THE INNOWAG PROJECT

Project coordinator: Newcastle University
Total Budget: 1.5 M
Duration: 01/11/2016 – 30/06/2019
Call addressed: S2R-OC-IP5-03-2015

Complementary CFM project: S2R-CFM-IP5-01-2015 - FRBRAIL

The INNOWAG project aims at developing a rail freight service that fits the needs of modern manufacturing and supply chain, through its following specific objectives:

- Increase freight rail capacity by optimising and lightweighting the wagon design for increasing the ratio payload/wagon tare;
- Increase freight logistic capabilities by:
  i. offering real time data on freight location and condition through a smart self-powered sensor system and communication technologies;
  ii. optimised wagon modular design capable to transport various types of goods; and
  iii. improved availability to freight customers, enabled by a safer and more reliable and interoperable freight service;
- Increase RAMS and reduce LCC by implementing modern and innovative predictive maintenance analytics, models, and procedures.

CARGO CONDITION MONITORING

Specific objectives and approach

- Formulation of the overall measurement concept with focus on architecture design and sensor arrangement;
- Design of a power supply system based on energy harvesting technologies;
- Design of a data communication system based on WSN;
- Validation of the developed cargo condition monitoring system at TRL5.

WAGON DESIGN

Specific objectives and subsequent approach:

- Development of a novel concept of modular and lightweight wagon through:
  • Analysis and selection of lightweight materials;
  • Optimised structural design;
  • Modular components and/or sub-assemblies;
  • Structural strength and fatigue analysis of critical sub-assemblies;
  • Validation of design concepts through specific laboratory tests.

INNOWAG lightweight concepts:

- Lightweight Y25 bogie design (17% mass reduction)
  • HSS bogie frame & optimised design
  • lightweight wheelsets and brake assembly
- Lightweight 60’ container wagon (22% mass reduction)
  • HSS underframe & optimised design
  • lightweight brake system
- Lightweight cereal hopper wagon (21–27% overall mass reduction; 51% carbody mass reduction)
  • HSS underframe and bottom
  • composite (GFRP) side wall panels
  • lightweight bogies

PREDICTIVE MAINTENANCE

Development of approaches to support predictive maintenance (PDM) strategy for freight vehicles:

- Cost driven analysis through Life Cycle Cost (LCC) model
- Reliability driven analysis through Failure Mode and Effect Analysis (FMEA)
- Development of a guided procedure (Wizard Tool) to support maintenance operators in the optimisation of the maintenance policy on freight wagons

Example result of cost-driven analysis:

Prioritisation of components based on their Life Cycle Cost

![Example result of cost-driven analysis](image)

Example result of reliability-driven analysis:

Prioritisation of failure modes for the wheelset based on FMEA analysis

![Example result of reliability-driven analysis](image)

INNOWAG consortium:

- Newcastle University
- INNOVATIVE TECHNOLOGY
- GROUP LVUCCHINI®
- UNIFE
- POLITECNICO MILANO 1863
- Shift2Rail
- perpetuum