PROJECT FACT SHEET

CONTRACT TITLE: Real-Time Coiled Tubing Inspection System (PARTNERSHIP)

ID NUMBER: P-81(FEW 4340-41)

B&R CODE: AC1005000

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PROJECT SITE
CITY: Idaho Falls **STATE**: ID
CITY: **STATE**:
CITY: **STATE**:

CONTRACT PERFORMANCE PERIOD:
4/15/1998 to 4/14/1999

PROGRAM: Supporting Research
RESEARCH AREA: Partnership/Drilling & Completion
PRODUCT LINE: RLE

FUNDING (1000'S)	DOE	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	0	0	0
FISCAL YR 1998	100	0	100
FUTURE FUNDS	0	0	0
TOTAL EST'D FUNDS	100	0	100

OBJECTIVE: Provide real time inspection of coiled tubing. To accomplish this goal a permanent mark and mark recognition system will be developed together with life cycle fatigue models. Additionally lifetime coiled tubing tracking software will be developed. As oil and gas operators expand their use of coiled tubing an inspection system is needed in order to minimize failures and premature scraping of coiled tubing in order to achieve economic efficiencies in what are typically high cost operations.

PROJECT DESCRIPTION:

Background: Real-time data acquisition and inspection of coiled tubing (CT) is important when: 1) assessing its integrity to meet intended service applications, 2) assessing effects of short-term inactivity (storage) in corrosive environments, and 3) predicting remaining life. Current CT field inspection technology is relatively crude, consisting of rolling friction wheels to monitor depth, and limited systems which monitor diameter and ovality, with little reliability in identifying which section of tubing is being inspected. CT operates in an extremely severe mechanical environment, where large bending strains are combined with significant internal pressure. This can cause diametral growth, wall thinning, ovality, and elongation, that can result in shortened operational life spans.

The reliability of CT has been enhanced by extensive refinements to its manufacturing process. CT strings are now making as many as forty trips into bore holes, often with long periods of inactivity in which corrosion can damage the tube surfaces. This success partly results from laboratory experimentation and theoretical work involving fatigue durability. Sophisticated plasticity and fatigue damage models predict life for discrete sections along the entire string throughout its service history. However, used CT tends to fail sooner than predicted, due the presence of imperfections in the surface of the CT incurred through mechanical damage or corrosion. Furthermore, sections of CT can be removed or new ones spliced into a string, often without reliable measurement or documentation. Theoretical fatigue programs could benefit greatly from real-time information about the measured state of each section of CT during its use, and reliable information about the location of that section in a given CT string.

Currently, CT inspections are performed off-line at on-shore locations. However, real advantages occur if inspections were to be performed at off-shore locations, but this requires a re-evaluation of the current electronics so as to permit taking the entire unit offshore to the well site. In respect to offshore applications, sensor packaging must be designed to meet Zone I and II certifications and/or qualifications.

Work to be Performed: Phase 1 (Marking) Develop permanent marking scheme for uniquely identifying position on CT. Develop computer code to identify permanent markings and recognize flaws in CT.

Phase 2 (Inspection) Develop flaw characterization software from CT inspection signals, and process quantified input parameters necessary for operational-life modeling.

Phase 3 (Integration) Develop and assemble a data acquisition system for inspection of CT. Develop software to track the state of the CT string.

Phase 4 (Life Extension) Develop CT fatigue life prediction model. Integrate lifetime prediction models into data-acquisition system software.

Phase 5 (Offshore Qualification) Harden equipment for offshore application.

PROJECT STATUS:

Current Work: Work is currently being conducted on the permanent marking system. Initial tests have been conducted using different application technologies and methods. The project is also working on developing a joint industry proposal and a CRADA.

Scheduled Milestones:

Develop unique marking scheme	07/98
Develop mark application and sensing technique	10/98

Accomplishments: Assembly of a linear slide was initiated to develop permanent mark technology for CT. The computer controlled linear slide will be used to simulate the coiled tubing operation and to test mark and mark recognition technology in the laboratory.

Paint sprayers to apply to permanent marking on the CT were identified and procured for testing.

Performed initial tests of spraying system.

A marking scheme based on binary numbering theory, to identify longitudinal length and bias welds in CT has been initially devised.