NUMBER 16 APRIL 1995

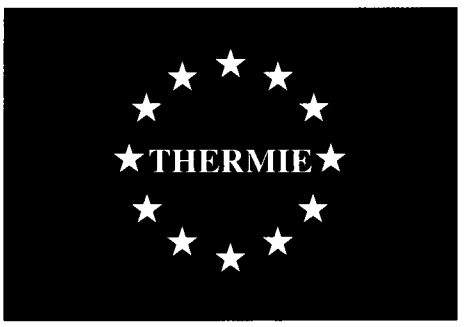
OIL & GAS TECHNOLOGY

THERMIE PROGRAMME: promotion of energy technology in Europe

New technologies for subsea pipelines

IN PROVIDING THE TRANSPORT LINK between oil fields and shore, pipelines represent a very important part of the hydrocarbons production process. Subsea pipelines represent a large investment for operating companies and any new technology or technique which can reduce costs will always attract attention.

Once installed the integrity of a pipeline is of vital importance both for financial and environmental reasons. If a pipeline has to be closed down the loss in revenue will be a major blow to the operating company, especially if it is the only means of transporting the produced oil to shore. If a pipeline is breached then the escaping oil may cause significant damage to the local environment.



EDITORIAL

Although designed to the highest standards, the extreme conditions under which pipelines operate mean that mechanical damage caused by sea currents and waves, and internal and external corrosion are all liable to reduce integrity.

As existing facilities are extended beyond their intended working lifetime the need to be able to assess a pipeline's condition and take preventative action is becoming increasingly important.

Many of the projects supported by the EC's THERMIE Programme focus on pipeline technology. Five of these technologies from France, The Netherlands, Italy, Denmark and the UK are described in this issue of *Oil & Gas Technology Newsletter*.

Pipeline technology is only one of the areas which receives support from the EC. Other THERMIE funded hydrocarbons technologies which are approaching market readiness will be exhibited on the European Union's stand at OTC '95 being held in Houston from 1 - 4 May 1995.

Inspection tools to prevent unexpected downtime

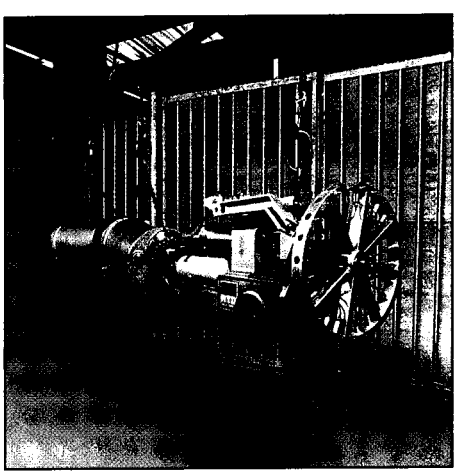
THERE IS AN INCREASING DEMAND to establish or monitor accurately the condition of subsea pipelines which have been in service for several years. The Dutch company RTD has designed a range of motor driven Pipeline Inspection Tools (PIT) with support from the EC's THERMIE programme. These tools measure and record wall thickness with a high degree of accuracy. The PIT is cable operated, powered by a crawler and capable of inspecting liquid filled pipelines up to 17,000 metres long. The present range provides for the inspection of pipelines with diameters between 16 inch and 56 inch. Mitre and 3D bends can also be negotiated.

PIT systems can be designed to suit customer requirements but they are particularly suitable for the inspection of pipelines with single-sided access, namely loading and off-loading lines and open offshore risers.

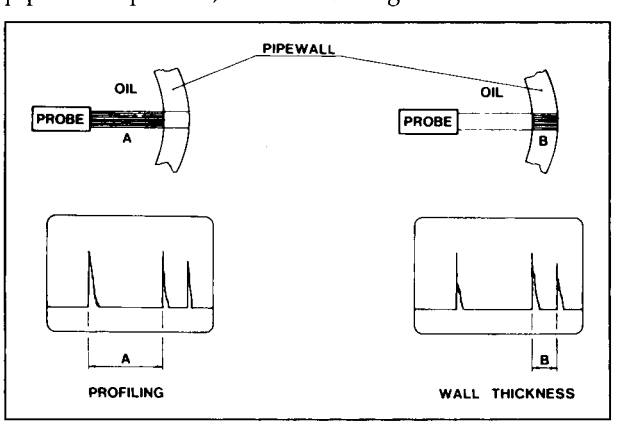
The PIT is deployed from a tailor-made temporary launch. A preliminary run is undertaken to establish the presence and nature of the corrosion. Finally, one or more PIT runs are made to evaluate and quantify the severity. For this purpose, the array of up to 64 ultrasonic probes round the circumference of the tool can be pre-set to any required arrangement.

A single run usually takes one day. Site time for a complete job, including local preparation and calibration of the equipment as well as the actual inspection of one pipeline, usually takes about seven working days.

There are many benefits of PIT tools including on-line control of tools, on-line analysis, differentiation between internal and external corrosion, they are suitable for thin and heavy wall pipes, and can operate in any liquid.



Crawler type PIT



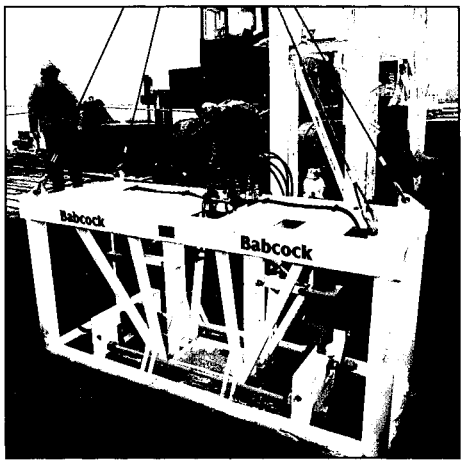
Schematic of PIT application

European Commission - Directorate-General for Energy DG XVII

Diverless subsea pipeline connection system

"CUSP", CONNECTION OF UNDERWATER SYSTEMS AND PIPE/FLOWLINES, is a system for pressure connections of rigid or flexible underwater flowlines, bundles and electro-hydraulic umbilicals. The CUSP connector allows for diverless installation and retrieval of valves and other equipment for repair and maintenance. Originally designed by Alpha Thames with financial support from the EC's THERMIE Programme, CUSP is now licensed to and manufactured solely by Babcock Energy Ltd.

The system consists of a pressure retaining component with associated assemblies designed for remote installation. The main body/clamping mechanism forms the innovative pressure retaining assembly of the CUSP system which enables diverless, pressure retaining (up to 10,000 PSI), sealed mechanical connections to be made in underwater pipelines. The connector is also fully retrievable which will allow periodic maintenance or inspection operations to take place, if required.



CUSP offshore trials (June 1994)

The CUSP connector has been designed for a number of subsea diverless operations including flowline connection, electro/hydraulic umbilical connection, valve installations, pipeline repairs and pig receiver installation.

CUSP offers a number of advantages including:

- significantly reduced installation cost;
- significantly reduced retrieval costs;
- competitive connector unit cost;
- significantly reduced maintenance down time;
- improved safety features due to diverless installation and retrieval;
- the option of double metallic seals giving increased reliability;
- integrated pull-in tool for flowlines;
- integrated flowline pressure and seal test facility.

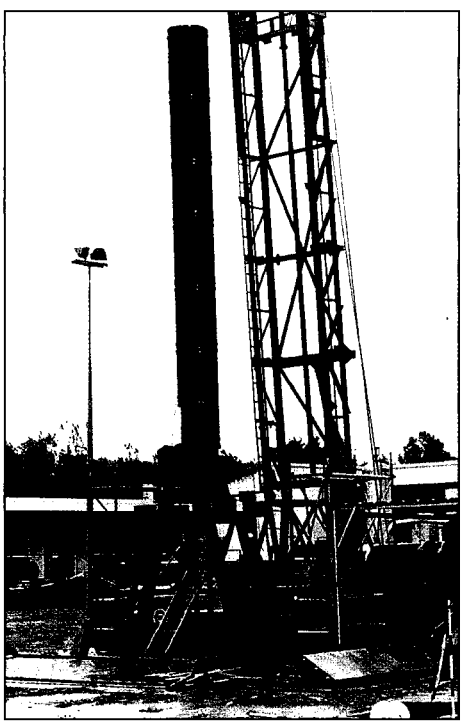
The full production system has been subjected to a full subsea demonstration which resulted in type approval of the connector system. The series of totally diverless tests included pressure testing of the connector and repeatability tests of the installation and retrieval system. Following the completion of the approval tests, a further week of demonstrations were carried out, during which the equipment was demonstrated subsea to a large audience from the offshore industry.

Linear motor powered pumping unit for oil production

IN A PROJECT SUPPORT BY the EC's THERMIE Programme, the French company MAPE has developed a linear motor powered pump for well activation. The motor directly applies a vertical load to the string of rods making the mechanical structure particularly simple.

The motor is supplied with variable low frequency AC current, provided by a solid state power inverter. As the force is generated by an electrodynamic action, the electrical parameters can be varied to make the pump have a movement, the stroke, speed and acceleration of which is programmed. In particular, it is possible to have a rise time which is different to the fall time and limit acceleration applied to the string of rods as much as possible.

A pneumatic balancing cylinder is placed at the centre of the motor armature. This cylinder operates like a counter-weight. It is connected to a large size compressed air tank so that once the pressure is reached, it remains practically unchanged throughout an operating cycle. Consequently, this cylinder only requires a small compressor to build up the pressure and compensate any leaks.



Linear motor powered pumping unit

Calculating critical span lengths

LONG SECTIONS of spanning pipelines are often unavoidable when crossing very uneven seabeds. In addition, erosion, sediment transport and sand waves may develop free spans during the operation of a pipeline.

The techniques used at present to determine critical span lengths are based on limited sets of two-dimensional experimental tests. As such they do not take into account the main peculiarities of the phenomena, which in turn can result in expensive profile corrections of the sea-bed.

In a project undertaken by the Italian company Snamprogetti and supported by the THERMIE Programme, a procedure for assessing free span fatigue has been formulated including:

- characterisation of the dynamic response of free spans;
- calculation of the occurrence of synchronisation between the regular shedding of vortices and the natural frequency of the free span during the design life of the pipeline, based on a long-term distribution of on-bottom current;
- definition of the stress range and related number of cycles in the most hazardous sections;
- verification that the progressive damage, calculated on the basis of either S-N (stress range - number of cycles to fatigue failure) standard curves or an approach based on the fracture mechanics, remains within the allowable values throughout the design life of the pipeline.

This project has demonstrated that the application of advanced design criteria to the more irregular sections of the line can result in significant cost savings. Draft guidelines, which will be certified by an internationally recognised body, are currently being prepared.

Integrated pipeline management system

THE AIM OF THE INTEGRATED PIPELINE MANAGEMENT SYSTEM (IPMS) project, developed by the Danish Hydraulic Institute and Rambøll & Hannemann A/S with support from THERMIE, was to design and implement a computerised information management system for data arising from the design, fabrication, construction, and inspection of marine pipelines and risers.

IPMS consists of 12 modules which allow the system to be customised to the particular needs of the operator. IPMS can be used for any network of pipelines and risers and includes a wide range of standard reporting, analyses and drafting routines. Supplementary reports can easily be created if required.

The system has proved its worth in daily operations over several years in the North Sea and IPMS-compatible products for subsea structures, topsides plant, and general subsea survey data management have also been developed.

IPMS can be used by any oil company with marine pipelines and riser systems. The benefits include:

- Data management: improved efficiency of data storage/retrieval routines.
- Condition analysis and planning of operations: improved efficiency of the planning of inspections and of the subsequent maintenance planning.
- Inspection surveys: reduced demands on survey contractors regarding hard copy drawings, etc.

Inspection surveys alone can easily pay back the purchase cost within a few survey seasons.

Further details of this technology are available in Flag brochure No.132.

CONFERENCE, EXHIBITION and WORKSHOP REPORTS

Delegates visiting the EU stand at Offshore South East Asia

ALTHOUGH THE OIL & GAS Tyumen Exhibition has only been running since 1993 it is becoming established as a major show for Russia's largest oil and gas province. **Tyumen '94** (14 - 18 November 1994) attracted approximately 7,000 visitors, predominantly from the scientific and research community. Nearly 1,500 delegates visited the EU stand which featured seven new European technologies of relevance to the Russian market. Particular interest was shown in joint ventures to manufacture western equipment in Russia while, unsurprisingly, there was less interest in buying equipment directly from Europe. Nevertheless, the seven companies on the EU stand reported new contacts which they would be following up.

The EU participated for the first time at **Offshore South East Asia** (6 - 9 December 1994), the principal oil and gas exhibition in this region. Over 11,500 delegates attended the event of which 1,500 visited the EU stand. Significant interest was shown in the eight European technologies featured on the EU stand and all of the companies reported firm business leads, some sales and the opening of negotiations with potential business partners.

A two-day seminar on **Drilling Technologies** (1 - 2 February) was organised by the Energy Centre Tyumen, IRO, GEP and the Siberian Drilling Association. The event, held in Tyumen, was greatly appreciated by the Russian industry. Many of the 100 delegates who attended the event had worked for 20 to 30 years in drilling and this seminar was their first opportunity to discuss technological developments in drilling with their west European counterparts.

New Publications

A NUMBER OF NEW hydrocarbons publications have recently been produced by the EC, including two new maxibrochures and three flag brochures.

A 16-page maxibrochure entitled *Oil and Gas Process Technology - the latest advances for use on offshore production installations* is now available from PSTI. The report examines all aspects of process technology including three-phase separation, heat exchange, gas treatment etc and highlights new technologies in these areas.

Also available is a 22-page maxibrochure on *European Technologies for Oil and Gas Exploration in Remote and Poorly Accessible Areas* which examines a wide range of innovative technologies including satellite and airborne techniques, geological and geochemical surveys, electromagnetic methods, seismic exploration and reducing the high cost of drilling in remote areas. This publication is available from GOPA Consultants.

Flag brochure No. 193 describes the results of a project examining deep water mooring lines with buoys. The project, undertaken by the Italian company Tecnomare, provides tools for the optimisation of size and position of the buoys along the mooring lines, as well as improving the accuracy of the measurements by increasing the water depth of the experimental site.

Improved simulation tools for multiphase production are described in flag brochure No. 194. The Greek company Alfapi, together with AEA Petroleum Services in the UK, is aiming to extend the existing knowledge of multiphase flow analysis. The end result will be a self-sufficient computer aided engineering system for the hydrocarbons industry.

SME brochure No. E-7 outlines a new application of the Fischer-Tropsch refining process for converting gas to syncrude. The gas conversion modules, developed by DCA Consultants in the UK, provide an economically attractive alternative to gas reinjection or flaring.

All of the above flag brochures can be obtained free of charge from PSTI.

Four companies from Belgium, the UK, France and The Netherlands participated on the EU stand at **IADC/SPE** (28 February - 2 March). The technologies on show included slimhole drilling (Security DBS), automated guidance system for directional drilling (Cambridge Drilling Automation), monitoring drilling paths (SMF International) and remotely operated bent housing (Newbergh Industries Ltd). All four companies reported making new business contacts.

CONFERENCE, EXHIBITION and WORKSHOP DIARY

Offshore Technology Conference, Houston, 1 - 4 May 1995

Once again the European Union will be participating at OTC, one of the main events in the offshore calendar. The EU will have a large stand promoting European near-market technologies. Approximately 12 companies will be invited to exhibit their technologies on the EU stand, giving them the opportunity to promote their technologies at this prestigious event.

Workshop on Platform Decommissioning, Houston, 1 - 4 May 1995

A one-day workshop on innovative European technologies for platform decommissioning will be held in Houston during OTC '95. The exact date has still to be set but further information can be obtained from Guus Hutjes at IRO (Tel: +31 79 41 19 81. Fax: +31 79 41 97 64)

Workshop on Seismic Applications for Reservoir Monitoring, Vienna, 14 May 1995

A half-day THERMIE workshop on seismic applications for reservoir modelling is being held in conjunction with the 8th European Symposium on Improved Oil Recovery. The workshop will focus on the new and advanced seismic applications currently available and being used for reservoir monitoring. For further information contact John Panayiotopoulos at LDK Consultants, Greece (Tel: +30 1 856 3181. Fax: +30 1 856 3180).

EAEG/EAPG, Glasgow, 29 May - 2 June 1995

The European Union will participate for the first time at EAEG/EAPG, the annual conference and exhibition of the European Association of Exploration Geophysics and the European Association of Geoscientists and Engineers. Four European companies will be invited to participate on the EU stand at the technical exhibition. Further information from Amy Middlemass at PSTI (Tel: +44 1224 706600).

Workshop on Reliability Based Inspection Scheduling for Fixed Offshore Platforms (RISC), The Hague, 16 June 1995

In order to ensure the structural integrity of fixed offshore platforms and other structures it is necessary to conduct periodic inspections. RISC aims to provide the offshore industry with a rational methodology for the scheduling of inspections. This one day workshop, which will be held in conjunction with ISOPE '95, will allow delegates to assess the system for themselves. Further details and a registration form can be obtained from Jane Kennedy at PSTI (Tel: +44 1224 706600).

RIGSIM - technology transfer to FSU

The UK company Drilling Systems Ltd has developed a rig-based simulator called RIGSIM, which received support from the EC's THERMIE Programme and was introduced to the Russian market at an EC seminar in Moscow.

RIGSIM has been developed to make well control training more realistic by interacting with the real rig equipment. The prototype can be viewed on the EC stand at the Offshore Mediterranean Conference in Ravenna.

JOULE-THERMIE: dissemination activities continue to play a crucial role

The first phase of the EC's THERMIE Programme ran from 1990 - 1994 and had a budget of 700 MECU. From 1995 the bulk of THERMIE activities will be carried out with a budget of 530 MECU, as the demonstration component of the Non-Nuclear Energy Programme (JOULE - THERMIE).

Disseminating information on THERMIE funded projects which are ready to penetrate the market continues to be an important aspect of the EC's strategy. By encouraging the adoption of new energy technologies the EC aims to secure supply, build an industrial base and improve the potential for exports, while at the same time protecting the environment.

Dissemination activities in the hydrocarbons sector are currently undertaken by 12 OPETs with special responsibility for the oil and gas industry. Details on how companies operating in this very important energy sector can benefit from participating in the THERMIE programme can be obtained from the appropriate OPET office.

OPETs in the hydrocarbon sector: contact details

BCEOM: Société Française d'Ingénierie, Place des Fréres Montgolifier, F-78286 Guyancourt Cédex
FRANCE Tel: +33 1 30 12 49 90 Fax +33 1 30 12 10 95 Mr C Stratford

CEEETA - PARTEX: Calçada da Estrela, 82 - 1° DT°, P-1200 Lisbon
PORTUGAL Tel: +351 1 395 56 08 Fax: +351 1 395 24 90 Mr P Bollinger

CESEN: Viale Brigata Bisagno, 2 - 16129 Genova
ITALY Tel: +39 10 550 45 80 Fax: +39 10 550 46 18 Ms M Fabianelli

COWIconsult: Consulting Engineers and Planners, Parallelvej 15, DK-2800 Lyngby
DENMARK Tel: +45 45 97 22 11 Fax: +45 45 97 22 12 Miss B Pedersen

ECD: Energy Centre Denmark, Suhmsgade 3, DK-1125 København K
DENMARK Tel: +45 33 11 83 00 Fax: +45 33 11 83 33 Ms H Hansen

EVE: Ente Vasco de la Energia, Edificio Albia 1, San Vincente, 8 - Planta 14, E-48001 Bilbao
SPAIN Tel: +34 4 423 50 50 Fax: +34 4 424 97 33 Mr J Reig

FAST: Federazione delle Associazioni Scientifiche e Tecniche, Piazzale Rodolfo Morandi 2, I-20121 Milano
ITALY Tel: +39 2 76 01 56 72 Fax: +39 2 78 24 85 Ms Gandolfi

GEP: 45 rue Louis Blanc, La Défense 1 - Cédex 72, 92038 Paris la Défense
FRANCE Tel: +33 1 47 17 61 39 Fax: +33 1 47 17 67 47 Ms C Burlot

GOPA: Consultants, Hindenburgring 18, D-61348 Bad Homburg
GERMANY Tel: +49 6172 930 235 Fax: +49 6172 35046 Mr S Malin

LDK: Consultants, Engineers & Planners, 7 Sp Triantafyllou Str, GR-113 61 Athens
GREECE Tel: +30 1 856 3181 Fax: +30 1 861 76 81 Ms E Koulouvaris

IRO: Association of Dutch Suppliers in the Oil and Gas Industry, Engelandlaan 330, PO Box 7261, 2701 AG Zoetermeer
The NETHERLANDS Tel: +31 79 41 19 81 Fax: +31 79 41 97 64 Mr G Hutjes

PSTI: The Petroleum Science and Technology Institute, Offshore Technology Park, Exploration Drive, Aberdeen AB23 8GX
UNITED KINGDOM Tel: +44 1224 706 600 Fax: +44 1224 706 601 Miss J Kennedy

This Newsletter is produced by the Petroleum Science and Technology Institute for the European Commission.
For further information please contact:
Jonathan Shackleton, Editor, O&GTN, PSTI, Offshore Technology Park, Exploration Drive, Aberdeen AB23 8GX, UK.
Tel: +44 1224 706 600 Fax: +44 1224 706 601
Back numbers may be obtained by mailing or faxing your request to the Editor.