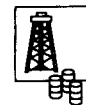


OIL & GAS TECHNOLOGY



THERMIE PROGRAMME: promotion of energy technology in Europe

EU Hydrocarbons Symposium - a showcase for innovative technology

The prime objective of European Union energy policy, in the broadest sense, is to ensure durable and reliable energy sources at affordable costs and conditions, while minimising the environmental impact of energy production and use. Oil and gas are central to this policy.

Technical innovation provides the key to these issues and the THERMIE Programme continues to play a major role in encouraging the development of new products. This issue of O>N describes five technologies which have been developed in Portugal, Italy, France and the Netherlands with THERMIE support, and includes subjects as varied as deepwater production systems, reservoir modelling and platform foundations.



EDITORIAL

A wide range of technologies supported by JOULE-THERMIE will be presented at the 5th EU Hydrocarbons Symposium being held in Edinburgh, UK (26-28

November 1996). Ninety papers over 3 days will present the latest results of these projects, all of which are at the leading edge of hydrocarbons technology.

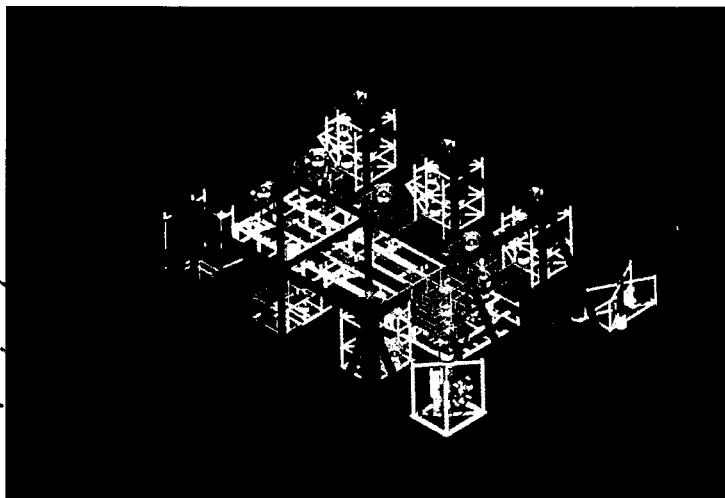
The symposium will also be used as a forum to examine the future of the hydrocarbons energy sector, address the challenges facing the hydrocarbons industry in Europe, and discuss the importance of securing European funding for innovative oil and gas technologies in the future. This Symposium, held every four years, provides the oil and gas industry with the opportunity to express its opinions on EU activities in the hydrocarbons sector and to present its case for continued and enhanced EU support in the future.

Deepwater Autonomous Multiwell Production System

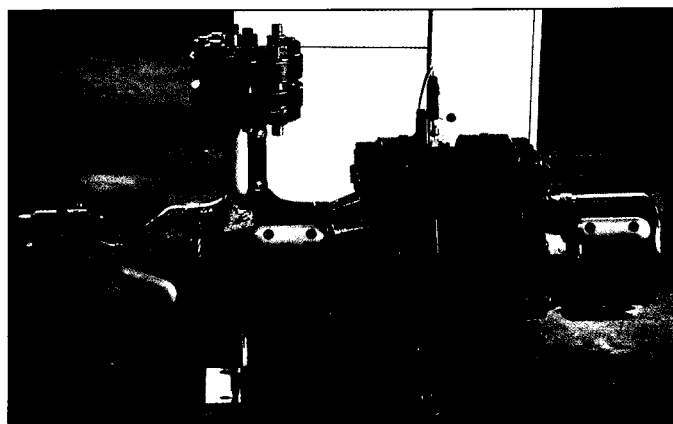
Tecnomare's Deepwater Autonomous Multiwell Production System (DAMPS) provides an innovative solution to the need for flexible, diverless technology which lacks guidelines. The technology has been tested to a water depth of 1,000 m but is also cost-effective in the 200-400 m range.

The DAMPS project, supported by the EC's THERMIE Programme, was developed to Agip system requirements. The project involved the design of a subsea production system based on a compact bi-axial symmetry structure and is made of modular components including:

- manifold module;
- Xmas tree modules;
- jumper modules;
- control module;
- generator;
- well testing module.



Compact bi-axial symmetry structure



Hydraulic power unit

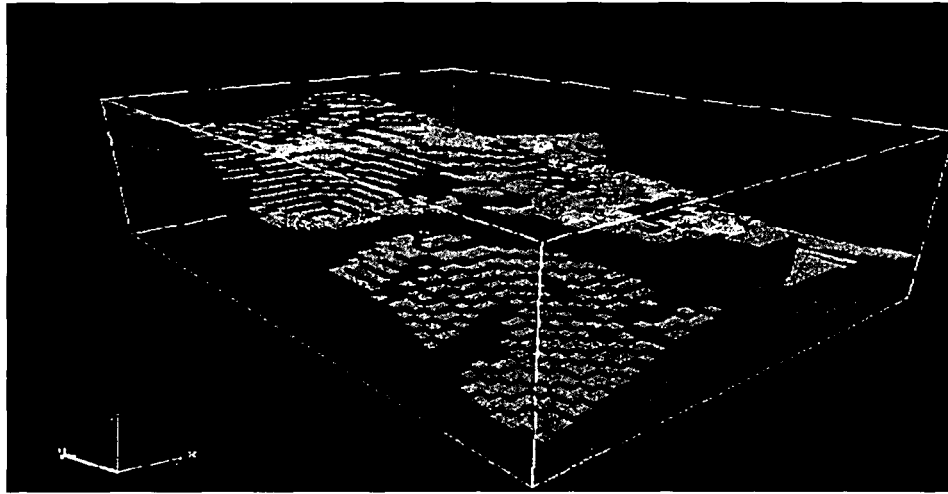
Control requirements are managed by an autonomous control system in which communication relies on an acoustic link. Signals are sent by means of acoustic waves in the exportation flowlines inside the production fluid. The acoustic link was validated in a range of system transmission tests for the transportation of multiphase mixtures. Electric power is generated locally by a turbo generator operating on gas from the reservoir. This was validated by tests in a qualified laboratory on a generator prototype set up for this purpose.

The technology for the subsea hydraulic power unit and the relevant hydraulic closed loop was developed from the Subsea Well Autonomous Control System (SWACS) which has been operating since 1987 on Agip's Luna field in the Ionian Sea.

European Commission - Directorate-General for Energy DG XVII

CEE: XVII/27

HERESIM 3D - a new approach to reservoir characterisation



Global reservoir model

HERESIM 3D, a geostatistical based reservoir modelling package, has been designed by the French Institute of Petroleum and the Geostatistical Centre of Paris School of Mines. The package is aimed at interactively building 3D reservoir models for fluid flow simulation and is consistent with both geological (derived from structural and sequential stratigraphy interpretations) and petrophysical information. HERESIM 3D features a flexible and high performance methodology to build geologically consistent upscaled reservoir models for fluid simulation including:

- geological and petrophysical data analysis;
- high-resolution lithofacies model

generation using stochastic modelling;

- high-resolution petrophysical properties model calculation, using statistical simulation techniques;
- reservoir mesh building;
- upscaling.

In the currently marketed version, each module has been refined to minimise data manipulation for enhanced productivity and computational efficiency. This provides the user with: flexible formation geometry description facilities; efficient and easy management of multiple geological hypotheses; fast simulation algorithm; easy petrophysical assignment facilities; numerous quality controls; interactive reservoir mesh builder; and optional 3D visualisation facilities.

New Publications

The 1996 edition of the "European Oil and Gas Demonstration Project Inventory" is now available. This publication, which complements the Project Status Reports published by DGXVII, includes details of innovative oil and gas technologies developed in Europe which have not received funding from the EC. Over 70 projects are included from the UK, Italy, France, the Netherlands and Germany.

Small and medium sized companies (SMEs) play an important role in the development of innovative technologies in the oil and gas sector. The EU has published the "European Union Oil & Gas SME Directory" which provides details of innovative SMEs in the hydrocarbons sector. The aim of the directory is to help SMEs and major oil companies to identify potential partners for collaborative cross-border projects.

An innovative slimhole drilling technique developed by DBS Security and Forasol is described in **Flag brochure No. 198**. This new technique is expected to reduce exploration costs by 25% to 50%.

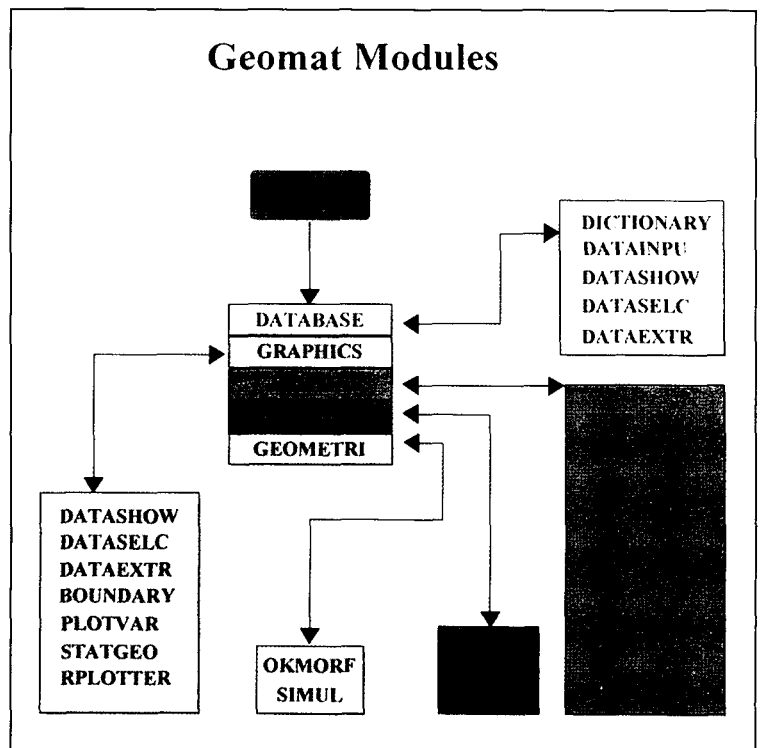
These publications can be obtained free of charge by faxing or e-mailing your request to Jonathan Shackleton at PSTI. Fax: +44 (0) 1224 706601. E-mail: j.shackleton@psti.co.uk

GEOMAT - geomathematical modelling of oil reservoirs

GEOMAT is an integrated software package for stochastic modelling of oil reservoirs, incorporating geostatistical and multivariate data analysis techniques.

The software package is the result of a project supported by the EC and conducted by PARTEX with the co-operation of the Technical University of Lisbon. It is a key component of the methodology used by PARTEX in the area of reservoir modelling applications. The technique allows the incorporation of data from different disciplines such as geology, seismic, petrophysics and petroleum engineering (well testing). The package contains a root and five main modules. All the menus are designed to lead the user through each application. The main block (root) has several options to deal with the projects and the five modules include:

- DATABASE - builds and manages project databases and creates data files;
- GRAPHICS - performs statistics and allows several types of raw /processed data visualisation;
- ESTIMA - performs estimation using different methods;
- MULTIVA - performs multivariate data analysis (Principal Component Analysis and Correspondence Analysis);
- GEOMETRI - performs morphological kriging and simulation.



(continued from previous page)

These modules are interconnected through temporary files created in the Database module to be processed and visualised.

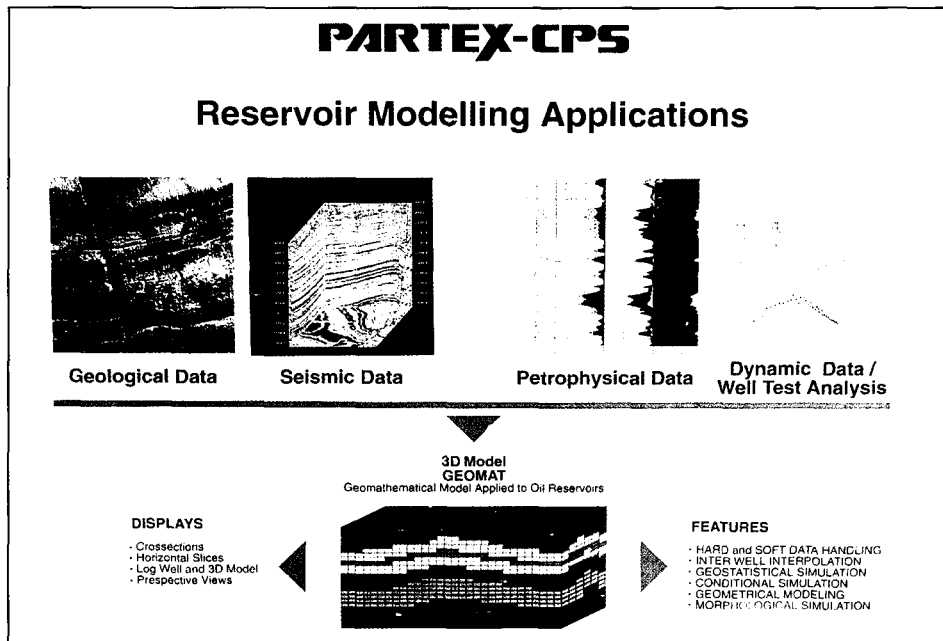
The innovative techniques developed in this project provide a better understanding of the internal architecture of reservoirs. This, in turn, will optimise oil production and recovery, and reduce drilling costs.

describing and characterising the bulk mechanical properties of fractured rocks.

Fractal models, which are characterised by the concept of self-similarity, may provide a useful tool to overcome scale problems related to sampling limitations, as they allow the extrapolation from the sample domain to other scales.

One of the most powerful achievements with fractals is related to the possibility of predicting small scale faults in terms of their geometry, frequency and location. Since this kind of fracture can act as both a permeability barrier or preferential fluid path, it is important that they can be predicted if the quality of the data to be used as input for reservoir simulators is to be improved.

This project has resulted in more reliable performance predictions being made which in turn has improved simulation results. Software modules are now available to implement different aspects and methods of fractal analysis.



The key functions of GEOMAT

Modelling of naturally fractured reservoirs

Modelling of a fracture network is a complex problem. In a project supported by THERMIE, Partex has developed a software package to model naturally fractured hydrocarbon reservoirs.

Fractures can be studied at various scales including large faults (kilometre scale), fractures (metre/centimetre scale), and micro-fissures (millimetre scale). At

each scale two distinct features can be studied: the fracture network and the single fracture.

Applying fractal models to characterise geological features such as fracture networks, derives from the fact that they provide quantitative understanding of size scaling and spatial clustering. This is fundamental to cope with the problem of

CONFERENCE, EXHIBITION and WORKSHOP REPORTS

A EUREKA Brokerage event on **Oil and Gas Technologies** (Edinburgh, 23-24 April 1996) attracted over 100 delegates eager to build international partnerships for R&D and demonstration projects. Twelve countries were represented at the event which was successful in drawing organisations together in a constructive manner and resulted in many projects being discussed. This event may become a regular feature in the oil and gas calendar.

The **Offshore Technology Conference** (Houston, 6-9 May 1996), the world's premier oil and gas trade show, attracted over 36,000 delegates wanting to investigate the latest developments in offshore technologies. The 11 companies on the EU stand reported making extensive contacts with interested American oil companies and regional agencies, as well as new contacts with companies from the Middle and Far East.

Attendance at **Offshore South East Asia** (Singapore, 24-27 September 1996) was lower than expected and this was reflected in the number of visitors to the EU stand.

Despite this the companies exhibiting their products on the EU stand reported that the level of contact made was of a higher than average quality, with new business

opportunities being identified in Singapore, Malaysia and Indonesia.



The EU stand at OSEA 96

EURIPIDES - reducing platform foundation costs

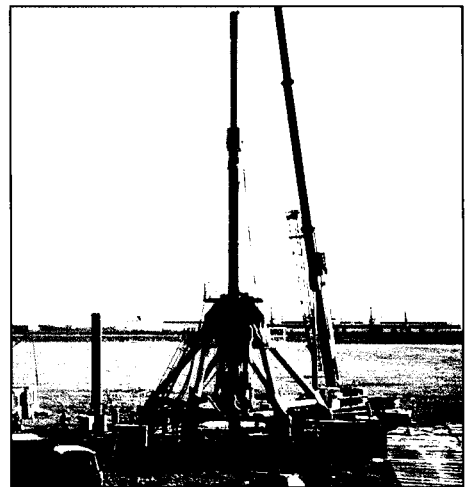
Foundation piles for offshore platforms driven in sand are commonly designed according to API RP2A recommended practice. However, existing data suggests that this practice may not be adequate for North Sea conditions. The underlying problem is the lack of in depth understanding of the actual interaction between the shaft of the pile and the sand which is necessary to develop a realistic design model. In addition, load tests on life size piles under loads representative of offshore practice (25 to 60 MN) were non-existent.

In 1993 the EURIPIDES project started to address this problem. Testpiles and instruments were designed and tested and a 30 MN testing rig was built. In 1995 a 0.75 m diameter pile with 107 integrated instruments was driven in very dense sands at Eemshaven in the Netherlands,

and tested at depths of 31 m, 38 m and 47 m. Thereafter it was extracted, driven and tested again at a depth of 47 m. The tests, including 12 compression and tension tests with in between unload and reload tests, were performed in sand types comparable with those in the southern North Sea.

The project was performed by FUGRO Engineers and GEODIA. It was sponsored by the EC's THERMIE Programme, seven oil companies, the performing consultants, and various institutes and governmental bodies in The Netherlands, UK and France.

The tests provided a wealth of data giving a detailed insight into the pile-sand interaction problem. With the new data, computational models will be used to prepare a basis for new design codes. It is expected that considerable savings in platform foundation costs will be possible



Pile load test rig during driving of the test pile

and that a rational method will become available to re-assess existing pile foundations.

CONFERENCE, EXHIBITION and WORKSHOP DIARY

International Offshore Contracting and Subsea Engineering Exhibition, Aberdeen, 29-31 October 1996

IOCE has a reputation for attracting senior engineers and managers from the hydrocarbons industry. The EU will once again participate at this event with a stand featuring innovative technologies developed by four European companies. Further details from Marsali Blake at PSTI [Tel: +44 (0)1224 706600].

Holland Oil and Gas Exhibition, Amsterdam, 12-14 November 1996

The EU is participating at Holland Oil and Gas with a stand which will feature hydrocarbon technologies from five European companies.

Further details from Guus Hutjes at IRO [Tel: +31 79 3411981]

5th EU Hydrocarbons Symposium: The Strategic Importance of Oil and Gas Technology, Edinburgh, 26-28 November 1996

The 5th EU Oil and Gas Symposium will present the latest technologies developed in Europe for the exploration, production and transport of oil and gas. The event will also be used as a forum to examine the future of the hydrocarbons energy sector. For a copy of the final programme, registration form and accompanying persons programme contact Jane Kennedy at PSTI [Tel: +44 (0)1224 706600]

1st European Union / Gulf Co-operation Council conference on advanced oil and gas technologies, 25-26 February 1997, Bahrain

The European Commission's Directorate-General for Energy is holding its first joint

EU-GCC conference and exhibition in Bahrain. This two-day event will provide a platform for promotion of innovative European technologies and the transfer of technology to the strategically important oil and gas producing region of the Middle East. The event will provide export opportunities for European technologies and products in this important hydrocarbons province, and will cement relations between the European Union and the states of the Gulf Co-operation Council. The conference will focus on four main themes:

- exploration of oil and gas;
- oil and gas reservoirs;
- advanced drilling technologies;
- advanced production technologies.

Further details from Guus Hutjes at IRO [Tel: +31 79 3411981]

JOULE-THERMIE Programme - call launched on 17 September 1996

A call for proposals under the JOULE-THERMIE Programme was launched on 17 September 1996 and it is expected that approximately 240 MECU will be available to fund projects.

The THERMIE part of the programme will invite proposals for demonstration projects in the rational use of energy in buildings, transport and industry; renewable energies; solid fuels; and hydrocarbons. A further and final call will be made in September 1997.

In the hydrocarbons part of the programme attention will focus on oil exploration, production, and transport and natural

gas. Specific emphasis within these broad categories and instructions on how to apply are detailed in the THERMIE Information Brochure. Copies can be obtained from:

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