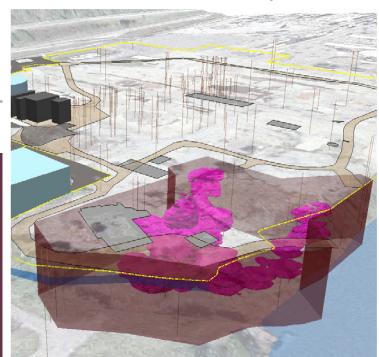
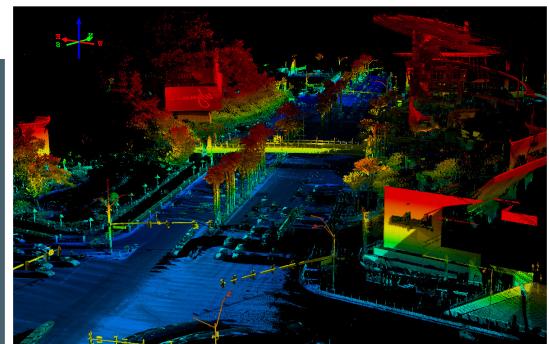
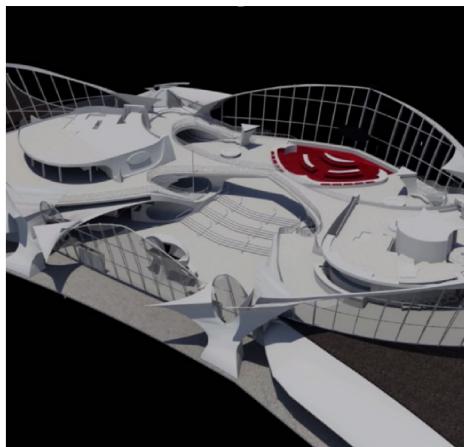


LANGAN

GENERAL STATEMENT OF QUALIFICATIONS SURVEY & GEOSPATIAL



Technical Excellence

Practical Experience

Client Responsiveness



SUSTAINABLE DESIGN



Langan professionals design solutions that maintain the inherent connections between structures and their natural surroundings. The result - sustainable communities for future generations to live, work and play.

HEALTH & SAFETY

Langan is committed to providing a healthy and safe working environment.
Langan's goal is to be SAFE (Stay Accident Free Everyday).



Corporate Summary

Integrated Solutions. Measurable Value.

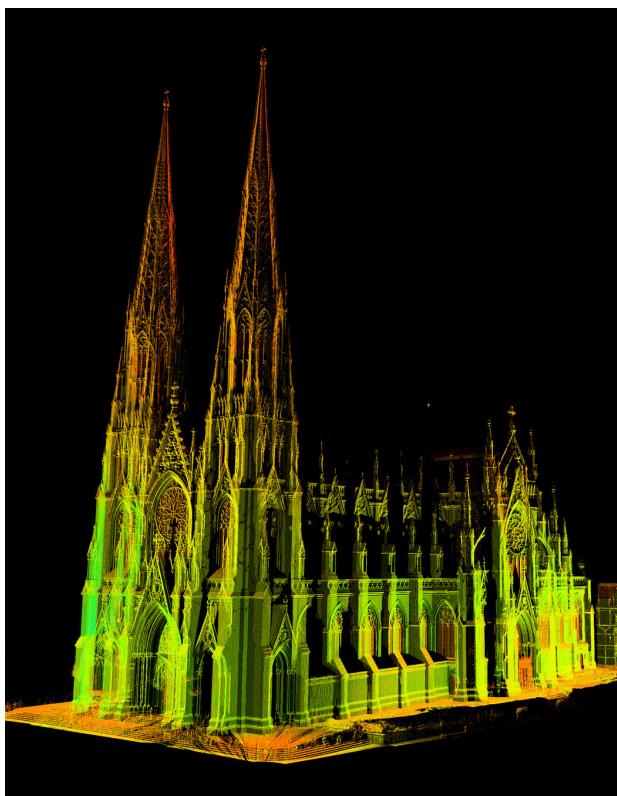
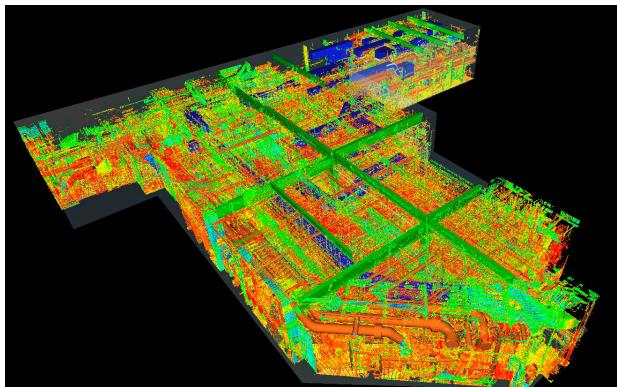
Langan provides an integrated mix of engineering and environmental consulting services in support of land development projects, corporate real estate portfolios, and the energy industry. Our clients include developers, property owners, public agencies, corporations, institutions, and energy companies around the world.

Founded in 1970, Langan employs over 1,300 professionals in its **Parsippany, NJ** headquarters and among regional offices in:

- New York City, NY
- White Plains, NY
- New Haven, CT
- Boston, MA
- Lawrenceville, NJ
- Philadelphia, PA
- Bethlehem, PA
- Doylestown, PA
- Pittsburgh, PA
- Cleveland, OH
- Arlington, VA
- Houston, TX
- Dallas, TX
- Austin, TX
- Tyler, TX
- San Francisco, CA
- Oakland, CA
- Sacramento, CA
- San Jose, CA
- Los Angeles, CA
- Santa Barbara, CA
- Irvine, CA
- Seattle, WA
- Phoenix, AZ
- Denver, CO
- Miami, FL
- Fort Lauderdale, FL
- Tampa, FL
- West Palm Beach, FL
- Orlando, FL

Langan International, the firm's wholly owned subsidiary headquartered in New York City, provides all firm services for projects in the Middle East, Eastern Europe, Latin America, and the Caribbean. Langan International regional locations are in:

- Athens
- Calgary
- Dubai
- London
- Panama



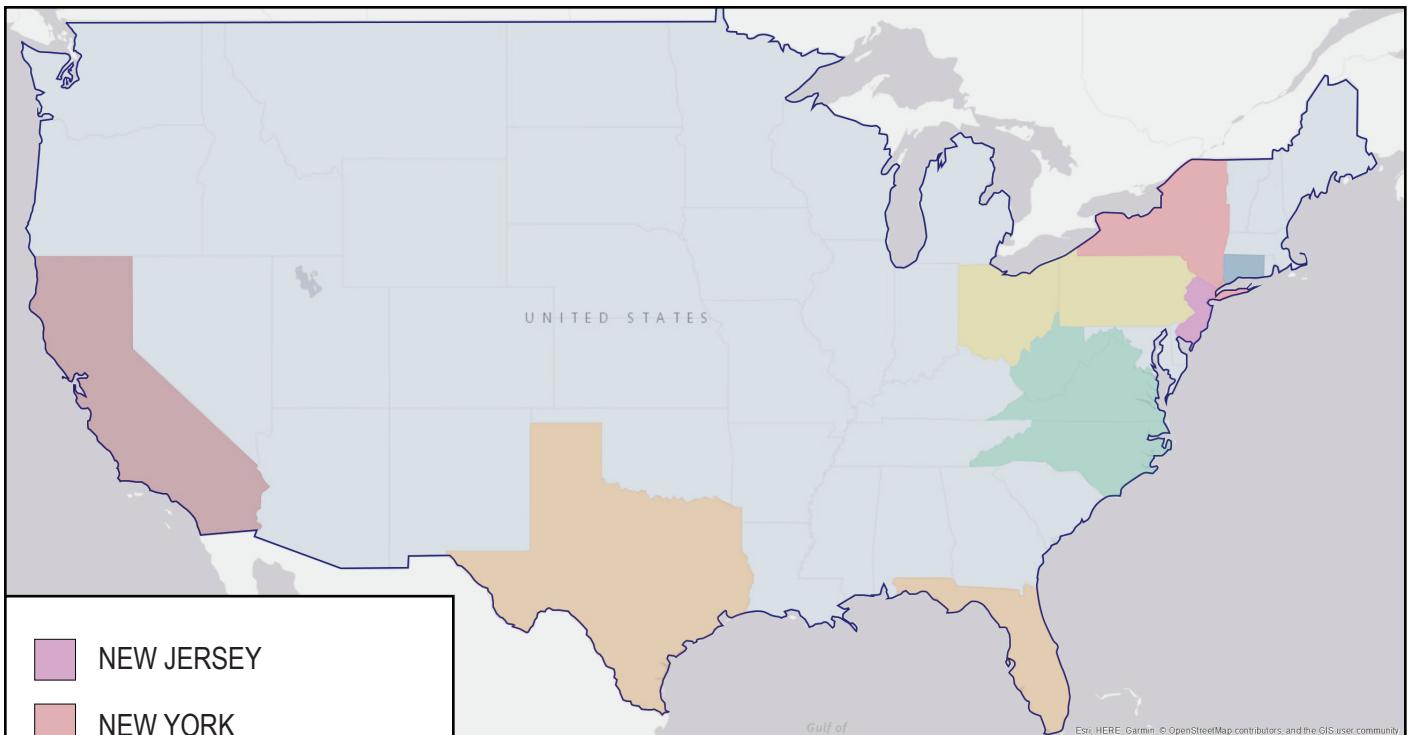
SUSTAINABLE DESIGN:

As the recognized industry leader, Langan's team of over 125 LEED Accredited Professional provides sustainable solutions for every aspect of your project.



LANGAN

Contacts

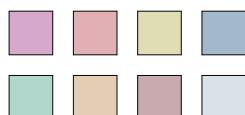


- █ NEW JERSEY
- █ NEW YORK
- █ PENNSYLVANIA/OHIO
- █ CONNECTICUT
- █ MID-ATLANTIC REGION
- █ GULF STATES
- █ CALIFORNIA
- █ NATIONWIDE

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SHAUN HIGGINS

PLS, Senior Associate | SURVEYING
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Surveying/Mapping

Accuracy and Efficiency

Langan's survey group combines experience, technology, and responsiveness to meet our clients' needs and maintain project schedules and budgets. The group is versed in traditional survey methods, as well as cutting-edge technologies including 3D Laser Scanning, UAV/Drones and BIM support. The group's efforts are overseen by Professional Land Surveyors who bring experience and a solid knowledge of traditional methods to new innovative technologies. Seamlessly coupled with Langan's integrated technical disciplines, the group is positioned to meet every survey challenge.

Langan approaches surveying problems with a combination of knowledge, experience and innovation that we believe renders the most efficient solutions while maintaining cost effectiveness. Our staff of professionals and specialists combines their knowledge and experience to provide comprehensive services to our clients. They are supported by field personnel who possess an understanding of both the technical aspects of survey and the practical potentials of design/construction. Either completing a standalone mapping task or when seamlessly coupled with Langan's integrated technical disciplines, the group is positioned to meet every survey challenge. We apply the same degree of professionalism and interest to both large scale and small project assignments.

Langan Survey/Mapping Services:

- Boundary Surveys
- ALTA/NSPS Land Title Surveys
- Topographic Surveys
- GPS
- GIS/LIS Data Acquisition/Systems
- Riparian Surveys
- 3D Laser Scanning
- Construction Stakeout
- Hydrographic/Bathymetric Surveys
- Environmental Surveys
- As-Built Surveys
- Photogrammetric Control
- Deformation/Monitoring Surveys
- Wetlands Location Surveys
- Utility Surveys
- Subdivisions
- Highway/Route Surveys
- UAV/Drones



High Definition 3D Laser Scanning

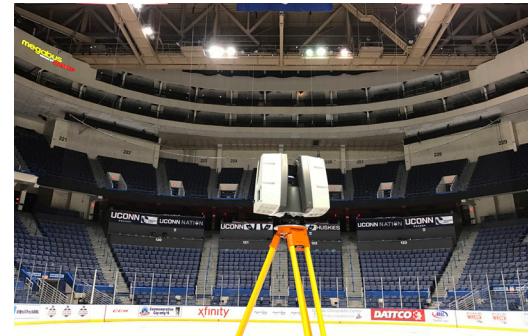
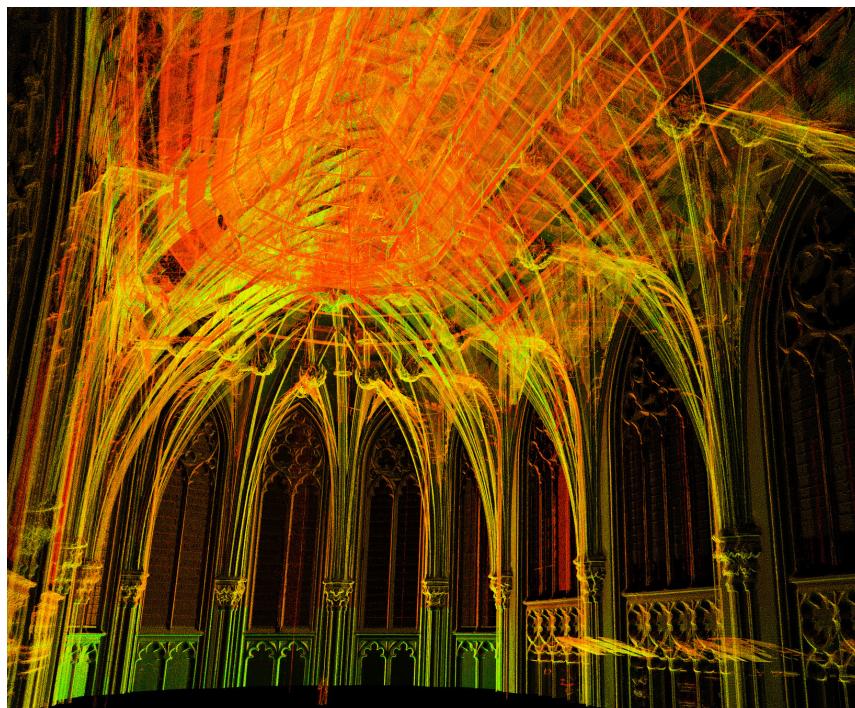
Work in the Data, Not on the Data

3D Laser Scanning is changing the surveying/mapping industry and Langan is leading the revolution. Since the addition of High Definition Laser Scanning services in 2003, Langan has offered the most accurate and highly detailed existing conditions surveys possible. This advanced technology allows for the collection of millions of data points in less time and with lower overall cost than traditional techniques. 3D Laser Scanning equipment allows end users to accomplish project objectives more efficiently and accurately at all stages, in turn minimizing overall project costs and reducing turn around time, while achieving a higher level of detail.

Our ability to offer a combination of High Definition Laser Scanning and conventional surveying methods allow Langan to deliver a complete product. As with all of our surveying services, the scanning effort is overseen by Professional Land Surveyors who bring experience and knowledge of traditional methods to this cutting-edge technology.

In scanning, the data collected is known as a “point cloud” which contains a 3D database of the entire project area and allows the measurement of any surface information that is visible in the cloud to be used during the entire project lifecycle. After processing, the data from the “point cloud” can be utilized to produce dimensionally correct 3D models and/or 2D dimensional plans, with outputs to Microstation, AutoCAD or a host of other platforms. The registered data can also be used as a base to create highly detailed site visualizations or mass models. The end data can be used for the generation of existing condition BIM models, forensics studies, to determine possible construction conflicts, to validate construction/fabrication dimensions, or even to model major motion picture sets.

With prior technologies the end user had to work on the data. High Definition Laser Scanning allows the end user the ability to work in the data and be “on site virtually” with the push of a button.



BIM/Building Information Modeling Support

Leading the E-BIM Revolution

Construction depends on sharing accurate data. E-BIM or BIM (Existing Conditions Building Information Modeling), as it is known to the AEC industry, is changing the way we use data. As in many other design industries such as automotive, aerospace, aviation and others where computer modeling is the norm, the construction industry now recognizes the benefits of this modeling revolution. Modeling allows the entire design team to use data in a new fashion, pre-assembly of the project in a virtual 3D world, not on flat 2D paper. By assigning attribute data to each component of a building, structure or site, the design team can assemble, analyze, coordinate, review, prepare cost estimates, and make informed decisions early in the design process. This new way of using data bridges a wide gap in the design process, greatly reducing cost and schedules while allowing the final product to be consistent with the original design intent. For the first time in our industry, IM allows a team member to truly visualize the data, and Langan is leading this 3D revolution.

Langan saw the benefits of E-BIM early on as our Survey Group was spearheading their way through the Nationwide 3D Laser Scanning Market. As with many design challenges, the need for accurate and precise existing conditions data is critical to the outcome of a project's design. This need is greatly magnified with building reuse and interior construction projects. The solution was obvious, offer our 3D Laser Scanning services and provide the same level of "survey grade data" to the IM world (construction industry). Who better than licensed surveyors could understand the accuracy requirements and adjustments in scanning control needed to produce accurate existing conditions base mapping?

To date, Langan has successfully provided existing conditions data for a wide range of IM projects. From standard 2D CADD elevation and floor plans to fully intelligent 3D, 4D, and 5D models, Langan continues to lead the industry with unmatched solutions to complex challenges.



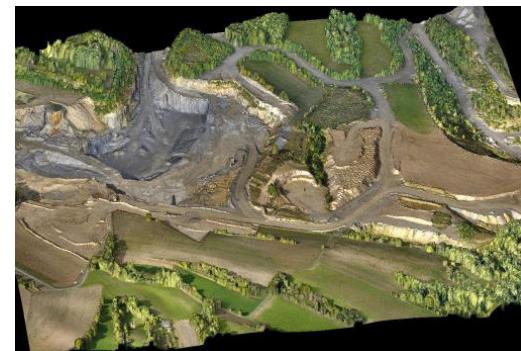
Unmanned Aerial System (UAS) Data Collection and Mapping

Raising the Data Bar

Langan has been actively positioned to provide Unmanned Aerial System (UAS) acquisition and data processing services to support and supplement our clients needs. Utilizing DJI Unmanned Aerial Systems, Langan can provide aerial imagery products and services that are in compliance with Federal Aviation Administration (FAA) rules and regulation governing the commercial operation of unmanned aerial systems. Langan's UAS Data Collection and Mapping program has been designed to provide aerial video and imagery, orthophotography, digital point clouds, planimetric and topographic mapping products in various levels of accuracy on projects where the geographic size, location, budget or schedule of the project limits the effectiveness of a manned aircraft acquisition. Our UAS acquisition and processing team has the ability to mobilize quickly and efficiently, taking advantage of the nimbleness of the collection platforms. Processing of project deliverables as well as any required field control surveys are performed in-house, while being controlled, registered and projected to the level that satisfies most project requirements and specifications.

Langan UAS Services:

- Construction Monitoring
- Site Reconnaissance
- Site Design
- Aerial Photography/Videography
- Orthophotography
- Planimetric/Topographic Surveys
- Colorized Point Clouds
- GIS/LIS Data Supplementation
- Wetlands Surveys
- Subdivision Surveys
- Campus Mapping
- Environmental Surveys
- As-Built Surveys
- BIM Modeling



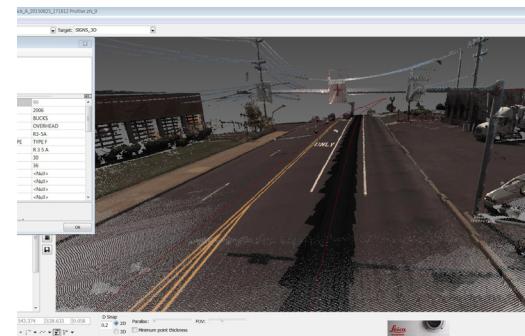
Mobile LiDAR Data Collection and Mapping

Taking Scanning on the Road

As one of the emerging technologies in the Surveying/Scanning/Mapping/GIS profession, Mobile Mapping has been added to Langan's capabilities. Langan has acquired a Leica Pegasus 2 mobile mapping system and has built a team of professionals to provide our clients with these new services. Langan's mobile mapping combines the usability and familiarity of videos and photographic images with the accuracy and precision of LiDAR point clouds to deliver a total asset management solution. The Pegasus 2 is fully transportable and can be shipped anywhere in the world to provide cost effective mobility while maintaining the accuracy and precision required by our clients. The Pegasus 2 can be placed on a vehicle for roadway based collection, on a boat for shoreline or bridge projects, on a rail car for railway and transit applications, or even on an ATV/UTV for off road uses in the Utility, Oil and Gas, and Electrical energy industries. Langan's survey and mapping group has been a leader in the 3D scanning and BIM markets for years by providing survey grade existing information in innovative formats. The new mobile mapping department is the next part of that innovation.

Langan Survey/Mapping Services:

- Boundary Surveys
- ALTA/NSPS Land Title Surveys
- Topographic Surveys
- GPS
- GIS/LIS Data Acquisition
- Deformation/Monitoring Surveys
- Wetlands Location Surveys
- Utility Surveys
- Subdivisions
- 3D Laser Scanning
- Campus Mapping
- Mobile Scanning/Mapping
- Construction Stakeout
- Hydrographic/Bathymetric Surveys
- Environmental Surveys
- As-Built Surveys
- Photogrammetric Control
- Riparian Surveys
- Highway/Route Surveys
- BIM Modeling
- Geographical Information Systems



GIS/Data Management

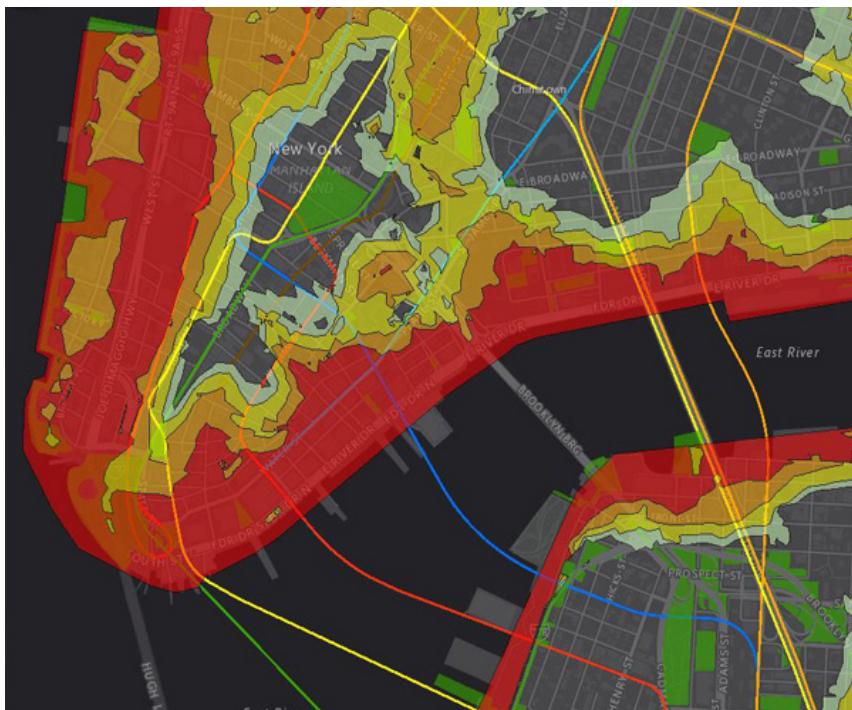
Cutting-Edge Data Visualization

Langan utilizes the latest CADD, GIS, and Data Management software applications to analyze and design cost-effective solutions to our clients' problems. Our CADD-GIS group provides custom training, programming, and technical support to both our staff and to our clients in Autodesk's Map, Land Desktop and Civil 3D, as well as ESRI's ArcGIS suite of applications including ArcMap, ArcEditor, and ArcInfo and their assorted extensions. Langan utilizes SITEOPS software for value engineering and to provide design optimization of land development projects. We use Earthsoft's EQuIS Chemistry and Geology products to manage large datasets for our environmental and geotechnical clients, and use GIS, Rockworks, GMS and EVS to visualize the data. Langan also uses 3D Studio and various post production products to generate computer generated animations of our clients' projects, allowing them to see the virtual design before construction.

Langan provides our clients with easy access to their project data by developing Extranets and Sharepoint data portals that allow for easy data exchanges between all of the project team members. Our Web designers can develop custom Web-based applications using ESRI's ArcIMS and ArcGIS Server to further leverage our clients' data.

Langan GIS/Data Management Services:

- Software Integration and Technical Support
- Custom Programming
- Software Training
- Web Design
- CADD Conversions
- GIS Mapping
- 3D Animations
- SITEOPS®
- Data Entry





Key Personnel

Key Personnel



Joseph E. Romano, PLS, Senior Associate | Parsippany, NJ

Mr. Romano has a broad range of experience in construction related fields. Starting his career as a title searcher, he developed his expertise working as a draftsmen, construction inspector, rodman and survey party chief. His experience in land surveying includes topographic and boundary surveys as well as wetland location and delineation, G.P.S. Surveys, construction stake-out, monitoring, development of as-built site plans and ground control for aerial photography surveys. His experience in all phases of surveying procedures also includes: drafting, note reduction, historical record research, deed analysis, dimensional control and sub-division plans, and preparation of legal property descriptions. Mr. Romano is responsible for developing and implementing proprietary survey software used on Langan's advanced CADD and computer systems. As Director of Surveying and Manager of the Langan Survey Department, his areas of special interest include boundary law, G.P.S/G.I.S. technologies, scanning, and BIM modeling. As a member of various State and National societies he has lectured on advanced surveying technologies including High Definition Laser Scanning and its applications.

Education

New Jersey Institute of Technology

Professional Registration

Registered Professional Land Surveyor (PLS) in NJ, NY, CT, DC, FL

Paul Fisher, PLS, Principal, Survey Manager | New York, NY

Mr. Fisher's 29 years of experience have exposed him to all phases of land surveying, including topographic, boundary, subdivision, construction stake-out, and photo control. He has extensive experience in G.P.S. surveying, and has also spearheaded Langan's foray into laser scan based surveying. His principal focus is on laser scanning and modeling, and providing solutions for difficult surveying tasks such as tunnel surveying, subsurface surveys, and detailed mapping of historic structures. Mr. Fisher has also developed educational programs on laser scanning and general surveying which he has presented to a wide array of architects, engineers, construction managers and attorneys. His responsibilities include management of the New York survey office, which services Langan's New Jersey, Connecticut, and New York clientele.



Education

M.Sc., Civil Engineering
Ramapo College of NJ

Professional Registration

Registered Professional Land Surveyor (PLS) in CT, NY

Key Personnel



Shaun Higgins, PLS, Senior Associate/VP, Survey Manager Philadelphia, PA

Mr. Higgins has over 22 years of experience in all aspects of land surveying. He is well-versed with all types of modern surveying field equipment and various software systems for computer aided drafting. The majority of Shaun's experience has come as a survey project manager, in charge of field and office personnel involved with gathering and manipulating existing conditions information for residential, retail, institutional and commercial properties and preparing and managing construction layout projects for various types of development. Shaun also has extensive experience with 3D laser scanning services.

Education

Dublin Institute of Technology,
Ireland

Galway Regional Technical
College, Ireland

Professional Registration

Professional Land Surveyor (PA,
VA, WV, NC)

Brett Milburn, GISP, Senior Associate | Lawrenceville, NJ

Mr. Milburn has over 18 years of experience in Geographic Information System (GIS) mapping and analysis activities along with enterprise database design and management to support compliance, municipal, utility, renewable energy, environmental, survey, litigation, natural resource, geotechnical and site/civil projects. In his current role as the leader of Langan's GIS and Data Solutions group, he oversees various GIS, enterprise data management and web/mobile technology related projects, and is responsible for the development of this technology within the firm. This includes managing a diverse staff of analysts, programmers and engineers on a wide variety of projects, researching new technologies, beta testing, development of corporate-wide standards and best management practices along with training of staff on these technologies. Over his career, he has amassed extensive experience in the use of Esri products including ArcGIS Desktop and associated extensions, ArcGIS Server and ArcSDE along with Earthsoft's EQuIS data management software based on Microsoft's SQL platform. This includes using the aforementioned software to support mobile LiDAR scanning, Unmanned Aerial Vehicle (UAV) and field GPS survey data collection and reduction, due diligence mapping, renewable energy and contaminant concentration modeling, 3-D model and animation development along with web and mobile-based application development a myriad of application programming languages.



Education

B.S., Geo-Environmental Science
Shippensburg University

Certifications and Training

Certified GIS Professional (GISP)

Esri System Architecture Design
Strategies; 2012

Esri Working with Geometric
Networks for Utilities; 2012

ArcView GIS 10.x

ArcGIS Server Administration

Key Personnel



Andrew G. Ives, LS, Associate | New Haven, CT

Mr. Ives has nineteen years of experience on projects throughout the northeast including Massachusetts, Connecticut, and New York. Providing land surveying and mapping in both the public and private sectors, he is responsible for project coordination, research, field location, mapping, and boundary determination.

Education

A.S. Engineering Naugatuck Valley Community College

Professional Registration

Land Surveyor (MA, CT, NY)

Anthony L. Maione, PLS, Senior Survey Manager | Pittsburgh & Cleveland

Mr. Maione is a professional surveyor with extensive leadership experience and knowledge of the principles, practices and procedures of ALTA, topographic, boundary, utility and construction layout surveys. He has delivered successful results in the land development and oil and gas industry and efficiently managed numerous projects and many field and office personnel. Mr. Maione has created strategies under changing conditions and has demonstrated excellent communication skills with other disciplines, outside agencies and clients. His technical experience includes use of 3D laser Scanners, Hydrographic Echo Sounders, GPR (ground penetrating radar) and other utility locating devices; AutoCAD (Civil 3D) and Carlson drafting software. He is also familiar with Spectra, TDS and Trimble/GPS software platforms.



Education

B.S., Surveying and Mapping Technology
University of Akron

Professional Registration

Professional Land Surveyor (OH)



Bryan A. Merrit, PSM, PLS, Senior Survey Manager | Florida

Mr. Merritt is a licensed land surveyor in the States of Florida and New York with extensive background that includes terrestrial and mobile LiDAR (laser scanning), GPS surveys, GIS Development, horizontal/vertical control, right-of-way survey and mapping projects, preliminary design surveys for engineering projects, and ALTA boundary surveys.

His experience in land surveying ranges from traditional survey tasks to advanced mapping technologies. As Manager of Surveying for the State of Florida, Mr. Merritt is very active in promoting land surveying and has been a guest speaker at numerous conferences. He is part of curriculum advisory board at Florida Atlantic University Geomatics Engineering program.

He is one of the founding members and board of directors of the USIBD (United States Institute of Building Documentation), the only non-profit organization dedicated to the profession of building documentation.

Education

A.A.S., Civil Engineering Technology, Monroe Community College

Professional Registration

Professional Surveyor and Mapper (FL, NY)

Key Personnel



David Avery, PLS, Senior Survey Manager | Parsippany, NJ

Mr. Avery has 30+ years of land surveying experience. Mr. Avery oversees the survey operations in Langan's headquarters, Parsippany, New Jersey. Prior to Langan, Mr. Avery served as a Boundary Analyst, focusing on small and large-scale land development projects, including, but not limited to, commercial, big box, power centers, and residential properties. In addition, he has also served as boundary analyst and project manager for a large engineering/surveying firm and an analyst and supervisor of office and field operations for a land surveying firm.

Education

B.S., Surveying
Oregon Institute of Technology

A.A.S., Surveying
Paul Smiths College

Professional Registration

Professional Land Surveyor (NJ,
PA)



Emanuel Donate, Project Surveyor | Arlington, VA

Mr. Donate has over fourteen years of experience in the Washington, DC region providing surveying experience including structural deformation monitoring. He has provided these services for public- and private-sector clients including DC Water and the Washington Metropolitan Area Transit Authority. Mr. Donate is well-versed in the use of AutoCAD Civil 3D and is an expert with the latest Leica robotic total stations. The Leica total station has an internal monitoring program that Mr. Donate has configured to be able to use Excel spreadsheets to develop movement monitoring graphs.

Education

B.Eng., Land Surveying and
Geomatics
University of Puerto Rico



Matthew Sipple, PLS, Survey Manager | Parsippany, NJ

Mr. Sipple has 14 years of experience in land surveying and has utilized a broad range of technology to obtain field data and produce deliverables based on specific client needs. His responsibilities include maintaining complex project schedules and coordinating with employees, consultant teams and the client. Mr. Sipple specializes in field data reduction and preparation of detailed drawings based upon 3D point clouds and conventional ground based survey information. He has an intimate knowledge of a variety of software platforms, including AutoCAD, Cyclone, Terramodel, Cloudworx, Rhinoceros, and Revit. Over the years he has worked on projects ranging from large scale public/private redevelopments to highly detailed models for part replications. Mr. Sipple has also been developing solutions to incorporate highly accurate existing condition models into Information Models and Facility Management systems for long term asset and facility operations. His expertise helps the Langan team remain on the cutting edge of technology.

Education

New Jersey Institute of Technology

Professional Registration

Professional Land Surveyor (NJ)

Key Personnel



John Hsu, Project Surveyor | Parsippany, NJ

Mr. Hsu has 20 years of experience in the architecture and engineering fields. His main responsibility includes creating 3D existing condition models based on point cloud data. Prior to joining Langan, Mr. Hsu had practice in the architectural profession, gaining extensive experience in all facets including planning, design, and construction over a wide range of corporate, retail, institutional, hospitality, and residential projects. With a concentration on multi-family residential work, Mr. Hsu has been involved in the design and planning of thousands of residential units. In addition, Mr. Hsu has also been involved in the development and implementation of the overall Building Information Modeling process as it relates to software application and project support. He has worked closely with a variety of architectural firms to provide Revit/BIM management, leadership, model management, Revit standards and support.

Education

New Jersey Institute of Technology
MS – Industrial Management
BS – Architecture

Lance Berliner, Senior Survey Manager | New York, NY

Mr. Berliner is a project manager with experience in survey, computer drafting, mapping, and boundary analysis for commercial, residential, and industrial properties throughout New York. His expertise includes utilizing various CAD platforms, boundary analysis, and extensive field experience.



Education

B.S., Architectural Engineering Technology
Ward College of Technology at the University of Hartford



Ronald King, PLS, Senior Survey Manager | Lawrenceville, NJ

Mr. King has extensive experience in a wide variety of survey functions including ALTA/ACSM Land Title Surveys, boundary, topographic and utility surveys for site development and roadway design, GPS control surveys, right of way surveys, preparation of parcel maps and descriptions for right-of-way takings, 3D laser scanning, construction layout and bathymetric surveys.

Professional Registration

Professional Licensed Surveyor
(PA, CT)

NSPS Certified Survey Technician
Level III (NJ)

Key Personnel



Timothy O'Connor, Senior Survey Manager | New York, NY

Mr. O'Connor is a surveyor with experience in boundary, topographic and utility surveys. He also has experience in performing surveys for oil/gas, hydrographic studies and 3D laser scanning. He has worked throughout the United States and internationally.

Education

New Jersey Institute of Technology

Professional Registration

Professional Land Surveyor (NJ)

Ian Wisuri, Senior Survey Manager | Boston, MA

Mr. Wisuri has over 25 years experience performing boundary, topographic, and construction surveys for public and private sector clients. Ian is an active member of each state society he is licensed in, as well as the National Society of Professional Surveyors. He is the Survey lead in Boston office responsible for lead generation, discipline specific proposals, scheduling, project management and QA/QC. Mr. Wisuri is an active member is the Massachusetts Association of Land Surveyors and Civil Engineers, New Hampshire Land Surveyors Association, and Vermont Society of Land Surveyors.



Education

A.S., Civil Engineering and Survey
University of Massachusetts

Professional Registration

Professional Land Surveyor (MA,
ME, NH, VT)



Steven Waldemer, PLS, Survey Manager | White Plains, NY

Mr. Waldemer is an experienced survey analyst with extensive knowledge in project management and a variety of surveying techniques. His practice spans a wide range of scenarios including projects for transportation, airports/aviation, and railway. Areas of Mr. Waldemer's expertise include geodetic, topographic, and boundary surveys; GIS and GPS data analysis, 3D laser scanning, and tunnel surveys. He also has significant experience in the areas of right-of-way, as-built, and construction surveys. Mr. Waldemer has a comprehensive knowledge of field and office logistics and has been instrumental in the completion of large projects for private, state and federal agencies nationwide.

Professional Registration

Professional Land Surveyor (NY)



Recent Publications & Awards

MAY 2013

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POINT OF BEGINNING

How to Make Your **TECHNOLOGY INVESTMENT PAY OFF**

P. 12

PLUS:

- Professional Pay: Highlights From POB's 2013 Salary & Benefits Study, P. 10
- Improving International Data Management Through GIS, P. 18
- The Benefits of Real-Time Office-to-Field Collaboration, P. 26



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ROI



How to Make Technology Pay Off

By Christine L. Grahm

Technology advances are making it faster and easier for surveying and mapping professionals to collect data and provide increasingly sophisticated deliverables that solve complex problems for clients. But the situation also presents a challenge. With technology changing so rapidly, any new investment typically must pay for itself within five years, if not less. How can a firm make a solid business case to invest in the latest state-of-the-art system?

At Langan, an international engineering and environmental consulting firm headquartered in Elmwood Park, N.J., staying on the leading edge of 3D laser scanning technology is a chief objective for the firm's surveying and mapping group. An early adopter of scanning technology, the company has rapidly expanded its arsenal of laser scanning equipment and expertise within the last several years. In 2006, the firm purchased one of the early Leica Geosystems ScanStation units. Since then,

the firm has added a Leica ScanStation 2, a Leica HDS6000 and a Leica ScanStation C10. Recently Langan became the first to purchase the new Leica ScanStation P20, an ultra high-speed laser scanner that provides high scan density and high accuracy.

At any given time, all five of the scanners are in operation on various projects, from large infrastructure surveys to building information modeling (BIM) for a wide range of facilities and clients, and Langan sometimes needs to rent additional scan-

With technology changing rapidly, making the business case to invest in new equipment can be a challenge. How do you know the investment will provide a return? Here are six strategies from a surveying and mapping group on the leading edge.

ners to meet demanding project deadlines. How has the firm made laser scanning such a successful part of its business? According to Joseph Romano, PLS, vice president of the firm's surveying and mapping group, there are no shortcuts. "With technology, everything is very dynamic; it's always changing," he says. "You have to keep track of the latest advances and make smart decisions to stay on the leading edge."

Following are six strategies that can be implemented by any firm seeking to get the best return on their technology investment.

IDENTIFY YOUR NICHE

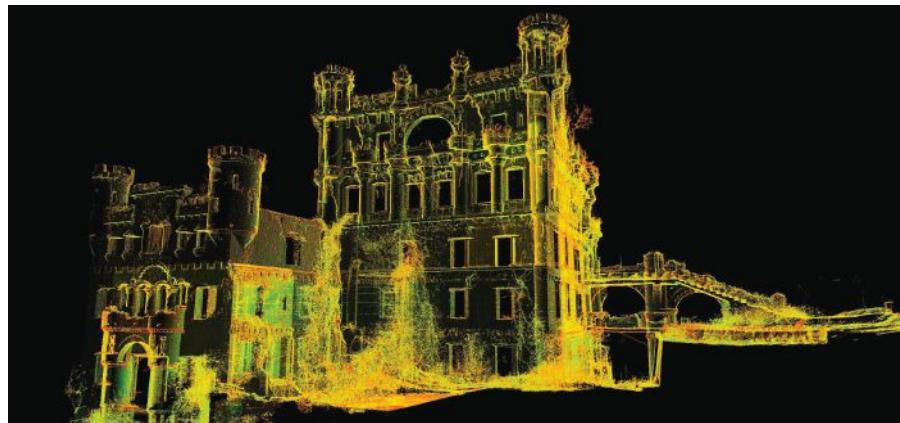
The rapid pace of technology innovation presents exciting new opportunities, but trying to keep up with all the latest advances can be both frustrating and futile. Instead, investments should be made strategically and aligned with the company's primary areas of expertise. "We can't jump on every new technology as it comes out just because it's new," Romano says. "We have to make sure we're making the right decision. Each piece of equipment has a specific role and fits a niche for us. We have to stay within our core strengths."

UNDERSTAND YOUR CAPABILITIES

Investing in new technology is just one part of the equation. Although some clients might actively seek service providers who use the latest piece of equipment or software, most are more interested in how a firm's capabilities fit a specific need. "As clients become more knowledgeable about the equipment and options available, having current technology is important," says Matt Sipple, PLS, project surveyor for Langan, "but being able to explain why we use that equipment is just as critical."

For example, being able to share how the density of data captured by the latest laser scanner can save time and money downstream compared to an older technology can be big selling point. "On some of the long term projects we're involved with, we have been asked to rescan for details that previously we were unable to obtain," says Sipple. Equally important is the ability to convey the benefits that experience and skill bring to a project.

An important step in any new project or client relationship is to understand the expectations of everyone involved and avoid the temptation to oversell capabili-



Opposite: Greg Jensen, Langan scanning technician, adjusts settings on the firm's new Leica ScanStation P20. Above: Colorized point clouds from laser scans of Bannerman's Island Arsenal in New York. All images courtesy of Langan.

ties. The technology alone is not enough to guarantee success; having adequate training and knowing when and where to apply the technology are vital.

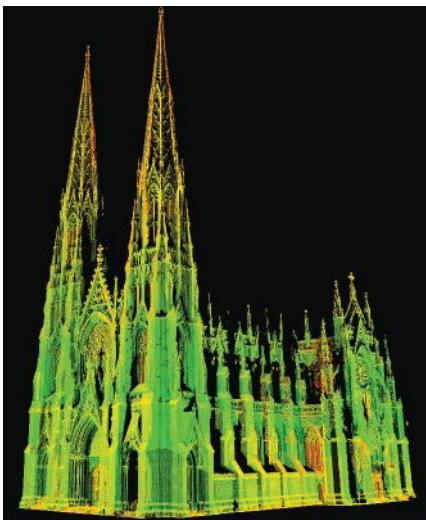
STAY UP TO DATE ON SOFTWARE

With the trend toward building information modeling (BIM) and integrated project delivery (IPD), clients are looking for ways to add intelligence to their datasets. Often software can be a differentiating factor in choosing a service provider. "BIM and IPD are becoming more common as a final deliverable, and there's a lot more demand for 3D design," Sipple says. "Clients want more working models and datasets they can integrate into their own workflows. Staying on top of software development is critical to meeting these needs."

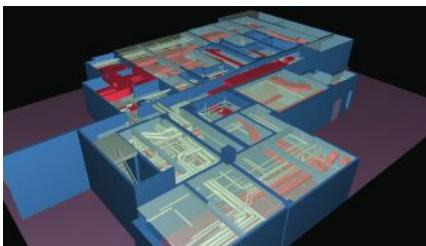
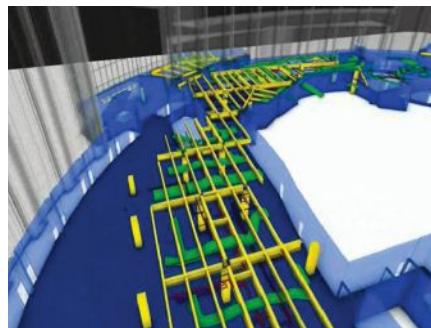
Technology manufacturers and independent software developers have introduced new software solutions in the last few years that automate and streamline data processing and management. One example is Leica CloudWorx for Revit, a plugin that allows as-built point cloud data captured by laser

scanners to be manipulated directly within Autodesk Revit software for an improved BIM workflow. "Previously we'd have to export the point cloud out of Cyclone and import it into Revit, and we'd lose our coordinate system and orientation because the software wasn't compatible," Sipple explains. "As surveyors, we have to ensure that everything is survey-accurate, so that meant a lot of time on our end correcting the model. CloudWorx for Revit has allowed us to bring in point clouds accurately, which saves us a lot of time in transferring files and checking for discrepancies."

The streamlined workflow has allowed the firm to provide accurate deliverables much faster, which is a benefit to clients on a tight timeline. It also allows Langan to make better use of its internal resources. "Now we can have one person working on one side of the building and another person on another side of the building, each on a different part of the point cloud, and they're all tied together because they all go back to Cyclone," Sipple says. "It reduces the chance of error because we don't have



Left: Langan's 3D laser scanning projects have included St. Patrick's Cathedral in New York (top) and the U.S. Court of Appeals of the Armed Forces in Washington, D.C. (middle). A benefit of laser scanning is the ability to provide MEP models (bottom) without having to return to the site. Right: Langan's survey technicians used a combination of 3D laser scanning technology and traditional surveying methods in support of renovations at the 21,000-square-foot Madison Square Garden arena.



ity to capture a full 360-degree dome scan. Although the dome scan requires a few extra minutes of scan time, the additional data is invaluable. "It allows us to capture the scene—to get data everywhere surrounding the project site in case any other needs arise," Sipple says. "We've had projects where the client has contacted us several weeks later wanting to know the elevation of the building next door, or an MEP designer needs models of the building's existing mechanical, electrical and plumbing, and we were able to provide that data without having to go back onsite."

"Making additional data available as needed keeps the costs manageable for the client while streamlining the process. It also allows us to continue to add value as a project progresses."

BREAK DOWN BARRIERS

Achieving success with a new technology requires identifying the potential barriers as well as knowing how to skillfully remove them. For example, individuals within a firm might be resistant to change or may lack the understanding needed to fully embrace a new technology. Creating a seamless flow of information often requires adapting to new processes and breaking down silos between roles or departments.

Barriers can also exist in a client's understanding of a technology or process. "Everyone is at a different stage in technology adoption," Romano says. "Some clients want everything in BIM, and others just want 2D drawings. Whenever we meet with a new client, we try to assess their level of technology awareness and identify any preconceptions they might have about the process. Then we either have to adapt to what they want or guide them to alternative solutions based on our knowledge and expertise. We have to spend a lot more time in planning to ensure a successful outcome."

to split the data up and transfer to it other software packages. If additional data is brought in, everyone has access to it. And we don't have to worry about the loss of data due to software incompatibility."

GO BEYOND THE MINIMUM

A benefit of modern technology is that it can expand a surveyor's capabilities far beyond what was traditionally possible. Although there is such a thing as providing too much data all at once (does the client really need billions of points in that model?), it can be difficult to predict the downstream requirements of a project. "Once we've collected the data, we can't increase its accuracy, so it needs to be collected correctly and for more than its intended purpose," Romano says. "We try to anticipate our client's needs and structure our data collection efforts accordingly."

For example, the group frequently uses its ScanStation C10 when working on building exteriors due to the instrument's speed, range and color capabilities, as well as its abil-

INVEST IN RELATIONSHIPS

Relationships are crucial in business, and this is especially true when investing in new technology. Having a strong network of partners and clients can make all the difference in how quickly a new technology investment provides a return. "We value the relationships we have with our hardware and software providers," Romano says. "The feedback we give to them is critical, and they've never let us down."

Langan also maintains relationships with past clients and participates in professional and community events to make sure the firm understands where the needs are in the market. "Some of our past clients that didn't have an interest in 3D previously now have a client that wants something in 3D or BIM. They're calling us up saying, 'Hey, I remember you guys had that 3D laser scanning technology,'" Romano says. "In other cases, we've made connections at a trade show or professional event that took time to come to fruition but led to new projects eight to 12 months later. It's all about relationships, and you have to nurture those wherever you are in the process."

As clients seek increasingly complex deliverables, technology advances will continue to play a key role in enabling surveying and mapping professionals to add value. With the right strategy—and perhaps a little patience—firms can reap the benefits of a good technology investment.

"This has been a long road for us in scanning," Romano says. "It's rewarding to see our efforts paying off." ☀

Christine Grahm is the editor of POB. She can be reached at pobeditor@bnpmedia.com. For more information about Langan, visit www.langan.com. Additional details about Leica Geosystems laser scanners and software can be found at www.leica-geosystems.us.

SURVEYING FOR UTILITIES | SAVING ON INSURANCE | DATA COLLECTION SOFTWARE

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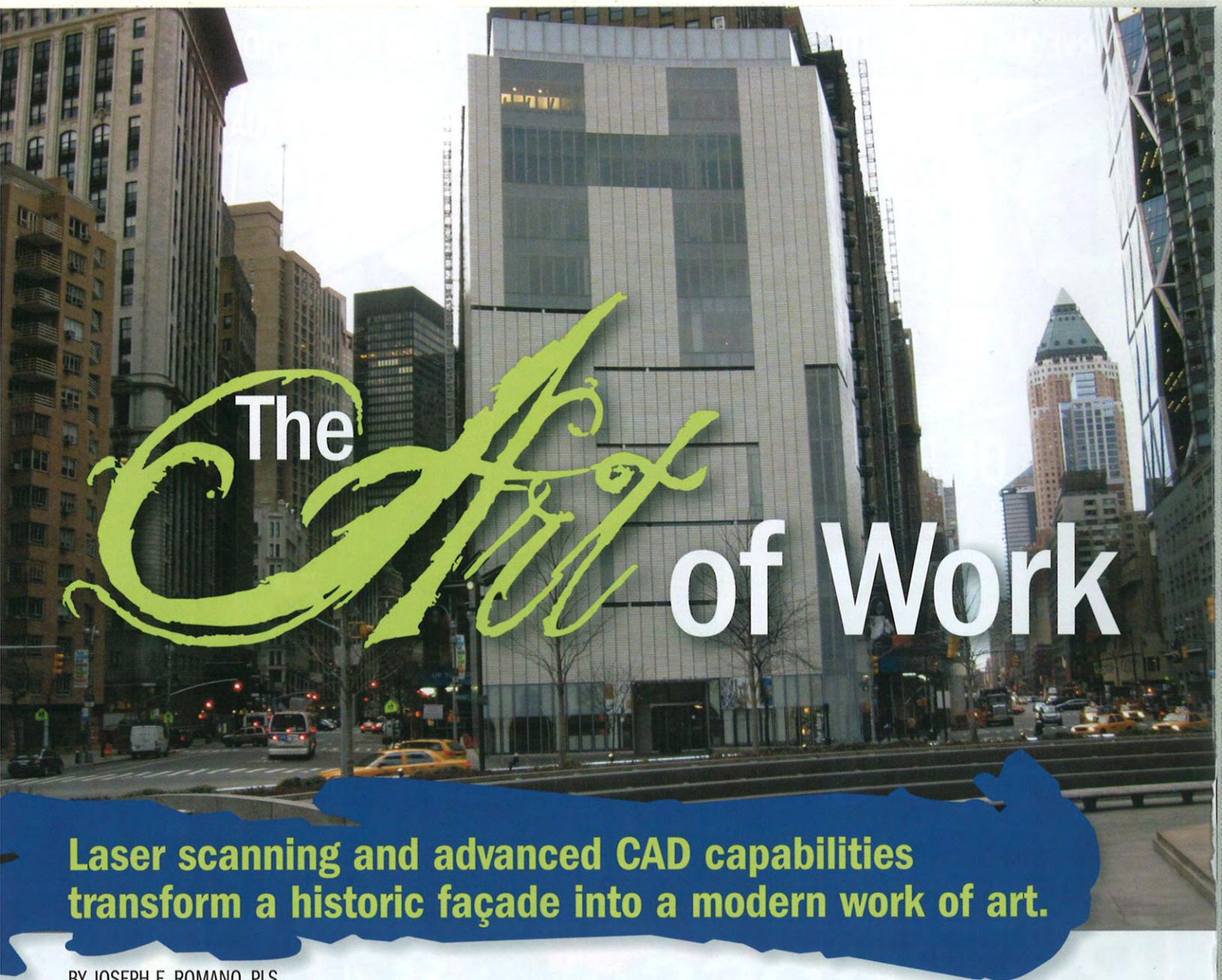


POINT OF BEGINNING

The Business of Scanning

Scanning Feature —

Langan scanning services benefit
a NY museum's new home



Laser scanning and advanced CAD capabilities transform a historic façade into a modern work of art.

BY JOSEPH E. ROMANO, PLS

New York City's Museum of Arts and Design (formerly the American Craft Museum) has showcased contemporary objects made from clay, glass, wood, metal, fiber and other media for more than 50 years. When the museum outgrew its 53rd Street location in the early 2000s and began looking for a new home, the board of trustees turned to the New York City Economic Development Corporation (NYCEDC), which recommended a vacant 12-story building at 2 Columbus Circle. Situated between Manhattan's Midtown, Upper West Side and Lincoln Center cultural corridors, the building was the ideal size and layout and would allow the museum to boast one of the city's most renowned addresses. But before it could lay claim to the space, the museum's board of governors would first have to win a difficult battle with preservationists.

Historic Boundaries

From 1874 to 1960, the Columbus Circle property was home to the seven-story Pabst Grand Circle Hotel where more than 100 stage performers joined together in 1913 to form the Actors Equity Association. The hotel was demolished in 1960, and in 1964, a 12-story modernist building designed by Edward Durell Stone was erected. The building opened as the Gallery of Modern Art and housed the art collections of A&P's founder Huntington Hartford. In 1969, the building was gifted to Farleigh Dickinson University and was operated as the New York Cultural Center. The building was then purchased in 1975 by Gulf and Western Industries and remained vacant until 1980, when Gulf and Western presented the building to the city as a gift. For the next 18 years, the building was occupied by the Department of Cultural

Affairs and the Convention and Visitors Bureau. Then, in 1998, the Landmarks Preservation Commission began holding hearings on designating the building as a landmark. Although the NYCEDC named the Museum of Arts and Design as the site's developer in 2002, it took the museum nearly three years and several lawsuits to overcome the attempted landmark status and obtain a permit to renovate the building.

During this time, the museum's board of governors, which was chaired by Jerome A. Chazen, began assembling the design team for the project. Allied Works Architecture was named as the team's design architect; F.J. Sciame Construction Co. was chosen as the construction manager; Robert Silman & Associates was assigned to structural engineering; R.A. Heintges & Associates was named to manage the curtain wall

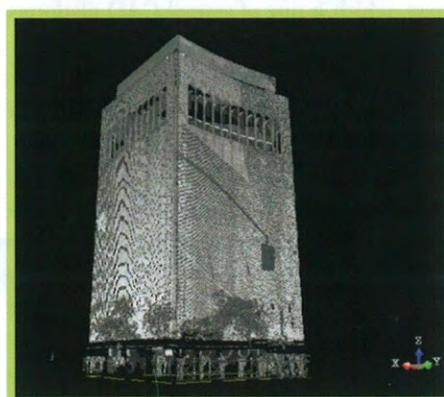
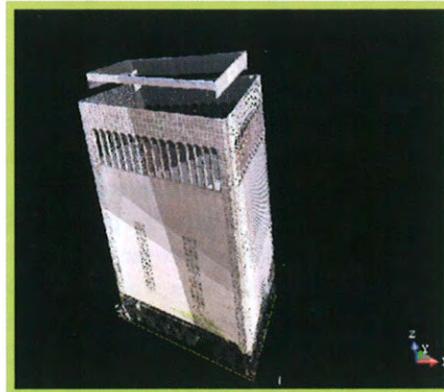


Left: The redesigned museum features a luminescent ceramic exterior. **Above:** The original façade dated back to 1964. **Right:** Advanced CAD work created high-quality point clouds of the building.

design; and Langan Engineering joined the team to act as project surveyor and site/geotechnical engineer.

The conceptual design for the building's exterior was to remove the original curtain wall and construct a new façade in front of the remaining structural wall. Under normal building conditions, achieving this objective would not be a problem. However, this building was originally constructed as a zero-setback condition—a review of historic hand-drawn surveys showed the building to extend to the right-of-way (ROW) lines on all four sides. The team realized that the proposed curtain wall might encroach into the adjoining street ROW. Such an encroachment would require a franchise agreement with the city—a license that would allow the use of the ROW encroachment area for specific fees and under certain terms.

Using original building design plans and select field measurements, the design team back-calculated the location of the structural wall in relationship to the property lines. These calculations were then used in conjunction with the thickness of the proposed curtain wall and bracketing system to provide an estimate of the encroachment condition



and minimize the franchise fees that would be required. The team settled on a 4-inch franchise requirement, submitted an application and received approval from the city.

Creative Exploration

During the preliminary design phase, Langan prepared a detailed CAD-generated site survey supported with digital terrain models (DTM) and a triangulated irregular network. The survey included boundary, topographic, utility and Builders Pavement Plan (BPP) data. (The BPP, which is unique to New York City, includes detailed curbing, walk, pavement elevations and utility data and is used to assist in the overall grading of the city's public spaces.)

While working on the site survey, Paul Fisher, PLS, project surveyor and manager of Langan's Laser Scanning Group, was approached by members of the design team with a request to confirm the building's façade and plumb status in relationship to the site's property lines. The team also requested clearance distances on a 2-foot by 2-foot grid across each façade of the building. These distances were intended to be used to design the brackets for the curtain wall. The design team detailed concerns relating to the possible building ROW encroachment and the sequence of the proposed construction and asked Fisher to provide a proposal.

Fisher met with the other survey project managers to determine the best methods and equipment for obtaining the required data. The survey team decided that laser scanning combined with an unconventional use of CAD options would provide the level of detail requested by the design team. However, while Langan had routinely used laser scanning to collect façade/planimetric data and had produced CAD models and paper prints of those data, the firm had never had been asked to provide detailed clearance distances. "Langan had produced similar elevation surveys in the past to check for deformation in building walls and encroachments," Fisher says, "but those point data sets were collected on a very large grid using Trimble reflectorless total stations. With the laser scans, Langan would have to address the amount of data produced and how to decimate the data to make it usable in CAD and [useful] to the client."

To further complicate the project, the building would be wrapped in scaffolding during the field work. "We knew we had a difficult task to complete," Fisher says.

Scans and Models

Using the horizontal and vertical controls that had been established during the site survey, the three-person crew began obtaining multiple scans of the building using a Trimble GS200 3D scanner. The first set of scans captured data with the marble panels still on the building. If the crew was unable to obtain enough data with the scaffolding and netting installed, these data sets would allow the team to back-calculate to the concrete structure using some general thickness measurements of the marble. However, Fisher

notes, "our hope was this data would only be for backup and we would not have to use this data for the final calculations."

A second set of scans was completed with the scaffolding in place and with the marble panels removed. To observe the building facade, the scan sessions had to be completed not only from grade level but also from various vantage points adjoining the site. "The crew needed to perform multiple scans of the same area to enable the scanner to obtain data on the building face that was obscured by the scaffolding," says Crew Chief Tim Hydrusko. "We were able to use a fourth-floor office, which had an overlooking window, as well as the roof of a seventh-floor apartment and a balcony of a 15-story building. The large number of scan sessions required the setting of over 60 building-mounted scan targets, which by far is the greatest number of targets that we ever had to set."



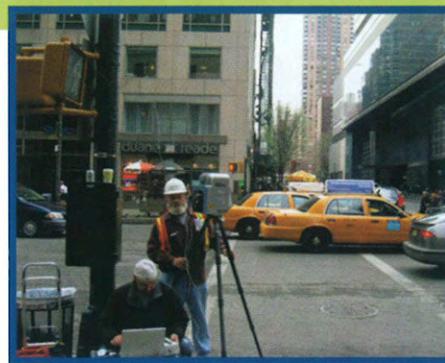
After the scan data were collected, technicians began the registration process using Trimble's RealWorks Survey software. The massive amount of targets made the registration process far more complex than most of the firm's previous scan projects, and a lot of time was spent registering the clouds together. Once registration was complete, the firm began the tedious process of removing all of the scaffolding from the cloud. "We had to be sure all of the point data we would be using to create our offset plans was real wall data and not scaffolding or other construction components," Fisher says.

Technicians spent a lot of time working on the model to remove anchor plates and other fixtures used to hang the scaffolding. Chris Tarzia, senior scanning technician, was tasked with this critical portion of the project. "Removing the scaffolding from the point cloud proved to be the toughest part of the project," Tarzia says. "Every object along the building face had to be removed, from

the wooden planks down to the bolts holding the scaffolding into the building. It was the toughest 'noise-removal' task from a scan project I have ever completed to date, but in the end the process worked perfectly."

Once the cloud was reduced to only the concrete structure, technicians decimated the point data to make it usable. After some experimentation, the team reduced the point cloud to a 1/2-foot grid, which made the data "light" enough to work with in a standard CAD program. The point data were then exported as an ASCII file into Trimble's Terramodel, a stand-alone CAD/survey/modeling program, which is one of several CAD platforms Langan employs for modeling.

Each elevation was prepared in a separate file that included the franchise line adjacent to the building face and the point data. Each face and franchise line was rotated to either due north or due east. Elevations were



Left: The building was scanned with the scaffolding in place, and the survey team had to digitally remove the scaffolding from the point cloud. **Above and right:** The Langan survey crew used a Trimble GS200 3D scanner for the scan work.

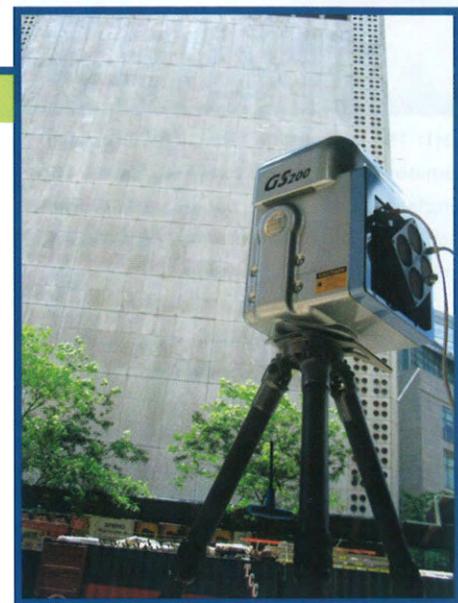
assigned to the franchise line to produce a 3D plane that ran parallel with the vertical wall of the building. These data were then exported as an ASCII file and imported into a new CAD file. The coordinate values were changed so that the z value was entered as a northing. This provided a scaled elevation of the building that served as a DTM surface and allowed a horizontal plane to be created from the franchise line.

The final step was to create an isopach model from the two surfaces using standard surface modeling options within the Trimble Terramodel design and surveying software. A dense grid was then overlaid on the isopach data, and offset values to the fran-

chise line were extracted. The deliverables to the design team were a CAD file in the original dense-grid format as well as paper prints created with a 2-foot grid to make the data legible and to coincide with the curtain wall grid. The curtain wall designer was then able to overlay its bracketing plan onto the wall offset drawing and determine the exact size of the bracket required to place the curtain wall on the franchise line.

A Work of Art

In February 2005, the New York State Supreme Court ruled in favor of the city regarding the sale of 2 Columbus Circle, and the museum was finally able to move forward with the renovations. The new Museum of Arts and Design at 2 Columbus Circle opened to the public in September



2008 boasting a luminescent ceramic exterior that, according to the museum, "symbolizes the revitalization of an important urban space and underscores the museum's dedication to modern materials and processes." In the end, laser scanning and the creative insight to push common CAD options to their limits proved the correct approach for a unique design and construction project that created a cultural work of art. ☽

LANGAN

ENGINEERING & ENVIRONMENTAL SERVICES

Joseph E. Romano, PLS, oversees the surveying and mapping efforts for Langan's 12 national offices. For more information, e-mail jromano@langan.com or visit www.langan.com. More information about the Museum of Arts and Design can be found at www.madmuseum.org.

NOVEMBER 2008

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POINT OF BEGINNING

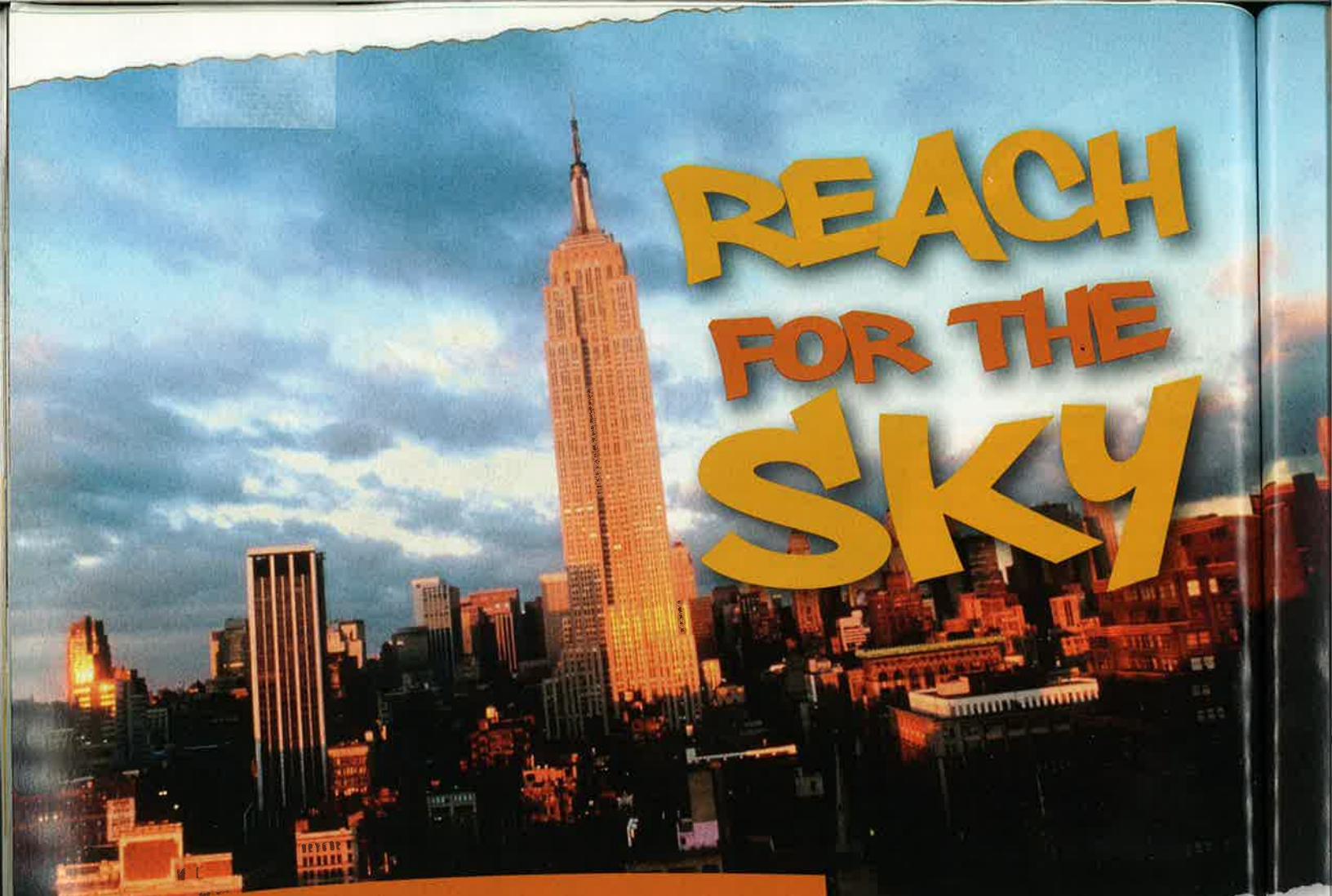
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REACH FOR THE SKY

A hands-on exhibit at New Jersey's Liberty Science Center inspires the next generation of surveyors.

At the reinvented Liberty Science Center (LSC) in Jersey City, N.J., exhibits go beyond the conventional science center model and seek to actively engage visitors and impact society on a local, national and international level. The center focuses on interactive experiences that inspire lifelong learning. In the center's Live Science program, visitors can perform a live surgery on a "vegetative" patient after diagnosing the patient's mystery ailment, delve into the survival strategies of invertebrates through hands-on live animal presentations, or experience eye-popping films in what is reportedly the nation's largest IMAX dome theater. With all of this innovation, it makes sense that an interactive exhibit focused on surveying would also find its home here.

The surveying exhibit is found in "Skyscraper! Achievement and Impact," a 12,800-square-foot

exhibit originally conceived by Helene Alonso, an LSC creative leader and project manager, as part of the science center's ambitious 22-month, \$109 million expansion that began in 2005. For the surveying portion of the exhibit, Alonso envisioned a permanent physical

display where guests would be able to use surveying equipment for themselves. To explore the feasibility of such a plan, Alonso contacted Langan Engineering & Environmental Services headquartered in Elmwood Park, N.J., the survey, site/civil and geotechnical engineer for the center's original design and expansion.

"The excitement in the room was unmatched when the team unveiled the schematic interior configuration of the exhibit area and the plan for a survey exhibit," says Joseph E. Romano, LS, a senior associate at Langan Engineering who oversees the surveying and mapping functions for the firm's nine offices. "I remember the enthusiasm I felt first during my first survey class at NJIT, in Newark, N.J. More than 15 years later while working on the Liberty Science Center project, I felt the same enthusiasm."

The development team at LSC, which included Alonso as well as designer Carlos Fierro and graphic

designers Judeann Hook and Elizabeth Grotjohann, had designed an exhibit that encompassed various remote measurements, including details for horizontal and vertical survey observations. However, having never used or seen a transit or total station, the team was at a loss for the details that would be required for a hands-on exhibit. "After learning that the entire survey exhibit would be required to be fully operational by the visitors and that none of the results could be predetermined, we decided we required assistance from an equipment vendor," Romano says.

The Tools of the Trade

Romano contacted John White, a long-time friend and local Leica representative. "John's dedication to the surveying profession and to the education system is unparalleled," Romano says. "He and Leica are supporters and equipment suppliers to many local educational institutions including NJIT and their surveying program."

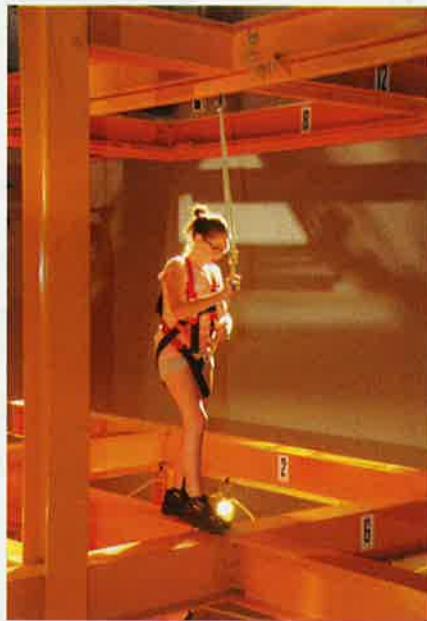
After meeting with the team

and reviewing the goals and requirements for the exhibit, White suggested that the team use the intuitive Leica TCR703 (3-inch) reflectorless total station with a red-laser-dot pointing scope as the exhibit's centerpiece. (White later recommended the Leica TCR705 [5-inch] instrument instead.) During the exhibit, visitors would be able to make three distance and two angular observations and calculate three missing distances. To complete these tasks, the team proposed to have the total station set in the lobby area with the points to be measured located on portions of steel I-beams that were part of other exhibits, such as the "Walk the Beam" exhibit, in which visitors would walk an elevated I-beam to experience the thrill of skyscraper construction.

Langan Engineering's graphics department developed a studio-generated 3D model of the proposed exhibit using Autodesk 3ds Max software. From there, the necessary equipment was secured from Leica and other suppliers, and a temporary exhibit was set up at the science center. In addition to the total sta-

tion, equipment in the exhibit included a tripod, prism pole and tilting prism, various tapes, a Gunter's chain, a measuring wheel, plumb bobs, corner markers and other small survey tools.

The next step was to complete a "hands-on trial," which LSC staff would use to assess the feasibility of the exhibit



Opposite: Scaled models of some of the world's tallest and best-known buildings, including New York's Empire State Building, are on display throughout the exhibit. **Above:** In the "Walk the Beam" exhibit, visitors walk an elevated I-beam to experience the thrill of skyscraper construction.

and determine whether it would be a permanent display. The trial was conducted on a weekend in early 2007 as construction of the expansion area was under way. Overall, the exhibit was deemed a success. However, the team believed that having the visitors complete the measurements was too difficult. While the summary reports showed that visitors enjoyed the exhibit, the sensitivity of the total station coupled with the need for the operator to aim, adjust and focus was overwhelming for some. The team decided to change the surveying display into a "rolling exhibit" that would have scheduled experience times guided by an LSC staff member. This approach would retain the hands-on experience for visitors without the frustration of trying to figure out how to use complex surveying tools on their own.

An Inspiration for Learning

When the newly expanded Liberty Science Center reopened in mid-July 2007, the skyscraper exhibit was an immediate success. "This exhibition is impressive enough that it would merit its own visit," noted a museum review in *The New York Times* shortly after the LSC expansion opened to the public.¹ A writer in *Living Media* described the exhibit as "the ultimate expression of human engineering" and noted that visitors would be "sure to leave this exhibit with a new appreciation and completely changed outlook regarding the impressive skyline that so many take for granted."² Yet another reviewer called the exhibit "spectacular."³

But perhaps the best reviewers have been the children who visit the science center. "The kids love looking through the total station and using the measuring wheel; it's the hands-on thing," notes Andrew Prasarn, one of the LSC science educators who presents the surveying exhibit. "We have scaled models of some of the world's tallest and best-known buildings throughout the exhibit. Using the total station, each visitor gets to measure the slope distances to the base and to the top of one of the models and also record the vertical angle. Using trigonometry, we then calculate the horizontal distance to the base and the scaled height. Then we use pacing and the measuring wheel to the same building and compare our findings. The kids really get it and ask a lot of questions; the interaction is great. I hope it's planting a seed and providing some vision."

The exhibit features a Leica TCR705 reflectorless total station that was donated to the center as well as a Sokkia 630R reflectorless total station purchased by LSC. The surveying activity is scheduled for peak periods when large numbers of visitors are in the building. Recently, the center decided to also take the activity on the road as part of its traveling science and math program. "This way, instead of just three to four people an hour getting to learn about surveying, we'll be able to introduce up to 120 kids a day to the skill—it's very exciting!" says Elizabeth Romanau, vice president of communications at LSC. Romanau notes that there might also be opportunities for engineers and professional surveyors to accompany the LSC team to talk directly to students.



Left: The surveying activity in Liberty Science Center's skyscraper exhibition introduces guests to a real-world application of math in everyday life.
Above: The proposed layout of the skyscraper exhibit at LSC.

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"Workforce development in surveying and engineering, math, science, and technology is one of our nation's most critical tasks," Romanau says. "The surveying activity in Liberty Science Center's skyscraper exhibition introduces guests to a real-world application of math in everyday life, making their school work more relevant to young people. Additionally, students and parents alike will understand what workers are doing the next time they see surveying taking place along a road or at a construction site in their town."

Romano, who had the opportunity to visit the exhibit recently, takes personal satisfaction in his role in seeing the exhibit come to fruition. "It is very rewarding to have been able to assist in providing today's youth with a small but effective experience in the world of land surveying," he says. "LSC board of trustee member William A. Tansey III, MD, could not have said it better: 'Today's childhood experiences do become tomorrow's careers!'"

For more information about LSC or the skyscraper exhibit, visit www.lsc.org. More information about Langan Engineering can be found at www.langan.com. Additional links can be found in the online version of this article.

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2019

TWA FLIGHT CENTER SOARS AGAIN THROUGH POINT CLOUDS!

Surveyors Pilot the Second Departure of Saarinen's Masterpiece into a World-Class Hotel

Designed by Eero Saarinen, the TWA Flight Center's history encompasses its unique "wing-shaped" design from 1962 and its cultural significance. Reimagined as a hotel in 2014, documenting and preserving the landmarked building's integrity was vital during the restoration. The survey team's innovative use of multiple methods and technologies provided the hotel design team with a highly detailed existing conditions 3D model of the building along with a comprehensive site survey. Combined, these two approaches provided the basis of the restoration efforts, soaring above expectations and allowing Saarinen's masterpiece to take flight once again!

2016

WORLD'S FAIR - NEW YORK STATE PAVILION GOES FULL CIRCLE

3D LASER SCANNING PROVIDES CATALYST TO DIGITALLY RECREATE THIS 1960'S LANDMARK

The 1964/65 World's Fair drew more than 51 million visitors from around the world, showcasing the most cutting edge technological and architectural innovations of the time. While the fairgrounds have begun to show its age after 50 years, the remnants of the exposition stand as a monument to a special time in American history.

UCF, CyArk, and Langan joined forces to create a highly accurate digital model of one of the World Fair's most recognizable features, the New York State Pavilion. Framed by its dual Astro-View Towers, a Theaterama, and the Tent of Tomorrow, the Pavilion, now serves as an anchor to Flushing Meadows Park. Captured utilizing full-color survey-grade high-definition 3D laser scanning technology, the simulation will provide people around the world the opportunity to experience a very important cultural milestone of the 20th century.

WORLD'S FAIR SITE IN 1964/1965

DATA ACQUISITION: Scanning the pavilion to start the documentation

DIGITAL EXPERIENCE: Detailed model in an interactive video based viewer

The result is a 3D modeled digital experience that returns the user to the wonder of this 1960s American landmark.

ACCURATE POINT CLOUD: Scanned data collected of the site

Project: World's Fair - New York State Pavilion, Flushing Meadows, NY
Client: University of Central Florida (UCF), Orlando, FL
Entering Firm: Langan, Parsippany, NJ

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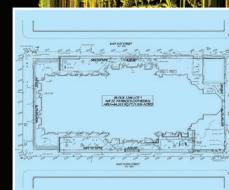
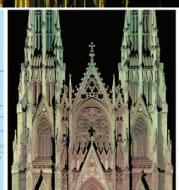
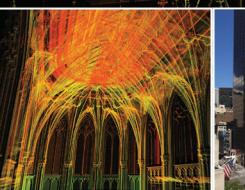
LANGAN

2015

SURVEYING ST. PATRICK'S CATHEDRAL

The Foundation of its Restoration

St. Patrick's Cathedral publicly announced its restoration in 2012 after years of pollution critically deteriorated both the interior and exterior. However, investigation for the restoration officially began six years earlier. In 2006, a site survey of the National Landmark building was submitted to the design team for use as the basis of the restoration plans and the design of improvements. Over the next few years, 3D laser scans of the façade, sanctuary, and attic spaces were performed to document existing conditions and model the building's unique layout. This highly detailed data saved the project team time and money, and the deliverables were regularly compared to the base survey to maintain accuracy. To put it simply, the site surveys and 3D laser scans are the foundation of the cathedral's restoration.


2006

During the initial stages of planning for the restoration, a highly detailed site survey was performed to determine boundary lines and provide topographic and utility information for scaffolding design, utility improvements, and construction coordination.

2007

A laser scan of the cathedral's façade was conducted to identify areas of concern. Challenges arose during this task because of passing vehicles, pedestrian traffic, unsecure entry to higher locations, and limited access to adjacent structures.

2012

The cathedral's intricate interior design called for a 3D laser scan and model of the sanctuary and attic spaces. The laser scans were used for structural improvements and design of the unique fire-suppression system.

2015

Scaffolding was removed to reveal the \$177 million restoration of St. Patrick's Cathedral – just in time for a visit from Pope Francis.

Project: St. Patrick's Cathedral Restoration, New York, NY
Client: Murphy Burnham & Buttrick Architects New York, NY
Entrant: Langan New York, NY

2012

GOVERNORS ISLAND: MARCHING FORWARD WITH A NEW RETREAT

Transformation of a Military Facility into a Peaceful Park



DETAILED TOPOGRAPHY AND BOUNDARY SURVEY

The detailed survey is vital to the core design principle of "Transformation through Topography" and will continue to guide the future development of this "Beacon in the Harbor."

Liggett Terrace **Historic District** **Hammock Grove** **The Hills**

Project: Governors Island Survey, New York, NY
Client: West 8 Urban Design & Landscape Architecture, New York, NY
Entrant: Langan Engineering, New York, NY

2011

3D Surveying Keeps a Station on Track

Langan's Survey Team helped to keep Philadelphia's historic 30th Street Train Station on track with the use of advanced mapping. Coupling 3D laser scanning technology with traditional surveying and mapping techniques, the team created survey plans showing detailed floor and reflected ceiling information. The data also served as a basis for a 3D Building Information Model of the entire sub-surface area. The use of the latest surveying technology reduced the client's fieldwork timeline by over 100 days, eliminated any need to return to the site in the future to locate additional data, and was completed without any disruption to the daily use of the station.

Garage Level 3D Model

Scanner Point Data Combined with 3D Model

Tunnel Level 3D Model Viewed Through Ceiling

Tunnel Level 3D Model

Laser Scanner at Work

Tunnel Level Photo

Title: 30th Street Station Garage, Philadelphia, PA
Client: KlingStubbins, Philadelphia, PA
Owner: Amtrak 30th Street Station, Philadelphia, PA
Entrant: **LANGAN**
 ENGINEERING & ENVIRONMENTAL SERVICES
 Philadelphia, PA ACEC/PA
 AMERICAN COUNCIL OF ENGINEERING COMPANIES
 of Pennsylvania

2008

DEVILS SCORE A GOAL WITH THE CITY OF NEWARK

Prudential Center

- Innovative Foundation Design Saves Millions
- Transit-Oriented Design Reduces Automobile Emissions
- Former 17th Century Cemetery Disinterred By Over 60 Archaeologists
- Premier Urban Core/Brownfields Redevelopment

Demolition and Clearing of Site

Archaeological Excavation to Clear Former Cemetery

Upgrade in Bearing Pressure Reduces Footing Size

Deep Dynamic Compaction Eliminates Need for Piles

REVITALIZATION OF DOWNTOWN NEWARK

TITLE: THE PRUDENTIAL CENTER, NEWARK, NJ **CLIENT:** DEVILS RENAISSANCE DEVELOPMENT LLC, NEWARK, NJ
ENTRANT: LANGAN ENGINEERING & ENVIRONMENTAL SERVICES, INC., ELMWOOD PARK, NJ

LANGAN
 ENGINEERING & ENVIRONMENTAL SERVICES

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2007

SCANNING THE SEAPORT

HIGH DEFINITION LASER SCANNING Relocates History

3D laser scanning coupled with traditional surveying techniques was used to create a building recordation plan. The survey documented the architectural details of the 100-plus-year-old "Tin Building," serving as the roadmap for the building's relocation.

Original 1907 location

Capturing the data

Cross-sectional view of scan

Exterior view of scan

Title: Pier 17 Redevelopment
New York, NY

Client: SHoP Architects PC
New York, NY

Entrant: Langan Engineering & Environmental Services
New York, NY

2003

St. John's University

a campus grows in Queens

surveyors map the transformation of a commuter school to an on-campus community

control network
aerial mapping boundary

ground topography
utility tone-out

3-D digital terrain model
plan preparation

design & construction

as-built

A unique survey cycle method was derived to supply a growing campus with a constantly evolving, cost and schedule efficient master plan survey. Combining advanced survey technologies and traditional survey techniques, a survey team plants the seeds of growth for a LIVING and LEARNING campus.

Project- St. John's University
Jamaica, Queens, New York
Client- St. John's University
Surveyor- Langan Engineering & Environmental Services, P.C., N.Y., N.Y.

SURVEYMA



Project Experience

LANGAN

BUCKEYE PIPELINE SURVEY

SERVICES:

- *Pipeline Survey*
- *Topographic Survey*
- *Bathymetric Survey*

LOCATION:

Confidential

CLIENT:

Buckeye Pipeline



As part of our on-call contract with Buckeye Pipeline, Langan provided survey services for an existing river crossing. The survey was required to document the site conditions as they related to the location of the pipeline and the remains of a former dam.

Our survey services included right of way survey to confirm the pipes alignment. A topographic and bathymetric survey was also completed to determine the horizontal and vertical position of the pipe.

The deliverables includes various plans, profiles and cross sections of the river crossing and the adjoining upland areas

3-D TCE GROUNDWATER PLUME VISUALIZATION

SERVICES:

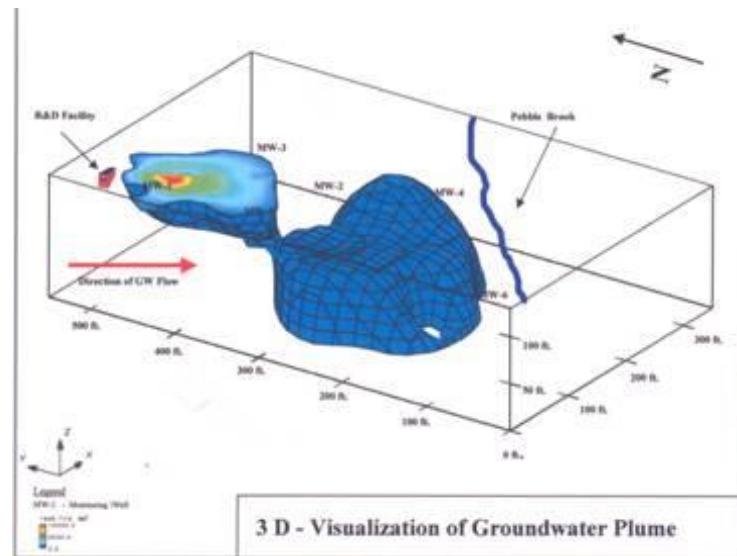
- Plume Assessment
- 3D Groundwater Modeling System (GMS) Application
- Data Visualization
- Remediation by Natural Attenuation

LOCATION:

Northeast United States Major Military Facility

CLIENT:

Confidential



In order to support an evaluation of natural attenuation by reductive dechlorination of a TCE plume, Langan completed a three-dimensional data visualization of complex chlorinated hydrocarbon plumes at a major military installation.

The project involved the application of Groundwater Modeling System (GMS) software to project 3D models of the contaminant plumes to analyze temporal and spatial trends in over fifty wells from four groundwater sampling events. TCE concentrations and concentrations of TCE daughter products, dichloroethylene (DCE) and vinyl chloride (VC) were plotted to evaluate temporal trends and plume status over time.

Three dimensional color visualizations were created in various formats to present the observed spatial and temporal trends.

LANGAN

GSA NATIONWIDE BUILDING INFORMATION MODELING (BIM) RELATED SERVICES

SERVICES:

- 3D Laser Scanning
- BIM Support

LOCATION:

Nationwide

CLIENT:

General Services Administration



Langan is a member of two awarded teams for the GSA Nationwide Building Information Modeling (BIM) and Related Professional Services. Under this contract, Langan will provide 3D Laser Scanning and BIM support services on an as-required basis for all government agencies administering or funding, design, construction and/or operations and maintenance programs. At any time during a project/property's development and delivery, including planning, design, construction, operations, facility management, and/or disposal, Langan will provide:

- Exterior and interior 3D Laser Scanning
- Professional BIM modeling services based on survey grade 3D Laser Scanning data
- Survey grade 3D Laser Scanning based analysis and applications, including visualization and constructability analysis
- Integration of multiple 3D Laser Scanning data and BIM software
- 3D Laser Scanning implementation support, including the development of 3D Laser Scanning assessment and project and review of BIM models and analysis completed by other services
- Development of best practices guidance, case studies, procedures and training
- Development of long- and short-term 3D Laser Scanning implementation
- Development of benchmarking and measurement standards and programs

Langan's long history as professional land surveyors positions the team to provide survey grade existing condition modeling.



MASTER PLAN SURVEY UNIVERSITY OF MEDICINE AND DENTISTRY

SERVICES:

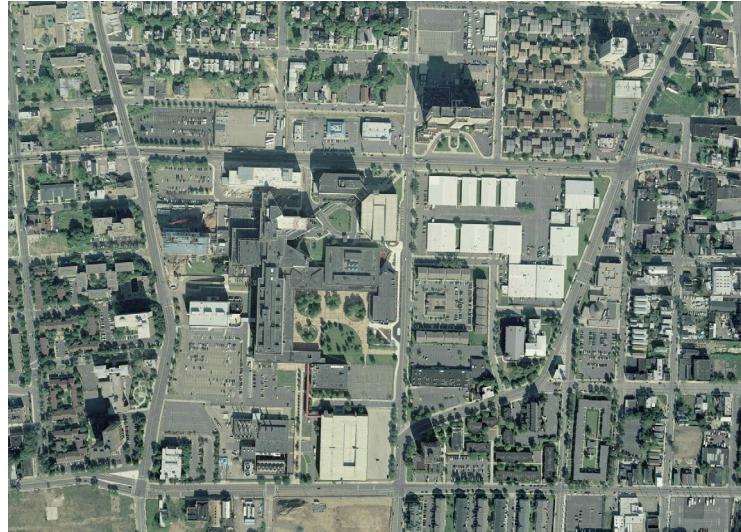
- Survey
 - *Master Plan Survey*
 - *Boundary*
 - *Aerial Topography*
 - *Ground Topography*
 - *Utility Survey*
 - *Construction Stake-Out*
 - *As-Built*

LOCATION:

Newark, New Jersey

CLIENT:

University of Medicine & Dentistry of
New Jersey (UMDNJ)



Langan provided survey support for a matrix of uses at the University. These included the preparation of a master plan base map survey, numerous detailed surveys, utility locations, construction stake-out, and as-built surveys.

The master plan survey began with new topographic mapping which was obtained specially for the project, a full boundary survey was then added, as was referenced utility data. As individual sites were selected by the design teams, Langan added on-ground topographic and utility data to provide design quality existing condition data. Langan also provided construction stake-out and as-built services. Langan's final task was to merge the as-builts with the master plan data to produce an up to date base map.

SERVICES:

- Geotechnical Engineering
- Site/Civil Engineering
- Environmental Engineering
- Boundary/Utility/Topographic Survey
- Site-specific Seismic Evaluation
- Land Use Permitting
- Landscape Architecture
- Traffic Engineering

LOCATION:

East Rutherford, New Jersey

CLIENT:

*New Meadowlands Stadium Company
(Joint Venture between the New York Football Giants and the New York Jets)
Skanska USA Building*

ARCHITECTS:

*Ewing Cole
HOK*

STRATEGIC PARTNERS:

*Thornton Tomasetti
Skanska*



MetLife Stadium is an 82,566-seat open-air stadium within the Meadowlands Sports Complex which opened for the 2010 season. The project was challenged by poor subsurface conditions, numerous existing site utilities, proximity to the existing stadium and racetrack, and the need to construct the proposed stadium while operating the existing Giants Stadium and utility infrastructure that serves the Meadowlands Sports Complex.

The expertise of several Langan disciplines was called upon to facilitate design and construction of the stadium and maintain the project schedule. Langan provided geotechnical, site/civil, environmental, traffic engineering, surveying, permitting, and landscape architecture services for MetLife Stadium – working with the owners, design-build contractor, and a diverse team of architects and designers.

Langan's detailed design and engineering responsibilities included: subsurface investigation and foundation design, site-specific seismic evaluation, site layout, grading and utility design, environmental remediation design, boundary and topographic survey, traffic modeling, and landscape design. Langan was responsible in assisting the owner and contractor in obtaining all necessary permits. In addition, Langan experts provided engineering inspection during construction of all foundation components, earthwork, site utility infrastructure, and environmental controls.

FORT MONMOUTH

SERVICES:

- *Surveying*
- *Environmental Engineering*
- *Traffic/Transportation*

LOCATION:

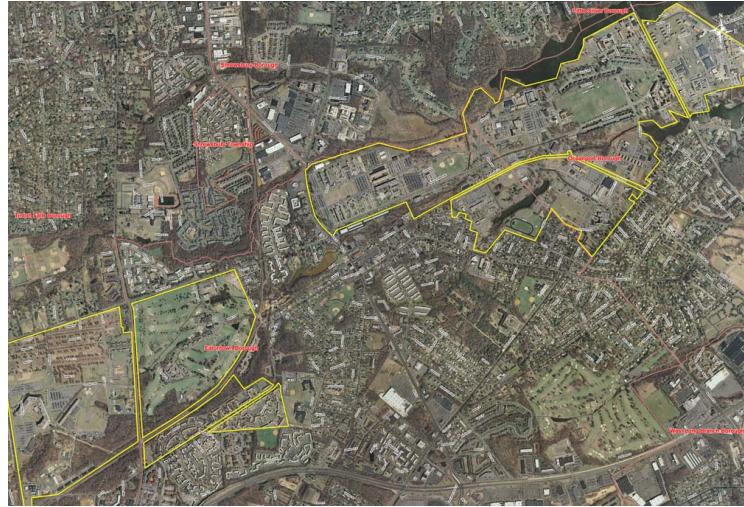
Oceanport, Eatontown and Tinton Falls, NJ

CLIENT:

Various

STRATEGIC PARTNER:

Fort Monmouth Economic Revitalization Authority



In May 2012, Fort Monmouth was transferred from the US Army to the State of New Jersey. Under the Fort Monmouth Economic Revitalization Authority (FMERA), the property will be redeveloped to provide investment, continuity and economic growth opportunities to the communities impacted by the closing of the Fort. Langan's integrated engineering and environmental services have played a key role in FMERA's ongoing projects.

Langan is providing surveying services for the entire 1,100-acre Fort Monmouth site. The survey will be used to convey the property from FMERA to private developers.

NEW JERSEY DOT I-195 MOBILE LIDAR SCANNING

SERVICES:

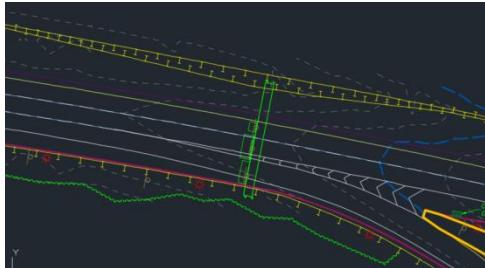
- *Mobile Mapping*
- *Survey Control*
- *3D Modeling*
- *Feature Extraction*
- *Drafting*

LOCATION:

I-195 Central NJ

CLIENT:

New Jersey DOT



Langan utilized our Leica Pegasus 2 Mobile Mapping System to collect high density ground based LiDAR on I195 in New Jersey for a topographic and structure mapping project. The collected LiDAR Data was registered to 80 survey ground control points set by traditional survey means. The registered LiDAR point clouds were then used as the base for the topographic mapping of 35 overhead sign structures located on I195.

The 3D point cloud was imported into Certainty 3D's TopoDOT software suite that runs inside of Bentley's Microstation. TopoDot was used to extract topographic and planimetric features from the point cloud. Microstation DGN files and 3D surfaces were created for each structure location (300' before and after).

CENTRAL AVENUE LASER SCANNING FAÇADE SURVEY

SERVICES:

- Survey Services
- 3D Laser Scanning

LOCATION:

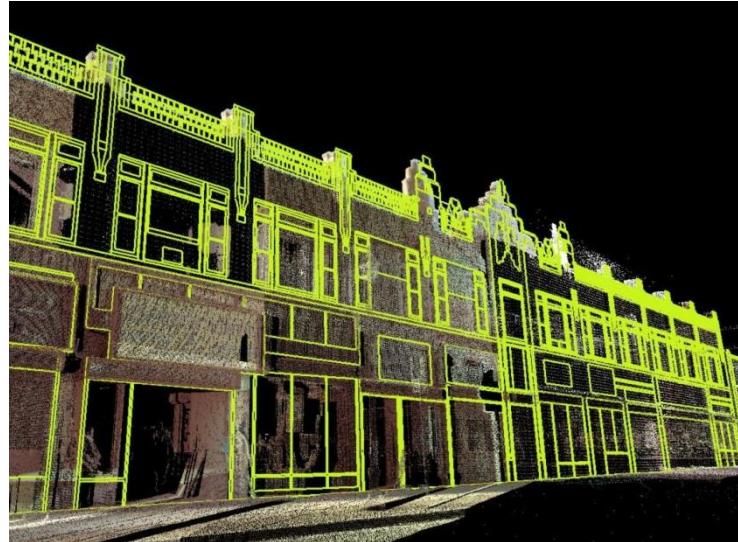
East Orange, New Jersey

CLIENT:

City of East Orange

ARCHITECT:

The Edgecombe Group

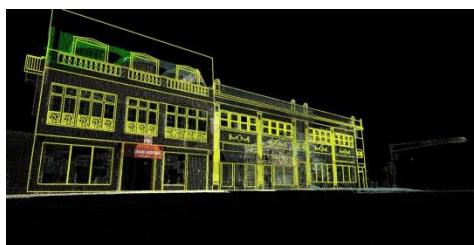


This project involved the documentation of the facades of historic buildings located along Central Avenue in downtown East Orange, NJ.

Langan surveyors provided both traditional and 3D laser scanning services in support of the project. The use of 3D Laser scanning made it possible to capture the many fine details of the structures.

The deliverables included building elevations, which were used for presentation purposes to the City of East Orange and for future redevelopment planning. The scans will also provide permanent documentation of all the structures as they existed at the time of the survey.

Laser scanning also provided a cost effective means of adding information to the elevation drawings. Any additional detail of the buildings that was needed after the initial submission was obtained from the 3D data without the need for additional field visits.



UNITED NATIONS MASTER PLANNING SURVEY

SERVICES:

- *Boundary Survey*
- *Topographic Survey*
- *Utility Survey*

LOCATION:

*The United Nations
New York, New York*

CLIENT:

The United Nations



Langan completed an accurate boundary, topographic, utility master planning survey of the perimeter of the United Nations Secretariat complex in preparation for the installation of a new security fence. In addition, the survey will be used as a base map for future site development.

The survey included the surface area of the headquarters and the adjacent roadways to the adjoining building facades. This survey was completed using an innovative combination of both on-ground survey technologies and GPS technologies. Langan provided full 3-D CADD files to the project team to allow for ease of future 3-D design.

MADISON SQUARE GARDEN

SERVICES:

- *3D Laser Scanning*
- *CADD Modeling*

LOCATION:

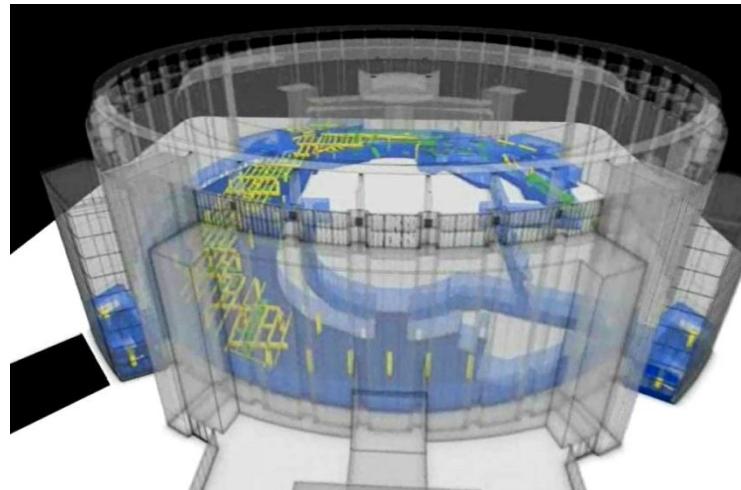
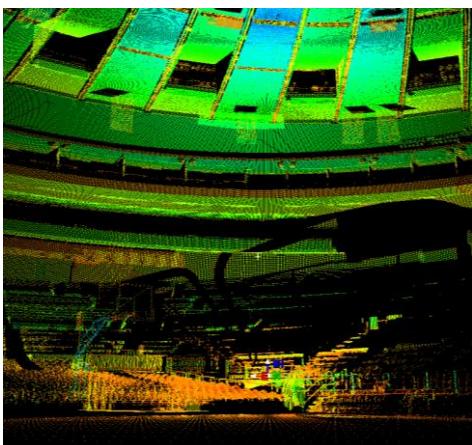
New York, New York

OWNER:

Madison Square Garden, Inc.

CLIENT:

Turner Construction Company



Langan provided 3D laser scanning surveying services in support of renovations at the 21,000 SF Madison Square Garden (MSG) arena in New York City.

Langan's survey technicians utilized a combination of 3D Laser Scanning technology and 'traditional' surveying methods in order to complete the surveying tasks, including "floor to ceiling" 3D Laser Scanning of the entire arena "bowl" and concourse areas. Utility areas above the ceiling and selected backstage areas were also scanned, including the sport locker rooms, star dressing rooms and staging areas. After completion of the field scans, the images were then combined to form a single registered point cloud which was then used in the creation of 3D CAD drawings. The deliverables for this project included 3D models, traditional 2D floor plans and point cloud flythroughs. The needs of the client determined the most appropriate delivery method.

Challenges included working around the schedule of the many events taking place at this very active arena, and keeping clear of the normal day-to-day operations taking between events.

Without the use of Langan's laser scanning services, it is doubtful that the interaction between the various levels and spaces within the arena could be fully understood. As renovations continue at MSG, identification of utilities above the area's ceiling have significantly added to the value of this project.

FT TOTTEN DRONE MAPPING

SERVICES:

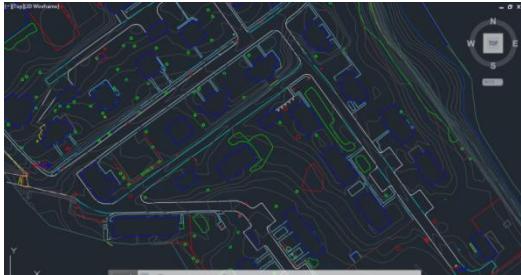
- *Drone Mapping*
- *Survey Control*
- *3D Modeling*
- *Feature Extraction*
- *Drafting*

LOCATION:

New York, New York

CLIENT:

Smith-Miller & Hawkins, Architects



Langan utilized our Unmanned Aerial System (UAS) to acquire color aerial photography to create planimetric and topographic mapping at a scale of 1"=50', with 1' contour intervals. In order to produce mapping and surveying grade data products with the verifiable positional accuracy, 9 ground control targets were placed within the boundaries of the project area. Utilizing the 9 ground control points acquired for this project Langan performed an aerial triangulation process to generate interior and exterior photo parameters for the accurate horizontal and vertical placement of the aerial imagery within the project coordinate system. From the properly oriented imagery a Digital Surface Model (DSM) was generated and delivered as well as a 3D point cloud. A digital orthophoto mosaic with a 1" Ground Sample Distance (GSD) was also produced.

The 3D point cloud was classified for ground and non-ground features. Non-ground features such as vegetation, vehicles, equipment or buildings were classified as non-ground and not included in the bare-earth surface model. Contour data generated to support a 1' topographic interval contained spot elevations extracted from the surface model as required. All planimetric features relating to a 1"=50' map scale were digitized and classified to their respective digital feature classes.

SERVICES:

- *3D Laser Scanning*
- *Topographic Survey*
- *Boundary Survey*
- *Utility Survey*

LOCATION:

New York, New York

CLIENT:

H. Thomas O'Hara Architect, PLLC



Langan's survey group provided its full suite of surveying services for existing conditions mapping of this site. The acquisition of survey data was difficult, as the existing building was constructed on a platform above the active Amtrak Empire rail line. Langan provided boundary, topographic and utility surveys of the site for use in planning and design. Langan also scanned the existing conditions of the area below the platform, including the Amtrak rail line and all of the structural elements relating to the platform.

Deliverables on the project were 3D CAD files of the entire site, from the rails to the building roof. A point cloud database was also maintained on Langan's servers, and this data has been revisited multiple times to extract additional data for the client without costly extra visits to the site and rail closures.



AMERICAN MUSEUM OF NATURAL HISTORY

SERVICES:

- Survey Services
- 3D Laser Scanning

LOCATION:

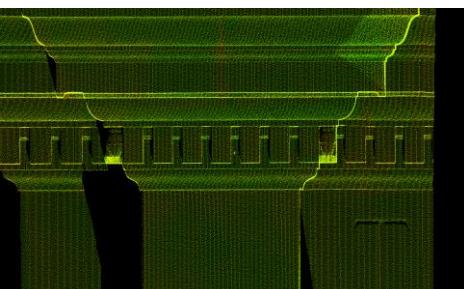
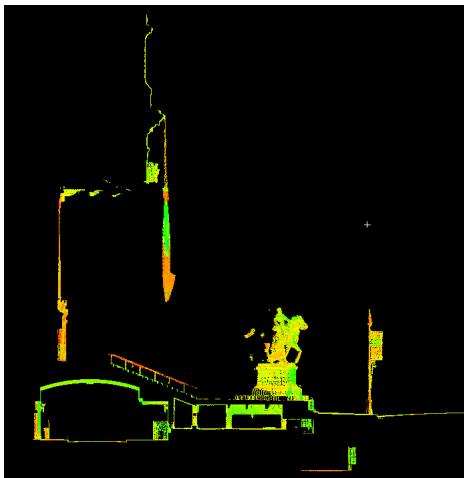
New York, New York

CLIENT:

American Museum of Natural History

ARCHITECT:

Dinkerloo Architects



This project at the Roosevelt Memorial entrance of the American Museum of Natural History is located on the Central Park West side of the museum. The work done by Langan's work was related to the planned construction of new entry pavilions to the north and south of the existing entrance stairs.

Langan surveyors provided both traditional and 3D Laser Scanning services in support of this project. These combination of services were utilized to gather multiple levels of information that impact the entrance, entrance stairs, and column-supported portico. We also addressed subsurface features including a vault beneath the stairs, subway entranceways and station.

The deliverables on this project included traditional plan views of the area on multiple levels, as well as cross sectional views. The way the 3D Laser Scanner stitches the information together allowed these views to come together in a very visual and easy to understand way. Additional details in areas which were important to the architect for their design were able to be given with minimal delays and with no further field visits.

NEW YORK JETS STADIUM

SERVICES:

- Geotechnical Consulting
- Schematic Foundation Design
- Environmental Consulting
- Site/Civil/Infrastructure Design Consulting
- Survey
 - Boundary
 - Topographic
 - Utility
 - Tunnel



LOCATION:

West Side Rail Yards
New York, New York

CLIENT:

New York Jets

Langan was retained by the New York Jets to provide survey, geotechnical, site/civil and environmental engineering consulting services during the schematic design phase of the proposed new Jets Stadium. The stadium is to be constructed over the existing Long Island Railroad Westside Yards on the west side of Manhattan. Langan gathered historic geotechnical and civil engineering information from various sources including in-house archives and governmental agencies.

Of particular importance was Langan's extensive in-house test boring records from past investigations in the vicinity of the project. Using this information, Langan assisted the design team in developing realistic foundation designs able to withstand the large axial and lateral loads from the stadium, while preventing loads from being transmitted to the existing rails per LIRR requirements.

Langan also gathered available utility information from various sources including ConEdison and the New York City Department of Environmental Protection. This information highlighted the need to include a significant cost estimate for relocating and upsizing numerous existing utilities to accommodate the desired structure and user demands.

Langan assisted in interviewing local foundation contractors to obtain input regarding constructability issues, materials, and logistics. This information was critical to assessing the premium costs that will be incurred during construction due to the necessity of keeping the existing rails active throughout the construction schedule.

During the design phase Langan's survey group prepared full 3D boundary, topographic, utility and tunnel surveys. As utility and existing track clearance and location were critical to the final design, the survey team worked closely with other members of the team to obtain detailed existing conditions. This included pre-staking the proposed foundation locations and providing exact dimensions to critical features. To obtain accurate utility locations and depths, Langan subcontracted a utility location firm who staked-out each utility line, which were then field located by our survey crew. In total, our survey teams obtained over 40,000 field located points throughout the project limits, providing the design team with an accurate set of plans and supporting digital 3D-model of the site.

PORT AUTHORITY LINCOLN TUNNEL MOBILE LIDAR SCANNING

SERVICES:

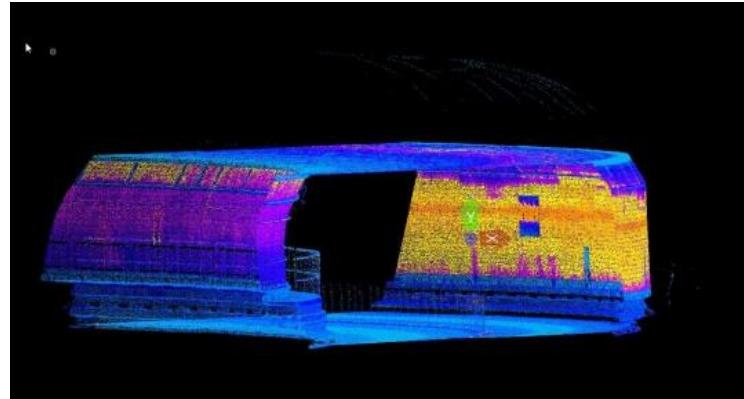
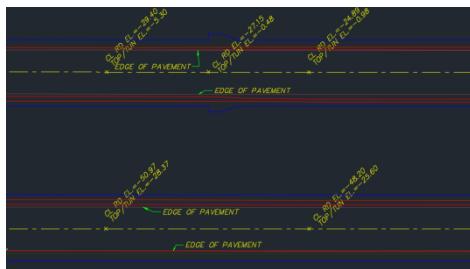
- *Mobile Mapping*
- *Survey Control*
- *3D Modeling*
- *Feature Extraction*
- *Drafting*

LOCATION:

New York, New York

CLIENT:

Port Authority NYNJ



Langan utilized our Leica Pegasus 2 Mobile Mapping System to collect high density ground based LiDAR within all three tubes of the Lincoln Tunnel for a Topographic and Tunnel Mapping Project. The collected LiDAR Data was registered to 100 survey ground control points set by traditional survey means along the centerlines of the tunnel tubes. The registered LiDAR point clouds were then used as the base for the topographic and tunnel mapping.

Langan imported the 3D point cloud into Certainty 3D's TopoDOT software suite that runs inside of Bentley's Microstation. We then used TopoDot to extract topographic and planimetric features from the point cloud and created Microstation DGN files for each tunnel tube (north, center, south) and the helix entrance.

HISTORIC 'TIN' BUILDING AT SOUTH STREET SEAPORT

SERVICES:

- Survey Services
- 3D Laser Scanning

LOCATION:

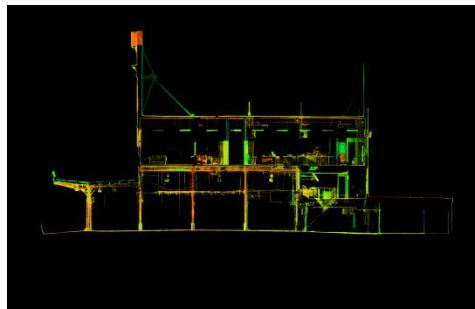
New York, New York

CLIENT:

General Growth Properties

ARCHITECT:

SHoP Architects PC



This project involved the documentation of the historic 'TIN' building which is located at South Street Seaport along the East River in Manhattan. The work done by Langan was related to the planned relocation of this building to another site at the seaport. The building itself dates back to the early 1900's.

Langan surveyors provided both traditional and 3D Laser Scanning services in support of the project. The combination of the two types of surveying allowed drawings to be generated in a much more cost effective and timely manner than would be possible otherwise. The use of 3D Laser Scanning made it possible to capture the many fine details of this structure.

The deliverables for this project included detailed 2D and 3D AutoCAD drawings of the both the exterior and interior building elevations, floor plan views and cross sections, which were used for presentation to the NYC Landmarks Commission. A light weight 3D poly-line model of the building was also completed. The scans will provide permanent documentation of the structure as it existed at the time of the survey.

JAMES FARLEY POST OFFICE/ PENNSYLVANIA STATION REDEVELOPMENT

SERVICES:

- *3D Laser Scanning*
- *Boundary Survey*
- *Topographic Survey*
- *Modeling*
- *Tunnel Survey/Scanning*
- *Rail Survey/Scanning*

LOCATION:

New York, New York



As the surveyor of record for this major redevelopment of one of New York City's most recognizable buildings, Langan's surveying group provided a full suite of surveying services. Langan's work began with a street level detailed boundary, topographic and utility survey that was used by the project team as the base mapping for the projects site and utility designs.

As the design team developed their plans the focus began to shift to the lower levels of the building's structure and to the rail beds that traversed the site. The team provided Langan with the additional challenge of providing detailed and highly accurate mapping of the rail system and of its associated facilities and structures.

Langan employed a combination of standard survey techniques and state of the art 3D Laser Scanning. This solution produced the required mapping results without the need for extensive rail closures and without placing surveyors in harm's way of the track system. An added benefit is that this solution allowed the survey team to create a dimensionally correct 3D model (point cloud) of the entire subsurface survey area. This model was then used to allow the team to revisit the sites details without having to go to the field.

To date the survey team has updated the existing conditions data from the completed laser scan files and has never made an additional field visit.

MUSEUM OF ART AND DESIGN

SERVICES:

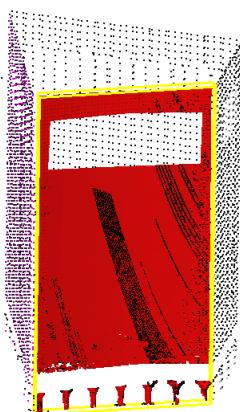
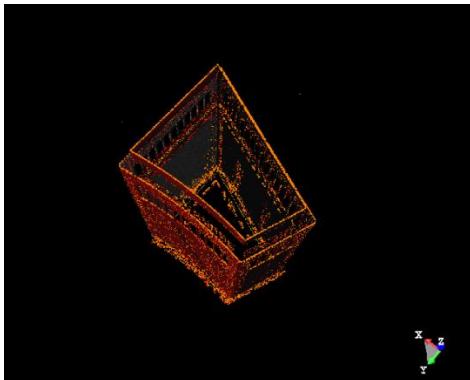
- *Boundary Survey*
- *Topographic Survey*
- *3D Laser Scanning*
- *Modeling*
- *Construction Stake-Out*

LOCATION:

New York, New York

CLIENT:

Allied Works
FJ Sciame Construction



Langans surveying department provided 3D Laser Scanning services of the exterior of the new home for the NYC-based Museum of Art and Design. Located at the famous Columbus Circle the redesign of this highly known structure was vital to the Museum futures. A full exterior laser scan of the building facades was performed, as well as a control survey for the accurate merge of the laser scan “point clouds.” The building was scanned with and without the existing panel system in place. Detailed elevations and cross sections of the building were produced from the scan data for the coordination of the new exterior skin of the building and the sites boundary.

Deliverables on the project were detailed 2D AutoCAD drawings of the building elevations with offset distances to the site boundary. These offsets were used by the design team to back calculate the thickness of each panel and the length of each hanging bracket.

MEMORIAL SLOAN-KETTERING CANCER CENTER CYCLOTRON

SERVICES:

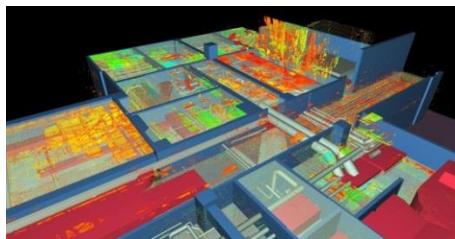
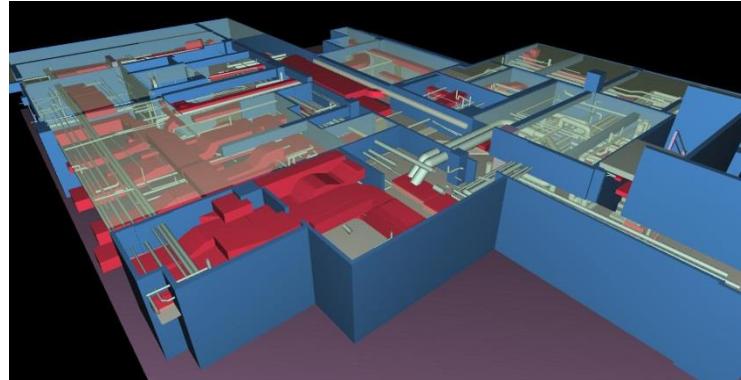
- *3D Laser Scanning*
- *Surveying*
- *3D Modeling*

LOCATION:

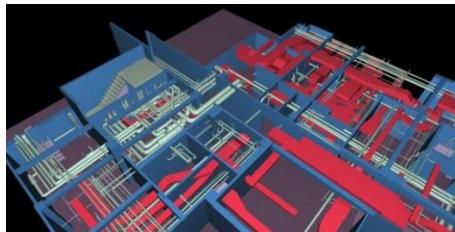
Memorial Sloan-Kettering Cancer Center, New York, New York

CLIENT:

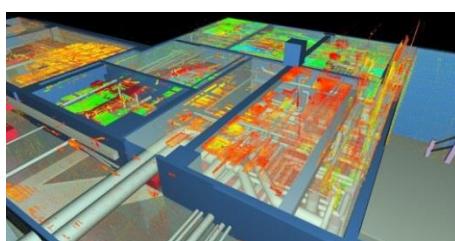
Memorial Sloan-Kettering Cancer Center



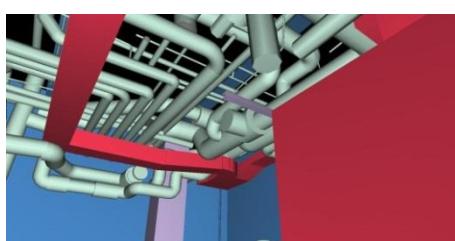
Scan data with modeling



Model



Scan data with modeling



Model

Langan provided a complete 3D model of the spaces which will house the new cyclotron in the basement of the Schwartz Research Building. Langan employed the use of 3D High Definition Laser Scanning to capture the complex features within the space. Since the area is not easily accessible part of the scan work involved scanning and surveying the path which the new equipment would need to take in order to reach its final installation area. This included portion of the roof and a large ventshaft. All of these areas needed to be tied together accurately which requires surveying expertise.

Once all the laser scan data was gathered it was combined with our survey information to provide an accurate base from which the model was generated. The final 3D model includes all accessible structural elements, electrical conduits, gas and oxygen lines, HVAC ductwork, fire protection piping, wall surfaces and other utility items that were visible to the scanner.

This 3D model was merged with Building Information Model (BIM) for utility design, space planning and clash detection.

Deliverables on the project were detailed 3D AutoCAD drawings of the interior space.

LANGAN

MUSEUM OF MODERN ART

SERVICES:

- Survey Services
- 3D Laser Scanning

LOCATION:

New York, New York

CLIENT:

Museum of Modern Art

ARCHITECT:

Gensler



Located in Midtown Manhattan, the Museum of Modern Art (MoMA) is often identified as one of the largest and most influential modern art museums in the world. As part of its expansion project, Langan provided surveying, laser scanning, and modeling services to accurately record the existing configuration and layout of the museum's interior and exterior space.

The base scope of work included a partial interior and exterior scan of the building for coordination with the design models being prepared for the expansion. Highly accurate survey control was used for the scan registrations to provide point clouds and existing conditions models that were suitable for construction design.

Langan's surveying team has also been back to the museum several times to provide laser scanning documentation of additional spaces, such as the MoMA theaters. Deliverables included point clouds and basic Revit models that can be provided to artists for use in their art design for the spaces.

SERVICES:

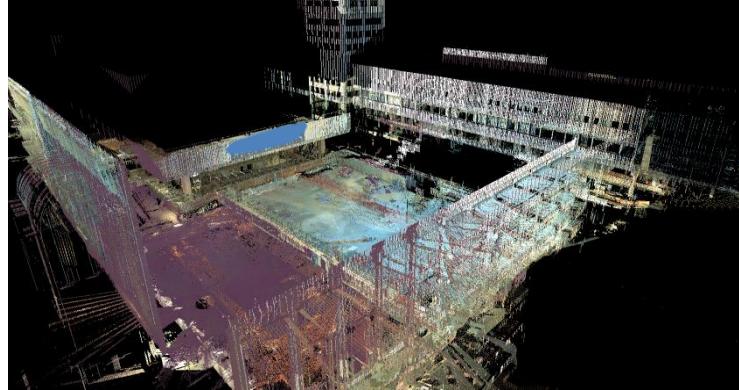
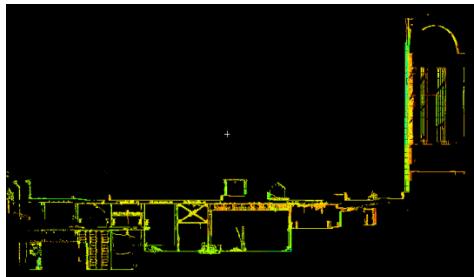
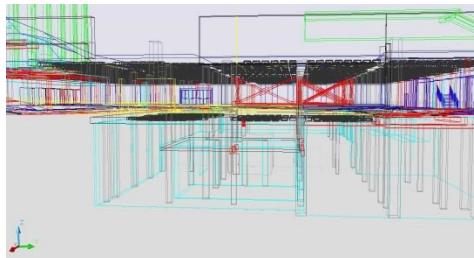
- *3D Laser Scanning*
- *Modeling*

LOCATION:

New York, New York

CLIENT:

Confidential



Langan was charged with providing a complete 3D Laser Scan and conflict model of the surface and sub-basement levels of this arts related complex. This data was intended to be merged with a BIM model of a proposed addition that was being completed by other members of the project team.

All of Langan's scan data and models were referenced to the existing on-site survey control that had been established by the existing site surveyor. This allowed the new data to fall in the correct location relative to the existing survey and proposed structures. In addition we provided point verification within the point cloud for quality control issues.

Deliverables on the project were detailed 3D AutoCAD drawings of the both the exterior and interior of the various levels, elevations, and cross sections. A light weight 3D polyline model and video fly thru of the scanned complex was completed.

ST. PATRICK'S CATHEDRAL

SERVICES:

- Surveying
- 3D Laser Scanning

LOCATION:

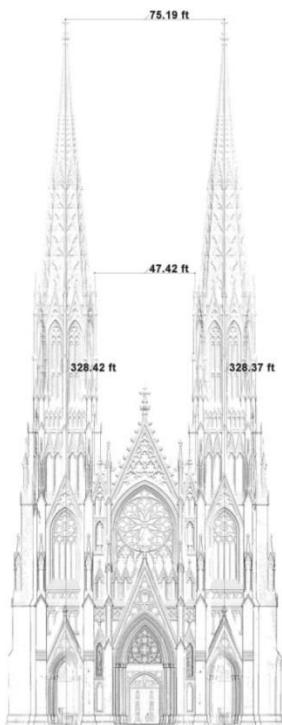
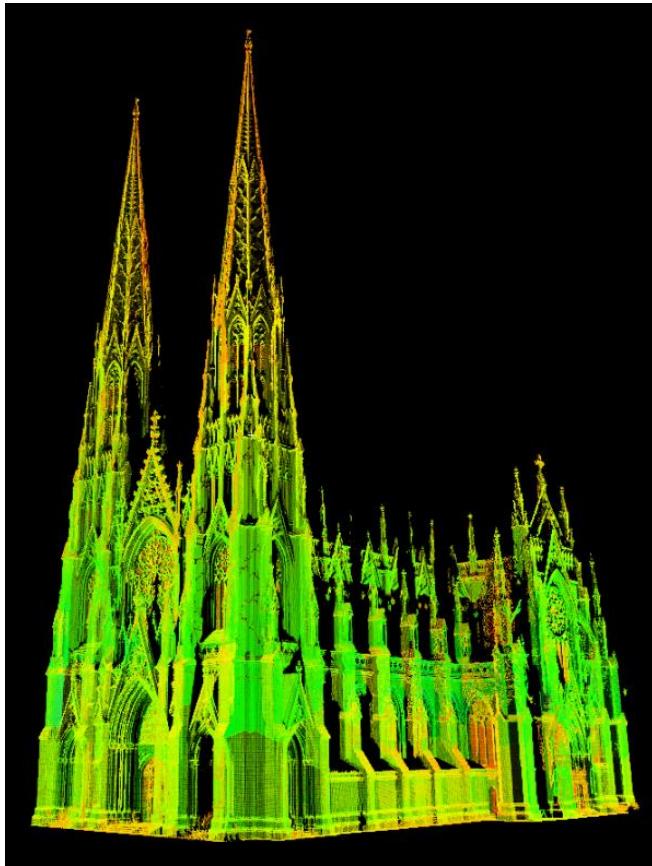
New York, New York

CLIENT:

Building Conservation Associates

AWARDS:

- 2017 ACEC Engineering Excellence, Honor Award
2017 ACEC NY Engineering Excellence, Diamond Award
2016 ENR New York Best Projects Awards: Cultural/Worship
2016 AIA New York Design Awards: Merit Award
2016 MASterworks Awards: Best Restoration



Langan's surveying department provided surveying and 3D Laser Scanning services at St. Patrick's Cathedral in support of restoration work on the Cathedral's exterior. An exterior 3D laser scan of the building facades was performed for use in preparation of building elevations. Detailed elevations and cross sections of the building were produced from orthorectified images derived from the scanner software. A traditional topographic, boundary, and utility survey was also performed for the site.

Deliverables on the project were detailed 2D AutoCAD files of the building elevations. The AutoCAD files contained a "mosaic" of jpeg images that were used to trace 2D elevations of the Cathedral. An added benefit to the project is a 3D point model of the building, which is stored in Langan's digital archives for use whenever the site needs to be revisited, or when additional data on the elevations is required. This avoids costly additional field work when new information is required.

NEEDLE AND BUTTON SCULPTURE

SERVICES:

- *3D Laser Scanning*

LOCATION:

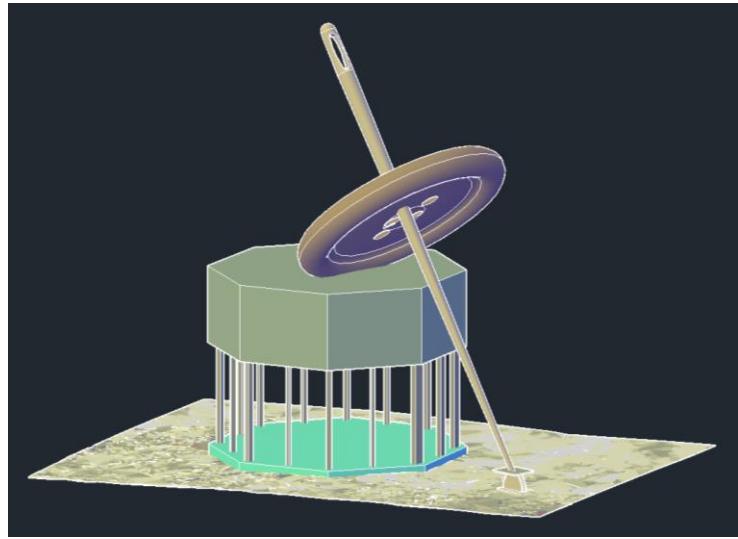
New York, New York

OWNER:

Garment District Alliance

DESIGNER:

Hugh Cosman



The sculpture, which is part of a Fashion Center information kiosk, is located within Manhattan's Garment District at 7th Avenue and 39th Street. Designed in the 1990s, the sculpture's needle is 31-feet long with a 14-foot wide button.

Langan's survey crew documented this iconic sculpture by providing both traditional and 3D laser scanning services. The combination of the two types of surveying allowed drawings to be generated in a cost effective and timely manner.

Deliverables for this project included detailed 2D and 3D AutoCAD drawings. A detailed 3D point model of the structure, which is stored in Langan's digital archives, could be referenced should the site need to be revisited. This avoids costly additional field work when new information is required.

SERVICES:

- *Master Planning Site Improvements*
- *Geotechnical Engineering*
- *Evaluation of Historic Seawall*
- *Feasibility Study*
- *Environmental Assessment*
- *Surveying Services*

LOCATION:

Staten Island, New York

CLIENT:

U.S. National Park Service



Langan provided master planning and restoration design of the Fort Wadsworth Naval Base to a National Park. Our services included master planning of site improvements, geotechnical engineering, evaluation of historic seawall and pier restoration; a feasibility study for potential ferry service from Manhattan to Fort Wadsworth, environmental assessment of lead-based paint and asbestos within historic stone fort and miscellaneous buildings; review of regulatory issues as they relate to Phase I development, and future development plans.

Langan prepared construction documents and specifications for Phase I improvements which included reconstruction of roads, parking areas, lead-based paint and asbestos abatement, and wayside exhibits.

BROOKLYN NAVY YARD MOBILE LIDAR COLLECTION AND MAPPING

SERVICES:

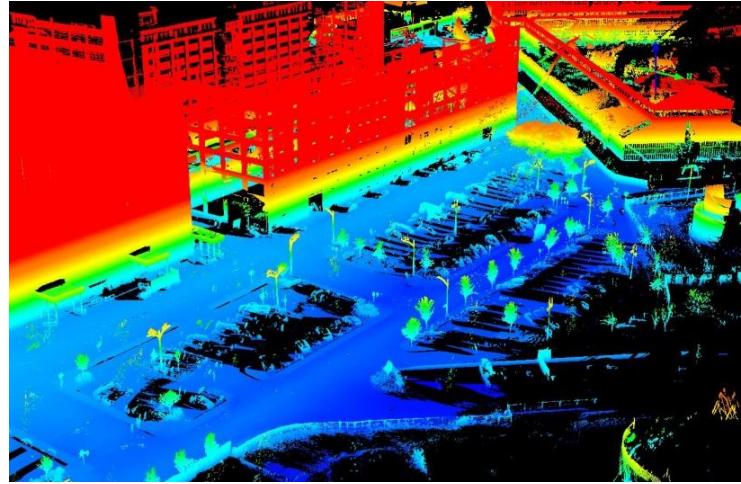
- *Mobile Mapping*
- *Video Logging*
- *Feature Extraction and Attribution*
- *Topographic Mapping*

LOCATION:

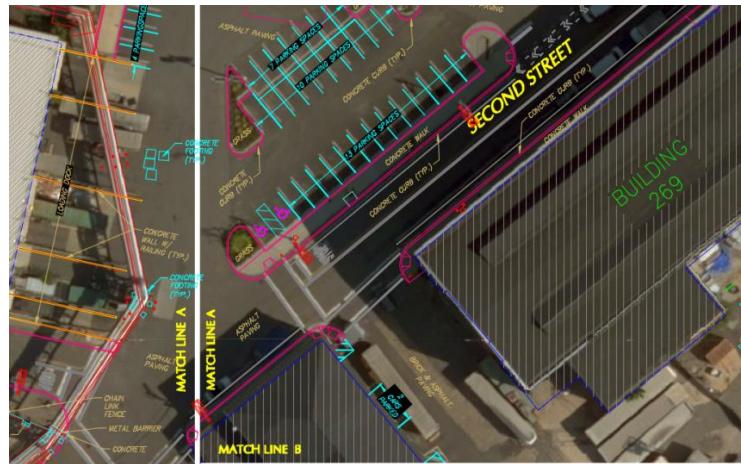
Brooklyn, New York

CLIENT:

Boston Properties



Langan provided mobile LiDAR data collection, feature extraction, and mapping services for the Brooklyn Navy Yards (BNY). We deployed our Pegasus Mobile Mapping System within BNY and collected integrated video logging and LiDAR data for the project area. We placed survey control points within the project limits to register the LiDAR and imagery data with. LiDAR and imagery data was survey grade accurate (+/- .02').



LiDAR point clouds were brought into Leica's Map Factory and Cyclone products to extract roadway and vertical features. The list of extracted features included signs, posts, signals, hydrants, valves, manholes, curb, sidewalk, pavement markings, centerlines, poles, overhead wires, building footprints, and storm grates.

All features were attributed and exported to GIS databases as well as into AutoCAD files.

JFK INTERNATIONAL AIRPORT TWA FLIGHT CENTER

SERVICES:

- *3D Laser Scanning*
- *Mobile Mapping*

LOCATION:

Jamaica, New York

OWNER:

*Port Authority of New York and
New Jersey*

STRATEGIC PARTNERS:

*University of Central Florida
Institute for Simulation & Training*

ChronoPoints

AWARD:

*2016 SARA|NY Excellence in Historic
Preservation and Restoration Award*



As part of an effort to preserve this New York City landmark, University of Central Florida's Institute for Simulation and Training called upon Langan surveyors to create a comprehensive 3D laser scan of this historic Flight Center. Langan's scanning process recorded highly detailed digital models that could then be incorporated into educational programming about the structure. We also provided a digital model of the building.

Langan's survey technicians combined 3D laser scanning technology, traditional surveying methods and truck mounted mobile scanning in order to complete the surveying tasks. Our scope included "floor-to-ceiling" 3D laser scanning of the entire TWA center and concourse areas, perimeter roadways, and exterior building facades.

After the completion of field scans, the data was combined to form a single point cloud, which was then used in the creation of 3D CAD and Revit drawings. Future applications may also include 3D models, traditional 2D floor plans, and point cloud fly-through videos.

Langan previously teamed with the USF team on a preservation project for the New York State Pavilion at the 1964 World's Fair grounds in Flushing Meadows, New York.

JFK INTERNATIONAL AIRPORT RUNWAY 13-31

SERVICES:

- *Construction Verification*
- *As-Built Survey*
- *Lighting Survey*
- *Utility Survey*

LOCATION:

Jamaica, New York

CLIENT:

Port Authority of New York and
New Jersey



Our field survey teams are working closely with the PANYNJ to provide verification of existing, pre, and post milled pavement conditions. In addition, the crews are providing field as-built documentation for the final runway condition, lighting, and utility features.

The survey group at Langan is providing construction verification survey services to support the re-construction of runway 13-31 at the Port Authority of New York and New Jersey's JFK airport. The \$375 million 13-31 or the "Bay Runway" project will close the airport's busiest runway for 4 months. This 24-hour, seven-day a week project will widen the nearly three mile long runway from 150 feet to 200 feet. In addition to the widening, this east coast NASA Space Shuttle backup landing runway will be re-milled to provide additional foundation support. The project also includes the reconfiguration of several taxiways and staging area. The entire subsurface utility and surface lighting layouts are also being reconstructed as part of the airport master plan.

SERVICES:

- *Boundary*
- *Aerial Topography*
- *Ground Topography*
- *Utility Builders Pavement Plan*
- *Construction Stake-Out*
- *As-Built*

LOCATION:

Jamaica, Queens, New York

CLIENT:

St. John's University



Langan provided survey support for a matrix of uses at St. John's University. These included the preparation of a master plan base map survey, numerous detailed surveys, utility locations, construction stake-out, and as-built surveys.

Using a unique combination of ground surveying, real-time GPS and aerial mapping, Langan first prepared a master plan survey for the entire 89-acre campus. Utility data was then added by researching St. John's facilities records for design and as-built data. Once a development site was chosen, Langan updated the master plan survey by ground surveying the features within the limits of proposed construction and produced a "for design" survey. This procedure aided in cost reduction and allowed the design team to focus on one area of development while still being concerned about impacting adjoining areas.

NORTH SHORE UNIVERSITY HOSPITAL

SERVICES:

- *Topographic Survey*
- *3D Laser Scanning*
- *Modeling*
- *Interior Floor Plan Survey*

LOCATION:

Manhasset, New York

CLIENT:

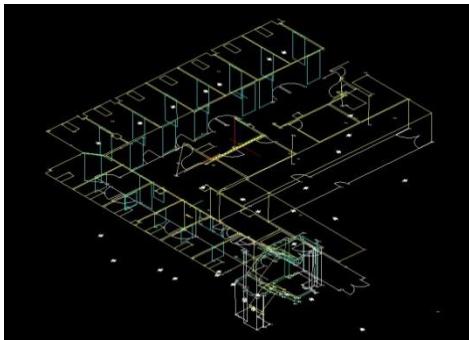
Stantec - Granary Associates

ARCHITECT:

Francis Cauffman Architects



Exterior Point Cloud



Interior Wire Frame Model

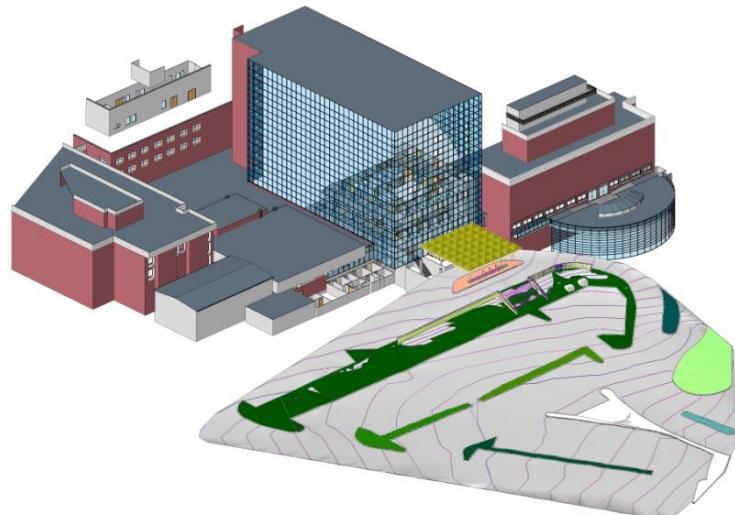


Aerial Photo

Langan provided a full range of surveying services including topographic surveying, laser scanning, floor plan surveys and modeling of the exterior and interior of the North Shore University Hospital. These services were completed to provide a combined model of the interior and exterior of the hospital site. The survey data was combined to create an overall model that would be used by the architectural team to prepare design plans for a proposed addition to the hospital.

A fully adjusted survey control network was established and all exterior and interior survey data was referenced to this control network.

Deliverables on the project were detailed 2D and 3D AutoCAD drawings of both the exterior and interior building elevations, floor plan views and a Revit model.



Model

1964 WORLD'S FAIR NEW YORK STATE PAVILION— FLUSHING MEADOWS-CORONA PARK

SERVICES:

- 3D Laser Scanning
- Surveying
- Modeling Services

LOCATION:

Flushing, New York

OWNER:

*New York City Department of Parks
and Recreation*

STRATEGIC PARTNERS:

*University of Central Florida, Institute of
Simulation & Training*

CyArk



The “space aged” Observation Towers and ‘Tent of Tomorrow’, located in Corona Park, were originally completed for the World’s Fair of 1964-65. Recognized as a National Treasure, the structures have deteriorated to the point of possible removal. A Kickstarter campaign was launched and successfully funded to digitally preserve the historic site in 3D as it appears today, and to help generate estimates for possible revitalization.

Langan’s surveyors provided high definition 3D Laser scanning services (partnered with conventional data capturing methods) to define all interior and exterior spaces of the structures. By visiting multiple locations at the site, our survey teams were able to “stitch” together a complete 3D point cloud that could then produce models that reveal minuscule details of the existing buildings.

Deliverables included Finite Element Analysis compatible models for interior and exterior scans of the pavilion structures to obtain accurate wall thicknesses. Our study saved the client both money and time by eliminating the need for multiple site visits.

KINGSBRIDGE NATIONAL ICE CENTER

SERVICES:

- *3D Laser Scanning*
- *Revit Modeling*
- *Topographic and Utility Survey*

LOCATION:

Bronx, New York

CLIENT:

Kingsbridge National Ice Center Properties, LP

ARCHITECTS:

*BBB Architects, Ottawa
SCI Architects*

STRATEGIC PARTNERS:

*STV
Severud
Vidaris, Inc.
M-E Engineers*



The majority of the 750,000 GSF site is currently occupied by the historic Kingsbridge Armory building. Built by the city between 1912 and 1917, the landmark armory once served as one of the largest indoor training facilities in the world.

The redevelopment includes conversion of the Armory's interior into a national ice rink facility with below-grade parking. Nine ice rinks will be constructed within the shell of the armory, including a main, ground-level rink with 5,000 seats. Additional ice rinks will be constructed on both the ground level and mezzanine. Vehicle access ramps run to cellar parking garages. Loading docks will span between the building and existing street infrastructure.

The Langan survey group performed High-Definition 3D Laser Scans throughout the interior and exterior of the facility. This point cloud data was then used as the base for an Existing Conditions Model completed in Revit and delivered to the design team. In addition, Langan performed a traditional topographic and utility survey of the grounds for use in site design followed by precise hand measurements of the curved roof trusses for structural analysis.

All survey data was provided in a project specific horizontal datum and included ties to the New York East State Plane Coordinate system. Elevations were provided in NAVD 1988 as required by the City of New York. Langan's prior services on-site also include environmental and geotechnical investigations.



HUNTERS POINT MOBILE LIDAR COLLECTION AND MAPPING

SERVICES:

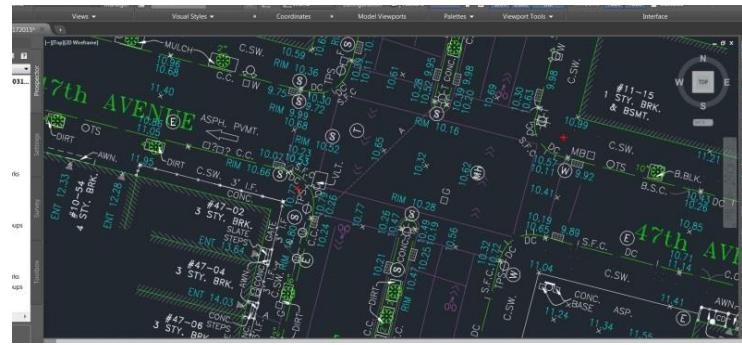
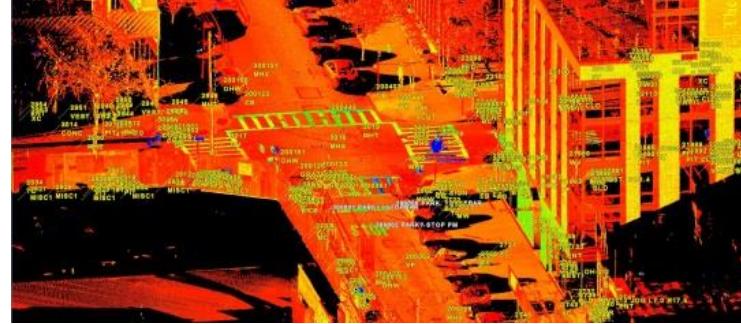
- *Mobile Mapping*
- *Video Logging*
- *Feature Extraction and Attribution*
- *Topographic Mapping*
- *Geospatial Data Integration*

LOCATION:

Long Island City, New York

CLIENT:

New York City Department of Design
and Construction



Langان provided mobile LiDAR data collection, feature extraction, and mapping for the Hunters Point region of Queens. We deployed our Pegasus Mobile Mapping System and collected integrated video logging and LiDAR data for the project area. We placed survey control points within the project limits to register the LiDAR and imagery data with. Langان's LiDAR and imagery data was survey grade accurate (+/- .02').

Langان LiDAR point clouds were brought into Leica's Map Factory and Cyclone products to extract roadway and vertical features. The list of extracted features included signs, posts, signals, hydrants, valves, manholes, curb, sidewalk, pavement markings, centerlines, poles, overhead wires, building footprints, and storm grates.

All features were attributed and exported to GIS databases as well as into AutoCAD files.

NORTH SHORE-LIJ SOUTHSIDE HOSPITAL

SERVICES:

- *3D Laser Scanning*
- *Modeling*
- *Interior Floor Plan Survey*

LOCATION:

Bay Shore, New York

CLIENT:

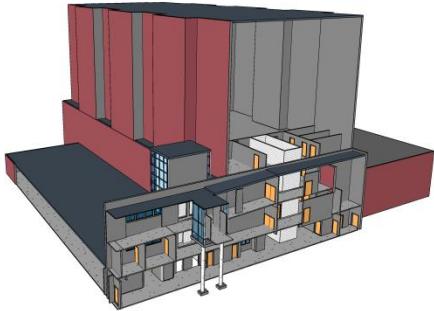
Northwell Health (North Shore-LIJ)

ARCHITECT:

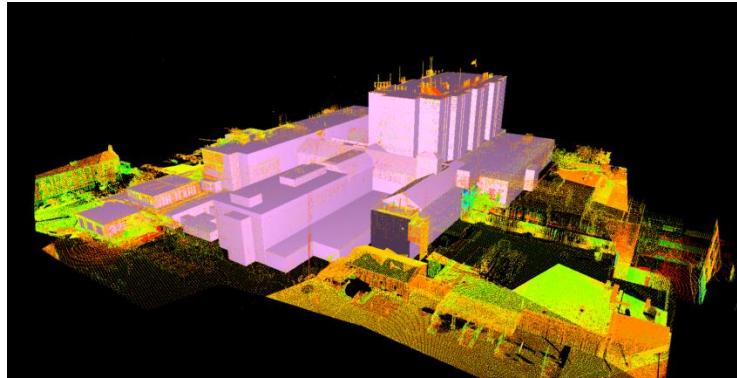
Francis Cauffman Architects



Field Scan



Cross Section through Building



Model and Point Cloud

Langan provided laser scanning and modeling of the exterior and interior of the Northwell Health Southside Hospital. The data was utilized to provide base 3D documentation of the existing building conditions for the design of an addition and for the creation of demolition plans.

The laser scan and model were tied into existing site horizontal and vertical datums utilizing traditional surveying methods. Deliverables included 2D floor plans and a Revit model of the exterior facades of the buildings to remain. Interior models were also provided for the rooms and corridors along the perimeter of the buildings, which were used to facilitate connections from the newly designed addition into the existing buildings.



Model

SERVICES:

- *Boundary Surveys*
- *Topographic Surveys*
 - *Aerial*
 - *Ground*
- *ALTA/ACSM Land Title Surveys*
- *Utility Surveys*
- *Bulk Parcel Plans*
- *Major Subdivision Plans*
- *Easement Plans*
- *Roadway Surveys*
- *Wetlands Surveys*
- *Financing Surveys*
- *Preliminary Stakeout Surveys*

LOCATION:

Tuxedo, New York

CLIENT:

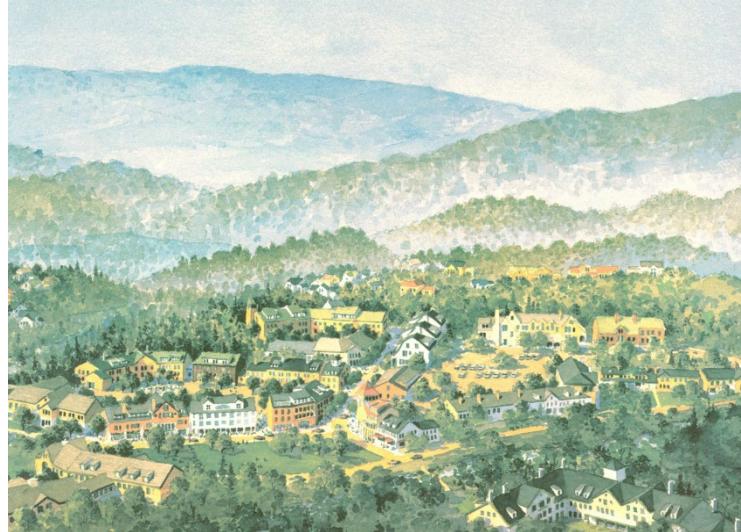
R-H Tuxedo Development, LP



**TUXEDO
RESERVE**
*"We have conceived
Tuxedo Reserve in
the spirit of the towns
of the Ramapo*

*Mountains and the Hudson Valley,
where the streets and houses work
with the terrain rather than against it
and main streets anchor the
center. Our goal is to foster a
sympathetic community of
architecturally appropriate buildings in
nature, nestled into the valleys of the
site, leaving the ridges and peaks
protected and forever undeveloped."*

-- Robert A.M. Stern



As part of a multi-disciplinary design team Langan has completed numerous survey tasks. Beginning in the 1980's with preliminary planning surveys which were used for conceptual design of this distinctive planned development, and continuing with full design quality site surveys, our survey group has become a vital part of the design effort. Combining traditional on-ground based survey procedures with state-of-the-art real-time GPS technologies, Langan has provided the design team with surveying solutions to fit the requirements of this unique project.

The planned development comprises three tracts totaling approximately 2,250 acres. With only an approximate 19 percent of the acreage being used, this project combines development, a traditional Hudson Village setting, and conservation principles. The final build-out is planned to include 1,195 residential units, 33,000 square feet of retail space, 65,000 square feet of recreational space, a 5,000-square-foot library, and a 40-acre school. The site will also include approximately 1,900 acres of green space.

NEW YORK CITY ECONOMIC DEVELOPMENT CORPORATION – ON-CALL LAND SURVEYING

SERVICES:

- *Topographical, Boundary, and Utility Surveying*
- *Agency Meetings*

LOCATION:

Five Boroughs of New York City

CLIENT:

New York City Economic Development Corporation (NYCEDC)



Langان is providing services for a surveying on-call contract with NYCEDC. Our work supports the agency's goal of promoting economic growth and improving the quality of lives for residents living in the five boroughs of New York City.

Our surveying scope includes boundary, topographical, and utility surveys, wetland location, preparation of all graphic materials needed for Uniform Land Use Review Procedure applications, and meetings with the NYCEDC.

Langان navigated numerous challenges while performing surveying services under this contract including varied site conditions, pedestrian and vehicular traffic, ongoing construction, and coordination with various public agencies and private properties.

Select projects include:

The Christopher School

Langان provided survey services for this location in the Bronx including detailed topographic, utility and boundary surveys.

CUNY Hunter MFA Building (455 West 40th Street)

Langان was authorized to perform survey services for this location in Manhattan, including a boundary survey of the parcel and on-site features.

FOXWOODS RESORT CASINO

SERVICES:

- *3D Laser Scanning*
- *Information Modeling*

LOCATION:

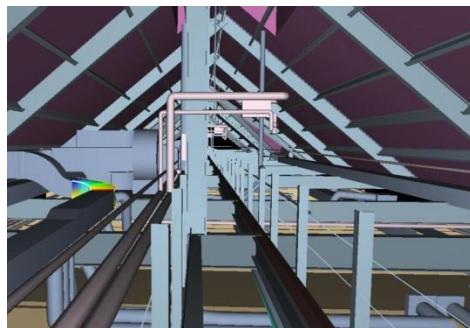
Foxwoods Great Cedar Hotel
Mashantucket, Connecticut

CLIENT:

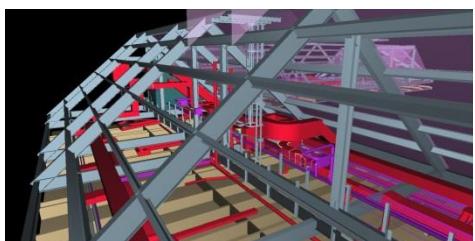
Standard Builders



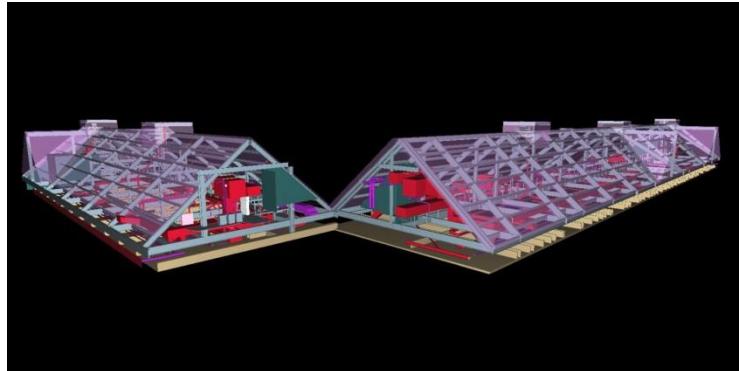
Photo



Model



Model



Foxwoods Resort Casino is the second largest hotel casino complex in the United States with an area of approximately 4,700,000 SF. The casino areas (approximately 340,000 SF) have over 380 gaming tables for blackjack, craps, roulette, and poker, more than 6,300 slot machines and several restaurants. The complex has 2,266 hotel rooms and a two-story arcade for children and teens.

Langان was tasked with providing a complete 3D model of the 8th floor ceiling/attic space of the hotel building. The generated model is to be used as part of a larger effort to correct specific code remediation issues. This 3D model was merged with a Building Information Model (BIM) for utility design and clash detection. Langان employed the use of 3D High-Definition Laser Scanning to capture the complex features within the space.

The scan data was reduced into the final 3D model which includes all accessible structural steel, access walkways and ladders, HVAC ductwork, fire protection piping, wall surfaces and other utility conduits that were visible to the scanner.

Deliverables on the project were detailed 3D AutoCAD drawings of the interior space. A video fly through of the scanned space was also provided.



SERVICES:

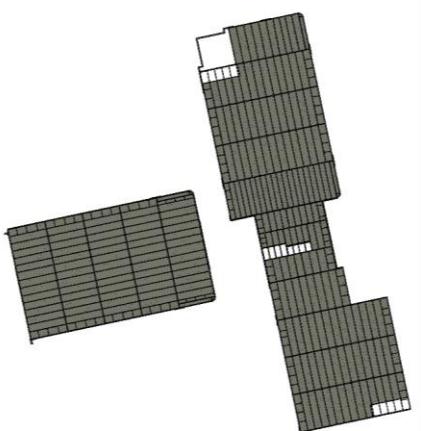
- *Laser Scanning*
- *3D Modeling*

LOCATION:

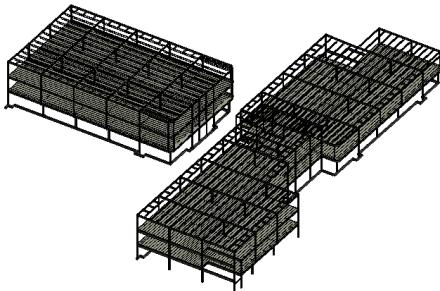
*Capitol Region Education Council
Windsor, Connecticut*

CLIENT:

*O&G Industries
112 Wall Street
Torrington, CT 06790*

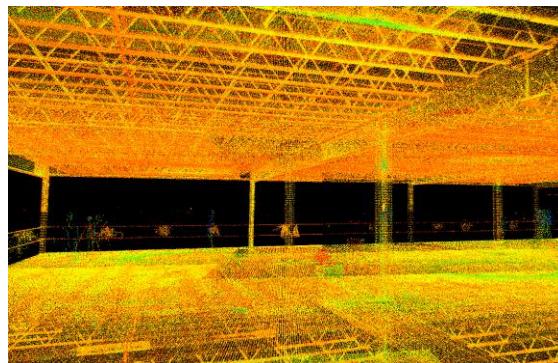


Revit Top View



Revit 3-D View

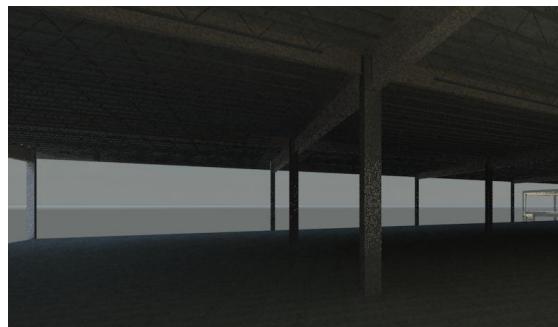
Langan's Surveying Department provided surveying and laser scanning services for the new Capitol Region Education Council (CREC) Aerospace School. The building is a steel structure approximately ____ years old. The building envelope was demolished leaving the structural skeleton. The client wanted a 3-D base model that could be used for the design of the school.



Scan Data from Cyclone by Leica Geosystems



TruView by Leica Geosystems



3-D Revit Model

The laser scan data was transformed into a final 3-D model which includes all accessible structural steel beams, columns, open-web joists, floor slabs, pipes, and foundation walls. The final deliverable was a Building Information Model (BIM) with a level of development of 300.

SERVICES:

- *Surveying*
- *3D Laser Scanning*

LOCATION:

Westport, Connecticut

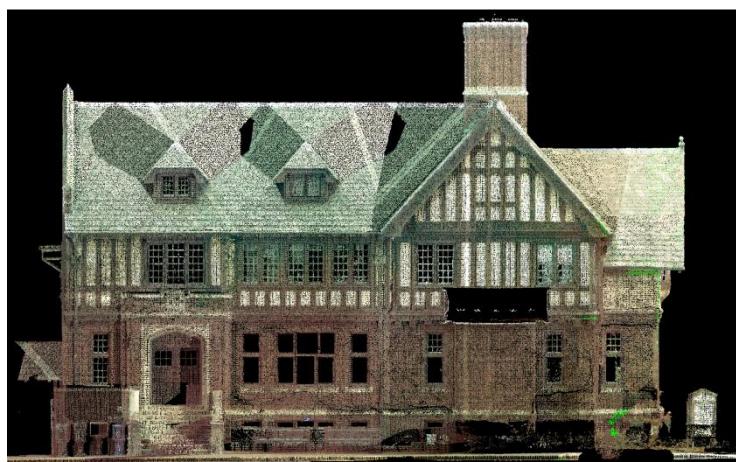
CLIENT:

Centerbrook Architects and Planners



Langan's surveying department provided its full suite of surveying services for existing conditions mapping of the site. This historic building is currently home to the Westport YMCA, and Langan was asked to document the existing conditions for use in the design of an addition. The Langan survey Group provided boundary, topographic, and utility surveys for use as base mapping for the design effort. Laser scanning services were also provided to facilitate the creation of elevations of the historic building and a 3D model of the existing conditions.

Deliverables on the project were 3D CAD files of the entire site, 3D building elevation drawings, and a Revit model of the existing building. All survey work, scanning and modeling was performed in-house by Langan's surveying team.



SERVICES:

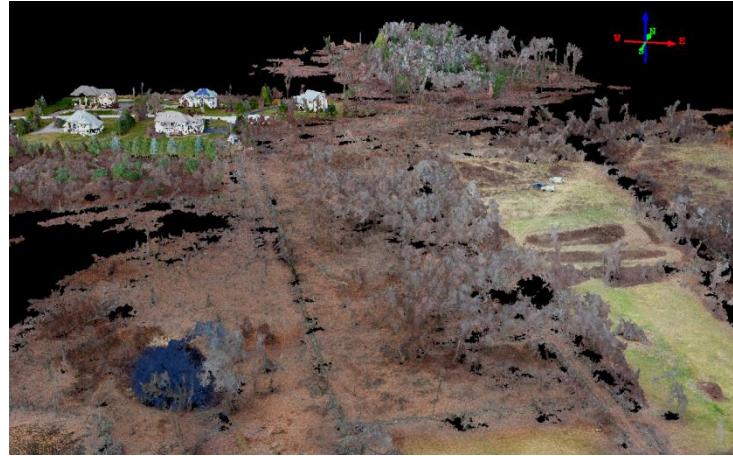
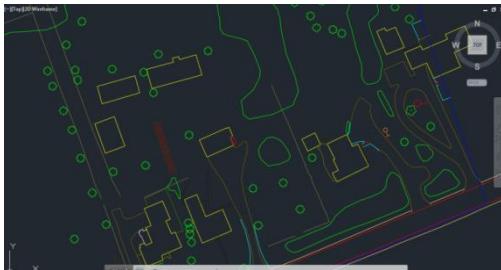
- *Drone Mapping*
- *Survey Control*
- *3D Modeling*
- *Feature Extraction*
- *Drafting*

LOCATION:

Mansfield, Connecticut

CLIENT:

The Shepard Companies



Langan utilized our Unmanned Aerial System (UAS) to acquire color aerial photography to create planimetric and topographic mapping at a scale of 1"=50', with 1' contour intervals. In order to produce mapping and surveying grade data products with the verifiable positional accuracy, 9 ground control targets were placed within the boundaries of the project area. Utilizing the 9 ground control points acquired for this project Langan performed an aerial triangulation process to generate interior and exterior photo parameters for the accurate horizontal and vertical placement of the aerial imagery within the project coordinate system. From the properly oriented imagery a Digital Surface Model (DSM) was generated and delivered as well as a 3D point cloud. A digital orthophoto mosaic with a 1" Ground Sample Distance (GSD) was also be produced.

The 3D point cloud was classified for ground and non-ground features. Non-ground features such as vegetation, vehicles, equipment or buildings were classified as non-ground and not included in the bare-earth surface model. Contour data generated to support a 1' topographic interval contained spot elevations extracted from the surface model as required. All planimetric features relating to a 1"=50' map scale were digitized and classified to their respective digital feature classes.

NORTH HAVEN LASER SCANNING QUINNIPAC UNIVERSITY

SERVICES:

- 3D Laser Scanning

LOCATION:

North Haven, Connecticut

CLIENT:

Quinnipiac University



Centerbrook Architects hired Langan to perform interior laser scanning of four floors of an existing office complex that will be the new home of the Quinnipiac University School of Medicine. Due to an extremely aggressive schedule, laser scanning of the interior space allowed for the project to be designed while abatement and demolition was going on.

Langan performed a detailed laser scan of the interior space and prepared floor plans and elevations for Centerbrook's use in the new design. The ability to capture this data using laser scanning saved a tremendous amount of time and money. This approach allowed abatement to begin immediately following the laser scanning work but also allowed Centerbrook to begin their design.

Without the use of laser scanning, Centerbrook would have had to wait several months for the abatement work to be completed before they could get back into the space and conduct the onerous task of taping and measuring of the four floors. Laser scanning proved to be a cost effective solution that allowed the project to remain on schedule.

SERVICES:

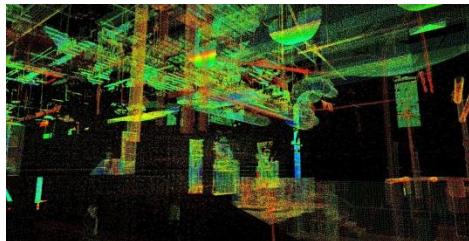
- *3D Laser Scanning*
- *3D Modeling*

LOCATION:

*Yale University – New Haven Hospital
New Haven, Connecticut*

CLIENT:

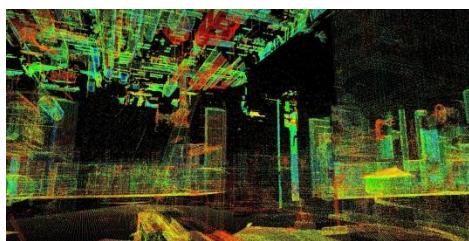
Turner Construction



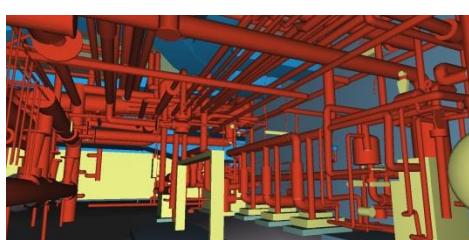
Scan



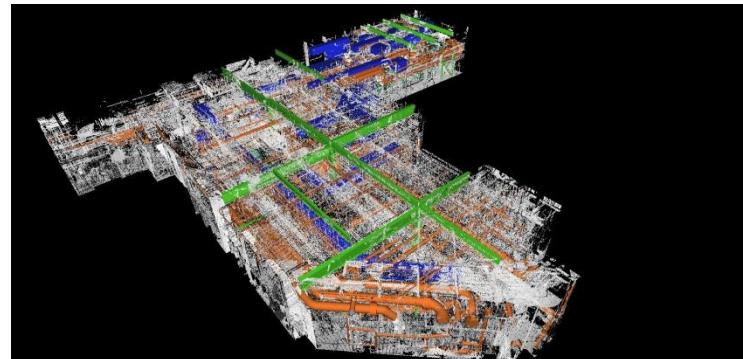
Model



Scan



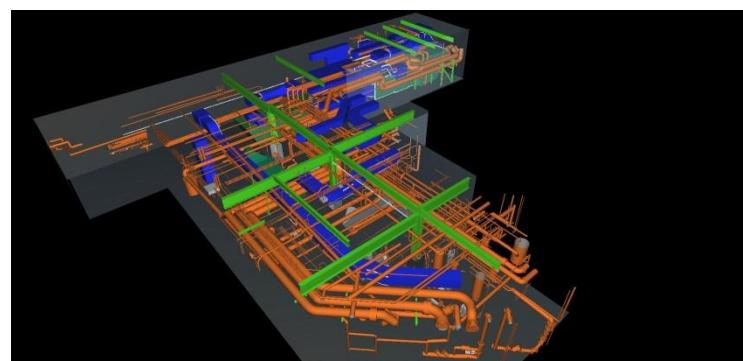
Model



Langan was tasked with providing a complete 3D model of the basement mechanical room. The generated model was used as part of a larger effort to upgrade specific mechanical equipment. This 3D model was merged with a Building Information Model (BIM) for utility design, space planning and clash detection. Langan employed the use of 3D high definition laser scanning to capture the complex features within the space.

The scan data was reduced into the final 3D model which includes all accessible structural steel, access walkways and ladders, HVAC ductwork, fire protection piping, wall surfaces and other utility conduits that were visible to the scanner.

Deliverables on the project were detailed 3D AutoCAD drawings of the interior space. A video fly through of the scanned space was also provided.



DEVIL'S HOPYARD STATE PARK MOBILE LIDAR COLLECTION AND MAPPING

SERVICES:

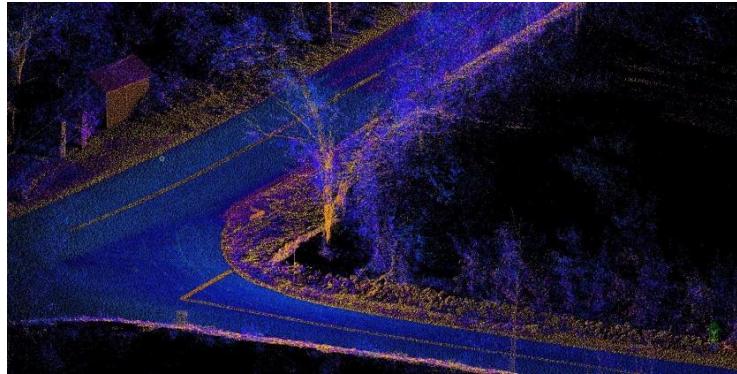
- *Mobile Mapping*
- *Video Logging*
- *Topographic Mapping*
- *DTM*

LOCATION:

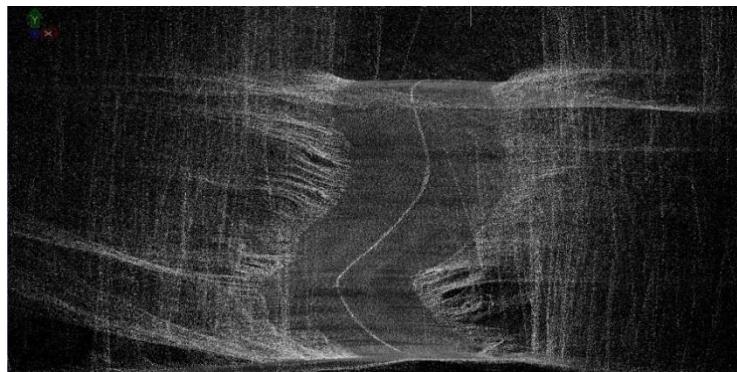
East Haddam, Connecticut

CLIENT:

PASCO Corporation and SHOWA Japan



Langan provided mobile LiDAR data collection, feature extraction, and mapping services for Devil's Hopyard State Park. We deployed our Pegasus Mobile Mapping System within Devil's Hopyard State Park and collected integrated video logging and LiDAR data for the project area. Survey control points were placed within the project limits to register the LiDAR and imagery data with. Langan's LiDAR and imagery data was survey grade accurate (+/- .02').



Langan brought the LiDAR point clouds into Leica's Map Factory and Certainty 3D's TopoDOT products to create survey grade accurate LiDAR point clouds and a 5mm spaced DTM.

SERVICES:

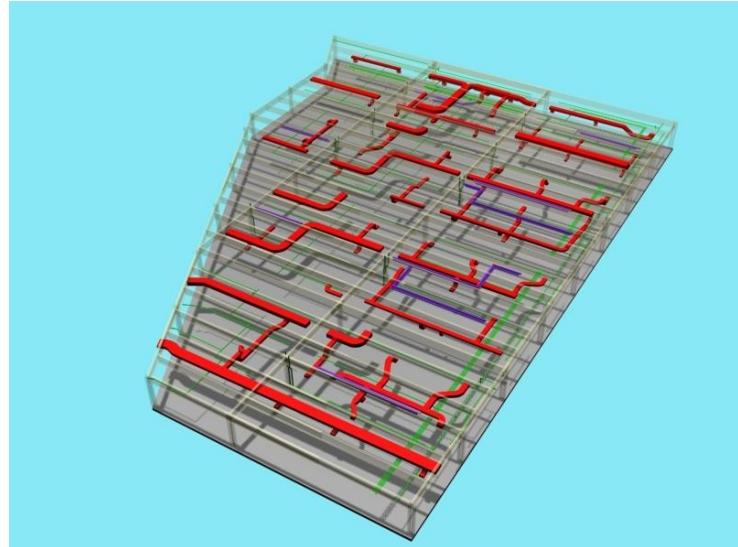
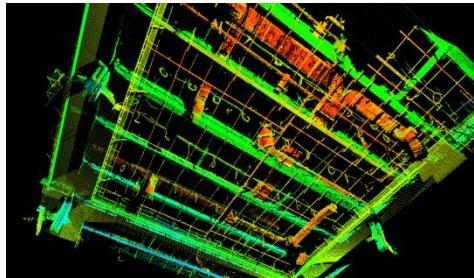
- *3D Laser Scanning*
- *Revit Modeling*

LOCATION:

Stamford, Connecticut

CLIENT:

Turner Construction Company



Langan's surveying department provided laser scanning services at the Royal Bank of Scotland's world headquarters. Langan scanned the as-built conditions of the utilities serving the bank trading floor prior to completion of the trading floor wall installation. Full information was obtained on the installed utilities and the structural elements of the building within the trading floor space.

Deliverables on the project were 3D Revit models of the utilities and structural elements for use in a BIM application. Langan provided field to finish support by gathering the laser scan field data, providing the registration and processing of the point cloud, and then producing the Revit model as the ultimate deliverable.

TRAVELERS TOWER

SERVICES:

- Surveying
- 3D Laser Scanning

LOCATION:

Hartford, Connecticut

CLIENT:

Building Conservation Associates



Langan's Surveying Department provided surveying and laser scanning services at the Travelers Tower. The structure was built in 1919 and was once the tallest structure in New England and is still a dominant architectural feature in Hartford. Laser scanning was needed in support of restoration work on the exterior. An exterior laser scan of the building facades was performed for use in preparation of building elevations. Detailed elevations and cross sections of the building were produced from ortho-rectified images derived from the scanner software.

Deliverables on the project were detailed 2D AutoCAD files of the building elevations. The AutoCAD files contained a "mosaic" of jpeg images that were used to trace 2D elevations of the tower. An added benefit to the project is a 3D point model of the building, which is stored in Langan's digital archives for use whenever the site needs to be revisited or when additional data on the elevations are required. This avoids costly additional field work when new information is required.

SERVICES:

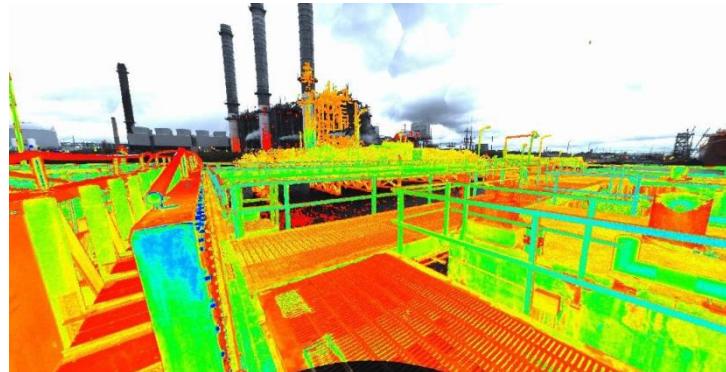
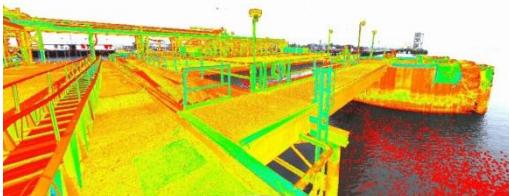
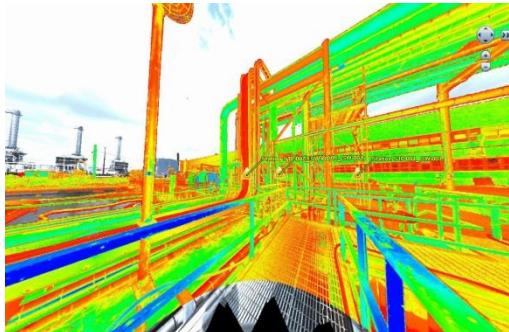
- *3D Laser Scanning*
- *Information Modeling*

LOCATION:

Marcus Hook, Pennsylvania

CLIENT:

CB & I



The Sunoco Refinery in Marcus Hook, PA is undergoing renovations and additions to add services provided at the site. As part of a prosed addition of tanks and pipelines to the site, Langan was engaged to provide existing conditions models of the proposed route of the pipeline and the locations of the proposed tanks.

Langan provided conventional site survey control and 3D laser scanning to capture the existing conditions in a high level of detail.

The site area covered approximately 100 acres of the existing refinery. The sections of pipeline that were scanned covered approximately 11,000 linear feet of elevated pipelines.

This site included the typical challenges of working in a refinery that is largely developed with detailed site infrastructure including pipes, tanks, buildings, jetties and driveways.

Langan provided the required 3D site information that was to be used by the site design engineers to allow accurate design based on detailed existing conditions. This information will greatly reduce the amount of conflicts that might be expected during construction.

TAYLOR SHOPPING CENTER DRONE MAPPING

SERVICES:

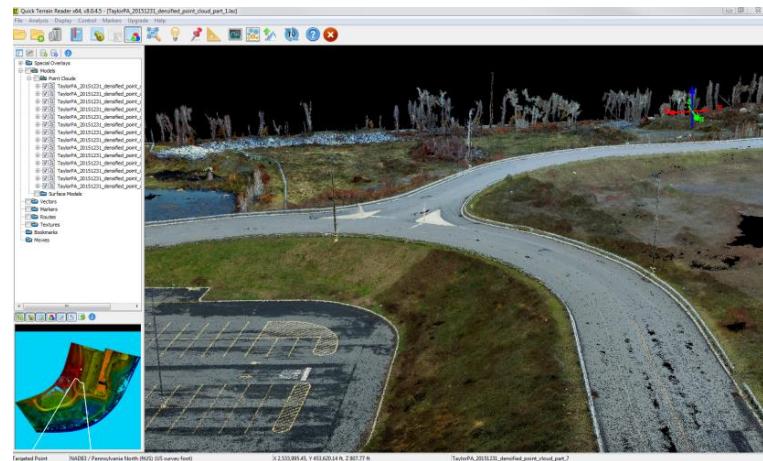
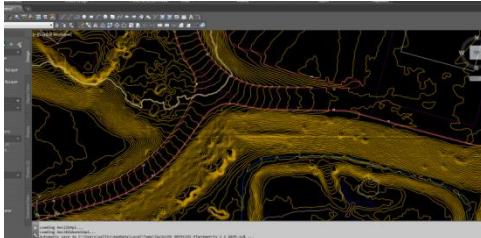
- *Drone Mapping*
- *Survey Control*
- *3D Modeling*
- *Feature Extraction*
- *Drafting*

LOCATION:

Taylor, Pennsylvania

CLIENT:

Confidential



Langan utilized our Unmanned Aerial System (UAS) to acquire color aerial photography to create planimetric and topographic mapping at a scale of 1"=50', with 1' contour intervals. In order to produce mapping and surveying grade data products with the verifiable positional accuracy, 10 ground control targets were placed within the boundaries of the project area. Utilizing the 10 ground control points acquired for this project, Langan performed an aerial triangulation process to generate interior and exterior photo parameters for the accurate horizontal and vertical placement of the aerial imagery within the project coordinate system. From the properly oriented imagery a Digital Surface Model (DSM) was generated and delivered as well as a 3D point cloud. A digital orthophoto mosaic with a 1" Ground Sample Distance (GSD) was also be produced.

The 3D point cloud was classified for ground and non-ground features. Non-ground features such as vegetation, vehicles, equipment or buildings were classified as non-ground and not included in the bare-earth surface model. Contour data generated to support a 1' topographic interval contained spot elevations extracted from the surface model as required. All planimetric features relating to a 1"=50' map scale were digitized and classified to their respective digital feature classes.

EASTERN STATE PENITENTIARY

SERVICES:

- *3D Laser Scanning*
- *Information Modeling*

LOCATION:

Philadelphia, Pennsylvania

CLIENT:

National Geographic TV Channel



When the National Geographic television show producers required an accurate 3D model of the Eastern State Penitentiary, they turned to Langan. The premise of the investigative television show was to scientifically investigate the prison for the presence of any paranormal activity. Langan provided 3D laser scanning services to accurately measure the dimensions of some of the more haunted portions of the former prison building.

Philadelphia's Eastern State Penitentiary is said to be the one of the most haunted places in America. The prison ceased to operate as a correctional facility in 1971 but has been opened to the public in recent years as a museum. Since the closing of the prison many visitors and staff have reported hearing voices, people crying and screams coming from a number of cells. Some people have even seen ghostly figures moving around the prison cells.



AMTRAK 30TH STREET STATION GARAGE

SERVICES:

- *Topographic Survey*
- *3D Laser Scanning*
- *Modeling*

LOCATION:

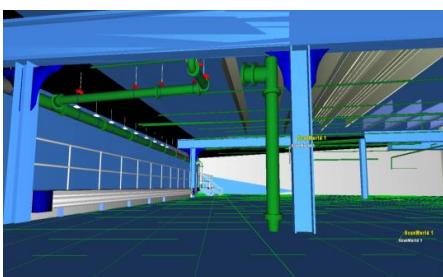
30th Street Station
Philadelphia, Pennsylvania

CLIENT:

Kling Stubbins

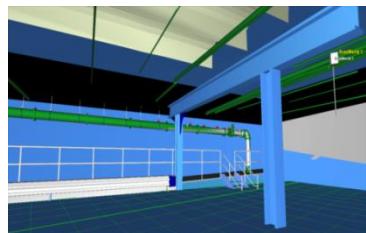
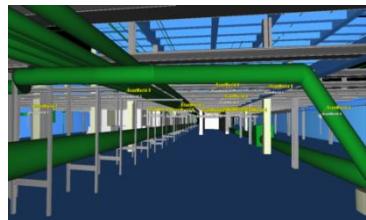
AWARDS:

ACEC PA Engineering Excellence
Award



Langan prepared existing conditions plans of the surface parking and driveway areas on the west side of 30th Street Station and the parking level and basement level below the west side surface. The surface level survey was done by conventional survey methods to provide topographic and boundary/right-of-way information surrounding the 30th Street Station building. The parking level and basement level were surveyed with the use of 3D Laser Scanning.

The sub-surface levels were surveyed with a 3D Laser Scanner to provide a high level of detail to show the existing site conditions. From the field data, Langan created survey plans showing the floor and reflected ceiling information and also created a 3D computer model of the entire sub-surface area. The model that was created will be used as the basis for the site redesign.



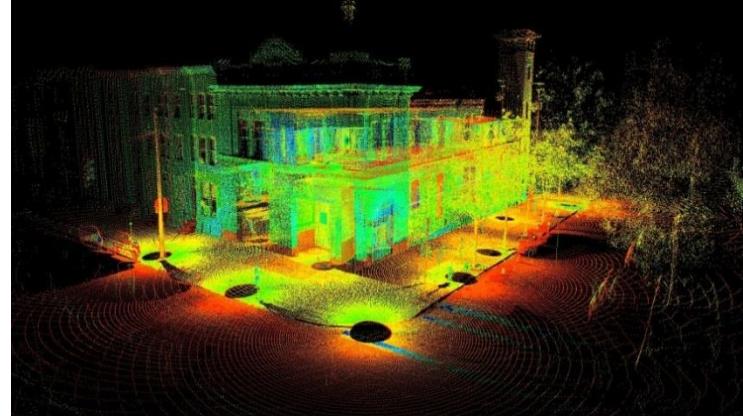
NATIONAL GREAT BLACKS IN WAX MUSEUM EXISTING CONDITION DOCUMENTATION

SERVICES:

- Survey Services
- 3D Laser Scanning
- Façade and Elevation Plans
- Floor Plans

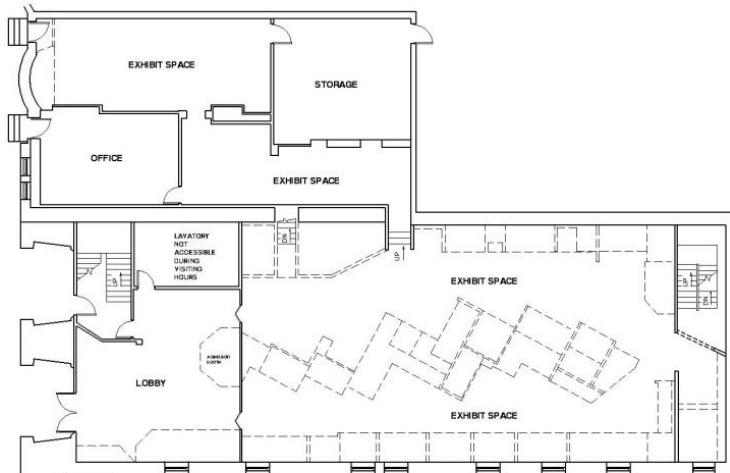
LOCATION:

Baltimore, Maryland



Langan provided conventional surveying and 3D Laser Scanning services in support of the planned expansion of the National Great Blacks in Wax Museum. The project consists of a full block of row houses anchored by historic buildings at each end and the new museum is planned to replace the row houses and inter-connect with the two anchor buildings. Langan was tasked with the development of existing condition plans, floor plans and façade elevations for all of the existing buildings.

Langan visually documented the facades and interiors of buildings, providing both traditional and 3D laser scanning services in support of the project. The use of 3D Laser scanning made it possible to capture the many fine details of the structures to establish a baseline and serve as a potential reference for improvements associated with the project.



FIRST FLOOR PLAN

Scale: 1/16" = 1'-0"

GALLAUDET UNIVERSITY HISTORICAL DENISON HOUSE

SERVICES:

- *3D Architectural Survey*
- *Topographic Survey*
- *Utility Survey*

LOCATION:

Washington, DC

CLIENT:

Gallaudet University

ARCHITECT:

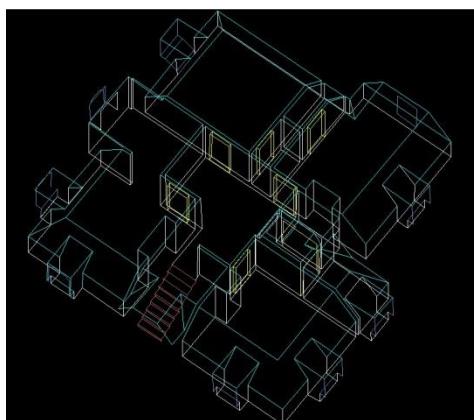
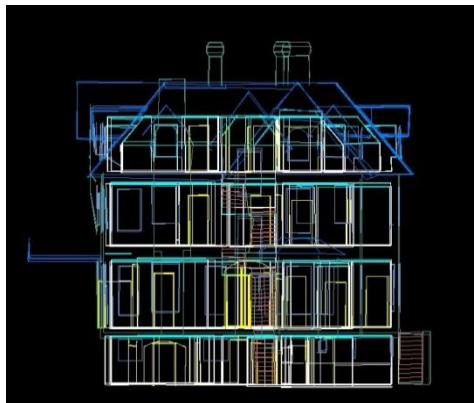
Ayers Saint Gross



Langan worked closely with Ayers Saint Gross to create a topographic survey and 3D AutoCAD model of the historic Denison House on Gallaudet University's campus. The building survey was required to develop a base layout for an interior renovation project which included the preservation of key historic building elements.

The survey work included interior and exterior items such as walls, windows, doors, roof lines, chimneys, dormers, and other prominent building features. A combination of conventional survey and Point-Shoot-Draw (PSD) technology was used to record and create the building base plan files. The survey deliverables were then used by the architect to create an intelligent 3D REVIT model of the building.

The detail and efficiency achieved with PSD technology was critical to the success of this project's survey work and fast-paced schedule. PSD technology has proven to be a valuable survey technique to obtain difficult angles and measurements in a working environment. The instantaneous recording and mapping eliminates the time delay between field measurements and producing the final product.



UNITED STATES COURT OF APPEALS OF THE ARMED FORCES

SERVICES:

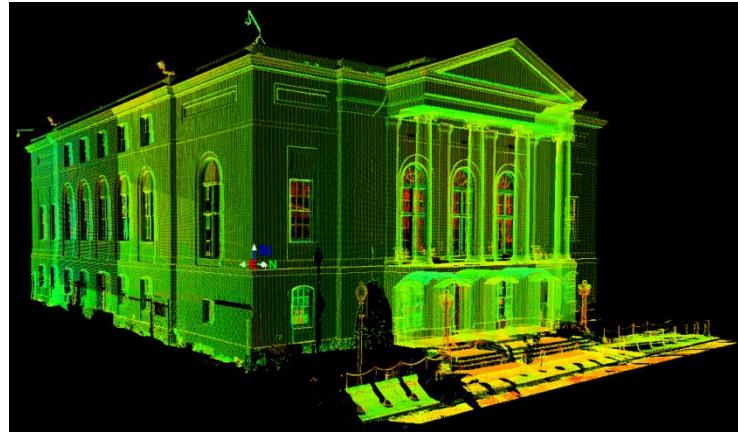
- *Surveying*
- *3D Laser Scanning*

LOCATION:

Washington, DC

CLIENT:

IBI Group – Gruzen Samton Architects



Langan provided 3D laser scanning services at the United States Court of Appeals of the Armed Forces. A full exterior laser scan of the building façades was performed, as well as a control survey for the accurate merge of the laser scan “point clouds”. Detailed elevations and cross sections of the building were produced from the scan data for the planning and implementation of a new lighting scheme for the building.

Deliverables on the project were detailed 2D AutoCAD drawings of the building elevations and cross sections. An added benefit to the project was a 3D point model of the building, which is stored in Langan’s digital archives for use whenever the site needs to be revisited, or when additional data on the elevations is required. This avoids costly additional field work when new information is required.

UNION STATION – CAPITAL IMPROVEMENTS

SERVICES:

- *Boundary Survey*
- *Topographic Survey*
- *Utility Survey*
- *3D Laser Scanning*
- *Site/Civil Engineering*
- *Geotechnical Engineering*

LOCATION:

Washington, DC

CLIENT:

*Burns Engineering, Inc.
Amtrak*



Langan was retained to perform multiple services at this busy landmark Amtrak facility for future proposed improvements including a mixed-use overbuild project, below-grade parking, and track service improvements.

Langan performed a boundary, topographic, and utility survey to facilitate the design and permitting of site demolition work; and construction of a substation, parking lot improvements, and several new catenary structures. Langan also performed a 3D laser scan of the Amtrak rail lines and surrounding parcel features from an adjacent lot, which enabled the design team to collect track data without closing the rail lines or incurring the services of Amtrak flagmen.

Langan performed geotechnical and civil engineering services to support the permitting and construction of the improvements. The geotechnical investigation and report included design recommendations for large, diameter-drilled shafts to resist the high overturning loads of the catenary systems. The site design included parking lot improvements and a stormwater management system, designed in accordance with DDOE regulations.

NEW STUDENT CENTER UNIVERSITY OF THE DISTRICT OF COLUMBIA

SERVICES:

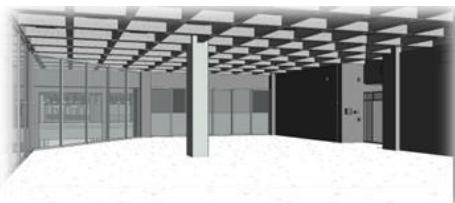
- *Topographic Survey*
- *3D Laser Scanning*
- *Revit Modeling*
- *Interior Floor Plan Survey*

LOCATION:

Washington, DC

CLIENT:

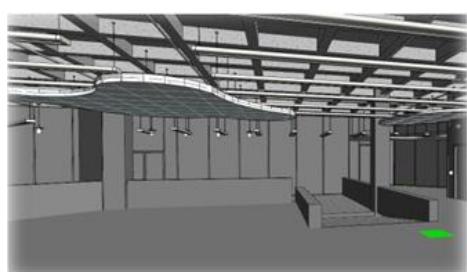
CannonDesign



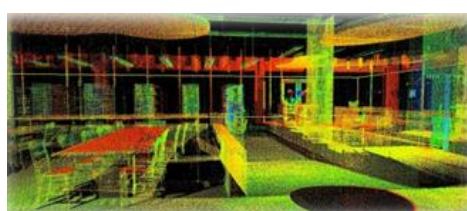
Cafeteria Model



Library Model



Library Model



Library Point Cloud



Aerial view of existing model with proposed campus Student Center

Langان, in association with CannonDesign, performed laser scanning and 3D modeling of Buildings 38 and 39, located on the University of the District of Columbia's Van Ness Campus, near the northwesterly corner of the intersection of Connecticut Avenue NW and Van Ness Street NW. Original building design plans were not available and this survey was prepared as a basis for new design. The scan included three interior levels as well as a connector between the two buildings, totaling approximately 160,000 SF.

Langان provided a full range of surveying services including topographic surveying, laser scanning, floor plan surveys and Revit modeling. These services were completed to provide a combined model of the interior and exterior of the university project site. The survey data was combined to create an overall model that would be used by the architectural team to prepare design plans for a proposed addition to the campus. A fully adjusted survey control network was established and all exterior and interior survey data was referenced to this control network. Deliverables on the project were detailed topographic base plan and Revit model.

A 3D CAD model was converted into a Revit deliverable that included the building exterior, building floors, walls, windows and door locations as well as the visible column and beam locations and the larger ductwork and mechanical equipment that will be visible to the scanner.

During the on-site survey activity, the buildings remained occupied and in full operation.

ARLINGTON COUNTY HUMAN SERVICES CENTER

SERVICES:

- *3D Laser Scanning*
- *Information Modeling*

LOCATION:

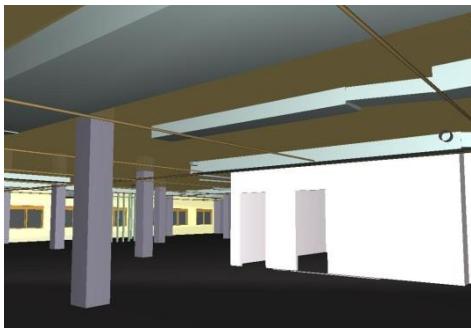
Arlington, Virginia

CLIENT:

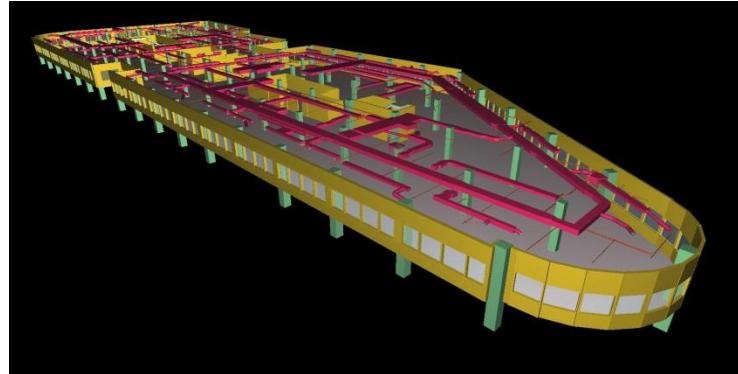
Turner Construction Company



Site Photo



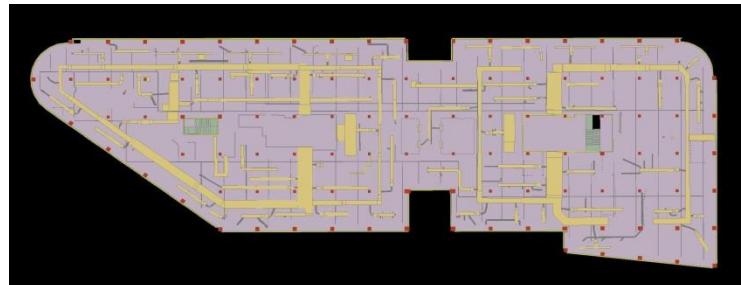
Model



Langan was tasked with providing a complete 3D model of the third floor of the new Human Services Building. This generated model was used as part of a larger effort to rehabilitate the interior space. Langan employed the use of 3D high definition laser scanning to capture the complex features within the space.

The scan data was reduced into the final 3D model which includes all accessible structural steel, columns, walls, stair towers, windows, HVAC ductwork, fire protection piping and other utility conduits that were visible to the scanner.

Deliverables on the project were detailed 3D AutoCAD drawings of the interior space. A video fly through of the scanned space was also provided.



Floor Plan

MEDICAL CENTER OPERATING ROOM RENOVATION VIRGINIA COMMONWEALTH UNIVERSITY

SERVICES:

- 3D Laser Scanning
- Survey
- 3D Modeling

LOCATION:

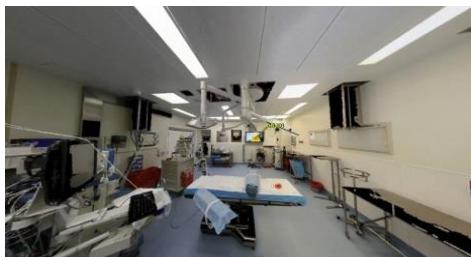
Richmond, Virginia

CLIENT:

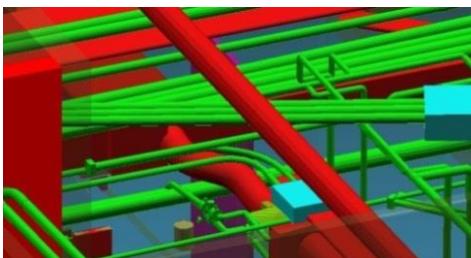
DPR Construction

ARCHITECT:

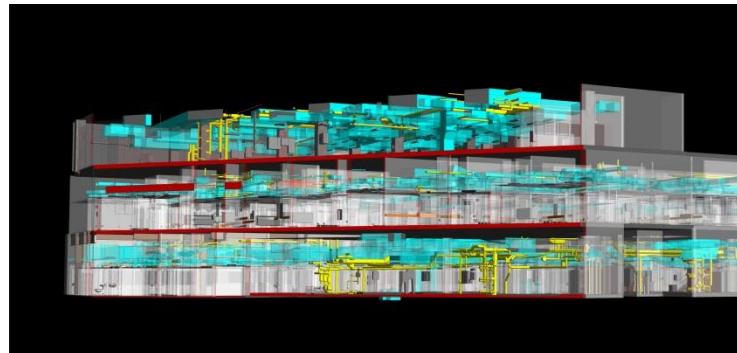
HKS



Colorized Point Cloud of OR



Detailed Section of Model



This 200,000 SF operating room space was identified for a major redesign and upgrade. Virginia Commonwealth University was concerned about minimizing the downtime associated with both the design and reconstruction of the space. Langan worked closely with DPR Construction and the hospital staff to design and complete a pilot project to demonstrate our project approach, which utilized a mobile enclosed HEPA cart as a movable scanning platform. This allowed the team to remove areas of the ceiling for access without debris and material compromising the operating room or patient spaces.

The laser scan data was acquired and referenced to survey grade control to provide an accurate base from which the model was generated. The final 3D model includes all accessible structural elements, electrical conduits, gas and oxygen lines, HVAC ductwork, fire protection piping, wall surfaces, and other utility items that were visible to the scanner.

Our modeling team worked in coordination with both the construction team and hospital staff to identify and name all MEP elements at the time of modeling. This reduced the coordination time normally associated with element identification. This task was completed with a unique use of web enabled photo linked TruView software.

ORLANDO INTERNATIONAL AIRPORT TERMINAL C

SERVICES:

- Survey

LOCATION:

Orlando, Florida

CLIENT:

Memco LLC

STRATEGIC PARTNER:

Greater Orlando Airport Authority (GOAA)



Work is underway on the South Terminal, Phase 1 and Phase 1 Expanded, which will add 19 gates capable of accommodating over 20 aircrafts. The three-floor facility will be adjacent to the South Airport APM Complex and Intermodal Terminal Facility and is anticipated to open in late 2021.

Langan is providing as-built survey for various components of the air-side terminal steel erection. Langan verified the existing on-site control and located over 2,600 anchor bolts. Over 500 columns were observed for plumbness. Langan completed a laser scan of four shear towers to verify the locations of various welding plats to hang steel girders. This complex project ranks as one of the largest airport expansions projects in the United States.

TAMPA INTERNATIONAL AIRPORT (TPA) CURBSIDE LOCATIONS

SERVICES:

- *Mobile Mapping*
- *Laser Scanning*
- *Surveying*

LOCATION:

Tampa, Florida



CLIENT:

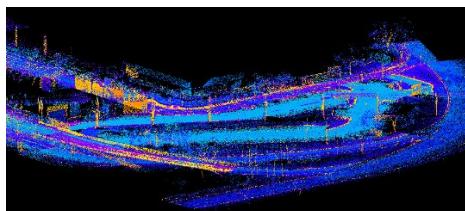
Vivid Consulting Group

OWNER:

*Hillsborough County Aviation Authority
(HCAA)*

Tampa International Airport (TPA) is one of the nation's busiest airports, serving over 20 million passengers annually. Langan supported Vivid Consulting surveying efforts by providing existing survey grade, base mapping of select areas of the airport. Langan provided static and mobile Lidar-based scanning of the areas. The deliverable was a unified point cloud of the areas scanned. To complete the services, Langan provided field locations of the scan targets, access to the areas was during off hours, and with strict coordination with the Airport.

The expansion program required all design and construction be completed using a BIM approach. To assist in the creation of Existing Conditions BIM model Langan was charged with data acquisition that was utilized by the design team.



ULTIMATE I-4 EXPANSION

SERVICES:

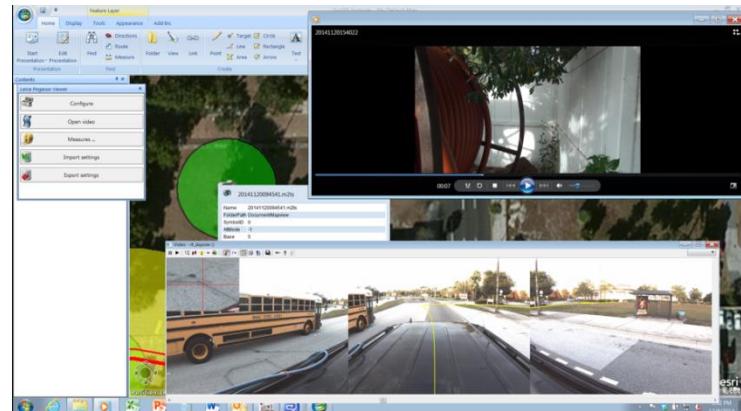
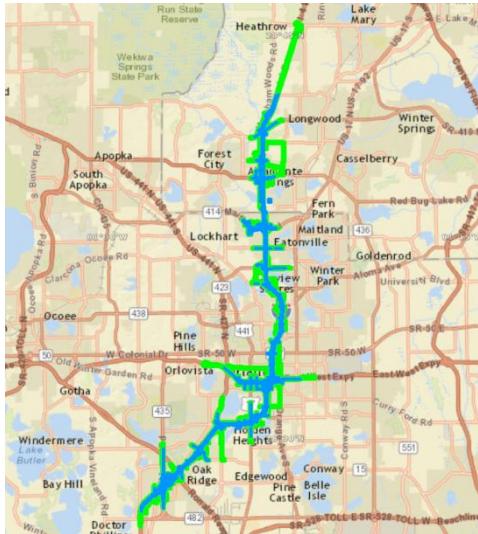
- *Mobile Mapping*
- *Video Logging*
- *Field Video Capture*
- *Geospatial Data Integration*

LOCATION:

Orlando, Florida

CLIENT:

Skanska/Granite Lane Joint Venture (SGL)



Langan provided mobile mapping, video logging, field video capture, and geospatial data integration services in support of the major expansion of a 21-mile stretch of U.S. I-4, which includes the addition of four new express lanes, and reconstructed interchanges and bridges.

Our scope consisted of the documentation of all existing conditions prior to the start of construction, including every exit and entrance ramp, overpass and underpass, and everything within the right-of-way and 100 feet beyond, which includes hundreds of houses.

We delivered full project video documentation in the form of the Pegasus's imagery for all the traveled lane miles viewable by using the Leica Pegasus Viewer that runs as an add-on to Esri's ArcGIS Explorer. In addition to the video logging, Langan collected hundreds of high definition field videos of the suspect areas. Langan integrated these GPS referenced videos into the final ArcGIS Explorer deliverable for a full project workflow.

We also provided training to the SGL and FDOT project personnel.

MD ANDERSON CRB ANIMAL AREA RENOVATION

SERVICES:

- *3D Laser Scanning*
- *3D Modeling*

LOCATION:

Houston, Texas

CLIENT:

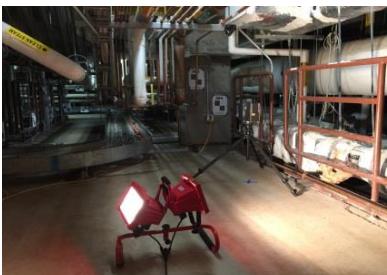
The University of Texas MD Anderson Cancer Center

ARCHITECT:

Perkins + Will Architects

STRATEGIC PARTNERS:

Whiting Turner Construction



Langan is currently working on a project in the interstitial space between the basement and 1st floors of the Clinical Research Building at The University of Texas MD Anderson Cancer Center. The project entails raising the ceiling level of the basement research areas by 1 to 2 feet and shrinking the area of the existing interstitial space, which is currently very dense with MEP equipment.

Langan is responsible for performing a 3D Laser Scan and 3D Revit Model for the almost 15,000 square foot interstitial space. This model will be used by the design team to produce accurate design drawings which will allow for the prefabrication of many of the new utility runs that will need to be made for this renovation, thus cutting down on overall construction time.

Langan was chosen for this project because of our experience in scanning dense and difficult MEP areas as well as our ability to produce an accurate 3D model with our in-house modelers.

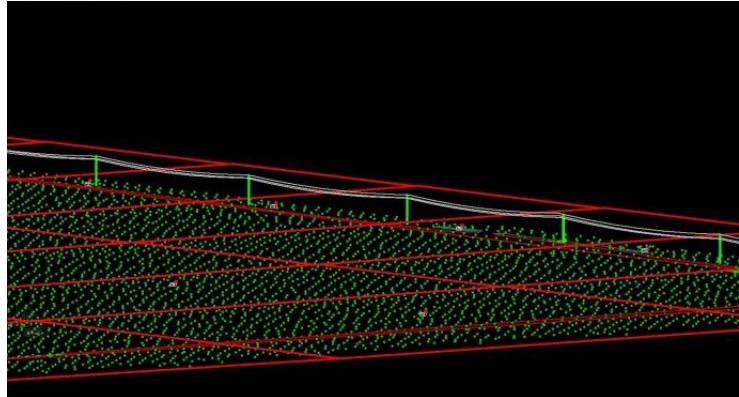
LITTLE BEAR SOLAR MOBILE LIDAR COLLECTION AND MAPPING

SERVICES:

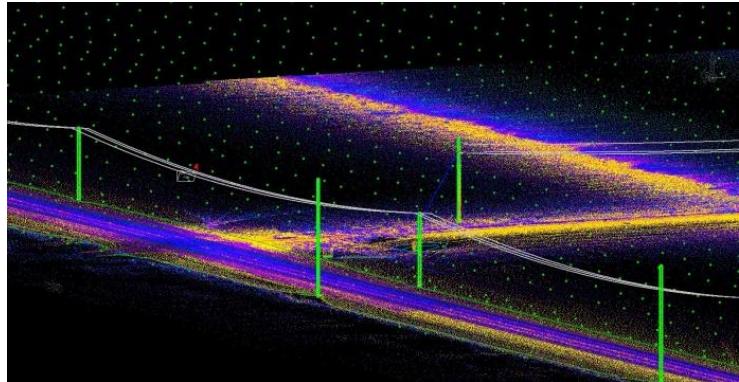
- *Mobile Mapping*
- *Video Logging*
- *Topographic Mapping*
- *DTM*

LOCATION:

Fresno, California

**CLIENT:**

First Solar



Langan provided mobile LiDAR data collection, feature extraction, and mapping services for Little Bear Solar. We deployed our Pegasus Mobile Mapping System within the Little Bear Solar Farm and collected integrated video logging and LiDAR data for the project area. Survey control points were placed within the project limits to register the LiDAR and imagery data with. Langan's LiDAR and imagery data was survey grade accurate (+/- .02').

Langan brought the LiDAR point clouds into Leica's Map Factory and Certainty 3D's TopoDOT products to create survey grade accurate LiDAR point clouds and a DTM.