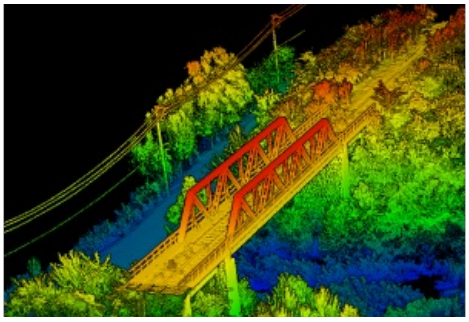
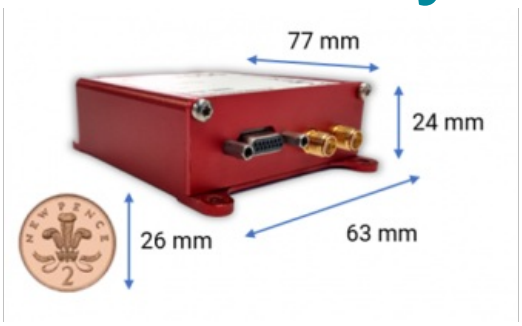
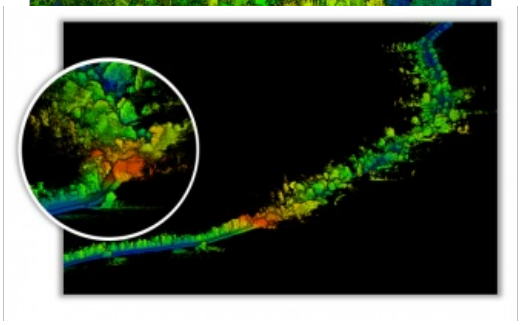
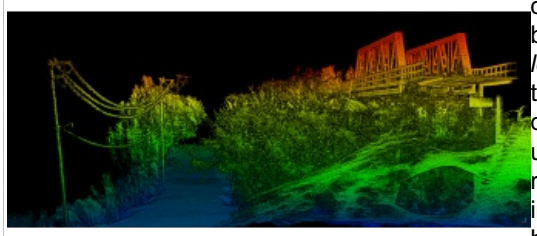
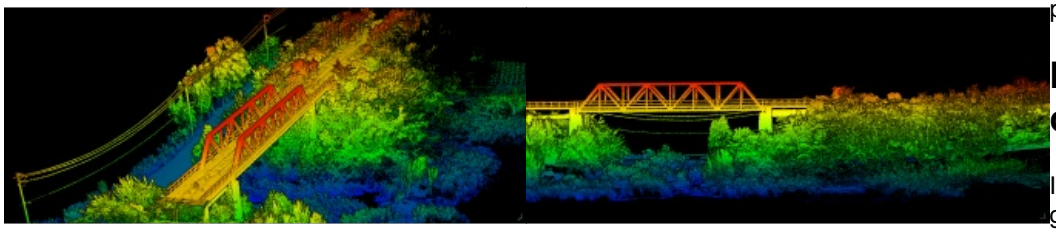
How to Get the Best Navigation Data for Lidar Surveying











A new INS from Oxford Technical Solutions aims to break new ground in bringing high-quality navigation data to the Lidar surveying industry. Launched on 22 March 2021, the xNAV650 promises to be the company's smallest, lightest and most affordable INS to date, featuring the latest technology developed with the Lidar surveyor in mind.

It is tempting to shun the navigation device in favour of the surveying device, but surveying is primarily a work of *locating* objects in space. This requires the best navigation data. However, these devices can be difficult to pair with Lidar units or they can be very expensive in relation to the surveying device. This new inertial navigation system (INS) has been built with all of this in mind and with a unique software suite that allows surveyors to use the INS and Lidar to produce a full point cloud and more.

How to interface the devices

Interfaces are a very important aspect of getting your hardware setup ready and working, and every surveyor has a different need, depending on their application and the devices they wish to use. The more flexible the INS can be with these, the better. Few INS units offer PTP (Precision Time Protocol) to synchronize their time data with Lidar, even though Lidar units often offer this as an easy way that does not require bespoke cabling; just an ethernet connection is needed. The xNAV650 offers PTP for time synchronization but also offers the traditional PPS to work flexibly with any Lidar and setup. A number of output and input triggers and options for sending NMEA data are also available so you can have the confidence that you will be able to get exactly what you need, no matter how specific your application.

The xNAV650 has a very small mass and form factor.

How to georeference a point cloud

Perhaps the proudest offering of OxTS is the OxTS Georeferencer, a software package that combines Lidar and OxTS INS data to create a point cloud. Whether due to lack of expertise, time or budget, it is often a difficult and underestimated step for surveyors to create their own program to decode the Lidar data and INS data and then to combine it to georeference a point cloud. OxTS Georeferencer works with a range of Lidar units from the largest manufacturers as well as offering unique features that have been developed with much experience. One of these features is a calculation for every point of the estimated uncertainty in its position. This data can be viewed in the pointcloud itself and the pointcloud can be edited to remove inaccurate points or to identify areas that need resurveying. OxTS has worked with Lidar manufacturers such as Velodyne to develop this software with the end user in mind.

Road survey point cloud where GNSS signals have been blocked by a treeline, the longer GNSS signals are blocked the more the position drifts. This can be seen by the orange colour instead of green and blue.

How to calibrate your Lidar to your INS

A very important consideration is how to calibrate the Lidar and INS coordinate frames. When considering the accuracy of a point cloud, a very high degree of angular accuracy is required. The navigation data is on the order of 0.05o so the orientation of the Lidar with respect to the INS ought to be known to this high degree of accuracy. This is very difficult and time-consuming to do with traditional methods and can easily be the bottleneck in terms of accuracy. OxTS Georeferencer offers a very intuitive data-driven calibration solution to get the coordinate frames appropriately aligned. The procedure can be added to any survey in ten minutes and does not need to be repeated if the hardware setup is not changed. This maximizes setup flexibility. OxTS Georeferencer also offers a handy window to help you visually get your initial orientation correct.

Example case study – Bridge survey

The following is an example case study of a drone survey using a VLP16 Lidar and an xNAV650. The data has been processed using OxTS Georeferencer including using the boresight calibration feature. The aim was to scan the aging bridge to find potential structural weaknesses or overgrown areas.

The drone has been flown all around the bridge to view it from every angle. This requires that the setup is well calibrated. Otherwise, different perspectives of the same object would combine to give blurring and double vision.

Pointcloud taken of bridge looking for structural weaknesses. Data collected using and OxTS xNAV650 INS and Velodyne VLP-16 Lidar. Data processed using OxTS Georeferencer.

Pointcloud of Bridge Survey used to help identify overgrown foliage. Data collected using and OxTS xNAV650 INS and Velodyne VLP-16 Lidar. Data processed using OxTS Georeferencer.

Side view pointcloud of bridge. Data collected using and OxTS xNAV650 INS and Velodyne VLP-16 Lidar. Data processed using OxTS Georeferencer.

The Lidar data has been logged directly onto the INS, saving power and weight and allowing a long flight time to get a large range of perspectives on the bridge and generating a very full point cloud.

How to complete further applications

Any number of applications are possible to carry out with the xNAV650 and OxTS Georeferencer. For example:

- Building Survey
- Coastal Monitoring
- Forestry Survey
- Map Creation
- Pipeline Exploration
- Rail Survey

Applications do not stop with Lidar; the interfaces and navigation data of the xNAV650 make it suitable for any surveying work, whether photography or detecting gas.

To learn more about the xNAV650 watch the video below.