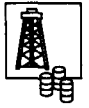


# OIL & GAS TECHNOLOGY



## THERMIE PROGRAMME: promotion of energy technology in Europe

### Downhole Technology - Hitting an All Time Low

IN MOST INDUSTRIES "hitting an all time low" would be associated with a particularly bad spell in business. However, when it comes to drilling and downhole technology exactly the opposite is true.

As the search for new reserves of oil and gas continues, so the need to drill to ever greater depths becomes important. This is pushing current technology to its absolute limit. One of the main reasons for this is the high temperatures experienced when drilling deep boreholes and the ability of equipment to function in this environment.

This issue of Oil & Gas Technology Newsletter describes a number of downhole projects, including a technology



#### EDITORIAL

which is increasing the temperatures at which Moineau direct drive bits can operate. Other technologies featured include a new method for monitoring

drilling paths, mud analysis and control, a remotely operated bent housing system and gamma-ray density sondes. These technologies, developed in France, Ireland, the UK and Germany, have all received support from the EU's THERMIE programme and are now available commercially.

A number of downhole projects, together with other technologies, will be exhibited on the EU's stand at OTC '94 being held in Houston on 2-5 May 1994. The EU will have its biggest stand ever at this event, promoting innovative technologies developed by European small and medium sized enterprises which are poised to break into the oil market.

### VARISTAB - improving the monitoring of drilling paths

METHODS FOR REDUCING the time spent drilling are of great benefit due to the cost savings which can be achieved. VARISTAB, engineered and manufactured by SMF International in France, reduces the number of drill pipe operations by improving the monitoring of drilling paths. As a result VARISTAB can directly reduce

drilling time.

VARISTAB is a downhole adjustable stabiliser which features three blade diameters, three integral spiral blades and a low flow actuator and position indicator system. Due to its unique features, the three position tool allows the control and optimisation in real-time of the inclination

of hole profiles, especially in the tangential sections.

Specific procedures or flow rate sequences actuate the tool and these are fully compatible with all MWD systems. The flow rate values used are much lower than the drilling flow rates. For each configuration change at bottom hole conditions, a specific pressure signal transmits the position of VARISTAB to the surface. Due to its overall engineering characteristics, there are no operating limits for utilising VARISTAB either from drilling parameters or hole trajectory standpoints.

The VARISTAB project was developed in collaboration with the French Petroleum Institute and financially supported by the EC. The next stage is to include VARISTAB as a key component in the development of a rotary steerable system which will allow the control of both azimuth and drift angles without the need of a downhole motor. The VARISTAB tools are already available for 12<sup>1</sup>/<sub>4</sub>" nominal hole size and will be available in 8<sup>1</sup>/<sub>2</sub>" at the end of this year.

*The VARISTAB tool*



L2/11A x 330

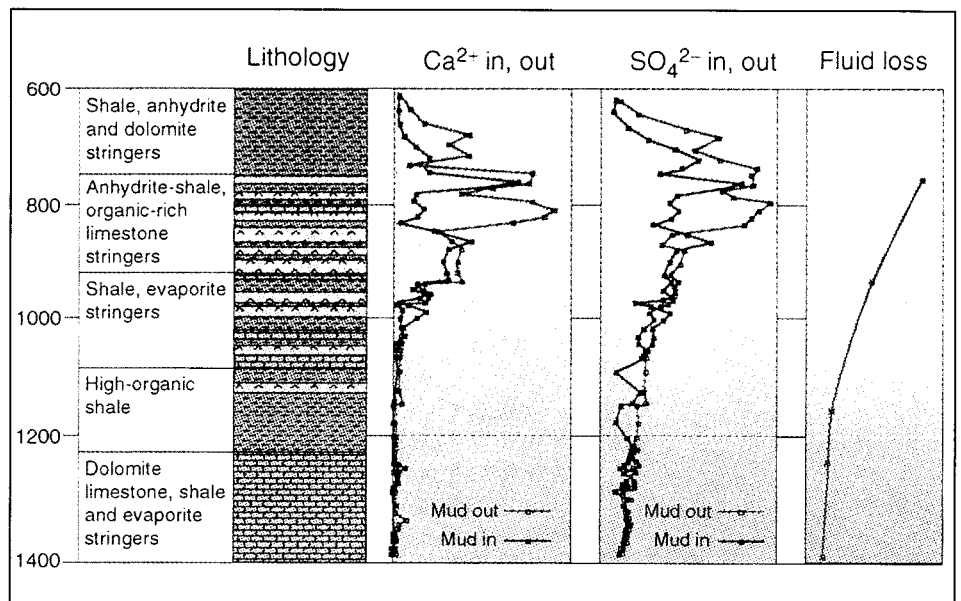
## Mud Analysis and Control - towards better drilling fluids engineering

DRILLING FLUIDS play an important and sometimes critical role in the safety and technical efficiency of drilling operations. Yet monitoring and control of fluids operations at the rig remain relatively primitive. As part of a broad effort to develop a new process control approach to drilling fluids management Schlumberger Cambridge Research, between 1987 and 1989, set out to devise a prototype Mud Analysis and Control (MAC) system. The total cost of the project was 3.2 MECU of which the EC contributed 35% under its hydrocarbons programme.

The aims of the MAC project were:

- to devise practical rig-site monitoring procedures;
- to use these to generate chemical logs of mud composition versus depth;
- to provide interpretation models to enhance drilling efficiency.

The major innovation in monitoring was the application of ion chromatography (IC) to the analysis of salts in mud filtrate. A complete analysis can be carried out automatically at a rate of up to 5 samples per hour, in contrast to API 13B titration methods which are relatively inaccurate and restricted to a few ions. A particular



advantage of IC is its wide dynamic range - from mg/L levels to major components - and it can also detect heavy metals for environmental audit and discharge monitoring.

The equipment was successfully field tested both on land and offshore. The figure illustrates a typical log and the potential value of early chemical detection for avoiding departures of mud properties from specification. Interpretation of the

data is aided by a mineral-fluid chemical reaction simulator, also developed within the project.

The techniques and methodology have been taken up by Schlumberger Dowell as the basis of a Fluids Ions Monitor (FIM<sup>TM</sup>). This is currently undergoing rigorous field evaluation with a view to eventually offering this as part of Dowell-IDF's MUDSCOPE<sup>TM</sup> fluids engineering service.

## Gamma-Ray Density Sondes - modelling environmental effects

THE EFFECT of unusual environmental conditions on the response of gamma-ray density sondes has been examined in a project recently completed by AEA Technology with support from a consortium of oil companies and an award from the THERMIE programme.

In recent years there have been a number of publications on the enhancement of vertical resolution of nuclear logging tools for evaluation of thin beds. These publications have almost all dealt with the simple situation where the bed lies perpendicular to the borehole. This project examined the more realistic situation where the bed is not at right angles to the borehole.

The project involved building a special test-pit at the EUROPA calibration facility in Aberdeen that enabled the thin bed response of commercial logging tools to be determined in a systematic way. This and other measurements made in EUROPA

were used to validate detailed numerical models of the logging tools that were then used to calculate the tools response to thin beds of different thickness and angles of inclinations. A method was developed by which the density of a thin bed that has not been fully resolved can be estimated provided that the vertical resolution of the logging tool is accurately known.

The development of formation density sensors for MWD Formation Evaluation now offers a significant advance in logging technology. The same techniques used in the thin bed study have also been applied to quantifying the effects of borehole shape on the response of two types of MWD density tools. The calculation which uses a generalised 3D geometry package is ideal for this purpose because the validated tool model can be used in quasi-experimental conditions that would be difficult and costly to simulate in the laboratory.

## HANDS - remotely operated bent housing system

NEWBERGH INDUSTRIES Ltd has patented and developed a technology which will significantly enhance the steerable drilling systems currently being used in the oil, gas and mining industries. The technology called "HANDS" (Hydraulically Activated Navigational Drilling System) has been incorporated in a motor bent housing, making it remotely adjustable for the first time. HANDS technology can also be used to remotely adjust other downhole equipment such as stabilisers. HANDS, with its surface adjustability, could dramatically improve drilling in terms of speed, steering ability, component longevity and reduced costs.

The first phase of research involving the hydraulics of flow in annular channels and stress analysis was partially funded by EOLAS in Ireland. Further work on upgrading and the manufacture of prototypes was supported under the EC's THERMIE programme.

Development and testing of the first

**HANDS cont.**

prototype has been completed successfully. Tests have shown that the adjusting mechanism operates as predicted under various loading conditions and the actual hydraulic behaviour corresponds closely to that predicted by the scale research model.

A simple flow switch has been developed to enable activation of the mechanism in the low flow region by means of a specific pump procedure. This also guarantees that during normal drilling operations the tool can not be activated inadvertently. In a later phase, integration with MWD is envisaged to produce a semi-intelligent system.

At present, Newbergh Industries is upgrading and improving the 9<sup>5</sup>/<sub>8</sub>" tool and down scaling to a 8<sup>1</sup>/<sub>2</sub>" and 6<sup>3</sup>/<sub>4</sub>" tool. Manufacturers and investors are currently being assessed with a view to commercialisation of the project.

**New Moineau Drives Achieve High Temperature Drilling**

**DUE TO THE DECREASING** availability of fossil energy especially in Central Europe, more and more wells are drilled down to greater depths. As a result the demand for temperature resistant downhole direct bit drives is growing.

With existing Moineau drives it is not possible to drill at temperatures greater than 150°C, for instance in deep boreholes or geothermal applications. The importance of this area is such that the EC provided 2.5 MECU to partly fund a project aimed at overcoming these limitations and developing Moineau direct bit drives capable of operating at temperatures of 200°C with peak temperatures of 250°C.

The critical motor parts developed in this project were the polymeric elastic lining of the stator tube and the metal surface of the rotor. The materials of both parts are

exposed to high mechanical, chemical and thermal stresses during drilling and had to be developed for operation at much higher temperatures.

Extensive tests with different polymers were necessary to develop special elastomers with improved strength and resistance to drilling fluids, while also exhibiting good dynamic properties. Test facilities were developed to assess the performance of suitable high temperature elastomers in model motors and small full size motors. Successful test runs were performed at temperatures exceeding 200°C.

Successful motor tests have been carried out in the laboratory and the next stage is to prove the performance in the field. New field systems will be phased in by Baker Hughes INTEQ from the beginning of 1994.

**CONFERENCE, EXHIBITION and WORKSHOP DIARY REPORTS**

**THE EUROPEAN** Commission's Directorate-General for Energy attended the second **Mediterranean Oil & Gas Exhibition (MOEX)** which took place in Malta from 25 to 27 January 1994. A large number of delegates visited the EC stand and much interest was generated in the activities of the THERMIE programme, particularly in relation to the support and dissemination of hydrocarbon technologies. Among them, the Hon Dr E Fenech Adami, Prime Minister of Malta, congratulated the EC on the objectives and activities of THERMIE.

Thanks to EC support, five small-medium sized European enterprises were able to promote their technologies at MOEX on the Commission stand. They all reported firm enquiries for their products.

A THERMIE workshop on **Non-Destructive Testing for Offshore Applications** was held in London on the 22



*The THERMIE stand at MOEX*

February. The event was run in collaboration with the British Institute of NDT and was timed to coincide with Offshore 94. In a lively question and answer session delegates from

The Netherlands, Denmark, Norway and the UK discussed how technologies were rapidly changing and the importance of retraining in this respect.

**IEA Conference on Natural Gas Technologies, Kyoto, 31 Oct to 3 Nov 1993.**

**THE FUTURE** for natural gas as a fuel is assured. Above all this is due to the fact that natural gas is environmentally "clean" when compared with other fuels. However, in many parts of Europe the cost of electricity production by natural gas is high due to the need to liquefy the gas, transport it and then regasify it. In the next 10 to 20 years a total investment of \$150 billion is expected to be spent on an extensive pipeline infrastructure which will open up the vast gas reserves in Central and Eastern Europe (primarily Russia) to markets throughout Europe. This

gives an indication of the effort that will be required to develop efficient innovative technologies in the gas sector; an area in which THERMIE will be actively involved.

During the three-day conference, 10 parallel workshops explored the development and market penetration of new and efficient technologies for the exploration, production, transport, storage and use of natural gas. In addition, promising new sectors for the use of natural gas were discussed including road transport and central air conditioning for small apartment

dwellings and houses.

It was appropriate that such an important international event attracted 550 high level delegates representing all the world's natural gas companies, associations and related industries. Mr Maniatopoulos, the EC's Director-General for Energy, expressed the importance that the Commission placed on being closely involved in such a major event. This was emphasised by the suggestion of the Commission to hold the 3rd IEA Natural Gas Technology Conference in Berlin in 1996.

## EC Energy Centre - Tyumen

THE RUSSIAN OIL and gas industry is in great need of new technology to maintain oil and gas production at a level which allows significant quantities to be exported; the revenue from exports is required to finance the new Russian economical development. European oil and gas related companies can help meet this technological challenge and benefit from this new market.

The THERMIE programme has extended its operations to the countries of Central and Eastern Europe by the setting-up of so-called EC Energy Centres. In the hydrocarbons sector the Tyumen Energy Centre acts as the main node for promoting new technologies to the oil and gas producers of Siberia. It is connected to the INMARSAT satellite and the NEFTALINK telecommunications network, which links all production associations.

The personnel includes an expatriate engineer assisted by two Russian engineers, who cover the technical aspects of all exploration and production activities. Since becoming operational in July 1993, the Energy Centre has established relationships with managers of oil and gas operations in Western Siberia.

The Centre has produced a list of all

## CONFERENCE, EXHIBITION and WORKSHOP DIARY

### Exploration Software - Vienna, 6 June 1994

Workshop featuring geoscience software technology from Jason Geosystems and Oilfield Systems Ltd. Further details from Guus Hutjes or Koen Schiphorst at IRO, The Netherlands (Tel: +31.79.411981. Fax: +31.79.419764).

### Heavy Oil Technologies in a Wider Europe - Berlin, 7-8 June 1994

As part of its promotional campaign in the hydrocarbons sector, the EC is sponsoring a two-day conference on the increasing

importance of heavy oils. For further details contact Stefan Drenkard at GOPA.

### Offshore Northern Seas Stavanger - 23-26 August 1994

The EC stand at ONS '94 will feature a number of technologies developed by European small and medium sized enterprises (SMEs). An International Conference on Offshore Technology will be run in parallel with ONS. For further details contact Bent Petersen at ECD.



The EC Energy Centre Tyumen can be contacted on Tel: +873 111 06 11 and Fax: +873 111 06 37

organisations and associations involved in oil and gas production and related activities. This "mailing list" will be available in the near future to European companies wishing to promote their new technologies in Western Siberia.

One of the Energy Centre's first actions was in response to a request from the Noyabrsk municipality. A working group was seconded to an expedition studying the environmental impact of oil and gas exploration and production operations in the region of Western Siberia. A maxibrochure will present the results of this expedition.

## 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 Community.

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 Community.

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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