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# CONDITION MONITORED MAINTENANCE OF BOGIES AND TRACK

**JUSTIN SOUTHCOMBE** 

**ASSET MANAGEMENT RAIL SUMMIT** 

LONDON, 28 MARCH 2018

#### Who we are



#### A company built around excellence and value creation for rail

- World class knowledge in vibration engineering
  - Condition-monitored maintenance information for
     bogies focus on bespoke algorithm development
  - Design & build of vibration energy harvesting sensors
    - wireless maintenance free design
- Spin out from the University of Southampton in 2004
- International order book and a global supply chain
- Dedicated to rail



# **Targeted needs for customers**



Maintenance

Operations

New Build

Resources

Safety

Warranty

Wheel/rail

Punctuality

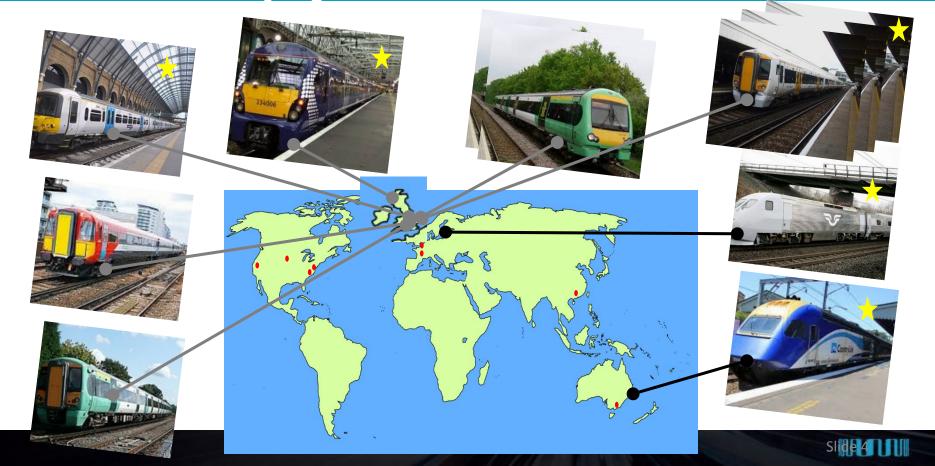
- Differentiation

- Skills

- Comfort

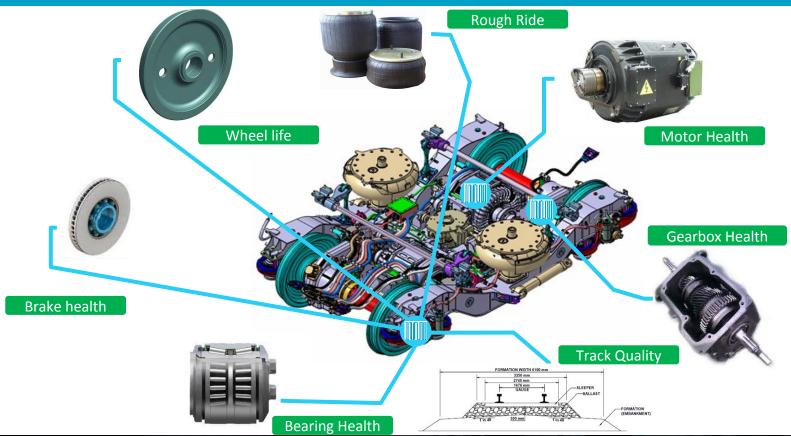
Development

# RCM/CBM market is expanding worldwide Global fleet deployments – 5 in 2017



# The intelligent, connected "IoT" bogie

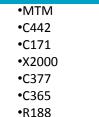




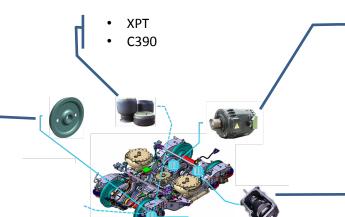
# Deployment of the intelligent bogie

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LAmetroWagonC465









- C377
- C465
- C365
- Loco



•C375 •C376

•C376

•C334

•MTM

•C442

•C171

•X2000

•C377

•C365

•R188

LAmetro

Wagon

·C465



NR Scotland

T I

NSWT

NR LNW(S)

SPT Glasgow

X2000 (Se)



>10 000 sensors globally



### "MONAXLE" latest R&D



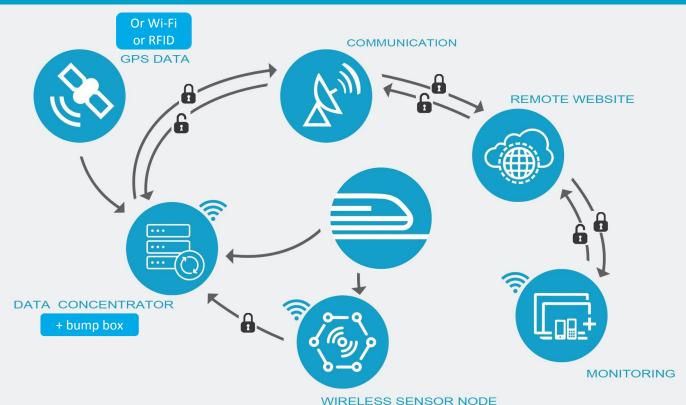
 Vision. This project will research the feasibility of detecting axle cracks on trains through vibration measurement using on-board self-powered monitoring. The vision is to use continuous live monitoring of axles with low cost self-powered wireless systems that are easy to install and will replace expensive and disruptive NDT methods in maintenance sheds.

Concept: Use acceleration to monitor stiffness

- Funding programme: RSSB Accelerating Innovation (UK)
- Awarded: January 2018. Duration: 30 months
- Partners: Perpetuum, TWI, University of Southampton

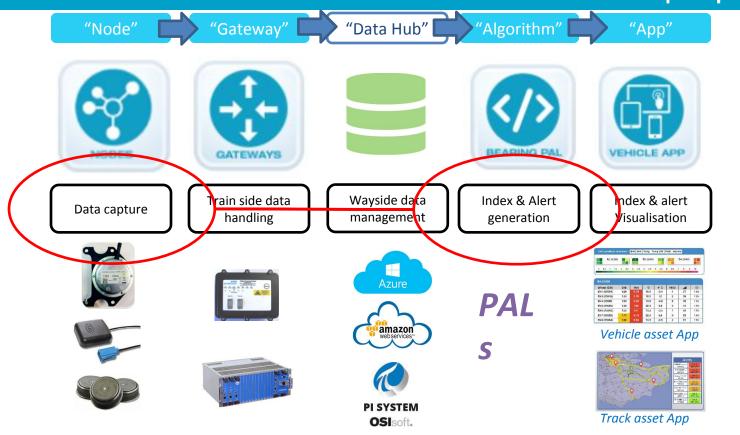
# **Condition Monitoring**





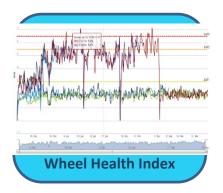


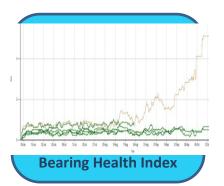
# **Key System Elements**



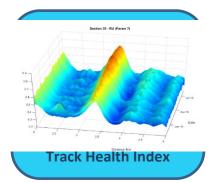
### Bespoke algorithms for each asset







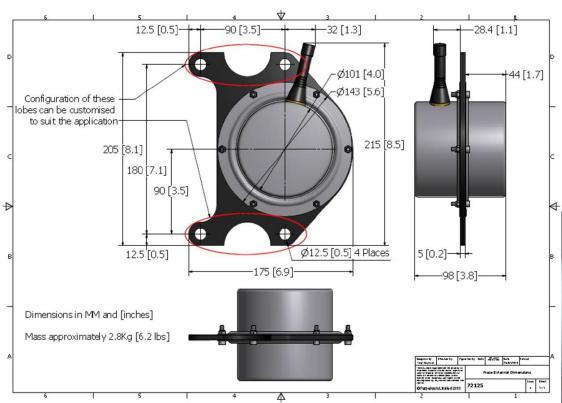








### **The Wireless Sensor Node**







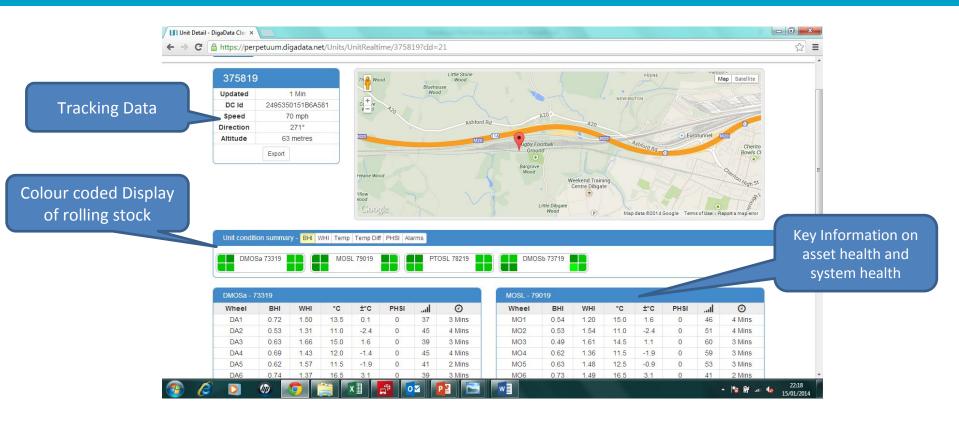






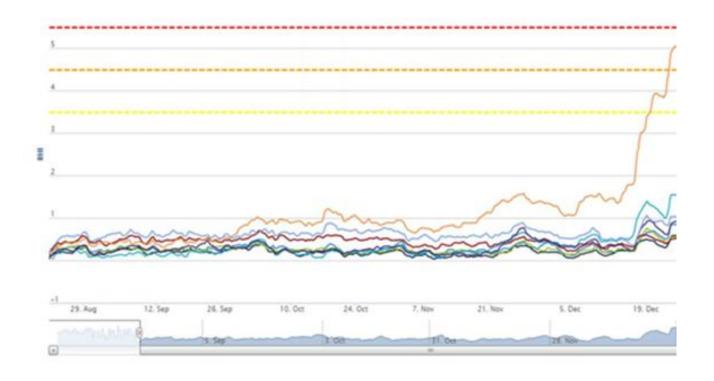
### **Easy, live asset health information**





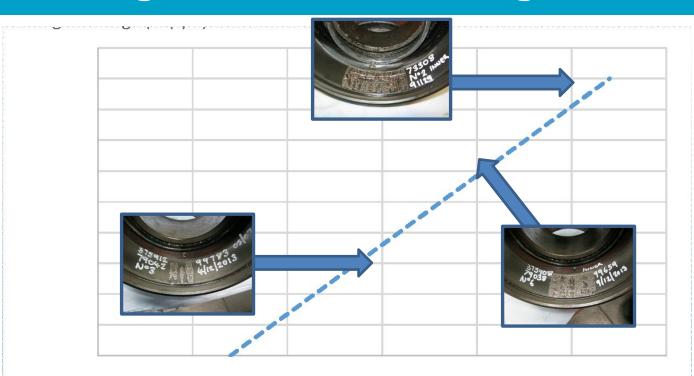
# **Bearing Health Index**





# Strong Correlation to damage for CBM

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#### Real-time on-board condition monitoring of train axle bearings

I Corni<sup>1,2</sup>, N Symonds<sup>1</sup>, R J K Wood<sup>3</sup>, A Wasenczuk<sup>2</sup>, D Vincent<sup>2</sup>
<sup>1</sup> National Centre for Advanced tribology at Southampton, Faculty of Engineering and the Environment, University of Southampton, UK
<sup>2</sup> Perceptum Ltd. Southampton. UK

#### ARCTRACT

Premature failure of rail axie bearings causes a significant increase in train operating costs and can impact train safety. A new on-board condition monitoring approach provided by Perpeturu Ltd is fitted on passenger trains to provide the operator with real-time information on bearing health. This new technology allows the detection of early bearing damage.

This paper reports an initial study to understand the source of vibrations. The final aim of the project is to connect the increasing vibration data to the bearing surface damage, measured with surface profilemetry.

#### 1 INTRODUCTION

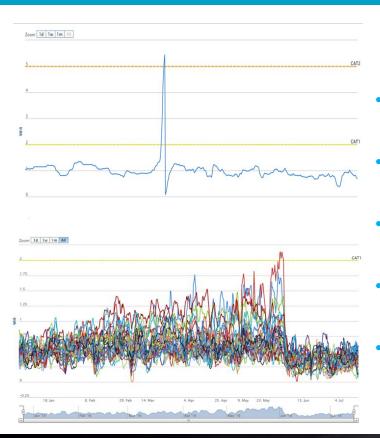
Rolling element bearings are mechanical components widely employed in industrial applications, from rotating machinery to means of transport. Rolling element bearings consist of a complex structure (outer ing. inner ring, cape and rollers) and usually operate in hanh working environments (e.g. high temperature, rotational speed and loads) and therefore they are often at risk of failure.

Fadgue is the normal failure mode for bearings that are properly installed and maniformed. Unfortunative, numerous bearings suffice eith Fallers due to poor and missignment. Early failure can cause the firmalisment of the normalism of the fallers of the failure can cause the firmalisment of the mischinery, decrease its efficiency and even reduce and with visit to like (1-3). For these reasons it is visit to mention the bearing condition and that of reasons has been accounted emissions (15-16) and timenenthe measurements. Changes in vibration signature have been employed for many years to defind deprating bearing setting a setting the control of the properties of the separation. (Ledgregued nession making condition memberors none complex (3) in order to evercome this difficulty, rempiraci mode deeponosion (1691 (2, 4, 5, 16, 18-19-19). Hinter-Hauge grantimer (HPT) (4, 7), werelet transferre (VPT) (5, 12, 20) and minimum entropy processly in the vibration data. The data used to develop these benchmarks were partly originated in the biochastry (1, 4, 6, 8, 10-14, 19), partly obtained from the only a first acquired from in-this quement (1, 6, mingring machines (13)).

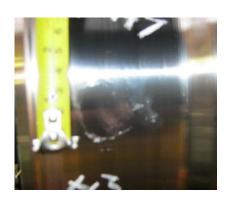
100



### **Wheel Health Index**

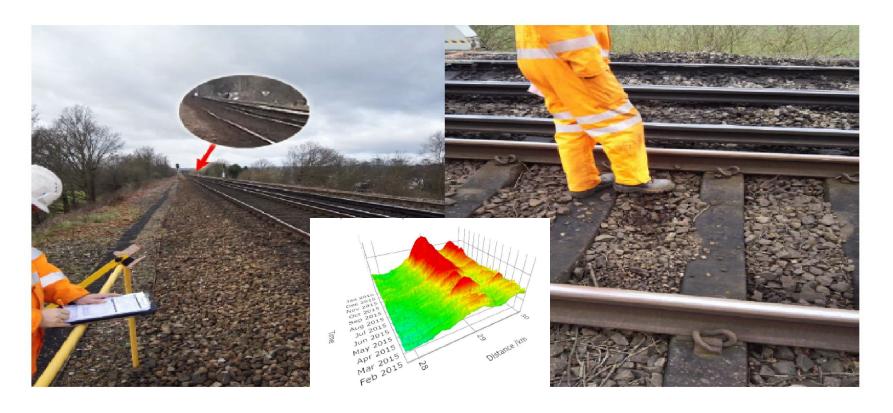


- 0 wheels have triggered a WILD alarm without a preceding WHI alert
- All L2 wheels have been corrected and reduced to L1 or less
- Wheel turning now based on WHI score as "inspection" is automated
- Flats, RCF, cavities, out of roundness
  ... all create a vibration signal
- Diagnostics RCF diagnosed 2 months ahead

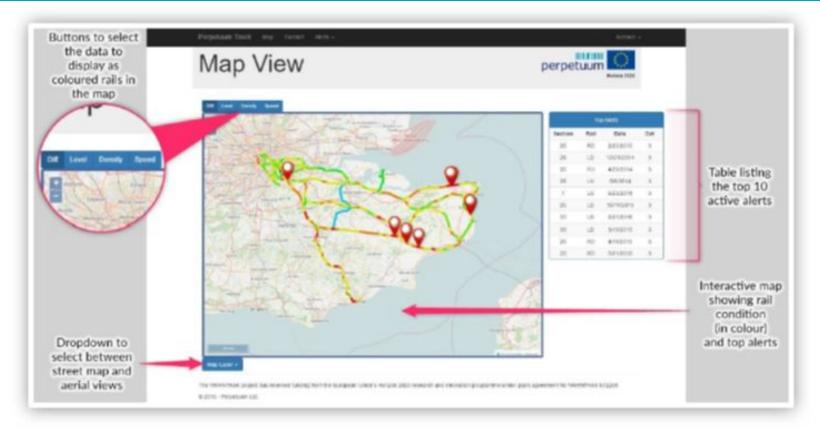




### **Correlation with site visits**



### Track (& Ride) Health Index alerts





"IF THE RAILROADS WERE AUDITED TODAY AGAINST WORLD CLASS ASSET MANAGEMENT STANDARDS THEY WOULD ALL FAIL"

N. AMERICAN RESEARCH CENTRE – CAPE TOWN, 09/17



# MTM Metro asset utilisation - Dec 2017 perpetuum

Melbourne MTM deputy CEO maps out what a commitment to change should look like. Real actions, real conviction and real confidence in how knowlegable use of tech and data can change the status quo.



AusRAIL: Predictive onboard diagnostics to help Melbourne trains meet ... railexpress.com.au

- Progressive adoption of asset management through the board, and the company
- 5 year development strategy for testing RCM technology
- Maintenance plan and component studies completed
- New franchise secured in 2017 through CBM savings supporting a competitive subsidy level
- Rapid mobilisation: Benefits in <3 years</li>



### **Abellio Scotrail:**

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Country: UK

Business: Passenger Operator

#### **Equipped Trainsets:**

• 40 EMU (C334)

#### **Ongoing Information Services**

- Wheel Bearing health
- Wheel health

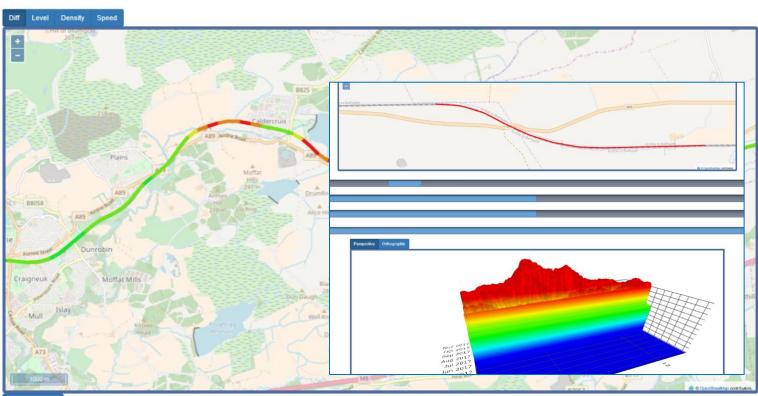
Installation: 2017



# **Commissioning is underway**

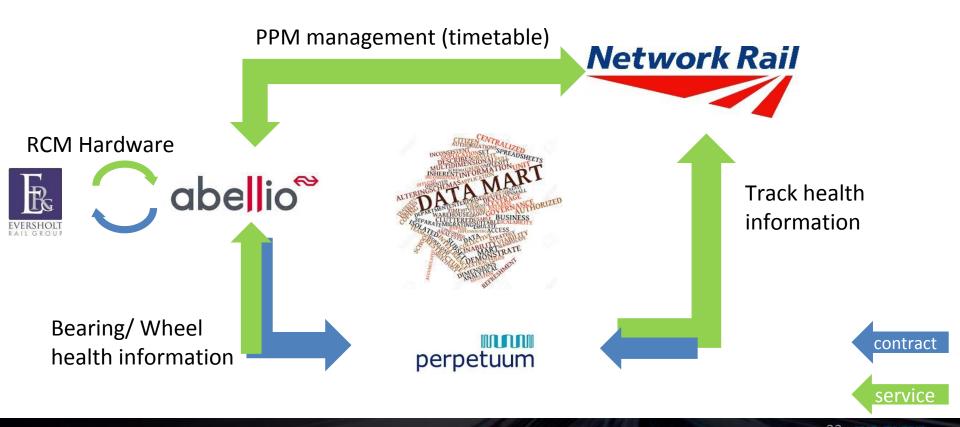






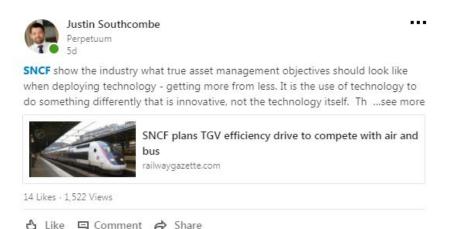
### The "Data Mart" at Scotrail alliance





# **SNCF TGV asset utilisation – Jan 2018**





- Committed to a "more from less" strategy – Step change
  - €2.5bn savings by 2020
- 25% fewer assets for the same
   service level 300 not 400 TGVs
- Maintenance plan and RCM tech studies completed upfront
- Rapid deployment: < 3 years</li>

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IT IS NOT THE TECH ITSELF





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