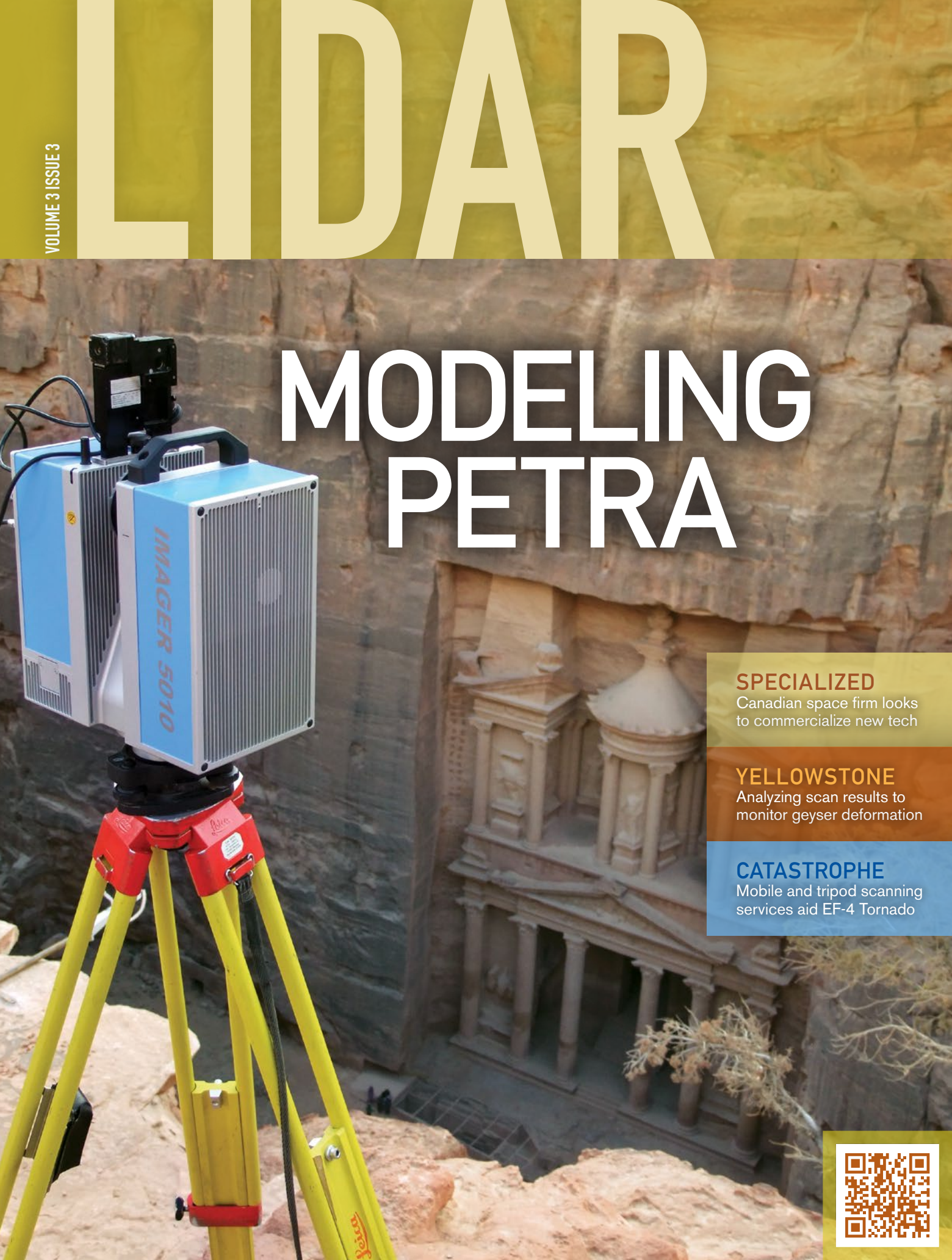
VOLUME 3 ISSUE 3

LIDAR



MODELING PETRA

SPECIALIZED
Canadian space firm looks to commercialize new tech

YELLOWSTONE
Analyzing scan results to monitor geyser deformation

CATASTROPHE
Mobile and tripod scanning services aid EF-4 Tornado

LiDAR point cloud colorized by reflectance of the University of Southern Mississippi's Eagle Walk. The data was acquired using the Riegl VMX-450 mobile mapping system. The Eagle Walk is an area of fame that is located under the east side of the university's football stadium.

LiDAR Supports Post Tornado Response in Mississippi

In the late afternoon hours of February 10, 2013, the University of Southern Mississippi and the city in which it is located, Hattiesburg took a direct hit from a tornado that was officially classified as an EF-4. The destruction left in the wake of the tornado is vast, and it will likely take years before the University and the surrounding community will fully recover. Miraculously, while there was an official report of 84 injuries, not a single death was recorded from the tornado. However, with over two thousand structures damaged or completely destroyed, the use of highly precise geospatial data may help expedite the recovery process both on and off the University campus.

The tornado hit on the day that most LiDAR mapping firms were traveling to this year's International LiDAR Mapping Forum (ILMF). With it being an uncharacteristic storm for this time of year, the news of the tornado quickly made national headlines. In addition, there are a plethora of videos on the internet and YouTube that were filmed by locals in the community who turned storm chasers with the use of video cameras and smart phones. While these videos in addition to the images of the aftermath are harrowing, one

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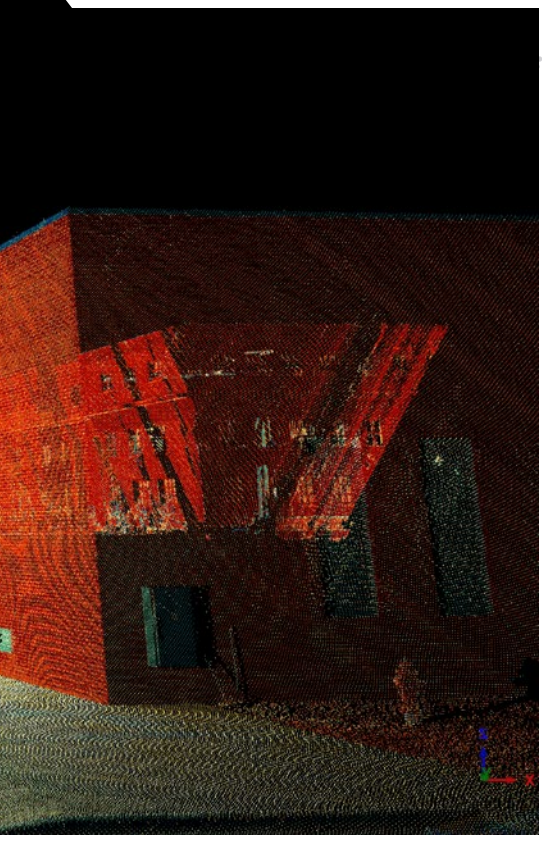

must visit the actual devastation to fully understand the impact this storm has had on an otherwise small, quiet city in southern Mississippi.

While attending a dinner one evening of the ILFM conference, Surveying Solutions, Inc. (SSI), EMC, and Riegl USA decided to explore the use of mobile mapping and static terrestrial LiDAR technologies in conjunction with the University of Southern Mississippi's Geography and Geology department. While aerial LiDAR is often deployed to areas following a natural disaster, mobile and static terrestrial LiDAR often seem to be overlooked. The tornado that devastated Hattiesburg was no different. In the days immediately following the tornado, the sky was peppered with both low altitude fixed wing and low altitude rotary aircraft. The data collection effort was obvious even to the untrained eyes of the general population. In an effort to investigate both mobile mapping techniques and static terrestrial LiDAR data collection methods, the University of Southern Mississippi agreed to allow SSI, EMC, and Riegl USA to demonstrate these technologies on the university's Hattiesburg campus.

With the SSI MoLi system already on deployment for another project and the recently purchased EMC mobile system in transit through US Customs from Riegl's Austria production facility, the Riegl USA demonstration system that was being driven back from the ILMF conference in Denver to the company headquarters in Orlando, FL, would be the best available system for use. In addition, EMC would supply a Riegl VZ400 static LiDAR scanner and a GPS base station for use in the processing of the GPS/INS data. The data collection team met in Hattiesburg on Sunday, February 17, to finalize the data acquisition plan and any other logistical concerns. This was exactly one week following the wrath of the tornado. The data collection took place on Monday, February 18.

The University of Southern Mississippi is not new to LiDAR and remote sensing technologies. There are several individuals on the university's staff that are familiar with the technologies. The campus located on the Mississippi Gulf Coast at Stennis Space Center specializes in hydrographical surveying in addition to bathymetric LiDAR. The university has spent a great deal of time utilizing LiDAR for many different applications, and since the team was able to collect mobile mapping data on the majority of the campus and not just on the areas that were hit by the tornado, the project team hopes to be able to share this data with other departments at the University as well. In addition, there are programs and research that is being conducted within the geography department that will be able to benefit from the mobile LiDAR data.

To maximize the collection efforts with limited field time, the team decided to divide their efforts during the collection into two teams. One team would conduct all of the mobile

The Riegl VMX-450 mobile mapping system on the University of Southern Mississippi's Hattiesburg campus.

Above: LiDAR point cloud collected from the Riegl VMX-450 of the Aubrey K. Lucas Administration Building at USM.

Right: EMC field crew scanning the Alumni House on the campus of the University of Southern Mississippi with a Riegl VZ400.

mapping data acquisition, and the other team would handle the data acquisition from the static LiDAR scanner. Once the base station was set up and logging the GPS data, the project team divided and started the data acquisition.

For project control, the data collection team used an established benchmark that was located on the southern portion of the university's campus to set up the base station. An additional benefit to using a benchmark on the campus was that the campus is centrally located in the path of the tornado. If the project team was able to collect any additional data off of the university's campus, the base station would not have to be relocated throughout the day. Additionally, by setting the base station on a benchmark with known values, the team was able to collect the most accurate data possible without having to establish survey control. The relative accuracy of the data was far more important for this investigation compared to the absolute accuracies that were being achieved. The absolute accuracy of data was sufficient with the manufacturer's specification of 2-5 cm.

The acquisition team also collected data with a static terrestrial laser scanner. The use of the Riegl VZ400 proved to be very helpful for capturing the high resolution 3D data that was either out

of range or not in the line of sight of mobile LiDAR sensors. The static data was collected with an integrated RTK rover that was in constant communication with the same base station that was used for the mobile mapping system. The use of single base station with multiple data sources makes it extremely easy to merge the datasets even though they were collected with different LiDAR technologies. Because the same base station data was used for the mobile mapping system and static laser scanner, the data fusion that are implemented to create the high resolution 3D datasets are streamlined and simplified for rapid turnaround and production.

The Alumni House is one of the oldest buildings on the USM campus. It is located on the southeast corner of the Hattiesburg campus, and the structure took a direct hit from the tornado. Because of the extensive damage to the building, it remained fenced off and completely surrounded by heavy construction equipment. This situation proved to be less than optimal for the mobile mapping system. Because work had already started on securing the building, the heavy equipment and large team of contractors caused some laser shadowing from the mobile mapping system. However, the project team was able to access the fenced area with the VZ400 static scanner and a tripod. This allowed for a complete data collection on the historic building without any laser shadowing or loss of data. Additionally, the project team was very non-intrusive to the construction area with the static scanner. Because of the speed of acquisition from the VZ400, the construction workers were able to keep the equipment working without having any delays caused by the survey team.

The project team was able to collect data for about six hours throughout the day. Mobile mapping data was collected throughout the city of Hattiesburg. Also, the team collected the majority of the USM Hattiesburg campus. The Riegl VMX 450 collected just over 500 gigabytes of laser data throughout the tornado damaged areas. In addition to collecting static LiDAR data on the university campus, the static scanning team also deployed into some of the hardest hit areas. Within six hours, the project team was able to collect high resolution, high definition, 3D geospatial data on the hardest hit areas of the USM campus, the city of Hattiesburg, and the surrounding areas.

The ability to deploy rapidly and effectively collect the data without intruding on any of the recovery efforts proved to be very beneficial. The data was collected without interrupting a single disaster relief worker, lineman trying to get power back to the neighborhoods, or one heavy equipment operator trying to clear debris from the streets and homes. The very non-intrusive nature of mobile mapping makes it a good fit for data collection methods in many different applications moving forward.

Colorized point cloud collected of the Alumni House on the campus of the University of Southern Mississippi with the Riegl VZ400.

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