-15
- Anti-armor weapons including:
  - Franco-German HOT
  - U.S. TOW
  - Russian AT-6/SPIRAL
  - Franco-German MILAN
  - Russian AT-5/SPANDREL
- Anti-ship weapons including:
  - French EXOCET
  - Italian OTOMAT
  - U.S. HARPOON

V CONSOLIDATION MASTER PLAN

As described above, at the outset there were 17 sites with EC T&E roles and investment funding requirements. Through the T&E Reliance process, a comprehensive, distributed and interactive set of EC T&E capabilities was identified that collectively represent the DoD EC T&E core infrastructure. [The facilities and ranges that form this infrastructure are described in Appendix C.]

Intra-Service Initiatives

Each Service has and continues to individually evaluate its current capabilities and capacities versus projected requirements to identify streamlining opportunities. The Army called its most recent studies a "reshaping" effort, the Navy called it "Mission Purification", and the Air Force named it "EC Consolidation." Service initiated consolidations and/or closures have resulted from these internal studies.

The Army has realigned the EPG at Ft. Huachuca, AZ on 1 October 1994 as a directorate under the WSMR, NM. This action moved the EPG mission and resources under a primary site in accordance with the T&E Reliance strategy and achieved significant overhead savings through elimination of EPG as a separate Army test center. It also transferred the radar cross-section capability at WSMR to Aberdeen Test Center (the Reliance lead for land vehicles). Finally, the Army transferred the Big Crow Project Office mission and assets from the Army Research Laboratory to the Army Test and Evaluation Command in accordance with its primary test mission.

In 1991, in anticipation of the Defense Management Review, the Secretary of the Navy approved a plan for major consolidation and realignment of Navy T&E facilities and capabilities. Under this plan, the Navy disestablished a large number of existing T&E facilities and consolidated essential core capabilities into four full-spectrum warfare centers and a corporate laboratory. These commands include the: Naval Air Warfare Center (NAWC), Naval Undersea Warfare Center (NUSC), Naval Surface Warfare Center (NSWC), Naval Command, Control, and Ocean Surveillance Center (NCCOSC). The Navy corporate laboratory is the Naval Research Laboratory. Mission purification efforts have occurred both between these commands and internal to these commands. For example, the mission of the NAWC includes providing infrastructure to support all EW T&E capability for Naval Aviation. The NAWC maintains one OAR, one ISTF, one HITL facility, and three specialized Radar Cross Section (RCS) signature measurement facilities, each essential to EC T&E.

Since the mid-1970s, Air Force has focused its core T&E infrastructure at three Test Centers: the Air Force Flight Test Center (AFFTC) for air vehicles and electronic combat, the Air Force Development Test Center (AFDTC) for air weapons and Command, Control, Communications, Computers and Intelligence (C^4I), and the Arnold Engineering Development Center (AEDC) for propulsion, wind tunnel and space chambers to support the other centers. This led to the

disestablishment of the Air Force 4950th Test Wing at Wright-Patterson AFB and consolidation with the AFFTC at Edwards AFB, which was completed in July 1994. This action included the movement of test-bed aircraft with EC T&E capabilities and was the first step in a series of actions to consolidate the management and core T&E capabilities for EC under the AFFTC.

Inter-Service Initiatives

To facilitate Inter-Service Reliance, the EC T&E community uses three tiers of review to identify unwarranted cross-service duplication. At the most technical level, reviews are conducted by the tri-Service Electronic Warfare Test Resource Office (EWTRO) which was established and chartered under DoD T&E Reliance in 1992. The EWTRO annually reviews the EC T&E infrastructure and develops a Test Capability Master Plan which identifies total DoD EC test requirements and capabilities. This review of requirements and capabilities identifies opportunities for infrastructure reduction when capacity has outstripped demand and screens future investment proposals, to preclude unwarranted duplication, when new requirements are surfaced or workload requirements expand. The second tier of review is provided by the TERIB. The TERIB consists of senior Service technical personnel who are responsible for development of the Test Investment Strategy and the Test Resource Master Plan for T&E. A third tier of management review is provided by the BoOD and the BoD. This process is managed and directed by the T&E Executive Agent and its supporting boards, not only for EC but across the breadth of T&E activities. In 1995, the Navy retired its King Crow aircraft and transferred its high power jamming mission for fleet EC T&E support to the Army's Big Crow Program at Kirtland AFB.

Investment Control

A key element of T&E Reliance is the control of future investments to ensure that required DoD capabilities are maintained or developed to support future weapon system developments and T&E workload without unwarranted duplication. A decision flow process, shown in Figure 2, has been developed for reviewing all Service proposed investments, consolidations, and allocation of funds to the EC T&E primary and specialty sites.

The investment control process has been applied to FY97-01 investments, and is planned for all future investments. Its purpose is to promote consolidation through migration of EC functions and capabilities toward a minimum number of sites and to minimize overlap of functional EC capabilities across DoD. Each Service conducts an independent review of their proposed T&E investments with its own tailored process. The Navy uses the Navy Test and Evaluation Investment Process (NTEIP), the Air Force uses its Test Investment Planning and Programming (TIPP) process and the Army uses the Technology Development and Acquisition Process (TDAP). The results of these different processes is a single set of investment documents to feed the cross-service review process. The EWTRO reviews all Service EC plans for investments that exceed Reliance thresholds and forwards those planned investments with technical

recommendations and endorsements to the TERIB for review. The TERIB applies an additional

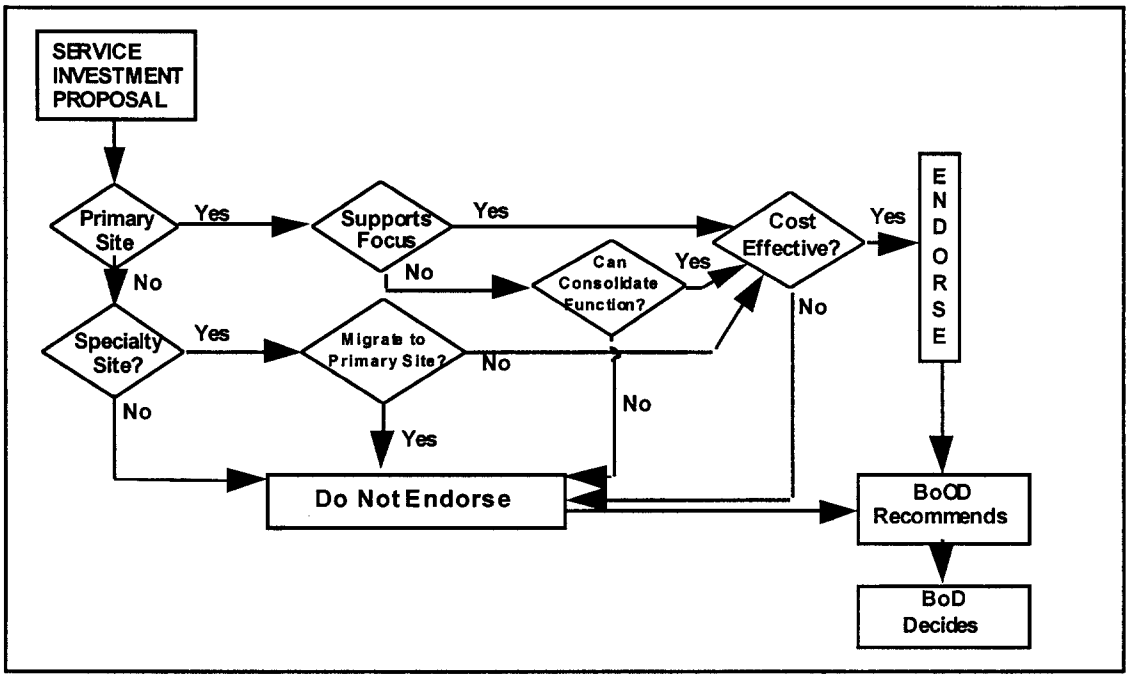

Figure 2
Investment Control Process

set of endorsement criteria and forwards its endorsed results to the BoOD. The BoOD, after reviewing the TERIB submittal, forwards a recommend list of investments to the T&E BoD for final approval to forward to the Defense Test and Training Steering Group (DTTSG).

The Inter-Service methodology to eliminate duplication across Services, and the control of future investments, embody a T&E Reliance Strategy between the Services. The overarching goal of the T&E Reliance Strategy is to ensure that the critical air/land/sea space and associated DoD core EC T&E infrastructure needed to support present and future EC system acquisition programs, with acceptable risk, are identified and retained.

The strategy of T&E Reliance is to eliminate unwarranted duplication, rely on other Services to provide non Service unique T&E capabilities, and to size the DoD T&E infrastructure to support future development and acquisition of weapon systems with acceptable risk. The overall approach right-sizes the T&E infrastructure through control of future EC T&E investments to ensure they are consistent with the DoD vision for the core T&E infrastructure. Key elements of this approach are: (1) defining what constitutes the core T&E infrastructure; (2) controlling future investments to ensure they are consistent with the core T&E infrastructure; and (3) ensuring that this core T&E infrastructure is consistent with other OSD and Service right-sizing activities such as the BRAC Commission. In order for Reliance to be successful, all three of these elements must be defined, integrated, and controlled. The T&E Executive Agent structure

provides the mechanism for successfully integrating and controlling these efforts as described in Appendix A.

The implementing agent for the EC T&E Reliance Strategy is the EWTRO. The EWTRO consists of standing committees which represent the Services in the areas of EC Modeling and Simulation, Measurement Facilities, Hardware-in-the-Loop Facilities, Installed Systems Test Facilities, and Open Air Ranges. The Leadership of the EWTRO rotates every two years between the Air Force and the Navy.

Right-Sizing Efforts

Of the original 17 sites with EC T&E roles, six have been designated as primary EC T&E sites (Patuxent River, Eglin AFB, Edwards AFB, Point Mugu, China Lake, and Aberdeen). Five have been designated as specialty EC T&E sites (Buffalo (REDCAP), Ft. Worth (AFEWES), Holloman AFB, the NRC, and Ft. Huachuca). These 11 sites are the subject of this Consolidation Master Plan and represent the core EC T&E infrastructure that supports the EC T&E. The remaining six baseline sites are non-T&E sites with ancillary EC capabilities that exist to support other missions (e.g., S&T, Training, etc.). They are not part of the core EC T&E infrastructure, as depicted in the EC Roadmap (Section VI), and therefore are sites for limited, tightly controlled EC T&E investment (if any). The primary and specialty EC T&E sites which make up the core EC T&E infrastructure are shown geographically in Figures 3 and 4, respectively.

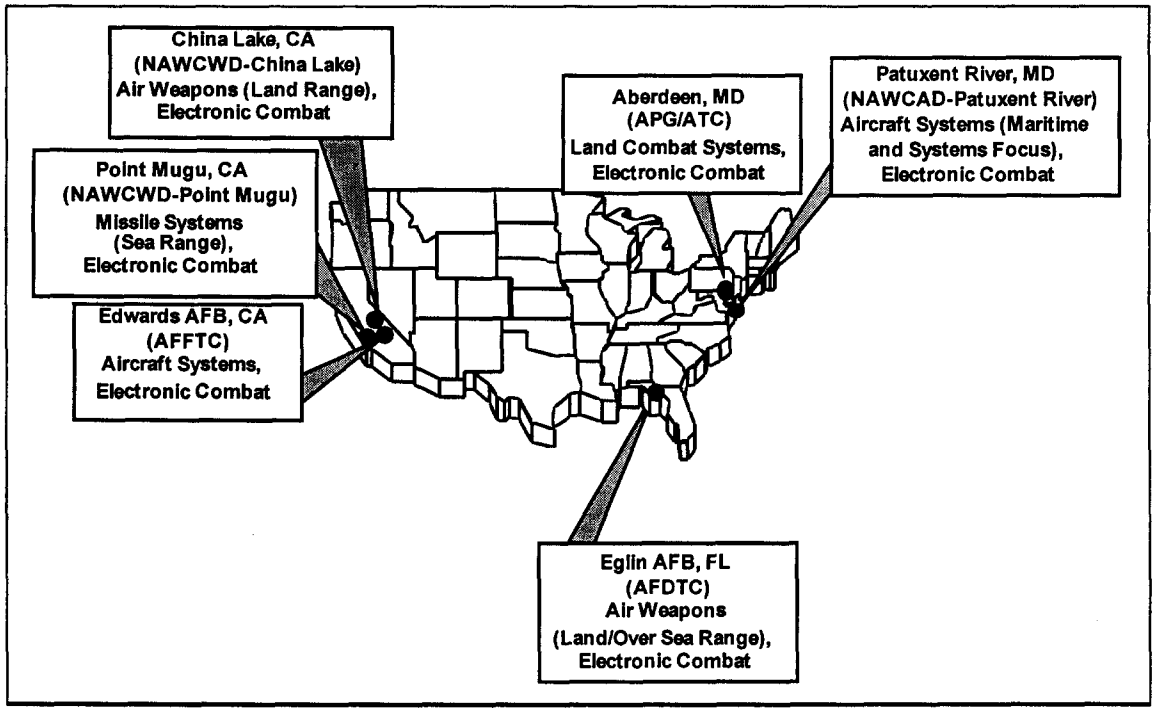

Figure 3

Defense EC T&E Complex - Primary Sites

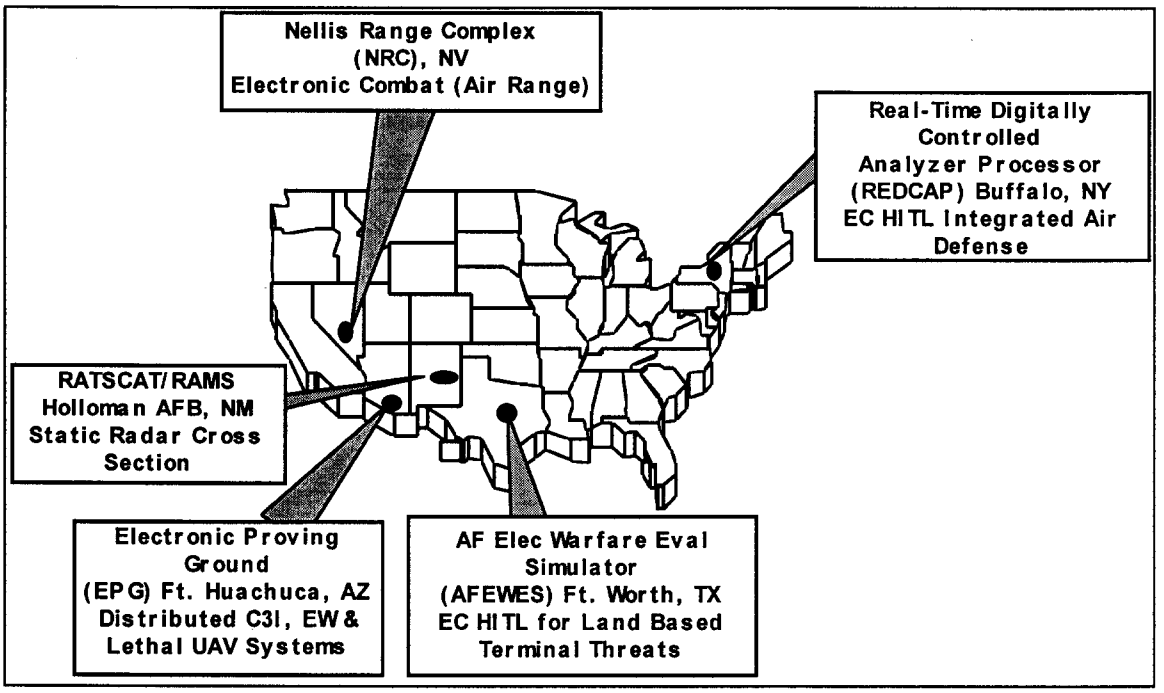

Figure 4
Defense EC T&E Complex - Specialty Sites

Several significant (Capstone) consolidation studies were initiated in 1993 and 1994 to investigate the potential for further consolidations. These studies were initiated by the T&E BoD and executed by the TERIB/Reliance Teams, under guidance from the T&E BoOD. Five of the initial studies and one follow-on study involved the EC T&E infrastructure. The EC studies focused on the consolidation of:

- EC Modeling and Simulation
- EC Radar & Electro-Optic (EO) Measurement Facilities
- EC Installed Systems Test Facilities/Hardware-in-the-Loop facilities
- EC Open Air Ranges
- Synergy of EC Facility Collocation

The studies looked at the costs and savings associated with consolidating major EC infrastructure components at single locations. Precepts included maintaining required EC test capabilities and ensuring that the resulting infrastructure was capable of supporting projected workload. Cost models were used to determine future payback periods. No actions were taken upon completion of these studies due to initiation of 1995 BRAC deliberations. The Roadmap provided in Section VI of this plan is based on results of the BoD EC Capstone studies and 1995 BRAC findings.

The study of EC Radar and EO Measurement facilities found no significant savings and demonstrated that the scope of the consolidation study was much too broad. A subsequent study of Static Outdoor (Air) RCS Facilities was initiated in the spring of 1993. The narrowed scope involved only the RCS facilities at the Naval Air Warfare Center, Weapons Division (China Lake), and Holloman Air Force Base. Of the many options considered by the study team, only three were determined to be feasible. The three feasible options included eliminating the Junction Ranch facility at China Lake, eliminating the Radar Target Scatter (RATSCAT) facility at Holloman AFB, or downsizing both facilities commensurate with workload. Based upon evidence of significant downsizing underway at both sites, preliminary data to the BoD resulted in an interim agreement to continue downsizing in place until cost and workload issues are resolved. A cost and workload comparison between the two sites will be accomplished as part of the study to develop the 5-year plan for T&E and Laboratory consolidation required in response to Section 277 of the FY96 Defense Authorization Bill.

The Air Force recently reached the conclusion that the number of HITLs and OARs could be reduced by one per test resource category. These actions, also held in abeyance pending the outcome of BRAC '95, were reinforced by BRAC Commission findings and are documented in this plan (See Section VI). For specific test resources, REDCAP resources and management will transfer to Edwards AFB, as will those for AFEWES. Future EC ISTF upgrades will be made solely at the Avionics Test and Integration Complex (ATIC). Air Force open air EC test resources will be centralized on the NRC. EC test customers currently using Electromagnetic Test Environment (EMTE) resources at AFDTC will transition westward, accompanying the consolidation of T&E capabilities.

In the next five years, as a result of these and other right sizing initiatives, the EC T&E related primary sites will be reduced from six to five (Patuxent River, Edwards AFB, Point Mugu, China Lake, and Aberdeen) and EC related specialty sites reduced from five to three (Holloman AFB, the NRC, and Ft. Huachuca), once the realignments, consolidations and right sizing efforts are complete.

The EWTRO is responsible for reviewing EC investments to ensure there is no unwarranted duplication of capability and that Service investments conform to the migration paths identified for the EC sites. Tri-Service I&M funded programs are provided in Appendix D. Approval for EC investments outside of the core infrastructure (as with other T&E areas) relies on the decision matrix of the investment control process described earlier (see Figure 2) and requires specific approval of the T&E BoOD. The results of these efforts are described in Section VI, the Roadmap.

Test Investment Strategy (TIS)

The DoD TIS focuses investments in a core EC T&E infrastructure that provides the critical land/air/sea space, unique geographies, diverse topography, varied climatology, skill base, and facilities required to test current and future systems in realistic environments. Through

reengineering of strategic and business planning processes, this infrastructure shall ensure it is able to remain responsive to new and evolving warfighter test requirements and systems technologies, adjust to a changing workload, and exploit new instrumentation technologies and test methodologies to achieve the most effective and efficient T&E possible. Key elements of the TIS are:

(1) Increased emphasis on modeling, simulation, ground based testing, and the internetting of multiple test facilities to provide more cost effective methods for satisfying test requirements.

(2) Development of common range systems architectures and standards to reduce acquisition costs and ensure interoperability among ranges.

(3) Encouragement of dual use of DoD's primary test capabilities by commercial industry to leverage our investments in these facilities.

(4) Seizing opportunities for leveraging T&E investments through cooperative efforts with the S&T, program development and training communities, as well as other government agencies and allied nations.

T&E Reliance shall continue to be the primary focus for Joint Service investment planning, and the T&E Executive Agent structure shall provide the forum, executive leadership, and coordination to ensure successful execution of this Test Investment Strategy.

VI ROADMAP

Figure 5 depicts the planned progressive reduction of primary and specialty EC T&E sites associated with the implementation of this EC T&E Consolidation Master Plan. The following paragraphs provide amplifying information on the consolidation approach.

Digital Models and Computer Simulations (M&S)

Digital models and computer simulations are used to represent weapon systems, host platforms, and other friendly players in the combat environment with the threat systems. They are used to help design and define EC systems and test against the associated threat simulations, using digital missile flyout models. Due to the relatively low cost and speed of exercising these types of models, these tests can be run many times to check "what ifs" and explore the widest possible range of system parameters without the cost and concerns of flight safety. These models may run interactively in real or simulated time and space domains, along with other factors of a combat environment, to support EC T&E.

The majority of the Digital Models and Computer Simulations being used today have been developed around a closed architecture, with only limited application outside their designed uses.

The models were designed with an architecture that allowed little or no interface with other models. A common modeling and simulation architecture supporting real-time operations is necessary to provide an interactive capability between existing and future models used for EC

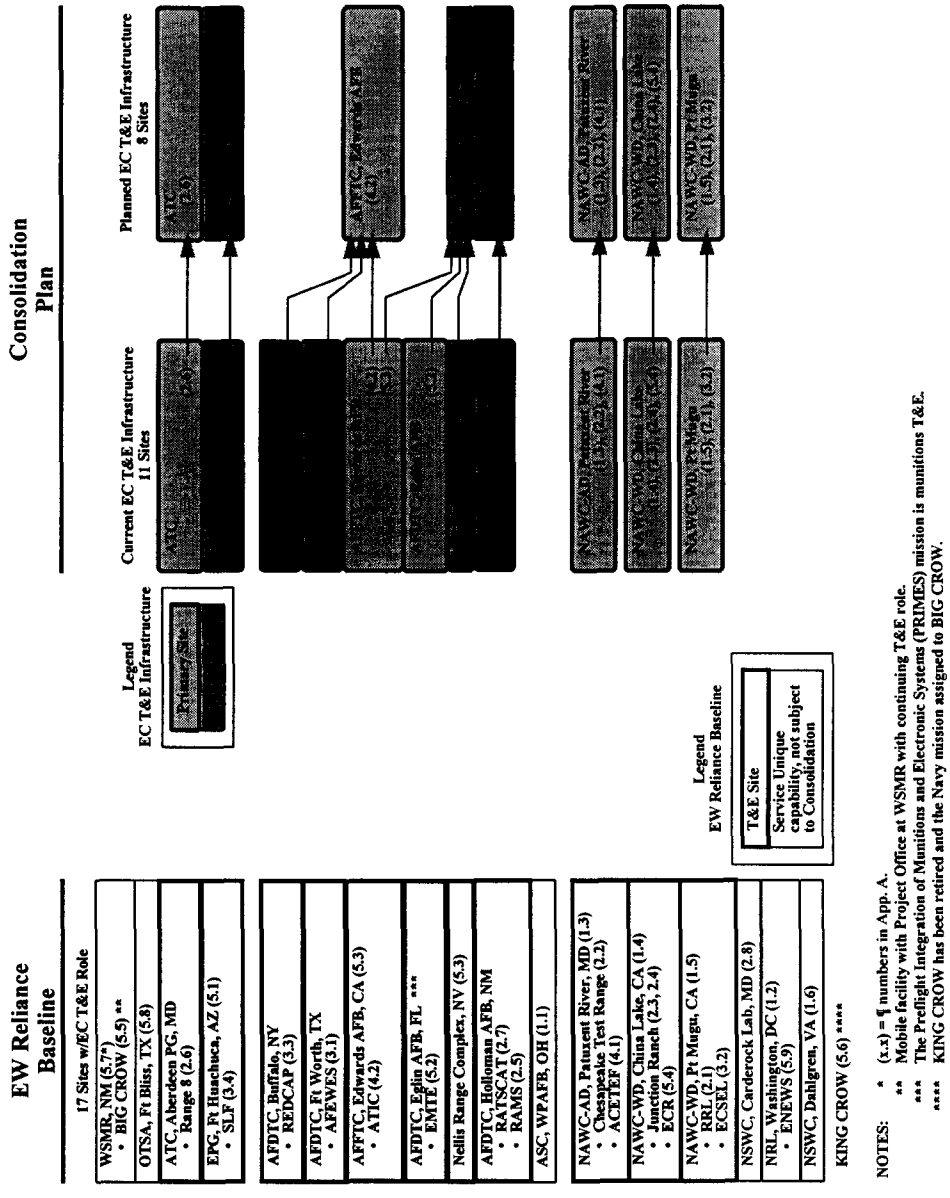

Figure 5

EC T&E Consolidation Master Plan Roadmap

T&E and support efforts such as cost and operational effectiveness analyses and alternative design approaches.

The current emphasis on correcting the past deficiencies in the architectural approach of the EC M&S is an open architecture concept. The approach is to adopt a standard model architecture that will allow EC models to operate independently or be integrated to represent the necessary force structure required to evaluate the performance of friendly system(s) in the threat mission scenario. The current focus is placed on the Air Force led initiative for a Joint Modeling and Simulation System (J-MASS) architecture and Defense Intelligence Agency/Missile Space and Intelligence Center development of a C++ based Simulation Environment (MSIC C++). Both approaches are designed to develop modular, supportable models of friendly and threat weapon systems and have made major contributions to the required Open Architecture approach to EC M&S.

The plan for future development of required models will be focused on the J-MASS architecture. The Deputy Director, Test Systems Engineering and Evaluation for Modeling & Simulation/ Software Evaluation, has signed a 7 September 1995 memo, that will initiate the establishment of a Joint Program Office for J-MASS and will also form a Senior Steering Group to guide the necessary decisions for transition to and sustainment of the architecture. The intent is to build on the J-MASS and MSIC C++ early developments and converge on one stable architectural environment for the future development of weapon systems models. The future end product will be Standard J-MASS Compliant Model Sets, supporting all functional categories of EC weapon T&E (e.g. HITL and ISTF).

Measurement Facilities (MFs)

Based upon the BoD studies described in Section III (BoD directed studies on EC Radar & EO Measurement Facilities and Synergy of EC Facility Collocation of 1993/94), any further consolidations will be addressed as part of the study to develop the 5-year plan for T&E and Laboratory consolidation required in response to Section 277 of the FY96 Defense Authorization Bill.

Hardware-in-the-Loop Facilities (HITLs)

The REDCAP capability, located in the Calspan facility in Buffalo, NY, is to be disestablished and reconstituted at Edwards AFB per the 1995 BRAC recommendation. REDCAP is a HITL representation of several versions of an Integrated Air Defense System (IADS) that tests the effectiveness of EC systems to counter multiple radars and C3 nets and obtains data that cannot be extrapolated from results of single radar simulations. Capabilities provided include hybrid radar simulations, data links, manned data fusion and weapons control posts, and manned interceptor stations in a multi-level security building. The manned hybrid simulators include

early warning, ground controlled intercept, height finder, and airborne early warning radars, plus voice links.

REDCAP capabilities required for continued support of EC T&E will be relocated from the Calspan facility to the AFFTC for collocation with the ATIC ISTF. The transfer of REDCAP includes both short-term management of the existing program (including upgrades) and transfer/re-establishment of capabilities to/within the AFFTC. Management responsibility transferred to AFFTC in FY96, and physical movement of all test resources will be completed as directed by the BRAC '95 decision. The schedule for transfer and reconstitution of essential test capabilities is based upon customer requirements, and may be modified to accommodate changes thereto. Currently, F-22 testing is the schedule driver.

Test capabilities at the AFEWES facility in Ft Worth, TX are considered terminal threats and are viable to support EC T&E for several years into the future. AFEWES management responsibility transferred to AFFTC in FY96, resulting in a single organization responsible for all Air Force EC test and evaluation resources. AFEWES test capabilities will be relocated to AFFTC for collocation with the ATIC ISTF when workload dictates.

The BoD studies identified in Section III (BoD directed studies on EC Installed Systems Test Facilities/Hardware-in-the-Loop facilities, and Synergy of EC Facility Collocation of 1993/94), determined that consolidation of all EC HITLs to a single site was not cost effective. The Navy Electronic Combat Simulation and Evaluation Lab (ECSEL) was a primary contributor to this outcome, since ECSEL performs dual roles as an EW HITL and as the test facility for the Naval Airborne EW Software Support Activity. Consolidation of ECSEL to another site would require duplication of current resources used to support life cycle support or relocation of operational assets required to support this role. Currently, no further consolidations of HITLs are warranted or planned.

Installed Systems Test Facilities (ISTFs)

The BoD studies identified in Section III (BoD directed studies of EC Installed Systems Test Facilities/Hardware-in-the-Loop facilities and Synergy of EC Facility Collocation of 1993/94) and the BoD directed study on Fixed Wing Aircraft recognized ISTFs as critical to the success of future T&E of advanced aircraft/weapon systems. They further noted that collocation of ISTFs with aircraft flight test centers was essential based on workload and cost. A key feature of the ISTF decision was based upon the multiple support roles these ISTFs perform. Both the ACETEF at NAWC-AD Patuxent River and the ATIC at Edwards AFB were designed and developed to perform multiple support roles. The ACETEF/ATIC support Electronic Combat testing, Systems Integration Testing, Weapons Systems Performance Testing, and Flying Qualities and Performance Testing. Consolidation of ACETEF or ATIC EC capabilities to another site would require duplication of current resources used to support other functional areas. Currently, no further consolidations of ISTFs are warranted or planned.

Open Air Ranges (OARs)

The BoD studies identified in Section III (BoD directed study on EC Open Air Ranges of 1993/94), identified excess EC OAR capacity. Future workload identified during the study requires two EC OARs for accomplishment. Based upon the results of the BoD study and BRAC recommendations, the EMTE at Eglin AFB, FL will be relocated to the NRC. The electronic combat test capability on the NRC and the Electronic Combat Range (ECR) at China Lake, CA will continue as primary open air EC test ranges.

Future Consolidation Criteria

Criteria for future consolidation have been under development since the first series of Reliance and Capstone studies. Along with criteria for future consolidation studies, a reduction in workload or a budget threshold is a potential trigger for further study of downsizing or consolidation opportunities. The studies should consider that the current criteria used for downsizing of the T&E EC infrastructure have two thrust areas.

The first thrust area is an overarching strategy that is based on the premise that sufficient T&E infrastructure must be retained to preclude the following:

- *Major Impact on Other Mission Areas*
  Impact on other mission areas due to loss of capability (e.g., S&T, Development, In-Service Engineering, Training, Other T&E Areas, etc.)
  Measure: Percent of workload supporting non-T&E

- *Loss of Quick Response Capability*
  Determine whether sufficient capability/capacity exists to respond to wartime contingencies without serious disruption of acquisition programs
  Measure: Cost per day slip of a major acquisition program relative to cost of retaining capacity

- *Loss of Surge Capability*
  Determine if elimination of this facility or capability reduces overall capacity below levels of previously demonstrated surge capability requirement.
  Measure: Peak workload less current workload<Unused capacity

- *Single-Node Failure*
  The potential to lose a type or class of test capability as a result of a natural disaster (e.g. hurricane, earthquake, etc.).
  Measure: Frequency or proximity of occurrences for key facility locations

The second thrust area includes quantitative measures that are typically associated with facility capacity and utilization studies. Workload is the primary area of consideration in this arena, but other metrics will also be considered. The preliminary metrics include:

- *Workload*
  A metric which numerically describes the use of the facility.
  Measure: Percent utilization, Number of operations/time, Number of test events/time, etc.

- *Geographical Constraints / Natural Attributes*
  Critical Land/Sea/Air Space attributes necessary for operation.
  Measure: Square miles of airspace, Depth of water, Altitude of test asset, Temperature, etc.

- *Costs to Move and/or Realign*
  Total costs to the taxpayer involved in a closure/realignment action.
  Measure: Total costs.

- *Service Uniqueness / Technical Uniqueness*
  Not used by any other Service or capability does not exist elsewhere.
  Measure: N/A

- *Multi-Mission Use*
  Used to support multiple missions (e.g. S&T, Training, T&E, Logistics, etc.)
  Measure: Identify the number of missions supported and percentages of workload associated with each mission.

The combination of overarching strategies and specific quantitative metrics are tailored for each study to be performed. Weighting factors may also be applied to the metric set to ensure that more important factors are properly considered.

VII SUMMARY

This Consolidation Master Plan describes the strategy by which DoD EC T&E resources have been, and continue to be, right-sized to meet Service requirements without unwarranted duplication. It addresses past, present, and future consolidation actions associated with 17 separate sites involved in EC T&E and plans which will result in a reduction to five primary test sites (Patuxent River, Edwards AFB, Point Mugu, China Lake, and Aberdeen) and three specialty sites (Holloman AFB, the NRC, and Ft. Huachuca). Reductions have been accomplished via a series of intra- and inter-Service efforts, and continue through active control of future investments by the T&E BoD, as well as downsizing in place to continue to match resources to workload.

Capabilities to be retained are matched to current and future test requirements in terms of the five categories of resources needed to support EC T&E. Major consolidations have been planned in the resource categories of digital models and simulations, hardware-in-the-loop test capabilities, and open air ranges, as follows:

> Digital models and computer simulations are inherent within most test resources and significant improvement in EC T&E is anticipated via the implementation of a single system level Joint Modeling and Simulation System (J-MASS) architecture. Future J-MASS compliant electronic combat models will be interoperable, will minimize the need for duplicative model development, and will promote data standardization. J-MASS compliance with the DoD Common Technical Framework for modeling and simulation will allow the use of these models to support of a wider range of DoD analytical requirements.
>
> EC HITL facilities represent a combination of unique roles as well as some excess capacity. O&M and I&M savings are anticipated by collocating two of the facilities to an ISTF. Additionally, collocation of HITL capabilities with installed systems test facilities allows a reduction in the overall number of EC T&E sites and a corresponding decrease in excess capacity within both resource categories.
>
> Finally, the capacity of EC open air ranges exceeds requirements by approximately 30%. Thus, a consolidation from three to two is planned, which will provide a monetary savings, development of better T&E capabilities via concentration of available threat simulators (producing greater signal and pulse density with reduced duplication), and better focus for limited investment dollars..

The Tri-Service EC T&E infrastructure is currently right-sized to meet today's workload and warfighters' requirements, and criteria are in place to trigger the study and evaluation of further downsizing or consolidation opportunities. Furthermore, through the T&E Executive Agent structure, appropriate controls are in place ensure that the necessary facilities are improved and modernized, without unwarranted duplication, to meet the technological demands of current and future EC systems, and to ensure that the EC T&E infrastructure remains right-sized in the future.

APPENDIX A

T&E EXECUTIVE AGENT STRUCTURE

APPENDIX A
EXECUTIVE AGENT STRUCTURE

On 1 October 1993, the USD(A) approved the Services' proposed structure for the T&E Executive Agent. The structure retains OSD in its role of policy formulation and oversight, with the Defense Test and Training Steering Group (DTTSG) providing interface to the T&E Executive Agent. The T&E Executive Agent and its relationships with T&E organizational elements is depicted in Figure B-1.

The Under Secretary of Defense (Acquisition & Technology) (USD(A&T)). The USD (A&T) provides overall Department of Defense (DoD) policy guidance and oversight of the T&E Executive Agent. As outlined in the following paragraphs, the USD(A&T) is the approval authority of the DoD Test Investment Strategy (TIS), and all OSD and Service-funded T&E investment projects. As requested by the USD(A&T), the Chairman of the BoD provides status and progress reports on the activities in support of the Executive Agent.

The Director for Test, System Engineering and Evaluation (DTSE&E), Office of the Under Secretary of Defense (Acquisition & Technology)(OUSD(A&T). As appropriately delegated by the USD(A&T), the DTSE&E approves T&E documents or projects as appropriate. With assistance from the Defense Test and Training Steering Group (DTTSG) and the Test and Evaluation Resources Committee (TERC), the DTSE&E manages the Central Test and Evaluation Investment Program (CTEIP) and conducts the annual Office of the Secretary of Defense (OSD) Test Capability, Budget and Investment Review of the Major Range and Test Facility Base (MRTFB). The DTSE&E serves as the Chairman of the DTTSG. The Deputy DTSE&E for Test Facilities and Resources (TFR) serves as the Executive Secretary for the DTTSG. The DTTSG advises the USD(A&T) relative to any recommendations and actions concerning T&E infrastructure management and T&E investment planning and execution.

The Defense Test and Training Steering Group (DTTSG). The DTTSG is a DoD-level advisory group consisting of the Services' T&E Principals and representatives from the DoD Agencies, the Office of the Director of Operational Test and Evaluation (DOT&E), the Acquisition community, the Training community and the Science and Technology community. The DTTSG advises the DTSE&E and the USD(A&T) relative to any recommendations and actions concerning the DoD T&E infrastructure management and the DoD T&E investment planning and execution. The Deputy DTSE&E for Test Facilities and Resources (TFR) serves as the Executive Secretary for the DTTSG.

The Test and Evaluation Resources Committee (TERC). The Deputy DTSE&E/TFR serves as the Chairman of the Test and Evaluation Resource Committee (TERC). Members of the TERC include representatives from the Services' T&E headquarters and DoD Agencies (DNA, BMDO, and DISA). The TERC advises the DTTSG regarding CTEIP submissions.

The Board of Directors (BoD). The BoD consists of the Service Vice Chiefs of Staff, with the Assistant Commandant, United States Marine Corps, serving as an advisory member. When

appropriate, the BoD may include representation from the Joint Staff. In addition, the BoD may establish liaisons and coordinate plans, as deemed necessary, with the Joint Chiefs of Staff, DoD agencies, OSD, and other cognizant activities. The Chairman of the BoD is filled on a two-year rotational basis. Principal responsibilities of the BoD are to approve the Services' T&E infrastructure requirements and commit Services' T&E resources to meet these requirements; to approve and promulgate Services' T&E investment and infrastructure policy and guidance; and to provide program review and advocacy support of the Services' T&E infrastructure to OSD and Congress.

The BoD Executive Secretariat (BoD(ES)). The BoD(ES) consists of the Service T&E Principals. In support of the BoD, the BoD(ES) serves in an advisory capacity regarding T&E investment and infrastructure requirements policy and guidance; promulgates the decisions of the BoD; and as appropriate, provides analyses, reviews, and recommendations to the BoD regarding studies, projects, and resolution of issues. During each two-year residency of the BoD Chairman, the chairing Service's T&E Principal will assume the lead for execution of all BoD(ES) responsibilities.

The Board of Operating Directors (BoOD). The BoOD consists of the Service intermediate headquarters flag officer T&E managers. Currently, these officers are the Commander, U.S. Army Test and Evaluation Command; Commander, U.S. Naval Air Warfare Center; and Director of Operations, U.S. Air Force Materiel Command. The DTTSG Executive Secretary serves as an advisory member of the BoOD. The chairman of the BoOD reports directly to the Chairman, BoD, and is filled on a two-year rotational basis. The Chairman of the BoOD will be from a Service different from that of the Chairman, BoD. Principal responsibilities of the BoOD are to implement the policies, direction, and guidance of the BoD; oversee the identification of T&E infrastructure requirements; oversee the development and implementation of the BoD Test Resource Master Plan (TRMP) and DoD Test Investment Strategy (TIS); identify opportunities to reduce test investment costs; and develop T&E infrastructure streamlining and realignment options.

The Test and Evaluation Reliance and Investment Board (TERIB). The TERIB consists of senior technical experts from the Service T&E community and representatives from the Defense Agencies. The CTEIP Program Element manager serves as an advisor to the TERIB. The TERIB provides technical expertise and recommendations on T&E investments to satisfy Service and Defense Agency T&E requirements. The TERIB provides consolidated and deconflicted requirements and recommended joint solutions to the BoOD and the TERC; finalizes the BoD Test Resource Master Plan (TRMP) produced by the JPO(T&E) and develops the DoD Test Investment Strategy (TIS). The TERIB also provides technical recommendations to the BoOD and TERC on any resulting T&E investment issues. Three individuals, one from each Service are appointed by the BoOD to serve as TERIB Co-chairmen. During each two-year residency of the BoOD Chairman, the chairing Service's TERIB Co-chair will assume the lead for execution of all TERIB responsibilities

The T&E Reliance Structure. The T&E Reliance Leads, established during the T&E Reliance process and expanded under the T&E Executive Agent under TERIB guidance, develop and maintain Test Capability Master Plans (TCMPs) as annexes to the BoD TRMP for future test resource investments in each of the following areas: Airborne Instrumentation; Precision Time-Space Position Information; Supersonic Sled Tracks; Climatic Test Facilities; Land Vehicle Testing; Nuclear Effects; Chemical Weapons and Chemical and Biological Defense T&E; Air Breathing Engines; Ground and Air Targets; Gun Munitions Testing; Air-Air Weapons Testing; Air-Surface Weapons Testing; Surface-Air Weapons Testing; Electric Gun Testing; Electronic Warfare Testing; T&E Support Aircraft; Fixed Wing Aircraft; Space and Ballistic Missiles Testing; Command, Control, Communications, Computers, and Intelligence Testing; Sea Combat; and Aero-Thermodynamic Facilities. These areas were selected to ensure appropriate technical coverage across all previously existing Reliance areas as well as areas anticipated but not covered by the T&E Reliance process. As T&E Reliance continues, new areas will be identified, studies conducted and memoranda of agreement developed to bring these new areas under the purview of the T&E Reliance process. These Leads serve as the Department of Defense (DoD) points of contact for the investment area and are responsible for coordinating all Service resource requirements within the investment area. The Leads report through the TERIB directly to the BoOD for test resource matters and receive technical coordination and guidance from the TERIB.

The Range Commanders (RC). The RC represent the T&E and training ranges, and have been responsible for achieving commonality and standardization in range technical capabilities. In support of the BoOD, the RC assist the BoOD in identifying T&E range investment and sustainment requirements and providing personnel with the expertise required to address complex technical questions regarding T&E ranges. The RC ensure involvement of the T&E and training range commanders in the investment review process and coordinate and promulgate technical commonality and interoperability standards for T&E investments.

The Joint Program Office for T&E (JPO(T&E)). In support of the BoOD, the JPO(T&E) coordinates the execution of Service and multi-service T&E investment projects. Specific principal responsibilities of the JPO(T&E) include (1) facilitate deconfliction and integration of the various T&E investment products (Services' submissions, Central Test and Evaluation Investment Program (CTEIP) submissions, BoD TRMP and DoD TIS production) and developing development of requirements prioritization; (2) assisting the OSD Test Capability, Budget and Investment Review process by reviewing and deconflicting the T&E investment portions of the draft Service briefings; (3) managing the T&E Corporate Information Management (CIM) initiative; and (4) conducting special studies as directed, to include new projects requirements development, on-going project reviews, and developing opportunities for common maintenance facilities. The JPO(T&E) is composed of a senior-level civilian director, a military deputy director, and supporting staff.

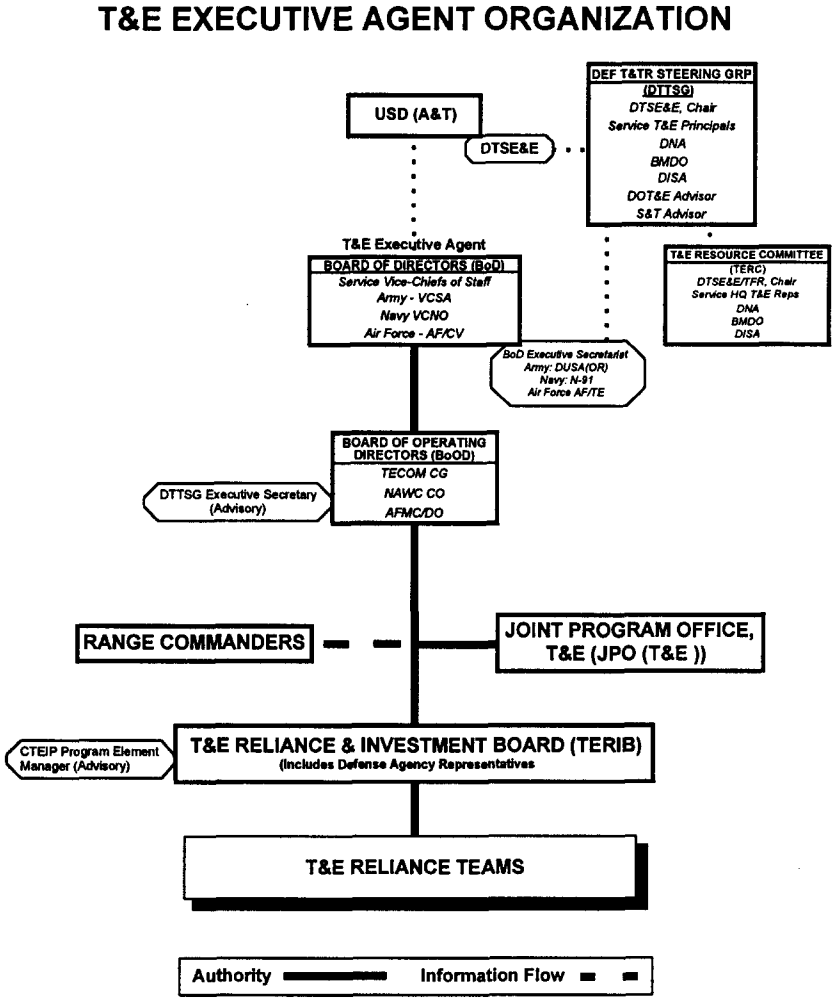

Figure A-1
T&E Organizational Elements

APPENDIX B

DEFINITION OF TEST CATEGORIES

APPENDIX B
DEFINITION OF TEST CATEGORIES

A. Digital Models and Computer Simulations

A digital system model is a computer model, or software equivalent, of a system under development. Digital models and computer simulations are embedded across all of the resource areas. These models and simulations support cost and operational effectiveness analyses (COEA), trade studies, test planning and post-analysis, and test and evaluation support. Digital models may be first created during the Concept Exploration and Definition acquisition phase and updated and used through development and test and Evaluation. Digital models are used during Research, Development and Acquisition activity to evaluate concept feasibility, to attempt to define the technical limits of system performance, to allocate requirements and functions, to plan tests, to interpolate test results, and to provide a rigorous evaluation methodology. Digital models selected for use in EC T&E must be appropriately validated and certified. Test and evaluation support includes providing drivers for stimulation equipment, missile fly-out models, propagation phenomena etc. Digital models capable of supporting a wide range of applications including acquisition (test and evaluation), analysis and training can only interoperate if they comply with the required system level architecture and the DoD Common Technical Framework for modeling and simulation. The components of the Technical Framework are the High Level Architecture, the Conceptual Models of the Mission Space and the DoD Standardization initiatives. The HLA will support not only real-time test and evaluation requirements but will provide a cohesive set of time management functions common to the wider range of simulation activities within DoD. All of the above requirements rely on models and simulations of various degrees of fidelity and various operating times including faster than real-time. All aspects of system operation and environment will be modeled to support efforts such as cost and operational effectiveness analyses.

B. Measurement Facilities

Performing full multi-spectral signature measurements in both static and dynamic conditions are required to support the development of a variety of air vehicles and enhance their survivability. Platform signature is a key parameter in EC performance equations.

Although actual signature measurement requirements are classified, some general measurement capabilities can be assumed, including: 1) Frequency response (i.e., wideband RCS as opposed to spot frequency) 2) Radar Images, 3) High Frequency (below 100 MHz), 4) Millimeter Wave (above 35 GHz), Coherent Bi-static, Near and Far Field.

C. Hardware-In-The-Loop (HITL)

HITL tests use elements of the system-under-test in combination with software to examine the performance of those elements before the entire system is available or when a specific capability cannot be tested. For EW systems, these events are conducted indoors in a secure environment to test the systems against manned, closed-loop, and open-loop threat simulators. HITL testing provides repeatable measurement and verification of EW system/subsystem (ECM, ESM, AND ECCM) effectiveness. The effectiveness of the ECM system/subsystem is measured against the threat system in the loop. The threat system can be actual threat hardware, simulators of the threat hardware, or combinations of hardware simulators and accurate computer simulation. HITL capabilities provide unique opportunities to evaluate EW systems hardware at different stages of development (breadboard, brassboard, prototype, or production). HITL also allows production systems to be tested under controlled and repeatable conditions providing an inexpensive complement to flight testing. The controlled environment readily lends itself to EW technique optimization and closed-loop operational effectiveness evaluation.

D. Installed Systems Test Facilities (ISTFs)

ISTF provide capabilities to evaluate systems-under-test and functions that are installed on and integrated with their host platform to provide critical information regarding integrated system performance, compatibility, and interoperability. The ISTFs are required to provide the high threat density environments and secure signal generation capabilities that are not feasible or affordable in an open air test environment. ISTF's also perform testing of systems, as installed, to ensure that they meet specification and mission performance requirements. More advanced ISTF's provide the capability to test in complex warfare environments and measure EW/EC systems effectiveness. These tests can occur in indoor facilities such as EW anechoic chambers in which free-space radiation measurements are made during simultaneous operation of the EW system and other host platform systems, or climatic chambers or as outdoor developmental and operational tests. The need for installed systems test facilities has become increasingly evident in the last five years. These existing facilities are being upgraded to ensure that fully installed current and modern (i.e., multi-sensor/multi-spectral) EC and avionics systems are fully integrated into their host platform and meet both operational needs and technical performance criteria.

E. Open Air Test Ranges (OARs)

OARs refers to any test conducted outdoors. It includes surface (land and sea), undersea, airborne and spaceborne testing. OARs are conducted to test all or part of the system-under-test in an environment that is normally more realistic than any attainable indoors. OAR testing may allow the system-under-test to be operated more closely to its operational conditions; OARs are the final "proving ground" in the EC development process. As the primary sites for operational testing, they must provide the highest fidelity threat simulation, real-time data processing, and off-line analysis tools possible. Threat fidelity is created by fielding modern threat systems, generating high pulse and signal densities, geographically dispersed threats, and an integrated air

defense system. A key to the OAR's ability to meet future EC test requirements will be flexibility. No longer is the threat clearly defined and limited to a known structure. The OAR must be able to adapt to new and emerging threat assessments, laydowns, and configurations in a timely and cost effective fashion. An appropriate mix of actual foreign weapon systems and modular/flexible simulators to meet the EW T&E goals is required. OARs are divided into two sub-categories: EW test ranges and airborne testbeds.

APPENDIX C

EC FACILITY & RANGE

DESCRIPTIONS

APPENDIX C
EC FACILITY & RANGE DESCRIPTIONS

INTRODUCTION:

This plan considered all facilities within the Services with significant involvement in EC Testing. Of those, several major facilities account for the preponderance of EC testing and have been extensively studied during the T&E Reliance and Base Realignment and Closure (BRAC) processes. The remaining facilities are either service unique or non-T&E facilities with ancillary EC testing capability. The EC T&E infrastructure which forms the basis for this plan is distributed among the 17 sites discussed in Section V. The facilities and ranges that form this infrastructure are described in this Appendix.

Furthermore test capabilities associated with these Service core activities are further defined according to five of the six test resource categories defined in the annual TRMPs and summarized in this Appendix by category:

- Digital Modeling and Simulation (M&S)
- Measurement Facilities (MFs)
- Hardware-in-the-loop (HITL) test capabilities
- Installed System Test Facilities (ISTF)
- Open Air Ranges (OARs) (note: This includes ground and airborne assets)

Integration Laboratories (ILs) are not addressed in this consolidation plan because they are system specific, as opposed to general purpose, test and evaluation facilities.

1.0 MODELING AND SIMULATION (M&S) FACILITY SUMMARIES

1.1 AERONAUTICAL SYSTEMS CENTER (ASC)

LOCATION: Wright Patterson AFB, Dayton, OH

ASC/XREM develops and uses models and simulations to do research and advanced development in Electronic Combat technology, and the application of technology to solve military problems. M&S is used to accomplish operational and advanced system studies for theoretical prediction and verification of electronic warfare subsystem performance. Electronic warfare digital and hybrid simulation technology is developed to support the division mission and to support external organizations on an as required basis.

The Joint Modeling and Simulation System (J-MASS) program is developing a standardized digital modeling and simulation (M&S) capability with which to develop, test, and assess the capabilities of weapon systems in a simulated operational environment and a modeling library. The simulation support environment is the heart of J-MASS and enables the user to create models, configure scenarios, execute simulations, and analyze results. The modeling library contains models and model components of weapon systems developed by the RDT&E community, intelligence community developed threat systems, and environmental effects provided by the scientific community. As it matures, J-MASS will support the integration of various models in detailed scenarios of one-on-one through many-on-many.

J-MASS is structured so models of friendly and threat systems are modular, well documented, readily transportable, and fully capable of supporting activities throughout the DoD. The J-MASS system enables a user to build simulations of aircraft, missiles, SAM sites, ships, etc., from reusable software components. The user can configure and execute a scenario using various models to meet specific requirements and they can enjoy a robust post-processing facility to analyze the results of the simulation.

When mature, J-MASS will support simulations at multiple and mixed levels of fidelity and complexity: One-on-one simulations using emulative or high fidelity threat models to support design tradeoff analyses such as electronic countermeasures design; dynamic or medium level of fidelity for use in simulating typical low density tactical combat operations; and, analytic or low fidelity for Many-on-Many support to large military operations such as exercises with large numbers of threat systems.

The J-MASS digital threat models will be the DoD and DIA-approved digital threat simulations. This approval will be the result of a plan developed by J-MASS SPO, in concert with the DIA, for validating, verifying, and accrediting threat models throughout the DoD. The first systems being modeled include the SA-8 surface-to-air missile system. The J-MASS proof of concept will be the SA-8 model. Other models being developed using the J-MASS architecture, but n not funded by the program office, include the SA-6, SA-10, generic aircraft, and generic electronic countermeasures system.

1.2 NAVAL RESEARCH LABORATORY (NRL)

LOCATION: Washington D.C.

FACILITIES/RESOURCES

NRL both develops and uses EC models and simulations for testing and evaluation of advanced and developmental Naval electronic warfare and weapons systems. These EC modeling and simulation tasks are primarily accomplished within NRL's Tactical Electronic Warfare Division.

MODEL TYPES

NRL maintains a comprehensive set of EC models and simulations for real-time, hardware-in-the-loop test and evaluation of off-board countermeasures, airborne electronic warfare systems, shipboard electronic warfare systems, electronic support measurement systems, and models designed to explore advanced electronic warfare techniques. NRL's EC modeling and simulation capability is supplemented by scale-model analysis, wind-tunnel testing, and other large scale computer simulations.

DEVELOPMENT CAPABILITIES

NRL develops EC modeling and simulation for RDT&E activities within the following areas:

Decoys (RF and IR)
Repeaters/jammers, EO/IR active countermeasures
EW/C2W system concepts

VERIFICATION AND VALIDATION CAPABILITIES

Verification and Validation of NRL's EC modeling and simulation activities are either performed internally for EC models developed by NRL or provided with EC models and simulations obtained from other activities.

DATA ANALYSIS CAPABILITIES

Each NRL division involved with EC modeling and simulation will perform data collection, reduction, and analysis using tools developed internally or using a variety of commercially available software programs.

1.3 NAVAL AIR WARFARE CENTER-AIRCRAFT DIVISION

LOCATION: NAWC-AD Patuxent River, MD

FACILITIES/RESOURCES

NAWC-AD EC modeling and simulation activities are centralized within the Air Combat Environment Test and Evaluation Facility (ACETEF) complex.

APPLICATIONS

NAWC-AD makes extensive use of EC models and simulations to support a wide range of aircraft test and evaluation tasks. These T&E tasks include EC modeling and simulation for the T&E of individual aircraft systems, integrated suites of aircraft systems, and to test the performance of aircraft systems as they are engaged in complex mission environment simulations.

MODEL TYPES

NAWC-AD maintains an extensive set of EC models and simulations for both real-time and non-real-time EC T&E support. The set of all EC models, maintained by NAWC-AD includes threat models, red/blue/gray EC system models and large scale mission environment simulations. The complete NAWC-AD EC modeling and simulation types include those configured for interfacing into both hardware and man-in-the-loop test facilities as well as purely software driven EC models and simulations.

DEVELOPMENT CAPABILITIES

NAWC-AD primarily develops blue-system models and uses other EC models and simulations. However, NAWC-AD is fully capable of developing specific EC models and simulations as required to support T&E requirements.

VERIFICATION AND VALIDATION CAPABILITIES

Although NAWC-AD is primarily a user of EC models and simulations developed elsewhere, it has initiated a formal V&V capability to assist in the accreditation of multiple simultaneous simulations.

DATA ANALYSIS CAPABILITIES

Each NAWC-AD division involved with EC modeling and simulation performs data collection, reduction, and analysis using tools developed internally or using a variety of commercially available software programs.

1.4 NAVAL AIR WARFARE CENTER - WEAPONS DIVISION (CHINA LAKE, CA)

MODEL TYPES/DEVELOPMENT CAPABILITIES

The Electronic combat range develops and maintains high fidelity red and gray threat missile and AAA flyout models operated in both real-time and post-flight for in depth mission data analysis. NAWC-WD provides EC M&S support for major weapons system programs. Systems include warning receivers; jammers; EO/IR systems and missile-warning, counter-measures, and support systems.

NAWCWPNS also provides development support for missile components (seekers, guidance and control, fuses, airframes, propulsion, and data links), Ship-Launched weapons (Rolling airframe missile, the Sea-Sparrow point defense missile, and the area defense Standard Missile), the Tomahawk missile support laboratory, and strike weaponry; new families of weaponry for air-to-surface applications with an emphasis on affordability (Joint Direct Attack Munitions, Advanced Rocket System, and Advanced Interdiction Weapon System).

VERIFICATION AND VALIDATION CAPABILITIES

V&V operations at China Lake are conducted through coordination with the Weapons Systems Evaluation Directorate at Pt. Mugu, CA.

DATA ANALYSIS CAPABILITIES

Weapon System Instrumentation and Data Analysis facilities support weapons testing instrumentation requirements related to tactical missiles, aircraft, and other NAWCWPNS product areas. The data analysis laboratories provide near real-time data extraction and evaluation for timely assessment of aircraft/weapon integration and missile system performance.

1.5 NAVAL AIR WARFARE CENTER - WEAPONS DIVISION

LOCATIONS: Pt. Mugu, CA

FACILITIES/RESOURCES

NAWC-WD, Pt. Mugu, in close collaboration with China Lake, performs EC modeling and simulation for Naval weapon systems with an emphasis on its sea range facility.

VERIFICATION AND VALIDATION CAPABILITIES

Weapon System Instrumentation and Data Analysis facilities support weapons testing instrumentation requirements related to tactical missiles, aircraft, and other NAWC-WD product areas. The data analysis laboratories provide near real-time data extraction and evaluation for timely assessment of aircraft/weapon integration and missile system performance.

1.6 NAVAL SURFACE WARFARE CENTER (NSWC)

LOCATION: Dahlgren, VA

FACILITIES/RESOURCES

NSWC performs a broad range of EC modeling and simulation activities oriented toward the Navy's surface warfare mission. These EC M&S applications involve space, air, over-land, and underwater systems. The multi-warfare nature of NSWC RDT&E activities involve an extensive array of EC modeling and simulations applicable to the ATBM, AAW, ASuW, ASW, Strike, and amphibious warfare operations. NSWC is the Navy's leading facility for the development of surface warfare models and analysis including an extensive capability in surface ship EC modeling and simulation.

2.0 MEASUREMENTS (RCS) FACILITY SUMMARIES

2.1 RADAR REFLECTIVITY LABORATORY

LOCATION: NAWC-WD, Pt. Mugu, CA

TYPE FACILITY: Indoor, static

PERTINENT TESTING: Far-field RCS, bi-static RCS measurements of full size missiles, aircraft, ship models, and components.

FACILITY DESCRIPTION:

Range length:	37 feet, far-field
Frequency coverage:	0.5-18, 26-40, 35 GHz, 1-40, 54, 94 GHz (1993)
Polarization coverage:	HH, VV
Dynamic range:	70 dB
Range resolution:	< 10 centimeters
Target supports:	Foam columns, 500-pound pylon
Target classification:	Up to TOP SECRET
Target limitations:	Up to 3000 pounds, 30 feet long, 30 feet wide

2.2 CHESAPEAKE TEST RANGE (CTR)

LOCATION: NAWC-AD, Patuxent River, MD

TYPE FACILITY: Outdoor, dynamic

PERTINENT TESTING: Dynamic in-flight RCS, J/S, chaff measurements of full size aircraft.

FACILITY DESCRIPTION: The CTR is a dynamic in-flight test facility that controls 2400 square miles of restricted airspace and provides RCS measurements in conjunction with an EW facility.

Range length:	Variable: 3-20 nautical miles
Frequency coverage:	3-35 GHz
Polarization coverage:	HH, VV
Dynamic range:	+80 dB
Range resolution:	1 foot (IOC 92)
Target classification:	Up to TOP SECRET
Target supports:	Dynamic In-flight Air Vehicles

2.3 JUNCTION RANCH - LOOK-DOWN RANGE

LOCATION: NAWC-WD, China Lake, CA

TYPE FACILITY: Outdoor, static, look-down

PERTINENT TESTING: Wide band monostatic, full scatter matrix testing of ship models and other targets in a simulated ocean environment.

FACILITY DESCRIPTION: The JR Look-Down Range has a 10-degree look-down angle from antennas on a mountain peak to a 78-foot by 110-foot water site. The look-down angle to the 80-foot by 140- foot tilt deck can be varied from 5 to 32 degrees.

Range length:	17,000 feet
Frequency coverage:	S, X, Ku, and Ka bands
Polarization coverage:	HH, VV, VH, VV
Real-time display:	Multiple RCS line or pixel plots and ISAR images
Measurement types:	Wide band monostatic, full scatter matrix
Dynamic range:	> 60 dB single pulse
Range resolution:	1 - 3 inches (varies with band and depends on available bandwidth)
Target supports:	30-foot, 10,000-pound turntable on a tilt-deck or in the water site
Target pit locations:	17,000 feet
Classification:	Up to and including TOP SECRET - SAR
Target storage:	Two storage/work barns with data safes and STU-3 phones

2.4 JUNCTION RANCH - HORIZONTAL RANGE

LOCATION: NAWC-WD, China Lake, CA

TYPE FACILITY: Outdoor, static, ground-bounce

PERTINENT TESTING: RCS measurements of full size missiles; aircraft models; missile and aircraft components; tanks; and trucks.

FACILITY DESCRIPTION: Junction Ranch is in a remote valley at China Lake, which limits visual access and provides a low RFI environment due to surrounding mountains.

Range length:	4000 feet
Frequency coverage:	0.15 - 18 GHz, 35 GHz
Polarization coverage:	HH, VV, VH, HV
Real-Time display:	Multiple RCS line or pixel plots and ISAR images
Dynamic range:	> 60 dB single pulse
Range resolution:	1.5 inches to 5 feet (varies with band and depends on available bandwidth)
Target supports:	40-foot Ogive pylon; 7000 pounds; foam columns; and 30-foot turntable up to 100,000 pounds.
Target pit locations:	700, 2000, and 4000 feet
Target classification:	Up to TOP SECRET - SAR
Target storage:	Three storage/work barns with data safes and STU-3 phones

2.5 RATSCAT ADVANCED MEASUREMENT SYSTEM (RAMS)

LOCATION: Holloman AFB, NM

TYPE FACILITY: Outdoor, static, ground-bounce

PERTINENT TESTING: RCS measurements of sub-scale through full- scale models of missiles, aircraft, and components.

FACILITY DESCRIPTION: Longest outdoor ground-plane static range featuring a shadow designed target area with a 95-foot retractable pylon. Target capacity up to 30,000 pounds.

Range length:	8900 feet
Frequency coverage:	0.12 - 18 GHz, 35 GHz
Polarization coverage:	HH, VV, HV, VH
Dynamic range:	64 dB
Range resolution:	3-12 inches
Target supports:	Retractable pylon up to 56 feet above ground plane, 30,000 pounds
Target classification:	Up to TOP SECRET - SAR
Target storage:	Storage and prep in silo area; storage and prep in paint facility; storage in K-SPANS (2)

2.6 RANGE 8

LOCATION: Aberdeen Test Center, Aberdeen Proving Ground, MD

TYPE FACILITY: Outdoor, static

PERTINENT TESTING: Multi-spectral measurements of full size ground vehicles and surrogates.

FACILITY DESCRIPTION: Facility includes a 125-foot tower and two turntables, one fixed and one portable with 70-ton capacities. Calibrated visible, near IR, mid IR, far IR, and acoustic measurements are also available. Depression angles available from 0 to 65 degrees.

Range length:	150 feet
Frequency coverage:	34 and 94 GHz ISAR, 35, 60, 95, 140, 220 GHz non-coherent, 8-18 GHz ISAR
Polarization coverage:	HH, VV, HV, VH, circular (R, L)
Dynamic range:	69 dB instantaneous, 80 dB ISAR imaging
Range resolution:	3 inches
Target limitations:	70 tons
Target classification:	Up to SECRET - SAR
Target storage:	Up to SECRET - SAR

2.7 RADAR TARGET SCATTER (RATSCAT) - NORTH AND WEST RANGES

LOCATION: Holloman AFB, NM

TYPE FACILITY: Outdoor, static, ground-bounce

PERTINENT TESTING: RCS, antenna pattern, and bi-static measurement of scale and full-size missiles, aircraft, models, components, tanks, and trucks.

FACILITY DESCRIPTION: Multiple ground-bounce ranges available (up to 7500 feet) with pylon, foam column and turntable pit locations. Bi-static and glint testing and an on-site model fabrication shop. Facility located inside White Sands National Monument.

Range length:	Variable up to 7500 feet
Frequency coverage:	0.12 - 18 GHz, 35 GHz
Polarization coverage:	HH, VV, HV, VH, circular
Dynamic range:	70 dB
Range resolution:	3-12 inches
Target supports:	26-foot and 75-foot fixed pylons; foam columns; five turntables (maximum 100,000 pounds)
Target classification:	Up to SECRET - SAR
Target storage:	Four target prep areas

2.8 RADAR IMAGE MODELING SYSTEM (RIMS)

LOCATION: NSWC Carderock Laboratory, MD

TYPE FACILITY: Indoor, static; outdoor, dynamic

PERTINENT TESTING: Indoor and outdoor RCS measurements of ship models and full-scale ships.

FACILITY DESCRIPTION: Facility performs RCS measurements on models in an indoor 200-foot by 300-foot pool of water with wave (up to sea state 5) and wind (up to 25 knots) capability. Look-down capability up to 30 degrees. The radar also serves outdoors as an interim east coast full-scale ship measurement system.

Range length:	300 feet indoors; 20 miles outdoors
Frequency coverage:	X, Ku
Polarization coverage:	HH, VV, HV, VH
Dynamic range:	105 dB
Range resolution:	0.03M
Target limitations:	Up to 12,000 pounds and 50 feet for models
Target classification:	Up to TOP SECRET - SAR
Target storage:	Up to TOP SECRET - SAR

3.0 HARDWARE-IN-THE-LOOP (HITL) FACILITY SUMMARIES

3.1 AIR FORCE ELECTRONIC WARFARE EVALUATION SIMULATOR (AFEWES)

LOCATION: Air Force Plant 4, Fort Worth, Texas.

MISSIONS:

The role of the AFEWES is to provide technical evaluation of the performance of EC systems and techniques in a simulated IR and RF threat environment.

PERTINENT TESTING

The AFEWES is used by all services and some foreign services in every phase of the EC system life cycle from concept definition through operational changes.

FACILITY DESCRIPTION

The AFEWES is a comprehensive, anti-aircraft, terminal threat HITL laboratory facility capable of simulating multiple threats in an open and closed loop, real-time, dynamic environment. The facility simulates RF and IR signatures of the threat in a secure enclosure. The key features of AFEWES are actual RF, real-time, and man-in-the-loop testing with the capability to evaluate effectiveness in a dense background environment. A complete IR HITL is also available using actual seekers and a background generator. The table below summarizes the current closed loop threat simulations.

SA-2	SPIN SCAN	RED EYE	GUN DISH
SA-3	SKIP SPIN	AIM-9L	FLAP WHEEL
SA-4	TWIN SCAN	AMI-9M	LONG TRACK
SA-6 (notes 1,2)	BIG NOSE	STINGER BASIC	COMM/DL
SA-6M	JAY BIRD	SA-7A/B	WILD CARD
SA-8	FOX FIRE	SA-13	TACAN
SA-10	FLANKER (note 3)	SA-14	IFF
SA-11 (notes 1,2)	FULCRUM (note 3)	SA-16	C3
SA-12 (notes 1,2)	FOXHOUND (note 3)		
	GENERIC PD		

Notes:
1. Reconfigurable SAM (R-SAM) Acq & TTR radars (1997)
2. Missile seeker & flyout model
3. Reconfigurable Airborne Interceptor (RAI) (1995)
   Radars/missiles (RF/IR)/cockpit

AFEWES Closed Loop Threat Simulations

3.2 ELECTRONIC COMBAT SIMULATION AND EVALUATION LABORATORY (ECSEL)

LOCATION: NAWCWPNS, Point Mugu, California.

MISSIONS

The primary mission of the NAWCWPNS is to perform development, test and evaluation, development support, production support, follow-on engineering, logistics, and training support for weapon systems, electronic warfare systems, target systems, and related support equipment.

NAWC-WD is responsible for EW systems development for the EA-6B. The EA-6B weapon system support laboratory (WSSL) is the major facility for developing, managing, and maintaining software for the EA-6B AN/ALQ-99 Tactical Jamming System. The EA-6B WSSL requires continuous use of the ECSEL HITL closed-loop threat simulations.

The role of ECSEL is to evaluate and optimize ECM techniques against specific threats, evaluate the operational and technical characteristics of new EW systems, reprogram and update threat parameters of reprogrammable EW systems, and determine the effects of changes in the electromagnetic environment on EW systems and techniques.

PERTINENT TESTING

The ECSEL is used by all U.S. services and by Allied services in every phase of the EC life cycle from concept definition through operational changes.

FACILITY DESCRIPTION

The ECSEL is a comprehensive Naval anti-aircraft terminal threat HITL laboratory facility capable of simulating multiple threats in a closed loop, real-time, dynamic environment. The facility simulates RF and IR signatures of the Naval threat in a secure enclosure. The key features of ECSEL are actual RF, real-time, and man-in-the-loop testing with the capability to evaluate effectiveness in a dense background environment.

The ECSEL will also house the Integrated Naval Air Defense Simulation (INADS). The INADS will combine with the existing HITL simulations to form a complete threat capital warship. The ship simulation will interact as a task force on a command, control, and communications (C^3) basis to represent modern naval air defense tactics. The INADS is the Navy part of the OSD Advanced Threat Simulator (ATS) Program. The table below summarizes the current closed loop threat simulations.

SA-N-1*	TOP PAIR	DRUM TILT
SA-N-3*	TOP STEER**	IHAWK
SA-N-4	TOP PLATE**	GUN DISH*
SA-N-6	TOP SAIL**	FLAP WHEEL*
Notes: * Available in the Radar Equipment Simulator (RES) ** TOP PAIR is reconfigurable to the other "TOPs"		

ECSEL Closed Loop Threat Simulations

3.3 REAL-TIME ELECTROMAGNETIC DIGITALLY CONTROLLED ANALYZER-PROCESSOR (REDCAP)

LOCATION: CALSPAN Corp., Buffalo, NY

MISSIONS

The role of the REDCAP is to evaluate strategic and tactical Electronic Warfare (EW) and Electronic Combat (EC) hardware, techniques, tactics and concepts to defeat or degrade a threat Integrated Air Defense System's (IADS) ability to detect, track, and engage penetrating forces.

PERTINENT TESTING

The REDCAP is used by all services and some foreign services in every phase of the EC system life cycle from concept definition through operational changes. The REDCAP history of EC testing is outlined below:

1990	1991	1992
JCCWC	NRL	DOE
NRL	C^3 MODEL DEVELOPMENT	ALQ-99
USAF RF STUDY	EMTE/AFEWES/REDCAP LINK	B-2
ACETEF/REDCAP LINK	EF-111A	ESD
ESD	B-2	NAWCWPNS

FACILITY DESCRIPTION

The REDCAP is a comprehensive IADS that tests the effectiveness of EW/EC to counter the multiple radars and command, control, and communications (C^3) nets that cannot be extrapolated from the results of single radar simulations. REDCAP provides RF HITL radars and data links, manned data fusion and weapons control posts, and manned interceptor stations in a multi-security-level building.

The RF HITL simulations at REDCAP are Early Warning, Ground Controlled Intercept, Height Finder, and Airborne Early Warning radars, plus voice and data communication links. REDCAP has the only HITL simulation of the SUAWACS. Terminal threats are digitally simulated (not HITL).

REDCAP is the only RF HITL, man-in-the-loop, simulation of a complete threat IADS with many-on-many battle management capabilities. REDCAP has a 2000 $ft.^2$ RF shielded TEMPEST special compartmented information facility (SCIF). The table below identifies the REDCAP HITL simulations.

Vozduk 1 C3 Backtrap Flat Face	Side Net Squat Eye Thin Skin	Bar Lock Flat Jack Spoon Rest	Tall King Mainstay

REDCAP HITL Simulations

3.4 STRESS LOADING FACILITY (SLF)

ACTIVITY: US. Army Electronic Proving Ground

LOCATION: Fort Huachuca, Arizona

MISSION

The U.S. Army Electronic Proving Ground is the Army's primary facility for the conduct of communications-electronics (C-E), electronic warfare (EW), non-communications electronics, and communications, command, control, computer, and intelligence systems. Other activities include the test of unmanned air vehicles (UAVs), imaging systems, and optic systems.

PERTINENT TESTING

The Electronic Proving Ground (EPG) is a directorate of the Army's White Sands Missile Range. Testing of Army Intelligence Sensor Systems, Army Tactical Jamming Systems, Army Avionics Systems, and Army Aircraft Survivability Systems are conducted at the EPG. Testing also includes the determination of vulnerability for tactical communications systems, the measurement of system mounted antenna patterns, the conduct of EMI/EMC/TEMPEST tests and the development and use of models and simulations.

FACILITY DESCRIPTION

The STRESS LOADING FACILITY (SLF) is a real-time laboratory simulator capable of generating a complex dynamic electromagnetic (EM) environment. The normal configuration of the SLF is for closed-link testing of communications-electronics (C-E) systems; however, the facility can be used for radiated testing at low power levels. The SLF consists of a central computer and test control and monitoring stations plus the following three major subsystems: the Non-communications Threat Simulator (NCTS), the Communications Threat Simulator (CTS), and the Functional System Simulator (FSS).

The NCTS is based on the Naval Research Laboratory Advanced Tactical Electronics Warfare Environmental Simulator (ATEWES). The NCTS can simulate up to 1,023 dynamic pulsed emitters on a time-multiplexed basis.

The CTS is capable of generating a wide variety of waveforms from voice, digital, and jamming to commercial television (TV) in the 0.5 to 500 MHz frequency band. The CTS consists of 32 signal sources which can be time-shared to represent a multiple emitter environment.

The FSS is a software and hardware subsystem which simulates ancillary hardware and software processing for the system under test (SUT). Typical functions of the FSS include (1) simulating support/control systems associated with the SUT; (2) simulating C3I systems which interface with the SUT that are unavailable for test; (3) simulating additional units of the SUT that are

unavailable for test; (4) monitoring SUT performance; (5) generating scenarios (6) running pre-designated scenarios; (7) monitoring audio commentary by onboard SUT operators; (8) interacting with any onboard tactical communications which relate to test.

4.0 INSTALLED SYSTEMS TEST FACILITIES (ISTF)

4.1 AIR COMBAT ENVIRONMENT TEST AND EVALUATION FACILITY (ACETEF)

ACTIVITY: Naval Air Warfare Center, Aircraft Division

LOCATION: Patuxent River, MD

MISSION:

Provide an installed systems test facility to conduct test and evaluation of complex, highly integrated, adaptive aircraft systems in a multi-spectral, realistic simulated combat environment. Provide a real-time secure test capability for red and blue closed loop, man-in-the-loop testing of the total weapon system including threat realistic radar signals, electro-optical signals, laser signals, communications and data-link signals, jamming and electronic countermeasures to stimulate the primary vehicle, attached weapon systems and aircrew.

PERTINENT TESTING

Articles tested at the ACETEF include Army, Navy, Air Force, Coast Guard and foreign aircraft; aircraft systems and subsystems; satellites and air defense systems. Tests are isolated in the anechoic chamber; with test assets linked to other operational units such as ships in the Chesapeake Bay and aircraft in flight; linked with other major test facilities; and in the facilities large shielded hangar. The types of testing and support performed to date include:

Installed avionics systems/subsystems testing
Flying Qualities & Performance (FQ&P) support
Countermeasures Effectiveness testing
Electronic warfare (EW) systems testing
Electromagnetic interference (EMI), compatibility (EMC) and vulnerability (EMV) testing
Electromagnetic Pulse (EMP) testing - vertical & horizontal polarization
TEMPEST testing
Lightning, Precipitation Static testing
Controls and displays evaluation
Software validation and verification
Systems integration testing

FACILITY DESCRIPTION

ACETEF is a fully integrated ground test facility which supports test and evaluation of highly integrated aircraft and aircraft systems in a secure and controlled engineering environment. The facility uses state-of-the-art simulation and stimulation techniques to provide test scenarios which reproduce conditions approaching actual combat. In ACETEF, a fully integrated weapons

system, incorporating vehicle, avionics, weapons, crew, other platforms, and critical elements of the operational command/control hierarchy can be immersed in a simulated environment that deceives both the aircraft and flight crew into believing that they are in actual combat. Aircraft systems are deceived through a combination of simulation by digital computers and stimulation by computer controlled environment generators that provide radio frequency, electro-optical (future) and laser (future) stimuli which duplicate, as closely as possible, real signals. The flight crew is provided very high fidelity visual, aural and tactical workload conditions (threats, mission objectives and constraints, communications channels, etc.).

4.2 AVIONICS TEST INTEGRATION COMPLEX (ATIC)

ACTIVITY: Air Force Flight Test Center

LOCATION: Edwards AFB, CA

MISSION:

The ATIC supports installed systems testing for avionics test programs requiring a large, shielded chamber with radio frequency (RF) absorption capability that simulates free space.

PERTINENT TESTING

The types of testing performed to date include:

Installed avionics systems/subsystems testing
Antenna radiation coverage measurements
Electromagnetic interference/compatibility (EMI/C)
Systems sensitivity measurements
Controls and Displays evaluation
Electronic warfare (EW) systems testing
Free-space threat signal generation identification
Repeater jamming
System response time
EW avionics software development testing
Angle of arrival measurement

The largest platform to use the ATIC has been the B-52 aircraft. The ATIC can also support testing of other types of systems such as spacecraft, satellites, tanks, air defense systems, and armored vehicles.

FACILITY DESCRIPTION

A large or single/multiple tactical-sized vehicles can be operated in a controlled electromagnetic (EM) environment with emitters on and sensors stimulated while RF signals are recorded and analyzed. The ATIC instrumentation generates RF signals with a wide variety of characteristics for surface-based, sea-based, and airborne threat systems, inclusive of most red/blue/gray systems known to date.

The anechoic chamber is located within a parent building, located at the west end of the Edwards Air Force Base flight line, with tow-way access from the aircraft parking ramp. The anechoic chamber is the largest in the free world with an interior volume of 4.62 million cubic feet. The shielded chamber measures 264 feet long, 250 feet wide and 70 feet high. The ATIC contains labs, test control rooms, computer control rooms, and administrative offices.

Three threat sites within the ATIC generate threat signals, one with a Combat Electromagnetic Environment Simulator (CEESIM). Threat generation frequencies range from 0.5 to 18 GHz. The CEESIM can simulate single/multiple emitter threat environments, antenna sidelobe patterns, background signal environments, telemetry signals, and tailored scenarios.

Data collection and analysis capabilities include frequency spectrum analyzers with a frequency range of 0.5 to 40 GHz, an avionics integrated test data system, a telemetry processor, SUN workstations and ethernet.

5. OPEN AIR RANGE (OAR) FACILITY SUMMARIES

5.1 ELECTRONIC PROVING GROUND (EPG)

LOCATION: Fort Huachuca, Arizona

MISSION:

EPG is the Army's primary facility for the conduct of communications-electronics (C-E); electronic warfare (EW); non-communications electronics; and command, control, computer, and intelligence systems. Other activities include the test of unmanned air vehicles (UAVs), imaging systems, and optic systems.

PERTINENT TESTING:

EPG is a directorate of the Army's White Sands Missile Range. Since its establishment in 1954, EPG has been involved in a myriad of electronics-related testing including the test of Army intelligence sensor systems, Army tactical jamming systems Army avionics systems, and Army aircraft survivability systems. Testing also included the determination of vulnerability for tactical communications systems.

FACILITY DESCRIPTION:

EPG's available real estate includes 70,000 acres on Fort Huachuca; 23,000 acres at Wilcox Dry lake; and 5.5 million acres of public land near Gila Bend. Controlled airspace is 1170 square miles in area. In addition to Libby Army Airfield, EPG has a runway dedicated to UAVs. EPG is unique because of its naturally quiet electromagnetic environment, its access to various types of terrain, and its year-round testing climate.

Field testing uses the EPG Instrumented Test Range to include instrumentation radars, surveillance radars, range communications, range instrumentation, and a large number of signal simulators.

5.2 ELECTROMAGNETIC TEST ENVIRONMENT (EMTE)

LOCATION: AFDTC Eglin AFB, FL

MISSION:

The primary mission of the EMTE is development, testing, and evaluation (DT&E) of electronic combat (EC) systems in an EC environment. In addition to the primary mission of DT&E, specialized testing conducted at the EMTE, in conjunction with other AFDTC resources, includes operational testing and evaluation (OT&E), characterization and effectiveness testing, foreign material exploitation, signature measurement, air-to-air and air-to-ground munitions in an EC environment testing, special activities support, and training and tactics development. The 46th TEST WING is manager of the major range test facility base (MRTFB) resources which includes the EMTE is responsible for conducting tests using the facilities resources and analyzing and reporting the results.

FACILITY DESCRIPTION:

The EC open-air test range at AFDTC is the Electromagnetic Test Environment (EMTE). The range includes 724 square miles of land area, and 86,500 square miles of water test area. This large land/sea test arena provides a realistic and flexible test environment, while minimizing reflections and clutter due to large obstructions.

The EMTE consists of 65 highly instrumented ground threats and high fidelity validated simulators at 23 test sites, and multiple airborne simulated threat seekers and jammers. These are used to realistically simulate various threat air defense systems, including blue/gray threats, real-time closed-loop digital missile and bullet flyout simulations, airborne threat pods and instrumentation systems.

Support systems include precision RF and photo-optic time-space-position-information (TSPI) tracking systems, RF monitoring stations, telemetry, multi-spectral measurement and analysis, and radar cross section measurement.

Airborne systems include instrumented aircraft, captive-carry threat seekers and jammers, and simulators for real-time measurement and analysis of ECM and tactics in a dynamic airborne environment. Airborne data includes on-board recordings, telemetry data and aircraft position information. Other airborne instrumentation is available to measure and record IR spatial, radiometric and missile performance data from airborne targets including supersonic targets, airborne spectral imaging equipment, and a multipurpose airborne platform for DT&E/OT&E of airborne seekers and sensors including RF, MMW, laser, and EO.

Extensive specialized instrumentation for data collection and analysis are available, including support for simultaneous multiple test missions and real-time merging of multiple data streams. Testing support includes DT&E/OT&E of electronic-countermeasures (ECM), electronic-

counter-countermeasures (ECCM), electronic support measures (ESM), aircrew training, RF signal measurement and analysis, and foreign material exploitation (FME).

5.3 AIR FORCE FLIGHT TEST CENTER (AFFTC)

LOCATION: Edwards AFB, CA, Hill AFB, UT, and the Nellis Range Complex, NV

MISSION:

AFFTC integrated avionics test and test support related to electronic combat (EC) includes developmental test and evaluation (DT&E), initial operational test and evaluation (IOT&E), operational test and evaluation (OT&E), follow-on operational test and evaluation (FOT&E), and Engineering and Manufacturing Development (EMD) of manned/unmanned aerospace vehicles, research aircraft and aerospace subsystems. Specific avionics related EC tests and test support includes: installed avionics integration (both hardware and software), Electronic Attack (EA) systems/functions, Electronic Protect (EP) systems/functions, radar/ECCM interoperability, electromagnetic interference/compatibility (EMI/C), radio frequency (RF) compatibility, RF signature measurement, environmental monitoring, signal parameter verification, Electronic Support (ES) system/function performance, integration of electronic countermeasure dispensing systems, infrared countermeasures and jamming systems, active/passive EM deception capabilities, aircraft operational flight program (OFP) software verification/validation, and functional check systems.

PERTINENT TESTING:

The AFFTC currently conducts approximately 40 percent of Air Force Materiel Command's DT&E test activity. Avionics and EC test support significantly increases with the relocation of the 4950th Test Wing to Edwards AFB (which includes a fleet of 25 test and support aircraft) and will increase as AF EW T&E capabilities are consolidated there. The AFFTC has the capability to conduct integrated avionics DT&E, IOT&E, OT&E, FOT&E. Modeling and Simulation (M&S), indoor range/ground, and open air test facilities at AFFTC can support integrated avionics systems and associated EC testing for virtually every current generation and planned next generation aircraft.

FACILITY DESCRIPTION, GENERAL:

Primary facilities and assets which support integrated avionics and EW testing at AFFTC include large dedicated military airspace (R-2508 Complex airspace which exceeds 20,000 square miles) permitting subsonic/supersonic/supercruise flights over extended straight line distances; remote, desert land holdings; instrumented multipurpose and special purpose ranges, and support an Electronic Warfare Directorate capable of providing full and seamless T&E support; the Electronic Combat Test and Integration Division which operates co-located integrated avionics/simulation/EC ground test facilities; EA Pod Facility/ECM Functional Check Facility; Electronic Warfare Development Division for exploratory DT&E programs; ten aircraft-specific CTFs (test squadrons) each with dedicated avionics engineering test support; an EW modeling and simulation facility (the Test and Evaluation Modeling Simulation Facility), and coordination

responsibility for all EW T&E resources located on the Nellis Range Complex further described in a separate classified facility description.

5.4 ELECTRONIC COMBAT RANGE (ECR)

LOCATION: NAWC-WD China Lake, CA

MISSION:

The mission of the ECR is to develop, operate, and maintain a free-space laboratory providing engineering support, testing (DT&E and OT&E), analysis, and training resources to the developers, integrators, testers, and users of systems and technologies that counter or penetrate air defenses. The mission includes acquisition and development of air defense threats, range instrumentation, and the required facilities, as well as operation and maintenance of the Range.

PERTINENT TESTING:

The ECR provides a comprehensive, stand-alone electronic warfare (EW) test environment permitting multiple tests to be conducted concurrently. The ECR performs EW tests to support exploratory development, engineering development, developmental testing, operational testing, and training. In addition, live fire tests can be conducted. Radar cross section tests (as seen by up to four threats simultaneously) are conducted for both air vehicles and expendables. Multi-spectral measurements can be made using non-ECR NAWC-WD assets. Captive arm weapons seekers and related avionics systems are tested. Unmanned air vehicles and cruise missiles are tested in a variety of ways. Hardware-in-the-loop tests are conducted at the Slate Range Facility (SRF).

FACILITY DESCRIPTION:

The ECR is the only major Navy free-space test facility for Airborne Electronic Warfare systems and tactics. It contains both shipboard and land-based air defense threats as well as blue and gray systems, integrated by a reconfigurable integrated air defense network.

The Electronic Combat Range (ECR) is located on the 800 square-mile DoD withdrawn Randsburg Wash/Mojave "B" complex in southern California just west of Death Valley. The location offers dedicated airspace with minimum electromagnetic radiation interference in a region selected for its remoteness and relative absence of population. The ECR dedicated airspace consists of the R-2524 and R-2509 complexes (1150 square miles). This airspace is dedicated to EW testing and is scheduled and controlled by ECR.

ECR currently provides 54 highly instrumented threat simulator and real world systems of various types including multi-object tracking phased array designs. The ECR Integrated Air Defense System (IADS) links various combinations of the ECR's air defense assets to represent surface and naval air-defense networks found around the world.

ECR data systems include TSPI reference systems (tracking radar and RAJPO GPS), a real-time and off-line data collection, processing and display center, a telemetry facility, a static ground testing, and an RF monitoring.

The ECR Slate Range Facility (SRF) is located on Slate Mountain at an elevation of 4,700 feet. SRF has a good line-of -sight visibility to all existing and planned ECR threat system sites. The SRF houses the Signal Monitoring System (SIMON), the Static Radar Performance Exerciser (STARPEX) and the Moving Target Simulator (MTS). The MTS allows HITL testing using open air range systems. Display and processing of the data from an MTS event are identical to those of an event using a real airborne target.

5.5 BIG CROW

LOCATION: White Sands Missile Range, Kirtland AFB, NM

MISSION:

Airborne and ground based ECM/ECCM Test Platforms for comprehensive T&E and training support.

PERTINENT TESTING:

Open air range testing, using instrumented aircraft and ground based platforms for equipment and technique, testing and evaluation.

FACILITY DESCRIPTION:

White Sands Missile Range's Big Crow Program Office (BCPO) operates a comprehensive inventory of electronic warfare instrumentation/equipment mounted on large fixed wing and rotary wing aircraft and wheeled vehicles, used for both testing and training in a dense and expansive electronic countermeasures and counter-counter measures environment. This inventory represents a unique collection of EW capabilities, the cornerstone of which is the program's highly modified NKC-135E aircraft. The program also features platforms such as ground-based vans, CH-47D EW helicopters, and a Gulfstream G-II. Each platform has extensive electronic warfare mission equipment, including both comprehensive internal ESM/ECM systems and external pylon-mounted pods (ALQ-167). Test support is routinely provided to the Navy, Army and Air Force.

The flexibility of BCPO inventory is enhanced through an innovative engineering approach to its mission equipment suites. All equipment suites are rapidly reconfigurable from one platform to another. The BCPO can simultaneously deploy sufficient electronic warfare capabilities to provide EW T&E and training to large, widely dispersed formations (e.g., naval task forces, EW training ranges, and associated supporting aircraft).

BCPO EW suites generate various modulation schemes, including barrage noise, spot noise, continuous-wave and deception signals. It can attack all modern modulated radars with essentially any electronic warfare technique requested by the user (e.g., communications jamming, stand-off/escort self-screening/chaff clouds/radar/data link jamming, and a full range of electronic support measures). It can also carry aloft entire missile systems or subsystems.

Active EW Capabilities:

Frequency Coverage:	5 MHz to 26.5 GHz; MMW (26.5 to 100+ GHz), EO (far IR to UV)
Modulation:	FM, AM, FM/AM; Repeater, DRFM, and active coherent MMW receivers.
ERP:	up to 1 MW

Passive EW Capabilities:

RF Receivers:	Superheterodyne (100 MHz to 50 GHz); Spectrum Analyzers (5 MHz to 26.5 GHz)
EO Sensors:	UV (solar blind): Imaging Radiometers
Visible:	Silicon Vidicon and CCD Cameras
IR:	Radiometers, Imaging Radiometers, Spectrometers, Hyperspectral Imaging Spectrometers
Chaff:	ALE 22, ALE 38, ALE 43

5.6 KING CROW

LOCATION: Corpus Christi, TX

MISSION:

Airborne and ground based ECM/ECCM Test Platform

PERTINENT TESTING:

Open air range testing, using instrumented aircraft and ground based platforms for equipment and technique, testing and evaluation.

FACILITY DESCRIPTION:

King Crow is a suite of electronic warfare instrumentation/capability mounted on NKC-135A airplane. It is operated by Chrysler Technologies in Corpus Christi, TX under contract to the Navy. The platform has extensive electronic mission equipment, including both comprehensive internal ESM/ECM systems and external pylon-mounted pods (ALQ-167). Test support is routinely provided to the Navy, Army and Air Force.

The flexibility of King CROW is enhanced through an innovative engineering approach to its mission equipment suites. King CROW can simultaneously deploy sufficient electronic capabilities to provide EW T&E and training to large, widely dispersed formations (e.g., naval task forces, EW training ranges, and associated supporting aircraft).

King CROW generates various modulation schemes, including barrage noise, spot noise, continuous-wave and deception signals. It can attack all modern modulated radars with essentially any electronic warfare technique requested by the user (e.g., communications jamming, stand-off/escort self-screening/chaff clouds/radar/data link jamming, and a full range of electronic support measures). Also it can carry aloft entire missile systems or subsystems.

Active EW Capabilities:

Frequency Coverage:	5 MHz to 26.5 GHz; MMW (26.5 to 100+ GHz),
Modulation:	FM, AM, FM/AM; Repeater, DRFM, and active coherent
ERP:	up to 1 MW

Passive EW Capabilities:

RF Receivers:	Superheterodyne (100 MHz to 50 GHz); Spectrum Analyzers (MHz to 26.5 GHz)
IR:	Radiometers, Imaging Radiometers, Spectrometers,
Chaff:	ALE 22, ALE 38, ALE-43

5.7 WHITE SANDS MISSILE RANGE

LOCATION: White Sands Missile Range (WSMR), NM

MISSION:

WSMR conducts testing for all Department of Defense agencies, private companies, allied governments and non-defense organizations.

PERTINENT TESTING:

The size and location of WSMR allows a variety of test opportunities. Most tests involve missile firings, tracking missions, Electronic Warfare (EW), (including communication jamming) and ground equipment. Facilities and expertise are available to assess Life Cycle testing including environmental testing (climatic, dynamic, nuclear) and electromagnetic radiation effects, IR emissions, human factors and RAM.

FACILITY DESCRIPTION:

The main range area is approximately 40 miles wide and 100 miles (north to south) long. The air space over the range is controlled by WSMR. Additional space is available due to agreements with McGregor Range of Fort Bliss, Texas South of WSMR and ranchers in the areas north and west of the range proper

Truth data and system telemetry data is collected using 26 radars, 51 cinetheodolites, 27 telescopes, 300 fixed cameras, 10 telemetry receivers, two fixed interferometer systems, a laser tracking system and shuttered video cameras. Data is transmitted throughout the range on fiber-optic links (or microwave for very remote sites).

5.8 U.S. ARMY OPTEC THREAT SUPPORT ACTIVITY (OTSA)

LOCATION: Ft. Bliss, El Paso, TX

MISSION:

OTSA provides replica simulations and actual threat systems, with trained operations and appropriate logistic and maintenance facilities, to support ARMY user operational testing and training requirements.

PERTINENT TESTING:

OTSA supports testing and training according to a priority system headed by those tests designated in the Army's Five Year Test Program (this includes joint tests). Second priority is other ARMY tests followed by other services requirements. Training is supported on an as-available basis. Capability ranges from one-on-one to many on many with on-board instrumentation providing engineering level data including audio and video recording. The embedded instrumentation is flexible and compatible with all the services' major test ranger.

FACILITY DESCRIPTION:

OTSA occupies two facilities on Ft. Bliss, Texas which are used to accomplish necessary administrative, training, maintenance and modification activities. The threat systems currently available include air defense, command and control, communications jammers, and attack helicopters. All systems are exportable and totally supportable at remote locations. Current inventory can support testing and training activities in several separate locations simultaneously. It is common to have OTSA systems and associated support personnel and equipment location at five testing and training facilities around the country at any one time.

5.9 NAVAL RESEARCH LABORATORY (NRL) - ENEWS PROGRAM

LOCATION:

The Effectiveness of Navy EW Systems (ENEWS) program includes flyable anti-ship missile (ASM) seeker simulator assets and resides at the Naval Research Laboratory (NRL) in Washington, DC. These flyable ASM seeker simulators are flown onboard a Navy EP-3B, Flying EW laboratory, which is based at the Naval Air Test Center, Patuxent River, Maryland. EW RDT&E flight operations in support of the Surface Navy are conducted worldwide in operational areas designated by user requirements.

MISSION:

The ENEWS program's primary mission is to evaluate the effectiveness of Navy EW systems. This includes the responsibility to develop and operate Electronic Warfare (EW) Simulation assets which include flyable functional simulators to simulate threat anti-ship missile seekers.

These assets are employed to support:

Conceptual studies and EW system requirements definitions,
Electronic Warfare (EW) subsystem design and development, and
EW system T&E (TECHEVAL, OPEVAL, etc.)

PERTINENT TESTING:

The ENEWS program is executed by the Naval Research Laboratory. Because of the wide variety of problems to be solved, ENEWS uses a diversified simulation approach for EW RDT&E efforts. An open air range (OAR) element is included as part of this approach in order to provide a degree of realism not readily available by other methods.

Prior to OPEN AIR OR FIELD SIMULATION, ENEWS simulators are evaluated internally within the laboratory. This process provides for a detailed investigation and analysis of the system's performance under controlled conditions. Once this testing is complete the simulator pods are flown on a specifically equipped EP-3B aircraft dedicated to the ENEWS program. The EP-3B can carry five pods under each wing and three centerline pods in the bomb bay area. Each pod can operate independently. The operators are located in the aircraft and record pertinent test data.

In addition to the nose and tail radome areas, the EP-3B has ten (10) completely-wired wing stations that can carry electronic pods weighing up to 2500 pounds for EW test programs. The wing stations include provision for an array of ASM seeker simulators which represent a large selection of RF and IR threats. Included are chaff control panels - 2 ALE-29 dispensers and 2 ALE-41 chaff pods.

The aircraft interior has been configured with standard airline-type seat tracks for rapid installation and removal of electronic equipment test racks. The laboratory test equipment installed permits immediate fine-grain analysis of test results during project flights. In-flight dissemination of analysis information provides the capability to immediately make any necessary adjustments to the equipment being evaluated. This capability often reduces required evaluation time, and precludes the necessity of additional test flights.

APPENDIX D

FUNDED TRI-SERVICE INVESTMENT AND MODERNIZATION (I&M) PROGRAMS

APPENDIX D
FUNDED TRI-SERVICE INVESTMENT AND MODERNIZATION (I&M) PROGRAMS

EW Projects for FY97 Execution

Project	Service	Fielding Location
Advanced Airborne Interceptor Simulator	AF	Mobile
Advanced Static RCS Measurement System	AF	Holloman AFB, NM
Air Force Electronic Warfare Evaluation Simulator	AF	Ft Worth, TX
Automated Threat Measurement Equipment System	AF	Mobile
Electronic Combat Integrated Test	AF	Edwards AFB, CA
Joint Modeling and Simulation System (J-MASS)	AF	Multiple
Real-Time Electromagnetic Digitally Controlled Analyzer Processor	AF	Buffalo, NY
Vehicle Signature Test Instrumentation	Army	Aberdeen PG, MD
Dynamic Avionics Measurements	N	Multiple
EC OAR Instrumentation - Multi-spectral Platforms	N	China Lake, CA
EC OAR Instrumentation - Secure Existing Comm Sys	N	China Lake, CA
Electro-Optical & Reconn Sys Test Facility	N	Patuxent River, MD
Electromagnetic Transient T&E Facility (EMTTEF)	N	Patuxent River, MD
RCS Bi-Statics	N	China Lake, CA
RCS Low Frequency Broadband Data	N	China Lake, CA

EW Projects for FY98 Execution

Project	Service	Fielding Location
Advanced Airborne Interceptor Simulator	AF	Mobile
Advanced Static RCS Measurement System	AF	Holloman AFB, NM
Air Force Electronic Warfare Evaluation Simulator	AF	Ft Worth, TX
Automated Threat Measurement Equipment System	AF	Mobile
Electronic Combat Integrated Test Program	AF	Edwards AFB, CA
Multi-Spectral Test Capability	AF	Eglin AFB, FL
Real-Time Electromagnetic Digitally Controlled Analyzer Processor	AF	Buffalo, NY
Signature Measurement & Database	AF	Multiple
Threat Systems	AF	Eglin AFB, FL
Dynamic Avionics Measurements	N	Multiple
ECR Data Processing Upgrade	N	China Lake, CA
ECR Fiber Optic Network Expansion	N	China Lake, CA
Electro-Optical & Reconn System Test Facility	N	Patuxent River, MD
Electromagnetic Environmental Effects Facility	N	Patuxent River, MD

APPENDIX E

ACRONYMS

APPENDIX E
ACRONYMS

ACRONYM	DESCRIPTION
– A –	
AAED	Advanced Airborne Expendable Decoy
AAIS	Advanced Airborne Interceptor Simulator
AAM	Air-to-Air Missile
AAW	Anti-Air Warfare
AC	Anechoic Chamber
ACC	Air Combat Command
ACETEF	Air Combat Environment Test and Evaluation Facility
AFB	Air Force Base
AFDTC	Air Force Development Test Center (Eglin, FL)
AFEWES	Air Force Electronic Warfare Evaluation Simulator
AFFTC	Air Force Flight Test Center
ARM	Anti Radiation Missile
ASC	Advanced Simulation Center
ASC	Aeronautical Systems Center
ASUW	Anti Surface Warfare
ASW	Anti-Submarine Warfare
ATEWES	Advanced Tactical Electronic Warfare Environment Simulator
ATIC	Avionics Test and Integration Complex
AX	[advanced aircraft, USN]
– B –	
BAF	Benefield Anechoic Facility
BoD	Board of Directors
BoOD	Board of Operating Directors
– C –	
C-E	Communications - Electronics
C4I	Command, Control, Communications, Computers and Intelligence
CEESIM	Combat Electromagnetic Environment Simulator
COE	Center of Excellence
COEA	Cost and Operational Effectiveness Analysis
CTS	Communications Threat Simulator
CTTRA	Common Test and Training Range Architecture
– D –	
DIA	Defense Intelligence Agency
DMSO	Defense Modeling and Simulation Office

DoD	Department of Defense
DT&E	Developmental Test and Evaluation

– E –

EA	Electronic Attack
EC	Electronic Combat
ECCM	Electronic Counter Countermeasures
ECM	Electronic Countermeasures
ECR	Electronic Combat Range
ECSEL	Electronic Combat Simulation and Evaluation Lab
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMD	Engineering and Manufacturing Development
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
EMTE	Electromagnetic Test Environment
EMV	Electromagnetic Vulnerability
ENEWS	Effectiveness of Naval Electronic Warfare Systems
EO	Electro-Optic
EO/IR	Electro Optical/Infrared
EP	Electronic Protection
EPG	Electronic Proving Ground
ES	Electronic Support
ESM	Electronic Warfare Support Measures
EW	Electronic Warfare
EW/C2W	Electronic Warfare/Command and Control Warfare
EWTRO	Electronic Warfare Test Resources Office

– F –

FOT&E	Follow-on Operational Test and Evaluation
FQ&P	Flying Qualities And Performance
FSS	Functional Systems Simulator
FSTC	Foreign Systems Technology Center
FSU	Former Soviet Union

– G –

GPS	Global Positioning System

– H –

HITL	Hardware-in-the-loop
HLA	High Level Architecture

– I –

I&M	Improvement And Modernization
IADS	Integrated Air Defense System
IFAST	Integration Facility for Avionics System Testing
INADS	Integrated Naval Air Defense System
INEWS	Integrated Electronic Warfare System
IOC	Initial Operational Capability
IOT&E	Initial Operational Test and Evaluation
IR	Infrared
ISAR	Inverse Synthetic Aperture Radar
ISTF	Installed Systems Test Facility

– J –

J-MASS	Joint Modeling and Simulation System

– M –

M&S	Modeling and Simulation
MMW	Millimeter Wave
MOE	Measure Of Effectiveness
MRTFB	Major Range and Test Facility Base
MSIC	Missile Space Intelligence Center
MSTIRC	Multi-Service Test Investment Review Committee

– N –

NAWC	Naval Air Warfare Center
NAWC-AD	Naval Air Warfare Center, Aircraft Division
NAWC-WD	Naval Air Warfare Center, Weapons Division
NAWCWD	Naval Air Warfare Center, Weapons Division
NAWCWPNS	Naval Air Warfare Center Weapons Division
NCCOSC	Naval Command, Control, and Ocean Surveillance Center
NCTS	Non-Communications Threat Simulator
NRC	Nellis Range Complex
NRL	Naval Research Laboratory (Washington, DC)
NSWC	Naval Surface Warfare Center

– O –

O&M	Operations and Maintenance
OAR	Open Air Range
OFP	Operational Flight Program
OPTEC	Operational Test and Evaluation Command
OT&E	Operational Test and Evaluation

– P –

PMTC	Pacific Missile Test Center (now NAWCWPNS)

– R –

R&D	Research and Development
RAM	Reliability, Availability, Maintainability
RAMS	RATSCAT Advanced Measurement System
RATSCAT	Radar Target Scatter
RCS	Radar Cross Section
RDT&E	Research, Development, Test and Evaluation
REDCAP	Real-Time Electromagnetic Digitally Controlled Analyzer Processor
RF	Radio Frequency
RIMS	Radar Image Modeling System

– S –

S&T	Scientific and Technical
SAM	Surface-to-Air Missile
SCIF	Special Compartmented Information Facility
SCRIF	Santa Cruz Radar Imaging Facility
SEAD	Suppression Of Enemy Air Defense
SLF	Stress Loading Facility
SUT	System Under Test

– T –

T&E	Test and Evaluation
TCMP	Test Capability Master Plan
TCS	Test Capability Summary
TECOM	US Army Test and Evaluation Command
TENA	Test & Training Enabling Architecture
TSPI	Time-Space-Position-Information

– U –

UAV	Unmanned Air Vehicle
USAEPG	U.S. Army Electronic Proving Ground (Fort Huachuca, AZ)
USAF	U.S. Air Force

– W –

WSMR	White Sands Missile Range
WSSL	Weapon Systems Support Laboratory

– Z –

ZEUS	[UK integrated EW system]