

EC RESEARCH TO AIM AT END USE

Maurice Jones
Maurice has been a construction journalist for over 30 years, and is a former miner



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Funding is coming from the EC's Seventh Framework Programme for Research, Technological Development & Demonstration (FP7 2007-2013) under grant agreement 280712.

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NeTTUN Project participants are 'end users': Metro C SCPA (Line C) in Rome, the Spanish contractor Obrascon Huarte Lain, and the French contractor Razel SAS.

The project's programme, agreed with the European Commission, has four themes and five main objectives. "Most subjects were already part of our R&D programme here," said Camus, "but the EC also wanted us to address subjects not related to TBM tunnelling. These were mandatory, so in addition to previous development partners, we have also contacted other organisations that we did not know personally."

PERIOD

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An unusual aspect of the programme is that it will be integrated with projects

organised by the end-user participants.

GOALS

The ambitious goals set by the EC and the NeTTUN participants themselves are:

1. An advanced multi-sensor ground prediction system for TBMs for fast, frequent and effective detection of ground anomalies ahead of the face;

2. Advanced robotics for TBM maintenance enable automation of routine but hazardous tasks;
3. Cutters tools with a greatly increased useful lifetime;
4. A novel system for the modelling of global risks, to be used for the definition of the best strategy for during both project design and construction phases;
5. A suite of systems to model and control the impact of tunnelling on surrounding structures;
6. A decision support system for tunnel maintenance.

The common theme to all of these is to meet end-user expectations with the target of putting tunnelling in a better business position. In order to keep the research findings relevant to end use NeTTUN plans to test and evaluate its activities in actual tunnel operations including the Rome Metro Line C construction, which runs under ancient monuments, the road tunnel under the Guadalquivir River near Spain being administered by OHL, and Razel Fayat's work on the Fréjus Tunnel.

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One of the matters of particular concern to the EC FP7, Dr Camus explained to *Tunnels*, was the viability of computer software development. "For this reason," explained Camus, "we have a software expert on our advisory panel who

provides guidelines in terms of software development with a goal of producing software that can be commercialised."

On one of NFM's priorities, that of a multi-sensor ground prediction system for TBMs, Camus said, "Although there have been attempts at some methods, there has not been enough effort put into methods for ground investigation in front of the face. 'Off-the-shelf' equipment in ground-probing radar, for example, is not designed for TBM use and does not work properly. The requirement is horizontal, rather than vertical, and there are thousands of tonnes of steel around that distort readings. Standard TBM layouts are not designed for the necessary instrumentation, so any detection method has to be integrated into the overall TBM design."

Regarding the other method often promoted, seismic 'mapping', Camus said, "Most of the current work is for hard rock using explosive charges in holes drilled into the sides of the rock tunnel, as this is feasible, but it won't work like that for soft-ground TBM tunnelling.

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ROBOTICS AND TOOLS

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Another aim directed at more efficient cutter usage is to improve the life expectancy of tools. "Although a lot of work has and is still being done on disc cutters," said Camus, "not much has been done on improving the wear of static tools such as picks, rippers and scrapers.

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PROJECT RISK

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This is also related to the aim of developing a suite of systems to model and control the impact of tunnelling on surrounding structures.

When asked how the aims of this work package differ from systems that are already being introduced, Camus said, "We will use both physical modelling and numerical modelling for the same type of ground and excavation method. The work is closely related to the Rome Metro Line C where there are concerns about the impact on ancient monuments."

In comparison to previous work he says, "We want to make modelling results available in a simpler way that all projects can use. Existing models are generally complicated. Our study will be paid for by future projects in other tunnels, and validated in the field."

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work packages and to assess developments in the field in existing and future projects.

REFURBISHMENT

In view of the predictions of a high proportion of tunnels work in Europe being in need of refurbishment, end users have been keen to have a way of assessing and programming necessary work in terms of priorities and project costs. "Most operators have been carrying out repair work, usually in small sections, according to urgent need (such as water leaks and section subsidence), and leaving the rest of the tunnel until later. As a result tunnels can have a complex history, making assessment of future work needs difficult."

"Clients want to know what tunnels are most urgent to take care of, and how much should be worked on," said Camus, "There are a lot of parameters to include in the decision support system, including the importance of end use (transport route usage for example), safety and the likely speed of degradation without refurbishment. The most urgent needs may not be obvious without analysis."

Concluding Dr Camus says, "NeTTUN will deliver maximum impact with its results, well beyond the current state of the art, to demonstrate real progress that can be utilised to the benefit of the tunnelling sector across Europe, and for European industry with research and development to compete globally" 🌐

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