ITF Call for Proposals

Focus: Innovative Drilling Technologies

Aims

This is an open invitation to any organisation, from any sector, seeking partners and funding for innovative technologies in the oil and gas industry to submit high quality proposals for research, development and / or field trial of potential solutions that will help address Drilling challenges in the Oil and Gas industry.

Specific areas of interest:

- Improved Well Control
- Improved Blowout Response
- Formation Support while Drilling
- Zonal Isolation of Reservoir Sections
- Improved Information Recovery from the Drillstring while Drilling
- Improved Pressure and Temperature (PT) Sensors for High Pressure High Temperature (HPHT) Wells and Heavy Oil
- Other Interests

Justification

ITF members, major operating and service companies in the oil and gas sector, met at an international ITF Technology Challenge Workshop (TCW) and explicitly identified the current shared challenges they are facing across the industry in drilling for hydrocarbons.

Who Should Respond

The invitation is open to all relevant industry sectors and all credible entities from small and medium sized enterprises, to academic and research institutions, to large industry players alike.

Benefits of Participation

- Funding: Up to 100% funding for any stage of the research, development and demonstration cycle.
- IP Protection: A proven confidential, collaborative and standard contractual process
- Exposure and validated applications for your scientific and technological expertise
- Access to the key global players in the oil and gas sector

How to Participate

Your contact points and outline method for submitting a proposal are provided in this document but you can immediately learn how to submit a proposal by going to our website http://www.oil-itf.com/index/submit-a-proposal

Alternatively you can ring us and talk to one of our analysts about your idea, +44 (0)1224 222410.

Keywords and Potential Technology Areas

Drilling, hydrocarbons; well control; blowout; blowout preventers; formation support; drillstring; high pressure; high temperature; heavy oil; wells; annulus; casing; mud density; blind rams; hydrogen sulphide; sensors; warning system; hydrates; chemical injection; heavy mud insertion; deepwater challenges; buoyancy issues; kill fluids; escape; marine environment; pressure; flow rate; hydrostatic pressure; drill bit; drill cuttings; drilling assembly; fish bone completion; specific gravity; polymer sprays; epoxy; zonal isolation; reservoir sections; casing wear; bottom hole assembly; drill collars; weight on bit; transition pipe; drill pipe; drill stem stubs; petro-steering, geo-steering; seismic while drilling; steel cuttings; bigger bore.

(NB. The above list is not necessarily exhaustive).

Drilling Challenges

The prime areas of concern have been identified by ITF members as follows:

- Improved Well Control
- Improved Blowout Response
- Formation Support while Drilling
- Zonal Isolation of Reservoir Sections
- Improved Information Recovery from the Drillstring while Drilling
- Improved Pressure and Temperature (PT) Sensors for High Pressure High Temperature (HPHT) Wells and Heavy Oil
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Improved Well Control

Well control can be described as the processes involved in maintaining the fluid column hydrostatic pressure and formation pressure to prevent the influx of formation fluids into the wellbore. The technique takes into account; an accurate estimation of formation fluid pressures, the strength of the geologic formations and the use of casing and mud density to offset those pressures in a predictable fashion. The understanding of pressure and pressure relationships within the wellbore are critical in dealing with well control. Whilst some solutions exist already, improvements to current technology are required.

The Challenges

- Improved solutions for the sealing of annular blow out preventers (BOP) on tubing with control lines. Factors to consider include the improved sealing of blind rams after cutting
- Improved techniques for dealing with corrosive and poisonous properties of Hydrogen Sulphide (H_2S) on personnel and equipment.
- Improved barrier technology as well as downhole equipment that can withstand extreme HPHT conditions
- The possible introduction of an additional BOP (Blow Out Preventer) downhole or other barrier (downhole or on surface)
- Introduction of more downhole sensors to improve logging while drilling as well as the integration and interpretation of all available data (e.g. automatic warning systems)
- Development of an automated drilling process (expert system) utilising data from well control incidents in order to facilitate this development. Data will

need to be garnered from operators and contractors to make this a true expert system

- There is a requirement for an improved deepwater subsea BOP, taking into account new methods of transmitting the energy required downhole (no longer purely hydraulic), Develop simpler, more reliable ram systems, look at alternatives to hydraulic power for rams as well as looking outside the box for novel deepwater drilling systems where a much simpler subsea BOP device can be used.
- Improved methods for handling gas in the low pressure riser on deepwater rigs. As well as the development of improved "diverter" systems and high performance degassers able to cope with the flow rates and pressures expected. Possible integration with managed pressure drilling systems.

Improved Blowout Response

Blowouts occur when there is an uncontrolled release of crude oil and/or natural gas from an oil well or gas well usually after pressure control systems have failed. Current technology involves controlling downhole fluid pressures through the balancing of the hydrostatic pressure provided by the drilling mud used. If the right balance of drilling mud pressure is not maintained, formation fluids (hydrocarbons and associated water) flow into the wellbore and up the annulus and/or inside the drill pipe. This is commonly called a 'kick'. If the well is not shut in, a kick can quickly escalate into a blowout when the formation fluids reach the surface with disastrous results. Early warning signs of a well kick are: Sudden change in drilling rate; Change in surface fluid rate; Change in pump pressure; Reduction in drillpipe weight; Surface mud cut by gas, oil or water. Improved blowout responses are required to ensure that early signs are identified and mitigated better.

The Challenges

- The possible introduction of an additional BOP (Blow Out Preventer) downhole or other barrier on the surface
- Improved chemical injection techniques to ensure timely and adequate responses to early warning signs downhole
- Improved technologies for heavy mud insertion into the well to mitigate responses to changeable conditions downhole
- Improved solutions to deepwater challenges particularly methods for dealing with hydrate formation as well as buoyancy issues

- The development of 'kill fluids' to cap the well in order to prevent the escape of hydrocarbons into the marine environment.
- Improved ranging and interception methods for relief wells, significantly accelerating the relief well drilling process. Making well design "relief-well friendly"
- Development of a rapid ROV (Remotely Operated vehicle) deployable capping system in case of BOP failure.

Formation Support While Drilling

Formation damage is said to occur when there is a decrease in the ability of the formation to transmit oil into the wellbore at a given pressure and flow rate. In some cases the damage can be repaired, however it is better not to happen at all. Drilling fluids are used to mitigate this happening. The main functions of drilling fluids include providing hydrostatic pressure to prevent formation fluids from entering into the well bore, keeping the drill bit cool and clean during drilling, carrying out drill cuttings, and suspending the drill cuttings while drilling is paused and when the drilling assembly is brought in and out of the hole. The drilling fluid used for a particular job is selected to avoid formation damage and to limit corrosion.

The goal will be developing methods and techniques to mitigate this happening in a hydrocarbon producing well.

The Challenges

- Explore innovative technologies that deal with open hole fish bone completion
- Development of water based drilling fluids with a specific requirement for a water based drilling fluid with a specific gravity as low as 0.9
- The development of inductive heating techniques while drilling to enable more efficient drilling
- The development of polymer sprays that could be applied to the formation to provide additional formation support
- Development of techniques for microbial near wellbore strengthening. Also, considerations for R & D in biological and fungal applications to deal with this
- The development of composites and chemicals used in other industries as well as possible solutions utilising nanotechnology to provide formation support
- The possible development of an epoxy that could surround the casing providing additional strength to the formation while drilling

- "Sealing the junction": explore technologies currently used in other industries (sewer construction) for their adaptability to the pressure and temperature and the hydrocarbon environment so that junctions in multilateral and conductor-connector wells can be sealed fluid and/or gas-tight, and more flexibility on the formations where branches can be rooted is obtained.
- Develop a low Hollow Gas Spheres (HGS) drilling fluid for HP/HT environments requiring mud weights in excess of 18ppg with superior fluid properties to what exists today.
- Put the observed wellbore strengthening and loss prevention capabilities of casing/liner drilling on a scientific basis. Investigate the best fluid system for this drilling practice.

Zonal Isolation of Reservoir Sections

Zonal isolation is required to prevent the cross-flow of fluids between geological layers and to reduce the volume of produced water. It is important in these circumstances to achieve the best possible seal between reservoirs. The principal issue is that fractured zones need to be isolated to allow the fractures to be stimulated individually, and then the flow through each fracture interval may be selectively controlled to allow optimum heat extraction from the reservoir. Failure to achieve isolation of fracture zones prior to stimulation may prejudice the capacity to stimulate the total drilled reservoir section.

The goal is to improve upon current technology and practices with a view to provide improved Zonal isolation in the reservoir.

The Challenges

- Alternatives to current cementing technologies, e.g. higher viscosity. Potential use of foam technology. Automatic foam cementing manifold guaranteeing foam quality throughout the job at all flow rates.
- Improved connections to prevent leaks, improve the life time of connections, as well as avoid casing wear
- Innovative ways to provide additional protection for packers.
- Develop a drill-in system for highly fractured carbonates providing zonal isolation at Terminal Depth (TD) without an additional trip.
- Develop a plug-based cementing system for casing/liner drilling.

Improved Information Recovery from the Drillstring while Drilling

The drillstring is commonly applied as the assembled collection of the drill pipe, drill collars, tools and drill bit. The drill string is hollow so that drilling fluid can be pumped down through it and circulated back up the annulus. The drill string is typically made up of 5 sections: bottom hole assembly (BHA), drill collars (used to deliver WOB), weight on bit, transition pipe (which is often heavyweight drill pipe), drill pipe and drill stem subs.

Each section is made up of several components, joined together using special threaded connections known as tool joints. It is critical to obtain all information required from the drillstring to enhance operations.

The Challenges

- There is a requirement to develop techniques to extend 'geo-steering' to 'petro-steering'. Improved drainage is required from the most productive zone, taking into account, permeability and pore pressures
- There is a requirement for new measurements for measuring permeability from the drill string while drilling
- The development of a system that can provide real time rock mechanics / wellbore stability out of the drillstring while drilling as well as structural confirmation at the drill bit in order to avoid faults or low conformity zones
- Improved software development to create an improved decision tree to facilitate more efficient drillstring operations
- Alternatives to wired drill pipe, such as Seismic While Drilling (SWD), to retrieve vast amounts of data. Also the use of radio-active techniques to retrieve vast amounts of data produced, bearing in mind that any radio-active substances used need to have little or no effect on personnel or equipment, can be explored.
- Improve the connection technology for "wired" drill pipe allowing also the transmission of electrical power.
- For look ahead / around Seismic While Drilling (SWD) there is a requirement for better sources, receivers as well as real time interpretation of data.

Improved Pressure and Temperature Sensors for HPHT Wells and Heavy Oil

Operators need tools that are reliable and robust for longer time frames in a variety of wells at extreme to ultra temperatures and pressures (350°F - 500°F and 15Kpsi – 30Kpsi) to enable improved pressure and temperature readings in extreme environments.

The Challenges

- Development of sensors to withstand temperatures up to 500°F
- Improved packaging systems to prevent failures at extreme pressures and temperatures
- Development of high temperature electronics that are not silicon based (alternatives to silicon based electronics)
- Non-sensor methods
- The development of cooling systems that can be used downhole at extreme temperatures and pressures
- The development of sensors that can be easily retrieved or swapped if they have a short operating life window
- The development of non intrusive methods of measuring downhole temperature. For example, the use of beams
- Improved gauge capability for temporary gauges to place into HPHT wells with increased data points to allow monitoring of suspended well to determine interference etc.

Other Interests

Other areas of interest identified for the workshop are listed below;

The Challenges

- Improved techniques for cost effective slot recovery as well as swarf (steel cutting) handling
- Devise new methods to ensure cuttings are left downhole and not brought to the surface. Possible use of filters and other innovative techniques
- Develop more efficient handling equipment for oil on cutting reduction
- Improved solutions for transporting oil based drill cuttings to shore as well as shore treatment
- Improved integrated well solutions in order to deal with marginal fields making uneconomical wells, economical

- The design and development of a 10 ¾" multilateral level 5 junction system (bigger bore) for drilling applications

ITF's Role & Approach

The Industry Technology Facilitator (ITF) is a not for profit organisation owned by, and with access to funds from major oil and gas operating and service companies that comprise its membership. ITF has an impressive track record in delivering finance to help develop new initiatives for oil and gas technologies from early stage joint industry projects (JIPs) through to field trials and commercialisation. Since 1999, ITF has supported over **150** projects and secured approximately **£50 million** in funding. ITF's key objectives are to identify technology needs, foster innovation and facilitate the development and implementation of new technologies.

A fundamental element of ITF's role as an internationally recognised champion for facilitating research, development and deployment of technology innovation within the upstream oil and gas industry is to engage with key industry sources. ITF uses a proven process, working in collaborative participation with both its Members and industry to identify technology needs and potential solutions.

The ITF process, illustrated below as a step-by-step course of actions, endeavours to bridge the gap between the industry's large global players and development community with the ultimate aim of implementing new technology solutions:

STEP 1 - Understand and Identify Technology Needs

STEP 2 - Engage the Development Community / Invite Proposals

STEP 3 - Evaluate Proposal Submissions

STEP 4 - Secure Funding

STEP 5 - Assist the Launch of JIPs

STEP 6 - Facilitate the Implementation of Technologies

ITF has contractual confidentiality arrangements with all its Members and will enter into a parallel agreement with all developers submitting proposal applications. Proposals will be submitted to our Members only for the purpose for which they are provided, i.e. assessment for funding support and implementation.

Proposals submitted under this Theme will be reviewed for financial sponsorship by **all ITF Members** therefore this is an excellent opportunity to gain a global audience in

seeking support for your technology. The focus of all ITF themes is to identify technologies which bring clear benefits to sponsors but which require assistance in **research, development, and / or field trial.**

For details of ITF's full Portfolio of Members, please visit our Website - www.oil-itf.com

Technology Challenge Timeline

The ITF Technology Challenge follows a staged timeline from the initial workshop through to launch of successful projects. The following list of tasks describes the key milestones and their associated dates.

Note: If there is significant interest in a proposal, ITF has a mechanism for fast tracking projects.

- Programme Start: Technology Challenge Workshop May 2011
- Call for Proposals Re-issued 04 Oct 2011
- ***Deadline for Receipt of Proposals*** ***4 Nov 2011***
- Publish to Members for Review Dec 2011
- Member Review and Voting Jan 2011
- Technical Clarification Meeting Feb 2012
- Members finalise commitment to sponsor Feb 2012

Process for Submitting a Proposal

1. **Register Interest with ITF**

   Register your interest as early as possible by sending an email to Mark Anju at m.anju@oil-itf.com.

2. **Visit the ITF Website -** www.oil-itf.com

   On the ITF Home page, click on the "How to Submit a Proposal" button or follow this link to access all the information required to submit a proposal.

3. **Read the 'Project Application Guidance' Document**

   This document is available to view or download from the 'ITF Downloads' / 'Proposal Submission' section of the ITF Website. Reading this document prior to submitting a proposal is essential. If you require further clarification or are unsure if your proposal is suitable for submission, please call ITF (Contact Information below).

4. **Download and Complete the 'Project Application Form'**

   This form is available to download from the 'ITF Downloads' / 'Proposal Submission' section of the ITF Website.

5. **Download and Complete the 'Project Presentation Template'**

   This template is available to download from the 'ITF Downloads' / 'Proposal Submission' section of the ITF Website.

6. **Email the Completed 'Project Application Form' and 'Project Presentation Template' to ITF**

   Email the Completed 'Project Application Form' in Microsoft Word format **(not PDF)** and the 'Project Presentation Template' in Microsoft PowerPoint format **(not PDF)** to Mark Anju at m.anju@oil-itf.com by **no later than 19 September 2011**. Proposals received after this date may not be processed.

Qualifying Technologies

In order to qualify for potential sponsorship, technologies submitted in response to this Call for Proposals must:

- be applicable to at least one of the identified requirements
- be novel or innovative
- demonstrate a clear business case for support
- have a clear and demonstrable path to commercialisation and implementation

Note: Proposals submitted to any other ITF Call in the past nine months or any previously unsuccessful applications should not be resubmitted without first consulting ITF (contact information provided later in this document).

Qualifying Organisations

Proposals are invited from any organisation including SME's, academia, research institutions, large organisations, consortiums or alliances. Proposals may be submitted by a national or international organisation, and equal opportunities will be extended to all proposers. Please keep in mind however that should your proposal be taken forward, you will be required to participate in meetings and make presentations to interested parties in the English language (teleconference and video conference are acceptable).

ITF Contact Information

If you would like to discuss any matters related to this call or any other issue related to ITF, please contact any of the following people:

Technology Challenge Manager and primary contact point for this Call:

Mark Anju - ITF Technology Analyst

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Other members of team available for your support:

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For more information on ITF please visit the ITF Website - www.oil-itf.com