

How San Diego State University Researchers Track Changes in San Andreas Fault with Geodetics Mobile Mapping and Velodyne LiDAR Technology

SAN DIEGO, Calif.—(BUSINESS WIRE)—Scientific study of the evolution of the southern end of the San Andreas Fault is of vital importance given the earthquake-prone nature of southern California. Mapping fault zones and land surface changes that resulted from previous earthquakes can deepen the understanding of hazards posed by the fault, including the possibility of future temblors.

To advance this effort, the Department of Geological Sciences at San Diego State Univ. (SDSU) teamed with Geodetics Inc., a leading manufacturer of integrated mobile mapping systems that utilize passive and active vision sensors (LiDAR/Camera), to research the San Andreas Fault in southern California. The study scanned the fault with Geodetics' drone-based Geo-MMS™ LiDAR/Camera mapping system that uses Velodyne LiDAR technology and an RGB camera to deliver the most accurate 3D data on the market.

The research is focusing on evaluating both past large slip events (earthquakes) and aseismic creep (also known as “silent earthquakes”), which are tremors that release their energy over weeks or months rather than seconds. It is looking to discover new fault zones and active fault traces, which are visible marks where a geological fault meets the ground surface. The research is also looking to detect fault slip that has resulted from past earthquakes.

“LiDAR mapping represents a very exciting technology for geology since it enables the generation of accurate 3D mapping, even in the vertical component where classical photogrammetry techniques are lacking,” said Dr. Allen Gontz, Professor and Chair of Geological Sciences at San Diego State Univ. “Our researchers at SDSU are planning to continuously monitor the fault to better characterize it and exploit the advantages of the current 3D mapping technique.”

“Being deeply rooted in the LiDAR mobile mapping market, Geodetics is always on the lookout for the best-of-breed sensors for use in our products,” said Dr. Lydia Bock, President and CEO, Geodetics Inc. “We have been working with Velodyne as our LiDAR provider for several years. Velodyne continues to enable Geodetics to meet its goal of offering state-of-the-art systems that are easy to use and offer excellent cost/performance value to our customers.”

“Industry leaders rely on accurate, dependable data created by Velodyne LiDAR technology to provide the highest performing mapping systems in a compact solution,” said Mike Jellen, President and CCO, Velodyne LiDAR. “Geodetics designs and builds advanced mapping systems that make them a go-to provider for precision navigation and sensor integration for mobile applications in the air, on land and sea.”

San Andreas Fault Research

In their study, SDSU researchers are developing a comparison between several techniques for evaluating past slip events and looking to establish precision and accuracy of the techniques relative to each other.

Previous work in this area has utilized traditional photogrammetry techniques using small drones to build digital terrain models of earthquake faults. The Structure from Motion (SfM) approach in photogrammetry to monitor topography changes has been a hot topic in geology for the past two years. However, SfM does not have inherent referencing scale – the scale at which symbols and labels appear on a map at their intended, true size. Other techniques involve LiDAR with the U.S. Geological Service using airborne LiDAR while other researchers have tapped ground-based LiDAR to map topographic expression of the fault and examine offsets, which are the distance the fault is out of line with the map.

The SDSU team used a Geodetics Geo-MMS system including the mapping payload and DJI Matrice M600 Pro drone for its San Andreas Fault mapping. The Geo-MMS payload was equipped with Geodetics' Point&Pixel™ technology (the Point (provided by the LiDAR) and Pixel (provided by the camera)) which enabled researchers to generate 3D models without the use of ground control points (GCP), which are marked points on the ground that have known geographic locations.

“Traditional techniques including topographic surveying tools require ground control points in the surveyed area, which are challenging in remote, high alpine environments and fault areas. LiDAR topographic surveying operating on unmanned aerial vehicles takes mapping to a new level because of its coverage scale and high resolution without the need of ground control points,” said Dr. Bock.

Geodetics Expands Product Portfolio

Geo-MMS, which currently uses several Velodyne LiDAR sensors including the Velodyne PUCK™ VLP-16 sensor, delivers accurate georeferenced LiDAR point clouds to customers in agriculture, construction, forestry, infrastructure, mining and urban planning. Since Geodetics develops all electrical, mechanical, algorithm design and software components used in its products, the company is in a unique position in the LiDAR drone mapping space to innovate quickly to deliver new state-of-the-art technologies.

Geodetics is deepening its relationship with Velodyne by expanding its Geo-MMS product offering with integration with the Velodyne's ULTRA Puck™ VLP-32C. The VLP-32C is a long-range LiDAR sensor that combines best-in-class performance with a small form factor. It is a high-resolution LiDAR sensor that is cost effective compared to similar performance sensors and retains innovative breakthroughs such

as 360° surround view along with real-time 3D data that includes distance and calibrated reflectivity measurements along with rotational angles.

Geodetics is also introducing the innovative Point&Pixel™ capability to its Geo-MMS product offerings, advancing its strategy to provide industry professionals with cost-effective, streamlined solutions to produce 3D georeferenced point clouds. Point&Pixel enables accurate colorization of the LiDAR point cloud using synchronously captured RGB images from a camera during the same flight as the LiDAR scanning collection. The industry-leading Geodetics approach allows users to create colorized point clouds and photomosaic quickly without requiring multiple overflights of an area or different scan patterns. Point&Pixel is expected to be available in the third quarter of 2018.

Additionally, Geodetics is introducing its new Geo-Photomap™ product for applications such as vertical mapping and corridor mapping. Geo-Photomap enables accurate automated 3D mapping using direct-georeferenced images (geo-tagged images) – images associated with a geographic location. With Geo-Photomap, high-accuracy positioning and external orientation angles are generated, eliminating the need for ground control points and reducing image overlap to as low as 30 percent resulting in significant cost savings.

“Our team of scientists and engineers enables Geodetics to be much more than a system integrator. We design and build the technologies in our LiDAR mapping systems and are poised to move the state-of-the-art in LiDAR mobile mapping for geological research and much more to the next level,” said Dr. Bock.

About Geodetics

Geodetics, an advanced sensing and navigation company, was founded in 1999 by a team of passionate scientists and engineers that pride themselves on innovative products. Our Assured Positioning, Navigation and Timing (A-PNT) solutions are designed to address a wide range of requirements for Air, Sea and Land applications. These solutions have been deployed in mission critical applications including Aerial Refueling, Aerial Combat Training, Intelligence, Surveillance and Reconnaissance, UAV's, Aerostats and Dismounted Soldier tracking as well as applications for the commercial market. Geodetics products and technologies are designed and built in the U.S.A. When unique application requirements arise, our dedicated team of project managers, support engineers, scientists, algorithm developers, software, hardware and test engineers stand ready to work with our customers to precisely meet their application objectives.

About Velodyne LiDAR

Founded in 1983 and headquartered in Silicon Valley, Velodyne is a technology company known worldwide for its real-time 3D LiDAR computing and software platforms. Velodyne LiDAR Inc. emerged in 2005 as the unmatched market leader of

real-time 3D vision systems used in a variety of commercial applications including autonomous vehicles, vehicle safety systems, mobile mapping, aerial mapping, and security. Its products range from the high-performance, surround view Ultra-Puck™ VLP-32, classic HDL-32/64, cost-effective VLP-16, the newly released VLS-128, to the upcoming, hidden Velarray™. Velodyne's rich suite of perception software and algorithms are the key enablers of its perception systems. Velodyne supports customers from offices in San Jose, Detroit, Frankfurt, and Beijing. For more information, visit <http://www.velodynelidar.com>.

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