2002 Annual Report

Arnold Engineering Development Center

An Air Force Materiel Command Test Center

Who We Are

Arnold Engineering Development Center is the world's largest and most complex collection of flight simulation test facilities.

The 4,000 acres that comprise AEDC are part of the 40,000-acre Arnold Air Force Base. The base was dedicated June 25, 1951 by President Harry Truman. AEDC has tested virtually every high performance aerospace system the Department of Defense has developed since the mid 1950s.

Our Mission

To provide our customers with the world's most effective and affordable aerospace ground test and evaluation products and services. To ensure Arnold Engineering Development Center ground test facilities, technologies and knowledge fully support today's and tomorrow's customers.

AEDC Strategic Objectives

1. Satisfy our internal and external customers and stakeholders
2. Reduce the unit cost of products and services each year
3. Increase our overall external customer business
4. Improve productivity each year
5. Nurture a high-performance work force

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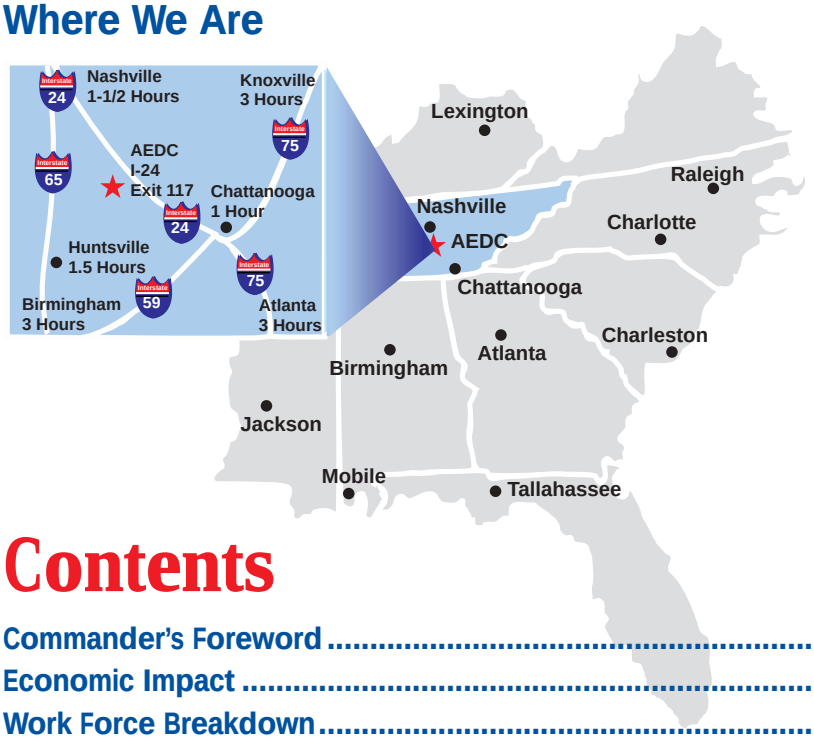
Where We Are



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ISO 9000 – World Class Quality Standards

To meet the highest quality standards and customer expectations, AEDC has worked hard to measure up to quality standards like ISO 9000, the worldwide standard for quality. AEDC's contractors–center support contractor ACS and test support contractor Sverdrup Technology Inc./AEDC Group–have been deemed ISO 9000 compliant by an auditing team from Georgia Institute of Technology, while the government work force will be compliant by the end of 2003.

ISO 9000 is a series of five individual, but related, standards on quality management and quality assurance. The ISO system created a set of standards for the exchange of goods and services. The primary objective of a compliant ISO 9000 operation is to have all major processes documented to reflect the actual way an organization performs work.

The Department of Defense's Software Engineering Institute has designated Sverdrup a level 3 organization, according to its Capability Maturity Model. It's a distinction test customers look for in selecting organizations that have taken quality steps in ensuring software is what it should be.

The Gartner Group, an independent service assessment firm, gave ACS world-class marks for the computer support it provides to AEDC.

Commander's Foreword

I'd like to thank the men and women of AEDC, as well as our partners and customers, for yet another great year at the center.

Throughout 2002, Team AEDC continued to test air and space weapons both for use in the current war on terrorism and for systems in development. As has been the case throughout the history of the center, the men and women of AEDC were at the cutting edge of air and space technology providing insight for the development of systems such as the F-35 Joint Strike Fighter and F/A-22 Raptor.

Propulsion testing continued at full bore with testing of the Pratt & Whitney F119 engine for our nation's next air dominance fighter/attack aircraft, the F/A-22 Raptor. Engine testing also included the P&W F100 for the F-15 Eagle and F-16 Fighting Falcon, the General Electric F118 for the B-2 Spirit, the GE TF39 for the C-5 Galaxy and the Williams International F415 used to power the Tactical Tomahawk Cruise Missile.

We continued important test work for the Minuteman III propellant replacement program and the Peacekeeper aging and surveillance program, ensuring upper stage engines will perform as designed. Other space programs supported by AEDC test work include Delta IV, Theater High Altitude Air Defense missile, the Navy Dual Combustor Ramjet and work for the Missile Defense Agency.

The sustainment upgrade program continued in our Propulsion Wind Tunnel complex, driving greater efficiency in operating the tunnels. At the same time in PWT, our people worked with the Joint Strike Fighter program providing on-time quality testing, helping keep the program on schedule. Other programs supported through AEDC aerodynamic testing included the Small Diameter Bomb, Joint Direct Attack Munition, F-15 Eagle and B-61 weapon.

Although we had a great year testing, supporting many of our nation's key air and space programs, we've continued to look at the future, as well as where and how AEDC will fit into that future.

First and foremost in that effort was the beginning of the source selection competition for the next center support contract covering the next several years. Based on our evaluation of center needs and the current aerospace industry, we made the decision to open the competition to aerospace hardware manufacturers for the first time ever and move to only one contract versus the two we currently have in place. We expect to reduce operating expenses at the center significantly and improve efficiencies at the same time under the new contract.

Simultaneously, we began the process to gain International Standards Organization (ISO) certification for the government work force and expect this process to be complete by the end of fiscal 2003. We strongly believe in the need for this certification to better interact with our customers and provide the quality assurance they expect when bringing their test hardware to AEDC.

It's been an exciting year at AEDC with an even more exciting future in store for all of us. As we move to the 100th Anniversary of Powered Flight, AEDC is well positioned to be an integral part of the next 100 years. I'm proud to be a part of what we've done over the last year, but even more proud to be part of preparing our center for the future of keeping our nation the air and space leader of the world.

The following pages detail more fully our activities at AEDC over the last year. If you would like more information regarding the center, our people and our mission, please contact me through the center's Public Affairs office at (931) 454-4204.

David J. Eichhorn, Col., USAF
Commander

Economic Impact

Arnold Engineering Development Center's economic impact in Middle Tennessee was more than $491.3 million for fiscal 2002.

The economic impact data and secondary employment estimates are based on the Tennessee Valley Authority economic impact model methodology.

The Air Force model, which uses a different, more conservative methodology, shows economic impact at $381.9 million.

AEDC employed 2,676 people this year; these numbers include military personnel, government civilian and contractor employees. Active duty military personnel make up about 3.5 percent of the work force.

The total economic impact includes the center's payroll, secondary jobs created locally through the spending of that payroll and other direct expenditures.

Examples of secondary jobs would be those created to build new houses or jobs created at local supermarkets. Direct expenditure examples include money spent to pay for utilities, service contracts with outside vendors and military health insurance paid to local hospitals or doctors.

In addition to the 2,675 people employed at Arnold Air Force Base, including part-time and temporary employees, the center gave a boost to the local economy by creating some 1,846 secondary jobs for a total of 4,521 jobs related to AEDC.

The payroll for AEDC government personnel and contractor employees was $186.5 million. Other direct AEDC expenditures were almost $147 million with the payroll for the secondary jobs approximately $48.5 million.

AEDC remains the single largest employer in Coffee and Franklin counties. The center employed 1,393 people in Coffee County and 670 from Franklin County.

Not reflected in AEDC's economic impact are the approximately 3,500 military retirees living in the local area surrounding Arnold Air Force Base who receive more than $50 million in retirement pay or the retirement pay of several hundred former government civilian employees and contractor personnel from AEDC.

The current replacement value for the aerospace testing complex at Arnold Air Force Base is almost $7.5 billion.

(See complete listing of facility values on inside back cover; a list of AEDC test facilities can be found on page 30.)

Fiscal 2002 Economic Impact Data

TVA Model Estimates for AEDC

As of Sept. 30, 2002

Direct Employment at AEDC	
Military	112
Government Civilian	235
Non-appropriated Fund	46
Sverdrup/ACS	2,273
AEDC Federal Credit Union	5
Base Exchange	5
Total	**2,676**
Secondary Jobs Created	1,846
Total Employment Impact	**4,521**
Economic Impact (in millions)	
Non-construction Expenditure	$ 332.6
Indirect Spin-off Impact	$ 156.3
Construction Expenditures	$ 0.9
Indirect Spin-off Impact	$ 1.5
Total Direct Expenditures	**$333.5**
Total Indirect Expenditures	**$157.8**
Total Economic Impact	**$491.3**

AEDC Work Force Demographics

Outside Middle Tennessee 36

Total Employment 2,676

Total Economic Impact $491.3M

As of end fiscal 2002

Work Force Breakdown

Arnold is unique in the Air Force not only because of its world-class test facilities, but also because of its distinctive work force, which are 89 percent contractor employees and 11 percent government personnel.

The philosophy behind this distribution, which has been in place since the center's inception in 1951, is to save money and create an experienced group of people who would make their careers at AEDC.

That philosophy has worked. The average age of the 2,835-member work force is 47, with an average of 16 years experience at the center.

AEDC's government staff is composed of military and civilian employees and provides management direction, resource allocation, oversight and contractor administration.

The contractors are Sverdrup Technology Inc./AEDC Group – a Jacobs Engineering Company, and ACS, a joint venture of Computer Sciences Corp., DynCorp and General Physics.

Sverdrup conducts aerospace testing and is led by General Manager Dr. David Elrod. ACS is the center support contractor and is led by General Manager John Miller.

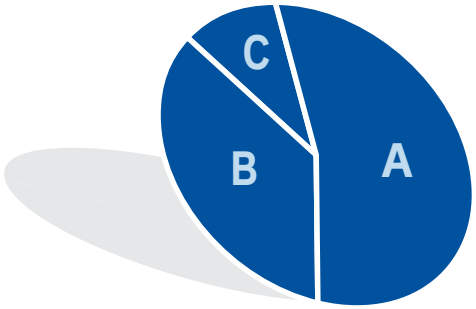
The consolidation of Department of Defense test facilities brought Navy and Army personnel to AEDC over the last several years. The Air Force made the center's vice commander slot a Navy position, occupied by Navy Capt. Larry Judge. Army Col. James Hesson headed the center's Space and Missiles Division during fiscal 2002.

Craft employees make up 35 percent of the work force.

Engineers and craft personnel check out a GE F118 jet engine in an altitude test cell.

Who Works for Whom

A	Sverdrup	54%
B	ACS	35%
C	AF/Navy/Army	11%



What They Do

Craft	36%
Engineers/Scientists	30%
Technical Associates	15%
Administrative	14%
Managers/Supervisors	5%

Craft Employee Breakdown

Machinists	20%
Instrument Technicians	18%
Electrical	15%
Operating Engineers	10%
Pipefitters	7%
Police/Fire	5%
Storekeepers/Drivers	5%
Janitors	4%
Boilermakers	3%
Other	13%

Engineers/Scientists Breakdown

Mechanical	26.7%
Aeronautical/Aerospace	19.2%
Electrical	18.2%
Computer Science	8.1%
Mathematical	5.2%
Physics	5.2%
Industrial/General	5.2%
Other	12.2%

Bachelor's	60%
Master's	35.3%
Doctorate	4.7%

History of Excellence

Before World War II ended, Commander of the Army Air Forces, General of the Army Henry H."Hap"Arnold, was alarmed by the Germans' development of advanced jet aircraft and rockets. Had these sophisticated systems been introduced earlier, they could have changed the outcome of the war.

Arnold learned the vitality of air research and development from the Germans.

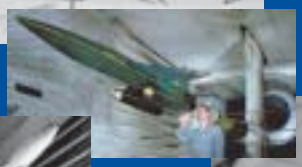
"I had ... to project myself into the future ... and determine what steps the United States should take to have the best air force in the world 20 years hence," he said.

Arnold enlisted the help of Dr. Theodore von Karman, one of the world's leading aeronautical scientists. He asked von Karman to form a Scientific Advisory Group to chart a long-range research and development program for the future U.S. Air Force.

Members of this "Scientific Advisory Group" went to Germany in the

General of the Air Force Henry 'Hap' Arnold (top) led the Air force in World War II. Dr. Theodore von Karman (bottom left) headed up the first Air Force Scientific Advisory Group. Dr. Frank Wattendorf (bottom right), a member of that group, proposed creation of AEDC.

Propulsion Wind Tunnels



Engine Test Facilities

Mark I Space Chamber

Altitude Rocket Test Cells

Lunar Landing

50s

60s

70s

Korean War

von Karman Gas Dynamics Facility

Vietnam War

First GPS Launch

last weeks of the war to study testing facilities and techniques. One member of the task force, Dr. Frank Wattendorf, penned a memo on the return trip calling for an Air Engineering Development Center for ground testing of aerospace systems.

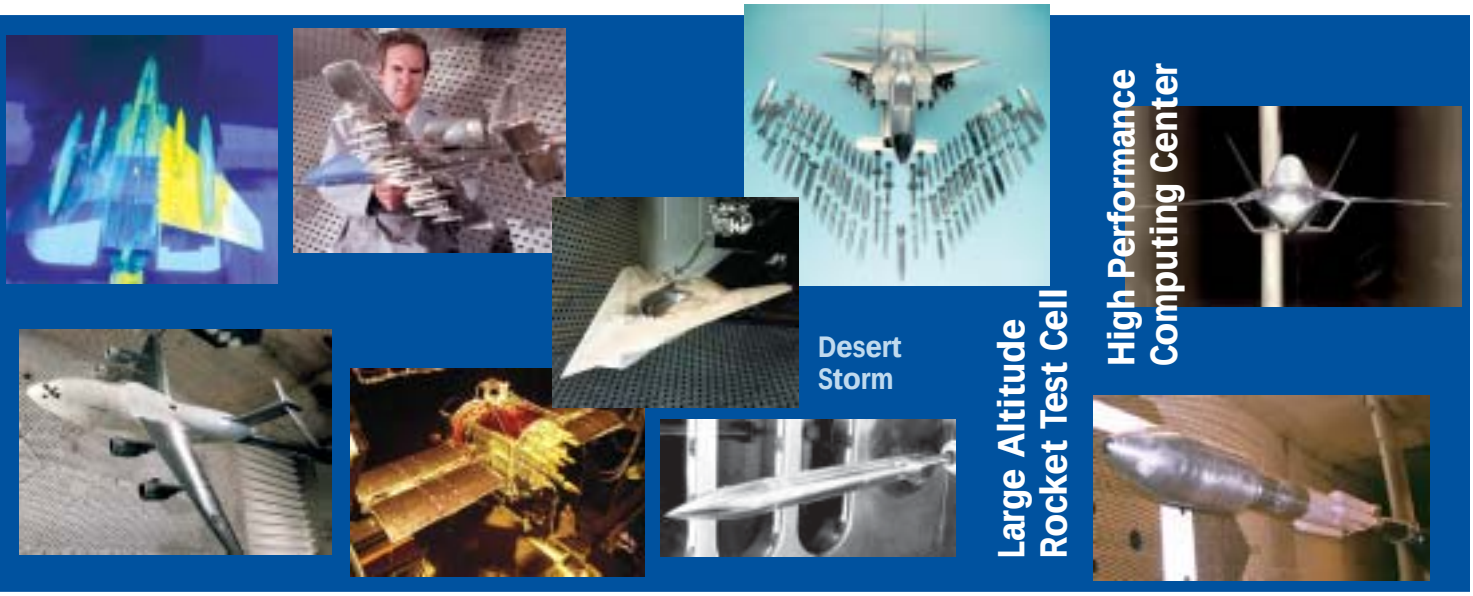
The memo became part of von Karman's 1945 study, "Toward New Horizons," that served as a blueprint for the future U. S. Air Force and for what is now AEDC.

Shortly thereafter, the Air Force began planning the development of the aerospace testing center. By 1949, the leading civilian and military scientists had completed the plan for such a facility. That year, Congress passed the Unitary Wind Tunnel Plan Act and the Air Engineering Development Center Act. President Truman signed it into law, setting in motion the establishment of AEDC.

Southern Middle Tennessee was selected because of its availability of land, water and power. Construction of the center began in 1950. President Truman dedicated the center on June 25, 1951, and the first tests were run here in 1953. Since then, AEDC has tested virtually every high-performance aerospace system in the Department of Defense's inventory.

At the dedication, Truman vowed, "Never again will the United States ride the coattails of other countries in the progress and development of the aeronautical art." His promise was renewed in 1995 in a study to determine where America should turn its aerospace research attentions in the 21st Century. The resulting report, "New World Vistas," serves as a blueprint for future development that von Karman and the Scientific Advisory Group report, "Toward New Horizons," provided 50 years earlier.

President Truman with Mrs. Henry Arnold unveiling the AEDC dedicatory plaque in front of thousands of guests in 1951.



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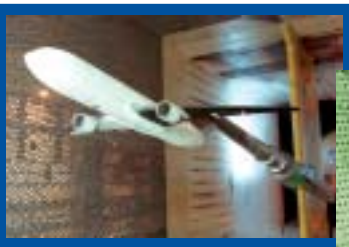




Space Shuttle

Aeropropulsion Systems Test Facility

Integrated Test & Evaluation

Commercial Alliances

September 11

Community Involvement

Many AEDC employees devote their time away from the center to community service in the areas in which they live by holding political office, teaching or otherwise volunteering with religious and community organizations including the Boy and Girl Scouts and many civic clubs.

Center employees make a difference in communities all across the Midstate, including Tullahoma, Winchester, Manchester, Shelbyville, Murfreesboro and a host of other Tennessee cities (breakdown of employees by county on page 2).

The Arnold Community Council (ACC) has been expanding its membership and support to the base since its inception in 2000. The ACC is a group of civic and government leaders and business people from ten Middle Tennessee counties surrounding Arnold AFB who are dedicated to the support and promotion of AEDC.

The council supports quarterly and annual military awards programs, an annual veterans picnic and several other base activities. In addition, they provide speakers to civic groups in Middle Tennessee on the value of AEDC.

The group receives regular briefings from the AEDC commander and key staff on situations and events impacting the base. The council played a role as community liaison and support for AEDC's 50th Anniversary Air Show and Rededication Ceremony in June 2001.

Gen. Lester Lyles, commander of the Air Force Materiel Command (AFMC), was the guest speaker at the council's membership appreciation banquet in March 2002.

A Tri-Chamber of Commerce Coalition of Manchester, Tullahoma and Franklin County is already a driving force in organizing the center's Centennial of Flight Air Show, scheduled June 21-22, 2003.

Local communities are a partner in sponsoring AEDC's 2003 Centennial of Flight Air Show.

Base civic leaders visited Wright-Patterson AFB and jet engine manufacturer Pratt & Whitney.

Janice Willis hugs a Special Olympics participant at Tullahoma High School. Many AEDC employees volunteer for this annual event.

AEDC employees get ready to deliver Christmas presents to local needy children as part of the base's annual Angel E-mail program, which serves children in Bedford, Coffee and Franklin counties.

Tim Sanders (right) is president of the Arnold Community Council. Jeff Fishman (left) is vice president; Harry Brittain, secretary and Lana Woodard, treasurer.

Gen. Lester Lyles (left) talks with Tullahoma, Tenn. Mayor Steve Cope and his wife at a social during an AFMC Commander's Conference.

Company Grade Officers refurbished a small wind tunnel for display at Tullahoma's Hands-On-Science Center.

Base Shooting Club members train Boy Scouts in safe firearms handling at annual clinics.

Kathy White, CAD instructor at Tennessee Technology Center in Shelbyville, explains a class project to AEDC Commander Col. David Eichhorn.

Transformation

Mission

The Investments Directorate is responsible for directing the investments program to sustain and modernize AEDC's test facility infrastructure and to improve test capabilities.

The Maintenance Directorate provides maintenance management of all test infrastructure programs, manages the operations of the center's utilities, coordinates maintenance of buildings, roads, grounds, utilities and the technology infrastructure.

James Y. Parker (left), director of investments, meets with Col. Craig Priebe (center), director of maintenance, and Center Commander Col. David Eichhorn.

The Department of Defense Transformation initiative is changing the nature of military competition and cooperation through new combinations of concepts, capabilities, people and organizations. DoD recognized a need to exploit our nation's advantages, protect our vulnerabilities and sustain our strategic position, helping to maintain peace and stability in the world.

The changing operational culture affects the acquisition culture. Budgeting, acquisition, personnel and management systems must be able to operate in a world that changes rapidly. Without change, the current defense program will only become more expensive in the future, and DoD will forfeit many of the opportunities available today.

During fiscal 2002, in response to the transformation effort, the Air Force began transitioning to combat wing organizations. This structure recognizes the Air Force's core competencies of flying and fixing airplanes, mission and medical support.

Transformation at AEDC

This fiscal year, AEDC changed the center's organization to anticipate the needs of the combat wings. This change strengthens and improves the center's infrastructure, which is critical to the accomplishment of our mission.

Rather than locate test cell operation, maintenance and investment responsibilities within each product area in the Directorates of Operations and Support, separate directorates were established and made responsible for investment management and for operations and maintenance of test facilities, plants and utilities.

For example, the Propulsion Systems Division (DOP), one of three product areas at AEDC, was formerly responsible for testing and for operating, maintaining and managing investments in its own infrastructure. Under the reorganization, the new Maintenance Directorate (MA) is responsible for operating and maintaining AEDC's approximately $7.5 billion test infrastructure.

The new Investments Directorate (IV) is responsible for improving systems engineering, managing investment programs for the test infrastructure and providing the expertise to manage the center's multi-million dollar upgrade programs. Since the center's investments over the next few years approach $500 million, this area is of great importance to AEDC.

The new directorates will help AEDC meet DoD needs in the new millennium, making best use of government resources to maintain and modernize AEDC. The reorganization will also allow the test areas to concentrate on testing while experts in operations, maintenance and investments look after those areas on behalf of the entire center.

Product areas within the Directorate of Operations will provide input to the maintenance and investments directorates and accurately document and communicate their requirements.

The maintenance and investments directorates take requirements from product areas, then work to meet those requirements more effectively and efficiently.

All three report directly to the commander. As a consequence, communication is enhanced, as is the center's ability to avoid problems through proactive decision-making.

Source Selection Changes

In addition to changing the center's organization, changes were made in the source selection process; the way AEDC selects its main contractor. Base leadership looked closely at the role of the government in the current contract and at changes needed to operate the center more effectively and efficiently. As a result, the upcoming contract requirements changed from the current system of two main contractors with one providing testing and the other support services to one contractor offering both support and testing services. Additionally, the organizational conflict of interest clause was deleted, providing an opportunity for many new contract competitors. Companies who produce aerospace products can now bid on the contract. Formal source selection began in fiscal 2003.

Agile Acquisition

The Air Force continues to face the realities of cost, schedule and performance as it strives to equip the warfighters with everything they will need to protect this nation.

Despite constraints and technical challenges, the service has been very successful in fielding the world's best systems, and doing so before anyone else. So why change? The answer is more obvious as one reflects on today's world events. Defense dollars are being refocused in theater, and today's threats are coming faster and evolving more quickly. Systems must be delivered sooner meeting the needs of the warfighter with greater speed and credibility.

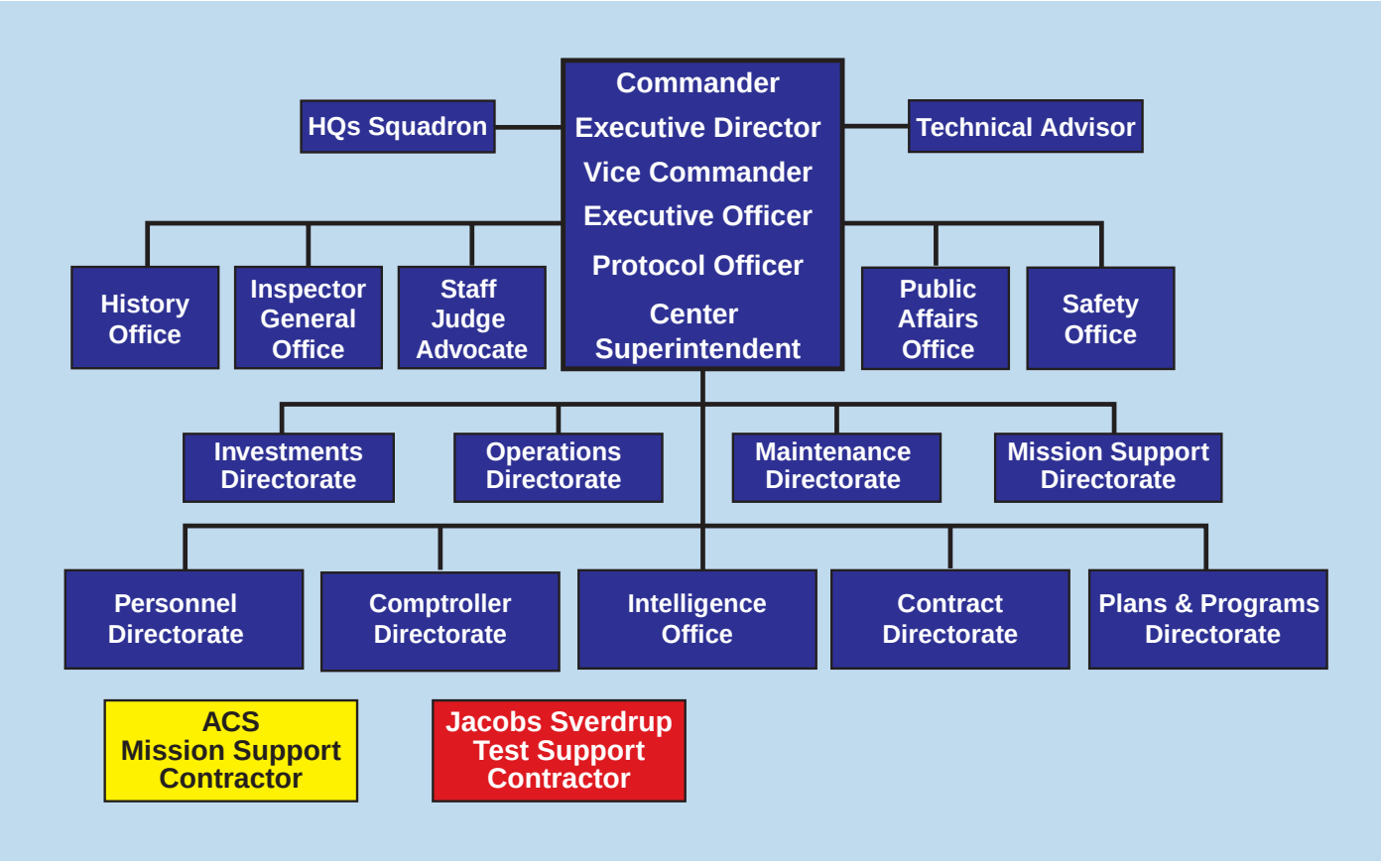
In the spring of 2002, AEDC responded to a mandate from the Assistant Secretary of the Air Force, Acquisition, establishing an Acquisition Center of Excellence (ACE) and selecting a director of Acquisition Excellence.

The "ACE" is charged with supporting not only AEDC acquisition programs, but also with helping AEDC's testers more effectively and efficiently support weapons system acquisitions with streamlined test and evaluation.

A primary focus is on "Seamless Verification," integrating planning and execution of both development and operational test and evaluation. To further support the transformation of test and evaluation, AEDC hosted a meeting in July 2002, at which the AFMC director of operations addressed how the Air Force Materiel Command test centers would accommodate the changing environment and provided an opportunity for the AFMC test centers to discuss a combined test and evaluation enterprise.

The new AEDC organization and initiatives gather the strength of AEDC and better prepare the center for the future. They position AEDC to meet DoD's future needs and requirements, not just today's.

Military transformation is all about being ready to deal with new threats in a new way and being prepared and ready to protect the American way of life.



Jacobs Sverdrup AEDC Group

Mission

Sverdrup is AEDC's test support contractor. Our 1,360 employees operate and maintain the center's aerospace flight dynamics, space and propulsion test facilities. Primary services include test planning and execution, data analysis, technology development and application and facility maintenance. Auxiliary services provided include investment program planning, design and implementation; machining and fabrication, metallurgical/ chemistry laboratory operation; and test data and controls design, development and implementation.

Jacobs Sverdrup's AEDC group is led by Senior Vice President/General Manager Dr. David Elrod (left) and Deputy General Manager Steve Pearson.

Fiscal 2002 Overview

During fiscal 2002, Jacobs Sverdrup successfully supported a broad range of F-35 Joint Strike Fighter (JSF) wind tunnel tests delivering on productivity and cycle time commitments. Our Space and Missiles Team was nationally recognized for their breakthrough testing of a scramjet in G-Range. They also brought APTU to new levels of productivity in support of the Navy Dual Combustor Ramjet test. Our turbine engine test teams delivered outstanding support for the F119, the Rolls-Royce Adour, and the Tactical Tomahawk programs.

In the spring, we responded to the Commander's 90-day challenge to make major facility repairs to a sea-level turbine test cell critical to the F119 program. Using corporate reach-back, we delivered the project under cost, ahead of schedule and meeting all performance requirements. By the end of fiscal 2002, we had delivered our best-ever safety performance in terms of recordable injury and lost-workday case rates.

Fiscal 2002 test workload was projected to decline in the fourth quarter with the greatest downturn occurring in aeropropulsion. However, the projected year-long downturn in turbines work did not materialize and increasing test requirements led us to seek additional staff as we prepared to enter fiscal 2003.

Fiscal 2003 Forecast

During fiscal 2003, AEDC will continue to support many national weapons systems and commercial programs such as the F-35 Joint Strike Fighter, F/A-22, F100 engine and Small Diameter Bomb.

The challenges for the coming year include:

- Delivering JSF aerodynamic testing on target in support of the program critical design review
- Supporting critical F119 testing in ASTF and sea-level cells
- Accommodating increased workloads in turbines and the Advanced Missile Signature Center
- Continuing to improve our safety performance
- Driving increased discipline into all of our processes

A $2.2 million repair/upgrade added new unique capabilities to the sea-level test facility.

ACS

A joint venture of Computer Sciences Corp., DynCorp and General Physics

Mission

ACS is AEDC's support contractor. Its employees support the center with a wide range of services including: information technology, desktop computer operations and maintenance, center communications, test utility operations, environmental, safety, industrial health and quality assurance, calibration, chemical and photo laboratories, civil engineering, transportation, materials management, fire protection, security services, emergency management, food services, custodial and public affairs.

ACS is led by Vice President/General Manager John Miller (left) and Deputy General Manager Keith Humphryes.

Fiscal 2002 Overview

Fiscal 2002 was a challenging year for AEDC and ACS. The world changed forever on September 11, 2001, just days before fiscal 2002 began, and the impact on the center was dramatic.

Despite a whole new security reality, ACS continued to provide base services and logistical support to our customer and test contractor Jacobs Sverdrup. Those services helped continue important testing of high priority test programs like the F/A-22 Raptor and F-35 Joint Strike Fighter, as well as infrastructure upgrades for future work.

ACS provides the personnel for AEDC's Security Forces, and the team responded to increased security responsibilities immediately. New shifts and security procedures were implemented, and initially an augmentee security force of trained employees from across ACS supplemented the company's full time security officers.

ACS provided planning, logistical and civil engineering support to a host of new projects to enhance security and upgrade test facilities. Many of these projects were not identified until after the fiscal year began. Major upgrades to computer systems and security protection were also undertaken. In July, John Miller, who had served as deputy general manager for operations, took over as vice president and general manager from Jim Nicholson, who had served in that role since the inception of the contract in 1995. Keith Humphryes became deputy general manager on October 1.

Fiscal 2003 Forecast

ACS will continue to provide the base support services to ensure AEDC can meet its mission obligations to the nation's warfighters, as well as providing the best security possible for the people of AEDC and its facilities.

Earned Value Management practices have been fully implemented to better measure each task carried out by ACS.

In the last year of the support contract, the company will continue to provide the high quality services the government and AEDC test contractor need, including planning and smooth transition to the winner of the single AEDC support contract that starts in October 2003.

ACS pipefitters spent their Thanksgiving holiday repairing a raw water leak in a 72-inch line which feeds the Engine Test Facility area. Skilled crafts people often sacrifice their holidays to complete maintenance and repair work that can only be done when facilities are not testing.

Directorate of Mission Support

Mission

Responsible to the AEDC commander for all aspects of installation support, including communications, computers, logistics, utilities, security, fire protection, civil engineering, environmental management and base services. The directorate also plans, programs and budgets support mission area resources to achieve the center's strategic objectives and evaluates the center's support contractor, ACS.

The Mission Support Directorate is led by Col. Quincy Purvis (right). Bill Gray serves as technical director.

Mission support contractor pipefitters making repairs and modifications to the Propulsion Wind Tunnels Plenum Evacuation System.

Fiscal 2002 Overview

The Mission Support Directorate continued its pursuit of excellence by improving computer and network systems, completing critical utility upgrades, maintaining environmental compliance, responding to increased security requirements and making numerous facility improvements.

AEDC leads Air Force Materiel Command (AFMC) in computer network security efforts and stands as a benchmark for other Air Force bases. Under a new center-wide centralized Personal Computer management effort, the center support contractor, ACS, reviews requirements, procures, receives, stages and installs new PCs, excesses old PCs and makes PC and component recommendations. This has produced significant cost savings and increased productivity. The directorate also upgraded the High Performance Computing systems, increasing their capacity from 320 to 930 giga-flops.

In the area of utilities, AEDC continued its world-class performance in utility management by providing critical test support utilities with minimal test schedule or cost impact. AEDC also implemented an electricity time-of-use contract with the Tennessee Valley Authority that will bring savings and allow customers to have a choice of when to conduct a test.

In the area of environmental management, AEDC maintained environmental compliance with all state and federal permits, continued aggressive restoration activities as outlined in our Tennessee Department of Environment and Conservation and Environmental Protection Agency permits, approved corrective action management plan meeting all regulatory milestones, identified several pollution prevention alternatives that reduced AEDC's environmental risk and maintained our course in ecosystem management protecting rare, threatened and endangered species located at AEDC.

AEDC Security Forces protect the center's personnel and facilities.

Security and emergency response forces continue to provide vigilant support to Arnold Air Force Base and the center's 40,000-acre installation and multi-billion dollar infrastructure. Efforts to upgrade all facilities on AEDC to meet Air Force and command Anti-Terrorism/Force Protection requirements are underway. The Automated Entry Control System (AECS), recently employed at key facilities, provides for a more secure environment for building occupants.

The Civil Engineering (CE) organization initiated, executed and completed more than $18 million in construction, renovation and upgrades to the center's test and support infrastructure. These necessary projects will keep AEDC viable to support national defense today and tomorrow. The CE Design Team planned Antiterrorism/Force Protection Projects valued at nearly $3.3 million that will be constructed in fiscal 2003, greatly increas-

AEDC's firefighters train to respond to a wide variety of situations.

Military family housing and most Services facilities are located on the base's Woods Reservoir.

ing the security posture of the installation. In addition, CE developed a comprehensive facility Right-Sizing plan that will result in a reduction of over 110,000 square feet, saving nearly $1.55 million in operation and maintenance costs annually and eliminating the overall backlog of maintenance and repair. Funding for the demolition of three buildings is expected in fiscal 2003. Finally, two Military Construction Program Projects (MILCON) were awarded this year. These projects include Phase 4 of the fighter engine inlet upgrades in the Engine Test Facility and upgrades to APTU.

The Services Division continued to improve all aspects of quality of life for customers. Through Air Force Materiel Command Year of the Family (YOFAM) initiatives, the Arnold Lakeside Club (ALC) beach area was improved and expanded to include a pavilion, picnic tables and volleyball courts. A chuck wagon grill was also purchased for installation at the ALC beach pavilion. The ALC was enhanced with an upgrade to the sound system, portable bar and the Landing bar area, including a new crud table.

The Golf Course procured several equipment upgrades including three new mowers to better maintain a healthy, attractive course.

The Fitness Center improved the weight room with two televisions and personal sound equipment, plus a functional training area and equipment. The Fitness Center also began a flag football intramural league and recreational fitness hikes at local wilderness trails.

The Wingo Inn installed automatic doors in the entryway to add convenience and safety features for customers. The Marina improved the safety and function of the fueling area with a new gas dock and the FamCamp added fire rings and grills to tent sites.

Youth Programs hosted Missoula Children's Theater and Services began showing free movies at the Community Center and ALC.

Fiscal 2003 Forecast

Continuing health and quality of life improvements through superior facility management and projects will always be the Support Directorate's top priority.

Projects in fiscal 2003 include a million dollar repair of the heating, ventilation and air conditioning (HVAC) system in the headquarters building, renovation of the interior of the Chemical Lab Facility, renovation of the Arnold Lakeside Club beach bathhouse (a YOFAM project) and repairs to several other building roofs and HVAC systems.

Military Support Facilities/Functions

Medical Aid Station - A small Air Force medical aid station looks after the needs of assigned active duty military personnel. Limited pharmacy service is available for active and retired uniformed services members and their dependents two days a week. The pharmacy schedule and formulary are available on the AEDC Web site at http://www.arnold.af.mil/aedc/medicine.htm#PHARMACY or call (931) 454-5351.

VA Clinic - The Alvin C. York VA Medical Center operates a satellite clinic at AEDC to save area veterans the drive to Murfreesboro, Tenn. The VA clinic also serves AEDC's active duty military personnel. For information on the clinic contact (931) 454-6134.

Base Exchange & Commissary - A small military exchange and commissary serve active duty and retired military members and their families. The facilities are open Tuesday through Saturday, except federal holidays. For information on the Base Exchange call (931) 454-5014/5016. For information on the Commissary call (931) 454-5921/7249. More information is available on AEDC's Web site at http://www.arnold.af.mil/aedc/tenants.htm

Military Personnel/ Casualty Assistance/ Retiree Affairs - A small military personnel office is available to assist with military personnel issues, including retiree affairs. They can be contacted at (931) 454-4308 or through the AEDC Web site at http://www.arnold.af.mil/aedc/military.htm

Environment

Mission

AEDC's Environmental Management Division manages conservation, pollution prevention, restoration and compliance within existing regulations.

A Southern Pine Beetle infestation led to early harvest of pine trees.

AEDC emphasizes environmental stewardship as a part of everyone's day-to-day job. The environmental management division effectively manages conservation, pollution prevention, restoration and compliance with existing regulations.

AEDC recognizes the magnitude of the challenge represented by that commitment. The center is a large industrial complex that requires the use of large amounts of fuels, oils, hydraulic fluids, refrigerants, antifreeze, solvents, acids and other such materials to accomplish its test mission. While we are diligently seeking to eliminate or replace hazardous materials with environmentally friendly ones, we will continue to have to use these materials in significant quantities for the foreseeable future. Therefore, it is absolutely essential that AEDC satisfy all environmental requirements as we accomplish our test mission. To do otherwise puts not only our environment, but also our test mission at risk.

Every AEDC employee is familiar with those things in their workplace that represent a threat to the environment and is getting involved in eliminating or controlling them. "Excellence" goes beyond merely meeting the standards. We are committed to setting the standard by which others will be judged in the future.

AEDC has developed a Geographic Information System to facilitate the mapping of various components of the resource management program. The system enhances the ability to make better management decisions by locating facilities or conducting operations where there will be limited environmental impact.

Ecosystem management is an important aspect of the AEDC environmental program. AEDC accomplishes resource management objectives through the formation of partnerships with environmental agencies and organizations and the development of conservation programs. To date, rare plant and animal investigations have revealed the presence of at least 68 rare, threatened and endangered species on base property. Two federally protected species, the Gray Bat and Eggert's Sunflower, are located at the installation. We have entered into a partnering arrangement with the U. S. Fish and Wildlife Service to promote and enhance the management of these species.

An engineer inspects the oil water separator at AEDC's fuel farm.

AEDC consistently seeks to better integrate the management of irreplaceable biological, cultural and land resources within the overall framework of the test mission.

Pollution prevention and conservation go hand-in-hand to preserve the environment for future generations. A hazardous material pharmacy tracks hazardous materials throughout their life cycle as they are received, issued and used. The recycling operations center consists of a baler and a used-oil space heater.

Pollution prevention initiatives include an environmental approach to waste management. AEDC saves more than $35,000 in hazardous waste disposal by improved processing of oil-soaked absorbents, aerosol cans and excess materials. The model shop reduced the generation of hazardous waste from a fluid eliminator by more than 50 percent with the installation of a coolant wizard. The wizard cleans the coolant and extends the lifecycle of the coolant.

Our pesticide management program pursued environmentally friendly pesticides and fertilizers used on base and reduced the dependency on higher toxicity pesticides used in the past. The paint shop cut up to 80 percent of hazardous materials generated from paint stripping with the introduction of a new portable blasting machine. The photo lab came up with a new chemical precipitation method for silver recovery from photographic processing saving over $2,000 a year.

One other major pollution prevention effort has been the recycling of waste oil and Trichlorethylene (TCE) at AEDC engine test cells and heating and air conditioning units on base. Used oil is now recycled and reused in AEDC plants, and TCE is put back into refrigeration systems. Prior to this practice, used waste oil and TCE were disposed of as hazardous waste.

AEDC strives to maintain an aggressive program of hazardous waste cleanup from past industrial practices under the DoD Environmental Restoration Program. Stakeholder involvement is crucial to the success of the cleanup effort.

The local community is kept informed of important site activity through a variety of information sources. One of these primary sources is the Community Advisory Board (CAB)—a committee consisting of AEDC personnel and local residents. The CAB meets regularly to discuss plans relating to ongoing restoration activities at AEDC. Another source of environmental information to the local populace is the ENVISION newsletter.This semi-annual product is written and produced by the Environmental Management Division and distributed to 600 homes and businesses in the communities surrounding AEDC. Environmental news is also published in the base newspaper, the HIGH MACH, and released to the local media.

Teaming with the Tennessee Department of Environment and Conservation (TDEC), AEDC has volunteered to adopt state corrective action reforms that streamline the investigation and remediation process of environmental sites. A testament to this streamlined process was AEDC's ability to finalize a work plan and complete fieldwork on a $1.1 million project at the retention reservoir and former chemical treatment pond. The project focused on mapping and assessing the bottom of the retention reservoir and treatment pond to see if contaminants were present in the sediments. This effort was completed in a fourteen-month period – something that would have taken three years prior to the reforms initiative.

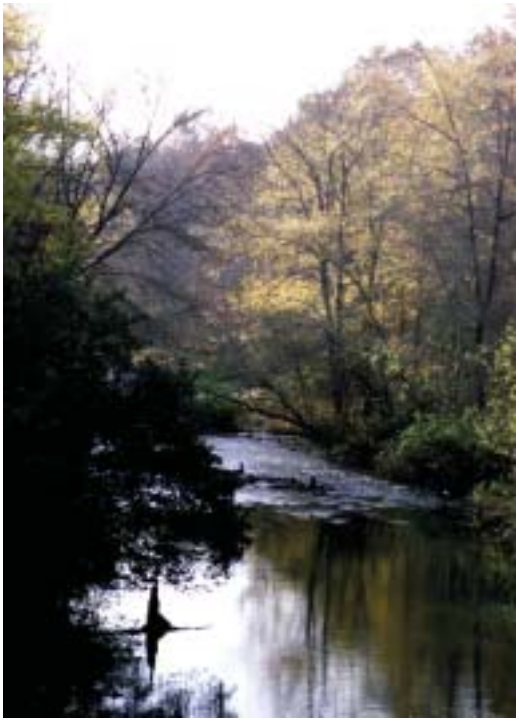
The Zigzag Bladderwort found on base is one of Tennessee's 50 rare, threatened or endangered plants. It has no roots or leaves.

An important step in the AEDC restoration program took place in May 2002 with the completion and approval of a Resource Conservation and Recovery Act (RCRA) facility inspection for the Coffee County Landfill. Personnel are now evaluating final remedy alternatives at the 97-acre landfill, which will include continued operation and maintenance of the gas and groundwater recovery systems at the landfill.

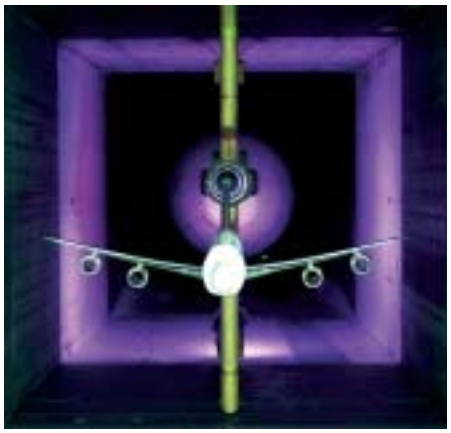
AEDC also concluded the field work portion of the site investigation at the former leaching pit north of the Model Shop. Field work included detailed characterization of contaminate flow in a complex fractured bedrock system. This information will allow us to develop a final remedial strategy for this site in 2003–2004. Key to understanding the mechanics of the system was AEDC's use of innovative techniques that include digital borehole image processing systems (BIPs) and hydro physics that provide characterization of water bearing fractures.

Pump back projects on local base creeks not only reduce the risk of pollution's being allowed to enter local waterways but the facilities allow for the operational reuse of the water, saving the cost of pumping cooling water from Woods Reservoir.

AEDC has an excellent environmental track record, but our vision for the future is to do even more. To secure our ability to execute our mission and serve our customers, we must have impeccable environmental performance. The future of the center's vital national test mission depends on it. In fact, the center's vision includes the statement of becoming "a model of environmental excellence for our communities."



Alliances



Pratt & Whitney 4084 for the Boeing 777 in AEDC engine test facility (top) and Boeing 747 in AEDC wind tunnel.

AEDC was established to ensure that America always led, not followed in the aeronautical arts. In the more than five decades since AEDC was established, it has grown to a complex of 58 test facilities that can simulate the operating environment from sea level to outer space for aircraft, missiles and space systems.

The center provided services critical to the development of some of the best flight systems ever seen by man that have allowed the American military to dominate the air and play a critical role in winning the Cold War. Testing at the center was critical to America's successful access to space for manned and unmanned systems.

AEDC was born as a bold idea. The men and women who came to Tennessee in the early 1950s created an air engineering development center unlike anything before.

More than once in the center's half a century of serving the nation, the people of AEDC have transformed the way they do business to be more efficient and better serve their customers' needs. Not just developing new testing technology and facilities, but relationships that serve the military and economic defense of the nation.

In the last decade of the 20th century, the center forged new alliances and relationships to better serve the nation and recognize the global aspect of American aerospace leadership.

Legislation in the early 1990s gave the center commander more flexibility in doing commercial business to utilize available resources to benefit the nation's aerospace industry.

The center also forged long-term alliances with key aerospace companies, as well as educational institutions and other high technology government and private organizations. These brought non-traditional revenue to AEDC and helped start the transformation to better serve the nation in the 21st century.

Examples of testing under these alliances are wind tunnel testing for Boeing airliners and commercial engine testing for Pratt & Whitney.

Some Key Alliances

Major Industry Alliances:

- Boeing
- General Electric Aircraft Engines
- Lockheed Martin
- Pratt & Whitney (United Technologies)

Educational Alliances:

- Air Force Institute of Technology
- Hands-on Science Center
- Middle Tennessee State University (MTSU)
- Motlow State Community College
- Tennessee Technological University
- University of Maryland
- University of Tennessee Space Institute
- Vanderbilt University

Other Government Agencies:

- AEDC/NASA/DOE (Tri-Lateral Alliance)
- Air Force Seek Eagle Office
- Defense Threat Reduction Agency
- DOE - Oak Ridge National Laboratory
- NASA - Ames Research Center
- NASA - Lewis Research Center
- NASA - Stennis Space Center
- Naval Air Warfare Center Aircraft and Weapons Divisions
- Tennessee Valley Authority

Community Agreements/ Membership:

- AEDC Heritage Foundation
- Alvin C. York VA Medical Center
- Local Police, Fire and Ambulance Services
- Southern Tennessee Medical Center
- Tennessee Correction Academy
- Tennessee Economic and Community Development Agency

Directorate of Operations

America's Air & Space Advantage

Aerodynamics

Aeropropulsion

High Performance Computing

Technology

Space and Missiles

Directorate of Operations

Mission

Provide fast, effective and affordable test and evaluation services to DoD customers, U.S. government agencies and commercial corporations. Ensure that test capabilities, technology and analysis will support both today's and tomorrow's customers.

The Directorate of Operations manages operations and maintenance of AEDC's Research and Development Test & Evaluation infrastructure and investment programs to meet testing requirements; develops future workload to establish resource requirements for budget and operating contract formulation; manages the allocation of resources between the approved annual program for test, analysis, research, technology, operations, maintenance, repair, improvement and modernization; interfaces with DoD, government, and commercial acquisition and development organizations to provide project and engineering management for test, research and technology projects; directs investment programs to sustain and modernize test facility infrastructure and technology programs to improve AEDC test capabilities; develops new test capabilities to satisfy future requirements; and evaluates test support contractor's performance.

Col. Vincent Albert (right) serves as Director of Operations; Ron Polce is the Technical Director.

Fiscal 2002 Overview

The Directorate of Operations oversees and manages the AEDC testing divisions including Aerodynamics (Flight Systems), Aeropropulsion, Space and Missiles and Technology. A recap of fiscal 2002 is provided in the pages that follow, along with a forecast for fiscal 2003 in each of our major mission areas.

AEDC's total customer funding for all testing in fiscal 2002 was $90 million–a decrease of more than $11 million from fiscal 2001 due primarily to a reduction in propulsion testing. Air Force-led projects represented about one-third of the center's total workload, with joint and commercial programs making up another third of the total. The remaining third of the workload was composed of a combination of missile defense agency, Navy, Army and other government programs.The general trend in testing has been stable, but fiscal 2002 was the first year of a projected lull in aeropropulsion development testing following the completion of development for the Joint Strike Fighter engine. Commercial and Advanced Missile Signature Center testing are continuing to grow.

Some of the major test programs AEDC supported in fiscal 2002 include the Air Force's top priority program, the F/A-22 Raptor air dominance fighter, development work for the Joint Strike Fighter, continuing testing for the Joint Direct Attack Munition, and cryogenic liquid propellant rocket engine testing for the Boeing Delta IV Evolved Expendable Launch Vehicle (EELV). Many other programs such as national and theater missile defense, space access, commercial and various classified programs were also tested in fiscal 2002.

F/A-22 Raptor.

Fiscal 2003 Forecast

In fiscal 2003, the center will continue to provide support for the F-35 Joint Strike Fighter F/A-22, F-15, F-16 and F/A-18E/F and as well as commercial tests.

Active testing in the 16-foot and 4-foot wind tunnels resume in fiscal 2003. Engine Component Improvement Program (CIP) tests continue to be the largest occupant in our large propulsion test cells. An increase in ballistic missile, missile defense agency and space access programs are also scheduled. Upgrade and modernization work will continue on the Propulsion Wind Tunnel complex, as well as data and control systems for critical test

Navy F/A-18 Super Hornet.

F-35 Joint Strike Fighter.

F-15 Strike Eagle dropping JDAMS

cells. A military construction project funded in fiscal 2002 will allow AEDC to close the aging Engine Test Facility (ETF) air supply infrastructure. Other investments will continue to improve testing productivity and environmental factors while lowering life cycle costs to the test customers and DoD.

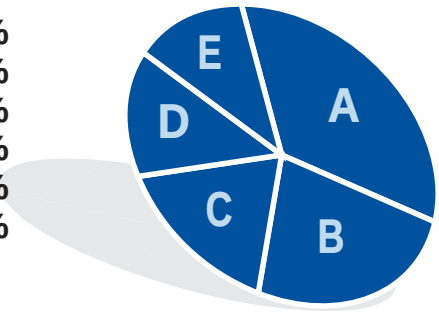
Total replacement cost for AEDC test facilities now exceeds seven billion dollars.

Government, commercial and educational organizations interested in testing at AEDC should visit our extensive Web site at www.arnold.af.mil or contact the Directorate of Operations at (931) 454-6418 (DSN 340-6418), where they will be directed to the appropriate test/technology program manager.

First Delta IV Evolved Expendable Launch Vehicle (EELV) successfully deployed a $200 million defense communications satellite.

Fiscal 2000 Total Workload by Revenue

A	Air Force	32%
B	Joint	24%
C	Commercial	16%
D	Other Government	14%
E	Other DoD	13%
F	Other	1%



Test Mission Areas Total Earnings

A	FY99	$111.9M
B	FY00	$120.1M
C	FY01	$99.5M
D	FY02	$91.4M
E	FY03 Projected	$98.6M

Product Area Earnings

FY	99	00	01	02	03
Aerodynamics	19.3	24.9	26.3	25.0	30.0
Aeropropulsion	59.9	63.3	43.3	32.8	34.1
Space & Missiles	22.1	21.8	20.3	23.5	24.4
Technology*	4.6	9.4	9.7	10.1	10.1

**FY99 technology programs embedded in product area earnings*

Aerodynamics

Mission

Provide fast, effective and affordable aerodynamic test and evaluation services for the DoD, U. S. government agencies and commercial aerospace corporations and ensure that test capabilities support today's and tomorrow's customers. Test assets include the large transonic and supersonic tunnels (16T and 16S), medium-sized transonic tunnel (4T) and hypersonic tunnels (A, B and C) and supporting plants. Analysis and computational modeling, such as computational fluid dynamics, are also key assets.

Air Force Lt. Col. Chris Smith heads the Aerodynamics Division.

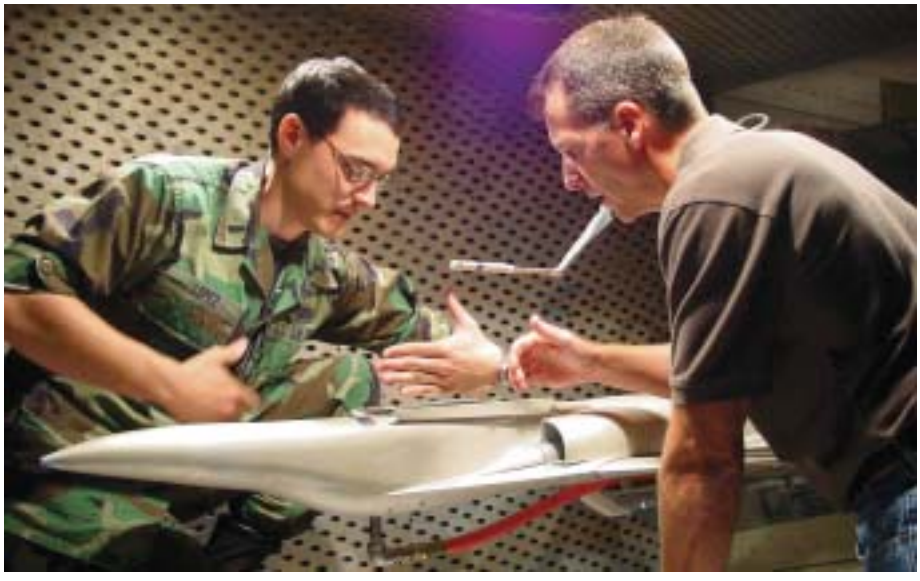
Fiscal 2002 Overview

The earnings for the Aerodynamic Product Area were $25.02 million in fiscal 2002, marking a 4.5 percent decrease under fiscal 2001 earnings. The decrease in earnings was related to anticipated work from Small Diameter Bomb, the Navy's F/A-18 Hornet and Boeing's Sonic Cruiser falling off of the Propulsion Wind Tunnel (PWT) schedule due to uncontrollable circumstances.

The PWT Sustainment Program remains an ongoing effort. Full implementation of the continuous sweep data acquisition technique is providing 16T customers with state-of-the-art test and evaluation tools that have improved cycle time and lowered costs. Other major investments aimed at improving tunnel operation efficiencies completed in fiscal 2002 include: introduction of improved tunnel temperature control by new K1 coolers, partial automation of the Plenum Evacuation System (PES), installation of the dynamic data acquisition system, improving controls for compressor operation in 4-foot transonic wind tunnel, a Mach number calibration of 16-foot transonic tunnel, replacing motor controls for PWT main drives, replenishment of critical component supplies for the PWT main compressors, plenum evacuation system, and high pressure and process air compressors in von Karman Facility (VKF).

An investigation of current force balance manufacturing techniques and comparison of balance suppliers' products with those produced by AEDC was completed. Investments initiated in the small tunnels and VKF in preparation of anticipated space access support testing included: the refurbishment of the Captive Trajectory System and model injection systems in Tunnels A, B and C, restoration of critical component monitoring system required for safe operation of Tunnel A flex nozzle, replacement of small tunnel data acquisition components and replacement of V Plant facility monitoring computers.

The Matrix-One Software® continued under development and implementation to be an invaluable tool to improve customer and AEDC pretest planning and test management by providing accessible, accurate and rapid access to contracting and test performance metrics information. This system was a high priority.



Personnel from the Air Force Research Laboratory prepare an F-111 Aardvark aircraft model for small bomb separation testing at AEDC.

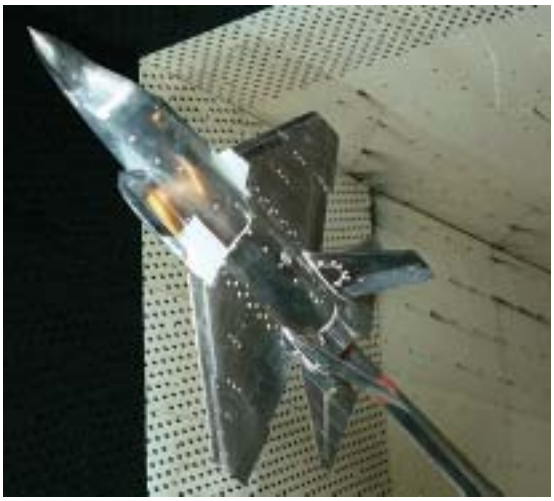
Fiscal 2003 Forecast

Flight testing is risky and expensive. To mitigate the risks, AEDC is increasing the use of integrated test and evaluation techniques.

An integrated, knowledge-based approach to developmental test and evaluation tasks can reduce acquisition costs by increasing the integration of computer modeling and wind tunnel simulations. This, in turn, can decrease the number and duration of individual flight tests and their associated costs without increasing program risk.

AEDC has several successful pilot programs directly supporting flight tests on programs such as the F-111, F/A-22, F-16 and F-15. These programs integrate computational modeling and simulation with ground and flight-test to reduce the cost, cycle time and risk of these critical weapons development programs.

Craftsman repairs fiberglass blade from 16-foot wind tunnel.



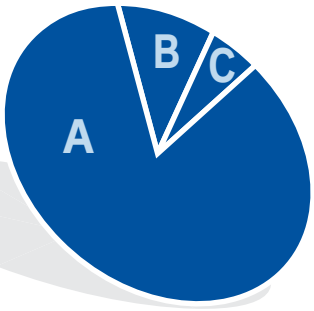
A variant of the F-35 Joint Strike Fighter in the 16-foot transonic wind tunnel.

Full-scale Joint Direct Attack Munition (JDAM) in the 16-foot transonic wind tunnel.

Workers perform maintenance on VKF compressor.

Fiscal 2002 Workload by Customer

A	Joint	84.5%
B	Other Government	9.5%
C	Commercial	3.0%
C	Air Force	2.0%
C	Navy	1.0%



Aerodynamics Total Revenue

A	FY99	$19.3M
B	FY00	$24.9M
C	FY01	$26.2M
D	FY02	$25.0M
E	FY03 Projected	$30.0M

Aeropropulsion

Mission

Provide fast, effective and affordable aeropropulsion test and evaluation services for the DoD, U.S. government agencies and commercial aerospace corporations, and ensure that test capabilities, technologies and analysis support both present and future customers. Key assets include the Aeropropulsion Systems Test Facility engine test cells: C-1 and C-2, Sea Level test cells SL-1,-2,-3 and the Engine Test Facility test cells: J-1, J-2, T-11 and T-12.

Air Force Lt. Col. Bruce Magoon (right) headed up the Propulsion Testing Division in 2002. Navy civilian Jack Walters was his deputy.

Fiscal 2002 Overview

Aeropropulsion generated $32.8 million of revenue in fiscal 2002, accounting for over one-third of AEDC's total reimbursement revenue. The three primary customers were the Air Force, Navy and commercial industry.

The major driver in Aeropropulsion continues to be engine Component Improvement Program (CIP) testing. With development of the Pratt & Whitney (P&W) F119 engine for the F/A-22 Raptor transitioning into CIP, testing funded by CIP increased to nearly 52 percent of the total Aeropropulsion test workload. In addition to the F119, CIP also funded continued testing of the P&W F100 engine for the F-15 Eagle and F-16 Fighting Falcon fighter aircraft, assurance testing of a new digital engine control (DEC) for the General Electric (GE) F118 engine used in the B-2 Stealth Bomber, and fan-disk-cracking investigation testing of the GE TF39 engine for the C-5 Galaxy.

Other Aeropropulsion testing included the Air Force Research Laboratory (AFRL) funded Pratt & Whitney XTC67/1 Advanced Turbine Engine Gas Generator (ATEGG) Core and the Navy funded qualification test of the Williams International F415 engine for the Tactical Tomahawk cruise missile.

Commercial funded testing included the completion of the qualification test of the General Electric F110-GE-132 Enhanced Fighter Engine (EFE) and the development test of the Rolls-Royce Mk951 Adour engine.

The P&W F100-229 engine for the F-15 and F-16 fighter aircraft completed 3,503 sea level accelerated mission tests and 988 RAM accelerated mission cycles in SL-3.

Fiscal 2003 Forecast

Aeropropulsion projects a small rise in revenue in fiscal 2003. Responding to acquisition program needs, the business area strives to focus on reducing the cost of engine test services and translating these savings into reduced prices for our customers. Ongoing investments in a balanced test operations and maintenance program ensure excellent test support while protecting both the test article and test infrastructure.

The P&W F119 engine for the F/A-22 Raptor undergoes CIP testing in the Aeropropulsion System Test Facility Altitude Development Test Cell C-1.

Through benchmarking activities with commercial engine producers and other DoD agencies, Aeropropulsion is eliminating noncompetitive cost areas and business practices. Our customers have greater flexibility to tailor the specific test services required, thus reducing both price and required test times.

As in fiscal 2002, engine CIP will continue to account for the major portion of the fiscal 2003 revenue. Aero-

propulsion will see increased testing of the P&W F119 engine, used in the F/A-22, in AEDC's C-1 and SL-2, as well as increased testing of the P&W F100 engine, used in the F-15 and F-16, in AEDC's J-2 and SL-3. AFRL funded advanced development engine testing will also be conducted with the continuation of the P&W XTC67/1 ATEGG Core test into early fiscal 2003 and with the P&W XTE67/SE1 Joint Technology Demonstrator Engine (JTDE) test, in support of the high cycle fatigue (HCF) initiative, later in the fiscal year.

Commercial testing will continue to be included in the overall Aeropropulsion test workload in fiscal 2003 with the return of the Rolls-Royce Mk951 Adour engine for follow-on development testing. Additionally, the amount of commercial testing is expected to grow as a result of the establishment of stronger partnerships with Pratt & Whitney.

Significant efforts are planned in fiscal 2003 for preparation of the JSF engine testing that is scheduled for November 2003 (early fiscal 2004). Efforts include test cell repair and facility checkouts in order to accommodate the JSF engine requirements.

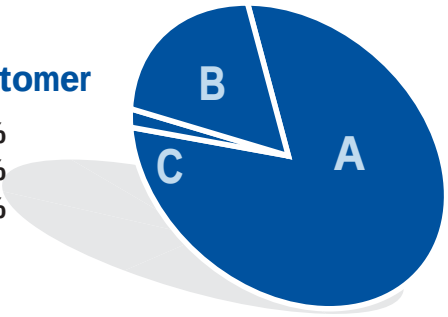
(above) General Electric's TF39-1C engine, powerplant for the C-5 Galaxy, was tested in one of AEDC's large altitude jet engine test cells.

P&W's Joint Strike Fighter Concept development F119 derivative engines underwent more than 1,400 hours of testing in Propulsion Test Cell J-2.

The P&W Advanced Turbine Engine Gas Generator for the Joint Technology Demonstrator engine completed initial operational checkouts including starting and operation at idle conditions in J-1.

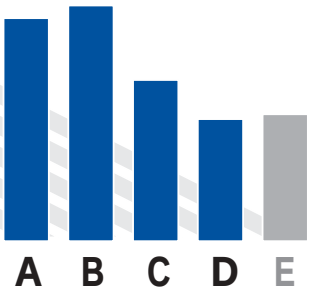
Fiscal 2002 Workload by Customer

A	Air Force	78%
B	Commercial	20%
C	Navy	2%



Aeropropulsion Total Revenue

A	FY99	$59.9M
B	FY00	$63.3M
C	FY01	$43.3M
D	FY02	$32.8M
E	FY03 Projected	$34.1M



Space and Missiles

Mission

Provide fast, effective and affordable test and evaluation services for the DoD, U.S. government agencies and commercial aerospace corporations, and ensure test capabilities to support today's and tomorrow's customers. Test and evaluation services include a broad range of technical disciplines that are divided among five areas: rocket propulsion, space environmental, hypersonics, nuclear weapons effects and missile signatures.

Army Col. James M. Hesson (left) headed up the Space and Missile Division in 2002. Air Force Lt. Col. Curtis R. Amble was his deputy.

AEDC completed its first commercial electric propulsion test in the 12V Space Chamber.

Fiscal 2002 Overview

The Space and Missiles product area earned $23.3 million in fiscal 2002, a 15 percent increase in test revenue from fiscal 2001. Space and Missiles continued with significant investment in select sub-product areas to meet future ground testing requirements.

Cryogenic liquid propellant rocket engine testing for the Pratt & Whitney RL10B-2 engine began in September 2002 in AEDC's J-4 Rocket Development Test Cell with three simulated altitude test firings. Testing supported Boeing's qualification of the engine's large carbon/carbon nozzle expansion skirt for the Delta IV Evolved Expandable Launch Vehicle (EELV), built using new production techniques. The engine provides the EELV with the highest performance upper stage engine of any current launch system.

The J-6 Large Solid Rocket Motor Test Facility supported tests of two Minuteman Propellant Replacement Program motors to verify performance characteristics, as well as aging surveillance testing of a Peacekeeper Stage III. The tests support the Intercontinental Ballistic Missile Program Office's Minuteman III Production Quality Assurance Program.

G-Range, the center's hypervelocity ballistic range, conducted impact lethality testing in support of the Missile Defense Agency (MDA) and the Ground-based Midcourse Defense (GMD) Program (formally National Missile Defense). G-Range conducted eight sub-scale projectile launches against sub-scale simulated nuclear targets for the Boeing GMD Lethality Program. The tests provided data that support GMD's Integrated Flight Test Program. In support of MDA programs, AEDC conducted an experimental study to upgrade the G-Range facility to allow impact lethality testing at speeds up to 22,400 mph. AEDC initiated a five-year G-range upgrade program designed to launch larger subscale projectiles that more closely simulate the actual interceptor. The upgrade will also provide increased velocities and ability to pitch the projectiles at higher angles. The new capability is required for the Theater High Altitude Area Defense (THAAD) Live Fire Test and Evaluation program in 2006.

The High-Enthalpy Ablation Test (HEAT) Facility made seven runs in the H1 arc heater, testing thermal protection components for the Army's THAAD Missile Program. H1 also made 12 runs to develop and qualify thermal protection materials for the Navy's Trident Submarine Launched Ballistic Missile. H1 and H2 arc heaters also saw thermal ablation testing for the Air Force's Re-entry Vehicle Applications Program. The H3 large arc heater underwent checkout testing for 2003 Navy and Air Force tests and the transition to a production test capability in the years to follow.

A Minuteman ICBM upper stage motor is prepared for simulated altitude testing in rocket test cell J-6.

Technicians prepare the Navy/DARPA Dual Combustor Ramjet for a test.

The Aerodynamic and Propulsion Test Unit returned to service with multiple checkout runs for the Navy Dual Combustor Ramjet (DCR) engine test program. DCR testing at Mach 4.1 began late in the fiscal year, with Mach 3.5 testing scheduled in 2003.

AEDC's Hypervelocity Wind Tunnel 9 in White Oak, Md., continues to provide test support and capability enhancement for MDA. Tunnel 9 completed a three-year Test Technology Development and Demonstration (TTD&D) project sponsored by the Office of the Secretary of Defense (OSD) to develop advanced sensors to extend new aero-optics capabilities, as well as develop interface between that capability and the target-scene-generation capabilities of hardware-in-the-loop facilities supporting MDA interceptor development. Since completion, Tunnel 9 has conducted significant one-of-a-kind measurements at Mach 7 to fully integrate and validate the new capability for MDA. MDA interceptor programs, such as THAAD and Arrow have been briefed on this data for future test planning purposes at AEDC.

The Advanced Missile Signature Center (AMSC) provides archival, analysis and distribution services for DoD and continued to be active in supporting MDA, Defense Threat Reduction Agency (DTRA), USASMDC, AFRL, DIA/MSIC, DARPA, CECOM, ARL and other organizations. MDA and its associated execution agencies are the primary customers.

The AMSC saw a total 2002 budget of $4.3 million with $2.5 million from MDA, partially for expansion of the Virtual Data Center (VDC) classified network. The AMSC was designated the archive for the Corporate Lethality Program (CLP) and published more than 750 documents on-line for unclassified CLP access. Preliminary exploitation of the Cobra Ball Multi-Optics Data System 70-mm film legacy data using modern processing tools extended AMSC's support to MDA programs, resulting in a partnership with the National Air Intelligence Center. MDA also used AMSC subject matter expertise to validate the initial operational capability of the High Altitude Observatory (HALO II) sensor system and to assess deficiencies in threat and target data required for the Boost Phase Intercept program. AMSC continues to load Tactical Missile Signature data into a Central MASINT Office on-line signatures database with funding from the National Ground Intelligence Center.

An AMSC-Redstone Technical Test Center HPCMO CHSSI project was started to generate real-time 3-D missile fly-out signatures for insertion into an Anti-Tan Guided Missile hardware-in-the-loop training simulator. Other primary modeling and simulation efforts focused on predicting signatures of foreign tactical missiles for use in intelligence community signature assessments and in developing an empirical plume transient feature model for use in the MDA Battlespace Environment Simulation Tool. Other efforts included monitoring a MDA Small Business Innovative Research effort to improve the efficiency of radiation prediction codes and acquiring the NATO developed NIRATAM/NEOTAM signature prediction code. The AMSC Field Measurement group, consisting of personnel from the Space and Missiles and Technology divisions, was quite active in supporting MDA and earned AEDC's Quarterly Team Excellence Award for its support to MDA's System Integration Test II.

Sensor test chamber 7V supported Ground Missile Defense programs. MDA provided funding to sustain space sensor test capabilities in chambers 7V and 10V and supported a variety of facility upgrade efforts throughout the year, including two checkout pump-downs, the second of which was a risk reduction effort for the AE-GIS Ballistic Missile Defense Program. The 10V chamber hardware-in-the-loop upgrade program for GBI testing underwent several project challenges this year with two Boeing-proposed program terminations being reversed, as a result of MDA, GMD and AEDC efforts. The program ended the year on firm footing. A successful Preliminary Design Review was held in December 2001 with more than $5 million in contracts awarded on critical long lead procurements by AEDC Contracting and Boeing on behalf of AEDC. Design efforts are nearing completion, with Critical Design Review scheduled in January 2003. The revised facility Initial Operating Capability is September 2005.

AEDC tests of the RL-10B2 rocket motor supported the first launch of the Delta IV.

AEDC demonstrated successful electric propulsion (EP) test capability in 12V test chamber, using a Hall

Looking up from 260 feet down in Rocket Development Test Cell J-4.

thruster at simulated deep space environment conditions. Lockheed Martin Space Systems used 12V to conduct Hall Thruster plume characterization testing for the U.S. Air Force Advanced Extremely High Frequency Satellite Program. This test leveraged heavily on support from AEDC's Technology directorate for 31 GHz microwave interferometry and UTSI for Langmuir Probe instrumentation.This was the first test under the Lockheed-Martin/AEDC Memorandum of Understanding, signed last year.

The Decade Radiation Test Facility Quad X-ray simulator, operating in the cold X-ray hardware configuration, was put through a series of performance tests to optimize its performance characteristics. These tests will continue into 2003.

Initial planning and design was accomplished for a $42.7 million DoD-funded enhancement to Decade. The seven-year program will provide an unprecedented national nuclear weapons effects simulation capability designed to closely simulate the total spectrum of photon radiation emitted by a nuclear blast in space. The capability will provide the U.S. with a previously unavailable means to ensure that space assets (satellites, missiles, missile interceptors, etc.) are nuclear environment survivable.

Fiscal 2003 Forecast

The Space and Missiles business area expects a small increase in total tests over 2003. Past forecasts predicted large increases in space technology spending by the Air Force over the next decade, but many key programs have met technical and funding challenges. The Space and Missiles growth period is now expected to start in 2004 and 2005. During 2003, Space and Missiles will remain heavily engaged with programs to determine investment requirements for test facilities to meet projected increase in workload in the out years.

Rockets

No liquid rocket engine test programs for either commercial or Air Force Evolved Expendable Launch Vehicle programs are projected for 2003. AEDC is in the initial planning efforts for NASA's Space Launch Initiative large cryogenic engine development program.

The nation's ICBM fleet continues to undergo testing at AEDC. A total of four Minuteman III Propellant Replacement Program second and third stage motors will be tested in the J-6 Large Rocket development Test Facility to assess motor production quality in 2003.

Hypersonic Testing

The use of hypersonic systems has received increased attention in the DoD for space access missions. AEDC's hypersonic test infrastructure represents the majority of the nation's hypersonic test and evaluation capability and will be useful in the development of high speed strike systems, defensive interceptors and access to space platforms.

Following completion of the Navy's DCR test program, the Aerodynamic and Propulsion Test Unit will be turned over to the Army Core of Engineers to undergo a $10.4 million upgrade, including installation of a sudden expansion burner, increased high pressure air storage and an improved air ejector. The upgrade will permit testing for extended run times at Mach 8 conditions.

The G-Range Hypervelocity Ballistic Range is the only facility in the U.S. capable of meeting the lethality requirements of MDA's GMD Program. The Live Fire Test and Evaluation phase for GMD will begin in fiscal 2003. AEDC will continue testing for Boeing, the prime contractor for the GMD program, to obtain data in support of flight testing. Near full-scale lethality testing for the Aegis Ballistic Missile Defense program, as well as testing for DARPA's scramjet technology effort are also programmed.

Developmental work in the HEAT facility will continue on a production model positioning system for the H3 Large Arc Heater. The ADACS CTEIP-

An upgrade to the High Altitude Observatory (HALO) is prepared for testing in the center's 7V Space Environmental Chamber.

funded investment will allow production testing of up to 10 models on a single run. In the meantime, testing of single specimens will correlate data preparation for transition of testing to the H3 heater.

As the U.S. Air Force looks to hypersonics for access to space and other missions, it is expected that Tunnel 9 will continue to provide high Mach number test and evaluation for vehicle configurations and engine inlets. Hypersonic test support for MDA will continue as the various interceptor programs look to Tunnel 9 for sensor window testing. Development of the complete aero-optics test capabilities are expected to be completed this year, and planning continues to conduct seeker window tests in support of

MDA's technology programs. New data requirements for high-speed aerodynamics and aerothermodynamics are evident, and MDA will continue to rely on Tunnel 9's unique capabilities.

Environmental Space

Support of the NMD GBI program will continue in the 7V and 10V sensor chambers. Significant design, procurement and fabrication efforts will be completed for the AEDC GBI 10V Upgrade Program in support of an initial operating capability at the end of fiscal 2003.

AEDC's budget for 10V upgrade for GBI has been set at $2.1 million, including labor, consultants and materials, out of a total Boeing fiscal 2003 budget of $11 million and an overall 10V upgrade budget of $50 million from 2001 through 2005. A number of major procurements will be completed or near completion at the end of 2003 with delivery of all major equipment. Installation and integration into the chamber will be initiated in August 2003. Boeing's schedule stretches have pushed the IOC to the end of 2005, causing some problems in adequately supporting the acceptance testing of these critical procurements. Overall, the program seems to be on track for activation in 2005.

2003 will see more customer tests of electric propulsion thrusters in thermal vacuum chamber 12V. This new test capability provides customers with a high vacuum, low temperature space environment during thruster operations. Material bake-out tests and contamination studies will be performed in the smaller thermal vacuum chambers. BMDO funding to sustain space sensor test capabilities in 7V and 10V will continue to support a variety of facility upgrade studies and efforts throughout the year.

Nuclear Weapons Effects

Work in the Decade Radiation Test Facility (DRTF) during fiscal 2003 will focus on optimizing the performance characteristics of the plasma radiation source that produces the cold (soft) X-ray portion of the X-ray spectrum produced by a nuclear blast. The effort supports the Defense Threat Reduction Agency's long-range plan to consolidate its nuclear weapons effects simulation capability to AEDC.

Parallel to this effort and continuing for the remainder of 2003 is the development, design, acquisition and integration of key hardware components required for the $42.7 million DoD and MDA-funded enhancement program, which has been underway since 2000. The program is scheduled for completion in 2007 and involves the addition of a second Decade Quad, a prompt gamma source, debris gamma and electrons, and a cryogenic test chamber replete with dynamic scene generation and nuclear clutter. This effort will result in a nationally unique nuclear weapons effects test capability, allowing exposure of test articles to multiple simultaneous nuclear environments, which will more accurately replicate the time history of a nuclear event. The enhanced DRTF is projected to play a critical role in the test and evaluation of crucial components of the National Missile Defense System, as well as all forthcoming national space systems.

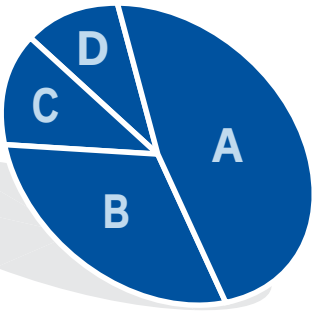
Advanced Missile Signature Center

MDA support and funding for data center operations and Virtual Data Center deployment continues in 2003. Additional resources are also expected for processing legacy data, developing disaster recovery plans and capability modernization. As the BMD architecture expands to include a boost defense segment, AMSC support to the missile defense community should grow. HPCMO CHSSI task execution will also build capability for expanding support of other HWIL and scene simulation customers. Measurement support to MDA, DIA, Air Force and Army programs is forecast to continue with several high visibility measurement programs planned.

The Theater High-Altitude Area Defense Dem-Val missile model was tested in AEDC's Hypervelocity Wind Tunnel 9 in White Oak, Md. and in VKF.

Fiscal 2002 Workload by Customer

A	Other DoD	47%
B	Commercial	29%
C	Air Force	13%
D	Army	7%
D	Navy	4%



Space and Missiles Total Revenue

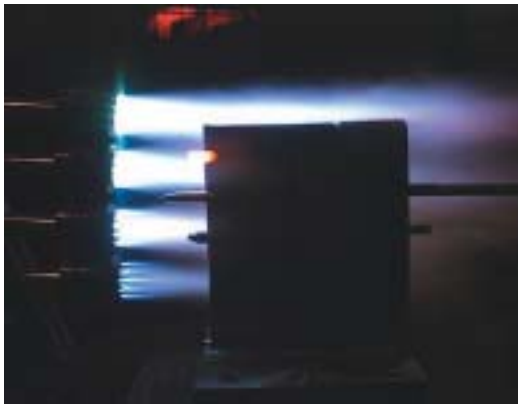
A	FY99	$22.1M
B	FY00	$21.8M
C	FY01	$20.3M
D	FY02	$23.5M
E	FY03 Projected	$24.4M

Technology

Mission

The Applied Technology Division develops technologies that enable faster, more effective and affordable test services for AEDC's three test product areas to ensure that test capabilities, techniques and analysis support today's and tomorrow's customers. These technologies include new or improved test techniques, test facility capability (performance, efficiency, productivity), instrumentation, information processing, computational techniques, analyses and foreign technology assessments. The division also provides applied technology and analysis services to a wide range of external customers.

Tom Best (left) leads the Applied Technology Division assisted by Robert Crook.



A shielded thermocouple probe undergoing thermal qualification testing in an oxy/acetylene torch rig.

Fiscal 2002 Overview

In fiscal 2002, the Applied Technology Division carried out a $29 million program, of which $10.2 million was customer funded.

The three AEDC product areas fund programs to benefit their specific areas. These tend to be near-term and requirements-driven. Examples are: The Wind Tunnel Flow Diagnostics, Pressure Sensitive Paint (PSP), Model Attitude and Deformation (MA&D), Captive Trajectory System test techniques and Jet Interaction (JI).

Propulsion technology developments have been focused on test techniques, information management, facility and plant modeling, engine structural analysis, instrumentation, diagnostics and facility technologies. The programs tackle development challenges on the F/A-22 Raptor, F-35 Joint Strike Fighter and Unmanned Aerial Vehicles.

Space technology emphasis has been towards increased facility capability, hypersonic test techniques, instrumentation, nuclear weapon effects, and rocket test and analysis enhancement.

A major part of the program was core technologies that have joint application to the product areas or those with projected payoffs five to 10 years in the future.

These include: the introduction and integration of new sensor technology into the production environment, reducing test installation time and improving system performance and reliability. Advanced turbulence modeling simulating unsteady shear layer applications will improve the store separation accuracy for advanced aircraft and the capability to predict aerodynamic flow fields for inlets.

The program works on efforts funded by external sources like the Small Business Innovation Research (SBIR) program, the DoD Test Technology, Development and Demonstration (TTD&D) program, the Air Force Office of Scientific Research (AFOSR) and various other technology customers.

The division emphasizes working with other organizations to leverage its investments in research. Partners include NASA (Langley and Glenn Research Centers and Marshall Space Flight Center), Boeing Co., Air Force Research Laboratory, University of Tennessee Space Institute, Vanderbilt University, Air Force Institute of Technology, University of Maryland, the DoE Oak Ridge National Laboratory, the DoE Sandia National Laboratory and the DoD High Performance Computing Modernization Office.

Fiscal 2003 Forecast

The fiscal 2003 workload is about the same as fiscal 2002.

The RBA program providing technology products to others will grow somewhat. Providing faster, cheaper access to customer test data and analysis will be a key part of the program. The program will still support future PSP improvements, as well as the demonstration/transition efforts associated with MA&D, CTS, JI and force balance technology development. Further developments will be sought in distortion synthesis, icing certification, data validation manager, dynamic data measurement and analysis, measurement techniques and plant control automation support. Cost and test efficiency will be major targets.

Successful collaboration will continue with the AFOSR and TTD&D, which fund development of new AEDC test or modeling and simulation techniques. The SBIR program will continue to be an important part of the total effort. The new programs for funding technology begun in fiscal 2002 will continue.

High Performance Computing

Fiscal 2002 Overview

AEDC maintains one of the Department of Defense's High Performance Computing Modernization Program (HPCMP) Distributed Centers (DC). AEDC boasts the most powerful computational capability supporting the Test and Evaluation (T&E) community.

The center's test mission requires reliable, time-critical, secure processing of test information in near real-time with HPC systems connected to test facility networks. In addition to a near real-time requirement, the center supports a substantial modeling and simulation mission in support of Integrated T&E. Much of the modeling and simulation work has the same time-critical, secure processing requirements as near real-time work playing a key role in weapons system design and testing.

In fiscal 2002, HPC resources supported a wide variety of testing and modeling and simulation work. Efforts included support for operational weapon systems, such as the F-16 Fighting Falcon and new systems, such as the F/A-22 Raptor and the F-35 Joint Strike Fighter (JSF). HPC resources were also used to support test facility modeling; significantly reducing downtime of test facilities and minimizing risks to personnel and facility infrastructure during improvements. Facility models were also used to ascertain whether test facilities could simulate the environmental conditions an aircraft propulsion system will experience in flight. Other modeling and simulation was performed in support of Orbital Sciences Space Taxi™ reusable space vehicle.

In fiscal 2002, the center began a $3.25 million upgrade to its HPC assets. This funding made it possible to nearly triple the computational capability of AEDC's HPC systems from 320 gigaflops to 930 gigaflops. The upgrade also included the replacement of mass storage systems tape drives increasing the speed and reliability of the data archival systems.

Fiscal 2003 Forecast

The center is pursuing initiatives to reduce test cycle time, cost and risk by infusing computational simulation into test processes. These initiatives depend on state-of-the-art HPC resources and include:

Model-based test data validation - Test data is compared with real-time simulations in order to provide time-critical diagnostics for instrumentation in hostile environments.

Non-intrusive instrumentation - Pressure-Sensitive Paint (PSP) is one of many non-intrusive techniques that promise to substantially decrease labor costs and increase data production, especially for wind tunnels.

Integrated test information - Many data flows will be fused interactively into a single real-time stream. These flows include test data, archived data, management information and simulations.

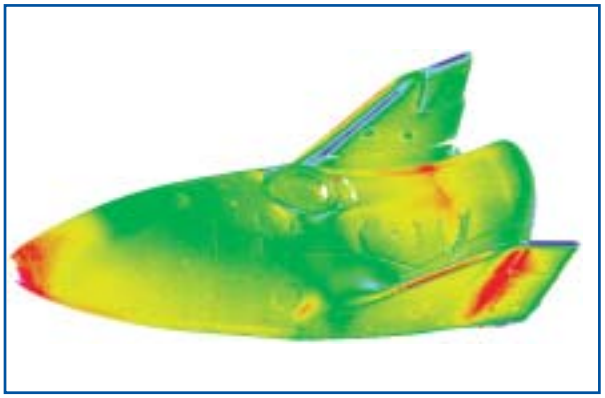
Test-Driven Computational Fluid Dynamics (CFD) - CFD calculations are used to reduce the test schedule by reducing the amount of testing required in ground test facilities. CFD also provides critical design information to weapon system developers.

In fiscal 2003, AEDC will complete upgrades to the HPC systems begun in fiscal 2002. These upgrades will allow AEDC to meet computational requirements into fiscal 2005 and will preserve the center's reputation as the most computationally powerful T&E site within the DoD HPCMP.

Mission

Provide the near real-time and off-line computational resources in support of Integrated Test & Evaluation (IT&E) mission.

The full scale AIM-9 Sidewinder short-range air-to-air missile shown in 16T during a flow visualization test.

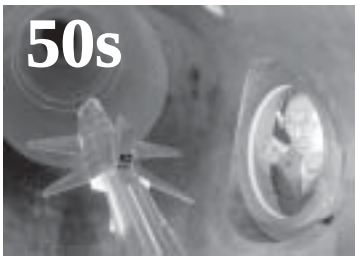


Pressure sensitive paint image of NASA's X-38 vehicle.

AEDC Test Facilities

Wind Tunnels

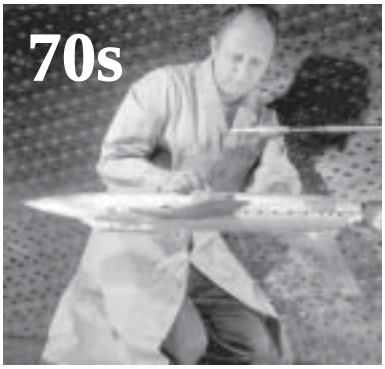
16T *- 16-foot Transonic*
16S *- 16-foot Supersonic**
4T *- 4-foot Transonic**
Tunnel A *- Supersonic**
Tunnel B *- Hypersonic **
Tunnel C *- Hypersonic and Aerothermal**
APTU *- Aerodynamic and Propulsion Test Unit**
Tunnel 9 *- Hypervelocity (AEDC White Oak, Md.)**



X-15.

Ranges

G-Range *- Hypervelocity Range/Track**
***I-Range**
S-1 *- Hypervelocity Impact Range*
S-3 *- Bird Impact Range*



F-105 Thunderchief.

Radiation

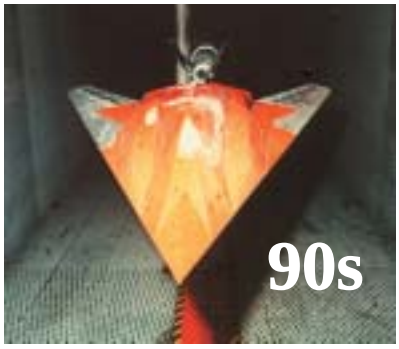
MBS *- Modular Bremsstrahlung Source*
Decade *- Radiation Test Facility**

Contamination

BRDF *- Bidirectional Reflectance Distribution Function*
COP *- Cryogenic Optical Properties Chamber*
SMOG *- Space Materials Outgassing Chamber*
SAM *- Solar Absorption Measurements Chamber*

Thermal Vacuum Chambers

Mark I *- Aerospace Environmental Chamber*
12V *- Aerospace Chamber*



F-117 Nighthawk.

Sensor Test Facilities

FPCC *- Focal Plane Characterization Chamber*
DWSG *- Direct Write Scene Generator*
7V *- Aerospace Chamber**
10V *- Aerospace Chamber**

Arc Heaters

H-1 *- High-Enthalpy Ablation Test (HEAT) Unit**
H-2 *- High-Enthalpy Ablation Test (HEAT) Unit **
H-3 *- High-Enthalpy Ablation Test (HEAT) Unit**
HR *- Sensor Checkout †*

Component Check Out

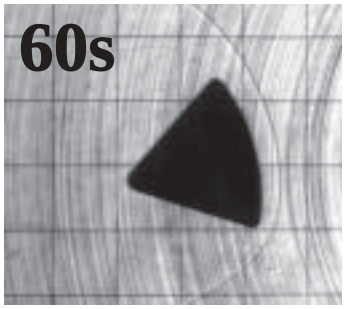
7A* *- Vacuum*
UHV *- Ultra-High Vacuum*

Cryogenic Vacuum

4x10 *- Propulsion/Plume Effects Chamber*
CroVac *- Cryogenic Vacuum*

Propulsion Research Cells

R1A1 *- Combustion Research Cell*
R1A2 *- General Research Cell*
R2A2 *- Freejet Research Cell*
R1D *- Icing & Severe Weather Simulation**
R1E *- General Research*
R2H *- Ultra-High Altitude Research Test Cell**



Apollo Capsule.

Rocket Altitude Test Cells

J-3 *- Vertical Liquid/Solid Rocket Test Cell* †*
J-4 *- Vertical Liquid/Solid Rocket Test Cell**
J-5 *- Horizontal Solid Rocket Test Cell* †*
J-6 *- Horizontal Solid Rocket Test Cell**

Space Shuttle.

Gas Turbine Engine Test Cells

T-1 *- Propulsion Development Test Cell †*
T-2 *- Propulsion Development Test Cell †*
T-3 *- Propulsion Development Test Cell **
T-4 *- Propulsion Development Test Cell*
T-5 *- Propulsion Development Test Cell †*
T-7 *- Propulsion Development Test Cell †*

J-1 *- Propulsion Development Test Cell*
J-2A *- Propulsion Development Test Cell*
J-2 *- Propulsion Development Test Cell*
T-11 *- Small Turbine Engine Test Cell*
T-12 *- Turboshaft Engine Test Cell †*
C-1 *- Aeropropulsion Systems Test Facility**
C-2 *- Aeropropulsion Systems Test Facility**
SL-1 *- Sea Level Test Facility*
SL-2 *- Sea Level Test Facility*
SL-3 *- Sea Level Test Facility*

Others

ACL *- Air Calibration Lab*
AMSC *- Advanced Missile Signature Center**

F-35 Joint Strike Fighter.

** Unique facilities*
† Inactive or standby

Major Systems Tested at AEDC

Fighters

F-4 Phantom II, F-5 Freedom Fighter, F-14 Tomcat, F-15 Eagle/Strike Eagle, F-16 Fighting Falcon, F/A-18 Hornet, F/A-18 E/F Super Hornet, F-20, F/A-22 Raptor, F-35 Joint Strike Fighter, F-105 Thunder Chief, F-111 Aardvark, F-117A Nighthawk, LAVI (Israel)

X-15 Rocket Plane.

Attack

A-6A Intruder, A-7 Corsair II, AV-8A Harrier, A-10 Thunderbolt II, A-37

Bomber

B-52 Stratofortress, B-58 Hustler, B-1 Lancer, B-2 Spirit, FB-111

F-105 Thunderchiefs with KC-135.

Transports/Tankers/ Special Mission

C-130 Hercules, C-141 Starlifter, C-5 Galaxy, C-17 Globemaster III, KC-135 Stratotanker, E-3A (AWACS) Sentry, EF-111 Raven, V-22 Osprey

Trainers

T-6 Texan II, T-37 Tweet, T-38 Talon, T-46, Dornier Alpha Jet

Experimental/Prototype/Demonstrators

YA-9, YF-17, Microfighter, YF-23, X-32 and X-35 Joint Strike Fighter Prototypes

X-Planes

XB-70 Valkyrie, X-29, XT-4 (Japan), X-15, X-24A, X-24B, X-24C, X-30 National Aerospace Plane, X-32 and X-35 Joint Strike Fighter Demonstrators, X-33 (Lockheed Martin Skunk Works), X-43, X-37, X-38

Unmanned Aircraft

Firebee, Global Hawk, UCAV

F-117 Nighthawk Stealth Fighter.

Commercial

Boeing 747, Boeing 767, Boeing 777, Airbus

Air-to-Air Missiles

AIM 120 Advanced Medium Range Air-To-Air Missile (AMRAAM), AIM 9 Sidewinder

Cruise Missiles

Air Launched Cruise Missile, Ground Launched Cruise Missile, Navy Tomahawk Cruise Missile, Short Range Attack Missile (SRAM), AGM 158 Joint Air-to-Surface Standoff Missile (JASSM)

Munitions

GBU-31/32 Joint Direct Attack Munition (JDAM), AGM 154 Joint Standoff Weapon (JSOW), ALS 101

Intercontinental/Submarine-Launched Ballistic Missiles

Polaris, Poseidon, Trident, Atlas, Titan, Minuteman, Peacekeeper

Other Missiles Tested

Quail, Army Sergeant Missile, Bomarc, Hedi, Little John, Maverick, Navy Standard Missile, Nike-Zeus, Patriot, Army Pershing, Snark, Sprint, Thor-Delta, Walleye, THAAD

Manned Space Programs

Mercury, Gemini, Apollo, Skylab, Dynasoar, Space Shuttle, Manned Orbiting Laboratory (MOL), Space Station

Apollo spacecraft takes man to the moon.

Satellites and Space Probes

NAVSTAR Global Positioning Satellite, Transtage, IUS, Pam, Star 12-48, Discoverer, Voyager, FLTSATCOM, Intelsat VI, Miniature Vehicle, Eris, Sagittar, Pathfinder, Space Probe, Viking, NOAA/GOES-M Weather Satelite, NASA-MAP, GBI

Space Shuttle launch.

Space Launch Vehicles

Atlas, Saturn V, Scout, Titan II, Titan III, Titan 34D, Vanguard, EELV, Hardware in the Loop, Ground-Based Missile Defense/Lethality

Gas Turbine Engines

Pratt & Whitney
- *TF33 (B-52, KC-135, C-141)*
- *F100 (F-15/F-16)*
- *F119 (F/A-22/JSF)*
- *4084, 4090, 4098 (Boeing 777)*

General Electric
- *J-85 (T-38, F-5, A-37)*
- *F101 (B-1)*
- *F110 (F-16, F-14)*
- *F118-100 (B-2)*
- *F404 (F-117A, F/A-18)*
- *F414 (F/A-18)*
- *TF39 (C-5)*

Rolls-Royce
- *F402 Pegasus (AV-8B Harrier)*
- *Trent 800 (Boeing 777)*

Orneda - Iroquois (AVRO CF-105 Arrow)
Williams - F415-WR-400 (Tomahawk)
Allison - AE3007 (Global Hawk, Embraer 145, Citation X)
Lycoming T-55 (CH-47-D Chinook)

F-35 Joint Strike Fighter.

Test before flight.

Major AEDC Test Facilities
Nominal Values

ENGINE TEST FACILITY	Test Section Size		Total Temperature, °R	Speed Range	Pressure Altitude (Nominal), ft	Capacity of Installed Thrust Stand, lb	Primary Use*
	Cross Section, ft	Length, ft					
Propulsion Development Test Cell T-1***	12.3 diam	39 to 57	380 to 1,110	Mach 0 to 3.0	Sea Level to 80,000	30,000	(2) (6) (9)
Propulsion Development Test Cell T-2***	12.3 diam	42 to 50.5	380 to 1,110	Mach 0 to 3.0	Sea Level to 80,000	30,000	(2) (6) (9)
Propulsion Development Test Cell T-3	12 diam	15	450 to 1,660	Mach 0 to 4.0	Sea Level to 100,000	20,000	(2) (3) (6) (9) (11)
Propulsion Development Test Cell T-4	12.3 diam	39 to 47.8	380 to 860	Mach 0 to 3.0	Sea Level to 80,000	50,000	(2) (6) (9)
Propulsion Development Test Cell T-5 ***	7 diam	17	395 to 660	Mach 0 to 2.0	Sea Level to 80,000	2,000	(2) (6) (9)
Propulsion Development Test Cell T-6 ****	3 diam	18	430 to 760	Mach 0 to 3.0	Sea Level to 90,000	None	(1) (3) (4) (6) (7) (11)
Propulsion Development Test Cell T-7 ***	7 diam	9	395 to 1,110	Mach 0 to 3.0	Sea Level to 80,000	1,000	(2) (6) (9)
Propulsion Development Test Cell T-11	10 x 10	17	395 to 860	Mach 0 to 2.0	Sea Level to 80,000	2,000	(2) (6) (9)
Propulsion Development Test Cell T-12	10 diam	20	396 to 860	Mach 0 to 2.0	Sea Level to 80,000	None (7,000 hp)	(2) (6) (9)
Propulsion Development Test Cell J-1	16 diam	65	395 to 1,210	Mach 0 to 3.2	Sea Level to 80,000	50,000	(2) (3) (6) (9)
Propulsion Development Test Cell J-2	20 diam	67.3	395 to 1,110	Mach 0 to 3.0	Sea Level to 80,000	50,000	(2) (3) (6) (9)
Propulsion Development Test Cell J-2A****	18.3 diam	32	(Wall, 144)	Static	450,000	20,000	(1) (5) (11)
Sea Level Test Cell SL-1	24 x 24	50	Ambient	Static	Sea Level	52,500	(2)
Sea Level Test Cell SL-2	24 x 24	62	395 to 720	Mach 0 to 1.1	Sea Level	50,000	(2) (6) (9)
Sea Level Test Cell SL-3	24 x 24	50	395 to 720	Mach 0 to 1.1	Sea Level	30,000	(2) (6) (9)
Propulsion Development Test Cell C-1	28 diam	57	360 to 1,480	Mach 0 to 3.8	Sea Level to 100,000	100,000	(2) (3) (6) (9)
Propulsion Development Test Cell C-2	28 diam	57	360 to 1,110	Mach 0 to 3.0	Sea Level to 100,000	100,000	(2) (6) (9)
Rocket Development Test Cell J-3**	12 diam 17 diam	26 High 20, 30, 40 High	– – –	Static	125,000	200,000	(1) (5)
Rocket Development Test Cell J-4	48 diam	82 High	– – –	Static	100,000	500,000	(1) (5) (11)
Rocket Development Test Cell J-5 ***	16 diam	50 to 85	– – –	Static	100,000	300,000	(1) (5) (11)
Rocket Development Test Cell J-6	26 diam	50 to 85	– – –	Static	100,000	500,000	(1) (5) (11)

PROPULSION WIND TUNNEL FACILITY	Test Section Size		Total Temperature, °R	Speed Range	Pressure Altitude (Nominal), ft	Dynamic Pressure, psf	Reynolds No./ft (x10^{-6})	Primary Use*
	Cross Section, ft	Length, ft						
Propulsion Wind Tunnel 16T	16 x 16	40	540 to 600	Mach 0.06 to 1.6	Sea Level to 90,000	2 to 1,100	0.2 to 6.0	(6) (9) (14)
Propulsion Wind Tunnel 16S ***	16 x 16	40	580 to 1,080	Mach 1.5 to 4.75	45,000 to 155,000	25 to 550	0.1 to 2.4	(6) (7) (9) (14)
Aerodynamic Wind Tunnel 4T	4 x 4	12.5	540 to 600	Mach 0.2 to 2.0	Sea Level to 65,000	20 to 1,400	2.0 to 7.0	(6) (14)

HYPERVELOCITY WIND TUNNEL 9	Test Section Size, in.	Total Pressure, psia	Total Temperature, °R	Speed Range	Pressure Altitude, ft	Dynamic Pressure, psf	Reynolds No./ft (x10^{6})	Primary Use*
Aerodynamic Facilities	33 diam Free Jet	1,000 to 11,500	1,500 to 1,750	Mach 7.3 to 7.9	50,000 to 97,000	986 to 10,450	4.3 to 48.4	(6) (7) (15)
	60 diam	500 to 14,000	1,700 to 1,800	Mach 9.5 to 10.2	81,000 to 155,000	144 to 4,000	0.86 to 20	(6) (7)
	60 diam	300 to 19,000	2,460 to 3,160	Mach 12.8 to 14.1	128,000 to 220,000	20 to 950	0.11 to 3.8	(6) (7)
	60 diam	3,200 to 19,500	2,900 to 3,150	Mach 15.5 to 16.4	154,000 to 191,000	87 to 465	0.53 to 2.55	(6) (7)
Thermal Structural Facilities	11.3 diam Free Jet	2,800 to 5,600	3,200 to 3,400	Mach 6.7 to 6.8	38,000 to 52,000	3,500 to 6,900	4.0 to 8.0	(6) (7) (16) (17)

von KARMAN GAS DYNAMICS FACILITY	Test Section Size, in.	Total Pressure, psia	Total Temperature, °R	Speed Range	Pressure Altitude, ft	Dynamic Pressure, psf	Reynolds No./ft (x10^{6})	Primary Use*
Supersonic Wind Tunnel A	40 x 40	1.5 to 200	530 to 750	Mach 1.5 to 5.5	16,000 to 151,000	53 to 1,780	0.3 to 9.2	(6) (7) (14)
Hypersonic Wind Tunnel B	50 diam	20 to 900	700 to 1,350	Mach 6 to 8	98,000 to 180,000	43 to 590	0.3 to 4.7	(6) (7) (14)
Hypersonic Wind Tunnel C	50 diam	200 to 1,900	1,650 to 1,950	Mach 10	132,000 to 188,000	43 to 430	0.3 to 2.4	(6) (7) (14)
Aerothermal Wind Tunnel C	25 diam Free Jet	200 to 2,000	1,220 to 1,900	Mach 8	95,000 to 149,000	132 to 1,322	0.7 to 7.8	(6) (7) (13)
	25 diam Free Jet	20 to 180	720 to 1,660	Mach 4	56,000 to 105,000	231 to 1,928	0.2 to 8.1	(6) (7) (13)
Aerodynamic and Propulsion Test Unit (APTU)	192 diam	20 to 300	700 to 2,000	Mach 0.9 to 4.1	Sea Level to 80,000	500 to 9,300	1.1 to 3.16	(1) (3) (4) (6) (7) (9) (11) (12) (13)
Hypervelocity Range/Track G	120 diam	– – –	– – –	To 24,000 fps	Sea Level to 244,000	– – –	– – –	(8) (10)
Hypervelocity Impact Range S1	Target Tank 30 diam	– – –	– – –	To 32,000 fps	Sea Level to 244,000	– – –	– – –	(10)
Bird Impact Range S3	240 x 144	– – –	– – –	200 to 1,400 fps	Sea Level	– – –	– – –	(10)

ARCS	Nozzle Exit Diameter, in.	Model Enthalpy, Btu/lb	Model Pilot Pressure, atm	Mach Number	Erosion Simulation		Primary Use*
					Dust Particle Diameter, µm	Dust Velocity, fps	
High Enthalpy Ablation Test Unit (HEAT) H1	1.12 to 3.0	1,500 to 9,000	8 to 95	1.8 to 3.5	70 to 200 Graphite	5,800 to 7,300	(13)
High Enthalpy Ablation Test Unit (HEAT) HR **	1.8 to 3.2	2,000 to 5,200	19 to 77	1.1 to 4.0	– – –	– – –	(13)
High Enthalpy Ablation Test Unit (HEAT) H2	5, 9, 24, 42	2,000 to 5,200	0.14 to 3.4	3.4 to 8.0	– – –	– – –	(7) (13)
High Enthalpy Ablation Test Unit (HEAT) H3	5, 9, 24, 42	1,500 to 9,000	8 to 75	1.1 to 3.5			

Major AEDC Test Facilities
Nominal Values

AEROSPACE CHAMBERS	Test Section Size		Wall Temp., K	Chamber Empty Pressure, torr	Pressure Altitude, miles (1962 U.S. Std Atm)	Thermal Radiation Simulation	Primary Use*
	Cross Section, ft	Length, ft					
Mark I	42	(Vert.) 82	77	10^{-7}	210	Collimated Solar and Programmed Heat Flux	(5)
10V	10	(Vert.) 30	77	10^{-7}	200	Tungsten Lamps	
12V	12	(Vert.) 35	77	10^{-7}	200	8-ft-diam Xenon Solar and Programmed Tungsten Lamps	
7V	7	24	<20	10^{-7}	200	N/A	
FPCC	5	5	<20	10^{-7}	200	N/A	
DWSG	Varies	Varies	<20	N/A	200	N/A	
BRDF	3	5	AMB	10^{-5}	AMB	N/A	
COP	2	3	77	10^{-5}	200	N/A	
SAM	2	15	77	10^{-7}	200	Xenon Lamp	
SMOG	2	1	AMB	10^{-5}	AMB	N/A	
7A	3	5	<20	10^{-7}	200	– – –	
UHV	2	3	<20	10^{-7}	200	N/A	

DECADE RADIATION TEST FACILITY	Average Dose	Area	Dose Rate	Pulse Width FWHM	Vacuum Chamber Size	Average Peak Diode Voltage	Primary Use*
Bremsstrahlung Sources							
Decade Quad	20 krads (Si)	2,000 cm^2	1 x 10^{11} rad/se	<50 msec	5-ft diam x 10-ft length	<1.8 MV	(18)
MBS	410 rads (Si)	3,000 cm^2	1 x 10^{10} rad/sec	30 nsec	5-ft diam x 10-ft length 2-ft diam x 3-ft length	< 200KV	(19)
Plasma Radiation Sources							
Decade Quad	Under development. Source intensity >30KJ, debris-free area >150 cm^2.						

USE LEGEND: * Testing of (1) Rockets, (2) Turbojets (3) Ramjets (4) Missile Base Heating Models, (5) Space Environmental Tests, (6) Aerodynamic Models, (7) Aerothermodynamic Models, (8) Aeroballistic Models, (9) Combined Aerodynamic Inlet and Propulsion System Tests, (10) Impact Studies, (11) Free-Jet Expansion of Rocket Exhaust Plumes, (12) Ablative Materials, (13) Ablative and Erosive Materials, (14) Store/Stage Separation (15) Shroud Separation, (16) Thermal Structural, (17) Aero-Optics, (18) Electronic Sub-Assemblies, (19) SGEMP and Cables

** Currently Mothballed
*** Standby Status
**** Currently Non-Operational

01/02

FACILITY VALUE	Funding Year	Original Cost ($M)	Replace Value (FY95 $M)	Replace Value (FY00 $M)	Replace Value (FY02 $M)
Initial Central Facility	**1951**	**83**	**996**	**1,063**	**1,114**
ETF-B (T-Cells)	1951	12	139	148	155
PWT (16S, 16T)	1952	185	2,500	2,668	2,795
VKF (ABC)	1952	16	193	206	216
Computer & Support Equip.	1953	143	456	487	510
ETF-A (J-Cells)	1955	10	100	107	112
Rocket Cells J-3	1960	3	23	25	26
Rocket Cells J-4	1961	12	86	92	96
Arcs	1965	20	130	139	145
APTU	1970	15	67	72	75
ASTF (C-1, C-2)	1977	625	1,453	1,551	1,625
T-3, T-5, T-7, T-9	1980	15	26	28	29
Rocket Cells J-5	1983	30	43	46	48
Rocket Cells J-6	1990	226	270	288	302
Ranges	1990	45	50	53	56
DECADE	1992	60	63	67	70
NAWCAD (4 Cells)	1994	62	65	69	73
Total AEDC Value		**1,562**	**6,660**	**7,109**	**7,447**

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