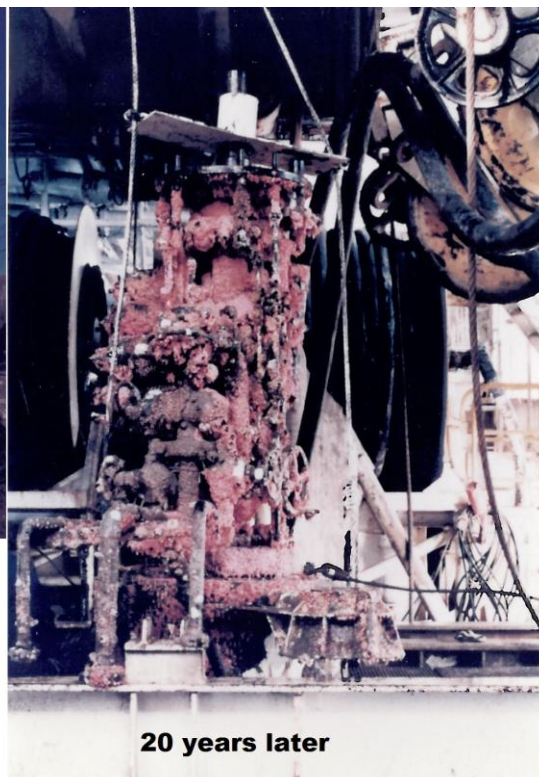


Subsea Decommissioning Joint Industry Project to Identify Dramatic Improvements



Caliente State #2 wellhead, circa 1964



20 years later

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Endeavor

Subsea Decommissioning JIP

Overview

Endeavor Management has recently completed a project for Petrobras requiring over 1,000 man-hours to research global best practices for subsea decommissioning. This study included sharing of information in a benchmarking study with 6 Operators, including Petrobras. Based on the outcome of this study, Endeavor has summarized areas needing more work related to subsea decommissioning and would like to invite Companies to participate in a Joint Industry Project (JIP) to collaborate as to how the industry can achieve dramatic improvements in subsea decommissioning.

Invitation to Participate

The effective decommissioning of subsea assets is one of the most important challenges facing the E&P industry today. In order to provide a better understanding of solutions to some of the areas faced by the oil & gas companies related to subsea decommissioning and plug & abandonment of subsea wells, Endeavor Management is inviting companies to participate in a JIP on these topics.

The output from this study will only be available to participating organizations.

What We Aim To Achieve	Why participate	Who should participate
<p>For participating organizations, the study will deliver new insight and practical understanding of the industry’s capabilities related to subsea decommissioning activities with a focus on a number of issues that need clarification. The issues range from practical, cost-based information on current industry capabilities to theoretical answers to today’s problems that may take some time to be fully developed. The common thread among all of these issues is that each one of them addresses a common problem or subject of interest to the decommissioning industry as a whole; the industry will benefit from progress in each of these issues.</p>	<p>Recognizing that approaches to subsea decommissioning vary from region to region, this study will be one of the first of its kind to focus on practices and performance impacts of different approaches across the globe. Participants will be able to compare and contrast, qualitatively and quantitatively:</p> <ol style="list-style-type: none"> 1) The mechanisms to accomplish decommissioning 2) The factors that contribute to effective decommissioning 3) Possible solutions to current industry issues related to P & A of subsea wells and decommissioning of subsea infrastructure 	<p>We encourage all oil and gas companies who recognize the importance of decommissioning to their operations and wish to optimize its effective management to join the study. The study is also of interest to decommissioning industry contractors, service providers, and subsea manufacturers.</p>

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Costs to Participate

This work will be performed on a lump sum basis. The proposed JIP cost is a total of \$590,000. The cost per participant is expected to be \$59,000 based on 10 participants.

Proposed Scope of Work

The scope of work is based on Issues identified in a recent study done by Endeavor related to subsea decommissioning which was funded by Petrobras and included 5 other Operators who shared subsea decom information. These issues are as follows:

A. Build an Economic Model that will allow operators to predict the costs to perform various projects using three basic vessel types.

This model will give a quick, accurate prediction of the relative costs to perform intervention and P&A activities based on three vessel types, allowing the user to better predict cost and capabilities in using the vessel types generally available. The three vessel types are:

- Dynamically Positioned (DP) vessel with no riser (Riserless Lightwell Intervention)
- DP vessel with a small bore workover riser
- MODU with full drilling riser and BOP system.

B. Is there a way to achieve MODU capabilities at a substantially lower price?

The best vessel available to the decommissioning industry relative to downhole risk is the MODU. However, MODU spread costs are high and can be the biggest cost driver for most decommissioning work. Endeavor believes that there may be a way to convert existing vessels for lower cost subsea P&A service and will pursue a CAPEX estimate and predicted spread rate for such a solution.

C. Use of Resins as a replacement for Cements in Well P&A

While cement is a staple of well construction and also for well plugging, it has technical limitations. Resins, on the other hand, have clear advantages. The issue with resins is that they are far more expensive on a cost-per-barrel basis. This study seeks answers to two questions:

- What are the primary pros and cons of resins versus cements?
- Using a common P&A project as an example, compare the “all-in” costs of resins versus cements to answer: Are resins really all that expensive?

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D. Assess improved methods and equipment to enhance the decommissioning of subsea infrastructure.

Flushing of offshore pipelines and subsea systems has proven to be full of pitfalls, in the areas of stuck pigs / line blockages, as well as the best methods to effectively flush long runs. In addition, there is a need to reduce the cost of flushing by minimizing the use of fluids other than seawater and to ensure we can properly clean these flushing fluids to protect the environment. This study explores how the industry can achieve dramatic improvements in these areas.

E. Cement Bond Logging: Can we get past the first casing string?

Cement Bond Logs are the industry's common solution to confirm the state of the cement just outside the production casing wall. Can technology be found to gather CBL data in situ for the outer strings of installed casing?

F. Improvements in Casing Cutting and Milling

Cutting and milling of casing is used in a substantial number of P&As to deal with various downhole conditions during a P&A. This usually requires a MODU to provide the necessary rotation and torque for the cutters. Is there a way to effectively cut and mill casing without a MODU, e.g. from the back of the proverbial boat? Also, how can the time be reduced to cut through all downhole components (including control lines, electrical cables and all casing strings) to achieve "rock to rock" plugging?

G. Sensing Annulus Conditions in Outer Annuli of Existing Wells

The production annulus is nearly always accessible in subsea wells. However, to effectively P&A any well, every annulus must be assessed and, if need be, mitigated. Is there any technology out there to allow us to sense conditions in the outer annuli without having to penetrate them?

H. Improvements in future OEM Equipment or Systems to allow more effective P&A

Now that the industry knows more about what to expect in a typical subsea P&A and decom project, are there areas in which additions or modifications to OEM subsea well equipment would pay dividends in making future decommissioning work safer, faster, cheaper? Endeavor would be interested in promoting any ideas the industry may have on this subject. In the early stages of this study, feedback has shown us two areas for further examination:

- (H1) Equipment or systems which will allow improvements in flushing and decommissioning of subsea pipelines and subsea hardware.
- (H2) Equipment, assemblies, or modifications to subsea wellhead systems which would allow on-demand future access [during P&A] to all outer annuli.

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I. Dealing with Well Contaminants

A serious concern of some subsea wells and production systems is mercury, arsenic and NORM (Naturally Occurring Radioactive Materials). This study will outline the state of the art and future outlook for handling these three contaminants.

Deliverables

The study will be delivered through a multi-step approach:

- (1) Information gathering in the industry, including face-to-face interviews and group meetings with JIP participants;
- (2) Economic modeling as appropriate;
- (3) Delivery workshops;
- (4) Iteration and final report.

Each participant organization will be asked to attend a face-to-face group workshop with Endeavor at the end of the study, during which a report will be delivered and study findings will be discussed and debated. The data will be held exclusively for the use of participating organizations.

How to Get Involved

If you would like to participate or are interested in finding out more about this Subsea Decommissioning Joint Industry Project, please contact either:

- **Bruce Crager**, Executive Vice President, bcrager@endeavormgmt.com
- **Keith Caulfield**, Decommissioning JIP Study Team Lead, kcaulfield@endeavormgmt.com

If you would like to review the full JIP proposal, please go to <http://www.endeavormgmt.com/decommissioning-joint-industry-project/>

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About Endeavor Management

Endeavor Management provides strategy development, market research and technology advisory services to the oil and gas industry. Our Expert Advisory Group has a large number of experienced personnel in all phases of upstream oil and gas activities. Over the past several years, Endeavor has successfully initiated and delivered multiple offshore focused projects and studies for IOCs, NOCs, Independent Operators, service companies and subsea manufacturers.

Endeavor Management is an international management consulting firm that collaboratively works with their clients to achieve greater value from their transformational business initiatives. Endeavor serves as a catalyst by providing pragmatic methodologies and industry expertise in Business Transformation, Expert Advisory Services, and Revenue Generation.

The firm's 50 year heritage has produced a substantial portfolio of proven methodologies, deep operational insight and broad industry experience. This experience enables our team to quickly understand the dynamics of client companies and markets. Endeavor's clients span the globe and are typically leaders in their industry.

Gelb Consulting Group, a wholly owned subsidiary, monitors organizational performance and designs winning marketing strategies. Gelb helps organizations focus their marketing initiatives by fully understanding customer needs through proven strategic frameworks to guide marketing strategies, build trusted brands, deliver exceptional experiences and launch new products.

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