

The different channels of Intensity data from the Titan as provided by Ryerson University and Optech

# Review of the Optech Galaxy, Titan and CZMIL LiDAR Sensors

Optech has a long history of developing state of the art LiDAR sensors. They have had many very good sensors over the years and some less than stellar sensors. Overall, Optech sensors have performed very well. The latest line of sensors show some great potential and as a result of the lessons learned from the predecessor sensors they keep getting better.

The one sensor that seems to show the highest degree of promise and potential is the Galaxy which was developed from the Orion technology. The Orion sensor including the Orion

C200, M200, C300, M300, and H300 is one of the most accurate, best performing sensors in the profession. The galaxy is a very compact sensor similar to the Orion and rumor has it based on the current technology that its collection efficiency is better than sensors twice the repetition rate as a result of how it collects data and deals with Terrain.

Optech is having a hard time keeping up with the demand for these sensors. It is hard to not trust the Orion technology this sensor is based on. In late 2012 a project for the USGS was collected in Colorado with one of the first Orion

M200 sensors manufactured and after the project was completed, several trusted LiDAR professionals from the USGS indicated that to date that was the best LiDAR data they had received. Like most models of LiDAR sensors, Optech had initial challenges with the Orion but once the kinks were worked out the sensor has become one of the best data producing sensors currently used.

The Titan and latest CZMIL sensors are very new and extensive testing of these sensors are currently being done and surely Optech is keeping some of the confidential uses of these sensors under wraps. It seems that the Titan is a hybrid of the Pegasus system. Although, the Pegasus was developed to compete

BY JAMES WILDER YOUNG



The Optech Galaxy, CZMIL Nova and Titan LIDAR sensors

with the latest from the other big two LIDAR manufacturers, it has shown great results and Optech has done an extremely good job supporting the continued development of the Pegasus. They have continued to support the evolution of this system by providing firmware and hardware upgrades that improve its performance.

In the latest 4 to 5 years, the increase of repetition rates has presented some unique challenges in areas of relief. In areas of extreme terrain, planning a mission has become less than desirable as a result of blind zones in the collection as a result of the electronics to receive any data in these blind zones. The technology that is available in the Galaxy has been applied to the Pegasus through updates that eliminate these blind zones in the Galaxy and Pegasus.

What seems apparent is that the sensors continue to produce better data with much more efficiency. The only thing that is irritating is it seems right

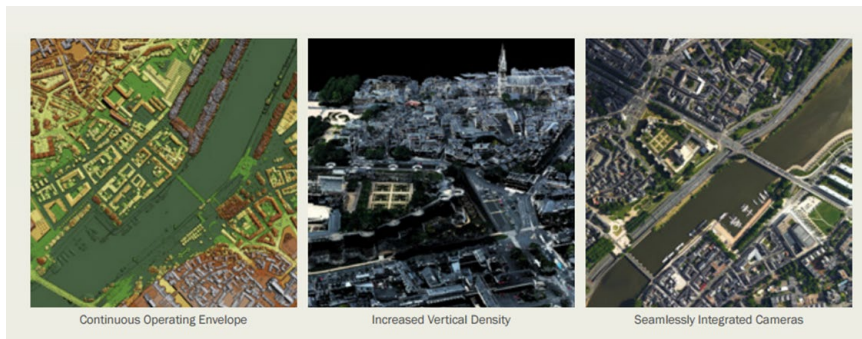
when the latest and greatest sensor is purchased from any LiDAR manufacturer, the next best thing is coming out. This is good for the manufacturers but a struggle for the profession. That being said, we as a profession need to concentrate on the end product and just because someone has the latest does not make their data the best. The processing of the data is paramount to the success of a LiDAR campaign. That being said, the Optech sensors are providing much improvement to the overall LiDAR products being delivered.

The Optech Galaxy is one of the most compact sensors currently on the market. It can be hard mounted or in a gyro-stabilized mount. It has the ability to be co-mounted with several sensors but comes standard with 1 to 6 cameras. The most impressive feature of this sensor is the continuous operating envelope accommodates high-relief terrain with no data gaps or loss of density across multi-pulse transition zones with

the ability to capture up to 8 returns per emitted pulse. This is done without the processing and storage burden of voluminous waveform capture. So as Optech asks, *“What is the secret to the Galaxy’s performance advantage?”* PulseTRAK™ is an innovative set of LIDAR technology enhancements that significantly increases sensor reliability and collection efficiency, improves data quality and simplifies the collection process according to Optech.

The main components and functions to the PulseTRAK™ are a high performance scanner, continuous operating envelope, swath tracker and real-time sensor protocol. The high performance scanner is a new form of scanner that features extremely high torque and minimal electronic inductance. This provides faster scan speeds at reduced voltages. In short this will produce much more accurate data with less noise associated with the scan. As stated above, the continuous operating envelope provides continuous coverage in all areas eliminating the data “blind zones”. The swath tracker maintains regular point distribution and constant-width flight line despite changes in terrain height. It uses the programmable galvanometric scanner to create a real time dynamic FOV that maintains constant swath width and point distribution throughout the terrain. The real-time sensor protocol provides real-time continuous true coverage during collection. The galaxy operates between 150m and 4700 meters AGL at programmable repetition rates of 35-550kHz operating at 1064-nm (near-infrared). The sensor captures up to 8 returns with 8 -12bit intensity returns. Additional technical specifications can be found on Optechs web site ([www.optech.com](http://www.optech.com)).

The Titan appears to be the big daddy of LiDAR sensors. This sensor is the culmination of Optech's nearly 50 years of laser experience. The Titan is a multi-spectral LIDAR sensor operating at 532, 1064 and 1550-nm. These wavelengths combined all the functionality and precision of different sensors in one to provide a unique collection capacity not realized until now. A high-resolution "green" channel that ensures high point density for shallow water mapping applications. Narrow pulse widths, state of the art receiver and electronics provide the absolute highest range precision possible based on today's technology, while providing maximum data quality. A fully programmable scanner enables huge increases in point density at narrower FOVs for maximum target resolution and accuracy as related to other widely used sensors. Additionally, the titan is capable of providing full waveform data at all three bands. The titan also can be fitted with fully-embedded high resolution



Data captured by the Optech Galaxy as provided by Optech

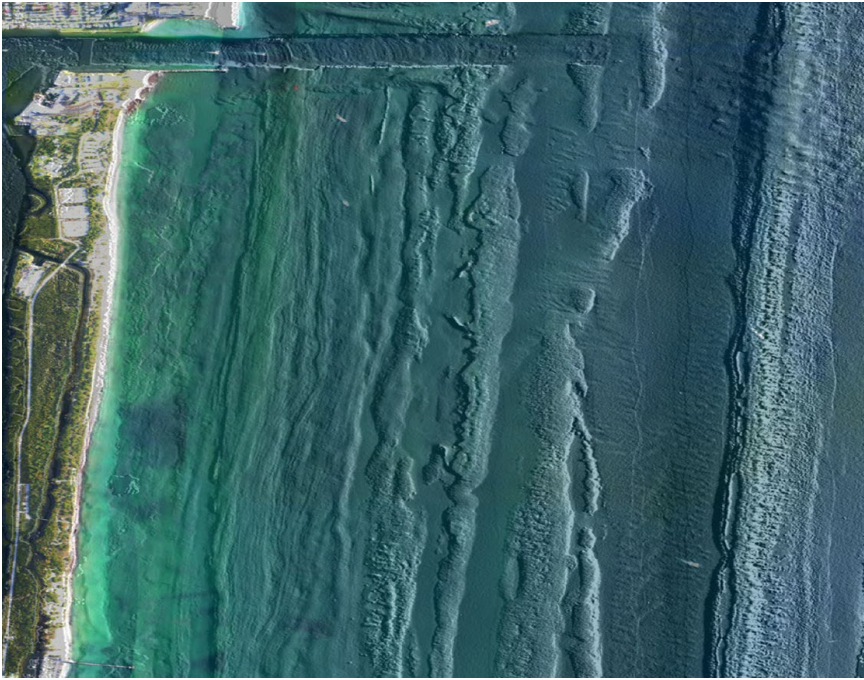
metric cameras, including multispectral, thermal, NIR and RGB cameras. The Titan can operate at between 300 and 2000m AGL, all three channels and the bathymetric 532nm operates at 300-600m AGL. Optech can provide more details on exactly what this means. The repetition rate for all three channels can be programmable between 50 to 300khz or a maximum total of 900khz. The sensor comes with a 29 megapixel QC 4-band camera and can come with an 80 megapixel 4-band camera as an option.

The sensor is capable to receive up to 4 returns with 4- 12 bit intensity returns and waveform capture is 12-bit 1GS/sec and optional. This sensor provides an excellent option to the other two big sensor manufactures. The data from this sensor is very accurate, crisp and impressive.

Lastly, The CZMIL has been around for a bit and is a descendent of the shoals system. It is the RAM Truck of bathymetric sensors. Even Optech has a much sexier version of this sensor and like most LiDAR recent bathymetric sensors each has its sweet spot. All Optech bathymetric LIDAR sensors are the grand dad of bathymetric and it is hard to argue there is anyone that knows bathymetric better than Optech. There are detractors to everything, Apple vs. Microsoft, Coke vs. Pepsi, Dodge vs. Chevy vs. Ford, but the fact is Optech has been a leader before most were in diapers in this type of LiDAR. The latest Optech is called the CZMIL Nova and it was released recently. It is billed as "the most advanced solution for airborne hydrography". The Optech CZMIL Nova Coastal Zone Mapping and Imaging Lidar is an airborne multi-sensor system designed for highly automated generation of 3D topo/bathy information for



Three channel 1550/1064/532nm analysis data from the Optech Titan as provided by Optech and Ryerson University.



Shoreline data captured using the Optech CZMIL Nova sensor

coastal zones, especially in turbid and muddy water conditions. The CZMIL Nova is the only airborne bathymetric system tested against military specifications such as shock, vibration and EMC. It has been validated and in use by multiple government agencies to map coastal areas on a regular basis.

The new CZMIL Nova is 30% smaller and 25% lighter and uses 15% less power. This is a great improvement from past models. The CZMIL has the ability to map through most water at depths up to 50 meters reliably. The data produced from this sensor show much improvement over previous sensors and remains superior to other makes and models. The one thing that Optech has done very well is map and correct for refraction. This process has always been done better using the software tools that Optech provides. Additionally, the ability to map

“A smaller, lighter, lower-power consumption system that operates more efficiently with simplified maintenance—and fits in smaller aircraft for a more versatile and mobile deployment.”

the water column is very good with any Optech bathymetric sensor including the CZMIL NOVA. The CZMIL Nova operated at 400 to 1,000 meter above surface height. It should be noted that the closer the sensor is to the surface the better the results. Although, other systems including the Titan operate at much height pulse rates this sensor operated at 10khz in bathy-mode and 70khz in topo-mode and is designed to get

much deeper than the other bathymetric system it also uses a circular scan of 10 degrees which in theory should improve the resulting data. The CZMIL Nova includes a CASI 1500-H Hyperspectral, 16mp, 80mp and thermal sensors.

Optech has adapted several times over the last two decades as a result of competition from the other two major LIDAR manufactures. They continue to provide some of the best sensors in the profession and this go-around has been one of the best introductions of a new line of multi-use sensors to date. Optech is very good at admitting their mistakes with sensors. The Gemini was not a great sensor and probably was released too early as a result of the competition but Optech adapted from that lesson and has been making a very positive impression on the LIDAR profession. This is not to say that the other manufactures of

LIDAR are not making great sensors. It is always a shell game with the production and release of LiDAR sensors but the Optech shell is clearly marked and it is very impressive right now. ■

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