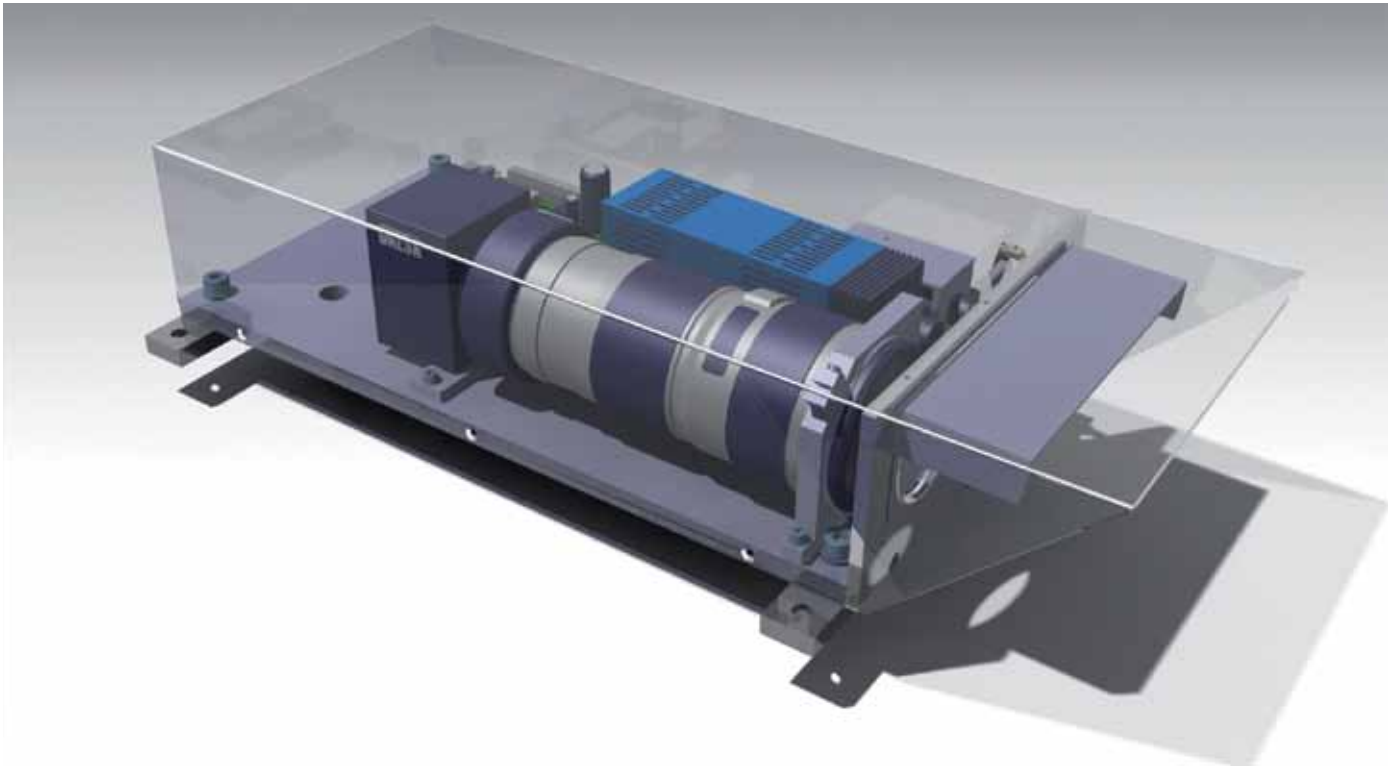


# On Quiet Wheels through Berlin's Underground

Many Berliners still have clear memories from last winter of the massive technical problems experienced by the city's S-Bahn – the municipal rail system operated by the German national railroad the Deutsche Bahn. At times only half the trains were running; the rest had to be taken out of service for safety reasons. For operators of railway vehicles in particular, it is important to know the condition of their trains so as to be able to plan their maintenance and repair in advance. In the innovation cluster »Maintenance, Repair, and Overhaul – MRO«, Fraunhofer IPK collaborated with experts for railway vehicles from Berlin's Technische Universität in the development of a novel monitoring system that identifies wheel damage early and reliably while the trains are in operation.



*Preproduction model of the optical wheel tread inspection sensor*

## ► Railroad safety

Anyone who uses Berlin's subway system, the »U-Bahn«, expects the trains' undercarriages to be intact as the vehicles cross bridges and go through tunnels at speeds of up to seventy kilometers per hour. The city's transportation authority, the Berliner Verkehrsbetriebe (BVG), guarantees passengers that the vehicles are safe, and so the time-consuming service of the wheels is

done at the company's facilities on a regular basis, even if no damage is expected. When a problem is discovered, a substitute vehicle must be found immediately.

A lack of knowledge about the current state of their trains is a serious management issue for railway operators. A solution has become available through scientific cooperation between Fraunhofer

IPK and the Department of Rail Vehicles at the Technische Universität Berlin's Institute for Land and Sea Transport (ILS). Experts at the two institutes have been working since December 2009 on a process to automatically monitor the condition of the wheel tread in the context of the »MuSen-Rad« project. The innovative idea involves a system combining a variety of sensory principles that is integrated into the bed of



Trigger system for measurements on railway tracks



Acceleration sensor installed on the base of the track

the railroad tracks. »We combined optical and acoustic test systems,« explains Eckhard Hohwieler, manager of the project at Fraunhofer IPK. »Using a camera system, we check for pits, cracks, and peeling on the surface of the wheels while the train car is still in operation. Using sensors fit into the base of the tracks, we can also see changes in a wheel's geometry that are characteristic of this type of damage by means of acceleration signals emitted when the train is passing over the tracks.«

#### ► Less damage, quieter rail traffic

The advantages for the rail operators are obvious because time and cost savings are a direct concomitant of the improved ability to plan rolling stock use. This is an important topic for the BVG, and so the company welcomed the opportunity to cooperate in the research by making stretches of track available for experiments. »The possibility to have regular measurements taken that reflect the current condition of our trains' wheels is of great interest to us,« says Martin Suess, a department head at the BVG. »This is why we are supporting the development of the wheel measurement technology by making our facilities and vehicles available.«

Besides the railway operators, the people who live along the tracks also benefit from the monitoring because noncircular wheels are not only more prone to damage, they also cause considerably more noise. MuSenRad can recognize such deformities early on, allowing them to be repaired before they cause problems. The BVG has integrated prototypes of the individual sensory checks into their track beds for testing, and a combination of the individual systems is on its way to becoming a product that is ready for the market.

MuSenRad is a project from the Fraunhofer innovation cluster »Maintenance, Repair and Overhaul in Energy and Transportation«, a joint endeavor of seven research partners and fourteen companies. The cluster is looking into research areas that include status monitoring and diagnosis, planning and digital support of MRO, as well as cleaning and repair technologies. The work is supported by the Federal States of Berlin and Brandenburg and the Fraunhofer-Gesellschaft. ■

#### Fleet maintenance at Public Cleaning Berlin (BSR)

In another project within the Fraunhofer Innovation Cluster »MRO«, IWF and Fraunhofer IPK work on effective methods to improve the BSR maintenance network, its planning and workflow. As a local company with around 5300 employees and an annual income of 485 billion Euros, the Berliner Stadtreinigungsbetriebe (BSR) is one of Europe's leading service providers for the collection, recovery and disposal of urban waste, street cleaning, and comprehensive winter maintenance. Up to 60 percent of its vehicle fleet's operating costs is covered by maintenance and repair tasks. The project's goal was better utilization of the BSR's network of workshops. Thanks to the »Tecnomatix Plant Simulation Software« developed by the researchers, the BSR is better able to plan and manage preventive maintenance as well as measures for dealing with unforeseeable repairs.

#### Your contact

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