VOLUME 3 ISSUE 4

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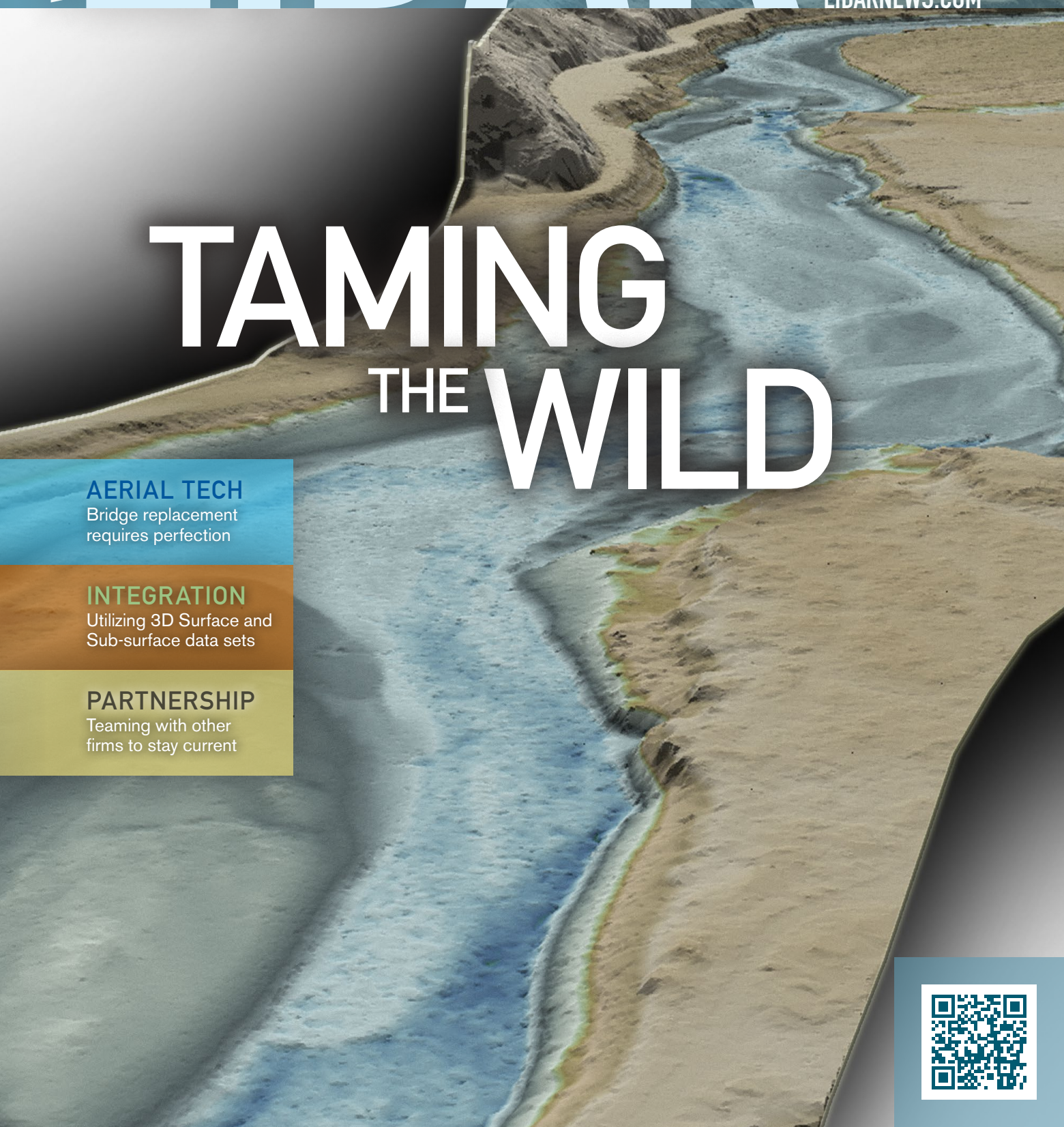
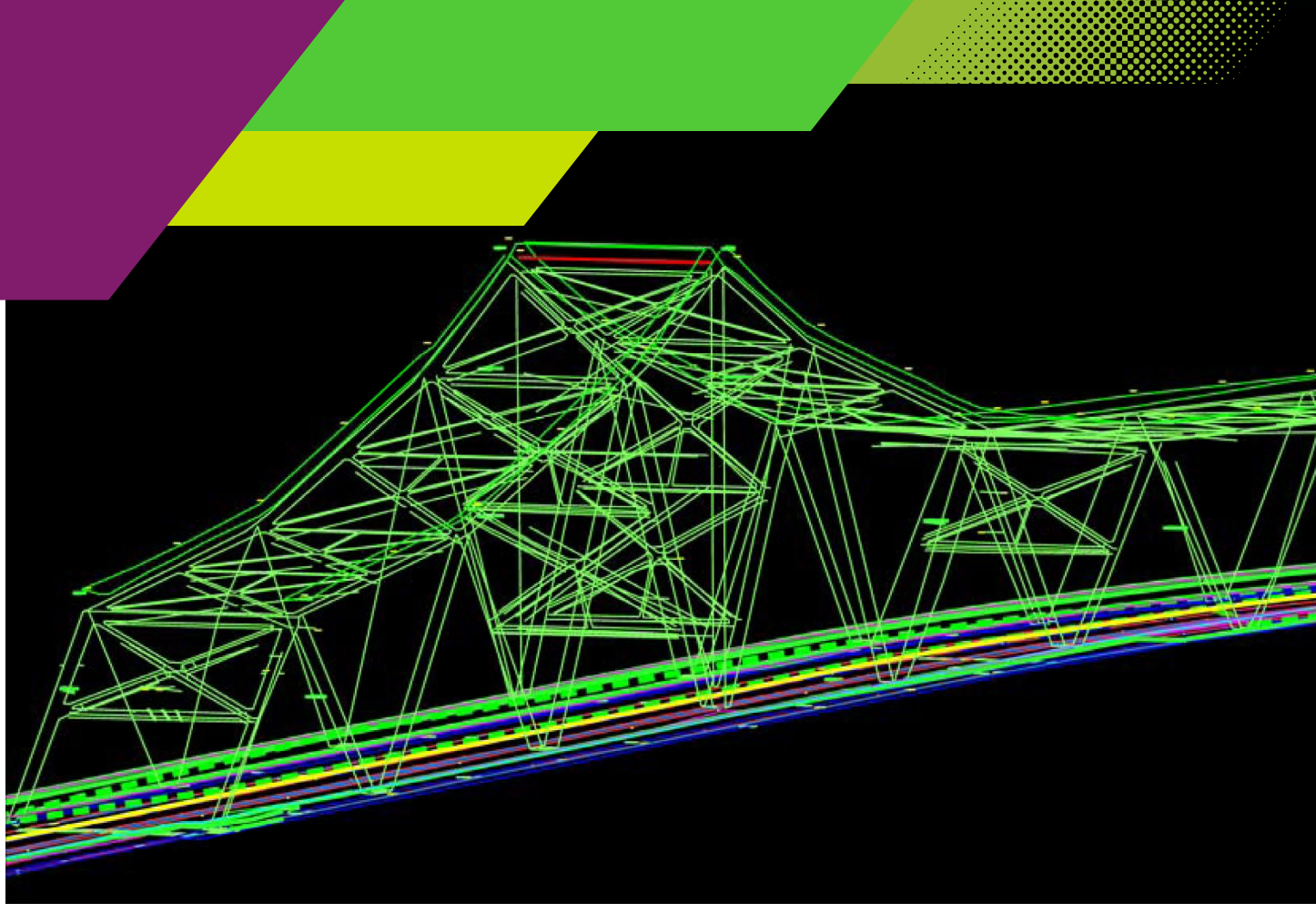


TAMING THE WILD

AERIAL TECH
Bridge replacement requires perfection

INTEGRATION
Utilizing 3D Surface and Sub-surface data sets

PARTNERSHIP
Teaming with other firms to stay current



AERIAL MAPPING

Low-Altitude Aerial Mapping Photography (LAMP) for Goethals Bridge Replacement Project

The Port Authority of New York and New Jersey (PANYNJ) has embarked on a project to provide the design, build, finance, and maintenance for a replacement to the 80 plus year old Goethals Bridge. The new bridge will be located directly south of the existing bridge.

The Goethals Bridge connects Elizabeth, New Jersey to Staten Island (New York City), near the Howland Hook Marine Terminal, Staten Island, New York over the Arthur Kill. Operated by the Port Authority of New York and New Jersey, the span was one of the first structures built by the authority. On the New Jersey side it is located 2 exits south of the terminus for the New Jersey Turnpike-Newark Bay Extension. It is essential to moving cargo between airports and seaports and regional markets in the New York/New Jersey metropolitan area.

As part of a complex surface transportation, network, its strategic location places it at the center of one of the largest air cargo gateways in the nation and provides truck and auto connections between the New Jersey Turnpike, Routes 1 & 9 and other New Jersey highways, the Staten Island Expressway (I-278), and the Verrazano-Narrows Bridge. More than $33 billion of regional goods pass over the bridge each year. Eastbound traffic totaled over 14 million vehicles in 2009. Since 2001, the Bridge has provided corridor redundancy for national security and homeland preparedness. The Goethals Bridge opened on June 29, 1928, the same day as the Outerbridge Crossing. This marked the successful completion of the then-fledgling Port Authority's first bi-state development project. The

BY KURT LUTZ

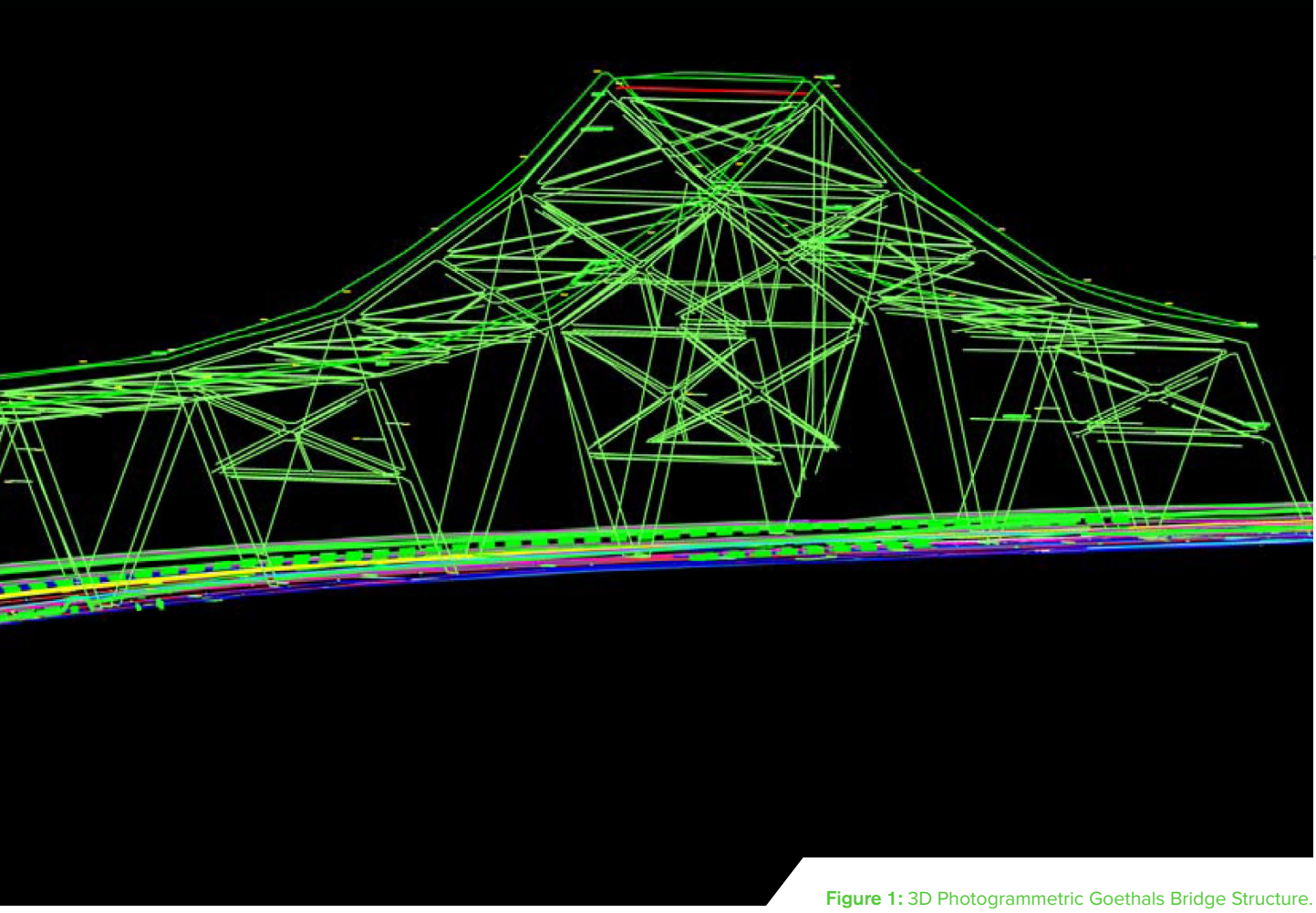


Figure 1: 3D Photogrammetric Goethals Bridge Structure.

TECHNOLOGY

bridge was named in memory of Major General George W. Goethals, builder of the Panama Canal and the first consulting engineer of the Port Authority.

The process will also include the demolition of the existing bridge upon completion of a new bridge. The new alignment will consist of the construction of a cable-stayed bridge over the Arthur Kill south of the existing bridge. The new bridge will contain:

- Six 12-foot wide travel lanes, three lanes in each direction
- A 12-foot wide outer shoulder, and a 5-foot wide inner shoulder on each roadway;
- A 10-foot wide sidewalk/bikeway along the northern edge of the New Jersey bound roadway;
- A central area to be maintained between the eastbound and westbound roadway decks, sufficient to accommodate the provision of future transit service.

Robinson Aerial Surveys, Inc. (Robinson) was commissioned by PANYNJ to provide new color digital Low-Altitude Aerial Mapping Photography (LAMP), analytical triangulation and topographic mapping services at 1"=30' scale in AutoCAD format adhering to Port Authority Mapping & CADD Standards. The PANYNJ chose LAMP because they realized that it is one of the best ways to develop very accurate three-dimensional models with only limited, if any, disruption to the heavy vehicular traffic on the bridge and its approaches. Robinson was selected due to its extensive experience in developing LAMP DTMs.

LAMP, typically, is a helicopter based camera system. Photogrammetric firms that specialize in LAMP make the flight arrangements necessary to carry it out. Robinson, in partnership with our flight sub-consultant, coordinated with the air traffic controllers at Newark-Liberty International airport to fly the LAMP aerial imagery within days of Notice to Proceed. The Team's high level of experience in dense air traffic conditions was a key factor in smooth project scheduling. It can utilize either LAMP cameras or the latest in digital sensors with Forward Motion Compensation (FMC), a device that stabilizes the sensor in the three axes using a gyroscopic mount.

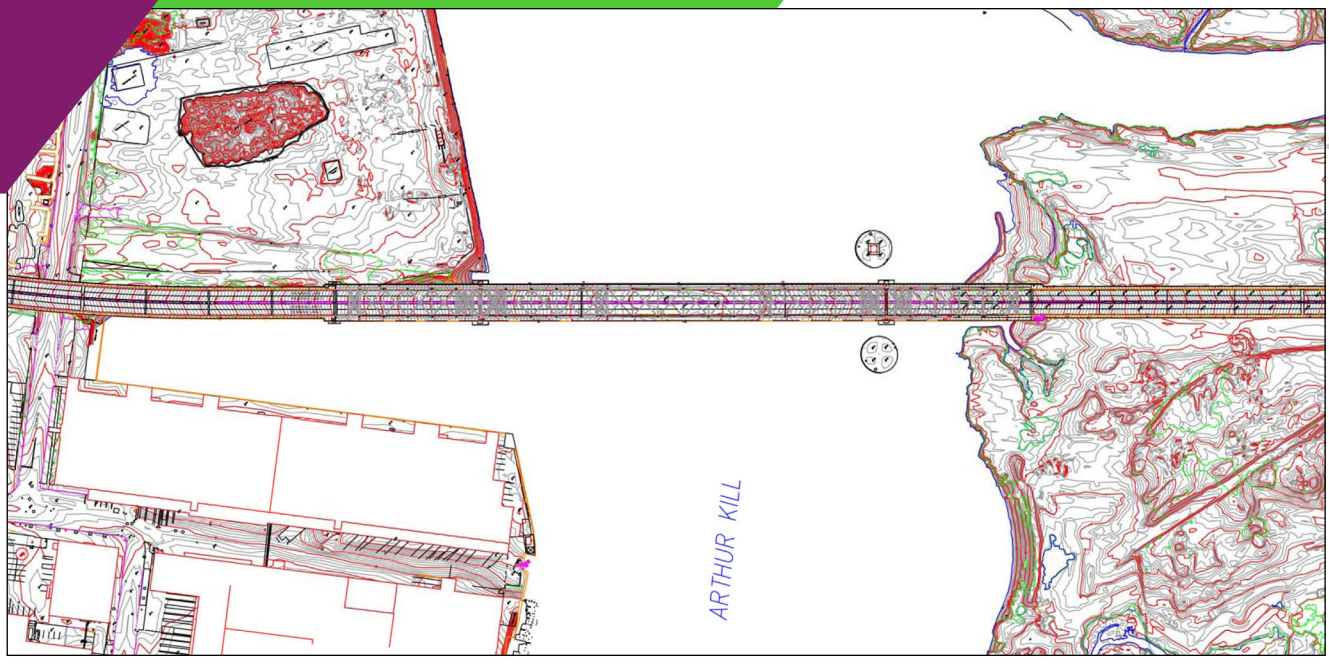


Figure 2: 30 Scale Photogrammetric Mapping with 0.2ft Contours.

The combination of the slower forward speed of the helicopter and the use of FMC allows for unparalleled clarity in the photographic image. The latest in Digital Sensors provide imagery clarity that is un-paralleled even in low-light environments such as during the winter months or in the deep shadow of city streets. Since they collect wavelengths of light across a wide portion of the spectrum, Digital sensors have the added ability to acquire black & white, color and color infrared imagery all within the same photo mission. The improved image clarity allows for ground control points to be observed much more closely than with conventionally flown photography. This allows the control network to be held to a much greater accuracy.

Robinson encountered a challenge in the midst of the project when several large property owners that surround the bridge refused access to Robinson's survey crews for the purposes of establishing the required ground control points. Robinson's staff quickly overcame this by abandoning the initial points and selecting additional points as close to the original points as possible, without encroaching on private property. This was made possible through Robinson's extensive experience in aero-triangulation utilizing Airborne GPS & IMU technology and three-dimensional mapping from LAMP imagery helped to insure that timely and accurate topographic mapping was delivered.

GOETHALS BRIDGE REPLACEMENT ILLUSTRATIVE DESIGN

The use of LAMP technology allows areas that are prone to dense traffic to be accurately mapped with minimal impact on traffic flow and more safely by reducing field personnel's exposure to hazardous situations.

Utilizing LAMP is the safest technical approach to create a new Digital Terrain Model of the hard paved surfaces and the right of way corridor. It keeps surveyors out of harm's way while experienced stereo compilers collect the required ground data for a comprehensive DTM. The use of LAMP allows for highly accurate mapping to be done by means of photogrammetry while reducing the amount of field survey

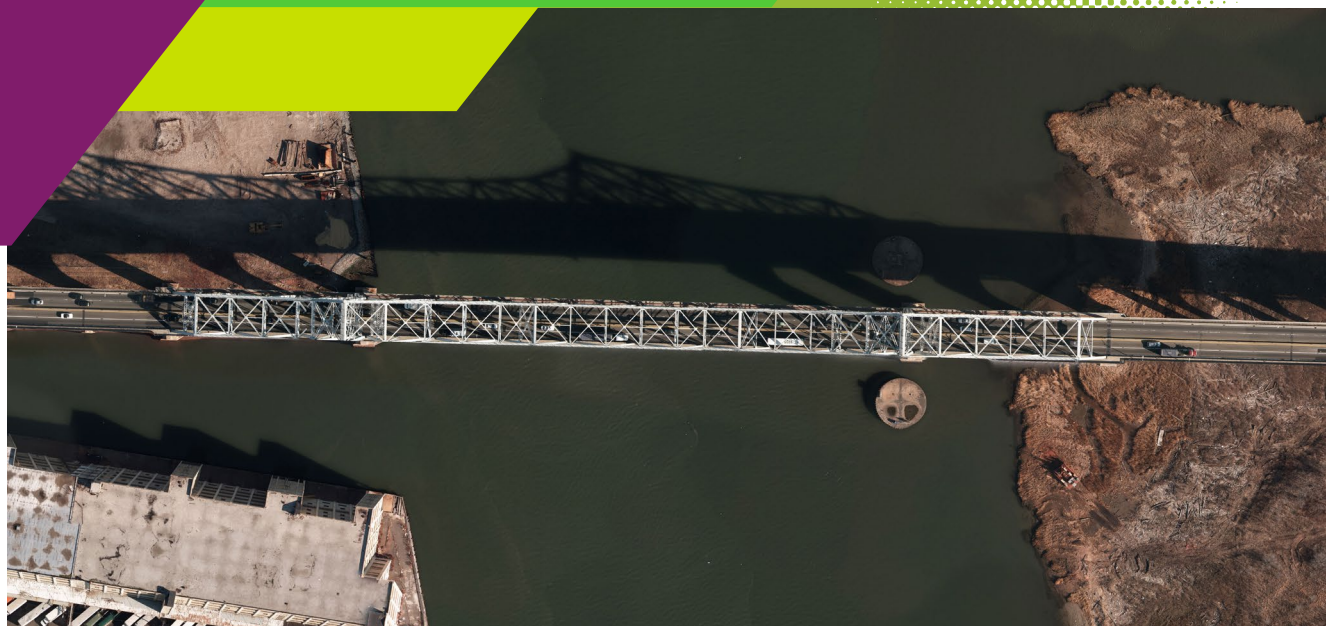


Figure 3: 0.25ft GSD Orthophoto

required as well as protecting field personnel by limiting their exposure to potentially unsafe situations such as rail and highway projects.

LAMP makes use of high resolution cameras to create crisp final results and it is highly useful in surveying projects such as: roadway and railroad master planning and design, power line and pipeline right-of-way design and landscape architecture to name only a few of its applications. LAMP can also be used as a monitoring tool with Homeland Security applications.

For the **Goethals Bridge** scope of work, some of the project deliverables Robinson included were the following:

- Contours at .2-foot intervals. The topographic mapping covered the bridge as well as any turn-around areas and on/off ramps.
- Mapping in DWG format, AutoCAD Civil 3D 2010
- Overall DWG
- Index DWG
- Individual Panel DWGs
- Surface files to be either TIN or Civil3D Surfaces.
- Surface files containing sufficient data to be used for a future mapping update
- Full results of Aerial Triangulation
- Signed and Sealed Control Report also containing the Mapping Certification
- Mapping & Surface files to be provided in NYSPCS

Robinson had previously utilized LAMP technology for a variety of transportation related projects such as:

- **Atlantic City Brigantine Connector in Atlantic City, New Jersey** in which The New Jersey Department of Transportation (NJDOT) proposed to replace the I87 Bridge over Absecon Inlet between Atlantic City and Brigantine, NJ. The proposed bridge replacement project was undertaken in order to improve the sole means of access to the Brigantine community.
- **Bass River Bridge Replacement in Burlington County, New Jersey** where The New Jersey Turnpike Authority (NJTA) plans to replace the Garden State Parkway Bridge over Bass River near New Gretna, NJ. The proposed bridge replacement is in conjunction with the overall Garden State Parkway Widening Program as well as improving traffic safety.
- **I-78 Bridge Project** between Warren County, New Jersey & Northampton County, Pennsylvania supporting traffic improvements.
- **Rt.23 Bridge over the Pequannock River Kinnelon, New Jersey** in which the New Jersey Department of Transportation was proposing preliminary and final design phase survey and mapping to support the bridge replacement project.
- **East Side Access/LIRR Grand Central Connection Project** that provides a vital link from Queens to Manhattan the design of two miles of tunnels, a new station and a rail yard, ten new tracks, five new platforms and the rehabilitation of 20 bridges.
- **Number 7 Subway Line Extension, New York** planning to extend the No. 7 Line Subway services to the area known as Far West Midtown Manhattan which will allow for the expansion of the Midtown Manhattan Central Business District.

Kurt Lutz, CP is the Director of Operations with Robinson. He is a Certified Photogrammetrist with over twenty-five years of experience in the industry. He joined Robinson in 1987 as an Aerial Mapping Pilot with hundreds of hours of flight experience.