



HOWARD SCOTT
OSYS TECHNOLOGY

EDITORIAL

This is the second issue of ORFEUS Newsletter focusing on the Consortium's progress in the development of a radar system for the drill tip of a horizontal directional drilling (HDD) machine to provide real time information on obstacles affecting the drill path to the operator on the surface. The data provided will enable action to be taken to steer the pilot hole in a direction that will avoid the obstacle(s).

In the first issue of the project's newsletter, we reported that we were focussing activities on the possible alternatives for the antenna design to optimise the application. This work has now been concluded, and the most promising design has been implemented, and the radar system is ready for field evaluation.

In addition to the design of the radar system, the other key challenge of the project is to transmit power and radar image data along the drill string. This aspect of the development continues, and is nearing completion, which will allow field trials to commence in the autumn of 2014.

Meanwhile, as reported below, work on the production of a DIN on horizontal directional drilling standard has started, together with the development of consortium plans for the exploitation of the technology when the project is completed.

in focus

RADAR DEVELOPMENT

Since the previous issue of the newsletter, hardware development has continued in the key areas of:

- ▶ antenna design and directional sensing using 3 axis electronic gyroscopes
- ▶ communications systems utilising spread spectrum technology and a novel drill string interconnection solution to provide a reliable electrical pathway between drill tip and surface for the transmission of radar data and power

In addition, some aspects of integration of the subsystems have been investigated, particularly the reliability of the electrical interconnection between the individual drill rods as they are inserted into the drill string during pilot hole boring, then removed as the back reaming process proceeds. This work is essential in ensuring that a reliable pathway for data and power can be established and maintained during the drilling operation.

In terms of traditional ground probing radar, the system concept of ORFEUS is comparatively complex. It involves the generation, then transmission and reception of radar pulses at the drill tip, and its transmission to the surface for aiding the operator in avoiding obstacles affecting the drill path. The management of this process involves not only the production of hardware elements, but their integration into a coherent, functioning, system. The conceptual representation of this process is shown in the system flow diagram presented below.

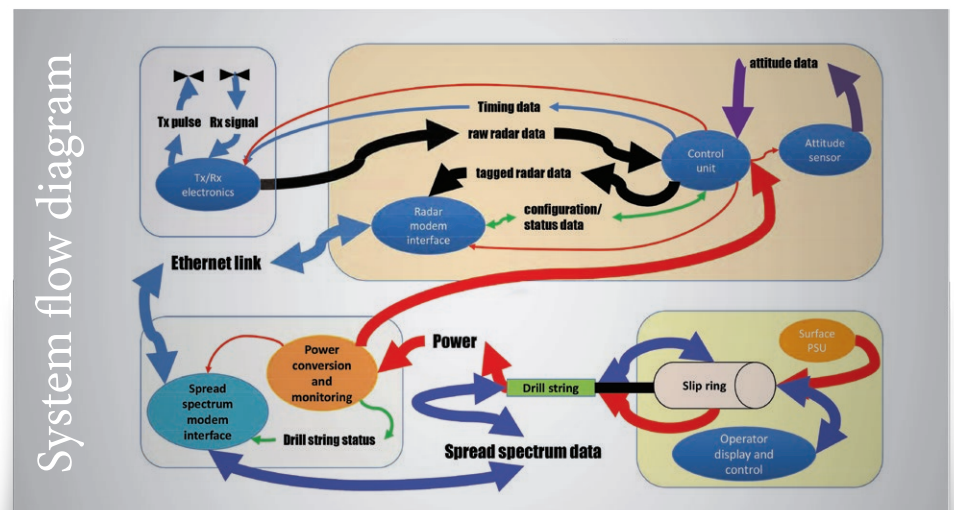


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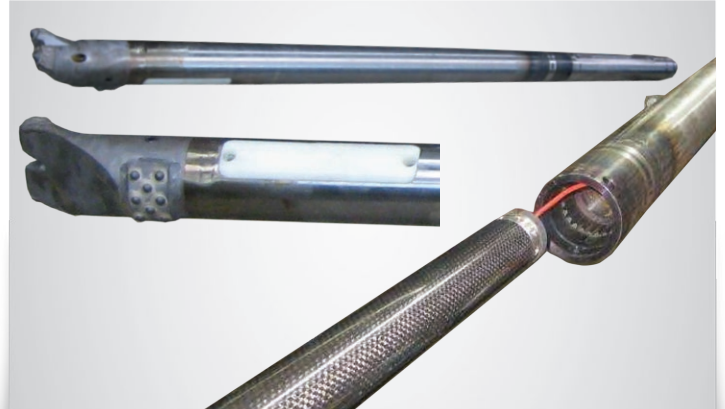
in focus

The translation of the conceptual arrangement into a physical form involved not only leading edge radar and electronics design, but also attention to mechanical detail in order to meet the demanding environmental requirements of temperature, shock and vibration, and resistance to ingress of water. The conceptual

physical implementation details of the system are illustrated below. The project has progressed to the stage of hardware production, and the remaining tasks to be accomplished are associated with final integration and the preparation of systems ready for the field trials programme.



► ORFEUS concept



► ORFEUS hardware

STANDARDISATION

Standards planning is an important work package in ORFEUS and after analysing the relevant European standards the consortium concluded that the project has the potential to go beyond the original recommendations by creating a standard. ORFEUS has agreed a cooperation with DIN (German Standardisation Organisation) in order to create "DIN SPEC 91322 - Bore head radar for horizontal directional drilling; environment, conditions,

limitations of use". Under the guidance of DIN and the leadership of Dr. Mike Farrimond of Wellington Associates, the Kick-off Workshop took place in Berlin on September 8th 2014. The work on the Standard is open to all specialists who can join the ORFEUS consortium members in this activity. It is expected to have the standard published by end of the project.

DEMONSTRATIONS

Trials will be completed before the summer of 2015. The first steps are tests at the Tracto-Technik test field in Lennestadt, Germany. The main purpose is to check the interaction of the different parts of the ORFEUS system and to optimise the system regarding performance and resistivity against shock and vibration.

The next step is tests on real test sites.

Tracto-Technik (TT) is in contact with construction companies in Germany, to clarify the options for doing so. Engie is planning such operations in France supported by TT. In Slovenia, planning and execution lies in the hands of Vilkograd.



► Operational field demonstrations process



MARTIN MOREY
OSYS TECHNOLOGY

A quite difficult and challenging task in ORFEUS project has been the development of the communications system and the system that connects down the drill rods. The system has to take power from the top, where the drill rig is down to the drill head. The difficulty is that you have to have both data and power and that you are working with an imperfect system, where the connection system is working in water and mud and is being connected and disconnected automatically. So there is little chance of intervention to just anything. And during say, a 100-meter drill operation, there will be about 30-35 changes of rods, so there are a lot of connectors involved, a lot of interconnections and a lot of distance down the drill string to attenuate the signals.



EMELINE DROUET
ENGIE

Engie invests money on research projects concerning buried asset location tools, so as to be able to detect and locate any part of its network, anywhere. The ORFEUS radar improves the safety of our gas distribution networks and guarantees the supply of our customers with a decreased amount of accidents. The ORFEUS radar will be tested in the company's Gas Research Centre, in Saint-Denis in France, one of the biggest gas research centres in the world and unique for such purposes.



MIKE FARRIMOND
WELLINGTON ASSOCIATES

I think the one thing to remember about ORFEUS is that more than 50% of the population of the world now live in urban areas and in those areas they receive electricity, they use gas, they have telephone and broadband services, they have water to use, they have drainage. We manage the traffic through traffic signals and through CCTV. All those services in urban areas are delivered by pipes and cables, most of which we never see. Because they are buried under the ground. That means we need to mend them some time, we need to find them. And in some areas, there is not much room left under the street because there are so many services. So we need technologies like ORFEUS to help us manage better what we have under the ground.



MEINOLF RAMEIL
TRACTO-TECHNIK

In Germany, the cost of damages to underground assets caused by all kinds of civil engineering works amounts to almost 200 million Euros a year. The main obstacle to increased use of HDD techniques is the lack of effective location technology. Up to now HDD was considered to work in a black box. The ORFEUS bore head radar will now switch on the light in this black box and increase the safety of installations by reducing the insurance costs for the contractors. We expect the radar to be available within the next 3 to 5 years.



DEREK DIXON
DUBLIN CITY COUNCIL

Currently, road authorities would not be very happy with the use of HDD in an urban environment because when HDD is used, it can do a lot of damage to service connections and pipes and there is no way of telling that. So, if you can clearly see from a datalog or from images what the drill is doing at the time, that it is not hitting any of the services that are buried in the ground, that is a major advantage and it means that you are not chasing the company who is doing the drill for damages done. From a traffic point of view, it means that the job can be done quicker with less disruption and possibly it means that less junctions are affected. And when you are running a city and when you are trying to make sure that traffic flows smoothly, junctions are key.



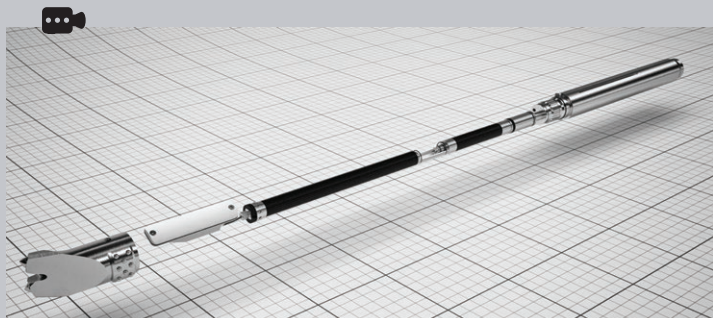
MARIA ATHANASOPOULOU,
EXERGIA S.A.

EXERGIA works on the promotion of the ORFEUS drill tip radar in order to demonstrate its added value to the Horizontal Directional Drilling market as well as the utilities. This is accomplished through workshops, exhibitions, tutorials, films, publication material and other promotion material. The ORFEUS drill tip radar takes the guesswork out of the HDD, it increases the quality and safety of work through minimisation of damages and accidents and it also ensures a greater acceptance of HDD technologies.

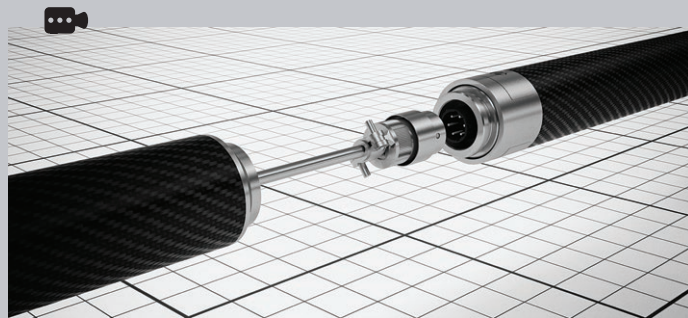


VIDEO ON THE RADAR ASSEMBLY

The Consortium has developed a 3D video animation on the assembly of the ORFEUS prototype drill tip radar system enriched by interviews of ORFEUS partners. The assembly sequence is close but not identical to the actual construction sequence. The video is hosted at the project website (www.orfeus.org).



▶ Drill tip radar system



▶ Connection of radar system module and communications module

UPCOMING EVENTS



ORFEUS consortium is exhibiting in the 32nd ISTT INTERNATIONAL NO-DIG EXHIBITION which will take place in the IFEMA Convention Centre in Madrid on 13-15 October 2014. The event is the trenchless industry's highlight of the year and is hosted for the first time by the Iberian Society for Trenchless Technology.

ORFEUS consortium invites you to **booth G7**, where you can be informed about our project. For more information, please contact Maria Athanasopoulou at m.athanasopoulou@exergia.gr

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This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 308356