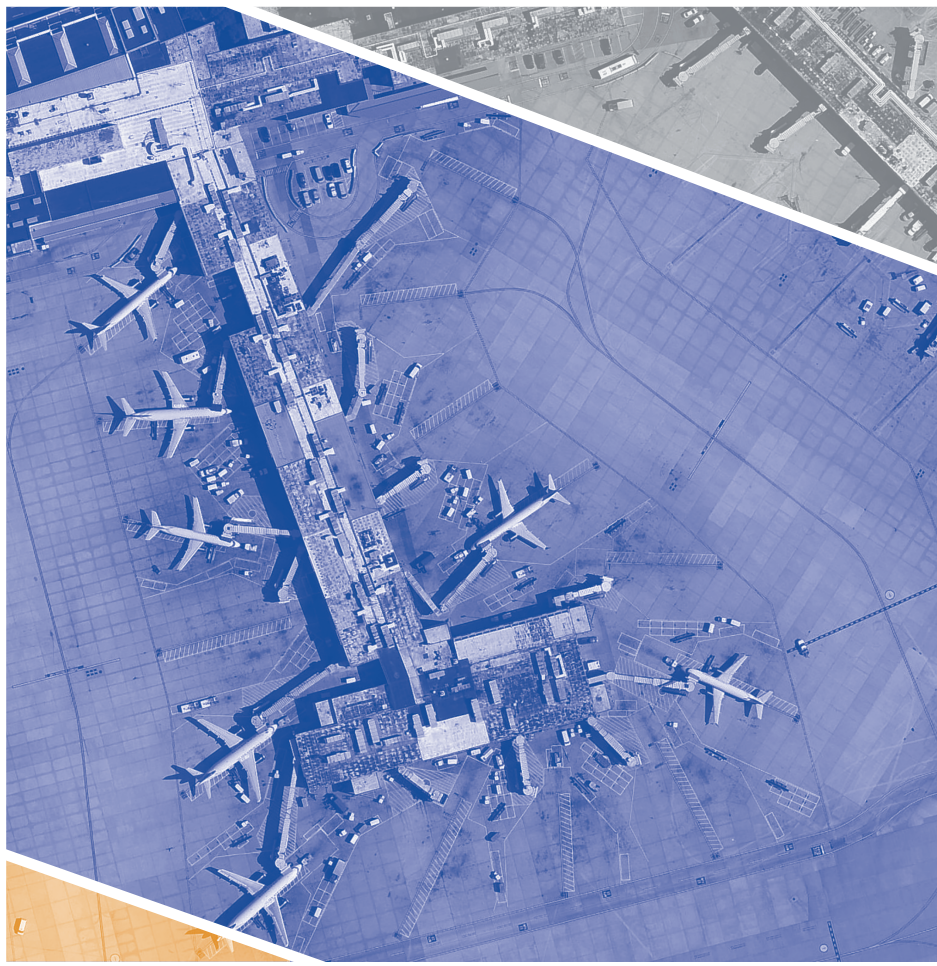




Geospatial

Services and Solutions

CONTACT:

Scott Howell

Arora | 61 Wilmington–West Chester Pike
Chadds Ford, PA 19317-9024

T (484) 770-1205

showell@aroraengineers.com

Rethinking Infrastructure®

ARORA®

Arora Engineers
aroraengineers.com
P (610) 459-7900
F (610) 459-7950

Dear Prospective Client,



A certified MBE/DBE, Arora Engineers (Arora) offers multidisciplinary engineering and geospatial services. Since 1986, Arora has specialized in providing asset-based engineering services tailored for clients in aviation, transportation, education, and the commercial sectors. We have reassessed the role played by traditional engineering providers and our practice has evolved to emphasize the technology that integrates asset infrastructure systems, improves operations and longevity, and makes life safer and easier for those who use it.

Arora's comprehensive engineering practice includes oversight, project management, infrastructure/facilities management, design of new and existing mechanical, electrical, plumbing, fire protection, IT building and airfield systems, as well as GIS based enterprise asset management tools and techniques, including data governance, asset inventory, condition assessment, and gap analysis. Risk management and financial investment strategy recommendations are essential elements to developing well rounded and resilient solutions.

With earth observation data, improved positioning, and cloud-based services at our core and innovation as a catalyst, our desire is to leverage technology and our expertise to develop solutions that inform decision-makers with information products which facilitate and contribute to positive process improvements, both within their organization and to the general public served. Extending from Environmental Impact Statements to on-call Planning and Engineering services, Arora can lead and efficiently manage numerous geospatial data collection, mapping, and information technology functions for design, planning, and construction projects.

Our Geospatial practice supports these efforts independently and dovetails into strengthening both the Arora Technology Group (ATG) for customized applications development, as well as Arora's dedicated disciplines in Building Information Management (BIM), Mechanical, Electrical, Plumbing, Fire/Life Safety, and Special Systems (Security, Telecom, IT). Our capabilities in these areas range from airfield lighting, wayfinding, digital signage, and NAVAIDS, to field lighting vaults, paging, and access control systems.

Arora's Geospatial practice also works closely with our Construction and Program Management group (PM/CM)—supporting efforts to serve as an extension of staff and owners Rep - running capital projects and programs, performing field inspections, working with general contractors as master systems integrators, performing constructability reviews, and managing and overseeing the design and construction process.

Arora's national engineering practice is built on the principles of quality, innovation, and hyper-responsiveness. Our multidisciplinary approach offers clients comprehensive, cost-effective solutions to their most challenging situations. From the initial design process, bid services, and cost estimation to construction and ongoing facility/asset maintenance and management, Arora's team of professionals is equipped to address any problem, and most importantly, to find the right solution.

Sincerely,

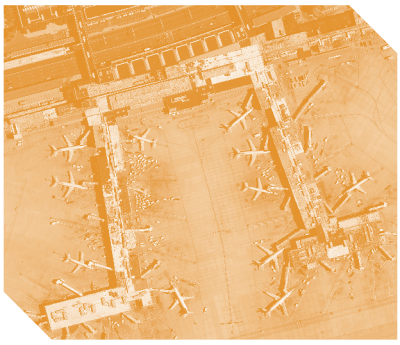
Manik Arora
President and CEO



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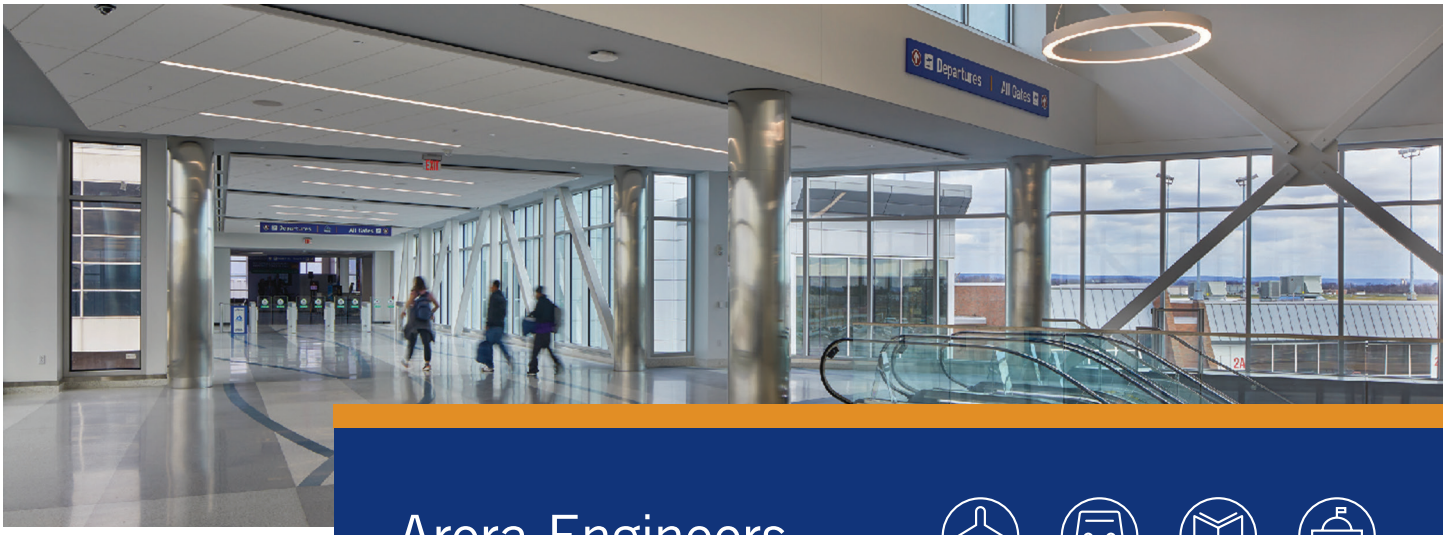
+ Company Overview



+ Geospatial Experience



COMPANY OVERVIEW



Arora Engineers

At Arora Engineers, we believe infrastructure needs to do far more than provide a seamless, safe, sustainable and comfortable environment. Our goal is to maximize its role, impact and value through highly intelligent solutions that not only meet operational needs, but forward business objectives.

We meet the evolving needs of the world's most critical industries – aviation, transportation and education – through more intelligent, sustainable and connected infrastructure solutions that maximize value for our clients and partners.

Expertise

Since 1986, we have held ourselves to rethinking the role of the traditional MEP firm. As a result, we've evolved our practice to emphasize the technology and processes that connect systems infrastructure, improve operations and longevity and make life safer and easier for those who use it.

Arora specializes in providing engineering services tailored for clients in aviation, transportation, education, government and commercial sectors, and has developed a unique understanding of the challenges and opportunities facing these critical industries.

Services

SPECIAL SYSTEMS / TECHNOLOGY

+ Mass Notification & Public Address
+ WiFi systems
+ Voice/data systems
+ Network architecture
+ Data centers
+ MDF/IDF room layouts
+ Network design via fiber or copper backbone
+ Plant cabling systems
+ Fiber optic and copper structured cabling systems
+ Communications system design
+ CCTV/MATV/CATV systems
+ Program Scheduling & Scheduling Review
+ Access control
+ Duress systems
+ Perimeter intrusion detection
+ Risk and needs assessments
+ Video walls
+ Security operations and procedures evaluation
+ Passenger/customer information display systems
+ Signage systems/Electronic video information display systems (EVIDS)
+ Software and equipment evaluation and recommendations
+ FIDS/BIDS/GIDS/CUPPS/SUPPS
+ Multi-lingual/International traveler



ATLANTA

BOSTON

CHICAGO

DALLAS

DENVER

FORT LAUDERDALE

HOUSTON

LOS ANGELES

NEW YORK

ORLANDO

PHILADELPHIA

PHOENIX

SAN DIEGO

SAN JOSE

SEATTLE

BENGALURU, INDIA

PUNE, INDIA

ELECTRICAL

+ Low and medium voltage power distribution
+ Emergency and standby power systems
+ Lighting design and photometrics
+ Substation/switchgear
+ Grounding and lightning protection
+ Single-line diagrams
+ Short circuit & coordination studies
+ Traffic Studies
+ Roadway and ITS Design
+ Power and lighting equipment selection and specifications
+ Motor control centers
+ Electrical equipment sizing
+ Energy efficient systems
+ Electrical code analysis
+ Electrical plan review and master plan development

AIRFIELD ELECTRICAL

+ Airfield Lighting and Signage
+ Approach Lighting Systems
+ Instrument Landing Systems
+ Navigational Aids
+ Airfield Lighting and Control Systems
+ Runway Incursion Mitigation
+ Pavement Surface Sensor Systems
+ Vertiports

HVAC / PLUMBING

+ Sustainable/Green Building design
+ HVAC
+ Central plant design
+ Underfloor Air Systems design
+ Constant and variable air volume systems
+ Radiant heating systems
+ Geothermal system design
+ Building automation and digital controls
+ Domestic water systems
+ Storm and sanitary system design
+ Fuel system design
+ Lifecycle Costing, Energy Analyses

FIRE PROTECTION AND LIFE SAFETY

+ Fire alarm and detection system design
+ Standpipes & water-based sprinkler system design
+ Foam systems & special hazard suppression design
+ Fire pumps & fire protection water supply system design
+ Smoke management
+ Code analysis and consulting
+ Plan review
+ Due diligence reports
+ Performance based analysis
+ Risk/hazard assessment
+ Site conditions survey

GEOGRAPHIC INFORMATION SYSTEMS (GIS)

+ Database setup and implementation plans
+ CAD to GIS conversion plans
+ FAA Airport GIS program compliance
+ Legacy data access integration
+ Web-based GIS portal development
+ Asset and utility data management
+ Field inspection and inventory
+ GPS data capture and attribution

PROGRAM MANAGEMENT

+ Project management
+ Procurement coordination
+ Information management
+ All-inclusive project control
+ Runway Incursion Mitigation
+ Pavement Surface Sensor Systems
+ Airfield Lighting Vaults and Power Distribution
+ Sustainable Solutions
+ Construction Safety and Phasing
+ Multi-Airport Program Management

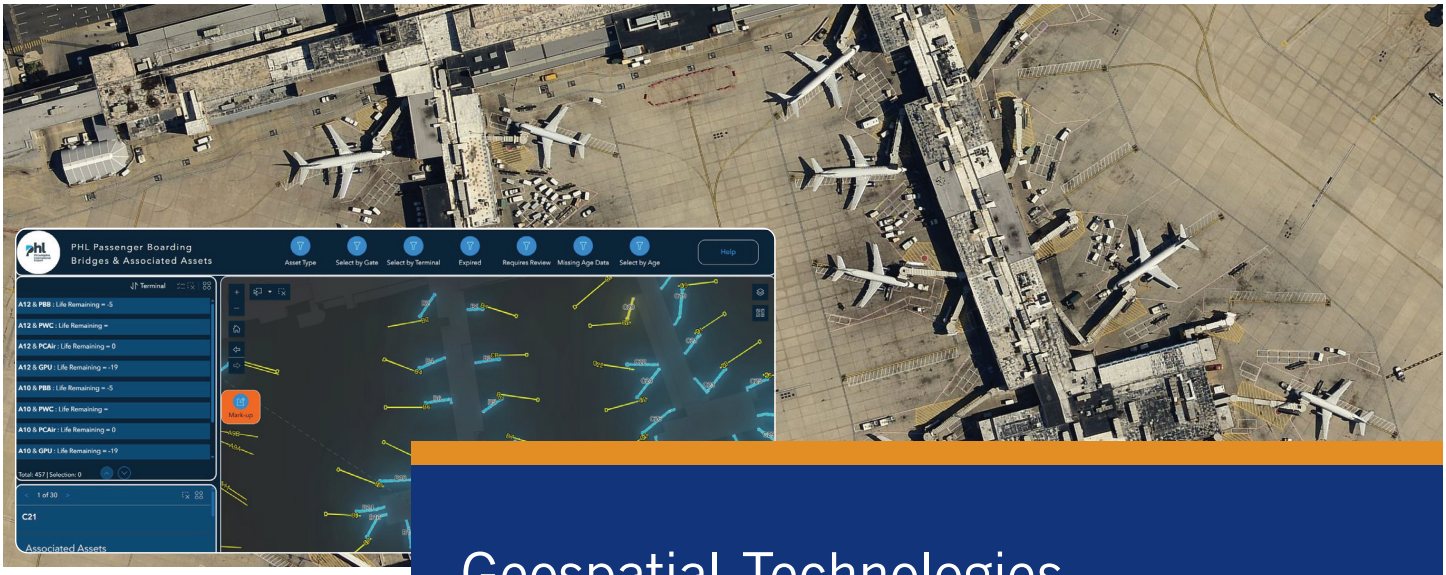
CONSTRUCTION MANAGEMENT & INSPECTION

+ Project administration
+ Master systems integrator
+ Daily inspection
+ Project documentation
+ Submittal review/tenant permit reviews
+ Design Development & Management
+ Owner's Representative
+ Feasibility & Planning Studies
+ Project controls
+ Design Development & Review
+ Quality Control & Quality Assurance
+ Constructibility reviews
+ Value engineering
+ Runway Incursion Mitigation
+ Airfield Lighting Vaults and Power Distribution
+ Pavement Surface Sensor Systems
+ Construction Safety and Phasing

ARORA®



GEOSPATIAL EXPERIENCE



Geospatial Technologies

Geospatial technology is more than precise data collection and information systems. With earth observation data, improved positioning, and cloud based services at our core, and innovation as a catalyst, Arora Geospatial looks beyond technology-driven change to find solutions that empower our clients with the intelligence to make positive impacts for the communities they support.

Key Services

SYSTEM SOLUTIONS

+ Enterprise System Design, Implementation, Support
+ Application Design and Development
+ Application Framework Implementation
+ CAD/GIS/BIM Interoperability
+ Legacy System Integration
+ Mobile Data Collection
+ ArcGIS Online/Portal

ORGANIZATIONAL SOLUTIONS

+ Needs Assessments
+ Implementation and Strategic Plans
+ Governance Models
+ Vendor Evaluation Services
+ Cost/Benefit Studies
+ Staffing Plans
+ Technology Road Maps
+ Staff Augmentation
+ Utility Studies and Master Planning Leadership

DATA SOLUTIONS

+ Data Development/Maintenance
+ Signage & Amenity Inventory
+ Interior Space Management
+ FAA Airports GIS Compliance
+ Floor Plan Conversions
+ Utility Mapping and Master Planning Support
+ Obstruction Identification
+ Data Governance
+ Indoors Positioning Systems
+ Indoors mapping
+ Wayfinding

RESEARCH AND STUDIES

+ Airports Cooperative Research Program (ACRP)
+ National Cooperative Highway Research Program (NCHRP)
+ Master Planning
+ Airport Layout Plans
+ Environmental & Noise
+ Obstruction Analysis

Representative Clients

+ Philadelphia International Airport
+ Reno-Tahoe International Airport
+ Fort Lauderdale-Hollywood International Airport
+ San Francisco International Airport
+ Paine Field International Airport
+ Louisville Muhammed Ali International Airport
+ Oakland International Airport
+ San Diego International Airport
+ Dallas Fort Worth International Airport
+ Salt Lake City International Airport
+ Minneapolis–Saint Paul International Airport
+ Hartsfield-Jackson Atlanta International Airport

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esri Indoor GIS Specialty

esri Partner Network Member

Gold Business Partner IBM

BROWARD COUNTY AVIATION DEPARTMENT (BCAD)

GIS Program Management and Systems Integration

Ft. Lauderdale-Hollywood International Airport (FLL) and North Perry Airport (HWO), Ft. Lauderdale, FL

PROJECT DETAILS

CLIENT

Broward County Aviation Department
William Castillo, Airport Planning Manager
Fort Lauderdale-Hollywood International Airport
2200 SW 45th Street, Suite 101,
Dania Beach, FL 33312
wcastillo@broward.org
954-359-2291

CONSTRUCTION

N/A

PROJECT START

2014

PROJECT COMPLETION

2019

HIGHLIGHTS

+ Enterprise GIS Services
+ Data Development and Management
+ Custom GIS Solutions
+ Systems Integration



Arora is currently providing professional GIS services to the Broward County Aviation Department (BCAD) for the implementation and integration of GIS technology at FLL and HWO.

Arora is assisting BCAD in the development and implementation of both off-the-shelf and customized applications that will leverage GIS technology across multiple BCAD departments and functions. Arora is also leading the integration of GIS with other existing BCAD systems and technologies including Maximo, SharePoint, and BIM.

SCOPE OF WORK INCLUDED:

+ Stakeholder engagement and information gathering
+ GIS Data Acquisition, Conversion, Maintenance and Compliance
+ Deployment on an HTML5 based GIS Viewer
+ Public address, CCTV, and cable TV systems were installed.
+ Assessment of BCAD's existing geospatial workflows
+ Development & Enhancement of Geospatial Data Standards (GIS, CAD, BIM)
+ Assessment of key business systems (Maximo, PropWorks, SharePoint, MicroPaver for integration with GIS
+ GIS Application Development, System Integration, and Deployment
+ Onsite GIS Support, Training and Advisory Services

RENO-TAHOE AVIATION AUTHORITY (RTAA)

Electronic Airport Layout Plan (eALP) and GIS Services

Reno-Tahoe International Airport (RNO) Reno, NV

PROJECT DETAILS

CLIENT

Reno-Tahoe Aviation Authority
2001 E. Plumb Lane
Reno, NV 89502
Daniel P. Bartholomew, AICP, MBA, AAE
Manager of Planning and Geographical Information Systems
dbartholomew@renoairport.com
(775) 328-6801

CONSTRUCTION

N/A

PROJECT START

2014

PROJECT COMPLETION

2018

HIGHLIGHTS

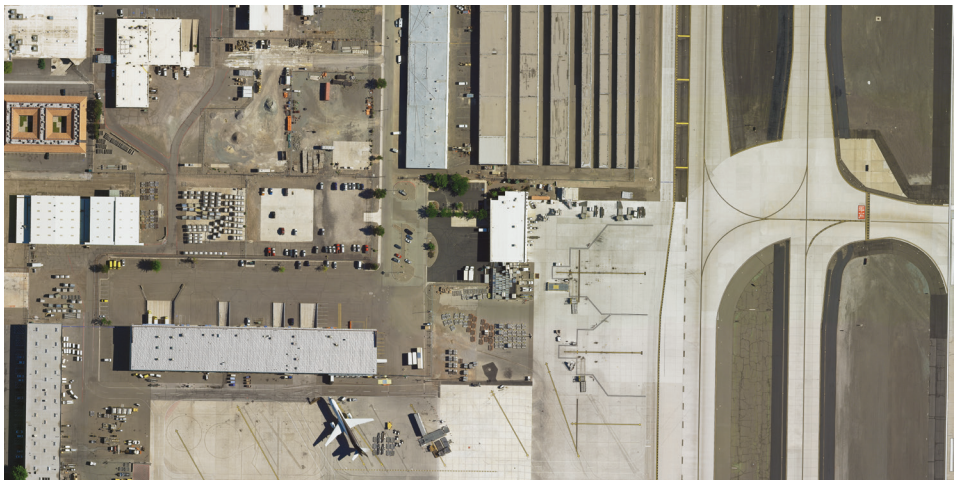
+ Stakeholder Engagement
+ Data Standards Development
+ eALP Development and Delivery
+ Enterprise GIS Solutions
+ Maintenance Storage Facility

Arora was tasked with providing all the services required for Reno-Tahoe Airport Authority (RTAA) to complete airport and aeronautical data collection necessary for the development and acceptance/approval of an eALP at Reno-Tahoe International (RNO). In addition, Arora was tasked with leveraging the data collected through RNO eALP to support revenue growth, enhance safety, increase operational efficiency, streamline administrative processes, and support customer service through GIS solutions.

The implementation of these solutions enabled RNO to leverage GIS to provide increased efficiencies to everyday business practices, support ongoing and future capital programs through powerful analytical tools, and allowed them to share a common set of data across airport departments.

SCOPE OF WORK INCLUDED:

+ Developed complete eALP dataset and airspace analysis for submission to FAA Airports GIS program.
+ Completed a GIS needs assessment and prioritized applications to support a variety of airport business processes including, but not limited to : facility planning, engineering, facility management, concessions and revenue management, and environmental compliance.
+ Conducted teleconferences and facilitated onsite RTAA stakeholder meetings to gain input on needs and workflows
+ Developed and deployed master GIS database to house RTAA datasets



METROPOLITAN AIRPORTS COMMISSION

Minnesota St.-Paul International Airport Enterprise GIS Implementation

Minneapolis, MN

PROJECT DETAILS

CLIENT

Metropolitan Airports Commission
Shane Vandervoort
Enterprise Architect
6040 28th Avenue South
Minneapolis, MN 55450
shane.vandervoort@mspmac.org
612-725-6329

CONSTRUCTION

N/A

PROJECT START

2017

PROJECT COMPLETION

Ongoing

HIGHLIGHTS

+ Enterprise GIS programming
+ Integration of existing GIS systems across separate departments
+ Plan and implement MAC's Enterprise GIS technical platform through four tracks: Data, Technology, Governance, and Staff Support

Arora Engineers, Inc. (Arora) was selected to complete four tasks in support of the Enterprise GIS Implementation Program for the Metropolitan Airports Commission (MAC). The tasks are organized into four primary program tracks:

+ Data – Identify and manage data, architect and implement database, important and provide access to the data, create standards.
+ Technology – Complete the architecture, implement the GIS software/ hardware, document and support the stack.
+ Governance – Utilize MAC's GIS technology group within IT department, define and develop governance, communications strategy.
+ Staffing & Support – Provide GIS Project Manager, Develop/Implement staffing support, training.

SCOPE OF WORK INCLUDED:

Data Track

+ Collect and Review Existing Data
+ Develop Data Model and Target Database
+ Data Migration
+ Develop Geospatial Data Standards
+ Produce GIS Template
+ Data Development Procedures

Technology Track

+ Define and Document Technical Architecture
+ Impement Technical Architecture

Governance Track

+ Develop Governance Document
+ Facilitate Governance Steering Group Meetings
+ Program Success Metrics
+ Monthly Program Progress Meetings and Telecons

Staff Support Track

+ Provide Program Guidance

CITY OF CHARLOTTE, AVIATION DEPARTMENT

CityWorks Implementation

Charlotte Douglas International Airport, Charlotte, NC

PROJECT DETAILS

CLIENT

AECOM
Brian Reever
Vice President, Transportation, North America
100 South Wacker Drive
Suite 500
Chicago, IL 60606
brian.reeever@aecom.com
561-398-9715

CONSTRUCTION

$25,000

PROJECT START

2014

PROJECT COMPLETION

2014

HIGHLIGHTS

+ Disconnected Data Collection Methodology
+ Cloud Based GIS Solutions
+ Asset Management

Arora provided professional GIS services for Charlotte Douglas International Airport (CLT) to assist in the Phase 1 implementation of CityWorks at CLT. CityWorks is acting as a management tool and tracking system for the Airport's asset renewal and replacement program. This program serves to enhance and improve multiple business lines at CLT including capital improvement planning, asset management, and operational risk.

Arora is led the effort to develop a methodology for the collection and attribution of assets at CLT in a "disconnected" data development and editing environment due to CLT's limited network connectivity in portions of the terminal complex and airfield. Arora also led the development of a training manual that assists CLT staff who collect these assets to create locations and attributes of airport assets and transfer this data to and from CLT's data collector tablets.



CITY OF PHILADELPHIA, DIVISION OF AVIATION

Capacity Enhancement Program, GIS Standards

Philadelphia International Airport (PHL), Philadelphia, PA

Arora Engineers, Inc. (Arora) provided professional GIS services for Philadelphia International Airport (PHL) in support of the airport's Capacity Enhancement Program to develop and implement GIS Standards. These standards specify the geometry, attributes, and metadata requirements that apply to all GIS data submitted to PHL. A corresponding data model ensures that project datasets are delivered to the airport in a consistent manner and structured to be compatible with one another.

Since GIS layering and CAD layering schemes are traditionally different, these standards include a GIS-CAD Crosswalk for converting GIS data into CAD data that complies with PHL's Standards, and vice versa. This project also provides a framework to develop a GIS-BIM Crosswalk for PHL to translate data layers between GIS and BIM software.



PROJECT DETAILS

CLIENT

City of Philadelphia, Division of Aviation/Global Program Partners
Dave Nisula, Program Manager
CEP/PMO Office @ PHL
Terminal E, 2nd Floor
Philadelphia, PA 19153
dave.nisula@ch2m.com
(215) 640-9054

CONSTRUCTION

N/A

PROJECT START

2014

PROJECT COMPLETION

2014

HIGHLIGHTS

+ Stakeholder Engagement
+ GIS Standards
+ Data Model Development
+ GIS-CAD Crosswalk

CITY OF PHILADELPHIA, DIVISION OF AVIATION

FAA AGIS Compliance Mapping and Airspace Analysis Tasks

Philadelphia International Airport, Philadelphia, PA

PROJECT DETAILS

CLIENT

City of Philadelphia, Division of Aviation/ Global Program Partners
David J. Nisula
PHL CEP Program Director
PHL Terminal E, 2nd Floor
Philadelphia, PA 19153
Dave.Nisula@phl-ceppmo.com
215-863-4063

CONSTRUCTION

N/A

PROJECT START

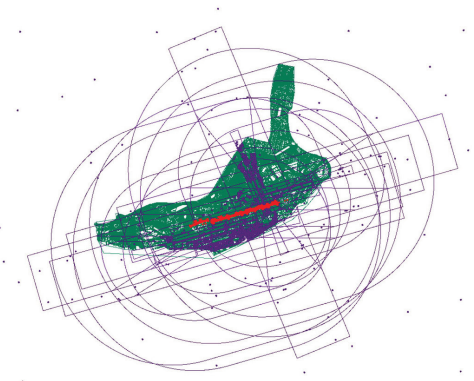
2016

PROJECT COMPLETION

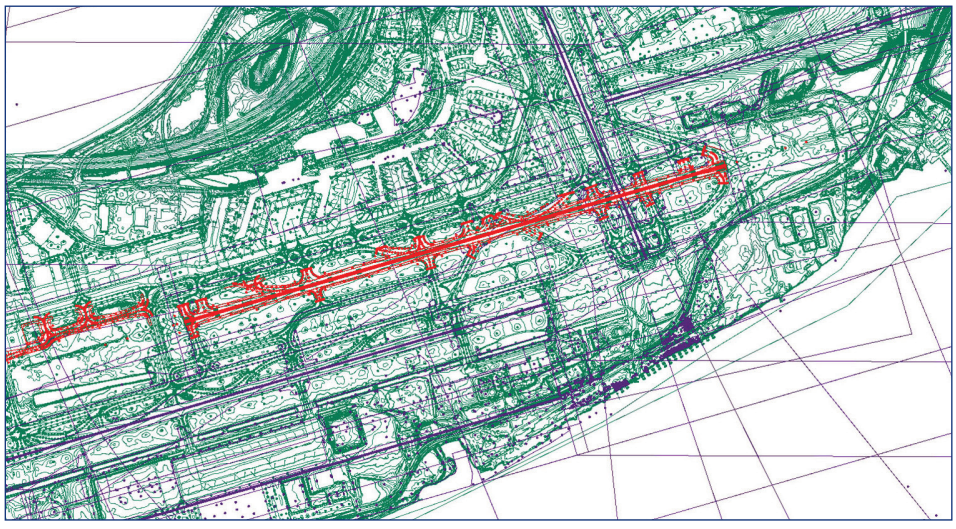
2018

HIGHLIGHTS

+ Existing Conditions AGIS Gap Analysis
+ FAA/Stakeholder Coordination
+ Data Development & Consolidation
+ Airspace Analysis



Arora Engineers, Inc. (Arora) provided professional Federal Aviation Administration (FAA) Airports GIS Program (AGIS) compliance services to the Philadelphia International Airport (PHL) Capacity Enhancement Program (CEP). For this project, Arora led the effort to develop and update PHL GIS datasets for submission to the AGIS website for FAA approval. To ensure full compliance with the AGIS regulations, Arora first conducted a gap analysis to determine the extent to which the existing data complies with the FAA's requirements. Following this step, Arora engaged the FAA and airport stakeholders to define an AGIS Statement of Work (SOW) that fulfills all of project goals and requirements. Upon FAA approval of this SOW, Arora led the efforts to populate and attribute GIS datasets for submission to the FAA. Additional tasks to support the development of these features included an airspace analysis of the airports existing conditions and the collection new aeronautical data imagery to ensure that PHL fulfills all of the AGIS program requirements. AGIS data for this project included both safety-critical data common to all AGIS runway and airspace projects, and non-safety-critical data typically used for airport planning purposes.



CITY OF PHILADELPHIA, DIVISION OF AVIATION

Maximo Enterprise Asset Management System Upgrade

Philadelphia International Airport, Philadelphia, PA

PROJECT DETAILS

CLIENT

Electronic Data, Inc.
Scott Yates, Vice President
780 Carillon Parkway, Suite 100
St. Petersburg, FL 33716
syates@edatai.com
727-289-0708

CONSTRUCTION

N/A

PROJECT START

2015

PROJECT COMPLETION

Ongoing

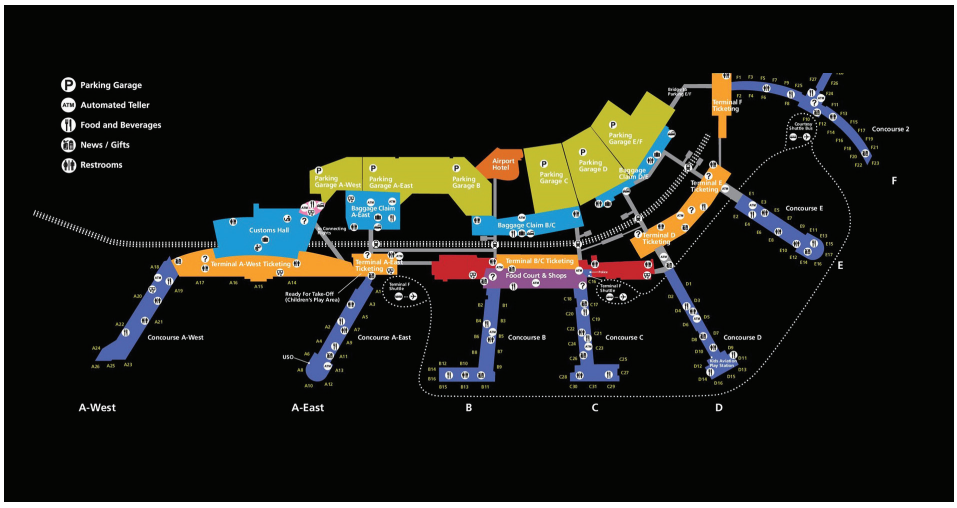
HIGHLIGHTS

+ Upgrade of PHL's Maximo system to Version 7.5
+ Project will provide a unified solution for separate standalone systems
+ Asset data discovery, inventory, and field verification
+ Asset tagging
+ GIS integration

Arora Engineers, Inc. (Arora) is served as a subconsultant to Electronic Data, Inc. (EDI) for upgrades to Philadelphia International Airport's (PHL) Maximo Enterprise Asset Management System. The airport's Maximo environment was Maximo ADvantage version 3.1, which was first deployed in 1999. The airport's Maximo environment and other legacy systems had limited functionality and utility that could not adequately support PHL's long-term vision for a robust Enterprise Asset Management program. To realize this vision, this project enabled comprehensive maintenance and asset tracking functionalities as well as integrate with existing PHL business systems.

SCOPE OF WORK INCLUDED:

Arora's responsibilities on the project included providing professional GIS services to support the development of a functional requirements document and to lead the integration of Maximo with GIS, which includes data access and updating on mobile devices. Arora was also tasked with leading data collection activities for this project that are comprised of data discovery, data inventory, and asset walk-down tasks to tag and field verify critical assets at PHL.



DALLAS / FORT WORTH INTERNATIONAL AIRPORT, TX

Professional Services for Signage Planning, Assessment, and Design - Contract 8500540

Dallas / Fort Worth International Airport, TX

PROJECT DETAILS

CLIENT

Kirk Evans, PE, H.W. Lochner, Inc.
12001 N. Central Expy.
Suite 1050
Dallas, TX 75243
kevans@hwlochner.com
405-517-1387

CONSTRUCTION

N/A

PROJECT START

2017

PROJECT COMPLETION

Ongoing

HIGHLIGHTS

+ Special Systems and Electrical Assessment, Evaluation, and Design
+ Collection of all assets in GIS

Arora Engineers Inc. was selected as part of the team to provide Airport signage standards development and on-call support services for Facilities, Airfield, and Landside locations. All services required under this agreement and any issued Delivery Order were provided to DFW's Planning Department. The DFW Board wanted to engage our team because of our expertise and recent experience in the planning, programming, and design of Airport Terminal Wayfinding and Signage at large U.S. and international airports. DFW believes that effective wayfinding is critical to enhancing the customer experience at DFW, and signage should be integrated into spaces and general passenger circulation pathways to facilitate the wayfinding experience.

SCOPE OF WORK INCLUDED:

Arora is currently working closely with DFW to formulate a Wayfinding and Signage Improvements Plan that enhances the DFW customer experience by considering airport users visual and cognitive needs from wayfinding and signage systems. Below are three task orders Arora is currently working on for this on-call contract:

Task 1 - Arora is currently supporting the collection of an Airport-wide signage inventory using mobile devices and GIS technology. The resulting data will be delivered and incorporated into the Airport's new on-line database called the Registry. The Registry will contain every sign on Airport property, including, but not limited to, all roadways and all terminal facilities (airfield signage is not included). The inventory and database will track each sign through its life-cycle and will set up the Airport to obtain an assessment of existing signage as well as the creation of an improved comprehensive signage guideline for the Airport.

Task 2 - The existing Skylink Vehicles and Station signage elements are outdated and do not integrate current technology advancements in digital and dynamic wayfinding. In collaboration with DFW, Arora is preparing biddable documents for upgrading the Skylink technology with enhanced in-car displays and implementation of digital signage for the Skylink. These upgrades will enhance the communication with passengers by providing dynamic displays of the Skylink train locations and wait times for the next train arrival. In addition, the displays will provide opportunities for additional advertising and communications.

Task 3 - Arora is providing an assessment and recommendations to enhance the current Flight Information Displays (FIDS) in specific areas. A bench-mark analysis has been completed to document what DFW is currently implementing compared to similar airports. Our team met with key stakeholders to understand the content strategy for the layouts and designs to give that WOW factor. Two conceptual designs will be developed for review and feedback and based on this information conceptual drawings will be detailed into buildable design drawings.

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CONTACT:
Scott Howell
Arora | 61 Wilmington–West Chester Pike
Chadds Ford, PA 19317-9024
T (484) 770-1205
showell@aroraengineers.com

aroraengineers.com

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