

LeadMind: CAF's Digital Train Platform.

Our roadmap to Innovation: what does the future look like?
Using advanced analytics to improve safety, LCC and energy efficiency.

LeadMind





CAF as a Group

37

Countries

5

Continents

150 M€

R&D. Last 6 years

89 %

International Business

Over 50 years of Service Solutions



SPAIN UNITED KINGDOM ITALY SWEDEN NORWAY FINLAND NETHERLAND BELGIUM FRANCE IRELAND GERMANY HUNGARY ROMANIA ESTONIA TURKEY
SAUDI ARABIA TAIWAN AUSTRALIA NEW ZELAND ALGERIA BRAZIL ARGENTINA CHILE COLOMBIA VENEZUELA ECUADOR MEXICO UNITED STATES



LeadMind Projects

21

Projects
awarded

774

Train Units
Monitored

2.938

Cars
Monitored

PROJECTS IN PROGRESS

- 📍 Euskotren EMU 900
- 📍 Brussels Metro
- 📍 Amsterdam Tram
- 📍 Locos TrenItalia
- 📍 Metro Chile L3 & L6
- 📍 Euskotren EMU 950
- 📍 Zaragoza. 1T 2019
- 📍 Madrid Metro
- 📍 Northern Arriva
- 📍 Transpennine
- 📍 SAR Arabia

NEXT PROJECTS

- 📍 Schönbuchbahn
- 📍 Wales & Borders
- 📍 Canberra. 2T 2019
- 📍 Oslo Trams
- 📍 Auckland EMU's
- 📍 Napoles Metro
- 📍 Metro Amsterdam
- 📍 Westmidlands
- 📍 Liege Trams

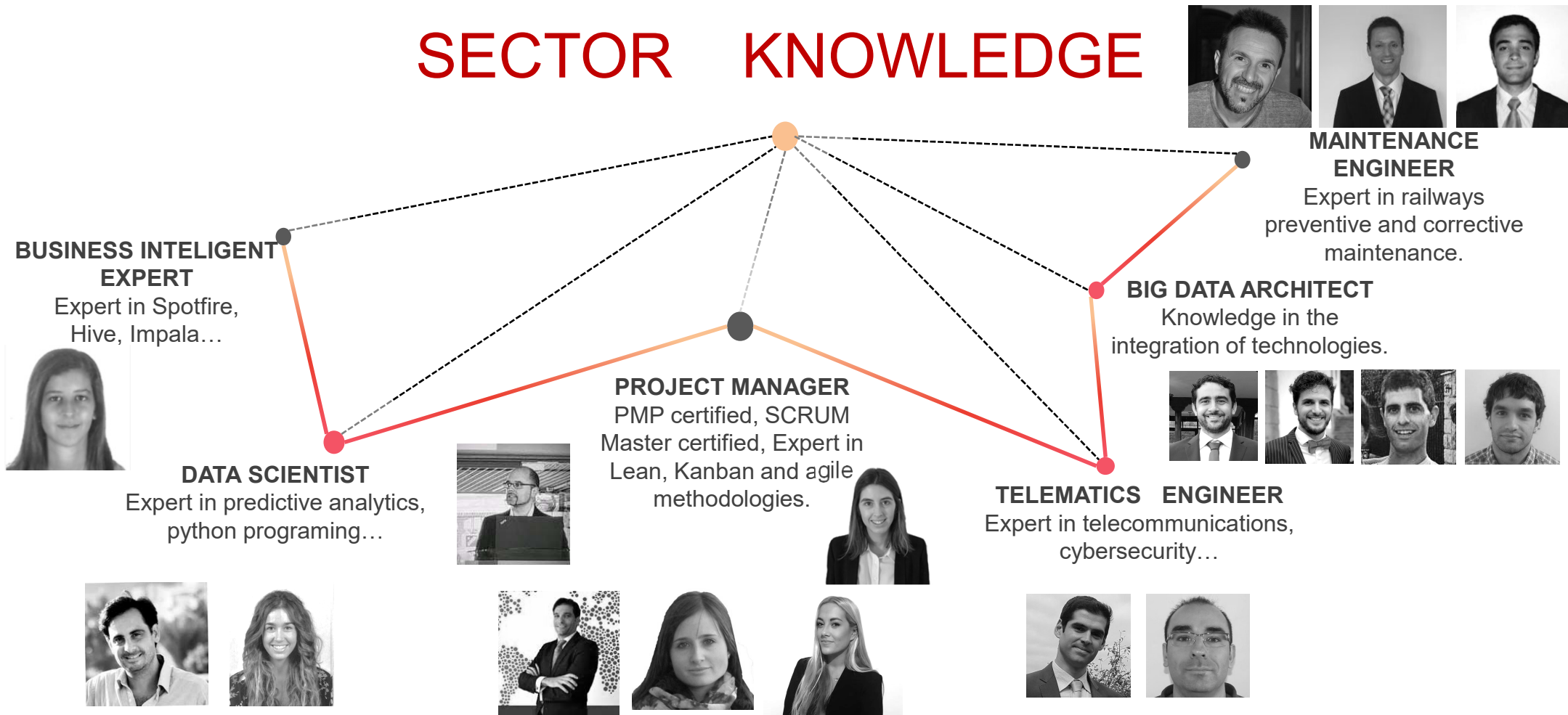
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Specialization leads to success



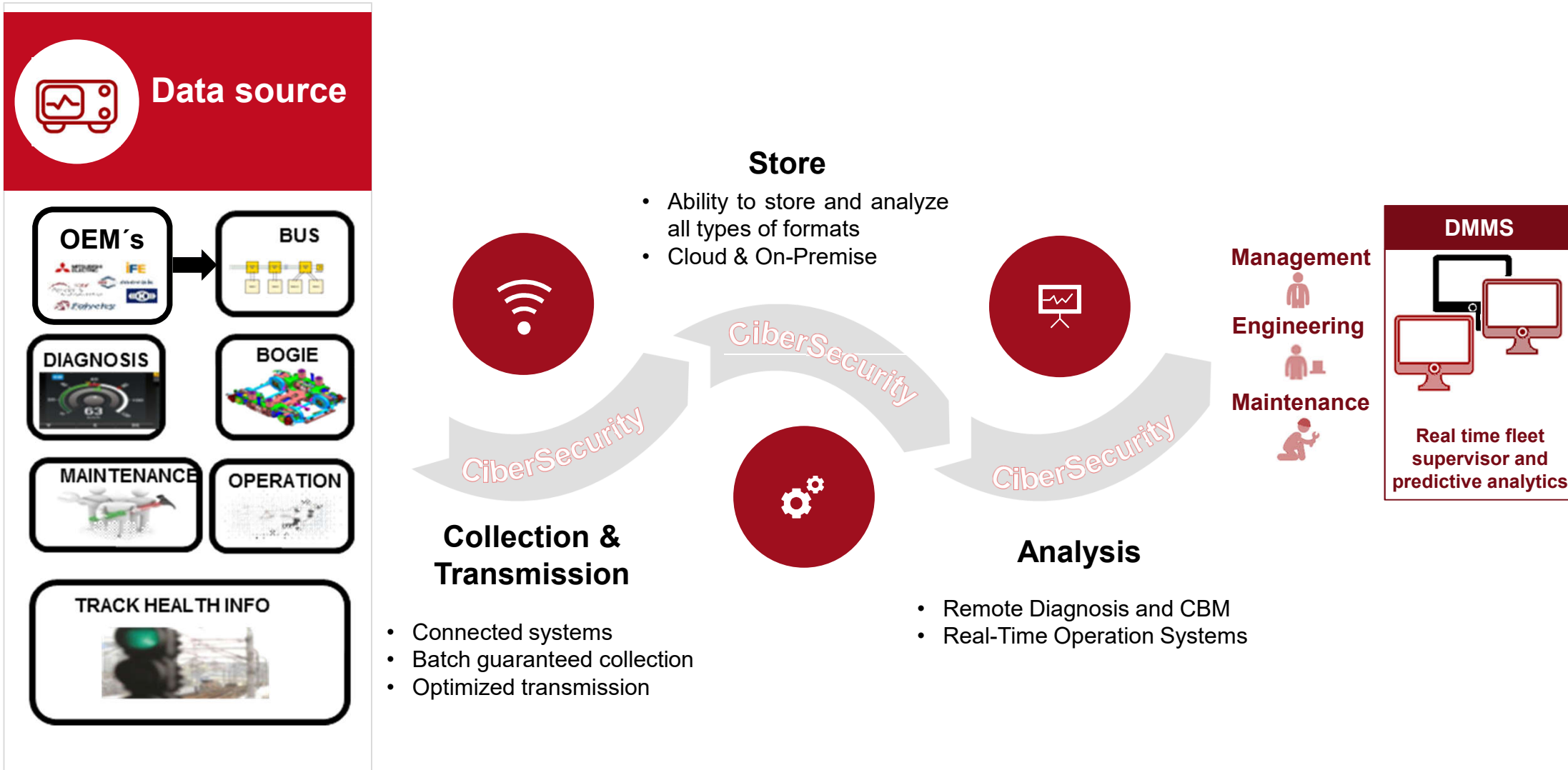
Our greatest asset is our professionals. We have **specialized teams** in the different domains that define the digital experience and in the railway sector. This allows us to offer to our customers a global solution.

SECTOR KNOWLEDGE



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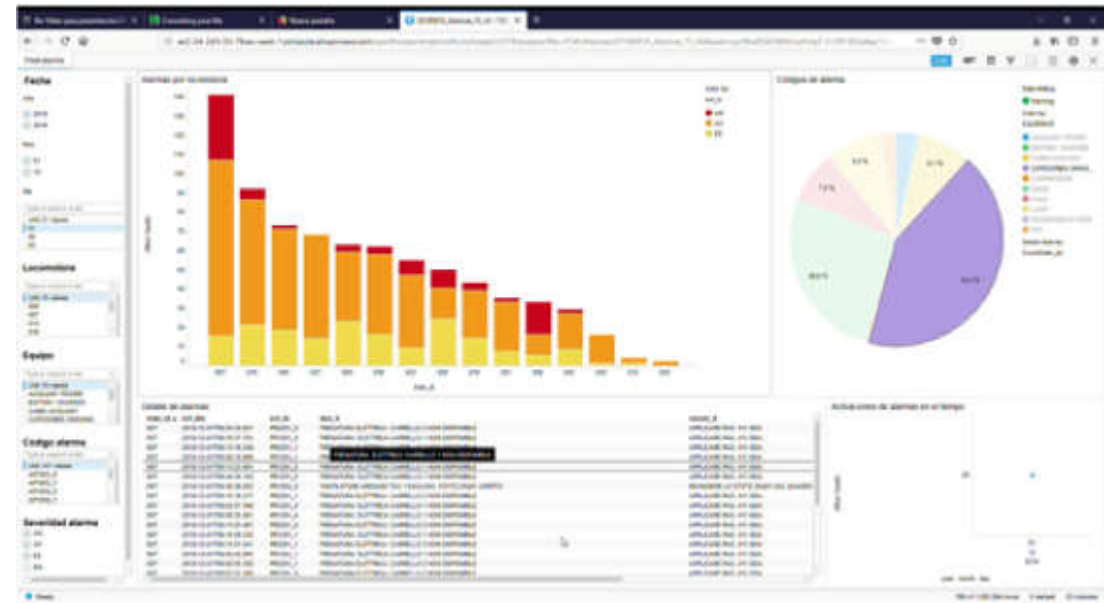
From Data to ROI





Refurbished Locomotives for Trenitalia. Fleet: Electrical Locomotive. 40 Train Units

- › Reduced time in Troubleshooting by **8%**.
- › **89** CBM algorithms (**Health and Life**) being run on board.
- › Automated **notifications** send to e-mails.

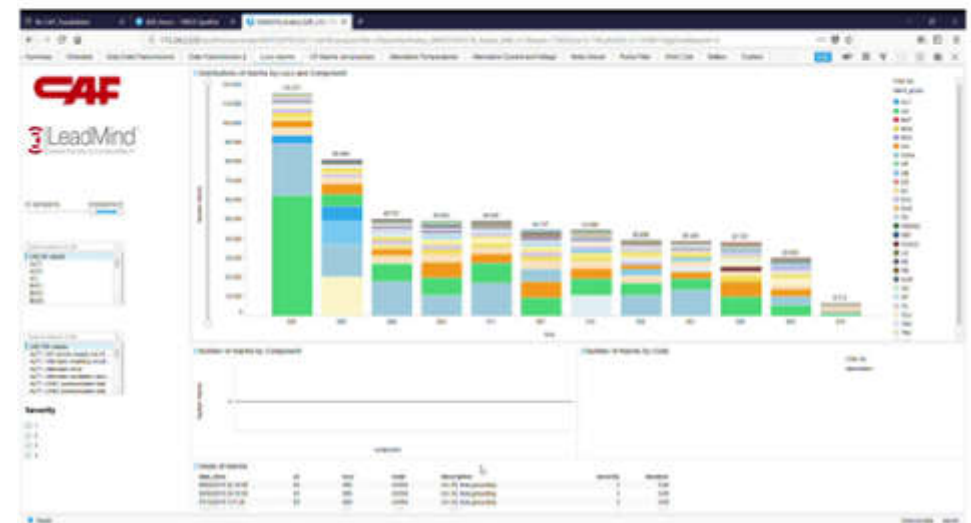
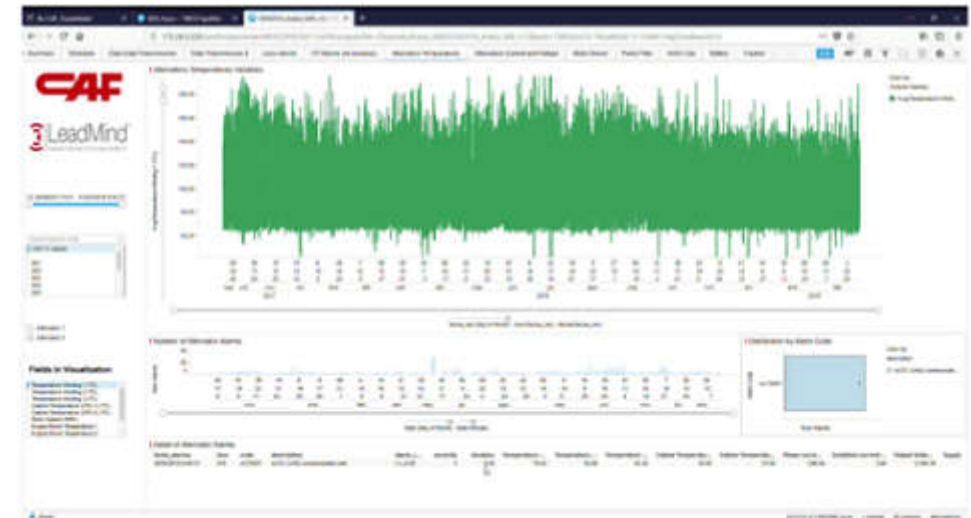


LeadMind Success Stories

SAR

SAR Arabia Fleet: 12 Locos + 62 Coaches

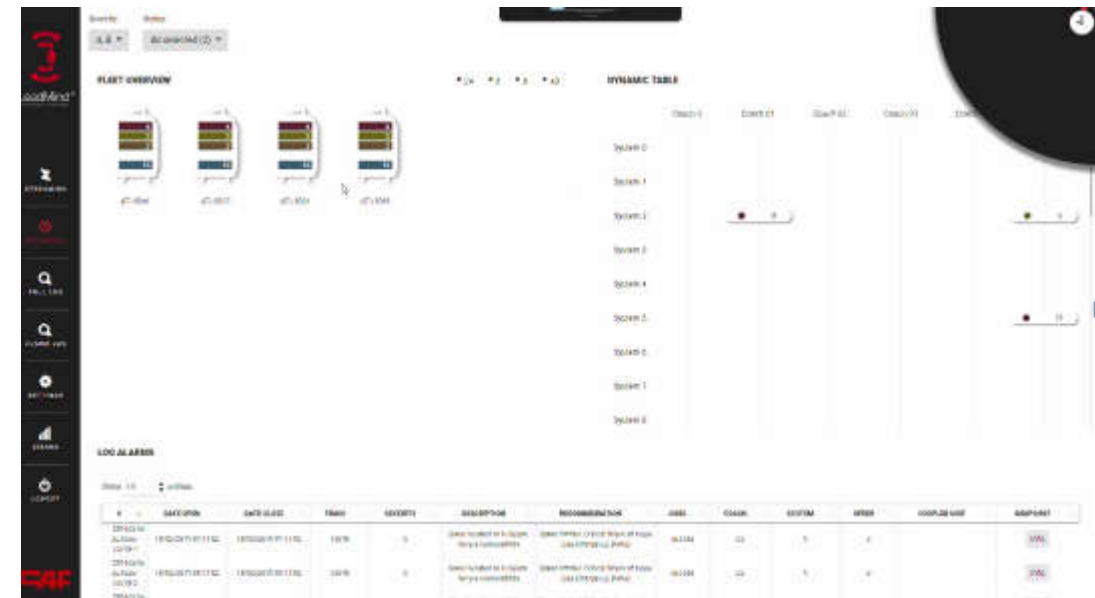
- › **Root Cause** study for Alternators fatal failures.
- › Diesel engines maintained by **working hours** directly transferred to **CMMS**.
- › **Improve** reliability of diagnosis system at composition level higher than **5%**.





Amsterdam Tram

- › Microsoft **Azure** Cloud deployment
- › **Real time** fleet health status.
- › **Priorization + Recommendation** in ground diagnosis system





Metro Chile L3 & L6: Automated Metro. Fleet: 5 Cars. 41 Train Units

- › Joint Analytics of **Train & Infrastructure (Safety)**.
- › Root Cause analysis for **Platform** Door misalignment.
- › Wheel Extension Life based on **Geolocation** of Flange Lubrication + Wheel Slide Protection + Sanding.

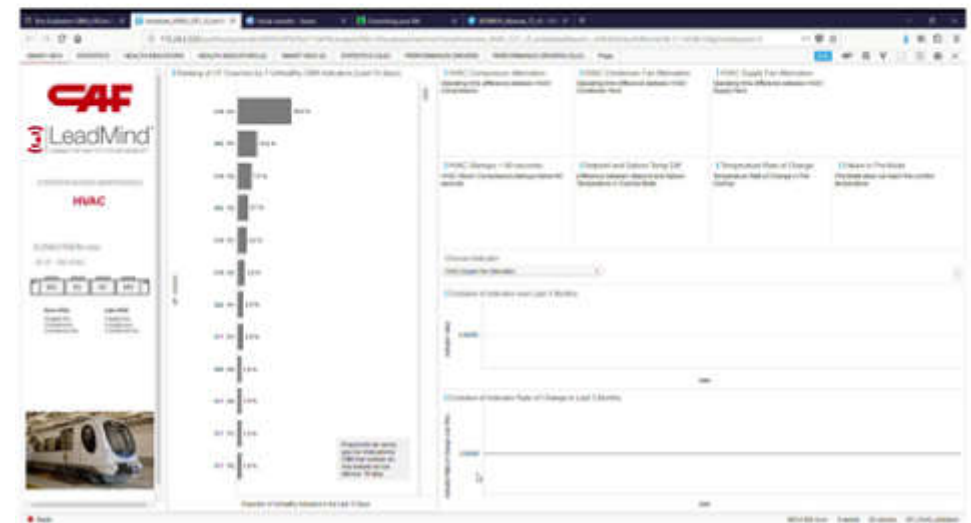


LeadMind Success Stories



Euskotren: Commuter Service.
Fleet: 4 Cars EMU. 50 Train Units.

- › **LCC Reduction:** Removing Preventive tasks & **Predictive** Service Failures (Batteries / HVAC / AGTU / Doors).
- › **Energy Efficiency.**
- › Voltage Catenary Health **Monitoring & Geolocation**

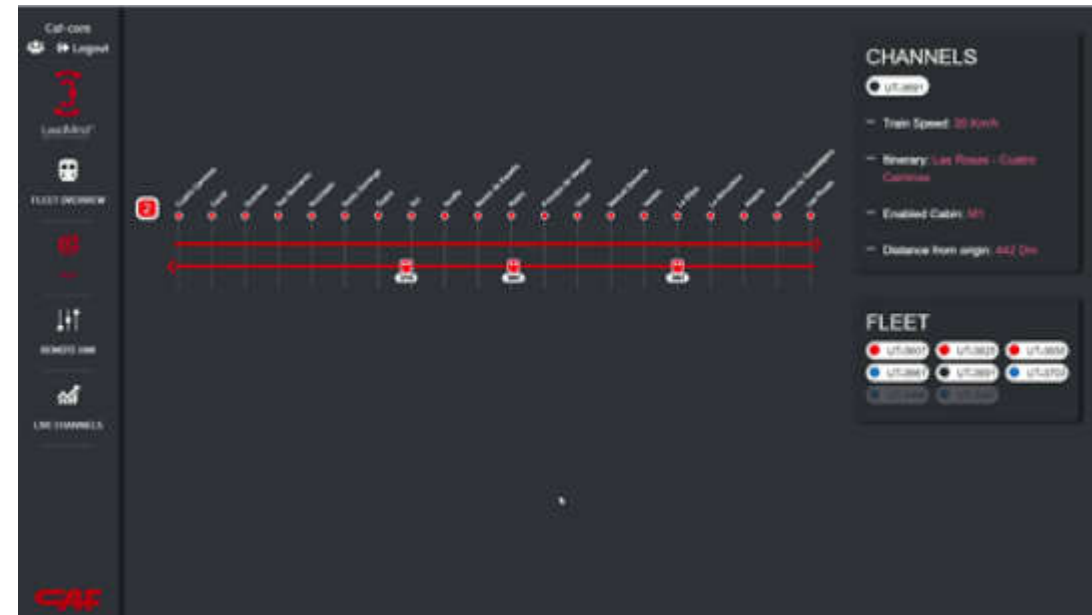


LeadMind Success Stories



Metro Madrid

- › **Passenger counting.**
- › **Integration with Metro Madrid Mobile App.**
- › **Real Time Location** based on Odometry (No GPS signal)

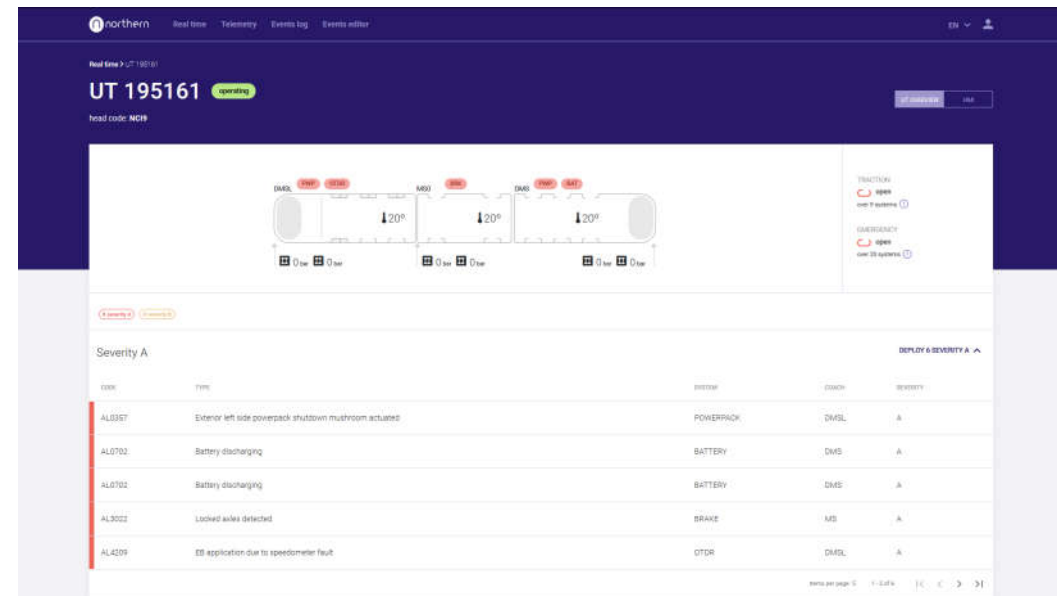


LeadMind Success Stories



Northern Arriva

- › The total monitored cars add up to a total **amount of 431.**
- › **Legacy Fleet** No CAF.
- › Remote **HMI & Replay Mode**
- › **Integration with SKF vibration sensors.**



LeadMind What's Next?



Brussels. GOA-4 Unattended Train Operation

- › Actuate **remotely** bypassing or Perform tests (HVAC, Brake, ...).
- › Updating SW **remotely**.
- › **CMMS Complete integration.**



Liege PPP:

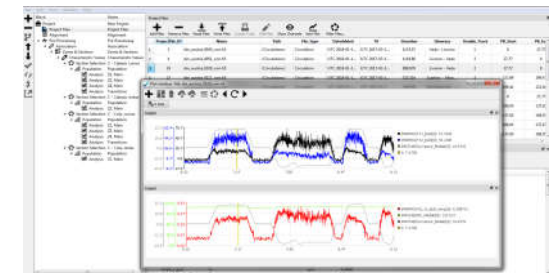
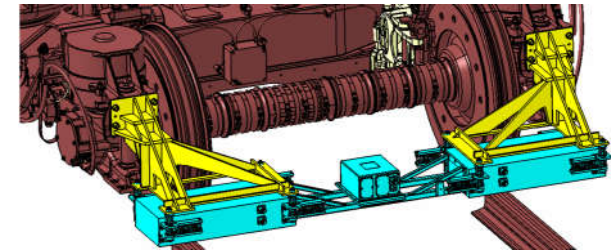
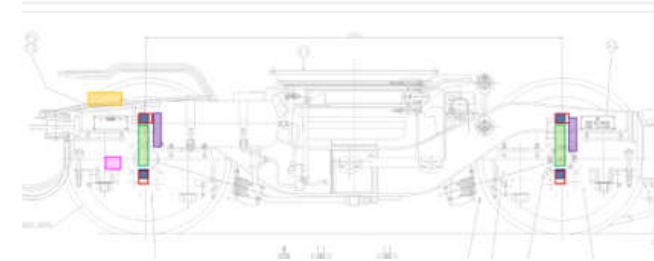
- › Track & Catenary Inspection.
- › **Image Recognition.**



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What's Next? Track Inspection

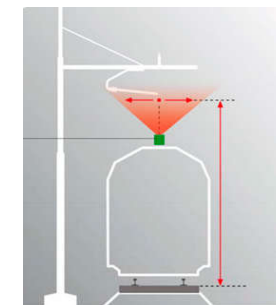
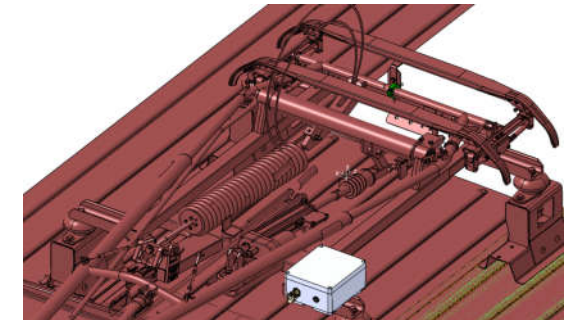
- › Only Geometric:
 - › Easy Integration.
 - › Track Parameters Monitoring (not according standards)
 - › Use Case: Metro Bilbao.
- › Optic-Geometric:
 - › More Complex. Mechanical Interface needed.
 - › Allows Track Profile Monitoring / Wear according standards.
 - › Use Case: Flytoget.
- › Dynamic based on accelerometers.
 - › **Easy Integration.**
 - › **Based on Vehicle Dynamic Parameters**
 - › **Use Case: COPASA**
- › Dynamic based in Efforts.
 - › **Wheel – Track Effort. Best Solution for Safety assurance**
 - › **Safety Parameters Monitoring (protection against Derailment)**
 - › **Currently in Development Phase**



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What's Next? Catenary Inspection

- › Panto – Catenary Effort Interaction:
 - › Equipment Required.
 - › Compliant with EN50317
 - › Use Case: Tren-Tram.
- › Based in Accelerometers in Panto:
 - › Equipment Required.
 - › No Compliant with Standards.
 - › Use Case: Boston Tramway.
- › Electrical Arch Detection.
 - › No Equipment Required.
 - › Compliant with EN50317
 - › **Use Case: Sidney Metro**
- › **Optic Inspection.**
 - › **Laser Inspection**
 - › **Catenary Wear Monitoring.**
 - › **Currently in Development Phase**



- › Dirty Inspection
 - › Interior Lights Malfunction.
 - › Grafitti detection.
 - › Windows cracks.
 - › Pictograms Integrity
 - › Vandalism
 - › Others...
- › FUNDAMENTALS
 - › Object detection in image or video through Deep Learning.
 - › Possibility of Edge computing: the model run on-train and there is made the decision to send notifications (App, SMS, etc...
 - › Use of models pre-trained (Grafitti) offered by the main Cloud Platforms
- › FOCUS => Work Automatization & Availability Increase.

If you are interested in classifying images in realtime using an IoT device, this is what you will need to start:





Daniel Sánchez Ortega
LeadMind Analytics/Digital Train Manager | Rail Services Engineering Department
Móvil: +34 689 285 364 (ext. 656288)
dsanchez@caf.net

Paseo de la Castellana 139, 10º-B 28046 Madrid - SPAIN
www.caf.net