OxTS Webinar

Boresight Calibration

In association with our partners

NavtechGPS®

DTC GmbH
Navigation & Security Solutions

DATRON TECHNOLOGY

Introduction: Peter Wood, Commercial Manager
Presentation: Jacob Amacker, Product Engineer

OxTS are experts with reliable and consistent position and orientation data, with over 20 years of experience.

We make our iconic red box INS devices to give survey grade navigation data. We also provide OxTS Georeferencer, software to turn your LiDAR and INS data into a pointcloud.
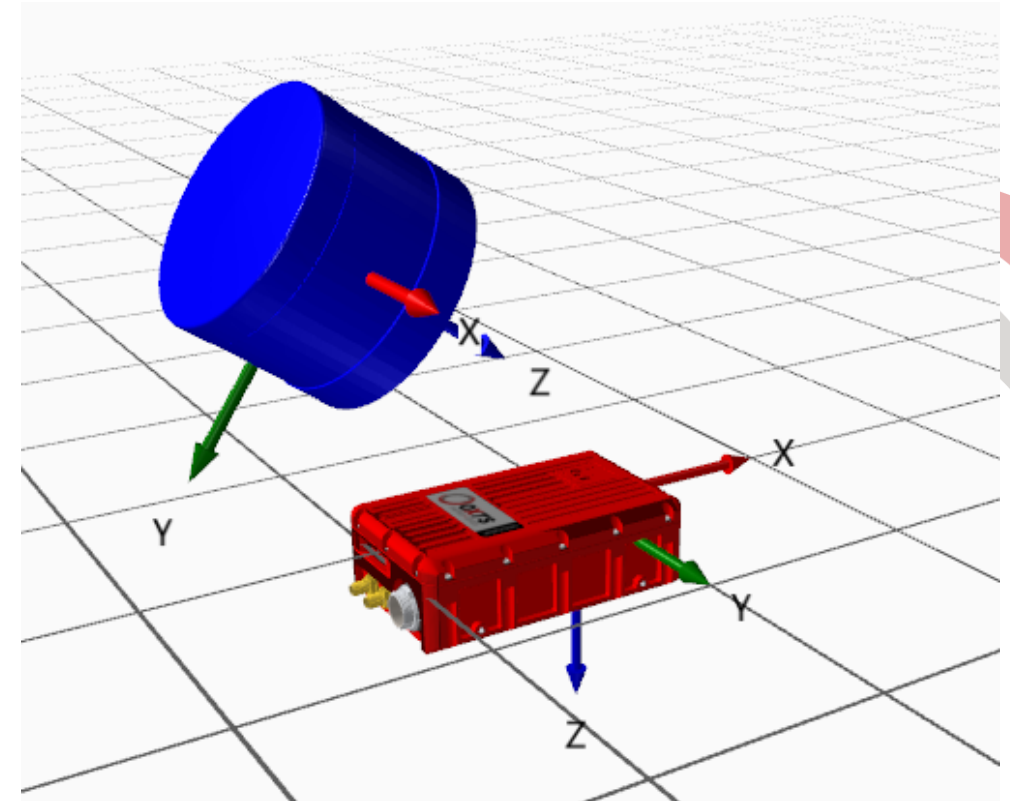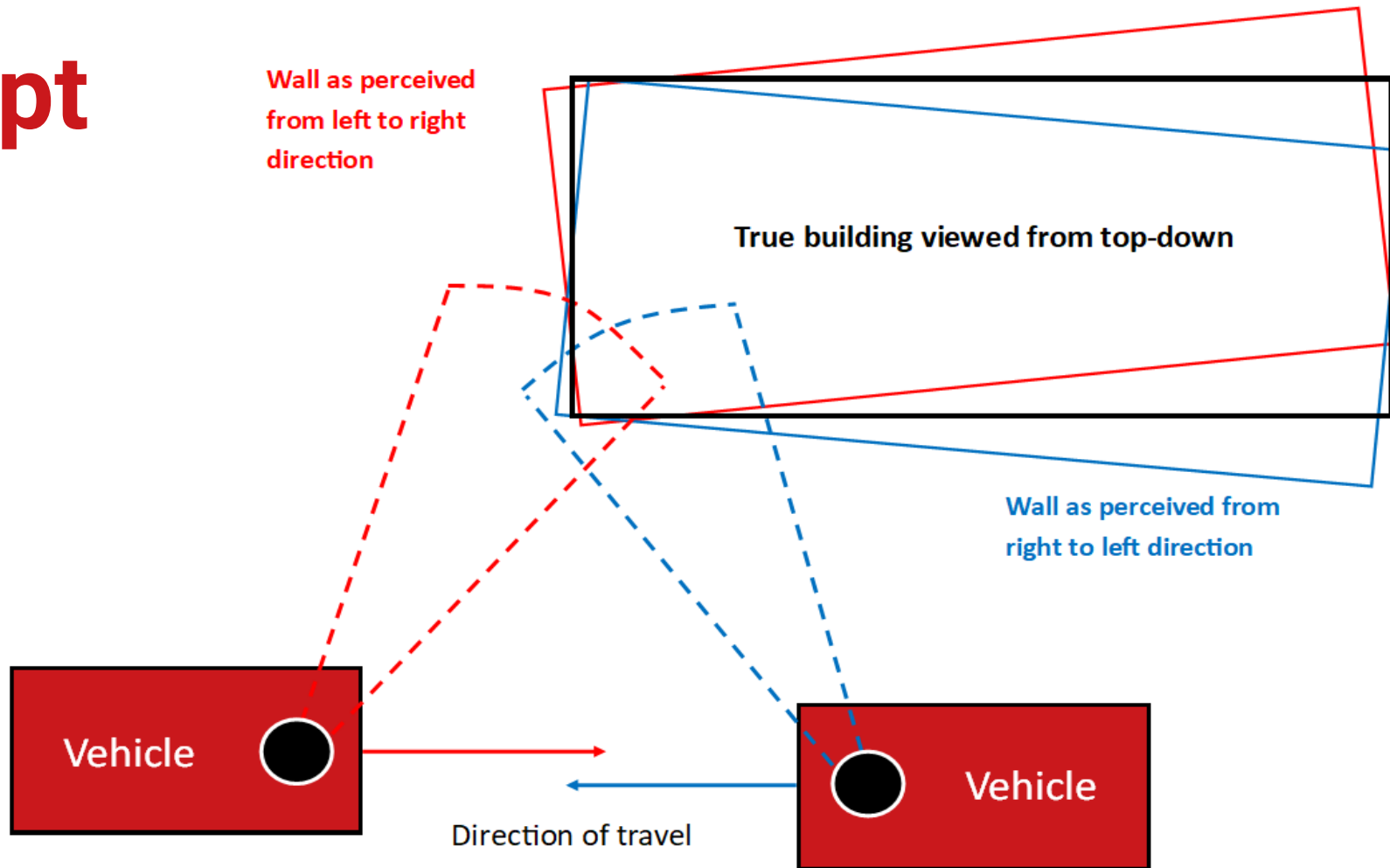
The Problem: Boresight Misalignment

Concept

Boresight misalignment occurs when there is an imprecision in the angles measured between your tracking device (INS) and your surveying device (LiDAR).

- A tiny imprecision can cause significant distortion in a pointcloud and may render it unusable

- Measuring these angles precisely enough is extremely difficult and often requires a data-driven calibration technique

- The problem gets amplified the further from the INS the LiDAR device is

Concept

Wall as perceived from left to right direction

True building viewed from top-down

Wall as perceived from right to left direction

Vehicle

Vehicle

Direction of travel

The boresight misalignment causes objects to be seen in different places when viewed from different positions and angles.

Concept
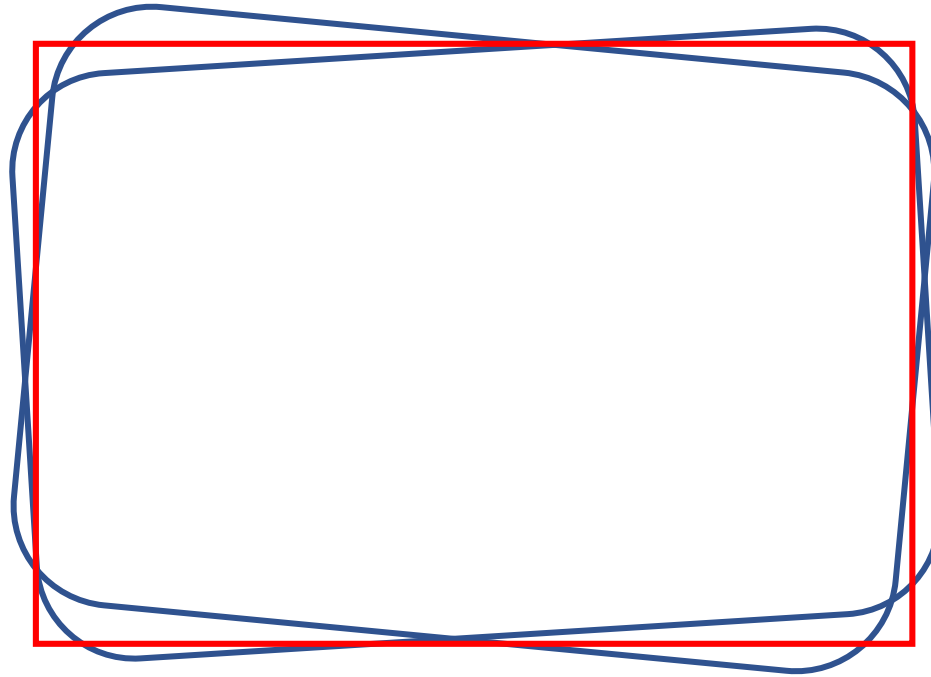
- Instead of a nice crisp rectangle with right angles, the resultant shape will be blurred and stretched at the edges

- As a quick calculation: If you have an error of 0.2° in one axis then the position error of a point only 10m away will be approximately $\frac{0.2 \times 2}{360} \times 2\pi \times 10 \simeq 7cm$ (in just one axis)

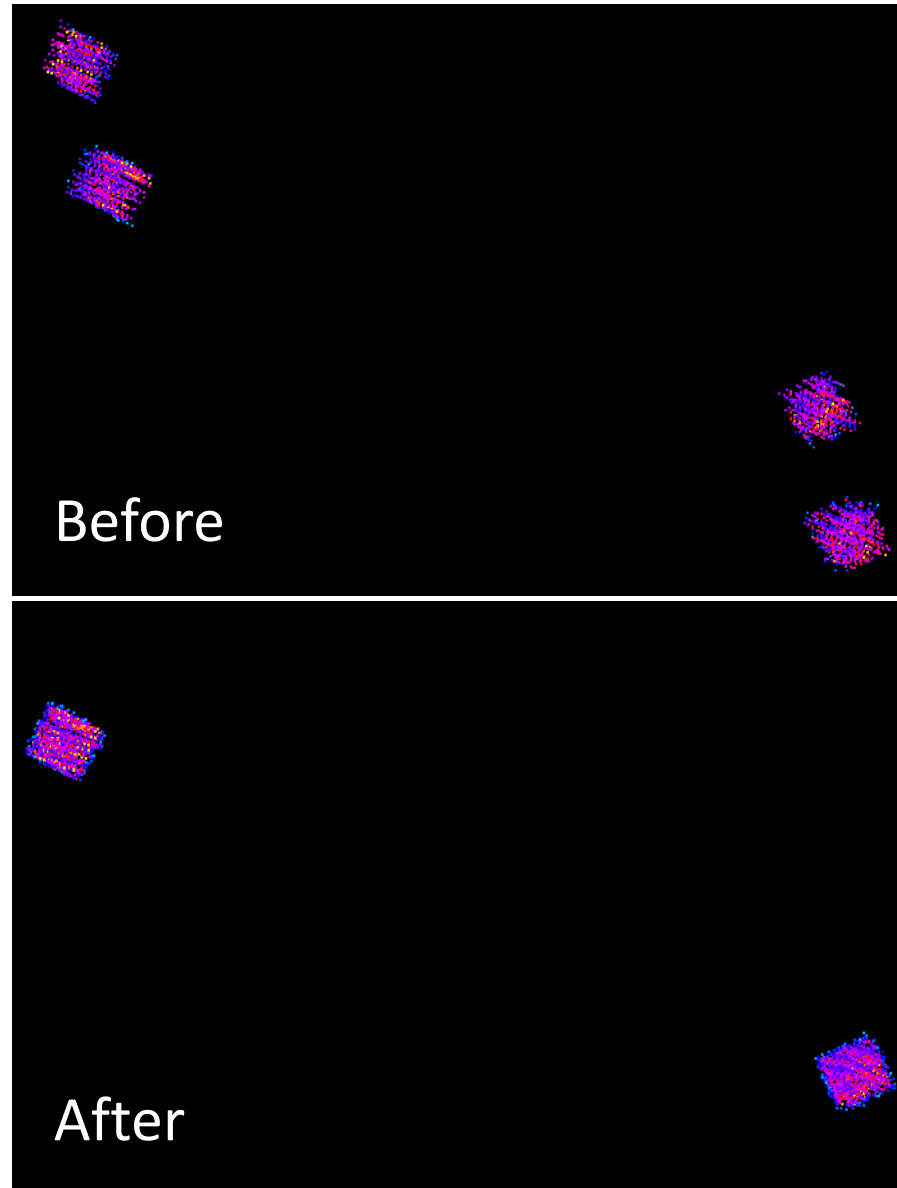OXTS
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In Practice

What is the effect in practice?

- A very real problem and fatal for many applications

- The larger the distance, the more pronounced the effect

- 'Double vision' is the worst outcome of boresight misalignment

The angles between the devices need to be known as precisely as possible (better than 0.1° for the best results). This is often impossible by eye and difficult with most measurement devices.
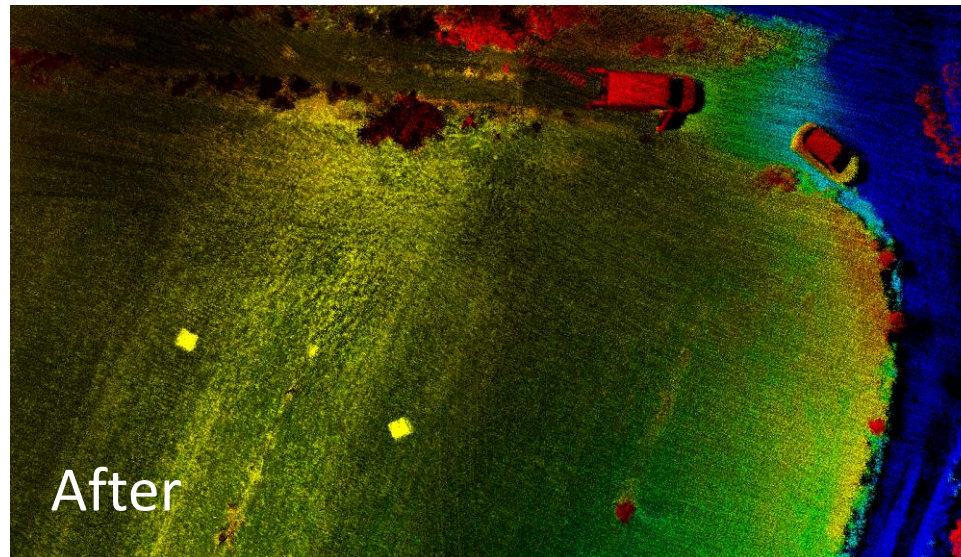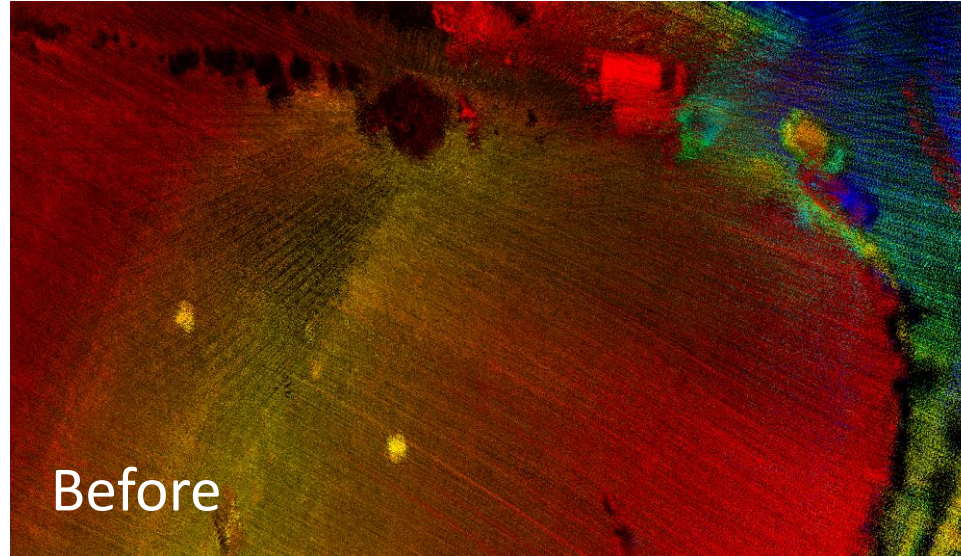
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Example: Double-vision elimination

- UAV survey

- Flown at 50m

- Two passes north/south flight path (data cropped)

- xNAV550 used

- Velodyne VLP-16 used

- LiDAR angle imprecision of 5° in 2 axes

- Data filtered on 100 reflectivity value

Before

After

Example: Blurring removal

- Same raw data as the first example

- 24 passes north and south flight path (full data set)

- xNAV550 used

- Velodyne VLP-16 used

- LiDAR angle imprecision of 5° in 2 axes

Before

After

The Solution: OxTS Boresight Calibration

We have seen that we need to know the angles between the INS and the LiDAR as precisely as possible.

How can we do that?
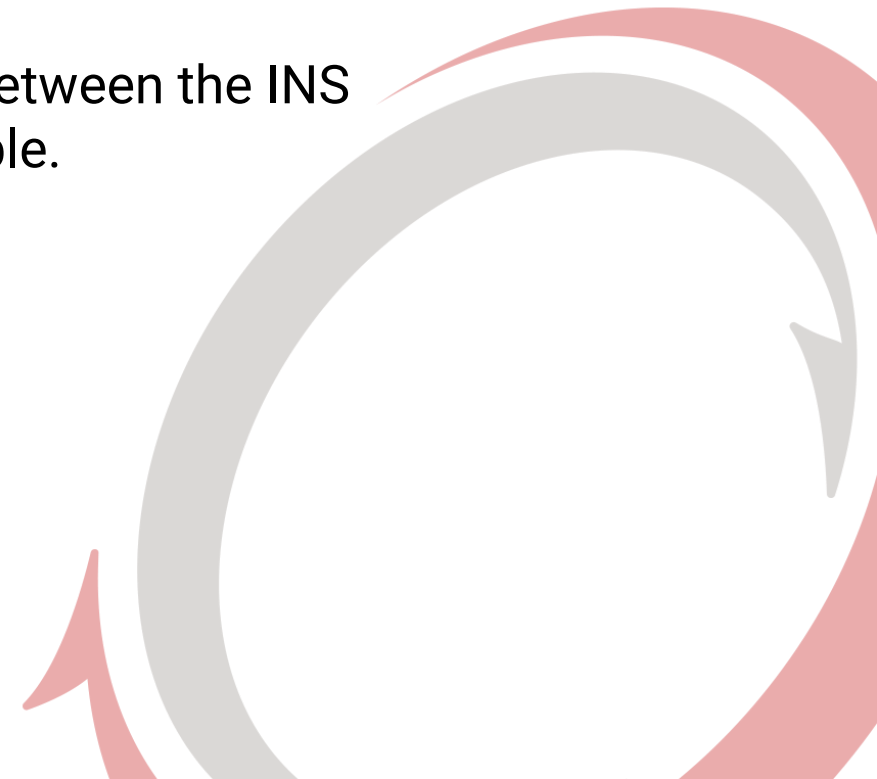
Procedure

Set up flat, square, retroreflective targets

↓

Have the LiDAR view the targets from all angles and distances

↓

Use OxTS Georeferencer to calibrate the LiDAR orientation

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Demonstration

We will now do a demonstration of using our OxTS Georeferencer software to perform a boresight calibration of data captured with an OxTS Survey+ INS and a Velodyne VLP-16 LiDAR.

We used:

- OxTS Georeferencer

- OxTS Survey+

- Velodyne VLP16

Summary

- Blurring and double-vision make intelligent (or by eye) classification of objects difficult or impossible (needed for lane-marking, road sign, car, barrier, trees etc recognition).

- Fine details of objects can be lost without boresighting. Volume and distance measurements will be incorrect.

- The further away objects are the more distorted they will be.

- A data-driven calibration technique is necessary to get angles precise enough.

- OxTS boresight solution is a simple procedure that can be added to any survey-run.

Resources and contact details

Resources used

- OxTS Georeferencer software

- xNAV550 INS

- Survey+ INS

- Velodyne VLP-16

- Cloud compare pointcloud software

Contact details

- Peter Wood – Commercial Manager at OxTS – pwood@oxts.com

- **OxTS LinkedIn pages**

- Mobile mapping

- UAV mapping

Questions

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