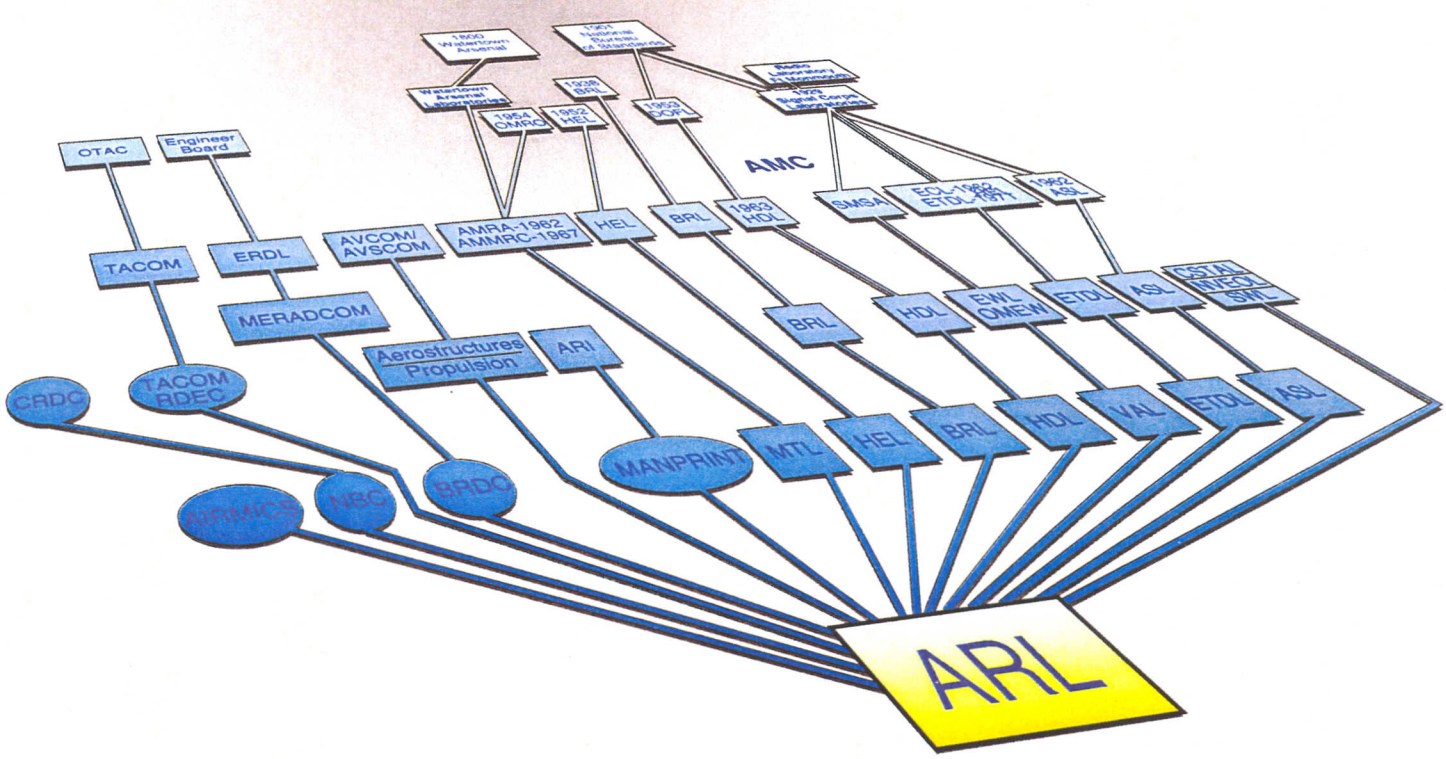
The Genealogy of ARL



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The ARL Mission

Execute fundamental and applied research to provide the Army the key technologies and analytical support necessary to assure supremacy in future land warfare.

The ARL Vision

A laboratory *preeminent* in key areas of science, engineering, and analysis relevant to land warfare.
A staff widely recognized as outstanding.
A laboratory seen by the Army users as essential to their missions.
An intellectual crossroads for the technical community.

Dr. John W. Lyons

Director, U.S. Army Research Laboratory, September 14, 1993 -

Previously, Dr. Lyons was director of the National Institute of Standards and Technology (NIST). Lyons graduated from Harvard University with a Bachelor of Arts degree in 1952. He also holds a Masters and a Doctorate of Philosophy in Physical Chemistry from Washington University in Saint Louis. He worked at Monsanto from 1955 until joining the National Bureau of Standards (NBS, now NIST) in 1973. He served as director of the National Engineering Laboratory at NBS from 1977 until 1990, when President George Bush named him director of NIST. Lyons has published four books and over 60 papers, and holds a number of patents. He has served on many boards and commissions, including the National Commission on Superconductivity and the Federal Advisory Commission on Consolidation and Conversion of Defense Research and Development Laboratories. He was elected to the National Academy of Engineering in 1985. Lyons is a Fellow of the American Association for the Advancement of Science and of the Washington Academy of Science. He is also a member of the American Chemical Society and of Sigma Xi.

Preface

The following provides a brief organizational history of ARL and its various components. At the summary level, it is the story of the Army's attempt to exploit the tremendous technical advances of the past 50 years while preparing to meet the needs of soldiers 20 years into the future. On a more prosaic level, it is an attempt to trace the kaleidoscope of reorganization, restructuring, and reengineering, the almost continuous change endemic to Army and AMC attempts to balance future technology needs against current readiness demands. The front section outlines events and issues leading to the current organization of ARL, and the back section provides brief historical profiles of some of the component activities.

William T. Moye
May 1997

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U.S. Army Research Laboratory

In October 1992, the U.S. Army Research Laboratory (ARL) was activated, growing out of the Base Realignment and Closure (BRAC) process, the LAB 21 study, and other evaluations. The new lab consolidated the seven corporate labs of the Laboratory Command (LABCOM) with other Army research elements to form a centralized laboratory concentrating on scientific research, technology development, and analysis.

For more than 50 years, in laboratories belonging to the Army Materiel Command (AMC) and their antecedents in the Technical Corps, civilians have conducted the great majority of the Army's basic science programs, whether as in-house scientists and engineers or as contractors in private industry and academia. These civilians helped develop the proximity fuze; worked to develop ENIAC (Electronic Numerical Integrator and Computer), the first operational, general purpose, electronic digital computer; grew some of the first synthetic large quartz crystals; and developed the titanium alloy T1-6A1-4V. In looking toward the 21st century, ARL scientists and engineers are pioneering research in such areas as information distribution and management technologies; human cognitive and sensory capabilities; simulation and virtual environments; nanoscale electro/optoelectronic devices; teleoperations; composites and ceramics; ultra-wide-band radar; and lightweight, rechargeable power sources.

Indeed, development of the proximity fuze and the ENIAC – and their follow-ons – illustrates both the technical capability of the Army's scientists and engineers, as well as the value of technological interchange between and among the military, academia, and private industry. Concentrating in its core skill areas, ARL is reaching out to "partner" with leading researchers in industry and academia, while it is also reaching out to the active Army to ensure that programs produce advanced technologies that support soldiers in the field today – and in the future.

National defense is one of the most critical duties performed by the federal government for the American people. Cutting-edge technology research and development offer incredible potential to improve the Army's chances of surviving and winning any future conflicts. ARL, as the Army's corporate or central laboratory for combat materiel, will play a constructive, key role in the national defense as it executes its strategies to take full advantage of the exciting opportunities that lie ahead.

Recently, ARL restructured to focus more effectively on a set of "grand challenges" designed to support Force XXI and the Army After Next (AAN) planning processes, as follows:

- Provide weapons systems technology for the Future Combat System.
- Develop lighter, faster, and more efficient mobility technologies to reduce the logistics "tail" and enhance deployability.
- Provide commanders unprecedented real-time situation awareness of the battlefield.
- Significantly improve the battlefield commander's ability to absorb information and make decisions.
- Solve the defensive information warfare problem.

Background

During World War II, research facilities that now constitute ARL mobilized to support the war effort, producing important advances in such areas as radar and fuzing. In the 50 years since, these laboratories and R&D centers have developed many technological innovations that benefit the soldier and, in many instances, the general population. Some of these accomplishments by the labs and their contractors are noted in the adjoining chart.

Technical Accomplishments by Labs and Contractors

"Zahl" tube (VT-158) for radar
Proximity fuze for mortars
Electronic Numerical Integrator and Computer (ENIAC)
Synthetic large quartz crystals grown
Radar applied to weather forecasting
Titanium alloy, Ti-6A1-4V
Photolithographic masking technique for integrated circuits
Heart pump
Viscous damping mechanism for large-caliber guns
High-power transmitter tubes for radar
Fiber-optic inverter for night vision devices
Lithium primary batteries
Integrated flight-control system for one-handed flying
Family of smart munitions systems
Rare earth high-power permanent magnet structure for magnetic resonance imaging
Advanced composite technologies for armor
Global Positioning System registration round for artillery

The first Army regulation to include R&D appeared in 1924, an incidental part of the theme, "Types of Equipment Used by the United States Army."[1] During World War II, the technical services were responsible for nearly all Army R&D, except for separate Army Air Forces programs.[2] Critics and reformers charged that R&D of new weapons and equipment was subordinated to production and supply and that conflicts between the technical services and Army Ground Forces delayed production and procurement of new materiel.[3]

On May 1, 1945, the Army published its first official policy on R&D, recognizing the need for civilian scientific assistance in military planning as well as in the production of weapons. Significantly, the policy statement advocated responsibility for R&D separate from the functions of procurement, production, and materiel distribution. The Research and Development Division of the War Department General Staff was established on June 11, 1946 as a separate General Staff agency equal to those for supply, training and planning, personnel, and intelligence.

However, Army R&D suffered when Army Air Forces projects were transferred to the new U.S. Air Force. In December 1947, the R&D Division was abolished as a separate unit and redesignated a group in the Service, Supply, and Procurement Division of the General Staff.

Army organization studies produced some administrative changes, and civilian scientists campaigned for recognition. Opposition to establishment of a separate R&D command or element rested with Army staff and technical service chiefs who opposed dismantling the traditional technical service structure.

Then, in October 1955, the Office of the Chief of Research and Development (OCRD) emerged as an independent General Staff agency, with Lt. Gen. James M. Gavin as chief. About the same time, the civilian position of director of R&D was established at the assistant secretary level.

This action reflected the influence of the Army Scientific Advisory Panel, a group of civilian scientists and industrialists established in 1954. In 1958, panel pressure also succeeded in organizing the U.S. Army Research Office under the OCRD to "plan and direct the research program of the Army."

During the 1950s, the Army accomplished some very innovative R&D successes, perhaps most dramatically exemplified by the Redstone and Jupiter missile programs. Even so, critics complained about the lack of coordination between strategic planning and R&D, as well as about the long lead times required for development. Meanwhile, costs for developing modern weapons were increasing tremendously, and especially in view of the Soviet success with Sputnik in 1957, public faith in the management of defense programs wavered.[4]

General reorganization of the Army in 1962, based on Project 80 (the Hoelscher Committee Report), heavily impacted R&D alignment. Initially, the committee's R&D task force had suggested separating R&D from other supply functions. Under the final plan, however, two new organizations were erected to replace the discontinued Technical Corps, with the Army Materiel Command inheriting both the procurement and development functions for weapons and munitions. The Defense Logistics Agency inherited the procurement functions for common supply items.[5]

From the beginning, AMC encountered problems in balancing its two basic missions: systems acquisition and readiness. In 1966, the Commanding General, AMC appointed a Deputy for Research and Laboratories to exercise complete and direct line authority over the nine AMC central laboratories and over the technical quality of research conducted in the laboratories of the Major Subordinate Commands (MSCs), and to represent the Commanding General in communications with OCRD and the Assistant Secretary of the Army for Research and Development.[6] In 1969, AMC established two deputy commanding generals, one for materiel acquisition and one for logistics support. Even so, the Special Review Panel on Department of the Army Reorganization (Parker Panel, 1971) seriously considered dividing AMC into two separate commands.[7]

The end of the Vietnam War pushed AMC to adjust for steadily declining people and dollar resources, prompting several studies of command organization. Then, in December 1973, the Secretary of the Army established the Army Materiel Acquisition Review Committee (AMARC), an ad hoc group consisting primarily of civilians from outside the government with a charter to analyze the whole materiel acquisition process and to recommend improvements.[8]

In the science and technology area, AMARC faced several questions about laboratories. It noted the progress achieved over the previous ten years, but found a number of weaknesses in the scientific development and technology areas.[9]

To address some of these deficiencies, AMARC proposed to separate the management of new weapons systems and major product improvements from logistics management. Specifically, the committee recommended consolidating laboratories, RDE (Research, Development, and Engineering) elements, project managers, support elements, selected user elements, and command activities into mission-oriented development centers. These centers would carry out research, exploratory development, and innovation of hardware; specify and manage RDE efforts conducted by industrial contractors; develop and actually produce hardware where industrial capability and interest was lacking; contribute to the Army's capability as an educated buyer of weapons systems; and provide in-house expertise for quick reaction to critical problems. The committee proposed development centers for armaments, communications, combat support, air mobility, and ground mobility.

In implementing this organizational concept, AMC (or DARCOM, Materiel Development and Readiness Command from 1976 to 1984) discontinued its commodity commands and established parallel R&D and readiness commands.

Reviewing the Electronics Command (ECOM), AMARC complained of the "extensive spectrum of research, development, and commodity responsibility which has evolved over the years" that tended "to defocus this organization's responsiveness to modern, mission-oriented needs, especially in the areas of electronic warfare, combat surveillance, and avionic systems." Therefore, the committee recommended separating the development of communications and automatic data processing from the development of electronic warfare capabilities.[10]

On July 13, 1977, the Deputy Secretary of Defense and the Secretary of the Army announced a modified plan for the organization of the Electronics Research and Development Command (ERADCOM), giving it responsibility for development of all the noncommunications and nonautomatic data-processing electronics materiel for the Army. Thus, for the first time, the Army had a single command responsible for its combat electronics materiel.[11]

On January 3, 1978, ECOM was deactivated, and ERADCOM was formally activated, along with the Communications Research and Development Command – which inherited the Communications/Automatic Data Processing Laboratory – and the Communications-Electronics Readiness Command, both headquartered at Fort Monmouth, New Jersey.

Elements Constituting ERADCOM

Laboratories
- Atmospheric Sciences Laboratory (ASL), White Sands, NM
- Combat Surveillance and Target Acquisition Laboratory (CSTAL), Fort Monmouth, NJ
- Electronics Technology and Devices Laboratory (ETDL), Fort Monmouth, NJ
- Electronic Warfare Laboratory (EWL), Fort Monmouth, NJ
- Harry Diamond Laboratories (HDL), Adelphi, MD
- Night Vision and Electro-Optics Laboratory (NVEOL), Fort Belvoir, VA
- Signals Warfare Laboratory (SWL), Vint Hill Farms Station, VA

Support Activities
- Tactical Software Support Center (TSSC), Fort Monmouth, NJ
- Technical Support Activity (TSA), Fort Monmouth, NJ
- ERADCOM Flight Test Activity (EFTA), Lakehurst, NJ

Special Management Elements
- U.S. Army Countermeasures/Counter-Countermeasures Center (CM/CCM Center), Adelphi, MD
- Project Manager, FIREFINDER/Remotely Monitored Battlefield Sensor System (REMBASS), Fort Monmouth, NJ
- Product Manager, Modular Integrated Communications and Navigation System (MICNS), Fort Monmouth, NJ
- Deputy Project Manager, Combat Identification Systems Program Office (CISPO), Adelphi, MD
- Deputy Project Manager, Joint Surveillance Target Attack Radar System (JSTARS), Hanscomb Air Force Base, MA

Joint Tactical Fusion Program reported to ERADCOM strictly for administrative purposes.

During more than seven years of intense efforts, ERADCOM equipped Combat Electronic Warfare and Intelligence battalions with state-of-the-art sensing, electronic warfare, and intelligence-collection systems, while it also conducted research in a broad range of technology areas. Among the general areas in which ERADCOM conducted R&D were tactical weather intelligence, signal processing, identification friend-or-foe, electronic countermeasures, very-high-speed integrated circuits, sensor technology, thermal imaging, low-energy lasers, artificial intelligence, nuclear weapons effects, millimeter-wave and near-millimeter-wave studies, and very intelligent surveillance and target acquisition. Fieldings included FIREFINDER/REMBASS, the Electro-Optical Systems Atmospheric Effects Library, the night sight for the tube-launched, optically-tracked, wire-guided missile (TOW II), the Technical Control and Analysis Center, the G-76 hand-cranked direct current generator, the Mobile Army Ground Image Interpretation Center, the Side-Looking Airborne Radar, Improved GUARDRAIL, and QUICKFIX, as well as TACJAM, TRAFFIC JAM, TRAILBLAZER, TEAMPACK, and TEAMMATE.

DARCOM had scarcely completed the reorganization growing out of the AMARC recommendations when it launched another review of the entire structure. This reflected the continuing tensions between R&D missions and readiness or logistics functions. "Transitioning" proved to be a major problem under the AMARC alignment, in that commands could not easily agree as to when responsibility for an item moved from the R&D command to the readiness command.[12]

The format suggested under AMARC Revisited was to reunite the R&D with the readiness commands along commodity or mission-area lines. Thus, the Missile Research and Development Command and the Missile Readiness Command were consolidated to form the Missile Command (MICOM) effective July 1, 1979. Revisitation and reconsolidation were extended to other MSCs, with issues affecting electronics and laboratory management the last to be worked out.[13]

Laboratory Improvement....LABCOM

AMC (renamed in 1984) realigned the combat electronics elements at the same time it restructured its laboratories and R&D activities. General Richard H. Thompson, the new Commanding General of AMC, later wrote the Chief of Staff of the Army that the electronics materiel commodity area suffered from particularly acute deficiencies in the management of integrated logistics support. He attributed this to the lack of unity of command across the life cycle. On the other hand, Thompson wrote, the senior leadership of the Army had criticized the lack of direction, sense of purpose, and product, as well as the apparent duplication of effort within the laboratories and between the laboratories and industry.[14]

Lt. Gen. Robert L. Moore, AMC Deputy Commanding General for Research, Development, and Acquisition, had spurred the effort in laboratory reform in 1983 when he directed the staff to generate plans for improving laboratory effectiveness and for reorganizing R&D functions and elements. This launched the Laboratory Effectiveness Improvement Program (LEIP),[15] which generated a number of studies and proposals.

Gen. Thompson advanced the concept of a Laboratory Command. Such a structure would consolidate and centralize management of AMC's laboratories under a single MSC, similar to the placement of all depots under Depot System Command (DESCOM).[16] It would also provide intensive front-end management of the acquisition cycle, tying in with another Thompson goal, that of shortening the acquisition process. In October 1984, a Command Group meeting affirmed this as the official AMC position.

During 1985, transition into and activation of LABCOM were accomplished. The formal announcement was made on April 25, the provisional command was established on July 1, and the activation was implemented on October 1. AMC Permanent Orders 35-1, dated August 26, 1986, formally established the new command.

Elements Constituting LABCOM

Laboratories.
- Army Research Office (ARO)
- Atmospheric Sciences Laboratory (ASL)
- Ballistic Research Laboratory (BRL)
- Electronics Technology and Devices Laboratory (ETDL)
- Harry Diamond Laboratories (HDL)
- Human Engineering Laboratory (HEL)
- Materials Technology Laboratory (MTL)
- Vulnerability Assessment Laboratory (VAL)

Special Management Elements.
- AMC Field Assistance in Science and Technology Program (AMC-FAST)
- Antiarmor Munitions Technology Office (AMTO)
- Army Space Technology and Research Office (ASTRO)
- Low Observable Technology and Applications Office (LOTA)
- Survivability Management Office (SMO)
- Signatures, Sensors, and Signal Processing Technology Organization (S^3TO)
- Target Acquisition for Army Weapons Systems Program Direction Office (TAAWS)

Joint Tactical Fusion Program reported to LABCOM strictly for administrative purposes.

During the same period, ERADCOM elements were transferred into the Communications-Electronics Command (CECOM), including CSTAL, NVEOL, SWL, and EWL (less the Office of Missile Electronic Warfare, which became VAL), together with the TSA, TSSC, and EFTA and the special management functions for JSTARS and MICNS. In addition, in internal realignments, RDE Centers were established at Armament, Munitions, and Chemical Command (AMCCOM); Aviation Systems Command (AVSCOM); MICOM; Tank-Automotive Command (TACOM); and Troop Support Command (TROSCOM).

Managing AMC's Technology Base

The establishment of LABCOM brought together under one MSC the AMC research laboratories that generated generic technologies and advanced concepts to carry the Army into the future. The laboratories conducted basic research and exploratory and advanced development, working primarily in the 6.1, 6.2, and 6.3a areas of Research, Development, Test, and Evaluation (RDTE) funding. An Army and AMC technology resource, LABCOM – the Corporate Technology Center – provided technical support and services to other MSCs, program executive officers, and activities.

To centralize management of the technology base, the LABCOM Commander was also AMC's Deputy Chief of Staff for Technology Planning and Management (DCSTPM), charged to focus and integrate the technology base programs for all AMC laboratories and RDE centers. As the senior manager of about 75 percent of the Army's technology base effort,[17] the AMC DCSTPM championed the technology base to the Department of the Army (DA), the Office of the Secretary of Defense (OSD), and, occasionally, Congress.

Commander LABCOM/AMC DCSTPM produced significant achievements in tech base planning, especially the Technology Base Investment Strategy, which was built into the Army Technology Base Master Plan. The command also conducted a series of seminar war games that gave both technologists and developers insights into fighting the future battlefield. In the area of international cooperation, the command established closer ties with a number of Allied countries, specifically France, Egypt, Japan, Israel, and the United Kingdom. Numerous cooperative programs were negotiated with private industry and universities to conduct R&D in areas useful to the Army.

U.S. ground forces deployed to Saudi Arabia in 1990 were equipped with systems that AMC R&D activities developed in the 1970s and 1980s, many of which had never been tested in combat: the Abrams (M1A1) main battle tank, the Bradley Fighting Vehicle, the Patriot point-defense antimissile system, the Multiple Launch Rocket System (MLRS), the HMMWV (High-Mobility, Multipurpose Wheeled Vehicle) – which had seen action in Panama, and the Army Tactical Missile System (ATACMS). Furthermore, the NAVSTAR GPS and the prototype JSTARS proved invaluable in providing troop location and in detecting deep targets.

The LABCOM/TPM team also made some immediate contributions to support troops deployed in Operation Desert Shield/Storm, as indicated in the accompanying box.

Adapter kits for night vision equipment
Auxiliary power units for the M1A1 tank
Power sources, especially lithium batteries
Combat identification (anti-fratricide) technology
Sleep restraint system for tankers
Failure analysis on helicopter parts
Battle damage assessment on armor
Procedures for monitoring and dealing with chemical/biological hazards
Assistance in fielding Hawkeye and FIREFINDER
Vulnerability and lethality projections

During 1990 and 1991, as the Army and AMC faced declining personnel and budgetary resources, proposals emerged to manage the Army's technology base more efficiently. As part of the streamlining of AMC headquarters, a single Deputy Chief of Staff for Research, Development, and Engineering (AMCRD) was created (effective November 30, 1991) by consolidating much of TPM with some of the functions and roles of Concurrent Engineering (AMCCE) and Development, Engineering, and Acquisition (AMCDE).

Provisional

Orders establishing ARL (Provisional), dated July 23, 1992, provided operational control of LABCOM, the seven corporate laboratories, the LABCOM Installation Support Activity, and the Special Technology Offices, as well as those elements transferring into the new laboratory.[18] The activation ceremony was held at Adelphi on October 2, and permanent orders organizing ARL were published on November 2, 1992.

ARL grew out of efforts to realign the Army's technology base following the collapse of communism in Eastern Europe and the end of the Cold War. In December 1988, the Defense Secretary's Commission on Base Realignment and Closure (BRAC) identified the "Army Material Technology Laboratory" for closure, primarily on grounds that MTL facilities "need major renovation or replacement." Missions and functions would be dispersed and the property sold, with transfers of functions scheduled for 1994, and all realignments completed by September 30, 1995.[19]

On January 6, 1989, the LABCOM Commander signed a memorandum stating the command position:

> I am currently reevaluating means to most efficiently accomplish the Army's material[s] research, development, and consultation requirements. . . . We are seeking further clarification, and I am asking that we be given the maximum flexibility and self-determination within our organization to meet our materials mission. . . . We are developing alternative solutions with supporting arguments which I believe will provide compelling justification for continuation of the materials mission within LABCOM. It has been the position of this Command that MTL should remain intact.[20]

In the ensuing months, LABCOM developed a proposal to move the core of materials research to one location as part of a concept for integrating the corporate laboratories into a single physical entity, first called the Army Research Laboratory.

President Bush launched the Defense Management Review (DMR) shortly after his inauguration, resulting in formation of the Army Management Review (AMR) Task Force and, in the fall of 1989, chartering of the LAB 21 effort. The ARL or Combat Materiel Research Laboratory (CMRL) construct[21] continued to evolve during FY 90, emerging as the centerpiece of the Army's LAB 21 effort. Implementation of the LAB 21 scheme was delayed, however, while OSD sponsored another laboratory consolidation study. Then, Congress initiated another round of base closure and realignment activity, passing legislation (P.L. 101-510) establishing BRAC 91, with members nominated in January 1991.

In April 1991, the Department of Defense (DoD) published its recommendations to BRAC 91, adopting the LAB 21 proposal to realign Army laboratories. Under the scheme, CMRL would be consolidated, primarily at Adelphi and Aberdeen Proving Ground, Maryland (APG), and the BRAC 88 mandate would be revised, with most of MTL relocated to APG.[22]

In its report to the President, released in July 1991, BRAC 91 endorsed the LAB 21 plan for laboratory restructuring but directed DoD to delay implementation until January 1992 in order to consider guidance from the Federal Advisory Commission on Consolidation and Conversion of Defense Research and Development Laboratories. Also established under Public Law 101-510, the Federal Advisory Commission was charged with recommending various means to improve the operation of the laboratories, including (1) conversion of some or all to government-owned, contractor-operated (GOCO) labs, (2) mission and/or function modification at some or all, and (3) consolidation or closure of some or all.

In its report, released in September 1991, the Advisory Commission stated that "fixing the problem organically is preferable" to converting to GOCO organizations and suggested a number of steps to improve the effectiveness of the labs as "dedicated organizations free from commercial pressure." In the main, the Advisory Commission also accepted the LAB 21 scheme, stating that proposed consolidations and realignments should begin in January 1992.[23]

DA added several actions that were reflected in the Implementation Plan of December 1991, which the Assistant Secretary of the Army for Research, Development, and Acquisition (ASA(RDA)) approved in March 1992, with exceptions that reflected a number of policy decisions. Perhaps most importantly, on the issue of the top ARL management position, the Implementation Plan had called for a Major General military Commander and a civilian Technical Director, with the ARL Commander reporting to the Commanding General, AMC. The Assistant Secretary, however, stipulated that the new laboratory would have a civilian Director as its Chief Executive and a General Officer as Deputy.

With activation in October 1992, Richard Vitali, formerly the LABCOM Director of Corporate Laboratories, became the Acting Director of ARL, a position he held for almost one year. In a change of command ceremony on September 14, 1993, Gen. Jimmy D. Ross, Commander, AMC, installed Dr. John W. Lyons as the new Director. Dr. Lyons had formerly been Director of the National Institute of Standards and Technology (NIST).

Reinventing the Laboratory

In February 1993, the Board on Army Science and Technology (BAST) began a study to examine approaches leading to and the implications of converting ARL to a GOCO facility or to a model based on NIST. The study panel, chaired by Charles A. Zraket, formerly of Mitre Corporation, was asked to investigate and define three alternatives: ARL with improvements, a "NIST-like" organization, or a GOCO arrangement.

The proposal to convert defense labs to GOCO operations had been raised in the 1987 Defense Science Board (DSB) Summer Study, Technology Base Management, chaired by Dr. John M. Deutch.[24] During deliberations, the study group reviewed GOCO alternatives but decided that implementation costs were too high and processes too complex to consider under its charter. Instead, the group recommended a Laboratory Demonstration Program, which was formally inaugurated by the Deputy Secretary of Defense in November 1989, with the goal of showing that management changes would lead to greater efficiency and productivity.

However, continuing and increasing pressures on the defense community to downsize spurred undertaking of a more intense look at alternatives. The Federal Advisory Commission (September 1991) recommended that the Laboratory Demonstration Program be extended to all DoD laboratories and be carried out without delay. However, in a 1992 report, the Office of Technology Assessment recommended that some labs be converted to GOCO operations, an idea echoed in the 1992 lab consolidation studies sponsored by OSD.

In the spring of 1993, Gen. Ross changed the name of the BAST study from "Conversion of ARL" to "Alternative Futures for ARL" and enlarged the scope somewhat. In its 1994 report, the group, after outlining problem areas and examining possible organizational constructs, recommended implementation of streamlined procurement practices, reformed personnel procedures, a more focused technical program, expanded partnerships for technology interaction, and a new reporting channel direct to the ASA(RDA).[25]

Dr. Lyons' first swing through the directorates and various sites convinced him that the lab faced several serious difficulties in its operating environment that threatened its ability to perform. He moved swiftly to adapt and co-opt those suggestions, as well as opportunities afforded by the Clinton Administration's campaign to

reinvent government, requesting AMC assistance in securing a reform program as outlined below:

- Modified, flexible personnel system.
- Consolidated funding authority (one-color appropriation).
- Creation of an industrial fund and discretionary accounts.
- Emphasis on fundamental/generic research (doubling 6.1 program).
- Reconfiguration as an "open laboratory," with greatly increased numbers of staff exchanges and guest researchers.
- Approval as a pilot program under the Government Performance and Results Act of 1993 (GPRA).

Significantly, many of these suggestions were part of the so-called "NIST-like" option studied by the BAST committee, and the lab director had previously been director of NIST. Gen. Ross embraced the "NIST-like" plan and, at a briefing on December 16, 1993, endorsed most of the suggestions. Then, in January 1994, ARL staff briefed the proposals to the Vice Chief of Staff of the Army as well as the Under Secretary.

Meanwhile, yet another study of DoD laboratory management actually provided the impetus and the vehicle to consider some radically new constructs. In December 1993, the Under Secretary of Defense chartered the DSB Task Force on Defense Laboratory Management chaired by Gen. (Retired) Paul F. Gorman. During briefings and discussions with Gen. Gorman and others in the spring of 1994, a new proposal emerged to address digital communications issues and to put ARL construction programs back in motion. A federated, or distributed, laboratory in digital technology would be established that would join together in-house capabilities with new research centers in the private sector.

In a dramatic departure for a military activity, the lab would morph into a distributed structure and would fund as many as ten new centers that would be integrated into the ARL program in an open configuration, with large exchanges of staff in both directions. The strategy behind this was not only to maintain strong in-house capabilities for Army-unique requirements or areas where little outside interest exists, but also to forge direct partnerships with the private-sector elements where they have the lead and the commitment. Included in the new structure would be two existing university centers of excellence that previously reported to ARO, the Army High-Performance Computing Research Center (AHPCRC) at the University of Minnesota and the Information Sciences Center at Clark-Atlanta University, as well as the Institute for Advanced Technology at the University of Texas, a Federally-Funded R&D Center (FFRDC) that had reported to the Armament Research, Development, and Engineering Center (ARDEC).

Several funding sources, including ARL monies, were redirected to support the effort. As part of this action, the Army shifted to the Federated Lab a substantial portion of the 6.1 funds previously allocated to the RDECs, starting with FY 96.

A significant aspect of the program is the requirement that interested parties form consortia involving both industry and academia. As a minimum, a consortium must consist of an industrial partner as leader of the group and two academic institutions, one of which must qualify as a Historically Black College/University (HBCU) or Minority Institution (MI).

In January 1996, ARL reached a major milestone and launched the next step of the Federated Laboratory initiative, entering into cooperative agreements with three consortia consisting of industry and university partners. These agreements, valued at a total of $122 million over five years, establish external centers for research in the areas of advanced sensors, telecommunications/information distribution, and advanced/interactive displays, as follows:

Advanced Sensors. Lockheed Sanders, along with Texas Instruments, Clark-Atlanta University, Environmental Research Institute of Michigan, Georgia Tech Research Corporation, Lockheed Martin Missiles and Space, MIT, Ohio State University Research Foundation, University of Maryland, University of Michigan, University of New Mexico Center for High Technology Materials, and Stanford University.

Telecommunications. Lockheed Sanders, along with Bell Communications Research; GTE Laboratories, Inc.; Howard University; MIT; Motorola, Inc.; University of Delaware; University of Maryland; City College of New York; and Morgan State University.

Displays. Rockwell International, along with University of Illinois at Champaign-Urbana; Sytronics, Inc.; North Carolina A&T State University; and the Microelectronics Center of North Carolina.

Continuous Change

In accompanying action, the lab carried out a round of internal restructuring as part of a strategy to develop an ARL center of excellence in digital communications sciences that would support the Chief of Staff's push to digitize the battlefield. Effective April 1, 1995, the former Sensors, Signatures, Signal and Information Processing Directorate (S^3I) was split, with the bulk forming the new Sensors Directorate (SEN) and part joining with other elements to form the new Information Science and Technology (IST) Directorate. At the same time, most of the Electronics and Power Sources Directorate (EPSD) became the Physical Sciences Directorate (PSD), and the Advanced Computational and Information Sciences Directorate (ACIS) segued into the Advanced Simulation and High-Performance Computing Directorate (ASHPC).

SEN, most of S^3I joined by three branches of EPSD located at Fort Belvoir, focused its activities on infrared focal plane arrays, microwave and millimeter-wave radar, optics, and acoustic sensors, as well as advanced sensor concepts.

The Information Processing Branch of S^3I, the Military Computer Science Branch of ACIS, and a few people from EPSD and the Battlefield Environment Directorate (BED), formed the IST Directorate, with areas of technical expertise in sensor and data fusion, display integration, knowledge-based reasoning, high-performance wireless networks, automated information distribution, data and image compression, adaptive communications and networks, secure information exchange, and architectures research.

The major portion of EPSD became PSD, charged to focus on "pervasive 21st century technologies," including solid state physics, nanotechnology, chemical science and technology, biological sciences, and manufacturing science.

ASHPC concentrated on advanced distributed-simulation technology, software engineering, artificial intelligence and expert systems, real-time language translation, supercomputing, distributed and parallel computing, and wide-bandwidth networks.

The BED Atmospheric Analysis and Assessment team moved to the Survivability/Lethality Analysis Directorate (SLAD), expanding SLAD's threat-effects analysis mission and consolidating all the lab's 6.5 mission money in the one directorate.

The restructured BED concentrated on signature distortions, atmospheric modeling, electromagnetic energy propagation, remote detection and identification of chemical and biological agents, weather analysis aids, weather measuring techniques, and land battlespace modeling. The Human Research and Engineering Directorate (HRED) reorganized internally to form a Soldier Information Division to support the lab's emphasis on digitization and communications science.

Meanwhile, several realignments were accomplished within the Operations Directorate, the former ACAP (Advanced Concepts and Plans) Directorate, and the immediate Office of the Director. In the spring of 1994, two new positions were established in the Office of the Director, with an Associate Director for Plans, Programs, and Budget and an Associate Director for Science and Technology joining the Director and the Deputy Director/Commander. At the same time, ACAP was disestablished, and its functions were distributed.

Then, in 1996, the lab implemented another reorganization. In March 1996, the ASA(RDA) approved a plan to sharpen the technical focus while reducing overhead. Then, during the summer, with the retirement of the Deputy Director/Commander, the support staff was rearranged, with the Deputy position filled by a civilian SES and a military Chief of Staff taking over the former Operations Directorate. Thus, ARL began FY 97 with five technical directorates and two centers, with a Chief of Staff support function.

Weapons and Materials Research Directorate (WMRD) combines materials and weapons research to position ARL more effectively to support development of future land combat systems.

Information Science and Technology Directorate (IST) addresses a broad spectrum of research aimed at the digitized battlefield beyond Force XXI.

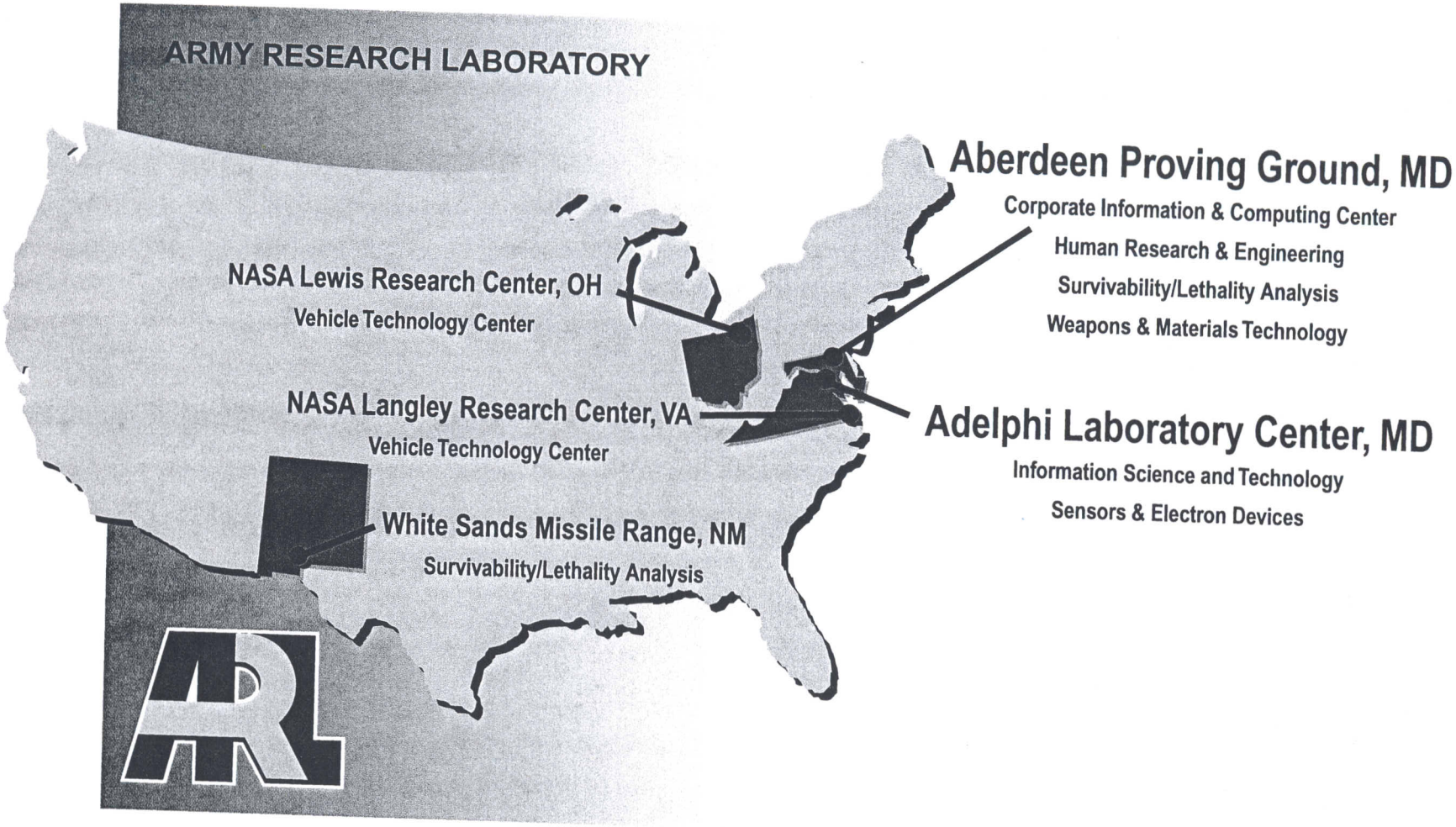
Sensors and Electron Devices Directorate (SEDD) develops technology for advanced solid state components and state-of-the-art sensor systems to provide battlefield awareness and targeting.

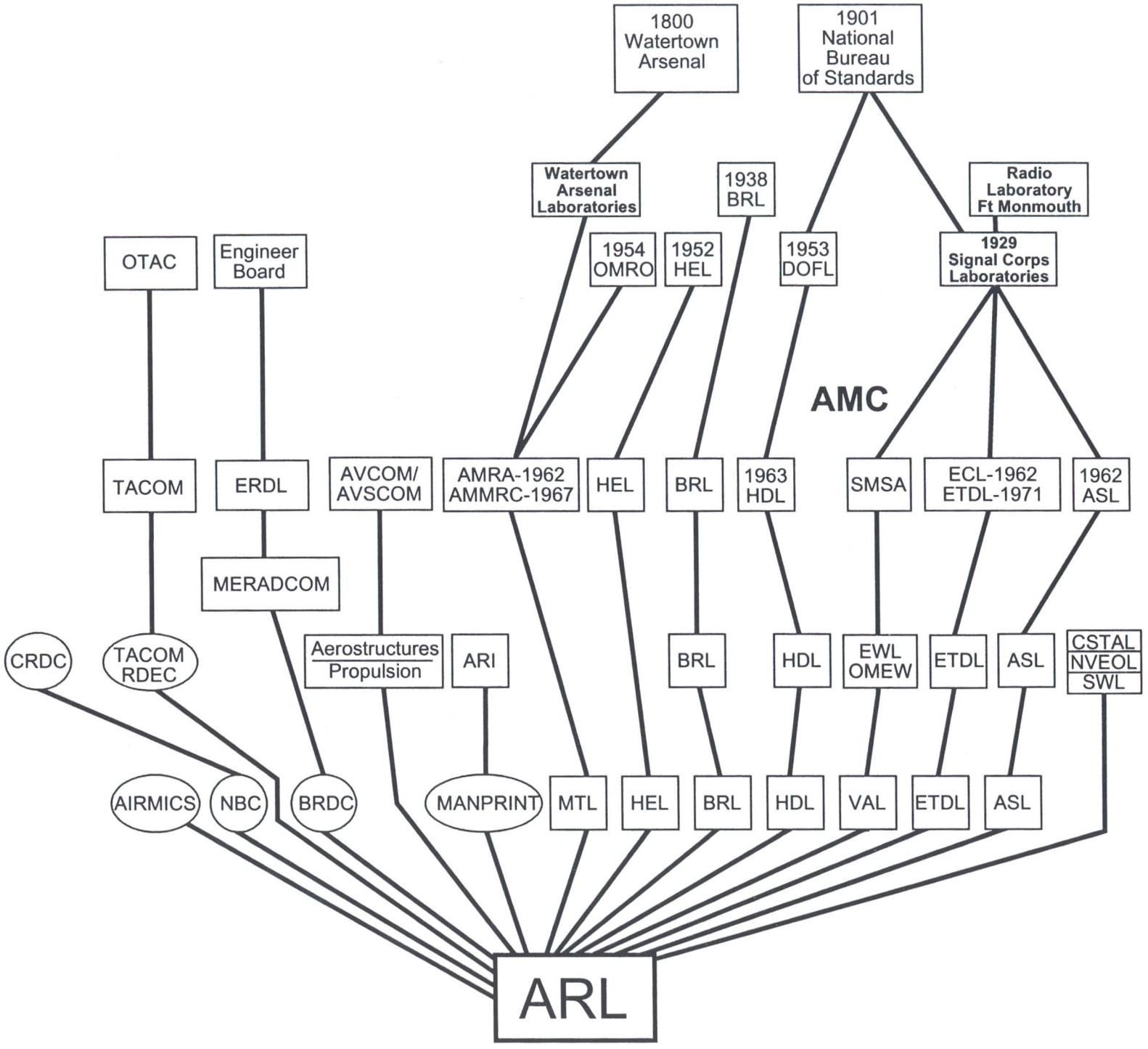
Human Research and Engineering Directorate (HRED) conducts a broad-based program of scientific research and technology directed toward optimizing soldier performance and soldier-machine interac tions in order to maximize battlefield effectiveness, while ensuring that soldier performance requirements are adequately considered in technology development and system design.

Survivability/Lethality Analysis Directorate (SLAD) provides technical support in the analysis of the survivability and lethality of Army technologies and systems in the full spectrum of battlefield threats and environments.

Vehicle Technology Center (VTC) addresses propulsion and structure technologies for both air and ground vehicles, while maintaining the existing relationship with NASA.

Corporate Information and Computing Center (CICC) focuses resources on ARL's business and high-performance computing assets. It also serves as the management vehicle for the DoD Major Shared /Resource Center (MSRC) and the AHPCRC.


ARMY RESEARCH LABORATORY
Aberdeen Proving Ground, MD
Corporate Information & Computing Center
Human Research & Engineering
Survivability/Lethality Analysis
Weapons & Materials Technology
NASA Lewis Research Center, OH
Vehicle Technology Center
NASA Langley Research Center, VA
Vehicle Technology Center
Adelphi Laboratory Center, MD
Information Science and Technology
Sensors & Electron Devices
White Sands Missile Range, NM
Survivability/Lethality Analysis
ARL


1800
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OMEW
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CSTAL
NVEOL
SWL
AIRMICS
NBC
BRDC
MANPRINT
MTL
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ARL

Component Activities

Corporate Laboratories
Atmospheric Sciences Laboratory

Located at White Sands Missile Range, New Mexico (WSMR), ASL evolved from small groups established in the Technical Corps shortly before World War II, primarily the meteorological group of the Signal Corps Engineering Laboratories (SCEL) at Fort Monmouth. Army meteorology at White Sands Proving Ground (WSPG) grew out of radar and communications efforts in support of the V-2 rocket test program. Activities at WSPG were conducted by the Atmospheric Sciences Office. In the 1962 Army reorganization, responsibility for meteorological R&D was assigned to the U.S. Army Electronics Command (ECOM), which later established the Atmospheric Sciences Laboratory at Fort Monmouth. In 1969, ECOM transferred the headquarters of ASL from Fort Monmouth and the meteorological activities from Fort Huachuca to WSMR. In 1978, ASL became part of ERADCOM. Then, with the establishment of LABCOM in 1985, ASL became part of that command.

With establishment of ARL, ASL transitioned into the Battlefield Environment Directorate. In 1995, the BED Atmospheric Analysis and Assessment team moved to the Survivability/Lethality Analysis Directorate (SLAD), expanding SLAD's threat-effects analysis mission and consolidating all the lab's 6.5 mission money in the one directorate. In 1996, the bulk of BED was folded into the Information Science and Technology Directorate as the Battlefield Environment Division.

Ballistic Research Laboratory

The origins of BRL lie in World War I, when pioneering work was done in the Office of the Chief of Ordnance, and especially the Ballistics Branch created within the Office in 1918. In a 1922 reorganization, the Ballistic Section became part of the Ordnance (later Gun) Testing Division, emerging in 1935 as the Research Division, Aberdeen Proving Ground. In December 1938, the Research Division was renamed the Ballistic Research Laboratory.

With the Army reorganization in 1962, BRL was transferred into AMC and reported directly to Headquarters as a corporate laboratory. In 1968, the laboratory became part of the Aberdeen Research and Development Center (Provisional). In 1972, however, the short-lived center was abolished, and BRL was reconstituted as a Class II Activity reporting to AMC Headquarters. In 1977, BRL became a commodity-oriented laboratory reporting to the U.S. Army Armament Research and Development Command. Then, in 1983, on the formation of the U.S. Army Armament, Munitions, and Chemical Command (AMCCOM), BRL was incorporated into the Armament Research and Development Center. In 1984, BRL was reassigned directly to AMC headquarters as a corporate laboratory, and only a year later, it became part of LABCOM.

In the transition to ARL, BRL formed the core of the Weapons Technology Directorate (as of 1996, the Weapons and Materials Research Directorate), with computer technology elements migrating to the Advanced Computational and Information Sciences Directorate (now the Corporate Information and Computing Center, CICC) and vulnerability analysis moving into SLAD.[26]

Electronics Technology and Devices Laboratory

ETDL's origins trace to the Signal Corps Laboratories at Fort Monmouth, New Jersey, which had its beginnings in World War I with units conducting research in Paris and Washington as well as Little Silver, New Jersey. In the 1920s, Fort Monmouth emerged as the Army's center for communications training and research. Thus, in 1929, the Electrical Laboratory and the Research Laboratory (at the National Bureau of Standards, NBS) were moved from Washington and consolidated with the Radio Laboratory at Fort Monmouth to form the Signal Corps Laboratories – subsequently renamed the Squier Signal Laboratory (SSL).

Specifically, ETDL's predecessors were the devices and materials branches active in the SSL complex of the late 1930s and early 1940s and the Thermionics Branch in the Evans Signal Laboratory. With the Army reorganization of 1962, the renamed U.S. Army Electronics Research and Development Laboratory – later the Army Electronics Laboratories – joined AMC as an element of ECOM. In a 1965 restructuring, ECOM organized seven separate R&D activities along functional lines, among them the Electronic Components Laboratory and the Institute for Exploratory Research. In 1971, these two activities were consolidated to form the Electronics Technology and Devices Laboratory. In 1978, ETDL was placed in ERADCOM in order to consolidate R&D activities in intelligence and electronic materiel and systems. Then, in 1985, ETDL became part of LABCOM.

With the realignment into ARL, ETDL provided most of the Electronics and Power Sources Directorate. In 1995, the major portion became the Physical Sciences Directorate, slated to move into new facilities at Adelphi. In 1996, most of PSD migrated into the Sensors and Electron Devices Directorate.

Harry Diamond Laboratories

The early history of HDL dates back to 1940, when the National Defense Research Committee organized a group of scientists and engineers at NBS to develop fuzes for nonrotating (i.e., fin-stabilized) munitions such as bombs, rockets, and mortar shells. Harry Diamond, a pioneer radio engineer, was given technical direction of the program. In 1953, the Ordnance Development Division was transferred to the Army as an R&D installation under the Chief of Ordnance and named the Diamond Ordnance Fuze Laboratories (DOFL) in honor of the early leader. In the 1962 Army reorganization, DOFL was assigned directly to AMC as a corporate laboratory. In June 1963, its name was officially changed to Harry Diamond Laboratories.

Following the 1974 report from the Army Materiel Acquisition Review Committee, AMC studied the possibility of establishing a Harry Diamond Development Center. Instead, AMC shifted the concept, establishing ERADCOM as the overall command in January 1978, with HDL a major element. Then, HDL became a crucial component of LABCOM when it was activated in 1985.

In the organization of ARL, most of HDL transitioned into the S^3I Directorate, although some fuze functions transferred to the Armament RDE Center and the Missile RDE Center. The nuclear weapons effects (NWE) activities were separated, with the technology base research functions migrating to the Weapons Technology Directorate and the analytical functions moving to SLAD. Microelectronics moved into EPSD. In 1996, S^3I Directorate was split, with parts going into IST and parts into SEDD

Human Engineering Laboratory

In 1951, the Chief of Ordnance wrote, "It appears timely to provide human engineering assessments in our development engineering designs and in our tests of these designs." This letter to the Commanding General at Aberdeen led to several studies and surveys, culminating, in 1952, in formation of HEL. With the Army reorganization in 1962, HEL became a corporate laboratory within AMC, charged with coordinating all the human factors engineering within the Army. In 1968, HEL, BRL, and other elements were combined into the Aberdeen Research and Development Center (Provisional). The Center was short-lived, lasting only until 1972, when HEL again became a corporate laboratory reporting to AMC Headquarters.

In 1975, AMC agreed to a pilot project to convert the human engineering groups at MSCs into HEL detachments, giving HEL detachments at each MSC and field office representatives at the major centers and schools of the U.S. Army Training and Doctrine Command (TRADOC). As part of LABCOM since 1985, HEL closely coordinated its research and applications support programs with TRADOC and the Deputy Chief of Staff for Personnel (DCSPER), DA.

In the ARL alignment, HEL has transitioned into the Human Research and Engineering Directorate.

Materials Technology Laboratory

MTL traces its roots through the Watertown Arsenal back to 1800 and the establishment of an arsenal at Charlestown, on Boston harbor. Following the War of 1812, the Ordnance Department purchased land at Watertown, constructed buildings, and transferred activities to Watertown from Charlestown, that site becoming the Boston Navy Yard.

Until the Army reorganization of 1962, Watertown was part of the Ordnance Department. Then, the Army assigned responsibility for conventional weapons work to the Rock Island Arsenal, and Watertown took a supporting role in the Missile Command. At the same time, the Army Materials Research Agency (AMRA) was created by combining the Ordnance Materials Research Office (OMRO) and the Watertown Arsenal Laboratories (WAL). From its inception in 1962, AMRA reported to AMC as a corporate laboratory. In 1964, the Secretary of Defense announced that Watertown Arsenal would be declared excess and phased out, while the AMRA would continue in place. In 1967, AMC consolidated structural materials R&D at AMRA, renamed the Army Materials and Mechanics Research Center (AMMRC). In transition to LABCOM during 1985, AMMRC was renamed the Materials Technology Laboratory.

BRAC 88 recommended closing MTL and dispersing the functions. LAB 21/BRAC 91 revised this, and most of MTL will move to Aberdeen as part of the Materials Directorate (now part of W&MRD). The structures element transfers to NASA-Langley as part of the Vehicle Structures Directorate.

Vulnerability Assessment Laboratory

VAL began, in 1951, as Field Station #1 of the Signal Corps Engineering Laboratory. By the early 1960s, it was a component of the Electronics Research and Development Activity. In the 1962 Army reorganization, it became part of ECOM, conducting research in missile electronic warfare, missile vulnerability, missile surveillance, and environmental sciences and by coordinating the missile electronic countermeasures effort of the Army.

In the mid-1960s, in a series of actions, the element was renamed the Missile Electronic Warfare Division, it was assigned to the newly organized Electronic Warfare Laboratory (EWL), and its name was changed again to Missile Electronic Warfare Technical Area. In the early 1970s, it became the Office of Missile Electronic Warfare (OMEW). In actions spurred by AMARC, ERADCOM was established, with EWL a major unit and OMEW a subordinate activity. In 1985, the Commander of ERADCOM/LABCOM recommended including OMEW – renamed the Vulnerability Assessment Laboratory – within the new command in view of its vital survivability/vulnerability functions.

In the ARL scheme, VAL transitioned into SLAD.

Special Technology Offices
Army Space Technology and Research Office

In July 1987, the ASA(RDA) established a Director for Space and Strategic Systems to oversee all aspects of the R&D program. The Army Space Institute (ASI) was identified as the user, or combat development, proponent. In August 1987, the ASA(RDA) wrote the Commander, AMC, requesting establishment of a technology manager for R&D programs, which would interact with ASI. About the same time, AMC charged LABCOM to "assume technology base responsibility and provide leadership for AMC's participation in the Army's space endeavors." In January 1988, Commander, AMC approved creation of ASTRO. The office supported AMC and coordinated activities with the Corps of Engineers and the Medical Materiel Development Activity of the Surgeon General.

ASTRO was initially placed under the operational control of CECOM, with ARL providing base operations support. However, in 1993, it was decided that ASTRO would be assigned to the new Space and Strategic Defense Command (SSDC).

Low Observable Technology and Application Office

LOTA was organized to exploit low-observable and counter-low-observable technologies and to support integration of the technologies into critical combat systems so as to reduce the signatures of U.S. systems while increasing U.S. capabilities to recognize reduced enemy signatures.

LOTA emerged during the transition into LABCOM during 1985. A low observables program was established at AMC in 1984. During discussions leading to the establishment of LABCOM, the recommendation was made for joint management of Countermeasures/Counter-Countermeasures (CM/CCM) and the low observables program, but it was suggested instead to establish a low observable technology office as a separate element. AMC agreed, and the LOTA Office was organized as part of LABCOM in August 1985. In 1987, ASA(RDA) signed the charter formally establishing the LOTA Office and assigning it to Commander LABCOM/AMC DCSTPM.

In the ARL alignment, LOTA became an office within the Weapons Technology Directorate, with direct reporting responsibilities to the ASA(RDA). In 1996, the function migrated into SEDD.

Survivability Management Office

A CM/CCM branch was established at HDL in September 1976. In May 1977, the office assimilated the HDL Office of Technical Vulnerability Reduction. Under the charter of November 7, 1977 and the DARCOM Regulation 70-4 (November 21, 1977), the ERADCOM CM/CCM Office was designated the DARCOM management focal point for coordination and integration and, further, directed to assist in studies, analyses, and evaluations and to conduct independent assessments.

Established as a DARCOM office as of January 1982, the Army CM/CCM Center, among other things, developed and managed the Army's laser hardening program and performed C^3I (Command, Control, Communications, and Intelligence) analysis. With the emergence of and the transition into LABCOM in 1985, the center was renamed the Survivability Management Office (SMO).

In the transition into ARL, SMO was renamed the Survivability Enhancement Office and reported to the ARL Deputy Director. Subsequently, the office disappeared, and its assets were distributed between the Weapons Technology Directorate and SLAD.

Signatures, Sensors, and Signal Processing Technology Organization

S^3TO oversaw S^3 technology base activities throughout the AMC community, coordinating the Army's technical activities related to target and background signatures; facilitating horizontal integration of S^3 technology activities; performing technical studies and analyses in S^3 technology areas; and assessing acoustic target detection technology for battlefield applications.

The S^3TO was provisionally established at HDL during FY 87. In 1988, the office was made a Special Technology Office and reported through the LABCOM Deputy Commander. With the organization of ARL, S^3TO was abolished and its technology assessment functions transferred into the Advanced Technology Management Office in the S^3I Directorate. The function migrated into Sensors in 1995 and, then, in 1996, into SEDD.

Combat Identification Systems Program Office

A DARCOM message dated September 30, 1983 designated ERADCOM the center of technical excellence for Army combat identification programs and named the first project manager, resulting in organization of the Army Combat Identification Systems (ACIS) Project Office. As part of LABCOM, ACIS continued to work very closely with its Air Force counterparts and sponsored two NIFFTE (Noncooperative Identification Friend-or-Foe Technology Evaluation) exercises.

In June 1988, ACIS was officially redesignated the Target Acquisition for Army Weapons Systems (TAAWS) Program Direction Office, with responsibility for developing target acquisition and identification technology, with emphasis on noncooperative technology, for both air and ground targets. Specifically, TAAWS was assigned AMC/LABCOM responsibility for planning and conducting demonstrations in support of the Multiple-Mission Area Sensor (MMAS) concept.

During FY 90, the Director of Corporate Laboratories selected TAAWS to form the nucleus of a new, restructured Advanced Systems Concepts Office (ASCO) designed to facilitate the rapid development of advanced system and component technologies and their timely insertion into weapons systems. The ASCO function (less CISPO) transitioned into the new Advanced Concepts and Plans Directorate of ARL, becoming part of the Military Operations and Analysis Office during 1994.

In May 1991, the Chief of Staff of the Army directed formation of a joint task force composed of TRADOC and AMC to evaluate solutions to friendly fire incidents during Operation Desert Storm. LABCOM was designated to lead the AMC effort, and the Combat Identification Systems Program Office was chartered, splitting out of ASCO. In January 1993, CISPO was transitioned to a Project Manager for Combat Identification (PM-CI), reporting to the Program Executive Officer for Intelligence/Electronic Warfare (PEO IEW). An AMC Special Assistant for Combat Identification reports to the AMC DCS for Research, Development, and Engineering.

Joining Elements
Army Institute for Research in Management Information Communications and Computer Sciences

AIRMICS was established in 1977 as part of the U.S. Army Computer Systems Command, which became, in 1984, part of the U.S. Army Information Systems Command. In the transition to ARL, AIRMICS moved into the Advanced Computational and Information Sciences Directorate. In 1996, the function migrated into IST.

Army Research Institute for the Behavioral and Social Sciences
(MANPRINT function)

ARI has been in continuous existence since 1939, but its antecedents go back to World War I, when, in 1917, a Psychological Examining unit was established in the Medical Department. In the summer of 1940, The Adjutant General (TAGO) established the Personnel Research Section (PRS), which incorporated the Personnel Testing Section of TAGO established in March 1939. ARI recognizes this event – effective July 1, 1940 – as its birth date.

In 1953, PRS was renamed the Personnel Research Branch, which later became the Human Factors Research Branch, part of the Adjutant General's R&D Command. Then, in the 1962 Army reorganization, the branch was transformed into the U.S. Army Personnel Research Office, a Class II activity under the supervision

of the Human Factors Research Division of the U.S. Army Research Office (ARO), Office of the Chief of Research and Development (OCRD).

The activity underwent several name changes – Behavioral Science Research Laboratory (1967), Behavior and Systems Research Laboratory (1969). In 1970, BESRL was redesignated the Manpower Resources Research and Development Center (ManRRDC), incorporating BESRL, the Manpower Resources R&D Center, and the Motivation and Training Laboratory (MTL). In 1972, ManRRDC was redesignated the Army Research Institute for the Behavioral and Social Sciences. A number of research functions were transferred from ARO (Arlington) when that unit was disestablished, MTL was converted to the Individual Training and Performance Research Laboratory, and the Organization and Systems Research Laboratory (later Systems Research Laboratory, SRL) was formed.

In 1974, ARI was transferred from the jurisdiction of OCRD to DCSPER, where it remains. Under the LAB 21/CMRL concept, the MANPRINT function of SRL was transferred into ARL, where it resides in HRED.

Armament, Munitions, and Chemical Command, Chemical Research, Development, and Engineering Center

(Survivability Analysis function)

The Chemical RDE Center (CRDEC) traces its history to the Edgewood Arsenal. In 1917, the Ordnance Department started construction of a chemical shell-filling plant at Edgewood, Maryland, establishing "Edgewood Arsenal" the next year. Also during World War I, the Chemical Warfare Service emerged, with the Research Division as one of its elements.

In the 1962 Army reorganization, the materiel development as well as the procurement and production missions of the Chemical Corps became part of the Army Munitions Command (MUCOM). In 1973, MUCOM was merged with the Weapons Command to form the U.S. Army Armament Command (ARMCOM). However, in 1977, ARMCOM was split into the Armament R&D Command (ARRADCOM) and the Armament Materiel Readiness Command (ARRCOM). In the 1983 recombination that spawned the U.S. Army Armament, Munitions, and Chemical Command (AMCCOM), the Chemical R&D Center was organized in the Edgewood Area of Aberdeen Proving Ground.

The survivability assessment element traces to the Nuclear, Biological, and Chemical (NBC) Survivability Office established in 1985. In 1990, this office merged with the Systems Integration Office (established in 1988) to form the Mission Sustainment and Survivability Division of the Advanced Systems Concepts Directorate. The Munitions Directorate's Countermeasures and Test Division also was created in 1990. In the transition into ARL, these CRDEC elements, along with other individual research analysis elements from CRDEC, became part of the NBC Effects Division of SLAD.

Army Aviation Systems Command, Aviation Research and Technology Activity

NASA-Lewis Research Center (Propulsion Directorate) and NASA-Langley Research Center (a majority of the Aerostructures Directorate)

Modern Army aviation R&D dates from the mid-1960s. Until then, the Transportation Materiel Command and its successor, the Army Aviation Materiel Command (AVCOM), part of the Army Mobility Command (MOCOM), conducted no R&D, only the engineering functions. Only in 1965 did the Army receive permission for direct development, engineering, and procurement, having previously depended on the Air Force for this support. With this authority, AMC and AVCOM took a number of crucial steps.

In 1964, MOCOM assigned the Transportation Research Command at Fort Eustis, Virginia, to AVCOM, which redesignated it the Army Aviation Materiel Laboratories (AVLABS) in 1965. Also in 1965, AMC organized the Army Aeronautical Activity (the Army Aeronautical Research Laboratory, AARL, as of 1966) at the NASA-Ames facility at Moffett Field, California. The existence of AARL depended entirely on a cooperative agreement with NASA negotiated late in 1964 and implemented in 1965.

AVCOM, as of 1968 the Army Aviation Systems Command (AVSCOM), wanted its own consolidated R&D center, to be called the Air Mobile R&D Center, but agreed to a dispersed configuration based on an extension and expansion of the 1965 cooperative agreement with NASA. Under the new terms, the Army gained access to facilities at the Langley Research Center, Hampton, Virginia, and at the Lewis Research Center, Cleveland, Ohio.

In 1970, AMC formally established the Army Air Mobility Research and Development Complex (later Laboratory) consisting of five elements: Headquarters, located at Moffett Field, and four research directorates at Ames, Eustis, Langley, and Lewis.

The Army Aerostructures Directorate (ASTD) has been collocated with the NASA-Langley Research Center since 1970, with a mission focusing on basic and applied research in structures and aeromechanics for rotorcraft. The BRAC 91 and LAB 21 recommendations moved the MTL structures element to Langley and expanded the mission to form the Army Structures Directorate. Under ARL, this became the Vehicle Structures Directorate, now part of the Vehicle Technology Center.

The Army Propulsion Directorate had its beginning in the restructuring of the aviation laboratories in 1970 and the agreement to conduct basic aircraft propulsion research at the NASA-Lewis Research Center. The BRAC 91 and LAB 21 recommendations moved the ground vehicle propulsion basic and applied research from the TACOM RDE Center, Warren, Michigan, to Lewis to form the Army Propulsion Directorate. Under ARL, this became the Vehicle Propulsion Directorate, also part of VTC.

Tank-Automotive Command Research, Development, and Engineering Center

(a portion of the Ground Vehicle Propulsion Basic and Applied Research activity)

The TACOM story dates to September 1942, when the Ordnance Department formed the Tank-Automotive Center (T-AC) in Detroit, combining operations of the Motor Transport Service (recently transferred from the Quartermaster Corps) and the Tank and Combat Vehicle Division, along with other elements concerned with tank and automotive matters. Ground had been broken for the Detroit Tank Arsenal two years before, in September 1940. T-AC was redesignated the Office, Chief of Ordnance-Detroit (OCO-D) on January 1, 1944.

In 1946, demobilization brought the demise of OCO-D and transfer of personnel and function to the Detroit Tank Arsenal. However, the fighting in Korea prompted formation of the Ordnance Tank-Automotive Center (OTAC) in 1950, redesignated the Ordnance Tank-Automotive Command in 1954.

With the formation of AMC, OTAC, renamed the Army Tank-Automotive Center (ATAC), became part of MOCOM. Then, in 1967, ATAC became an MSC as the Army Tank-Automotive Command. In 1976, TACOM was split into the Army Tank-Automotive Research and Development Command (TARADCOM) and the Army Tank-Automotive Materiel Readiness Command (TARCOM), only to be reconsolidated in 1980 as TACOM.

In 1985, R&D elements were organized into the TACOM RDE Center. With the emergence of ARL, a portion of the basic and applied research activity in ground vehicle propulsion was merged with Army aviation propulsion personnel at the NASA Lewis Research Center to form the Vehicle Propulsion Directorate, now part of VTC.

Troop Support Command, Belvoir Research, Development, and Engineering Center

(Technology Base Materials missions and functions to include research in the area of organic chemicals and coatings, rubber and coated fabrics (polymers))

The Army established its first Engineer Board at Willets Point, New York, now Fort Totten, in 1870. Around 1900, the Board was transferred to Washington, where it was disbanded in 1920, to be replaced in 1921 by the Board on Engineer Equipment organized at Camp Humphries, now Fort Belvoir. This was the forerunner of the Engineer Board, which guided R&D activities of the Corps of Engineers from 1933 to 1947, when the name was changed to the Engineer Research and Development Laboratories (ERDL).

ERDL transferred into AMC in 1962, first as part of the Mobility Command, then as part of the Mobility Equipment Command (MECOM). In 1967, ERDL became the Mobility Equipment Research and Development Center, which was renamed the Mobility Equipment Research and Development Command (MERADCOM) in 1976. Then, in 1983, MERADCOM became part of TROSCOM and was redesignated the Belvoir Research and Development Center. Two years later, the word "Engineering" was added to the name.

With the transition to ARL, 6.1 and 6.2 materials elements transferred from Fort Belvoir to Aberdeen Proving Ground as part of the Materials Directorate, now part of the Weapons and Materials Research Directorate.

Communications-Electronics Command, Night Vision and Electro-Optics Directorate

(Optical and infrared research program; algorithm development; target signature activities and laser activities; infrared, optoelectronic, and microwave/photonic materials and devices R&D)

Night vision research started before World War II under the Engineer Board at Fort Belvoir, which conducted and managed R&D for the Corps of Engineers. In 1947, the name was changed to ERDL, with the Warfare Vision Division as one of its elements.

ERDL transferred into AMC in 1962, first as part of MOCOM, then as part of MECOM. In 1965, night vision activities were transferred from MECOM to ECOM, and the Warfare Vision Division became the core of the Night Vision Laboratories (NVL), organized as part of Combat Surveillance, Night Vision, and Target Acquisition Laboratories headquartered at Fort Monmouth.

In the early 1970s, NVL separated from the Combat Surveillance and Target Acquisition Laboratory (CSTAL). Then, in 1977/78, the CSTAL Laser Division was moved from Fort Monmouth and assigned to the new Night Vision and Electro-Optics Laboratory (NVEOL), which became part of ERADCOM. In 1985, during the transition into LABCOM, NVEOL was transferred into CECOM. Then, during 1992, several R&D functions were transferred into ARL as part of the Sensors, Signatures, Signal and Information Processing (S^3I) Directorate. In 1996, the function migrated into SEDD.

Base Realignment and Closure

Woodbridge Research Facility (WRF). In accordance with BRAC 91, WRF was scheduled to close in FY 97; however, the Under Secretary of the Army directed that the action be accelerated to September 30, 1994, and ARL held the closure ceremony at WRF on September 16.

Laboratories at Watertown. Closure ceremonies were held on September 29, 1995, ending 179 years of Army contributions at the Arsenal site.

Aurora. The Aurora gamma radiation simulator fired its last shot before decommissioning in September 1995, and the facility at Adelphi has been deactivated, with the capacitors and oil being transferred to the Defense Nuclear Agency's DECADE program at Tullahoma, Tennessee. The Aurora building will be renovated to house the high-power microwave functions, since the building already has adequate shielding and space.

Glossary

AAN	Army After Next
AARL	Army Aeronautical Research Laboratory
ACAP	Advanced Concepts and Plans Directorate
ACIS	Army Combat Identification Systems Project Office, also Advanced Computational and Information Sciences Directorate
AHPCRC	Army High-Performance Computing Research Center
AIRMICS	Army Institute for Research in Management Information Communications and Computer Sciences
AMARC	Army Materiel Acquisition Review Committee
AMC	Army Materiel Command
AMCCE	AMC Office of Concurrent Engineering
AMCCOM	Army Armament, Munitions, and Chemical Command
AMCDE	AMC DCS for Development, Engineering, and Acquisition
AMC-FAST	AMC Field Assistance in Science and Technology
AMCRD	AMC DCS for Research, Development, and Engineering
AMMRC	Army Materials and Mechanics Research Center
AMR	Army Management Review
AMRA	Army Materials Research Agency
APG	Aberdeen Proving Ground, Maryland
ARDEC	Armament Research, Development, and Engineering Center
ARI	Army Research Institute (for the Behavioral and Social Sciences)
ARL	Army Research Laboratory
ARMCOM	Army Armament Command
ARO	Army Research Office
ARRADCOM	Army Armament Research and Development Command
ARRCOM	Army Armament Materiel Readiness Command
ASA(RDA)	Assistant Secretary of the Army for Research, Development, and Acquisition
ASCO	Advanced Systems Concepts Office
ASHPC	Advanced Simulation and High-Performance Computing Directorate
ASI	Army Space Institute
ASL	Atmospheric Sciences Laboratory
ASTD	Army Aerostructures Directorate
ASTRO	Army Space Technology Research Office
ATAC	Army Tank-Automotive Center
ATACMS	Army Tactical Missile System
AVCOM	Army Aviation Materiel Command
AVLABS	Army Aviation Materiel Laboratories
AVSCOM	Army Aviation Systems Command
BAST	Board on Army Science and Technology
BED	Battlefield Environment Directorate
BESRL	Behavioral Science Research Laboratory, also Behavior and Systems Research Laboratory
BRAC	Base Realignment and Closure Commission
BRL	Ballistic Research Laboratory
C^3I	Command, Control, Communications, and Intelligence
CCM	Counter-Countermeasure(s)
CECOM	Army Communications-Electronics Command
CI	Combat Identification
CICC	Corporate Information and Computing Center
CISPO	Combat Identification Systems Program Office
CM	Countermeasure(s)
CMRL	Combat Materiel Research Laboratory
CNVEO	Center for Night Vision and Electro-Optics (CECOM)
CRDEC	Chemical RDE Center
CSTAL	Combat Surveillance and Target Acquisition Laboratory
DA	Department of the Army
DARCOM	Army Materiel Development and Readiness Command
DCS	Deputy Chief of Staff
DCSPER	DCS for Personnel
DCSTPM	DCS for Technology Planning and Management
DESCOM	Army Depot System Command

DMR	Defense Management Review
DoD	Department of Defense
DOFL	Diamond Ordnance Fuze Laboratory
DSB	Defense Science Board
ECOM	Army Electronics Command
EFTA	ERADCOM Flight Test Activity
ENIAC	Electronic Numerical Integrator and Computer
EPSD	Electronics and Power Sources Directorate
ERADCOM	Army Electronics Research and Development Command
ERDL	Engineer Research and Development Laboratories
ETDL	Electronics Technology and Devices Laboratory
EWL	Electronic Warfare Laboratory
FFRDC	Federally Funded R&D Center
FIREFINDER	Counter-mortar and Counter-battery Systems (AN/TPQ-36 and AN/TPQ-37)
GOCO	Government-Owned, Contractor-Operated
GPRA	Government Performance and Results Act of 1993
GPS	Global Positioning System
GUARDRAIL	Airborne VHF Intercept and Target Location System
HBCU/MI	Historically Black Colleges and Universities/Minority Institutions
HDL	Harry Diamond Laboratories
HEL	Human Engineering Laboratory
HMMWV	High-Mobility, Multipurpose Wheeled Vehicle
HRED	Human Research and Engineering Directorate
IEW	Intelligence/Electronic Warfare
IST	Information Science and Technology Directorate
JSTARS	Joint Surveillance and Target Attack Radar System
LABCOM	Army Laboratory Command
LEIP	Laboratory Effectiveness Improvement Program
LOTA	Low Observable Technology and Application Office
MANPRINT	Manpower and Personnel Integration
ManRRDC	Manpower Resources Research and Development Center
MECOM	Army Mobility Equipment Command
MERADCOM	Army Mobility Equipment Research and Development Command
MICNS	Modular Integrated Communications and Navigation System
MICOM	Army Missile Command
MLRS	Multiple Launch Rocket System
MMAS	Multiple-Mission Area Sensor
MOCOM	Army Mobility Command
MSC	Major Subordinate Command
MSRC	Major Shared Resource Center
MTL	Materials Technology Laboratory, also Motivation and Training Laboratory (ARI)
MUCOM	Army Munitions Command
NASA	National Aeronautics and Space Administration
NBC	Nuclear, Biological, and Chemical
NBS	National Bureau of Standards
NIFFTE	Noncooperative Identification Friend-or-Foe Technology Evaluation
NIST	National Institute of Standards and Technology
NVEOL	Night Vision and Electro-Optics Laboratory
NVL	Night Vision Laboratory
NWE	Nuclear Weapons Effects
OCO-D	Office, Chief of Ordnance-Detroit
OCRD	Office of the Chief of Research and Development, DA
OMEW	Office of Missile Electronic Warfare
OMRO	Ordnance Materials Research Office
OSD	Office of the Secretary of Defense
OTAC	Ordnance Tank-Automotive Center
PEO	Program Executive Officer
PRS	Personnel Research Service
PSD	Physical Sciences Directorate
QUICKFIX	Heliborne Intercept and Jamming System (AN/ARQ-33), with direction-finding,provides location, also (AN/ALQ-151)
QUICKLOOK	Noncommunications Emitter Location System Mounted in Mohawk Aircraft (AN/ALQ-133)

RDA	Research, Development, and Acquisition
RDE	Research, Development, and Engineering
RDEC	Research, Development, and Engineering Center
RDTE	Research, Development, Test, and Evaluation
REMBASS	Remotely Monitored Battlefield Sensor System
S^3	Signatures, Sensors, and Signal Processing
S^3I	Signatures, Sensors, Signal and Information Processing
S^3TO	Signatures, Sensors, and Signal Processing Technology Organization
SCEL	Signal Corps Engineering Laboratories
SEDD	Sensors and Electron Devices Directorate
SEN	Sensors Directorate
SES	Senior Executive Service
SLAD	Survivability/Lethality Analysis Directorate
SMO	Survivability Management Office
SRL	Systems Research Laboratory
SSDC	Space and Strategic Defense Command
SSL	Squier Signal Laboratory
SWL	Signals Warfare Laboratory
TAAWS	Target Acquisition for Army Weapons Systems
TAC	Tank-Automotive Center, also Technology Assessment Center
TACJAM	vhf Communications Jammer (AN/MLQ-34)
TACOM	Army Tank-Automotive Command
TAGO	The Adjutant General's Office
TARADCOM	Army Tank-Automotive Research and Development Command
TARCOM	Army Tank-Automotive Materiel Readiness Command
TEAMMATE	Communications-intercept and Direction-finding System (AN/TRQ-32)
TEAMPACK	Noncommunications Direction-finding System (AN/MSQ-103A)
TOW	Tube-launched, Optically tracked, Wire-guided Missile
TPM	Technology Planning and Management
TRADOC	Army Training and Doctrine Command
TRAFFIC JAM	Transportable hf/vhf Communications-intercept and Jamming System (AN/TLQ-17A)
TRAILBLAZER	Ground-based, Tracked, vhf Intercept and Emitter Location System (AN/TSQ-114A)
TROSCOM	Army Troop Support Command
TSA	ERADCOM Technical Support Activity
TSSC	ERADCOM Tactical Software Support Center
VAL	Vulnerability Assessment Laboratory
VLAMO	Vulnerability/Lethality Assessment Management Office
VTC	Vehicle Technology Center
WAL	Watertown Arsenal Laboratories
WMRD	Weapons and Materials Research Directorate
WRF	Woodbridge Research Facility
WSMR	White Sands Missile RangeWSPG White Sands Proving Ground

End Notes

1 Much of the following discussion is based on "U.S. Army R&D Traveled `Rocky Road' to Reach Present Status," Army Research and Development Newsmagazine (December 1963 - January 1964).

2 The Manhattan Project, reporting to the Military Policy Committee, pioneered what became known as project management.

3 James E. Hewes, From Root to McNamara: Army Organization and Administration, 1900-1963, U.S. Army Center of Military History (1975), pp. 120-122.

4 C. W. Borklund, The Department of Defense (New York: Frederick A. Praeger, 1968), pp. 67-68 and 153-154.

5 Historical Office, U.S. Army Armament, Munitions, and Chemical Command, The Evolution of the Army Armament, Munitions, and Chemical Command, pp. 4 and 6; Hewes, From Root to McNamara, p. 334.

6 Historical Office, AMC, Arsenal for the Brave, A History of the United States Army Materiel Command, 1962-1968 (September 30, 1969), p. 79.

7 U.S. Army Materiel Acquisition Review Committee, Report, Vol. II, Committee Reports (April 1, 1974), pp. II-3-II-5.

8 U.S. Army Materiel Development and Readiness Command, Annual Report of Major Activities, Fiscal Year 1975, prepared by Myles G. Marken, Sr., Historical Office, DARCOM (November 1, 1976), p. 12.

9 AMARC, Report, Vol. I, Precis (April 1, 1974), pp. 13 and 26-27; Vol. II, Committee Reports, p. VI-2.

10 AMARC, Report, Vol. II, Committee Reports, p. VI-5; U.S. Army Electronics Research and Development Command, FY 78 Historical Review, pp. 2-3.

11 ERADCOM, FY 78 Historical Review, pp. 2-3 and 6.

12 Historical Office, AMCCOM, The Evolution of the Army Armament, Munitions, and Chemical Command, p. 7.

13 DARCOM, Annual Historical Review, Fiscal Year 1979, prepared by Historical Office, DARCOM (September 30, 1981), p. iii.

14 LABCOM Transition Team files, Gen. Richard H. Thompson, Commander, AMC, to Gen. John A. Wickham, Chief of Staff, Army, March 11, 1985.

15 Much of this discussion is based on "Laboratory Effectiveness Improvement Program," a typescript submission by Herbert Leventhal, Historical Office, AMC, which, in turn, is based on LEIP archives compiled by Bruce M. Fonoroff, principal staff person, and now located in the Historical Office, AMC.

16 LEIP archives, "Progress Report (B. Fonoroff) for the Period 28 July - 25 August 1984."

17 Other Army technology base assets are managed by the Army DCS for Personnel, the Surgeon General, and the Corps of Engineers.

18 As of January 31, 1992, ARO became a separate reporting activity to Headquarters, AMC. The AMC Field Assistance in Science and Technology Office (AMC-FAST) became a separate reporting activity to Headquarters, AMC on March 19, 1992.

19 Defense Secretary's Commission on Base Realignment and Closure, Base Realignment and Closures, Report (December 1988), pp. 60-61.

20 Memorandum, HQ LABCOM, AMSLC-CT, January 6, 1989, Brig. Gen. Malcolm R. O'Neill, Commander, subject: Recommendation for Closure of MTL.

21 In October 1991, the Secretary of the Army approved the name change from CMRL to Army Research Laboratory.

22 Department of Defense, Base Closure and Realignment, Report (April 1991), pp. 49-50.

23 Federal Advisory Commission on Consolidation and Conversion of Defense Research and Development Laboratories, Report to the Secretary of Defense (September 30, 1991), pp. ES-3-ES-4.

24 Deutch was later the Under Secretary of Defense for Acquisition and Technology and, then, Director of Central Intelligence.

25 National Research Council, Board on Army Science and Technology, Committee on Alternative Futures for the Army Research Laboratory, The Army Research Laboratory, Alternative Organizational and Management Options (Washington, 1994), pp. 61-62.

26 Several functions were shifted to other organizations, including creation of and updates to Firing Tables, operation of the Transonic Range, free-flight instrumentation and testing, warhead technology R&D, some armor technology and armor engineering and experimentation, and high-power laser technology.

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