**CATIEMON**

**Catenary Interface Monitoring**

**Funding:** European (6th RTD Framework Programme)  
**Duration:** Apr 2005 - Jan 2009  
**Status:** Complete with results  
**Total project cost:** €5,722,563  
**EU contribution:** €3,199,982

**Call for proposal:** FP6-2003-TRANSPORT-3  
**CORDIS RCN :** 74812

**Background & policy context:**

In a deregulated EU rail market, the monitoring of the train-infrastructure interface is essential for an enhanced availability of operation, which reduces costs. The SMITS (Smart Monitoring In Train Systems) EU Fifth Framework Programme project built the foundation for the CATIEMON project. The principles for condition monitoring were investigated and are now further developed and applied within this project in the Sixth Framework Programme.

SMITS solely considered the use of techniques involving the pantograph to detect overhead line condition. CATIEMON considered this aspect further and also examined the use of an infrastructure device to assess pantograph condition.

By investigation damage to these components, effective responsibility can be attributed to the rolling stock or infrastructure owner in relation to the condition of their equipment. The method could also be used to determine access charges and to restrict the use of locos with damaged pantographs running on a network.

**Objectives:**

The project's objectives are to develop a system to minimise damage on the OCL (overhead contact line) and the CC (current collector).

The vision of the CATIEMON project was to define different steps to be crossed over in order to evolve from the current rail system/organisation ('multiple national rail networks') toward the new targeted one ('high quality rail network'). The partners kept that vision in mind during the research and development phase in to be able to meet the target of CATIEMON in the implementation phase of the project.

Therefore it was important to determine during an early stage of the project the key performance indicators and to create synthetic figures (mainly linked to regulation and standards), to identify the lack of standards (common harmonised qualification criteria and inspection procedures) and to participate and be directly involved in standard works.

The main target of the project was to gather experience with the application of CATIEMON in a real life environment including the integrated approach necessary for this. The application and testing of CATIEMON technologies under real life conditions will deliver the full information that enables the functioning of the European railway system as a whole. The experience with the system will lead to new insights and ideas that can be inspired only by actually acting in that field.

**Methodology:**

The main technical tasks are as follows:

- requirement specifications  
- modelling of sensor system integration  
- solutions of sensor long-range and cross-talk phenomena
CATIEMON investigated methods to determine damaged pantographs and overhead line equipment. Effective in-service monitoring of these components ensured that preventive action could be taken before more serious damage occurred. The project stemmed from the SMITS project. The principles for condition monitoring were investigated in SMITS and CATIEMON further developed and applied them.

SMITS considered solely the use of techniques involving the pantograph to detect overhead line condition. CATIEMON considered this aspect further and also examined the use of an infrastructure device to assess pantograph condition.

In laboratory tests the behaviour of the carbon-strips with the fibre optic sensors directly glued to them was examined. It was found that there will be a possibility to distinguish between vertical (from top) and horizontal (frontal) hits. As the sensors are located in small grooves that were milled into the carbon they are as close to the interface between contact-wire and carbon-strip as possible. The deformation that horizontal (frontal) hits cause to the current-strip can be clearly detected.

Several innovative electromagnetic immune optical fibre Bragg grating (FBG) sensors and two interrogators suited to railway applications have been developed and intensively tested during the CATIEMON European research project. In addition to in-lab design and tests, this sensing equipment have been installed for several field tests on commercial lines dispatched over an eighteen months long period. FBG sensors, able to sustain high voltage at railway infrastructures as well as outdoor conditions, and efficient installation procedures have been developed and validated. Data acquired during the course of the project have shown that FBG-based sensing is promising.

Parent Programmes:
**FP6-SUSTDEV-2 - Sustainable Surface Transport**

Institute type: Public institution  
Institute name: European Commission  
Funding type: Public (EU)

Lead Organisation:

**Siemens Ag**  
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Organisation Website:  
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Partner Organisations:

**Bls Loetschbergbahn Ag**  
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**Morganite Electrical Carbon Limited**
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**Technologies:**
- Non destructive testing
- Railway and rolling stock condition monitoring system

**Development phase:** Research/Invention

**Key Results:**
The Project publishable results are as follows:

- OCL uplift device for the inspection gate – possible applications in on-line distance measurements in energy and transportation industry;
- Smart carbons for hit detection current collector - possible applications in transportation industry: structural health monitoring, operational monitoring;
- High energy carbon testing machine - possible applications in further research: testing of current collectors for railway or tramway end users;
- Detection device for wavelength shift of fibre Bragg peaks - possible applications in energy and transportation industry: structural health monitoring, fatigue investigations;
- Laser-based 2D-profiler for OCL displacement measurement - possible applications where main characteristic would be high-speed profile inspection on surfaces having a very low optical albedo; as an example: track ballast, tires, underwater monitoring;
- Bragg sensor-based 3d-OCL displacement measurement - possible applications in any research/industrial sector requiring displacement measurement based on fibre optics, for instance to benefit of electrical insulation provided by fibres;
- Fibre Bragg sensor based strain measurement for overhead line deflection - possible applications in all the sectors addressed by CEA LIST such as: Civil Engineering, Energy and Nuclear Industry, Oil and Gas, Transportation sector;
- Detection system for steady arm vibration measurement - possible applications in dedicated to the characterization of hits and sideward oscillations of contact lines on railway infrastructures;
- Detection device for measurement of wavelength shift of fibre Bragg sensors - possible applications in possible applications in all the sectors addressed by CEA LIST such as: Civil Engineering, Energy and Nuclear Industry, Oil and Gas, Transportation sector;
- Procedure for data fusion of location and hit measurement data of smart current collector system;
- Calibration device for overhead line sensors;
- Overhead contact line monitoring with integrated vehicle identification;
- Contact strip quality monitoring.

**Documents:**
- Publishable Final Activity Report (Final report)
- Final Report Summary - CATIEMON (Catenary Interface Monitoring Coherent sensing technology for electrical railway infrastructure and rolling stock for interoperable cross boundary transportation)

**STRIA Roadmaps:** Infrastructure

**Transport mode:** Rail transport

**Transport sectors:** Passenger transport, Freight transport

**Transport policies:** Societal/Economic issues

**Geo-spatial type:** Infrastructure Node