BY ORDER OF THE
SECRETARY OF THE AIR FORCE

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27 MARCH 1995

Test and Evaluation

ELECTRONIC WARFARE TEST AND EVALUATION PROCESS--DIRECTION AND METHODOLOGY FOR EW TESTING

This manual implements AFI 99-103, *Air Force Test and Evaluation Process*, for Electronic Warfare Test and Evaluation. It provides a methodology for use by program managers, test managers, test engineers, test organization personnel, major command headquarters staffs, and others regardless of command level, involved in Electronic Warfare Test and Evaluation. ***NOTE:*** See attachments 1 and 2 for definitions and subdivisions of Electronic Warfare respectively. This manual directs use of the Electronic Warfare Test and Evaluation Process, describes the process, provides application information, and summarizes resources available. Nonuse of the process described in this manual shall be by exception only and require written approval by the Director, Test and Evaluation, Headquarters United States Air Force (HQ USAF/TE).

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Tables

Attachments

Section A--Introduction to the EW T&E Process

1. Overview. The Electronic Warfare (EW) Test and Evaluation (T&E) Process is intended to be universal, for use by both Government and contractors in any phase of the acquisition cycle, whether your test and evaluation is developmental, operational, or combined. Its use implements a predict-test-compare philosophy and stresses adequate ground testing before implementing a flight testing methodology.

1.1. **Planning.** If, as in figure 1, you are starting to plan, manage, or conduct an EW T&E effort, this manual will help you do it in a disciplined, scientific, and cost-effective manner. The EW T&E Process described herein has been developed to help you think through the steps that should be taken to plan and execute an EW test and evaluation effort that meets the needs of the Air Force for mature, usable EW hardware and software.

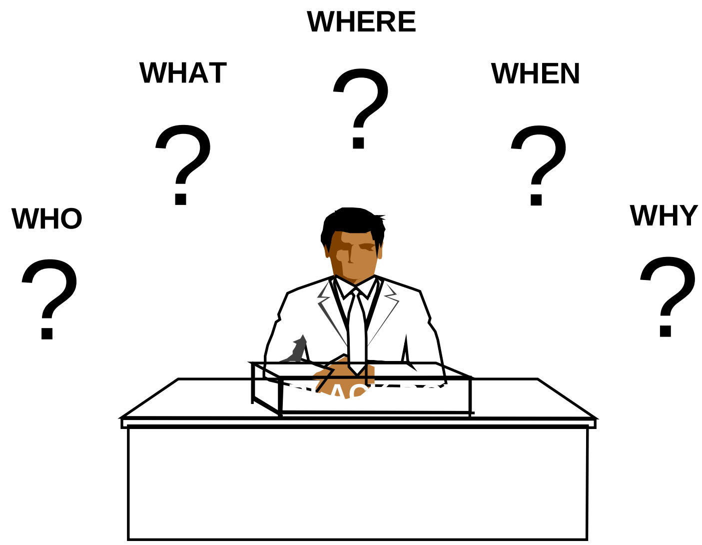

Figure 1. Planning EW T&E.

1.2. **Purpose.** The purpose of this manual is to keep you from using an undisciplined approach having too little pre-test planning and too little post-test evaluation. You should use an EW T&E Process that does the right tests at the right time in the right facilities and helps you avoid the costly mistakes that have troubled past EW test programs. This manual describes an EW T&E Process intended for EW components, subsystems, systems and functions of integrated avionic suites. Regardless of whether your test is developmental or operational, is to evaluate a concept or concerns an item from the operational inventory, you must use the EW T&E Process described in this manual as a roadmap to plan your test and evaluation. Then use it as a check for the execution of your EW T&E. ***NOTE:*** Public Law 103-160, November 30, 1993, requires the completion of an appropriate, rigorous, and structured test and evaluation regime for Acquisition Category I level Electronic Warfare systems prior to entering low rate initial production. Electronic warfare acquisition programs under OSD oversight require compliance with testing and reporting requirements of OUSD (A&T) DT&E Policy Letter, *DoD Test and Evaluation (T&E) Process for Electronic Warfare (EW) Systems--A Description*, dated 27 May 94.

1.3. **Objectives.** The three primary objectives of the EW T&E Process are: 1) to reduce the risk of hidden flaws in the product that will be very costly to fix later, 2) to demonstrate system performance that proves new and modified systems are being properly developed/improved and will meet the needs of the user, and 3) to contribute timely, accurate and affordable information to support life cycle acquisition and support decisions.

1.4. **Need.** Why do we need a disciplined EW T&E Process?

1.4.1. First, this need has been demonstrated many times by the troubled histories of EW programs that came on line too late, were over budget, or unable to meet user needs. Past EW programs have displayed a pattern of latent deficiencies manifesting themselves in operational test and evaluation, necessitating expensive fixes and retesting.

1.4.2. Second, we need to efficiently use the limited and costly resources that exist to support EW T&E. This means using test concepts that take advantage of current and emerging Modeling and Simulation (M&S) and ground test technologies to streamline Developmental Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E). Test concepts that promote a **fly-fix-fly** methodology or emphasize open air range testing as the primary test method are not prudent approaches to testing.

1.4.3. Third, we need a process that will help us do a better job of assessing and managing risk. Risk as used here means the probability that the product will have latent deficiencies that will not show up until later testing or when fielded. This risk will likely cause significant, 1) disruption of schedule, 2) increase in cost, and/or 3) degradation of performance. Risks are always a future consideration. Once a risk event happens, it is no longer a risk; it is a problem.

1.4.4. Fourth, we need a quality product for the user. Quality as used here means customer (user) satisfaction is our goal. Customer requirements will be the basis for our T&E efforts. We want the end result of Air Force acquisition and T&E efforts to be an effective and efficient EW product that satisfies user requirements. Thus we want a process that takes a product orientation where T&E activities are focused on the EW product that will be delivered to the user.

2. Direction. AFI 99-103, *Air Force Test and Evaluation Process*, applies to all Electronic Warfare T&E efforts. It will be implemented and used as described in sections B and C of this manual. These sections describe and define the process as it relates to developmental and operational testing of EW hardware and software. In sum, the EW T&E Process described in this manual will be used as the test process for all EW T&E efforts.

Section B--Description of the EW T&E Process

3. Predict, Test, and Compare. The EW T&E Process is built upon the three pillars of Predict, Test, and Compare; and its foundation is to do ground testing before flight testing. Tools are used with the process to plan, execute and record T&E efforts. This is illustrated in figure 2.

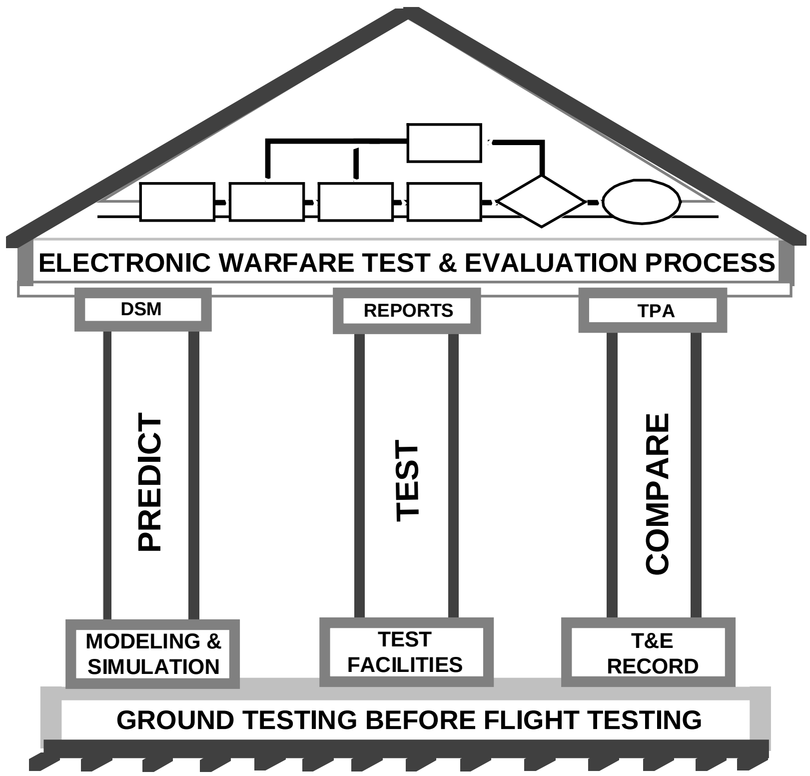

Figure 2. EW T&E Process Structure.

3.1. The **Predict** pillar is supported by Modeling and Simulation (M&S) tools. These are used to help develop test concepts, and predict test results prior to testing. A model of the EW System Under Test (SUT) interacts with other models at various levels of performance to estimate and predict system performance. The EW system model will usually be a Digital System Model (DSM) that can be run on a digital computer with other digital models such as platform models, threat models, environmental models and scenario models.

3.2. The **Test** pillar is supported by test facilities and reporting tools. These are used to produce and record data and information from the tests. Test facilities will be selected to be efficient and cost effective. The EW Single-Face-To-Customer (SFTC) office is available to assist with this significant task. Test reports must be concise, timely and contain information needed by decision makers. Risks areas identified in pre-test planning must be addressed along with risk mitigation measures evaluated. Test reports will be written by the Responsible Test Organizations (RTO) and Operational Test Agencies (OTA) you will use.

3.3. The **Compare** pillar is supported by the T&E record tools. These are T&E requirements documents, test data, plans, evaluations, test results and summaries that will be explained in more detail in section C. The T&E record is implemented in the form of a Test Process Archive (TPA) that is used to track test progress as the EW system matures.
3.4. In **Summary**, the EW T&E Process uses M&S and a DSM, Test Facilities and Reports, a T&E record in the form of a TPA and a six step disciplined test process (see figure 3). The resulting robust structure of figure 2 is representative of the desired EW product--quality and low risk.

3.5. **Use.** The process for achieving quality, low risk EW products has applicability at both macro and micro levels in the Air Force. It is for use at the Air Staff level, Major Air Command level, Center level, and Squadron level. The following discussion will largely be at the macro level. A micro level example as used by a test manager or test engineer is described in paragraph 9. An understanding of the process is needed at both levels. Figure 3 illustrates the six step EW T&E Process, which follows from the AF T&E Process described in AFI 99-103.

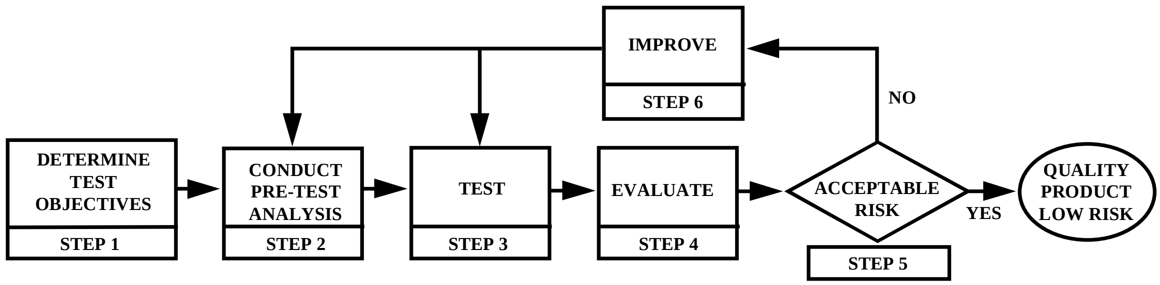

Figure 3. The EW T&E Process.

4. Six Steps. Using it involves taking actions and making decisions that answer the following questions.

Step 1) **Determine Test Objectives--**This is an action step. What are the technical and operational issues that must be proved? What are the risk areas? What T&E information is needed by decision makers? Are the test objectives based upon mission, task and performance requirements? What are the underlying assumptions supporting these objectives, and are they likely to change?

Step 2) **Conduct Pre-Test Analysis--**This is an action step. What is the test concept? What are the test points? What are the predicted outcomes? What analytical tools must be developed? What types and quantities of data are needed?

Step 3) **Test--**This is an action step. Are the appropriate T&E resources being used to conduct the tests? Will they accomplish the major test objectives? Will the tests show if risk mitigation measures work? Is the required data being collected and analyzed? Are results being reported?

Step 4) **Evaluate--**This is an action step. Have conclusions been reached and recommendations made? How do results compare with predictions? Did post test analysis compare predicted outcomes to test measured outcomes? Has analysis identified the root cause of discrepancies? Have technical and operational judgments been applied to the results? Has the information been reported to decision makers?

Step 5) **Acceptable Risk--**This is a decision step, a judgment call by a decision maker. Was the test outcome satisfactory? Have technical and operational risks been reduced to acceptable levels? Will user needs be met? If yes, proceed forward. If no, go to the sixth step of the process.

Step 6) **Improve--**This is an action step. What must be changed or refined? Who must take corrective action? These are actions to improve the EW system design, correct a flawed test method, find and fix errors in models and simulations, or improve the test process.

NOTE: The user needs a first-rate, test proven product. In DT&E you need to demonstrate the product will meet specifications and ensure readiness for OT&E. In OT&E you need to prove it will meet operational requirements (i.e. be operationally effective, suitable, and meet mission requirements). You do this through a disciplined application of the predict-test-compare philosophy throughout the entire life-cycle of the EW system. Each step of the EW T&E Process will now be described in more detail.

4.1. **Determine Test Objectives.** The first step of the process, shown in figure 4, is to determine the test objectives. To accomplish this you need to work with several source documents. Use the following check-list to ensure use of these important references.

- ❑ Mission Need Statement (MNS)
- ❑ Operational Requirements Document (ORD)/Requirements Correlation Matrix (RCM)
- ❑ System Threat Assessment Report (STAR)
- ❑ Cost & Operational Effectiveness Analysis (COEA)
- ❑ Concept of Operations (CONOPS)
- ❑ Design and Performance Specifications

4.1.1. These documents will provide details on the user requirements and the threats that may be encountered by the system once it is deployed. From these, the developer, user and test organizations will derive detailed specifications and test requirements for the system.

NOTE: The EW T&E Process will be severely impacted by poorly defined user requirements.

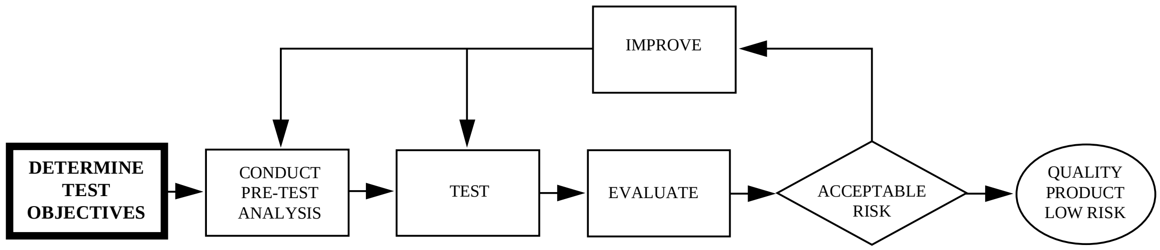

Figure 4. Determine Test Objectives.

4.1.2. Documents and products that need to be used or developed from this step of the process includes the following. Use the following checklist to avoid overlooking any of these.

- ❑ Critical Operational Issues (COI)
- ❑ Measures of Effectiveness (MOE)
- ❑ Measures of Performance (MOP)
- ❑ Test and Evaluation Master Plan (TEMP)
- ❑ Integrated Logistics Support Plan (ILSP)
- ❑ System Maturity Matrix (SMM)
- ❑ Digital System Model (DSM)
- ❑ Test Process Archive (TPA)

4.1.3. The heart of this step is boiling down all the above into concise, written statements that describe what is to be done in the T&E. This will require careful wording to prevent misunderstandings. To convey the proper meaning of T&E objectives, the following accepted terminology should be used.

4.1.3.1. Collect**--**Testing to collect data with no analysis or evaluation.

4.1.3.2. Compare**--**Testing for the purpose of perceiving likeness and difference in test items.

4.1.3.3. Demonstrate**--**Testing to clearly show or make evident by action or display. Demonstration serves as conclusive evidence of feasibility or possibility without inference to expected behavior or performance.

4.1.3.4. Determine**--**Testing to reveal, recognize or establish a particular characteristic, trait, or attribute.

4.1.3.5. Evaluate**--**Testing to establish worth (effectiveness, suitability, adequacy, usefulness, capability, or the like) of a test item.

4.1.3.6. Measure**--**Testing to make a quantitative determination.

4.1.3.7. Verify**--**Testing to confirm a suspected, hypothesized, or partly established contention.

4.1.4. To further define the test, a mission scenario can be specified (e.g. Evaluate jammer effectiveness against the SA-X in a Southeast Asia scenario).
NOTE: Tools that will be helpful during this step are the Air Force Acquisition Model (POC: ASC/CYM, DSN 785-0423), Wright-Patterson AFB OH; Automated Test Planning System [POC: OUSD(A&T)/DT&E, DSN 225-4608, Pentagon Building]; and DoD Instruction 5000.2, Part 8, *TEMP Preparation*.

4.1.5. This step is the start of early test planning to include a test strategy, modeling and simulation analysis and support requirements and data management. This is the time to contact the EW SFTC office and request their assistance, DSN 872-9650 or (904) 882-9650. The EW SFTC has test planners that can help you define the test concept and identify options for your T&E effort (see also attachment 3, paragraph A3.2). It is also the time to contact the National Air Intelligence Center (NAIC/POC), DSN 787-2378 or (513) 257-2378, for threat definition test support (see also attachment 3, paragraph A3.10..

4.2. **Pre-test Analysis.** Once the test objectives have been identified, you need to determine the overall test concept and exactly what will be measured for each objective and how it will be measured. Pre-test analysis, see figure 5, is used to predict the results of the test in terms of events that will occur and to predict values for system performance. Pre-test analysis is also used to determine test conditions and sequences.

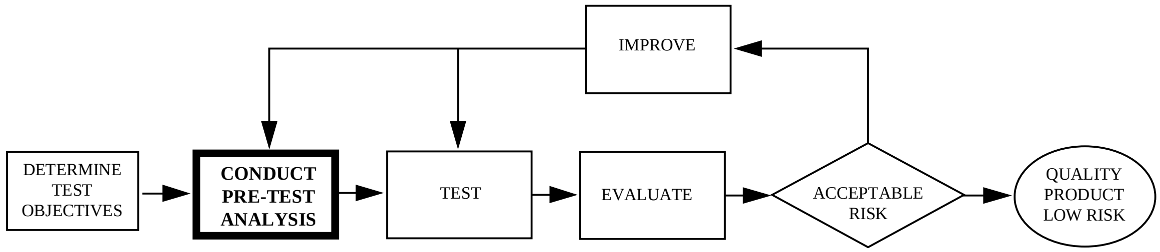

Figure 5. Pre-test Analysis.

4.2.1. Questions that should be addressed are: how to design the test scenario; how to set up the test environment; how to properly instrument the test articles; how to man and control the test resources; how best to sequence the test trials; and how to predict the outcome values for each of the objectives. A data management and analysis plan should be developed to define test data requirements, determine how the test team will analyze data, and identify specific M&S requirements. The analysis plan part should include the statistical requirements for establishing performance measurements. By performing this analysis a better understanding of risk areas can be achieved, resulting in a test program that will find problems not previously discovered and provide the required data for decision makers. Modeling and simulation tools can aid in this effort.

4.2.2. One outcome of the pre-test analysis could be the discovery that current test resources are not available to accomplish the desired testing. In that case, the EW SFTC office can help define alternatives or develop needs and solutions for test resource investments.

4.3. **Test.** The test step as shown in figure 6 includes many activities ranging from test planning, test conduct and data management to test reporting.

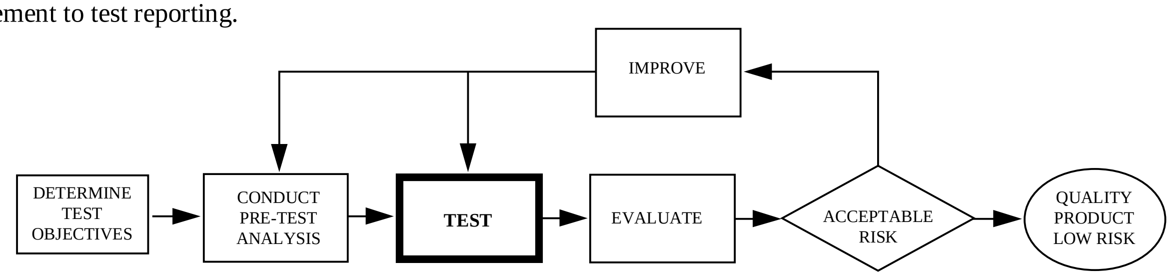

Figure 6. Test.

4.3.1. Figure 7 shows the content of these activities.

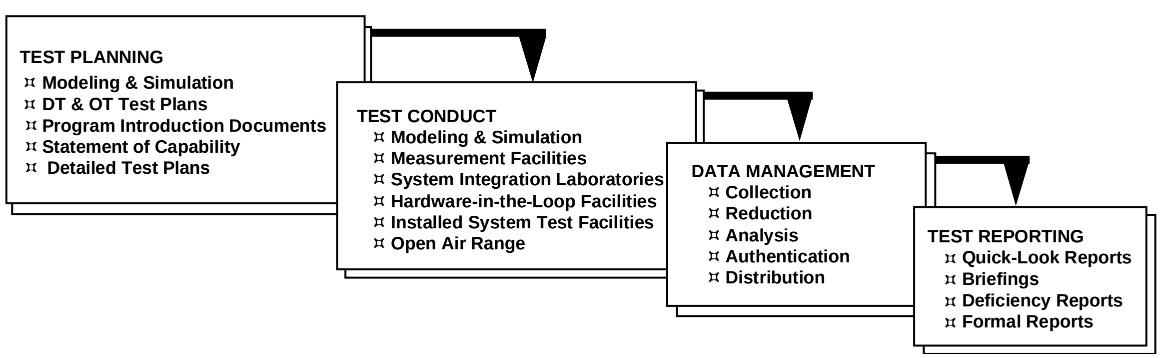

Figure 7. Test Activities.

4.3.1.2. Test planning is necessary in order for test conduct to take place in an orderly and efficient manner. However, it also should be done to define risk areas where early testing is needed to identify problems so improvements can be incorporated while economically feasible. In performance of test planning duties, DT&E and OT&E personnel will work together as part of a test planning team. This will ensure they are minimizing duplication by using common data requirements, T&E resources, analysis tools and instrumentation, as much as possible and practical.

4.3.1.2.1 Detailed test plans are used by test personnel to plan and execute the actual test conduct. These evolve from pre-test analysis work, continuing modeling and simulation work, and test planning documents such as DT&E and OT&E Test Plans, Program Introduction Documents and Statements of Capability. Detailed Test Plans define specific test objectives, test conditions, test article configurations, numbers of tests, and test events. They focus on testing in an orderly, efficient, and safe manner.

4.3.1.3. Tests are conducted in six general categories of T&E resources as described in AFI 99-103. For EW T&E these resources are described in section C and attachment 4 of this manual. The primary organizations involved during this step are the System Program Office (SPO), RTO and OTA while the SFTC maintains cognizance.

4.3.1.4. Data management includes all the data handling and processing tasks required. This starts with collecting the raw test data, converting it to engineering units, analyzing and validating the data, and finally getting it to the people and organizations that need part or all of it for information and storage.

4.3.1.5. Test reports are provided to the test customer. That customer could be a small project office, a Guard/Reserve unit, an operational unit, a large system program office, or another Government agency. Test reports may include quick-look reports for immediate feedback, briefings for decision makers, deficiency reports, and formal published documents.

4.3.1.6. System deficiencies identified during this test step, and the following evaluation step, will be documented and processed in accordance with TO 00-35D-54 chapter 2. The Deficiency Reporting (DR) system provides a systematic way to document and validate problems. Then it must be used to investigate, track, and resolve problems.

4.4. **Evaluate.** To evaluate means to establish worth or value by analyzing data. In figure 8 the evaluate step is shown following test; however, test and evaluate go hand in hand. Doing a thorough evaluation is key to a well executed T&E. For test objectives having qualitative or quantitative criteria to meet, test item performance data must be evaluated. In practice the evaluation usually lags the testing, but every effort should be made to minimize this lag. It is important to review the data as soon as it is available to determine data quality and validity.

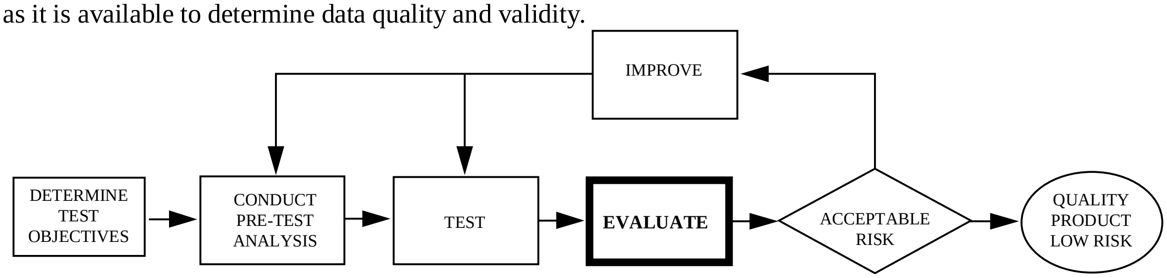

Figure 8. Evaluate.

4.4.1. Sadly, this step of the process is often the weak or missing link in test programs. Test data must be evaluated to determine if the predicted results were achieved. Where differences are found, evaluation must determine if the differences are due to errors in pre-test analysis, flaws in test design, or failures in system performance. Actions which address analyses errors, test design flaws and system failures are described in paragraph. 4.6.

4.4.2. The evaluation should result in conclusions and recommendations. Conclusions should correspond directly to the test objectives. Recommendations should focus on both performance and operator issues. Recommendations should be made 1) regarding the ability of the system to accomplish its most critical task, and 2) regarding implications of the T&E on the next planned step for the program.

4.4.3. Evaluation is not complete until all test data and objectives have been analyzed, and any differences between predicted and measured values have been resolved. Input of this step is data from the simulations and testing. Output is information for the customer and decision maker. In this step digital system models and computer simulations should be updated and a record of system performance prepared, dated, and placed in a test program information archive called the Test Process Archive.

4.5. **Acceptable Risk.** As shown in figure 9, this step is a yes/no decision by a decision maker* that the test outcome was either satisfactory or not satisfactory. Was the testing done right? Did the product (system tested or test item) perform as predicted? Were risk mitigation measures successful? Is it ready to move ahead in the acquisition cycle? If it was not satisfactory, an unacceptable risk may exist in the product until proven otherwise. Failures in DT&E may be serious but correctable. However, failures in OT&E may result in program cancellation with no possibility for corrective action.
NOTE: The test manager determines if the test demonstrated the objectives, insures test adequacy, and then makes a recommendation. The acceptable risk decision is made by a decision maker--the program manager (PM) or higher authority.

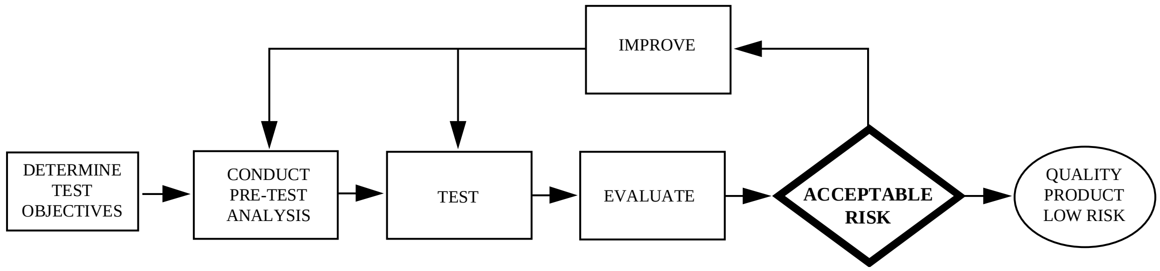

Figure 9. Risk Decision.

4.5.1. If an acceptable level of risk was not achieved, it must be determined if it was due to the system design, the test method, or if the pre-test predictions were in error. When potential solutions are found, the system should be retested until the decision maker is convinced that an acceptable level of risk has been achieved.

4.6. **Improve.** Figure 10 highlights the all important improve feedback loop where corrective actions should be taken. If problems were discovered during testing, they could be in the system design, the test method, or flawed predictions. Analyzing and fixing these problems is the key to reducing product risk. The benefit of the EW T&E Process is that feedback from the evaluation step is available early, when design changes can be economically incorporated. As development/testing of the product progresses, predictions and measures of performance and effectiveness are verified and improved. Just as EW system problems must be corrected by the program office, so must test method problems be corrected by the tester. Similarly, deficiencies found in models and simulations used in the pre-test predictions must be brought to the attention of the responsible organization. Failure to respond to this feedback information in DT&E can adversely affect OT&E and a program's ultimate success.

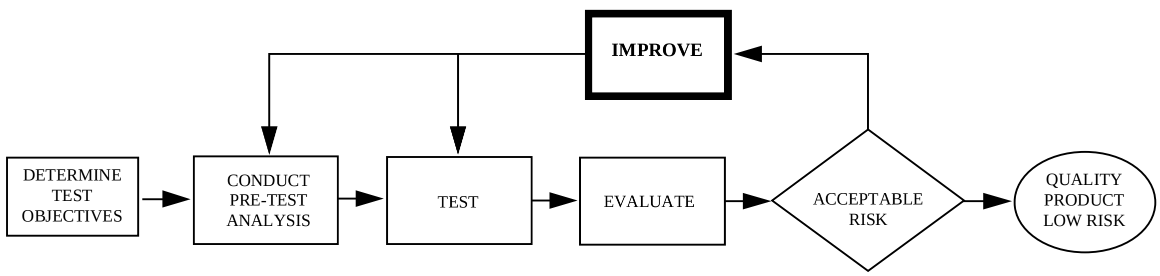

Figure 10. Improve.

4.7. **Quality Product--Low Risk.** Figure 11 shows the desired output from the process. Properly employed testing at appropriate times will reduce risk by identifying areas early that need improvement. The biggest benefit of a well-run test is the customer's confidence in the results and his appropriate reaction to the feedback provided. Predict-test-compare … then fix, is the way to transform a product with risk into the robust, low-risk product the user wants and needs … a quality product.

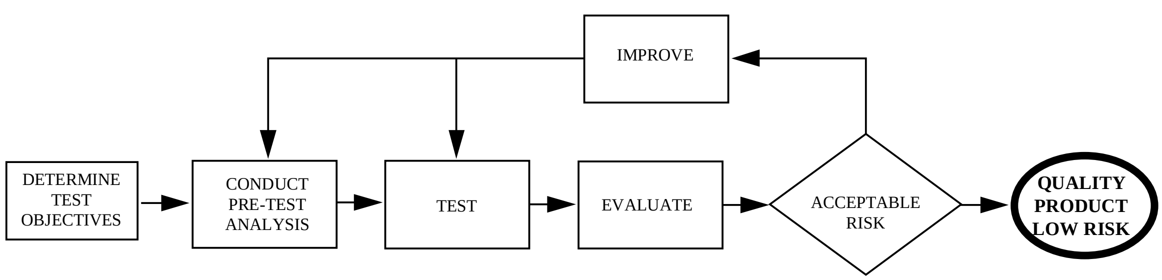

Figure 11. Product.

4.7.1. **Deficiency Reports.** Per AFI 99-101, Developmental Test and Evaluation, and TO 00-35D-54, the Product System Manager (SM) is required to set priorities on all Deficiency Reports (DR) for all Air Force acquisition programs involving DT&E and OT&E. If the SM cannot correct or resolve all known system deficiencies before OT&E or defers any system capabilities past OT&E, the SM must list, prioritize, and analyze the impact of those deficiencies and capabilities. The SM must also develop a plan for testing fixes and deferred capabilities after OT&E completion.

NOTE: For ACAT I level electronic warfare systems, Public Law 103-160, Section 220, requires deficiencies be corrected before the system proceeds beyond low-rate initial production.

4.7.2. **Quality.** Quality is achieved by using the acquisition and T&E processes to incorporate and evaluate improvements until the product satisfies customer requirements.

4.8. **Integrated Processes.** The EW T&E Process supports and must be integrated with the more complex Acquisition Process. The EW T&E Process interfaces with the system acquisition process as shown in figure 12. The user defines system requirements and deploys the system after development. The SM controls program specifications, design and production. The Responsible Test Organization (RTO) and Operational Test Agency (OTA) are responsible for detailed test planning, conduct, evaluation and reporting. Information must be developed and shared between user, tester, and acquisition communities. Responsibility for the product rests with the SM who depends upon the RTO and OTA to provide needed test information. EW testing requires an integrated effort (teamwork) to get a quality product with low risk that meets user needs.

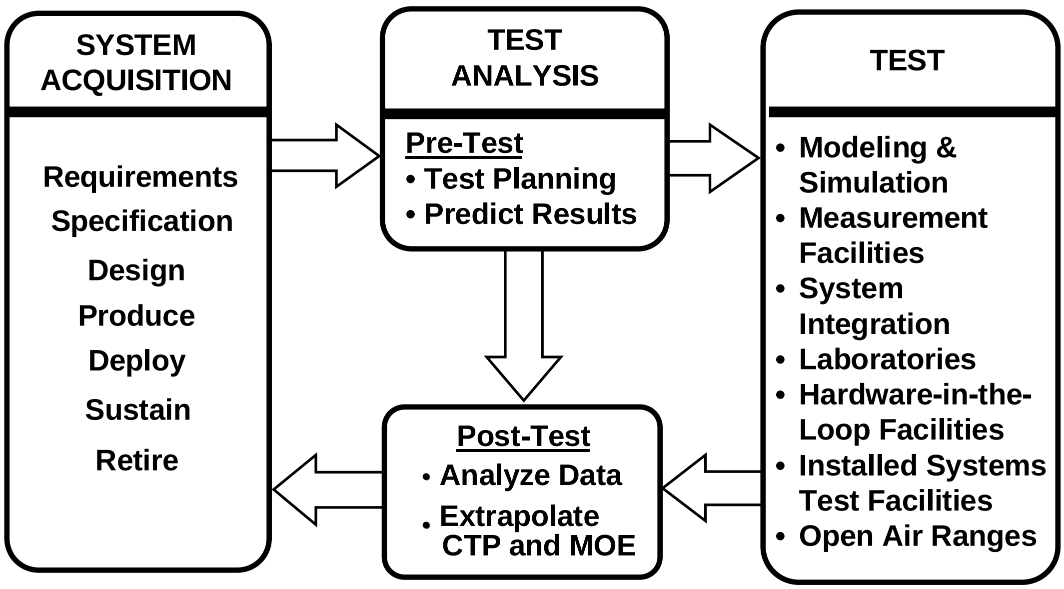

Figure 12. Integrated Effort.

4.8.1. **Integrated Mission Area T&E Processes.** The EW T&E Process could overlap with the Aircraft-Propulsion-Avionics T&E Process; the Armament/Munitions T&E Process; the Command, Control, Communications, Computers and Intelligence T&E Process; or the Space T&E Process. If this is the situation, interfaces and teaming relationships with the other mission areas should be established to plan tests, share information, and efficiently use resources.

Section C--Application of the EW T&E Process

5. DT&E and OT&E. Having defined the process it is now time to discuss its use. It will be used for both DT&E and OT&E. These two basic but different approaches to testing are defined in DoD Instruction 5000.2 Part 8. T&E efforts involving suitability, reliability, availability and maintainability should include the methodology detailed in DoD Handbook 3235.1-H, *Test and Evaluation of System Reliability, Availability, and Maintainability A Primer*, March 1982. DT&E may be a QT&E, and OT&E includes IOT&E, QOT&E or FOT&E. A Comparison between DT&E and IOT&E shows the differences (table 5.1).

Table 5.1. Comparison of DT&E and IOT&E.

DT&E	IOT&E
Measurement Of Technical Performance	Determine Operational Effectiveness And Suitability
Technical Personnel	Operational Personnel
Development Agency Responsible	OT&E Agency Responsible
Prototype Developmental Test Article	Production/Production Representative Test Article
Controlled Environment	Combat Environment
OT&E Preview	DT&E Feedback
Contractor Heavily Involved	System Development Contractor Not Allowed

5.1. **Tools.** Modeling and Simulation, Test Facilities, and a T&E Record (reference figure 2) are required tools to make the EW T&E Process work. Modeling and simulation is used for analysis and predicting outcomes. Test facilities will first be used for ground testing, then flight testing. A Test Process Archive (TPA) will be used to maintain a complete history of the T&E and permit traceability back to user requirements. In addition to the benefits described in section A, using these tools with the process will add value through more productive flight testing, better integration of DT&E and OT&E, and the increased use of Government test facilities.

5.1.1. **Modeling and Simulation (M&S).** The EW T&E Process uses computer-aided simulations and analysis prior to testing to help design tests and predict test results, and after testing to extrapolate test results to other conditions. M&S should also be used to provide constant feedback for system development/improvement. M&S use should start as early as possible during concept exploration and continue though open air testing. M&S is not limited to DT&E; M&S applications can be used to assist in planning OT&E assessments and to replace certain portions of resource-rich operational testing. The linchpin of M&S efforts will be the Digital System Model (DSM) which should be one of the first contract deliverables acquired by the program office. In the EW T&E Process the DSM is used to predict test results, to optimize test conditions and sample sizes, to extrapolate data, and to minimize program risk.

5.1.1.1. **Digital System Model (DSM).** The DSM is a tool that should be developed to help in system design, perform pre-test analysis, and evaluate the results from testing. A DSM is a digital representation (model) of the system under development. The DSM should be updated as the system is matured and maintained throughout the life-cycle of the system. The DSM should have an interface compatible with the AF standard modeling architecture for digital simulation (see attachment A4.2.1) to permit it to use the AF standard simulation support environment and modeling library.

5.1.1.1.1. A DSM can vary significantly in its level of detail (and thus cost). A digital system description (i.e. model) of a system under test may be as simple as an aircraft flight path with its associated characteristics (speed, altitude, attitude) and conditions under which these will change, what they will change to, and their rates of change. EW can be added with varying degrees of detail depending upon system test requirements. At the other extreme is a digital pulse-to-pulse model (emulative level) designed to interact with specific threat radar models in order to develop EW techniques. Thus, depending on the complexity of the system and test requirements, the DSM could be as simple as a single number or as complex as the HARM missile model interacting with actual missile software.

5.1.1.1.2. A DSM can interact with other models at various levels of detail to predict a system's estimated performance. For example, a DSM for a B-1B bomber, with its accompanying EW suite and reaction logic can be **flown** through a single engagement with a SA-8 threat in a platform level model. Many such engagements involving numerous threats and perhaps supporting forces can be combined into a single model to simulate a mission (i.e. a mission level model), and many missions can be simulated in a higher level model to simulate combat action over a time frame (a campaign level model). DSM interactions with other models and simulations allows extrapolation of empirical data to conditions which can not be tested against and enables analyses of test results with user requirements.

5.1.1.1.3. To support ground testing and hardware integration, DSM functional modules should be developed to match the functional modules of the EW system hardware and embedded software.

5.1.1.1.4. The DSM will normally be developed by the System Manager (SM) as a system development or modification contract deliverable. It models the proposed EW system design or brassboard/production hardware. An EW DSM would be developed as part of the systems engineering process to support system design, analysis and testing at the engineering, platform, and mission levels, as appropriate. If new components are being developed, an engineering-level DSM is likely to be developed. A platform and mission-level DSM should be developed by all EW system development and modification programs. The EW DSM should be maintained by the System Program Office (SPO) or SM responsible for AF management of the system.

5.1.1.1.5. It is recognized that not all EW systems, such as presently fielded systems, will have a DSM to support this process. If there is no DSM, an alternate way of predicting system pre-test performance must be used. For example, this could be an analog model, equations, or data from similar systems. However, the DSM is a powerful tool. The lack of one will put an extra burden of responsibility on the System Manager. Full use of the EW T&E Process requires having a DSM. Not developing a DSM is more than tailoring, it severely constrains the ability of the EW T&E Process to work as intended.

5.1.2. **Test Facilities.** EW systems require the use of both ground test facilities and open air range facilities for DT&E and OT&E. These facilities are tools which provide the data and test information to verify performance, risk mitigation and operational suitability. Selecting appropriate facilities for specific EW T&E efforts requires knowledge of the capabilities of such facilities. This is discussed in section C in a generic way, with the capabilities of specific facilities described in attachment 4. Make early contact with the EW SFTC for assistance in selecting the proper facilities to support your EW T&E.

5.1.2.1. **Test Reports.** Output from these test facilities will be data and information summarized in various test reports. The implementing command should use the test results to guide design and development decisions. Decision makers need the results for program reviews and briefings for milestone decisions. The user also needs test results to determine if the system's effectiveness and suitability will meet their requirements. Various formal reports include DT&E, QT&E, IOT&E, QOT&E, FOT&E reports and operational assessments. Information on these can be found in AFI 99-101, *Developmental Test and Evaluation,* and AFI 99-102, *Operational Test and Evaluation*, and supplements to these documents. Test reports must detail each DR written and corrective action(s) taken.

5.1.2.1.1. A number of other test reports are generated during the life of an EW program. For each T&E effort the customer and RTO or OTA agree on the number of reports and the report formats in pre-test planning meetings. One or more of the following reports is typically required:

5.1.2.1.1.1. A complete and detailed Technical Report (TR) that summarizes the testing done, presents the results and may analyze the results and give recommendations. The TR is a formal report published a few months after test completion and is typically available to DoD organizations through the Defense Technical Information Center (DTIC).

5.1.2.1.1.2. A Technical Letter Report (TLR) covers test areas of narrow scope and responds to near term concerns that need to be answered prior to completion of the TR.

5.1.2.1.1.3. A Preliminary Report of Results (PRR) that is typically a briefing intended to present test results in a timely and concise manner.

5.1.2.1.1.4. A Quick-look Report that may be an informal fax or phone call of information available at the completion of a test event.

5.1.3. **T&E Record.** It is recognized that during the life cycle of an EW system, the program will evolve and change. Technical considerations, schedule requirements, budget realities, facility constraints, and decision makers will impact the T&E. Thus an important part of implementing the EW T&E Process is maintaining a record of all T&E associated with each EW system, and the budgets, decisions, and reasons for the way the T&E was planned and executed.

5.1.3.1. To record this history each EW T&E effort will establish and maintain a Test Process Archive (TPA). The TPA is a file of information and documents of all the T&E efforts of an EW system for the life of that system. It consists of the T&E Structure; Test Data Collected; Test Plans, Evaluations, and Results; and Test Process Summaries as described below.

5.1.3.1.1. **T&E Structure.** This includes all of the planning documentation (e.g., MNS, ORD, STAR, CONOPS, PMD, ADM, System Specification, TEMP, Threat Validation/Baseline reports, PID, and all test plans). Further, it is an audit trail for all test objectives (including supporting COI, MOP and MOE) and supporting documentation of test process decisions, resource choices, DSM information (including DSM definition and interface specification), data management and analysis plans, predicted test results, test reports and documentation describing how the reports/results affected program decisions. This part of the TPA is typically maintained at the SPO.

5.1.3.1.2. **Test Data.** These are all data collected during a test including raw data (e.g., weather information, observer logs and video tapes), merged data (e.g., missile flyouts, DF plots and optimized TSPI) and reduced and analyzed data. The RTO maintains this data for reports and future analysis requirements. All data will be retained for at least 1 month after results are reported. After this time period the test manager, with customer approval, can designate how long the data should be retained.

5.1.3.1.3. **Test Plans, Evaluations and Results.** The TPA also contains a record of the information produced by the T&E. It documents the predictions (M&S results), test procedures and answers the test objectives with results and recommendations. This information is typically documented in T&E plans, test reports, deficiency and service reports, and corrective actions.

5.1.3.1.4. **Test Process Summary.** An annual Test Process Summary will be generated by the SPO or SM which records testing accomplished, key test process decisions, T&E deficiencies and risk areas. This summary will also list all documents added to the TPA during the year.

5.1.3.2. A way to implement the TPA is to create a file for the **TPA Summaries, T&E Structure** and **Test Plans, Evaluations and Results**. For **Test Data**, you should develop a data management plan which identifies all test products and addresses the need for automated test data tracking and analysis tools.
NOTE: An automated tool supported by the primary open air ranges and managed by the Air Force is the PC (Windows) based Mission Analysis and Reporting System (MARS). POC for this tool is 96 CCSG/SCWD at Eglin AFB FL, DSN 872-8470 or (904) 882-8470.

5.2. **System Maturity.** Typically T&E is accomplished as the design of a system matures from the component level to sub-system, to system, to integration with other installed systems, and finally to the fielded system.

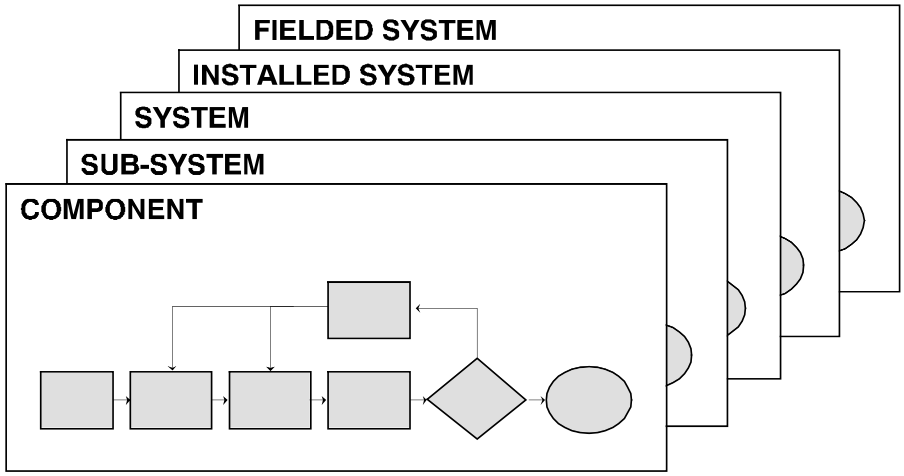

Figure 13. System Maturity.

As illustrated in figure 13, the same basic EW T&E Process is applied during each level of system maturity, whether it be a contractor testing components or the operational community performing IOT&E on a production representative system.
5.3. **System Architecture.** Complexity of the T&E will vary with platform and system architecture. Following are the different system architectures:

5.3.1. **Discrete Unit.** The EW equipment is individual and distinct, not integrated with other hardware and software systems on the aircraft. The ALQ-131 jammer pod, ALR-69 radar warning receiver (RWR) and ALE-40 chaff and flare dispenser are examples of discrete EW units.

5.3.2. **Federated Systems.** The various EW units (warning receiver, jammer, dispenser, etc.) function independently and interface where data transfer is required. In addition, each subsystem interfaces (via control panels, displays, scopes, etc.) with the aircrew separately. The F-15C TEWS is an example of a federated EW architecture.

5.3.3. **Integrated Systems.** In this architecture, data is shared between subsystems (usually via MIL-STD-1553 data buses). Each subsystem has a processor that controls the data flow within the subsystem (intra-subsystem data flow via subsystem bus) and also communicates with other subsystem data processors (inter-subsystem data flow via system bus). Situational awareness is enhanced because data from multiple subsystems can be presented to the aircrew on a single display and automated threat hand-offs can occur. The B-1B is an example of an integrated EW system.

5.3.4. **Integrated Suite.** Integrated suites are characterized by common executive control and shared core hardware and software used to implement all required functions. What was referred to as a system in the federated and integrated system architectures is now referred to as a function in the integrated suite. The system is now defined as the total hardware and software resources used to implement all required mission functions. Integrated suites often use common data processing and signal processing components in a modular, scaleable computer architecture. Preprogrammed and collected data is fused in the central processor to provide air vehicle mission management, mission level situational awareness, navigation, targeting, fire control, and defensive functions. The data displayed to the pilot is an amalgamation of the data collected and processed simultaneously by the total system resources. The F-22 avionics are an example of an integrated suite.

5.4. **Perspective.** The way EW T&E is viewed will change with organizational perspective. Congressional and OSD staffers may have different interests and objectives. Further, an Air Staff action officer would have different responsibilities and information requirements than a manager in a program office or a test engineer in a responsible test organization.

Regardless of point-of-view, the same EW T&E Process is intended to provide the needed data and information from the micro-level of the engineer to the macro-level of the politician (see figure 14).

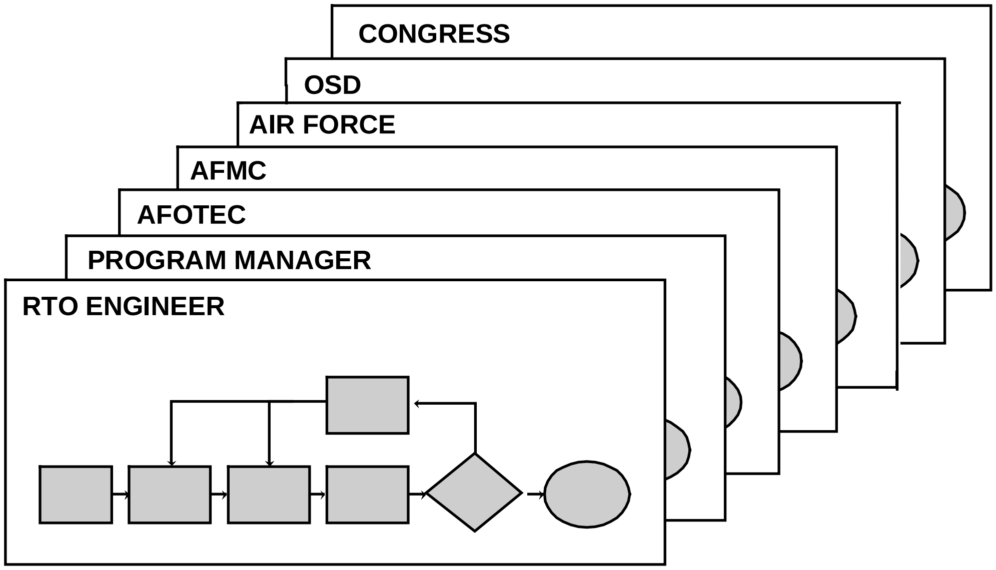

Figure 14. EW T&E Perspective.

An example that has EW implications is the development of a new aircraft. Assume a DoD review of the issues (Step 1) decides the aircraft must be twice as survivable as the aircraft it is replacing. From that perspective the T&E process includes whatever it takes to answer the survivability question for a later decision in Step 5. When viewed from the Test Engineer's perspective, an important part of survivability is the lethality envelope of the threat which is often not identified until detailed test planning in discussions between the RTO, SPO and the user. From this narrow perspective the test conducted in Step 3 could be the determination of the detection range for the Radar Warning Receiver (RWR) for a specific threat. The associated action in Step 5 is a decision by the program manager as to the adequacy of the demonstrated detection range in meeting the overall survival requirement.

5.5. **Value Added.** In addition to meeting the primary objectives of paragraph 1.3, the EW T&E Process with its extensive use of Modeling and Simulation provides opportunities for more productive flight testing, better integration of DT&E and OT&E, and better correlation of data. These and other benefits that follow allow for constant information feedback for system development and improvement.

5.5.1. **More Productive Flight Testing.** The EW T&E Process replaces the **fly-fix-fly** test philosophy with the more scientific **predict-test-compare** philosophy. Rigorous ground testing is done before and during flight testing to permit a high confidence flight test. Simulations are used to predict ground and flight test results at specific points in the performance envelope. Ground tests are then conducted, differences analyzed, and if appropriate, deficiencies corrected. Once ground testing achieves positive results, flight testing starts using the predict-test-compare philosophy with deficiencies investigated on the ground. Verification of the ground test data at the proper envelope points means flight testing will not have to be done throughout the entire performance envelope. This approach amounts to flight testing **smarter, not harder**.

5.5.2. **Better Integration of DT&E and OT&E.** To the extent possible a combined DT&E and OT&E Test Team concept can be used. By teaming, DT&E and OT&E personnel can do integrated planning and execution and independent analysis and reporting. However, the OT&E community is often prohibited from using DT&E results because of contractor involvement.

NOTE: For major defense acquisition programs ($300M RDT&E or $1.8B procurement) Title 10 of the US Code requires dedicated and exclusive operational testing (no development contractor involvement) of products designed for use in combat. For these products a separate IOT&E must be satisfactorily completed before approval can be given for full rate production.

5.5.2.1. Starting the OT&E program from scratch, however, besides being expensive, is not in accord with an iterative process based upon prediction and feedback. Integrated DT&E and OT&E has become essential. Given that the EW T&E Process provides an audit trail from test criteria to operational requirements, operational testers can use portions of Government developmental test data to evaluate initial operational performance and thus concentrate their efforts on verifying performance at the mission/task level. The system TEMP can reflect an integrated T&E strategy in which OT&E builds upon DT&E in such a way as to avoid repetition.

5.5.2.2. One example of how operational testers can use developmental test data would be an EW program in the engineering and manufacturing development phase of the system acquisition cycle. Prior to the start of Initial Operational Test and Evaluation (IOT&E), the Air Force Operational Test and Evaluation Center (AFOTEC) would make an Operational Assessment (OA) summarizing the operational issues addressed in the DT&E.

5.5.3. **Test Teams.** In the early phases of acquisition programs prior to RTO and OTA designation, Government test involvement is primarily limited to the SPO and the SFTC office(s). During these early phases, Government testers should familiarize themselves with the system's design. This occurs through the review of system design documents, attending various program design reviews (Preliminary Design Review, Critical Design Review, Software Requirements Review and others) and attending contractor in-plant tests. Building a strong T&E foundation upon extensive knowledge of the system under test is an important factor in determining the success or failure of a test program.

5.5.3.1. Once the RTO and OTA has been designated, the level of Government participation will increase. A small cadre of experienced test personnel form the core for the initial test team. The Government testers bring to the table knowledge of the EW T&E process and a wide experience base with which to assist the contractor and ensure critical test issues are addressed early. As stated above, this small cadre should familiarize themselves with the system design, establish contacts with SPO and contractor personnel and assist in test planning and use of the EW T&E process.

5.5.4. **Increased Use of Government Test Facilities.** There has been a lack of discipline among programs as to which test facilities should be used. Large programs have a tendency to delegate EW developmental testing to a prime contractor, who formulates his own test process (with Government approval) and may develop program-unique test facilities to carry it out. This usually results in tests that do not address or adequately demonstrate key performance parameters, and data that cannot later be compared with data from Government facilities. The EW T&E Process requires that test criteria reflect operational performance requirements, and pre-test analysis provides a means to statistically correlate test results from multiple test facilities. If programs require their contractors to follow the EW T&E Process and use existing Government test facilities as much as possible, data will be more reliable, comprehensive, repeatable, and correlatable. This will enhance the integration of DT&E and OT&E, and yield the following additional benefits: 1) Increased confidence in test results; 2) Increased commonality in data products; 3) More standardized data analysis and reporting; 4) Reduced test schedules and cost; and 5) Enhanced credibility in modeling and simulation.

5.5.5. **Improve Correlation of Data from Different Test Facilities.** Historically, the correlation between data from different facilities has been poor. This can be a huge problem if calibrations are off, if site operators have different expertise levels, and if sites operate in unauthorized modes. However, the predict-test-compare philosophy makes use of digital modeling and simulation and detailed analysis to improve correlation by identifying and eliminating fixed biases, and point to facility calibrations and/or test modifications that will improve correlation. Test results from different facilities should then become complementary so that both the amount of system knowledge and its associated confidence level will increase with each stage of testing.

5.5.6. **Additional Benefits Derived from Use of the EW T&E Process:**
Early and thorough evaluation of system concepts.
Early feedback to the design process.
The creation and evolution of test requirements through rigorous analysis and evaluation.
The identification of performance parameters that are critical to operational effectiveness.
Establishment of validated linkages between operational requirements and test criteria.
Timely and credible test results to support milestone decision making.
A closer tie between intelligence analysis, systems engineering, test facilities and testers.
Early identification and acquisition of test assets.

6. EW T&E Resource Categories. AFI 99-103 describes six general categories of T&E resources. These are Modeling & Simulation (M&S), Measurement Facilities (MF), System Integration Laboratories (SIL), Hardware-In-The-Loop (HITL) Facilities, Installed System Test Facilities (ISTFs), and Open Air Ranges (OAR). Proper selection and use of these resources (facilities and capabilities) is an important part of the EW T&E Process. ***NOTE:*** Public Law 103-160, 30 November 1993, Section 220 (a) applies to ACAT I level electronic warfare systems. That law requires T&E be considered at **each** of the above types of facilities before proceeding into low-rate initial production. Thus a thorough understanding of these categories and their interrelationships is necessary. Descriptions of each are provided in the following paragraphs and a list of facilities associated with each resource category is located in attachment 4. Figure 15 is intended to show how these primarily support the test execution step. Note, however, that Modeling & Simulation also supports the other action steps in the EW T&E process.

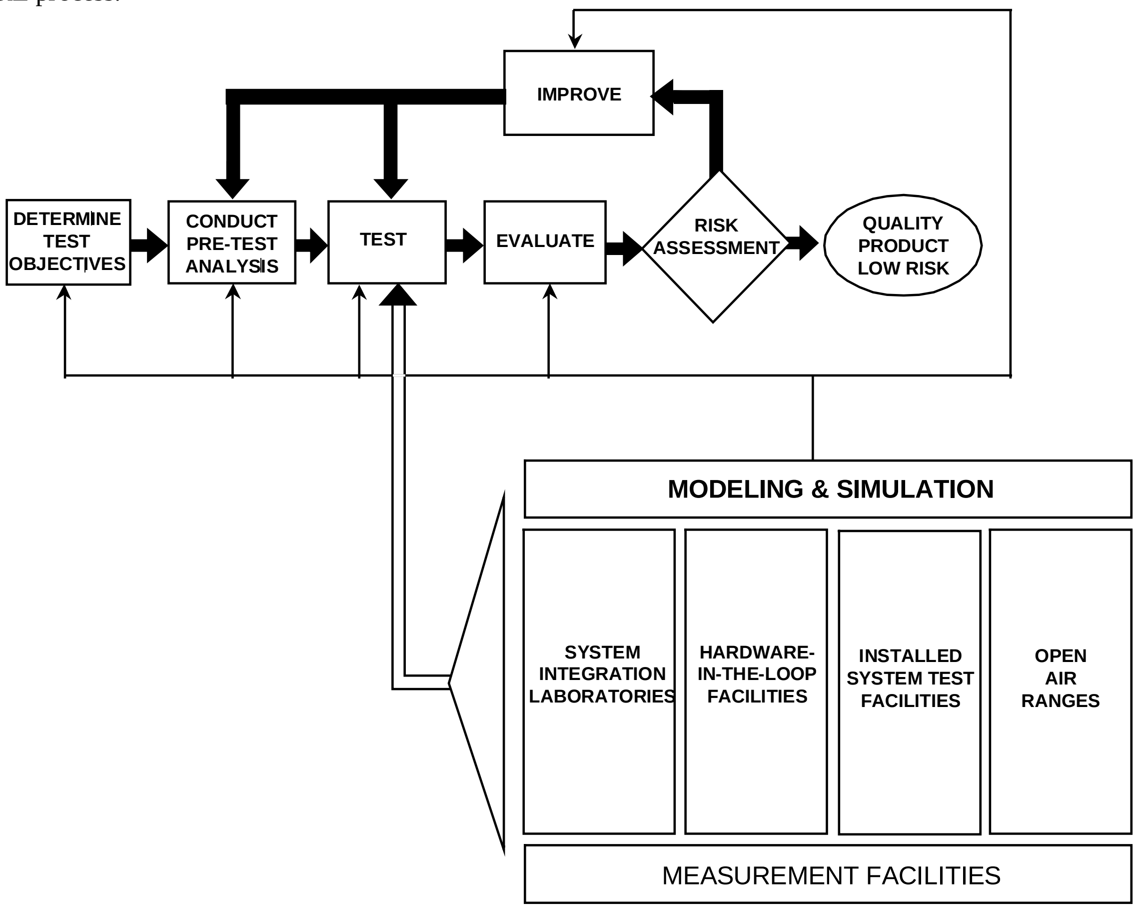

Figure 15. Resource Categories Support Test Execution.

6.1. **Modeling and Simulation (M&S).** Digital models and computer simulations, illustrated in figure 16, are used to represent systems, host platforms, other friendly players, the combat environment, and threat systems. They can be used to help design and define EW systems and testing with threat simulations and missile flyout models. Due to the relatively low cost of exercising these models, this type of activity can be run many times to check **what ifs** and explore the widest possible range of system parameters without concern for 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 the entire T&E process. Computer simulations are constructed to the following levels of technical complexity:

6.1.1. Level I--Engineering. Component level model used to examine technical performance of an individual component or sub-system in the presence of a single threat.

6.1.2. Level II--Platform. Weapon system level models used to evaluate effectiveness, including associated tactics and doctrine, in the context of an integrated weapon system engaged with a single (one-on-one) or a few (one-on-few) threats in a simulated scenario.

6.1.3. Level III--Mission. Multiple weapon systems level models (with varying degrees of detail) combined into a simulated mission to analyze mission effectiveness and force survivability of friendly, multi-platform composite forces opposing numerous threats (many-on-many).

6.1.4. Level IV--Theater or Campaign. This level incorporates the C4I contributions of joint-Service (i.e., Army-Air Force-Navy) operations against a combined threat force (force-on-force). Level IV integrates the various missions into regional, day and night, and joint operations and assesses the input of electronic warfare on force effectiveness. Inputs into this level consist of the output from Level III analysis and from unique Level IV force-on-force analysis of Level III and force level C4I doctrines .

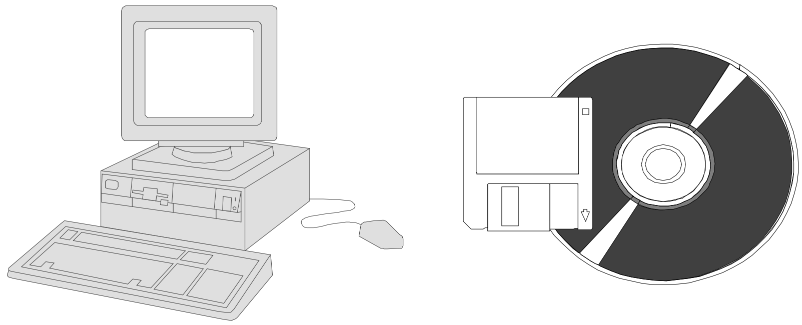

Figure 16. Models and Simulations.

6.1.5. The objectives of modeling a parameter in the test process are to:
Define safety footprints or limits.
Extrapolate test data into untestable regimes.
Increase sample size once confidence in the model is established.
Define test facility requirements (e.g., number and types of threats, airspace required, control of background noise and emitters and instrumentation).
Define and optimize test scenarios.
Select test points (i.e., successful results would not indicate the need for additional heart-of-the-envelope testing).
Predict test results for each test objective.

6.1.5.1. These modeling objectives must be tailored to the test program and specific DSM requirements identified. The first place to start is the COEA, and if a computer simulation is required to meet your modeling needs, contact the Headquarters Air Force Directorate of Modeling, Simulation and Analysis, HQ USAF/XOM. The point of contact there familiar with Air Force M&S capabilities is the AF Studies and Analyses Agency, AFSAA/SAG, DSN 224-4247 or (703) 614-4247.

6.1.6. The EW T&E Process uses computer-aided simulations and analysis prior to testing to help design tests and predict test results, and after testing to extrapolate test results to other conditions. In this way M&S is part of all six resource categories. M&S should also be used to provide constant feedback for system development/improvement.

6.1.7 The unique capabilities of M&S, what M&S can do, and M&S limitations are summarized in table 6.1.

Table 6.1. Modeling & Simulation Capabilities.

What Makes M&S Unique	Only way to do **T&E without hardware** Only way to evaluate operational effectiveness at the campaign level
What M&S Can Do	Allows a system to be analyzed before any hardware is built
	Provides an audit trail from operational requirements to test criteria
	Allows evaluation in complex scenarios/environments that could not be simulated in a ground test facility or open air range
	Provides high flexibility, repeatability, and insight into results at low cost
M&S Limitations	Prediction of absolute performance/effectiveness with high confidence
	Achieving the same degree of fidelity as an RF simulator for certain complex functions

6.2. **Measurement Facilities (MF).** Measurement facilities establish the character of an EW related system/subsystem or technology. They provide capabilities to explore and evaluate advanced technologies such as those involved with various sensors and multi-spectral signature reduction. Figure 17 illustrates an aircraft radar cross section measurement range.

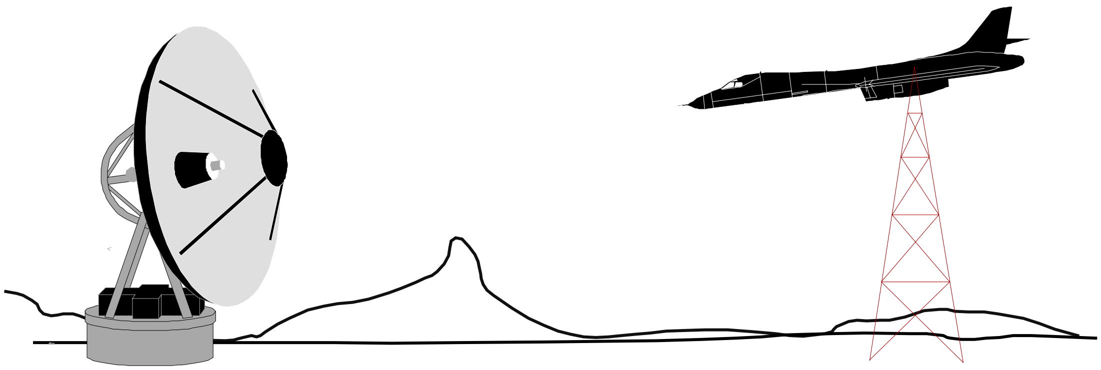

Figure 17. Measurement Testing.

6.2.1. Measurement facilities generally fall into the sub-categories of antenna measurement, Radar Cross Section (RCS) measurement, infrared/laser signature measurement, Electromagnetic Interference and Electromagnetic Compatibility (EMI/EMC) test capabilities. Measurement facilities provide EW and platform antenna pattern descriptions and platform signature data critical for system design and refinement, computer simulation, and HITL testing.

6.2.2. The unique capabilities of Measurement Facilities, what they can do, and their limitations are summarized in table 6.2.

Table 6.2. Measurement Facilities Capabilities.

What Makes MF Unique	**Provides empirical data** that cannot be emulated accurately
What MF Can Do	Measure parameters that contribute to EW performance and effectiveness
	Test certain EW components/techniques to optimize design
	Acquire input data for digital models
MF Limitations	Simulation of electronic warfare
	Evaluation of EW performance/effectiveness

6.3. **System Integration Laboratories (SIL).** SILs, illustrated by figure 18, are facilities designed to test the performance and compatibility of components, subsystems and systems when they are integrated with other systems or functions. They are used to evaluate individual hardware and software interactions and, at times, involve the entire weapon system avionics suite. A variety of computer simulations and test equipment are used to generate scenarios and environments to test for functional performance, reliability, and safety. SILs are generally weapon system specific and are found in both contractor and Government facilities.

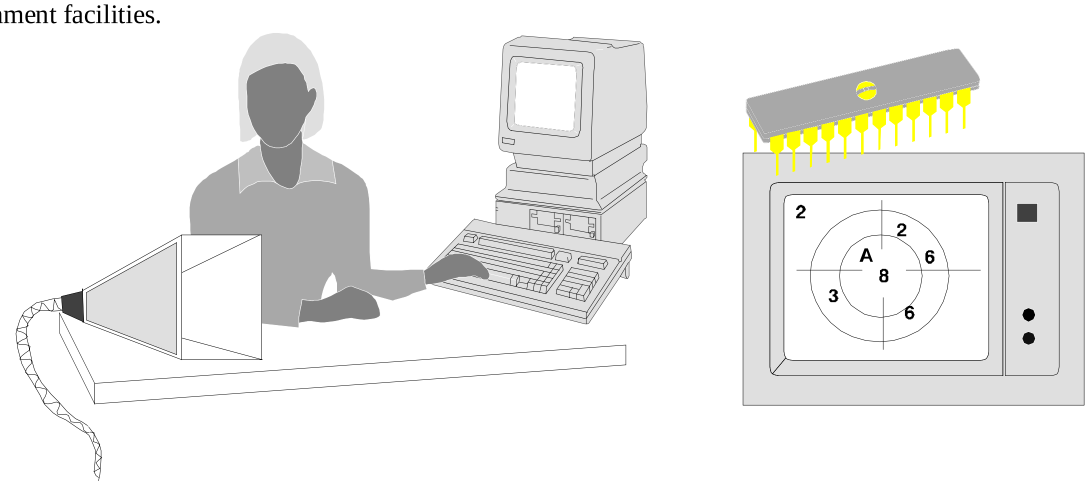

Figure 18. System Integration Testing.

6.3.1. SILs often employ a variety of real-time/near-real-time digital models and computer simulations to generate scenarios and multi-spectral backgrounds. These models are interfaced with brassboard, prototype, or actual production hardware and software of the systems under test. SILs are used from the beginning of an EW system's development through avionics integration and fielding. Moreover, SILs continue to be used to support the testing of hardware and software modifications or updates occurring throughout an EW system's operational life.

6.3.2. The unique capabilities of SILs, what they can do, and their limitations are summarized in table 6.3.

Table 6.3. System Integration Laboratory Capabilities.

What Makes a SIL Unique	Tests technical performance down to the **component level** in the controlled environment of a testbed
What a SIL Can Do	Facilitates EW/avionic integration using a building block approach
	Permits stimulation of the integrated system with threat signals
	Tests static, open-loop performance at specific points in design envelope
	Provides a Baselined environment in which hardware and software changes can be tested
SIL Limitations	Evaluation of dynamic performance
	Evaluation of closed-loop EW performance against threat
	Evaluation of EW system effectiveness

6.4. **Hardware-in-the-Loop (HITL).** HITL, illustrated by figure 19, is an important test category because it represents the first opportunity to test uninstalled system components (breadboard, brassboard, preproduction prototypes, etc.) in a realistic RF, Laser, or IR environment. HITL operating environments can provide: terrain effects; high signal/threat density; realistic interactive scenarios; multi-spectral capability; background noise; modern threat representation via closed-loop hybrid threat simulator for EC effectiveness testing; man-in-the-loop interaction; and Integrated Air Defense System (IADS) networking. Capabilities provided by the HITL test environment are: secure (shield/screen room); high data pass rate; test replay/repeatability; and high capacity data collection and recording.

6.4.1. Thus HITL facilities are indoor test facilities that provide a secure environment to test EW techniques and hardware against simulators of threat systems. Primary EW HITL facilities contain simulations of hostile weapon system hardware or the actual hostile weapon system hardware. They are used to determine threat system susceptibility and to evaluate the performance of EW systems and techniques.

6.4.2. Some EW HITL facilities contain US or friendly weapon system hardware. They are used to evaluate and improve the performance of US or friendly weapon systems. These HITL facilities can be used to test US EW systems where the US or friendly weapon system represents threat technology, or where the actual system has become a potential threat to friendly forces.

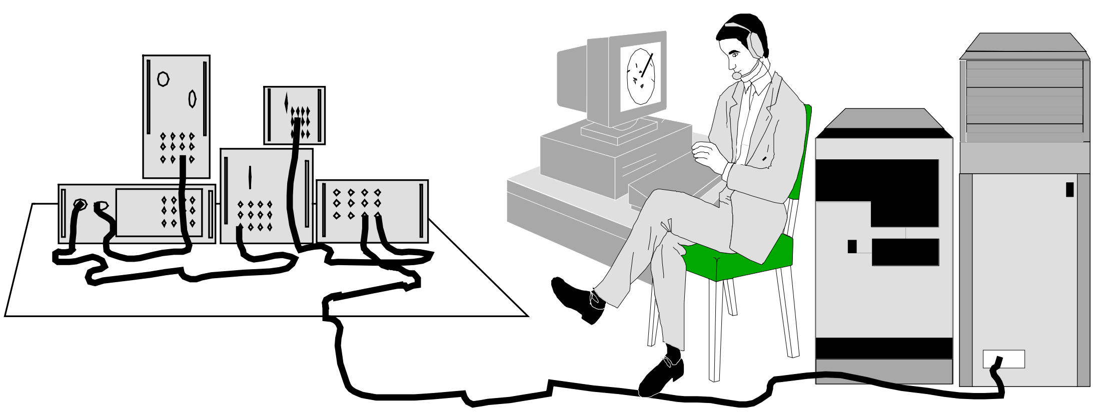

Figure 19. Hardware-In-the-Loop Testing.

6.4.3. HITL testing should be done as early in the development process as possible - even if that means using a brassboard configuration. Too often preproduction hardware is developed late in a program, making identification and remedy of problems difficult. EW HITL testing is done to provide repeatable measurements and verification of protection techniques and EW system effectiveness.

6.4.4. The unique capabilities of HITL facilities, what they can do, and their limitations are summarized in table 6.4.

Table 6.4. Hardware-In-The-Loop Facility Capabilities.

What Makes HITL Unique	**Evaluates EW system effectiveness** prior to host platform integration in a dynamic environment

What HITL Can Do	Allows closed-loop effectiveness testing against an IADS
	Allows dynamic testing across the system employment envelope
	Simulates a comprehensive battlefield threat environment
	Tests EW systems in an integrated configuration
	Allows both red and blue man-in-the-loop interfaces
	Provides high flexibility, repeatability, and insight into results at medium cost
	Excellent primer for OAR testing
HITL Limitations	Testing compatibility and interoperability with the host platform
	Simulation of all flight environment aspects with high confidence

6.5. **Installed System Test Facilities (ISTF).** ISTFs, illustrated by figure 20, provide a secure capability to evaluate EW systems that are installed on, or integrated with, host platforms. These test facilities consist of anechoic chambers in which free-space radiation measurements are made during the simultaneous operation of EW systems and host platform avionics and munitions. The EW system under test is stimulated by threat signal generators and its responses evaluated to provide critical, integrated system performance information. Their primary purpose is to evaluate integrated avionics systems (e.g., radar, infrared, communications, navigation, identification, EW systems or subsystems, integrated controls and displays) in installed configurations to test specific functions of complete, full-scale weapon systems. Such testing is done to determine if any EMI/EMC problems exist; to determine system reaction to electromagnetic environments of hostile and/or friendly systems whose signals cannot be radiated in free space on open air test ranges for security reasons; and to support flight testing by providing pre-flight and post-flight checkout capabilities. This ground testing can aid in isolating component, subsystem, or system problems not observable in other ground test facilities but crucial to system checkout prior to open air testing. Failure to evaluate installed EW system performance adequately on the ground typically results in significantly increased flight test cost and lengthened schedules.

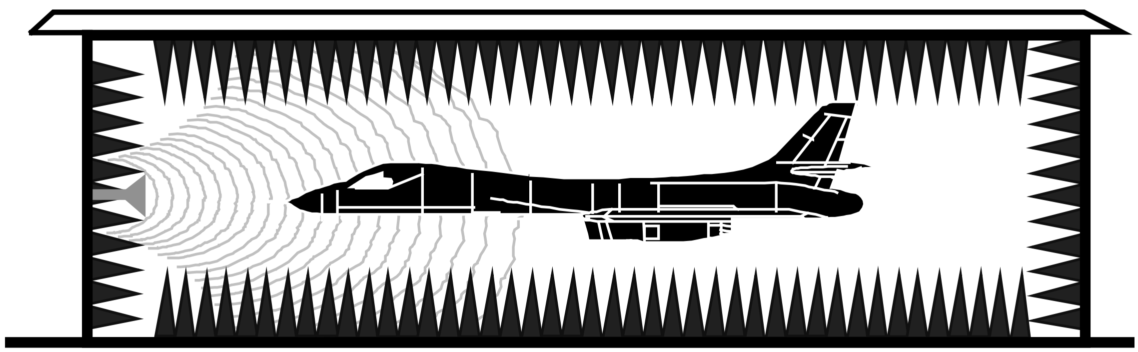

Figure 20. Installed System Testing.

6.5.1. A Category I ISTF performs end-to-end systems effectiveness testing on installed multi-sensor/multi-spectral EW and other avionics/vetronics (vehicle electronics) systems under a wide range of realistic threat and operational conditions. These conditions require the appropriate types and numbers of players. Test events range from DT&E to OT&E. Specific tests include EW effectiveness (especially multi-sensor cued countermeasures), platform susceptibility, human factors, Electronic Protection performance, weapon systems integration performance, Electronic Support systems performance and systems integration testing.

6.5.2. A Category II ISTF performs end-to-end systems integration testing on installed multi-sensor /Multispectral EW and other avionics/vetronics systems under conditions necessary to prove system performance. Test events are primarily DT&E oriented with some applications to operational testing. Specific tests include: human factors, Electronic Protection, avionics/vetronics systems performance and systems integration testing.

6.5.3. A Category III ISTF performs specialized testing such as: Electromagnetic environmental effects (E3), limited systems installation and checkout on aircraft, ground vehicles and components.
6.5.4. A Category IV ISTF performs specialized testing such as: RCS measurements, antenna pattern measurements, and susceptibility to High Powered Microwave.

6.5.5. The unique capabilities of ISTFs, what they can do, and their limitations are summarized in table 6.5.

Table 6.5. Installed System Test Facility Capabilities.

What Makes an ISTF Unique	Allows EW system testing on host platform under controlled conditions
What an ISTF Can Do	Evaluates EW system compatibility and interoperability with the host platform
	Provides pre-flight checkout capability and post-flight diagnostics
	Tests static EW performance of the integrated platform at specific points in the employment envelope
ISTF Limitations	Dynamic test performance in a free-space environment
	Evaluation of closed-loop performance against a threat in a free-space environment
	Evaluation of EW effectiveness

6.6. **Open Air Range (OAR).** Open air range test facilities, illustrated by figure 21, are used to evaluate EW systems in background, clutter, noise and dynamic environments. Typically these resources are divided into sub-categories of test ranges and airborne testbeds.

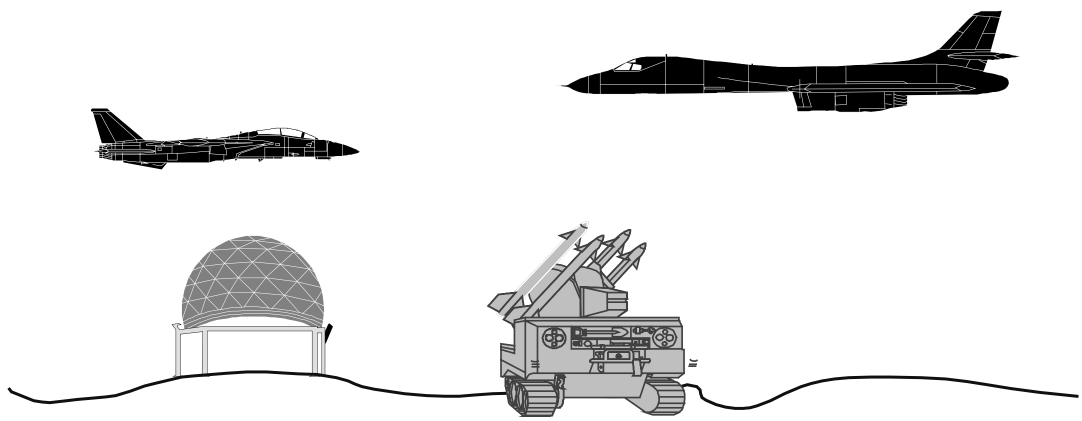

Figure 21. Open Air Range Testing.

6.6.1. Open Air Range EW flight test ranges are instrumented and populated with high-fidelity, manned or unmanned threat simulators. Additional emitter-only threat simulators are also used to provide the high signal density characterizing typical operational EW environments. The high cost of outdoor threat simulators limits current range testing to one-on-one, one-on-few, or few-on-few scenarios. Open Air Range testing includes the subcategories of ground test, test track, and flight test. The primary purpose of open air testing is to evaluate the system under real-world representative environment and operating conditions. Open air range testing is used to validate system operational performance/ effectiveness at a high level of confidence. If properly structured, flight testing can also be used to validate/calibrate ground test facilities and models. EW components, subsystems, systems, and entire avionic suites can be installed in either a ground or airborne testbed or in the intended operational platform and tested on open air ranges. Real-world phenomena encountered during open air range testing include terrain effects, multi-path propagation, and electromagnetic interference from commercial systems (television and radio broadcasts, micro-wave transmissions, etc.). Flight test ranges also offer the capability to conduct tests using captive carried and live-fired missiles.

6.6.2. Airborne testbeds range from small aircraft with pod-mounted components or systems to large aircraft designed for spread-bench installation and testing of EW and avionic systems. They permit the flight testing of EW components, subsystems, systems, or functions of avionic suites in early development and modification, often before the availability of prototype or production hardware.

6.6.3. The unique capabilities of open air ranges, what they can do, and their limitations are summarized in table 6.6.

Table 6.6. Open Air Range Capabilities.

What Makes Ranges Unique	Only facility which provides a realistic flight environment
	Provides high confidence necessary for production certification
What Ranges Can Do	Provide realistic flight environment including atmospheric propagation, terrain effects and clutter
	Allow dynamic closed-loop effectiveness testing at specific points in the design envelope

	Calibration and validation of digital models and ground test facilities
OAR Limitations	Achieving battlefield threat densities and diversities
	Scenario flexibility and statistical repeatability
	Relatively high cost per test

6.7. **Examples.** Figure 22 contains examples of how the six resource categories support the different kinds of EW testing required. Attachment 4 provides summary information on specific facilities typically used.

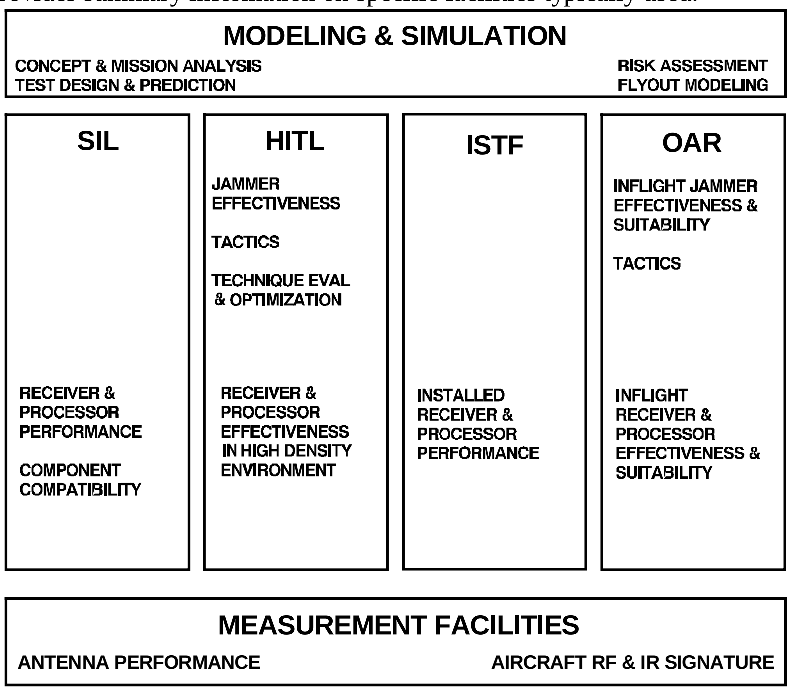

Figure 22. EW T&E Resource Category Examples.

7. EW T&E Resource Utilization. Recognizing that resources used may be dictated by threat system availability, threat density, and closed loop effectiveness, the following considerations apply.

7.1. **Simulator Validation (SIMVAL).** SIMVAL is a process to ensure the Air Force can simulate a realistic air defense threat environment for effective T&E of all Electronic Warfare equipment, aircrew training, and exercise operations. Baselining is an equivalent process used for validation when actual air defense systems are available. Before using a test resource it would be advisable to obtain the SIMVAL/BASELINE report generated by the National Aerospace Intelligence Center (see attachment 4, paragraph A4.2.2).

7.2. **Relative Cost.** In general, the cost per test becomes more expensive as the testing moves to the right as shown notionally in figure 23. The use of models, simulations, and ground testing can reduce overall test cost, since open air flight tests are the most costly.

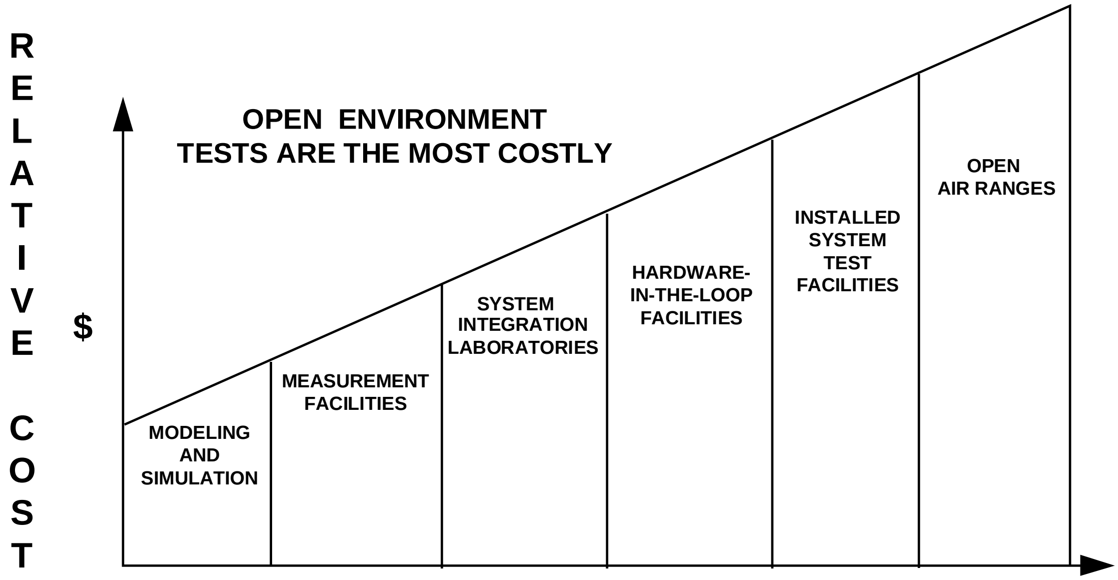

Figure 23. Relative Cost--T&E Resource Utilization.

7.3. **Relative Use.** Due to the complexity of EW systems and threat interactions, modeling and simulation can be used in a wide range of progressively more rigorous ground and flight test activities. Figure 24, also notional, shows that modeling and simulation and measurement facilities are used throughout the test spectrum. It also shows how the number of trials/tests should decrease as the testing proceeds to the right through the categories.

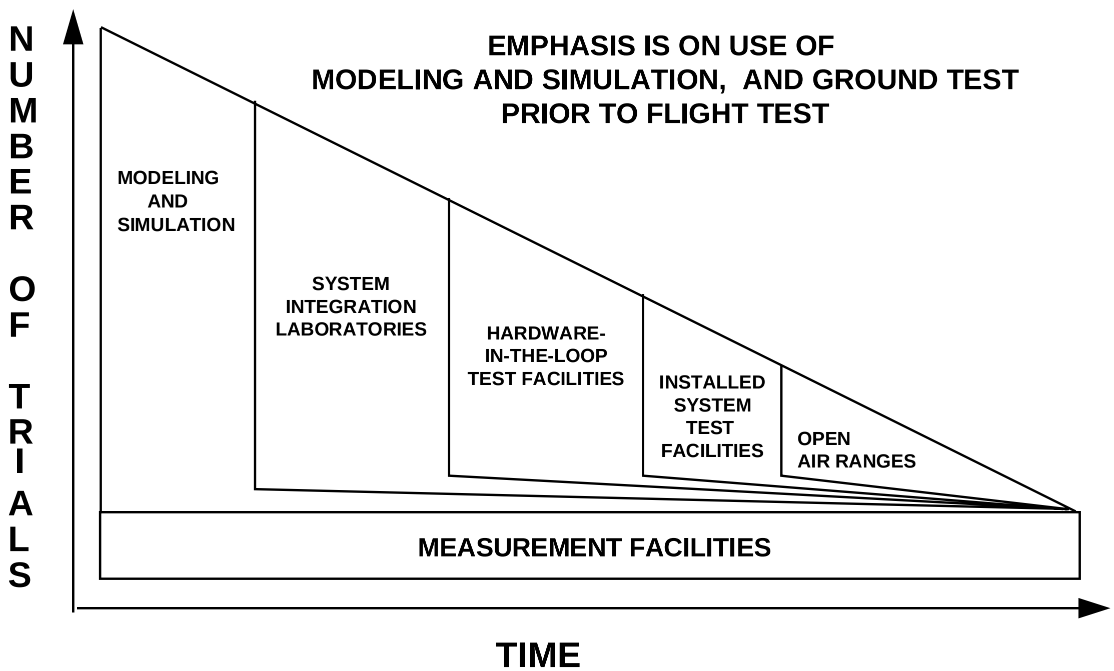

Figure 24. Relative Use--T&E Resource Categories.

7.4. **Linkage Between Processes and Resources.** The EW T&E Process supports and is tightly coupled to the Air Force Acquisition Process. To progress through the system acquisition phases and milestones requires testing, which requires resources. Thus the Acquisition Process, the EW T&E Process and T&E Resources are linked. It is the SM's responsibility to determine the optimum mix of test facilities to use and resources to expend during each phase of system acquisition. The

SM must also integrate the EW T&E Process outputs onto the critical path of his/her program's master schedule. Answers to design trade-offs predicted during modeling and simulation must lead hardware and software baseline decisions at milestones 1 and 2 by several months. Results from SIL, HITL and ISTF ground testing must also be on the program's critical path for program development baselines. If the SM allows EW T&E Process testing to proceed independently, and never reconciles the EW T&E results with the system hardware and software baselines, risk reduction benefits of the EW T&E Process will be wasted and program success delayed or jeopardized.

7.5. **EW Systems Life Cycle.** Figure 25 shows the relationship of the six resource categories as they support the five phases of the acquisition cycle. Each category is used in more than one phase of the acquisition cycle. Regardless of the acquisition phase of the program, the same EW T&E process (figure 3) should be used. Differences will occur in the amount of testing in each of the six categories. Early in the acquisition process, there is a concentration on ground-based controlled testing and testing that allows many repetitions at low cost, such as modeling and simulation and hardware-in-the-loop. While these resources continue to be used throughout the life cycle, as the system matures, increasingly complex system level and integration testing occurs including open air flight tests. Open air flight testing is required to determine if production and modified configurations of the system satisfy user requirements. This testing may require threat simulations that are more representative of the actual threat and may employ larger test scenarios than previously used.

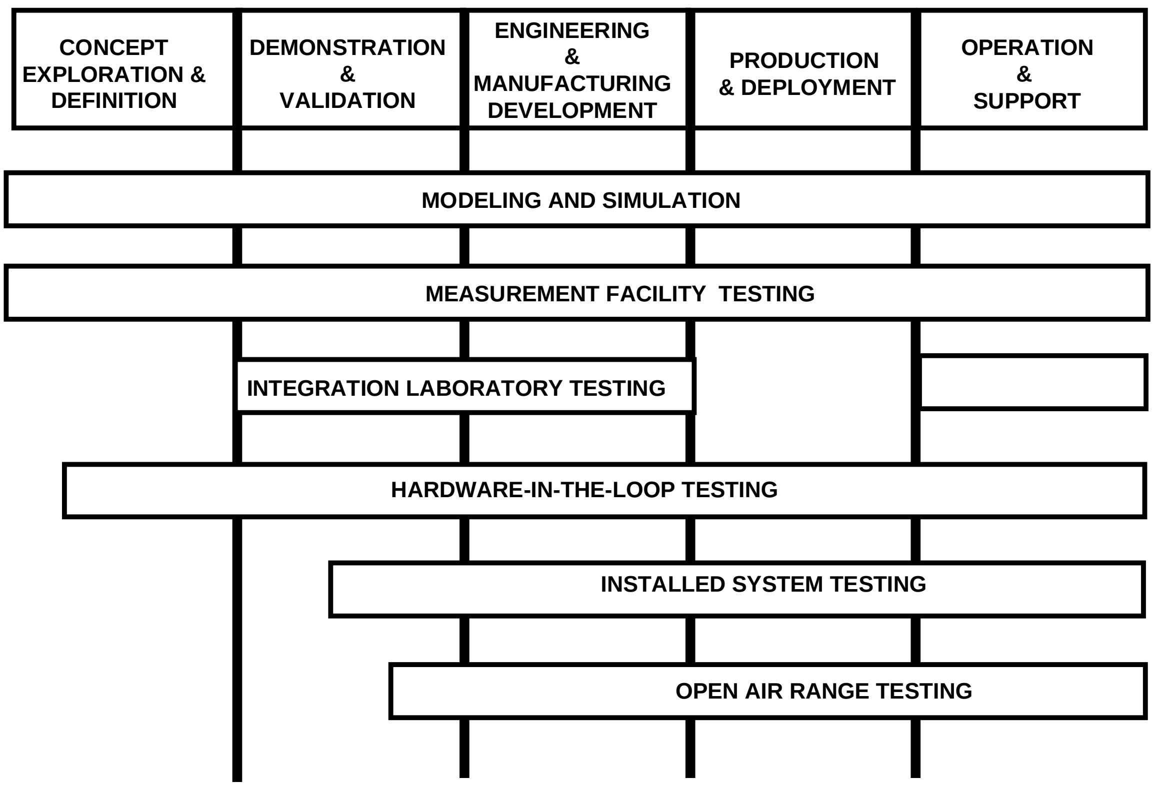

Figure 25. EW Systems Life Cycle (Notional).

8. Lessons Learned. In planning to use the different T&E resources, significant benefits can be gained from past lessons learned. Three brief histories follow that show the need to use the right resources in the proper order.

8.1. **Program A.** A bomber EW system leapfrogged directly from contractor System Integration Laboratories (SIL) to flight testing, skipping Hardware-In-The-Loop (HITL) facilities and Installed System Test Facilities (ISTFs) altogether. The program considered and rejected HITL testing because it was not mandatory and would have elongated the schedule. Flight testing revealed serious problems, and the system was sent back to HITL facilities and ISTFs for diagnostic testing. By then, however, it was too late. The design was **locked in**, the hardware had been built and packaged, and the fixes were prohibitively expensive. At that point the only alternatives were a **major** modification program or scrapping the existing design and starting over. Using a DSM and ground testing against an updated threat would have easily highlighted a flawed system architecture.

8.2. **Program B.** A fighter EW system went from its SIL to an ISTF to an Open Air Range, then finally to a HITL facility. By using facilities in the improper order, the program failed to achieve the timely design evaluation and deficiency identification that HITL facilities uniquely provide before the hardware is completely designed, fabricated, and packaged. As a result, after nominal completion of OT&E, the system was unable to obtain OSD/DOT&E certification. HITL facilities, initially ignored by the program, were then used to solve the problems. However, changes made at this stage were very expensive.

8.3. **Program C.** An RTO designed a radar warning receiver DT&E test plan which provided high confidence for a smooth transition into IOT&E. The program came under scrutiny at a high level requiring several quick-response, out-of-sequence, and inefficient tests, which consumed most of the budget and schedule allocated to the DT&E. The test was redesigned to fit the remaining resources, and as a result, failed three attempts at IOT&E. The system went through the expensive flight-test phase of IOT&E a total of four times before being approved for production.

8.4. The point to be learned from these examples is that, in the absence of a standardized test process, many EW programs will invent or will be constrained to a faulty or incorrectly applied process. In either case, the result is major program impacts.
NOTE: Additional T&E lessons learned information is available from databases maintained by AFMC and AFOTEC. The Air Force Lessons Learned Capture And Retrieval System (ALCARS) is a lessons learned database maintained by ASC/CYM, Wright-Patterson AFB OH, DSN 785-3454 or (573) 255-3454. The OT&E Lessons Learned Program is maintained by AFOTEC/XRX, Kirtland AFB NM, DSN 246-5242 or (505) 846-5242.

9. Radar Warning Receiver Example. The EW T&E Process supports the EW Acquisition Cycle. Figure 26 shows how a typical radar warning receiver (RWR) development or upgrade could use the various EW T&E resources during the five phases of the acquisition cycle. The right side of this figure shows the T&E contributions made by the testing accomplished.

9.1. **RWR Ground Testing.** For this RWR example, using the EW T&E Process, modeling and simulation can be used for concept validation and effectiveness predictions. When the system components are subjected to the SIL for system integration tests, high density threat presentations (thousands of emitters) and other environmental factors such as terrain can be simulated. This is the first opportunity to actually test the system. In the HITL facility, the system can be tested for closed-loop effectiveness and the results correlated with those from the earlier effectiveness assessments made with the digital models. The next step is the ISTF. Installed systems testing provides the first opportunity to test the system in its as-installed configuration. At this point, performance validation can be accomplished. High-density threat signals can be reintroduced and on-aircraft EMI/EMC testing can be completed. With all this ground testing accomplished, the system under test can next be evaluated in the OAR and dynamic performance with actual environmental effects assessed.

9.2. **RWR Open Air Range Testing.** In the open air range test, the system's effectiveness can be revalidated as well, this time in an environment of controlled tactics with multiple threats, aircraft, or systems in flight. Throughout the entire test process, M&S is used to predict test outcomes, and measurement facilities are sequentially used to measure signature characteristics, including low observable characteristics, to fully assess dynamic system performance. The objective is to integrate these EW evaluation results into an overall assessment of the weapon system's military worth.

9.3. **Detailed RWR Example.** The following is a more detailed example of how the EW T&E Process could be used to support a RWR development program. First let us assume the RWR program is in the Phase I, Demonstration & Validation (DEMVAL), part of the Acquisition Cycle.

9.3.1. **Situation.** The objective of the SPO during Phase I is to get ready for the Milestone II, Engineering and Manufacturing Development go-ahead decision. As part of DEMVAL, critical RWR performance parameters must be evaluated. The contractor has been tasked to provide test support as required including analysis using the DSM. You are a Test Manager/Engineer in the SPO and have been given a short suspense to conduct a low budget Government test to investigate the capability of your RWR to correctly identify an SA-31 in a 14-million pulses per second (PPS) environment. To accomplish this test you follow the EW T&E Process by taking the following actions (listed by step in the first column with the results listed in the second column).

T&E RESOURCE CATEGORIES	PHASE 0 CONCEPT EXPLORATION & DEFINITION	PHASE 1 DEMONSTRATION & VALIDATION	PHASE II ENGINEERING & MANUFACTURING DEVELOPMENT	PHASE III PRODUCTION & DEPLOYMENT	PHASE IV OPERATIONS & SUPPORT	T&E CONTRIBUTIONS
MODELING AND SIMULATION	Utilization	Utilization	Utilization	Utilization	Utilization	- RWR SYSTEM DESIGN - TEST PROCESS PLANNING/RESULTS PREDICTION - FORCE-ON-FORCE EVALUATION - PRE-COMBAT MISSION REHEARSAL
MEASUREMENT FACILITIES	Potential	Utilization	Utilization		Potential	- ANTENNA TECHNOLOGY EVALUATIONS - AUTONOMOUS ANTENNA CHARACTERIZATION - ANTENNA INSTALLATION OPTIMIZATION
SYSTEM INTEGRATION LABORATORIES		Utilization	Utilization		Potential	- RWR INTERNAL INTERFACE DEVELOPMENT - MULTI-LRU INTEGRATION TESTING (DIGITAL) - INTEGRATION TESTING OF P3I MODS
HARDWARE IN-THE-LOOP FACILITIES		Utilization	Utilization	Utilization	Utilization	- DENSE ENVIRONMENT PERFORMANCE TEST - MULTI-LRU INTEGRATION TESTING - PRE-COMBAT RWR PROCESSING OPTIMIZATION - EVALUATION OF RWR P3I MODS
INSTALLED SYSTEM TEST FACILITIES			Utilization	Utilization	Potential	- EMI/EMC EVALUATIONS - SAFETY-OF-FLIGHT EVALUATIONS - CATEGORY II INSTALLED FUNCTIONALITY TESTS
OPEN AIR RANGES		Utilization	Utilization	Utilization	Utilization	- INSTALLED AIRBORNE FUNCTIONALITY TESTS - DYNAMIC, FREE-SPACE PERFORMANCE TESTING - AIRBORNE EVALUATION OF PROTOTYPE ASSETS

Denotes Utilization (grey) *Denotes Potential* (striped)

Figure 26. RWR Resource Utilization Matrix.

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Step/Activity	Result
Step 1--Test Objectives	
1. Dialog with the test community on the availability of validated SA-31 software models and signal generation and facilities available (see Note 1).	1. One ISTF and one HITL available with validated capability.
2. Description of the test requirements (typically documented in a PID) developed with facility organizations.	2. Facilities generate statements of capability (SOC) which specify cost, schedule and test assets required.
3. Make decision on which facility to use: (a) Are both affordable? (b) Which schedules can the program schedule accommodate? (c) What is the fidelity of the background emitters? (d) What are the facilities prior experience with this type of test? (e) If the test is conducted, what performance risk remains?	3. Decision is made to test at the HITL. A memo is generated describing these factors and how they played into the decision and added to the TPA.
4. A testable objective is formulated (see table 9.1.). An agreement is made that sufficient data will be collected to achieve a 90% confidence.	4. The objective is refined to, “Verify the ability of the RWR system to correctly identify the SA-31 in a 14M pps RF environment.”
5. Dialog with HITL facility about responsibility for data analysis and evaluation and test reporting.	5. The HITL organization is appointed RTO for this test. Decision documented and added to TPA.
Step 2--Pre-Test Analysis	
1. Define tasks to accomplish the test.	1. Detailed test plan stating sub-objectives.
2. Predict test results using a Digital System Model and analysis.	2. Predicted results (The RWR will identify the SA-31 within 3 seconds).
3. Other considerations are: a. Mission scenarios for background signals. b. Select subset of modes for SA-31. c. RWR antenna pattern simulation. d. Control of RWR software. e. Control of RWR threat definition file. f. Type and quantity of data to be collected. g. Analysis and evaluation tools.	3. Test plan (copy goes in TPA).
Step 3--Test	
1. Execute the Test Plan.	1. Documentation of test plan deviations, test events and what data was collected
2. Manage the gathering and preparation of data for analysis.	2. Data ready for analysis and evaluation
3. Document deficiencies.	3. Processed Service Reports
Step 4--Evaluate	
1. The predicted correct identification is compared with the measured value and confidence interval determined. Did the interval exceed 90% (whether pass or fail)?	1. Generate Test Report and go to Step 5.
Step 5--Decision Maker Weighs Information	
1. Determine if the information provided is adequate to defend the capability of the RWR to correctly identify the SA-31 at MS II.	1. If the results are not as predicted, go to Step 6; If complete, prepare the TPA Summary.

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Step 6--Find And Fix Deficiencies (Improve)

1. The tester looks for errors or flaws in the test concept and test methods.	1. Test errors and flaws corrected if found.
2. The Program Office looks at Service Reports for problems in the RWR system and the DSM.	2. RWR and/or DSM problems fixed.
3. Retest as required.	3. 90% confidence achieved.

NOTE 1: The EW SFTC provided the information on available facilities. No open air range has the capability to generate 14M pps, although the SPO may consider one open air test mission with maximum pulses-per-second during DT&E. ISTF and HITL supplied copies of Defense Intelligence Agency (DIA) validation reports.
NOTE 2: The information in the following table was developed.

Table 9.1. RWR Key Test Information.

Test Hierarchy	**Example Test Information**	**Reference**
COI	Aircraft Survivability	MNS
MOE	Situational Awareness	MNS/ORD/COEA
MOP	Correct Identification	ORD/COEA/ADM
Scenario	Southeast Asia	COEA
Threat	SA-31 @14M PPS	STAR/System Spec/ADM
Test Objective	Verify Correct ID OF SA-31 IN 14M PPS Environment	Test Plan

10. Resources And Agreements. As discussed in section B, your test plans will evolve from user defined Mission Need Statements/ Operational Requirements Documents (MNS/ORD), other source documents and higher headquarters directives such as the Program Management Directive. A typical flow from user's need to tester's plan is shown in figure 27.

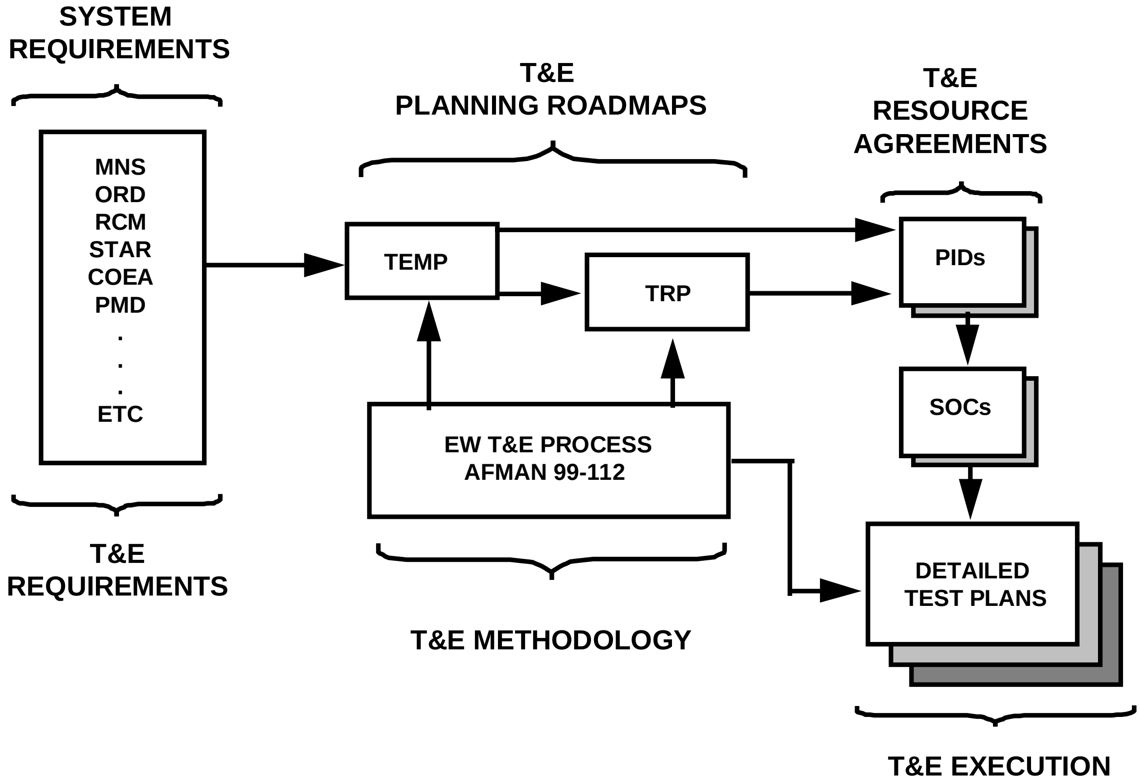

Figure 27. From Requirements to Test Plans.

10.1. Test requirements and resource requirements evolve and are defined through close coordination between the customer (user), Program Office (PO), the Responsible Test Organization (RTO) and Operational Test Agency (OTA). The PO lays out the T&E roadmap in the Test and Evaluation Master Plan (TEMP). For DT&E the PO then puts specific test needs into a Program Introduction Document (PID), and the RTO tester responds with a Statement of Capability (SOC). Government resource requirements are developed and refined as these documents are generated. Detailed test plans are then prepared to further specify the tests that will be accomplished.

10.2. For OT&E a Test Resource Plan (TRP) is used as a resource planning and management document. The TRP provides the means for programming all resources to support an OT&E. AFOTEC prepares the initial TRP and continues to maintain it following PMD approval. Each TRP is updated continuously as its program and test schedule changes to reflect the most current status of requirements.

10.3. These documents are formal agreements between Government organizations that will execute and support your T&E effort. You should ensure the EW T&E Process methodology is being used for the philosophy and development of your TEMP, TRP, PID, SOC, and individual test plans.

11. Contracts and Contractors. Contractors must abide by the EW T&E Process as you have tailored it for your project/program. You may also need to direct your contractors and suppliers to use certain Government facilities and equipment and produce certain test data and reports. It is vitally important to have your contract say what you want your contractor to do. **Ask yourself frequently, What does the contract say?** Plan early-on to get the contract written or amended to contain the provisions needed to integrate the contractor's effort into the overall T&E effort. What the contractor is to do and what the Government is to do must be unambiguous, on contract, and well documented in your lower level test plans.

11.1. Do you want the contractor to participate in Test Planning Working Group meetings? Do you want the contractor to develop or modify a Digital System Model? If so that needs to be in the contract. What about the Test Process Archive? Do you want the contractor to provide data items for the TPA during a certain part of your testing?

11.2. What about the contractor's internal deficiency reporting system? Is it compatible with the Government deficiency reporting system and does the Government have access to relevant information?

11.3. You should also plan to use Government test facilities and resources when possible. You do not want to have a contractor build and equip facilities that unnecessarily duplicate Government facilities that exist or could be readily modified to meet your needs.

12. **Implementation Checklist.** How do you know if you have taken the proper actions to implement the EW T&E Process for your test and evaluation effort? The following checklist is provided to answer this important question. If you follow this checklist a) you will have complied with the direction in this manual, and b) you will have properly set up your T&E to do the test. Then test execution will be done by test plan and/or handbook containing the **how to** procedures. If you get one or more negative checklist answers, you have more work to do.

YES	NO	
❑	❑	Do you have a Predict-Test-Compare test philosophy?
❑	❑	Do test requirements flow from user/customer requirements?
❑	❑	Have you gathered the appropriate source documents? (MNS, ORD, RCM, STAR, etc.)
❑	❑	Have you gathered or developed the needed program documents? (COI, MOE, MOP, TEMP, etc.)
❑	❑	Does your T&E effort use a disciplined, scientific process?
❑	❑	Have you addressed each of the six EW T&E Process steps in your TEMP and test plans, and justified any tailoring done?

❑	❑	Is the process being applied to answer the Critical Operational Issues and the T&E questions in the TEMP?
❑	❑	Does your T&E effort emphasize use of modeling and simulation and ground tests prior to costly flight tests?
❑	❑	Are you working with the EW SFTC office?
❑	❑	Do the people on your T&E effort understand the EW T&E Process?
❑	❑	Is your contractor on contract to use and support the EW T&E Process?
❑	❑	Do your Government T&E agreements require using and supporting the EW T&E Process?
❑	❑	Has a Digital System Model (DSM) been developed and is it being used in the T&E Process?
❑	❑	Have arrangements been made to maintain the DSM current with the real system?
❑	❑	Are your M&S efforts continually updated and do they provide constant feedback for making improvements?
❑	❑	Do you have a Test Process Archive (TPA) set up?
❑	❑	Have arrangements been made to keep the TPA on going and accessible throughout the life cycle of your EW System?
❑	❑	Will the T&E effort report results that will be used by decision makers to support system life cycle and maturity decisions?
❑	❑	If not planning to use the EW T&E Process, have you obtained a waiver from HQ USAF/TE?

13. Conclusion. This manual was written to institutionalize a disciplined EW T&E process. It describes the methodology you must use when doing your test planning at all levels from the TEMP downward. You now have an understanding of the EW T&E Process - what is the next step?
Contact the EW SFTC office (see attachment 3, paragraph A 3.2.). They exist to help you apply the EW T&E Process, help you with test planning and investments, and also help you decide where and how to test.

13.1. **Where To Test.** This involves looking at available facilities and capabilities, defining reasonable options, and determining pros and cons of each option. Capabilities, facility workload, upgrade plans, location, analysis capability, past performance, and a host of other considerations will enter into the *where to test* determination. The information in attachment 4 will be helpful to scope this, but follow-up will be required to ensure currency and applicability to specific testing needs. The EW SFTC is the place to start working this important consideration.

13.2. **How To Test.** Other documents such as handbooks, test concepts, test directives, and test procedures will contain the detailed *how to test* information. These documents will usually be developed by the various test organizations (RTO/OTA). *How to test* is highly dependent upon the kind of testing - DT&E or OT&E, the test concept chosen, and the specific system being tested. A wealth of *how to test* expertise resides in the RTO/OTA test organizations. You will use the EW T&E Process for the *how to test* methodology and discipline, and use the RTO/OTA knowledge and experience for the detailed *how to test* execution. Again the EW SFTC is a good place to start for consultation and points of contact in the RTO/OTA.

13.3. **Tailoring.** Rarely will your T&E effort be allocated enough dollars, people, and equipment to do all the testing everyone wants done. You may be severely limited in resources and have to make many tradeoffs in the number of tests, kinds of tests, and test facilities used. Your TPA Summaries, TEMP, and subsequent revisions will document the result of these tradeoffs as your project/program proceeds through its system life cycle. The TEMP will also document how you have tailored and will use the EW T&E Process. Your tailoring should be done to find a good balance between test requirements, available resources, and program risk. If major tailoring is required to adopt the EW T&E Process to an unusual or unique program, contact the EW SFTC. They can help you determine the limits of adaptability and flexibility that would be acceptable.

HOWARD W. LEAF, Lt General USAF (Retired)
Director, Test and Evaluation

Attachment 1

GLOSSARY OF REFERENCES, ABBREVIATIONS, ACRONYMS, AND TERMS

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AFI 99-103, *Air Force Test and Evaluation Process*

TO 00-35D-54, *Deficiency Reports*

CJCS MOP6, *Electronic Warfare*

Abbreviations and Acronyms

Abbreviations and Acronyms	***Definition***
ACAT	Acquisition Category
ADM	Acquisition Decision Memorandum
COEA	Cost and Operational Effectiveness Analysis
COI	Critical Operational Issues
CONOPS	Concept of Operations
CTP	Critical Technical Parameter
DEMVAL	Demonstration and Validation
DoD	Department of Defense
DR	Deficiency Report
DSM	Digital System Model
DT&E	Development Test and Evaluation
E3	Electromagnetic Environmental Effects
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EOA	Early Operational Assessment
EW	Electronic Warfare
FOT&E	Follow-on Operational Test and Evaluation
HARM	High Speed Anti-Radiation Missile
HITL	Hardware-In-The-Loop
IADS	Integrated Air Defense System

ID	Identify
ILSP	Integrated Logistics Support Plan
IOT&E	Initial Operational Test and Evaluation
ISTF	Installed System Test Facilities
M&S	Modeling and Simulation
MARS	Mission Analysis and Reporting System
MF	Measurement Facility
MNS	Mission Need Statement
MOE	Measures of Effectiveness
MOP	Measures of Performance
MS	Milestone
OA	Operational Assessment
OAR	Open Air Range
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation
OTA	Operational Test Agency
P3I	Pre Planned Product Improvement
PID	Program Introduction Document
PM	Program Manager
PMD	Program Management Directive
PO	Program Office
POC	Point of Contact
PPS	Pulses Per Second
PRR	Preliminary Report of Results
QOT&E	Qualification Operational Test and Evaluation
QT&E	Qualification Test and Evaluation
RCM	Requirements Correlation Matrix
RCS	Radar Cross Section
RTO	Responsible Test Organization
RWR	Radar Warning Receiver
SFTC	Single-Face-To-Customer
SIL	System Integration Laboratories
SIMVAL	Simulator Validation
SMM	System Maturity Matrix
SOC	Statement of Capability
SPO	System Program Office
STAR	System Threat Assessment Report
SUT	System Under Test
T&E	Test and Evaluation
TEMP	Test and Evaluation Master Plan
TLR	Technical Letter Report
TPA	Test Process Archive
TR	Technical Report
TRP	Test Resource Plan

Terms

Accreditation--The official certification that a model or simulation is acceptable for use for a specific purpose.

Closed Loop--A form of EW Testing in which both the friendly and threat systems react to each other’s actions.

Collect--Testing to collect data with no analysis or evaluation.

Compare--Testing for the purpose of perceiving likeness and difference in test items.

Critical Technical Parameter--Test and Evaluation Master Plan performance measures of the system that have been or will be evaluated during testing. Critical technical parameters are derived from the Operational Requirements. Document critical system characteristics and should include the parameters
in the Acquisition Program Baseline.

Demonstrate--Testing to clearly show or make evident by action or display. Demonstration serves as conclusive evidence of feasibility or possibility without inference to expected behavior or performance.

Determine--Testing to reveal, recognize or establish a particular characteristic, trait, or attribute.

Discrete Unit--EW equipment is individual and distinct, not integrated with other hardware and software systems on the aircraft.

Electronic Countermeasures--The division of electronic warfare involving actions taken to prevent or reduce the enemy's effective use of the electromagnetic spectrum. It includes electronic jamming and electronic deception. (Joint Pub 1-02)

Electronic Warfare--Military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. The three major subdivisions of Electronic Warfare are Electronic Attack (EA), Electronic Protection (EP), and Electronic Warfare Support (ES). EA uses electromagnetic or directed energy to attack an enemy's combat capability. EP constitutes protection of friendly combat capability against undesirable effects of friendly or enemy employment of EW. ES includes surveillance of the electromagnetic spectrum for immediate threat recognition in support of EW operations and other tactical actions such as threat avoidance, homing, and targeting.

Evaluate--Testing to establish worth (effectiveness, suitability, adequacy, usefulness, capability, or the like) of a test item.

Federated Systems--The various EW units (warning receiver, jammer, dispenser, etc.) function independently and interface where data transfer is required. In addition, each subsystem interfaces (via control panels, displays, scopes, etc.) with the aircrew separately.

Hardware-In-The-Loop Test Resources--HITL facilities are indoor test facilities that provide a secure environment to test EW techniques and hardware against simulators of threat systems.

Installed System Test Facilities--Test resources which provide the capability to test Electronic Warfare systems while installed on, or integrated with, host platforms.

Installed System Test Facility Categories--A Category I ISTF performs end-to-end systems effectiveness testing on installed multi-sensor/multi-spectral EW and other avionics/vetronics systems under a wide range of realistic threat and operational conditions. These conditions require the appropriate types and numbers of players. Test events range from DT&E to OT&E. Specific tests include EW effectiveness (especially multi-sensor cued countermeasures), platform susceptibility, human factors, Electronic Protection performance, weapons systems integration performance, ELINT systems performance and systems integration testing. A Category II ISTF performs end-to-end systems integration testing on installed multi-sensor/Multispectral EW and other avionics/vetronics systems under conditions necessary to prove system performance. Test events are primarily DT oriented with some applications to operational testing. Specific tests include: human factors, Electronic Protection, avionics/vetronics systems performance and systems integration testing. A Category III ISTF performs specialized testing such as: electromagnetic environmental effects (E3), limited systems installation and checkout on aircraft, ground vehicles and components. A Category IV ISTF performs specialized testing such as: radar cross section measurements, antenna pattern measurements, and susceptibility to High Powered Microwave.

Integrated Suite--Integrated suites are characterized by common executive control and shared core hardware and software used to implement all required functions. What was referred to as a system in the federated and integrated system architectures is now referred to as a function in the integrated suite. The system is now defined as the total hardware and software resources used to implement all required mission functions. Integrated suites often use common data processing and signal processing components in a modular, scaleable computer architecture. Preprogrammed and collected data is fused in the central processor to provide air vehicle mission management, mission level situational awareness, navigation, targeting, fire control, and defensive functions. The data displayed to the pilot is an amalgamation of the data collected and processed simultaneously by the total system resources. The F-22 avionics are an example of an integrated suite.

Integrated Systems--In this architecture, data is shared between subsystems (usually via MIL-STD-1553 data buses) Each subsystem has a processor that controls the data flow within the subsystem (intra-subsystem data flow via subsystem bus) and also communicates with other subsystem data processors (inter-subsystem data flow via system bus).

Measure--Testing to make a quantitative determination.

Measurement Facilities--Test resources used for exploring and evaluating EW technologies. Data collected from these resources include antenna patterns, radar cross sections and infrared and laser signatures.

Model--A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.

Modeling and Simulation Levels--Level I--Engineering. Component level model used to examine technical performance of an individual component or sub-system in the presence of a single threat. Level II--Platform. Weapon system-level models used to evaluate effectiveness, including associated tactics and doctrine, in the context of an integrated weapon system engaged with a single (one-on-one) or a few (one-on-few) threats in a simulated scenario. Level III--Mission. Multiple weapon-systems level models (with varying degrees of detail) combined into a simulated mission to analyze mission effectiveness and force survivability of friendly, multi-platform composite forces opposing numerous threats (many-on-many). Level IV--Theater or Campaign. Integrates the various missions into regional, day and night, and joint operations and assesses the impact of electronic warfare on force effectiveness. Inputs into this level consist of the output from Level III analysis and from unique Level IV force-on-force analyses of Level III and force level C4I doctrines.

Open Air Range--A test capability used to provide an outdoor operating environment, i.e., on an open air test range or on an airborne platform.

Open Loop--A test scenario in which a system reacts to another's actions without resulting feedback.

Preliminary Report of Results--A briefing intended to present test results in a timely and concise manner.

Quick-Look Report--An informal fax or phone call of information available at the completion of a test event.

Simulation--A method for implementing a model over time. Also, a technique for testing, analysis, or training in which real-world systems are used, or where real-world and conceptual systems are reproduced by a model.

System Integration Laboratories--SILs are facilities designed to test the performance and compatibility of components, subsystems and systems when they are integrated with other systems or functions.

Technical Letter Report--Covers test areas of narrow scope and response to near term concerns that need to be answered prior to completion of the TR.

Technical Report--Summarizes the testing done, presents the results and may analyze the results and give recommendations. The TR is a formal report published a few months after test completion and is typically available to DoD organizations through DTIC.

Test Process Archive--A file of data and information that documents and records T&E efforts for the life of the system. It consists of the T&E Structure, Test Data Collected, Evaluation/Results, and the Test Process Summary.

Time, Space, Position Information (TSPI)-- Location data referenced to a coordinate system as a function of time.

Validation--The process of determining the degree to which a model or simulation is an accurate representation of the real-world from the perspective of the intended uses of the model or simulation.

Verification--The process of determining that a model or simulation implementation accurately represents the developer's conceptual description and specifications.

Verify--Testing to confirm a suspected, hypothesized, or partly established contention.

Vetronics--Vehicle electronics.

ELECTRONIC WARFARE DEFINITIONS AND SUBDIVISIONS

A2.1. Introduction. Electronic Warfare incorporates all phases of interaction between the EW platform and the threat, be it denying detection (e.g. Low Observability), avoidance (e.g. situational awareness), preventing a firing solution (e.g. jamming) or confusing a missile during the end game (e.g. towed decoys). The following general definitions apply to the subdivisions of Electronic Warfare. Reference: Chairman, Joint Chiefs of Staff Memorandum of Policy No. 6 (CJCS MOP 6), dated 3 March 1993**.**

A2.2. Electronic Warfare (EW). Military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. The three major subdivisions of Electronic Warfare are Electronic Attack (EA), Electronic Protection (EP), and Electronic Warfare Support (ES). EA uses electromagnetic or directed energy to attack an enemy's combat capability. EP constitutes protection of friendly combat capability against undesirable effects of friendly or enemy employment of EW. ES includes surveillance of the electromagnetic spectrum for immediate threat recognition in support of EW operations and other tactical actions such as threat avoidance, homing, and targeting. Figure

A2.1. graphically illustrates EW as an overarching term that includes these three major subdivisions. The overlapping ovals indicate that some EW actions are arguably both offensive and protective in nature and may inherently use ES in their execution. Actions listed under the subdivisions of EW are intended to be illustrative, not all-inclusive.

A2.3. Electronic Attack (EA). That division of electronic warfare involving the use of electromagnetic or directed energy to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability. It combines nondestructive actions to degrade or neutralize, such as electromagnetic interference, electromagnetic intrusion, electromagnetic jamming, electromagnetic deception, and nondestructive directed energy, with the destructive capabilities of antiradiation missiles (ARM) and directed energy weapon systems (lasers, RF weapons, particle beams).

A2.3.1. **Antiradiation Missile (ARM).** A missile which homes passively on a radiation source.

A2.3.2. **Directed Energy (DE).** Use of DE weapons, devices, and countermeasures to either cause direct damage or destruction of enemy equipment, facilities, and personnel, or to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum through damage, destruction, and disruption.

A2.3.3. **Electromagnetic Jamming.** The deliberate radiation, re-radiation, or reflection of electromagnetic energy for the purpose of preventing or reducing an enemy's effective use of the electromagnetic spectrum, and with the intent of degrading or neutralizing the enemy's combat capability.

A2.3.4. **Electromagnetic Deception.** The deliberate radiation, re-radiation, alteration, suppression, absorption, denial, enhancement, or reflection of electromagnetic energy in a manner intended to convey misleading information to an enemy or to enemy electromagnetic-dependent weapons, thereby degrading or neutralizing the enemy's combat capability. Among the types of electromagnetic deception are:

A2.3.4.1. **Manipulative Electromagnetic Deception.** Actions to eliminate revealing, or convey misleading, electromagnetic telltale indicators that may be used by hostile forces.

A2.3.4.2. **Simulate Electromagnetic Deception.** Actions to simulate friendly, notional, or actual capabilities to mislead hostile forces.

A2.3.4.3. **Imitative Electromagnetic Deception.** The introduction of electromagnetic energy into enemy systems that imitates enemy emissions.

A2.4. Electronic Protection (EP). That division of electronic warfare involving actions taken to protect personnel, facilities, and equipment from effects of friendly or enemy employment of electronic warfare that degrade, neutralize, or destroy friendly combat capability. Focuses on protection of friendly forces against enemy employment of EW and against any undesirable effects of friendly employment of EW. This includes the protection from destructive and non destructive effects.

A2.4.1. **Emission Control (EMCON).** The selective and controlled use of electromagnetic, acoustic, or other emitters to optimize command and control capabilities while minimizing, for operations security (OPSEC), detection by enemy sensors; to minimize mutual interference among friendly systems; and/or to execute a military deception plan.

A2.4.2. **Electromagnetic Hardening.** Action taken to protect personnel, facilities, and/or equipment by filtering, attenuating, grounding, bonding, and/or shielding against undesirable effects of electromagnetic energy.

A2.4.3. **EW Frequency Deconfliction.** Actions taken to integrate those frequencies used by electronic warfare systems into the overall frequency deconfliction process. This involves coordinating and managing the use of the electromagnetic spectrum for operations, communications, and intelligence functions.

A2.4.4. **Other Procedures and Electronic Techniques/Modes.** Actions such as the use of Wartime Reserve Modes, Operations Security, EW expendables (chaff, flares, decoys, unattended jammers) etc.

A2.5. Electronic Warfare Support (ES). That division of electronic warfare involving actions tasked by, or under direct control of, an operational commander to search for, intercept, identify, and locate sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, electronic warfare support provides information required for immediate decisions involving electronic warfare operations and other tactical actions such as threat avoidance, targeting, and homing. Electronic warfare support data can be used to produce signals intelligence (SIGINT), communications intelligence (COMINT) and electronic intelligence (ELINT).

A2.5.1. **Combat Direction Finding (DF).** Actions taken to obtain bearings to emitters.

A2.5.2. **Combat Threat Warning.** Actions taken to surveil and analyze the electromagnetic spectrum in support of the operational commander's information needs.

A2.6. EW Hardware. Table A2.1. shows representative EW systems in their respective EW subdivisions. As can be seen, some of these systems are an integral part of their platform requiring the test manager to be knowledgeable of the other interacting systems, interfaces, and test plans.

Table A2.1. Representative EW Systems.

EA	EP	ES
EF-111A (ALQ-99)	ALE-47 CMDS	AAR-47 MWS
HARM	GEN-X	ALR-56C RWR
Compass Call	MJU-8 (Chaff)	OBEWS
ALQ-131 Jammer Pod	F-22 Observables	JSTARS

CMDS--Countermeasures Dispenser System
GEN-X--Generic Expendable
HARM--High Speed Anti-Radiation Missile
JSTARS--Joint Surveillance Threat Attack Radar System
MWS--Missile Warning System
OBEWS--On Board Electronic Warfare Simulator
SIP--System Improvement Program

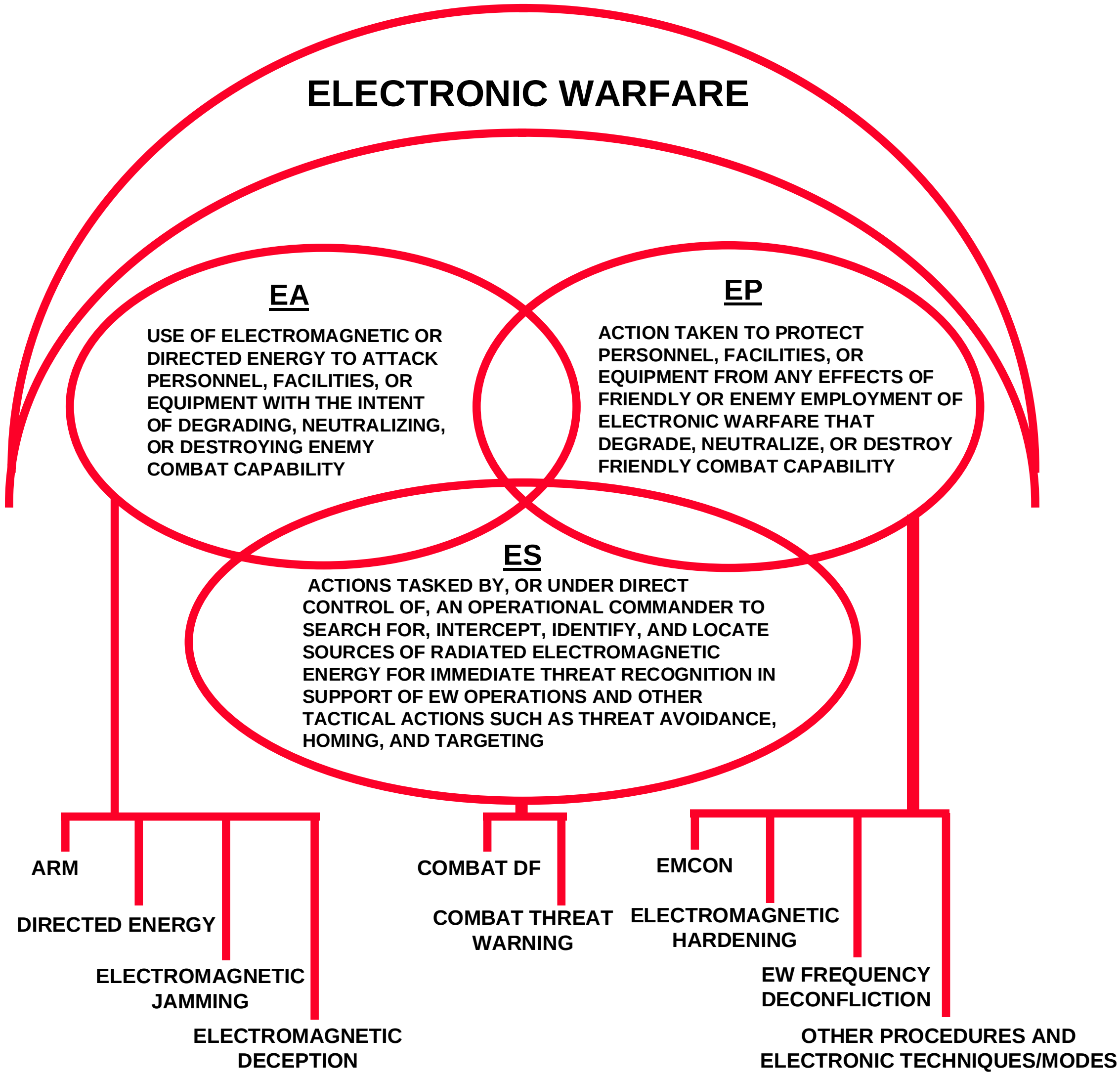

Figure A2.1. Electronic Warfare and Subdivisions.

AIR FORCE EW T&E COMMUNITY

A3.1. Introduction. Air Force Materiel Command Integrated Weapon System Management (IWSM) initiatives have changed relationships in the AFMC EW Community. Previously separate EW Acquisition and Logistics functions have merged and are now managed by the EW Product Group Manager (PGM). The comparable EW T&E functions have been merged and are now supported by the EW Single-Face-To-Customer (SFTC) office. The following descriptions will help you understand relationships of the different EW organizations involved in developmental and operational EW testing and how they can support your EW T&E. Geographic locations of the AF EW Community are as shown in figure A3.1.

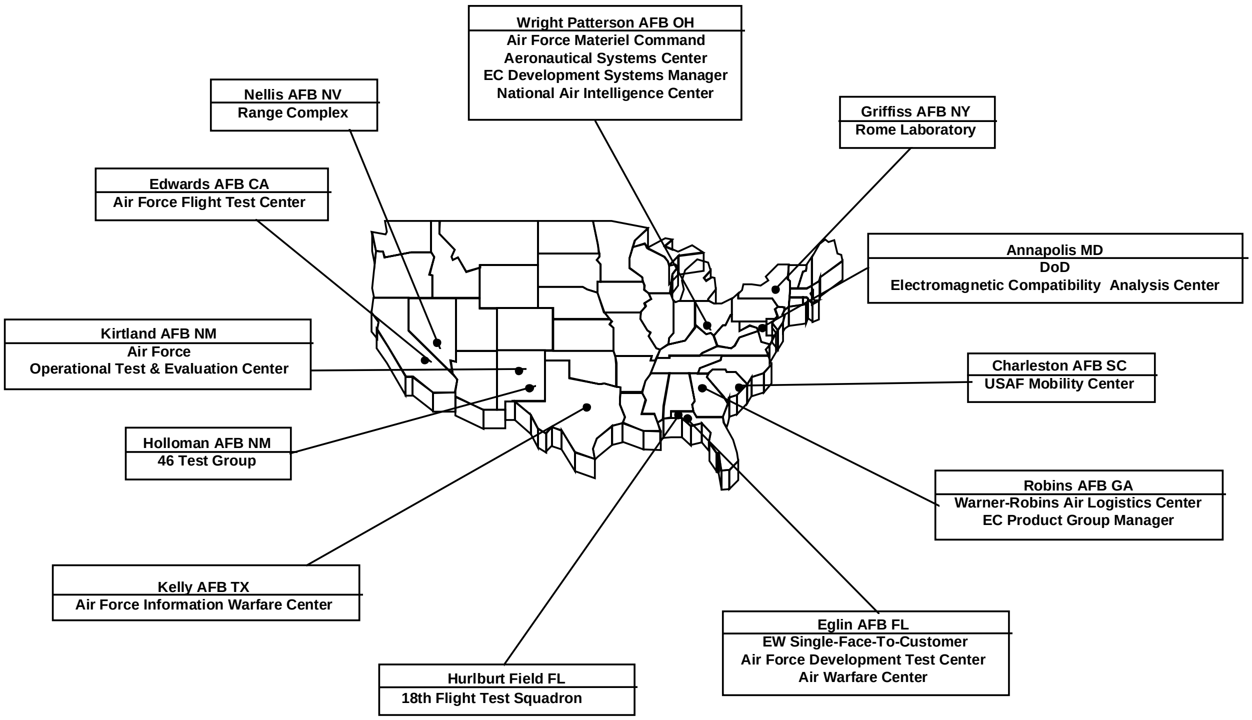

Figure A3.1. The Air Force EW T&E Community.

A3.2. EW Single-Face-To-Customer (SFTC) Office, Eglin AFB FL. The purpose of the EW SFTC is to improve the efficiency and cost effectiveness of EW T&E by assisting customers in the disciplined application of the EW T&E Process, defining the test concept and identifying risks in test options available to the customer, and helping the customer understand the capabilities and test applications of the resources available to them. Figure A3.2. illustrates the concept of operations for the EW SFTC.

A3.2.1. For assistance with the EW T&E Process contact the EW SFTC office. They helped mature the EW T&E Process, they are the custodian of it, and they can provide assistance with its implementation. They also have experienced test planners to help you define cost-effective testing options. Further, they have investment planners that are familiar with current and future test facilities and capabilities of the Air Force, Navy and Army. They will help you with your test planning and related test investment requirements.

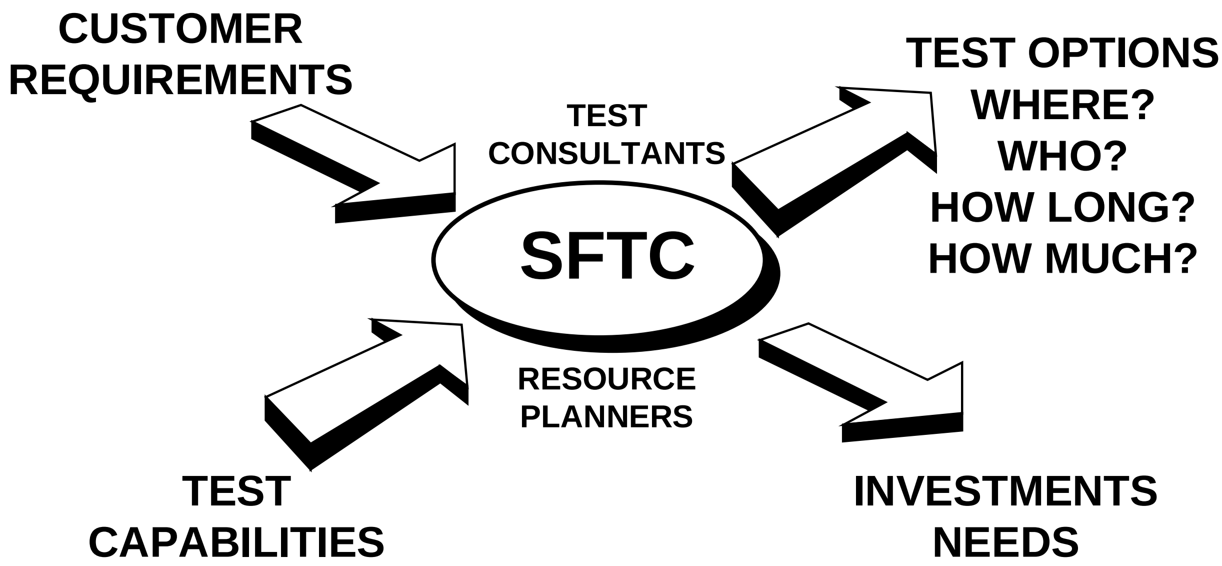

Figure A3.2. Concept of Operations.

A3.2.2. Contact: EW SFTC Office, AFDTC/XRE, 101 W D Ave Ste 125, Eglin AFB FL 32542-5495

Phone	DSN: 872-9650	Commercial	(904) 882-9650
Fax	DSN: 872-9361	Com Fax	(904) 882-9361

A3.2.3. AFI 99-103 requires EW Single Managers and Program Managers to contact the EW SFTC for T&E planning support. This is especially important: 1) if your EW test program is a new start and has a Program Management Directive (PMD) or 2) if you are writing or revising a Test and Evaluation Master Plan (TEMP). Working with the EW SFTC should save you considerable time and effort and help you get your test planning started early and in the right direction. Later, when you have a Responsible Test Organization (RTO) designated, such as a test wing, squadron or test facility, they will be working with you on detailed test plans and directives and specific test support needs. SFTCs will typically provide test planning services during the early phases of new programs or the early phases of modifications and Pre-Planned Product Improvement (P3I) programs as shown in figure 3.3. Once initial T&E planning is completed, the role of the SFTC will diminish to the role of test cognizance and support of the RTO, as requested. After the program completes a test phase, the SFTC reviews the planned versus the actual test conducted for lessons learned.

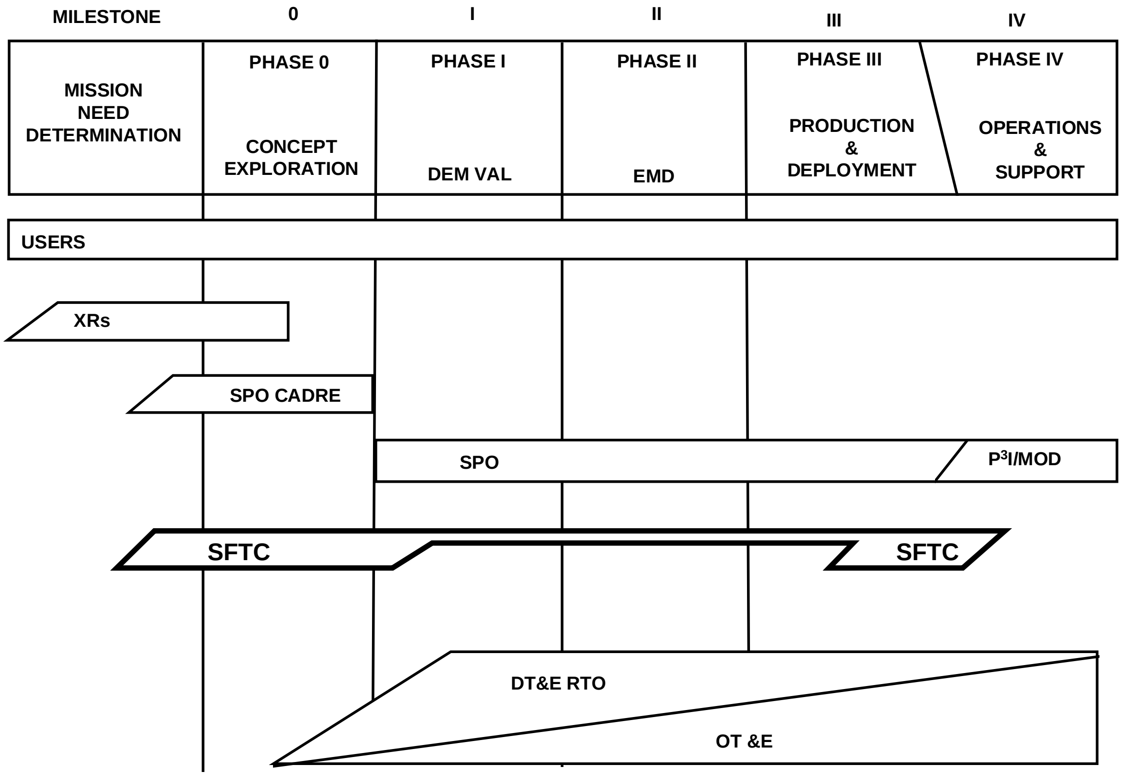

Figure 3.3. SFTC Initial T&E Support - New Programs & Phase IV Modifications.

A3.3. Responsible Test Organization (RTO). Upon designation of an RTO, test planning assistance transitions from the EW SFTC to the RTO. The RTO is the lead organization for designing and conducting all or assigned portions of your test program. The RTO will help prepare and update the TEMP or test section of the Program Management Plan, and the RTO will plan, program, budget, and manage test support resources. Thus, it is imperative that the RTO understand and implement the EW T&E Process into your test program. During the lifetime of a system, different RTOs may be needed for specific tests; however, you will only have one RTO for each major test at a given time. Examples of DT&E RTOs are the 412 Test Wing at Edwards AFB and the 46 Test Wing at Eglin AFB.

A3.4. Participating Test Organization (PTO). A PTO performs a portion of a program's DT&E or OT&E, as determined by the program office, RTO, or OTA. A PTO, if needed, is selected for its specific knowledge or capability to plan, support, or conduct a portion of the overall test program. PTOs collect, reduce, analyze, and evaluate data associated with their part of a test program and send a report or data package to the RTO, program manager or OTA. AFDTC, AFFTC and RL are the usual RTOs and PTOs for Air Force EW T&E programs.

A3.5. Air Force Development Test Center (AFDTC) Eglin AFB FL. AFDTC oversees the activities of the 46 Test Wing and the 46 Test Group. The 46 Test Wing, located at Eglin, is responsible for the testing of electronic warfare, electro-optical, intrusion and interdiction systems. Test resources include the Air Force Electronic Warfare Evaluation Simulator (AFEWES) and Real-Time Electromagnetic Digitally Controlled Analyzer Processor (REDCAP) and the Guided Weapons Evaluation Facility (GWEF) hardware-in-the-loop facilities, the Advanced Seeker Evaluation Test System (ASETS) airborne testbed, the Preflight Integration of Munitions and Electronic Systems (PRIMES) installed system test facility, and the Electromagnetic Test Environment (EMTE) open air test range. AFEWES, located at Fort Worth, Texas, provides a closed-loop, man-in-the-loop test capability for effectiveness evaluation of EW systems against terminal threats. REDCAP, located in Buffalo, New York, provides a closed-loop, man-in-the-loop test capability for effectiveness evaluation of EW systems against early warning, acquisition, tracking, ground control intercept, battle management, and C3 threats. The ASETS aircraft, located at Eglin is used to perform captive multi-spectral seeker evaluations and both spectral and spatial measurements of ground/airborne targets and countermeasures.

A3.5.1. The 46 Test Group, located at Holloman AFB, New Mexico, operates and manages the Radar Target Scatter (RATSCAT) facility and the RATSCAT Advanced Measurement System (RAMS). RATSCAT is the DoD center of expertise for monostatic and bistatic radar cross-section (RCS) measurements of aircraft, spacecraft, unmanned vehicles, and decoys. The RAMS is used for performing RCS measurements on very low observable test articles.

A3.6. Air Force Flight Test Center (AFFTC), Edwards AFB CA. The AFFTC oversees the activities of the 412 Test Wing, the 545 Test Group, and the Nellis Range Complex. The 412 Test Wing, located at Edwards AFB, California, is responsible for the Air Force DT&E flight testing of aircraft systems; supports IOT&E and FOT&E flight tests; and develops, operates, and maintains test facilities used to support flight testing. These include the Avionics Test and Integration Complex (ATIC) located at Edwards, which contains the Benefield Anechoic Facility (BAF), the Integration Facility for Avionic Systems Testing (IFAST), and the Test and Evaluation Mission Simulator (TEMS). Some of its EW-related flight test resources are the ECCM-Advanced Radar Testbed, ECM testbed aircraft (C-135s) ECM target aircraft (T-39s), and the Big Crow and Little Crow aircraft operated for the US Army.

A3.6.1. The 545 Test Group includes the 6501 Range Squadron at Hill AFB, Utah, which manages the Utah Test and Training Range (UTTR) and operates and maintains the UTTR facilities and equipment. The Nellis Range Complex has an Open Air Range capability for EW flight testing. For information regarding this capability contact the EW SFTC office.

A3.7. Rome Laboratory (RL), Griffiss AFB NY. Rome Laboratory plans and executes Air Force exploratory and advanced development programs for electromagnetic intelligence techniques, for reliability and compatibility of electronic systems, communications, and for information displays and processing. It provides technical and management assistance to support studies, analyses, development planning activities, acquisition, test evaluation, modification, and operation of aerospace systems and related equipment. EW related test resources available at Rome Laboratory include the Newport and Stockbridge Antenna Measurement and Analysis Facilities, the Verona Precision Airborne Antenna Measurement System (PAMS) and the Electromagnetic Environmental Effects Research Center (E3RC).

A3.8. Operational Test Organizations. Each Service has a designated Operational Test Agency (OTA) to perform operational test and evaluation on major programs. The OTAs were established by Congress to insure that testing was conducted under realistic conditions, to user requirements, prior to a production decision. Some programs are delegated to major commands (MAJCOM) for testing. MAJCOMs maintain individual test organizations to conduct Follow-on Operational Test and Evaluations (FOT&Es) on less-than-major programs. Typical OTAs are the Air Warfare Center (AWC) at Eglin AFB and the Air Force Operational Test and Evaluation Center (AFOTEC) at Kirtland AFB. For FOT&E, OTAs can delegate the testing to an organization like the 57th FWW at Nellis AFB, a test squadron like the 513th ETS at Offutt AFB, or a guard or reserve unit. Air Force OTAs are described below.

A3.8.1. **Air Force Operational Test and Evaluation Center (AFOTEC), Kirtland AFB NM.** The Air Force Operational Test and Evaluation Center (AFOTEC) is a direct reporting unit, independent of acquisition and operational commands, that plans and conducts realistic, objective, and impartial operational test and evaluation (OT&E)* to determine the operational effectiveness and suitability of Air Force systems and their capability to meet mission needs. Results are reported directly to the Air Force Chief of Staff. AFOTEC has primary responsibility for EW Test Process implementation during IOT&E, QOT&E and FOT&E when directed by HQ USAF/TE. AFOTEC responsibilities are stated in AFI 99-102, *Operational Test and Evaluation.* The following are representative AFOTEC EW T&E Process responsibilities.

Assist the user/operating command in the development of reasonable and achievable operational evaluation criteria that are based on valid user requirements.

Evaluate and report on system operational effectiveness and operational suitability.

Plan and conduct OT&E in accordance with the EW T&E Process.

Serve as a member of the TPWG.

Prepare the OT&E section of the TEMP if designated as the OTA.

Act in an advisory capacity to HQ USAF/TE on all matters affecting the conduct of OT&E and the maintenance of AF test infrastructure.

NOTE: An OT&E can be either an IOT&E, QOT&E or FOT&E. OT&E is planned and conducted in accordance with DoDI 5000.2., Defense Acquisition Management Policies and Procedures.

A3.8.2. **USAF Air Warfare Center (USAFAWC), Eglin AFB FL.** USAFAWC is involved in the following ways with EW T&E.

A3.8.2.1. **Mission Data.** USAFAWC has total mission data responsibility for EW systems on all Air Combat Command (ACC) aircraft. This includes conducting tests, both laboratory and flight, verifying that mission data changes perform as required and that no unintentional changes were introduced. Mission data are the threat parametric information that is stored in the reprogrammable data bases of EW systems. The most critical EW responsibility of USAFAWC is the production, generation, and testing of this mission data for fielded EW systems.

A3.8.2.2. **Operational Flight Programs.** USAFAWC identifies the need to change Operational Flight Programs (OFP) in EW systems. After approval by HQ ACC, needed changes go to AFMC for engineering action. After AFMC completes any required DT&E, USAFAWC subjects the new OFP to a thorough FOT&E prior to its release to the field.

A3.8.2.3. **IOT&E and QOT&E.** ACC uses USAFAWC as its technical focal point for EW OT&E. However, HQ AFOTEC is responsible for all IOT&E/QOT&E. USAFAWC often supports HQ AFOTEC in the IOT&E and QOT&E of EW systems. This assistance can be in the form of technical assistance during the planning phase or the assignment of USAFAWC personnel to the AFOTEC test team.

A3.8.2.4. **FOT&E.** ACC directs USAFAWC to conduct FOT&Es on fielded EW equipment that has undergone major hardware or software changes.

A3.8.2.5. **Foreign Materiel Exploitation.** USAFAWC conducts special EW test projects to determine the effectiveness of US EW systems against foreign assets.

A3.8.2.6. **Operational Demonstrations.** USAFAWC conducts early demonstrations of emerging EW technologies that seem to hold promise for increased EW effectiveness. These EW tests support the development of Operational Requirement Documents (ORDs) and Cost and Operational Effectiveness Analysis (COEAs) documents long before these technologies are developed into formal acquisition programs.

A3.8.2.7. **Tactics Development and Evaluation.** ACC directs USAFAWC to conduct EW tests on new tactical concepts developed for fielded EW systems. These concepts result from new ideas for employment, from changes in the threat environment, and from recommendations in FOT&E reports.

A3.8.3. **Air Force Special Operations Command (AFSOC) 18th Flight Test Squadron Hurlburt Fld FL.** AFSOC 18 FTS conducts operational tests and evaluations and logistics service tests, and participates in joint service test projects. They also support AFOTEC in the IOT&E and QOT&E of EW systems. The EW division participates in DT&E to make early operational assessments of systems and equipment under development. The EW division directs, conducts, and monitors OT&E and foreign military exploitation programs of new and modified systems and equipment. They prepare and conduct briefings on test accomplishments and developments. The EW division proposes recommendations to improve doctrine, operational concepts, requirements, tactics, techniques, and procedures for the employment of electronic warfare systems on all special mission aircraft.

A3.8.4. **USAF Mobility Center (USAFMC), Charleston AFB SC.** USAFMC plans and executes EW tests for Air Mobility Command (AMC). They conduct follow-on operational test and evaluation (FOT&E) of EW systems on airlift and tanker aircraft. USAFMC uses DOD test ranges and facilities for their EW tests. Their test aircraft come from the AMC operational fleet. They have no dedicated test aircraft, no organic EW assets, and no test and measurement equipment.

A3.9. Air Force Information Warfare Center (AFIWC), Kelly AFB TX. The EC Validation Branch, AFIWC/EAMV, performs electronic warfare validation of Aircrew Training Devices (ATDs). This office ensures that EW portions of ATDs accurately represent the real-world and meet the developer’s conceptual description and specifications.

A3.9.1. AFIWC/EAMV performs the following functions. Reviews and comments on system requirements documents during acquisition; Participates in contractor source selection and system design reviews; Participates in acceptance and operational testing; Performs threat data base verifications in conjunction with system development and reviews data bases for currency on existing ATDs and participates in recurring testing following operational employment and system modifications.

A3.9.2. The EC Engineering Branch, AFIWC/EAME, maintains a mobile EC test and measurement capability that covers 0.3 - 40.0 GHz. EAME provides unbiased measurement and analysis support for US EW-related weapon systems, as well as tactics and training development for Air Force and DoD test programs.

A3.9.3. EAME responds to requests for measurement from Air Force EW equipment development and test agencies, system users, and exercise planners. This test and measurement function uses the SENSOR ARROW measurement equipment to collect free space emissions and EW equipment responses from airborne platforms and threat radars. EAME also provides independent analysis, data reduction and reporting.

A3.10. National Air Intelligence Center (NAIC), Wright-Patterson AFB OH. NAIC provides scientific and technical information on threat systems to be faced by a USAF EW system from the beginning of the system's existence and throughout its entire life cycle. During initial concept and early system development, NAIC provides threat definition to Government and contractor organizations by identifying specific threat systems and their capabilities. NAIC also uses threat definitions to validate threat simulators at specific points during their acquisition and later operational use.

A3.10.1. Throughout development and test, NAIC continues to provide threat support through continued participation in threat working groups, providing briefings and specialized reports, and by inputting to, producing, or commenting on System Threat Assessment Reports (STARs). In the operational phases of an EW systems' life, NAIC provides Electronic Warfare Integrated Reprogramming (EWIR) database products, and provides briefings and documents relating to specific worldwide threats.

A3.10.2. NAIC can also provide Electromagnetic Intelligence (ELINT) and threat laydown information, both of which are used in EW T&E.

A3.11. Crossbow (DIA, MSIC/MSC-6D), Redstone Arsenal AL. CROSSBOW is an office established for the common development of threat radar simulators used in support of electronic warfare systems development. The acronym stands for Construction of a Radar to Operationally Simulate Signals Believed to Originate Worldwide. CROSSBOW operates as a Tri-Service committee that is the technical support arm of the DoD Executive Committee on Threat Simulators (EXCOM).

A3.11.1. EXCOM is chartered to provide program management, policy, guidance, and program approval for all DoD development and acquisition programs for hardware simulators, emitters, software simulators, hybrid representations and surrogates of threat weapon systems. CROSSBOW functions include assuring that simulators and simulations are consistent with DIA threat estimates and that validation procedures are being followed.

A3.11.2. Test and training threat simulator projects valued at one million dollars or more in a single year, or with a total project value of five million dollars or more, require CROSSBOW and EXCOM approval prior to obligation of funds.

A3.12. DoD Electromagnetic Compatibility Analysis Center (ECAC) Joint Spectrum Management Center, Annapolis MD. ECAC is a joint DoD center that provides advice and assistance on Electromagnetic Compatibility (EMC) and other Electromagnetic Environmental Effects (E3) matters to the Secretary of Defense, the Joint Chiefs of Staff, the Services, and other DoD components and departments of the US Government. ECAC provides EMC engineering and analysis support to spectrum-dependent system developers, managers, and operators throughout the life cycle for systems operating from the Very Low Frequency (VLF) to the Electro-Optical (E-O) and Infra-Red (IR) frequency bands.

A3.12.1. ECAC capabilities include test planning and analyses with an emphasis on Modeling and Simulation (M&S) for pre-test prediction of test outcomes and for efficiency in test planning. Using a myriad of EMC-related databases and automated modeling capabilities, analysis provides data on EMC at the intrasystem, intersystem, and system-to-environment levels. ECAC serves as the DoD repository for EMC and EMC-related databases. These encompass electromagnetic environmental data, electro-optical and equipment technical characteristics data, frequency assignment data, space system orbital data, tactical deployment data, and topographic data.

A3.12.2. ECAC possesses automated EMC M&S capabilities that range from antenna and propagation models to terminal-device-performance models. ECAC's M&S of electromagnetic interactions begins at the basic component level, extends to the intra- and intersystem levels, and to the system-to-environment level; that is, system effectiveness in the intended operational electromagnetic environment.

A3.13. EW Product Group Manager (EW PGM), Robins AFB GA. The test customer will frequently be one of the AFMC EW program offices working for the EW PGM. USAF EW programs are primarily managed at the Warner Robins Air Logistics Center (WR-ALC) at Robins AFB GA, and the Aeronautical Systems Center (ASC) at Wright-Patterson AFB OH.

A3.13.1. The EW PGM at WR-ALC is the EW Single Manager responsible for all planning, development, and sustainment activities for EW systems. The EW PGM reports to the Commander WR-ALC, who is the Designated Acquisition Commander (DAC). The EW Development System Manager (EW DSM) is located at ASC/RWW and is responsible for assigned development programs. The EW DSM at WPAFB reports to the EW PGM at Robins AFB.

A3.13.2. EW program offices must have T&E information to prove they have met the performance and operational requirements of the user. They will generate TEMPs, and test plans that follow the EW T&E Process.

A3.14. Air National Guard and Air Force Reserve Test Center (AATC), Tucson, AZ. The AATC conducts IOT&E and QOT&E as delegated by AFOTEC for Air National Guard and Air Force Reserve electronic warfare systems.

EW T&E CATEGORIES AND FACILITIES

A4.1. Introduction. This attachment provides general information on DoD EW test categories and associated resources for use in implementing the EW T&E Process. The resources are grouped by the six test categories defined in paragraph 6. Additional information on each resource may be obtained from the appropriate POC identified below, from the EW Single-Face-To-Customer office, the TECNET database, or from the AFOTEC ATRIS database. Table 4.1. is a summary chart showing the primary resource category for each facility and secondary categories if a facility has capabilities in more than one. The following information was provided by the respective organizations. The purpose of this attachment is to provide overview information before test facility decisions are made.

A4.2. Modeling And Simulation (M&S). The modeling and simulation capabilities within the Air Force are distributed, specialized and application specific. No common architecture exists although there are several efforts under way to provide collaboration among the Services and reduce duplication of effort. Current capabilities include six degree-of-freedom models of missiles, AAA projectiles, RCS prediction, survivability, flare trajectory, radar operator consoles, acquisition radars, target and missile tracking radars, guidance computers, seekers, autopilots, and fire control systems. They also include digital simulations of aircraft flight controls, cockpit and weapons displays, integrated air defense systems and command and control systems. For compatibility analyses there are electromagnetic interference, electromagnetic compatibility, and electromagnetic performance models. The primary OSD activity in common architecture development is the Joint Modeling and Simulation System (J-MASS) program described below.

A.4.2.1. **Joint Modeling And Simulation System (J-MASS).**

Location: Wright-Patterson AFB OH

Operated by: ASC/XR

Resource Category: Modeling and Simulation

Purpose: To replace the present piecemeal, duplicative development of models and simulation capabilities with a standard modeling architecture and simulation support system within the DoD. J-MASS is a software development program. With J-MASS, users will be able to run standardized architecture M&S software on off-the-shelf, desk top, engineering work stations available from a variety of manufacturers.

Capability: J-MASS will support trade-off analysis (COEAs, etc.) and simulations in the research, development, testing, intelligence, and user communities as well as across the entire acquisition process. J-MASS is composed of a Simulation Support Environment (SSE) and a Modeling Library. The SSE is the heart of J-MASS and enables the user to create models, configure scenarios, execute simulations, and analyze results. The Modeling Library will contain models and model components of weapon systems, friendly and threat systems and environmental effects provided by the scientific community. Model developers will be able to use J-MASS, then populate the Library with their models for use by other users and developers

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Table 4.1. Test Resource Categories.

Resources	Organizations	M&S	SIL	HITL	ISTF	OAR	MF
JMASS	ASC/XR	Primary					
SIMVAL	NAIC	Primary		Secondary	Secondary	Secondary	
ECSRL*	WL	Primary					
SURVIAC	WL/FIVS	Primary					
EMI/EMC/EME	DOD ECAC	Primary		Secondary			Secondary
IDAL*	WL		Primary	Secondary			
EWAISF	WR-ALC		Primary				
IFAST	412TW		Primary				
AFEWES	46TW			Primary			
REDCAP	46TW			Primary			
GWEF	46TW	Secondary		Primary			Secondary
RTF	84TS			Primary		Secondary	Secondary
PRIMES	46TW			Secondary	Primary		
BAF	412TW			Secondary	Primary		
ACETEF	NAVY			Secondary	Primary		
EMTE	46TW					Primary	
MORTE	46TW					Primary	
UTTR	545TG					Primary	
TFWC	554RG					Primary	
ECR	NAVY					Primary	
ABN TST BEDS	46TW and 412TW			Secondary		Primary	Secondary
HIGH SPD TRK	46TG					Primary	Primary
RATSCAT	46TG						Primary
RAMS	46TG						Primary
NWPRT RES FAC	RL						Primary
STOCKBRIDGE RES FACILITY	RL						Primary
PAMS	RL						Primary
E3RC	RL						Primary

Primary Category   Secondary Category   *Primarily used for 6.2/6.3 Technology Dev Programs

Models will be well documented, readily transportable, and reusable. Users will be able to configure and execute scenarios using various models from the Library to meet specific requirements, then do post processing to analyze the results. J-MASS will support simulations at multiple and mixed levels of fidelity and complexity.

For more information contact: ASC/XR, Wright-Patterson AFB OH
DSN: 785-3969 or Commercial: (513) 255-3969

A4.2.2. **Threat Simulator Validation (SIMVAL).**

Location: Wright-Patterson AFB OH

Operated by: NAIC/TANV

Resource Category: Modeling and Simulation

Purpose: To validate Red, Blue, or Gray electronic warfare threat simulators. SIMVAL can provide capability and limitation information on individual threat simulators, such as a simulated air defense site (e.g. SADS VIII), or on a complex ground simulator such as a man-in-the-loop integrated air defense system (e.g. AFEWES). SIMVAL can be used to evaluate a current operational EW simulator or a future one being developed.

Capability: Outputs of the SIMVAL process are reports. For an EW simulator in an early design phase, the product is a Letter Design Specification Validation Report (LDSVR). It compares the specification to currently available intelligence on the threat. When an EW threat simulator nears completion of detailed design a Letter Design Validation Report (LDVR) will recommend design changes needed to make the simulator a more realistic representation of the threat.

Acquisition validation takes place after the simulator has been built and fully tested. The Acquisition Validation Report (AVR) compares the measured performance of the simulator to the current DIA-approved threat. The AVR is an important tool for the threat simulator user because it points out limitations in simulator performance that can effect EW test scenarios. Once a simulator is in the field, SIMVAL is used for operational validations on a periodic basis or whenever intelligence updates warrant. An Operational Performance Validation Report (OPVR) describes significant differences resulting from changes in the threat or the simulator's performance and assesses the impact on EW testing.

For more information contact: NAIC/TANV, Wright-Patterson AFB OH
DSN: 787-3255 or Commercial: (513) 257-3255

A4.2.3. **Electronic Combat Simulated Research Laboratory (ECSRL).**

Location: Wright-Patterson AFB OH

Operated by: WL/AAWA-1

Resource Category: Modeling and Simulation

Purpose: To conduct initial M&S research in support of Wright Laboratory's exploratory and advanced development Electronic Warfare and Electronic Combat programs that develop requirements and technology for electronic warfare equipment.

Capability: The ECSRL is a 7500 square foot TEMPEST facility with data processing hardware and electronic instrumentation equipment. It provides an Electronic Warfare Modeling and Simulation (M&S) capability for developing and evaluating electronic warfare requirements and models. The facility is capable of three levels of digital simulation: one-on-one, one-on-many, and campaign level (many-on-many). It is primarily used for Wright Laboratory in-house research.

For more information contact: WL/AAWA, Wright-Patterson AFB OH
DSN: 785-4429 or Commercial: (513) 255-4429

A4.2.4. **Survivability/Vulnerability Information Analysis Center (SURVIAC).**

Location: Wright-Patterson AFB OH

Operated by: Booz-Allen & Hamilton Inc. for Wright Laboratories

Resource Category: Modeling and Simulation

Purpose: To provide the DoD survivability/lethality community with computer modeling services that include model distribution and expert support. Provide a centralized information resource for all aspects of nonnuclear survivability, lethality, and munitions effectiveness activities.

Capability: SURVIAC maintains computer models, libraries, methodologies, and databases and disseminates information and models to U.S. Government organizations and their contractors. SURVIAC has models that address engagement functions such as exposure, detection, track, launch and guidance, damage assessment, and failure analysis. SURVIAC analysts provide installation advice and user guidance in such areas as model applications, algorithms, limitations and options.

For more information contact: WL/FIVS/SURVIAC, Wright-Patterson AFB OH
DSN: 785-4840 or Commercial: (513) 255-4840

A4.2.5. **DoD Electromagnetic Compatibility Analysis Center (ECAC) Joint Spectrum Management Center.**

Location: Annapolis MD

Operated by: Department of Defense

Resource Category: Modeling and Simulation

Purpose: To promote electromagnetic compatibility between electromagnetic dependent systems within the DoD and between DoD and civil systems. ECAC capabilities include test planning and analyses with an emphasis on M&S. ECAC environmental models are used to define theater-specific and scenario-specific electromagnetic environments (EMEs) to define/limit bench test, flight test, and anechoic chamber test parameters for efficiency in test planning and for pre-test prediction of test outcomes. The EMEs are also input to ECAC system-level models and simulations to predict the operational effects of any proposed design changes and to analyze integration issues such as antenna location and the effects of blanking. Collected test data is utilized to calibrate and validate the system-level models that are then used to extrapolate limited test data to large-scale scenarios to support Cost and Operational Effectiveness Assessments (COEAs) and other acquisition milestones.

Capability: ECAC hosts a myriad of EMC-related databases and automated M&S capabilities plus a trained staff. ECAC also maintains a state-of-the-art measurement facility featuring over 2,700 sq. ft. of electromagnetically shielded enclosures that are certified and meet TEMPEST requirements. The measurement facility has provided analysis and measurement support to many DoD projects, including hardware-in-the-loop effects testing of Joint Tactical Information Distribution System (JTIDS) signal sources to air traffic control (ATC) receivers.

For more information contact: DoD ECAC/CF, Annapolis MD
Commercial: (410) 293-2681

A4.3. System Integration Laboratories (SIL). The test resources categorized under integration laboratories are the Integrated Defensive Avionics Lab (IDAL), the Electronic Warfare Avionics Integration Support Facility (EWAISF) and the Integration Facility for Avionic Systems Testing (IFAST). Each of these are discussed in the following sub-sections.

A4.3.1. **Integrated Defensive Avionics Lab (IDAL).**

Location: Wright-Patterson AFB OH

Operated by: WL/AAWA-2

Resource Category: SIL

Purpose: To provide an Electronic Warfare integration and evaluation capability for current and future defensive avionics systems, concepts, and subsystems.

Capability: IDAL supports both open-loop and closed-loop testing by providing a reconfigurable hardware/software simulator capability for conducting man/hardware-in-the-loop evaluations. IDAL consists of the following components: Multispectral Environment Generator (MSEG), Multispectral Electronic Combat Testbed (MSECT), Crew/Vehicle Interface (CVI), Threat Simulators (TS) and Composite Mission Simulator (CMS). The real-time man/hardware-in-the-loop interaction capability is formed by appropriately linking the MSEG, MSECT, CVI, TS and CMS components in an integrated configuration through the Simulation Support Environment (SSE). The IDAL is utilized to develop/evaluate electronic warfare technology such as radar warning receivers, jammers, techniques, processors and integration concepts/approaches.

Multispectral Environment Generator (MSEG). The MSEG has the Dynamic Electromagnetic Environment Simulator (DEES) and Combat Electromagnetic Environment Simulator (CEESIM) for generating both digital and RF dense threat radar pulse environments. The MSEG also has the Infrared Scene Generator (IRSG) for generating, digitally, the infrared threat environments.

Multispectral Electronic Combat Testbed (MSECT). The MSECT has operational systems as testbeds for EW technology development and transition. The planned operational testbeds are the ALR-46, ALR-56A/C/M, ALR-69, ALQ-131, ALQ-135, ALQ-153, ALQ-165, ALQ-172, ALQ-184, AAR-44, and AAR-47. In addition, MSECT has host processors and digital emulations for development/evaluation of processing technology such as data fusion for situation awareness and Real-Time Information in the Cockpit (RTIC).

Crew/Vehicle Interface (CVI). The CVI links the defensive avionics in IDAL to the crew and other aircraft avionics. The CVI provides the capability for the crew to interact with the defensive avionics and threat systems for real-time man/hardware-in-the-loop operation in realistic electronic combat environments.

Threat Simulators (TS). The TS has the Electronic Defense Evaluator (EDE) for evaluating electronic countermeasures. The EDE is a generic threat radar simulator that can be operated in an automatic and/or man-in-the-loop mode. The TS also has the Anti-Radiation Missile Simulator (ARM) for evaluating ARM countermeasures.

Composite Mission Simulator (CMS). The CMS has the Tactics and Engagement Evaluator (TEEVAL), which is SUPPRESSOR, with a software shell around it that allows control of the penetrating aircraft and extraction of engagement actions/results. The CMS provides the capability to execute a mission with realistic interactions between the penetrator and the threat environment. The CMS enables real-time man/hardware-in-the-loop interaction with the threat scenario.

Simulation Support Environment (SSE). The SSE provides the non real-time and real-time executive to setup and link the IDAL simulators and testbeds for man/hardware-in-the-loop capability to realistically interact with the threat environment.

For more information contact: WL/AAWA-2, Wright-Patterson AFB OH
DSN: 785-4265 or Commercial: (513) 255-4264

A4.3.2. **Electronic Warfare Avionics Integration Support Facility (EWAISF).**

Location: Robins AFB GA

Operated by: WR-ALC/LN

Resource Category: SIL

Purpose: To provide a Level I (engineering) and Level II (platform) support facility for, operations and support of AF airborne electronic warfare systems.

Capability: The EWAISF is used for the following tasks:

Analyze, design, development, test and distribution activities in support of peacetime and wartime software changes for USAF reprogrammable EW systems.

Analysis, design, development, test and distribution activities in support of EW reprogramming tools and EW mission data generators.

Logistical support activities for EW systems such as: ALR-46, ALR-69, F-15 TEWS, ALQ-131, ALQ-184, ALQ-99E, ALR-62, APR-47, ALQ-155, ALQ-172, ALQ-161, ALE-45, APM-427, USM-464, APR-39, ALQ-162, and others as assigned by PMD direction.

Analysis, design, development, test and distribution activities in support of peacetime and wartime software changes for USAF reprogrammable EW systems sold to foreign countries.

The EWAISF has the following:

Over 30 Integrated Support Stations (ISSs).

Over 28 hybrid simulators of emitter classification (electromagnetic environment generators).

Various EW system analysis tools.

For more information contact: WR-ALC/LNEV, Robins AFB GA
DSN: 468-3691 or Commercial: (912) 926-3691

A4.3.3. **Integration Facility for Avionic Systems Testing (IFAST).**

Location: Edwards AFB CA

Operated by: 412 TW/TSW

Resource Category: SIL

Purpose: To perform radar and integrated avionics ground test and evaluation, to verify functional performance, avionics and weapons integration, and software changes.

Capability: Six shielded bays for avionics spread bench testing.

Single and multiple sub-system and integrated offensive and defensive avionics testing.
Radar jamming--signal insertion and external transmission (fixed and airborne pods), for defensive avionics transmission and reception.

For more information contact: 412 TW/TSW, Edwards AFB CA
DSN: 527-5404 or Commercial: (805) 277-5404

A4.4. Hardware-In-The-Loop (HITL). This test facility category includes the Air Force Electronic Warfare Evaluation Simulator (AFEWES), the Real-Time Electromagnetic Digitally Controlled Analyzer Processor (REDCAP), the Guided Weapons Evaluation Facility (GWEF) and the Radar Test Facility (RTF).

A4.4.1. **AF Electronic Warfare Evaluation Simulator (AFEWES).**

Location: Air Force Plant 4, Fort-Worth TX

Operated by: Contractor for 46TW

Resource Category: HITL
Purpose: To provide a high density signal environment in a secure facility and to test ECM techniques during DT&E/OT&E using manned threat simulators.

Capability: Can test systems, sub-systems, and brassboards during different phases of system development to reduce flight test requirements. RF signals are controlled to simulate effects of range and aircraft movement.

Can measure effectiveness in terms of: Tracking error, Missed distance, Pk (Probability of Kill), and Ps (Probability of Survival).

Can generate the following threats: AI--Airborne Interceptor, SAM--Surface to Air Missiles, GCI/ACQ Radar--Ground Control Interceptor/Acquisition Radar, IR--Infrared, and AAA--Anti-Aircraft Artillery.

Can operate in open loop and closed loop modes.

For more information contact: 46 TW/TSWW, Eglin AFB FL
DSN: 872-3410 or Commercial: (904) 882-3410

A4.4.2. **Real-Time Electromagnetic Digitally Controlled Analyzer Processor (REDCAP).**

Location: Arvin Calspan, Buffalo NY

Operated by: Contractor for 46TW

Resource Category: HITL

Purpose: To provide a real-time, computer controlled, man-in-the-loop hybrid simulator of enemy Integrated Air Defense Systems (IADS) designed to evaluate the operational effectiveness of EC components. Provides simulations of Soviet Union Airborne Warning and Control System (SUAWACS), early warning/ height-finder radars, Ground Controlled Intercept (GCI), and weapon control radars.

Capability: Defensive systems, tactics, jamming techniques, to evaluate countermeasure effectiveness, and perform system studies versus simulations of threat forces.

Can measure effectiveness in terms of: Probability of engagement, probability of survival, radar track history and accuracy, and target and decoy discrimination.

For more information contact: 46 TW/TSWG, Eglin AFB FL
DSN: 872-3410 or Commercial: (904) 882-3410

A4.4.3. **Guided Weapons Evaluation Facility (GWEF).**

Location: Eglin AFB FL

Operated by: 46 TW/TSWG

Resource Category: HITL

Purpose: To develop and evaluate air-to-air and air-to-surface precision guided weapons using digital, hardware-in-the-loop, midcourse and counter-countermeasure simulations. Provides data equivalent to a flight test at a very small fraction of the cost, and with considerably less risk to test assets. Ground tests the complete spectrum of weapon seekers including millimeter wave, laser, infrared, radio frequency, midcourse and electro-optical in one 94,000-square-foot facility.

Capability: Provides weapon systems and subsystems engineering test and evaluation support covering a very large portion of the electromagnetic spectrum. It is designed to support concurrent, classified testing in all its major test areas up through Top Secret, Special Access Required, and limited compartmentalized activities.

The major GWEF test areas are Laser, Infrared, Millimeter Wave, Radio Frequency, Electro-Optical/Visual and Midcourse. Computer-controlled characterization tests measure all the parameters of a seeker, such as field-of-view, sensitivity and threshold.

Counter-countermeasure testing measures a weapon's ability to acquire and guide to a target while surrounded by a countermeasure threat.

Digital and HTIL simulations evaluate weapon performance from launch to intercept.

For more information contact: 46 TW/TSWG, Eglin AFB Fl
Eglin AFB Fl 32542
DSN: 872-9988
Commercial: (904) 882-9988

A4.4.4. **Radar Test Facility (RTF).**

Location: Tyndall AFB FL

Operated by: 84 Test Squadron

Resource Category: HITL

Purpose: To provide OT&E support of F-15/16 radar ECCM.

For more information contact: 84 Test Squadron/DOR, Tyndall AFB FL
DSN: 523-2018 or Commercial: (904) 283-2018

A4.5. Installed System Test Facilities (ISTF). Installed System Test Facilities include the Preflight Integration of Munitions and Electronics Systems (PRIMES) Facility, the Benefield Anechoic Chamber (BAF), and the Navy Air Combat Environment Test and Evaluation Facility (ACETEF).

A4.5.1. **Preflight Integration Of Munitions And Electronics Systems (PRIMES) Facility.**

Location: Eglin AFB FL

Operated by: 46 TW/TSWW

Resource Category: Installed System Test Facility

Purpose: To provide a realistic RF environment, both hostile and friendly, for testing systems in both the installed and uninstalled configuration. A test environment can also be provided using a distributed test capability utilizing the PRIMES/GWEF Link to provide laser, infrared, millimeter wave, radio frequency, electro-optical and visual stimulation to the system under test.

Capability: The PRIMES Facility provides a fighter-size anechoic chamber as well as two hangar stations, flexible laboratory space, and a ramp area for large aircraft tests.

System/sub-system testing in hot bench screen rooms, including 4300 sq ft of TEMPEST/shielded floor space (not including shield modules). Screen rooms may interface with the chamber through secure conduit.

Ramp testing for large aircraft supported by mobile simulators and instrumentation with the same RF Capabilities as listed.

The anechoic chamber (108’ X 78’ X 30’) has a 40 ton hoist, a minimum of 100dB isolation across the 0.5-18 GHz frequency band, halon and water fire suppression system, 400Hz/60Hz/28VDC power as well as aircraft support systems (air conditioning, hydraulics, power, cooling, and servo air).

Threat simulations provided from 50 MHz to 18GHz.
Chamber has been characterized at millimeter wave frequencies and sources are available.

Five RF threat simulators capable of generating in excess of 25 million pulses per second.

Three RF systems simulate eight time coincident beams.

Simulation of frequency agile emitters.

Complex threat modes available.

Threat systems are capable of generating signals with terrain occulting.
6174 simultaneous signals available using multiplex techniques. Total number of absolute simultaneous signals available is 66.

More than 70 threat simulations validated. Threat simulation validation performed by the National Air Intelligence Center and the CROSSBOW committee.

In-house noise floor measurement capability provided for each test configuration as required.

Secure fiber-optic link and synchronization and translation equipment support distributed testing with the PRIMES/GWEF Link. Distributed testing allows for flexible reconfigurability supporting tests based on specific requirements.

The Target ECM Generation System (TEGS) provides two free-space air targets with ECM for fire control radar stimulation.

A full Global Positioning System (GPS) simulation capability simulates the entire constellation and provides the dynamic/real-time signal at RF including anti-spoof and selective availability capabilities.

Monitoring/recording of two Pulse Code Modulation channels as well as up to 12 MIL-STD 1553B mux bus data streams.

Modeling and simulation used to provide inertial navigation system and synchronization data injection for coordinated scenario simulation.

Fully secure facility up to Secret/SAR approved and Top Secret upgradeable.

For more information contact: 46 TW/TSWW, Eglin AFB FL
DSN: 872-9354 or Commercial: (904) 882-9354

A4.5.2. **Benefield Anechoic Facility (BAF).**

Location: Edwards AFB CA

Operated by: 412 TW/TSW

Resource Category: Installed System Test Facility

Purpose: To provide realistic, free-space RF environment for evaluation of both uninstalled and installed, federated and integrated avionics and electronic combat systems on single/multiple host platforms.

Capability: The BAF is DoD's largest anechoic chamber (250' x 264' x 70') collocated with air vehicle modeling/simulation (TEMS) and systems integration laboratories (IFAST). The BAF provides:

In excess of 130 db of isolation/attenuation from the outside world.

115 VAC 400 Hz/115 VAC 60 Hz/480 VAC 60Hz power.

Aircraft cooling.
Aircraft hydraulics.

Monitoring/recording of two Pulse Code Modulated and five MIL-STD 1553B mux bus data streams.

The chamber contains an 80 foot diameter turntable and a 40 ton man-rated hoist. The turntable is capable of rotating in excess of a 250,000 pound test article 380 degrees (+/- 190 degrees) with a 0.1 degree positional accuracy. The turntable is capable of rotating at rates varying from 0.1 degrees per second to 0.6 degrees per second. The 40 ton man-rated hoist is capable of lifting test articles as high as 55 feet above the center of the turntable. The hoist has rotational capabilities as well.

The BAF has three threat sites (TS) that house the current threat generation systems. TS 1 houses the Combat Electromagnetic Environment Simulator (CEESIM) 8000 and 14 RF channels. TS 2 and 3 each house two remote CEESIM 8000 controlled channels and one hybrid threat simulator. Some threat generation capabilities are:

Simulates surface based, sea based, and airborne RF threat system signals.

Generates in excess of 64 Million Pulses Per Second (MPPS).

Generates 3-5 MPPS in a coordinated coherent scenario.

Simulates 640 emitters simultaneously at the digital level.

Twenty-two RF hardware channels (22 instantaneous RF signals).

Simulate eight time-coincident beams.

Various Pulse Repetition Intervals.

Various Pulse Widths.

Various Frequency Modulations.

Various Scan and Antenna patterns.

Terrain Occlusion.

Updates eight channels each microsecond.

For more information contact: 412 TW/TSWA, Edwards AFB CA
DSN: 527-5404 or Commercial: (805) 277-5404

A4.5.3. **Air Combat Environment Test and Evaluation Facility (ACETEF).**

Location: NAS Patuxent River MD

Operated by: Naval Air Warfare Center, Aircraft Division

Resource Category: Installed System Test Facility

Purpose: To provide the virtual warfare environment, man-in-the-loop simulation, and multispectral stimulation required for test of uninstalled, installed, and fully integrated mission sub-systems and systems on the ground prior to flight.

Capability: ACETEF is an integrated facility consisting of several laboratories and test sites. Test sites include:

An Integration Test Facility for the test of uninstalled systems connected to ACETEF labs.
The Aircraft Anechoic Test Facility, consisting of an anechoic chamber and shielded hangar. The 100 foot by 60 foot by 40 foot high anechoic chamber provides a noise and reflection free test environment and over 100 dB of isolation from the outside world. The anechoic chamber is accessed through a 40 foot by 20 ft high door. The shielded hangar measures 150 feet by 300 feet and is accessed through a 300 foot by 67 foot high door. It provides 40 dB of attenuation from the outside world. For high power work and those aircraft that will not fit in the hangar or chamber, an adjacent ramp area is available.

ACETEF provides both stimulation and simulation laboratories. Stimulation labs include:

The Electromagnetic Environment Generation System (EMEGS) which provides a high power RF environment for the test of electromagnetic environmental effects.

The Electronic Warfare Integrated Systems Test Laboratory (EWISTL) which provides multispectral open and closed loop stimulation of EW systems.

The Communications, Navigation, and Identification Laboratory (CNIL) which provides stimulation of friendly communication, data link, navigation, and identification systems as well as the stimulation of EW systems related to threat CNI recognition and exploitation.

The Offensive Sensors Laboratory (OSL) is planned to provide multispectral stimulation of aircraft offensive sensors and missile systems. OSL currently provides closed loop stimulation of air-to-air radar and IR systems.

ACETEF simulation laboratories include:

The Manned Flight Simulator (MFS), which provides high fidelity aircraft cockpit simulators for man-in-the-loop testing. MFS test stations include a 40 foot dome, 6-DOF motion base, and two 165 degree by 40 degree development stations.

The Aircrew Systems Evaluation Facility (ASEF) provides rapid prototyping of low fidelity dynamic crew stations for evaluation of man/machine/interface implementations.

The Operations and Control Center (OCC) provides a reactive wargaming environment for the evaluation of operational effectiveness. Other ACETEF laboratories are integrated with OCC to provide sensor-in-the-loop and man-in-the-loop testing in a realistic air combat environment on the ground.

For more information contact: Systems Engineering Test Directorate (SY04A), Patuxent River MD
DSN: 326-6347 or Commercial: (301) 826-6347

A4.6. Open Air Range (OAR). Open air range resources for EW include test ranges and airborne testbeds.

A4.6.1. **Electromagnetic Test Environment (EMTE).**

Location: Eglin AFB FL

Operated by: Air Force Development Test Center

Resource Category: Open Air Range

Purpose: To provide realistic open air threat signals of all types for the test and evaluation of EW system performance and effectiveness. EMTE supports the full scope of development test and evaluation and operational test and evaluation of electronic warfare systems.

Capability: The EMTE has 724 square miles of land ranges, 86,500 square miles of water range, and 46 actual and simulated threat systems located at 22 test sites. The EMTE has IR, EO, and RF equipment operating in different frequency bands and modes to provide a flexible test facility for evaluating electronic warfare (EW) devices and techniques. The EMTE uses actual or simulated air defense systems (SADS) and weapon effectiveness simulated threats (WEST) to provide a terminal threat environment. Mission and test control are managed from a Centralized Control Facility (CCF) where data are recorded and processed for display in real-time. For range control and tracking, real-time data from reference radars (AN/FPS-16s, AN/FPS-13, AN/MPS-19s, and Nike-Hercules) is provided to the CCF. Global Position System (GPS) Time-Space-Position-Information (TSPI) data is also available.

For more information contact: 46 TW/XP, Eglin AFB FL
DSN: 872-5307 or Commercial: (904) 882-5307

A4.6.2. **Multispectral Open Air Test Environment (MORTE).**

Location: Eglin AFB FL

Operated by: 46TW/XP

Resource Category: Open Air Range

Purpose: To provide open air test capabilities for missile warning systems, missile countermeasure systems, and search/track systems and EO and MMW instrumentation systems to support measurement requirements.

Capabilities:

a. The MORTE has four airborne test systems (helicopter, C-130, F-15) and a large number of fixed and mobile systems used to test countermeasure systems, warning systems, search/track systems, and missile guidance systems.

b. A large variety of measurement instrumentation covering EO and MMW spectrums is available to measure aircraft, airborne, and ground simulators, missile radiation, and atmospheric and background effects.

For more information contact: 46 TW/XP, Eglin AFB FL
DSN: 872-5307 or Commercial: (904) 882-5307

A4.6.3. **Utah Test And Training Range (UTTR).**

Location: Utah/Nevada, Hill AFB UT

Operated by: 545 Test Group

Resource Category: Open Air Range

Purpose: To provide test and evaluation of EW systems on manned and unmanned aircraft.

Capability:

UTTR has an instrumented facility to measure threat weapon effectiveness against home-on-emitter EW systems.

For more information contact: 545 Test Group/XRP, Hill AFB UT
DSN: 458-7852 or Commercial: (801) 777-7852

A4.6.4. **Weapons and Tactics Center (WTC).**

Location: Nellis AFB NV

Operated by: 554 Range Group

Resource Category: Open Air Range

Purpose: To provide an operationally oriented, combat-like test range for training and operational test and evaluation.

For more information contact: 554 RG/EN, Nellis AFB NV
DSN: 682-3637 or Commercial: (702) 643-3637

A4.6.5. **Electronic Combat Range (ECR).**

Location: China Lake CA

Operated by: Naval Air Warfare Center--Weapons Division

Resource Category: Open Air Range

Purpose: To provide a range for test and evaluation of airborne electronic warfare devices and systems. Provide threat simulation systems of various types including pulse, CW, and Pulse Doppler systems; with many different angular tracking techniques including multi-object tracking phased array.

Capability: The Electronic Combat Range (ECR) is operated on 900 square miles of land that has 1200 square miles of overlaid restricted airspace (R-2524). It has an extensive instrumentation infrastructure consisting of fiber optics communications, recording, and real time presentation of audio, video and digital data for monitoring the execution of tests against threat simulation systems. Data is centrally collected and presented in the Test Operations Center.

Five Nike Radars (AN/MPQ-45) provide reference tracking data. Also available is Global Position System (GPS) TSPI that provides multilateration range tracking for as many as 25 participants at once.

For more information contact: Code C33 NAWC-WD, China Lake CA
DSN: 437-9197 or Commercial: (619) 939-9197

A4.7. Airborne Testbeds. This section describes airborne testbeds of the 46 Test Wing, and the 412 Test Wing.

A4.7.1. **46 Test Wing.**

The 46 Test Wing, located at Eglin AFB FL, owns, maintains, and flies 28 test aircraft. Included are highly modified and instrumented F-16s, F-15s, F-111s, EF-111s, UH-1s and a C-130. These aircraft have a standard programmable digital instrumentation system and can be used for general mission support or modified for specialized test project requirements.

A4.7.1.1. **Airborne Seeker Evaluation and Test System (ASETS).** ASETS is a modified C-130 aircraft for flight testing infrared and electro-optical seekers against ground and airborne targets and threats. ASETS is capable of carrying various types of instrument sensors, missile seekers and other instruments mounted inside a turret. The turret contains a five-axis, gyro-stabilized platform that maintains a stabilized line of sight to an accuracy of $\pm$ 125 microradians. The turret components include a television camera, an infrared imager, and a laser ranger.

For more information contact: 46 TW/XP, Eglin AFB FL
DSN: 872-5307 or Commercial: (904) 882-5307

A4.7.2. **412 Test Wing.**

The 412 Test Wing, located at Edwards AFB CA, provides highly instrumented uniquely designed aircraft for flight testing a variety of EW systems, sub-systems, and components. The fleet consists of 39 test platforms including: C-135, C-141, T-39, T-37, C-18, and C-21 aircraft. The Test Wing can also perform Class II (RDT&E) modifications to test aircraft.

A4.7.2.1. **Big Crow Aircraft.** The Big Crow aircraft is a large-bodied NKC-135A with an extensive EW suite. It was designed to perform vulnerability investigations on US Army weapon systems. It has several types of emitters, including nose, and tail jamming antennas and upper and lower canoe radomes. The aircraft is based at Kirtland AFB NM.

A4.7.2.2. **Little Crow Aircraft.** Little Crow aircraft consist of two T-39Bs designed to carry EW jammers. They support the US Army's SAM-D susceptibility and vulnerability testing at the White Sands Missile Range. The aircraft are based at Holloman AFB NM.

A4.7.2.3. **ECM Target Aircraft (ETA).** The ETA is a modified T-39B aircraft to serve as a flyable instrumented testbed used in the development of radar ECCM.

A4.7.2.4. **Electronic Counter Countermeasures/Advanced Radar Testbed (ECCM/ARTB).** This specially modified C-141A aircraft is an airborne laboratory for testing current and future airborne radars. Its design incorporates the necessary mechanical and electrical interfaces for APG-63, 66, 68, and APQ-164 airborne radars.

A4.8. Measurement Facilities (MF). This section provides information on the Radar Target Scatter (RATSCAT) facility, the RATSCAT Advanced Measurement System (RAMS), the High Speed Test Track, the Rome Laboratory Newport, Stockbridge and Verona Antenna Measurement and Analysis Facilities and The Electromagnetic Environmental Effects Research Center.

For more information contact: AFFTC/CAS, Edwards AFB CA
DSN: 525-9253 or Commercial: (805) 275-9253

A4.8.1. **Radar Target Scatter (RATSCAT) Mainsite.**

Location: Holloman AFB NM (White Sands Missile Range)

Operated by: 46 Test Group/TGR

Resource Category: Measurement Facility

Purpose: To make laboratory quality monostatic and bistatic radar cross section (RCS) measurements of low observable aircraft and weapon systems. These RCS measurements are used in various stages of DT&E, OT&E and production testing. Typically, the data is used for weapon system development, RCS specification validation (fly-off/buy-off), production line quality control and threat modeling.

Capability: RCS measurements using up to 1024 selected radar frequencies from 150 MHz to 18 GHz can be taken simultaneously using co-polarized and cross polarized antenna. An additional millimeter wave frequency is available at 34-36 GHz. Target amplitude, phase and aspect angles are measured and recorded. RCS amplitude, diagnostic images, Doppler, and glint versus target aspect angle can be provided from the recorded data. Small models weighing a few pounds to large flyable aircraft weighing up to 100,000 pounds can be measured at RATSCAT Mainsite. Additional capabilities include high fidelity RCS model building, and RCS prediction and analysis.

For more information contact: 46 Test Group/TGR, Holloman AFB NM
DSN: 349-3365 or Commercial: (505)679-3365

A4.8.2. **RATSCAT Advanced Measurement System (RAMS).**

Location: Holloman AFB NM (White Sands Missile Range)

Operated by: 46 Test Group/TGR

Resource Category: Measurement Facility

Purpose: To make laboratory quality monostatic RCS measurements of very low observable aircraft and weapon systems. These RCS measurements are used in various stages of DT&E, OT&E and production testing. The data is used for weapon system development, RCS specification validation (fly-off/buy-off) decisions and threat modeling.

Capability: Monostatic RCS measurements in six separate frequency bands, from 120 MHz to 18 GHz can be taken simultaneously using circular, co-polarized and cross polarized antenna. An 35 GHz monostatic system is also available at RAMS. Target amplitude, phase and aspect angles are measured and recorded. Target amplitude, diagnostic images, Doppler, and glint versus target aspect angle can be provided from the recorded data. Small models weighing a few pounds to large aircraft weighing up to 30,000 pounds can be measured at RAMS.

For more information contact: 46 Test Group/TGR, Holloman AFB NM
DSN: 349-3365 or Commercial: (505) 679-3365

A4.8.3. **High Speed Test Track.**

Location: Holloman AFB NM

Operated by: 46 Test Group/TK

Resource Category: Measurement Facility

Purpose: To simulate selected portions of flight environments under accurately programmed and controlled conditions.

Capabilities: Observation and measurement of IR missile warning systems and decoy system performance from missile ejection through separation and flyout.

For more information contact: 46 TG/TK, Holloman AFB NM
DSN: 349-2133 or Commercial: (505)679-2133

A4.8.4. **Newport Antenna Measurement And Analysis Facility.**

Location: (Near) Griffiss AFB NY

Operated by: Rome Laboratory/ERS

Resource Category: Measurement Facility

Purpose: To evaluate on-aircraft antenna/system performance in a far field “freespace ultra low reflection environment.

Capabilities: Newport is a highly instrumented, highly accurate far field elevated antenna measurement and analysis facility capable of on-aircraft evaluation of antennas and antenna systems. Aircraft testbeds (F-16, B-1B F/RF-4, F-15, F/EF-111, A-10 and F-22) can be mounted right side up or upside down on elevated special 3 axis (azimuth over elevation over azimuth) positioners and rotated through a full 360 degrees at elevation angles from -45 degrees to +75 degrees. Cost effective antenna isolation (coupling) measurements and the effects of on-aircraft stores such as missiles, bombs and fuel tanks and structural effects such as advanced composite materials on antenna patterns can be quickly and accurately measured, evaluated and optimized. Systems evaluations such as ECM pods, radar warning receivers, direction finding (angle of arrival accurate to 0.1 degrees) and adaptive nulling systems can be accurately measured across the 100 MHz to 18 GHz frequency range and at spot frequencies in the 18GHz to 60 GHz range.

For more information contact: RL/ERS, Griffiss AFB NY
DSN: 587-4217 or Commercial: (315) 330-4217

A4.8.5. **Stockbridge Antenna Measurement And Analysis Facility.**

Location: (Near) Griffiss AFB NY

Operated by: Rome Laboratory/ERS

Resource Category: Measurement Facility

Purpose: To evaluate antenna system performance and ECM threat response on large airframes (B-52, KC-135, C-130 and B-1B) and to evaluate airborne reconnaissance and targeting sensors.

Capability: The Stockbridge Facility is located atop a 2300 foot hill, 23 miles southwest of Griffiss AFB. A Computer Controlled Antenna Measurement System (CCAMS) composed of antenna pattern measurement Elevation Coverage System (ECS) and ECM system Interrogate Threat System (ITS) are used to evaluate the performance of the large platforms. The CCAMS provides the capability for measuring antenna patterns and antenna isolation (coupling) on large airframes such as the B-52, C-130, KC-135 and B-1B mounted in an upright or up-side down configuration. The ECCM Interrogate Threat Simulator provides a multiple simultaneous interrogate capability to test new electronically steerable antenna systems. Stockbridge also provides a machine shop and sheet metal working facility where airframe modifications can be performed on-site to simulate numerous aircraft types and configurations.

For more information contact: RL/ERS, Griffis AFB NY
DSN: 587-4217 or Commercial: (315) 330-4217

A4.8.6. **Precision Antenna Measurement System (PAMs).**

Location: Verona Research Facility, (Near) Griffiss AFB NY

Operated by: Rome Laboratory/ERS

Resource Category: Measurement Facility

Purpose: To conduct dynamic engineering evaluations of airborne emitters and airborne antenna patterns on in-flight aircraft on a real-time radiated basis corrected with precise aircraft location.

Capability: The Precision Antenna Measurement System (PAMS) is an airborne antenna measurement facility located at the Verona Research Facility. Using the PAMS, antenna patterns of aircraft mounted antennas are measured in actual flight. The PAMS consists of high performance ground based antenna pattern recording system fed by an array of receiving antennas which track the aircraft flight path. The tracking is accomplished by slaving the receive antenna positioner to an FPS-16 precision tracking radar located adjacent to the PAMS facility. Antenna patterns for multiple antennas, at multiple frequencies, can be measured simultaneously during flight test. The pattern data recorded at the PAMS can be radiated power, or power spectral density. The PAMS will measure and record antenna patterns and effective radiated power from airborne and ECM noise emitters in the 0.1 - 18 GHz frequency range.

For more information contact: RL /ERS, Griffiss AFB NY
DSN: 587-4217 or Commercial: (315) 330-4217

A4.8.7. **Electromagnetic Environmental Effects Research Center.**

Location: Griffiss AFB NY

Operated by: Rome Laboratory/ERS

Resource Category: Measurement Facility

Purpose: To provide a unique electromagnetic (EM) simulation and measurement capability to support a broad range of EM technology developments and electromagnetic environmental effects (E3) assessments and to determine the electromagnetic susceptibility/vulnerability (EMS/V) of Air Force mission systems.

Capability: The Electromagnetic Environmental Effects Research Center (E3RC) provides the Air Force with the capability to simulate, measure and improve the EM performance of Air Force weapon, communication, command, control, computer and intelligence systems in the worldwide non-nuclear electromagnetic environments in which these systems must operate. These electromagnetic environments include both hostile and friendly sources such as communications transmitters, radars, jammers, high power microwave (HPM) directed energy sources (i.e. low-speed power microwaves), ultra wideband (UWB) and other electromagnetic sources. The measurement of the electromagnetic susceptibility characteristics allows the Air Force to perform vulnerability assessments of its operational systems. The E3RC also provides a capability to perform a broad range of electromagnetic effects (EME) phenomenology and research investigations of antenna/aircraft EM interactions and EM characterizations of advanced microcircuit devices and technologies. The facility consists of EM simulation and measurements research areas. The simulation area includes computer resources and programs to predict electromagnetic coupling. Intrasystem coupling and isolation can be predicted and measured. The measurement area consists of two EM anechoic chambers, two reverberation chambers, supporting research area, and associated RF source, instrumentation and support equipment. The two anechoic chambers (48 ft x 40 ft x 32 ft and 36 ft x 12 ft x 12 ft) provide a free space electromagnetic environment for detailed evaluation. Two reverberation chambers (32 ft x 17 ft x 12 ft and 3.8 ft x 4.7 ft x 4.9 ft) provide a “quick look”, frequency culling evaluation capability for EMS/V assessments and RF coupling and shielding effectiveness measurements.

For more information contact: RL/ERS, Griffiss AFB NY
DSN: 587-4217 or Commercial: (315) 330-4217

A4.9. Special Access Capabilities And Facilities. There are special access facilities available that have capabilities not found above. Air Force Materiel Command Special Programs Division (AFMC/DOS) WPAFB OH, can provide information/coordination on EW testing capabilities against foreign materiel in an open air environment. AFOTEC/XR has information on the use of special access test resources for operational testing. If you believe your program requires these capabilities contact the EW SFTC first. They will work with you initially and put you in contact with the proper people in AFMC/DOS and AFOTEC/XRR as needed.

A4.10. Other Department Of Defense (DoD) Resources. Information on other Service and DoD test resources can be found in DoD Directory 3200.11-D, Major range and Test Facility Base Summary of Capabilities. This directory has a collation of functional testing capabilities as well as overviews of the mission, location, features, ranges and facilities of each activity. In addition, AFOTEC/XRR maintains the Automated Test Resources Information System (ATRIS), a PC database containing detailed DoD test resource capabilities information.