Reel Reporter

Vol. 4 Issue 1 | Newsletter of the International Coiled Tubing Association | April 1999

ICoTA Gulf Coast Chapter Started

Another local Chapter has been added to the ICoTA organisation. The Gulf Coast Chapter has been formed for interested parties in and around the Houston area. Local Chapter Officers have been elected and a special committee charged with developing a successful "Lunch and Learn" program have been put in place. This offers oil and gas industry personnel within the district a unique opportunity to keep current with the latest well intervention techniques and equipment.

Principle office bearers for the new Chapter are:

Co-Chairmen: Marc Allcorn, Schlumberger Dowell and Shawn Glanville, Precision Tube Technology Treasurer: Corey Hoffman, Weatherford-TechLine, Secretarial Duties: Mel Hightower Maurer Engineering and Randy Valencia, BP Amoco. A listing of planned evnts will be published soon.

Register now for the North American Roundtable

The 1999 North American Coiled Tubing Roundtable on 25 - 26 May will once again be held in the Adams Mark Hotel, Houston. With a varied programme that is even fuller than last year, this promises to be a highly successful event. Once again, first day Sessions 1 and 2 have been organised in A and B Options oriented to reflect delegate preference for CT technology or well operations.

SPE/ICoTA North American Coiled Tubing Roundtable

25-26 May 1999
Adam's Mark Hotel, Houston

- **Fundamentals of CT Technology**
- **CT Well Operations**
- **Developments in CT Technology**
- **New & Innovative CT Applications**
- **New Equipment & Tool Developments**
- **Inspection, Fatigue & Materials Behaviour**
- **CT Drilling Technology**

Ice-Breaker Barbecue - Evening of 24 May

For programme details and registration contact:

SPE Registrar - SPE/ICoTA '99, PO Box 833836, Richardson, TX 75083-3836, USA
Tel: +1 972 952 9393 *Fax:* +1 972 952 9328 *email:* tech-prog@spelink.spe.org

In This Issue....

Our Special Feature looks at a range of ways to circumvent the problems associated with mobilising latest-generation CT equipment for offshore operations. As well as more conventional approaches, we review two innovative techniques for CT intervention in subsea wells from a DP monohull vessel. One has already been used successfully in the North Sea, while the other is at an advanced stage of development.

Scale and corrosion solids displaced from the ID of a working CT string while it is running in hole can result in plugging of the BHA and perforations. Chemical removal of these solids can be a difficult and time-consuming process, with significant fluid disposal problems. A new pump-through mechanical pig system is reviewed on page 3.

We look at some new CT JIPs on pages 6 and 7.

ICoTA

The **International Coiled Tubing Association (ICoTA)** is a not-for-profit, member-funded organisation with the primary objective of improving communication and promoting technical awareness within the coiled tubing industry.

Membership comprises individuals from all sectors of the coiled tubing industry including service users, service providers, tubing and equipment manufacturers.

Mission Statement

The ICoTA mission is to enhance communication, gather technical expertise and promote safety, training, competencies and industry accepted practices.

In this issue:

ICoTA News

European Chapter Report

Preparations are under way for the SPE/ ICOTA Roundtable to be held at the Aberdeen Exhibition and Conference Centre on 17-18th November 1999. The event committee has issued a call for papers and has determined the overall structure of the event.

To meet the growing call for a Well Intervention event, the organisers have elected to broaden the scope of the conference and exhibition to include wireline and snubbing/HWO technologies.

Another innovative approach during the event is reflected in the conference technical sessions. Three principal session topics have been identified, each spanning half a day, and following a conventional paper presentation and discussion format. However, at the end of each session, time has been allocated for a special presentation and discussion session on "the wishes and needs" for the new millennium. Presenters for these sessions are from oil and gas operating companies that have a special interest or involment in the main session topic.

The morning session of the first day will take the form of a "teach-in" with several local presenters providing useful background information for delegates not too familiar with current well intervention technology.

Abstracts for the event should be submitted - through the ICoTA office - before 30th June. Enquiries regarding exhibition or sponsorship opportunities at the event should also be directed through the ICoTA office - contact details below.

Event committee:

Jean Roch Graulier (Peak Well Management), Nicola Gordon (Shell Expro), Miles Ponsonby (PSL), Dave Shand (PES), Andrew Campbell (BJ Services), Tim Eley (Transocean), John Clark (Atlas Wireline), Eric Ladbrook (Deutag), Elaine Hulse (SPE ABredeen Section) and Bruce Adam (ICoTA)

People Events

API Resource Group for CT

Specification for Coiled Line Pipe

The proposed specification passed letter ballot and was finalised at the API Tubular Standardisation group winter work week. The final step will be to ballot the changes.

Specification for Coiled Tubing

The resource group is working on the second draft of this specification for grades CT-60 upwards. As much of the text accepted for the line-pipe document will be carried over into this one, there should be considerable progress towards finishing it during 1999.

Recommended Practice: Care, Maintenance & Inspection of CT

RGCT have formed several sub-groups to write sections on: corrosion and its mitigation; use of predictive programmes; updating collapse pressures; defining imperfections and defect conditions in used tubing; defining acceptable inspection procedures; a glossary of CT terminology. Work should pick up as the line pipe document nears completion.

Canadian Chapter Report

The Canadian Chapter continues its objectives of enlarging membership and pursuing certification and training issues for CT operations. Potential members have been extensively mailed by Membership Director, Adel Girgis of AEUB, with invitations to ICoTA functions.

The January board meeting decided that broad industry involvement with ICoTA would best be achieved by holding monthly luncheon meetings with featured speakers. These will be held on the third Thursday of each month. The first meeting, in February, was a very successful panel presentation on the new Industry Recommended Practice for Drilling and Servicing with CT. It also allowed the publicising of ICoTA objectives among the 60 contractors, operators and suppliers attending. Programmes Director Warren Zemlak, Dowell Schlumberger will coordinate the meeting agendas.

Steve Redmond of Fracmaster has been appointed a director of ICoTA - Canada. He will be responsible for dovetailing the efforts of ICoTA and PSAC (Petroleum Service Alliance of Canada) in developing certification and training guidelines. PSAC have many mutual members with ICoTA and have already addressed this issue as part of their Pumping Services training. Steve will also work with the Petroleum Institute of Training Services (PITS) to finalise the CTU servicing course that will become a requirement for all supervisors of CT service jobs. Elections for other positions on the board of ICoTA Canada will be held at a general meeting in March.

The Canadian Chapter now has a seat on the Drilling and Completions Committee (DACC), the organisation who set operating guidelines for all areas of industry on behalf of the Government regulatory bodies. ICoTA will represent the interests of both operators and contractors in the CT sector.

George Myette, Chairman.

Reel Reporter

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ReelNET is the World Wide Web facility of ICoTA and comprises pages and links which can be reached at the URL:

http://www.icota.com

Comments or enquiries on distribution, content or editorial contributions should be directed to:

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Telephone: +44 (0) 1651 862715 • Fax: +44 (0) 1651 862734 • *icota@marketec.co.uk*

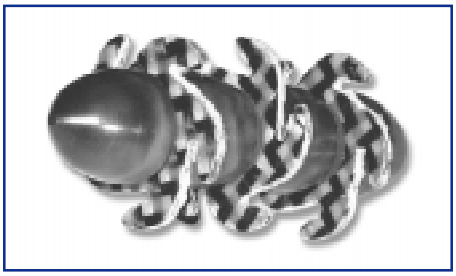
New CT Cleaning System

Technology Equipment

Turbine Cleaning System for CT

Pre-mobilisation pigging of a CT string with wiper dart and activation ball merely establishes the string volume while flushing out fluids and loose debris. It does not remove adhering scale and rust even if there is contact with the tubing ID throughout. Flexing of the string while running-in releases wall-bound material to drop down and plug the BHA or damage the perforations. Only removal of the solids adhering to the ID of a used CT string will prevent this.

This can now be done easily and efficiently with a revolutionary new turbine cleaning system - the Hippo™ technology product line, recently introduced by Aberdeen-based Hamdeen Ltd.



Hippo™ Cleaning turbine

Hippo™ Technology

Hippo™ turbines have a lightweight composite body with three sets of high-strength flexible blades. The blade profiles are specially designed to impart axial spin while being pumped down the string. Reverse mounting of the central blade enhances spin and guides the turbine over the CT internal weld bead. Heavy duty blades for primary cleaning are followed by more flexible ones for final polishing of the tubing ID. Blades are laser-cut from abrasion resistant, multi-ply kevlar/carbon fibre composite - the material for the thinner polishing blades having fewer plies. At the preferred 15 ft/sec displacement rate, fluid bypass carries the finely ground debris ahead of the turbine, so minimising the risk of sticking during transit.

Application

CT string cleaning is normally in three stages - the first two with cleaning turbines, the third with a polishing turbine. However, several passes at each stage may be needed to obtain clear fluid returns. Blade clearance from the ID is progressively reduced at each successive stage, typically:

- Cleaning-1 - 0.200 in.
- Cleaning-2 - 0.060 in.
- Polishing - 0.040 in.

The spinning and orbiting action of the turbine ensures that blades sized for the smallest ID of a taper string are equally effective in cleaning the largest ID.

Our thanks to Alan Reid of Hamdeen for contributing to this item.

Case History

17,500 ft x 1-3/4 in. CT (38 bbl vol.) unused 6 mths. Returns from the end of clear water discharge:

Run	Type	Clearance	Bbl Thru	Returns	Bbl
1	Cleaning	0.250 in.	42	ex. thick	4
2	Cleaning	0.200 in.	40	thick	5
3	Polishing	0.020 in.	40	ex. thick	4

13 bbl returns had 27.4% solids (3.6 bbl equivalent):
- 91% iron oxide, 7.6% Ca/Mg/Ba scale.

Offshore CT Operations

Technology Equipment

The progressive development of CT services inevitably generates ever larger and heavier equipment. This leads to increasing difficulty when mobilising for offshore operations, particularly with larger diameter workstrings. The limited lifting capacity of platform cranes is further inhibited by adverse weather conditions in the North Sea from October to April. Still further constraints are imposed by deck loading, wellhead accessibility and available operating space on platforms that were not designed for CT operations.

Although a latest-generation installation such as Hibernia has ample room for CT operations, space is at a premium on even the larger North Sea platforms.

Conventional Approaches

The lifting problem has so far been over come by:

- splitting equipment
- multiple reels
- spooling from boat
- vessel operations

Not yet explored is the use of lightweight composites to reduce the weight of tanks, towers and the like, as well as the CT string.

Electric CT Units

Changing to electrical drive from diesel would reduce both weight and maintenance while improving reliability. However, few electric units are yet in use - only three of the 50-strong North Sea fleet have combined power packs. The all-electric CT unit may be the logical way forward, but operators are still unwilling to consider dispensing with hydraulics completely. Reported difficulties in obtaining an electrical power supply from some platforms could be overcome by using a Zone 2 generator.

Split Strings

Because the reel is the heaviest single lift, on 25% of North Sea jobs longer and larger OD strings have had to be cut into 3 - 5 separately spooled, liftable sections that must be weld-rejoined aboard the platform. Even so, the ultimate controlling factor may be deck-loading, since mud-fill can increase the reel weight to 70 tons.

Improved welding techniques have enhanced weld fatigue life and reliability, while fatigue-resistant mechanical connectors with electrical connections have been available for some time. Although most welds are on single use completion strings, laser welding, ADB and other weld technologies need to be evaluated as the orbital welder may have reached its limit of development. Thin-wall tubing might not be a practical method of reducing on-site weight because of its liability to mechanical damage, seam weld failure and corrosion.

CT Reel Lift (tonnes)

	Crane Cap.	Reel Wt
North Sea - S	6 - 15	18 - 30
North Sea - N	25 - 35	18 - 30
Gulf Mexico	8 - 15	18 - 17
West Africa	0 - 8	10 - 36

"Platform crane limits seem to vary week by week - with any crane-lift compromise always offset from the crane onto the coil."

Boat-based CT

An alternative approach to the mobilisation problem is to carry out CT operations from a separate vessel, although this has not taken off in the North Sea because of weather-dependency and the time needed to minimise risks. Although special procedures are required for the initial crane pick-up of the CT, subsequent operations are virtually normal, with the vessel moved 500 ft away from the platform to assist injector head pull-in of the string.

Two disadvantages with this technique are the cost of the vessel and the need for a second unit and crew - an injector head is required on the vessel to spool the string onto and off the reel.

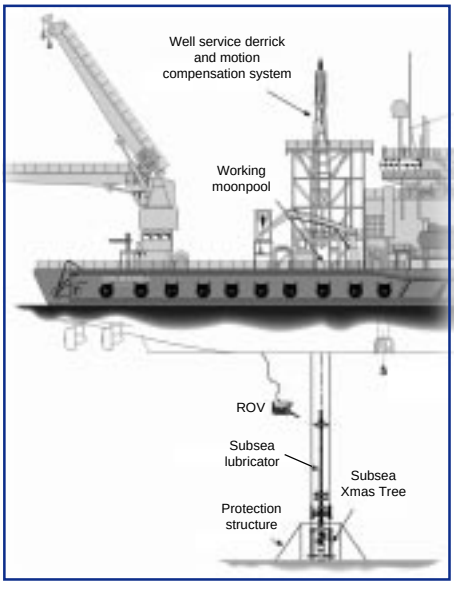
Innovative Solutions

The number of subsea wells in the UKCS has escalated because of ever more subsea tie-backs and floating production systems (FPS). This has prompted the development of novel techniques for CT intervention that offer cost-effective ways to circumvent mobilisation problems.

Intervention from A Monohull

One solution has successfully adapted the well-proven wireline subsea sliding sleeve system to a CT application through a rigid riser, from a DP light intervention vessel.

In this technique, the CT lubricator is deployed to the subsea tree then a rigid, jointed-pipe riser is run from the vessel deck to 5 metres above the tree. Since this arrangement does not require heave compensation, the riser can be set on slips on the rig floor. Once the BHA has been assembled and hung off in the riser, the



Well service derrick and CT operations area

- Problems and Solutions

Technology Equipment

CT injection head hanging in the well-servicing derrick with CT reel behind.

moon pool is opened and the BOP/injector head assembly is dropped down for making up onto the riser.

Heave Compensation

Only after engaging the riser to the tree does heave compensation become necessary - on a relatively modest scale since the CT reel and gooseneck are virtually on the same level. Because rig-up on a semi entails a high angle (40 - 70 deg.) from reel to gooseneck, heave is at 1 m./m. and can cause occasional reel reversal while running in. By contrast, the low angle (8 deg. from horizontal) of this new system reduces heave to about 0.2m./m. Consequently, the reel need only be accelerated and slowed if running in hole above the critical speed of 4 m./minute per metre of heave. Once at depth, slacking off the reel two turns accommodates all movement from up to 5 m. of wave height. This reduces spooling fatigue to the levels of a platform operation, while movement over the gooseneck is in the elastic range so does not present a problem.

Time Saving

A particular benefit of this system is the custom-built, compact CT tension frame that replaces the conventional lift frame. Offshore mobilisation and handling are greatly reduced because the injector head and BOP can be installed and tested onshore before load-out. The frame is vertically mounted on a skid base that occupies minimum deck space and can quickly be rigged up to the riser.

The monohull approach to CT subsea intervention offers significant time advantages over operations from a semi-submersible. For a multi-well sequence this translates into major cost savings overall.

Flexible Riser Project

Another approach to CT and wireline intervention in sub sea wells from a DP monohull is currently being developed - a low-cost flexible riser system that combines new technology with proven systems. Development engineering has already been completed, allowing prototype testing of the novel sub-systems during 1999.

Designed for use in 70 - 2500 m water depth, the 5.4 in. ID flexible riser system is intended for deployment from a vessel with an internal moonpool. The two main components of the system are:

- 100 m. long bow-shaped, flexible upper section, fixed in the moonpool area - hangs down through the turbulent surface zone in a chinese lantern profile.
- more rigid but spoolable vertical lower section that attaches to the wellhead - supported by two sets of wires from standard rig tensioners on the vessel.

Although the length of the riser assembly is fixed, heave compensation on the vessel is not needed because the flexibility and reach of the upper section absorb all hull movement and wave action. Sideways movement of the CT string within the riser is only second order, so has minimum effect at the foot of the coil.

Riser Deployment

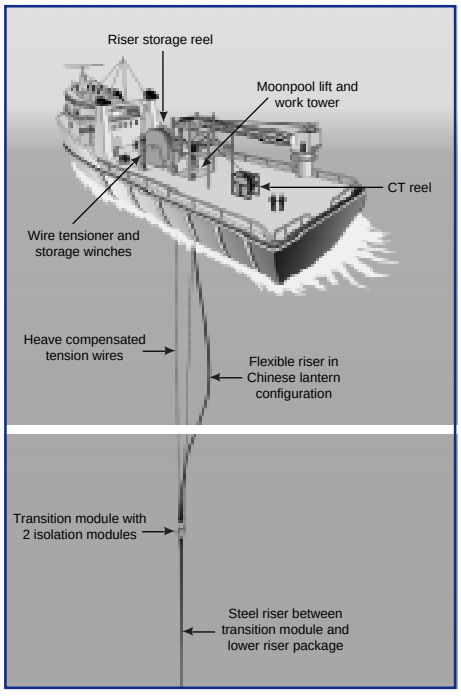
The two riser sections are spooled from their storage reels on the vessel and connected with a transition module. This module has two internal valves to isolate the lower riser for tool cycling when pulling out of hole. It is a machined trunnion block that has bend stiffeners and, on opposite faces, anchor points for the tension wires.

The Lower Riser Package (LRP) has two sets of subsea winches, an emergency disconnect and re-entry guide ports. The main set of winches are used for initial latching of the LRP to the subsea tree, while the upper set are for reconnecting the system after an emergency disconnect.

Since the riser effectively becomes a full bore extension to the well when it is connected to the wellhead, the whole assembly is a rated conduit.

A costing model developed in Phase 1 indicates that the system will give savings of 50 - 80% on drilling rig costs, depending on the location, type of operation and, in particular, the water depth.

Our thanks to Willem van Adrichem of Dowell, Eamonn McGennis of Coflexip Stena and Rory Cooper of XLT for contributing to this review of offshore CT operations.



Schematic of the flexible riser system

New CT JIPs

Technology Equipment

Fracturing Fluids - Coiled Tubing Consortium

Accurate estimation of frictional pressure losses is important in determining the horsepower requirements for pumping fluids through a CT string. Little that has been reported on the flow behaviour in CT of drilling, fracturing and similar fluids takes account of the effects of either the curvature of reeled tubing or the seam.

To address this, a 15-member Coiled Tubing Consortium was formed in July 1997 at the Well Construction Technology Center (WCTC) in the University of Oklahoma, in order to establish a JIP. The project will develop a database and correlations for determining the frictional losses and rheology of non-Newtonian fluids in a range of CT sizes from 1 in. to 2-3/8 in.

During Phase 1 (to be completed in June 1999) friction losses are being determined for a range of fluids as they are pumped through both reeled and straight tubing.

The experimental results have shown not only that these losses are significantly higher through reeled tubing than through straight lengths, but that in most cases measured values do not match theoretical predictions. For the first time, results are reported from the concentric and eccentric annuli, there being no explicit theoretical correlations in the literature.

Phase 2 is scheduled to start on 1 July 1999 and will pursue a range of topics that are of particular interest to CTC members. These will include:

- Drag reduction of solid-laden fluids
- Mathematical and experimental models for wellbore clean-out
- Friction loss of foams
- Evaluation of mud motor performance
- Evaluation of reeled composite tubing.

Contact: Subhash Shah or Max Mefford

Canadian Chapter mail address:

Box 20043
Calgary Place RPO
Calgary, Alberta T2P 4J2
Canada

ICoTA Member Registration Request

	Membership Category	Annual Membership Fee
Director Member	Applicable to individuals participating with a key role within the CT industry. Acceptance subject to ICoTA Board approval.	Please call for details
Ordinary Member	Applicable to individuals with a declared technical or commercial interest in the coiled tubing industry. Eligible to participate on working committees and task groups — may apply for Voting Delegate status	US$ 50.00 or UK£ 35.00

Organisation or Company _____

Contact Name (Last) _____ **(First)** _____

Job Title _____

Company Business Interests *(e.g., operator, tool rental, CT service etc.)* _____

Method of payment

- ☐ **American Express**
- ☐ **Visa**
- ☐ **Cheque**
- ☐ **Purchase Order**

Transaction Details

Amount: _____
Card No.: _____
Expiry Date: _____
Cardholders Signature: _____

Cheques and money orders should be marked payable to **"International Coiled Tubing Association".**

Mailing Address _____

_____

City _____ **State** _____ **Zip Code** _____

Country _____

Tel _____ **Fax** _____

Email _____

Check this box if you do not wish your contact details entered in the ReelNET Directory ☐

The completed registration form and supporting fee, or payment advice should be directed (mail or fax) to:

ICoTA, P.O. Box 10026, Aberdeen, AB21 0RA, Scotland, UK. Tel: UK +44 1651 862715 Fax: UK +44 1651 862734

Technology Round-Up

Real-time CT Inspection and Data Acquisition JIP

In May 1998, the US Dept of Energy initiated a three-year CT JIP at their Idaho National Engineering & Environment Laboratory (INEEL). The five-phaseproject will develop a real-time CT inspection and data acquisition system that will allow accurate prediction of remaining string life.

Fundamental to the system is newly developed string marking and reading technology that will uniquely and permanently identify each segment along the string, regardless of the removal or splicing in of other segments. Rotation effects may also be evaluated.

Real-time output from NDE (non-destructive examination) inspection of a CT string will be logged by the data acquisition unit to provide state-of-the-tubing information for each specific string segment. The marking system will also document any elongation of a segment both during individual jobs and throughout the string service life.

Contact: Timothy Green, INEEL, Idaho, USA

CT Inspection & Data Acquisition

1. Development of marking and flaw recognitiontechnology
2. Inspection signal processing and recognition
3. Data acquisition system development
4. Life prediction model development and integration into data acquisition system
5. Development of system for offshore operations

CT Elongation & Diametrical Growth
Study of coiled tubing deformation.

Status: Completed April 1998. Prediction software for any loading condition delivered to participants.

Contact: Steven Tipton, University of Tulsa, Tulsa, OK, USA

Tel: +1 918 631 2994 *Fax:* +1 918 631 2397

email: smt@utulsa.edu

Surface Defects & Fatigue Resistance
Influence of surface defects on CT string fatigue life and residual strength.

Status: Second year ends August 1999. Software will assess defects and optimum repair methods.

Contact: Steven Tipton, U of Tulsa (see above)

CT Structural Integrity Project
Continuation of CT elongation JIP for participant-decided research tasks.

Status: Starts September 1999

Contact: Steven Tipton, U of Tulsa (see above)

CT Mechanical Performance
Engineering study of the plastic deformation and elongation of CT during its life.

Status: Awaiting one more sponsor.

Contact: Ken Newman, CTES, Conroe, TX, USA

Tel: +1 409 521 2209 *Fax:* +1 409 521 2297

email: knewman@ctes.com

CT Development Project
Improvement in CT personnel verification, pipe inspection and equipment interaction.

Status: Phase 2 of Parts 1 & 2 now started, Phase 1 of Part 3 nearing completion.

Contact: Eric Evenson, Well Service Technology, Norway

Tel: +47 55 52 50 50 *Fax:* +47 55 52 50 51

email: wst@wst.no

DEA Project 67
CT software for CT/slimhole project; evaluation of new CT technologies and uses.

Status: Ongoing

Contact: Greg Deskins, Maurer Engineering TX, USA

Tel: +1 713 683 8227 *Fax:* +1 713 683 6418

email: deskins@maureng.com

Fluid Friction Losses in CT
Friction loss and rheology of non-Newtonian fluids.

Status: Phase 1, friction loss, started July 1997 ends June 1999. Phase 2 to include solids-laden fluid drag reduction, foam friction loss and wellbore cleanout.

Contact: Subhash Shah or Max Mefford, University of Oklahoma, Norman, OK, USA.

Tel: +1 405 325 1105 *Fax:* +1 405 325 2958

email: subhash@wctc.ou.edu; max@wctc.ou.edu

Advanced Well Construction Using CT
Reduced-clearance casing system avoiding conventional deployment issues.

Status: Phase 1 commenced December 1997.

Contact: Phil Head, XLT, London, England

Tel: +44 181 961 4795 Fax: +44 181 961 4805

email: phil.head@xltl.com

Novel Heavy Lifting System for CT Reels
Craneless vessel-to-platform lifting system for transfer of CT reels and other heavy loads.

Status: Phase 1 presented to DEA(E) December 1997. Participants required for feasibility study.

Contact: Phil Head, XLT, London, UK. (see above)

Coiled Tubing Flexible Riser
CT riser for DSV-deployed subsea well intervention.

Status: Phase 2 detailed engineering started Dec 97.

Contact: Rory Cooper, XLT, Aberdeen, Scotland

Tel:+44 1224 332385 *Fax:*+44 1224 581637

email: r.cooper@xltl.com

Electric Coiled Tubing Drilling
CT deployed electric drilling system.

Status: Phase 2 for 3-3/4 in. BHA started Jan 1998.

Contact: Dan Turner, XLT, London, UK (see above)

email: dan.turner@xltl.com

Advanced Mooring/Anchoring System
Accurate CT-deployed anchoring/mooring system

Status: Phase 1 - Feasibility study and novel anchor analysis to start January 1999, finishing Sept. 1999.

Contact: Phil Head, XLT, London, UK. (see above)

CT Vibrator Development Project
Vibrating tool to increase CT reach.

Status: Testing of prototype will start late 1998.

Contact: Bjørnar Lund, RF-Rogaland Research, Norway

Tel: +47 51 87 50 74 Fax: +47 51 87 52 00

DIODe - Drilling Independent of Depth
Mobile unit for seabed well construction and intervention using CT

Status: Phase 1, feasibility study, to start in 1998

Contact: Dick Winchester, CMPT Aberdeen

Tel: +44 870 608 3400 *Fax:* +44 870 608 3480

email: d.winchestr@cmpt.com

email: Bjornar.Lund@rf.no

CT Marking, Real-time Inspection, Data Acquisition and Life Prediction
Development of CT marking/recognition technology and a real-time inspection and data acquisition system

Status: Phase 1 development of marking technology, started May 1998.

Contact: Timothy Green, INEEL, Idaho, USA

email: TSG@inel.gov