Chapter 5 – Division Resources

Division Resources

5.1 Introduction

This chapter provides information on the Division's human, financial, facilities and equipment resources.

5.2 Human Resources

The AMAD's most valuable asset is our staff. AMAD currently has 50 staff members of which 47 are science and technical including 6 managers plus 3 administrative support staff. Figure 5.1 provides the organization structure and alignment of the Division's Federal employees. (It does not include other technical and administrative staff including personnel with the Senior Environmental Employee Program (SEEP), National Research Council (NRC), Oak Ridge Institute for Science and Education (ORISE), Science and Technology Corporation (STC), student services contractors, or other special contractor or grantee positions. As of 09/30/08, AMAD employed 14 people through these various programs. Although they are important to our organization, the focus of these peer review materials are on the permanent Federal staff.)

Our science and technical staff includes 28 Ph.D.-level scientists, 14 staff with masters degrees and 5 with bachelors degrees. Our science and technical staff hold degrees in the following disciplines.

- Atmospheric Science (14 staff)
- Engineering (11)
- Meteorology (9)
- Environmental Science (4)
- Statistics/Mathematics (4)
- Computer Science (3)
- Physics (2)

Most of AMAD's science and technical staff serve as principal investigators on a given area of research. Post-doctoral students, visiting scientists, graduate students, and other technical staff also support the Division's science mission. Our science and technical staff are also supported by contractor staff who provide additional technical support. Our administrative staff provide critical support to our science and technical staff including contract and financial management, travel assistance, time keeping, and management of EPA and ORD tracking systems. Our administrative staff are augmented by the Program Operations Staff (POS) of the Human Exposure and Atmospheric Sciences Division. Beginning in FY2009, all administrative support is provided by the POS personnel with the exception of AMAD's Office Manager. Figures 5.1 through 5.4 provide additional information and characterization regarding the Division's human resources.

Figure 5.1 Atmospheric Modeling and Analysis Division (AMAD)
Human Resources (January 2009)

Immediate Office
Dr. S.T. Rao, Director
David Mobley, Deputy Director
Kenneth Schere
Patricia McGhee
Jeff West
Gary Walter
Sherry Brown

Atmospheric Model Development Branch
Rohit Mathur, Branch Chief
Ann Marie Carlton
Bill Hutzell
David Wong
Deborah Luecken
Golam Sarwar
Heather Simon (post-doc)
Jeff Young
John Streicher
Jonathon Pleim
Prakash Bhave
Rob Gilliam
Shawn Roselle

Emissions and Model Evaluation Branch
Tom Pierce, Branch Chief
Alfreida Torian
Brian Eder
George Pouliot
James Godowitch
Kristen Foley
Sergey Napelenok
Steve Howard
Wyat Appel

Atmospheric Exposure Integration Branch
Val Garcia, Branch Chief
David Heist
Donna Schwede
Ellen Cooter
Jason Ching
Jesse Bash
Jim Crooks (post-doc)
Joe Touma
Robin Dennis
Steven Perry
Vlad Isakov

Applied Modeling Branch
Alice Gilliland, Branch Chief
Bill Benjey
Chris Nolte
Jenise Swall
Jerry Herwehe
Rob Pinder
Russ Bullock
Tanya Otte

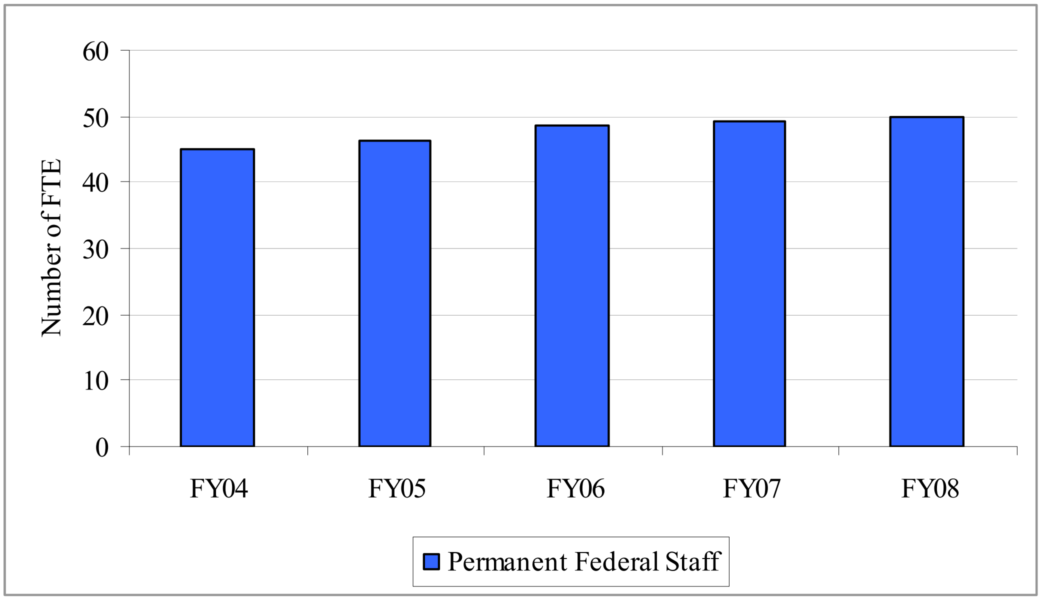

Figure 5.2 AMAD Federal FTE (FY04 - FY08)

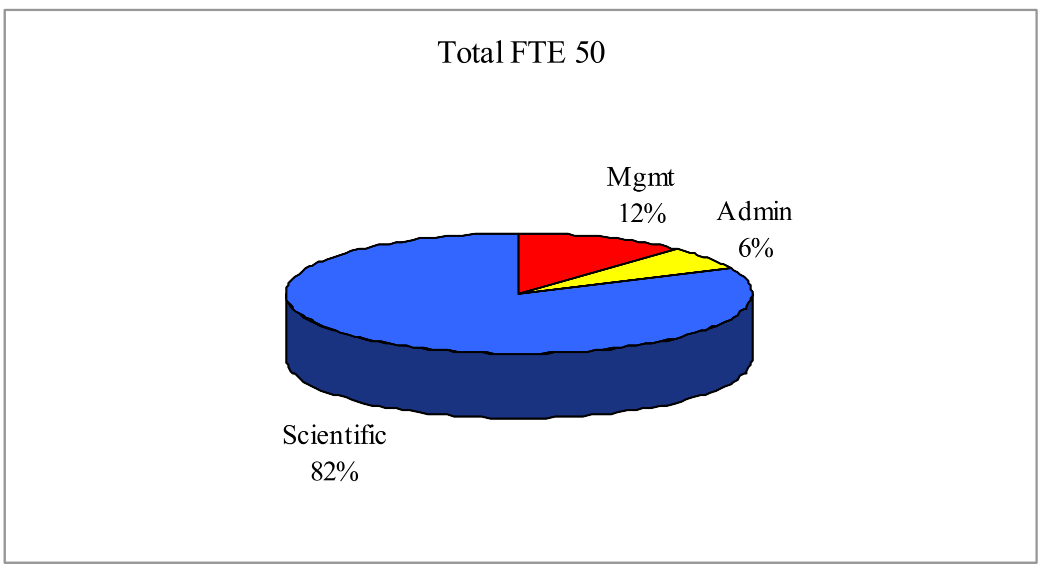

Figure 5.3 AMAD FY08 Federal FTE by Job Category

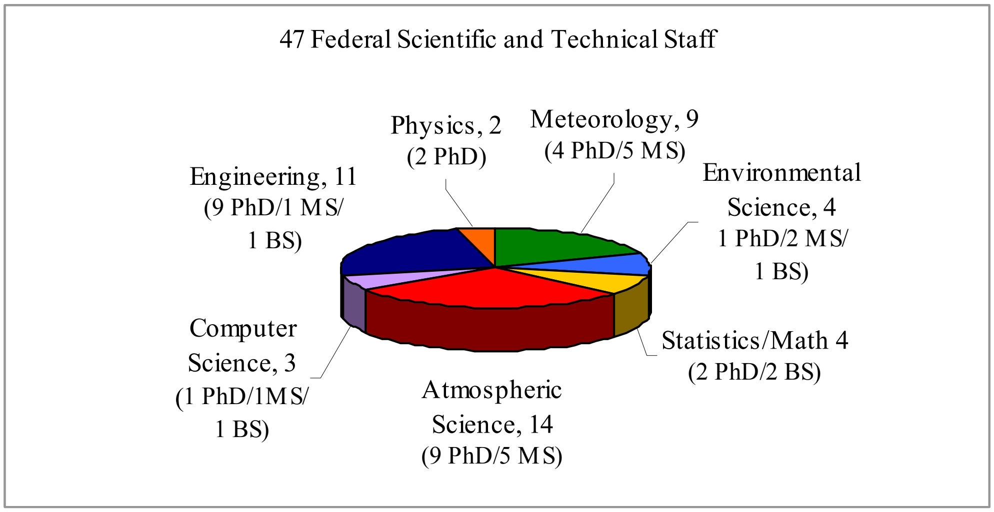

Figure 5.4 AMD Scientific and Technical Staff Disciplines and Degrees

5.3 Financial Resources

AMAD receives its funding in different allocations: salaries, operating expense, travel, and extramural. The salaries allocation covers wages and associated benefits for AMAD Federal staff. Operating expenses cover costs associated with maintaining AMAD research and purchasing supplies and research equipment for the Fluid Modeling Facility. Operating expenses also provide resources for training for AMAD staff. The majority of AMAD's travel allocation covers travel expenses for staff to attend scientific conferences, workshops, and meetings. The travel allocation is also used to fund travel to management and administrative meetings, invitational travel, and, in some years, relocation costs for new hires, and costs for AMAD staff to participate in longer term scientific details to external organizations (e.g., US Embassy Fellows program). AMAD's operating and travel allocations remained fairly constant during the period from 2003 to 2007.

AMAD's extramural resources are used to fund mission critical contracts and assistance agreements (e.g., cooperative agreements and interagency agreements), as well as, contracts for technical support from students and the Senior Environmental Employee Program (SEEP). Figures 5.5 through 5.7 present information about AMAD's financial (extramural only) resources. During the period from 2003 to 2007, AMAD's annual extramural resource allocation fluctuated with EPA and NERL's budgets. One of the major impacts has been the transition to "research support" for allocating resources over the past two years. This approach has resulted in a positive trend in AMAD funding. In addition, programmatic initiatives and reprogrammings such as the Advanced Monitoring Initiative, Nanotechnology, and Global Climate Change have augmented our budget. Most of AMAD's extramural resources are used to fund the Division's mission critical contracts that provide support for Division model development and applications as well as the operation of the Fluid Modeling Facility. AMAD also funds cooperative agreements and interagency agreements to support collaborative research endeavors. All AMAD extramural resources are tied to EPA strategic goals through the ORD Multiyear Plans (MYP). The majority of AMAD's extramural resources are used to support research conducted under two of these strategic goals: (1) the Clean Air Research which supports EPA Strategic Goal 1 (Clean Air and Global Climate Change) and (2) Goal 4 (Healthy Communities and

Ecosystems).

AMAD does not receive an annual allocation for major capital equipment purchases. Resources for these purchases are obtained via the ORD Capital Equipment process, which funds equipment purchases in excess of $85K. Each year, AMAD submits a list of prioritized capital equipment requests for consideration. These requests are then prioritized within NERL and, ultimately, within ORD. ORD funds the prioritized list of requests depending upon available resources. AMAD has received significant resources for computer equipment through the Capital Equipment process.

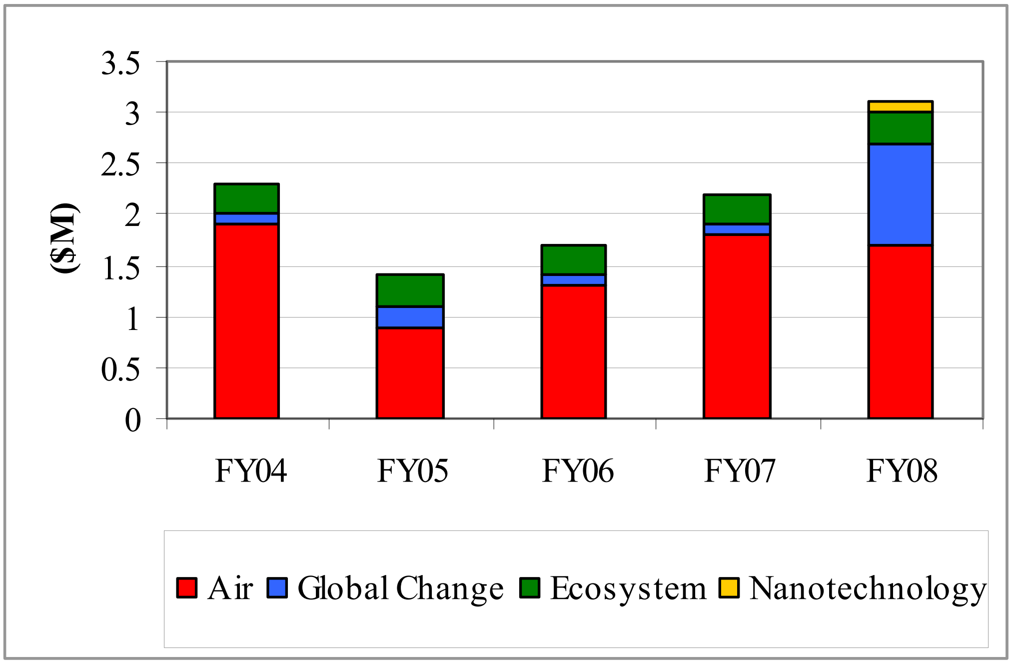

Figure 5.5 AMAD Extramural Resources by Fiscal Year (FY04-FY-08)

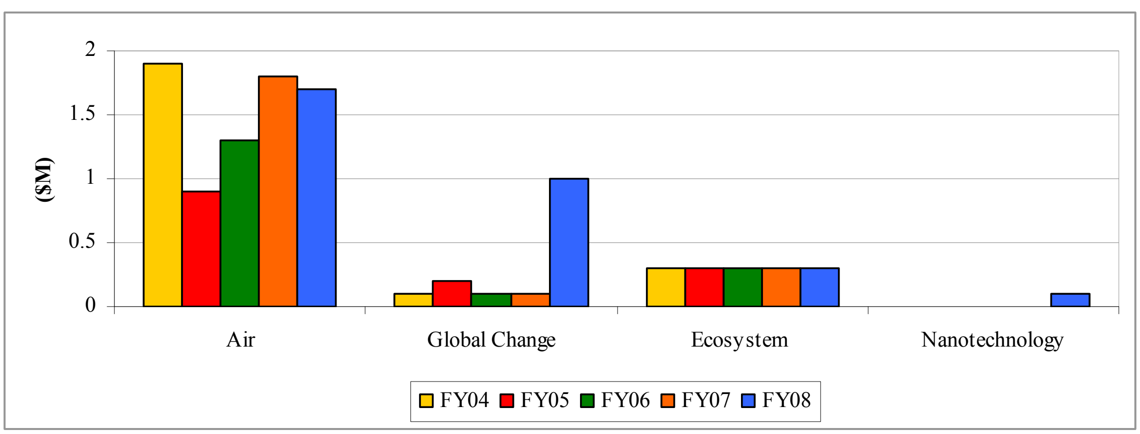

Figure 5.6 AMAD Extramural Resources by MYP (FY04-FY08)

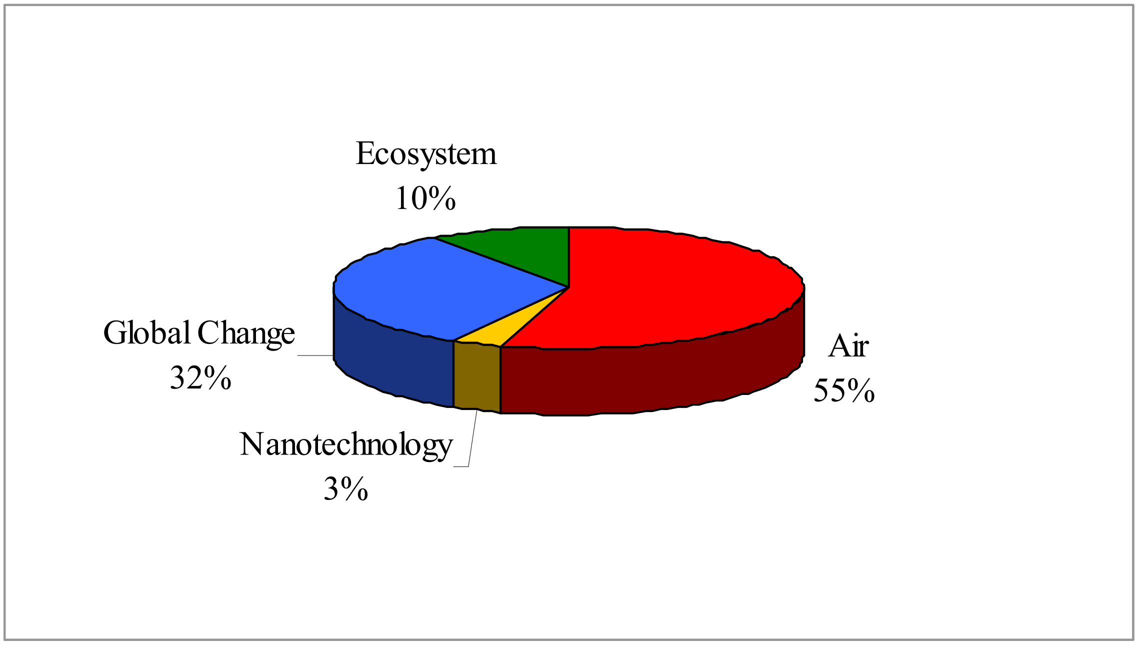

Figure 5.7 AMAD Extramural Resources and FTEs by MYP in FY08 ($3.2M & 47 FTEs)

5.4 Facilities and Equipment

The AMAD maintains and operates an extensive amount of state-of-the-science computer facilities and the Fluid Modeling Facility. The following sections provide brief descriptions of these facilities and equipment.

5.4.1 Fluid Modeling Facility

Over the past thirty five years, scientists at the EPA's Fluid Modeling Facility (FMF) have conducted laboratory studies of fluid flow and pollutant dispersion in support of the Agency's air research programs (e.g. human exposure, ambient air standards, air toxics, homeland security). Experimental studies within the FMF laboratory have produced hundreds of publications and reports contributing directly to the development and improvement of EPA's numerical air quality modeling tools that are used to formulate, evaluate, and enforce air quality policies and regulations. Studies within the meteorological wind tunnel (Figure 5.8) have included simulations of flow around individual buildings and building arrays, within complex topography, near roadways and in street canyons and within highly urbanized areas. In addition to studies of more general scientific design, the laboratory engages in site-specific experiments to address particular environmental or emergency response concerns. These have recently included an examination of the flow and dispersion around the Pentagon facility, the dispersion of gases and particles from the collapsed World Trade Center (Figure 5.9), and the flow and concentration distributions near Interstate 15 in Las Vegas, NV.

The primary clients for FMF research products are air-quality, human-exposure, and emergency-response modelers within EPA and in other government departments and national research laboratories. These include, first and foremost, our own organization, the National Exposure Research Laboratory, but additionally, EPA's National Homeland Security Research

Center, EPA's many program offices (e.g. OTAQ, OPPTS, OAQPS) and regional offices, the National Oceanic and Atmospheric Administration, the Department of Homeland Security, the Department of Defense and the Federal Highway Administration.

Currently the FMF is engaged in laboratory research projects designed to understand pollutant dispersion and potential human exposure within complex urban environments with particular emphasis on exposures near major roadways. These studies support the Agency's Near-Roadway and School Infiltration Research program and the Urban Dispersion Program.

The role and importance of the FMF is increasing as the Agency's air quality management issues are evolving from regional to urban scales. Issues such as Environmental Justice, near roadway exposures and health effects, and emergency response require an understanding of near field flow and dispersion. The FMF will provide significant insights to improve the Agency's ability to model urban scale air quality scenarios and develop effective guidance, mitigation, and policies. The general themes of urban dispersion, homeland security, emergency response, and human exposure will continue to be the focus of research in the laboratory over the next five to ten years.

Examples of significant contributions:

- Thirty five years of contributions to air quality modeling with hundreds of publications and reports leading to improved algorithms within Agency promulgated regulatory models (e.g. CTDMPLUS, AERMOD);
- Characterized the spread of pollutants from tall buoyant stack releases resulting in significantly improved dispersion algorithms; provided the scientific basis for the EPA Good Engineering Practice Stack Height Policy;
- Characterized the flow around buildings and building arrays resulting in the Building Downwash Algorithms currently used in modeling for permit applications of major sources;
- Discovered the concept of the Dividing Streamline greatly improving the algorithms for simulating the dispersion of pollutant plumes in regions of complex topography;
- Publication of the Guideline for Fluid Modeling Studies of Atmospheric Dispersion which has been adopted by the EPA as the regulatory standard for laboratory studies of dispersion phenomena;
- Developed the design criteria for the wastewater treatment out-fill diffusers in the Boston Harbor resulting in a savings of over $50 million during implementation;
- Described the flow of pollutants around the Pentagon to evaluate models for protection of building occupants from toxic releases; part of the DOD's Pentagon Shield Program;
- Examined the dilution of exhaust gases from the externally-vented chemical-fume hoods within the EPA Research and Administration Facility in Research Triangle Park to assess the potential for re-entrainment of pollutants into the building fresh-air intake ports; wind-tunnel study resulted in modification to building design;
- Characterized the dispersion of pollutants from the collapsed World Trade Center to assess risk and exposure of the population in the metropolitan area.

Figure 5.8. The EPA meteorological wind tunnel; simulates a neutrally stratified atmospheric boundary layer with a test section that is 3.7m wide, 2.1m high, and 18.3 m long and with free-stream speeds of approximately 0.5 to 10 m/s.

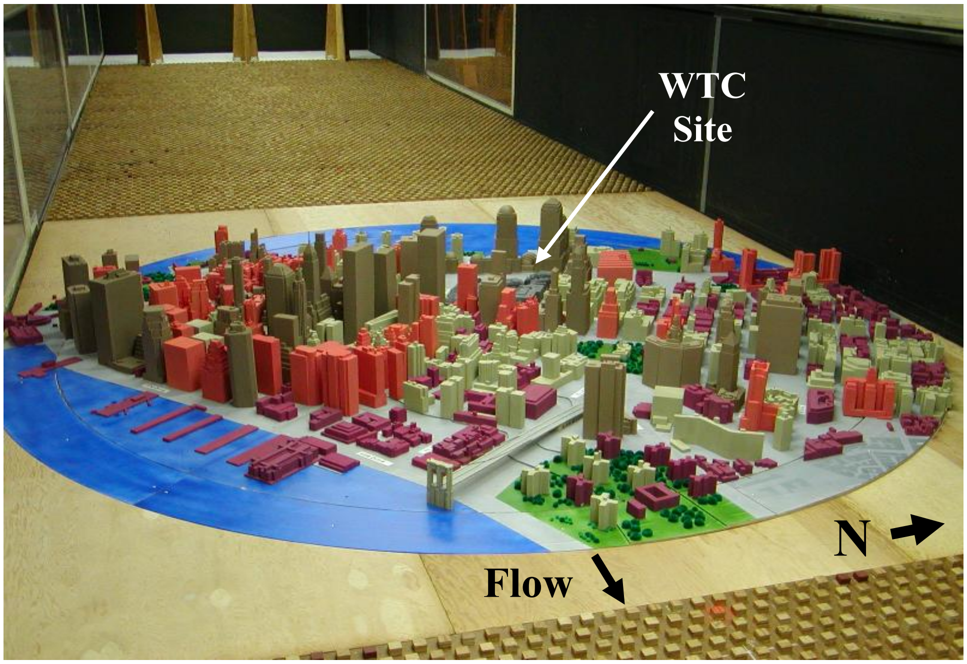

Figure 5.9 1:600 scale model of lower Manhattan including a representation of the remains of the collapsed buildings at the World Trade Center site. Extensive flow and tracer dispersion were collected in support of the EPA exposure assessments over the months following September 11, 2001.

5.4.2 AMAD Computational Resources

NERL's Atmospheric Modeling and Analysis Division uses a combination of two computer resource pools. The EPA's National Computing Center (NCC) offers High End Computing Equipment that is shared with other EPA groups. Locally we have a number of computer resources that are available for our mid-tier computing runs.

NCC Computational Resources
An SGI Altix 4700 (amber) provides a high-end scientific computing resource for visualization and high performance computing (HPC) projects and models. This HPC server was installed in November 2006 at the EPA's National Computing Center. The Altix has more than three times the compute capacity of the system it replaces, enabling AMAD scientists to work on more sophisticated and complex environmental problems. AMAD shares these ORD computational resources with other users in ORD and throughout EPA. Attributes of the amber system include:

- 96 compute blades, each containing one dual-core Intel Itanium2 processor and 8 GB of memory, for a system-wide total of 192 CPUs and 768 GB of memory
- Cache-coherent non-uniform memory access (ccNUMA) architecture, in which each CPU can access not only its local memory but also the memory of any other node through a globally shared address space
- Each Itanium2 processor operates at 1.6 GHz and contains 9 MB of L3 cache per core, or 18 MB of L3 cache per processor
- The peak floating point rate of each CPU, that is, each core, is 6.4 Gflop/s, and the system is configured with 4 GB of memory/core

- Each compute blade has two NUMALink4 connections to a network of routers with a peak bandwidth of 6.4 GB/s per link
- Two direct-attached file systems provide a total of 57.2 TB of usable file space
- Currently configured with 20 single-core Intel Itanium2 processors/80 GB for interactive use and 172 CPUs/688 GB for batch jobs.

Archival storage management at NCC is provided by two Sunfire E4900 servers, providing high-capacity tape drives, more disk for staging files to and from tape, and greater bandwidth. This system is backed by a complex of STK tape silos that provide near-line access to nearly a Petabyte of data. To ensure high availability, the archival server consists of two nodes operating in a cluster configuration so that either system can fail over to the other.

AMAD Local Computing Resources
AMAD's High Performance Computing and Communication Center (HPCC) is our primary Division resource for mid-tier computations. The center comprises data, computer, and network resources that have been developed in-house in partnership with EPA's network and security teams to provide affordable access to mid-tier high-performance computing facilities to the Division. Much progress in technology-driven and knowledge-intensive research and development has been made in recent years due to the availability of affordable high-end computing (HEC) facilities. Through our internal center AMAD has access to hardware, services and expertise that are essential to the effective use of HEC resources through both contractual and AMAD in-house expertise.

The core of this center is three 32 processor SGI Altix systems. The SGI Altix 4700 (ice) provides a high-end scientific computing resource for visualization and HEC projects and models. This HPC server was installed in June 2006. The other two Altix systems are both SGI Altix 3700's which are also primarily used for visualization and high performance computing projects and models. In addition to these Altix systems, AMAD owns a number of cluster based systems. The wind/rain cluster is a 16-node, P4 XEON CPU cluster. This cluster is based on Intel's 'XEON' CPU, the latest revision of Intel's Xeon architecture, which offers 50% higher clock rates and a larger cache size than its predecessors. This was the first cluster of this type to be installed in EPA's RTP LAN. Dedicated file servers offer more than 150 TB hard disk space with a high-speed link to the clusters. Additionally, high-end specification workstations allow direct access to the clusters.