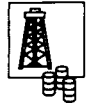


OIL & GAS TECHNOLOGY



THERMIE PROGRAMME: promotion of energy technology in Europe

Offshore Production - the technological challenge

In the future, oil and gas production will come increasingly from offshore deposits. Development in offshore technologies will therefore continue to play an important role in the industry for many years to come.

Already the evolution of technology has allowed oil companies to explore and produce in increasingly hostile environments. However, other areas of technological development are equally important. New technologies are already allowing significant cost savings to be achieved, for example through the improved design and maintenance of offshore fixed and semi-submersible platforms. In addition, the oil industry has not escaped the increasingly stringent



EDITORIAL

environmental legislation which will necessitate the review of procedures for disposing of drill cuttings and decommissioning activities.

By supporting projects which address these problems the EC, via its THERMIE programme, is actively encouraging the development of innovative technologies. In this issue five such technologies developed in the UK, Italy and Germany are described.

Participation at major events such as Offshore Northern Seas Stavanger (23-26 August) provides the EC with an ideal opportunity to promote the offshore technologies it has supported and which are now poised to break into the market. A number of European small and medium sized enterprises (SMEs) will join EC officials on the European Union stand at this year's event.

An environmentally friendly seabed clearance system

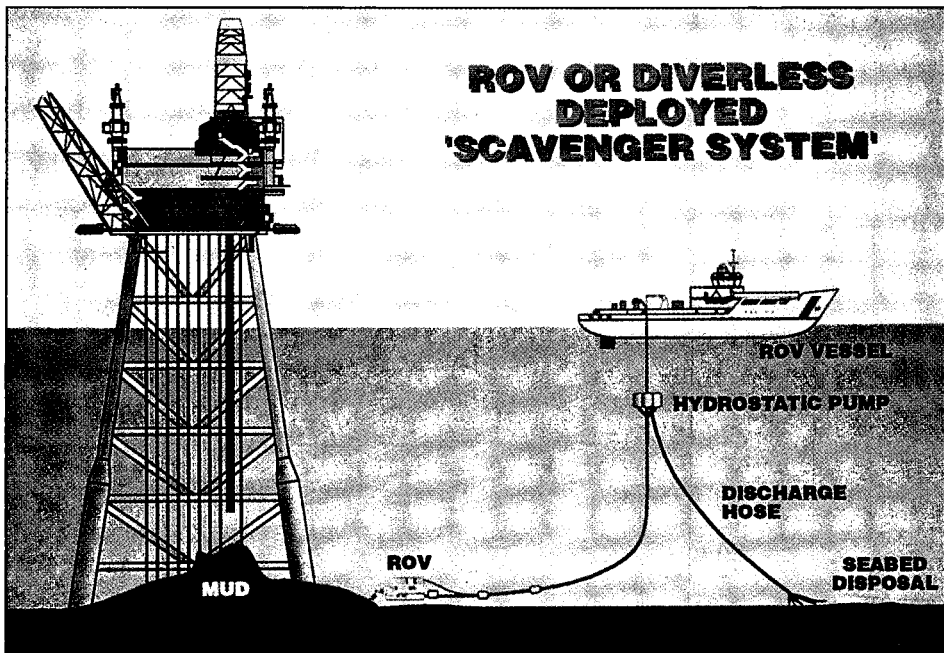
Traditionally drill cuttings have been dispersed away from the work site to alternative seabed locations. However, these methods cause secondary pollution and achieve very little since the material remains on the seabed. In view of the increasingly restrictive legislation pertaining to the discharge of drill cuttings,

IME Ltd, a subsea engineering specialist based in the UK, has identified the need for a viable, economic and environmentally safe means of removal. The system being developed by the company, with EC THERMIE programme funding, overcomes many of the drawbacks of existing technology.

Working with the Italian company Pneuma Srl, an extremely efficient drill cuttings removal system has been developed. The pump, upon which the system is based, can entrain dense and compacted material such as oil based drill cuttings without causing pollution. The "Scavenger" system comprises a main pump body positioned mid water and a remotely controlled suction head which moves over the material mound on the seabed.

The operation of the pump is dependent upon the development of a hydrostatic head; the configuration devised for this application generates a very steep pressure gradient which leads to an extremely efficient removal system.

The initial phases of the project, concerned with conceptual design and feasibility studies, have been successfully concluded. Further work on the system, which has already attracted additional THERMIE funding, will include finalising the design together with the fabrication and prototype testing of a complete system. The successful conclusion of this stage of the project requires the involvement of a major oil operator or offshore contractor. In return for this the participant could benefit from a first hand knowledge of this innovative seabed rehabilitation system.



Possible method of deployment and operation

C&C: XVII/27

EXCUT - Engineered explosive underwater cutting

EXCUT, developed by Marinotech in the UK and supported by the EC's THERMIE programme, is aimed at the development of a safe, reliable and proven explosive underwater cutting system to be used in the decommissioning and removal of steel offshore structures.

Two novel explosive charge designs have been manufactured and validated. The Shockwave Focusing Charge (SWF) uses a convex shaped flexible waveguide to generate focused tensile stress waves in the target material. Once a crack greater than the critical crack size for the material is established, much lower force (i.e. less explosive weight) will cause it to propagate round the pile or platform leg.

The Radial Hollow Shaped Charge



End view of RHC showing detonation system at APEX

(RHC) is made like a pie segment, with the explosion initiated at the apex causing the curved liner to collapse instantaneously all round the circular periphery, generating a radially flowing jet which fans out as it travels towards the target. This new device is easy to manufacture, uses less explosive than a straight linear equivalent charge and, due to the fanning nature of the jet,

fewer numbers of the device will be required per unit length of cut.

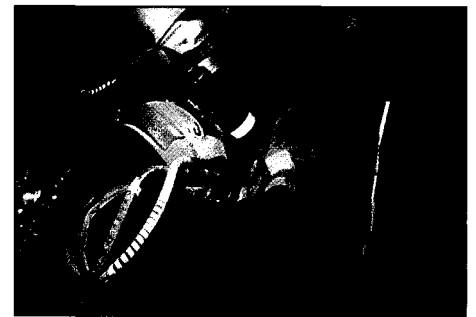
Phase II of the project, which is due to be completed in November 1994, will result in the manufacture of an explosive cutting tool, incorporating the RHC charge design and capable of performing efficiently in offshore conditions on tubulars commonly found on North Sea platforms.

RISC - reliability based inspection scheduling for fixed offshore platforms

In order to ensure the structural integrity of fixed offshore platforms and other structures it is necessary to conduct periodic inspections. The number of inspections, the locations and the frequency of inspections have traditionally been a matter for engineering judgement but more recently attempts have been made to rationalise this approach using methods developed from structural reliability theory.

For a successful development of a usable methodology, it is necessary to have accurate fracture mechanics modelling, databases for all the modelling parameters, a reliability based approach that includes updating to take advantage of service data, and information on NDT reliability to allow interpretation of service inspection data.

The Reliability based Inspection Scheduling for fixed offshore structures (RISC) project aims to provide the offshore industry with a rational methodology for the scheduling of inspections of fixed offshore platforms based on reliability techniques. This is implemented as a knowledge based system which can carry out the required analysis for the structure



Diver inspecting a tubular joint

and can integrate the interpreted analysis results with scheduling constraints to produce a rational, practical scope of work for inspection, repair and maintenance. This will result in:

- improved safety of fixed offshore installations;
- increased effectiveness of subsea work by eliminating unnecessary repairs and targeting maintenance;
- enhancement of operating life of the structure by concentrating resources on critical problem areas.

Reliability-based inspection scheduling services based on RISC are now available from PRISM Ltd in the UK.

New Publications

Five new EC brochures are now available from PSTI. Flag brochure No.182 examines the Heavy Floater Expert System (HFES), developed by Marcon Engineering in The Netherlands, a tool for incorporating life-cycle cost considerations at an early stage of the design process of semi-submersible platforms or offshore operations.

The HYDRA hydrogen diving technique developed by Comex of France is detailed in flag brochure No.184. The technique has been fully tested and allows deep-diving companies to extend their range of subsea operations to 600-650 m.

Brochure E-1 describes a subsea mateable optical connector developed by the French company ECA, which can be used in any application requiring a wet connection either in water or any other fluid. The technology will be of primary interest to oil companies although it can be applied to any industry requiring underwater connection on an optical fibre link.

Brochure E-2 discusses Seismaster, a towed land geophone streamer, developed by SMA Ltd in the UK. The main benefit of Seismaster is in the reduced man-power required over conventional seismic data acquisition methods. Over a 15 km stretch Seismaster requires 30 man-hours compared with 400 for conventional techniques.

IIP InTerPipe of France has developed a new pipeline insulating technique that saves heating costs and eliminates or reduces hydrate formation. Details of this promising new technology are available in brochure E-3.

A 16-page maxibrochure entitled "Oil and Gas Technology: Investing in a major European industry for future security and prosperity" gives an overview of the European oil industry and examines the importance of encouraging new developments in hydrocarbon technology.

All of the above publications are available from PSTI.

Life cycle design of semi-submersible platforms

DESIGNERS continually have to make a compromise between the initial cost of a system and its in-service running costs. The aim of this project, carried out by Marcon Engineering of The Netherlands with support from the EC THERMIE programme, was to include life-cycle cost considerations at an early stage of the design process of semi-submersible platforms for offshore exploitation of oil and gas. The project concentrated on the development of quantitative assessments for life-cycle costs resulting from decisions early in the design process. This assessment was integrated in a prototype computer aided design (CAD) system, called the Heavy Floater Expert System (HFES).

The CAD system was set up as a complex conglomerate of miscellaneous programs or

Deepwater subsea production system and maintenance

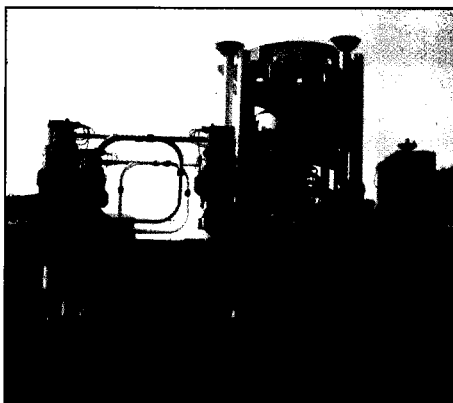
modules, different in nature and in use. The process starts with sizing of the design. Main dimensions and layout are refined to meet specific client wishes, to accommodate practical considerations and cater for improved characteristics. Determination of local scantlings, weight and initial cost estimates are part of this design stage.

Inspection, repair and maintenance (IRM) strategies are focused on fatigue sensitive locations. The long-term stress range distribution for these locations is determined. The reliability of the structure based on these stress data is used to estimate in-service costs of the structure.

The benefits result from a trade-off between the initial cost and in-service cost of semi-submersibles being designed. The initial cost of structural changes which reduce in-service costs is usually modest when a semi-submersible is still at the design stage. Typical figures would be in the order of US\$100,000. The cost of inspections over the life-time of a structure may be ten times this amount. The cost of failure (risk of failure times cost consequences) can be higher still. Full details of this project are available in flag brochure No.182.

THE DEVELOPMENT of technologies needed for the exploitation of offshore hydrocarbon fields in deep waters has been one of the main targets of many oil companies in the past 20 years.

In the late eighties the Italian oil company AGIP undertook the development of the SAF (Sistemi Alti



The SAF system in the final production configuration

Fondali) Project, a modular production system integrated with a maintenance system for very deep water. The project received support from the EC's hydrocarbon demonstration programme.

The aim of the SAF project is to overcome many of the problems related to the commercial exploitation of deepwater oil and gas fields. This goal can be achieved only through an optimum mix of technology and practical expertise: a multidisciplinary approach has been adopted also borrowing, whenever possible, technologies from sectors other than the oil industry.

The SAF system is designed to operate in water depths of up to 1,000 m. It is based on a modular configuration of the production system and integrated with an installation and maintenance system. The latter is built around an unmanned vehicle which when mated with several modules, provides installation, maintenance and recovery functions at the production facilities on the sea bottom. Although the prototype is designed for a single well installation, the system can be, with minor adaptations, tailored to different subsea development scenarios, including template configuration.

Installation of the prototype is planned for the end of 1994 on AGIP Luna gas field, in the Ionian sea at a water depth of 170 m.

CONFERENCE, EXHIBITION and WORKSHOP REPORTS

Activities in the THERMIE hydrocarbons sector continue to promote innovative European technologies worldwide with the EC attending recent events in the United States, Russia, Ukraine, Azerbaijan and Austria with events closer to home focusing on France, Germany and Greece.

A workshop on EUROSLIM, a complete slimhole drilling and coring system, held on 18 March in Paris attracted 84 delegates. The cost saving potential of this technology is generating great interest in the oil industry, evidenced by the high attendance.

The EU stand at the **Moscow International Oil & Gas Exhibition** held between the 18-22 April featured technologies developed by four European SMEs and attracted many Russian and international visitors, with promising business contacts being made. The stand also displayed the activities of the EC Energy Centre in Tyumen. During the exhibition, representatives of DGXVII, the Energy Centre and the OPET GEP had constructive meetings with the Ministry of Sciences and Technology Policy and the management of LUKOIL and ROSNEFT.

Losses from pipelines is a major issue in

Central and Eastern Europe. It was therefore no surprise that a workshop on **Pipeline Integrity** in Kiev on the 26 April attracted over 100 delegates. The main message of the workshop was to stress the importance of pipeline coating in reducing losses.

The European Commission's decision to expand its participation at the **Houston Offshore Technology Conference** (2-5 May), the world's premier oil and gas exhibition, was vindicated by the overwhelmingly favourable response from the stand participants and visitors. The European Union's stand was the largest ever organised under the THERMIE Programme, with twelve THERMIE contractors and European SME's exhibiting their latest oil and gas technologies and products. A workshop organised by the OPET IRO on **European Offshore Deepwater Technologies** held during OTC '94 was a success and well attended.

Over 100 companies from 14 countries exhibited their products at the **Caspian Oil and Gas Exhibition and Conference** held in Baku on 24-28 May. The EU stand included companies from the UK, Italy, France and Germany all of which reported making good business contacts.

A successful workshop organised by IRO on **Exploration Software** was held in Vienna on 6 June. In lively brainstorming sessions delegates from Italy, Norway, the UK, Poland, The Netherlands, USA, Denmark, Austria and France discussed the technologies featured by Jason Geosystems and Oilfield Systems Ltd. In addition, important trends in geoscience were discussed.

A high quality programme was presented to delegates attending a seminar on **Heavy Oil Technologies in a Wider Europe** on 7-8 June in Berlin. Although a highly specialised topic, the event attracted around 100 delegates to hear about the latest advances in exploration, production, processing and transport technologies for heavy oil. Proceedings will be available in approximately two months.

The EC Energy Centre in Tyumen organised a seminar on **Geology and Geophysics** (15 - 16 June) which attracted 110 delegates, mainly from the oil and gas producing Associations of northern Siberia. The seminar provided an opportunity for delegates to exchange ideas and compare experiences of geophysics technologies.

THERMIE Exhibition, Berlin, 19 - 24 September 1994

This year's THERMIE Exhibition will take place at the Martin-Gropius-Bau in Berlin. The event will coincide with the 6th OPET meeting and an informal meeting of the THERMIE Committee hosted by the German Presidency. As with last year's exhibition, DGXVII is expecting enthusiastic participation from experts and industry, as well as the general public. Further details are available from Stephan Wünnlich at OPET-CS (Tel: +32 2 778.28.55)

IOCE Exhibition and Conference, Aberdeen, 4 - 6 October 1994

The European Union will once again participate at the International Offshore Contracting and Subsea Engineering Exhibition and Conference following the high quality of visitors to the stand at IOCE 92. The EU stand will include five European companies which will be exhibiting their innovative technologies.

Representatives from the EC and the OPET network will also be available to answer questions relating to the THERMIE programme. Further details are available from Jane Kennedy at PSTI.

Multiphase Flow Workshop, Aberdeen, 7 October 1994

This one-day workshop, which is being held to coincide with IOCE 94, will demonstrate technology developed by AEA Technology of the UK and ALFAPI of Greece in the area of multiphase flow analysis. The workshop will examine up-to-date computational modelling skills in complex multiphase pipeline technology and two-phase steady or transient flow analysis in pipelines and pipe networks. Further details are available from Jane Kennedy at PSTI.

SMEs Receive Assistance with Promotional Literature

THERMIE has one major difference from many other EC programmes - it helps

SMEs (small and medium sized enterprises) to promote their innovative technologies, even if they were not originally funded by the EC.

One method by which THERMIE can help is through the production of promotional literature for a new technology which has yet to penetrate the market. These brochures are similar to the EC's own flag brochure series in that they are four pages (A4 size) and printed in full colour. These brochures are prepared and printed by the EC at no charge to the SME.

Many SMEs do not have the time or money to allocate to the production of literature and already a number of companies have taken advantage of this opportunity. Details of the technology are submitted to the EC for approval. If accepted the EC takes care of all stages of brochure production, with proofs submitted to the company for approval prior to final print.

If you wish to investigate the possibility of having a brochure produced free of charge contact Jonathan Shackleton at PSTI.

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

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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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