



GLOBAL CAPABILITIES

data centers



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01 AECOM highlights

87K+

Over 87,000 employees worldwide

700+

716 offices in 150 countries
on all seven continents

\$17B+

\$17.4 billion in annual revenue

#1

Top 500 Design Firms
(Engineering News Record)

integrated delivery

Design, build, finance, operate

100+MW

Mission-critical facility design

25M+

Constructed over 25 million sq. ft.
of mission-critical space

state-of-the-art

Critical infrastructure capabilities

dedicated

Data center practice

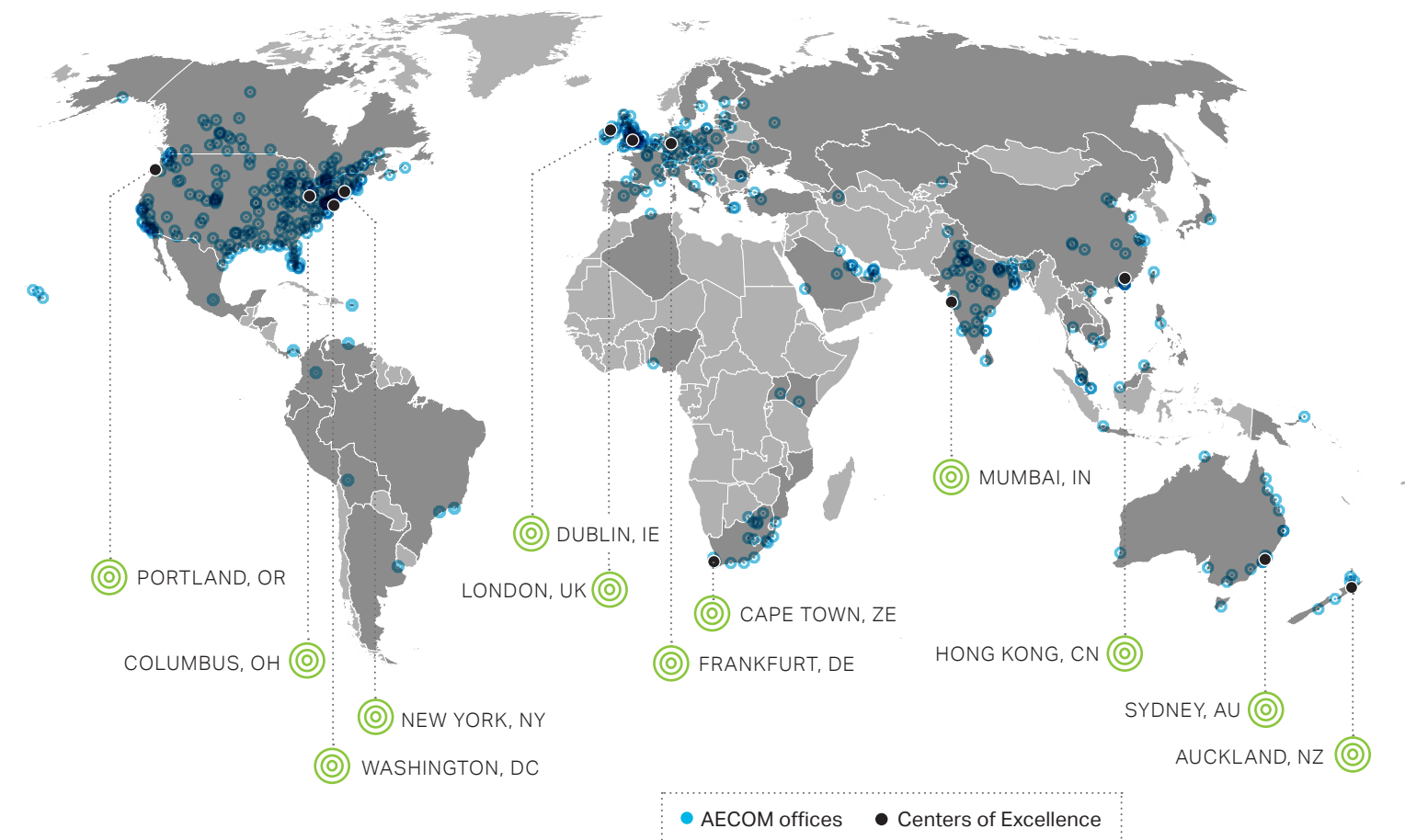
AECOM

Imagine it. Delivered.

AECOM is an industry-leading firm providing engineering, construction, environmental, managerial, and technical services to clients in more than 150 countries around the world. Listed on the Fortune 500 as one of America's largest companies, AECOM's technical expertise and creative excellence come from our abundant professional network. This enables us to collaboratively work globally and deliver locally.

We are a global network of experts working with clients, communities and colleagues to develop and implement innovative solutions to the world's most complex challenges. We connect expertise across services, markets, and geographies to deliver transformative outcomes.

AECOM Centers of Excellence » Data Centers



Specialized data center + mission-critical expertise.

AECOM has extensive experience in planning, permitting, designing, and constructing data centers and mission-critical facilities, including comprehensive site selection services for global data center programs. We have successfully provided design, construction management, maintenance and operational services for hundreds of facilities, including 100+MW sites and projects over 500,000 sq. ft.

Our experience covers greenfield construction of new build-to-suit data centers, data center infrastructure upgrades and expansions, conversion and renovation existing space, fit-outs, and operations and maintenance.

We understand that redundancy, reliability and availability are key aspects of data center facilities when it comes to dealing with events, including natural disasters and power outages. Critical and non-critical elements must resist failure to maintain operational and functional capabilities. In this era of reliance on electronic data, primary and alternative lines of communication need to be protected and maintained.

Standardization and flexibility are also key components in system design. We recognize the need to provide solutions that allow simplified installation processes that enable future expansion with cost, time, and maintenance benefits.

project life cycle complete support

CONSULTING + PLANNING

- Site Selection
- Due Diligence
- Master Planning
- Feasibility Studies
- Facility Assessments
- Permitting
- Site Surveys
- Environmental Services
- Remediation
- NEPA Compliance
- Climate Change
- Life Cycle Analysis
- Sustainability
- Business Strategy
- Financial Analysis
- Real Estate
- Acquisition Support
- Space Planning & Workspace Strategy
- Geospacial Technical Services
- EHS Compliance Audits
- Risk Assessments

DESIGN + ENGINEERING

- Mechanical Engineering
- Electrical Engineering
- Architecture/Interiors
- Civil Engineering
- Structural Engineering
- Geotechnical Engineering
- Value Engineering
- Cyber Security
- IT Infrastructure/Video Services
- Water & Wastewater
- BIM
- Power Solutions
- Mission-critical Solutions
- Facility Engineering
- Strategic Facilities/Infrastructure Planning
- Logistics

CONSTRUCTION

- Owners Representation
- General Contractor
- Schedule & Cost Control
- Estimating & Budgeting
- Design & Constructability Review
- Quality Assurance & Control
- Construction Management
- Program & Project Management
- Construction Inspection
- Real Estate Acquisition Support
- Bid Process Administration
- Design/Build
- EPCM Services
- Equipment Pre-purchasing
- Claims & Dispute Resolution
- Integrated Project Delivery

OPERATIONS

- Commissioning & Retro-commissioning
- Regulatory Compliance
- Move Planning & Coordination
- Record Drawings
- Warranty Administration
- Licensing
- FF&E Installation Coordination
- Training
- Facilities Operations
- Cloud Computing
- Condition Assessments
- Design Reviews & Quality Management

Key data center services are discussed on the following pages.

Integrated solutions to support your data center projects

We focus on delivering the best possible outcomes for our data center clients. This is achieved through our in-depth understanding of the data center industry. Our sector-focused teams work closely with our clients to create resilient, innovative and sustainable solutions which fit commercial constraints, from meeting lowest capital expenditure to delivering best value over the project lifecycle. With projects spanning the globe, from Europe to the Americas to Africa to Asia to Australia, we have worked on behalf of the companies such as:

TECHNOLOGY

Providing best practice methodologies and using cutting-edge technologies

EFFICIENCY

Minimizing power usage effectiveness (PUE) and carbon footprint within operational and cost constraints

GLOBAL REACH, LOCAL KNOW-HOW

Navigating local permitting, planning, and regulations, and understanding local equipment, materials, and installation methodologies while providing global procurement advice and assistance in preferred supplier agreements

PROCESS

Better communication resulting in better coordination and more efficient processes

COMMITTED TO A SUSTAINABLE FUTURE

Sustainability, reducing energy consumption, and minimizing greenhouse gases are major considerations in the design and operation of data centers and mission-critical facilities. Solutions must address both power and data needs while supporting energy efficiency, reliability, uptime, and space utilization requirements. Our engineering and environmental resources work together to provide clients with integrated solutions to optimize the overall performance and efficiency of their facilities.

CONSISTENCY

Coordinating project delivery and ensuring consistency across sites and geographies

VALUE

Understanding Total Cost of Ownership (TCO), creating optimum return on investment and maximizing value

RISK

Safeguarding business resilience and continuity, and providing cost and program surety

FLEXIBILITY

The option to plan and accommodate the phased expansion of your data center

02 consulting + planning

Site selection due diligence + permitting

AECOM is a leader in providing comprehensive site selection due diligence (SSDD) services for global data center programs.

We know that site selection services require strict confidentiality and we believe the best results are achieved when data center expertise is combined with the site and regulatory knowledge of local experts.

We also understand the time-critical nature of the due diligence process—our wealth of experience on data center projects allows us to quickly identify critical site development and regulatory issues.

SSDD services:

- Determination of owner requirements
- Infrastructure availability assessments (e.g., power, water, telecom/fiber)
- Site inspections and surveys
- Geotechnical engineering
- Civil site design
- Remedial liability assessments
- Building condition surveys
- Wetland and ecological evaluations
- Cultural resource studies and compliance
- Environmental site assessments (ESAs)
- Noise modeling and impact assessments
- Air emissions modeling and permitting
- Local jurisdiction/agency coordination and entitlements negotiation
- Incentive analysis – tax and other
- Preliminary schedule and budget analysis
- Sustainability consulting
- Labor force assessments



Confidential Technology Client, Data Centers

Global locations

Due diligence, site selection strategic operations

AECOM was retained by a confidential enterprise client to conduct due diligence reporting on multiple sites across various states and countries to analyze the cost and benefits of potential locations for large data centers. We provided resource evaluations and strategies for site development to avoid resource impacts. Our recommendations were fully integrated by a team of engineers, designers, environmental specialists, and acquisition specialists who evaluated all the potential site constraints. The client used this input to select the preferred site and to develop realistic expectations for design, construction, and approvals/permits for the data center project.

AECOM provided topographic and American Land Title Association (ALTA) surveys, property owner research, and zoning requirement research. Both tabletop and field geotechnical investigations were performed to determine whether the geostrata at each site would be suitable for the proposed data centers and roadway access. Local and state agency development standards were researched and summarized. Drainage and runoff requirements were researched, and control requirements and concepts were developed. Based on our evaluations we provided recommendations, one of which was to shift part of the site development plan to avoid a habitat area.

A Phase I environmental site assessment (ESA) was performed using data that could be obtained without an intrusive investigation, which would have compromised the confidentiality of the project. This research included identification of archaeological, regulatory compliance, wetland, stream, and floodplain information.

Civil engineering assessments were developed to provide information on ground transportation options, traffic/site security control, and local utility service providers.

Confidential Client, Data Centers

North America and Europe

Environmental planning, site selection, due diligence

AECOM is working with a large high-tech client to evaluate sites and obtain environmental permits for facilities throughout North America and Europe. AECOM is performing due diligence studies that vary depending on the local and country-specific requirements and that range from simple desktop studies to more detailed assessments and modeling. The goal of the evaluations is to identify potential environmental constraints (e.g., biological, cultural, flood risk, Phase I ESA) and geotechnical conditions on the site (e.g., compressible or expansive soils) that could influence permitting and construction timelines and/or design parameters.

The tasks included in AECOM's scope—due diligence studies, geotechnical services, civil services, masterplanning services, and data center services—are managed and coordinated out of our San Francisco office. The processes involve a fatal flaw analysis, a significant constraint analysis, and a preliminary geotechnical investigation of the site. This global program management and coordination allows us to apply the client's criteria under a single contracting mechanism in different site locations. There is clear communication between all parties, less paperwork, and no need to repeat standards from the client. Once the sites are selected, AECOM will obtain environmental permits and conduct public/agency/stakeholder meetings and outreach.

Confidential Client, Data Centers

United States, Europe, and APAC

Global site selection program

With a dedicated program manager in place and local office expertise in multiple geographies, AECOM provided consistent project delivery per task order under a broader global framework. Scope of work included project management, due diligence, environmental (biological, cultural, flood, Phase 1 ESAs), geotechnical engineering, and civil engineering.



Confidential Client, Seismic Hazard Analysis for Domestic Data Center

Confidential location, United States

Natural hazards assessment, environmental site assessment, water/waste water contingency assessments and mitigation, floodplain evaluation, environmental engineering

A confidential client was considering expansion of its data center facilities to a portion of the continental United States that had recently begun to experience a notable increase in localized seismic activity as a result of oil and gas exploration and extraction activities. Seismic activity had not previously been considered a concern in the area. AECOM completed an initial assessment to determine whether site-specific probabilistic seismic hazard analysis should be performed to quantify any potential increase in seismic hazard at the data center site and assess whether the seismic design ground motions proposed for the site needed to be increased to accommodate recent and future oil and gas production activities in the area.

AECOM performed an evaluation of what, if any, increase in seismic hazard could result from oil and gas activities and what its impact would be on the proposed seismic design parameters. The AECOM team collected and analyzed information on existing and near-future oil and gas activities within 31 miles of the site as well as current seismic activity and geologic data, and provided recommendations for design criteria for the data center.

Confidential Technology Client, Data Centers

United States and Europe

Multi-site due diligence and master planning

AECOM's successful relationship with this high-tech industry leader began with data center site selection exercises in the southeastern United States via our connections with various state and local planning and development organizations. We were commissioned to prepare master planning and due diligence reports for several sites in the United States and Eastern Europe under a single delivery. These reports included an analysis of available utilities (electrical, water, wastewater, natural gas, and telecommunications), natural hazard risks, geotechnical resource reviews, environmental background checks, protected/endangered species review, wetlands assessments, regulatory guidance, and an assessment of the available operations and construction workforce that would establish the basis for the company's future planning and development efforts.

The reports also included conceptual site designs (test fits), preliminary cost estimates, initial build schedules, and critical resource and regulatory trigger matrices for each site. Two-thirds of these sites have advanced to construction and commissioning, for which AECOM is providing ongoing design, construction administration, and health and safety (H&S) consulting services.

Equinix Data Centers

Multiple locations, Washington, DC, Metro Area; Virginia, New Jersey, Texas and California, United States

Permitting and SPCC planning

Equinix is a leading provider of data center and interconnection services with more than 175 data centers worldwide. Based on its decade-long relationship, AECOM was chosen to provide air quality permitting, water pollution prevention, and other environmental services for Tier II data centers in various U.S. locations.

AECOM has supported more than 1.5M sq. ft. of Equinix facilities. Under the new contract, AECOM is providing assistance with permitting for generators and boilers and minor New Source Review (NSR) Permitting, conducting initial permit-specified performance (stack) testing and developing permit-required data tracking spreadsheets.

To support Equinix's water pollution prevention strategy, AECOM is developing streamlined SPCC plans and assisting with state and federal tank registration and permitting. Other services include serving as the interface with regulators and the public, and conducting compliance reviews and audits.

Confidential Client, Data Center

Confidential location

Air modeling/permitting, water pollution prevention, and SPCC services

AECOM performed state-required air modeling and assisted the client with permitting, including preparation of Title V and minor new source review permit applications. AECOM estimated potential emissions and provided expertise in operating strategy discussions related to permitting requirements. AECOM also assisted the client in negotiations with regulators and with public hearings, created data tracking spreadsheets, and performed compliance reviews.

AECOM's water pollution prevention support services included SPCC (spill prevention, control, and countermeasure) plan updates and SPCC training.

ASB Ashburn Data Center, LLC, Data Center Air Permit Application and Compliance Support

Dulles, Virginia, United States

Air emissions permitting

AECOM was chosen to assist ASB Ashburn Data Center, LLC, in complying with the Virginia Department of Environmental Quality (DEQ) and U.S. Environmental Protection Agency (EPA) air pollution control and spill prevention, control, and countermeasure (SPCC) regulations at the firm's Technology Center Building in Dulles, Virginia.

Purchased from AOL in 2014, the Technology Center Building was outfitted with nine Caterpillar 3516-A emergency engine-generator sets, rated 1,635 kilowatts (kW) each (some with selective catalytic reduction for air pollution control); two Teledyne Laars natural-gas-fired boilers, rated 1.2M British thermal units per hour (BTUH) each; and two 20,000-gallon underground diesel storage tanks serving the existing engine-generators.

AECOM prepared a change-of-ownership Form 70 for submittal to the air compliance manager of the Northern Virginia Regional Office and a draft and final Form 7 permit application. The Form 7 application included the new ownership information and existing equipment in the Technology Center Building as well as manufacturer's specifications for the engine-generators and selective catalytic reduction systems.

As part of post-application support, AECOM prepared an emissions and operating hour tracking spreadsheet to assist the facility in complying with the permit's recordkeeping and monitoring requirements as well as those contained in the National Emissions Standards for Hazardous Air Pollutants (NESHAP) of 40 CFR Part 63, Subpart ZZZZ. AECOM also prepared a compliance memo outlining the requirements of the permit and other regulations that the facility must comply with to avoid action by the DEQ or EPA.

CoreSite Data Centers

Reston, Virginia and Secaucus, New Jersey, United States

Permitting, stack testing, and SPCC planning

A carrier-neutral provider of data center, cloud, colocation, and interconnection services, CoreSite selected AECOM to provide support for a 285,000 sq. ft. Tier II data center in Virginia, and a 280,000 sq. ft. Tier II facility in New Jersey.

AECOM developed an air quality permitting strategy for CoreSite and provided support for minor NSR Permitting, initial permit-specified performance (stack) testing, and permit-required data tracking spreadsheets. AECOM also developed SPCC plans, assisted with state and federal tank registration and permitting, and conducted compliance reviews and audits.

02 consulting + planning

Environmental services

AECOM is committed to helping protect the environment, health, and safety (EHS) of our clients' employees, customers, and the global communities in which they operate. Our team has performed thousands of audits and developed EHS programs for clients in over 150 countries. Our services are tailored to helping our clients evaluate policies, procedures, and practices that govern EHS management against applicable legal requirements and industry best practices. Our team can help evaluate the quality, comprehensiveness, and administration of EHS training programs, and evaluate the implementation of programs across sites; assess staffing levels for EHS programs; and assess the anticipated level of effort required to implement corrective actions.

Our unique International Audit Protocol Consortium®(IAPC) supports the cost-shared development of leading EHS audit protocols that address regional and national requirements around the world, contributing to the environmental quality and safety of data centers.

EHS services:

- EHS compliance audits
- EHS program development
- EHS management systems
- Environmental permitting
- Regulatory reviews
- Risk assessments
- Site assessments
- Social compliance audits (SCA)
- Permitting
- Supplier compliance audits
- Training
- Construction safety management
- Environmental, social, and governance (ESG) due diligence
- Sustainability assessment and efficiency programs
- Data analytics



Confidential High Tech Client, Data Centers

United States, Asia, and Europe

EHS program and energy management

Over the past 10 years, AECOM has worked closely with a Fortune 100 technology company to develop and implement EHS and energy management systems for the client's global data centers. Each of the client's facilities has been certified to International Organization for Standardization (ISO) 14001/50001 and Occupational Health and Safety Assessment Series (OHSAS) 18001 standards. AECOM continues to diligently lead facility integration for all of this client's new data centers.

AECOM's EHS work has included identifying environmental impacts and health and safety risks, establishing objectives for risk mitigation, developing targeted actions plans, conducting audits, and training site staff and leadership. EHS program and maintenance work has covered hazardous waste, universal waste, stormwater, wastewater, fall protection and prevention, electrical safety, fire protection and prevention, mobile and personal protective equipment, lock out/tag out, and confined spaces.

In recent years, AECOM has successfully designed and implemented a behavior-based construction safety program across the United States and Europe for this client, which AECOM integrates with data center site leadership to effectively mitigate field safety risks.

Confidential Client, Data Center

Confidential Location

Sustainability and EHS services

AECOM was engaged by this confidential client to provide permitting, water pollution prevention, Emergency Planning and Community Right-to-Know Act (EPCRA), and EHS services for this confidential data center. AECOM audited the client's regulatory and management system performance requirements and developed storm and waste water corrective and preventative action plans, which AECOM also audited. To comply with the EPCRA, AECOM created procedures for the handling of hazardous and universal waste.

The client also turned to AECOM for other environmental services, particularly with respect to safety. AECOM helped the client identify and assess health and safety risks, determine regulatory requirements, create operating staff safety procedures, and establish EHS performance targets. In addition, AECOM developed an Environmental Health and Safety Management Information System (EHSMIS) for the client.

Honda Data Center

Longmont, Colorado, United States

LEED consulting and commissioning

AECOM provided LEED sustainability and commissioning oversight consulting services for a new 61,000 sq. ft. Tier III data center in Longmont, Colorado. Under AECOM's stewardship, this new American Honda data center became the first data center facility in the world to achieve LEED NC v2.2 Silver Certification. The project team was able to achieve a more than 10 percent reduction in energy in this high energy usage building type through the use of innovative strategies such as free cooling, high-efficiency equipment, and a confidential high-performance building shell.

Sustainability highlights include free cooling for approximately 40 percent of the year, 34 percent water reduction, and 50 percent of the site is designed as open space.

Sabey Corporation Data Center

Ashburn, Virginia, United States

Sustainability and other environmental services

Sabey Corporation, a leading provider of customized data center solutions, selected AECOM to provide air quality and water pollution prevention services for the 900,000 sq. ft. facility in Ashburn, Virginia.

AECOM's sustainability services included generator compliance stack testing and permit compliance services, facilitated by our prior experience working with local regulators and performing stack testing. AECOM also provided water pollution prevention support, developing SPCC plans and assisting with state and federal tank registration and permitting.

The facility design is flexible and modular, with hot aisle/cold aisle and raised floor options. Security features include a secure perimeter with security beams, setbacks, and fencing with intrusion detection; a secure access checkpoint; and 24/7 roving patrols. SSAE 16 Type II Certification is planned. The data center has 70+MW of aggregate power and a 300MW dual-fed N+1 configuration on-site substation. AECOM utilized leading energy-efficient HVAC technologies to make the facility "free-cooling" most of the year through economizer cooling (Kyoto Cooling Wheel).

03 design + engineering

Architecture, MEP, + site civil

AECOM has been designing data centers and mission-critical facilities for more than 25 years. We have the technical expertise along with an understanding of the practical, day-to-day issues unique to these types of facilities. Our knowledge of the special issues and experience in designing these complex facilities enable us to develop cost-effective solutions that meet the specific needs of our clients.

Architecture, MEP + site civil services:

- Architecture/interiors
- Civil engineering
- Structural engineering
- Mechanical engineering
- Electrical engineering
- Geotechnical engineering
- Water & wastewater
- Power solutions
- Facility engineering
- Strategic facilities/ infrastructure planning
- Logistics
- Value engineering
- Mission-critical solutions
- Cyber security
- IT infrastructure/video services
- High-voltage/low-voltage power distribution systems
- Uninterruptible power supply (UPS)/ stand generation facilities
- N+1 through N+N redundant systems
- Coordinated services distribution
- Rack layouts/space planning
- High-density services provisions
- Control and building management systems
- Fire detection/protection systems
- Security and access systems
- Internal and external lighting
- Heating, ventilation, and air conditioning
- Voice and data systems
- Water leak detection systems
- Aboveground public health
- Condition/pre-acquisition surveys
- Computational fluid dynamics (CFD) analysis

Confidential Technology Client (Software/ Hardware), Data Centers

Various locations, United States

Design services and construction administration

For this confidential client, AECOM provided the complete design, including all local authority approvals, and construction administration of four Tier III Greenfield "24/7 occupied" data center facilities within 14 weeks. Applying lessons learned from previous data center designs, AECOM helped the client make critical decisions and lower the total cost of ownership (TCO). At all four sites, AECOM utilized computational fluid dynamics (CFD) modeling to validate the design layout and configuration for the outdoor heat rejection system.

At the Virginia site, AECOM designed a data center for a 137,000 sq. ft. colocation facility with IT capacity of 13.2MW on an existing 169-acre campus. TCO was <US\$7.5M/MW to the client. In a 112,000 sq. ft. data center colocation facility on an existing 42-acre campus in Iowa, AECOM designed three data center colo rooms at a 4.4MW nominal IT load each, with a total nominal critical IT capacity of 13.2MW. The cooling design for the data center colo rooms utilizes 100 percent outside air as the cooling medium. For the entire Iowa site, AECOM updated the air quality permit and SPCC plan. TCO was <US\$2M/MW.

For the client's data center facilities in Washington and Wyoming, which are located on 84-acre campuses, AECOM delivered facility designs within 12 weeks, including early long lead equipment and site and foundation packages. The center spline infrastructure designs support individual customized containers with a total nominal critical IT capacity of 30.6MW. For both sites, AECOM provided civil/site and electrical master plans and achieved a TCO of <US\$2M/MW for the client.

Internal Revenue Service (IRS), Computer Processing Centers

Nationwide locations

On-call architectural and engineering services

AECOM provided planning, studies, design, engineering, and construction phase services throughout the IRS' northeast, mid-Atlantic, and southeast regions. Services included design and engineering program assistance; system integrations and telecommunications; project monitoring; physical facilities analysis; construction monitoring; operations and maintenance procedures; safety, security and risk analysis; and special technical and supplemental studies.

Confidential Software Company, Data Centers

United States

Civil, structural, and MEP engineering; construction administration

AECOM provided full architectural and design services for two new corporate containerized data centers. Work included a Tier III infrastructure, a network operations command center, and support facilities. The PUE is less than 1.10.

Tyco International Ltd. Backup Data Center

Wall, New Jersey, United States

Mechanical and electrical design

AECOM developed the mechanical and electrical design to upgrade the Tyco New Jersey data center, adding an additional switchboard and backup UPS.

The data center provides the main control for the network of Tyco communications systems. The original power design called for fully redundant systems that were not implemented. This project implemented the fully redundant backup systems for the data center.

The project challenge was to minimize downtime to avoid penalty fees. The original design called for two outages over 8 hours each. The innovative AECOM design minimizes this to one outage of less than 1 hour.

New Jersey Department of Human Services Computer Room

Trenton, New Jersey, United States

Architectural and engineering design

AECOM was selected to provide architectural and engineering design services for the renovation of the vacant office space of the New Jersey Department of Human Services (DHS) on the first floor of the Capital Place One building in Trenton, New Jersey. The renovation expanded the DHS's computer network capacity. The design of the new computer center included selected demolition of existing conditions; window and door alterations; upgrades to lighting, electrical, fire and security systems; installation of new computer network wiring; new chilled-water air-conditioning units with proper temperature and humidity controls; water/heater sensors; and air-conditioning fault alarms.



National Library of Medicine Data Center Expansion, Bethesda, Maryland, United States

National Library of Medicine, National Institutes of Health, Data Center Expansion

Bethesda, Maryland, United States

Architecture and engineering

AECOM provided architecture and complete engineering services (planning, structural engineering, MEP engineering, acoustical and audio/visual, commissioning, fire protection, environmental compliance, industrial hygiene, cost estimating, computer-aided design) for the expansion of Building 38A for the National Library of Medicine B1 Level Data Center. AECOM developed drawings, specifications, and construction cost estimates for the four-phase project.

The scope of work included design of reallocation of space for chilled water distribution to in-rack cooling units and computer room air-conditioning (CRAC), UPS systems, a ladder rack system, bus bar and grounding, fire protection and related systems to accommodate total capacity of 3.2MW; evaluation of overhead power distribution and location of UPS and power distribution units (PDUs); and computational fluid dynamics (CFD) modeling.

Baltimore/Washington International Airport

Baltimore, Maryland, United States

Mechanical and electrical engineering

AECOM evaluated the existing HVAC and electrical systems in 4 main computer rooms and 44 remote intermediate distribution frame (IDF) rooms and designed new computer rooms with redundancy for HVAC and electrical systems. A new UPS was provided for computer rooms in the Consolidated Dispatch Center (CDC) and Kauffman Building. A new 2MW generator was installed in Concourse C to serve the airport's CDC computer room and other parts of the airport in case of power failure. AECOM relocated the existing 400kW generator from the CDC to the computer room in the Kauffman Building.

Chesapeake College, Learning Resource Center Data Systems

Wye Mills, Maryland, United States

Design and engineering

AECOM, as a subcontractor to PrimeNet, Inc. (in association with CS&D Architects), designed, engineered, specified, and project managed the cable plant (inside and outside), data networking system, and audiovisual (AV) systems for the new library at Chesapeake College.

Confidential Client, Data Center

Virginia, United States

Mechanical and electrical engineering, BIM, and construction management

This project was a cooling system retrofit of a 120,000 sq. ft. data center site in Virginia. The total critical load is approximately 14MW, with a peak PUE of less than 1.4. The cooling system, when fully populated, is capable of providing 5,250 tons of cooling—achieved using 5 chiller modules (N+2), 5 cooling towers (N+2), 22 chilled water coils (N+1), and 22 fan arrays (N+1).

AECOM was selected to design an ultra-efficient critical cooling system, including the office cooling and the overall plumbing, as well as to provide construction administration support. To keep expenses down and enable flexibility for expansion, AECOM designed a modular, built-up cooling system.

Mechanical engineering teams from both companies collaborated on the development of the mechanical design throughout all the design phases of the project. One of the first, and possibly the most significant, challenges in the project was to enable the site to house a 14MW data center. The selected site was originally designed to house a 12MW data center, and had an 85 percent space utilization factor that applied to all white spaces. The feasibility study, which featured the innovative use of higher supply air temperature, built-up air handling systems, and fan walls, enabled AECOM to deliver a 16 percent larger data center on the original site.

To keep capital expenses down while avoiding conventional designs that use CRAC units, the team designed a modular, flexible cooling solution by using built-up air handling systems that are completely modular and flexible. At the client's request, AECOM used CFD modeling to analyze and validate the proposed design and to validate the installation of the cold aisle containment proposed by the client.

To achieve significant cost savings with respect to equipment and installation, AECOM's design did not require a separate cooling infrastructure, but achieved cooling through coordinated phasing of the initial cooling equipment and installation of future architectural elements.

Department of Defense, Medical Health Services Data Center

Culpeper, Virginia, United States

Design and engineering

AECOM redesigned and deployed a web-based application for the Uniformed Services Family Health Plan and the TRICARE Management Activity, which supports 100,000 active and retired service members and their families. AECOM implemented a commercial cloud environment to deal with surges in demand and green IT benefits. The project involved a virtualized server environment, Terremark Intrusion Detection Service, and log aggregation.

BAE Systems, Mission-Critical Data Center

Newington, Virginia, United States

Architecture and engineering

AECOM renovated 34,628 sq. ft. of office space into a new mission-critical data center. Facilities include a Tier III data center; two high-security, self-contained spaces; and a communications, server, and power room. Features include reconfigurable communications systems and power locations, critical power systems, power distribution with 50 percent spare capacity, cooling HVAC system with 100 percent redundancy on all critical areas, and new and backup HVAC systems.

The Pentagon, National Military Command Center (NMCC)

Arlington County, Virginia, United States

Design and engineering services

AECOM provided design and engineering services for renovation of the the NMCC, which was constructed as a sensitive compartmented information facility (SCIF). Rated at Tier IV+, the NMCC includes distributed redundant UPS, 500,000 sq. ft. of raised access floor, red/black communication systems, patch and test, 2N+ systems, a new communications interface, and approximately 20,000 sq. ft. of high-altitude electromagnetic pulse (HEMP) protected space.

The design included replacement/upgrade of the entire electrical and mechanical building infrastructure, including normal and emergency power; UPS, security, and fire alarm systems; red and black structured cable plants; HVAC redundant systems; and steam, water, sewer, and fire protection systems.



Division of the World Bank, International Finance Corporation Data Center Relocation

Washington, DC, United States

Design services

AECOM was selected by the World Bank to design a new Tier III data center for the International Finance Corporation (IFC). The existing data center was located on the second floor of the bank building, along with the software/configuration/testing group. AECOM was asked to design a 20,000 sq. ft. data center in the second level of the World Bank's parking garage and to provide a new copper, fiber, and video backbone infrastructure. Designing this data center posed many challenges, given the garage's confined floor-to-ceiling heights, the requirement to maintain the existing server racks, and the equipment moving involved.

The new data center was designed with a new UPS in an ISO-redundant configuration. This facilitated the relocation of the existing UPS, after the move, to the new location as the bypass backup. The data center copper and fiber backbone was engineered to incorporate new NT servers while keeping the Banyan vines active during the relocation. The new computer room was designed for both 50 and 60 Hertz power. The new design included a copper grounding mat, under-floor leak detection, a fire alarm, and a new security system.

Qwest Communications, Data Center

Washington, DC, and Akron, Ohio, United States

Design services

AECOM designed a new 60,000 sq. ft. telephone switching data center and colocation facility for Qwest Communications in Washington, DC. The design and engineering included new three-transformer spot network configuration, three 2000KW standby power generators, and six DC power plants. New fiber backbone design was included for colocation tenants. The fire alarm design incorporated a very early warning smoke detection (VESDA) system throughout the facility. AECOM also designed a new security system for the facility per Qwest requirements.

Additionally, AECOM was selected by Qwest Communications to design a new colocation facility in Akron, Ohio. The 18,000 sq. ft. facility has an N+1 system.

United States General Services Administration, Space Reconfiguration and Data Center Design

Washington, DC, United States

Architecture, space planning, engineering, project monitoring, and construction monitoring

AECOM designed upgrades and expansions to an existing data center that serves the U.S. House of Representatives. The Tier III data center is approximately 20,000 sq. ft. with new ceiling, raised flooring, security, HVAC, and fire protection systems. Since the work occurred inside a critical 24/7 facility, work was scheduled to allow the facility to be occupied, ensuring uninterrupted operations.

WLVT PBS 39 New Broadcast Center

Bethlehem, Pennsylvania, United States

Design services

AECOM was selected to provide professional design services to create a new building to house administrative and broadcast functions for PBS 39, Bethlehem's local television station. This site was originally part of the Bethlehem Steel manufacturing business. When Bethlehem was a center for steel manufacturing, the plant once boasted a workforce of 31,000. In 1995 all this came to an end with the closing of the plant. Its iconic architectural features and historic buildings fell into disrepair and plans were put in motion to level the buildings and scrap the "Steel Stacks." However, city leaders and developers stepped in, and the area is now undergoing a rebirth as an arts district. Currently the area directly adjacent to the new PBS 39 building includes an outdoor concert space, a performing arts center, and a large public plaza that hosts a variety of events and festivals. All of this takes place against the backdrop of the Steel Stacks, the industrial relic across Founders Way.

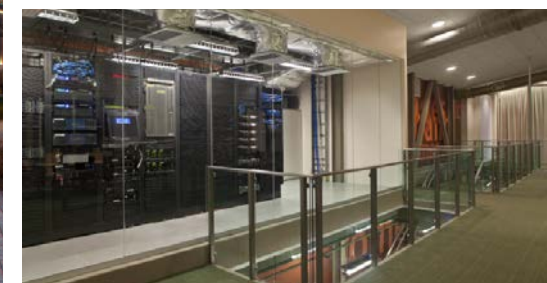
The award-winning building is a new two-story broadcast facility and office building. The building contains administrative functions as well as two television recording studios and their associated editing, sound, and control rooms. The project is the cornerstone of a new arts district that will undoubtedly be a catalyst for additional revitalization and mixed-use development. Located on one of the largest brownfield sites in the country, the project is on track for Leadership in Energy and Environmental Design (LEED) certification.

Part of the program was to create two HD studios that would allow the community at large to participate in studio events and visualize the mechanics of broadcasting. This was accomplished by creating a community meeting space on the front of the building and prominently featuring the broadcast master control room and technical core functions, which are now part of the building's public space.

The PBS-39 Digital Broadcast Center is a 100% intelligent smart building, with a future-proof capability of connecting any broadcast space with the world via global satellite and fiber networks.

The Master Control Network Operating Center is connected to the PBS network of 388 local US stations and reaches broadcast distribution worldwide. It is designed to accommodate future developments in social media, IPTV, Internet 2, Mobile 4G to 5G, streaming media, and 4K technology. The technical core of the new broadcast center was also designed so that it can be expanded to twice its design size to meet future technology requirements.

The high-definition, 1:9 aspect ratio, digital broadcast studios have state-of-the-art, network-quality lighting grids, control rooms, editing suites, and technology support. AECOM designed the broadcast studios for both live and post-production applications at network, on-air quality.





American Electric Power (AEP), Transmission Operations Center

New Albany, Ohio, United States

Architecture and engineering=

AECOM provided architecture and engineering services to AEP for the construction of a transmission campus on a 35-acre site. The Tier IV, state-of-the-art campus consists of a transmission operations center facility, a shipping/receiving facility, a gatehouse and entrance facility, and a possible future administration facility. The Transmission Operations Center contains an administration area, two 25-foot-high operations console rooms with large flat-screen video walls separated by an elevated command and control conference room, and a building systems utility equipment area. The utility equipment was designed with multiple redundancies to ensure continuous operation.

AEP required the design of the Transmission Operations Center to meet and, in some cases, exceed redundancy, security, and tornado-resistant design standards. Mechanical systems were designed for noise attenuation and contained special air-conditioning units (self-contained with integral condensing section and no use of hydronics). In addition, the facility incorporated dedicated outside air systems with continuous HEPA filtration to protect against chemical, biological, radiological, and nuclear threats. A VESDA system with alarm is incorporated behind the video walls within the command center, and a FM200 fire suppression system was designed for three zones. Both the VESDA and FM200 systems are connected to an UPS.

Due to the nature of the facility, AEP required stringent security measures as well as a high level of redundancy to maintain operations 365/24/7. Security and access control were integral parts of this complex project. Access control utilized state-of-the-art access portals and biometric fingerprint scanners. In addition, the facility was designed to resist blasts and F4 tornadoes. The facility used the same anti-terrorism/force protection standards that are used for U.S. Department of Defense facilities with a similar mission.

Verizon Wireless, Data Center

Dublin, Ohio, United States

Architecture, engineering, and planning

AECOM provided architecture, engineering, and planning services for a new data center to handle all calls east of the Mississippi River. The project included a 10,000 sq. ft. data center with 5,000 sq. ft. of future expansion and 42,000 sq. ft. of standard office support within the new 118,000 sq. ft. shell office facility. All systems were designed to N+1 redundancy, 300KVA UPS with PDUs, 1.5MW of parallel power generation, and a direct current (DC) power distribution system. The design also included a Liebert site scan system, a pre-action sprinkler system, and an FM200 system.

AECOM provided architectural/interior space planning services as well as design services for new fire protection, HVAC, and separate electrical systems. The existing PBX room was expanded to accommodate the installation of new equipment as well as temporary generator and temporary UPS installation. AECOM also designed a permanent generator and UPS system for the data center and new PBX room. The office area will use the main building mechanical and electrical systems with minor modifications.



State of Ohio General Services Administration, Hilltop Development Communications Project

Columbus, Ohio, United States

Planning, architectural, and engineering design

The State of Ohio General Services Administration selected AECOM to provide professional planning, architectural, and engineering design for a 720,000 sq. ft. campus. The facility houses headquarters for the Ohio Departments of Public Safety and Transportation. The design of the telecommunication system was critical to the functional success of the project and includes over 14,000 workstation outlets, 20,000 pairs of riser cables, and 900 strands of fiber optic cable. A modular wiring concept was utilized under raised access floors for distribution to each workstation. Each workstation was designed to have three Category 5 outlets for use with voice or data. Each 60,000 sq. ft. floor plate was designed with three 120 sq. ft. telecommunications closets. Specialized computer rooms and a data center were required, so a total of 44 telecommunications closets were included in the design.

Each telecommunications closet on the campus contains rack-mounted modular patch panels and fiber optic hubs. The backbone consists of fiber, Cat 5, and riser cable terminated on Cat 3, Cat 5, and fiber modular patch panels. Building systems also include a fire alarm and specialty area paging, a security CCTV system with more than 60 cameras and more than 20 monitors, a central control room, and a card access system.

Nationwide Mutual Insurance Company, Nationwide Enterprise Data Center – Silo Tape Storage/Office Space

Columbus, Ohio, United States

Design services

AECOM was hired to design the modifications necessary to extend the computer floor area of this Tier IV data center into what was originally mechanical space. Environmental control for tape silo storage space and office space was also provided. The project included hot tapping the existing chilled-water piping system and extending it into the area. Meeting ventilation requirements for office personnel while maintaining close tolerance environmental control for the tape silos was a project challenge.

Boehringer Ingelheim Roxane, Data Center Expansion

Columbus, Ohio, United States

Site/civil engineering services

AECOM was selected to provide civil engineering services for the Boehringer Ingelheim Roxane data center expansion. The project consisted of a one-story, 2,000 sq. ft. building expansion along the south side of the existing data center and an approximately 9,000 sq. ft. mechanical courtyard along the east side of the existing data center.

John Glenn Columbus International Airport, Data Center Study

Columbus, Ohio, United States

Architectural services

The Columbus Regional Airport Authority (CRAA) selected AECOM to provide as-needed architectural services, which included creating 30% design plans and a cost estimate for a data center to centrally house the CRAA servers and associated equipment. Through interviewing technology stakeholders, researching existing conditions, and comparing conditions against plans for the future, AECOM and CRAA determined the best location and AECOM developed 30% design documents for this option, complete with construction cost estimates.

University of Cincinnati Data Center Study

Cincinnati, Ohio, United States

xxxx services??

AECOM was selected to assist the University of Cincinnati with evaluating an existing warehouse space for potential relocation and consolidation of a hardened data center. Services included evaluation and feasibility cost estimates for a Tier III and Tier IV data center with between 10,000 sq. ft. (Tier III) and 16,000 sq. ft. (Tier IV) of raised access floor.

The study specified that the data center was to be hardened and installed within the existing two-story warehouse building, which was built to withstand F4 tornado effects and designed to anti-terrorism/force protection (AT/FP) standards. The parameters of MEP systems and fire protection systems were also specified, and AECOM evaluated the data center with respect to green initiatives such as LEED, low PUE, free cooling, in-row cooling solutions, hot aisle containment, and cold aisle containment.

The study was summarized in a bound report and included preliminary field data, load information, discussion of data center design parameters, potential risks associated with the site, recommendations for system improvements (redundancy, reliability), and a budgetary cost estimate for the proposed hardened data center.



Gundersen Lutheran, Stukins Building Renovation

La Crosse, Wisconsin, United States

Architecture, interior design, lighting design, and engineering services

AECOM was selected to design a complete renovation of the existing Stukins Building, which included a 3,000 sq. ft. data center, office spaces, electronics testing, and shell space for a training center for the Gundersen Lutheran healthcare campus. The building, comprised of approximately 30,000 sq. ft. of space on five levels, was originally built as a cold storage building for the John Gund Brewing Company in 1898. Along with the complete renovation of the building, a new entry and test lab addition of 1,900 sq. ft. was also a part of the project.

The building is one of a few LEED® Certified data centers in the country. AECOM specified efficient equipment, designed the building heating system to run entirely on recovered heat from the data center, and used a heat recovery wheel to minimize outside air heating and cooling needs in the future training center. Additional LEED energy points were earned through the energy use reduction from a server virtualization program. We are also assisting Gundersen Lutheran to qualify for rebates from Wisconsin's "Focus on Energy" program.

Karmanos Cancer Center, Data Center Relocation Study

Detroit, Michigan, United States

Analysis, design and feasibility studies

Karmanos retained AECOM to develop the required analysis, design and feasibility studies for a new data center and the relocation of the current computer services to support the radiology imaging services expansion. The goal was to create a state-of-the-art, future-proofed computing services facility to support the anticipated future growth in computing services and image storage and retrieval at the cancer center.

AECOM performed data center planning and schematic design for the new data center. The proposed site facility's existing conditions were analyzed to develop the space required to support the new data center, its secure computer room, and IT staff areas, and to upgrade the remaining general office networking and telephone services.

AECOM evaluated the environmental and flood vulnerability of the building location. The potential risks from the current mechanical systems (fire and HVAC systems) as well as the structural systems (roof and floor) were identified and a mitigation plan was developed. Other risks due to building location and probability of flooding were quantified and addressed in the new data center design. The design of the mechanical systems for the new facility included temperature, humidity, and leak detection. An electrical service upgrade was studied, and AECOM developed a schematic plan of the required components and processes, including utility coordination, to support new electrical and mechanical systems for the data center

Spectrum Health, Data Center

Grand Rapids, Michigan, United States

Architecture and engineering

AECOM provided architectural and engineering services for a renovation and addition project for Spectrum Health. The project consisted of an office renovation (3,600 sq. ft.), data center addition (10,000 sq. ft.), and a mechanical/electrical courtyard (4,200 sq. ft.) that can withstand an F3 tornadic event and is designed to mitigate any water infiltration into the facility.

The data center is constructed of disaster-resistant materials, has multiple control centers and comprehensive security systems, and has multiple-level system redundancy.

The main service consists of a 4,000-amp, 480/277V, 3-phase, 4-wire switchboard with generator paralleling gear for two 2MW outdoor generators. Each generator has a 2,999-gallon, double-wall sub-base fuel tank for 22.9 hours of run time at 100% load.



Gundersen Lutheran, Stukins Building Renovation, La Crosse, Wisconsin, United States





Fox Chicago Studio and Newsroom Renovation

Chicago, Illinois, United States

Planning, architectural design, and engineering services

One way Fox Broadcasting remains one of the most competitive media and entertainment companies in the world is by investing in current infrastructure systems and state-of-the-art studios and master control rooms in all its facilities. AECOM provided professional planning, architectural design, and engineering services to renovate the existing Fox Chicago facility, including the HD control room, HD audio room, news director and assistant news director offices and two new Americans with Disabilities Act (ADA) compliant restrooms. In addition, AECOM modified the existing studio for Full HD 16:9 aspect ratio Digital News Studio, expanding the existing 80-rack data center to a total of 1,600 racks. A Tier III UPS system with redundant 500KVA UPS provides power to broadcast, IT, computer, and penthouse broadcast equipment. A horizontal in-rack cooling system for high heat density loads was installed to cool the data center.

The design included a new 1,000kW generator with a 4,000-gallon fuel tank installed in a 4-hour-rated room with spill containment.

Iron Mountain Incorporated Data Bunker

Kansas City, Missouri, United States

Engineering services

AECOM provided preliminary engineering to expand the existing 5,000 sq. ft. backup data center located in an abandoned limestone mine to approximately 17,000 sq. ft. with associated N+1 redundant infrastructure. This Tier II client provides data archiving and storage for major corporations.

United Parcel Service (UPS) Hub 2000 Project

Louisville, Kentucky, United States

Design services

AECOM provided design services to UPS for its 42-acre facility in Louisville, Kentucky. The Hub 2000 houses office space, break rooms, locker rooms, and support offices, and includes a 25,000 sq. ft. Tier III data center, that handles all overnight package delivery tracking systems. The design includes N+1 systems, Vesda fire alarm/ pre-action, three utility feeds and UPS/PDUs, 40 2500KVA double-ended substations, and 120MVA capacity.

AT&T Ojus Cable Station

Miami, Florida, United States

Architecture and engineering services

AECOM provided design, permitting, purchase, installation support configuration and commissioning of an additional long distance submarine cable switching facility and operating center. The services included MEP infrastructure improvements, re-stacking of existing facilities, tenant improvements for call and service centers, and a large data center.

The main elements of the project included the demolition and renovation of a 20,000 sq. ft. equipment space and the addition of a 3,500 sq. ft. stand alone building for standby power and vendor equipment lease spaces. Mechanical and electrical improvements included the installation of a sophisticated PLC based building monitoring/control system so that electrical, HVAC, fire alarm, and security systems could be monitored and operated remotely. The electrical system consisted of a 3,000 amp double-ended switchgear, paralleling gear, three 750kW engine generator set with automatic controls, and two 25,000 gallon underground fuel storage tanks. The HVAC system included three 60-ton DX split systems with variable frequency drive trains.

Frontier Communications, Data Center and Fiber Optic Distribution Center

Salt Lake City, Utah, United States

Design services

AECOM was selected to design this 10,000 sq. ft. data center and fiber optic distribution center in an existing historical building located in the heart of downtown Salt Lake City, Utah.

The project included a new 12,000-amp service, a 10,000-amp vortex DC plant, on-site power generation, HVAC systems, FM200 and preaction fire suppression/ alarm systems, and security systems that were integrated into the architecture of the historic structure.

Systems were designed for N+1 redundancy. The floor loading criteria of the DC plant required that the floor structure be enhanced to accommodate the concentrated battery loads. Both power and signal systems were distributed overhead via cable trays. The facility included both dedicated and colocation spaces.



US NASA - Ames Research Center Supercomputing Data Centers

Moffett Federal Airfield, California, United States

Planning, design and construction management

AECOM provides on-site design and engineering services for the Facilities Engineering Branch of all NASA Ames Research Center (ARC) facilities, the NASA Research Park, the greater Moffett Field, and the former Moffett Naval Air Station. Our on-site architecture, engineering, and construction services average more than 275 task orders per year, with tasks ranging from less than US\$500,000 to more than US\$3.5M. The program will feature over 7.3M sq. ft. of R&D, high tech, university, housing, hotel, and retail space.

Under this program, AECOM has provided architecture/engineering services for the NASA ARC's supercomputing facilities and completed more than US\$30M in 13.8kV distribution system reliability improvements over the last 10 years.

AECOM has been assisting NASA with several modular data center designs to support the cloud computing network that NASA is evolving toward. AECOM designed a single-container modular data center that was installed as a pilot project. Currently AECOM is working with NASA engineers on preliminary designs, conceptual drawings, and a cost estimate for a 100-container modular data center estimated at 50MW. This data center will require two 115kV breakers and two new bays in the main substation, two new 115kV underground transmission lines (approximately 2 miles long), a new 115kV-3.8kV substation, and a 13.8kV distribution system with multiple 13.8kV-480V step-down transformers.

3011 Lafayette Turnkey Data Centers

Santa Clara, California, United States

Master planning and design

AECOM provided master planning and detailed design for a carrier neutral colocation data center consisting of approximately 60,000 sq. ft. of raised access floor. The electrical system is designed to deliver 125 W/sf of power to the data room floor in a 2N redundant configuration. The entire build out consists of 38 500 kVA UPS units and six 2,000kW generators in parallel.





Weather Channel Studio and Data Center Expansion, Atlanta, Georgia, United States

Weather Channel Studio and Data Center Expansion

Atlanta, Georgia, United States

Engineering services

AECOM was selected to provide professional engineering services for the expansion of the existing Weather Channel studio facilities in Atlanta, Georgia. The first task was to perform a structural engineering study of the existing facility to determine whether an expansion/renovation could meet floor flatness and floor levelness studio requirements, as related to design schemes previously developed by another firm. Following the structural engineering study, AECOM provided comprehensive engineering design (mechanical, electrical, plumbing, structural and civil) for the proposed studio and data center expansion project. The data center expansion included increasing the rack count from 200 to 380 on a new raised access floor. The design included FM200 and preaction fire suppression, and a VESDA fire alarm system. The design expanded the emergency power system by adding a 1500kW generator and new 4,000-amp paralleling gear to sync with Georgia Power Spot Network. The power system was designed for spot loading. A new 500kVA UPS system was added to the existing 500kVA UPS for dual corded loads.

This project implemented several sustainable design concepts and will achieve a LEED Gold rating from the US Green Building Council. The design included an N+1 chiller system design and a redundant chilled water loop, and utilizes the office air handler system as a third backup to the data center cooling system.



U.S. Army Engineering and Support Center, Huntsville, Utility Monitoring and Control Systems Program, Data Center Expansion

Vicksburg, Mississippi, United States

Design services

AECOM provided design services for expansion of the U.S. Army Engineering and Support Center's existing data center from 8MW to 12MW of critical load and the addition of new service to the building with cooling towers, distribution piping, switchgear, paralleling gear, generators, UPS, and electrical distribution. AECOM provided alternatives for reducing costs to meet the budget without reducing the scope of the project.

URS, Data Center UPS System Upgrade

Austin, Texas, United States

Electrical design and security

This project included the design of an electrical system upgrade to the existing URS data center located in Austin, Texas. This project consists of building out the electrical infrastructure required to support the future addition of 16 equipment racks, (total 54 equipment racks in data center).

The existing UPS systems supplying power to the data center were replaced with two 250kVA/225kW UPS systems (N+1), with provision for a third 250kVA/225kW UPS. The new UPS system was installed in the telecommunications room, which is adjacent to the data center. The existing PDUs were replaced with two 225kVA units (one for each UPS system), with the provision for one additional 225kVA unit. In addition, a new overhead busway provides power distribution from the PDUs to each load. Upon completion of the new UPS system, the existing systems were decommissioned and removed from the data center.

A lightning protection system was installed for the entire building. A security system to protect the doors into the data center and the telecommunications room was also installed. The system protects four doors using readers equipped with both biometric and PIN technology.

Equinix, Inc., Data Center Renovation and Expansion

Chicago, Illinois, United States

Architectural and engineering

AECOM provided professional architectural and engineering design services for the renovation and expansion of an 80,000 sq. ft. Tier III (N+1) Equinix data center in Chicago, Illinois.

The project design consisted of the addition of two 1,200-ton drycooler systems serving more than 50 computer room air-conditioning units for each loop, two 3000kVA spot network transformers, four 2000KW diesel generators and the associated switchgear. The facility was designed for 99.99% system operation year-round.

AECOM's ability to meet the project's budget constraints and manage construction cost changes began up front in the design phase of the project with the extensive Quality Assurance/Quality Control (QA/QC) program.

In order to meet the fast-track design schedule, AECOM relied on its depth of resources to design all elements of the data center renovation and expansion, completing the project on time and within budget. AECOM provided full-service commissioning for this facility and was on-site 24/7 during equipment start-ups.



Equinix, Inc., Data Center Building F Mechanical Cooling System Study

Ashburn, Virginia, United States

Engineering services

Equinix, Inc. is a leading global provider of network-neutral data centers, also known as Internet Business Exchange (IBX) centers. IBX centers provide Smart Hands services—on-call and on-location professional support staff of trained engineers to ensure reliable operations, and protects mission-critical internet business operations 24/7. Equinix has an approximately 180,000 sq. ft. IBX center in Ashburn, Virginia. Other IBX centers are located in San Jose, Los Angeles, Dallas, Chicago, Honolulu, and Singapore, as well as in China, Japan, and Australia.

AECOM was contracted to evaluate the operation of the waterside of the HVAC system serving Building F of the Equinix Data Center in Ashburn, Virginia. This study was completed to evaluate the adequacy of the cooling towers, the condenser water system, and the feasibility of the ice storage system for their 24/7 operations.

Equinix was pleased with the outcome of the HVAC cooling study for the Ashburn facility. The AECOM team's technical expertise and successful management of this contract was rewarded with a nationwide contract for all of Equinix's U.S. facilities.

Equinix, Inc., Data Center Support

Nationwide locations, United States

Architecture and engineering

AECOM provided full architectural and engineering design services for new designs and renovations to Equinix data centers located across the United States and overseas. These network-neutral Tier III data centers, also known as Internet Business Exchange (IBX) centers, provide Smart Hands services—on-call and on-location professional support staff of trained engineers to ensure reliable operations and protect 24/7 mission-critical Internet business operations.



M. F. Malone, Sungard Toronto Mega Center

Ontario, Canada

Architectural, structural, mechanical, electrical, environmental, and civil engineering

AECOM provided architectural, environmental, and engineering services for this two-story, 25,000 sq. ft., Tier IV addition to the Mega Center. The building provides uninterrupted computer backup services and facilities to clients in the event of power, system or network failures due to a natural or man-made disaster. The mechanical system incorporates 15 30-ton, 300,000 BTUH CRAC units with upwards of 30 6-ton remote terminal units (RTUs) and includes three self-contained 2,000 kW electric diesel-generating plants, a UPS battery backup system, and multiple mainframe computer and network systems.

PMC Sierra, Inc., Data Center/Telecommunication Design

Burnaby, British Columbia, Canada

Planning, design, and development

For this data center in British Columbia, AECOM provided an integrated design approach for the building mechanical systems, which consisted of a thermo-active slab system for space temperature control and an access floor air plenum system providing displacement ventilation.

The 60,000m² project was designed to require 60 percent less energy than a baseline model that meets the Model National Energy Code for Buildings. Other features include stormwater storage and detention, green roofs, low-consumption water systems, natural ventilation of atriums, high-efficiency condensing boiler systems, and ventilation air heat recovery systems.

Public Works Government Services Canada, Environment Canada Prairie Weather Center Server Room UPS and Cooling Upgrades

Winnipeg, Manitoba, Canada

Mechanical and electrical engineering

AECOM designed electrical and cooling upgrades in preparation for Environment Canada's installation of new equipment in its existing server room on the third floor of the VIA Rail building.

AECOM's mechanical and electrical engineering services included confirming power and cooling requirements and investigating power distribution and standby generator capacity. A new CRAC and rooftop condensing unit was provided, along with a newly designed UPS system and power distribution system. Various rack modifications were designed as well as the relocation and upgrading of data cabling. Subfloor leakage and air distribution were addressed, physical capacity of the access flooring was confirmed, and sprinkler and alarm systems were modified to suit the new installations.

AECOM also provided contract administration services for the installation and performed all work while maintaining Environment Canada's ongoing operations at all times.



Manitoba Hydro, Headquarters and Data Center

Winnipeg, Manitoba, Canada

Mechanical and electrical engineering

AECOM provided mechanical and electrical engineering services for the design and construction of Manitoba Hydro's new 700,000 sq. ft. 23-story headquarters office tower in downtown Winnipeg. The new facility houses 2,150 personnel and hosts the main data center and power trading facility.

The new, green office building is a state-of-the-art, world class, "cold climate" sustainable and energy-efficient building. It has targeted energy savings of 60 percent and complies with the LEED Platinum level and Natural Resource Canada's C-2000 Program standards.

AECOM's services included fire protection, plumbing and heating, and UPS design. The mechanical systems included radiant heating and cooling, displacement ventilation, natural ventilation, and a high-efficiency central heating and cooling plant with a geothermal component. The building is heated and cooled with radiant slabs (hydronic tubes embedded in the concrete), and its displacement ventilation system supplies the office space with 100 percent fresh air (unlike a conventional building where air is recirculated).



OptiGlobe Telecommunications, Internet Data Centers

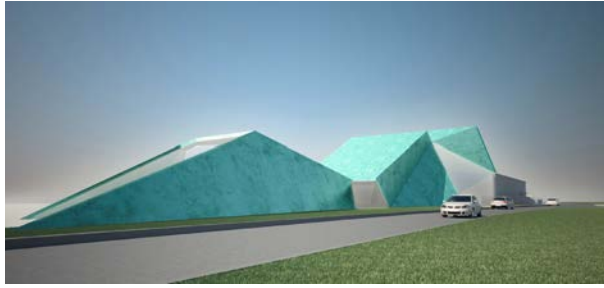
Sao Paulo, Brazil; Rio de Janeiro, Brazil; Buenos Aires, Argentina; Mexico City, Mexico; Santiago, Chile

Architecture and building engineering

AECOM was commissioned to provide complete architecture, engineering, and technology consulting for a multiple-site program in Central and South America. One of the goals was to create a strong physical representation of the OptiGlobe brand in the technology-driven market space.

The ITCs provide customers with a full range of in-region hosting, colocation, IP connectivity, Tier I peering, and the highest level of security and redundancy. Through a mix of renovation and new construction, the program provides OptiGlobe with over 300,000 sq. ft. of high-availability data center space. The template program has 60,000 sq. ft. of raised floor in each facility, and is designed to accommodate two subsequent expansions. For each facility, the power and cooling distribution systems are designed for concurrent maintenance and "plug-and-play" scalability to react to changing technology and market demands.

AECOM prepared an Internet connectivity and system architecture design that included backbone interconnections with service providers, passive and active electronics, cable infrastructure, telecommunications, and LAN/WAN design.



IT Construct, Cheshire Data Center

Cheshire, United Kingdom

Architecture, BREEAM, building physics, computational fluid dynamics, digital media, fire engineering, mechanical engineering, structural design

AECOM was asked to look at developing a new scheme for a data center on the site of a former mine in Winsford, Cheshire. The proposal was for a new aboveground office building and a data center storage structure belowground, located within a disused portion of the mine.

The project aims to deliver a 2,000m² data center over two phases. The overall building size, including office and plant space, is approximately 4,000m². The data center is designed to use the vast labyrinth of tunnels for heat rejection purposes. The concept is based on thermal modeling techniques developed by AECOM using a thermal conductance program. The program is also able to simulate the rate of decay in terms of heat absorption over the life of the data center.

The systems deliver an ultra-low PUE of less than 1.1. The site is designed to deliver a Tier III site with 1 to 2kW/sqm in localized areas. High Volt 11kV standby generators with step-up transformers are located above-ground and transformers with static UPS are belowground. The scope of work included site evaluation, a feasibility study, and high-level design. AECOM's architectural team addressed the constraints of the triangular site with an aboveground structure in the form of salt crystals.

AECOM took a multidisciplinary role, which included overseeing site commissioning and full Interconnect Stress Test (IST) testing.

Confidential Client, Data Center Conversion

London, England, United Kingdom

Civil, structural, mechanical, and electrical engineering; CFD modeling; site supervision

AECOM implemented conversion, extension, and fit-out of an existing food distribution warehouse into a major Tier III colocation data center. The project included the addition of a steel mezzanine on 300 piled foundations and a bridge to an adjacent building. Tenants include healthcare companies and other businesses.

Confidential Client, Data Center and Office

London, England, United Kingdom

Structural, mechanical, and electrical engineering; CFD/thermal models

AECOM provided services to client's flagship 86,111 sq. ft., Tier III data center, which houses both office and data space.

Confidential Client, Data Center Conversion

Manchester, England, United Kingdom

Civil and structural engineering, landscape architecture, flood risk assessment, traffic studies

AECOM provided engineering, landscape architecture, flood risk, and traffic services for the conversion and extension of an existing 53,820 sq. ft. factory building into a Tier III data center and the addition of a mezzanine.



Titanic Quarter/Data City Exchange (DCE), Data Center, Belfast, Ireland

Titanic Quarter/Data City Exchange (DCE), Data Center

Belfast, Ireland

Architectural design; civil, structural, mechanical, and electrical engineering

AECOM provided architectural design and engineering services for this state-of-the-art Tier III data center that is one of the world's most energy efficient, given its use of renewable energy sources and carbon footprint reduction technologies. This 46,500 sq. ft. facility houses the same storage capacity as 11 standard data centers, providing storage solutions for a range of companies, including financial and software firms.

United States Armed Forces, Network Center

Wiesbaden, Germany

Architecture and engineering

As a subconsultant, AECOM provided architecture and engineering design services, including energy consulting, for this high-security data center with office facilities for the U.S. Armed Forces. Built to LEED Gold certification standards, this facility boasts a renewable energy roof and a highly efficient combined heat and power (CHP) mechanical and electrical supply system.



NTT Communications Data Center, Tseung Kwan O Industrial Estate

Hong Kong

Geotechnical, structural, and civil engineering

AECOM provided engineering services for NTT Communications for a new Tier IV-ready data center and a network operations facility at Tseung Kwan O Industrial Estate. This five-story facility accommodates more than 6,000 server racks. The complex was Hong Kong's first "financial data center" consisting of high-performance infrastructure designed to meet the requirements of the financial services community and cloud computing providers.

HSBC Data Center

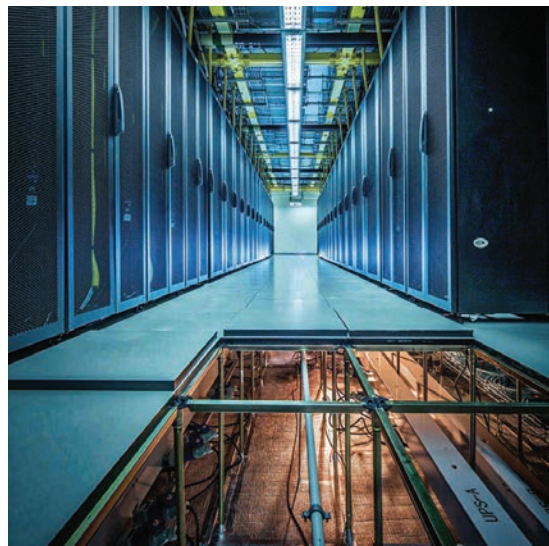
Hong Kong

Geotechnical, structural, and civil engineering

AECOM provided particular value in the design of the physical infrastructure of this 42,000m² data center, including structural considerations related to bomb blast resistance, specialist seismic design, and long spans with heavy-load data storage facilities.

In its engineering design, AECOM optimized construction sequencing of the 15-story building with its office and data center facilities, which resulted in project delivery to HSBC in a very tight time frame.

The new Tier II+ data center, which includes a basement level for MEP facilities for emergency and contingency uses, was designed to be upgradable to Tier III; it was also designed to Class C+, upgradable to Class B of the client's in-house classification standard.



HKEX Next Generation Data Center, Tseung Kwan O Industrial Estate

Shatin, New Territories, Hong Kong

Structural, geotechnical, civil, and environmental engineering

This project is located in a reclamation area at Tseung Kwan O Industrial Estate and is a development for a next generation data center. The redevelopment comprises five-story building blocks with a one-level-deep basement. To support the special function of the structure, seismic design was also considered for the building.

Hong Kong Jockey Club, Data Center Expansion

Hong Kong

Structural engineering services

AECOM provided structural engineering services for the environmentally friendly, state-of-the-art proposed data center expansion at the Hong Kong Jockey Club (HKJC). One of several Tier II and Tier III data centers operated by the HKJC and located at the headquarters building, the 10,000 sq. ft. expansion adds nearly 50 percent more space to the data center and provides equipment for critical business systems.

Top to bottom
 / NTT Communications Data Center, Hong Kong
 / HSBC New Data Center, Hong Kong
 / HKEX Next Generation Data Center, Hong Kong

Confidential Data Centers

Singapore and Hong Kong

Engineering design for mechanical, electrical, and communications systems

AECOM leveraged teams in Australia, New Zealand, Hong Kong and Singapore to deliver technical specialist services for a Tier III, 30MVA HV Supply, 139,931 sq. ft. RFA data center in Singapore and a Tier III, 70MVA HV Supply, 269,098 sq. ft. data center in Hong Kong.

Bombay Stock Exchange Business Continuity Program

Hyderabad, India

Engineering services

AECOM provided engineering services for Bombay Stock Exchange's highly redundant and scalable Business Continuity Program center consisting of an approximately 75,000 sq. ft. built-up area at Hyderabad. Building engineering services included HVAC, electrical system, emergency power, UPS system, public health engineering, fire detection suppression, building management system, safety and security system, gas suppression system, smoke aspirator system, water leak detection system, and a low-voltage system.



Reliance Communications Ltd., IDC-5 Building

Navi, Mumbai, India

Engineering services

Reliance Communications selected AECOM to set up its IDC-5 building, one of Asia's largest Internet Data Centers (IDC), within the company's 133-acre Dhirubhai Ambani Knowledge City site in Navi Mumbai.

For the 363,000 sq. ft. built-up area of the project, which consists of the main IDC building and a utility building, AECOM designed spaces for servers, server service equipment, and support per the TIA-942 standard for building infrastructure for data center facilities. The Tier IV data center was designed for a total of 4,800 servers utilizing 160,000 sq. ft. of white space.

For this five-phase project, AECOM provided building engineering services, including HVAC, electrical systems, emergency power generation, public health engineering, fire detection and alarm, building management system, public address CCTV and access control system and vertical transportation services.



Top to bottom
 / Bombay Stock Exchange Business Continuity Program
 Hyderabad, India
 / Reliance Communications Ltd., IDC-5 Building,
 Hyderabad, India

CtrlS Data Center Ltd.

Mumbai, India

Engineering services

CtrlS created a fault-tolerant data center that can guarantee an uptime of 99.995%, the highest in the data center industry, with the capacity to provide services of more than 30MW at a security eight zone level.

AECOM designed 5,000 racks in an area of 115,000 sq. ft., with a total building area of some 200,000 sq. ft. The building consists of one basement and seven floors.



Spark, Project Gemini Data Center, Auckland, New Zealand

Spark, Project Gemini Data Center

Auckland, New Zealand

Engineering services

Spark's new NZ\$60M Takanini Data Center includes modular systems and base isolation bearings to maximize its resiliency, while the scalable power and cooling features provide an overall cost saving of approximately 20 percent.

Spark (formerly Telecom), Retail Holdings, AECOM, and Hawkins Construction worked closely together to design and build the data center. AECOM's designers discovered that base isolation would reduce the seismic load on the building. This meant that the foundation could be smaller and the structure lighter, while still protecting sensitive IT equipment in case of an earthquake.

The team's open, integrated approach resulted in the delivery of a state-of-the-art base-isolated building for less than a traditional piled solution.

Confidential Client, Data Center

Auckland, New Zealand

Architecture and engineering design

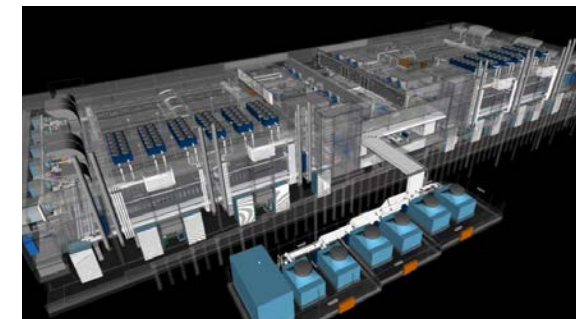
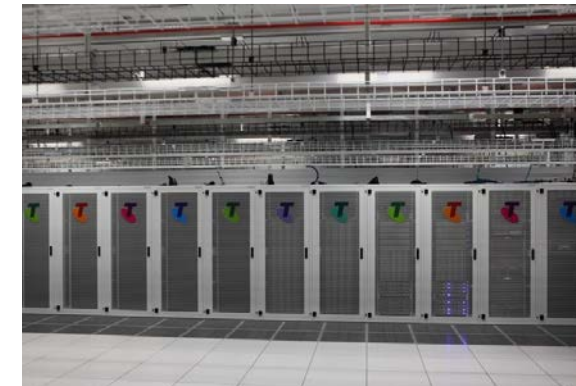
AECOM recently completed the preliminary design of a new Tier III data center cell within an existing data center for a confidential client and is currently providing comprehensive design services for renovation of the existing data center. Work includes architectural and engineering design, fire protection and security design, and acoustic design for the final design development and detailed design phases.

Vodafone World Trade Centre Project

Wellington, New Zealand

Architecture

The principal function of the facility is to house Vodafone's core network equipment for the lower North Island in a secure environment to withstand a natural disaster and continue to function after such an event. The architectural design is based around the function of the building and security of the service it provides in a highly seismic environment.



Telstra Clayton, Data Center

Victoria, Australia

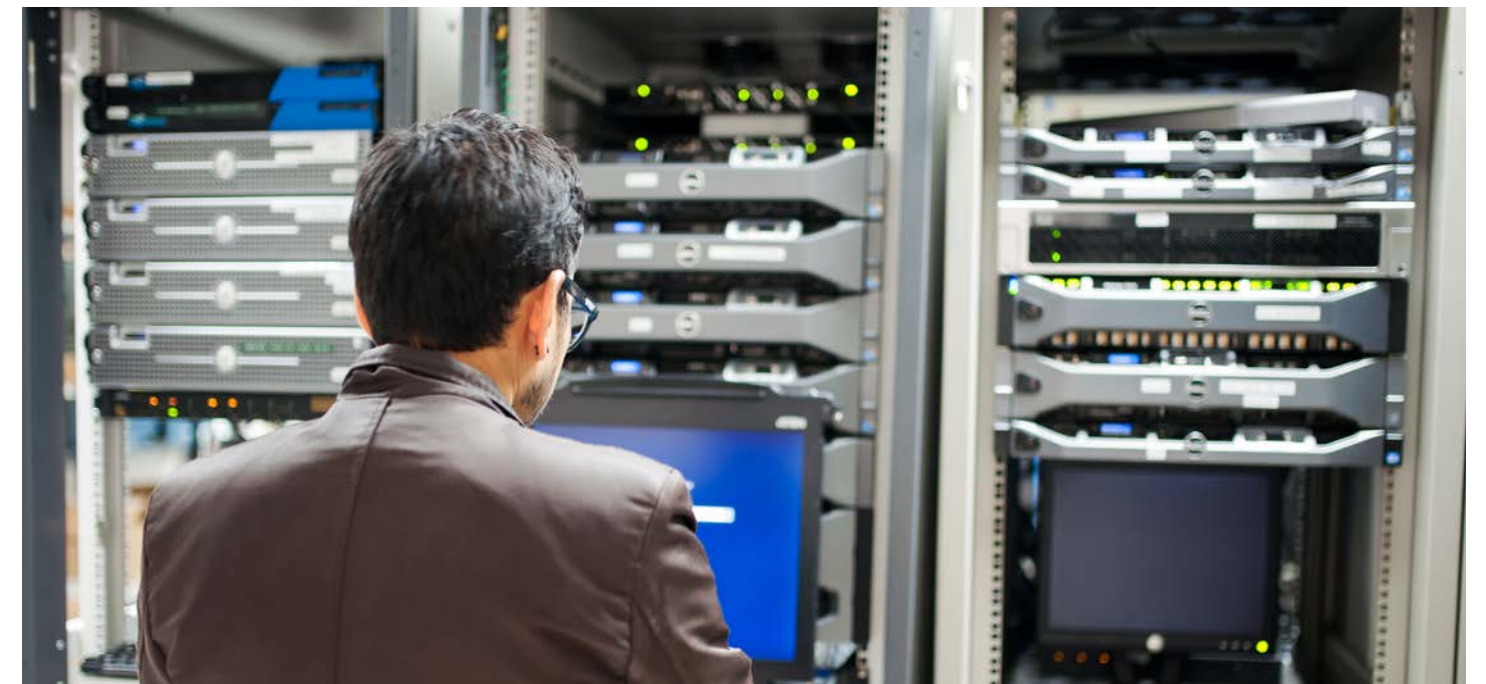
Lead consultant, building engineering, electrical, mechanical, hydraulics, fire, structural, civil and ESD (environmentally sustainable design)

As part of its billion-dollar cloud computing strategy, the Australian telecommunications giant Telstra needed to create a new flagship data center and supporting energy center. At its site in Victoria, Australia, two 1,000m² data halls were designed to a power density of 3,000W/m².

AECOM designed a data center in line with Telstra's sustainability target of PUE 1.3 or less. The design team used CFD analysis to understand the effectiveness of different low-energy cooling strategies, maximizing free cooling by meeting the latest ASHRAE standards to optimize cooling distribution to the racks. The design achieved mechanical cooling redundancy at N+1 and high volt/low volt redundancy at N+N.

AECOM was able to lower overall energy consumption and create a design that fulfilled Telstra's vision of creating a high-efficiency data center.

The development also includes the construction of an A\$40M new energy center designed to provide 20MVA high-voltage power and 10MVA emergency backup power for the data center. The new energy center is capable of seamless return to mains via a make-before-break arrangement with the supply authority and operating generators in parallel with the mains for ongoing testing and maintenance.





03 design + engineering

Security + resilience

Our approach provides integrated, holistic solutions that bolster our clients' ability to anticipate, avoid, and absorb threats. We specialize in the design of security systems for critical facilities. We focus on full protection of critical assets so that redundant electrical and mechanical systems are not affected after experiencing an event. Our structural and mechanical designs guard against natural and man-made hazards for the protection of critical assets and people. AECOM has implemented layered security design for existing buildings converted for large-scale, mission-critical operations as well as for new complexes on greenfield sites. AECOM is the leader in the design of secure facilities and anti-terrorism/force protection measures.

Security + resilience services:

- Threat risk vulnerability assessments
- Enterprise architecture and design
- Cyber operations/network monitoring
- Wireless and remote sensing
- Secure industrial control system
- Disaster recovery and backup
- Exercises and security evaluations
- Information assurance
- User training and cyber awareness
- Policy and regulatory requirements
- Bomb blast analysis
- Secure cloud solutions
- Access security assessment and remediation

United States Secretary of Defense, Global Facilities Network Security Services

Global Facilities

Network security services

AECOM provided network security services, including information systems engineering and integration, for the U.S. Office of the Secretary of Defense, Army and Air Force components of the Pentagon information technology enterprise, which supports more than 22,000 users. AECOM was responsible for detecting threats and controlling access to classified and sensitive but unclassified information. Work included periodic assessment of the network and subnetwork structure and configuration to identify vulnerabilities. The scope of this effort extends around the world.

Central Michigan University, Foust Hall Data Center

Mount Pleasant, Michigan, United States

Risk assessment

Central Michigan University teamed with AECOM to conduct a comprehensive facility risk assessment of the existing Foust Hall Data Center. The goal of the risk assessment study was to make every effort to quantify, qualify, and value the various possible risk events that could occur at the data center. The assessment document also included both the probability of specific noted events as well as the cost impact on the University's operations. Along with the assessment and cost impact of various risk events, the study also included recommendations on mitigating the various risk events and the potential construction cost required to complete the mitigation efforts. The risk assessment report directly contributed to Central Michigan University's Overall Strategic Plan by providing a clear document that defined the University's exposure to operational risks, which included a comprehensive mitigation plan to significantly reduce that risk.

AECOM evaluated, analyzed and provided risk mitigation recommendations for the following risk categories:

- Site/civil exposure
- Architectural systems exposure
- Mechanical systems exposure
- Plumbing/fire protection systems exposure
- Electrical systems exposure

Illinois State Tollway Highway Authority, Data Center

Chicago, Illinois, United States

Threat and vulnerability assessment

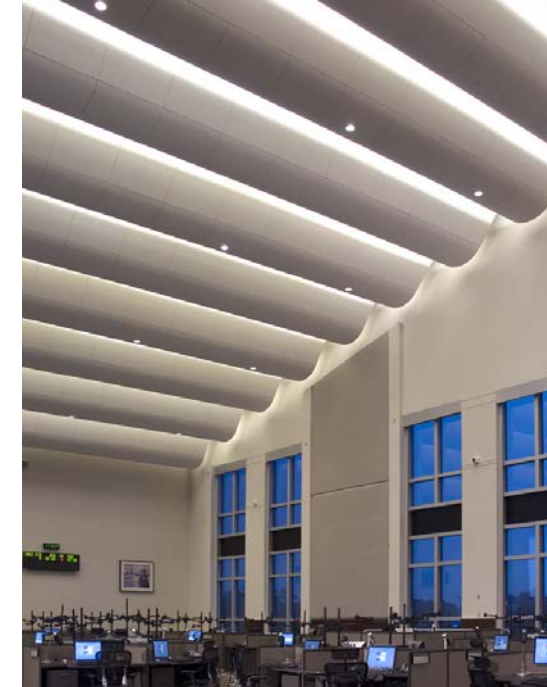
AECOM is performing a threat and vulnerability assessment of the Illinois State Tollway Highway Authority's (ISTHA) enterprise-wide assets. The initial focus is on ISTHA's data center, including cyber/IT connectivity and integration to support the tollway's US\$1.1B revenue. I-Pass transactions, network and telecommunications, connectivity, and integration for the entire tollway require focus on continuity of operations and hot/warm site coordination where failure or DOS is not an option.

The assessment addresses all hazards (natural, technological, and man-made threats), requires development of the design basis threat and on-site assessments of all assets, and results in documented quantitative vulnerabilities to which we apply recommended mitigation countermeasures with rough order of magnitude (ROM) costs. The project also requires a gap analysis of emergency action plans and procedures, and operational functions linked to continuity of operation requirements, resulting in recommended improvements. The project approach allows ISTHA to determine the best use of available resources, define a timeline approach to the entire transportation network and facilities, and identify the facilities requiring immediate attention. An outcome of the project was the renovation design of the existing data center.

The design basis threat includes:

- Explosives and armed attacks
- Insider threats (i.e., cyber threats, criminal activity, equipment sabotage, active shooter)
- External threats (i.e., civil disruption, criminal activity, kidnapping/hostage situations, arson events, chemical, biological, radiological and nuclear threats, and cyber attack threats)

In support of this project, AECOM worked closely with local law enforcement on protective strategies. AECOM has completed all on-site assessments, prepared the 30% data center design options, conducted the gap analysis, and developed the enterprise-wide findings and recommendations deliverable.



District of Columbia, Unified Communications Center (UCC)

Washington, DC, United States

Architecture, interior design, building engineering, fire protection, life safety, information technology, public safety communications, and security

UCC is a high technology, state-of-the-art call center. The US\$85M, 139,000 sq. ft. facility houses what were previously separate call centers for police, fire, Emergency Medical Services, and non-emergency public safety calls. This integration of services provides the District of Columbia with the necessary tools to face the continuing issues of emergency preparedness and security. The full redundancy of all mechanical, electrical, and telecommunications systems and blast-resistant design are important factors for heightened survivability. During major emergencies, the UCC provides centralized regional coordination and communications for the FBI, Capitol Police, U.S. Secret Service, and Federal Emergency Management Agency (FEMA).

The facility received the 2007 Business Continuity and Disaster Recovery Award from the National Association of State Chief Information Officers (NASCIO).

Blast Hardening

A formal plaza in front of the public entrance provides both adequate prominence for the public functions of the UCC facility while meeting established security requirements for building setbacks. The three-story building, including the 90-foot-span roof over the column-free call center area, is blast hardened. A fully grouted concrete masonry unit exterior absorbs blast loads, and a fully grouted concrete masonry unit wall provides a high degree of resistance.

Engineering Systems Redundancy

The individual communications console module dictated the UCC's size and configuration, emphasizing the central role of communications. The District handles 8,200 calls daily. With 100 consoles total, each console can manage 820 daily calls. Full redundancy with independent power generation was provided for all systems.

AECOM's electrical design included a mission-critical data center and call floor design with 99.999% availability, with varying levels of redundancy and maintainability while keeping systems online. Systems designed included UPS cabinets, generators, and generator paralleling switchgear, low-voltage switchgear, static transfer switches and PDUs, dimming systems, energy monitoring and control systems, and grounding systems for radio and IT systems. Our team developed the basis of design for the building automation system as well as systems integration. Systems included HVAC, life safety and smoke control systems lighting, security, card access, and energy monitoring.

The communications area is augmented by administrative headquarters space, federal government adjunct facilities, briefing and media centers, training rooms, a child development center, and parking for 272 vehicles.

Defense Information Systems Agency (DISA), Defense Information Systems Network (DISN)

Fort Meade, Maryland, United States

IT, security, and network engineering

To support DISA's network security systems and data infrastructure, AECOM provided security engineering services. Our team collaborated with DISN core program teams and NOCs, acquiring knowledge of the underlying telecommunications transport and Internet infrastructure. We also provided network security experts for consultation on DISN network security; comprehensive NIPRNET, SIPRNET, and transport system migration to the new DISN core; and related IT redesign activities. Our network security engineers coordinated engineering efforts in concert with DISA divisions to implement and evolve programs via C&A services toward achieving Authority to Operate for all relevant systems.

AECOM assessed, evaluated, and validated security service areas for DISN Services Networks and underlying transport infrastructure security. For this two-phase project (US\$4.9M and US\$5M, respectively), our team participated in requirements development, acquisition, testing and evaluation, suitability reviews, and solution deployment. We assessed and evaluated the proposed network architecture and supporting systems; reviewed network management security solutions; developed the requisite test plans and procedures; installed and integrated network security solutions; and wrote/updated government documentation for the deployed infrastructure and systems. The consulting activities also included managing wireless security, developing implementation guidance, and providing implementation and life cycle (Tier III) support.

City of Raleigh, Central Communications Center

Raleigh, North Carolina, United States

Design, IT, security, and engineering services

AECOM worked on a project to develop critical infrastructure to support the City of Raleigh's emergency communications center, emergency operations center, traffic management center, and data center. AECOM's technology engineers designed and engineered the data, voice, and wireless infrastructure, including the build-out of the site's 2,000 sq. ft. data center, radio and dispatch system, audiovisual systems, and electronic security systems located throughout the facility.

University of Texas System, Guhn Road Data Center

Houston, Texas, United States

Flood mitigation and fire code compliance

AECOM designed a flood protection system for an off-site data center used by MD Anderson Cancer Center (MDACC) and situated within the 500-year floodplain footprint (Water Surface Elevation 89 ft). Our scope of services included the development of construction plans, specifications, and estimates for the flood mitigation project, as well as project scheduling and construction phase services.

In order to meet FEMA's 2-year project completion requirement, the MDACC set the schedule for the architecture and engineering part of the contract, requiring extra effort to coordinate and schedule the design of the project. AECOM met the challenge by completing the design within a year.

The architectural components of the project included infilling of existing doors and windows, complying with ADA accessibility issues, constructing connections into future expansion areas, and constructing a permanent enclosure to house a fiber optic facility. The structural components included 300 ft. of free-standing floodwall with drill shafts and 950 ft. of primary floodwall connected to the existing tilt-wall building. The civil components included sump pumps in the equipment yard, a sanitary vault with backflow preventer, and swinging, sliding, and flip-up flood gates. Finally, major components of MEP design included demolition of the existing air-handling unit (AHU-6), natural gas piping, controls, and ductwork. The project also included installing new CRACU-17, raising existing CRACU piping, and connecting electrical controls and conduits as needed.

Electronic Data Systems Corporation, Information Processing Centers

Plano, Texas, United States

Security site surveys

AECOM performed security site surveys for Electronic Data Systems (EDS) Corporation to assess the state of security at six locations, including the headquarters in Plano, Texas. EDS provides data processing services to its clients from information processing centers located throughout the United States. Because of the sensitivity of their clients' information, EDS Corporation was concerned about the security of its various facilities and its ability to adequately protect its data products from physical attack, terrorism, and insider threats. Although the facilities are similar in layout and function, each site is independently operated and has its own unique features and security challenges. The diversity of the environment surrounding the individual sites dictated original design solutions for each. Design solutions were complicated by the requirement to develop standard approaches, where feasible, that could be applied to all the sites. AECOM delivered a master plan for a physical security upgrade for the entire corporation and individual site survey reports and recommendations for six information processing centers. AECOM developed comprehensive recommendations for EDS that emphasized security operations, access control, and employee protection during various attack scenarios.



America First Credit Union (AFCU), Ogden Data Center

Riverdale, Utah, United States

Vulnerability and site assessment, security system design, and IT/telecommunications

AECOM performed a detailed vulnerability assessment as well as security system design for the new AFCU data center. The 20,000 sq. ft. facility provides office space for the IT staff, a war room, conference rooms, and an expandable data center space that was designed to facilitate future growth of data processing area systems. Due to seismic activity in the region, the building "floated" above the basement space and all systems servicing the building were designed and installed to allow for sway, swing, and shifts.

Following the threat and vulnerability assessments and the evaluation of the existing security arrangements, AECOM implemented a simple, streamlined plan. This involved the programming, planning, design, and construction of effective solutions for mitigating risk and increasing the effectiveness of security. The solutions included recommendations for updates and integration of computer-controlled access systems, fence and intrusion detection systems, a public address system, closed-circuit television systems, fire prevention personnel identification, and integration.



Hawaii Regional Security Operations Center

Wahiawa, Hawaii, United States

Building engineering, security, communications, audiovisual, and acoustics/vibration

The Hawaii Regional Security SCIF-rated Operations Center uses specialized HVAC systems to function in Hawaii's harsh tropical environment, to control environmental conditions, and to keep out contaminants.

As part of a design-build team, AECOM provided US\$318.2M in mechanical, electrical, and plumbing engineering, anti-terrorism/force protection (AT/FP) consultation; and supervisory control and data acquisition (SCADA) system design services for the facility.

This secure complex consists of four buildings on a 70-acre site at the U.S. Navy's Naval Computer and Telecommunications Area Master Station Pacific in Wahiawa. The main facility, the Operations Center, is a high-security, two-story building containing a command center, secure data operations center, briefing area, data analysis, mission planning, offices, electronic equipment, video-teleconferencing rooms, a kitchen/dining area, and support facilities.

The Operations Center is designed to function within Hawaii's tropical (humid and corrosive) environment. Specialized HVAC systems were designed to control environmental conditions, including humidity, temperature, and facility pressurization to keep dust, smoke, and other contaminants out of special-use spaces. Acoustics were a key component of the HVAC design, including a unique sound attenuation solution for the emergency generators located inside the Operations Center.

All utility systems for the complex are designed for redundancy. The 249,000 sq. ft. facility has diesel-powered emergency generators and UPS. It also has secure/non-secure information systems, EMI shielding, electronic security systems, AT/FP design, and intrusion detection systems.

In addition to the Operations Center, the complex houses a visitor control center, warehouse, and antenna farm.

03 design + engineering

Building Information Modeling/Virtual Design and Construction

AECOM's Building Information Modeling (BIM)/Virtual Design and Construction (VDC) program delivers cost, schedule, coordination, constructability analysis, feedback, and tracking from early design through project closeout. The program integrates and synthesizes project information and processes and enables effective project team collaboration, identifying and resolving potential problems before they become reality. For built environments, our BIM solutions give facility management teams the digital tools to effectively and efficiently leverage facility information in support of the ongoing management.

BIM/VDC are an increasingly powerful tool to simulate elements of live construction in advance. Implementing BIM/VDC can assist greatly in planning and coordinating the work, particularly as it relates to conflict resolution in the design, existing conditions, structural details/framing and utility tie-in locations. Key features allow cloud data survey, clash detection, visualization, 4D models with time, 5D models with cost, 6D models with facilities management, and models showing safety enhancement.

AECOM's investment in BIM has resulted in world-class, award-winning performance. Our firm has received 15 BIM-related awards since 2015, including two Bentley Systems "Be Inspired" awards, a GEO Smart India 2015 award, and the 2016 Building & Construction Authority's BIM organization category Platinum award.

BIM/VDC services:

Design

- Design coordination
- Design communication
- Volume, threshold and scale
- Design review
- Pre-visualization
- Performance and sustainability analysis
- 3D and 4D modeling

Building/construction

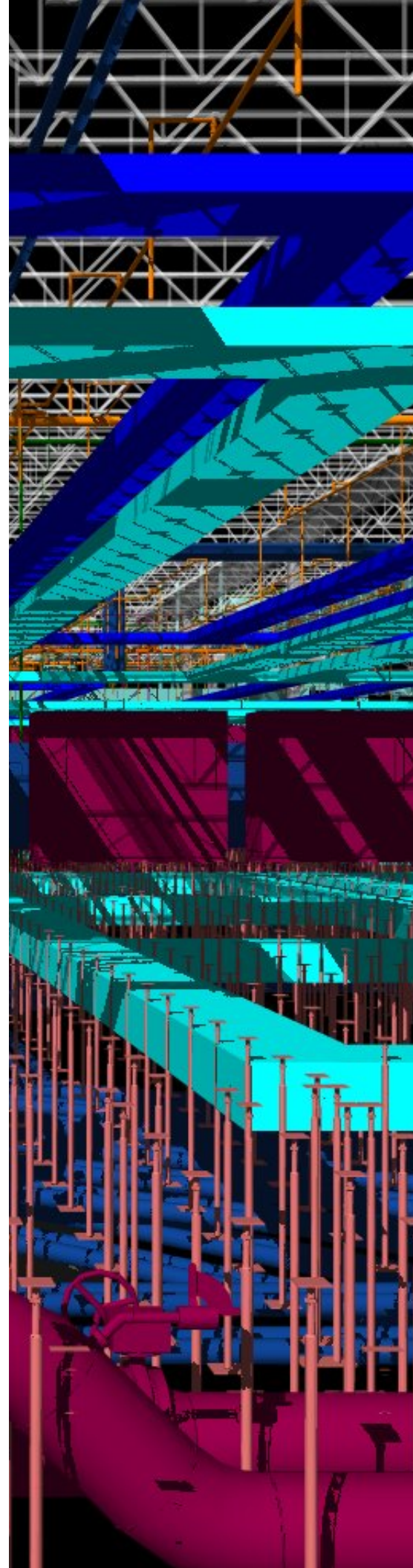
- Construction and fabrication coordination
- Hazard perception

Financing

- Cost estimation
- Cost validation

Operation

- Asset management
- Building operation



Denver International Airport, On-Call GIS Data and Development Services

Denver, Colorado, United States

BIM design and implementation services

AECOM developed the BIM standards, manuals, and templates used by all consultants performing work at Denver International Airport (DIA). AECOM targeted project implementation of the BIM process for all QA/QC models through design and construction. As the lead firm of the joint-venture program management team, AECOM provided technical design and construction oversight for the US\$3.7B airport, overseeing more than 100 design firms and 115 construction contracts.

AECOM has provided QA services for BIM implementation on multiple programs at DIA, including eight runway and apron improvement projects in the last 5 years. Currently, AECOM is supporting DIA with QA full-time on the hotel and transit center, a major capital improvement program, as well as on all landside and airside civil infrastructure projects. AECOM continues to work on-site to oversee maintenance, design, and expansion of technology upgrades to the airport's communications and electronics systems, and also provides geographic information system (GIS) integration under a separate contract.

Gatwick Airport North Terminal, BIM Utilization

Horley, Gatwick, United Kingdom

BIM design and 3D/4D modeling services

AECOM's BIM solution was deployed across the engineering design framework for Gatwick Airport Limited, supporting the client's 2-year Capital Investment Plan.

Using our visualization tool, AECOM delivered a range of multidisciplinary design services, including architectural, structural, mechanical, and electrical design in both landside and airside aspects of the Gatwick Airport site. Sharing and exchanging model data through BIM was essential for the successful refurbishment of Gatwick Airport's North Terminal.

Skanska Data Center Animation

London, United Kingdom

Digital media services

Skanska appointed AECOM's Digital Media Team to design a high-definition (HD) 3D animation to be presented at the Data Centre Dynamics trade show in London. The HD movie file was commissioned specifically to be displayed on an 83-inch plasma screen, the main focus of the Skanska exhibition stand.

The team used the Blu-ray format to ensure the highest possible quality for the end result. Impressive features of the animation included a walk through a secure air lock door into an empty data hall where the room came to life in the order it would be constructed. The last stage of the animation was a view of a typical control room, complete with a bank of computer monitors that we created to display the actual software used in a Skanska data center. This helped convey the type of important technical data that are monitored in such a control room, such as data on efficiency, server rack temperatures, cost per month, and emissions.

Data City Exchange, 3D Visualization and Animation for Data Center

United Kingdom

3D modeling and digital media services

AECOM was commissioned by Data City Exchange to produce an immersive, walk-through experience of their flagship data center in Birmingham, England. The AECOM team created the animation for this flexible data center using AutoCAD, Revit, 3DS Max, Vray, and Adobe Creative Suite. The visualization demonstrated the facility makeup to stakeholders, as it walked them through the flow between the server/data storage area, the network operations center, and the mechanical and electrical rooms, and it highlighted the significant security that was in place to protect their data.

04 construction services

Project management/ Construction management

Our project and construction management professionals have successfully managed the design and construction of data centers and mission-critical facilities worldwide. We understand that construction of these complex facilities requires close collaboration with clients to ensure that their goals and objectives are the drivers of the project. By taking a proactive approach, we anticipate and identify issues early in order to mitigate any potential impacts. We manage costs and time efficiently to maximize our clients resources. Our professionals plan all aspects of every project so there are no unwanted surprises.

PM/CM services:

- Design management
- Contract development
- Quantity surveying
- Value engineering
- Cost and schedule management
- Project controls
- Document control
- Program cost consultancy
- Inspection
- Contract compliance
- Claims avoidance/dispute resolution
- Critical path method (CPM)
- Master scheduling
- Delivery and contracting strategies
- Design standards
- Risk management
- Plans and procedures
- Procurement
- Value engineering
- BIM
- Project administration
- CPM schedule analysis
- Change management
- Estimating and budgeting
- Quality assurance/quality control
- Construction inspection
- Construction management
- Program and project management
- Bid administration
- Engineering, procurement, and construction management (EPCM) services
- Equipment pre-purchasing
- Integrated project delivery





Charles Schwab & Company, Facilities Program

Nationwide, United States

Program and project management

AECOM provided program and project management services for a variety of capital projects nationwide and overseas, totaling over US\$1B in project value. The Tier III and Tier IV projects included a new US\$80M data center (150,000 sq. ft. computer room and 90,000 sq. ft. infrastructure space), a US\$40M data center expansion (90,000 sq. ft. of computer space and 65,000 sq. ft. of infrastructure space) to an operating data center. Both fast-track projects were designed to run 24/7 with Six Sigma reliability, and both have water cooling and UPS systems.

Confidential Client, 3.6MW Data Center

Multiple locations, Europe

Full project management/contract administration

This confidential client is one of Europe's leading providers of premium carrier-neutral data centers, operating facilities in urban locations across Europe. Their data centers are built and operated to provide a resilient and always-available hosting environment. Outsourcing mission-critical IT systems involves trust and this governs the principles on which they design and maintain their data centers. As such they need to be built to the highest industry standards, offer high levels of physical and environmental resilience, and must be protected against fire and power outages.

The project involved the conversion of an existing warehouse into a new, state-of-the-art data center on a busy business park campus. A new ESB Medium Voltage (MV) substation was constructed, and the building was expanded to provide for electrical and mechanical systems as well a new compound for backup generators.

Full testing and commissioning of the new MV system associated with the data center included testing of failovers to maintain a live system.

Southern California Regional Rail Authority Data Center and Dispatch Center

Los Angeles, California, United States

Construction management services

The Southern California Regional Rail Authority engaged AECOM to provide construction management and resident engineering services for the construction of a 22,000 sq. ft. facility consisting of a Tier III data center and dispatch center for the Authority's positive train control program. AECOM provided coordination and design support for drawings development and interfaced with the design team, contractor and regulatory authorities.

Digital Realty Trust, 600 W. 7th Street Turnkey Data Centers

Los Angeles, California, United States

Design/build services

Digital Realty Trust selected AECOM to design and build three new data centers of 9,000, 8,400, and 4,000 sq. ft., respectively, in an existing high-rise building in downtown Los Angeles. The electrical power systems consist of multiple UPS units arranged in a 2N redundant configuration.

A new 1,500kW diesel-engine driven generator and paralleling switchgear was added to the existing bus to complement the four existing generators. The system was commissioned requiring a Level 5 integrated test.

AECOM also provided master planning for additional data center spaces, incorporating and documenting the as-built conditions; the planning for a new, high-voltage utility service on the roof; and the addition of seven new rooftop generators.



Frontier Global Communications Data Center

San Diego, California, United States

MEP support, construction administration

AECOM was tasked to provide on-site MEP engineering support and construction administration for Frontier Global Communications. The approximately 20,000 sq. ft. data center facility is located at the San Diego Bank Building in North Park, a suburb of San Diego, California.

AECOM designed a new standby power system that included a 1000kW generator, 70db enclosure, transfer switch and controls to support their new data center. The generator was located in the bank parking lot, and designed with a blind wall, planter, and other amenities to gain approval from the City of San Diego. AECOM also engineered a new 4,000-amp service along with a new metered secondary distribution board and three 225KVA UPS (N+1). All work was done in cooperation with San Diego Gas and Electric. The critical cutover plan resulted in a minimal power outage to all of the bank's existing and new tenants. AECOM value engineered a solution for the open loop system on the cooling tower to avoid the additional cost of a booster pump.

U.S. Department of Defense Washington Headquarters Services, Pentagon U.S. Marine Corps Server Room Renovation and Command Center

Washington, DC, United States

Project management services

As part of the Pentagon Renovation project, AECOM managed the off-site renovation of the server room and administrative and other offices for the U.S. Marine Corps at the Navy Annex in Washington, DC. Since the facility needed to maintain ongoing data center operations the project team used a phased process to complete the project.

Data center work included interior demolition and abatement, and installation of new (slab-to-slab) perimeter walls, new raised access flooring (antistatic tile), three (15-ton) CRAC units, two 100KVA UPS units, an overhead StarLine Buss power distribution system, overhead cable trays, an Emergency Power Off (EPO) system, fire suppression and detection systems, overhead data cabling, and access controls. All the new equipment was then relocated in the new server room.

AECOM managed the completion of this highly successful project on time and on budget. The client was so pleased with the results that the Commandant cut the ribbon at the opening ceremony for the new facility and Michael Dell (the founder of Dell Computers) was also present.

04 construction services

Program cost consultancy

AECOM offers a full range of program cost consultancy (PCC) services for data centers around the globe. During the design phase we provide cost planning services to maintain an alignment between project requirements, the design, and funding availability. We do this on behalf of the owner or the design team. We evaluate and negotiate bids, and during construction we manage contractor payments, including change order and claims reviews, as well as settlements.

PCC services:

- Cost consultancy
- Cost modeling and cost planning
- Quantity surveying
- Benchmarking
- Value and risk analysis
- Life cycle costing
- Funding schedules
- Cash flow analysis
- Procurement
- Project controls
- Project planning
- Scheduling
- Engineering cost management
- Project/program management
- Post-contract cost management and final account settlement
- Value and risk consulting
- Capital and asset optimization
- Sustainability consulting and research

+ Global Unite

Global Unite is AECOM's international benchmarking and project performance indicator database. A great complement to PCC services, this database gives AECOM the ability to provide early-stage construction cost and design advice based on the benchmarks of similar projects – via GUIDE (Global Unite Indicative Design Estimator).

GUIDE draws on project information in Global Unite's data warehouse, predicting early-stage construction costs better than any of our competitors due to the size, scale and reach of our information library. This tool allows our clients to access a wealth of global project knowledge, which leads to better project outcomes locally.



Confidential High Tech Client (Hardware/Software)

Multiple locations, Global

Document management/controls services

AECOM has been providing document management/controls services to this industry-leading technology client since 2015. Initially, we performed an assessment of the entire backlog of documentation at three of their major data center sites in the U.S. Our team selected one of the sites as a core location to work from and were able to make assessments of the other sites. After the backlog assessments were completed, we developed a backlog processing program that included a scope of services, the required resources, and a time frame for the work. Our backlog work includes developing documentation, compliance, and formatting standards; auditing metadata for completeness; and performing metadata updates and uploads into the client's existing system. Once the backlog of documentation processing has been completed, we have a plan for completing the sustaining work at 9 to 11 different sites, including more sites in the U.S., 3 sites in Europe, and 2 sites in Asia.

We are also continuing to work with the client on evaluating various document management systems, including our own, for their long-term systems solution.

AECOM continues to provide planning/program support, design, construction administration, commissioning, and construction health and safety consulting services for 10 sites across the globe. From design and service-provider-coordination of on-and off-site critical utility infrastructure to seconded personnel supporting the client's internal engineering and development programs, AECOM employs over 40 staff who are dedicated to helping the client address new challenges and future growth.

Confidential High Tech Client, Data Centers

United States, Ireland, Singapore

Quantity surveying services, cost estimating, bid analysis, GMP negotiation, cost tracking, value engineering

AECOM produced cost estimates for various data center locations for this confidential client. Estimates were developed by a local AECOM team using local knowledge to provide costs that reflect current market rates. In addition, AECOM was involved in the negotiation with the general contractor for the award of the guaranteed maximum price (GMP) for the data center. To provide the best value to the client and to reduce the impact of change orders during the construction phase, AECOM's PCC team provided recommendations on the rates, quantities, and qualifications in the GMP.

To streamline the design and budgeting process for future projects, AECOM is currently in the process of providing a cost comparison between two of the data center projects, with the goal of streamlining the design and budgeting process for future projects. This task includes assessing the impacts of design on schedule and life cycle costs so that the client can better understand how design decisions may impact the full project cost. Additionally, AECOM is currently working on providing a standardized estimate and bid form for future data center projects. The goal is to simplify the bid leveling process by comparing returned bids on a "like for like" basis as well as with bids for other projects. To compare estimated project costs for different regions, AECOM is developing a factoring tool that can be used to apply region-specific factors for labor and materials to an estimate.

Confidential Client, Data Center Infrastructure and Integration Management

Washington, United States

Cost controls management

This confidential client chose AECOM to support its cost controls team. AECOM cost analysts are providing pre-construction/design, procurement, change management, estimating, project cost reporting, payment applications, post contract, and final account services to the client on its data center infrastructure and integration project. AECOM has developed a detailed target cost plan for the project that is based on site layout, conditions, and constraints. AECOM's cost analysts are also supporting and assisting the client with:

- Pricing methodology and a project-specific tendering process
- Negotiation of utilities contributions
- Guidance on the best procurement route for the project
- Development of a project commercial plan with dates for estimates, quantitative risk assessment workshops, and construction audits
- Local contract terms and conditions, contract strategy, and a general contractor negotiation plan
- Procurement of sub-contract trade packages

AECOM's cost analysts are also assisting the client with change management, analyzing project changes submitted by vendors, leading the vendor negotiations, and maintaining a live change order request log. AECOM is preparing detailed budgets based on 30%, 60% and 90% designs in support of the Project Expenditure Release (PER) process and any other financial analysis required for PER compilation. In addition, the AECOM team is leading all value engineering workshops and cost exercises, and negotiating a GMP / Lump Sum estimate with the general contractor.

AECOM's post-contract services include:

- Attendance at all regular design team, change request review, and budget review meetings
- Management of the change control process and contractual, construction cost, and budget advice on all proposed changes
- Management of quantitative risk analysis
- Support on issues relating to contractor or subcontractor contract performance
- Implementation of issues resolution processes
- Review of all project contract documents, including review and audit of contractors' insurance certificates / performance bonds
- Assistance with all commercial performance issues, including escalations
- Compilation of the Final Account and negotiation of same with the general contractor

Confidential Data Center Provider, Data Centers

Abu Dhabi and Dubai, United Arab Emirates

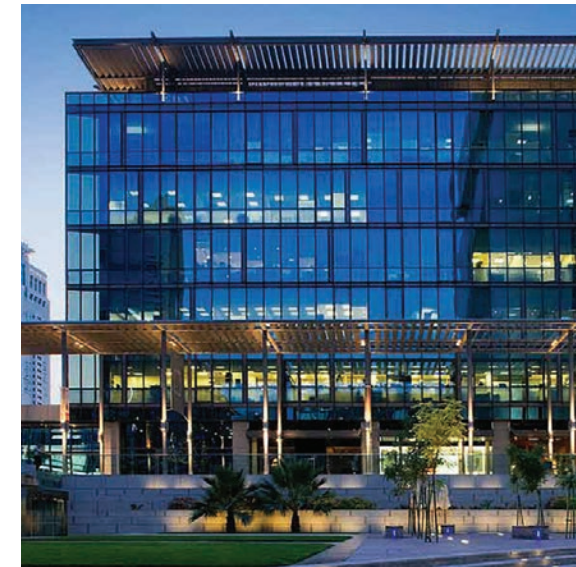
Cost management

AECOM is providing full cost management services for a confidential client's US\$291M data center project in the United Arab Emirates. The project's key features include extension of existing facilities, design and build procurement, a 32-month project timeline (22 months for construction), fully fitted-out data halls, and certification to the uptime Tier III standard.

The project involves two data center buildings containing six data halls with a total floor area of 28,000m² and with a data capacity of 7.5MW per building (each building is 14,000m² and contains three data halls) together with associated mechanical and electrical spaces and parking. A two-story utility building will be linked to the data center via a bridge.

The project includes:

- Emergency backup generators
- Water-cooled chillers
- CRAC units
- UPS system
- Water mist fire suppression system
- New site access, temporary construction access, and parking plans
- Site infrastructure (power supplies from the nearest substation, drainage, water, landscaping, security, lighting, internal roadways and footpaths, and shaded car parking spaces)
- Hard and soft landscaping
- Ancillary site works, including underground electricity MV cables between the substation and data centers



HSBC Bank Middle East Limited, Dubai, UAE

HSBC Bank, Middle East Limited, Data Center

Dubai, United Arab Emirates

Project management and cost management

AECOM provided pre- and post-contract project and cost management services for a Tier III data center located within HSBC Bank Middle East Limited's headquarters facility in Dubai. The technical space is 155m². The space has cooling and power design loads of 1,000VA/m² and houses 50 server racks. The office building is equipped with trading areas and other highly serviced spaces.

Injazat Data Systems, Data Center

Abu Dhabi, United Arab Emirates

Cost management

AECOM provided Injazat Data Systems with pre- and post-contract cost management services for a Tier IV data center consisting of a 2,000m² data hall with a cooling load of 1,450W/m² and the capacity for 800 server racks with 100 percent redundancy on all systems. A separate office building includes the network operations center, a three-level atrium at the entrance area, an auditorium, and a 24,000m² car park building.

Standard Chartered Bank, Data Center

Dubai, United Arab Emirates

Cost management

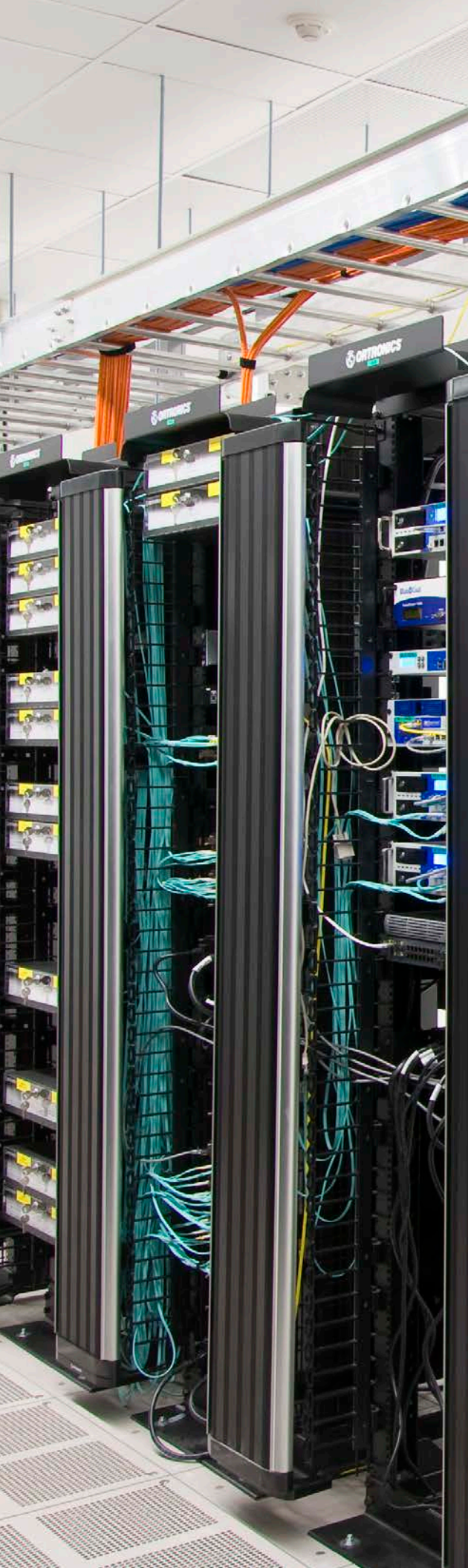
AECOM delivered pre- and post-contract cost management for a 225m² Tier III data center with cooling and power design loads of 1,000VA/m², situated within the bank's Dubai headquarters. The office building is equipped with trading areas and other highly serviced spaces.

Standard Bank, Data Center

Midrand, Gauteng Province, South Africa

Quantity surveying and cost management

The project comprised the construction of a 64,583 sq. ft. white space data center with a Tier IV configuration. AECOM provided full quantity surveying and cost management services. As this facility is a cornerstone for data centers in South Africa, we applied our global expertise locally to ensure visibility of the risks, their impact and their probability.



Hewlett Packard, Data Center

Milan, Italy

Project management and cost management

Through a framework agreement we are engaged with Hewlett Packard design to provide project management and cost management services for a new Tier III data center in Milan. The completed facility will be the first example of the HP Plex concept in Europe and will provide 21,528 sq. ft. of white space.

Telecity Group, Data Center Program Expansion

Ireland

Project management, cost management, contract management, contract administration, project supervisor design process services

AECOM Ireland worked with Telecity on this US\$96.6M, 3-year program rollout, which formed part of their wider pan-European US\$753M expansion program.

Individual projects included:

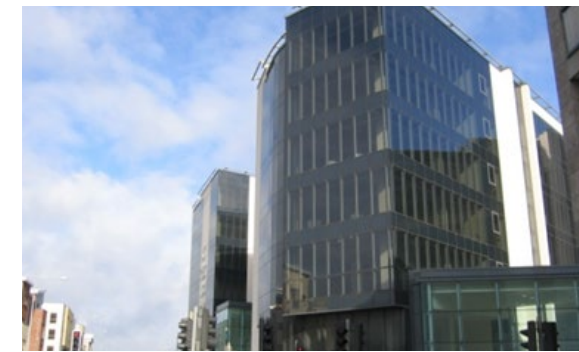
- Two substantial efficiency upgrade projects
- Addition of 4MW power to an existing data center
- New 3.5MW data center
- Two new 10MVA 20kV substations
- Two re-roofing projects for live facilities



Novartis, Elm Park Global Business Services Center

Dublin, Ireland

Full project management, cost management, health and safety, and design team services



Health Service Executive (HSE), Data Centre

Dublin, Ireland

Full cost management services



Deutsche Bank, EastPoint Business Park Offices

Dublin, Ireland

Full cost management, contract administration



Dublin Airport, Terminal 2

Dublin, Ireland

Full cost management services

AECOM was engaged to construct a US\$807M, 1,076,391 sq. ft. terminal and an associated pier and energy center.

04 construction services

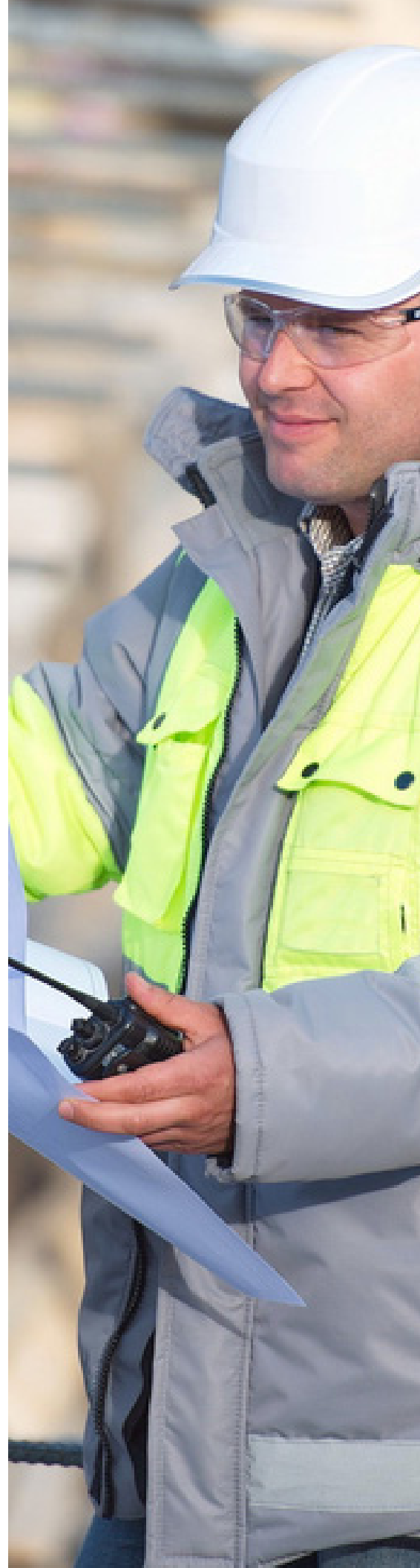
General contractor

AECOM delivers construction services to data center clients around the world—from project concept to completion, commissioning, and retrofits. AECOM's construction services business brings together the world's leading builders and offers clients a single, comprehensive source of solutions backed by AECOM's combined local knowledge and global expertise.

Our construction services experts provide clients with an extensive range of pre-construction and construction-related services and solutions for projects of varying scope, budget, schedule, and complexity. As a project progresses—or increases in complexity—we customize our services to fit each client's unique needs and requirements. We have a proven track record of delivering new, zero-defect facilities that are day-one optimized without compromising the ability to grow and meet future mission-critical needs. As an essential team member on each project, we play a crucial role in helping clients realize their visions.

Construction delivery methods:

- Construction management
- Project and program management
- Construction inspection
- Bid process administration
- Design/build
- Owners representation
- EPCM services
- General contractor
- Integrated project delivery



Thomson Reuters Corporation Data Center Renovation and Expansion Projects

Multisite, United States

Construction management and construction

AECOM has managed and constructed 1.7 million sq. ft. of space in seven locations for Thomson Reuters. Projects have included the 885,000 sq. ft. 32-story global headquarters in New York, a new media headquarters in Washington, DC, and office and data center renovations in Illinois, Missouri, and Wisconsin.

Three of the data center projects were in Missouri. AECOM managed the expansion and upgrade of a 24/7 financial and media data processing facility in St. Louis. This project included zero-tolerance criteria for planned and unplanned outages at the 125,000 sq. ft. Tier IV facility, which has 80,000 sq. ft. of white space, with fully redundant 2N power and cooling infrastructure. Innovative workarounds for short-term solutions during construction were critical to the project's success. The high-density servers that were installed required the mechanical and plumbing systems to be reconfigured to support a "cold aisle / hot aisle" configuration. The project also included concurrent power plant and mechanical system upgrades—all performed with no interruption to the data center's operations.

At the data center in Hazelwood, Missouri, AECOM completed a series of upgrades as well as a new addition, also without a single interruption to data center operations. The first project added a temporary chiller and generator to provide immediate additional cooling capacity. AECOM integrated the chiller into the building management system so that it would work in conjunction with the four existing air-cooled chillers to maintain a 2N arrangement. The second project, which AECOM implemented concurrently with the first, was a 21,000 sq. ft. mechanical and electrical plant addition inside the white space of the data center to support its long-term power and cooling needs. The new equipment doubled the data center's power capacity and increased its cooling capacity by 50 percent.

Other Thomson Reuters projects include:

Data Center Refurbishment / Brookfield, WI

AECOM was the Owner's Representative for various tasks to refurbish the Brookfield Data Center.

Aurora Day 1 Deployment / Hartland, WI

AECOM was the Owner's Representative on this project, which included the installation of new cabinets and associated power and data infrastructure.

Internap, Data Center Infrastructure Expansion

Somerville, Massachusetts, United States

Construction management

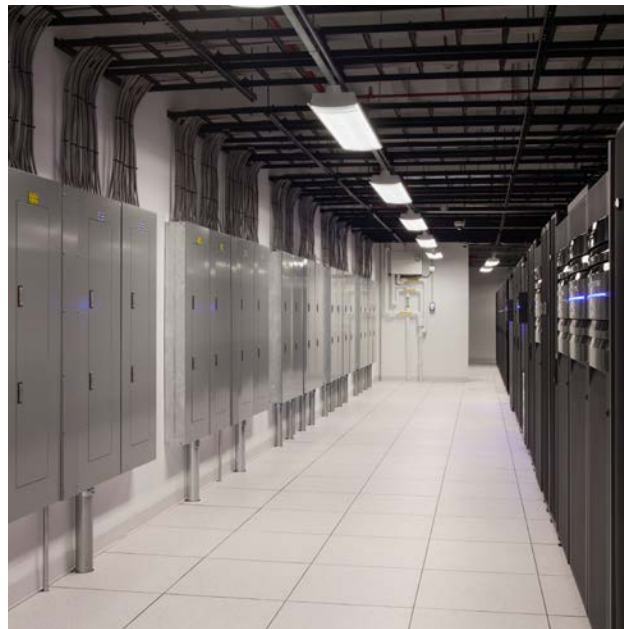
AECOM served as Construction Manager for Internap's 15,000 sq. ft. Tier III data center infrastructure expansion in Somerville, MA. Working inside an existing, one-story colocation facility, we built out new 8-inch supply return piping with 4-inch supply/return branch lines for new CRAC units. We also installed a new 750KVA UPS system as well as two 225KVA PDUs, which are fed by distribution panels located in the main electrical room, as well as new bus ducts that serve the raised floor environment.

One of the major challenges of this project was working next to a fully operational data center. The on-site team coordinated and oversaw the rigging, installation, start-up and commissioning of all equipment, carefully sequencing all tie-ins to make sure the new infrastructure was successful integrated into the existing asset.





Markley Group, Data Center, Boston, Massachusetts, United States



Markley Group, Data Center

Boston, Massachusetts, United States

Construction management

AECOM served as Construction Manager for multiple concurrent projects for Markley Group LLC. The projects include data center build-outs, major infrastructure upgrades, and expansions/face-lifts of office space and common areas. As Construction Manager, we prepared bid packages and buy-out proposals, managed multiple budgets and schedules, managed procurement of critical electrical and mechanical equipment, and coordinated the design team. Our field staff also oversaw multiple subcontractors—more than 100 individual workers on-site daily; the Markley method of procedure process for work affecting critical building systems; general site logistics; and major crane picks to place new equipment on the rooftop in a busy, dense urban environment.

Current projects under way at the facility included a new electrical vault in the basement, a new UPS room on the fifth floor, and a new rooftop enclosure to house paralleling switchgear for backup generators. The new rooftop enclosure is directly above a critical data center space, so we proposed constructing the roof of the enclosure before removing the roof membrane below in order to safeguard the data center from water and wind infiltration. Although a complex solution, this was the most efficient strategy and in the best interest of the client. Furthermore, the critical-path project required multiple crane picks to the eighth floor roof level.

Aside from these projects, we also executed dozens of smaller projects for our client. Additionally, one of the ongoing challenges at Markley Group is working around active, fully functioning data center spaces and critical rooftop equipment. The team continuously coordinates with the Markley team on all construction and installations to ensure all client and tenant protocols are followed and that there is zero interruption to the company's 24/7/365 operations.

Tufts University, Data Center Upgrade

Somerville, Massachusetts, United States

Construction management

AECOM served as Construction Manager at Risk for the 10,000 sq. ft. expansion of the existing Tufts Administration Building Data Center (TAB DC), including updates to all MEP systems. The TAB DC serves as the primary data communications and networking site for Tufts University and is located inside an operational Tier II mission-critical facility. In this capacity, TAB DC acts as a critical hub for providing connectivity to the University's Boston and Grafton campuses, to multiple Internet Service Providers, to the Internet2 link, and to a central node on the Tufts fiber ring.

AECOM performed a schematic review of the survey conducted by the design consultant. The major challenge was to integrate the equipment update without impacting operations to a live data center, including installing new electrical and mechanical infrastructure. The installation was phased in and around the existing data center while keeping the fire protection systems operational. The physical layout of the support space was relocated, and a new building management system system was installed to monitor the new infrastructure.



University of Massachusetts (UMASS) Medical School, Data Center

Worcester, Massachusetts, United States

Construction management

AECOM served as Construction Manager for the 37,000 sq. ft. Tier III data center and supporting infrastructure for the UMASS Medical School. AECOM provided comprehensive planning and pre-construction services leading up to the construction of this US\$20M project. The new energy-efficient data center provides scalable, secure, and redundant storage capabilities for the medical school's current and future critical data requirements, and uses new technologies, such as flywheel-backed UPS systems and air-side economizing. In addition, by removing all HVAC components from the data center box and providing complete system monitoring, the owners can essentially "turn off the lights."

The data center contains 7,000 sq. ft. of raised floor, 15,000 sq. ft. of utility support spaces, and 10,000 sq. ft. of office area. Construction took place at an existing clean room fabrication facility with a two-story perimeter mezzanine for support utilities.

The design engineer had desired air flow volume and air mixture (return air and outside air) requirements. However, due to the existing building structure layout, an economical method of creating the correct environment was hard to achieve. After reviewing the layout and the return/outside air requirements, a fan wall system made up of a series of smaller fans was developed. This not only produced the design air flow requirements, but also gave the facility the desired redundancy for the data center. To create the balance of optimal outside/return air mix desired for energy efficiency, a free-standing interior plenum wall system was designed with integral dampers. This final layout proved to be economical and energy efficient.

The data center construction was critical to the transfer of U.S. patient information from paper to digital formats. In working on this data center the team had to negotiate various challenges, including the risk of disturbances in power supply, voltage surges, and other abnormalities, as well as the complications of construction of a facility that must support a complex network of technology systems that extend from the data center to the patient bedside.



Sentinel Data Centers, Trumbull Data Center, Trumbull, Connecticut, United States

Sentinel Data Centers, Data Center Fit-out

Needham, Massachusetts, United States

Construction management

AECOM served as Sentinel Data Centers' Construction Manager for the fit-outs and associated infrastructure upgrading of an approximately 140,000 sq. ft. Tier III data center space into a 220,000 sq. ft. Tier IV facility. Our team was responsible for both the high-voltage and low-voltage installations accommodating power densities in excess of 100W/SF. In addition to the data center fit-outs, we also managed a successful 14MW upgrade to the site, which included the installation of six new substations, seven 2MW generators, and 12 new UPS systems.

During the construction management process, the project team prepared budgets, reviewed the proposed design and conducted construction feasibility studies, as well as managed scheduling, bid packaging and bid evaluation for each data center fit-out. The building remained occupied by other tenants during construction, which was completed on a fast-track schedule.

Sentinel Data Centers, Data Center Retrofit

Trumbull, Connecticut, United States

Construction and construction management

AECOM managed the phased retrofit, upgrade, and construction of new raised floor space within Sentinel's existing 117,000 sq. ft. mission-critical facility, which was originally built in 1991 as a stand-alone data center. Sentinel engaged AECOM to reconfigure the three-story complex to suit the needs of a variety of new data center tenants from the financial services industry. The first floor houses MEP infrastructure, and the second and third floors contain white space.

Phase 1 entailed the build-out and commissioning of approximately 25,000 sq. ft. of critical data center space on a 36-inch raised floor system, including the installation of approximately 30 30-ton Liebert CRAC units, a combination of 10 400-amp and 600-amp static switches, 20 225KVA PDUs and the associated remote power panels. Phase 2 consisted of the installation of a new 1.2MW power upgrade to the facility, including the installation of a new 2MW generator and associated loadbank, one new 2,500KVA substation, two Powerware 750KVA UPS units, as well as an enhanced electrical distribution to two floors of data center space. AECOM was also responsible for the fit-outs in each of the tenant spaces, which as live data center environments required extensive coordination between vendors and facility personnel.

Sentinel Data Centers, Franklin Data Center

Somerset, New Jersey, United States

Construction management

Sentinel Data Centers needed to convert their existing 220,000 sq. ft. warehouse into a multi-tenant Tier III data center facility. AECOM worked with Sentinel to provide construction management services over a three-phase delivery, and also helped them meet sustainability targets while pursuing LEED Gold certification.

In Phase 1, AECOM was responsible for the construction of four 10,000 sq. ft. data pods, a new 69kV substation, an outdoor modular chiller plant, four 2,500kW emergency generators, three UPS systems, and associated switchgear. Phase I also included two 25,000-gallon underground fuel oil tanks and associated fuel oil piping to tie into the generators. Cooling of the pods is provided by 32 Liebert 50-ton CRAC units, and the UPS rooms are serviced by three 30-ton CRAC units. Phase I also called for the build-out of 10,000 sq. ft. of office space and storage.

In Phase 2, four generators, two outdoor modular chiller plants, three UPS systems, five 10,000 sq. ft. data pods, 32 50-ton CRAC units, two 25,000-gallon fuel oil tanks, and nine 30-ton CRAC units for UPS room cooling were added.

In Phase 3, AECOM was responsible for the construction of an 86,000 sq. ft. expansion with four generators, five 10,000 sq. ft. data pods, two UPS systems, 32 50-ton CRACs units, and six 30-ton CRAC units.

All data halls, corridors, UPS rooms, and generator rooms throughout the complex are protected by eight pre-action zones, and all office areas are protected by a sprinkler system. The entire facility contains 42-inch raised access flooring, enabling chilled water and electrical power to be distributed under the floor. To increase the operational efficiency of the data center, AECOM implemented a chimney system for heat rejection to the hung ceiling, increasing overall PUE.

Sentinel Data Centers, Orangeburg Data Center

Orangeburg, New York, United States

Construction management

AECOM is serving as Construction Manager for the greenfield construction of a new build-to-suit mission-critical Tier III data center for Sentinel that will be constructed in two phases. The 150,000 sq. ft. facility will contain 40,000 sq. ft. of raised flooring, with a distributed electrical infrastructure that provides 4.8MW of usable critical power in a 2N configuration.

This equates to approximately 120 watts per sq. ft. The building is being designed to support the addition of 2.4MW of additional power infrastructure, bringing the total critical power load for the site to 7.2MW. The chiller configuration will be arranged in an N+2 capacity. The project is aiming for LEED Gold certification and will have an estimated PUE of 1.3 to 1.4 at completion.



Sentinel, Franklin Data Center Somerset, New Jersey, United States



Sentinel, Orangeburg Data Center Orangeburg, New York, United States



Bank of America Building at One Bryant Park, New York, New York, United States

Bank of America Building at One Bryant Park

New York, New York, United States

Construction

AECOM built the world's first LEED Platinum certified skyscraper for The Durst Organization and Bank of America. The 2.1 million sq. ft. commercial tower contains three Tier IV data centers and a host of high-performance sustainable features, such as a cogeneration plant, thermal storage system, and green roof.

The cogeneration plant simultaneously provides both electric power and low-pressure steam for the building's use. The plant burns natural gas in a 4.6MW combustion turbine generator (CTG) with the output shaft spinning an electric generator. The plant also includes a steam-powered absorption chilled water (CHW) machine. During the summer this CHW is used to both improve the plants efficiency by cooling the CTG's combustion supply air and to air-condition adjacent spaces. During the winter the low-pressure steam is used to heat the building and with the help of a reinforcing burner section, it will provide 100 percent of the building's winter heating needs, while the generator simultaneously provides a large percentage of its electrical needs. This plant will provide about 33 percent of the peak electric loads and 66 percent of the building's annual electrical energy requirements. The building also contains two 7,500 sq. ft. data centers at 60W/SF and one 18,000 sq. ft. data center at 180W/SF. Cooling is provided by a high-density modular cooling solution throughout the equipment.

Barclays, U.S. Headquarters and Data Centers

New York, New York, United States

Construction

AECOM was engaged to build a 32-story office tower that serves as the US headquarters for Barclays, a global financial services firm, and as the workplace for more than 5,500 employees. The project included the build-out of the data centers and backbone fiber and copper installations.

We also managed the installation of six data centers with more than 500 cabinets containing 48 4-pair CAT6 cables and 24-strand multimode fiber. In total, the six data centers contain 15,000 sq. ft. of raised floor space.

Goldman Sachs, 200 West Street

New York, New York, United States

Construction management

AECOM served as Construction Manager for a new 43-story, 740-foot, 2.1 million sq. ft. office building with 30,000 sq. ft. of Tier III white space. The building was constructed in New York City on Site 26 at Battery Park City, the last commercially zoned site in the development. Also known as the Goldman Sachs Tower, the building achieved LEED Gold certification by incorporating "green" building technologies, such as water and energy conservation and use of recycled materials.

Verizon, Freehold Data Center

Freehold, New Jersey, United States

Construction services

Verizon engaged AECOM to convert 5,000 sq. ft. of administrative office space into a data center as well as provided a host of infrastructure upgrades to support future white space expansion.

AECOM installed four Liebert plug-style CRAH (computer room air handler) units, a new security system, six new 225KVA Cyberex PDUs, two Liebert 400KVA UPS systems, raised flooring, a Starline Busway power system, a hot-aisle containment system, a suspended ceiling grid system, and lighting.

AECOM also installed 200,000 linear feet of underground conduit, two 1,250KVA backup generators, 3,000-amp bus load bank switchgear, a 2,000kW load bank and controls, and two outdoor pad-mounted transformers with 5,000-amp switchgear. The existing UPS system was demolished and four 500KVA UPS module units, one UPS module control cabinet, and four 1,200-amp module battery disconnects were installed.

Finally, the team installed new dunnage steel for four new Marley 750-ton cooling towers that will replace four 600-ton existing cooling towers at this Verizon facility.

Confidential Client, Data Center Expansion

Philadelphia, Pennsylvania, United States

Design/Build services

AECOM served as Design/Builder for a 19,000 sq. ft. expansion to an active Tier III data center facility in Philadelphia. The expansion, which is on the ninth floor of an operational data center, includes the installation of two 1.5MW generators and two new 900kW UPS systems along with two air-cooled chillers. The scope of work also included the diversification of the DC plant and additional CRAH units to provide redundancy for the new space.

Procter & Gamble Data Center

Cincinnati, Ohio, United States

Construction management

AECOM served as Construction Manager for a new 70,000 sq. ft. data center facility that was constructed as part of a larger corporate headquarters project in Cincinnati for consumer goods giant Procter & Gamble. The new 800,000 sq. ft. headquarters also includes conference facilities and an auditorium in addition to the data center facility.



JP Morgan Chase Central Data Centers 1 and 2

Wilmington, Delaware, United States

Construction

AECOM built two geoplexed data centers for JP Morgan Chase in Wilmington. Each facility has 2N electrical systems and 90,000 sq. ft. of white space that can support 100W/SF of power. The mechanical/electrical plants include 34.5kV primary electrical service to diverse substations and grids; 16 750KVA UPS systems, with a 44,000 point power monitoring system; six 2,000kW emergency generators, with paralleling gear; and a 6,000-ton chilled water plant with 200,000 gallons of water storage. More than 500,000 linear feet of conduit were buried beneath the foundations in order to reduce the structural load of the core and shell. This task required extensive coordination during the excavation and foundation phases. Our team oversaw and coordinated the design process, participated in site selection, and pre-purchased in excess of US\$100M of mission-critical equipment for the projects. The client realized a 10 percent savings in the equipment purchase by relying on AECOM's expertise and buying power.

Bank of New York Mellon, Tennessee Processing Center, Data Center

Nashville, Tennessee, United States

Construction

AECOM's mission-critical team constructed a new two-story, 165,000 sq. ft., Tier IV data center on a greenfield site for BNY Mellon in Nashville. The facility supports 56,000 sq. ft. of white space with 2N mechanical and electrical infrastructure. Construction was slated to begin when the costs and lead times for structural steel were at all time highs. Our team, with the BNY Mellon's approval, explored alternative structural systems that could lower the total cost of the building and compress the project schedule and after a thorough evaluation recommended poured-in-place concrete columns instead of steel. Also, during the course of this investigation, we discovered that the depth of the column footings was not sufficient to handle the amount of conduit that was supposed to be buried beneath the slab. So the team supervised a redesign of the footings. We also recommended an Epicore roof deck system because it enables all piping and conduit to be hung from the roof without penetrating the water-tight seal of the deck itself.



zColo, Data Center Fit-out

Chicago, Illinois, United States

Construction management

AECOM served as Construction Manager for this fast-track renovation and build-out of 15,000 sq. ft. of Tier IV mission-critical white space and its supporting infrastructure within a 12-story operational colocation facility in Chicago. Our team was hired early in the design phase to coordinate the efforts of the design team and manage the design process. The team ran twice-weekly design meetings and performed periodic budget estimates as the design progressed to ensure that construction costs were within budget. This cost validation enabled our client to manage the scope of the project more efficiently and mitigate the potential for redesign work.

To meet the project's aggressive schedule, we recommended splitting the permit between a self-certification permit for the interior build-out and a standard permit review for the exterior and common area work. The existing space required demolition of the walls, louvers, storefront, HVAC and electrical services. Significant coordination with the local electric utility company was required to bring new electrical service into the building. A 2.0MW generator was assembled on-site and installed in a new enclosure adjacent to the building's loading dock. An air-cooled modular chiller was installed on the roof. Due to the site's location, the steel for the chiller platform and the chiller itself were set with a series of helicopter picks.

zColo, Data Center Upgrade

Las Vegas, Nevada, United States

Construction management

AECOM served as Construction Manager for the infrastructure upgrade of an existing, operational zColo data center in Las Vegas. The work was performed in two phases. Phase 1 included an office renovation and fit-out project and Phase 2 included a complete upgrade of an existing 6,800 sq. ft. data center.

The upgrade entailed the installation of five new 30-ton chilled-water CRAC units and supporting infrastructure, including all new glycol piping, valves, and insulation. AECOM also managed the installation of a new 2,000kW generator, an applicant-tracking system, and a concrete pad to support the generator. The team also installed all new lighting, PDUs, and a new 500KVA UPS module.



First Data Corporation, Data Center Construction

Chandler, Arizona, United States

General contracting services

AECOM provided general contracting services for tenant improvements, including removal and restoration of floors and walls. The project was completed on a fast-track basis. Priority was given to tight scheduling and relocation of personnel between temporary work quarters while maintaining stringent occupational health and safety standards.

Countrywide Data Center

Chandler, Arizona, United States

Construction

The Countrywide Data Center in Chandler, Arizona, is an example of the adaptive reuse of a 185,000 sq. ft. single-story light industrial building, converting it into a Tier III data center with 12,500 sq. ft. of raised computer floor. The initial phase of the data center project included the construction of the raised floor plus associated infrastructure space with 2.5MW of UPS capacity for computer load, or an average of 200 W/SF UPS on the raised floor. The facility is designed to ultimately expand to 50,000 sq. ft. of raised floor with 10MW, or an average of 200 W/SF of raised floor. Our team subsequently constructed two additional three-story office buildings on the same campus along with a central plant, cafeteria, and fitness center.

California State University, Long Beach, Hall of Science

Long Beach, California, United States

Design/Build

This 160,000 sq. ft. research and teaching science building consists of research labs, a data center, six lecture halls with 580 seats total, classrooms, teaching and research laboratories, faculty offices and conference rooms, storage facilities, a vivarium and animal holding facilities. The space is used by the biology, physics, sciences, education, chemistry and geology departments. Additional work included the hazmat abatement and demolition of the existing Peterson Hall #3. The Tier II data center contains 10,000 sq. ft. of white space.

Discovery Communications, Inc., Latin American Headquarters Data Center Upgrade

Miami, Florida, United States

Construction management

AECOM managed the upgrade of the existing utility and emergency power systems of the data center at Discovery Communications' Latin American Headquarters. The project included the installation of a new 2.0MW utility service with associated service switchgear and the procurement, installation, and commissioning of a 2.0MW emergency generator. AECOM also oversaw the migration of all existing electrical services onto the new utility service as well as the decommissioning and removal of the existing infrastructure without impact to the operations of the facility. The project also included the installation of a larger chilled-water distribution system and the reconfiguration of existing chillers to allow for future installation of additional chillers when cooling demands increase. Mechanical upgrades and equipment reconfiguration were also performed without disruption to the client's existing infrastructure. A temporary cooling system was installed to carry the building load while the upgrade was under way.



05

Integrated service delivery

Confidential Client, Data Centers

United States, Europe, Asia

Master planning, environmental permitting, civil engineering, project/construction management, health and safety program management, and maintenance support services

AECOM is providing a broad range of services for nine Tier III data centers in the United States, three in Europe, and three in Asia. Services, which vary according to site, include master planning, environmental permitting, civil engineering, construction observation related to environmental and civil permitting and compliance plans, and project/construction management. Comprehensive EHS program and maintenance support are also provided.

Confidential Software Company, Data Centers

United States

Civil, structural, and MEP engineering services; construction administration

AECOM provided full architectural and design services for two new corporate containerized data center farms. Work included a Tier III infrastructure, a network operations command center, and support facilities. The PUE is less than 1.10 (projected).

El Paso Global Networks, Data Center Program Rollout

Nationwide, United States

Site selection studies; design and construction documents

AECOM was selected by El Paso Global Networks to roll out their Tier II and Tier III data center program. We completed design and construction documents for their new corporate data center and NOC room in the El Paso headquarters in Houston. Site selection and design were also completed for six new point-of-presence facilities averaging approximately 15,000 sq. ft. each.

The El Paso facilities included design of complete N+1 infrastructure, including climate control systems, emergency and AC power, a DC power plant, transport racks, and cable distribution systems. Each site has a variety of engineering challenges, including widespread structural upgrades to handle rack, battery and HVAC equipment loads, as well as routing of fiber and HVAC distribution.

Livewire Data Center

Fort George G. Meade, Maryland, United States, and Worldwide

Planning, project/construction management, design, and construction services

AECOM is providing an intelligence community agency with planning, PM/CM, design, and construction services to restore and modernize the agency's utilities infrastructure at Fort Meade and locations worldwide. The agency's mission requires a robust utilities infrastructure to support a net-centric technological enterprise composed of analytic centers networked with high-powered data centers. AECOM services supported the modernization of mechanical and electrical systems that serve 7 to 9 million sq. ft. of agency facility space to provide the capacity and reliability that the computer-intensive environment requires. Specific goals achieved under the contract to date include energy modeling and establishment of a Program Management Office (75 people are currently providing consulting services).

Our master planning has optimized space allocation and allowed for higher power density per sq. ft. of design as well as prioritized technical task orders. Facility, architectural, and space planning include the modernization of building cores with updated architectural finishes, communications, improvements to the office environment, data rooms, fire protection, MEP design, energy management control systems (EMCS), and construction.

Common infrastructure includes unit substations (USS), uninterruptible power supplies (UPS), computer room air conditioners (CRAC), chillers, motor control centers, cooling towers, fire suppression systems, and more. Design and construction encompasses civil and structural work for new duct banks and overhead feeder conduit supports. For the new chillers and cooling towers, new larger-bore piping and supports requiring structural design and seismic analysis are being installed. AECOM work includes extension and modification of both wet and dry pipe sprinkler systems. The new EMCS require software and programming changes as well as devel-

opment of a new sequence of operations. In order to maintain or mitigate the mission impact of the construction, AECOM is performing work on a 24/7 basis as needed.

This project includes extensive evaluation and design of a secondary unit substation (SUS) for consolidation and replacement of interior and outdoor substations. It also includes the demolition of any existing SUS and installation of dead break boxes, installation of new underground duct-bank and feeder cables, SCADA upgrades, and reconfiguration of existing substation rooms. AECOM provided short-circuit analysis and downstream compliance calculations for existing electrical equipment using network mode to evaluate inadequate short-circuit ratings. AECOM also provided thermal analyses and cross-sections of the proposed duct banks and performed cable fill calculations, which were computed using ETAP software to determine cable temperatures in the underground duct banks.

AECOM also provided design services for a 3,000-ton chiller plant upgrade. The project included drawings, specifications, calculations, and construction cost estimates for the renovation of the existing 4,500-ton chiller plant. The chiller plant houses three 1,500-ton centrifugal chillers. Supporting systems include primary chilled-water pumps, secondary chilled-water pumps, cooling towers, vertical turbine condenser water pumps, plate heat exchangers for free cooling, refrigerant recovery and monitoring systems, solids separators, sand filters, chemical treatment systems, air compressors for control and pneumatic tools, steam condensate pumps, three 25-ton CRAC units, and outside air and exhaust air fans. This plant serves the adjacent 9,800 sq. ft. building via underground chilled-water pipes.

U.S. Department of State – Consular Affairs, Passport Systems Data Center

Washington, DC, United States

Full life cycle development, modernization, and technical support

AECOM provided life cycle support for the 22,500 sq. ft. Passport Systems Data Center's secure storage and real-time retrieval for more than 125 million passport records and data for issuance of 13 million passports annually. Features include high-availability, redundancy, security, application support, routing, and clustering. Replication between two data centers now supports connections from 28 Passport Agency offices, the Social Security Administration, and a facial recognition database.

Architect of the Capitol, Library of Congress, Memorial Building Data Center Rehabilitation

Washington, DC, United States

Architecture, planning, structural engineering, MEP engineering, acoustical and audio/visual, commissioning, fire protection, environmental compliance, industrial hygiene, cost estimating, CAD services

AECOM provided services to rehabilitate and renovate the existing 15,000 sq. ft. data center of the Library of Congress—James Madison Memorial Building. The goal of the project was to improve the efficiency of the current data center, provide design for additional cooling units needed to support the anticipated growth, enhance reliability of year-round operations, and propose the most efficient rack layouts to separate cold and hot aisles.

U.S. Army Corps of Engineers, Camp Williams Data Center

Riverton, Utah, United States

Engineering, project, and construction management

The U.S. Army Corps of Engineers' LEED-certified US\$1.5B facility at Camp Williams in Riverton, Utah, houses nearly 1 million sq. ft. of space consisting of a mission-critical Tier III+ data center, technical support, and administrative spaces. This client's massive building complex also includes water treatment facilities, chiller plants, an electrical substation, a fire pump house, a warehouse, a vehicle inspection facility, a visitor control center, multiple diesel-fueled emergency standby generator buildings, and a fuel facility for full power backup capability.

Between 2010 and 2014, AECOM provided the client with the services of qualified and experienced engineers, project managers and construction managers who supplied engineering, project, and construction management support to the United States Army Corps of Engineers Real Property Services Field Office.

U.S. Army Corps of Engineers, Fort Harrison U.S. Army Finance and Accounting Center

Indianapolis, Indiana, United States

Design, mechanical and electrical engineering, and construction services

The U.S. Army Corps of Engineers selected AECOM for the challenging task of overhauling and modernizing a colossal structure consisting of 1.6M sq. ft. of offices, computer rooms, SCIFs, a worldwide teleconferencing center, a cafeteria, classrooms, security, auditoriums, a printing plant, maintenance shops, mail rooms, a bank, a credit union, a barber shop, a post exchange, a travel agency, and a museum.

AECOM's task was complicated by the requirement to avoid interrupting the critical work of 5,000 employees, as this facility houses the Defense Department's worldwide finance and accounting operations. We designed two additions totaling 260,000 sq. ft. for education, a warehouse, and data center support. Engineered systems included 2mVA of UPS, 2mVA of standby power, complete replacement and upgrade of the 15.5mVA power system, new security and fire alarm systems, and a new telecommunications structured cabling system. Construction was only partially completed, as the center was closed under the BRAC (Base Realignment and Closure) Act passed by Congress.

National Air and Space Intelligence Command (NASIC), Intelligence Production Complex

Wright-Patterson Air Force Base, Ohio, United States

Architecture and building engineering

NASIC provides real-time intelligence analysis for U.S. military assets worldwide, supporting mission critical activities through this Intelligence Production Complex in Ohio. As part of a design-build team, we served as the Architect and Engineer of Record for the expansion and renovation of the Intelligence Production Complex. This project increased the building by 135,000 sq. ft. and renovated 45,000 sq. ft. of the existing facility.

The addition includes a 500-seat auditorium, a cafeteria and an additional one-story SCIF designed to support future expansions. This facility incorporates significant electrical and HVAC redundancy for increased reliability. The complex houses multiple SCIF spaces and a large data center.

The biggest construction component was the data center. Part of the existing data center was modified and updated with new mechanical and electrical systems to create a new unclassified data center. This work was phased to maintain operations throughout construction.

This project also included the installation of a new 500-ton chiller and cooling tower with provisions for a future expansion. A new generator yard incorporates two 2,000kW generators with room for four additional generators, all associated switch gear, and a 25,000-gallon fuel storage tank to provide standby emergency power. This project provided significant CRAC units, PDUs, and an UPS.



Charles Schwab, South Mountain Campus and Data Center, Phoenix, Arizona, United States

Charles Schwab, South Mountain Campus and Data Center

Phoenix, Arizona, United States

Architecture, design, master planning, and structural engineering services

In 1999, Charles Schwab & Co., Inc. decided to focus on Phoenix, Arizona, as the expansion location for their data center operations. AECOM was asked to develop a master plan for the development of an existing 22-acre site, a vacant parcel immediately adjacent to Schwab's data center facility. The goal was to develop a scalable campus that would be flexible and accommodate the company's long-term growth while responding to its immediate space needs. The site was also to provide amenities and facilities for employees and a building configuration that would make subleasing or a future sale of part or all of the site possible.

Our solution was to provide three individual buildings of varying sizes and a combination of structured and surface parking with a strong pedestrian link between the new campus and the existing data center. Traffic patterns for internal site circulation together with the perimeter streets were configured in such a manner as to minimize non-Schwab through traffic and access.

To accomplish this, AECOM expanded the scope of the master plan to include the pedestrian and vehicular access systems of the existing data center facility and in doing so, created a visitor parking area and entry sequence common to both facilities. Upon completion of the master plan for the new site, AECOM was asked to develop the architectural image for the new campus.

The new structures incorporate basic rectilinear forms for ease of construction, space planning, and economy, while simple curves and arcs are used to create a contemporary feeling. To meet the requirement for building interiors with maximum flexibility, AECOM concluded that a 30-by-40-foot structural bay provided the cost-effective flexibility Schwab wanted. In addition, AECOM addressed the site's height limitation by minimizing the structural floor and roof thickness and by manipulating the site's slope to achieve the most advantageous configuration.

Central New Mexico Community College (CNM), Westside Campus Data Center

Albuquerque, New Mexico, United States

Design, construction administration, architectural, mechanical, electrical, structural, telecommunications, and security design and consulting services

AECOM provided consulting, design, and construction administration services to CNM in support of building their Westside Campus Data Center. The services included architectural, mechanical, electrical, structural, telecommunications, and security design and consulting services. This facility is the backup site to the primary data center, which is located on the main campus.

Services included preparation of detailed construction documents that describe all facets of the installation in order to provide the campus with reliable, code-compliant, low-maintenance, and efficient systems.

AECOM provided a detailed evaluation of architectural, electrical, structural and mechanical requirements for the data center, including UPS, existing communications distribution pathways, security system interface, and cooling requirements, and presented the findings to CNM's physical plant and IT staff. AECOM designed all communications-related infrastructure in accordance with the Communications Infrastructure Standards Manual developed by AECOM as part of an earlier project for CNM.

The primary data center of the new CNM Student Resource Commons project that AECOM completed was used as the reference site for this project. The two facilities had to share a common design, equipment specifications, and communications distribution methodology where it was feasible to do so.

AECOM also helped CNM determine where they could seek LEED benchmarks to design, construct, and operate both projects as high-performance green buildings.

TelecityGroup, Data Center Program

Multiple locations, Europe

Civil, mechanical, electrical, and structural engineering; public health engineering, CFD modeling, site supervision, landscape architecture, flood risk assessment, transport assessment

AECOM provided professional services throughout Europe to TelecityGroup, one of Europe's leading providers of carrier-neutral colocation data centers. The Tier III facilities are located in Manchester, UK; London, UK; Ealing, UK; and Stockholm, Sweden. AECOM's core team worked with TelecityGroup's stakeholders and called on local AECOM offices for support as needed.

The data center projects were completed between 2010 and 2012, and ranged from converting an industrial food distribution warehouse into a two-story data center to designing TelecityGroup's new 29MW Powergate 1 Flagship data center. Both the London and Manchester facilities include office, conference, and data space.

Notable highlights from these projects include:

- AECOM implemented flood mitigation solutions for the Manchester sites, which involved raising the ground floor by more than 4 feet above the external ground level.
- AECOM provided professional services during the feasibility study, conceptual design, detailed design, and site supervision phases of the London data center project, which was located in the high-profile Canary Wharf area.
- The Ealing data center included a link bridge to an adjacent building. AECOM also completed a CFD model of the data halls, cooling tower, and standby generator facility.
- AECOM's Swedish site team used their local knowledge to assist in negotiations with the local electricity supplier, Fortum, to secure 11MW for the site, and with the City of Stockholm to ensure that the completed facility was fully certified in accordance with all local regulations and laws.
- AECOM developed detailed engineering design for the design and build contractors for multiple sites.

The data centers are characterized by high levels of resilience, security, and flexible deployment options, and an average <1.35 PUE at each site. Standardization and flexibility were key components in the system design. AECOM provided solutions to allow a simplified installation process with future expansion considerations regarding cost, time, and maintenance benefits.

TelecityGroup, Harbour Exchange Data Center

London, England

Civil and structural engineering, site supervision

AECOM provided civil and structural design services for the feasibility study, tender design, detailed design and site supervision for this Tier III, 86,111 sq. ft. project. Conversion and extension of the Harbour Exchange Building 6/7 and construction of a new infill building created a major data center at the prestigious Canary Wharf in London.

The scope of work involved phased conversion of the existing building from general office space into data floors to house data racks and plant. The project also included construction of a new seven-story independent infill building of steel-framed construction with concrete floors on profiled metal decking on piled foundations.

As Site Representative we provided assurance to the client that the civil and structural works constructed were in accordance with the client's design and coordinated with the H&S manager and CDM (construction design and management) coordinator.

TelecityGroup, Powergate 2 (Phase I)

Ealing, West London, United Kingdom

Civil, mechanical, electrical, and structural engineering; public health engineering, CFD modeling, and site supervision

AECOM provided civil, structural, mechanical, and electrical and Public Health design services on behalf of both TelecityGroup and the main contractor, Spie Matthew Hall. We also provided site supervision services for this major expansion of Telecity Group's existing data center facilities in Ealing, West London.

This complex project involved the conversion, extension and fit-out of an existing food distribution warehouse into a 10,000m2 major data center. Designed over two floors, the project required insertion of a major steel mezzanine floor into the building on 300 piled foundations and construction of a link bridge to the adjacent building. Design duties also included CFD modeling of the data halls, cooling tower, and the standby generator facility. This fully operational data center was designed to run 24/7 and provide Tier III services at 2kW/m2.

TelecityGroup, Manchester 3 Data Center

Manchester, England, United Kingdom

Civil and structural engineering, landscape architecture, flood risk assessment, transport assessment

This 53,820 sq. ft., Tier III project involved the conversion of a two-story industrial building from a factory into a data center, with the addition of three stand-alone mechanical and electrical plant buildings around its perimeter.

New floor and roof structures were inserted inside a retained façade to provide two 1,250m2 data hall floors with minimal column interruptions, in addition to the associated plant room, office, and ancillary spaces.

Design challenges included:

- Supporting the large imposed loads over long 18-meter spans
- Devising a new system of piled foundations to fit the existing foundation system without disrupting the retained façade
- Implementing a flood mitigation solution, which involved raising the ground floor by 1.3 meters above the external ground level

TelecityGroup, Powergate 1 (Phase II)

Acton, West London, United Kingdom

Mechanical, electrical, and structural engineering; public health engineering, CFD/thermal models

This 86,111 sq. ft. site in Acton, West London, is Telecity's flagship data center, housing both office and data space, and delivering Tier III service at 2kW/m2.

AECOM's scope of work included design duties for mechanical, electrical and structures and CFD/thermal models. The design was procurement up to stage D on a traditional basis and then Design and Build for stages E and F. AECOM was also involved in the testing and commissioning phase of the project, which was completed in December 2010.

TelecityGroup, Skondal Data Center (Phase II)

Stockholm, Sweden

Civil, structural, mechanical, and electrical engineering; site supervision

AECOM provided services for the modification and extension of an existing reinforced-concrete warehouse into a data center with associated plant areas and office facilities. This project included a 21,530 sq. ft. Tier III data center and a new 6,500 sq. ft. steel-frame building to house the auxiliary plant areas and equipment.

Birchfield Estates, Data Center

East Grinstead, United Kingdom

Lead consultant (full duties); facility engineering, sustainability, and CFD modeling services

For this new 10,000m2 data center on an existing industrial estate in East Grinstead, UK, AECOM developed a design that concentrated on integrated spatial planning and services distribution to maximize facility operational efficiency and provide flexibility for future expansion options.

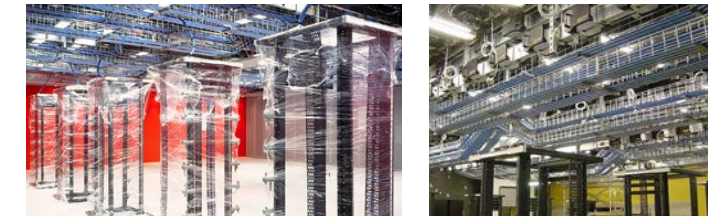
Wellcome Trust, The South Field Project

Hinxton, United Kingdom

Acoustic, building, geotechnical, and structural engineering services

This 1,000m2 data center was completed as part of a £95M leading-edge research development housing a bioinformatic supercomputer. The data center cooling system was designed for heat loads of 2kW/m2 with provision for increasing to 4kW/m2.

CFD modeling and a physical mock-up were used to verify the cooling system design. AECOM provided acoustic design and building engineering services, including geotechnical and structural services.





Northwest Data Center

London, United Kingdom

CFD modeling, structural engineering, civil engineering, and LEED consulting

For this new data center construction project, AECOM provided CFD modeling and structural and civil engineering services. The building consists of two dual-story data hall accommodation buildings arranged around an interlinking central services spine. The overall plan footprint of the building, which is about 24,000m², contains general office areas, up to 16 data halls, IT support areas, and associated mechanical and electrical plant areas.

GSS Propco/Volta Data Centers, Great Sutton Street Data Center

London, United Kingdom

Structural engineering, architectural, and building services; acoustics, geotechnical, CDM coordinator, and infrastructure services

AECOM's reputation for creative, smart thinking was recognized at the 2013 International Data Center and Cloud Awards, where the team picked up the Best Retrofit Award for the Great Sutton Street Data Center.

An existing data center, previously owned by BT, Great Sutton Street Data Center is in a unique, high-premium, central London location. Thinking strategically, we designed a new data center within the confines of the existing six-story building, where four floors dedicated exclusively to IT provision demand a final day IT load of 6.4MW.

University of Surrey Data Center

London, United Kingdom

Structural engineering and building services; acoustics, geotechnical, CDM coordinator, and infrastructure services

AECOM provided an array of design, engineering, and oversight services in the building of a new data center for the University of Surrey. Because the project was to be completed in three phases, all aspects of the project had to be extensible from the initial designs. The AECOM team provided services to complete the base build and phase one, which included the provision of 20 IT units.

Imagination Technologies Ltd., Data Center

Hertfordshire, United Kingdom

Structural engineering and building services; acoustics, geotechnical, CDM coordinator, and infrastructure services

AECOM is providing design, engineering, and infrastructure services for a data center for Imagination Technologies Ltd. in Hertfordshire. The data center will be a Tier II facility in accordance with the Uptime Institute, and will have two data halls, each with 4,844 sq. ft. (450m²) of space. The flexibility of the new data center's design is enabling it to remain functional through all stages of the project.

Confidential Client, Data Center

Confidential location, Ireland

Construction, cost management, civil and electrical engineering, landscape design, and water/waste water design and engineering services

AECOM was selected by this confidential social media client to provide cost management, construction, and environmental monitoring services for a two-phase data center project in Ireland.

In Phase 1, AECOM constructed two data center buildings with eight data halls totaling 50,800m² and a data capacity of 36MW per building (each building is 25,400m² and contains four data halls). AECOM also designed the associated mechanical and electrical spaces and parking as well as a single-story ancillary administration/office building of 6,424m² that links to the data center buildings.

In Phase 2, AECOM is building a third single-story data center building containing four data halls totaling 24,400m², with a data capacity of 36MW. AECOM also constructed the 4,360m² ancillary administration/office space and associated parking for this facility.

The project also includes:

- Ground-level emergency backup generators (with internal fuel tanks)
- New site access and temporary construction access and car parking arrangements (including utilization of existing farm access)
- Closure of existing accesses (following the demolition of two residential units)
- Site infrastructure, including entrance gates and appropriate signage, security hut (36m²), internal roadways and footpaths, 217 car parking spaces in total across the site in both phases, a bicycle shelter, a water sprinkler tank, pumping facilities, water tanks, drainage networks, attenuation ponds, and a connection to the public sewer
- Bridges and culverts over streams
- Hard and soft landscaping
- Bicycle path and pedestrian footpath
- Installation of temporary electrical infrastructure to service the data center campus before final connection
- Ancillary site works, including underground electricity 20kV cables between the substation and data centers

Confidential Client, Data Center

Dublin, Ireland

Design, engineering, construction, and cost management services

AECOM was selected by a confidential client in Dublin, Ireland, to provide design, engineering, and cost management services for a project consisting of a new shell and core data center in one two-story block and a fit-out of part of the same. The building will be operated as a satellite facility to the existing data center buildings on the nearby site.

AECOM's scope of work includes:

- Shell-and-core building design and construction
- Fit-out of two data halls on the first floor, complete with associated plant spaces on the ground floor
- Fit-out of two-story ancillary offices and staff welfare accommodations
- Site work, such as underground utilities/service; site preparation for future electrical transformer installation, including an acoustic barrier; new boundary structures, gates and a gatehouse; various outbuildings, roads and carriageways, and parking for cars and trucks
- Full cost management services

University of Ulster Data Center

Coleraine, Northern Ireland

Site selection, civil engineering, and structural design services

The University of Ulster has over 25,000 students and 3,000 staff in four campuses across Northern Ireland.

The University carried out a review of their computing services and decided to construct a centralized data center to consolidate their data facilities on one site. The site chosen was adjacent to the computing services team headquarters on the Coleraine campus.

AECOM provided structural and civil engineering services from RIBA Stage B to completion. Our first task was to support the site selection exercise, followed by assistance to the architect in preparing the planning application. The data center has its own dedicated main power supply and standby generator, with robustness built into all systems to ensure continuity of services. There is a plan to install a wind turbine generator to provide power for the data center to reduce its energy costs and carbon footprint.

Citigroup, Frankfurt Data Center

Frankfurt, Germany

Design, construction, and facility engineering services

Citigroup's Frankfurt data center supports the company's main business operating center and provides 9.380m² of business-critical facilities. For the project, AECOM designed a new two-story building, with a phased fit-out, in a business park environment.

Hessische Baumanagement (HBM), Clay Kaserne Network Center

Wiesbaden, Germany

Architectural, civil, mechanical, interior design/space planning, and environmental (LEED) services

AECOM was commissioned by HBM to be the lead design consultant for a new network center for the U.S. Forces in Wiesbaden, Germany. This new office and data center required exceptionally high security and technical design standards. The project had to satisfy both German and American building regulations. AECOM was selected because of its experience in both areas and our excellent record of providing the U.S. Department of Defense with high-quality work in Germany.

The program for this facility contained two separate building users. AECOM's plan provides each with a distinct office area connected only by a large central entry/meeting hall. The entire building is laid out on a 6-by-6-meter grid, allowing for maximum usage flexibility and versatility of furniture systems.

AECOM delivered a high-quality work environment for building users through the selection of interior finishes, the individual controllability of interior temperatures, and the ambient natural daylighting. AECOM also designed a green roof for the building and a highly efficient CHP mechanical/electrical supply system. HBM expects the building to achieve, at minimum, a LEED Silver certification.

In the basement, a high-security data archive area was accommodated. AECOM designed a heavy-duty armored structure with blast walls and floor slabs, which can withstand sustained attack. The main fabric of the building has been constructed to meet anti-terrorism force protection requirements. The perimeter of the building has a 25-meter force protection zone incorporating a series of ditches and high curbs.



- Architecture/engineering design
- Engineering (civil, electrical, mechanical, and/or structural)
- Security upgrades
- Construction supervision/inspection
- AT/FP
- Structural analysis/testing
- Safety and health coordination
- Project scope development
- Planning/cost estimating
- Materials/equipment testing
- System commissioning/decommissioning
- Biddability/constructability/operability/environmental compliance review
- Sustainable design
- Energy conservation/reuse of materials
- Pollution prevention
- Fire protection



Reuters, Global Technical Center, Geneva, Switzerland

MCI Worldcom, Data Center

Marseilles, France

Civil, structural, and electrical engineering; construction management services

AECOM was selected by MCI Worldcom to perform a structural assessment of its existing data center building in Marseilles, France. AECOM provided a high-level design for the 269,000 sq. ft. facility, including its infrastructure and power supply. Work included detailed A+B electrical design with N+1 generators. Structural and civil engineering accommodated the siting of chillers on the roof and alterations to the building fabric to allow penetration for risers. AECOM also managed the acquisition of permits and licenses.

MCI Worldcom, Data Center

St. Denis, Paris, France

Civil, structural, and electrical engineering; construction management services

AECOM performed a feasibility study and structural assessment of MCI Worldcom's existing building in Paris, and provided high-level design for the data center, including its infrastructure and power supply. Work included detailed A+B electrical design with N+1 generators. Structural and civil engineering accommodated siting of chillers on the roof and alterations to the building fabric to allow penetration for risers. AECOM also managed the acquisition of permits and licenses for the Tier III facility in Paris, France.

Reuters, Global Technical Center

Geneva, Switzerland

Electrical, structural, and civil engineering; acoustical design

Reuters selected AECOM to provide an electrical infrastructure design for its Geneva data center, including an innovative design solution for 4.8MW of on-site power generation, rotary UPS service, and acoustical design. AECOM also provided Reuters with traditional building engineering services.

Confidential Client, Chengdu Data Center

Sichuan, China

Architectural, structural, mechanical, electrical, and due diligence assessment services

AECOM is providing services for a new 16,000 sq. ft. data center and office facility in Sichuan, China, for a confidential client. Services include assessing the condition of the internal and external fit-out, the curtain wall, roof water tightness, key structural members, the ventilation system, the UPS system, the fire services system, the drainage system, and licenses.



Sonangol, Data Bank and Visualization Facility

Luanda Bay, Luanda, Angola

Architecture, digital media, infrastructure engineering, landscape architecture, mechanical and electrical engineering, structural design services

AECOM was asked by Angola's national oil company, Sonangol, to produce a feasibility study and concept proposal for the new headquarters of the Sonangol Geotechnical Division within the secure Essa site in Viana, near Luanda. The architectural team was asked to develop three distinct design solutions for a flagship building, all designed to one common brief, which AECOM jointly developed with Schlumberger.

All options incorporate an archive for physical data, a Tier II data bank facility, data processing departments, management suites, and a state-of-the-art 3D visualization auditorium. The three design options were presented to the Sonangol Board of Directors and one option has been chosen for detailed design and construction.

Farah Leisure, Ferrari World Data Center

Yas Island, Abu Dhabi

Design consultancy services

Farah Leisure, operator of Ferrari World, engaged AECOM to provide design consultancy services for a new (Tier II+) data center with a total of 24 new racks, inside Ferrari World at Yas Island, Abu Dhabi.

AECOM's services included investigation of the current site operations and validation of the concept design provided by Sorrento Data Center Consultants.

The project involved close coordination with the operations on-site, and site services had to remain available while the design of the Ferrari World renovation was under way.

AECOM's services included civil, infrastructure, structural, mechanical, and electrical engineering services as well as environmental, telecommunications, and IT services. AECOM coordinated all the design efforts for the new data center.

Etisalat, Khalifa A Data Center

United Arab Emirates, Middle East

Design and engineering services; facility engineering; space planning and workspace strategy

Etisalat, a United Arab Emirates telecommunications services provider, had reserved about 12,917 sq. ft. of unfinished floor space on two floors of its data center in Khalifa A for future expansion. The spaces on both floors had no mechanical, electrical, and plumbing (MEP) services or civil site design. Etisalat also wanted to develop the second floor as office space for a potential customer or for a network operations center (NOC).

Etisalat chose AECOM to design the available floor space and to provide all MEP and civil engineering design services for the Tier III data center. AECOM is preparing architectural, structural, electrical, and mechanical design documents and coordinating with local authorities to obtain the necessary approvals to start construction.

The design and engineering consulting services AECOM is providing include:

- Design of a separate entrance with a small lobby, circulation space, and a cargo lift serving both floors
- Complete MEP services, installed without disturbing existing services; power and cooling designed as a stand-alone entity but modified for the available space and existing building
- Coordination with the local authorities on requirements and necessary approvals
- Conformance with international design standards and compliance with the local authorities having jurisdiction
- Minimum of two designs for the office layout, which is to include meeting rooms, a NOC room, and office amenities that reflect the existing theme of the data center's offices
- Development of tender documents, with drawings, specifications, and a bill of quantities

Credit Suisse, Tier III Data Center

Riyadh, Saudi Arabia

Design, tender, and construction services

This Credit Suisse data center in Riyadh was an upgrade project. The challenge was to upgrade the data center and the disaster recovery center to Tier III without interruption of services or long shutdown periods.

The upgrade of the data center included new panel boards, new and independent power supplies, new generators, new CRAC units, and new UPS units. The same design was applied to the disaster recovery center.

The project was completed on time and under budget, while the main work was completed during evening hours and weekends.



HP, New Zealand Dual Data Centers

Auckland and Wellington, New Zealand

Construction management, architecture and planning, and facilities management services

AECOM has provided comprehensive design, planning and construction services for the development of two sister data centers each with an ultimate 5,000 square meters of net technical space. The project has been designed to TIA Tier III and can be upgraded to UTI Tier IV compliant if required. The project includes technical space designed for 3kW/m² with a special focus on very high availability. AECOM's involvement in the project is from concept design through detailed design, construction observation, commissioning, and ongoing facilities management and optimization.



Left to right

/ Monash Centre for Electron Microscopy, Clayton, Victoria, Australia

/ Verizon facilities and infrastructure, new design and upgrades at 1,200 locations, Northeastern USA

/ IBM Global Services Modular Center, Auckland, New Zealand. AECOM was a pioneer in the development of modular data center solutions.



Digital Realty, Erskine Park Data Hall Facility

Sydney, New South Wales, Australia

Design, engineering, and construction program and project management services

Due to an emerging sales market in Australia, Digital Realty needed to rapidly construct data halls in order to gain market share. In addition, the client needed a service provider that could update its design standards and specifications. AECOM performed design and construction management of the 89,340 sq. ft. (8,300m²) data center that provides a 24-hour/365-day secure environment with plant redundancy of N+1. The 11kV facility consists of: emergency diesel power generators, UPS, CRAC and AHU cooling systems, as well as special fire protection systems.

The facility houses four turnkey data centers. Their energy-efficient design achieved a Gold LEED rating and compliance with the Uptime Institute's (UTI) design standards. At the 2013 Mater Builders Awards, the project was named the best "Communications Building."

The Erskine Park project was delivered on time and under budget, and has exceeded the client's quality requirements. The facility has achieved both a Gold LEED rating and the UTI as-built certification. The Erskine Park project is now promoted as a flagship project for Digital Realty, and the design and IP developed for it are used to standardize and improve future projects.



05 global experience

AMERICAS

United States and Canada

- Bank of New York Data Center, Nashville, TN
- Confidential – Global data center design standards
- Facilities and Technology Planning and Design, Confidential Government Client, USA
- Merrill Lynch Cabling and Infrastructure, NY and NJ
- NASA, supercomputing facilities improvements, CA
- NAVFAC Anti-Terrorism Force Protection Ashore Program, various locations, USA
- NYSE Trading Floor Upgrade, NY
- Reno Technology Park, NV
- El Paso Global Networks, Data Center Program Rollout, nationwide
- Sentinel Data Centers, various locations, USA
- WorldCom Global Network Services and co-location facilities, various locations, USA
- Thomson Reuters Corporation data center renovation and expansion projects, various locations, USA
- WorldCom Global Network Services switch node and co-location facilities, various locations, USA
- California State University, Long Beach, Hall of Science, CA
- Country Wide DC, AZ
- Bank of America Building at One Bryant Park, NY
- Barclays, U.S. Headquarters and Data Centers, NY
- Goldman Sachs, 200 West Street, NY
- Tyco International Ltd. Backup Data Center, NJ
- New Jersey Department of Human Services Computer Room, NJ
- Verizon, Freehold Data Center, NJ
- Internap Data Center Infrastructure Expansion, MA
- Markley Group, Data Center, MA
- Tufts University, Data Center Upgrade, MA
- University of Massachusetts (UMASS) Medical School, Data Center, MA
- Equinix Data Centers, various locations, USA
- ASB Ashburn Data Center, LLC., VA
- CoreSite Data Centers, VA and NJ
- Honda Data Center, CO
- Denver International Airport, On-Call GIS Data and Development Services, CO
- Sabey Corporation Data Center, VA
- Internal Revenue Service (IRS), Computer Processing Centers, various locations, USA
- National Library of Medicine, National Institutes of Health, Data Center Expansion, MD
- Baltimore/Washington International Airport, MD

- Defense Information Systems Agency (DISA), Defense Information Systems Network (DISN), MD
- Chesapeake College, Learning Resource Center Data Systems, MD
- Livewire Data Center, MD
- Department of Defense, Medical Health Services Data Center, VA
- BAE Systems, Mission-Critical Data Center, VA
- The Pentagon, National Military Command Center (NMCC), VA
- Division of the World Bank, International Finance Corporation Data Center Relocation, DC
- Qwest Communications, Data Center, DC and OH
- United States General Services Administration, Space Reconfiguration and Data Center Design, DC
- District of Columbia, Unified Communications Center (UCC), DC
- U.S. Department of State – Consular Affairs, Passport Systems Data Center, DC
- Architect of the Capitol, Library of Congress, Memorial Building Data Center Rehabilitation, DC
- WLVT PBS 39 New Broadcast Center, PA
- American Electric Power (AEP), Transmission Operations Center, OH
- Verizon Wireless, Data Center, OH
- State of Ohio General Services Administration, Hilltop Development Communications Project, OH
- Nationwide Mutual Insurance Company, Nationwide Enterprise Data Center – Silo Tape Storage/Office Space, OH
- Boehringer Ingelheim Roxane, Data Center Expansion, OH
- John Glenn Columbus International Airport, Data Center Study, OH
- University of Cincinnati Data Center Study, OH
- Procter & Gamble Data Center, OH
- National Air and Space Intelligence Command (NASIC), Intelligence Production Complex, OH
- JP Morgan Chase Central Data Centers, DE
- Gundersen Lutheran, Stukins Building Renovation, WI
- Karmanos Cancer Center, Data Center Relocation Study, MI
- Spectrum Health, Data Center, MI
- Central Michigan University, Foust Hall Data Center, MI
- Fox Chicago Studio and Newsroom Renovation, IL
- Illinois State Tollway Highway Authority, Data Center, IL
- zColo Data Center Fit-out, IL
- U.S. Army Corps of Engineers, Fort Harrison U.S. Army Finance and Accounting Center, IN
- zColo Data Center Upgrade, NV

- U.S. Army Corps of Engineers, Camp Williams Data Center, UT
- Iron Mountain Incorporated Data Bunker, MO
- United Parcel Service (UPS) Hub 2000 Project, KY
- AT&T Ojus Cable Station, FL
- Discovery Communications, Inc., Latin American Headquarters Data Center Upgrade, FL
- Frontier Communications, Data Center and Fiber Optic Distribution Center, UT
- America First Credit Union (AFCU), Ogden Data Center, UT
- 3011 Lafayette Turnkey Data Centers, CA
- Southern California Regional Rail Authority Data Center and Dispatch Center, CA
- Digital Realty Trust, 600 W. 7th Street Turnkey Data Centers, CA
- Frontier Global Communications Data Center, CA
- Confidential Client, Data Center Infrastructure and Integration Management, WA
- Weather Channel Studio and Data Center Expansion, GA
- U.S. Army Engineering and Support Center, Huntsville, Utility Monitoring and Control Systems Program, Data Center Expansion, MS
- City of Raleigh, Central Communications Center, NC
- University of Texas System, Guhn Road Data Center, TX
- Electronic Data Systems Corporation, Information Processing Centers, TX
- URS, Data Center UPS System Upgrade, TX
- Charles Schwab, South Mountain Campus and Data Center, AZ
- Central New Mexico Community College (CNM), Westside Campus Data Center, NM
- M. F. Malone, Sungard Toronto Mega Center, ON
- PMC Sierra, Inc., Data Center/Telecommunication Design, BC
- Public Works Government Services Canada, Environment Canada Prairie Weather Center Server Room UPS and Cooling Upgrades, MB
- Manitoba Hydro, Headquarters and Data Center, MB
- Hawaii Regional Security Operations Center, HI
- Charles Schwab & Company, Facilities Program, various locations

Latin America

- OptiGlobe Telecommunications, Internet Data Centers, various locations, LATAM

EUROPE, MIDDLE EAST, AFRICA AND INDIA

United Kingdom and Ireland

- Barclays, London
- Lloyds of London, BBP2, London
- Northwest Data Center, London
- Morgan Stanley, Group Floor Extension project, Heathrow
- Norwich Union Dual Computer Centre
- Deutsche Bank - Risk Mitigation project, various locations
- University of Surrey Data Center, London
- Imagination Data Center, Hertfordshire
- Galileo Connect London Northwest Data Centre
- Confidential Data Center Client, London
- Confidential Client, Data Center Conversion, London
- Confidential Client, Data Center Conversion, Manchester
- Gatwick Airport North Terminal, BIM Utilization, Gatwick
- The Wellcome Trust South Field Project, Hinxton
- Telehouse 2000, London
- Cazenove & Co., Data Centre, London
- Reuters, Docklands, London
- GSS Propco/Volta Data Centers, Great Sutton Street Data Center, London
- Skanska Data Center Animation, London
- Data City Exchange, 3D Visualization and Animation for Data Center, UK
- Birchfield Estates, Data Center, East Grinstead
- Wellcome Trust, The South Field Project, Hinxton
- IT Construct, Cheshire Data Center, Cheshire
- Titanic Quarter/Data City Exchange (DCE), Data Center, Belfast
- Telecity Group, various locations, Europe
- Telecity Group, Data Center Program Expansion, Ireland
- Novartis, Elm Park Global Business Services Center, Dublin
- Health Service Executive (HSE), Data Centre, Dublin
- Deutsche Bank, EastPoint Business Park Offices, Dublin
- Dublin Airport, Terminal 2, Dublin
- University of Ulster Data Center, Coleraine

Central Europe

- Confidential Data Center Client, Amsterdam, Holland
- Reuters Ltd. Global Technical Center, Geneva, Switzerland
- Citigroup Data Center, Frankfurt, Germany
- Hessische Baumanagement (HBM), Clay Kaserne Network Center, Wiesbaden, Germany
- Telecity Group, Stockholm, Sweden
- Confidential Data Center Client, Germany
- United States Armed Forces, Network Center, Wiesbaden, Germany
- MCI Worldcom, Data Center Marseilles and Paris, France
- Hewlett Packard Data Center, Milan, Italy

Middle East

- Injazat Data Center, Abu Dhabi
- Farah Leisure, Ferrari World Data Center, Abu Dhabi
- HSBC Bank, Middle East Limited, Dubai
- Standard Chartered Bank, Dubai
- Morgan Stanley & Co., Dubai
- Lehman Brothers, Dubai
- Deutsche Bank AG, Dubai
- Barclays Wealth, Dubai
- MEERA, Doha
- Dubai International Finance Centre, Dubai
- Gulf Data Hub, Dubai
- Standard Bank, Data Center, Midrand
- Etisalat, Khalifa A Data Center, UAE
- Credit Suisse, Tier III Data Center, Saudi Arabia

ASIA-PACIFIC

India

- Reliance Communications, Navi, Mumbai
- Bombay Stock Exchange, Business Continuity Center, Hyderabad
- Comsat Max Tier II Data Center, New Delhi
- CtrlS Data Center Ltd, Mumbai
- HCL Technologies Data Center, Noida
- Pacific Century Cyber Works, Tier II and Tier III Data Centers
- Patni Computer Systems Ltd, Noida
- SAP Labs India

Singapore

- Confidential client, tier 3+ Data Center

Malaysia

- Intel PG12 Data Center, Penang
- Data POS 1&2, Kuala Lumpur

Hong Kong

- HKEX Next Generation Data Center, Tseung Kwan O Industrial Estate
- NTT Communications Data Centers
- Confidential Client Tier 3+ Data Center
- China Mobile Data Center
- China Unicom Global Solution Management Center
- City Telecom (HK) Limited, CTI Multimedia Production and Distribution Center
- HSBC Data Center
- Hong Kong Jockey Club, Data Center Expansion

China

- Chengdu Data Center, Sichuan

Australia and New Zealand

- QANTAM Computer Center, Sydney
- CBA Data Center, Sydney
- Cathay Pacific Data Center
- Woolworths Data Centre, Sydney
- Confidential Data Center Client, Sydney
- ANZ Data Center, Tullamarine, Melbourne
- ANZ Data Center site selection, Auckland
- ASB Data Center Infrastructure, Auckland
- Spark, Project Gemini Data Center, Auckland
- Vodafone Data Centers, Artarmon, Sydney and Newington, Ballaria
- Qantek Data Processing Center, Sydney
- UUNET Data Centre, St Leonards, Sydney
- Digital Realty Data Centers, Sydney and Melbourne
- HP, New Zealand dual Data Centres, Auckland and Wellington
- HP Data Center, Sydney
- Westpac Data Center, Sydney
- Gen-i Data Center, Auckland, NZ
- Telstra Clayton Data Center, Victoria
- Department of Defence - Head Quarters Joint Operations Command (HQJOC), Canberra, Australia
- Air New Zealand DC audit, Auckland
- EDS Mt Wellington upgrades, New Zealand
- IBM Data Center site selection, Auckland
- IBM Newton data center upgrades, Auckland
- UUNET Data Center, St Leonards, Sydney



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