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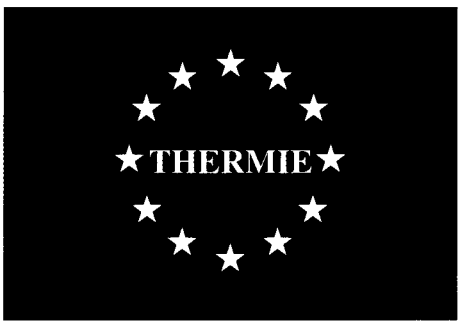
OIL & GAS TECHNOLOGY

THERMIE PROGRAMME: promotion of energy technology in Europe

Automating subsea operations improves safety and lowers costs

WHEN REMOTELY operated vehicles (ROVs) were first introduced in the mid-1970s, their role was primarily as an observation tool in support of diving operations. A decade later ROV systems were actually performing work tasks but still only in support of divers or as a back-up. Only by the late 1980s had confidence in ROVs grown sufficiently that they began undertaking work previously carried out by divers.

The rapid development of ROV technology was encouraged by the European Commission which funded a number of key projects during the seventies and eighties. Today, the EC recognises that support for this area of hydrocarbon technology is still very important. As worldwide demand for hydrocarbons continues to grow, this will



EDITORIAL

lead to the commercial exploitation of both marginal and deepwater fields within Europe, as an essential contribution to the security of the European Union's supply. This move into deeper waters, together with the need for ever-increasing safety and environmental awareness, makes the continuing development of remote intervention technologies a priority.

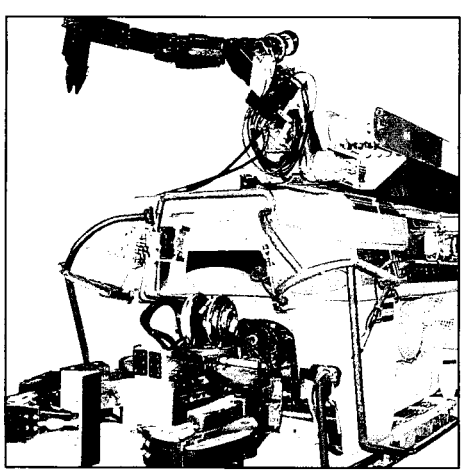
This issue of Oil & Gas Technology Newsletter describes a number of THERMIE supported projects which have increased personnel safety and reduced operational costs by removing divers from potentially dangerous working environments. As these and other remote intervention technologies are developed further, so the exploitation of new and existing reserves will become more cost-effective.

The latest developments in remote intervention technologies will be on show in Aberdeen at the International Offshore Contracting and Subsea Engineering Exhibition and Conference (4-6 October), at which the EU will participate with a stand featuring five European companies exhibiting their innovative technologies.

MARS: diver assistance vehicle-ROV for IRM work

THE FIRST ROVs (remotely-operated vehicles) were introduced purely as television camera carriers for general inspection and diver observation tasks. Further development aimed to reduce the diver's role in offshore work programmes by replacing him wherever possible by work ROVs.

The MARS project, developed by Herion Systemtechnik of Germany, was to build a vehicle system which was based on a diver assistance vehicle but which could easily be converted into a work ROV, thereby increasing operational capacity for a wide range of field applications and reducing total investment costs.



Mars vehicle equipped with manipulator

The complete system is self-contained and is intended for operation from a diving support vessel or platform. The system component parts are as follows:

- the MARS submersible vehicle;
- the surface control station;
- the umbilical winch with umbilical cable.

A containerised diesel generator unit is available for operations where power cannot be drawn from the vessel supply.

The MARS system is a versatile multi-purpose submersible support system for use either as a diver assistance vehicle or as a surface-controlled ROV. In the diver assistance mode, MARS provides the diver with a working platform, tools and facilities which may be required to complete subsea inspection, maintenance and repair work associated with offshore structures and equipment. For operation in the ROV mode the vehicle is fitted with

Control Unit

a range of tool packages and a manipulator to perform tasks under control from the surface and without intervention by a diver.

The MARS system saves, on average, 40% of diving time during field operations. This is worth approximately DM 11,000/day (5,800 ECU) giving the system a payback period of 273 operational days.

Commission of the European Communities - Directorate-General for Energy

Advanced underwater robotics

A REMOTE-CONTROLLED system has been built to perform subsea NDT inspection on offshore steel structures without diver assistance. The REMO system is constructed around a free standing toolskid that can be mounted on various ROV systems. Three main tools are used:

- the Eddy Current tool (Lizard ROVscan);
- the single leg Magnetic Particle Inspection (MPI) tool;
- a high-pressure water jet cleaning tool (Aqualazer).

The system is based on the use of a computer-controlled robotic arm that moves the tool according to the operator's instructions. 3-D measurements of the work location made with a combination of video cameras and computer algorithms give the operator the ability to make a correct computer model of the weld to be inspected. This model is used to program the movements of the tools in the robot arm. The computer can move the tool along the programmed inspection area without operator intervention.

The Eddy Current system is identical to the equipment currently used by divers, but the sensor is mounted in a purpose built adapter. The adapter that is grabbed by the robot arm also contains a miniature video camera to give the operator visual information from the scans performed.

The MPI equipment is also fitted with a miniature camera. This gives the opportunity to directly see the size and shape of the cracks. Colour video prints of the cracks can be made when required. Small lasers are fitted on the tool to give the operator known references on the images.

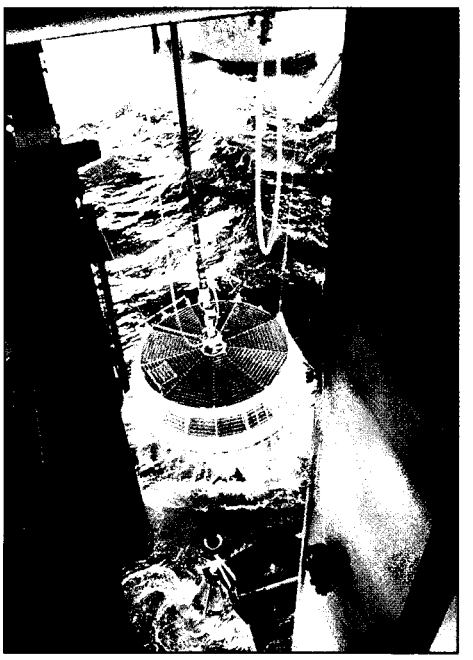
Special software and hardware for the control of the equipment mounted on the toolskid has been developed as well, and forms the basis of a general purpose system that can be used in a variety of tool control applications.

The test program has been performed in three phases: two dry test phases in the workshop (with and without the ROV), and one shallow water test. All tests have been successfully completed, and the evaluation of the test results is ongoing for the moment.

Stolt Comex Seaway has completed the REMO project according to the objective, and with a satisfactory result which shows that in the future inspection of steel structures can be performed with a remote controlled system.

Innovative subsea excavation system proves its worth

A diverless underwater excavation system developed by the UK company Underwater Excavation Ltd, has recently been successfully deployed in a deep-water, large-scale seabed cleaning operation. Originally supported by the EC, the technology has evolved during development to a stage where it is far removed from the original THERMIE project.



JetProp is recovered after completion of Conoco's mud removal operation

The JetProp system which is now being marketed by UEL, consists of a 4 m diameter propeller powered by peripheral water jets mounted on the blade tips. The low velocity downflow of water created can be controlled accurately, allowing cuttings and drilling mud to be removed without disturbing the natural seabed.

The level of precision which can be achieved by JetProp was recently demonstrated on Conoco Norway's Heidrun project. Cuttings and drilling mud produced during the pre-drilling of wells had to be removed to allow four large concrete foundation units to be positioned precisely; more than 2,500m^3 of material had to be cleared from the footprint areas. The depth of soil removed varied from 1.6 m near the template to a few centimetres at the periphery. The work was completed within budget and bathymetric surveys indicated that the necessary standards had been satisfactorily achieved.

Although JetProp was used at low power levels during the Heidrun project, it is capable of operating at 15,000 hydraulic horsepower which is sufficient to lift and disperse large boulders and remove gravel and sand at excavation rates of 10,000 m^3 per hour.

Automatic hyperbaric welding

IN A PROJECT supported by the EC's THERMIE programme, the French company SCS (Stolt Comex Seaway S.A.) has developed a hyperbaric robot which is used for advanced diver-assisted welded tie-ins of pipelines. The THOR (Tig Hyperbaric Orbital Robot) system has proved to be very reliable and is now regularly used by the oil companies.

The robot is installed by divers inside a hyperbaric welding habitat over the two pipe ends to be connected. Once installed, the actual welding sequence is fully automated and controlled from the support vessel by surface technicians through an advanced weld control system.

The original developments sponsored by the EC also featured some complementary equipment. The Tool Orbital Clamp (TOC) is an hydraulic clamp used to remove pipe ovality and providing a rotating face plate which carries the machining tool or the two welding heads. The Pipe Machining Tool (PMT) is a remotely controlled hydraulic machining tool allowing sawing, counterboring and bevelling of the pipe end. A laser metrology device was used for the control of the weld passes.

The THOR system is a successful first step towards completely diverless tie-ins by hyperbaric welding. It offers cost reductions for offshore tie-in operations due to:

- lower costs during unmanned onshore qualification;
- reduced operating costs (increased speed and efficiency);
- excellent quality and repeatability of the weld due to the automation.

Based on the know-how gained from the THOR project and its many commercial applications, SCS is currently continuing this programme of hyperbaric welding towards deeper and fully diverless operations. Such developments have a major impact on both costs and personnel safety for deep water tie-ins and repairs.

Further details of the THOR project are available in flag brochure No.128.

Improving subsea inspection and maintenance operations

A ROV mounted telemanipulation system skid unit and Supervisory Control system has been developed by Tecnomare within a 1.4 million ECU project supported by the EC together with AGIP, Ansaldo, Saipem and Tecnomare.

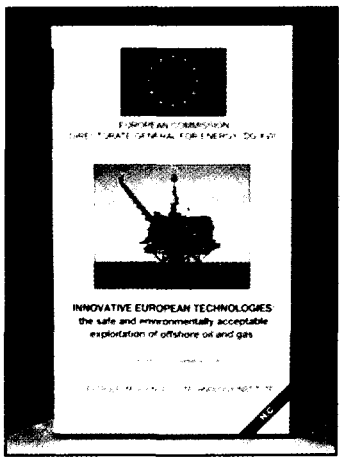
The skid has been integrated into the Saipem Triton ROV and tested in water at the Saipem base in Italy. The SCTS (Supervisory Control Telemanipulation System) first prototype was tested in the laboratory in 1989 within a previous EC supported project.

The system is intended for subsea cleaning and weld inspection of offshore platforms as well as for installation and maintenance of subsea systems, where ROV based telemanipulation is becoming an important enabling technology.

The system features manipulator control by means of a joystick and workspace measurement and computer modelling. The measuring device is the TV-Trackmeter, a precise 3-D real-time system based on TV cameras and data processing. Proper ROV close navigation control helps increase operational efficiency.

Tasks performed by the SCTS so far include jet cleaning and steel pipe cutting, weld brush cleaning, close TV inspection, eddy current tool control along weld, operation of a hand wheel, transponder installation on post, guideline installation, and hotline connection.

THERMIE Hydrocarbons Video now available



A new EC video on the safe and environmentally acceptable exploitation of offshore oil and gas is now available. The video covers the life of an offshore platform from design, to production, through to final decommissioning. All aspects of offshore technology are covered, showing the wide range of hydrocarbons projects supported by the EC. Copies of the video are available.

CONFERENCE, EXHIBITION and WORKSHOP DIARY

SPURS Workshop
Moscow, 27 October 1994

SPURS, developed by Drilling Systems (UK) Ltd, is a mathematical well control model which is used to simulate kick control situations and recreate well control problems. It can provide well control training validation in a rigsite environment, which is particularly relevant to drilling problems in the Former Soviet Union (FSU). The workshop is aimed at drilling contractors, operators and engineers working in the FSU.

Oil and Gas Tyumen '94
Tyumen, 14 - 18 November 1994

This year's event will be the 2nd international exhibition for oil and gas industries operating in Western Siberia. The EU stand will feature a number of innovative hydrocarbons technologies developed in Europe. Representatives of the EC will also be available to discuss THERMIE activities in the Former Soviet Union.

Offshore South East Asia
Singapore, 6 - 9 December 1994

The Directorate-General for Energy will participate for the first time at the OSEA Conference and Exhibition which is being held at the prestigious World Trade Centre, Singapore. The EU's presence reflects the importance of South East Asia as a rapidly growing market for European Technology.

Official visit to the EC Energy Centre Tyumen

A delegation led by His Excellency Ambassador Michael Emerson, Head of the European Commission Delegation in Moscow, visited Tyumen on July 5 1994.

This delegation of 75 people included representatives from the European Commission, in particular Mr H-E von Scholz the Head of DG XVII-D1 (Strategy, Dissemination, Promotion), the principal hydrocarbons OPET representatives, European industrialists, journalists from this specialised area of the press as well as ministerial representatives and those from the Russian petroleum industry.

During a reception in Moscow on July 4, a presentation was given on the Commission's work in the petroleum sector in Russia. The delegation travelled to Tyumen the following day.

During a plenary session, attended by important local administrative and industrial representatives and chaired jointly by Mr Roketsky (Governor of the Province of Tyumen) and Mr M Emerson,

Mr Roketsky (Governor of the Tyumen Oblast) and Mr H-E von Scholz (Head of DG XVII-D1) listen to Mr Emerson (EC Ambassador for Russian Federation) during the plenary session

the European Union programmes THERMIE and TACIS were presented, as well as the activities of the Energy Centre and the situation in the petroleum industry in Western Siberia. This latter presentation was made by Mr Alpatov, Vice President of the Oil Industrialists Union. British, German, Dutch and French industrialists from the petroleum service and supply industries also had the opportunity to present their points of view.

The plenary session was followed by a press conference and a tour of the Centre. A reception closed the day.

The final day was devoted to a visit to Surgut and Surgutneftegaz's main oil field Fyodorovskoye. During this visit it was possible to see at first hand the working conditions in Siberia and the present state of the installations. In a further meeting led by the deputy Head of Administration of the Okrug of Khanti-Mansiisk, the Mayor of Surgut and the Chief Engineer from Surgutneftegaz, the delegation was able to complete its viewpoint of certain aspects of the present situation in Western Siberia.

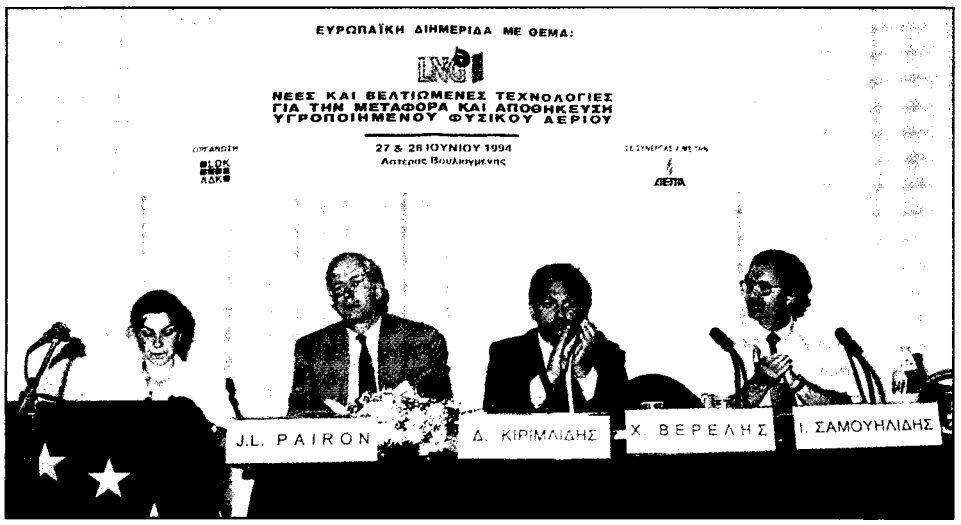
CONFERENCE, EXHIBITION and WORKSHOP REPORTS

Since the beginning of the 80's, world LNG trade expansion has risen by approximately 8%/year and it is estimated that by 2010 LNG will account for 10% to 12% of European energy supplies. Such is the interest in LNG that a two-day workshop entitled **New and Improved Technologies for LNG Transport and Storage** held in Athens on 27 and 28 June, attracted 80 delegates most of which were from southern countries.

The workshop focused on optimal operation and advanced concepts of LNG storage, the improved design and construction of LNG tankers, and LNG tanker marine analysis. These topics were presented by high-level representatives from major European gas, shipbuilding and engineering organisations.

The three topics which generated particular interest were safety and control systems for LNG terminals, advanced concepts in LNG storage in rock caverns and offshore terminals and the new design and technologies of LNG tankers. Among the safety and control systems discussed, those which received particular attention related to the development of powerful models and software for behaviour prediction of LNG incidents, preventive measurements as well as crisis management. Storage of LNG in rock caverns lined with a stainless steel membrane and offshore terminals for temporary storage and regasification of LNG appear to be promising new concepts. However, further development and testing is still required. New developments discussed in LNG tanker design included the dual fuel diesel engine propulsion option and automation system which can improve the performance and reduce significantly the cost of LNG transport.

The workshop was supported by the Public Gas Corporation of Greece (DEPA).



Dr I S Samouilidis of the EC's THERMIE programme (DG XVII-D1) chairing the LNG Athens workshop

OPET - Organisations for the Promotion of Energy Technology

THE ROLE of the EC's OPET Network is to encourage the development of an energy strategy and the implementation of innovative technology within Europe . The Network also fosters the growth of smaller enterprises and cross-border collaboration within the European Union.

The benefits for Europe which follow from these actions include securing the energy supply, building an industrial base and improving the potential for exports of energy technology, whilst at the same time protecting the environment.

To achieve these objectives, the OPETs are involved in a range of activities including market studies, workshops, conferences, trade exhibitions and publications.

The activities of the OPET Network promote improved efficiency and competitiveness, and contribute to European technology transfer not only within the Single Market but also outside the European Union.

OPETs are there to help and advise. For further information on the technologies described in this newsletter please contact the appropriate office.

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