T&E RESOURCES:
A CORPORATE APPROACH TO MANAGING FUTURE T&E RESOURCES

INTRODUCTION

After a decade of declining T&E resources and a deteriorating Major Range and Test Facility Base (MRTFB), the trend may be slowing. Over the last few years, Congress has been providing small increases over the requested amounts in the T&E funding lines as we have made a better case for support for T&E. I would like to thank the Congress for their support. Nonetheless, more needs to be done to compensate for the losses incurred during the previous decade and to close the significant gap that exists between T&E mission requirements and the T&E resources available to support the mission.

It is imperative that we maintain the viability of our major land, air, and sea test ranges as well as the unique, high-value ground test facilities. These test ranges and facilities are essential for testing systems for the foreseeable future. If ever lost to DoD use, these assets could not be recovered or replaced.

We continue to be concerned over DoD's ability to meet future T&E requirements. The following evidence points to the divergence between the workload and the resources needed to accomplish the workload:

- Resources supporting Operational T&E (OT&E) continue to decline while workload increases. Resources are insufficient to support early involvement of operational test personnel in acquisition programs or to adequately fund OT&E of minor acquisition programs.

- MRTFB operating and investment funding has been reduced each year since 1990. The annual funding is nearly $1 billion below the 1990 level, about a 30 percent reduction. The sum of the reductions over the decade totals $8 billion.

- The decline in T&E personnel at the MRTFB over the past 10 years continues unabated throughout our programming horizon. By 2001, T&E personnel will be down about 14,000, a 32 percent decrease, from the 1990 level. In addition, the number of military personnel in developmental and operational testing has declined dramatically. Army military personnel directly involved in developmental testing fell 99 percent from 1990 to 2001. Military personnel involved in Air Force development testing were reduced 39 percent in the same period. Between 1993 and 1999, the number of military personnel involved in operational testing decreased by 33 percent.

- The low rate of investment for T&E facilities continues to be a critical problem, especially in the category of military construction. From 1990 to 2001, overall investment in T&E was reduced by 28 percent, while the funding for military construction decreased by over 90 percent.

To compensate for years of decline in T&E resources, we must invest in more modern, efficient facilities that address new technologies, reduce operations cost, reduce the number of personnel required to perform the T&E mission, and accept the realities of constrained infrastructure resources—both

personnel and funding. The current DoD T&E investment rates are well below those for comparable facilities in the private sector.

In order to comprehensively address needed T&E resources and mission requirements, we have initiated the development of a T&E corporate strategic plan. The Service Vice Chiefs and I are sponsoring the plan. It will evaluate T&E future needs in the light of Joint Vision 2020 and the serious shortfalls that already exist due to resource reductions over the past decade. The plan will identify resource requirements from a Department-wide perspective and provide guidance for the next 20 years. Periodic updates will address changes to the Department's T&E needs and priorities.

T&E is supporting acquisition reform

As part of the acquisition reform process, a new series of acquisition policies is being issued. DoD Directive 5000.1, "The Defense Acquisition System," includes T&E as an integral part of the acquisition process through application of "integrated test and evaluation." To shorten acquisition cycle times, it is critical to have earlier involvement of OT&E personnel to ensure timely identification of potential problems when there are alternative solutions available. In this way, T&E can help ensure the most cost effective weapons reach our combat forces.

- T&E programs will be integrated throughout the acquisition process to provide essential information to decision-makers at the earliest feasible time; to assess progress in system development; to determine attainment of technical performance parameters; and to determine whether systems are operationally effective, suitable, and survivable for intended use.

- T&E is to be conducted to facilitate learning, assess technical maturity, facilitate integration into fielded forces, and confirm performance and interoperability.

- T&E will be closely integrated with requirements definition, threat projections, technology development, and systems design and development, and it will support the operational user through assessments of a system's contributions to mission capabilities and their integration into the field forces.

The new directive will result in an increasing workload for the T&E community and infrastructure. Members of the T&E workforce must be highly skilled, adaptable, and flexible, as they will be involved much earlier in all phases of the acquisition process. In addition, the technical capabilities of our test centers must be modernized and capacities expanded to keep pace with the rapidly changing technologies and accelerated rates of weapon system modernization programs. The increase in evolutionary developments within an acquisition program will equate to multiple concurrent programs at various stages of maturity, each requiring separate T&E. Integrated T&E will include:

- Emphasis on early operational assessments
- Development of an evaluation strategy and a T&E Master Plan earlier in the program
- Assessing contractor modeling and simulation data during evaluation of contractor proposals
- Emphasis on operational realism during developmental T&E
- Early interaction of OTA and developmental T&E personnel to determine when and how to combine OT&E events and to share data

- Creation of integrated test teams
- Emphasis on defining interoperability requirements

OPERATIONAL TEST AGENCY RESOURCES

Requirements for Operational Test Agencies (OTAs) are increasing

The Service OTAs have experienced increasing demands on their dwindling workforces, as shown in Figure 1, partially because of the effort to introduce the OTAs into the acquisition programs earlier. Early involvement by the OTAs is recognized as a primary way of gaining operational insights into the system under development at a time when flexibility in the design approach still exists. It also allows the OTAs to build a knowledge base that will lead to an effective operational test program.

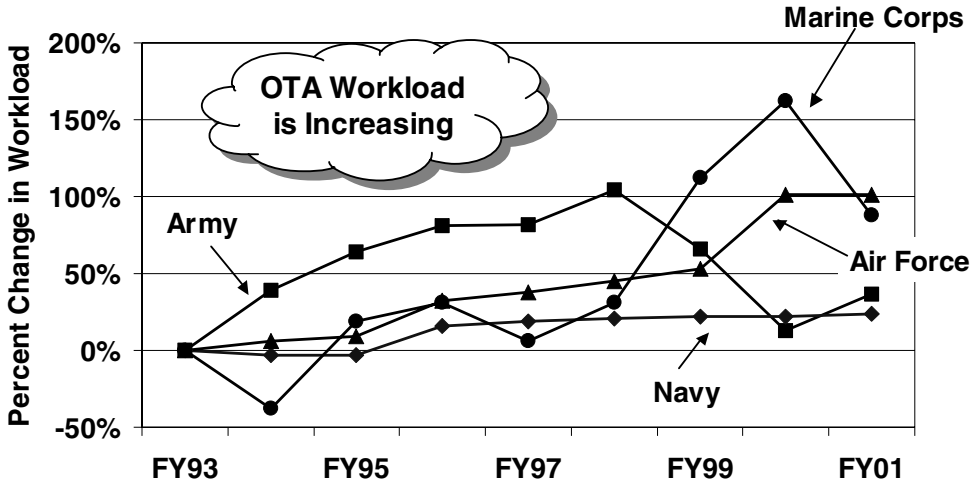

Figure 1. Operational Test Agency (OTA) workload is increasing

Shortfalls in funding constrain OT&E

The lack of resources available for OT&E has been limiting our ability to conduct OT&E for all required systems. This shortfall may result in (1) delay of acquisition programs, (2) diverting funds from other planned activities, (3) fielding of systems with increased risk or waivers of appropriate operational testing, or (4) delay of production until operational test is performed. All of the Operational Test Agencies are short of funding to comply with initiatives for earlier involvement.

Army OT&E funding has serious deficiencies, particularly with regard to the smaller acquisition programs. Some shortfalls were resolved during this past year's DoD programming reviews; however, there continues to be concern about the OT&E for smaller programs. There was a large funding shortfall for about 40 Acquisition Category II through IV programs during FY2000. Figure 1 indicates the Army OTA workload increasing by 13 percent between FY1993 and FY2000. A year ago, the Army was projecting an increase in FY2000 and FY2001, but, after a reduction in small test programs, the workload is now projected to show a decrease from the FY1999 level.

I am also concerned about the lack of funding for the Air Force OT&E Center (AFOTEC) to complete operational testing for the smaller acquisition programs. Air Force policy is that operational

testing of these programs is to be funded from an AFOTEC Program Element. Significant shortfalls in FY2001 and FY2002 will affect Advanced Concept Technology Demonstration (ACTD) programs, Battle Laboratory Experiments, and Joint Experimentation programs. As many as 36 of the smaller programs, those in categories below Acquisition Category I, appear to be unfunded.

The Navy's approach to funding OT&E is different than the Army's and Air Force's. The Commander of the Navy's Operational Test and Evaluation Force (COMOPTEVFOR) receives funding from the acquisition programs to finance OT&E. This approach makes the OT&E funding the responsibility of the program under test. There remains insufficient funding budgeted to finance early involvement of Navy operational testers in developmental T&E programs.

The Marine Corps's OT&E funding is also a matter of concern since workload is increasing but funding has declined from the levels in the mid-1990s. The Marine Corps Operational Test and Evaluation Activity (MCOTEA) does not have adequate resources to support nuclear, chemical, and biological defense operational test requirements.

OTA manpower is a concern

The OTA workload is increasing, yet the government workforce in the OTAs, which peaked in FY1993, continues to decline. Civilian personnel declined by 45 percent and military personnel declined by 35 percent between FY1993 and FY2000, as shown in Figure 2. These reductions exceeded the corresponding decline in the total DoD civilian population and military force (27 percent and 19 percent, respectively) during that same period. While there has been an increase in contractor personnel who support the OTAs, the total reduction in the OTA workforce from FY1993 to FY2000 was 25 percent.

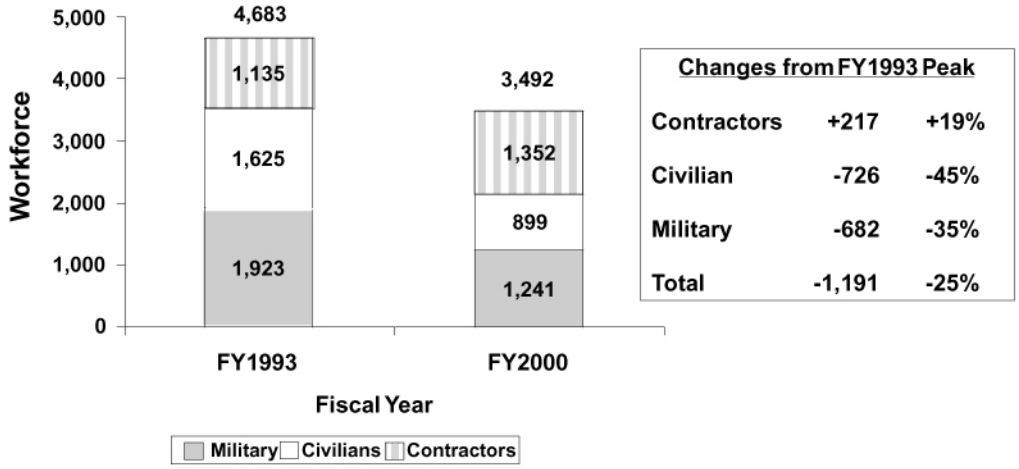

Figure 2. OTA workforce has declined

OTA workforce demographics are also a cause of concern. In FY 1999 more than half the civilian professionals were over age 50 and only 12 percent were under age 40. By the year 2004, 34 percent of those who fill GS-7 through GS-15 positions will be eligible for retirement. In addition, the number of OTA military personnel with tactical operations officer skills (the skills most useful in OT&E), and their percentage of the total workforce, has declined.

Examples of these disturbing trends in manpower can be found in each Service OTA:

- **Army**
  - Since the FY1993 peak, the Army OTA military workforce fell by 61 percent and civilian workforce by 50 percent. These shortfalls continue unabated.
  - Over that same period, the Army OTA workload increased by 13 percent.
  - In FY2000, it became clear that funding shortfalls would preclude support for approximately 40 initial operational tests.

- **Navy**
  - The Navy OTA workload is the highest in its 55-year history.
  - The Navy civilian government workforce has declined by 23 percent since FY1993.

- **Marine Corps**
  - The Marine Corps has allocated its manpower away from T&E to its combat units.
  - The Marine Corps OTA workload is increasing, while the workforce is decreasing.
  - Operational tests for major information systems will have to be prioritized so that the available resources can be appropriately committed, leading to increased risk for the remaining, lower-priority programs.
  - Resources are insufficient to satisfy the requirements for some nuclear/chemical/biological operational testing.
  - The Marine Corps OTA is now analyzing its need for additional workforce.

- **Air Force**
  - Between FY1993 and FY2000, the Air Force operational testing workload has increased by 100 percent.
  - This increase is the direct result of the assignment of all Air Force acquisition programs to the Air Force Operational Test and Evaluation Center for OT&E.
  - This workload growth is anticipated to continue until FY2005. In the meantime, manpower will increase only modestly, severely limiting the number of programs that operational testers will be able to support.

Adequate manning and funding at the OTAs is imperative, particularly if the acquisition process is to benefit from operational perspectives when changes in design, tactics, or doctrine are most easily accomplished. I intend to continue to do all I can to address the manpower and funding shortfalls at each OTA and to ensure that operational testers are involved early.

MAJOR RANGE AND TEST FACILITY BASE RESOURCES

In the past, I reported that operating and investment funding and personnel for the MRTFB had been reduced dramatically, while T&E workload had remained steady. Since 1988, at least 18 studies have focused on reducing the T&E infrastructure, although T&E infrastructure accounts for less than 2 percent of the approximately $100 billion spent by the Department on infrastructure overall. Between

1990 and 2001, the T&E workforce at major T&E centers is expected to reflect a reduction of 14,000 positions. I have argued against continued reductions because the T&E community's ability to test new weapons systems has not kept pace with the increasingly sophisticated technologies integrated into those weapons.

The complexity and interdependence of today's DoD weapons systems dictate that T&E capabilities support the development and acquisition process. A recent Defense Science Board (DSB) study concluded that full integration of the entire T&E cycle is essential. Critical knowledge is gained from testing at each stage in the cycle, from early development through operational T&E. If a phase is slighted through lack of adequate testing, a delay in testing, or a test limitation due to lack of capability within the T&E infrastructure, the acquisition program will suffer.

Unfortunately, past studies of T&E resources have often focused on optimizing capacity, instead of on identifying the best ways to support the acquisition process, such as reducing the cycle time for weapons programs. The cost of having reserve capacity is small compared to the cost of not having the capacity when needed. Also, reduced procurement programs do not change this need, since the T&E capabilities are needed, regardless of whether DoD is buying 10 or 1,000 of a particular weapon system. The DSB Task Force on T&E reached the following conclusion in its September 1999 report: "The focus of T&E should be on optimizing support to the development/acquisition process, not on minimizing (or even 'optimizing') T&E capacity. T&E is an integral part of system design, development, and acquisition."

To adequately support the acquisition process, T&E personnel must be involved early in programs; efficient and effective test processes must be in place; and the right test facilities and capabilities, in good working order, must be available when needed. Problems uncovered late in the acquisition cycle are often more expensive to correct and if not corrected may make deployed systems less effective than expected. It is imperative that T&E facilities be modern and capable of measuring data on system performance, operational effectiveness, suitability, and survivability. In his June 2000 report, *The Road Ahead*, the Under Secretary of Defense (Acquisition, Technology, and Logistics) highlighted the need for early involvement of T&E: "An integrated use of the time-phased requirements, more mature technology, evolutionary acquisition, and the early use of test and evaluation for discovery can result in reduced cycle times so that the warfighter will get delivery of required systems sooner and in planned increasing increments of capability to meet the evolving threat."

As in any business, improved T&E productivity requires some new investment. Since 1990, test investment budgets have been reduced about 35 percent. Not only have we been hard-pressed to finance the investments necessary to implement consolidation, but also we have been limited in our ability to field advanced test capabilities to match the rapidly advancing capabilities of new weapon systems. We have not made sufficient investments to reduce turn-around times at all of our T&E facilities or replace older, high-maintenance, and workforce-intensive facilities or equipment.

In summary, the Department has struggled to maintain the T&E infrastructure, while continuing to provide high-quality support despite the decline in available resources. The deep reductions in personnel and funding have brought us to a point where increased efficiencies can not be accomplished without new investment. The downward spiral of test resources must be reversed if we are to adequately test the weapon systems that our soldiers, sailors, airmen, and marines will need in the 21st century,

Development testing workload is robust

Despite reductions in the overall T&E workforce, the workload at the MRTFB has remained relatively stable in recent years. Beginning in 1990, test workload was expected to decline. Based on this

forecast, MRTFB operating and investment funding were dramatically reduced throughout the 1990s. The expected decline in workload did not occur, and in fact, over these years, some facilities operated at record workload levels causing a large divergence between the size of the T&E workload and workforce.

Not only is the overall level of workload at our test ranges and centers demanding, but the fluctuation of workload at the various test facilities is challenging, from both workforce and management standpoints. For example, Figure 3 depicts the open-air range workload at the Naval Air Warfare Center (NAWC)-Aircraft Division at Patuxent River, Maryland, over the last 10 years. The open-air range workload has increased slightly overall. The year-to-year fluctuations, however, are large, which illustrates that test capability should not be sized for a low year or even for the overall average. The capacity has to be at a level that supports the acquisition programs when the support is needed. The large acquisition programs, with their high test workload and significant daily costs, cannot afford to wait for access to the test ranges and centers.

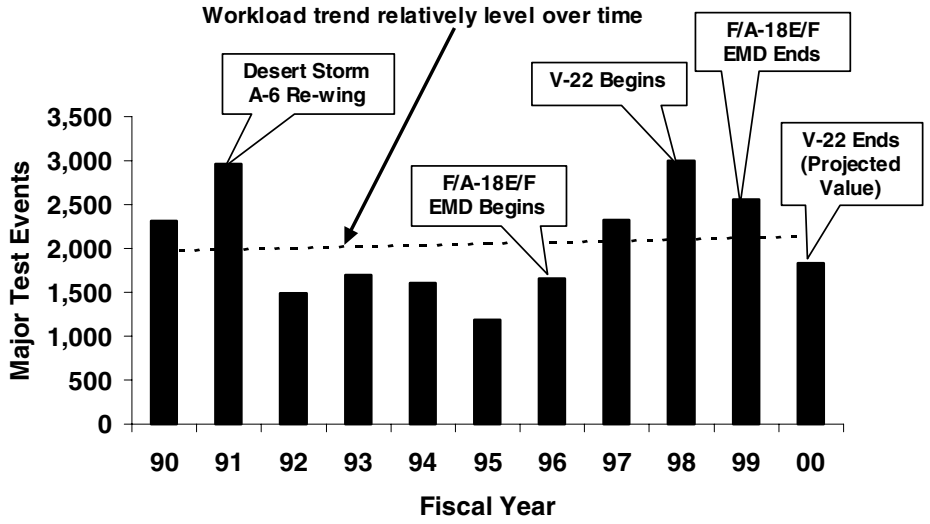

Figure 3 Workload fluctuates at open-air range, NAWC-Aircraft Division, Patuxent River

The Arnold Engineering Development Center (AEDC) in Tullahoma, Tennessee, is another example. During FY2000, the center's engine test facilities generated one of the highest workload levels ever experienced; but the FY2001 workload projections are approximately 15 percent lower. On the other hand, AEDC's wind tunnel workload was low in FY2000 but projected to increase by 10 percent during FY2001.

In addition to workload fluctuation, there are indications of workload increases at specific ranges and facilities. For example, with increased Navy Theater Ballistic Missile Defense Program testing at the Pacific Missile Range Facility (PMRF) at Barking Sands, Hawaii, the test and training workload is projected to increase by five times by the year 2004. Figure 4 illustrates this projected increase in workload for the next 10 years.

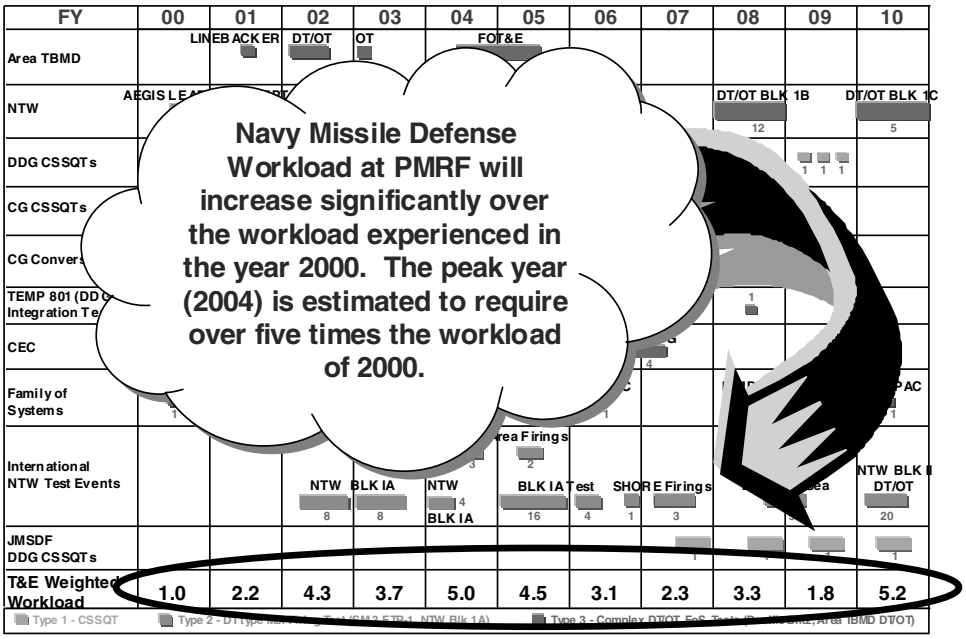

Figure 4. Navy Theater Missile Defense Workload at PMRF will experience a major increase

Declines in T&E resources are leveling off

In the early 1990s, T&E funding was reduced every year. However, in each of the last 6 years, as we have better articulated our needs, Congress has increased T&E funding. We are thankful for this congressional support, but the level of increase is still small compared to the decreases of the 1990s and does not compensate for the losses incurred. Overall, the T&E community still lacks the level of funding necessary to maintain current capabilities, let alone provide adequate future capabilities.

Figure 5 illustrates the leveling-out of RDT&E funding for T&E operations and investment. The decline in funding from FY1990 to FY1999 was 31 percent. Since then the funding level has fluctuated around a level that is approximately 29 percent below the FY1990 level.

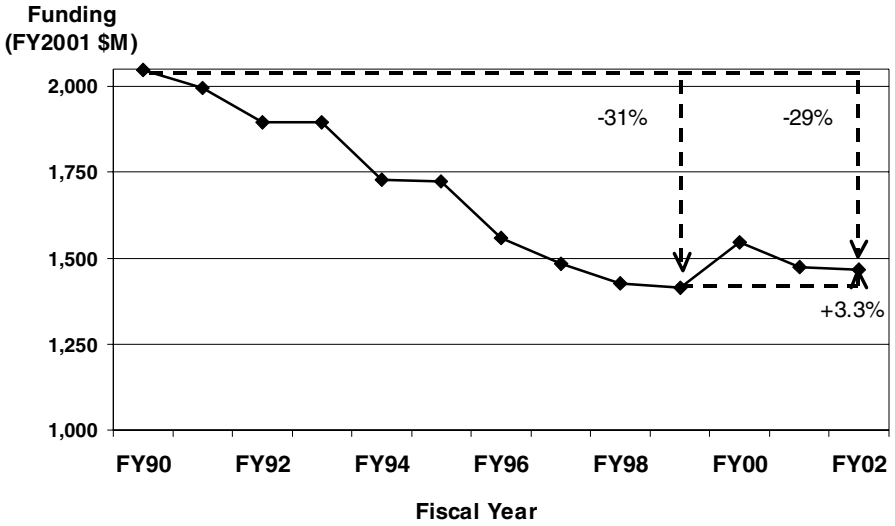

Figure 5. RDT&E funding for T&E operations and investment is stabilizing

Within the DoD, there are several categories of resources that have in the past 2 years either increased or remained the same. Funding for targets and threat simulation developments has remained relatively constant while improvement and modernization funding has increased. Institutional operating funds have also increased slightly. While these increases are dwarfed by the declines from FY1990 to FY1998, they are a welcome relief.

Nonetheless, one category that continues to decline is the workforce. In particular, the decline in military T&E personnel continues unabated and is a cause for serious concern. My office will continue to monitor this situation and make every effort to stop this trend.

Facilities are declining

In recent annual reports, I highlighted the deplorable status of facilities located within the MRTFB. I repeatedly stated that the test infrastructure is aging and our data now shows that over 75 percent of the MRTFB facilities are older than 30 years. Within the T&E community, we recognize the need to improve and modernize our facilities, while keeping them operational in order to provide the needed support to the acquisition programs. Unfortunately, we have had to choose which avenue to pursue. To continue to support required testing, we have had to keep our facilities operational. As a result, we have been unable to improve and modernize those facilities as we watched the backlog of maintenance and repair increase. The current low levels of investment funding have able to maintain the efficiency and productivity of only selected areas of the current T&E infrastructure. Additional funding is necessary to maintain the aging infrastructure and to provide those new capabilities needed to test the DoD systems of the future.

Partnerships and alliances are providing new opportunities for T&E

Partnerships and alliances formed with industry and other government agencies will lead to improved testing as well as cost savings for the taxpayer. While the T&E community, including the MRTFB, has participated in such activities for some time, we are beginning to see an increase in the number of such relationships and their scope. By forming partnerships and alliances with others, the test centers are able to pursue innovative approaches to problem solving, leading to better service for both old and new customers, and more effective use of existing facilities. Specific examples include:

- ***NASA/DoD Alliances:*** The DoD has had working relationships with NASA for many years and these have evolved into more formal alliances. A series of joint studies in the 1990s on improving the management and maintenance of various aeronautical and space facilities resulted in six formal alliances between the DoD and NASA that focus on better coordination and joint planning activities. This year, the DoD and NASA chartered a broader National Aeronautical Test Alliance to provide integrated strategic management of and planning for aerodynamic, aerothermal, and aeropropulsion facilities of both agencies.

- ***Chesapeake Regional Ranges Cooperative:*** The purpose of this alliance is to create testing and training opportunities that no one partner could support, fund, or build for a single use. The members of the Cooperative are: Aberdeen Test Center; Maryland National Guard; Fort A. P. Hill; Commander in Chef, Atlantic Fleet in Norfolk; Naval Air Warfare Center-Aircraft Division at Patuxent River; NASA Wallops Island; and the Naval Surface Warfare Center Division at Dam Neck, Virginia.

- ***Aberdeen Test Center (ATC)/Battelle Partnership:*** ATC has formed a partnership with Battelle Memorial Institute, Columbus, Ohio, to test the safety of fireworks. ATC's expertise

with explosives will help Battelle understand the conditions that exist when fireworks are stored in large quantities in warehouses or other facilities.

- ***Arnold Engineering Development Center (AEDC)/Loral Partnership:*** The large space chamber at AEDC had been idle for a decade. Loral wanted to use the facility to test, but the chamber and its instrumentation needed to be updated. After 4 years of negotiation, AEDC and Loral agreed to a 10-year partnership beneficial to each party. Loral contributed $1.5 million in new instrumentation to create a state-of-the-art space chamber at AEDC and AEDC will provide Loral with testing services that are beyond Loral's in-house testing capability. Loral will receive the testing at a reduced rate for the first four satellites tested at AEDC, after which they will be charged the normal AEDC commercial customer rates.

- ***Boeing/Air Force Partnership:*** A partnership between The Boeing Company and the Air Force is being executed at the Radar Cross Section (RCS) measurement ranges at Holloman Air Force Base, New Mexico. Under this agreement, Boeing provided the Air Force site with a test pylon and other equipment worth $5 million. In return, the Air Force will perform RCS testing for Boeing using both the Boeing equipment and the Air Force facility. Boeing will reimburse the Air Force for the direct cost plus any military pay associated with the testing. As a result, Holloman has a new customer with substantial test work and Boeing was able to close a costly test facility in California.

T&E INVESTMENTS

Investment funding is the key to maintaining existing T&E capability and to developing future T&E capability. Clearly, recent levels of funding have not kept pace with T&E needs. In some cases, limited modernization funding only supports expedient fixes and add-ons that do not capture the full capabilities and efficiencies of modern technology. There is significant risk associated with restricting investment to this level of funding. Acquisition decisions can be delayed or based on incomplete or inaccurate T&E results and could lead to the premature acquisition of less effective systems. Our future investment program will be to use the DoD T&E Enterprise strategic plan and its associated action plans and investment roadmaps. Our planning will also include those investments in T&E facilities and capabilities made by other program elements, such as acquisition programs (at contractor and government facilities), science and technology (S&T) programs, military construction, or programs of other DoD agencies.

Investment funds are declining as the need increases

During the 1990s, the resources to modernize T&E infrastructure were substantially reduced (see Figure 6). These declines occurred in conjunction with reductions in operations and maintenance funding and the T&E workforce. The Military Construction (MILCON) appropriation funds new facilities and major facility upgrades for T&E. In recent years, this funding has also been seriously reduced, as has funding for targets and threat simulators. The level of funding for improvement and modernization (I&M) is a small fraction of the level of funding that would be invested by private industry.

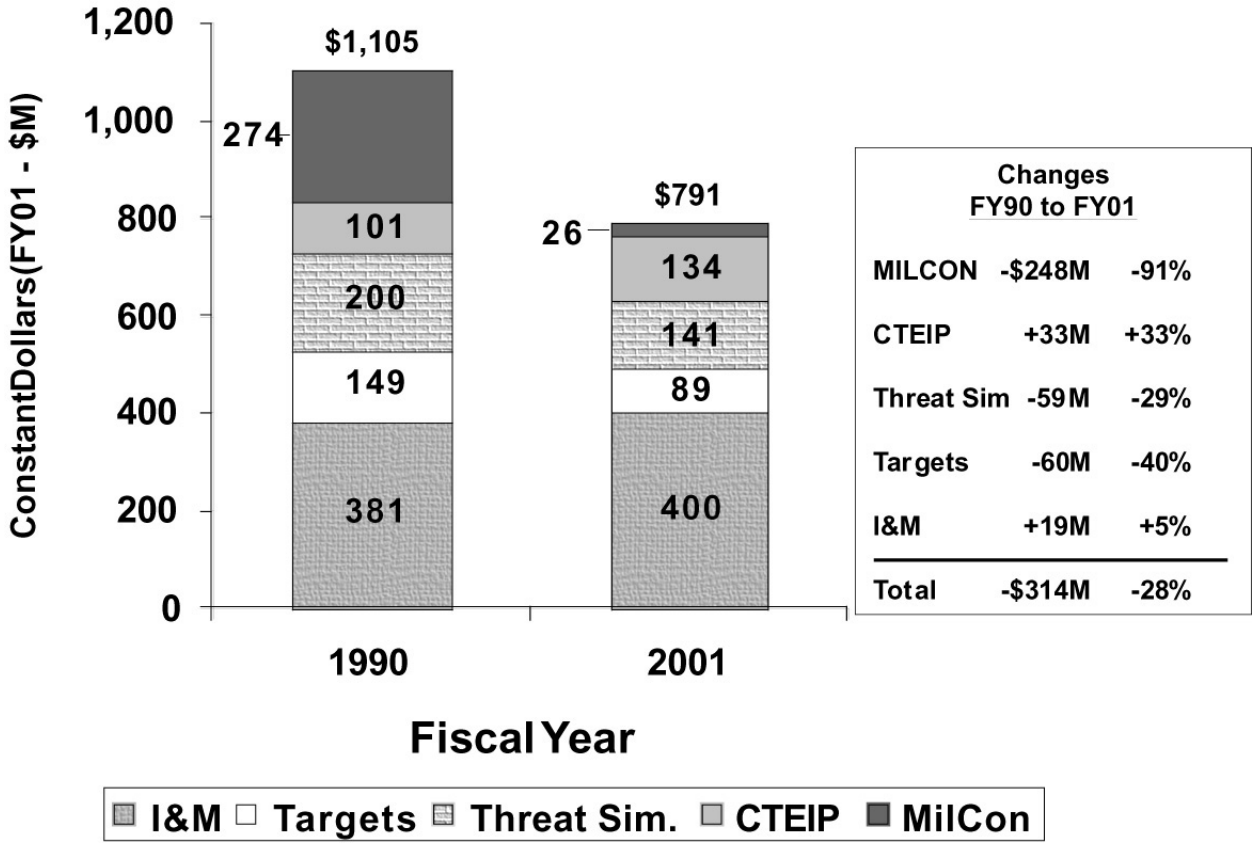

Figure 6. Total T&E Investment Funding has declined

It is increasingly difficult for the present T&E infrastructure to support testing of future needs (i.e., high-performance, high-technology-content weapon systems). Technology such as directed energy, precision guidance and control, "brilliant" weapons, data and signal processing capabilities, multi-spectral sensors, stealth, and information warfare challenge our current measurement capabilities; even more advanced technologies are under development in the laboratories or are being incorporated into emerging systems and weapon system upgrades. Our physical infrastructure averages over 40 years of age—far older than the physical infrastructure of comparable high-technology industrial concerns—and is inefficient and increasingly obsolete in significant technical areas. Efforts to respond to Joint Visions 2010 and 2020 will yield new systems and new concepts for warfighting. These systems and concepts must be tested to validate designs, to identify problems while they can still be remedied relatively inexpensively, and to determine military utility, suitability, lethality, and vulnerability. Not only must we test these systems and concepts on a schedule responsive to the needs of the acquisition community and the warfighters, but we must also modernize our T&E infrastructure if we are going to provide adequate T&E support.

Current investments are being made in T&E capabilities

The four sources of T&E investments are:

- ***Service and Defense Agency Investment and Modernization (I&M) Programs***. These programs provide modernization of existing capabilities and acquisition of new capabilities to meet the needs of the individual Service or Defense Agency.

- ***Central Test and Evaluation Investment Program (CTEIP).*** CTEIP provides a corporate investment approach to T&E needs, leverages Service and Defense Agency test investments, and funds those joint needs that would be considered beyond the scope of a single Service or Defense Agency. Individual CTEIP investment projects are executed and implemented by the Services and Defense Agencies.

- ***Military Construction Programs.*** These appropriations provide most major T&E capability, excluding instrumentation and minor construction.

- ***Acquisition Programs.*** Unique investments, at either contractor facilities or at government test centers, to support a specific acquisition program are planned and budgeted through the individual program.

Funding for Service investment and modernization (I&M) programs decreasing

Each Military Service pursues an I&M program focused on their test facilities in areas that have limited tri-Service use or interest. The funding for Service I&M projects has been declining at a time when additional investments are needed for new technologies. Service I&M requirements have had a difficult time competing with other critical needs in the Service budget processes. Between the FY1990 and the FY2001 President's Budgets, the total Service I&M funding decreased over $35 million (about 9 percent). This decrease was offset by congressional funding increases during the FY2001 appropriations process with the resulting appropriation being 5 percent above the FY1990 level.

As mentioned, each Service has I&M funding to apply to its test infrastructure. Projects within each Service compete for funding from this limited amount. In most cases, there are so many critical projects to improve *existing* test capabilities, that funding is not available for *new* capabilities. Selected I&M projects for each T&E center are discussed in the range summaries at the end of this section. Some of the most cost-effective Service I&M projects include the following:

- ***Kwajalein Missile Range (KMR) Modernization and Remoting Project.*** This project is a major modernization effort that includes updating four KMR radars and providing remote operations and diagnostics for Roi-Namur back to Kwajalein. At the completion of the project in FY2003, technical staff will be reduced by 20 percent from 520 to 417 persons. The radar modernization will result in a 70 percent reduction in lines of software code and an 80 percent reduction in custom hardware. The remoting will result in a 90 percent reduction in the need for inter-island commuting. In addition, this effort will reduce operating costs by over $17 million per year. The future savings from this project have been removed from the future years' budgets, so it is imperative that the project schedule remains on course.

- ***Network Centric Warfare (NCW) Project.*** The Navy initiated the NCW project to improve the network of RDT&E facilities required to support the development and testing of NCW-based systems such as E-2C Cooperative Engagement Capability and Joint Strike Fighter. The project will provide voice, video, and high-level architecture interface for T&E open-air ranges and simulation resources and for Navy laboratories. The NCW project will link nine T&E facilities in FY2001. Upon completion, this project will lower acquisition program technical risk by providing an environment for developing and testing system-of-systems interoperability requirements.

- ***Propulsion Wind Tunnel Upgrades.*** Using Air Force funding, Arnold Engineering Development Center (AEDC) has embarked on an aggressive upgrade and modernization

project to improve test capabilities and minimize future failures at its aging facilities. AEDC's project will install advanced data acquisition and processing systems in both the 16-foot transonic wind tunnel and the 16-foot supersonic wind tunnel. In addition, this multiyear project will upgrade the two 60,000-horsepower electric starting motors and install flow-quality improvements in these unique 45-year old national assets. These improvements will result in a 60 percent reduction in the cost per data point, a 90 percent reduction in test installation time, and a 30 percent reduction in lost test time.

CTEIP projects cover array of new test capabilities

CTEIP was created to improve the management of the Department's T&E infrastructure and has received strong support from the Congress. This corporate investment program has yielded important benefits: testing resources are allocated on the basis of DoD-wide rather than Service-level benefit; specific areas of commonality such as interconnectivity, interoperability, or improved telemetry techniques are emphasized for common solutions; and unwarranted duplication is minimized.

To carry out its objectives, the management of the CTEIP closely coordinates its activities, including selection of specific projects for funding, with the Services' T&E investment planning activities and the Department's Planning, Programming and Budgeting System. Individual CTEIP investment projects are assigned to a lead Service or Defense Agency for execution and implementation. The three CTEIP categories of projects are: *Joint Improvement and Modernization (JIM)* projects to provide critically needed joint or multi-service test capabilities to test increasingly complex and sophisticated weapon systems; *Test Technology Development and Demonstration (TTD&D)* projects to facilitate the transition of mature technologies from the laboratory environment into T&E facilities; and *Resource Enhancement Project (REP)* subprojects for quick-reaction, near-term solutions to test shortfalls in support of ongoing operational test programs. REP funding is appropriate when the timeframe from definition of need through critical test dates does not allow sufficient time in the budget cycle to fund the required capability. REP subprojects are proposed by the Operational Test Agencies of the Services and Defense Agencies.

The following are examples of new test capabilities being developed by CTEIP:

- ***Advanced Range Telemetry (ARTM).*** The ARTM project is developing instrumentation to increase the efficiency, reliability, utility, and availability of the aeronautical telemetry RF spectrum through improvements in bandwidth efficient modulation, multipath mitigation, channel management, data compression, and improved antennas. The project is leveraging advances in the commercial telecommunications industry for adaptation into test telemetry that can be implemented at MRTFB, and will provide improved commonality, interoperability, and standardization across the MRTFB.

- ***Airborne Separation Video (ASV).*** The ASV project developed ruggedized ultra high-speed/resolution digital cameras for use in airborne and ground-based optical coverage of weapon system testing. These capabilities provide enhancements such as high resolution, full color capability, and in-flight data review to the current systems. ASV eliminates the need for film processing for many applications, resulting in substantial savings in manpower and dollars while providing the associated environmental benefits. Cameras are being used in support of F-22, F-16, and F/A-18C/D and E/F test programs.

- ***Transportable Range Augmentation And Control System (TRACS).*** The TRACS project is developing a self-contained suite of transportable equipment and instrumentation to provide common range control functions. The system can both augment existing range capabilities or

provide standalone capabilities such as autonomous test command, control, data collection and analysis, and display. TRACS first deployment is to the Pacific Missile Range Facility to support Ballistic Missile Defense Organization (BMDO) theater missile defense testing.

- ***Shallow Water ASW Target (SWAT)***. The SWAT project will modify the USS *Dolphin* (AGSS 555), an existing, manned U.S. Navy diesel-electric research submarine for use as an ASW target. The *Dolphin* will be equipped with a 6-inch Acoustic Countermeasure Launch System, a mooring system to permit stationary bottom sitting, and upgraded shielding to permit testing with the next generation of torpedoes. In this configuration, the *Dolphin* will serve as a representative diesel-electric target. Target strength models of the *Dolphin* will be developed and validated to assist in the planning and evaluation of future developmental test and operational test events. At a minimum, SWAT will support the operational testing of Mk 54 Mod 0 Torpedo, Mk 48 ADCAP Torpedo, and SH-60R/ALFS programs.

Military Construction funding must increase

DoD's Military Construction (MILCON) appropriations, excluding family housing and homeowner assistance, totaled $3.31 billion and $2.97 billion in FY2000 and FY2001, respectively. Of that amount, only $65.4 million and $24.4 million; less than two percent of the FY2000 MILCON appropriations and less than one percent of the FY2001 MILCON appropriations, were appropriated for MRTFB T&E facilities in those years. We must find a way to increase MILCON funding if we are going to continue to provide the required testing and test support to the warfighter. Additional degradation in our test facilities and capabilities will lead to second-rate T&E facilities and second rate testing for our important acquisition programs.

Acquisition programs fund some T&E needs

Normally, generic T&E capabilities should be funded so they are located at the major MRTFB test centers. However, there are circumstances when a particular acquisition program requires a non-generic, unique test capability. As demonstrated in the following examples, the acquisition program must then define its unique requirement and fund the needed test capability.

- ***Underwater Explosions Test Facility***: This facility was constructed at Aberdeen Test Center (ATC) by the Navy's Seawolf program manager to support the Seawolf developmental test program because of the expense and difficulty of performing shock testing in the open sea due to environmental concerns. This facility has been used by other Navy programs for shock testing of components of the Virginia Class Submarine and for operational test and dock trials of the Navy's Advanced SEAL Delivery System, a manned submersible.

- ***Target Complex Upgrade***: The Brilliant Anti-Armor Submunition (BAT) program manager provided approximately $1 million to upgrade the fiber-optic communications data network and $200,000 for road widening at a White Sands Missile Range, New Mexico, test facility to aid in completing TACMS/BAT flight test missions, as well as captive flight and drop tests of the BAT submunition.

- ***Accelerated Corrosion Complex:*** The Family of Medium Tactical Vehicles (FMTV) program manager funded the development of the Accelerated Corrosion Complex at ATC to help predict the potential for corrosion on future combat vehicles. This facility provides aggressive, controlled exposure of land systems to corrosive conditions to hasten their weathering process and determine their susceptibility to corrosion. The facility includes a

series of components for individual corrosive environments including a mist booth; splash trough; grit trough; humidity booth; and facilities and equipment to provide identification, analysis, and documentation of corrosion. In addition to supporting tests for the Army's FMTV, the facility has also been used to test the Marine Corps Medium Tactical Vehicle Remanufacture (MTVR) truck program.

Additional T&E investments are needed

Increased modernization funding is needed to provide test capabilities, test processes, and more realistic test environments for future weapon systems T&E. Areas that must be improved include:

- Ballistic missile interceptor/target position location and telemetry instrumentation
- A space test range to safely and adequately test space systems involving self-defense concepts, directed energy systems, active on-orbit multi-participant test scenarios, and survivability
- Expanded ground test capabilities for air and space systems and components
- Improved stealth test capabilities
- Improved interoperability testing of systems-of-systems among services
- Improved hypersonic systems testing
- Improved propulsion systems testing
- Improved threat representations of hostile forces
- More realistic environments for testing chemical/biological systems, including physical areas, countermeasures and simulants for live agents
- Inter-range commonality for data acquisition, and command and control
- Integrated test and training modeling and simulation
- Expanded use of distributed simulation
- Use of embedded test and training instrumentation

Assessing the requirements for future T&E resources is relatively straightforward when considering near-term systems. That is not so for advanced concepts with underlying or enabling technologies still in the research phase. Some advanced systems will require incremental improvements to existing test resources and methods, while others will require major improvements to existing capability. Still others—well beyond the scope of current systems in complexity and capability—will likely require T&E resources that simply do not exist and cannot be clearly identified at this time.

T&E must invest to support the strategies and goals of Joint Vision 2020

Joint Vision 2010 provided a template for the evolution of our joint operational forces and the conduct of joint operations through the development of four "operational concepts"—precision engagement, dominant maneuver, focused logistics, and full dimension protection. These concepts, enhanced by the attainment of *information superiority,* an essential precursor to achieving *decision superiority,* will enable U.S. dominance in the full spectrum of military operations (air, land, sea, and space). Joint Vision 2020 reaffirms the Joint Vision 2010 operational concepts and emphasizes the need for *jointness* in every facet of U.S. warfighting.

Making these concepts a reality requires technological advances across a broad spectrum of systems and capabilities. Effective and timely development of the necessary systems will, to a large extent, be dependent on our ability to test these new or enhanced systems and their enabling technologies.

New test technologies require a long lead-time for development, as well as obtaining the necessary acquisition support in the budget process. In light of the substantial reductions sustained by our T&E infrastructure over the past decade, and considering this long lead-time, it is imperative that investment in T&E resources be increased in anticipation of significant requirements predicted by the Joint Visions 2010 and 2020.

T&E must invest to prevent Frequency Spectrum Encroachment from limiting testing

Of major concern to the open-air test ranges is the shrinkage of the frequency spectrum available for use in testing. The radio frequency (RF) spectrum is important to T&E as it supports the large volume of telemetry, communications, and command and control needed for almost all test programs. In fact, the test and training communities are the predominant users of Government spectrum within the U.S. However, as demand for frequency spectrum is rising, spectrum availability is declining. Technology advances in weapon systems cause increased demand for RF spectrum for testing and training purposes, just as technology advances in the private electronic sector create demand for more spectrum to service the personal communications, electronic commerce, and entertainment industries. As most of the desirable spectrum is currently occupied, significant expansion is not feasible, and available spectrum continues to be in demand.

Since 1992, we have lost access to over 275 megahertz of the shared or dedicated radio frequency spectrum. At the same time, the data rates needed by test programs, which directly affect spectrum usage, have continued to increase. For example, in the 1970s, testing the F-15 required telemetry instrumentation capable of data rates of only 100 Kbits. Adequate testing of the F/A-18E/F now requires the transmission of data at rates of 10 Mbits, an increase in data of almost 100 times. The potential consequences of decreased access to this scarce resource include schedule delays and elimination of key tests. Reallocation of the frequency spectrum will require a number of DoD open-air test ranges to migrate users from one frequency band to another. This change increases costs to the ranges and the range users, and, in some cases, will stretch out test schedules. Numerous programs will be affected including aircraft and missile acquisition programs such as the Joint Strike Fighter, F/A-18E/F, and F-22.

Much of the technology needed by the test and training communities to meet spectrum demand can be derived or directly obtained from commercial technology. However, there are a number of physical and operational characteristics of weapons, weapons testing, and training that are substantially different from commercial applications. New technology programs under development may allow more data to be put through a given amount of frequency spectrum. One CTEIP initiative aims to develop technology that will double the data-carrying capacity of our telemetry bands. A second project will provide similar efficiencies for our target control, scoring, and test support data links, while a third will provide an antenna to allow small test articles to operate in a number of frequency bands simultaneously. We are also developing a wide-band data recorder that will provide increased flexibility in on-board storage and selective playback of data, thereby improving the efficiency of bandwidth management.

We will continue to make decisions that will provide the most efficient use of the dedicated T&E frequency spectrum, but the demand for spectrum capacity will continue to increase. The DoD's only alternative is to use currently available spectrum as effectively as possible. This can only be accomplished through continued investment in the development and deployment of suitable, more spectrally efficient systems.

T&E needs science and technology projects to stay abreast of weapons requirements

Advances in weapons technology may soon result in new high technology systems that cannot be adequately tested within the current test infrastructure. To expedite the transition of new technologies from the laboratory environment to the T&E capabilities and to guarantee that T&E ensures the readiness of weapons systems, it is essential that a T&E science and technology program be initiated.

Currently, research into and development of technologies to advance our test capabilities are seriously underfunded. We anticipate that an effective T&E science and technology program would require sustained funding of approximately $30 million per year. A focused T&E science and technology program must be put into place soon to meet these requirements.

CORPORATE MANAGEMENT OF T&E RESOURCES

While there is need for additional funding to improvement of current test capabilities and provide advanced test capabilities for future systems, there remains opportunities to improve the management of the existing resources. A number of actions are underway to improve the Department's corporate management of the T&E resources.

DoD T&E responsibilities have been realigned

On June 7, 1999, the Secretary of Defense approved realignment of T&E responsibilities within the Office of the Secretary of Defense. Key T&E functions were transferred to me from the Under Secretary of Defense (Acquisition, Technology, and Logistics) to strengthen my role in supporting "serious testing and evaluation with a view toward operations early in the life cycle of a program." I now have oversight of:

- The DoD T&E investment strategies, business process policies, and infrastructure, including those in the MRTFB
- The Central Test and Evaluation Investment Program (CTEIP)
- The Joint Technical Coordinating Group for Munitions Effectiveness
- The Joint Technical Coordinating Group on Aircraft Survivability
- The Threat Systems Office (TSO)
- The Precision Guided Weapons Countermeasures Test Directorate, now called the Center for Countermeasures

In conjunction with the above, I am responsible for:

- Managing the joint T&E investments under the CTEIP program and
- Reviewing each DoD component's budget submissions to determine funding adequacy for test investments, range and facilities recapitalization, and other T&E resources, as well as the adequacy of funding for Live Fire T&E and OT&E

DOT&E is participating in the Planning, Programming and Budgeting System

My office has a new responsibility as a member of the DoD Program Review Group (PRG). In this new role, we have the opportunity to increase DOT&E participation in the corporate management and decision making regarding the Department's resource allocation. The PRG examines potential issues in the Military Department and Defense Agency Program Objective Memorandums. Any issue that cannot be resolved by the PRG is referred to the Defense Resources Board (DRB), which is the senior DoD resource review board. The DRB considers these issues and makes recommendations to the Secretary and Deputy Secretary of Defense, who make the major program decision. When the DRB considers an issue that involves modernization, I am invited to participate. DOT&E has been working hard within the department to aid in the resolution of resource issues in favor of the T&E community by participating on the PRG and DRB to influence DoD resource decisions for fiscal years 2002 through 2007.

T&E Strategic Plan is being developed

After a decade of downsizing, the Service Vice Chiefs and I, in our role as the T&E Executive Agent (EA), determined that a more corporate approach to T&E issues is necessary. This approach must consider not only future T&E requirements, as identified by Joint Vision 2020, but also current realities, such as workforce reductions, skill and retention issues, and aging and deteriorating facilities. To respond to these many demands, the T&E Executive Agent is developing a corporate T&E Strategic Plan.

This Strategic Plan will guide the Military Departments and Defense Agencies in developing their Program Objective Memorandums (POMs) and in examining resource requirements 10 to 15 years beyond the POM. The plan will institutionalize a strategic review as part of the T&E investment process and should serve to bridge the gap between today's capabilities and tomorrow's technology. A successful Strategic Plan requires full participation from members of the T&E Enterprise. To achieve this end, the T&E EA has initiated a series of meetings and reviews by members of the EA, test range commanders, operational test agency commanders, members of the acquisition community (including representatives of the Service Acquisition Executives), and representatives of industry.

Members of the EA developed initial vision and mission statements and drafted goals for the plan. Test range and operational test agency commanders reviewed these items and recommended modifications, which were incorporated into the current draft of the Strategic Plan, as reflected in Figures 7 and 8.

Vision: The world's best T&E capabilities for the world's best testers - T&E capabilities to thoroughly and realistically test and evaluate weapons and support systems for the warfighter.

Mission: Provide world-class, decision support information to acquisition program managers, decision makers, and warfighters, using the full spectrum RDT&E infrastructure, to ensure operationally effective and suitable systems are fielded, while continuing to be responsible stewards of the environment.

Figure 7. Draft T&E Strategic Plan states Vision and Mission

As shown in Figure 8, the draft Strategic Plan currently includes eight draft goals. These goals may change as the plan matures. The goals focus on the developmental and operational test workforce,

the decision makers, defense planners, infrastructure investments, policies, strategic partnerships, and test environments. The goals will be successfully met through the accomplishment of supporting objectives. These objectives and their implementation action plans are currently being developed.

Goal 1 - An experienced, trained, flexible, multi-skilled government civilian, military, and contractor workforce; continuously infused with new talent; to meet the nations T&E needs.

Goal 2 - A new, more complete appreciation of the value of T&E by acquisition decision makers, program managers, program executive officers, operators, defense planners, congressional members and staff, and other stakeholders.

Goal 3 - Improved infrastructure management of and better informed investments in test capabilities, facilities, and equipment to: 1) keep pace with advancing weapons technologies and changing operational conditions, and 2) ensure efficient and economical test and evaluation.

Goal 4 - Consistent core T&E standards, policies, practices, and processes for execution of T&E and full cost visibility to support "best value" determination.

Goal 5 - Policies and processes in place to test and evaluate rapidly evolving information technologies of systems ensuring real world interoperability.

Goal 6 - Early OTA involvement as an integral part of acquisition supporting warfighter requirements interpretation, program manager early insights into operational issues and where appropriate, combined T&E.

Goal 7 - Expert management of environmental and encroachment issues associated with T&E activities thus ensuring continued access to critical land, air, sea, and space environments.

Goal 8 - Strategic partnerships with program managers, other governmental agencies, industry, and academia to sustain superior T&E of weapon systems.

Figure 8. Draft T&E Strategic Plan lists draft T&E Goals

TEST RANGES AND CENTERS – WHERE TESTING OCCURS

It is critical that T&E ranges and centers be prepared for the challenge of testing the most advanced weapon systems and components and providing crucial support to the acquisition process. Responding to the challenges facing the T&E community requires facilities and capabilities that are modern, efficient, cost effective, and capable of providing the necessary data to answer critical questions on overall performance, operational effectiveness, suitability, and survivability.

The value of these T&E ranges and centers to the Department is impossible to calculate. The large areas of land, sea, and airspace at these locations are irreplaceable and absolutely essential for testing DoD systems. The need to prove the capability of long-range weapons, to provide realistic operating scenarios, and to assure the safety of personnel involved in the testing as well as personnel who are neighbors to our ranges all combine to demand the large operating environments (air, land, sea) at the ranges. On the other hand, there are only minimal costs associated with maintaining these large valuable

spaces during periods when they are not in use. The reason is that the operating costs are primarily the result of the cost of the personnel used to conduct testing at the ranges. There is a similar situation with the large, expensive-to-build, ground test facilities, such as the major wind tunnels and aeropropulsion test facilities. While the construction costs for these facilities are high (and the facilities have high value to the Department), the operating costs are primarily in the personnel who run the facilities and perform the testing. When capacity becomes an issue, the operating costs can be reduced by either reducing the number of test personnel or reassigned them to other testing assignments.

Importance of the test and training ranges is recognized

Over the past decade, encroachment on our land, sea, air, space, and frequency assets on DoD test and training ranges has evolved into a major concern within the Department. Compliance with escalating environmental legal statutes, competition for airspace, and erosion of the DoD frequency spectrum, and substantial urban growth around some previously isolated ranges have strained the Department's ability to conduct quality T&E essential to system acquisition and future readiness. Unless appropriate action is taken to sustain DoD range capability, this situation will continue to deteriorate.

The DoD Senior Readiness Oversight Council (SROC), which is chaired by the Deputy Secretary of Defense, is addressing T&E and training range sustainment issues. Range sustainment issues are complex and they involve multiple federal, state, and local agencies as well as Congress and the general public. The impact of encroachment is broad, affecting our ability to execute realistic air, ground, and naval T&E and training across the nation and beyond our borders.

The SROC determined that the DoD needs a comprehensive and coordinated approach to address range sustainment issues. As the chairman of the Defense Test and Training Steering Group (DTTSG), I have established a Sustainable Ranges Working Group (SRWG) to address sustainment of the DoD T&E and training ranges and provide a strategic framework leading to the development of an effective course of action addressing key range encroachment issues. This framework will lay the foundation for ensuring both near- and long-term sustainable T&E and training range availability, resulting in the highest level of readiness possible.

Major Range and Test Facility Base (MRTFB) supports most DoD testing

The MRTFB was established as an outgrowth of a 1971 blue ribbon study that recommended the major T&E assets be organized under defense-wide regulations and have uniform use and funding policies. In addition to the MRTFB, there are a number of other locations that are unique and essential to the testing mission. Figure 9 shows the major DoD test ranges and centers that compose the MRTFB.

The following pages give brief descriptions of DoD's major test and evaluation ranges and centers. Included in each description is a summary of some of the location's capabilities, and examples of the types of testing conducted at that location over the past year. The infrastructure outlook discusses the major investments underway and addresses the requirements of each range. In some cases, the requirements are for additional resources to maintain the infrastructure or to improve a technical capability. In other cases, the needs are for solutions to management challenges. Specific needs, which require increased support from DoD and congressional leadership, are addressed below.

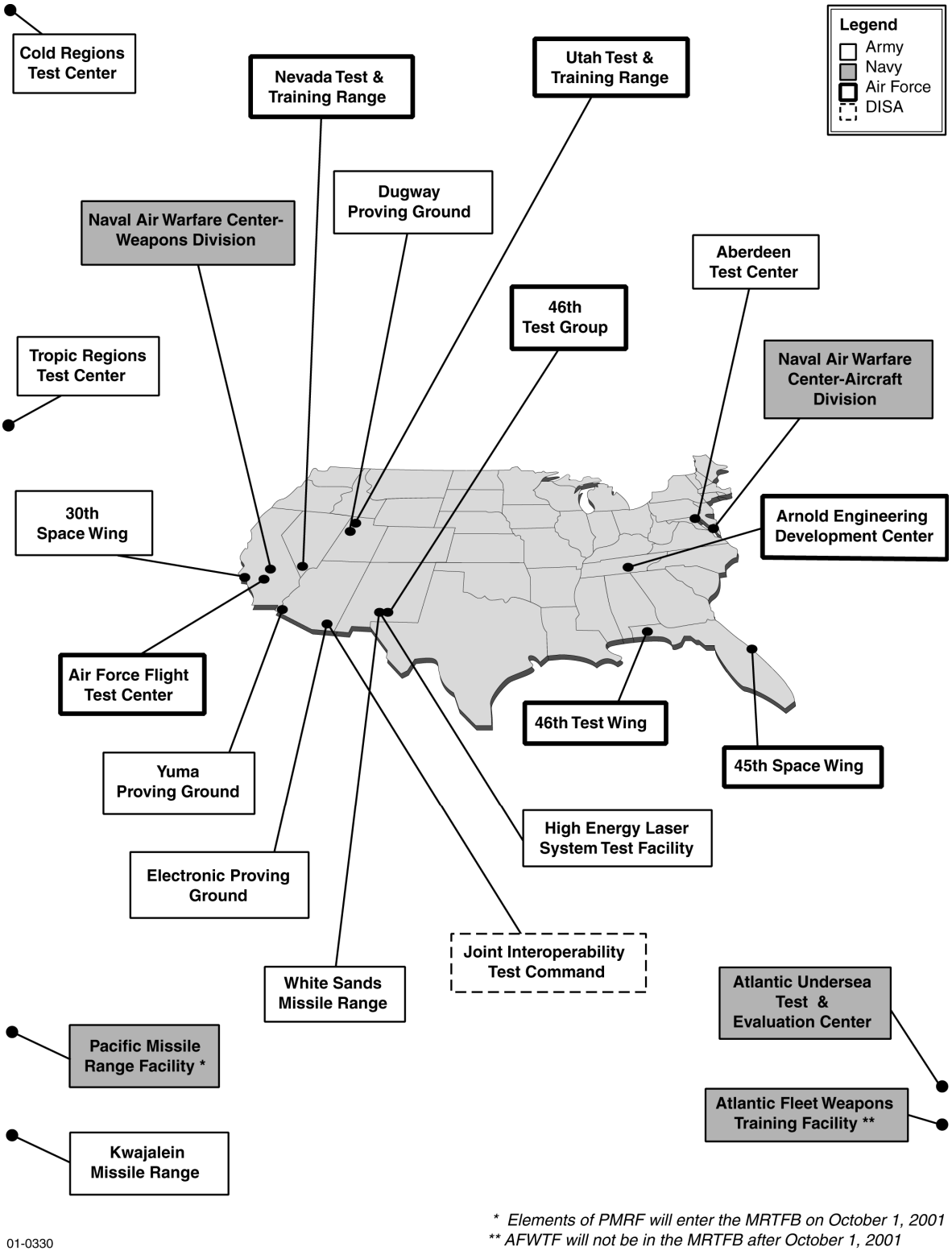

Figure 9. Major Range and Test Facility Base

ABERDEEN TEST CENTER (ATC)

U.S. Army
Aberdeen Proving Ground, MD

KEY/UNIQUE AREAS OF CAPABILITY

ATC is the DoD lead test agency for land combat, direct fire, and congressionally-mandated live fire testing. A diverse, multi-purpose proving ground, ATC encompasses 56,707 acres of land (with 40 miles of vehicle test track and 250 test ranges) and water, including restricted airspace from surface to unlimited. Entire systems as well as subsystems can be tested using ATC's facilities, simulators, and models. Items can be subjected to a large range of tests including automotive endurance and performance; full-scale live fire vulnerability, survivability, and lethality testing; and electromagnetic interference, fire safety, nuclear simulation, and surface/underwater shock and explosives testing.

TESTING IN FY2000 (767 TEST PROGRAMS AND 1,152 WORKYEARS)

ATC will be the primary test center for the new lighter-weight vehicles planned as part of the Army's transformation for the future. During FY2000 however, ATC continued to test more traditional Army systems and these systems will remain part of ATC's workload in the future. Testing of interim systems, such as the Interim Armored Vehicle, began in FY2000 and is expected to increase workload over 30 percent through FY2007.

As part of the solicitation for the Army's family of Interim Armored Vehicle systems, ATC supported the source selection by assessing the sample vehicles proposed for the Infantry Carrier Vehicle. This assessment was performed on an intense 30-day (20 hours per day, 7 days per week) schedule with the results provided to the source selection board in near real-time allowing the evaluation of written proposals and sample vehicles to be done concurrently.

ATC also supported testing of the Marine Corps Advanced Amphibious Assault Vehicle prototypes at Aberdeen Proving Ground, Quantico Marine Corps Base, and Patuxent River Naval Air Station. Data acquired from remote sites was relayed in real-time, using satellite links, to ATC, the test customer, and the contractor. ATC supported data collection from two instrumented prototypes during initial land mobility trials, water operations, and human factors tests at ATC facilities.

INFRASTRUCTURE OUTLOOK

Aberdeen Test Center, like many of the DoD test centers, is dealing with a number of workforce challenges. The ATC's civilian workforce is being reduced to meet the Department's civil service objectives. Junior civilian staff members are leaving for other opportunities (68 percent of recent resignations/transfers were below 40 years of age). Military personnel that were directly involved in testing are being reassigned and not replaced, eliminating this valuable insight from the testing process. To improve its efficiency and reduce workforce requirements, ATC is developing simulators to replace range testing. The three-phase, $38M Roadway Simulator project, funded by CTEIP, will complete its first phase in FY2002. The simulator will test two-axle, four-wheeled military and commercial vehicles from 5,000 to 26,000 pound gross vehicle weight, in a laboratory environment. The simulator will react to steering, acceleration, and braking inputs; drive axle torque; and dynamic motion of the test vehicle. Another new facility, a Bridge Crossing Simulator, will be used to quickly, accurately, and cost effectively test military bridges. It will be able to test 26-meter bridges to the crossing weight of an M-1 tank and 40-meter bridges to the crossing weight of a Heavy Equipment Transport.

ATC should complete development of a miniaturized instrumentation system to collect and record on-board technical and operational performance data on wheeled and tracked combat vehicles. This instrumentation will provide a common, embedded instrumentation system that will remain with the system from cradle to grave, providing a common platform to conduct contractor, developmental testing, training, and post fielding maintenance and logistics analysis.

COLD REGIONS TEST CENTER (CRTC)

U.S. Army
Fort Greely, AK

KEY/UNIQUE AREAS OF CAPABILITY

CRTC is DoD's cold weather, mountain test center with over 670,000 acres of land space and restricted airspace from the surface to unlimited altitude. Testing is centered at the Bolio Lake Test Facility that accommodates a full range of cold weather or temperate climate tests, depending on the season. Bolio Lake supports automotive cold-start testing and is a base for soldier equipment tests. Ranges are available for mine, explosives, and small arms tests; direct fire testing; sensor testing; air defense, missile, artillery, smoke and obscurant testing; and mobility testing. CRTC can accommodate indirect-fire testing for observed fire to 30 km and unobserved fire to 50 km. Indirect fire (up to 100 km) can also be accomplished by firing from ranges near Fort Wainwright, Alaska, with the impact on Fort Greely areas. Supporting infrastructure include a surveillance testing facility, ammunition storage area, administrative areas, communications circuits, meteorological sites, and an extensive network of roads and trails. Airfield-based and tactical air operations are supported and airdrop zones and facilities are available. Both the Army and the Air Force use CRTC ranges for training with minimum interference.

TESTING IN FY2000 (41 TEST PROGRAMS AND 41 WORKYEARS)

In FY2000, delays in the start of significant developer tests for the Bradley and 155mm Lightweight Howitzer reduced the overall workload for CRTC. These tests have been rescheduled for FY2001. Testing for the Marine Corps increased during FY2000 with the majority of the testing involving support to two Marine Corps operational tests, the Marine Corp Tactical Vehicle and the Predator (a shoulder-fired missile).

The center accomplished Missile Surveillance Tests on the Army Tactical Missile System, DRAGON, Hellfire, JAVELIN, Multiple Launch Rocket System, Patriot, and Stinger. In addition, a human factors assessment was done on the Interceptor/Modular Load-bearing Equipment. Preparations were made for testing the Armored Security Vehicle, which is used primarily by Military Police. Planned tests included a full cold weather and summer evaluation of vehicle operation, including durability, mobility, human factors, weapons firing, and fording operations.

INFRASTRUCTURE OUTLOOK

The workload at CRTC varies from year to year due to the cyclical phasing of the development programs. CRTC began implementation of BRAC 95 decisions to relocate the CRTC administrative complex from Fort Greely to Fort Wainwright, Alaska, with the start of construction of new long-term missile exposure sites at Fort Wainwright and new investments at Bolio Lake and Mississippi Ranges to ensure continuity of testing after the July 2001 BRAC completion date. The planned split of CRTC operations between Fort Greely and Fort Wainwright requires the completion of the CRTC Instrumentation Connectivity project. With the new connectivity via fiber optics, CRTC will be able to transmit high-bandwidth data from the Bolio Lake area directly to test customers and materiel evaluators. The project also includes a remote meteorological station monitoring capability. The current plan spreads the $530,000 costs over 4 years (FY2000-FY2003). Funding is also needed to improve the test instrumentation infrastructure at CRTC to facilitate testing and test data collection in severe cold environments and to develop advanced modeling capabilities for these environments.

CRTC has experienced a 90 percent decline in workload in recent years. This low level of workload does not represent the true need for cold weather testing. Program managers are accepting risk by not conducting adequate testing at extreme environments. Every DoD system should be exposed to the conditions it will experience in the hands of the warfighter. A fully capable, cold weather range must be available for systems that must operate in these extreme weather conditions. If we can get stability at CRTC after the recent realignments, the workload will increase.

DUGWAY PROVING GROUND (DPG)

U.S. Army
Dugway Proving Ground, UT

KEY/UNIQUE AREAS OF CAPABILITY

Dugway is the nation's only instrumented chemical and biological test site. This remote and isolated installation is comprised of almost 800,000 acres of desert environment that is acoustically and electronically quiet and free from population encroachment and from threatened or endangered species. DPG's primary mission is testing CB defense systems and performing nuclear, biological, and chemical survivability testing of defense materiel. Other unique capabilities include providing world-class meteorological and atmospheric modeling support to the MRTFB and other DoD and Federal agencies and testing smoke and obscurant systems and illumination devices. DPG's unique facilities include the Materiel Test Facility, which provides a one-of-a-kind capability to test the CB protection of large equipment such as a tank or fighter aircraft using chemical agents or simulants. The Life Sciences Test Facility provides a complete capability to test biological defense equipment including a one-of-a-kind chamber to challenge defense systems with aerosolized biological agents. Dugway is collocated with the Utah Test and Training Range and supports its aircraft weapons testing and training activities.

TESTING IN FY2000 (150 TEST PROGRAMS AND 324 WORKYEARS)

In FY2000, DPG conducted 150 programs in CB defense, smoke, obscurants, and illumination munitions testing; environmental characterization; and CB defense classes and training. DPG supported a number of Advanced Concept Technical Demonstrations (ACTD). For example, the Rapid Lightening ACTD provided DoD and FBI participants the opportunity to exercise operational procedures and test a commercially available decontamination system. The Restoration of Operations ACTD demonstrated the integration of mature technologies and operational concepts used to restore operations at a port or airfield after being attacked with chemical or biological weapons.

DPG also supported the Joint Vaccine Acquisition Program that developed a process to produce Tularemia vaccine and the Joint Biological Remote Early Warning System ACTD tested an early warning biological agent detection system.

INFRASTRUCTURE OUTLOOK

As the nation's only CB instrumented test site, DPG must be sustained and its workforce kept current with the CB warfare technology area. Additional manpower may be necessary to deal with increasing activity in nontraditional workload such as support to domestic CB program, CB defense classes and training, technology demonstrations, and domestic CB equipment certification.

DPG has had limited modernization funding since FY1996 and has deferred needed revitalization and modernization projects. Minor investment projects that are currently underway at DPG include the Aerodynamic Particle Sizer, the Aerosol Vapor Liquid Assessment Group Test Fixture, the Program Manager-Chemical Weapons Boundary Layer Radar Modernization, and the Test Data Storage Array.

Additional investment funding will be needed in the future for critical instrumentation and equipment needed to support advances in CB technologies. Without this funding, Dugway's test capabilities may become outdated and unusable. Acquisition programs will be affected including the Joint Chemical Detector, the Joint Protection Aircrew Ensemble as well as the Next Generation CB Ensembles and Chemical Point Detector. Also, major new test programs would be dependent on the Army airfield located at DPG, but there is an unfunded repair/replacement project for the airfield that has an estimated cost of $21M.

ELECTRONIC PROVING GROUND (EPG)

U.S. Army
Fort Huachuca, AZ

KEY/UNIQUE AREAS OF CAPABILITY

With its remote location and radio frequency interference-free environment, EPG, a subcommand of White Sands Missile Range, is the principal Army test center for electronic systems, including the developmental testing of Command, Control, Communications, Computers, and Intelligence (C4I) systems, Unmanned Aerial Vehicle (UAV) systems, and navigation and avionics systems. EPG's area of operation includes more than 9,000 square miles in and around Fort Huachuca. EPG tests distributed communication systems with emphasis on the testing of systems of systems. EPG developed the Virtual Electronic Proving Ground, which allows for testing in combined real, virtual, and constructive simulation environments. Facilities include a full range for test of electromagnetic compatibility and vulnerability of tactical electronic equipment, the intra- and interoperability of tactical automated C4I systems (including software and documentation), TEMPEST testing, and electronic countermeasures testing. EPG has an in-house developed suite of test instrumentation that includes test control, test stimulation, test data acquisition, and virtual jamming. EPG is also the flight test facility for Army's unmanned and micro-aerial vehicles and has extensive test capabilities in the areas of global positioning system testing, propagation simulation, and C4I battlefield simulations.

TESTING IN FY2000 (195 TEST PROGRAMS AND 525 WORKYEARS)

During this year, EPG was heavily involved with testing systems related to the digitization of the Army. Tests include the Force XXI Battlefield Command Brigade and Below (FBCB2) Limited User Test 2, FBCB2 National Training Center rotation, FBCB2 reliability testing, tactical operations center Electromagnetic Compatibility/Cosite testing, Joint Contingency Force exercise support, Central Test Support Facility support, and FBCB2 warfighter experiments. EPG conducted digitization technical tests, supported operational tests, and collected data and orchestrated scenario functionality during training and experiments.

EPG was also heavily involved with initial safety testing of the Interim Brigade Combat Team loaner vehicles and is scheduled to be the C4I tester for the target vehicle. Other major systems tested include the Enhanced Manpack UHF terminal; the Suite of Infrared Countermeasures; All Source Analysis System; global positioning system receiver; Guardrail/Common Sensor; Joint Tactical Information Distribution System; Near Term Digital Radio; Combat Survivor Evader Locator; Search and Rescue Satellite Aided Tracking; Tactical UAV; Micro UAV; Warfighter Simulation; Super High Frequency Tri-Band Advanced Range Extension Terminal; and fabrication support to various tactical elements at Fort Hood, Texas, and Fort Carson, Colorado.

INFRASTRUCTURE OUTLOOK

The projected FY2001 workload at EPG will be more intense, requiring more days in the field and additional, improved instrumentation. EPG's workload will not only be larger, but also more complicated and more difficult to execute. Challenges with executing this workload include the loss of test personnel and expertise due to retirement and resignations, the inability to recruit trained replacements, and the lack of sufficient instrumentation.

Project Starship is an EPG investment to provide the next-generation master controller and simulation engine. This equipment will provide a more effective and efficient test process for C4I systems in a distributed manner when all the resources required for testing (C4I systems, personnel, and instrumentation) are not available or are too costly to include. In addition, the Virtual Electronic Proving Ground (VEPG) is being developed to integrate instrumentation capabilities with legacy systems and with newly developed virtual and constructive simulations, all controlled by the Starship.

HIGH ENERGY LASER SYSTEMS TEST FACILITY (HELSTF)

U.S. Army
White Sands Missile Range, NM

KEY/UNIQUE AREAS OF CAPABILITY

In the 1980s, Congress directed the establishment of HELSTF as the nation's principal site for the testing of high-energy laser systems. The U.S. Army Space and Missile Defense Command (USASMDC) operates HELSTF as a separately managed facility located within the White Sands Missile Range (WSMR), an instrumented test range which provides 3,200 square miles of controlled land area and 7,000 square miles of controlled airspace. This permits HELSTF to accommodate live missile, rocket, artillery, mortar, and other dynamic high-energy laser engagement tests. HELSTF includes the Mid-Infrared Advanced Chemical Laser (MIRACL) and its Sea Lite Beam Director (SLBD), the nation's highest power laser and only high-energy laser/beam director integrated system. Other lower-powered lasers, pointing and tracking systems, specialized optics, a large vacuum chamber, instrumented open-air target areas, and meteorological measurement capabilities provide unique opportunities for the conduct of both laser and non-laser Directed Energy experiments. The SLBD also provides an excellent passive optical sensor for missile testing providing some of the best target imagery available at WSMR.

TESTING IN FY2000 (7 TEST PROGRAMS AND 143 WORKYEARS)

HELSTF test activity increased significantly in the past year, driven by support to the joint U.S.-Israeli Tactical High Energy Laser (THEL), a system intended to defend against terrorist attacks using small rockets. The testing at HELSTF included the entire THEL system, as well as tracking and support for the (target) rocket shoot-downs. The THEL was tested against a single armed Katyusha rocket in June during a high-power laser-tracking test. In August, THEL engaged two sequentially launched Katyusha rockets while September's test involved two simultaneous launched Katyusha rockets. In each test, WSMR launched the armed Katyusha rockets, while HELSTF provided laser testing, target support and tracking, and an instrumented test area.

In other testing, the MIRACL provided laser irradiation in tests to determine the time to cause missile warheads to detonate. The HELSTF also provided high-quality optical tracking and target imagery for missile tests at WSMR, including tests conducted for the Ballistic Missile Defense Organization.

INFRASTRUCTURE OUTLOOK

HELSTF testing in FY2001 is expected to be at a level similar to that of FY2000. The HELSTF has historically been a relatively low frequency, but high value test facility that provided unique capabilities for high-power laser testing. The importance of HELSTF has grown with forecasts of increased interest in Directed Energy (DE) applications. HELSTF is now preparing to support the Enhanced Area Air Defense (EAAD) program. This program will use advanced directed energy and/or kinetic energy technologies to provide cost-effective kill mechanisms for protecting tactical and operational forces from rockets, mortars, artillery projectiles, UAVs, and other air and missile threats.

To support the EAAD and other future DE programs, HELSTF must operate and maintain state-of-the-art laser systems and associated equipment. Current plans include installation of a solid-state laser (SSL) test bed that was developed at Lawrence Livermore National Laboratory. This test bed will support test and evaluation of four candidate laser technologies for an eventual selection of a single laser technology for incorporation in the Army air defense weapon systems.

KWAJALEIN MISSILE RANGE (KMR)

U.S. Army
Kwajalein Atoll, Republic of Marshall Islands

KEY/UNIQUE AREAS OF CAPABILITY

Located 2,300 miles southwest of Hawaii, KMR is the only U.S. treaty-approved launch site for testing strategic antiballistic missile interceptor missiles. KMR routinely supports testing of strategic and theater missile defense systems, operational and developmental reentry systems, and provides critical space operations support. Range instrumentation includes four high-power, highly sensitive radar systems operating at seven defense-relevant frequencies. Tracking radars, telemetry, optical systems, and a large-area hydro-acoustic missile impact scoring system complete the KMR instrumentation suite. The range sensors are integrated to a central control center via a high-speed, fiber-optic, intra-atoll network. Multiple target launch facilities are sited around the atoll to support intercept testing. Wake Island and Aur Atoll provide medium- and short-range target launch facilities. The primary atoll airfield handles all current U.S. air transport systems, and deep-water harbor facilities are available.

TESTING IN FY2000 (26 TEST PROGRAMS AND 2,942 WORKYEARS)

FY2000 was characterized by a heavier-than-normal workload with both a higher number of test missions and the high complexity of the National Missile Defense (NMD) and Theater Missile Defense missions. Major programs supported in FY2000 included three NMD Integrated System Tests (IST) of the exo-atmospheric kill vehicle (EKV), four associated NMD Risk-Reduction Flights (RRF), two tests of the NMD Ground-Based Radar-Prototype Radar Credible Target, a Theater Missile Defense Critical Measurements Program (TCMP) test, five operational and developmental tests of Air Force Minuteman III, and one Peacekeeper operational test.

During the three NMD Integrated Systems Tests, an unarmed Minuteman II intercontinental ballistic missile carrying target warheads was launched from Vandenberg AFB. Approximately 20 minutes later, 4,300 miles away, another missile was launched from KMR carrying a prototype interceptor, or exo-atmospheric kill vehicle. The test intercepts take place more than 100 miles above the Pacific Ocean in space. Additional tests of the NMD system involving both Kwajalein Missile Range and Vandenberg's 30th Space Wing are planned between now and 2005.

In addition, KMR had 40,000 taskings from U.S. Space Surveillance Network and 200 taskings for space object identification measurements in support of U.S. Space Command, Department of Energy, Delta and Titan missile launches, and the NASA Sharpe B reentry vehicle.

INFRASTRUCTURE OUTLOOK

The workload for FY2001 is expected to return to a more normal level with planned missions including a Theater Missile Defense Critical Measurements Program test, a Hera target demonstration test, a PAC-3 operational test, four NMD tests, three Minuteman IIIs, and one Peacekeeper.

The $91M KMR Modernization and Remoting (KMAR) project was started in FY1998 and is scheduled for completion in FY2003, but there is limited funding for other needed infrastructure projects. The KMAR has two major aspects. The first is to update four KMR radars to a common commercial-off-the-shelf system where possible. The second is to remote operations and diagnostics on Roi-Namur back to Kwajalein. When the KMAR project is completed, technical staffing in this area will be reduced by almost 20 percent. The radar upgrade will reduce custom hardware by 80 percent. The remoting will result in a 90-percent reduction in inter-island commuting. The KMR annual operating cost will be reduced by over $17M. In spite of these ongoing technical improvements, there continues to be a lack of funding for increasing KMR's communication bandwidth capability to support projected requirements of future test customers. The KMR Range Safety Control Center also requires an upgrade to meet safety requirements for planned simultaneous intercepts.

TROPIC REGIONS TEST CENTER (TRTC)

U. S. Army
Yuma Proving Ground, Yuma, AZ/Oahu, HI/Kauai, HI

KEY/UNIQUE AREAS OF CAPABILITY

The Army's Tropic Regions Test Center is headquartered at Yuma Proving Ground with test sites recently relocated to Schofield Barracks in Oahu, Hawaii, and Pacific Missile Range Facility (PMRF) in Kauai, Hawaii. These test sites will provide the necessary challenge to systems and material to assure developers and soldiers that equipment will perform reliably in the all-important natural tropical environment. Testing focuses particularly on soldier systems, communications, sensor adequacy, human factors, and performance. The hot, humid, wet climate and dense vegetation of the tropics provide the backdrop for a hostile environment for both soldiers and equipment to operate. The performance and reliability of equipment and systems in this environment can only be assured when adequate testing has been accomplished and design criteria and operational concepts have been fully incorporated. Since 1960, more than 75 percent of regional conflicts have had their roots in countries located within the tropics.

TESTING IN FY2000 (2 TEST PROGRAMS AND 15 WORKYEARS)

FY2000 was a year of relocation for TRTC. At PMRF, building of new testing facilities began for long-term exposure testing of missiles. At Schofield Barracks, a man-pack test course was prepared along with a limited administrative and logistics site. Memorandums of agreement were completed with the 25th Infantry Division for test support in Hawaii and two Cooperative Research and Development Agreements (CRADAs) were signed to allow limited use of University of Panama and Technological University of Panama facilities. TRTC expects an increase in workload in FY2001 as the relocation from Panama is completed.

Modular Light-weight Load-Carrying Equipment (MOLLE) is now undergoing developmental testing at Schofield Barracks with an operational test scheduled for next year. The MOLLE is a five-component item that allows individual soldiers to better carry the equipment necessary for sustainment during protracted periods in the field.

As part of the CRADA with the Technological University of Panama, materials exposure and performance testing (natural environmental degradation and long-term exposure testing) is continuing in Panama. Highly reflective plastic coatings and materials are being tested on behalf of the 3M Corporation while metals exposure testing is being done for the American Society of Testing Materials.

INFRASTRUCTURE OUTLOOK

The Tropic Test Center in Corozal, a sub-installation at Fort Clayton, Panama, was closed as a result of termination of the Panama Canal Treaty. Testing at Schofield Barracks and PMRF in Hawaii will be used to satisfy most of the tropic environmental testing mission. Schofield Barracks will be used for testing involving human factors effects, small arms, mobility, and soldier systems. PMRF testing will include long-term missile exposure and stockpile reliability as well as large-caliber stockpile reliability and firing programs.

The environments available at the Hawaiian sites present many of the environmental effects that are evident in the tropics; however, true tropical heat and humidity are not present in Hawaii. Without testing in true topical extremes, there could be risks in Army deployments to the tropical regions. In addition, the tropic testing workload has decreased from the significant amount in FY1997. The current workload does not represent the need for climatic testing. If we can get stability at TRTC after the relocation from Panama, the workload will increase. Every DoD system should be exposed to the conditions it will experience in the hands of the warfighter.

WHITE SANDS MISSILE RANGE (WSMR)

U.S. Army
White Sands Missile Range, NM

KEY/UNIQUE AREAS OF CAPABILITY

WSMR, one of the largest all-overland test ranges in DoD (3,200 square miles), is used for multi-service testing of air-to-ground and ground-to-ground munitions as well as surface-to-air, air defense, and fire support systems. It is a fully instrumented (radar, telemetry, optical, global positioning system, timing, and meteorological) land range with restricted airspace. WSMR has a unique combination of geography, laboratories, weather, personnel, and support activities. WSMR supports missile systems from cradle to grave, testing developmental systems and production units to assure continuing quality. WSMR operates test facilities that provide a full spectrum of battlefield environments, such as nuclear, electromagnetic, temperature, and vibration. It also has off-range launch sites for testing medium- and intermediate-range ballistic missiles at extended ranges.

TESTING IN FY2000 (500 TEST PROGRAMS AND 1,504 WORKYEARS)

WSMR supported test programs for the Army, Navy, Air Force, BMDO, foreign military sales, and other governmental agencies. Army programs included Patriot, Army Tactical Missile System (ATACMS) Block I/II and Brilliant Anti-armor Submunition (BAT), Multiple Launch Rocket System (MLRS), Guided MLRS, High Mobility Artillery Rocket System, M1 System Enhancement Program, M3A2 Bradley, and the Wolverine Combat Mobility Vehicle. Some of the major Navy programs were Evolved Sea Sparrow Missile, Rolling Airframe Missile, and Standard Missile (SM). Major Air Force programs included Airborne Laser, Advanced Medium-Range Air-to-Air Missile, and Joint Air-to-Surface Standoff Missile. WSMR also supported Theater Missile Defense Programs, joint demonstrations, and foreign tests such as Patriot Advanced Capability (PAC-3) and Standard Missile.

Two PAC-3 missions were conducted that required numerous personnel and instrumentation resources at both White Sands and Fort Wingate, and stressed the resources available for other missions. The missiles were launched from White Sands to intercept a Hera target and a Streaker drone launched into the range from Fort Wingate, New Mexico. WSMR was also the location of Navy Area Ballistic Missile Defense tests where missiles were launched from the Navy's "Desert Ship" to validate missile design, performance parameters, and the ability to intercept short-medium range ballistic missile targets, as well as aircraft and cruise missiles.

ATACMS testing was challenging to the range with its need for multi-object tracking, multi-target control, and data reduction of the optical data acquired from various range optical instruments to capture the performance of numerous dispensed munitions such as the BAT submunitions.

INFRASTRUCTURE OUTLOOK

WSMR is not funded at a level that permits the timely replacement of old and outdated radars and telemetry systems with more modern and efficient systems. In addition, funding for real property maintenance is at a level that may adversely affect test programs in the near future. WSMR did complete the construction of the Cox Range Control Center Facility and will complete the transition of all range control capabilities by mid-2001. The facility will include digital switching, composite cable, digital end devices, digital cross connect system, and a spectrum of network capabilities. The WSMR missile launch complexes are also undergoing a series of upgrades, including the launch control centers, missile engineering buildings, test operations buildings, and instrumentation and communications equipment. Other investments at WSMR include the Radio Trunking System, a new field radio system with repeaters at eight sites and the smart zone controller; the Laser Tracker Ranger, a laser tracker to achieve single station time-space-position solution for specific tests; and Virtual Proving Ground Developments for mission planning/rehearsal and safety analysis, mission playback analysis and reporting, architecture and distributed testing, nuclear effects, and integrated information systems.

YUMA PROVING GROUND (YPG)

U.S. Army
Yuma, AZ

KEY/UNIQUE AREAS OF CAPABILITY

YPG, at over 1,300 square miles in size, is larger than the state of Rhode Island and is the Army's largest desert environment test center and long- and medium-range artillery testing facility. Many miles of test courses are used for testing prototype and operational combat vehicle systems (both wheeled and tracked). Developmental testing of Army air-to-ground armament and target acquisition equipment and production acceptance testing for Army munitions programs is conducted at YPG. YPG also tests all parachute systems for personnel and air delivery of materiel and supports extensive global positioning systems testing. The extensive range facilities and support systems allow joint service combined arms testing and training. YPG is the national center for mine, countermine, and demolition testing and is responsible for desert, tropic, and cold regions testing.

TESTING IN FY2000 (324 TEST PROGRAMS AND 797 WORKYEARS)

Last year, at YPG, over 167,000 rounds were fired, 36,000 parachute drops took place, and nearly 4,000 air sorties were flown. YPG saw a 260 percent increase in equipment air drop tests in FY2000 over FY1999 and a 125 percent increase in personnel air drops tests. Helicopter testing sorties also increased by 80 percent with the beginning of Commanche tests and continuation of Longbow Apache tests. Overall, the number of test participants during FY2000 increased by 22 percent.

Testing of the long-range Crusader self-propelled 155mm howitzer was one of the most active test programs during FY2000. Tests were conducted over the entire year with well over 1000 rounds being fired. YPG built a second dedicated gun position so testing could be conducted simultaneously at two positions. Operational testing of the Crusader is planned for YPG in lieu of testing at traditional ranges such as Fort Sill since YPG can provide the extended range necessary for the Crusader. Overlapping developmental testing and operational testing will allow soldier inputs earlier in the development stage.

YPG conducted the limited user test of the Sense and Destroy Armor (SADARM), a "smart munition" projectile intended to provide all-weather, day and night enhanced counter battery capability for all 155mm howitzer systems. This testing used the 42-target array (an impact field with 42 live and/or simulated targets), the Acoustic Array (a series of directional microphones around the impact field that can determine the position of various projectile functions), and the Kineto Tracking Mount system.

The Engineering and Manufacturing Demonstration of the Battlefield Combat Identification System (BCIS) was comprised of two appliqué-equipped Bradley vehicles, one M1A1 Abrams tank, and one stand-alone unit. YPG tested the first units of the upgraded BCIS in a typical operating environment using soldiers from Ft. Knox and Ft. Benning.

INFRASTRUCTURE OUTLOOK

The Smart Weapons Test Range Complex is operational to support testing of smart mines and countermine systems that operate on acoustic, magnetic, and seismic sensors and require isolated test sites so physical input to the sensors can be controlled. YPG's Integrated Test Management Facility allows on-the-fly data basing of test data and transmission to materiel and combat developers. Requirements to test precision air drops for guided parachute technologies requires new approaches to telemetry and precision location instrumentation and will continue be drivers of future testing technology. In the area of unexploded ordnance remediation, continued development of laser cutting of high explosive munitions and bio remediation of explosive components showed promise for production quantities. The Range Digital Transmission System is being pursued to provide the capability to transfer data throughout the range via a fiber optic cable backbone. It will correct problems of limited, antiquated cable plant and dependency on a large numbers of microwave equipment. When completed, YPG will have installed over 600 miles of fiber optic cable to over 400 sites.

ATLANTIC UNDERSEA TEST AND EVALUATION CENTER (AUTEC)

U.S. Navy
West Palm Beach, FL/Andros Island, Bahamas

KEY/UNIQUE AREAS OF CAPABILITY

AUTEC operates a large underwater instrumented range of 500 contiguous square nautical miles (nm) located in a deep-water basin, 110 by 20 nm with depths of approximately 1300 to 2000 meters, off Andros Island, Bahamas. This basin is bounded on three sides by un-navigable or lightly navigated ocean areas, which make it an excellent, isolated ocean test area. AUTEC's geographically confined access provides unique, unmatched security from commercial or private encroachment. AUTEC supports Research, Development, Test and Evaluation (RDT&E) of undersea warfare systems as well as fleet training operations. AUTEC's facilities enable acquisition programs to complete critical performance milestones for torpedo and platform systems' testing. The sheltered location provides undersea acoustic noise levels that are typically below Sea State 1. This unique environment hosts the Navy's radiated noise measurement program and provides U.S. and Allied Navy platform measurement systems for basic acoustic, environmental, and oceanographic research and test programs. The NATO Fleet Operational Readiness Accuracy Check Site (FORACS) AUTEC supports the calibration of active sonar range and bearing (1–50 Hz) and passive sonar bearing (0.1–30 KHz) and the measurement of radiated noise (100 Hz-70 KHz). AUTEC has a portable three-dimensional tracking capability and survey capability, as well as a shallow-water test complex and a minefield that includes calibration spheres.

TESTING IN FY2000 (43 TEST PROGRAMS AND 828 WORKYEARS)

AUTEC testing workload during the FY2000 was relatively stable compared to prior years. Testing for foreign countries and commercial entities generates about a third of AUTEC's workload with the United Kingdom as AUTEC's largest foreign customer. Major testing of the Seawolf (SSN-21) was conducted in support of major program milestones. AUTEC provided sea- and land-based interoperability Special Forces testing and test support for Advanced Sensor Application, Periscope Imaging, Target Strength Reduction, Light Airborne Multi-Purpose System (LAMPS) III programs, and Torpedo Alertment Upgrades.

Other work included non-acoustic antisubmarine warfare and electronic support measures testing; United Kingdom (U.K.) trials; and combined U.S./U.K. Joint Operations. AUTEC supported Office of Naval Research Marine Mammal Monitoring Programs and Naval Oceanographic Airborne Lidar Bathymetric surveys in the Eastern Caribbean, provided portable marine mammal mitigation during a Composite Training Unit Exercise, and conducted integrated test and training exercises for the commanders of naval air, submarines, and surface forces in the Atlantic. AUTEC also supported the NATO Canadian programs for the Mobile FORACS and the Portable Tracking System.

INFRASTRUCTURE OUTLOOK

AUTEC continued work on the Tracking Hydrophone Replacement project and initiated radar system improvements, the Off-Board Advanced System Stimulator project, and the Underwater Range Data Communications project. The cost associated with base support is significant, with over half of AUTEC workforce involved in base support assignments. To improve the efficiency of the activity, AUTEC is initiating a reengineering effort modeled after the process used at the Air Force's Arnold Engineering Development Center. This effort will also address management's need to retain critical skill employees given AUTEC's remote location and the current labor market.

NAVAL AIR WARFARE CENTER – AIRCRAFT DIVISION (NAWC-AD)

U.S. Navy
Patuxent River, MD/Lakehurst, NJ/Key West, FL

KEY/UNIQUE AREAS OF CAPABILITY

NAWC-AD, Patuxent River, is the primary test center for Navy air vehicles and installed systems, and provides a sea-level, open-air range with access to 50,000 square miles of air space for conducting flight test operations. The open-air ranges cover regions over Chesapeake Bay and the Atlantic Ocean along the coastline of Delaware, Maryland, and Virginia. Patuxent River is also home to the Naval Test Wing Atlantic, which includes the United States Navy Test Pilot School and is comprised of more than 130 aircraft. Patuxent River MRTFB test facilities include the Air Combat Environment Test and Evaluation Facility (ACETEF); electromagnetic environmental effects test and evaluation facilities; a dynamic in-flight radar cross section measurement facility; propulsion system evaluation facilities; automatic carrier landing system facility; and shore-based steam catapults and arresting gear. The Lakehurst, New Jersey, site provides support equipment expertise and unique aircraft launch and recovery systems. The Key West, Florida, detachment provides testing of developmental anti-submarine warfare hardware in the open ocean environment.

TESTING IN FY2000 (126 TEST PROGRAMS AND 3,278 WORKYEARS)

Workload at NAWC-AD sites increased during the period between FY1997 and FY2000. The forecast for the next three years indicates relatively stable test workload from Navy users, while the workload from all users is projected to be at a level almost 35 percent above the FY1997 level.

Testing during FY2000 included the completion of the Navy's F/A-18E/F Super Hornet Operational Evaluation. The V-22 Osprey continued development testing and completed Operational Evaluation (OPEVAL). The Joint Strike Fighter demonstrated the use of Simulation Based Acquisition concepts at the ACETEF using the High Performance Computing Center to conduct distributed Virtual Strike Warfare Environment simulation events.

The Steam Catapult Test Facility was used to test new safety modifications to the Navy's T-45 Goshawk trainer aircraft. The developmental test programs for the E-2C eight-blade propeller system and the SH-60R were also started.

INFRASTRUCTURE OUTLOOK

NAWC-AD has made significant investments in the last few years. Most of the facilities at Patuxent River are considered state-of-the-art. Investments are being made to provide increased capability. These include the Electromagnetic Environmental Effects Generating System project, which was CTEIP-funded and will provide a test facility capable of assessing the actual performance of a full-scale, fixed-, or rotary-wing aircraft completely immersed in a user-specified, high-intensity, radio frequency (RF) environment.

The increased use of composites, exotic materials, and complex, low-power microelectronics in aircraft and other weapon systems can increase susceptibility to the threat associated with electromagnetic transients. The CTEIP-funded Electromagnetic Transient Test and Evaluation Facility provides Electromagnetic Pulse (EMP), lightning, and electrostatic multi-Service test facilities to evaluate the resources of full-scale aircraft, including small and cargo-sized aircraft. This project is developing new test environments and capabilities in EMP, lightning, and electrostatic charge to correct the present shortfalls in meeting the electromagnetic transient environments.

NAVAL AIR WARFARE CENTER – WEAPONS DIVISION (NAWC-WD)

U.S. Navy
China Lake, CA/Point Mugu, CA/WSMR, NM

KEY/UNIQUE AREAS OF CAPABILITY

NAWC-WD provides test and evaluation of weapons and weapons systems, aircraft weapons integration, and recovery systems. Major capabilities include two weapons test squadrons; fully instrumented air, land, sea, and electronic warfare ranges; ordnance, propulsion, warhead and explosive test facilities; simulation laboratories; military-target ranges; parachute recovery; gun ranges; live-fire weapon survivability facilities; and target and threat systems facilities. NAWC-WD ranges include 1.1 million acres of land space, 17,000 square miles of military restricted airspace, 125,000 square miles of instrumented sea range with 36,000 square miles of controlled overlying airspace, a deep draft port facility, and an airfield and instrumentation at San Nicolas Island. The Sea Range has the interconnectivity needed to support large complex operations and uses an approved flight corridor between the sea/land air ranges for land attack cruise missiles. The Electronic Combat Range provides free-space testing of airborne electronic warfare systems and tactics against shipboard and land-based air defense systems. NAWC-WD capabilities include the Navy's land-locked ship simulator ("Desert Ship") at White Sands Missile Range for testing shipboard fire control and ship-based missiles.

TESTING IN FY2000 (212 TEST PROGRAMS AND 2,080 WORK YEARS)

NAWC-WD projects that its test workload from Navy users in the years FY2000-2003 will be relatively stable and at a level about 18 percent below the level in FY1997. The total testing workload is projected to be about 13 percent below the FY1997 level.

Major test programs supported during FY2000 include eight air launches of the AIM-9X supporting the Low Rate Initial Production decision, the first AIM-9M separation firing from the F-22, and six SLAM-ER launches for Navy OPEVAL, and several developmental test missions. Operational Test Launches of Cruise Missiles and Tactical Tomahawks warhead penetration tests were conducted.

More than 70 Joint Direct Attack Munition (JDAM) weapons were launched for verification and validation (V&V) of software and for the Navy OPEVAL. Operational flight program V&V's were conducted for the F/A-18C/D/E/F. Other major testing included SPQ-9B radar, Integrated Defense Electronic Countermeasures (IDECM), and AV-8B. Support was also provided to extensive training conducted by Navy Air Pacific and the Third Fleet.

INFRASTRUCTURE OUTLOOK

Test programs have been negatively impacted by the lack of sufficient spares to maintain test support aircraft at NAWC-WD. While these aircraft are assigned a lower priority than operational aircraft, test support aircraft must have sufficient operational availability to support acquisition program schedules.

NAWC-WD pursued investments to upgrade and enhance its test capability. The investments during FY2000 included air route surveillance radar installation and FPS-16 radar service life extension, Navy integrated target control, San Nicolas Island data cable replacement, Navy GPS Advanced Range Data System upgrades, sea range telemetry systems and land range remote telemetry coverage, mobile optical tracking mounts, and range air traffic surveillance modernization.

The CTEIP-funded IBIS Hammer project is a high-technology foreign surface-to-air missile (SAM) system. The system is a mobile, medium-range SAM designed to defend ground forces from aerial attack by fixed- and rotary-wing aircraft. It will be instrumented to insure the commonality of data products between Electronic Combat Range and Western Test Range. This project will provide an instrumented threat asset to enhance the multiple threat environments at ECR and will support the testing of EA-6B, FA-18E/F, and ALE-50.

PACIFIC MISSILE RANGE FACILITY (PMRF)

U.S. Navy
Kauai, HI

KEY/UNIQUE AREAS OF CAPABILITY

PMRF is the world's largest instrumented, multi-environment sea range capable of supporting surface, subsurface, air, and space operations. One thousand square miles of instrumented underwater range and over 42,000 square miles of controlled airspace make PMRF a leading range for supporting operations from small, single-unit exercises to large, multiple-unit battle group scenarios. PMRF supports both testing and training missions. When needed, PMRF has cleared over one million square miles of surface and airspace for Navy ballistic missile defense testing. PMRF is linked to other range and data-processing facilities and can transmit real-time test data and video to DoD sites nationwide via microwave, fiber-optic, and satellite networks. While primarily a training range, it is the Navy's primary site for ballistic missile defense testing.

TESTING IN FY2000 (11 TEST PROGRAMS AND 48 WORKYEARS)

PMRF is the primary test facility for the Navy Theater-Wide Ballistic Missile Defense (TBMD) and Navy Area Ballistic Missile Defense programs, and supported various tests and training requirements associated with these programs during FY2000. Key test events in FY2000 included Flight Test Round-1 (FTR-1) and Pacific Blitz. FTR-1 was the first shipboard firing of the Standard Missile-3 (SM-3) missile. This test was part of a series of ballistic missile defense tests that will lead to the intercept of simulated enemy ballistic missiles.

PMRF was the site of the Pacific Blitz exercise, a complex missile defense and tracking event conducted to evaluate the Navy's progress and accomplishments in developing a Navy TBMD. It involved five simultaneous aerial targets, of which four were ballistic, and was part of the biennial, multi-national, Rim of the Pacific (RIMPAC) exercise. Navy, Marine Corps, Army, and Air Force systems tracked and shared data on six nearly simultaneously launched target missiles.

PMRF was also the site of the July 2000 test of the Navy Theater-Wide Aegis LEAP Intercept Flight Test Round. This was the second in a series of nine evaluation flights of the Navy's new long-range exo-atmospheric missile designed to counter the theater ballistic missile threat.

Other Navy testing at PMRF included Standard Missile 2 developmental and operational tests, Submarine Weapon Systems accuracy tests, and E2 Radar modernization research. Air Force tests were done for Minuteman and Peacekeeper, while support was provided for the Army's Tropical Test Center and NASA's ALTUS Unmanned Aerial Vehicle.

INFRASTRUCTURE OUTLOOK

Selected test facilities at PMRF will be added to the MRTFB in FY2002. PMRF has a multi-year instrumentation upgrade program that includes installation of three advanced radars (two fixed and one on a mobile sea-going platform), telemetry upgrades, missile assembly building and magazines, Stabilized High Accuracy Optics Tracking System (SHOTS), Mobile Aerial Target Support System (MATSS) Sea going Mobile Sensor Platform, MK-74 X-band Radar, and range operations computer and communications upgrades. Additional effort may be required to fully integrate these improvements and to fully realize their benefits in total test mission control and data collection for the complex ballistic missile missions.

PMRF has significant issues with its aging workforce. There is limited upward mobility, limited new hires, and insufficient high-grade positions to attract a high-quality workforce. The Navy is working on a longer-term plan to sustain the capabilities of PMRF and ensure that improvements and modernizations are planned, funded, and executed.

AIR ARMAMENT CENTER (AAC), 46TH TEST WING (46TW)

U.S. Air Force
Eglin Air Force Base, FL

KEY/UNIQUE AREAS OF CAPABILITY

The 46TW tests air-delivered weapons, navigation/guidance systems, and Command and Control (C2) systems using its unique sea and land ranges as well as ground test facilities. The Eglin Gulf Test Range (GTR) provides 100,000 square miles of overwater airspace. The land range covers 724 square miles and contains 51 test and training areas, including a depleted uranium test range and the only qualified air-to-ground supersonic range east of the Mississippi River. The Armament/C2 Systems Test Environment consists of precision instrumentation for data collection, microwave systems for data transfer, and radio and land communication networks to support tests. The unique McKinley Climatic Laboratory simulates rain, snow, icing, dust, sand, salt, fog, humidity, and solar radiation in six chambers. The main chamber will hold all operational aircraft, including the C-5. The Guided Weapons Evaluation Facility (GWEF) tests precision-guided weapons in simulated "real world" environments. The Preflight Integration of Munitions and Electronic Systems (PRIMES) Test Facility performs installed systems testing of air-to-air and air-to-surface munitions and electronics systems full-scale aircraft. The 46th Test Group at Holloman AFB, New Mexico, reports to the 46TW.

TESTING IN FY2000 (325 TEST PROGRAMS AND 2,556 WORKYEARS)

The 46TW performed testing for systems included precision-guided weapons (such as Joint Air-to-Surface Standoff Missile (JASSM), Enhanced GBU-15 (EGBU-15), and AIM-9X) and C2 systems (such as the Theater Battle Management Core Systems). Installed systems testing included air-to-air and air-to-surface munitions and electronics systems on aircraft and land vehicles. The McKinley Climatic Laboratory supported numerous tests of aircraft, avionics systems, and commercial test items.

Joint Air-to-Surface Standoff Missile (JASSM) testing included the launch of the first powered JASSM from an F-16. Supporting tests included engine firings in the climactic laboratory, separation analyses, aircraft integration tests, and live-fire tests on the JASSM and its fuses.

Numerous aircraft/store combinations were evaluated under the Seek Eagle program for safe carriage and separation. F-16 testing included the Wind Corrected Munitions Dispenser (WCMD), AGM-88, next-generation cargo pod, and aircraft flutter and loads validation missions. F-15E testing included WCMD, GBU-27 separation, and BDU-33 ballistic accuracy verification.

Other significant test programs supported by the 46TW include ammunition for Advanced Amphibious Assault Vehicle, AIM-9X, Directional Infra-Red Counter Measures, Hellfire, PATRIOT, Advanced Short Range Air-to-Air Missile, Link 16, and the Air Force Mission Support System.

INFRASTRUCTURE OUTLOOK

A large portion of the civilian scientific, technical, and engineering workforce at the 46TW is retirement eligible. Thus, the wing management must monitor the workforce to ensure the proper skill levels are maintained. In some specialized test facilities, such as the climatic hanger, it is a management challenge to adjust to program delays in major testing efforts. In these facilities, the workforce requires specialized skills, and when a planned test program is delayed, there can be significant unplanned costs as a result of the underused workforce.

The 46TW is continuing to upgrade various test capabilities. Expanded radar and midwave IR simulators were recently completed upgrades to the GWEF. Continuation of upgrades to TSPI systems, telemetry, microwave, communications, arenas, gun test, and photo-optics are occurring at the ASTE Range Systems. To improve the PRIMES capability, development of aircraft/munitions interface simulations for F-15 and F-16, and advanced signature generator upgrades were initiated, as well as the completion of the Com/Nav simulator data link.

AIR ARMAMENT CENTER, 46TH TEST WING, 46TH TEST GROUP (46TG)

U.S. Air Force
Holloman Air Force Base, NM

KEY/UNIQUE AREAS OF CAPABILITY

Part of Eglin's 46th Test Wing, the 46th Test Group provides a unique combination of test and evaluation services and state-of-the-art measurement and support facilities for guidance and navigation testing, sled track testing, radar cross section testing, and flight testing. The Central Integrated Guidance Test Facility (CIGTF) is the DoD center of expertise for the test and evaluation of Inertial Navigation Systems (INS), the Global Positioning System (GPS), and blended GPS/INS components and systems in both benign and electronic warfare environments. The Holloman High Speed Test Track (HHSTT) provides the only hypersonic sled test capability in the world and is the DoD's lead track facility and track center of expertise for aircraft escape system testing, full scale lethality testing, electronic countermeasure systems, explosive blast effects, environmental erosion, dispenser testing, and hypersonic environmental testing. The National Radar Cross Section (RCS) Test Facility (NRTF) is a one-of-a-kind facility combining the best monostatic and bistatic RCS measurements. The NRTF is moving toward consolidation with industry and is completing significant technology improvements to address advanced stealth techniques.

TESTING IN FY2000 (114 TEST PROGRAMS AND 515 WORKYEARS)

FY2000 testing involved all major facilities and assets. CIGTF performed laboratory, field, and flight testing in two major categories, GPS Vulnerability and GPS Performance. In these categories, CIGTF tested avionics (Miniature Airborne Onboard Processing (GPS) Receiver 2000), Battle Labs (Perimeter Protection), Joint Test and Evaluation), Vulnerability/Jamming Programs, and Special Projects.

The HHSTT performed lethality testing for the Army's Theater High Altitude Area Defense System and the Navy's Standard Missile 2, aircraft escape system testing for the F-22 aircraft and improvements to the ACES II seat, and Electronic Countermeasure (ECM) systems testing for Project ECM and the Army's Suite of Integrated Infrared Countermeasures.

The NRTF conducted both monostatic and bistatic tests during FY2000. Two of the bistatic test programs utilized the new Bistatic Coherent Measurement System (BICOMS). The 46TG used its newly acquired C-12J to conduct tests for the North Warning System (NWS), the Humvee-mounted system of Advanced Medium Range Air-to-Air Missiles (HUMRAAM), and Miniature Airborne Onboard Processing (GPS) Receiver 2000 (MAGR-2000) test programs.

INFRASTRUCTURE OUTLOOK

The CTEIP-funded upgrade to the HHSTT consists of design, development, fabrication, and test of new slipper/rail interfaces to address slipper wear, rail gorging, and excessive impact loads, as well as the development of a new rocket motor for the sled. The HHSTT upgrade will provide more reliability to current and future hypersonic test customers. Test reliability for HHSTT customers will be increased to above 90 percent for tests at velocities up to Mach 7. The HHSTT is experiencing high workload, but needs additional funding to expedite the refurbishment and repairs to cracked rails in the older portion of the track.

The 46 TG has developed a unique partnership arrangement with The Boeing Company at the NRTF at Holloman AFB. This arrangement benefits both parties and will result in reduced cost to the U.S. taxpayers. Additional funding would expedite efficiency upgrades at the NRTF and provide expanded test capability in this important area.

AIR FORCE FLIGHT TEST CENTER (AFFTC)

U.S. Air Force
Edwards Air Force Base, CA

KEY/UNIQUE AREAS OF CAPABILITY

AFFTC is the Air Force aircraft and aircraft systems development test and evaluation center for both manned and unmanned vehicles. It is located within 20,000 square miles of highly instrumented ranges, permitting unrestricted flight testing from near ground level to near space. AFFTC offers excellent year-around flying weather, relative isolation, and varied topography, including Rogers Dry Lake, a vast natural landing field that has saved countless lives and billions of dollars worth of test aircraft. In addition to open-air test ranges, AFFTC has an array of ground test facilities, including the Avionics Test and Integration Complex, which allows for complete testing of a fully integrated avionics suite in a simulated flight environment including electronic threats and software checkout. Other ground test facilities include the Test and Evaluation Modeling and Simulation facility; systems integration laboratories; hardware-in-the-loop facilities; and installed systems test facilities, such as the Benefield Anechoic Facility, the largest anechoic chamber in the world. Engine test facilities include one of only three fully automated engine test cells in the country.

TESTING IN FY2000 (221 TEST PROGRAMS AND 5,485 WORKYEARS)

The F-22 test aircraft fleet expanded to three this year. F-22 testing continued in the areas of avionics and weapons integration, open weapons bay tests, envelope expansion, and post-stall high angle-of-attack with thrust vectoring. AIM-9 separation tests from the F-22 were completed as well as tests for high angle-of-attack maneuvering in support of a program milestone review.

The Joint Strike Fighter (JSF) Joint Test Force completed preparations for arrival of the JSF prototypes and initial flight tests. The first prototype arrived in September.

The CV-22 project completed detailed test planning and the first test CV-22 test aircraft also arrived at AFFTC in September. The F-16 testing involved an Operational Flight Program (OFP) for capability improvements of the Modular Mission Computer, High-Speed Anti-Radiation Missile (HARM) Targeting System, and Digital Electronic Engine Controls.

INFRASTRUCTURE OUTLOOK

AFFTC workload for FY2001 is forecasted to be roughly the same as FY2000. AFFTC continues to pursue infrastructure investments toward the goal of providing fully integrated testing capabilities to meet advanced weapon systems requirements. This will include development of radio frequency (RF) simulation capabilities and integrated data collection and processing capabilities to meet requirements for real time processing, archiving, and display of high volumes of test data.

Upgrades will continue to the Electronic Combat Integrated Test (ECIT) facility to provide RF simulation capability to support advanced weapon systems requirements. The Advanced Data Acquisition and Processing Systems (ADAPS) project provides an integrated capability to satisfy real-time, first-generation, post-test data processing, archival, and display requirements of the next decade and the potential to satisfy data processing and display needs at various multi-Service test ranges.

AFFTC's aging test support fleet requires expensive upgrades, including engine upgrades for F-15 and F-16 aircraft as well as F-16 structure life extension programs. This trend may be reversing for F-16s with the potential acquisition of Peace Gate F-16's. If this acquisition is successful, AFFTC will receive two new F-16A and seven F-16B models to replace older support aircraft. AFFTC plans to deactivate its Advanced Range Instrumentation Aircraft (ARIA) in FY2002. Navy P-3 aircraft and satellites do not have the full capability to replace the ARIA, so compromises will have to be made. Maintenance of the infrastructure continues to be a concern as portions of the physical plant are deteriorating. For example, heavy use portions of the 3-mile long runway require repair.

ARNOLD ENGINEERING DEVELOPMENT CENTER (AEDC)

U.S. Air Force
Arnold Air Force Base, TN/White Oak, MD

KEY/UNIQUE AREAS OF CAPABILITY

AEDC is the nation's most advanced and largest complex of flight simulation and ground test facilities. Facilities include 58 aerodynamic (subsonic, supersonic, and hypersonic) and propulsion wind tunnels, rocket and turbine engine test cells, space environmental chambers, arc heaters, ballistic ranges, and other specialized units. Fourteen of these facilities are unmatched in the world. Advanced turbine engine and rocket propulsion facilities can simulate high-altitude operations (up to 100,000 feet altitude) even during testing of large, high-thrust engines. The Aeropropulsion Systems Test Facility, the largest, most capable engine test facility in the world, can simulate flight conditions and transient conditions of takeoff, climb, multi-speed combat maneuvers, descent, and landing, all using full-scale elements of an aircraft propulsion system or, in some cases, the complete propulsion system. Unique sea-level engine test cells provide the capability to perform accelerated engine durability testing and testing of engines in hostile environments (e.g., salt water atmosphere, icing conditions, and sand/dust ingestion). AEDC also operates a hypersonic wind tunnel at White Oak, Maryland.

TESTING IN FY2000 (86 TEST PROGRAMS AND 2,454 WORKYEARS)

AEDC aeropropulsion testing in FY2000 included the completion of both the EMD phase of the F-22's F119 engine and the concept validation phase of the JSF engines (both competitors' versions). Extensive testing was also performed on current F-15 and F-16 fighter engines in support of the USAF Component Improvement Program.

Aerodynamic wind tunnel testing in FY2000 included store separations testing of the Joint Air to Surface Standoff Missile (JASSM) from the B-1B. This testing is expected to reduce the required flight tests from 15 to 20 down to 7 or 8 flights. Store separations testing was also performed on the F/A-18E/F. Stability and control, pressure, drag, inlet integration, jet effects, and store separation tests were performed on both Boeing and Lockheed versions of the Joint Strike Fighter (JSF). Overall, wind tunnel output was 25 percent over the projected workload.

AEDC performed space simulation testing on Loral Space System's GOES commercial weather satellite in the Mark I Space chamber. G-Range provided impact lethality testing in support of the National Missile Defense (NMD) program. Simulated flight altitude testing on Minuteman Stage II and III rocket motors was performed in the J6 Rocket test facility. Heatshield and leading edge materials testing was performed in AEDC's Arc heater facilities to evaluate ablation performance and thermostructural reliability prior to flight. The Advanced Missile Signature Center (AMSC) collected missile signature data in support of various programs.

INFRASTRUCTURE OUTLOOK

AEDC is performing important testing using its upgraded, mostly 40-year-old facilities. We must insure that these unique facilities are upgraded and modernized and that investment funding is available to replace some of the aging facilities. Since Navy propulsion testing has been brought to AEDC, these facilities are even more important. In cooperation with NASA, new aeronautical testing capabilities are being defined to meet future national needs.

During FY2000, AEDC's aging infrastructure experienced a number of failures, including a damaged plant heater, transformer, plant motor, and a Propulsion Wind Tunnel starting motor, resulting in unexpected repair costs of $4.6M and delaying some FY2000 test programs until FY2001. To minimize the impact of unforeseen failures like these in the future, AEDC is aggressively managing its funds and pursuing infrastructure maintenance and repairs. AEDC has embarked on an aggressive upgrade/modernization schedule to include installing data acquisition and processing systems in both 16-foot wind tunnels, designing electric motor upgrades, and planning flow-quality improvements.

NEVADA TEST AND TRAINING RANGE (NTTR)

U.S. Air Force
Nellis Air Force Base, NV

KEY/UNIQUE AREAS OF CAPABILITY

With 12,000 square miles of airspace over 3,000,000 acres of ground space, NTTR is the largest range in the United States. With its primary mission of training combat aircrews, NTTR has a variety of threats (fixed and moving) and targets that are useful for conducting both developmental and operational testing for combat aircraft. NTTR supports operational testing for combat aircraft to ensure new and upgraded systems meet operational requirements. Tactics Development and Evaluation tests are conducted to guarantee aircrews are provided sound combat tactics in concert with new or upgraded systems. Test results are passed on to the USAF Weapons School to incorporate into training sorties and to the operational units to use in continuation training at their home stations or in large training exercises, such as Red Flag. NTTR provides unique instrumentation for tracking up to 100 high-activity aircraft participating in multiple missions for data collection and mission debriefing. Weapons scoring systems and tracking are available to support weapon system testing.

TESTING IN FY2000 (25 TEST PROGRAMS AND 726 WORKYEARS)

NTTR supports the conduct of operational tests in simulated combat environments for new aircraft as well as upgrades to existing aircraft such as the A-10, F-15C, F-15E, F-16C, and HH-60G aircraft.

Joint Test and Evaluation of Joint Suppression of Enemy Air Defenses was conducted at NTTR. It is an OSD-sponsored test designed to gather data on a baseline and enhance Intelligence, Surveillance and Reconnaissance architecture.

The Joint Expeditionary Force Experiment was a series of Air Force Chief of Staff–sponsored warfighter experiments to expedite the building of the Expeditionary Air Force. Primary themes were advanced command and control concepts and technologies to achieve the vision for Global Engagement.

Unmanned Aerial Vehicle (UAV) Battlelab at Eglin AFB joined with the Joint Surveillance Target Attack Radar System (JSTARS) in an imaging demonstration on the NTTR. The purpose of this demo was to show the military worth of providing JSTARS with real-time UAV ground target imagery to support precision targeting and attack, and a maturing battle management capability. The UAV continues to be tested in a variety of combat support roles.

INFRASTRUCTURE OUTLOOK

While NTTR is host to a large number of training activities, it also provides valuable support to testing. The high usage planned as part of future F-22 testing may impact NTTR ability to continue support to test and training customers through FY2003.

A number of areas require unfunded improvements to maintain NTTR support to its users. These areas include $12M for fiber optic links to remote sites and encryption, $4.5M for more realistic targets, and $5M for Tonopah airfield and runway projects. On an annual basis, additional funding is required for rental of advanced threats, and for new range support and technical contracts.

During FY2000, NTTR made investments in upgrades to the Nellis Range Support System, Nellis Air Combat Training System, Nellis Air Weapons Control System, Red Forces Command and Control, and Air Warrior Video Teleconference. NTTR also developed urban targets and installed a fiber optic network on the range. Also, NTTR was able to expand the use of its northern most range airspace by working with the FAA to redirect the nearby commercial airway away from the range space.

UTAH TEST AND TRAINING RANGE (UTTR)

U. S. Air Force
Hill Air Force Base, UT

KEY/UNIQUE AREAS OF CAPABILITY

UTTR is the primary, large footprint, open-air operational test and training range for DoD's precision guided, air-to-ground, weapons and munitions. UTTR's testing is characterized by its large airspace, exceptionally long supersonic corridors, extensive shoot box, large safety footprint area, varying terrain, and remote location. UTTR has a large block of overland, contiguous special-use airspace (12,574 square nautical miles) and one of the largest overland safety footprints available in DoD (2,675 square miles). It supports developmental and operational T&E of cruise missiles, unmanned air vehicles, munitions, and advanced weapons systems. UTTR is ideal for testing smart munitions, long-range standoff weapons, cruise missiles; boost-glide precision-guided munitions, and autonomous loitering anti-radiation missiles. Rocket motors for ICBMs and tactical weapons are tested on static firing facilities. Numerous areas are used for precision monitored explosive propagation tests and munitions "shelf-life" tests. Tests of up to 500,000 pounds of conventional explosive can be conducted at UTTR.

TESTING IN FY2000 (37 TEST PROGRAMS AND 310 WORKYEARS)

UTTR test activities include air munitions sustainment and flight testing (CBU munitions, fuses, mechanical fin's, air retarding system, flares, and chaff); Wind Corrected Munitions Dispenser (WCMD) developmental and operational testing, enhanced GBU-15 operational testing; tactics developmental and evaluation for the Joint Direct Attack Munition (JDAM); and Minuteman and Trident motor ground tests.

As part of the annual air-to-ground Weapon System Evaluation Program (WSEP), participating squadrons performed tactical deliveries of precision-guided munitions and other high-technology weapons and UTTR assessed, collected, and analyzed data covering the full scope of the surface attack mission. This included munitions storage, weapons buildup, launch, impact, and target damage assessment. Weapons delivered were the GBU-10, 12, 24, 27, and the AGM-130, 65, 88, 142, and 154. challenge the pilots in realistic threat environments, both air-to-air and surface-to-air adversarial defenses were employed. A number of moving tanks were developed and individually deployed as targets for the AGM-65.

In support of the Nuclear WSEP, five to six Air-Launched Cruise Missile and Advanced Cruise Missile tests are performed each year at UTTR. Each of these missions involves eight aircraft, personnel from at least nine organizations, the entire south range, and virtually all range test assets.

INFRASTRUCTURE OUTLOOK

In the last eight years, UTTR has received minimal Improvement and Modernization funding. The top three priorities at UTTR are air operations and air traffic command and control ($3.0M); test and training instrumentation ($8.7M); and test and training communications backbone ($4.7M). The command and control project would provide more versatile, supportable, joint service support with greater control over test and training activities. Instrumentation upgrades would provide enhanced radar, telemetry, and optical support for their customers. The communications backbone would allow greater control over all radio circuits, land lines, and their distribution. These upgrades are needed to improve capabilities to support training and cruise missile testing, enhance test data integrity, and improve optical instrumentation.

Some operational T&E targets have been integrated into training target areas and share time-space-position information systems. Capabilities required to support munitions and weapons in operational T&E (OT&E) and tactics development and evaluation (TD&E) have been integrated into training for pilot proficiency and large joint exercises.

30TH SPACE WING (30SW)

U.S. Air Force
Vandenberg Air Force Base, CA

KEY/UNIQUE AREAS OF CAPABILITY

30th Space Wing has the only national capability to launch space systems into polar orbit due to Vandenberg AFB's natural geographic location. It supports small through heavy lift launch systems (Titan, Atlas, Delta, and Pegasus). With Kwajalein Missile Range (KMR), it provides full ballistic missile operational test facilities (Minuteman and Peacekeeper) and R&D payload testing (sub-orbital reentry vehicle tests). The Western Range (WR) is managed by 30SW including all instrumentation (radar, optical, and communications) and telemetry systems. As a secondary mission, 30SW supports testing of aeronautical systems for other test ranges. The West Coast Offshore Operating Area, also managed by the 30 SW, is an aeronautical, ballistic missile, and guided missile test area,. This 200 by 1000 mile "over-water" area is located off the California/Oregon coastline. As a tertiary mission, 30SW supports the U.S. Space Command Space Surveillance Network.

TESTING IN FY2000 (1,756 WORKYEARS)

The number of launches in FY2000 was nearly the same as in FY1999, and is expected to increase significantly over the next few years. The range capacity of 30SW increased significantly in FY1999. The launch pad capacity began to increase in FY1997 and, by FY2001, will exceed the range capacity.

As part of three major National Missile Defense (NMD) tests during FY2000, Vandenberg AFB was the launch site for unarmed Minuteman II ICBMs carrying target warheads. The tests involved the launching of the target missile, followed by the launch, 4,300 miles away at Kwajalein Missile Range (KMR), of a prototype interceptor, or exoatmospheric kill vehicle. The intercepts were planned more than 100 miles above the Pacific Ocean. Additional tests involving the 30SW and KMR are planned between now and 2005.

30SW also supported launch of an unarmed Minuteman III ICBM as part of the Air Force's Force Development Evaluation Program. This program is designed to test the reliability and accuracy of Minutemen weapon system and to extend the life of the Minuteman booster. The first launch of the Lockheed Martin Atlas IIAS from Vandenberg AFB carried the NASA Terra satellite into orbit. A Boeing Delta II rocket carrying the IMAGE spacecraft was launched from Vandenberg's Space Launch Complex 2.

The Wing supported Pegasus rocket launched from an L-1011 aircraft carrying two DoD Space Experiments: Space Technology Research Vehicle-2 and the Compact Environmental Anomaly Sensor. 30SW also supported the launch of two Orbital Taurus launch vehicles.

INFRASTRUCTURE OUTLOOK

Phase II of the Range Standardization and Automation initiative provides for an Operation Control Center and short-range instrumentation facilities on Vandenberg AFB as well as upgrades to communications, air/sea/rail surveillance, vehicle tracking, optics, and weather forecasting. Phase II also includes long range instrumentation facilities at Pillar Point and Point Mugu as well as a radar for Kaena Point. This will increase the efficiency of the 30SW and improve future range test capabilities.

45TH SPACE WING (45SW)

U.S. Air Force
Patrick Air Force Base (PAFB)/Cape Canaveral AFS (CCAFS), FL

KEY/UNIQUE AREAS OF CAPABILITY

The 45SW is the nation's primary space launch facility for geosynchronous orbits and interplanetary space missions. Low/medium earth and highly elliptical orbits are also supported. The Wing supports various DoD, NASA, and commercial satellite and manned launch systems including Titan IV, Delta II/III, Atlas II/III, Pegasus, Space Shuttle, and Trident I/II. Preparations are ongoing for the Evolved Expendable Launch Vehicle program; first launch is scheduled for FY2001. The 45SW also supports Centaur, Inertial Upper Stage, and Atlas/Delta upper stages. The Eastern Range instrumentation includes radar, optical tracking, command and control, communications, range safety, and telemetry systems. A full range of satellite launch preparation, processing, and support facilities are available. The 45SW also provides extensive support to the U.S. Space Command's Space Surveillance Network.

TESTING IN FY2000 (2,177 WORKYEARS)

The number of launches at the 45SW increased in FY2000 from FY1999 and is expected to continue to increase. The range capacity of 45SW will increase in FY2003. The maximum launch pad capacity began increasing in FY1999 and will peak in FY2002. For the last several years, almost half of the launch activity supported by the 45SW at CCAFS has been commercial.

CCAFS was the site for the launch of a Titan IV/B-IUS rocket carrying a Defense Support Program (DSP) satellite into a 22,300-mile geosynchronous orbit. DSP satellites are part of North America's early warning system; helping to protect the United States and its allies by detecting missile and space launches as well as nuclear detonations.

There were four Delta II and one Delta III rocket launches. Three GPS satellites were launched in FY2000 (GPS IIR-3, IIR-4, and IIR-5) to sustain the current constellation. These GPS satellites provide the warfighter with precision targeting and navigation. A commercial Delta launched a Globalstar 7 satellite this year. In addition, the Delta III rocket system was checked out by launching an inert payload into orbit.

Seven Atlas rockets were launched with four carrying government satellites. Two commercial Atlas rockets launched the Hispasat-C and Eachostar VI satellites. Also, an Atlas III launched an Eutelsat WIV into orbit for European Satellite Operator. At sea, operational test launches of four Trident missiles were also supported.

INFRASTRUCTURE OUTLOOK

The Range Standardization and Automation (RSA) initiative is a three-phase program for overhauling and redesigning both the Western and Eastern ranges. Phase I addresses immediate needs, Phase IIA provides a new range architecture, and Phase IIB replaces fixed assets at CCAFS, Argentia, Bermuda, Jonathon Dickinson Missile Tracking Annex, Antigua, and Ascension. A related improvement and modernization sustainment investment will extend the life of downrange antennas and electronics.

The Air Force and NASA are working hard to improve the efficiency of the support contracts at their respective launch complexes. The commercial space launches place an additional demand on the management of these facilities. Both the 30th and 45th Space Wings should examine the potential of converting to GPS-based tracking systems on their ranges. If this option is adopted, future investment will be required to realize the potential for these space ranges. The Navy is departing Argentia, Newfoundland, where the 45th Space Wing currently maintains radar, telemetry, and command facilities. As a result, the Air Force will have to pay an estimated $350-400K per year for base support operations.

JOINT INTEROPERABILITY TEST COMMAND (JITC)

Defense Information Systems Agency (DISA)
Fort Huachuca, AZ/Indian Head, MD

KEY/UNIQUE AREAS OF CAPABILITY

JITC plans, conducts, evaluates, reports, and certifies the results of interoperability and other tests of information, communications, and intelligence hardware and software systems or elements.. It is the sole joint interoperability certifier for DoD. JITC offers complete systems testing with its one-of-a-kind array of hardware, software, and staffing and state-of-the-art technological flexibility. It operates a number of local/distributed test beds with an extensive network of military, commercial, and allied test facilities, interconnected by high-data-rate land circuits as well as radio and satellite links. JITC is also the Operational Test Agency (OTA) for DISA, and select programs for other agencies, such as, Defense Logistics Agency and Defense Finance and Accounting Service. JITC personnel provide real-time, on-site resolution of interoperability issues in CINC exercises and contingencies. Located at Fort Huachuca, Arizona, JITC is in a comparatively quiet and unrestricted electromagnetic environment. This unique location allows testing that cannot be performed elsewhere.

JITC's Joint Test Facility (JTF) operates a 16-acre test site with five test nodes. It tests every kind of transmission system including tactical line-of-sight, combat net radios; high-frequency microwave and tropospheric scatter systems; fiber optic cable; commercial telephone lines; and satellite links. It uses traffic and message loading devices to simulate high-volume conditions.

TESTING IN FY2000 (352 TEST PROGRAMS AND 736 WORKYEARS)

JITC testing extends from small standards conformance communications tests to major interoperability exercises and support of real world contingencies. During FY2000, JITC conducted over 100 interoperability tests and certifications and almost as many developmental and operational tests and evaluations or assessments. JITC personnel conducted 75 standards conformance tests/certifications as an important first step to achieving interoperability, and conducted about 30 performance and Y2K tests. JITC supports small standards conformance communications tests to major interoperability exercises and real world contingencies.

During FY2000, JITC conducted one of the largest DoD interoperability exercises occurred. The DoD Interoperability Communications Exercise (DICE 00) involved over 50 systems and 15 organizations distributed over a dozen locations. The exercise tested over 340 communications interfaces and identified many problems. JITC also supported Combined Endeavor, another exercise-based testing event focused on combined interoperability. As a Partnership for Peace initiative, it fostered interoperability among NATO, former Warsaw Pact nations, former Soviet Republics, and other members of the European Community. JITC provided primary technical support to U.S. European Command in planning, executing, and reporting on this annual interoperability event. Combined Endeavor 00 had personnel and equipment from 36 nations.

INFRASTRUCTURE OUTLOOK

New DoD initiatives, emphasizing testing for interoperability and information assurance, will cause an increase in workload as JITC's capabilities and facilities become more critical to achieving the Department's objectives. DoD acquisition programs have not fully utilized the capabilities of JITC, as the Services tend to conduct interoperability testing at their own sites using their own methodologies.

The CTEIP-funded Joint OT&E Simulation Environment Facility (JOSEF) provides JITC with a reusable capability providing an environment representative of warfare/contingency operations for OT&E of network-centric command, control, communications, computers, & intelligence systems. The JOSEF stimulates numerous users, which replaces the need for multiple human operators. It also provides a battlespace picture for tracking systems that removes the need for live interfacing platforms.