

In Well Communications

(Output from ITF Theme Day)

A Collaborative Approach to Investment in Technology

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 more than 138 projects worth in excess of £40 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 access to 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

Background to the Theme

This Call for Proposals is the collective output of an ITF 'In Well Communications' Theme Day held in Aberdeen on 23rd June 2009 in recognition that technology in relation to in wells communications needs to be developed further to help overcome the specific problems that are presented and to help eliminate the need for production logs. Retrofit of technology in wells that have been installed without gauges is another important aspect. Commercial aspects or workover can prove challenging as harsh environments with difficulty of access at various time of the year meaning that the requirement to operate reliable downhole tools remotely becomes critical.

The Theme Day included an intensive, facilitated workshop which brought together ITF Members, Operators, Service Companies, Small and Medium-sized Enterprises and research and academia players. The output of these discussions has formed the basis of this Call for Proposals.

Theme Timeline

Each ITF Theme follows a nine month timeline from Theme Day to Theme Completion. The following list of tasks describes the key milestones and their associated date:

Theme Start / Theme Day	Jun 2009
Call for Proposals Issued	Sep 2009
Deadline for Receipt of Proposals	Oct 2009
Publish to Members for Review	Nov 2009
Member Review and Voting	Dec 2009
Technical Clarification Meeting	Jan 2010
Members finalise commitment to sponsor	Apr 2010
Theme Complete	Apr 2010

An Open Invitation to Global Technology Developers

This document aims to stimulate proposals from global development expertise which meet the specific requirements for in wells communications. ITF and its Members will jointly assess all submitted proposals and our Members will potentially fund those proposals of greatest interest.

ITF and its Members will not prescribe specific technology solutions, but instead use the output gathered from the Theme Day to stimulate innovative proposals that offer potential solutions to identified needs. Key technology drivers, as identified by ITF Members, are the desire to produce fields in a more cost effective and efficient manner.

This is an open invitation to any organisation seeking sponsorship for **innovative technologies** in the **oil and gas industry to submit proposals for research, development, and / or field trial in the following areas, associated with the identified needs of the ITF In-Wells Communications Theme:**

- Instrumentation
- Communication between Wells
- Wireless Technologies
- Smart Technology
- Other

The list of detailed technology challenges are identified within each area that are of explicit interest to ITF Members in the 'Specific Technology Requirements' below. This information highlights key elements required but allows for innovation and flexibility in interpreting the most appropriate technical solutions.

The method for submitting a proposal is described later in this document but you can also learn how to submit a proposal by going to our website www.oil-itf.com

Specific Technology Requirements

(Any submitted proposal **must** address one or more of the following identified requirements)

INSTRUMENTATION

Background:

Instruments should be kept simple, reliable, and value added taking life cycle costing and cost of ownership into consideration. As future developments are likely to be HPHT, new tools are required that must be resistant to these environments. However, a requirement also exists for instrumentation to have a retrofit capability.

Requirements:

- **Reliability**
 - Improved reliability of instruments for harsh downhole HPHT environment where pressures up to 30,000 psi and temperatures greater than 350°F can be experienced.
 - Electronic systems need to be improved to endure the harsh HPHT environments.
 - Instruments should be constructed for other harsh environments including heavy oil, ultra deep wells and corrosive atmospheres.
 - The development of an ISO compliant reliability database, detailing e.g. failure modes or new equipment weak points
 - Techniques and systems for evaluating historical data and performing risk analysis

- **Sensors and Real Time Data**
 - Ability to retrofit at low cost, in sub-sea wells, a downhole pressure and temperature gauge.
 - Instrumentation to deal with the issues of communication without circulation (this may not always be present in the well)
 - The development of distributed low cost sensors for entire well monitoring and array sensors with a higher resolution per well
 - The ability to measure valve positions
 - The provision of multi-lateral individual branch metering and local water sensing
 - Systems to monitor distribution to detect flow irregularity (wax,

carbonate, etc) in horizontal completions

- Instrument to real time monitor erosion / corrosion solids
- In well, often deep (500m) resistivity investigation on a continuous basis
- Continuous pressure/flow transmission
- Multiphase PLT* capability
- Instruments that can provide more details on porosity, compaction (modules) and saturation (fluid content)
- Multi sensor availability re phase flow
- Instrumentation that can give information from beyond the well into reservoir - pressure, water saturation etc
- Continuous inflow profile measurement to help with reservoir characterisation
- Multi-lateral flow measurement (flow rate) from individual laterals
- Water cut meter

- **Standardisation**
 - Instruments with an improved 'plug and play' and/or subsea standard interface (open protocol)
 - Development of standards for qualification that provide a realistic, proven life expectancy

- **Well Integrity**
 - Outer casing pressure transients (i.e. annulus pressure monitoring)
 - Low cost wireless (real time) annulus pressure monitoring
 - Subsea well annulus pressure gauges

* PLT - Production Logging Tool

COMMUNICATION BETWEEN WELLS

Background:

Reservoir connectivity is often an important consideration for reservoir management. For example, connectivity information controls production efficiency and affects decisions concerning well placement and spacing. The areas requiring focus are:

Requirements:

- Downhole seismic

- Continuous VSP (Vertical Seismic Profile)
- In situ acoustic monitoring for fractures
- Well and Reservoir Management
 - Real time data management
 - Field production strategy
- Continuous resistivity measurements well to well

WIRELESS TECHNOLOGIES

Background:

Wireless technology would offer a step change by allowing the instrumentation of existing assets. This would facilitate the delivery of data to desk in real time for rapid decision making, whether that be for production optimisation purposes or for early warning of a need for remedial action. Wireless technologies for both in-well monitoring and flow control applications can provide data from places in the wellbore which are out of reach of cables. The key to widespread application of wireless technology is power and bandwidth on demand.

Requirements:

- **Signal Pickup for Offshore Platforms**

- Techniques to overcome high transmission losses and attenuation due to surface platform noise interfering with the signal pick up. High transmission losses also occur when sending signals to the surface up the well bore, therefore techniques to reduce the need for repeaters are required.

- **Downhole Power**

A clear requirement exists for **original** proposals for downhole power generation techniques to a minimum of 100 watts. Figures are given below for indication purposes:

- Alternative power generation and storage methods that could help increase the energy available per bit for data transmission. Generally a large battery pack is required to produce the power needed to cope with large amount of data in well. As an example, a subsea abandoned well: 20,000ft, >150°C, needed one reading per day for 10 years. A target of more than 10 000 kJ for longer than 2 years at between 85°C and 150°C would be ideal
- Improved battery technology, rechargeable batteries and extended battery life are major requirements.
- Alternatives to batteries as power storage may be sourced, for example the further development of electronics for autonomous local power generation. Downhole power generators could, for

example, use turbine technology driven from production fluids to keep batteries charged.

- Note - There are various battery operated systems but they tend to suffer from short life and are expensive to install. Ideally systems that could use the energy available in the well to produce power and transmit data to surface would be an advantage. Additionally systems need to stay above the perforations and not end up in the sump.
- Well flow dP measurements are required for virtual metering systems. An option may exist of gaining pressure data from subsea jumpers.

- **Go Further**

- Increased energy per bit and the ability to overcome transmission inefficiency with high attenuation. The extent depends on the means e.g. whether electromagnetic, acoustic, or radio frequency and the medium used. Communication systems offered may differ depending on the type of well e.g. gas, water, hydrocarbon liquid or multiphase liquid. The improved ability to communicate with tools downhole would also be beneficial
- Techniques are required to increase the bandwidth, improve the data rate and extend the range of wireless transmission. The ability to do this without circulation would be advantageous
- Development of modulation schemes and data compression techniques would be beneficial, perhaps learning from other communication sectors
- Wireless communications in multilateral wells would provide the means to both send data 'up-hole' and command signals back downhole. Multilaterals flow from each branch with the ability to retrofit.

- **Data Compression**

- Filtering technology - realistic expectations for field use
- Key data transmission - limit battery use
- Record by exception only
- Programmability of tool

SMART TECHNOLOGY

Background:

Smart or intelligent well technology is one of the up and coming technologies that have been developed to assist improvements in field development outcome. Smart technologies are required to simplify system complexities while maintaining reliability and long term (life of field) stability. The possible reservoir environments in which smart well technology could be used are numerous and the possible benefits that could be realized by utilizing smart well technology are now becoming realisable with further development.

Requirements:

- Smart techniques to improve flow measurement and control flow (remotely)
- Fibre optic technology which could potentially be adapted and transferred from the telecoms industry
- Fibre optic for communications and for monitoring (spectral encoded sensors, Raman-Brillouin scattering)
- Connections (wet mate)
- Methods to control downhole robots
- The consideration of the benefits of nanotechnologies for reservoir management
- Self controlled wells with capabilities such as:
 - Automated monitoring and control
 - Feedback loop as a health check
 - Reliable and failsafe systems
 - Autonomous controlling
 - Two-way wireless communication

OTHER

Background:

There are number of miscellaneous requirements which supplement in-well requirements.

Requirements:

- **Ease of Installation and Retrofit**
 - Streamlining and innovative alternatives of installation techniques
 - Improved ability and ease to retrofit instrumentation
- **New Completion Techniques**
 - Single control line complete with multifunction capability
 - Built-in future proof for wireless installation
 - Multipurpose completion components e.g. side pocket mandrel, safety shut off device
 - Monobore completion bias
 - External liner / casing pickup / booster for reservoir section
 - Smart design of wellhead/ surface tie in's
 - "IntelliPipe" for completions
 - Crossover from aerospace or medical industries
- **Existing Completion Techniques**
 - Minimise boosters required to operate wireless gauge
 - Reduction of the gauge length
 - Capillary string for downhole gauge
 - Clever, small booster design e.g. set in side pocket mandrel / nipple assembly downhole safety valve (DHSV)
 - Wireless DHSV / Choke/ safety shut off device
 - Insert DHSV complete with pickup - control line conduit
 - Surface tie in - home hub type wireless connector
- **Technology Transfer**
 - Low cost hardware solutions to transfer high tech ideas from high producing wells to marginal wells. This would allow more advanced reservoir management of brown fields, leveraging their remaining potential

Process for Submitting a Proposal

1. Register Interest with ITF

Register your interest as early as possible by sending an email to Keith Mackie at k.mackie@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 (ITF Contact Information appears later).

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 Keith Mackie at k.mackie@oil-itf.com by **no later than 19th October 2009**. 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 UK and 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:

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