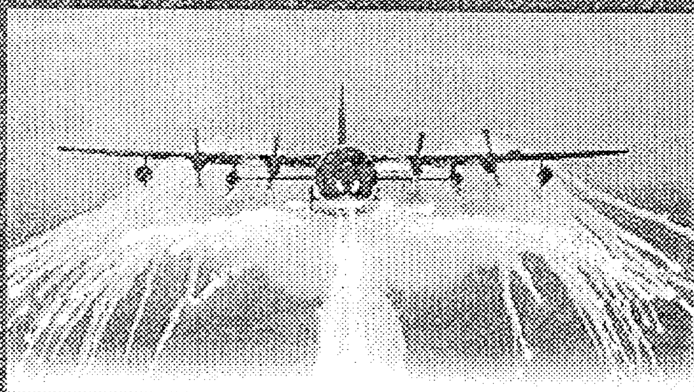
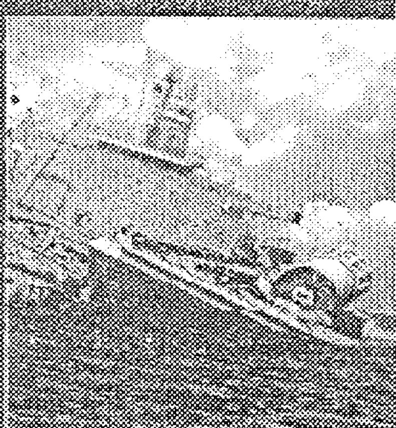
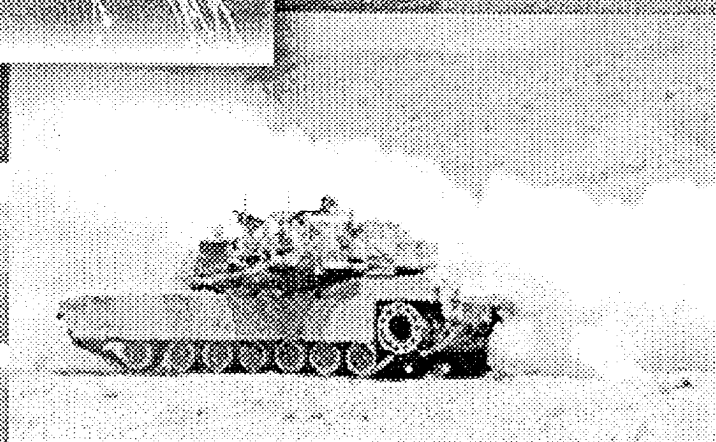
Joint Test & Evaluation







Annual Report

February 1998

JOINT TEST AND EVALUATION PROGRAM ANNUAL REPORT

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THE JOINT TEST AND EVALUATION PROGRAM

1.0 BACKGROUND

1.1 Initiation

In the office of the Under Secretary of Defense for Acquisition and Technology, the Director, Test, Systems Engineering and Evaluation manages the Joint Test and Evaluation (hereafter referred to as JT&E) Program, which is a current and long-standing Department of Defense program with the express aim of *improving* joint operations. Congress initiated the program as a result of a 1972 Presidential Commission, which stated that, at that time, there was no way to conduct test and evaluation in a joint environment. The panel recommended that responsibility for joint testing be vested in the Office of the Secretary of Defense staff dedicated to test and evaluation. The program has subsequently been institutionalized within DoD through regulations, handbooks, and memoranda of agreement.

The JT&E Program is not part of the Title X U.S. Code acquisition process; rather, it is *complementary to* the acquisition process. As systems, people, tactics, techniques, and procedures change, there is a continuous need to evaluate their interrelationships in a realistic, joint military environment. That is the purpose of the JT&E Program.

For 25 years, this program has satisfied warfighter requirements by identifying and institutionalizing improvements in the following areas: interoperability of Service systems; command, control, communications, computers, and intelligence; joint operations; joint targeting; combat identification; joint tactics, techniques, and procedures; and testing methodologies. Annex 1 chronicles all 54 past and present JT&E projects. Table 1 lists the areas of improvement targeted by current and recently completed Joint Test and Evaluations.

Service representatives attested to the success of this program in an October 1996 memorandum (reaffirmed by an August 29, 1997 memorandum), which stated in part, "Management of the JT&E Program has resided in DTSE&E since its inception in 1971. DTSE&E [Director, Test, Systems Engineering and Evaluation] has the corporate knowledge and experience for the JT&E Program and has produced many successful JT&Es. The extensive benefits the Services have derived from the DoD JT&E Program include enhanced joint procedures and valuable legacy products.... Our Warfighters are much better prepared to operate in the joint environment because of the contributions made by the JT&E Program. These procedures have allowed for active participation by the Services ensuring the most relevant issues are addressed by this valuable joint program. This is true, when tests are conducted with and influenced by the CINCs, which is the current procedure..."

1.2 Purpose

The JT&E Program was specifically established to improve joint warfighting capability by:

- Assessing the interoperability of Service systems in joint operations and exploring potential solutions to identified problems,
- Evaluating and providing recommendations to the Military Departments and Chairman of the Joint Chiefs of Staff on improvements in joint technical and operational concepts,
- Evaluating and validating testing methodologies having multi-Service application,
- Assessing technical or operational performance of interrelated and/or interacting systems under realistic joint operational conditions, and/or
- Providing data from joint field tests and exercises with which to validate models, simulations and test beds.

Table 1. Recent Joint Test and Evaluations and Their Areas of Improvement

Name	Year Complete	Areas of Major Improvement Contribution						
		Interoperability	C^4I	Joint Operations	Joint Targeting	Combat ID	JTTPs	Testing
JNCAS	FY 01	✓	✓	✓	✓	✓	✓	
JWF	FY 00	✓	✓	✓	✓		✓	
JADS	FY 99							✓
JSEAD	FY 99		✓	✓	✓		✓	
JTMD	FY 99		✓	✓	✓		✓	
JCSAR	FY 98		✓	✓		✓	✓	
JECSIM	FY 99							✓
SWOE	FY 97							✓
Band IV IR CM	FY 97	✓		✓				✓
JCCD	FY 96			✓	✓		✓	
JADO/JEZ	FY 95	✓	✓	✓		✓	✓	
JLOTS III	FY 95			✓			✓	
JCATE	FY 91							✓
JOTH-T	FY 91	✓		✓	✓			
JEMI	FY 91	✓	✓	✓			✓	

1.3 The Joint Test and Evaluation Process

Annual nominations for JT&E projects come from the Services, Commanders in Chief, and Defense Agencies. These nominations are carefully screened by the JT&E Planning Committee, which has members from the Office of the Secretary of Defense, Joint Staff, Services, and Defense Agencies. The Planning Committee forwards those nominations meeting criteria to the JT&E Senior Advisory Committee. This committee is composed of senior (Flag and Senior Executive Service-level) members from the Office of the Secretary of Defense, Joint Staff, Services, and Defense Agencies. The Senior Advisory Committee recommends to the Director, Test, Systems Engineering and Evaluation those candidates to be directed as Joint Feasibility Studies.

Each Joint Feasibility Study lasts about nine months and determines whether a JT&E is both NECESSARY and FEASIBLE to address the issue of concern. During the conduct of the Joint Feasibility Study, a Technical Advisory Board—senior Office of the Secretary of Defense, Service, and Defense Agency technical representatives—receives several briefings from the Joint Feasibility Study Director. The Technical Advisory Board recommends to the Senior Advisory Committee whether a Joint Test and Evaluation, as proposed by the Joint Feasibility Study, is technically feasible. Upon completing the Joint Feasibility Study, the Joint Feasibility Study Director briefs the Senior Advisory Committee. Based on this briefing and the Technical Advisory Board's recommendation, the Senior Advisory Committee recommends whether the Director, Test, Systems Engineering and Evaluation should charter the Joint Test and Evaluation. Once chartered by the Director, Test, Systems Engineering and Evaluation, the test and evaluation normally takes three years. When completed, the JT&E Director briefs the Senior Advisory Committee, Commanders in Chief, and others on the results of the JT&E and its legacy products. To ensure technical credibility, the Technical Advisory Board periodically reviews the program's progress and methodologies. All Joint Test Directors report directly to the Deputy Director, Systems Assessment, who manages the JT&E Program for the Director, Test, Systems Engineering and Evaluation.

The Deputy Director for Systems Assessment ensures that Joint Test and Evaluations focus on current problems and address current threats. He insists that the program not fall prey to the oft-cited mistake of fighting the last war. All scenarios follow current defense guidance and are validated by the Defense Intelligence Agency. JT&E directors must be familiar with Advanced Concept Technology Demonstrations, other technology initiatives, and theater contingency plans. Many Joint Test and Evaluations incorporate Advanced Concept Technology Demonstrations as test articles.

2.0 THE CONTRIBUTIONS OF RECENTLY COMPLETED JOINT TEST AND EVALUATION PROJECTS

JT&E programs completed in the 1990s continue to provide significant contributions to warfighters through the unique quality of testing in a realistic, joint, warfighting environment.

The Joint Electromagnetic Interference Joint Test tackled the long-standing problem of electromagnetic interference that plagued forces operating in a joint environment. When this program started in 1988, each Service's acquisition programs used effective measures to resolve electromagnetic interference for the systems being acquired. However, no program existed to investigate and fix electromagnetic interference problems with systems used in the joint environment. Furthermore, there were no joint programs to develop procedures, guidelines, and employment concepts to control, deconflict, or minimize electromagnetic interference. The Joint Electromagnetic Interference test also uncovered hardware, control and reporting, and doctrine deficiencies. This JT&E achieved its objectives. It produced an automated frequency management system, a common electromagnetic interference database, and ways to identify electromagnetic interference situations and effects. Its legacy products were institutionalized in the Electronic Combat Analysis Center, which became the Joint Spectrum Center. Contributions to the warfighter included improved communications and increased equipment interoperability in joint training and operations.

Even before Operation Desert Storm, warfighters recognized they lacked situational awareness, particularly an accurate picture of the entire battlefield, and the rapid pace of technology was worsening the problem. It was also commonly recognized that a digital targeting network linking sensors and sources to decision makers and shooters could significantly improve situational awareness. Called over-the-horizon targeting, the concept could only be validated in a joint environment. In 1988 the Joint Over-the-Horizon Targeting JT&E was established to demonstrate, test, and evaluate a digital network. The test was conducted in the Republic of Korea using U.S. Forces Korea, U.S. Pacific Command, national, and Service assets in the same conditions used in theater contingency planning. This JT&E proved that the digital targeting network concept was valid and was a significant contributor to battlefield situational awareness. Warfighters gained improved doctrine, military procedures, and enhanced situational awareness. This JT&E also passed specific development and acquisition requirements to the Joint Requirement Oversight Council.

Other Joint Test and Evaluations have proved concepts and planning factors to be invalid. This was the case with Joint Logistics Over-the-Shore III in 1995. This test was the third in a series. It built on lessons learned from earlier tests, which baselined over-the-shore capabilities and the contributions of deployable piers, auxiliary crane ships, and an offshore petroleum discharge system. The third test much more robust and with an improved offshore petroleum discharge system, was structured to answer questions of adequacy to support operations, interoperability, and suitable doctrine and operating procedures. The capabilities tested during Joint Logistics Over-the-Shore III did not meet expectations and requirements, falling short by about 70 percent. The major contribution to the warfighter was establishing realistic planning factors, which were scaled back to reflect known capabilities lest a force be emplaced without adequate logistics support. The JT&E also identified a need for joint training standards, more effective equipment, and improved joint logistics over-the-shore procedures.

An increase in the threats to deployed U.S. forces and their infrastructure from advanced fighters owned by potential adversaries highlighted the need for more effective air defense operations. The quickest and most effective method is the Joint Engagement Zone concept. This concept simultaneously employs aerial weapons and anti-aircraft weapons to maximize the potentials of both systems. The problem is fratricide—our ground systems shooting down our own fighters. The Joint Air Defense Operations/Joint Engagement Zone JT&E was chartered in 1992 to determine if simultaneous air and ground weapons employment was feasible and to develop necessary procedures. The test force developed rules of engagement based on predicted, positive hostile identification zones. These rules were evaluated in field tests employing Aegis and other control systems, fighter aircraft, and the Patriot missile system. The rules of engagement were proven—air defense effectiveness was improved and fratricide was reduced from that experienced in other engagement concepts. Along with those contributions to the warfighter, this JT&E revealed needs and possibilities concerning fratricide for a broad range of combat operations. The test findings were institutionalized in the ongoing All Services Combat Identification Evaluation Team, a multi-Service Operational Test and Evaluation. The rules of engagement and procedures developed in the Joint Air Defense Operations/Joint Engagement Zone JT&E are used today in Army, Navy, Air Force, and joint training.

In 1993, the Joint Camouflage, Concealment, and Deception JT&E was established to evaluate the effectiveness of camouflage, concealment, and deception against manned attack visual and sensor-aided systems. This test produced significant findings from both the "attack" and "defend" perspectives. It determined that camouflage, concealment, and deception is inexpensive and highly effective in protecting our assets. The evaluation also concluded that the enemy's use of camouflage, concealment, and deception could significantly reduce our attack effectiveness. In fact, it can reduce our attack effectiveness to the degree that exchange ratios (predicted aircraft losses for desired target damage) make it unacceptable to use manned systems against certain target classes. This test showed that camouflage, concealment, and deception have significant effects on the target development process, including imagery exploitation. This program's contributions to the warfighter in defend operations included databases on materials and techniques detailing sources, application techniques, and operational compatibility. In attack operations, joint, agency, and Service aircrew and imagery analyst training improvements came from this Joint Test and Evaluation.

In response to the threat of missiles using infrared Band IV (highlighted by the effectiveness of the SA-16 in Kuwait), Office of the Secretary of Defense chartered the Infrared Band IV Countermeasures JT&E in 1992 to evaluate the effectiveness of air-to-air and surface-to-air infrared Band IV missiles against U.S. aircraft with and without countermeasures. The test featured the static acquisition of signatures, live firing of missiles against replicas, and flight testing against maneuvering drones. The JT&E produced databases on the capabilities of infrared Band IV missiles to acquire, track, and hit U.S. aircraft, thus providing the warfighter with definitive threat information. The test also documented the capabilities of current countermeasures against threat Band IV missiles and the effectiveness of tactics against missiles. This gave the warfighter the invaluable knowledge necessary to best use tactics in conjunction with countermeasures to defeat the missiles. The Band IV databases are also being used to develop other defensive systems that the Department of Defense is acquiring,

If we had data—optical, infrared, and radio frequency—showing how various weapon systems appear in various environmental settings, we could simulate how those weapon systems would appear to a guided weapon such as a missile. This would greatly aid the developers of such "smart" weapons. The Office of the Secretary of Defense directed the Smart Weapons Operability Enhancement JT&E in 1993 to provide such data. This test developed a validated capability to integrate measurements, databases, models, and scene simulations for considering and exploiting the complex environments of potential battlefields throughout the world. This capability can be used to enhance the performance of future advanced weapons. The most advanced millimeter wave and infrared surface, atmosphere, and feature models with scene simulation were integrated for demonstration and validation. Thus, the warfighter will get more reliable, accurate, and versatile smart weapons along with an accurate assessment of weapon capabilities in a particular battlefield environment.

The Joint Tactical Missile Signatures JT&E brought together all three Services, industry, and academia to develop, define, and validate standardized missile signature data elements, definitions, and data formats. The standardized data elements, known as Tactical Missile Signature Measurement Standards, were tested and proven in field measurements of actual threat tactical missiles. Adopted by NATO, Tactical Missile Signature Measurement Standards are producing significant contributions to warfighters in streamlined acquisition, fewer tests, and much greater interoperability of warning and protection systems. The standards from the Joint Electromagnetic Signatures and Effects Database Library are institutionalized at the Arnold Engineering Development Center, Arnold Air Force Base, Tennessee.

JT&E projects do not have to be complete to provide a useful legacy product. The Joint Crisis Action Test and Evaluation project was directed as a feasibility study in 1993 to demonstrate the ability of joint task force command, control, communications, computers, and intelligence systems to maintain a timely and useful flow of information during crisis operations. The JT&E to be chartered after the feasibility study would have actually demonstrated the ability of Commanders in Chief to use an intelligent communications network to perform distributed, cooperative command and control during crisis response. Unfortunately, when the feasibility study had just produced a test design, budget action eliminated the program. However, that test design included a command, control, communications, computers, and intelligence system evaluation methodology, which is now the standard for joint training and exercises and was adopted by the U.S. Atlantic Command's Joint Battle Center and Joint Warrior Interoperability Demonstration series. The Joint Crisis Action Test and Evaluation project, although never a chartered Joint Test and Evaluation, has made a valuable contribution to the warfighter.

3.0 CURRENT JOINT TEST AND EVALUATION PROJECTS

Seven Joint Test and Evaluations are currently in progress; five directly address critical mission issues either validated by Operation Desert Storm or arising from that conflict. The Joint Suppression of Enemy Air Defenses, Joint Combat Search and Rescue, and Joint Warfighters projects address the following issues reinforced by Desert Storm and included in the DoD report to Congress on the Gulf War: 1) precision/accuracy, 2) standoff/depth, 3) mission-munitions fit, 4) desired effects, and 5) timeliness. The Joint Theater Missile Defense and Joint Night Close Air Support Joint Test and Evaluations address two new issues raised by Operation Desert Storm experiences.

The remaining two JT&E projects—Joint Electronic Combat Using Simulation and Joint Advanced Distributed Simulation—address using modeling and simulation in test and evaluation. Simulation has become an essential test and training tool. On the surface, this tool may have the potential to reduce funding requirements and the need for large-scale field tests—very desirable in this era of reduced funding and increased operations tempo. These two JT&E

projects will determine what models and simulations can and cannot do in testing and quantify their contributions to resource reductions. It should be noted that these projects use verified and validated models and simulations, which are often overlooked in calculating cost and benefit.

Suppressing enemy air defenses, like combat search and rescue, is a long-standing problem and one that has become more pressing with the reduction in our suppression capabilities. Furthermore, the surface-to-air missile threat is more technologically sophisticated and more mobile, making the Operation Desert Storm strategy of destructive, pre-emptive targeting to destroy the enemy's integrated air defense system less effective. The Commanders in Chief and the Services acknowledged need to improve our capability to suppress enemy air defenses, and Office of the Secretary of Defense chartered the Joint Suppression of Enemy Air Defenses test. This JT&E will characterize and baseline the current suppression of enemy air defense targeting processes and capabilities, quantify each element's contributions, identify deficiencies, and evaluate potential improvements. The test will be conducted through participation in and extensions to Service training exercises. The legacy products of the Joint Suppression of Enemy Air Defenses JT&E will include recommendations for improved doctrine, joint procedures, and conclusions regarding enhancements in systems management, battlespace coverage, and time-sensitive targeting. The warfighter will benefit from a more effective suppression of enemy air defenses and an improved intelligence, surveillance, and reconnaissance architecture.

Long-standing deficiencies in combat search and rescue are a major problem in achieving the full notion of force protection embraced by Joint Vision 2010. These deficiencies caused a search and rescue crew to become prisoners of war during Operation Desert Storm. The Joint Combat Search and Rescue JT&E was chartered in 1995 to identify and assess fixes for problems associated with combat search and rescue procedures, interoperability, and training. The test will assess and document current joint combat search and rescue effectiveness; identify critical problem areas; develop enhancements to resolve identified problems; evaluate enhancements in improving joint combat search and rescue effectiveness; and develop recommendations for doctrine, joint training, and interoperability. The test will also characterize the timeliness and accuracy of national assets to support a combat search and rescue mission. Most of the test will be conducted in conjunction with joint and Service training exercises and will involve agencies such as the National Reconnaissance Office and the National Imagery and Mapping Agency. Test events are scheduled for temperate, desert, and arctic environments in the U.S. and Europe. All Unified Commands will participate. The obvious and major contribution to the warfighter will be an increased probability of rescue. This increase will come from improved joint training; interoperability; concepts of operations; doctrine; tactics, techniques, and procedures; command, control, communications, computers, and intelligence architecture; and mission planning and analysis tools.

Of the five critical mission issues noted earlier, the consensus is that U.S. joint warfighting capabilities have improved in all areas but one—timeliness. Office of the Secretary of Defense chartered the Joint Warfighters JT&E in 1997 to address timeliness. Joint Warfighters will resolve this issue by evaluating the most time-critical process—the prosecution of time-sensitive surface targets. In partnership with the Unified Commands, Joint Warfighters will use major joint training exercises and selected Service training exercises to baseline joint targeting of time-sensitive surface targets, analyze baseline data, and recommend enhancements. Joint Warfighters will then incorporate and evaluate the enhancements and analyze their impact on the targeting process. Joint Warfighters is located in the U.S. Atlantic's Joint Training, Analysis, and Simulation Center, and has established working partnerships with the Joint Battle Center and Joint Warrior Interoperability Demonstration Office. In addition to U.S. Atlantic Command, the U.S. Central Command, U.S. Pacific Command, and U.S. Forces Korea will sponsor Joint Warfighters. The Joint Warfighters Test Director agreed with two program managers to include Advanced Concept Technology Demonstrations. Joint Warfighters will benefit the warfighter through more effective and efficient targeting; improved interoperability; streamlined coordination, deconfliction, and synchronization; and truly joint doctrine and tactics, techniques, and procedures.

Inability to locate and destroy threat theater missiles and their support systems was perhaps our greatest deficiency in Operation Desert Storm. Every potential adversary knows the problem posed by and the increased threat from theater ballistic missiles in the next conflict. The Joint Theater Missile Defense JT&E was chartered in 1994 to address the aspects of theater ballistic missile attack operations that were not covered by other organizations such as the Ballistic Missile Defense Office. The Joint Theater Missile Defense JT&E has three phases to accomplish the following: 1) evaluate theater missile defense attack operations architecture, tactics, techniques, and procedures; 2) evaluate the effectiveness of a joint force composed of an Air Force air expeditionary force, a carrier battle force, and an amphibious ready group in theater missile defense; and 3) expand the joint force of Phase II to include additional sensors, command elements, and attack systems of land-based Army and Marine units. The test initially used a Southwest Asia scenario but will repeat in a Northeast Asia scenario. The Joint Theater Missile Defense test includes participation in U.S. Central Command and U.S. Pacific Command joint training exercises, All Services Combat Identification Evaluation Team exercises, and the Joint Surveillance Targeting and Attack Radar System multi-Service Operational Test and Evaluation. The contributions to the warfighter from this test will be a reduced theater ballistic missile threat and an improved architecture for prosecuting time-sensitive targets.

The last joint look at close air support was during the Electronic Warfare Close Air Support JT&E, which concluded in 1982. Since then, the Services have fielded systems with greatly advanced capabilities, and with the advent of night vision devices, U.S. forces now conduct 24-hour, rapid pace operations. Operation Desert Storm showed that close air support required a new examination to ensure against fratricide during night operations. The Joint Night Close Air Support JT&E was chartered in 1997 to document, analyze, and recommend improvements for joint and Service training; joint tactics, techniques, and procedures; and equipment. Joint night close air support training rarely occurs—only the special operations forces currently practice joint night operations regularly The Services have been fielding technology for night operations and increasing night capabilities, but the technology, capabilities, tactics, and military procedures have not been validated in a joint environment. The Joint Night Close Air Support test will baseline current effectiveness, develop and evaluate alternative procedures, and evaluate enhancements to equipment and improvements in systems. Most field tests will be conducted at the National Training Center at Fort Irwin, California. Other field tests will be at the Joint Readiness Training Center and Army and Navy installations. Legacy products from the Joint Night Close Air Support JT&E will include a baseline of current night close air support capabilities; alternative joint tactics, techniques, and procedures; and suggestions for improved equipment with increased interoperability. The greatest benefits to the warfighter will be improved effectiveness and reduced fratricide.

Advanced Distributed Simulation is a rapidly evolving information systems technology that links distributed models, simulators, and live entities in a common environment. This technology appears to have an application to test and evaluation that could both improve testing and reduce test costs. The Joint Advanced Distributed Simulation JT&E was chartered to determine if this apparent application is real and effective. The evaluation is a series of three tests.

Test 1 focuses on systems integration using two phases. Phase I evaluates the utility of advanced distributed simulation in a closed loop test and evaluation of an air-to-air missile against a target employing countermeasures. Phase II is a "live fly" phase, linking an aircraft to a hardware-in-the-loop missile simulation. The "live fly" phase test architecture examines the benefits of linking live aircraft to a hardware-in-the-loop facility. It allows a manned target aircraft to perform realistic evasive maneuvers. The live launch aircraft provides a realistic environment for the fire control radar, which is affected by weather, clutter, and other variables for which good digital models do not exist. The hardware-in-the-loop missile test facility monitors the detailed performance of the missile subsystem and allows for testing electronic countermeasures modes against the missile, which cannot be done in the open air.

The second test, an end-to-end evaluation, will assess the ability of advanced distributed simulation to support command, control, communications, computers, and intelligence testing in a simulation-enhanced operational environment. This test seamlessly adds 8,000 additional entities to the battlefield as seen by Joint Surveillance Targeting and Attack Radar System sensors. Using advanced distributed simulation to add other command, control, communications, computers, and intelligence elements and weapons systems will provide a high fidelity, mission-level test environment that would not be affordable using conventional test methods. The threat scenario driver developed for the end-to-end test is already used to augment training exercises at the National Training Center.

Test 3 will evaluate the utility of advanced distributed simulation to support the electronic warfare test process. The primary goal of the Joint Advanced Distributed Simulation test is to determine if advanced distributed simulation can provide valid test results and make the test process faster and cheaper. Although this project focuses on improving the test process, contributions to the warfighter include quicker, less expensive test and evaluation—if advanced distributed simulation proves to be effective.

The Joint Electronic Combat Testing Using Simulation JT&E is the second ongoing joint test chartered to determine if simulation can reduce costs and improve test effectiveness. Joint Electronic Combat Testing Using Simulation differs from Joint Advanced Distributed Simulation in that it focuses on electronic combat and tests semi-active missile systems against multiple electronic countermeasure techniques employed by missile, fighter, and bomber targets. The test results will be compared to model and simulation predictions and correlated between model and live test results. This JT&E will assess the ability to apply test results to other scenarios, systems, and targets. The legacy products of this test will include test and evaluation methodologies for using digital models as an adjunct to hardware-in-the-loop simulations and open-air tests to improve test definition. Other legacy products include a cost benefit analysis of digital models to test electronic and other countermeasures and a common database for verification, validation, and accreditation. Benefits to the warfighter include streamlined, less expensive testing and improvements in the acquisition process that will produce more effective combat systems.

4.0 RECENTLY DIRECTED JOINT FEASIBILITY STUDIES

Two directed feasibility studies presently underway will come before the Senior Advisory Committee for charter recommendation in the summer of 1998. Both deal directly with core warfighting issues.

An inadequate joint theater distribution system frustrated cargo shipments for Operation Desert Storm forces. A serious deficiency in asset visibility (simply knowing what is on the way, where it is, and who is supposed to get it) resulted in duplication and waste, not to mention reduced capabilities. The Army nominated the Joint Theater Distribution Joint Feasibility Study to assess theater distribution problems. If chartered, the Joint Theater Distribution JT&E will analyze data, provide improvement recommendations, and evaluate enhancements for theater distribution. The test force will recommend improvements in joint doctrine, tactics, military procedures, and training. Specific areas for evaluation will be asset visibility, integration of automation tools, source data automation at transportation nodes, congestion at ports and in the distribution pipeline, and the widespread use of manual procedures and workarounds. The warfighter will benefit from improved theater logistics distribution systems and procedures.

The last few years have shown a marked increase in Army and Air Force helicopters operating from Navy ships. This trend will surely increase as all Services operate with fewer assets and the need for synergism in joint operations increases. Developing joint tactics, techniques, procedures, and processes required to safely operate Army and Air Force helicopters aboard Navy ships has not kept pace with the need. The Joint Shipboard Helicopter Integration Process Joint Feasibility Study was directed to determine if a JT&E should be chartered to evaluate the helicopter integration process. The overall objective of the JT&E would be to increase operational flexibility and readiness of helicopter use in a joint naval environment. It would focus on improving joint training, tactics, and military procedures as well as conducting necessary land and sea component training. Specific critical areas for evaluation are interoperability of systems and subsystems, electromagnetic environmental effects, and both static and dynamic interfaces of the ship and helicopter. The contributions to the warfighter will be increased effectiveness in communications, evacuation, and supply resulting from operating compatibility of other Services' helicopters with Navy ships.

5.0 RESOURCES

5.1 Office of the Secretary of Defense (OSD)

OSD, DTSE&E provides funding for costs that are unique to the Joint Test and Evaluation or Joint Feasibility Study. These costs include travel, per diem, and dedicated contractor support for the JT&E/JFS.

5.2 Service Resources

The Lead Service or agency provides funding for facilities, assigned and supporting civilian personnel, and all administrative and routine logistical support. The Lead Service or agency also provides the Joint Test Director; a Deputy Director; the majority of military personnel; administrative support; and assistance in personnel administration, comptroller activities, supply, and logistics. Participating Services provide Deputy Directors and additional military personnel.

5.3 Test Sites

Figure 1 shows the states where testing is planned (in green) and where recent past testing has been conducted (in blue).

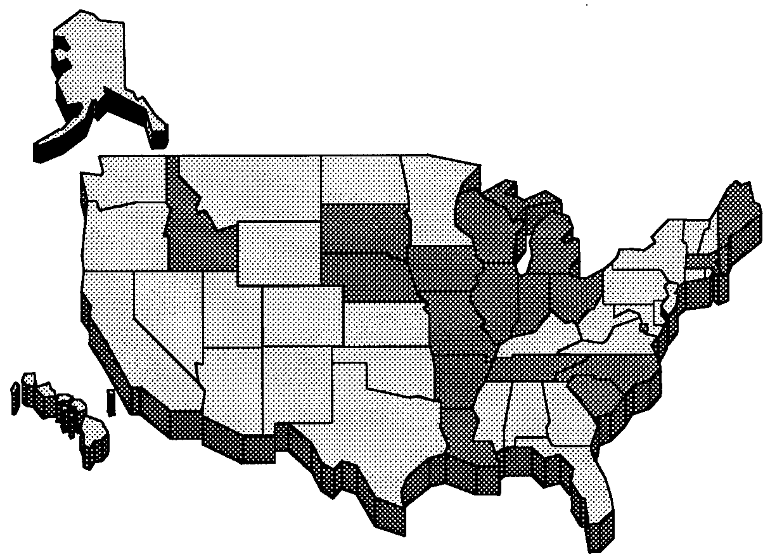

Figure 1. Joint Test and Evaluations are conducted in most of the 50 states.

6.0 CONCLUSION—BOTTOM LINE

Congressional concerns that resulted in initiating the Joint Test and Evaluation Program are especially valid in today's world. Improvements in joint operations can no longer be looked at as marginal enhancements to the Services' existing, stand-alone, warfighting capabilities. In the current environment, the Commanders in Chief depend more than ever on the effective joint integration of existing Service capabilities, a task that the individual Services are not fully equipped to address. Post-cold war force reductions; evolving military missions; growing dependence on high technology leading-edge weapon systems; demands for streamlined acquisition, expedited testing, and rapid assimilation; and effective joint employment of new technologies are but a few issues that the JT&E Program is structured to address.

The JT&E Program has the flexibility to examine the latest joint concepts and accommodate new initiatives. It can address all joint issues associated with evolving Department of Defense roles in combating terrorism, narcotics interdiction and eradication, border surveillance and protection, and special interdepartmental or multinational task forces. As we strive to keep our military's technological lead through rapid realistic testing and effective joint employment of new or candidate systems, we must continue to improve joint employment, tactics, techniques, and procedures for those systems. The JT&E Program has and will continue to be available to accommodate Advanced Concept Technology Demonstration and joint warfighting experiment initiatives. This approach saves time and money and improves test realism.

The Joint Test and Evaluation Program is one of the best means to pursue current and future joint Service employment efficiencies as stated in Joint Vision 2010. It is a prime vehicle for integrating Service tactics, procedures, and systems to expand their combined capabilities and meet the changing demands for joint military commitments.

Annex 1

JOINT TEST AND EVALUATION CHRONOLOGY

Chronological Number	JT&E Project Title	Year(s) Active	Remarks
1	Maverick (Combat Hunter)	72–73	
2	Test and Evaluation of Aircraft Survivability (TEAS)	72–75	
3	Air-to-Air Weapons Effectiveness (AIRVAL)	72–75	
4	Radar Bombing Accuracy (RABVAL)	72–75	
5	Electronic Warfare (EWJT)	72–76	
6	Airborne Target Acquisition (SEEKVAL)	73–76	
7	Hit Probability (HITVAL)	73–75	
8	Laser Guided Weapons Countermeasures (LGW/CM)	73–75	
9	Laser Guided Weapons in Close Air Support (LGW/CAS)	73–76	
10	A-7/A-10 Fly-off	74	
11	Close Air Support Command and Control ($CASC^2$)	74–76	
12	Forward Air Defense (FAD)	74–76	
13	Logistics Over-the-Shore (LOTS)	74–77	
14	Short Range Air-to-Air Missile (AIMVAL)	75–77	
15	Multiple Air-to-Air Combat (ACEVAL)	75–78	
16	Electro-Optical Guided Weapons Countermeasures/Institutionalized Counter-Countermeasures (EOGWCM/CCM)	76–85	Institutionalized as Precision Guided Weapons Countermeasures Test and Evaluation Directorate
17	Target Engagement (TEVAL)	76–77	Terminated due to funding priorities
18	Electronic Warfare during Close Air Support (EW/CAS)	76–82	
19	Tactical Aircraft Effectiveness and Survivability in Anti-Armor Operations (TASVAL)	77–81	

Chronological Number	JT&E Project Title	Year(s) Active	Remarks
20	Imaging Infrared Maverick (IIRM)	77	
21	Data Link Vulnerability (DVAL)	77–85	
22	Advanced Anti-Armor Combat Vehicle (ARMVAL)	78–81	
23	Identification Friend, Foe, or Neutral (IFFN)	78–89	TACCSF was a legacy.
24	Tube-Launched Guided Projectile (TLGP)	79	Army (lead Service) withdrew funding due to the existence of other similar efforts
25	Command, Control, and Communications Countermeasures (C^3CM)	79–89	
26	Central Region Airspace Control Plan (CRACP)	80–82	
27	Theater Air Defense (TAD)	81–82	Feasibility Study found that other non-JT&E programs were very similar and funding did not permit duplication of efforts
28	Joint Direction Finding (JDF)	81–82	Was not funded as a JT&E due to other higher priority projects.
29	Joint Forward Area Air Defense (JFAAD)	81–87	
30	Joint Logistics Over-the-Shore II (JLOTS II)	82–85	
31	Joint Air-to-Air Missile Concepts (JAAMC)	83–84	The feasibility study determined objectives were covered in the ongoing Advanced Medium Range Air-to-Air Missile (AMRAAM) program
32	Target Engagement Using Laser Designators (TELAD)	83–84	
33	Joint Chemical Warfare (JCHEM)	83–87	
34	Joint Live Fire (JLF)	84–91	The JLF Program continues today under the DOT&E Deputy Director for Live Fire Test and Evaluation.

Chronological Number	JT&E Project Title	Year(s) Active	Remarks
35	Joint Over-the-Horizon Targeting (JOTH-T)	88–91	
36	Joint Electromagnetic Interference (JEMI)	88–91	Institutionalized in ECAC, which is now the Joint Spectrum Center
37	Joint Crisis Action Test and Evaluation (JCATE)	90–91	Methodology transferred to DISA and used for JWID evaluations
38	Joint Suppression of Enemy Air Defenses (JSEAD)	90	Not funded as a JT&E due to higher priority projects.
39	Joint Air Defense Operations/Joint Engagement Zone (JADO/JEZ)	90–95	Institutionalized in ASCIET
40	Smart Weapons Operability Enhancement (SWOE)	91–95	
41	Joint Camouflage, Concealment, and Deception (JCCD)	91–96	
42	Infrared Band IV Countermeasures (Band IV)	92–97	
43	Joint Tactical Missile Signatures (JTAMS)	92–96	
44	Joint Theater Missile Defense (JTMD)	93–99	
45	Joint Advanced Distributed Simulation (JADS)	94–99	
46	Joint Combat Search and Rescue (JCSAR)	95–98	
47	Joint Electronic Combat Test Using Simulation (JECSIM)	96–99	
48	Joint Combat Identification (JCID)	95	Mission taken on by the ASCIET program.
49	Joint Suppression of Enemy Air Defenses (JSEAD)	96–99	
50	Joint Warfighters (JWF)	97–00	
51	Joint Night Close Air Support (JNCAS)	97–00	
52	Joint Theater Distribution (JTD)	98–	Current Joint Feasibility Study
53	Joint Shipboard Helicopter Integration Process (JSHIP)	98–	Current Joint Feasibility Study

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Annex 2

DOLLARS FLOWING TO THE STATES FROM CURRENT AND RECENTLY COMPLETED JOINT TEST AND EVALUATIONS

Joint Electromagnetic Interference (JEMI)

States	Test Sites
California	2
District of Columbia	1
Florida	1
Maryland	1
New Mexico	2
New York	1
North Carolina	1
Texas	1
Virginia	2
Program Cost: $27M	

Joint Over-the-Horizon Targeting (JOTH-T)

States	Test Sites
California	2
Texas	1
Virginia	1
Maryland	1
Program Cost: $20.6M	

Joint Crisis Action Test and Evaluation (JCATE)

States	Test Sites
District of Columbia	1
Maryland	2
Virginia	2
Program Cost: $0.83M	

Joint Logistics Over-the-Shore III (JLOTS III)

States	Test Sites
District of Columbia	1
Florida	1
North Carolina	2
Virginia	2
Program Costs: $17.4M OSD and $46.6M Unified Commands and Services	

Joint Camouflage, Concealment, and Deception (JCCD)

States	Test Sites
Alabama	1
Alaska	1
Arkansas	1
California	2
Florida	1
Georgia	1
Idaho	1
Illinois	2
Indiana	2
Iowa	1
Louisiana	1
Massachusetts	1
Michigan	1
Mississippi	1
Missouri	1
Nebraska	1
Nevada	2
New Mexico	2
North Carolina	1
Ohio	3
South Dakota	1
Washington	1
Wisconsin	2
Program Cost: $33.2M	

Joint Air Defense Operations/Joint Engagement Zone (JADO/JEZ)

States	Test Sites
Alabama	1
Florida	2
Mississippi	2
Nevada	2
New Mexico	2
Texas	2
Program Costs: $26.8M	

Infrared Band IV Countermeasures (Band IV)

States	Test Sites
Alabama	1
Florida	2
Mississippi	2
Nevada	2
New Mexico	2
Texas	2
Program Costs: $26.8M	

Joint Tactical Missile Signatures (JTAMS)

States	Test Sites
Alabama	1
California	1
Florida	1
Nevada	1
New Mexico	1
Tennessee	1
Texas	1
Program Costs: $23.05M	

Smart Weapons Operability Enhancement (SWOE)

States	Test Sites
Arizona	1
California	4
District of Columbia	2
Florida	3
Maine	1
Maryland	2
Massachusetts	2
Michigan	1
Mississippi	1
New Mexico	3
Ohio	1
Texas	1
Virginia	3
Program Costs: $15.25M	

Joint Live Fire (JLF)

States	Test Sites
California	1
Florida	1
Maryland	1
Ohio	1
Virginia	1
Program Costs: $38M	

Joint Suppression of Enemy Air Defenses (JSEAD)

States	Test Sites
Florida	1
Nevada	1
Virginia	1
Program Costs: $12.3M	

Joint Theater Missile Defense (JTMD)

States	Test Sites
California	1
Florida	3
Maryland	1
Mississippi	1
Nevada	1
New Mexico	2
South Carolina	1
Texas	1
Virginia	1
Wisconsin	1
Program Costs: $38M	

Joint Advanced Distributed Simulation (JADS)

States	Test Sites
California	2
Florida	2
Maryland	1
New Mexico	2
Ohio	11
Virginia	1
Program Costs: $33M	

Joint Combat Search and Rescue (JCSAR)

States	Test Sites
Alabama	1
California	1
Florida	1
New Mexico	2
Ohio	1
Texas	1
Program Costs: $24M	

Joint Warfighters (JWF)

States	Test Sites
Arizona	1
Florida	3
Nevada	1
Virginia	1
Program Costs: $18.3M	

Joint Night Close Air Support (JNCAS)

States	Test Sites
Arkansas	1
California	2
Florida	1
Georgia	1
Texas	1
Program Costs: $12.3M	

Annex 3

LIST OF ACRONYMS

AAA	Anti-Aircraft Artillery
ACA	Airspace Control Area
ACETEF	Air Combat Environment Test and Evaluation Facility
ACEVAL	Multiple Air-to-Air Combat
ACOM	Atlantic Command
ACM	Airspace Control Measures
ACTD	Advanced Concept Technology Demonstration
ADOCS	Automated Deep Operations Coordination System
ADS	Advanced Distributed Simulation
ADS	Airspace Deconfliction System
AFATDS	Advanced Field Artillery Tactical Data System
AFEWES	Air Force Electronic Warfare Evaluation Simulator
AFFOR	Air Force Forces
AFOTEC	Air Force Operational Test and Evaluation Center
AIMVAL	Short Range Air-to-Air Missile
AIRVAL	Air-to-Air Effectiveness
AL/HRA	Armstrong Laboratory
ALSA	Air Land Sea Application
AMC	Airborne Mission Commander
AMRAAM	Advanced Medium Range Air-to-Air Missile
ANG-CRTC	Air National Guard, Combat Readiness Training Center
AOR	Area of Responsibility
APA	Analysis Plan for Assessment
APS	Advanced Planning System
ARFOR	Army Forces
ARMVAL	Advanced Anti-Armor Combat Vehicle
ASAS	All Source Analysis System
ASCIET	All Service Combat Identification Evaluation Team
ATACMS	Army Tactical Missile System
ATO	Air Tasking Order
AVTB	Aviation Test Bed
AWACS	Airborne Warning and Control System
Band IV	Infrared Band IV Countermeasures

BF	Blue Flag
BSD	Battlefield Situation Display
BTS	Battlestaff Training School
$CASC^2$	Close Air Support Command and Control
CAX	Computer-Assisted Exercises
C^2	Command and Control
C^3CM	Command, Control, and Communications Countermeasures
C^4I	Command, Control, Communications, Computers, and Intelligence
C^4ISR	Command, Control, Communications, Computers, and Intelligence Surveillance and Reconnaissance
CCF	Central Control Facility
CENTCOM	Central Command
CFL	Coordinated Fire Line
CIC	Combat Integration Capability
CINC	Commander in Chief
CIS	Combat Intelligence System
CONOPS	Concept of Operations
CONUS	Continental United States
CRACP	Central Region Airspace Control Plan
CRC	Control and Reporting Center
CRE	Consolidated Resource Estimate
CSAR	Combat Search and Rescue
CTAPS	Contingency Theater Automated Planning System
CTN	Common Target Number
DAB	Defense Acquisition Board
DDT&E	Deputy Director, Test and Evaluation
DOCC	Deep Operations Coordination Cell
DoD	Department of Defense
DI	Dynamic Interface
DIA	Defense Intelligence Agency
DIS	Distributed Interactive Simulation
DMAP	Data Management Plan
DME	Data Management Exercise
DPRB	Defense Planning and Resources Board
DSI	Defense Simulation Network
DTSE&E	Director, Test, Systems Engineering and Evaluation
DT&E	Developmental Test and Evaluation
DTP	Detailed Test Plan

DVAL	Data Link Vulnerability
EADSIM	Extended Air Defense Simulation
ECM	Electronic Countermeasures
EEE	Electromagnetic Environmental Effects
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EOB	Enemy Order of Battle
EOGWCM/CCM	Electro-Optical Guided Weapons Countermeasures/Institutionalized Counter-Countermeasures
ETE	End-to-End
EUCOM	European Command
EW	Electronic Warfare
EW/CAS	Electronic Warfare During Close Air Support
EWJT	Electronic Warfare
FAD	Forward Air Defense
FFA	Free Fire Area
FLEX	Force-Level Execution
FPTOC	Force Protection Tactical Operations Center
FSCL	Fire Support Coordination Line
FSD	Feasibility Study Director
FTX	Field Training Exercise
FWA	Fixed-Wing Aircraft
GMS	Ground-Mounted Seekers
GOSC	General Officer Steering Committee
GPS	Global Positioning System
GTRI	Georgia Tech Research Institute
GWEF	Guided Weapons Evaluation Facility
HIDACZ	High Density Airspace Control Zone
HITVAL	Hit Probability
HWIL	Hardware-in-the-Loop
IADS	Integrated Air Defense System
IFFN	Identification Friend, Foe, or Neutral
IIRM	Imaging Infrared Maverick
INTEL	Intelligence Community
IPR	In-Progress Review
ISR	Intelligence, Surveillance, and Reconnaissance
JAAMC	Joint Air-to-Air Missile Concepts
JADO/JEZ	Joint Air Defense Operations/Joint Engagement Zone

JADS	Joint Advanced Distributed Simulation
JAOC	Joint Air Operations Center
JCATE	Joint Crisis Action Test and Evaluation
JCCD	Joint Camouflage, Concealment, and Deception
JCID	Joint Combat Identification
JCHEM	Joint Chemical Warfare
JCSAR	Joint Combat Search and Rescue
JDF	Joint Direction Finding
JECSIM	Joint Electronic Combat Test Using Simulation
JEMI	Joint Electromagnetic Interference
JFAAD	Joint Forward Area Air Defense
JFACC	Joint Force Air Component Commander
JFC	Joint Force Commander
JFS	Joint Feasibility Study
JLF	Joint Live Fire
JLOTS II	Joint Logistics Over-the-Shore II
JLOTS III	Joint Logistics Over-the-Shore III
J-MASS	Joint Modeling and Simulation System
JNCAS	Joint Night Close Air Support
JOA	Joint Operating Area
JOTH-T	Joint Over-the-Horizon Targeting
JPT	JFACC Planning Tool
JROC	Joint Requirements Oversight Council
JSAS	Joint Forces Air Component Commander Situation Awareness System
JSAT	JSEAD Analysis Tool
JSEAD	Joint Suppression of Enemy Air Defenses
JSEM	Joint Services End-Game Model
JSHIP	Joint Shipboard Helicopter Integration Process
JSRC	Joint Search and Rescue Center
JSSA	Joint Services Survival, Evasion, Resistance, and Escape (SERE) Agency
JSTARS	Joint Surveillance Target Attack Radar System
JTAMS	Joint Tactical Missile Signatures
JTAV	Joint Total Asset Visibility
JTD	Joint Theater Distribution
JT&E	Joint Test and Evaluation
JTF	Joint Test Force, Joint Task Force
JTFEX	Joint Task Force Exercises
JTMD	Joint Theater Missile Defense

JTTPs	Joint Tactics, Techniques, and Procedures
JWF	Joint Warfighters
JWG	Joint Working Group
LFG	Live Fly Phase
LGW/CM	Laser Guided Weapons Countermeasures
LGW/CAS	Laser Guided Weapons in Close Air Support
LIVEX	Live-Fly Exercises
LO	Low Observable
Loc/Id	Location and Identification
LOTS	Logistics Over-the-Shore
LSP	Linked Simulators Phase
MACA	Methodology for Assessment of C^4I Architectures
MAGTF	Marine Air-Ground Task Force
MARFOR	Marine Forces
ME	Mission Evaluation
MLM	Mission-Level Measures
MOA	Memorandum of Agreement
MOE	Measure of Effectiveness
MOP	Measure of Performance
MOU	Memorandum of Understanding
MNS	Mission Need Statements
MRC	Major Regional Contingency
MRR	Minimum Risk Routes
MSC	Military Sealift Command
M&S	Models and Simulations
MSIC	Missile and Space Intelligence Center
NAWCAD	Naval Air Warfare Center Aircraft Division
NAWCWPNS	Naval Air Warfare Center Weapons Division
NCBC	Naval Construction Battalion Center
NFA	No-Fire Area
NIMA	National Imagery and Mapping Agency
NRO	National Reconnaissance Office
NTC	National Training Center
OAR	Open-Air Range
OITL	Operator-in-the-Loop
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation

PACOM	Pacific Command
P_k	Probability of Kill
PTP	Program Test Plan
RABVAL	Radar Bombing Accuracy
RCS	Radar Cross Section
RESCAP	Rescue Combat Air Patrol
RESCORT	Rescue Escort
RF	Red Flag
RFA	Restricted Fire Area
RFL	Restricted Fire Line
RGFC	Republican Guard Forces Command
ROA	Restricted Operations Area
ROZ	Restricted Operations Zone
RWA	Rotary-Wing Aircraft
RV	Recovery Vehicle
SAC	Senior Advisory Council
SAIC	Science Applications International Corporation
SAM	Surface-to-Air-Missile
SARTF	Search and Rescue Task Force
SB	Surface Based
SEEKVAL	Airborne Target Acquisition
SERE	Survival, Evasion, Resistance, and Escape
SOF	Special Operations Forces
SOCOM	U.S. Special Operations Command
SOUTHCOM	U.S. Southern Command
SME	Subject Matter Expert
SUA	Special Use Airspace
SUT	System Under Test
SWOE	Smart Weapons Operability Enhancement
TAB	Technical Advisory Board
TAD	Theater Air Defense
T&E	Test and Evaluation
TACCSF	Theater Air Command and Control Simulation Facility
TASVAL	Tactical Aircraft Effectiveness and Survivability in Anti-Armor Operations
TCAC	Test Control and Analysis Center
TEAS	Test and Evaluation of Aircraft Survivability
TEL	Transporter-Erector Launcher

TELAD	Target Engagement Using Laser Designators
TEVAL	Target Engagement
TISD	Theater Integration Situation Display
TLGP	Tube-Launched Guided Projectile
TPAT	Tactics Process Action Team
TPPs	Tactics, Techniques, and Procedures
TRADOC	Training and Doctrine Command
TSPI	Time-Space Position Information
TSST	Time-Sensitive Surface Targets
UJTL	Universal Joint Task List
USACOM	United States Atlantic Command
USCENTAF	United States Central Air Force
USCENTCOM	United States Central Command
USD (A&T)	Under Secretary of Defense Acquisition and Technology
USFK	United States Forces Korea
USPACOM	United States Pacific Command
USTRANSCOM	U.S. Transportation Command
VS	Virtual Simulation
V&V	Verification and Validation
VV&A	Verification, Validation, and Accreditation
WS	Weapons School

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Appendix A

JOINT ADVANCED DISTRIBUTED SIMULATION (JADS)

1.0 BACKGROUND

1.1 Charter

JADS was chartered by OSD-DTSE&E in October 1994 to investigate the utility of Advanced Distributed Simulation (ADS) technologies for support of developmental test and evaluation (DT&E) and operational test and evaluation (OT&E). The Air Force leads the program, and the Army and Navy participate. Colonel Mark Smith is the Joint Test Director. The Joint Test Force (JTF) manning includes 23 Air Force, 13 Army, and 2 Navy personnel. Science Applications International Corporation (SAIC) and Georgia Tech Research Institute (GTRI) provide contracted technical support. The program is nominally scheduled for 5 years and has a program budget of approximately $25 million.

1.2 Problem Statement

New paradigms have emerged since the end of the Cold War for military systems acquisition and utilization. These new paradigms include reduced acquisition costs and joint Service interoperability. Because of these changes, the Test and Evaluation (T&E) community is faced with a combination of reduced funding and the requirement to test/field new, more advanced and interoperable weapons systems. Under current and future budget constraints, the T&E community needs advanced, more cost-effective test methodologies to provide the necessary capabilities for these upcoming systems. The Defense Science Board concluded in a 1992 study that the Department of Defense (DoD) should use distributed simulation to fully link test ranges and facilities, training ranges, laboratories, and other simulation activities to improve testing and training. ADS uses rapidly evolving information system technology to link ranges, laboratories, and simulations at multiple locations to create realistic, complex, synthetic environments that can be used for test and training purposes. The technology has proven very useful for many training applications; however, there are significant technical and infrastructure issues that must be resolved before it can be broadly used for test applications.

1.3 Purpose

Unlike the majority of JT&E programs, the purpose of JADS is to develop and validate a testing methodology that has multi-Service application. JADS will investigate the present utility of ADS, including Distributed Interactive Simulation (DIS). For T&E, JADS will identify the critical constraints, concerns, and methodologies when using ADS and will identify the requirements that must be introduced in ADS systems if they are to support a more complete

T&E capability in the future. The customer, in particular the Developmental Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E) communities, is the acquisition community as a whole.

1.4 Approach

JADS is directly investigating ADS applications in three slices of the T&E spectrum: a System Integration Test (SIT), which explores ADS support of guided missile testing; an End-to-End (ETE) test, which explores ADS support for Command, Control, Communications, Computers, and Intelligence Surveillance and Reconnaissance (C^4ISR) testing; and an Electronic Warfare (EW) test, which explores ADS support for electronic warfare testing. The JTF is also chartered to observe, or participate at a modest level, in ADS activities sponsored and conducted by other agencies in an effort to broaden the conclusions developed in the three dedicated test areas.

1.5 Past Activities

The SIT is currently being executed. The team completed the first phase of testing, a Linked Simulators Phase (LSP), in November 1996. Testing was done in partnership with the Naval Air Warfare Center Weapons Division (NAWCWPNS) using linked test resources at Point Mugu, CA; China Lake, CA; and test control resources at JADS in Albuquerque, NM. The LSP involved collecting data on a linked architecture, which included an F/A-18 manned simulator acting as the shooting aircraft, an F-14 manned simulator acting as a target aircraft, and an AIM-9M hardware-in-the-loop (HWIL) missile simulation laboratory. The linked architecture is shown in Figure A-1.

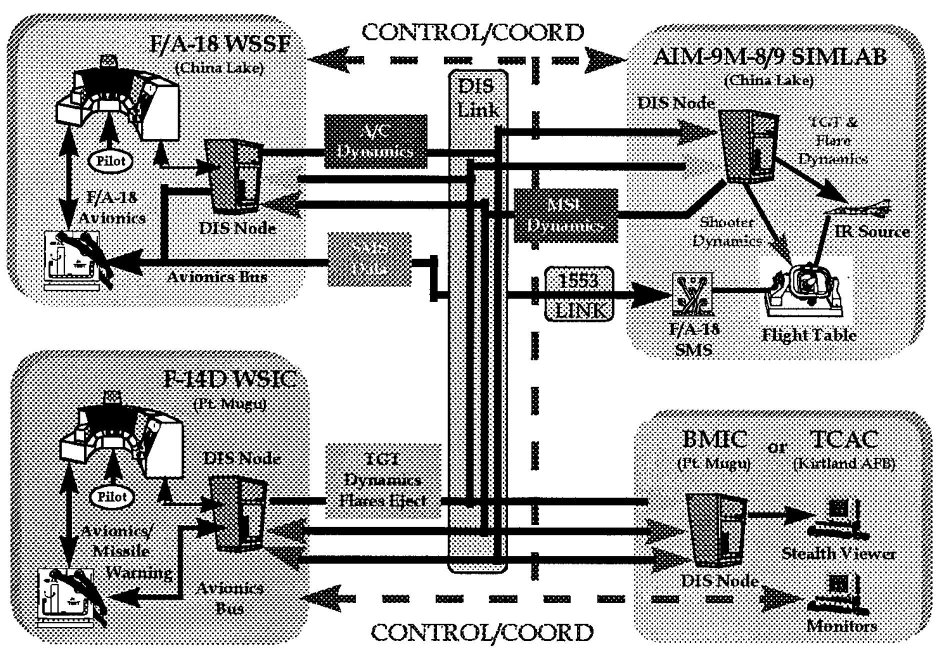


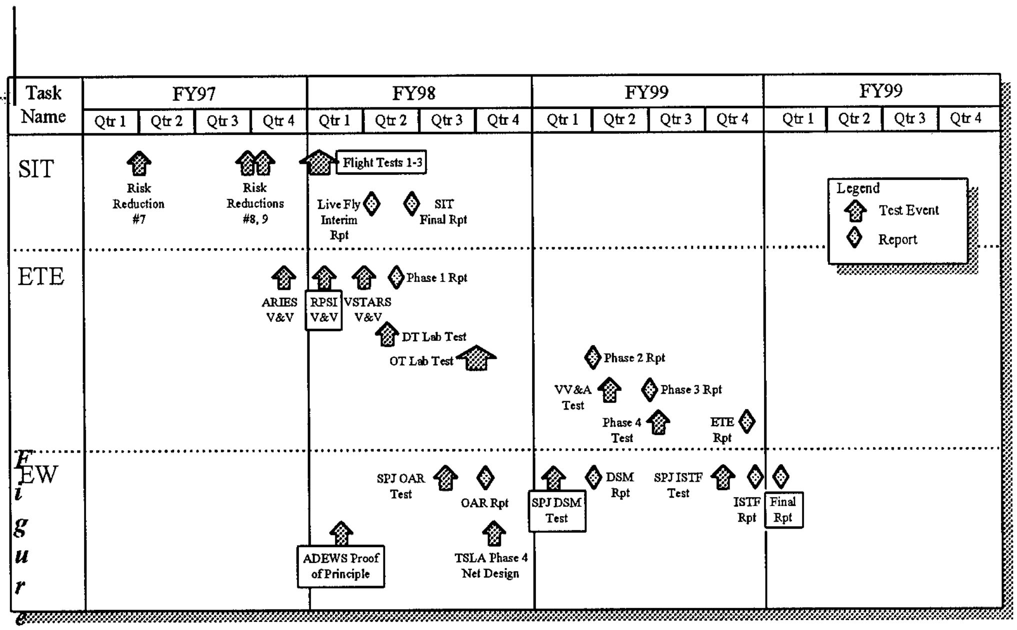
Figure A-1. Linked Architecture

The following process and technical lessons were learned during this first phase of JADS testing:

- A systematic approach to verifying network performance is necessary.
- A full-up linked architecture is necessary to validate architecture and simulation performance.
- Configuration control is even more critical/difficult in an ADS environment.
- Management is more complex with ADS, especially:
  - Coordinating multiple players and
  - Scheduling multiple facilities.
- Data collection and management are different from a "standard" test.
- An early, integrated team approach is critical, specifically:
  - System Under Test (SUT) experts,
  - Simulation node experts, and
  - Networking experts.
- Networking and analysis tools should be installed early to aid the architecture development process.
- The routers from different vendors caused interoperability problems.
- Transmission latency was predictable and tolerable; processing latency was not.
- Network interface to the simulations was critical.
- Synchronization problems can wreak havoc.
- A quantitative comparison of live test and ADS data for validation is difficult.
- A qualitative validation was useful in LSP.

2.0 MILESTONE SCHEDULE

Figure A-2 depicts the major test and reporting milestones for each of the three JADS tests.



A-2. Major Test and Reporting Milestones

3.0 CURRENT MAJOR ACTIVITIES

3.1 SIT

The purpose of SIT is to evaluate the utility of using ADS to support integrated missile weapon/launch aircraft system testing. The test is composed of two phases. The operational scenario for each phase consisted of a single shooter aircraft launching an air-to-air missile against a single target aircraft. In the previously discussed LSP, the simulators represented the shooter, target, and missile. In the Live Fly Phase (LFP), a live aircraft interacts with a missile represented by a simulator. Figure A-3 depicts the linked architecture for the LFP. A live launch aircraft flies against a live maneuvering target aircraft at the Eglin Gulf Test Range. Global Positioning System (GPS) aided Time-Space Position Information (TSPI) and telemetry data are down linked from the aircraft and passed to the Central Control Facility (CCF) at Eglin AFB. The CCF is linked to the Guided Weapons Evaluation Facility (GWEF), which contains an HWIL simulation of the Advanced Medium Range Air-to-Air Missile (AMRAAM). A link to the Test Control and Analysis Center (TCAC) at Kirtland AFB was used for test coordination. Thirty-eight members of the JTF were involved in both phases of SIT. The combined cost of the two phases is approximately $2.8 million.

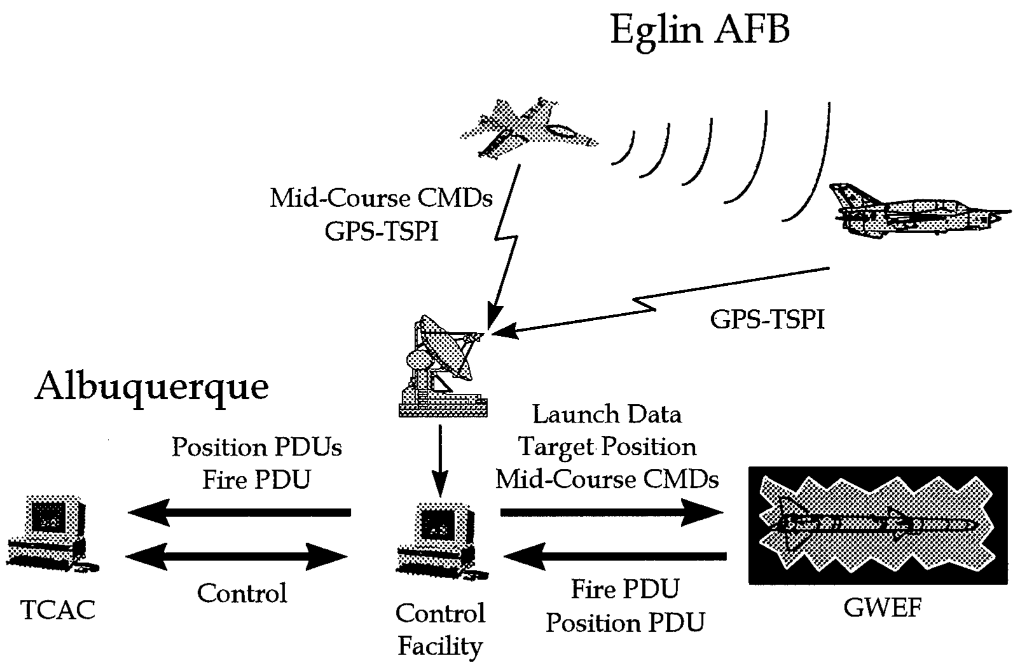


Figure A-3. Linked Architecture for the Live Fly Phase

3.2 Improved Test Capability

The LFP test architecture tests the benefits of having live aircraft linked to an HWIL facility. It allows the use of a manned target aircraft performing realistic evasive maneuvers. The live launch aircraft provides a realistic environment for the fire control radar, which is affected by weather, clutter, and other variables for which good digital models do not exist. The use of the HWIL missile test facility allows detailed performance of the missile subsystem to be monitored and for testing electronic countermeasures (ECM) modes against the missile, which cannot be done in the open air. The LFP test architecture can also provide more cost-effective testing by conducting multiple passes per range mission and allowing for the modification of passes during a range mission.

4.0 FUTURE MAJOR ACTIVITIES

4.1 ETE Test

The purpose of the ETE test is to evaluate the utility of using ADS to support T&E of command, control, communications, computers, and intelligence (C^4I) systems. The representative C^4I system for ETE is the Joint Surveillance Target Attack Radar System (JSTARS) combination of E-8C aircraft and ground station modules. ETE is a four-phase test. Phases 1 and 2 occur in a laboratory environment, suitable for exploring DT&E and early OT&E applications. Phase 3 checks the compatibility of the ADS environment with the actual JSTARS equipment. Phase 4 is an ADS-enhanced live open-air test examining the utility of using ADS to examine OT&E issues. Figure A-4 depicts the linked players involved in the Phase 2 and Phase 4 OT&E applications. Phase 2 will utilize Grumman Aerospace's HWIL and man-in-the-loop laboratory simulation of the E-8C located in Melbourne, FL. The threat scenario simulation located at Training Doctrine and Command (TRADOC) Analysis Center, White Sands Missile Range, NM, will provide a synthetic war to the JSTARS simulation in the laboratory. The radar feed will be transferred to a JSTARS ground station module located at Fort Hood, TX, where it will be analyzed and the targets selected. Requests for fire will be sent to an artillery simulation at Fort Sill, OK, and an Army Tactical Missile System (ATACMS) missile will be fired into the synthetic environment. The scenario driver will assess the damage to the target and reflect this information to the aircraft for damage assessment. In Phase 4, a live E-8C will replace the laboratory version and live targets at an open-air range (OAR) will be added to the synthetic targets. Approximately fifty-five JTF personnel will be involved in ETE. The total cost is estimated to be $7.5 million.

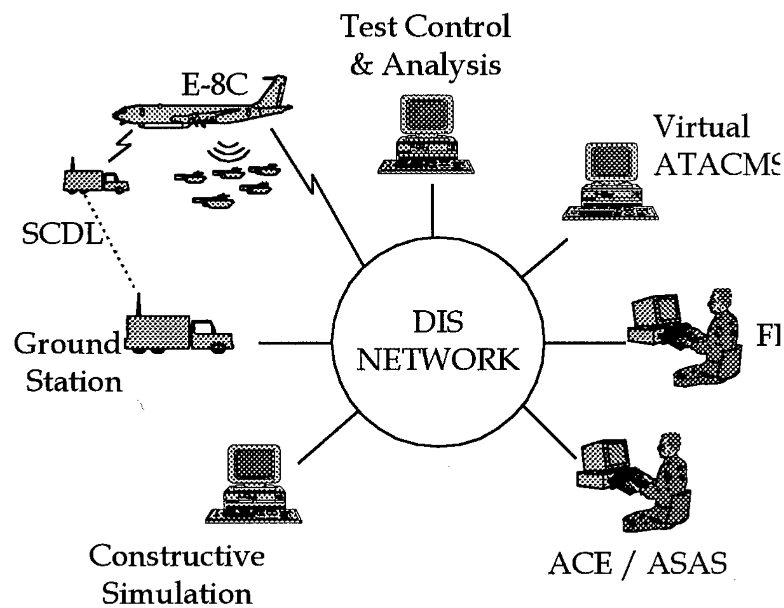


Figure A-4. Linked Players Involved in Phase 2 and Phase 4 Operational Test and Evaluation

4.2 Improved Test Capability

The ETE test provides a complete, robust set of interfaces from sensor platform to weapon system, including additional intermediate nodes employed in a tactical engagement. Using this type of ADS test configuration will allow tracing a thread of the complete battlefield process, from target detection to weapon assignment and target engagement. Processes can be examined at the corps level and below. The tester can evaluate this thread as a whole or as the contribution of any of the parts individually. The tester can also evaluate what effects an operationally realistic environment has on the SUT. The ETE seamlessly adds 8,000 additional entities to the battlefield as seen by the JSTARS sensors. In addition, adding some of the complementary suite of other C^4I and weapons systems via ADS will provide a high fidelity, mission-level test environment that would not be affordable using conventional test methods. ADS allows for flexible test scenarios and repeatable test environments.

4.3 Improved Training Capability

The high fidelity JSTARS simulation being developed for the ETE test is already being evaluated by the training community. It would provide a more operationally realistic training capability for both aircraft and ground station operators at significant cost savings over the currently planned training system. In addition, the simulation capability could be used to provide operationally realistic training while the aircraft is flying. The threat scenario driver developed for ETE is already being used to augment training exercises at the National Training Center.

4.4 EW Test

The purpose of the EW test is to evaluate the utility of using ADS to support electronic warfare testing. The test is composed of three phases. The first phase will be conducted at the Western Test Range to collect airborne self-protection jammer (AN/ALQ-131 Block 2) baseline data at an OAR. In Phases 2 and 3, ADS will be used to link laboratory facilities and simulations to create a synthetic test environment that replicates an OAR test environment. Figure A-5 depicts the Phase 2 ADS test configuration. The scripted flight profiles, ALQ-131 Digital System Model, and test control will all be located at the JADS JTF. They will be linked to the scripted Integrated Air Defense System (IADS) located at the Air Combat Environment Test and Evaluation Facility (ACETEF) at Patuxent River, MD, and to the HWIL threats located at the Air Force Electronic Warfare Evaluation Simulator (AFEWES) in Fort Worth, TX.

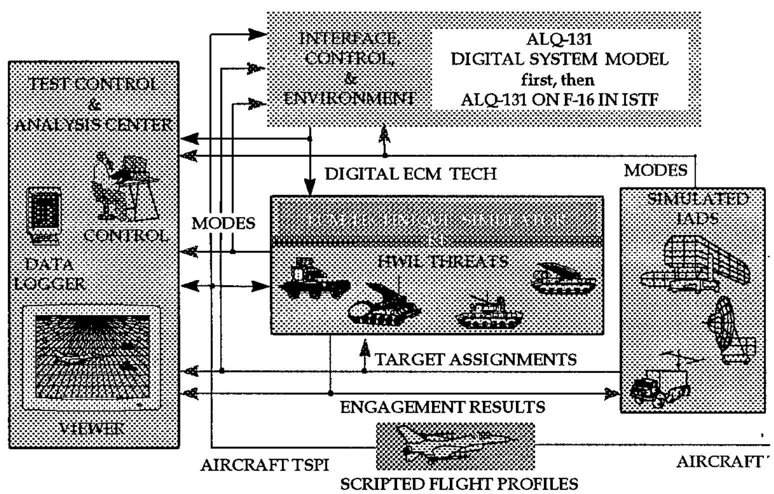


Figure A-5. Phase 2 Advanced Distributed Simulation Test Configuration

In Phase 3, the ALQ-131 Digital System Model is replaced by an AN/ALQ-131 pod installed on an F-16 suspended in an anechoic chamber at ACETEF. JTF personnel and contractor support will peak at 75 during Phase 3. The total cost of the EW test is estimated to be $6.3 million.

4.5 Improved Test Capability

In Phase 2, this test is designed to see if a Digital System Model of an electronic warfare system can be used against high fidelity threats to obtain results comparable to those obtained on the OAR. If this phase is successful, it will show that ADS is a viable enhancement to the EW test process. It would address documented shortfalls in correlation and allow the tester to more thoroughly evaluate the test system earlier in the test process when deficiencies are less expensive to fix. A successful Phase 3 would demonstrate the capability to do combined electromagnetic interference/electromagnetic compatibility (EMI/EMC) and operational effectiveness testing in a laboratory environment resulting in some reduction of more expensive OAR tests.

5.0 LEGACY PRODUCTS

The potential of ADS as a viable test tool, one with the ability to overcome many traditional shortcomings in present-day T&E methodologies, is exciting. JADS is determined to investigate this potential and let the T&E community know the true power, and limitations, of ADS. Our legacy program is being designed and executed so that this vital information gets to those who need it—in a format they can understand and use. Most notably, we are not waiting until we have completed all test activities to create one giant report. We are getting the word out as we go along and are using feedback from our customers to improve all of our legacy efforts.

The legacy of the JADS JT&E will be varied and will cover a broad range of issues for the T&E community. JADS has defined its legacy program as "all actions JADS takes to ensure that its products are fully incorporated into the user community." There are three aspects to this effort:

1. Educate the user community and assimilate ADS into their thought processes. JADS has developed a "Test & Evaluation Utilizing ADS" training course, which is offered at JADS on a quarterly basis and on request off-site. The course covers relevant definitions, regulations, and architecture components; the potential benefits of using ADS; an overview of the JADS test events; and lessons learned from completed tests. We describe what ADS is (and is not), encourage thinking and planning processes that include ADS, and include recommendations on how and when it might be used. In addition, JADS is actively involved in presenting technical papers at major simulation and T&E symposiums and workshops throughout the year.
2. Equip the user community with the proper ADS knowledge, procedures, and tools. Working with our customers, we will develop reports, training modules, roadmaps, checklists, etc., so that the testers can assess whether ADS is right for them in a particular application. JADS will also produce products so that, having made the determination that ADS is worthwhile in their situation, testers can then develop plans to apply ADS. Procedures are being developed for communication network design, installation, and checkout; ADS verification, validation, and accreditation (VV&A); test control and real-time analysis; and security. Specialized software tools are being developed for network monitoring, data collection, and real-time data analysis. Our products will span the entire spectrum of ADS-enhanced testing, from evaluation to planning to execution and analysis. We will include information (in a variety of media) about the judicious uses of ADS, technical how-to, VV&A strategies, pitfalls, lessons learned, and final interpretation of results.
3. 3. Institutionalize the products of the JADS JT&E for lasting value. JADS is working with a variety of agencies and repositories to arrange for the long-term custodial care of our products. Once these arrangements have been formalized, the T&E community will be told where they can go for information. In this way, future T&E

professionals can access what was learned and reap the benefits long after the JADS JT&E has concluded its work. Additionally, as experience in the use of ADS as a T&E tool proliferates, future efforts may delve further into this new technology. The groundbreaking work of JADS will then be available as a starting point for further study.

Tangible products from JADS so far include: a quarterly newsletter, a Worldwide Web site, a variety of brochures, information booths at T&E conferences and symposiums, presentation of technical papers, and an ADS training course designed for T&E professionals. Videos and interactive multimedia products are planned. Perhaps more importantly, JADS has a variety of intangible products. These include: knowledge and experience gained by T&E facility personnel as a result of our tests; infrastructure and computing power paid for by JADS, but left behind at those facilities upon completion of our tests; increased willingness of T&E professionals to consider ADS as a possible solution to their T&E challenges; and the tools to evaluate ADS for how it may fit their particular application.

The legacy of JADS will be much more than a voluminous report that no one reads. It will be real change, where warranted, and the knowledge and tools needed to implement those changes for better T&E in the future. "Better T&E" can mean a lot of things. It may mean T&E at lower cost; more complete T&E at the same cost; higher cost but greatly enhanced fidelity; or in some cases, the only way to test, period, due to safety and/or environmental constraints. Better T&E through the intelligent use of ADS is all of these and more. Giving our warfighters the best we can possibly give them is our ultimate goal. The proper use of ADS yields as an end result weapon systems with lower overall life-cycle costs that come from better design, testing, and evaluation before being put in the hands of our warfighters. While it is impossible to tally up a price tag for that outcome, it is easy to conceive the full benefits. This is the true legacy of the JADS JT&E.

Appendix B

JOINT COMBAT SEARCH AND RESCUE (JCSAR)

1.0 BACKGROUND

Recent combat experience highlighted a number of deficiencies in Combat Search and Rescue (CSAR) during joint operations that limit a Joint Force Commander's (JFC's) ability to provide full-dimensional protection as described in Joint Vision 2010. Mission area deficiencies encompassed several interoperability issues, such as nonstandard tactics, techniques, and procedures (TTPs) and incompatible communications capabilities. As a result, in 1995 the Office of the Secretary of Defense (OSD) chartered the JCSAR Joint Test and Evaluation (JT&E) to study the CSAR mission area as it applies to United States forces engaged in joint operations.

The JCSAR JT&E is based on a broad, joint-Service perspective of the mission area. The JCSAR Tactics Process Action Team's (TPAT's) reports and other sources yielded over 170 individual issues that identified potential problems, shortfalls, or deficiencies in the JCSAR mission area. Table B-1 groups the issues into five categories. A refinement of these issues resulted in the dendritic structure that is the basis for all JT&E testing.

1.1 Purpose

The purpose of the JT&E is to:

- Conduct a robust assessment of current JCSAR effectiveness in an operational environment
- Determine critical problem areas in executing JCSAR missions
- Develop a series of enhancements to address identified problems
- Evaluate the identified enhancements for measured improvement to current JCSAR force effectiveness
- Develop a series of legacy products for the Services and Theaters

Table B-1. JCSAR Mission Issues

Category	Summary
Concept of Operations (CONOPS) and Force Employment	Are current JCSAR CONOPS the most effective solution given the present force structure and resources? Are JCSAR CONOPS fully deployed to the proper forces? Are the roles, missions, and customers of JCSAR clearly defined? Do planners and operators use JCSAR CONOPS? Which JCSAR CONOPS best support CSAR-capable forces?
TTPs	Are current JCSAR TTPs the most effective for the expected threat? Which tactics best support the interoperability limitations of rescue forces? Which tactics best employ the available CSAR-capable forces?
Equipment and Interoperability	Which currently available CSAR-capable systems are interoperable and which are not? Which systems are survivable and which are not? Which systems are effective in their expected roles and missions?
Command, Control, Communications, Computers, and Intelligence (C^4I)	What is the most effective JCSAR C^4I system to support Theater deployment and combat operations? Are all intelligence assets optimally employed to support the JCSAR mission?
Training	Do the personnel who operate CSAR-capable systems receive the training needed to achieve and maintain proficiency? Are JCSAR CONOPs and TTPs part of the CSAR mission curriculum? Is CSAR training joint? Realistic? Standardized? Current? Is there training for all roles of the CSAR mission? Is Survival, Evasion, Resistance, and Escape (SERE) training joint? Realistic? Standardized? Current?

2.0 CURRENT CAPABILITY ASSESSMENT

The JCSAR Joint Test Force (JTF) structured the JT&E to examine all phases of the JCSAR mission, from the isolating event through mission initiation/planning to recovery of the isolated personnel, using selected forces from all of the Services. Where feasible, the JTF planned the majority of JT&E testing to be conducted in conjunction with planned training exercises. This approach conserves resources by avoiding the expense of assembling the numerous forces required for a dedicated JCSAR test. The JT&E consists of various field and simulation tests designed to fit a phased sequence where the cumulative results of previous tests guide and focus subsequent tests. Table B-2 provides an overview of the JT&E and indicates the types of test activities that apply to the primary JCSAR mission phases and the location and identification (Loc/Id) function.

Table B-2. JT&E Test Overview

TEST	LOC/ID		MISSION PLANNING	MISSION EXECUTION			
ACTIVITY TYPE	Space-based C^4I	Airborne C^4I	Surface-based C^4I	Airborne C^4I	Isolated Personnel	Recovery Vehicle	Support Forces
Command Post Exercise (CPX)	-	-	◆	-	-	-	-
Field Test Exercise (FTX)	◆	◆	◆	◆	◆	◆	◆
Minitest	◆	◆	-	-	-	-	-
Simulation	-	-	-	◆	-	◆	◆

2.1 Location/Identification Testing

Different Department of Defense (DoD) agencies such as the National Reconnaissance Office (NRO); the Joint Services Survival, Evasion, Resistance, and Escape (SERE) Agency (JSSA); and the National Imagery and Mapping Agency (NIMA) have placed a high priority on testing and procuring devices to aid in locating and identifying isolated personnel. The JT&E conducted several tests to assess the capability of selected assets to locate and identify isolated personnel. The schedule/locations for the individual test segments were:

- February 1996 — Nellis AFB, Nevada
- July 1996 — Kirtland AFB, New Mexico
- August 1996 — Elemendorf AFB, Alaska
- September 1996 — Eglin AFB, Florida
- September 1996 — Italy
- August 1997 — Woodland Cougar 97 — Fairchild AFB, Washington

2.2 Location/Identification Testing Purpose

The Loc/Id testing provided an opportunity for the JT&E to collect data on the performance of the PRC-112A and the new PRC-112B (HOOK-112) survival radios with National Assets. The internal differences of the PRC-112B radio drove many test efforts toward performance comparison. The HOOK-112 tests occurred in conjunction with the Air Force Operational Test and Evaluation Center (AFOTEC) evaluation and other tests while the PRC-112 testing occurred in concert with NRO and JSSA. The National Assets' support of personnel recovery was completed in Italy and during Woodland Cougar 97.

2.3 Location/Identification Testing Description

The JTF conducted test efforts in the continental United States (CONUS) in addition to the United States Pacific Command (USPACOM) and the United States Atlantic Command (USACOM) areas of responsibility (AORs), taking advantage of assets currently in use. The JTF coordinated tasking for selected assets to locate and identify isolated personnel equipped with the PRC-112 and PRC-112B (HOOK-112) survival radios. The National Asset testing takes a global perspective, concentrating on the location and identification of isolated personnel with current capabilities and without additional expense to the DoD. The test scenario reflected a combat environment. The evaders carried the equipment they would normally have in an evasion situation. Scenario scripting and approval was the responsibility of the participating units and agencies.

The JTF will use the collected test data to:

- Assess current Loc/Id capability using survival radios and collection assets
- Characterize the timeliness and accuracy of National Assets' support of personnel recovery
- Draft changes to a Loc/Id appendix to joint TTPs (JTTPs)
- Develop other detailed test plans (DTPs) and procedures

2.4 Surface-Based C^{4}I Testing

The JCSAR surface-based (SB) C^{4}I testing emphasized events in the JCSAR mission sequence from the isolating event through the launch order for rescue forces to the recovery of the isolated personnel. The JTF conducted testing in June 1996 and 1997 in conjunction with Blue Flag (BF) Exercises at the USAF Battlestaff Training School (BTS) facility at Hurlburt Field, Florida. The 3.5 days of exercise play included 10 hours of dynamic play each full day and approximately five hours of dynamic play the last day.

2.5 Surface-Based C^{4}I Testing Purpose

The BF SB C^{4}I tests provided the necessary data to assess the success of the SB C^{4}I in selecting and directing forces to accomplish JCSAR missions. The United States Central Air Force (USCENTAF) and United States Central Command (USCENTCOM) components, in conjunction with the JTF, developed the exercise scenario and formed the staff for exercise execution. The tests looked at the CSAR capabilities available to a JFC operating in a joint operating area (JOA). Further, these tests looked at CSAR capabilities when the JFC delegates JOA CSAR responsibility to the Joint Force Air Component Commander (JFACC).

2.6 Surface-Based C^{4}I Testing Purpose Description

The tests evaluated the current capability of SB C^{4}I to conduct JCSAR operations, specifically, how the C^{4}I elements plan, coordinate, and assign CSAR forces to recovery missions. The JTF will use the results of these tests to identify problems with SB C^{4}I and recommend enhancements. The JTF will also use the results to support the JCSAR JT&E Modeling and Simulation Program.

The JTF integrated test activities with the planned BF CSAR events with minimal impact. There was no attempt to control or influence the CSAR missions. The JTF conducted the tests in conjunction with the USCENTCOM scenario, using selected resource attrition to generate isolated personnel events for JCSAR. Scenario parameters were peculiar to the USCENTCOM AOR, with a major regional contingency (MRC) level of conflict.

2.7 Field Training Exercises

The JCSAR mission execution tests emphasized the phases of the JCSAR mission from the order to launch rescue forces to the recovery of the isolated personnel. The Field Training Exercises (FTXs) consisted of the following test activities, which focused on various components of JCSAR mission execution:

- A minitest concentrated on Airborne Mission Commander (AMC) contributions to mission effectiveness with reactionary CSAR missions. The JTF conducted this activity in conjunction with the December 1996 USAF Weapons School (WS) Mission Evaluation (ME) CSAR scenarios. Each WS ME CSAR scenario provided a representative USCENTCOM MRC threat overlay and operations tempo.
- A second minitest concentrated on the Recovery Vehicle (RV)/Rescue Escort (RESCORT)/isolated personnel contributions to mission effectiveness with preplanned CSAR missions. The JTF conducted this activity in conjunction with the May 1997 WS Search and Rescue Task Force (SARTF) scenarios. WS SARTF scenarios provided an ideal focus on the core CSAR mission execution tasks.
- A third minitest concentrated on AMC contributions to mission effectiveness with reactionary CSAR missions. The JTF conducted this activity in conjunction with the June 1997 WS ME scenarios to augment data from FTX 1A.
- The All Service Combat Identification Evaluation Team (ASCIET) 97 evaluation allowed the JTF to collect data on JCSAR missions conducted in the context of an MRC in dense vegetation. The JCSAR/ASCIET team conducted this evaluation at the Mississippi Air National Guard, Combat Readiness Training Center (ANG-CRTC) and the Naval Construction Battalion Center (NCBC) at Gulfport, Mississippi; the Camp Shelby National Guard ranges at Hattiesburg, Mississippi; Eglin AFB, Florida; and the northern Gulf of Mexico surface and air ranges during September 1997.
- The JTF tested the current capability of Special Operations Forces (SOF) ground teams and conventional CSARTF to conduct JCSAR during August 1997 in conjunction with the WC 97 exercise. The 336th Training Group, USAF Air Education and Training Command, Fairchild AFB, Washington, sponsored WC 97 with participation from NRO, NIMA, JSSA, and JCRA. The exercise provided a unique opportunity to conduct an end-to-end evaluation of all JCSAR mission phases.

2.8 Field Training Exercises Purpose

The primary purpose of the FTX tests was to gather data on the execution phase of the JCSAR mission. The JTF designed these tests specifically to:

- Characterize the effectiveness of the current capability available to the Commanders in Chief (CINCs) to conduct joint CSAR operations in a desert environment and in dense vegetation
- Characterize the effectiveness of the HH-60G and HH-60H performing RV duties in addition to the AH-64, F-16, and A-10 performing RESCORT duties

- Characterize night versus day mission effectiveness
- Characterize the effectiveness of the command and control teams performing AMC duties on E-3 Airborne Warning and Control System (AWACS), E-2C, and at ground-based radar equipment
- Identify interoperability and mission execution problems
- Identify potential enhancements to address the interoperability and mission execution problems

2.9 Field Training Exercises Description

The JTF focused on the effectiveness of selected combinations of JCSAR mission execution elements to successfully conduct recovery operations. The JTF collected data on JCSAR missions conducted in the context of an MRC in the USCENTCOM AOR. The JTF developed and coordinated a USCENTCOM scenario with the Defense Intelligence Agency (DIA). The test scenarios included and provide for:

- A threat lay-down based on the USCENTCOM threat and validated by DIA
- Realistic employment of rescue forces within a high operations tempo
- A mix of reactionary and preplanned CSAR missions
- Criteria for controlling mission variables were:
  - All RVs were planned as two-ship flights
  - All RESCORTs were scheduled as four-ship flights
  - Qualified controllers conducted AMC duties from either the E-3, E-2, or in a ground-based facility at Nellis AFB
  - The JTF kept the threat to CSAR forces constant by keeping the numbers and types of threat constant

2.10 Virtual Simulation 1 Testing

The Virtual Simulation (VS) 1 Mission Execution Test was a Distributed Interactive Simulation (DIS) exercise. The JTF designed the test objectives to provide a second look at the scenarios flown in the execution tests and to characterize the simulation architecture as a tactics-development, analysis, and training tool. The JTF conducted VS 1 in June 1997 at the locations shown in Figure B-1.

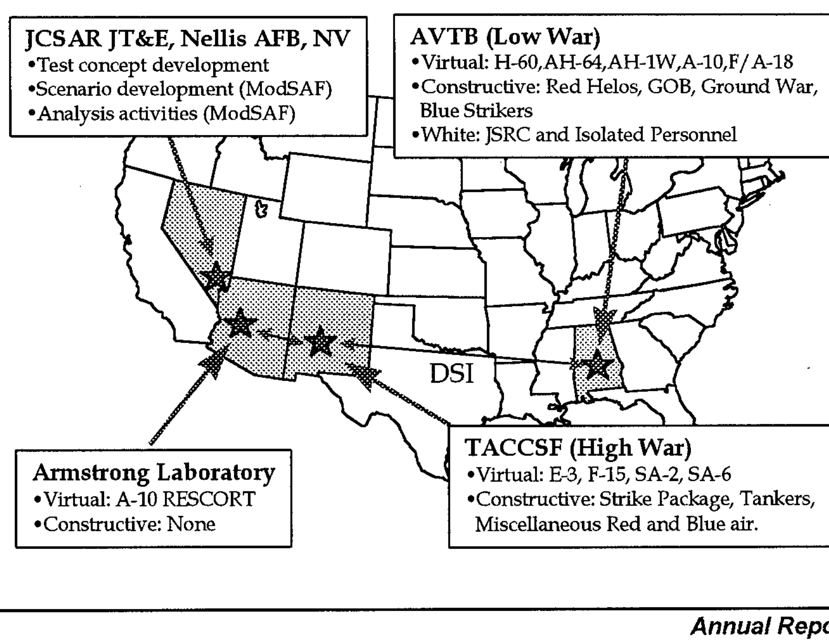


Figure B-1. Virtual Simulation 1 Distributed Architecture

2.11 Virtual Simulation 1 Testing Purpose

VS 1 addressed similar objectives to the mission execution field tests. Following the completion of VS 1 data analysis, the JTF will have accomplished the following:

- Accredited the Armstrong Laboratory (AL/HRA), Aviation Test Bed (AVTB), and Theater Air Command and Control Simulation Facility (TACCSF) devices and DIS architecture for the JCSAR JT&E
- Characterized current joint execution element interoperability procedural effectiveness and identified problem areas (airborne C^4I, RV, RESCORT, Rescue Combat Air Patrol [RESCAP])
- Utilized the data for review by expert panels to update/draft multi-Service and JTTP publications
- Provided JCSAR syllabus inputs to Service training schools (USAF WS, Naval Strike Warfare Center, Marine Aviation Weapons, and Tactics Squadron – 1 Air Warfare Training School, USA Joint Readiness Training Center, USN E-2 Weapons School, USAF E-3 Replacement Training Unit)
- Characterized TACCSF and AVTB architecture as a JCSAR test and training legacy product

2.12 Virtual Simulation 1 Testing Description

VS 1 incorporated operator-in-the-loop (OITL) interactions by linking simulators at the AVTB, Fort Rucker, Alabama; TACCSF, Kirtland AFB, New Mexico; and AL/HRA, Mesa, Arizona. The facilities used three constructive simulation applications to generate the JCSAR VS 1 scenario. These environment generators provided a flavor of realism to the battlefield by creating a background air/ground war.

Scenario execution began with the report of two isolated personnel incidents to the Joint Search and Rescue Center (JSRC). The TACCSF used virtual devices to simulate the AMC and RESCAP roles while the AVTB and AL/HRA incorporated various virtual RVs and RESCORT aircraft. All facilities simulated the virtual and constructive threat systems based on the threat laydown developed for the FTX tests.

The JCSAR scenario is defined as an MRC in the USCENTCOM AOR. VS testing focused on joint-force effectiveness in recovering isolated personnel. The JT&E based the test threat environment on a DIA-validated list of medium-threat system types and density. The threat environment included fixed-wing aircraft (FWA) and rotary-wing aircraft (RWA), defensive radar and infrared surface-to-air missiles (SAMs), anti-aircraft artillery (AAA), man-portable air defense system missiles, and conventional ground maneuver forces consisting of tanks, armored personnel carriers, wheeled vehicles, and dismounted infantry.

3.0 ENHANCED CAPABILITY ASSESSMENT

Phase 2 of the JCSAR JT&E will focus on assessing improvements to the JCSAR process contributed by identified enhancements. The JTF will derive enhancements from an analysis of data collected during current capability testing.

3.1 National Asset Support of Personnel Recovery

The JTF will head an effort to further fine-tune the use of National Assets to locate and identify isolated personnel worldwide. This effort is in conjunction with NSA, NIMA, NRO, JSSA, and JCRA. The test will be held in April 1998.

3.2 National Asset Support of Personnel Recovery Purpose

The purpose of this test is to assess newly developed CONOPS for the use of National Assets to support personnel recovery with no added expense to the CINCs. This CONOPS will be kept at the Secret classification, allowing all warfighters to use it worldwide.

3.3 National Asset Support of Personnel Recovery Description

The use of National Assets in this mission is a new concept. Command and control channels, assets and signal selection, platform detection/location capabilities and effectiveness, and overall timing need to be set and tested. The background work done during Woodland Cougar 97 will be used as a starting point. Once this test is completed, various agencies will have all the information needed to work this important capability into their exercise scenarios. If the JTF completes any other later testing after this event, then the CONOPS will be used to assess its seamless integration into the CSAR community.

3.4 Red Flag 98-1

The JCSAR JT&E will conduct FTX tests in conjunction with Red Flag (RF) 98-1 in January 1998, Nellis AFB, Las Vegas, Nevada. The framework of the RF exercises provides a good MRC environment in which to evaluate JCSAR missions. This reduces the number of assets that JCSAR must bring in to support test requirements.

3.5 Red Flag 98-1 Purpose

The purpose of this FTX test is to assess the effectiveness of JCSAR mission enhancements determined during previous testing. These enhancements consist of new improved training, incorporation of additional assets into the SARTF, and employment of new methods to locate and identify the survivor and improve communication between command authorities and the survivor.

3.6 Red Flag 98-1 Description

The basic structure of the FTX test will be similar to previous testing, which was conducted on the Nellis Range Complex. The participants in this FTX test will be line aviators from operational units, vice the weapons school instructors and students who were used during previous testing.

3.7 Blue Flag 98-2

The JCSAR SB C^4I testing assesses events in the JCSAR mission sequence of events from the isolating event to the launch order for rescue forces to recover the isolated personnel. The JTF will conduct the enhanced SB C^4I test during the scheduled USCENTAF BF at the USAF BTS at Hurlburt Field, Florida, in February 1998.

3.8 Blue Flag 98-2 Purpose

BF 98-2 will provide the JTF with an opportunity to collect data on the effect of selected enhancements to SB C^4I operations. The JTF will implement enhancements based on the priority established by the SB C^4I Expert Panels conducted after each of the previous test events. The results from this enhanced C^4I test will show whether or not the selected enhancements actually improve SB C^4I, the degree of improvement, and what impact the enhancements have on collateral processes.

3.9 Blue Flag 98-2 Description

The JTF will integrate test activities into the planned BF CSAR events. Much of the test will mirror procedures used during the initial SB C^4I tests except for implementing selected enhancements. In addition to having access to the standard C^4I systems, exercise players will have access to enhanced computer hardware and/or software systems.

3.10 Virtual Simulation 2 Testing

The VS 2 Mission Execution Test will be a DIS exercise. The test will provide a second look at the scenarios flown in the FTX tests, provide additional data points for aircraft combinations not flown in the FTX tests, and further characterize the simulation architecture as a tactics-development, analysis, and training tool. The JTF will conduct VS 2 during May 1998.

3.11 Virtual Simulation 2 Testing Purpose

The JT&E will execute this test as a follow-on VS test based on the results of VS 1, the live field tests, and an Advanced Distributed Simulation (ADS) study. The purposes and objectives of VS 2 parallel those of VS 1 with the addition of selected facilities to enhance the scenario.

3.12 Virtual Simulation 2 Testing Description

The test will link the core VS simulation facilities, AVTB and TACCSF, with other simulation facilities that satisfy the shortfalls identified during VS 1. Additional facilities may include all or some of the following facilities: ACETEF, AEWW, Armstrong Laboratories, and NRaD. JCSAR intends to use the Defense Simulation Internet (DSI) to provide network connectivity.

3.13 Test Option

The JTF is exploring the feasibility of conducting an integrated end-to-end test that would replace one or more of the previously described tests. The basic concept consists of a test that would integrate enhancements to location/identification, command and control, and mission execution. In addition, the VS 2 test may be used for enhanced training of integrated test participants. The JTF is currently researching a number of issues that will determine the feasibility of such an integrated test, including:

- Suitable venues
- Staffing
- Cost
- Schedule
- Availability of suitable forces
- Instrumentation
- Support from the CSAR and training communities

4.0 LESSONS LEARNED

The following lessons apply to test planning, coordination, and execution. JCSAR test reports address lessons specifically applicable to the JCSAR mission area.

- Simulation costs a lot of money. The JCSAR JT&E is breaking new ground in this area. The technology is there, but the standardization necessary to link simulators together still requires refinement.
  - At least a year of lead time is required (minimum) to put together a distributed simulation exercise. This time is required to develop test plans and scenarios, to perform integration testing of the distributed network, and to perform validation, verification, and accreditation (VV&A) testing of the network.
  - Standardization between simulation facilities is necessary to link them together and present a credible simulated combat environment to the participants.
  - Any joint test that includes simulation as part of its testing effort must hire personnel, both military and civilian, with experience in the simulation field. The time required to "spin up" managers and personnel is extensive if they have no experience in simulation and can significantly impact the test schedule.
- Integrating testing objectives into existing Service and joint exercises is a cost-saving measure, but the loss of test control may skew the results.
- Lead-time coordination for Service forces varies among the Services. The Army takes the longest (6 months to a year), the Navy takes the shortest (approximately 3 months), and the Air Force and Marine Corps fall somewhere in between. Even with Memorandums of Agreement/Understanding (MOA/MOU) ensuring required test support, last minute real world operations take precedence over extensively planned test events and introduces an element of risk in accomplishing a test.

- The expense and time required for operational tests precludes gathering statistically significant data on all possible variables. It is necessary to carefully define and control the major variables and use subjective analysis and operational expert assessments to produce meaningful results.
- Spinning up a JTF with over half of the people coming on board well after the charter significantly limits what can be accomplished in a three year period. Joint Test Directors should plan test activities and goals accordingly.

5.0 CONTRIBUTION TO THE WARFIGHTER

The JCSAR JT&E will provide the Services and CINCs with increased combat capability through easily implemented legacy products. The JTF will develop a strategy for implementing the legacy products. The anticipated legacy products include:

- Statistical data that validates doctrine and can be utilized to update JTTPs
- Identification of equipment shortfalls
- Improvements in mission debriefing capabilities for low-altitude aircraft integrated into existing debriefing systems
- Inputs to update training syllabuses for CSAR training programs
- Mission analysis tools for concept development studies
- A proven JCSAR virtual training architecture that provides a medium for Service and CINC-sponsored JCSAR training exercises using an effective mix of constructive and virtual combat environments
- JCSAR C^4I and joint force interoperability data needed to verify and validate the cost effectiveness of interrelated joint weapon systems at the Theater level
- Deployable automated JCSAR mission planning, rehearsal, and analysis tools
- Better understanding of the capabilities and limitations of existing force structure in executing CSAR

From this, the warfighter can apportion the available forces according to acceptable risk or request additional forces to reduce the risk to acceptable levels. Potential improvements to CSAR capability are:

- Less demand on primary warfighting forces to divert to the CSAR mission
- Ability to execute campaigns with fewer forces, shorter time, and less cost to the taxpayer
- Increased margin of error, should the unexpected be encountered
- More flexibility in executing a campaign
- Increased capability to recover isolated personnel from contested territory

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Appendix C

JOINT ELECTRONIC COMBAT TESTING USING SIMULATION (JECSIM)

1.0 BACKGROUND

1.1 Charter

The Joint Electronic Combat Testing using Simulation (JECSIM) was chartered 23 August 1996 with the United States Army, Navy, and Air Force as the participating Services. The Navy has been designated as the lead Service. JECSIM was chartered to investigate the utility of digital models and simulation in the test and evaluation of threat semi-active anti-air against friendly forces electronic countermeasures (ECM), low observable (LO), and large aircraft utilized in both developmental test and evaluation (DT&E) and operational test and evaluation (OT&E). JECSIM will evaluate the present utility and credibility of existing models and simulations (M&S) of semi-active threats and ECM/LO systems for Test and Evaluation (T&E); identify the critical constraints, concerns, and methodologies when using these M&S for T&E; and finally, identify the requirements that must be introduced into M&S if they are to support a more comprehensive T&E capability in the future.

1.2 Problem Statement

There are major limitations in the current Department of Defense (DoD) capability to evaluate the effectiveness of countermeasures, including both electronic countermeasures and LO technology. The availability of threat systems is severely limited and simulators depend on the degree and accuracy of intelligence data. Live fire tests are both limited and are most often used against non-representative drone aircraft. Additionally, the high costs of field testing prevent comprehensive evaluations against a wide range of engagement conditions that can have profound effects on ECM/LO effectiveness. Endgame evaluations (probability of kill (P_k)) are also limited. And finally, test results against threat systems cannot be effectively extended to other variants of the same system.

M&S play an essential role in the DoD life cycle process. M&S are used extensively to support DoD decision-making bodies such as the Joint Requirements Oversight Council (JROC), the Defense Planning and Resources Board (DPRB), and the Defense Acquisition Board (DAB). In addition, M&S play an important role in education and training of the military forces for all DoD components. The systems engineering process, so essential to the program office and the decision making bodies, is intended to provide disciplined engineering during all system life cycle phases. Throughout this process, analysis forms the foundation for the systems engineering performed. The keys to successful analyses are the tools used, specifically M&S.

Because of budget pressures, downsizing, consolidation, acquisition reform, technology advancements, and realignment, there is a major thrust in DoD to emphasize test and evaluation supported by simulation to become allied with acquisition programs from their inception. M&S applications are needed to support test design and extrapolate test data to the engagement/ mission and theater levels. The interdependent manner in which simulation and test tools are applied to support the acquisition process and remain available for reuse throughout the system life cycle is key to cost-effective acquisition. Funding shortages, complex systems, competition within DoD for dollars, and the overall reduction of resources have caused the Services to take a closer look at M&S applications through the DoD. A key finding of this effort was the lack of a standard approach for M&S application during requirements planning, system acquisition, and operation and support phases.

1.3 Purpose

Since recent technological advancements in both hardware and software have enhanced the utilization of M&S in solving this type of problem, the JECSIM JT&E will determine the degree to which digital models correlated with hardware-in-the-loop (HITL) and open-air range (OAR) testing can be used to credibly predict effectiveness of electronic countermeasures/low observable (ECM/LO) technologies utilized by small fighter- and bomber-sized targets versus threat semi-active anti-air missiles. While M&S has always been a critical element of T&E, technological advances and budget cuts have fueled a greater emphasis on improving and applying M&S, particularly with respect to guiding DoD's "what to buy" decisions. As a result, the role of M&S in T&E is transitioning from one of support in test planning to one with the capability for interpretation of the impact of test results; extension of test results to other scenarios, systems, and environments; and the generation of data for operation assessments.

The current "test, fix, test" methodology for planning development programs will soon be replaced with a "model, simulate, test, evaluate plan (STEP) model" approach that defines the role of M&S in T&E, defines the methodology for verification and validation (V&V) of M&S for T&E, and develops an approach for extending test results to other scenarios, systems, and environments. The process for meeting these objectives is described in JECSIM JT&E Program Test Plan (PTP). The JECSIM JT&E will compare data collected at various laboratories, HITL facilities, and OARs with predictions using M&S tools designated in the Joint Modeling and Simulation System (J-MASS). Additionally, the JECSIM JT&E will study the P_k sensitivity to variances in endgame parameters using the Joint Services Endgame Model (JSEM).

1.4 Past Activities

The JECSIM program began as an attempt to resolve problems experienced in OAR testing. The Air Force Test and Evaluation Center (AFOTEC) proposed the creation of a set of common flyout models for threat systems to Air Force Test and Evaluation in 1993. The Navy and Army were invited to participate in this effort. By late 1993, a Flyout Model Working Group met to define a common range architecture and model set. In mid-1994, discussion focused on the issue of modeling semi-active and/or active threat systems. The culmination of these initial efforts was a Joint Feasibility Study (JFS).

The purpose of the JFS was to conduct an in-depth analysis to assess the need and feasibility of performing a JT&E. The JFS concluded that a JT&E was necessary and feasible. The JECSIM project, with Navy, Air Force, Army, and intelligence community (INTEL) participation, was deemed necessary to answer the following questions.

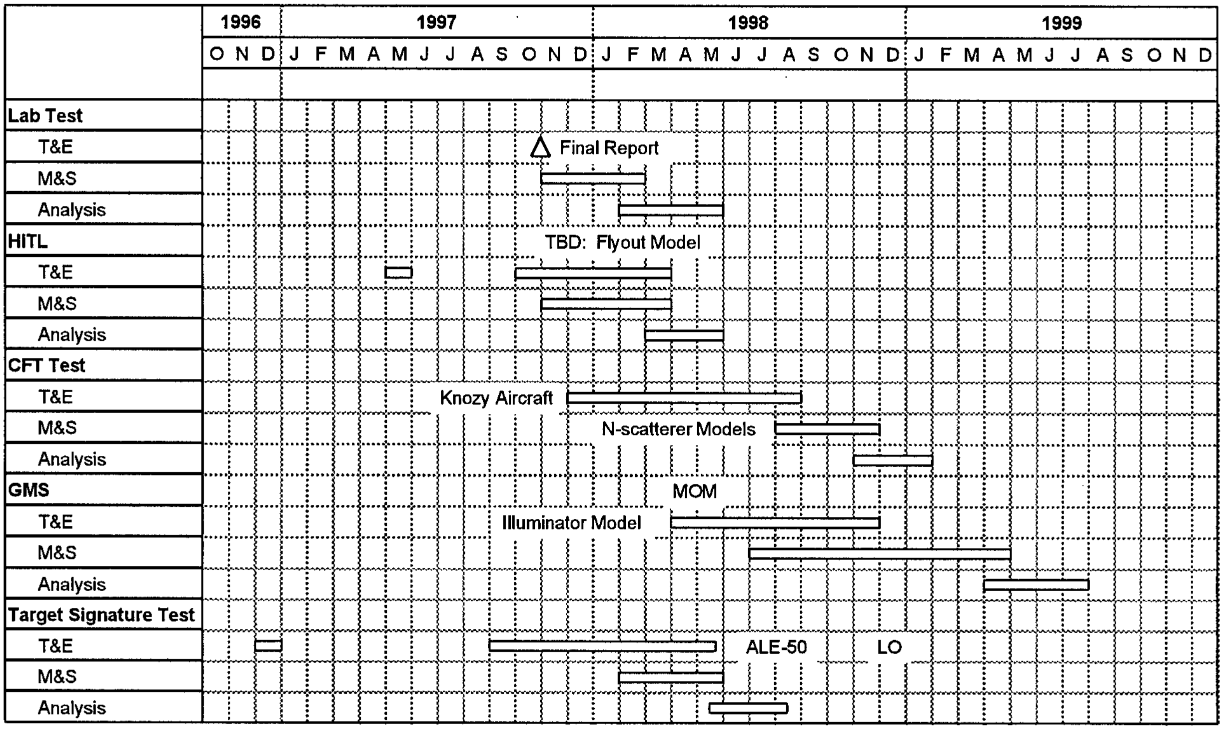
- What is the role of M&S in T&E (e.g., how well can models predict real world test results and be used in conjunction with OAR and/or HITL in the evaluation of threat semi-active, anti-air missiles versus ECM/LO systems)?
- What data should be collected for model validation?
- How can models required for simulation of semi-active, anti-air missiles from launch through endgame encounter be integrated and validated to the level required to produce credible results? This encompasses component models used in HITL and ground-mounted seekers (GMS). M&S applications are required to predict endgame geometry and fuzing to the accuracy required for P_k assessment.
- How do life cycle costs for M&S and T&E efforts compare?

The feasibility study concluded that a joint Service T&E would determine the capability and limitations of M&S in ECM/LO conditions and integrate methodologies and database requirements. The JFS also concluded that the synergistic use of all digital M&S in conjunction with HITL, GMS, and OAR testing could provide qualitative and more cost-effective methodologies for T&E of semi-active systems against cruise missiles, fighters, and bomber-size aircraft in ECM/LO environments.

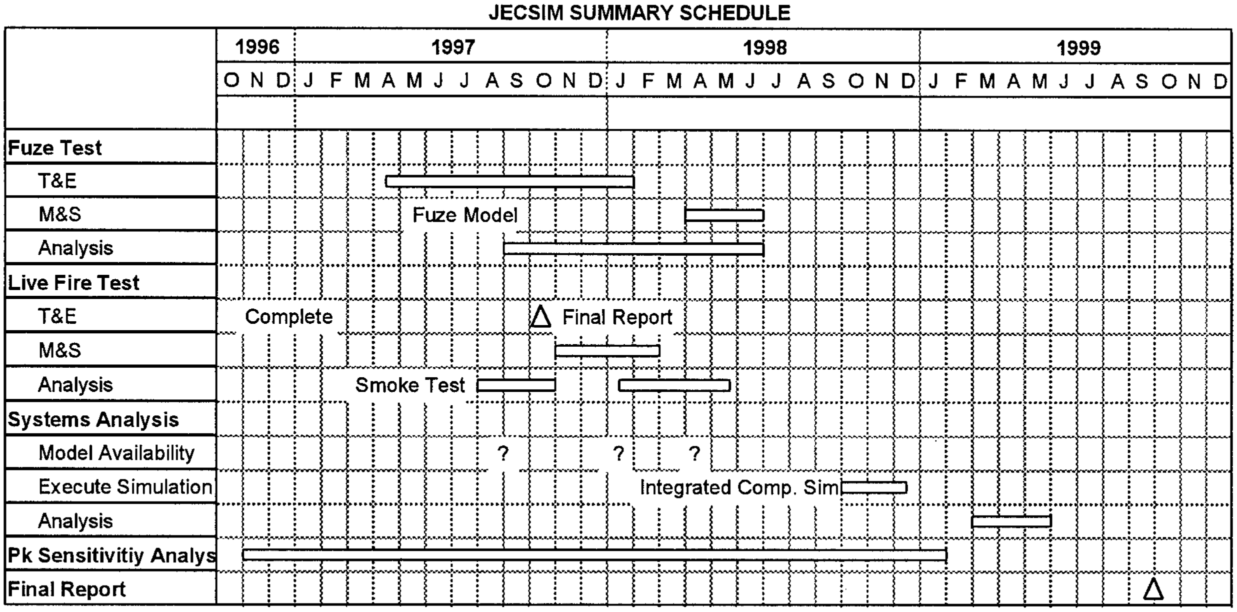
The JECSIM Analysis Plan for Assessment (APA), prepared in July 1996, documented the JFS. The APA also included a projection of resource requirements (e.g., funding, test assets, personnel, contractor support, exercise participants, administration, and accommodations). The APA addressed issues that the JECSIM JT&E would resolve and how the JT&E would resolve them and established a support base for the JT&E. The APA also detailed the JT&E purpose to determine the level of M&S required for use in conjunction with HITL and OAR testing to enable the assessment of credible performance Measures of Effectiveness (MOEs) with respect to missile, target, and ECM. Further, the APA established methods that illustrate how the use of credible M&S can more effectively distribute funds to the performance of T&E (in conjunction with semi-active surface-to-air missile [SAM] systems) and to the testing required to satisfy MOEs.

2.0 MILESTONE SCHEDULE

JECSIM SUMMARY SCHEDULE



JECSIM SUMMARY SCHEDULE



3.0 MAJOR ACTIVITIES

3.1 SA-6 Live Fire

Early in the planning and nomination phases, it was known that a series of SA-6 live fire tests were being planned by another testing activity to reach an acquisition decision on a countermeasures device. It was briefed that JECSIM planned to leverage on these tests for the purpose of data collection and later comparison to models. The tests occurred during the feasibility study phase; however, JECSIM was able to influence the missile calibration, characterization, and telemetry in such a fashion that valuable data was obtained.

3.2 Laboratory Testing

The purpose of the laboratory testing in JECSIM was to characterize the missile seekers and calibrate the missile accelerometers and gimbals. The seeker characterization was accomplished by measuring the responses and assemblies of the missile seeker subcomponents to specific input signals. The accelerometers were calibrated by mounting the missile seeker and autopilot section of the missile on a centrifuge and rotating the missiles at various angular rates, imposing known forces on the missile. The longitudinal accelerometer was calibrated by mounting the missile body parallel to the centrifuge arm; the lateral accelerometers were calibrated by mounting the missile body perpendicular to the centrifuge arm. The tests were conducted at Missile and Space Intelligence Center (MSIC) at Redstone Arsenal, AL. The cost of testing was approximately $500K.

3.3 Hardware-in-the-Loop

The purpose of the HITL measurements program is to characterize the response of the missile seeker to benign ECM and the fuze to extreme clutter. ECM devices of interest to JECSIM include the ALE-50 towed decoy, AN/ALQ-165 ASPJ, and ALQ-211 ECM device. The data gathered from HITL testing will support the evaluation of the composite missile simulation, seeker component model, ECM component model, and fuze component model. A detailed Test Activity Plan for HITL has been completed and the test is to be conducted at the Radio Frequency Simulation System facility located at Huntsville, AL. Preliminary efforts have begun and testing is expected to be complete in early CY 1998. The cost of HITL testing will be approximately $653K.

3.4 Radar Signature Tests

The purpose of the radar cross section (RCS) measurements program is to provide data to assess near- and far-field RCS prediction codes. JECSIM will collect monostatic and bistatic radar signature data on the QF-4E, F4-N, AH-64, ALE-50, and on a LO vehicle to validate near- and far-field radar signature prediction codes. This measurement program will include QF-4E measurements at the RATSCAT facility, F-4N measurements at the MESA Facility, AH-64 LONGBOW measurements at the Junction Ranch Radar Signature Measurement Range, and ALE-50 and LO measurements at the Radar Reflectivity Lab. The models supported by this testing are near- and far-field RCS prediction codes (XPATCH, NcPTD, and N-point Scatter models). The costs for all of the RCS testing is approximately $839K.

3.5 Captive Flight Test

The purpose of the captive flight test (CFT) measurements program is to provide data on seeker interaction with real targets, with and without ECM. The CFT provides the most realistic clutter environment of any test facility with the ability to position the threat missile seeker close to an actual target where test data can be obtained. Targets of interest to JECSIM include the B-1B, F/A-18, and AH-64. The data gathered from CFT testing will support the evaluation of the missile seeker, clutter model, and target RCS and glint (XPATCH, NcPTD, N-point scatter) models. Modifications have begun and testing will be completed at Naval Air Warfare Center, China Lake, CA. The approximate cost of CFT testing is $2,348K.

3.6 Fuze Tests

The purpose of the fuze test program is to provide a database of fuze antenna-target interaction data that covers a wide variety of missile-target intercept conditions to validate the fuze model elements of antenna patterns, target power return, and threshold detection. This validation will be accomplished using comparisons of model outputs (predictions) with data collected from a calibration target and a fighter-sized target. The MESA fuze test will provide verification of the monostatic near-field target model, fuze near-field antenna patterns, and fuze antenna-target interaction. The outdoor antenna range will provide elevation and azimuth, two-way, and far-field sensitivity patterns for transmit-receive antenna pairs mounted in a missile body section. The models supported by this testing are near-field target RCS model (NcPTD, N-point scatter) and the near-field fuze antenna model. The MESA test facility and its normal operational and support personnel will be utilized. Testing will be completed late in CY 1997 and will cost approximately $438K.

4.0 FUTURE MAJOR ACTIVITIES

4.1 Ground-Mounted Seeker (Missile on the Mountain)

The purpose of the GMS test program is to provide seeker interaction with real targets, with and without ECM. The GMS facility provides one of the most realistic test environments of any test facility. The targets of interest to JECSIM include the B-1B with the ALE-50 towed decoy, the F/A-18 with the AN/ALQ-165 ASPJ, and the AH-64 with the ALQ-211 ECM device. The data gathered from GMS tests will support the evaluation of the composite missile simulation, seeker component model, target signature model, TEL/weapon controller component model, clutter component model, and the characterization of a 2^{nd} EC device.

4.2 Modeling and Simulation

JECSIM will test the SA-6 and threat seeker/fuze configurations to provide validation data for digital models for use in the T&E of ECM and LO technologies. M&S tests will provide the digital simulation data that will be compared with data from the hardware tests (open-air tests, GMS, HITL, fuze, target signature, lab, and MESA) to determine the degree to which the digital models predict hardware performance. There is currently no database with which to evaluate the SA-6 hardware performance with performance of digital models. The planned tests will provide data that will contribute to system performance evaluation.

The primary objective of the M&S test series is to provide a database of digital simulation data that will determine the degree to which the models predict hardware performance. The methodology is to precisely replicate all hardware tests using the digital simulation. The data elements generated by the digital simulation will be compared with those generated from hardware testing.

The digital models will be tested in a series of open-loop tests in which each component model is executed in a stand-alone fashion. This will generate a database supporting the validity of each model by itself. Additionally, the component models will be integrated into the overall closed-loop simulation that will be executed to generate a database supporting the validity of the complete system simulation.

4.3 Endgame/Sensitivity Study (P_k)

JECSIM hardware and M&S test efforts will determine the degree to which the digital models predict hardware performance in terms of T&E MOEs. The P_k analysis will address the issue of how sensitive the lethality results are to endgame geometry and intercept conditions. The primary objective of the P_k sensitivity analysis is to provide a database of information that relates endgame input fidelity requirements to fidelity in P_k. The analyses will be used in performing P_k assessments for the aircraft involved in the JECSIM T&E. Additionally, JSEM will be used to perform sensitivity analyses for determining live fire range instrumentation accuracy requirements in regard to collecting test data that will support P_k calculations and in defining quantitative accuracy requirements for inputs to the JSEM.

5.0 LEGACY PRODUCTS

The JTF will identify the users of the legacy products and begin working a strategy to implement these legacy products at the conclusion of the JT&E. To outline the best way to implement the legacy products, the JTF will prepare a JECSIM Legacy Products Implementation Plan, coordinate it with the Services and OSD, and forward it to the Deputy Director, Test, Systems Engineering and Evaluation/Test and Evaluation (DDTSE&E/T&E). Anticipated legacy products include:

Supporting data for M&S verification, validation, and accreditation (VV&A) - The JT&E results will include extensive data on semi-active missile testing and P_k generation. These data can be utilized to support M&S VV&A.

Robust data set - A data set that can be used to identify M&S deficiencies and needed improvements will be acquired and archived.

Integrated set of M&S - The JT&E will determine, through sensitivity studies and requirements analysis, the need to hardwire the different M&S together in order achieve the desired results.

M&S roadmap guidance - JECSIM JT&E will provide additional insight into the need for refinement in physics-based modeling, M&S link requirements, configuration management, and VV&A of the individual models.

Sensitivities - JECSIM JT&E will:

- Look at various analytical tools used by DoD/Industry to assess vulnerability/lethality/susceptibility of airborne platforms from a T&E perspective and will study their interrelationships and sensitivities to input parameters, i.e., P_k sensitivity to endgame burst point geometry, burst point distance, body angle, and relative angle of approach.
- Determine whether instrumentation exists that is accurate enough to detect changes in the endgame burst point geometry that could make a difference in P_k. The team will specifically address the degree to which the instrumentation can collect the data to validate and use the model.
- Determine how accurate the model must be to detect changes in P_k.
- Compare sensitivities to the changes in those parameters expected from the application of chosen ECM techniques.
- Analyze the errors contributed by missile guidance variations imported by electronic differences among the missiles.

JECSIM process - The process was established to demonstrate the capability of M&S to predict missile performance. The process will be identified and demonstrated for the semi-active missiles of the JECSIM JT&E, thereby extending the utility of M&S in T&E.

Instrumentation Adequacy - As part of the JT&E, the team will address the adequacy of the instrumentation to collect the data needed to validate and use the model.

Assessment of M&S Capability - JECSIM JT&E will determine (1) the degree to which M&S, given T&E support to verify, predicts an actual missile engagement and (2) the sensitivity of P_k relative to endgame-related parameters.

J-MASS Compliance - The JECSIM JT&E team will work with the model development community to ensure that the integrated set of models to include the digital effectiveness models are JMASS compliant.

5.1 Potential Benefits

Credible, validated models for evaluation and analysis will provide the T&E community with capabilities that do not currently exist.

The resulting test methods and validated digital M&S can be extended to T&E of a wide variety of systems. This could evolve to the use of M&S as surrogates for threat systems, if hardware simulators do not exist.

Improved test planning through digital M&S can be used to define test sensitivities. This could simplify test requirements in many cases or result in tests that can be extrapolated to other systems, resulting in significant cost savings.

Knowing the appropriate, valid role of M&S, HITL, and open air testing in the EC test process will allow DoD management to allocate resources in order to obtain the maximum benefit for DoD test capability.

Appendix D

JOINT NIGHT CLOSE AIR SUPPORT (JNCAS)

1.0 BACKGROUND

1.1 Charter

The Joint Night Close Air Support (JNCAS) project was chartered on 14 August 1997 to employ multi-Service equipment and personnel conducting a Joint Test and Evaluation (JT&E) to investigate, evaluate, and improve the operational effectiveness of joint U. S. forces conducting night close air support. The JNCAS project will evaluate the current conduct of night close air support mission effectiveness of U. S. forces in a realistic joint military operations environment, identifying and verifying potential mission area enhancements.

1.2 Problem Statement

A joint working group validated the following problem statement: *"There has been no significant effort to evaluate the effectiveness of Joint Night CAS operations."*

1.3 Purpose

The purpose of the JNCAS JT&E is to provide the warfighter with an evaluation of the baseline effectiveness of conducting joint night close air support and to examine the potential for improvement in the areas of tactics, techniques, and procedures; systems capabilities; and training. The baseline effectiveness of conducting joint night close air support will inform the warfighting Commanders in Chief (CINCs) of their current capability. The study of potential improvements will provide the Services and the Joint Staff with a validated database from which to make informed decisions on future training and joint tactics, techniques, and procedures.

1.4 Past Activities

The Office of the Secretary of Defense (OSD) chartered the Joint Night Close Air Support Joint Feasibility Study in July 1996 to study the joint night close air support issue. A joint working group of 70 representatives from the four Services and joint agencies supported the problem statement and provided insight on shortfalls. The Feasibility Study Director provided briefings to the Services, CINCs, operational units, and Service training agencies to gain the opinions of a wide array of subject matter experts on night close air support capabilities and requirements. The following commanders provided strong support for the chartering of a joint test and evaluation:

- Commander, USAF Air Warfare Center
- Commander, USA National Training Center

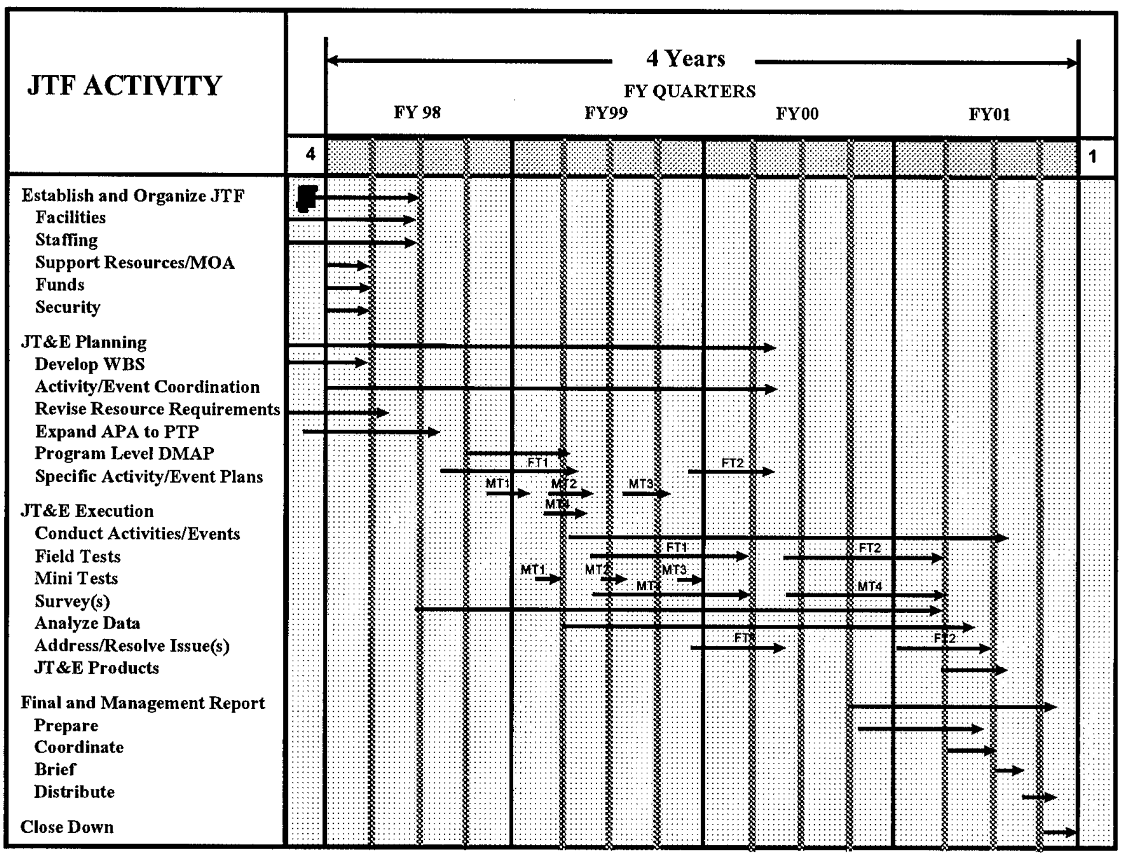
- Commanding Officer, Naval Strike & Air Warfare Center
- Commanding General, Marine Corps Air Ground Combat Center

The Joint Feasibility Study Director also conducted extensive research and study of Service and joint tactics, techniques, and procedures for employing joint night close air support. The Director also conducted a search for pertinent test data on the subject.

1.5 Lessons Learned

Little Joint Night Close Air Support testing has been accomplished by the Services. The last joint test of close air support capability was in 1977, with no night testing accomplished. The current joint night close air support tactics, techniques, and procedures have not been validated by a joint test. Neither joint close air support nor night close air support training occurs on a regular basis; in fact this training rarely occurs. The Services practice close air support independently, and joint night close air support missions are rarely flown in tactical scenarios. The Services have fielded improved technology for night operations, but the capability has not been validated in a joint, tactical environment. Various equipment devices individually improve night capability but are not always interoperable or compatible.

2.0 MILESTONES



3.0 CURRENT ACTIVITIES

3.1 Timeline

The present timeline establishes the Joint Test Force on 1 October 1997 with a build-up to a fully operational JT&E by 1 October 1998.

3.2 Locations

The Air Force-led Joint Test Force will be located at Eglin Air Force Base, FL, to take advantage of the Air Force testing facilities located there. The Joint Requirements Oversight Council-sponsored All Service Combat Identification Evaluation Team is also located at Eglin and has a wealth of information on joint testing that could help this Joint Test Force. Coordination for future testing locations and concepts will occur with:

- National Training Center, Fort Irwin, CA
- Air Warfare Center, Nellis AFB, NV
- Marine Corps Air Ground Combat Center, Twenty-Nine Palms, CA
- Naval Strike and Air Warfare Center, NAS Fallon, NV

3.3 First Year Activities

The Joint Test Force will establish the JNCAS JT&E site at Eglin AFB, FL. The current Joint Feasibility Study site must be expanded with space, furniture, and equipment to support the 22 military, five government civilian, and 21 contractor personnel that will compose the Joint Test Force. The team consists of the Joint Test Director, Col Boudreaux; the Air Force Deputy Test Director, LtCol Chiasson; and five members of supporting contract staff.

The team will develop a memorandum of agreement with the U.S. Army National Training Center (NTC) at Fort Irwin, CA. This agreement will be a follow-on to the current memorandum of understanding that the JNCAS team has with the National Training Center. The purpose of the agreement is to describe in detail the responsibilities of the Joint Test Force staff and National Training Center staff in supporting the joint test at the National Training Center without impacting the training that the Army units receive.

3.4 Develop Program Test Plan

The Program Test Plan will be the road map for the execution of the JNCAS JT&E. It will describe the individual tests in detail and include a Data Management and Analysis Plan, which will ensure that the issues can be answered with the data gathered at each test.

4.0 FUTURE ACTIVITIES

4.1 Timeline

The current timeline has the JT&E beginning testing 1 October 1998 and ending 30 September 2001. The JT&E will comprise large-scale tactical field testing, smaller-scale nontactical mini testing, and analysis of the subsequent data. The JT&E will then be completed with final reporting, coordinating recommendations, and briefings to the CINCs, Services, and Joint and OSD agencies. Contractor support costs for the four-year JT&E are estimated at $6,300,000. USAF infrastructure and civil service costs for the JT&E are estimated at $780,000.

4.2 Locations

The primary testing activities will take place at the National Training Center, Fort Irwin, CA, and U.S. Air Force Air Warrior, Nellis Air Force Base, NV. Supporting data, sorties, and concepts will be utilized from the Marine Corps Air Ground Combat Center, Twenty-Nine Palms, CA, and the Naval Strike & Air Warfare Center, NAS Fallon, NV.

4.3 Field Tests

Two large-scale field tests will be executed at the National Training Center during normal training rotations for Army units. Air Warrior at Nellis AFB will provide close air support sorties. The cost for support of field testing at NTC is approximately $4,800,000. Each field test will take nine months due to the limited number of CAS sorties per training rotation. The 11th Armored Cavalry Regiment is the permanent party opposing force located at the National Training Center and will be the unit used for JNCAS test excursions. Each blue force rotational training unit arriving at the National Training Center will also be studied during their exercise.

The Joint Test Force will use the first field test to establish the baseline effectiveness of joint night close air support and then compare excursions in control procedures. The second field test will study excursions in night systems. Approximately one half of the JNCAS staff (48 personnel at Eglin AFB, FL; two personnel at Nellis AFB, NV; and five personnel at NTC, Fort Irwin, CA) will participate during each of the nine rotations that will make up a field test. The remaining personnel will continue to analyze previously acquired data.

4.4 Mini Tests

The JNCAS Joint Test Force will also use four mini tests, executed at NTC, to provide a controlled environment for studying specific areas of night CAS operations. The cost for these mini tests is estimated at $210,000. Mini Test 1 will measure the forward air controllers' abilities to positively control close air support aircraft at night. Multiple aircraft passes will be flown under controlled conditions to determine if the forward air controllers can accurately assess which target the close air support aircraft are attacking. This mini test will take three to four days.

Mini Test 2 will measure the ability of forward air controllers and close air support aircrews to effectively use infrared pointers in single pointer and multiple pointer environments. Multiple aircraft passes will be flown while the forward air controllers attempt to mark targets with their infrared pointer. A maneuver platoon will also be employing their pointers in close proximity. This test will take three to four days.

Mini Test 3 will study the merits of various precision-guided munitions on close air support effectiveness. Multiple aircraft passes will be flown using various precision-guided munitions technologies. The accuracy and timeliness of target designation and engagement will be studied. This test will take four to five days.

Mini Test 4 will study the effects of various designation devices under live-fire situations. Infrared pointers, flares, and laser target designators are just three of many devices used to designate targets for close air support aircrews. This test will measure their accuracy and timeliness under actual weapons employment. This test will be accomplished during each training rotation used for field tests.

5.0 LEGACY PRODUCTS

The JNCAS JT&E will conclude the four-year test with a final report of recommendations and briefings to all affected and interested agencies within the Department of Defense. The JT&E will also offer several unique legacy products.

- **Baseline effectiveness data**. The JNCAS JT&E will leave behind a large database of the current capability. This validated information could readily be used for the development of new doctrine; new tactics, techniques, and procedures; support for acquisition programs; and to give CINCs a better understanding of current combat capability.
- **An improved understanding of the close air support process**. The JT&E will focus on the close air support process for four years. This will provide valuable insight on many portions of this process, particularly on how well the joint portion works.
- **Exercise and test enhancements**. Instrumentation has improved tremendously, but instrumentation systems are not always as compatible as they should be. The National Training Center and Air Warrior systems each provide valuable data to participants but are separate systems. The JNCAS Joint Test Force will attempt to merge these systems' data for display on a single system.
- **Joint training recommendations**. Studying and evaluating the current joint close air support process will highlight shortfalls in current joint training. The feasibility study has already discovered how little tactical joint close air support training occurs.

5.1 Enhanced Combat Capability

The culmination of the Joint Test Force legacy products should bring about a much better understanding of the JNCAS process, its strengths and its limitations. This will certainly enhance future combat capability where JNCAS is performed in the future.

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Appendix E

JOINT SUPPRESSION OF ENEMY AIR DEFENSES (JSEAD)

1.0 BACKGROUND

The warfighting commanders require a capability to conduct effective joint suppression of enemy air defenses (JSEAD). Since the Gulf War, JSEAD strategy has emphasized destructive, preemptive targeting to destroy an enemy's integrated air defense system (IADS). As the surface-to-air missile threat becomes more technologically sophisticated and more mobile, it is more difficult to target preemptively, making an effective, reactive JSEAD capability a continuing requirement. At the same time, the ongoing U.S. military drawdown is reducing the traditional assets (such as the F-4G Wild Weasel and the EF-111 Raven) available to perform reactive JSEAD. In this context, the Services have acknowledged the need to improve the Joint Force Commander's (JFC's) ability to use existing Service assets to conduct reactive JSEAD more effectively and efficiently.

At the direction of the Under Secretary of Defense, Deputy Director, Systems Assessment/Test, Systems Engineering and Evaluation, a Joint Feasibility Study was conducted from July 1995 to September 1996 to determine whether a Joint Test and Evaluation (JT&E) was needed to resolve JSEAD issues. The study recommended a JT&E that focused on the end-to-end reactive JSEAD targeting process.

1.1 Charter

In September 1996, the Office of the Under Secretary of Defense, Director, Test, Systems Engineering and Evaluation chartered the JSEAD JT&E program to conduct a JT&E with emphasis on improving the end-to-end JSEAD targeting process. The JT&E was chartered to characterize the reactive (localized) JSEAD targeting process, baseline current capabilities, quantify element contributions to that process, identify deficiencies, and test and evaluate potential improvements. The established JSEAD JT&E issue is: *"Do end-to-end JSEAD targeting process enhancements improve reactive, localized JSEAD effectiveness?"* Two separate test issues address specific parts of the program issue:

- **Test Issue 1:** "Do proposed changes to the intelligence, surveillance, and reconnaissance (ISR) architecture improve reactive, localized JSEAD effectiveness over the current baseline?"
- **Test Issue 2:** "Do proposed changes to the Joint Air Operations Center (JAOC) improve reactive, localized JSEAD effectiveness over the current baseline?"

1.2 JSEAD Problem Statement

The warfighting commanders require the capability to conduct effective JSEAD. Regardless of conflict intensity, the JFC currently conducts, as a subset of offensive counter-air, either area of responsibility/joint operations area (AOR/JOA) or localized JSEAD operations. AOR/JOA-level operations are conducted to break apart an enemy's IADS by targeting key command and control (C^2) and air defense positions. In most cases, however, AOR/JOA-level operations cannot completely eliminate enemy IADS capabilities. Pockets of integrated air defense components will remain and will continue to pose a threat to U.S. air operations. These pockets can either be avoided or suppressed for specific time periods through localized JSEAD.

Preplanned (preemptive) and opportune (reactive) targeting is applied within localized JSEAD operations. The current strategy preemptively targets key enemy IADS assets via the Air Tasking Order (ATO). Reactive targeting is conducted in conjunction with the ATO to protect offensive forces. Within preemptive and reactive JSEAD, commanders employ both destructive and disruptive force application methods. Destructive forces seek out and destroy IADS elements; disruptive forces attempt to temporarily deny, degrade, deceive, delay, or neutralize IADS elements. Within the context of the U.S. military drawdown and the increasing sophistication of the mobile surface-to-air missile threats, the Services have recognized a need to improve the JFC's near-term ability to conduct reactive JSEAD utilizing existing Service assets.

1.3 Purpose, Products, and Test Methodology

The purpose of the JT&E is to characterize the reactive JSEAD targeting process, baseline current capabilities, quantify element contributions to that process, identify deficiencies, and test and evaluate potential improvements. Two issues emerged as the most likely to have a near-term impact on the overall end-to-end reactive, localized JSEAD targeting process: (1) the potential contribution of an enhanced ISR architecture and (2) the potential improvements offered by better information use and targeting processes within the JAOC.

Test issue resolution is accomplished through a "test-evaluate-test" process. The test vehicles selected are field tests (Computer-Assisted Exercises [CAX] and Live-Fly Exercises [LIVEX]). The characterization of the end-to-end reactive, localized JSEAD targeting process is accomplished through a combination of qualitative and quantitative techniques. The CAX trials, conducted at the USAF-led BLUE FLAG multi-Service exercise, are utilized to characterize the information and decision-making processes in the JAOC and to quantify improvements in those C^2 processes in relation to the end-to-end reactive JSEAD targeting process (Test Issue 2). The LIVEX trials, conducted at Nellis AFB in conjunction with GREEN FLAG exercises, are used to characterize the end-to-end JSEAD process and to quantify the performance and improvements to that process in the ISR architecture. The evaluation focuses on total ISR architecture and JAOC reactive targeting processes, not on individual systems. At present, two CAX trials are planned for early Spring 1998 and 1999. Preceding the first CAX trial, however, will be a Data Management Exercise (DME), held at BLUE FLAG 98-1 (November 97), in which the program will test data collection, storage, and analytic techniques. Similarly, two LIVEX trials are planned for Spring 1998 and 1999.

The products resulting from this JT&E will provide recommendations for improving mission effectiveness and reducing enemy IADS capabilities for a wide range of Joint Force consumers. The final report will document test conclusions regarding ISR enhancements in systems management, battlespace coverage, and the time-sensitive targeting process as it relates to the enemy IADS. Recommendations for revisions to joint tactics, techniques, and procedures documents will be developed and coordinated with the Joint Staff, with emphasis on JSEAD, targeting, and electronic warfare. The JTF will also coordinate with the Joint Warfighting Center to apply relevant test results, lessons learned, and recommendations for multi-Service publications on doctrine, tactics, and targeting processes.

1.4 Completed Activities

1.4.1 JT&E Feasibility Study — *July 95 – September 96*

On 8 June 1995, the Senior Advisory Council recommended JSEAD as the first priority for an Office of the Secretary of Defense-sponsored Joint Feasibility Study (JFS). The JFS was conducted at Nellis AFB, Nevada, from July 1995 through September 1996. The JFS recommended a JT&E that focused on near-term improvements to the end-to-end reactive, localized JSEAD targeting process.

1.4.2 Service and National Agency Coordination — *July 95 – September 96*

Concurrent with the JFS, action officers assigned to the JSEAD Program initiated contact with major Service commands and with national-level agencies to ascertain the level of support available for a full-scale JSEAD JT&E program. Because of high personnel and operational tempos, an entering requirement from virtually all commands was that JT&E participation should have minimal impact on training opportunities and on operations tempo.

1.4.3 Technical Advisory Board Coordination — *July 96*

The OSD Technical Advisory Board (TAB) reviewed the results of the JSEAD JFS in July 1996 and concluded that the proposed JSEAD JT&E was feasible, within the context of available resources and technology, and within the scope of the established OSD JT&E concepts.

1.4.4 Establish and Organize JSEAD Joint Test Force — *October 96 – June 97*

The JSEAD Joint Test Force headquarters facility was established in October 1996 at Nellis AFB, Nevada. A total of 22 U.S. military and government civilian personnel were authorized for the JSEAD JT&E. Contractor personnel make up the remainder of the JSEAD JTF staff. Currently, the JTF is comprised of 41 government and contractor personnel. Additionally, two contract positions were established at Fort Walton Beach, Florida, to provide on-site coordination with the USAF Battlestaff Training School and with BLUE FLAG exercise personnel.

1.4.5 Program Test Plan (PTP) Initial Draft — *September 97*

The initial draft of the JSEAD JT&E Program Test Plan (PTP) was presented for review and comment to the General Officer Steering Committee (GOSC) on 9 July 1997. GOSC member comments have been incorporated into a final edit of the PTP.

1.4.6 U.S. Atlantic Command Sponsorship of JSEAD JT&E — *September 97*

The Deputy CINC of the U.S. Atlantic Command (USACOM) was briefed on the JSEAD JT&E in August 1997 and is considering USACOM sponsorship of the JSEAD tests. As force provider for continental U.S.-based commands, USACOM sponsorship of JSEAD tests establishes priority for national-level intelligence resources employed in the LIVEX trials. In September 1997, JSEAD coordinated with USACOM J2, J3, and J7 staffs to establish the details of sponsorship.

1.5 Current Activities

1.5.1 Data Management Exercise (DME)

A Data Management Exercise (DME) is planned for BLUE FLAG 98-1 at Hurlburt Field, Florida, for 13–21 November 1997 to test data collection, management, and analytic techniques. JSEAD JT&E personnel will conduct this test on a minimal-interference basis with the ongoing BLUE FLAG exercise. STATUS:

Site Surveys	*Complete June 1997*
Memoranda of Agreement	*Complete August 1997*
Site Test Plans	*60% Complete*
JSEAD Personnel	*12*
Cost Estimates	*$163K*

1.5.2 Computer-Assisted Exercise (CAX-1)

The first Computer Assisted Exercise (CAX-1) will be conducted at Hurlburt Field, Florida, on 1–8 March 1998. The CAX trials will characterize the information and decision-making processes in the JAOC and quantify improvements in those C^2 processes in relation to the end-to-end reactive JSEAD targeting process. STATUS:

Site Surveys	*Complete*	*September 1997*
Memoranda of Agreement	*Complete*	*August 1997*
BLUE FLAG Exercise Agreement	*Pending*	*ETC October 1997*
Site Test Plans	*40% Complete*	*ETC December 1997*
JSEAD Personnel		*19 + 14 Augmentees*
Cost Estimates		*$749K*

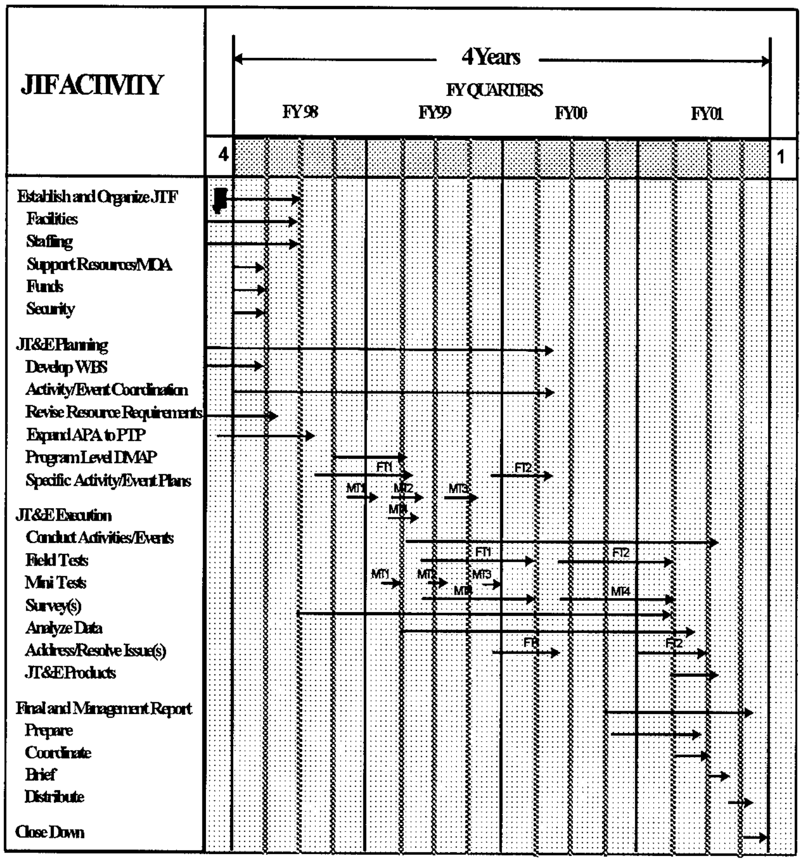
1.5.3 Live-Fly Exercise (LIVEX-1)

The first Live-Fly Exercise (LIVEX-1) will be conducted as part of the multi-Service GREEN FLAG 98-2, 18 April – 2 May 1998, at the Nellis Range Complex in Nevada. The LIVEX trials will characterize the end-to-end JSEAD process and quantify the performance and improvements to that process in the ISR architecture. Multi-Service participation, including U.S. Army APACHE helicopters, U.S. Navy strike and intelligence aircraft, U.S. Air Force strike and intelligence aircraft, and national intelligence sensors, are integrated into this exercise

to provide a true cross-discipline, cross-platform intelligence architecture and joint force test of JSEAD concepts. STATUS:

Site Surveys (Nellis Range)	*65% Complete*	*ETC February 1998*
Memoranda of Agreement	*75% Complete*	*ETC December 1997*
Site Test Plans	*40% Complete*	*ETC January 1998*
JSEAD Personnel		*36*
Cost Estimates		*$3.81M*

2.0 MILESTONE SCHEDULE



3.0 FUTURE MAJOR ACTIVITIES

3.1 Computer-Assisted Exercise

The second Computer-Assisted Exercise (CAX-2) is planned for the February 1999 time frame at the BLUE FLAG facility, Hurlburt Field, Florida. The CAX-2 trials will emphasize the information and decision-making processes in the JAOC and will focus on the results and enhancements identified in the CAX-1 trials. This exercise will refine the physical enhancements to the JAOC that were previously tested in CAX-1, and it will quantify the improvements in C^2 processes resulting from those enhancements. CAX-2 will again be preceded by a DME in which data collection, storage, and analytic techniques are tested and verified. STATUS:

JSEAD Personnel (DME)	*12*
Cost Estimate (DME)	*$105K*
JSEAD Personnel (CAX-2)	*19 + Augmentees (estimated)*
Cost Estimate (CAX-2)	*$529K*

3.2 Live-Fly Exercise

The second Live-Fly Exercise (LIVEX-2) is planned for the April 1999 time frame in conjunction with the GREEN FLAG exercise at the Nellis Range Complex, Nevada. An alternate site for this test, still under consideration, is the National Training Center at Fort Irwin, California. LIVEX-2 will refine the results and enhancements in ISR systems and architecture that were identified in the LIVEX-1 and CAX trials. The second LIVEX will also feature field-condition tests of several intelligence Advanced Concept Technology Demonstrations (ACTDs) in an effort to identify the best opportunities to improve JSEAD processes. These ACTDs will emphasize a seamless integration of national, theater, and corps-level sensors and the subsequent distribution of timely, processed intelligence to decision makers and to shooters. STATUS:

JSEAD Personnel:	*36 (estimated)*
Cost Estimate	*$4.002 M*

4.0 LEGACY PRODUCTS

4.1 JSEAD Analysis Tool

The JSEAD Analysis Tool (JSAT) is an interactive simulation tool whose purpose is to provide the JTF with a tool for test planning, sensitivity analyses, multi-source correlation and fusion for providing a battlespace visualizer, and training for time-sensitive targeting procedures. It is not to be used for issue resolution. The JSAT will allow analytic excursions and will serve as a training aid for individuals designated to perform reactive, localized JSEAD targeting tasks for enhanced configurations of CAX and LIVEX trials. JSAT is a collection of components including a constructive model (Extended Air Defense Simulation [EADSIM]), a high-fidelity ISR model (INSURRECTION), and a correlating suite and situational awareness visualizer known as the Joint Forces Air Component Commander Situation Awareness System (JSAS). JSAT will be made available to the Services, the intelligence community, and DoD for use in both analytic and operational environments. STATUS:

Under Contract (MRJ Corp, McLean, VA)	
Estimated Delivery Date	*January 1998*
Expended Funds to Date	*$749K*
FY 98 Cost Estimate	*$129K*

4.2 JSEAD Final Report

The JSEAD Final Report will contain a rigorous characterization of the end-to-end JSEAD process and contain specific recommendations for enhancements to both the baseline ISR architecture and to the JAOC configuration. ACTDs that have proven to be the most cost-effective leverage of technology will be identified and recommended for incorporation into the JSEAD process. Additionally, refined tactics, techniques, and procedures for prosecuting generic JSEAD targets and other time-sensitive surface targets will be identified and discussed. The final product, when integrated into warfighting forces, will be a joint methodology for prosecuting these targets that features more timely and complete battlespace awareness; seamless, increased data flow to the shooter; and quicker, more flexible decision cycles.

Appendix F

JOINT SHIPBOARD HELICOPTER INTEGRATION PROCESS (JSHIP)

1.0 BACKGROUND

Recent history has demonstrated a marked increase of shipboard operations by non-U.S. Navy (USN)/U.S. Marine Corps (USMC) helicopters aboard USN, Military Sealift Command (MSC), and U.S. Coast Guard ships. Most recently during Operation SUPPORT DEMOCRACY, the U.S. Army operated OH-58D Kiowa Warriors helicopters aboard USN frigates and a cross section of AH-64, UH-60, OH-58, and CH-47 helicopters from USS Eisenhower (CVN-69) and USS America (CV-66). The operations of these aircraft and their host ships were restricted in one or more ways due to a lack of helicopter-to-ship certification testing. CINCUSACOM, JTF 120, XVIII Airborne, CINCLANTFLT requested the execution of shipboard flight testing termed "Dynamic Interface" (DI). The Special Operations Forces (Army and Air Force) routinely operate from USN ship assets during Joint Task Force Exercises (JTFEXs). Shipboard compatibility is becoming a common thread in numerous operational requirement documents for the Department of Defense (DoD).

The overall objective of this Joint Test and Evaluation (JT&E) is to increase operational flexibility and readiness of multi-Service and other agency helicopters onboard USN ships when operating in a joint environment. JSHIP's focus will be to enhance interoperability by improving tactics, techniques, and procedures (TTPs) for shipboard operations. Execution of this JT&E will give future Joint Force Commanders the needed information for an accurate assessment of how joint helicopter operations from USN ships will impact the ships' tactical operations in the blue water and littoral environments. The emphasis of JSHIP is tactical interoperability analysis. This analysis focuses on how the operators and warfighters can effectively and efficiently maximize the shipboard environment by developing the necessary TTPs and conducting the required land/sea based sub-component testing. These tests are crucial in acquiring the baseline and technical data for joint helicopter/fixed wing operations and helicopter-only shipboard operations.

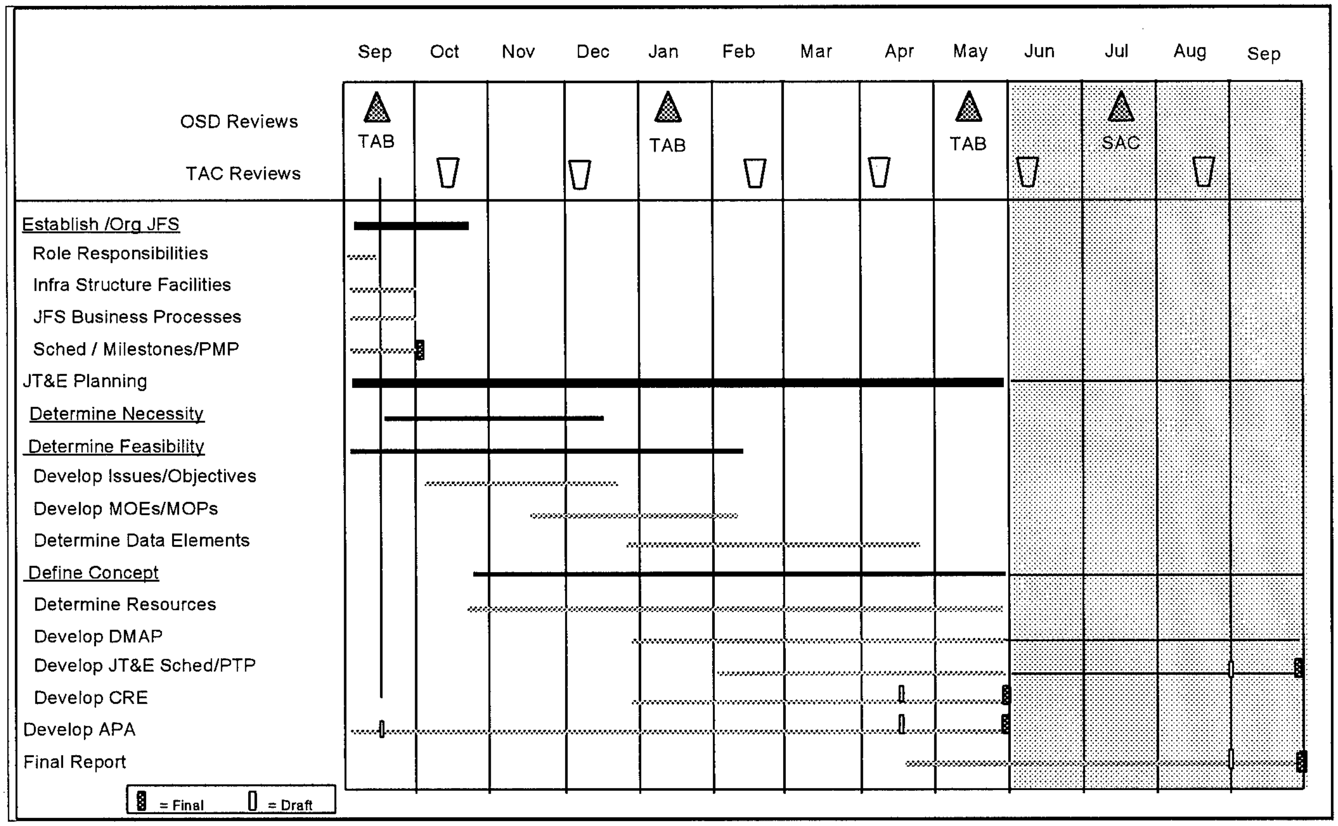
The Navy is the lead service for JSHIP and the Naval Air Warfare Center Aircraft Division (NAWCAD) at the Patuxent River Naval Air Station is the sponsoring agency. CAPT Jim Thompson has been designated as the Joint Feasibility Study Director and also resides at Patuxent River.

1.1 Problem Statement

Improvements in TTPs, training, and shipboard compatibility are required for enhanced capabilities and reaction time to support Joint Force contingencies. Joint helicopter shipboard operations are becoming the normal way for conducting business and not the exception to the rule. To effectively address changing threats, commanders need to better define how these operations can be safely conducted and still enhance joint helicopter shipboard evolution.

2.0 MILESTONE SCHEDULE (JFS PHASE)

The following graphic presents the JSHIP schedule during the one-year feasibility study. JSHIP is currently on schedule and the test team successfully briefed the Technical Advisory Board on 16 September 1997.



3.0 WARFIGHTER SUPPORT FOR THE STUDY

This program will give the warfighters a safer shipboard environment, operational flexibility, and a method of shipboard interoperability for current and future aviation and ship platforms. Strong support has been documented by the Army Deputy Chief of Staff for Operations and Plans, U.S. Special Operations Command, U.S. Air Force Special Operations Command, U.S. Pacific Command, U.S. Atlantic Command, U.S. Army Pacific, U.S. Navy CINC Atlantic Fleet, U.S. Navy CINC Pacific Fleet, and both the Army and Navy Safety Centers.

3.1 Test Planning Progress to Date

Following the nomination brief to the Senior Advisory Council (SAC), the recommendations of the SAC have been incorporated into the test planning process. Meetings with the Joint Spectrum Center to learn and apply appropriate parts of their methodology have been planned for the week of the 25th. Training issues will be included in the test concept, and legacy products will be provided from the JTE to support training for the joint community. We have initiated communication with Army and Air Force for potential syllabus issues.

The Analysis Plan for Assessment (APA), a major test planning document, is in progress. An annotated draft outline is complete, with first order objectives/issues delineated. The development of Measures of Effectiveness (MOEs)/Measures of Performance (MOPs) and data elements is in its initial stages and is undergoing a dendritic decomposition process.

3.2 Necessity Assessment to Date

An examination of the necessity of the program has begun by using the issues presented in the APA as focus points. These have been broken down into four major areas:

- TTPs
- Interoperability
- Electromagnetic Environmental Effects (EEE)
- Static/Dynamic Interfaces

For each of these areas, sub-issues and their supported objectives have been defined as initial starting points for defining the Mission-Level Measures (MLMs), MOEs, and MOPs. From these, the data elements for which test plans will be developed will be defined over the next few months.

The draft JT&E Scope and Test Approach is in development. This document will limit the scope of the JTE based on the criteria applied to the specific issues and objectives and provide the first definition of the test concept and test articles.

3.3 Feasibility Assessment to Date

Because the test planning is in the infant stages, the issues associated with feasibility have not been addressed. To this point, the test issues and objectives have not been constrained by issues of feasibility.

4.0 EXPECTED LEGACY PRODUCTS

The JSHIP program will develop a standardized process for use in testing future ship/helicopter combinations. This process can be applied to non-DoD/non-U.S. systems. Legacy products for the JSHIP JT&E program include specific data (operating envelopes and draft operating procedure changes, for example) for use by Doctrine, Safety, and Operational Commands. These will include recommendations for Standard Operating Procedures and TTPs for both training and operational uses and maintenance. Expanded operating envelopes are expected in many cases, providing the joint commanders with capabilities extended beyond those now currently available. These will translate to improved safety and warfighting effectiveness.

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Appendix G

JOINT THEATER DISTRIBUTION (JTD)

1.0 BACKGROUND

Contingency operations over the past several years have identified deficiencies within the current military distribution system. These deficiencies include: lack of visibility of assets, especially in transit; inadequate integration of automation tools; incomplete source data automation; incomplete source data capture at nodes; congestion at ports and other nodes in the distribution pipeline; and the wide-spread use of manual processes such as "sneaker nets." During Operation Desert Storm, Air Force, Army, Marine Corps, and Navy units all experienced incidents of frustrated shipments of cargo into the theater as a result of an inadequate joint theater distribution system. This and other historical distribution problems are well documented in Service and joint lessons-learned databases.

1.1 Sponsoring Agency - United States Army

It is anticipated that future warfighting contingencies will require greater integration of the Services' combat and combat support forces. Current Service physical distribution networks, the related information flows, and management processes are stovepiped so that they respond to the individual Service's needs, but they lack adequate integration to efficiently and effectively respond to the joint warfighter's logistical requirements with the right stuff, at the right place, at the right time. This JT&E will support the continued development of this concept and ensure joint resolution for problems that continue to plague joint force logisticians.

1.2 Problem Statement

Recent military and humanitarian operations highlighted difficulties in managing the in-theater physical distribution of assets (forces and sustainment), the related information flows (AIS/AIT), and the integrated management processes necessary for the Commander in Chief (CINC) to execute his directive logistics authority to provide the "right support to the right customer at the right time."

2.0 MILESTONE SCHEDULE (Joint Feasibility Study (JFS) PHASE)

August 1997 – September 1997: Organize the JFS

- Facilities
- Staff
- Contract
- JFS Plan/Schedule
- 1st JT&E JFS Planning Session

September 1997 – November 1997: Planning Phase

- Determine Necessity
- Technical Advisory Board (TAB), 16 September 1997
- Develop Concept, Scope, Issues
- Prepare Dendritic Structure
- Resource Requirements
- Determine Feasibility
- Develop Test Scenario, Data Analysis Methodology, Evaluation Criteria
- 1st In-Progress Review (IPR) – 4 December 1997

December 1997 – February 1998: Consider Alternatives

- Expand Concept to Analysis Plan for Assessment (APA)

March 1998 – June 1998: Preparation Phase

- TAB Review
- JFS Results Final Report
- Senior Advisory Council (SAC)

July 1998 – September 1998: Transition to Test Phase

3.0 WARFIGHTER SUPPORT FOR THE STUDY

In preparation for approval to proceed to a Joint Feasibility Study, support was sought from the primary benefiting warfighters. The following CINCs endorsed this JT&E:

- Pacific Command (PACOM)
- Central Command (CENTCOM)
- European Command (EUCOM)
- United States Forces Korea (USFK)
- Atlantic Command (ACOM)
- U.S. Special Operations Command (SOCOM)
- U.S. Southern Command (SOUTHCOM)
- U.S. Transportation Command (USTRANSCOM)

Extensive support was also received from the JCS J4, Under Secretary of Defense (Acquisition and Technology) (USD (A&T)), Service offices, and Joint Total Asset Visibility (JTAV) office.

4.0 TEST PLANNING PROGRESS TO DATE

The original test philosophy was to conduct the test using training and operational exercise scenarios. However, following extensive consultation with the warfighting CINCs, their preferred method for performing the test is to execute the JT&E effort during the normal course of operations. Once daily operations are worked, modeling/simulation would/could extrapolate wartime requirements. Should a contingency occur during the test period, the JTD Task Force would take that opportunity to incorporate the JT&E effort.

Test targets of opportunity considered to date include:

- EUCOM AIT Prototype — CINC Initiative
- EUCOM — normal business to include operations in Bosnia
- PACOM — participation in CINC logistics and distribution initiatives
- USFK — AIT Demonstration

Memoranda of Understanding (MOUs) are currently being drafted that will provide a commitment from the participating CINCs to ensure that the results of the JTD JT&E will be implemented within their respective resource and capabilities constraints.

5.0 NECESSITY ASSESSMENT TO DATE

The unanimous support of this JT&E prior to its approval to proceed to a JFS demonstrates that this test addresses a long-recognized need between the CINCs and Services. Clearly, Joint Theater Distribution is the key to achieving the CJCS Joint Vision 2010 Focused Logistics Pillar. This is accomplished by integrating and synchronizing distribution functions to best meet the deployment contingencies of the future and ultimately reduce the logistic footprint on the battlefield. This test is unique in that it will provide quantitative and qualitative metrics relating to the effectiveness and efficiency of the Joint Theater Distribution pipeline. No other joint- or Service-chartered activities adequately address the integration of all theater distribution issues under review in this JT&E.

6.0 FEASIBILITY ASSESSMENT TO DATE

Because the test planning is in the infant stages, the issues associated with feasibility have not been addressed. To this point the test issues and objectives have not been constrained by issues of feasibility.

7.0 EXPECTED LEGACY PRODUCTS

As a result of this JT&E, the expected legacy products are:

- Recommendations to improve the physical distribution network, the information flows, and the business and management processes, allowing refinement of the existing JTD system
- Training enhancements

- A quantitative and qualitative analysis that will support the necessary future resource expenditure to improve the JTD pipeline

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Appendix H

JOINT THEATER MISSILE DEFENSE ATTACK OPERATIONS (JTMD)

1.0 BACKGROUND

Joint Theater Missile Defense (JTMD) is the integration of joint force capabilities to find targets, task resources, attack, and kill the enemy's theater missile (TM) capabilities before they can be brought to bear on friendly forces, critical assets, and areas of vital interest. This requires the capability to attack theater missiles with an appropriate mix of theater missile defense (TMD) weapons. TMD activities are currently broken into three distinct areas: attack operations, active defense, and passive defense. An integrated C^4I architecture knits these elements together to form the total TMD operational capability.

1.1 Charter

The Joint Theater Missile Defense Attack Operations (JTMD-AO) Joint Test Force (JTF) was chartered to employ multi-Service equipment and personnel to conduct a Joint Test and Evaluation (JT&E) to investigate and evaluate the capability of U.S. Forces to conduct TMD Attack Operations employing existing and near-term (FY 98) systems. JTMD utilizes Commander in Chief (CINC)-approved/proposed architectures and an appropriate mix of simulation experiments and field testing to conduct the evaluation.

1.2 Problem Statement

One of the most important lessons learned from Operation Desert Storm was the threat posed by TMs. Although each of the Services and several national agencies possess some capability to detect, locate, and destroy TM elements on the ground within enemy territory, the effective employment of sensors, C^4I, and attack systems against TMs requires joint operations. Few problems confronting the U.S. military today require a joint solution more than TMD Attack Operations.

1.3 Purpose

The JTMD-AO examines the integrated application of national and theater sensors, C^4I systems and attack systems using CINC-approved TMD architectures, and tactics, techniques, and procedures (TTPs) for potential areas of conflict.

1.3.1 Contribution to the Warfighter

Besides defining baseline JTMD attack operations capabilities available to the CINCs, the JTF will also identify changes or developments that show the potential for improving this capability.

1.4 Customer

The customers are CINCs of all potential areas of conflict where TMs may be employed against friendly forces or for political purposes.

1.5 Past Activities

An integrated test concept was developed that included the use of existing data, leveraged field testing, and network simulation to address test issues. Operational and developmental test data has been acquired for sensors, C^4I, and attack systems to establish the operational and technical capabilities for these systems. Field tests are used to fill gaps in the data available for these systems. The collected data is instrumental in ensuring that the capabilities of these systems are accurately reflected in the simulation models. A combination of field testing and the distributed simulation network provides the primary tools to investigate JTMD Attack Operations. In December 1996, the JTF acquired a complete battalion of Scud B launchers, missiles, and support vehicles to use as ground targets in field testing. Over 15 field test events have been conducted and three of the four planned simulation phases have been completed to date.

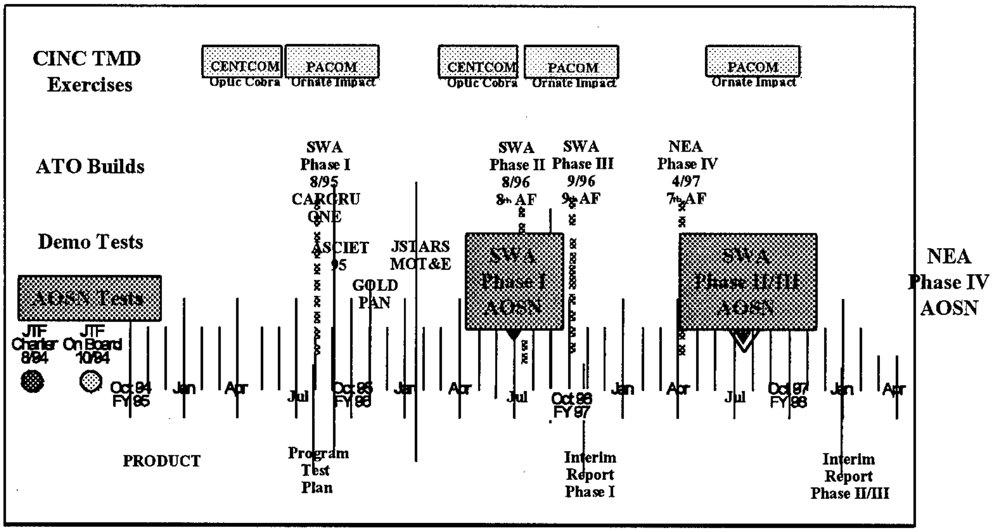
The Phase I Attack Operations Simulation Network (AOSN), conducted in July 1996, was designed to provide the necessary data to evaluate TMD architecture and TTPs for a Southwest Asia (SWA) scenario. The Phase I AOSN included a carrier battle group, amphibious ready group (ARG), limited Air Force assets, and Navy Special Operations Forces. Phase I results are documented in a classified JTMD Attack Operations interim report.

Phase II and III AOSN testing was conducted in July 1997. These activities were set in the same SWA scenario as was Phase I, in which a U.S. Joint Task Force has responded to the threat country's positioning of its land, sea, and air forces and the deployment of its theater missiles (ballistic and cruise). For Phase II, the centers of the Joint Task Force were an Air Force Air Expeditionary Force (AEF) and a Naval Task Force, comprised of a Carrier Battle Force (CVBF) and an ARG. The Air Force had an Air Operations Center (AOC) commanding a composite force of fighters, transport, tanker, command and control (C^2), and sensor support aircraft. Naval aviation in-theater included carrier, ARG, and land-based fighters and support assets. In addition, the Joint Task Force had access to national assets allocated for direct support of the theater commander's objectives. Phase III included the additional sensors, command elements, and attack systems associated with land-based Army and Marine units. The analysis is ongoing and the Phase II/III results will be published in a classified interim report.

2.0 LESSONS LEARNED

- Distributed Interactive Simulation (DIS) is a viable tool to conduct Joint Test & Evaluation.
- Training and experience levels are essential elements in the complex TMD mission area.
- U.S. forces currently posses substantial ability to conduct TMD Attack Operations.

3.0 MILESTONE SCHEDULE



4.0 CURRENT ACTIVITIES

To collect the necessary data, the JTMD AO JTF participated in ASCIET 97 from 26 August through 11 September, and Roving Sands 97 from 19 through 28 April, to produce and validate attack system probability of acquisition values against both static transporter-erector launchers (TELs) and transload activity arrays. In addition, the JTF is conducting monthly field testing on the Tonapah Test Range, NV, with the Scud B battalion for a variety of existing and developmental sensors.

5.0 FUTURE ACTIVITIES

The JTMD-AO test force is in the planning phase for participation in the JSEAD JTF Live Exercise (LIVEX) to be flown 20 April – 3 May 1998. The last simulation event of the JTMD program (Phase IV) will explore attack operations in a Northeast Asia (NEA) scenario. The JTMD Scud battalion will continue to be used extensively in leveraged testing opportunities to collect and analyze data relative to attack operations.

6.0 LEGACY PRODUCTS

Scud Battalion Target Set — Can be used for realistic training and evaluation of new system capabilities.

Attack Operations Models — Effects-level models developed for the AOSN are of sufficient fidelity and portability that they can be used to meet a multitude of generic simulation requirements.

Attack Operations Database — A unique database of quantitative values for accomplishing attack operations activities. Provides a valuable resource for future tests investigating the pursuit of time-sensitive targets.

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Appendix I

JOINT WARFIGHTERS

1.0 BACKGROUND

Targeting must be improved. (Department of Defense (DoD) Final Report to Congress, *Conduct of the Persian Gulf War*, 1992). To address this shortfall in our warfighting capability, the Deputy Director, Test and Evaluation (DDT&E), under the Director, Test, Systems Engineering and Evaluation (DTSE&E), Office of the Secretary of Defense (OSD), directed the Joint Warfighters (JWF) Joint Feasibility Study (JFS) in June 1995 with the Army as the lead Service. Initial JFS efforts focused on tactical fire coordination then drifted to joint fire support at the operational level of war, and the effort became embroiled in contentious doctrine/roles and missions issues. As a result, the Senior Advisory Council (SAC) refused to charter the JWF Joint Test and Evaluation (JT&E), instead extending the JFS and directing specific changes, central of which was to focus on the JT&E nomination issues.

The Army responded quickly and decisively to the SAC's guidance, moving the JFS sponsorship to the Training and Doctrine Command (TRADOC) and replacing the existing government and contractor staff. The new Feasibility Study Director (FSD) immediately directed his staff to research targeting deficiencies. A series of briefings began to the Joint Staff, the combatant commands, the Services, and the Test and Evaluation (T&E) agencies from the action officer through the director, and in some cases, the Commander in Chief (CINC). These briefings were used to obtain guidance and support and to ensure all interested parties that the JWF effort was back on track. The feasibility study team conducted a thorough problem characterization of the prosecution of time-sensitive surface targets (TSSTs) in a Joint Task Force (JTF), then accomplished an extensive characterization of the joint targeting cycle processes and elements. The characterizations were conducted through research; polling of subject matter experts (SMEs) from all of the Services, the Joint Staff, and the unified commands; and the efforts of a joint working group (JWG). After compiling Service and joint inputs and reviewing the JWF characterizations, the JWG adopted an entirely new problem statement that would be the basis for the JWF JT&E approach.

1.1 Charter

Following the new approach, JWF was recommended for charter by the SAC on 26 June 1997 and was chartered on 14 August 1997. The Under Secretary of Defense chartered the JWF Joint Test Force to:

> *Employ multi-Service and other Department of Defense (DoD) agency support, personnel, and equipment to investigate, evaluate, and improve the operational effectiveness of joint operations against time-sensitive surface targets. JWF will establish a baseline case by evaluating and documenting current time-sensitive target processes and procedures in realistic operational scenarios. Potential deficiencies and opportunities for improvement will be*

identified and verified. Potential improvements will be identified, installed, and tested in environments as closely aligned with baseline measurements as possible. Analysis of the collected data will be used to evaluate their effectiveness and suitability. The outcome of these evaluations will be used to determine the validity of these beneficial hypotheses.

1.2 Problem Statement

The JWF JWG, composed of 32 SMEs and Service doctrine developers in the grades of O-4 to O-6, was hosted by the Air Land Sea Application (ALSA) Center, Langley AFB, Virginia, in early October 1996. The group consensus was that there are documented, irrefutable problems in employing joint firepower, specifically in timeliness and particularly for time-sensitive targets. Many interoperability problems were recounted. Intensive examination of the problems revealed specific difficulties in timely and effective coordination, deconfliction, and synchronization, which increased execution timelines and caused the recurring need to create operational workarounds.

The JWG recommended limiting the JWF problem statement to targets that are considered critical, are unplanned, and must be engaged rapidly. Thus, the term "time-sensitive targets," as defined in Joint Publication 1-02 was selected:

Time-sensitive targets *— Those targets requiring immediate response because they pose (or will soon pose) a clear and present danger to friendly forces or are highly lucrative, fleeting targets of opportunity.*

The group also recommended restricting the problem statement to "surface" targets, excluding airborne and subsurface targets, such as submarines. Therefore, the problem's scope is limited to TSSTs as shown in the problem statement:

Joint military operations and exercises have revealed difficulties in effectively and efficiently prosecuting time-sensitive surface targets in an area of responsibility and/or joint operating area.

The group identified the *find, locate, identify, plan, task,* and *strike* functions as pertinent to timely target attack. Further discussion of these functions produced 44 questions for analysis that could be grouped into four categories: *doctrine, organization, process,* and *technology/equipment.* Subsequent analysis of the functions, categories, and questions surfaced by the working group revealed that each could be addressed under four issues relating to four phases of the joint targeting cycle (Figure I-1).

Figure I-1. The Joint Targeting Cycle

As shown in Figure I-1, targeting is a cyclical process consisting of six phases. The first phase, Commander's Objectives and Guidance, and the sixth phase, Combat Assessment, are not directly addressed as issues by JWF, because they are beyond the scope of the problem statement. The remaining four phases and their related test issues, as shown in Table I-1, make up the nucleus of the JWF issues.

Table I-1. Targeting Cycle/Issue Correlation

JOINT TARGETING CYCLE PHASE	TEST ISSUE
Target Development	Is the target acquisition process adequate to effectively support joint targeting of time-sensitive surface targets?
Weaponeering Assessment	Is the weaponeering assessment process adequate to effectively support joint targeting of time-sensitive surface targets?
Force Application	Is the force application process adequate to effectively support joint targeting of time-sensitive surface targets?
Execution Planning and Force Execution	Is the execution planning/force execution process adequate to effectively support joint targeting of time-sensitive surface targets?

1.3 Purpose

JFS research produced several reports of inefficient, ineffective targeting during combat operations and joint exercises. The prosecution of time-sensitive targets was often cited as deficient, highlighted by two examples from the Persian Gulf War:

- On 26–27 February 1991, a large portion (possibly 50 percent) of the Republican Guard Forces Command (RGFC) was allowed to escape across the Euphrates River. The RGFC escaped because of confusion and a breakdown in coordination.
- The first Army Tactical Missile System (ATACMS) ever fired in combat was delayed for hours while appropriate clearance was coordinated by all of the various nodes. While procedures were refined during the course of the war, it was not unusual for subsequent firings to be delayed up to two hours for clearance.

While several examples were discovered in the JFS research, the two above probably best illustrate the primary facets of the targeting problems that JWF will address: long-standing coordination, procedural, equipment, and interoperability problems in addition to problems that surface when a new weapon or other capability is introduced without examining its impact on coordination and procedures. This latter problem is illustrated in Figure I-2.

Figure I-2. Trends in Firepower

While progress has been made in the areas of precision/accuracy, standoff/depth, mission-munitions fit, and desired effects, the area of timeliness has not improved and has even declined, in some aspects.

1.3.1 Contribution to the Warfighter

Will JWF benefit the warfighter? Certainly. During the course of the feasibility study, the CINCs and many of the three-star warfighting commanders were briefed on the problem statement and methodology of the JWF JT&E. Support from these commanders is crucial. JWF will participate in their exercises, assist in planning for their exercises, establish TSSTs as exercise objectives, insert test articles, and collect data during their exercises. If they do not believe that the JWF product will help them fight, they certainly would not agree to allow JWF participation in these exercises. It is interesting to note that these senior warfighters are unanimously in support of JWF. The following are signed, written quotes from selected commands.

Examination of tactics, techniques, and procedures used by joint force commanders to attack time-sensitive surface targets is critical to the development of appropriate joint doctrine. U.S. Central Command supports the chartering of this important study.

DCINC USCENTCOM

The observations and recommendations that come from this JT&E will contribute to the enhancement of U.S. PACOM's joint [TSST targeting] procedures. U.S. Pacific Command supports the chartering of this important study.

DCINC USPACOM

We believe the proposed JWF Joint Test and Evaluation time-sensitive surface targets (TSST) study could benefit joint task forces in our theater.

DCINC USEUCOM

I support the continued development of the JWF concept... and encourage [incorporation of] other efforts into the overarching JWF effort.

CINC USFK

Joint Warfighters Joint Test and Evaluation is one of considerable interest to the Marine Corps and the Combat Development Command. Therefore, I endorse the chartering of this program.

DCG, MCCDC

I fully agree that the program is a worthwhile and much needed effort. The Commander and Staff of U.S. Marine Corps Forces, Atlantic, fully support your request for our involvement.

DCG, II MEF

I share your desire to refine the process of prosecuting time-sensitive surface targets (TSSTs). The process of prosecuting TSSTs is certainly worthy of examination.

CG, USCENTAF

This effort promises to provide Joint Force Commanders (JFCs) with a means to leverage capabilities to fight and win.

CG, III Corps

Your efforts are commendable, and we look forward to establishing a relationship that will include your participation in future Corps exercises.

CofS, XVIII Airborne Corps

1.4 Past Activities

In the year preceding charter, JWF conducted a Joint Feasibility Study to determine the necessity and feasibility of the JT&E. As specified in OSD's *Joint Feasibility Study Handbook,* one criterion is to determine whether the problem is of sufficient magnitude or significance that it warrants the expenditure of the estimated resources. Research indicated that the problem is definitely worthy of a JT&E.

The magnitude and significance of the problem begs elaboration. Difficulty in prosecuting TSSTs appears to be a common problem known to many whom are involved in this activity. Parochial Service interests in the joint application of firepower can be traced to World War II and are still being debated without resolution. This is reflected in the "Roles and Missions" debate among the Services over proposed joint doctrinal publications that address the command and control of firepower. The JWF JT&E does not seek to enter nor will it resolve this roles and missions debate. However, the critical nature of engaging TSSTs must be resolved and can be addressed outside the roles and missions debate.

The recent history of Desert Storm operations supports the need to address the timeliness of joint applications of firepower. Possibly the best example of a failure to prosecute a TSST occurred on 27–28 February 1991 when a large portion (possibly 50 percent) of the RGFC was allowed to escape across the Euphrates River. The fleeing RGFC, while either a quite large singular target or numerous small targets, certainly met the criteria to qualify as a time-sensitive surface target(s), as previously defined, "...highly lucrative, fleeting targets of opportunity."[1] Since one of the stated operational objectives of Desert Storm was to "destroy the Republican Guard," the "highly lucrative, fleeting targets of opportunity" phrase certainly applies.

The escape resulted from confusion between ground and air commanders and a breakdown in procedures to coordinate the fire support coordination line (FSCL).[2] Doctrinally, corps commanders position the FSCL to facilitate the attack of targets beyond it. As both the XVIII Airborne Corps and VII Corps were maneuvering to trap and destroy the RGFC, they were moving the FSCL forward, or to the East. In the case of XVIII Airborne Corps, the FSCL was placed north of the Euphrates to allow helicopters to attack the causeway leading to Basra. However, only a few Apache attacks actually occurred. Since the FSCL prevented the air component from attacking the causeway (short of the FSCL), the RGFC had approximately eight hours of virtual impunity to cross the river.[3]

VII Corps shifted its FSCL to the coastal highway but soon found its attack slowed. This prevented the Air Force from attacking the major escape route out of Kuwait. VII Corps attempted to move the FSCL back to the west but was prevented from doing so by CENTCOM. No firm rationale was given, but the indications were that the political aspects of the "Highway of Death" prevented the move.[4] There is little doubt that the breakdown in procedures and coordination caused much confusion about where the FSCLs were at any given time on any headquarters map. This was certainly true at VII Corps, where a planned Apache attack was canceled due to potential fratricide and anticipated interference with Air Force operations. The issue in this situation was not one of "battlespace" but rather one of coordination and procedural difficulties. The fact is that neither the Army helicopters nor the Air Force was able to attack the fleeing RGFC.

The above is an example of poor procedures and coordination in the prosecution of TSSTs with very complex and serious repercussions. The RGFC, as we now know, was afforded the opportunity to regroup and put down a U.S.-inspired rebellion, to assist Saddam Hussein in consolidating his power and remaining in office, and most recently, to deploy and become actively involved in the Kurdish faction fighting in Northern Iraq. The significance of the missed opportunity to prosecute this "time-sensitive target" is evident in the frustration of two U.S. Presidents and the expenditure of vast resources.

Another Desert Storm example of faulty procedures and coordination is the length of time required to coordinate and clear airspace for firing the ATACMS. The first ATACMS ever fired

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[1] Joint Publication 1-02, *DoD Dictionary, Military and Associated Terms*, 23 March 1994.

[2] Gordon, Michael R. and Trainor, Bernard E., *The Generals' War*, Boston: Little, Brown and Company, 1995, p. 411.

[3] *Ibid.*, 412.

[4] *Ibid.*

in combat was delayed for hours while the various nodes coordinated the appropriate clearance. While the target, a surface-to-air missile site, was relatively immobile, it should have been considered a time-sensitive target because it "presented a clear and present danger to friendly forces" on the first night of the air war. While procedures were refined during the course of the war, it was not unusual for subsequent firings to be delayed up to two hours for clearance.

In the Department of Defense, Interim Report to Congress, *Conduct of the Persian Gulf War,* the transmission of targeting information was cited as a shortcoming for being "slow and cumbersome because of inadequate interoperability. This increased workloads, lengthened transmission time, and reduced the potential flexibility and responsiveness of Coalition forces."[5]

The same report cites:

> *Much of the aggregate combat power achieved by the highly integrated military campaign was facilitated by 'work arounds' that bridged disparate Service planning procedures and cross-connected specialized intelligence and tactical data systems.... Evaluation of these lessons and the continued development of a comprehensive foundation of advanced joint doctrine will continue to be high priority objectives.*[6]

However, no joint doctrine has been published to address the time-sensitive surface target issue, to date.

The Department of Defense stated, in *Conduct of the Persian Gulf War, Final Report to Congress, 1992,* that "the theater Commander in Chief has the key role in theater-level targeting, but this role is not clearly defined in joint doctrine. This lack of definition caused confusion and duplication...." Another issue involved the problems encountered attempting to locate and destroy TSSTs. The finding for the issue: "...targeting must be improved."[7]

The last five to six years (since Desert Storm) have not seen much improvement in the JFC's ability to prosecute time-sensitive surface targets. *The Participant Guide – Phase I* for Unified Endeavor 97-1 under the subject of "Joint Fires" states, "Regardless of the issues and differing views, the Joint Force Commander, his staff, and components always make it work, albeit with varying degrees of success. **At what expense?**"[8] JWF will assess the capability of systems and procedures that are in development to resolve interoperability problems of a JFC to effectively and efficiently prosecute TSSTs. Recommendations for system improvements and requirements for new systems and/or procedures will be JT&E legacy products.

2.0 MILESTONE SCHEDULE

The JWF schedule is primarily driven by the existing schedule for exercise activity that will provide the primary sources of data. The schedule must account for a number of specific

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[5] Department of Defense, *Conduct of the Persian Gulf Conflict: An Interim Report to Congress,* Washington, D.C., July 1991, p. 15-5.

[6] *Ibid.*, 21-2.

[7] Department of Defense, *Conduct of the Persian Gulf War, Final Report to Congress,* Washington, D.C., April 1992, p. 181.

[8] Joint Training, Simulation, and Analysis Center (JTASC), J7, USACOM, *Participant Guide – Phase I,* Unified Endeavor 97-1, 1996.

functions: a period of preparation and detailed planning; the collection effort; data reduction; a regimented procedure for trial reconstruction, validation, and certification; analysis; and reporting. In addition, administrative, personnel, housekeeping, and other routine activities must be accounted for within the scope of the overall timetable for program execution. Figure I-3, JWF Schedule Overview, provides a synopsis of the overall schedule.

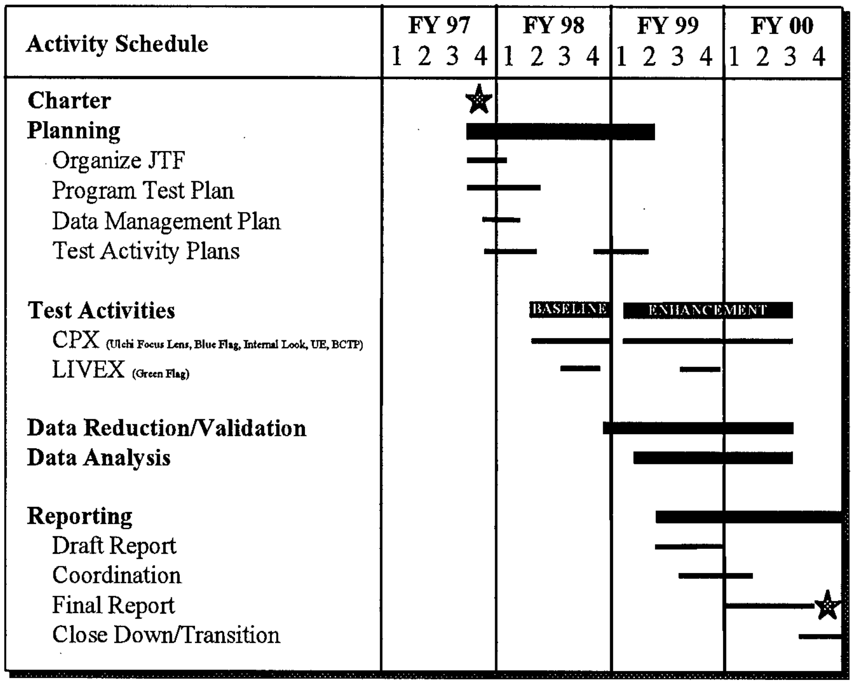

Figure I-3. JWF Schedule Overview

The spring months of 1998 and 1999 are periods when intense exercise activity occurs. Essential activities such as data collection are deconflicted, but data reduction and processing windows are currently in conflict depending on final personnel levels and timing. However, the corresponding late summer and fall periods reflect a relatively light resource loading that provides more than enough recovery opportunities when resources are leveled. A more detailed schedule reflecting this leveling depends on manning decisions by the Services, which cannot be sought prior to a charter decision.

The other apparent scheduling anomaly regards the exercise Internal Look, CENTCOM's primary training vehicle. This key exercise is conducted on a biannual basis, and therefore the second opportunity occurs very late in the JWF JT&E schedule. The potential value of this opportunity for the examination of a crucial warfighting command is evident. The JWF schedule has been structured to permit little or no conflict with utilizing this resource. All other program activities except for the integration of the last exercise should be accomplished prior to the execution of Internal Look 2000. In the event that budget or other resource considerations overcome the opportunity afforded by Internal Look 2000, it is the judgment of the JWF

Feasibility Study that the baseline alone is a product worthy of the effort. It is also an effort that will be useful to the supported warfighters.

3.0 CURRENT MAJOR ACTIVITIES

JWF is currently organizing the Joint Test Force. This includes the major effort of staffing the organization with the appropriate military, civilian, and contractor personnel. Between September 1997 and March 1998, JWF is expected to grow from the original group of eight to 68 personnel. Organizing also includes obtaining adequate facilities and equipment. JWF expects to remain in U.S. Atlantic Command's Joint Training, Analysis, and Simulation Center in Suffolk, Virginia. However, negotiations are under way to expand the JWF share of the building, an essential factor in determining the future location of JWF. Concurrent with the facility and personnel ramp-up, the JWF staff is planning for future activities. The major documents under preparation include the Program Test Plan (PTP), the Data Management Plan (DMAP), and Site Test Plans for each exercise location.

4.0 FUTURE MAJOR ACTIVITIES

4.1 Baseline Testing

Baseline testing will be conducted during 1998. JWF will collect data for the baseline test phase during theater exercises conducted by the combatant CINCs. The JT&E, through its collection, analysis, and reporting of baseline and enhanced theater joint force prosecution of TSSTs, will provide data for all combatant commands to examine for application to their operations. This legacy product can also be used to build valuable training plans.

The JWF JT&E will be conducted in the following six phases:

1. **Organization.** This phase encompasses those actions necessary to "stand up" the Joint Test Force following the chartering decision and includes establishing offices, obtaining personnel and equipment, etc. This phase is currently in progress.
2. **Spinup.** As this phase is initiated, preparations will be made to observe a joint force command exercise in its entirety. The objective for this phase will be to develop and refine test plans and procedures, practice data collection, and exercise data transmittal. These plans and procedures will be further refined and/or validated during a second joint force command exercise. This will be the "pilot" exercise for the Joint Test Force.
3. **Current Process Testing.** This phase will consist of testing and data collection of the current processes and technology for prosecuting TSSTs to build a baseline for evaluating improvements. This test phase will include at least two or more regional exercises, one Computer-Aided Exercise (CAX), and one Live Exercise (LIVEX). ***Note: The focus will be specifically concentrated on information gathering during the baseline effort and will avoid debate on doctrinal issues during this phase. JWF will include provisions for an intermediate phase to coordinate with the CINCs and Services prior to exploring any JWF-induced doctrinal alternatives to joint training exercises, if the baseline data indicates the need.***

4. **Enhanced Process Testing.** In this phase, the Joint Test Team will identify and examine proposed enhancements to prosecuting TSSTs, again during two or more regional exercises, one CAX and one LIVEX.
5. **Analysis and Assessment.** After the conclusion of the test activities, the Joint Test Force will analyze the data to establish baseline performance and to assess the effects of the tested enhancements on combat effectiveness and efficiency. These assessments will determine the merit and value of each tested enhancement. Periodically, findings and lessons learned during the course of the JT&E will be disseminated through Service channels and to the DTSE&E in the form of "interim reports."
6. **Reporting and Close Down.** The Joint Test Force will prepare the final JT&E briefings and final report, transition the JT&E's legacy products, and close out the JT&E.

The primary test articles and participants will be a JTF headquarters and its component commands. The size of the joint force and level of Service participation will vary by the scenario and threat played in each joint exercise. Component command size will vary from single tactical units (brigades, regiments, wings, and groups) to large operational units (Army Corps, Marine Air-Ground Task Force (MAGTF), Numbered Air Force, and Naval fleet accompanied by their respective tactical units). The units will be organized, trained, and equipped according to their respective Service standards. Participants will operate according to approved joint and Service doctrine and tactics, techniques, and procedures (TTPs) (to the extent that they exist).

Organizational echelons at the operational level of war (the JFC headquarters and component command headquarters) are responsible for planning, integrating and synchronizing, and executing against time-sensitive surface targets. The effectiveness and efficiency of their actions are evidenced through the tactical outcomes in the battlespace. JWF will document the outcomes of target engagements during time-sensitive surface targeting operations to assess the effects of the procedures used to execute the JFC's joint targeting strategy.

Enhancements selected during the JT&E to improve the combat effectiveness and efficiency of prosecuting TSSTs may include new or modified doctrine and TTPs, processes, organization, systems, equipment, and training. The Joint Test Force will ensure that units and personnel participating in joint exercises are adequately trained in the use or application of the selected enhancements.

JWF will require 68 personnel in order to accomplish baseline data collection and processing, including 34 active duty military, three DoD civilians, and 32 contractor personnel. The total cost for the baseline phase will be $6,868,112. This figure includes all costs for facilities, equipment, government personnel, and contractor support.

The baseline-testing phase is an essential requirement for JWF in order to satisfactorily measure and analyze the result of enhancements during the succeeding phases. Although not intended to provide a direct benefit to the warfighters, it is expected that the baseline data describing current procedures for prosecuting TSSTs will provide an immediate contribution because there is a void in the documentation of current procedures. Documentation of current procedures and the resulting contribution to the training effort will increase combat effectiveness to a large degree, even before the JWF enhancements are introduced during subsequent testing.

4.2 Enhancement Testing

Enhancement testing will be conducted during 1999 and 2000. The shortcomings in joint targeting, particularly the prosecution of TSSTs, are widely recognized, and several organizations have addressed the issue. As a result, many improvements in the areas of doctrine, TTPs, and equipment have been proposed. Doctrine development has advanced in narrow areas (e.g., the development of Joint Publication 3-01.5, *Doctrine for TMD*). Several equipment improvements have been evaluated and incorporated at the component level. However, we still have the Joint Surveillance Targeting and Attack Radar System (JSTARS) transmitting one picture to the ground element and another to the air element. The All Source Analysis System (ASAS) does about the same thing, giving the land/amphibious component commander a picture different from the one it gives the air component commander. In today's warfighting, in which each component has the capability to locate and attack time-sensitive targets (maybe simultaneously) in a mutual battlespace, *the prosecution of the full range of TSSTs by a joint force in a realistic environment* has not been and is not currently being addressed by any program other than JWF. The JWF JT&E will afford the opportunity for testing enhancements/test articles—those proposed by other organizations as well as JWF-produced—in the right environment.

The selection of test articles must be based on the problems to be solved. The basic problem is stated in the JWF problem statement and is summarized as "current joint force command and control systems do not allow unified, real-time coordination and deconfliction of all forces" in the ALSA multi-Service pamphlet, *Targeting—The Joint Targeting Process and Procedures for Targeting Time-Critical Targets*. Many procedural enhancements in the form of TTPs are proposed in the ALSA pamphlet. Where applicable, those proposed enhancements will be used as test articles, providing ALSA with the opportunity to "acid test" their TTPs. ALSA has long had the lead in attempts to improve the prosecution of TSSTs. They will continue to be used as SMEs and a sounding board in the JT&E planning and execution.

JWF will coordinate the actual enhancements with the warfighters who conduct the exercises. Some of the enhancements under consideration include:

- Extension of the Contingency Theater Automated Planning System (CTAPS) to the land component (currently adopted by USN, USMC, and USAF). CTAPS applications include the Air Campaign Planning Tool, Joint Force Air Component Commander (JFACC) Decision Support System, Force-Level Execution (FLEX), and Battlefield Situation Display (BSD), currently in development. Other capabilities include interfaces with the Airspace Deconfliction System (ADS), Theater Integration Situation Display (TISD), Combat Intelligence System (CIS), Advanced Planning System (APS), and JFACC Planning Tool (JPT).
- Joint application of the Advanced Field Artillery Tactical Data System (AFATDS) as a coordination and deconfliction aid. The current AFATDS, used by the Army and Marine Corps, is being modified to interface with the ATO and to provide situational awareness information for all joint force attack operations.

- Joint application of the Automated Deep Operations Coordination System (ADOCS). This LAN system, currently in Army field tests, was developed to provide targeting operation coordination and deconfliction capabilities. It has interface capability with ASAS and other situational awareness tools such as AFATDS.
- Improvements to TTPs addressing the coordination and the impacts on the components of restrictive and permissive measures such as boundaries; FSCMs (free fire areas (FFAs), coordinated fire lines (CFLs), fire support coordination lines (FSCLs), no-fire areas (NFAs), restricted fire lines/restricted fire areas (RFLs/RFAs), and airspace control areas (ACAs)); and airspace control measures (ACMs) (restricted operations areas/restricted operations zones (ROAs/ROZs), high density airspace control zones (HIDACZs), minimum risk routes (MRRs), and special use airspace (SUA)).
- Evaluation of any new doctrinal guidance on the employment of firepower as it pertains to TSSTs.
- Detailed TTPs for the employment, coordination, and use of common reference systems such as grid boxes.
- A system of ensuring automatic doctrinal, TTPs, CONOPS, etc., modifications when a new (to the theater or AOR) weapon system or capability is introduced.
- Doctrine for restructuring and streamlining the joint force and component structures to enhance timeliness in prosecuting TSSTs.
- Introduction of the Army's Deep Operations Coordination Cell (DOCC). The DOCC is a C^2 node that plans, coordinates, and manages deep operations. The DOCC selects attack assets, including those to be employed by other component commanders.
- Introduction of the Combat Integration Capability (CIC) system. The CIC, now in development, is designed to consolidate relevant sensor, intelligence, and ATO information at the control and reporting center (CRC) or JAOC/AOC. The CIC features connectivity to the BCD, DOCC, and force protection tactical operations center (FPTOC), thus providing a means to coordinate and deconflict TSST attacks.
- Introduction of interoperability (interconnectivity) efforts currently in development for existing communications equipment to permit communications between the BCD and JAOC and among the ARFOR TOCs, the MARFOR COCs, and the AFFOR CRCs.
- Establishing (artificially, if necessary) standardized locations for common and dissimilar C^2 terminals. This would facilitate TTPs and doctrine development as well as potentially improve joint force coordination.
- Establishing a common target number (CTN) system. CTNs currently exist for only fixed installations and enemy order of battle (EOB).

The costs for enhancement testing are similar to those for establishing the baseline. The personnel requirements remain the same—68 total military, civilian, and contractor. The total cost will be $9,181,998 in 1999 and $9,084,105 in 2000 for all facilities, equipment, government personnel, and contractor support.

The contributions to the warfighter will be significant in terms of return on investment for JWF. The joint procedural problems that currently exist and have been documented for years regarding timeliness of fires will be reduced, if not eliminated. Procedures will certainly improve—there are no standard TTPs now. Any procedures produced will not only improve interoperability and combat effectiveness but will reduce fratricide. Much of the delay in the prosecution of TSSTs is caused by the inability to rapidly coordinate attack locations versus friendly positions.

In summary, the JWF approach will be to document and assess baseline effectiveness and efficiency for each exercise, then apply enhancements and evaluate the joint force targeting process for improvements (and the reasons for the improvements). Enhancements selected during the JT&E to improve the combat effectiveness and efficiency of prosecuting TSSTs may include new or modified doctrine and TTPs, processes, organization, systems, equipment, and training.

5.0 LEGACY PRODUCTS

A legacy product provides a basis to implement and institutionalize the conclusions and recommendations of the JT&E when it is completed. Potential users of the JWF legacy products include the Joint Staff, combatant commands, the Services, and other JT&E efforts. The legacy products may be used to support actions by multiple agencies. JWF legacy products potentially include the documentation of joint force targeting procedures, validation of newly approved joint doctrine and TTPs, recommendations for system requirements, recommendations for JFC organization and joint training for both individuals and units at various echelons of command, and potential modifications to the UJTL.

5.1 Documentation of Operational Concepts and Tactics, Techniques, and Procedures

The documentation of the TSST process baselines will be of explicit value. There is near total agreement that documentation is a potential problem in our warfighting abilities. One hypothesis of JWF is that shortfalls in performance are related to the shortfalls in documentation. In addition to providing the comparative foundation for enhancement testing, the documentation and promulgation of the TSST processes will afford commanders an opportunity for objective scrutiny and provide trainers with the building blocks for tomorrow's curriculum. JWF will prepare a compendium of data that supports JT&E findings and outcomes concerning the operational concepts and TTPs to effectively and efficiently prosecute TSSTs. The documentation will address problem areas identified during the JT&E and will recommend changes to enhance combat effectiveness. The users of this data will be the Joint Staff, combatant command staffs, the Service staffs, and the commanders and staffs of operational units at all echelons. This data may also serve as a benchmark baseline of targeting transactions to support future improvement efforts.

5.2 Validation of and Input to Newly Approved Joint Doctrine and Tactics, Techniques, and Procedures

During the JT&E, the Joint Test Force will recommend changes to specific joint publications, multi-Service publications, and Service manuals that should be revised based on the JT&E findings. It is conceivable that JWF could produce requirements for a completely new publication. The JT&E team will prepare change recommendations and provide them to the Joint Staff, Services, and agencies as appropriate. Examples of joint, multi-Service, and Service publications that are potential beneficiaries of JWF findings include Joint Publication 3-09, *Doctrine for Joint Fire Support (Draft)*; Joint Publication 3-60, *Targeting* (currently being drafted); Joint Publication 2-01.1, *Joint Tactics, Techniques, and Procedures for Intelligence Support to Targeting* (Third Draft); Multi-Service Tactics, Techniques, and Procedures Publication, *Targeting: The Joint Targeting Process and Procedures for Targeting Time-Critical Targets* (Final Signature Draft); Air Force Instruction 14-207, *Air Force Targeting*; and Air Combat Command Instruction 13-AOCV3, *Operational Procedures-Air Operations Center*.

5.3 Recommendations for Joint Training

The JT&E team will identify and document potential enhancements to the training of individuals and JTF staffs as well as component commands/Service staffs in prosecuting TSSTs. As a result of the test activities conducted during the JT&E, the team will gain expertise in the methods and processes needed to enhance joint operational training. The team's findings and recommendations will be documented and provided to the Joint Staff, the combatant commands, the Services, and other OSD and joint organizations. Recommendations may concern proficiency standards; changes in the mix and echelons of units; assessment and feedback methods; and training methods involving live, constructive, and virtual simulations. Joint schools (e.g., the ACOM-sponsored Joint Targeting School), as well as Service training schools, receive recommendations on how to enhance their curriculum. These recommendations can also be incorporated into joint- and Service-hosted battle manager exercises to train battlestaffs on how to coordinate the efforts of multiple components.

5.4 Recommendations for System Requirements

JWF results will be the basis for providing recommendations to the Joint Staff and the Services for developing or modifying systems to enhance the effectiveness and efficiency of prosecuting TSSTs. It is anticipated that the JT&E team will identify problems in areas such as the interoperability of communications/data systems and the commonality and effectiveness of tactical situation displays. The JT&E team will prepare inputs that document such problems and recommendations on correcting them. The JT&E team will provide these inputs to the Joint Staff, OSD agencies, and the Services. These inputs will provide a basis for preparing requirement documents such as mission need statements (MNS) and operational requirements documents (ORD).

5.5 Recommendations for JFC Organization

No joint doctrine exists to describe how a joint force should be organized for the command and execution of fires. JWF expects to document the various organizational structures currently in use along with the positive attributes and problem areas associated with each example. Again, this documentation would serve as input to joint publications and would be made available to the combatant commands for their consideration during the organization for operations.

5.6 Modification to the Universal Joint Task List (UJTL CJCSM 3500.04)

JWF will provide input to the UJTL that contains no operational or tactical tasks for targeting TSSTs. As described in the discussion of the JWF problem definition and issue development in Sections 1 and 2, the criticality of time-sensitive surface targeting warrants specific tasks in the premier joint training task list.

5.7 Additions to JCS-Approved Joint Definitions

Based on its research of JCS-approved definitions, JWF will develop revised as well as new joint terminology definitions for incorporation into Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*. These definitions will expand and improve the joint lexicon by clarifying the current terminology and defining new terms to more precisely describe a JFC's functions and responsibilities when conducting time-sensitive surface targeting.

5.8 Development of a Desert Storm Monograph

As a product of research (during the JFS) into the problems and lessons learned from Operation Desert Storm, the JWF team will publish a monograph discussing the most notable wartime problems encountered in the joint environment when prosecuting TSSTs. These examples of the challenges incurred in conducting real-time targeting and the joint application of firepower will provide the Services with a relevant exemplar that can be used as an established point of departure in the training of battle managers.