

Using LiDAR Data To Feature Extract Railway Assets

Railway Asset Identification System (RAIS)

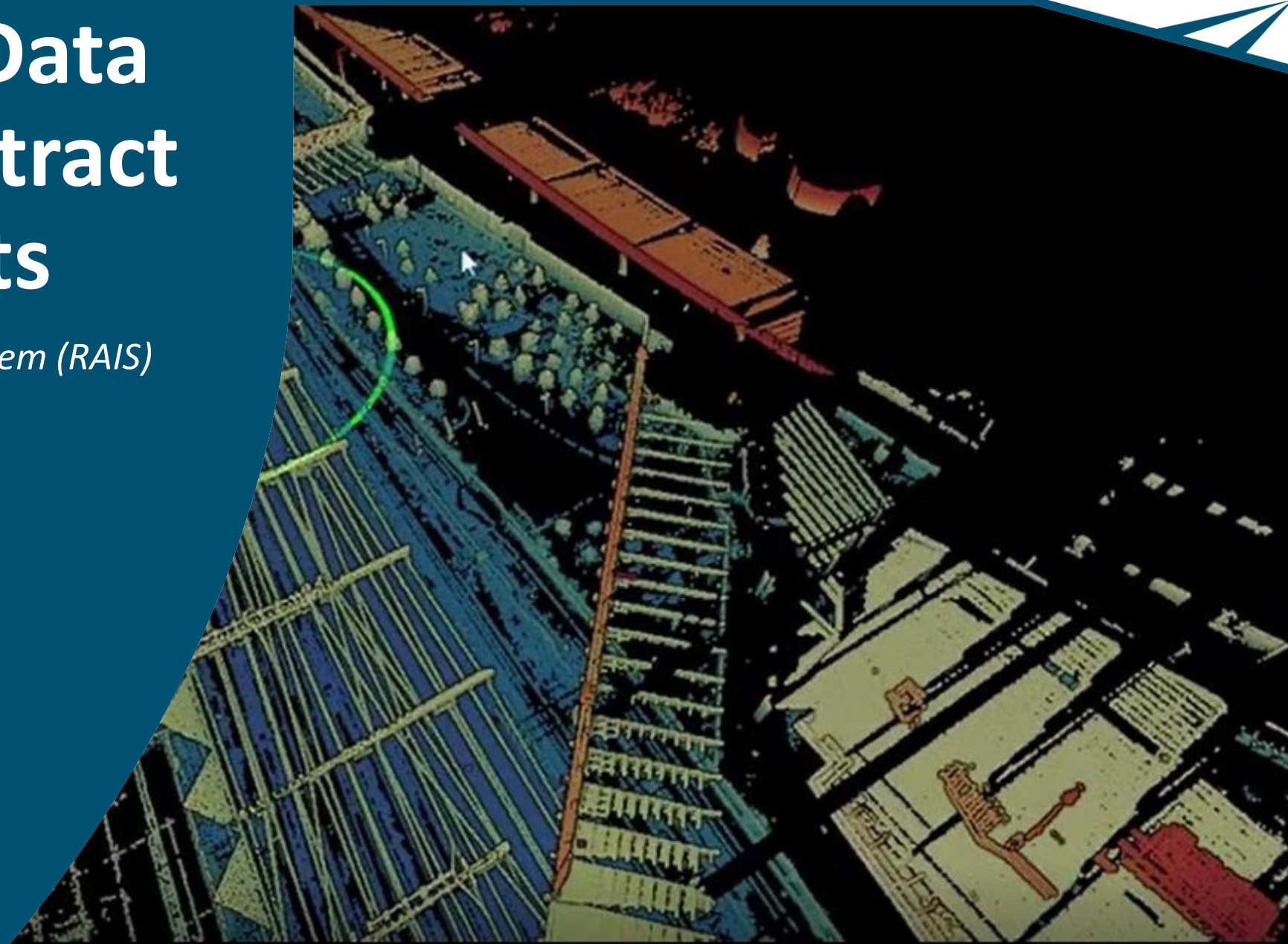
June 2021

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Project Manager



About Network Rail

We own, operate and develop Britain's railway infrastructure.

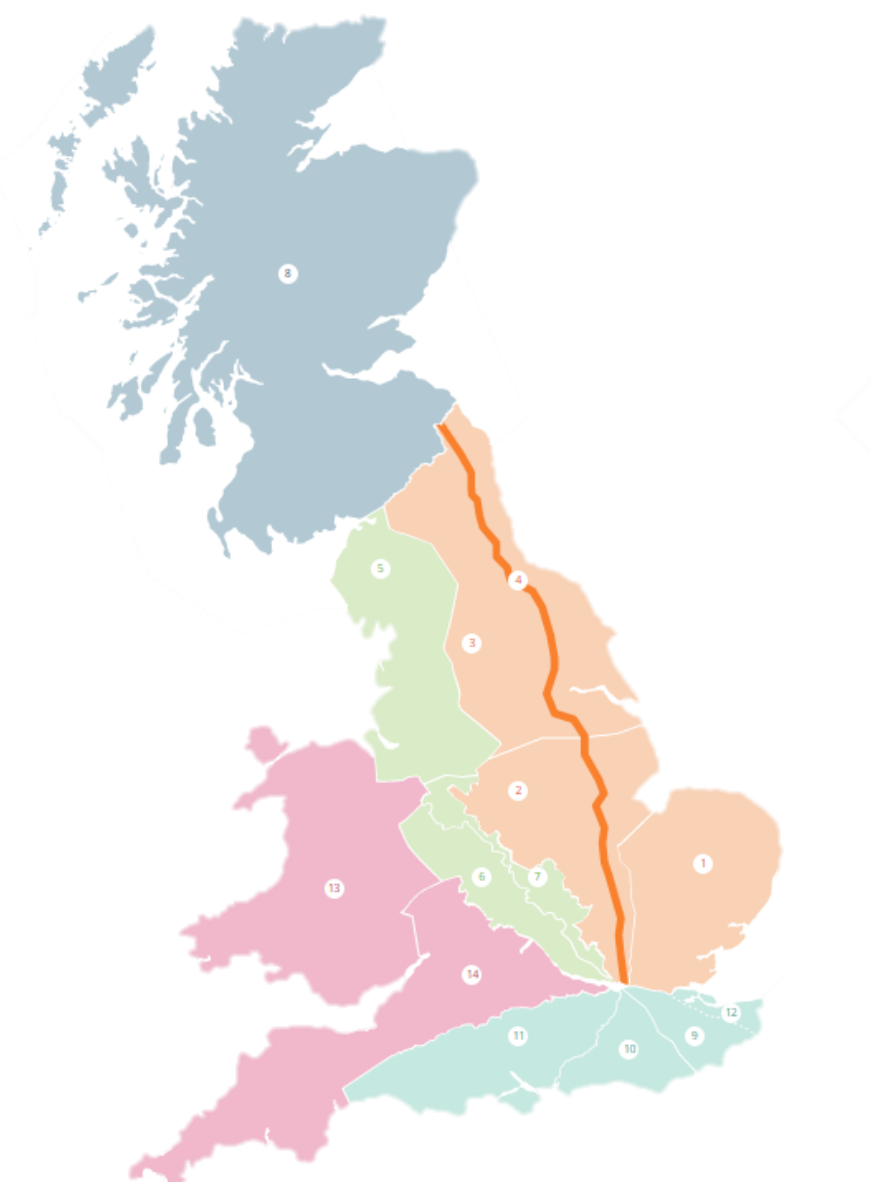
That's **20,000 miles** of **track**,

Over **30,000 bridges, tunnels** and **viaducts**,

Thousands of **signals, level crossings**
and **stations**,

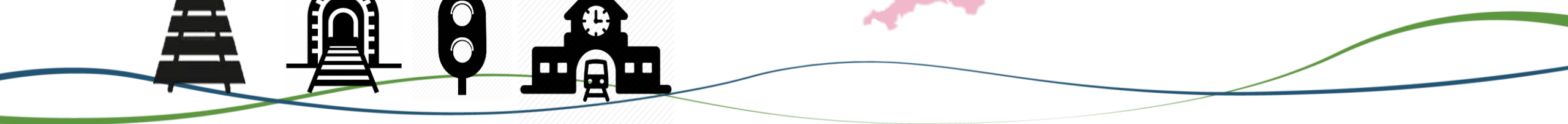
We **manage 20** of the **UK's largest stations**

while all the others, over 2,500, are managed by the country's train operating companies.



Network Rail Regions and Routes

- Eastern**
 - 1 Anglia route
 - 2 East Midlands route
 - 3 North and East route
 - 4 East Coast route
- North West and Central**
 - 5 North West route
 - 6 Central route
 - 7 West Coast South route
- Scotland's Railway**
 - 8 Scotland route
- Southern**
 - 9 Kent route
 - 10 Sussex route
 - 11 Wessex route
 - 12 Network Rail High Speed
- Wales & Western**
 - 13 Wales route
 - 14 Western route



Identified Business Problem

- UK railway is historically measured using mile posts
- Current assets displayed on a map do not align
- Corporate geospatial standard requires horizontal accuracy of +/- 1 metre.
- iPhone GPS accuracy circa 5m – 10m
- Locational accuracy needed for a range of applications



OFFICIAL

Ref:	NRL1ADD/984
Issue:	1
Date:	05 December 2020
Compliance date:	31 March 2024

**Level 1
Policy
Geospatial Referencing**

Approvals

Content Approved by

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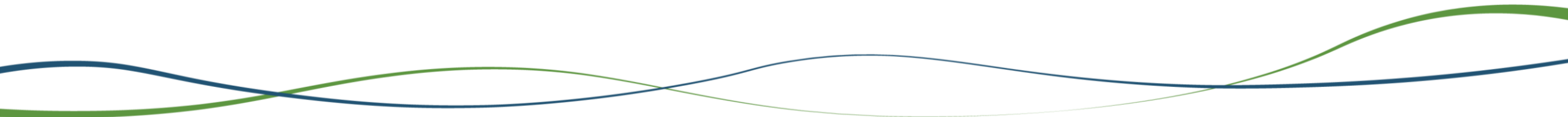
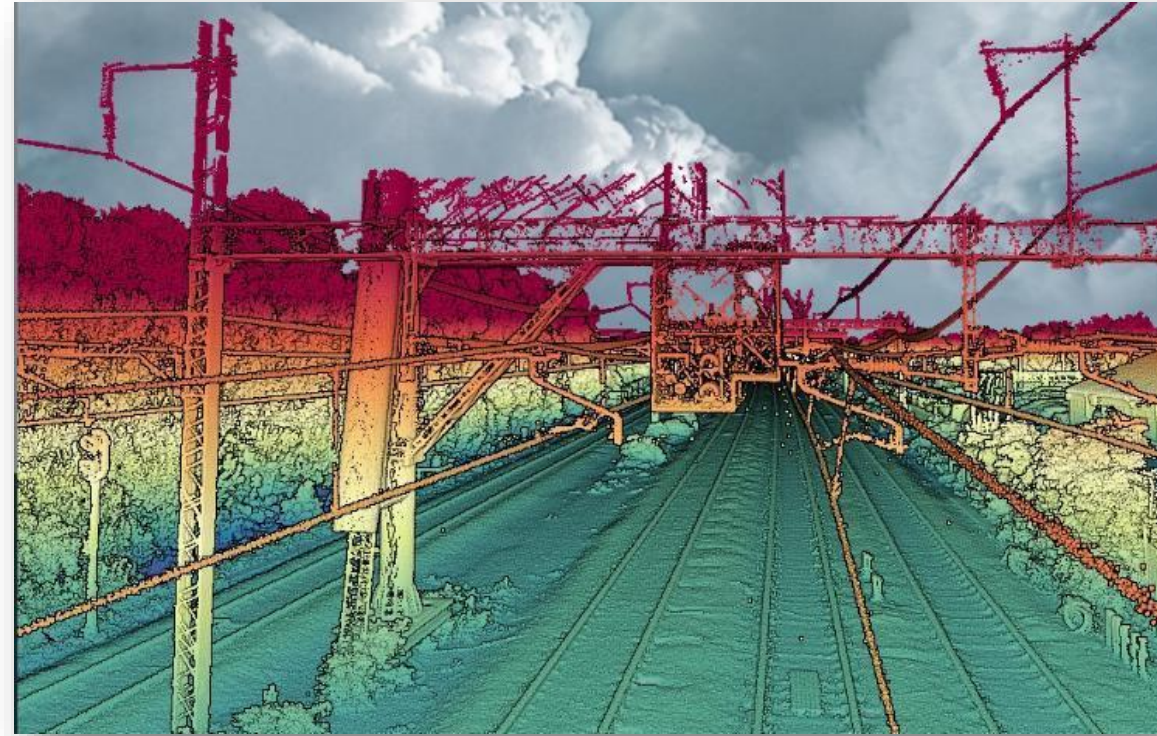
Tim Kersley,
Technical Authority, Technical Lead

Authorised by

[Signature]

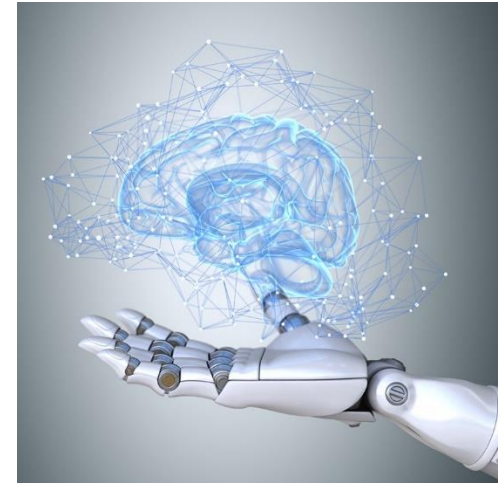
The Challenge

‘How to additionally use LiDAR data to automatically identify asset locations’?



From Idea to Product

- Hackathon submission submitted to Research & Development
- Fujitsu solution selected and taken forward
- Once trained, RAIS can use machine learning to automatically identify certain assets
- Able to pinpoint assets to around 10mm accuracy
- Identify what assets have been removed and highlight any additional assets
- Update Network Rail systems with correct locational data



RAIS Initial Scope

- Section of large and small, level track assets
- Testing the limitations of 3D extraction
- Promising initial results, but...



Portal



Cantilever



Drainage Catch Pit



Points Machine
Back drive



TPWS
Train Protection &
Warning System



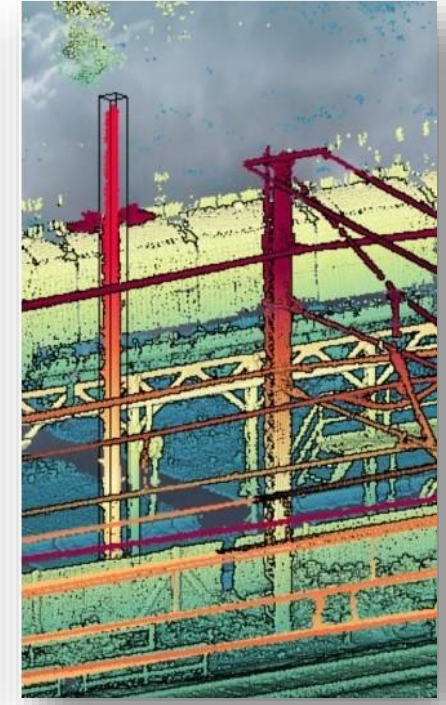
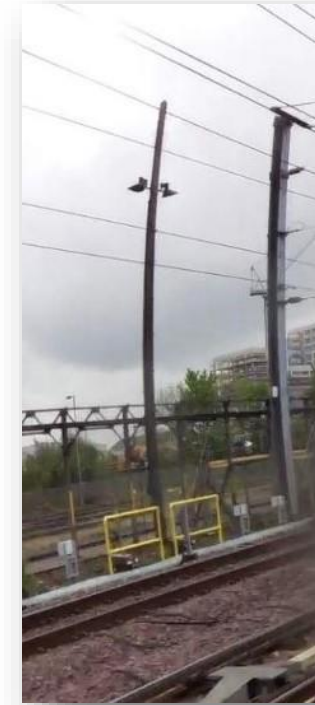
AWS – Automatic
Warning System



ATP - Automatic
Train Protection

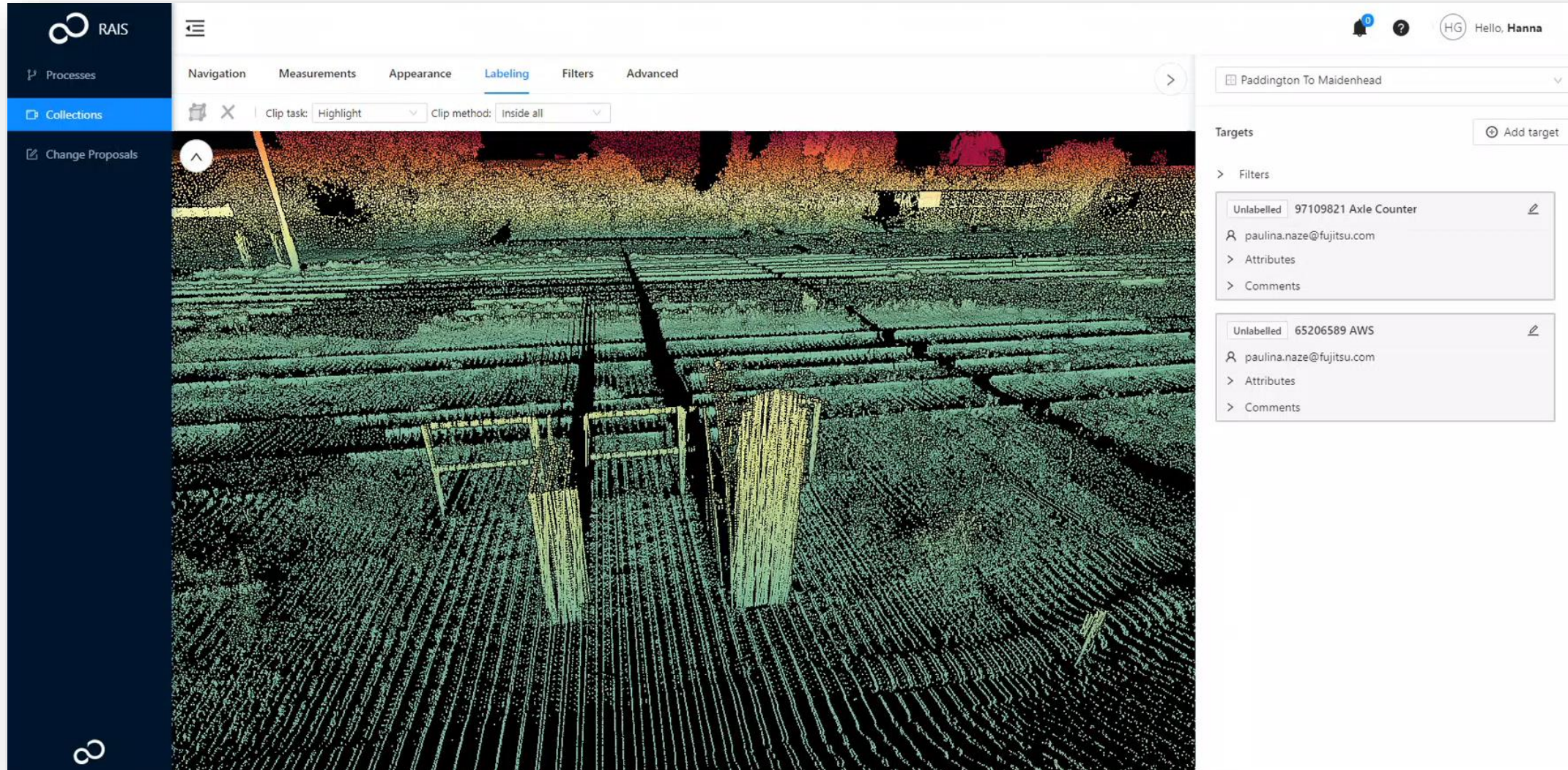


Points Machine
Motor



...there are limitations

Training the model



The screenshot displays the RAIS (Railway Asset Inspection System) interface. The main window shows a 3D point cloud of a railway track, with various components highlighted in different colors: green for the track bed, yellow for sleepers, and red for overhead equipment. The interface includes a navigation menu on the left with options like 'Processes', 'Collections', and 'Change Proposals'. The top navigation bar has tabs for 'Navigation', 'Measurements', 'Appearance', 'Labeling', 'Filters', and 'Advanced'. Below the navigation bar, there are controls for 'Clip task' (set to 'Highlight') and 'Clip method' (set to 'Inside all'). On the right side, there is a 'Targets' panel with a dropdown menu showing 'Paddington To Maidenhead' and an 'Add target' button. Below this, there are two target entries, each with a search icon, a name, an email address, and expandable sections for 'Attributes' and 'Comments'.

RAIS

Navigation Measurements Appearance Labeling Filters Advanced

Clip task: Highlight Clip method: Inside all

Paddington To Maidenhead

Targets Add target

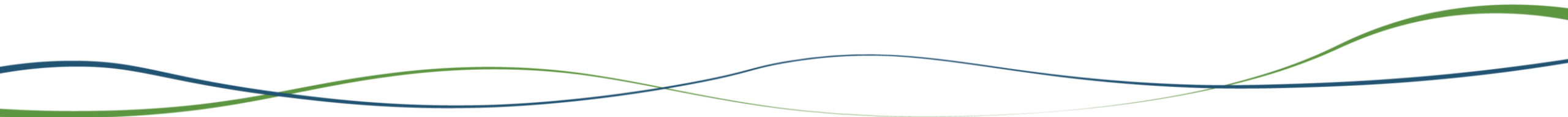
Filters

Unlabelled 97109821 Axle Counter paulina.naze@fujitsu.com Attributes Comments

Unlabelled 65206589 AWS paulina.naze@fujitsu.com Attributes Comments

Change Detection and Reporting

- Detection – database and LiDAR in sync
- Change – database and LiDAR not in sync
- Remove – record in database, not detected by LiDAR
- Create – no record in database, detected by LiDAR

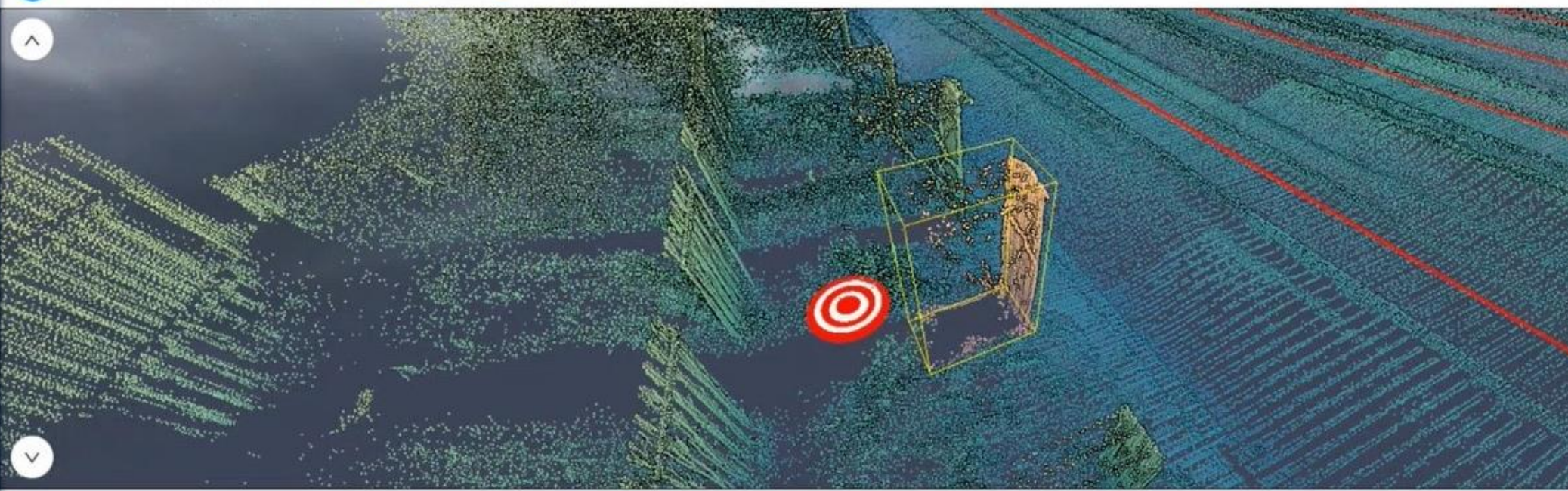


Change Detection and Reporting

- Processes
- Collections
- Change Proposals

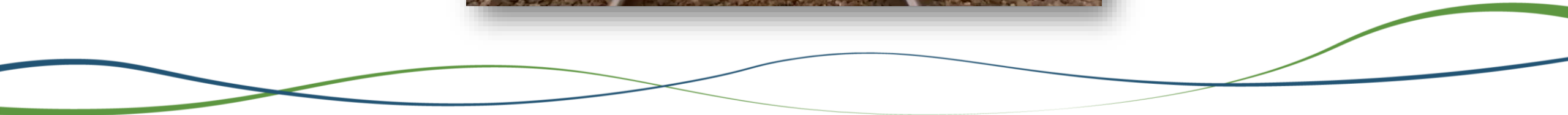
Navigation
Measurements
Appearance
Labeling
Filters
Advanced

Navigation icons
Camera projection: Perspective



State	Type	Asset Number	Asset Desc 1	Asset Position	ELR	Track ID	Asset Start Mileage	Asset End Mileage
		90000511	ATP:PLAT 10/1(BE) PLAT 10/1 BEACON	NV - Not Available	XR8E	1300	383.0719	383.0719

Video and Point Cloud Combined



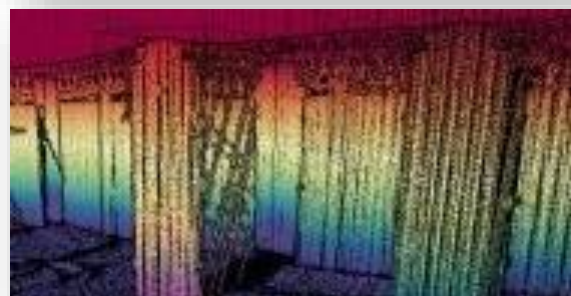
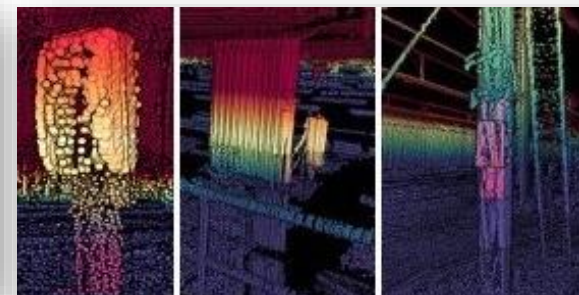
Trained Models

OLE Cantilever
 OLE Portal
 Signal Portal
 Signal Cantilever
 AWS
 ATP
 TPWS
 Drainage Catch Pit
 Points Machine Back Drive
 Points Machine Motor
 Location Case
 Wooden Poles
 Axle Counters
 SO Drives
 Supplementary Detector
 Signal Post Phone

Average accuracy of detection > 90%

Future training

Level Crossings
 Adjustment Switches
 Sleeper Types
 Point Types
 Guard Rails
 Switch Toe
 Stretcher Bar
 Cantilever Single track
 Signal type
 Platforms



Additional Benefits

- Allows reduction of track side visits
- Accurate asset locations allow for faster fault repairs
- Updates geospatial systems which feed into other initiatives
- Contributing to digital twin / BIM models

Other Opportunities

- Fouling and clearance points
- Gauging
- Measurements



Thank you
for listening

Questions ?

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