New Developments for Ultra Deepwater Hydrate Remediation Technology in the Gulf of Mexico

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Hydrate Remediation System Recap

At the 2009 Deepwater Intervention Forum, conference delegates learned about a successful hydrate remediation in 7200’ WD in the GoM using Wright’s Well Control Service’s (WWCS) Hydrate Remediation System.

Hydrate Remediation System Recap

Wright's designed and built the system in 18 months for a major energy company in response to a hydrate blockage.

On this first deployment, the Wright's system:

- cleared 15 miles of 12" pipeline
- removed 9000 barrels of hydrocarbons, condensate and other fluids

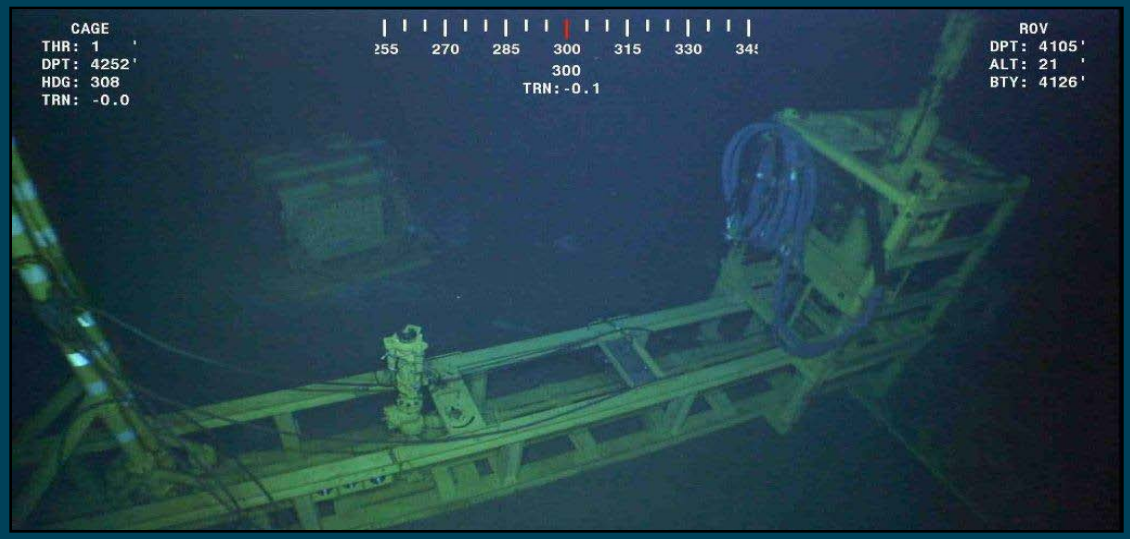
Hydrate Remediation Update

This year at DIF, we would like to tell you about:

- How the Wright's Hydrate Remediation System works
- What lessons were learned from this first deployment and the resulting enhancements made to the system
- Proven additional uses besides hydrate remediation
- Further non-hydrate remediation applications planned
- Current R&D and planned enhancements for hydrate remediation operations
- Our thoughts on next generation solutions that go beyond hydrate remediation

How the Wright's Hydrate Remediation System Works - Skid

- Self-contained system with pump and motor assembly placed on the mud line utilizing skirted steel mud mats
- Powered by filtered seawater from the surface via coiled tubing from a Multi-Service Vessel (MSV) or rig, or left on ocean floor for later use
- Not limited by a Remotely Operated Vehicle's (ROV) hydraulic energy

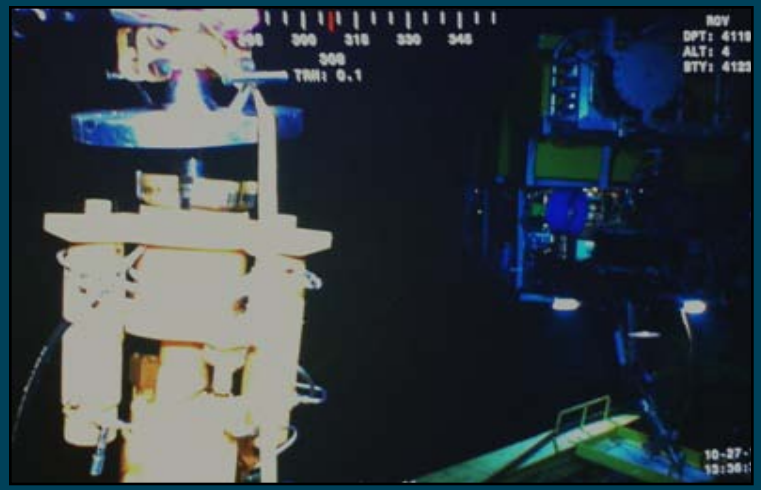


How the Wright's Hydrate Remediation System Works – Skid Deployment at Surface

How the Wright's Hydrate Remediation System Works - EQDs

- Subsea accumulators engage Emergency Quick Disconnects (EQD) with acoustic activation from vessel, initiating the following sequence:
  - Ongoing hydrate operations on the pipeline/subsea asset are shut off by isolating barriers
  - All four hot stabs eject at tie in points, thus overcoming differential pressure caused by a vacuum effect in the pipeline vs. hydrostatic pressure

- EQDs mitigate impact of:
  - MSV drive off and/or loss of DP power
  - Release of hydrocarbons
  - Sea water flooding the pipeline asset and hydrates reforming

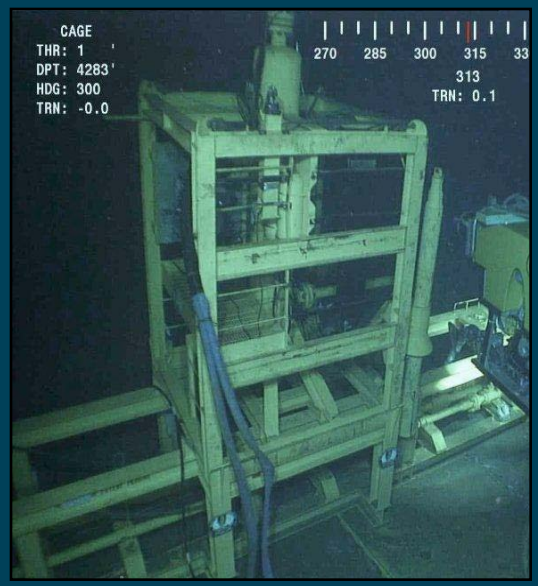


How The Wright's Hydrate Remediation System Works – Gas Separator

- Deployed in a modular fashion as a independent system that is designed to interface on the top of the hydrate skid, and separates gas from the fluids

- The first coil tubing line sends gas free flowing to a surface gas separator and/or flare boom

- The second coil tubing return line receives the processed hydrocarbons and other fluids to the surface for additional processing and containment



How The Wright's Hydrate Remediation System Works – Gas Separator

- A methanol injection panel prevents the formation of additional hydrates
- Several injection points throughout the hydrate skid and separator are able to receive methanol
- A ball check in the stack prevents fluid from filling the gas line
- The gas separator has a built in sand trap

How The Wright's Hydrate Remediation System Works – Gas Separator Deployment at Surface

Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #1:

- Needed to add the capability to remove asphaltene and paraffin blockages mixed with hydrates in a pipeline
  - Installed extra chemical injection lines, so as to treat asphaltene and paraffin during suction phase of remediation
  - Developed injection system capable of pumping multiple chemicals independently or simultaneously as needed at tie in point during suction phase of remediation
  - Also added injection system for skid and separator to avoid asphaltene and paraffin blockages forming within the hydrate remediation system

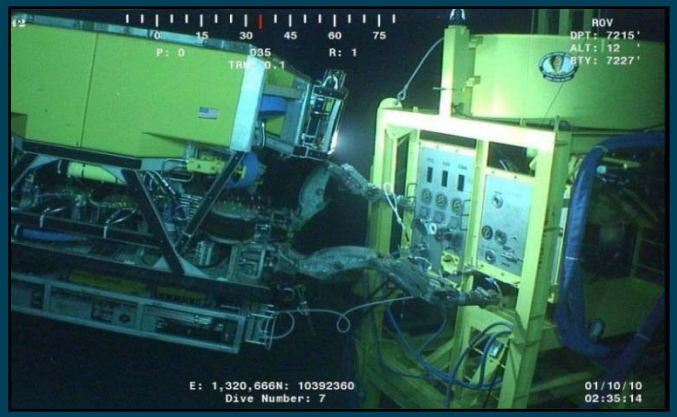
- RESULT: Successfully removed an asphaltene and paraffin blockage at 4,200' WD from several miles of pipeline

Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #2:

- Needed to enhance ROV friendly features:
  - Improve flying lead handling with better parking points
  - More strategic placement of analog gauges
  - Paddle vales responsible for flow metering and barrier isolation were redesigned to better handle an ROV's force
  - Installation of visual indicators to improve interpretation of valve actuation

- RESULT: better ROV tooling interface and actuation of components on system



Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #3:

- Needed to enhance connecting/disconnecting interface points for skid and separator
  - Previous male and female connectors were composed of multiple welded components - each one redesigned as one solid piece to increase connector strength and reduce damage during connecting and disconnecting operations
  - A filtration screen on the male connector prevents foreign objects from going into the coil and plugging it
  - Repositioned guide posts by moving two post to the back landing area and leaving one in the front area for optimal ROV maneuverability
  - Guideposts repositioned closer to the separator allowing for optimal ROV access

- RESULT: improved ROV access and mating points reducing the risk of possible damage at skid and separator interface points

Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #3:

ROV visual confirmation of mating point

Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #4:

- Needed to better manage and control nitrogen usage:
  - Valve configuration allows for a complete purge of hydrate system on deck of MSV
  - Isolation valves were installed on the coiled tubing ends used for condensate/fluids and gas returns
  - Valves used to remove trapped fluids and gasses in coiled tubing, before and after connecting or disconnecting
  - Valve configuration keeps system purged between subsea installation and the start of remediation operations

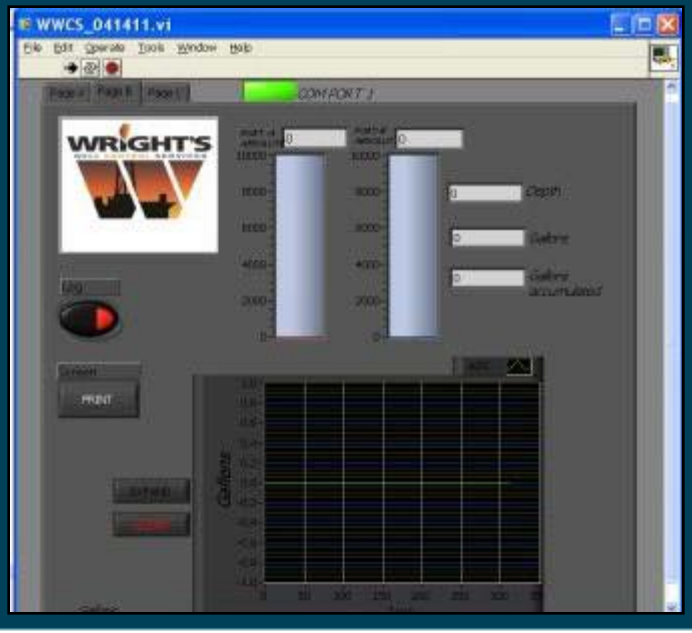
- RESULT: less nitrogen wasted and needed on site, as it is strategically used and controlled to meet job specifications

Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #5:

- Needed a more compact and advance data logging unit
  - Designed software/hardware to work in conjunction with WWCS subsea hybrid valve pack to better interpret internals of pipeline, gas separator and skid
  - Hybrid valve pack was created with a small footprint making it ROV porch compatible and bypassing the need for an ROV attachable skid

- RESULT: time savings due to:
  - Quicker installation
  - Quicker mobilization
  - Quicker repair time



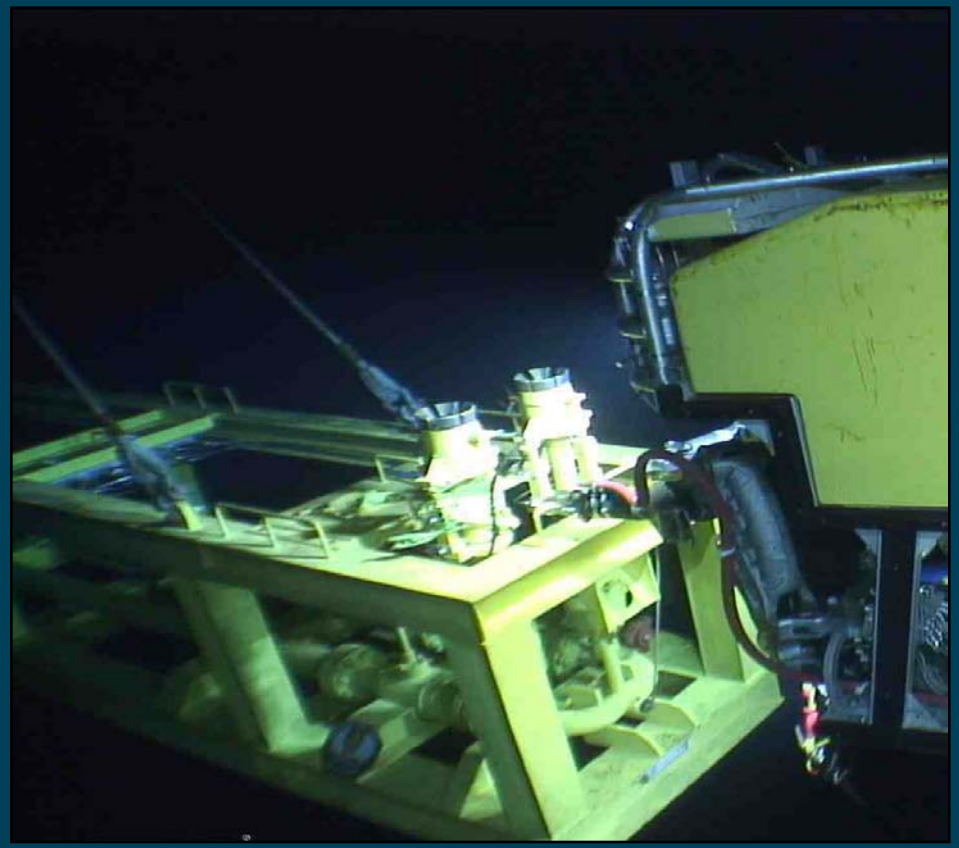
Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #6:

- Needed to improve system's center of gravity and sling configuration
- Skid
  - Length of skid (71') made setting skid on mud mats and retrieval challenging
  - New sling configuration improves skid's center of gravity placing less stress on the frame and critical stress points around the seal assembly
- Gas Separator
  - The new sling configuration for the separator improves its CG while reducing the risk of damage to interface points
- RESULT: better overall control and handling in all weather/installation scenarios

Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #6:



ROV handling the skid using WWCS sling system

Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #7:

- Needed a subsea analog gauge assembly to accurately interpret vacuum and absolute pressure data from internals of pipeline

- RESULT: increased topside reaction time with vessel spread by utilizing gauges strategically populated on skid to monitor pump inlet, pump outlet, and pressure in the gas separator

Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #8:

- Needed to re-engineer seal assembly for motor and pump
- RESULT: increased operational life of the system

Nine Lessons Learned from the first deployment of the Wright's Hydrate Remediation System

Lesson #9:

- Needed to enhance environmentally friendly features
- RESULT #1: developed subsea flush loop system to flush hydrocarbons out of the skid and separator with the inclusion of coiled tubing – flush loop also worked as a primer for the pump system
- RESULT #2: hydrocarbons are then placed in a topside containment system

Non-Hydrate Remediation Applications Implemented for the Wright's System

In addition to making improvements from the lessons learned from deploying the system for hydrate remediation, WWCS developed and executed new applications for the skid and gas separator

- The system has successfully flushed several miles of pipeline during plug and abandonment/decommissioning operations
- The system was also reconfigured to allow for the removal of pigs

So Where Do We Go From Here?

Current R&D and planned non-hydrate remediation applications

- Dewatering/unloading a pipeline
- Flooding and hydro testing a pipeline (max pressure 3600 psi in current configuration)
- Pushing a pipeline pig

Current R&D and planned enhancements for hydrate remediation operations

- Develop buoyancy system to counter the weight of skid and enable small crane launch from back of a boat

- Reconfigure system for deployment at greater water depths or for use in shallow water and inland waters

Conclusion – It's Time to go Beyond Hydrate Remediation

There is a great emphasis placed in the offshore industry on the entire hydrate remediation process. What we are proposing today is the need for operators to embrace ***flow assurance*** as the new solution of choice.

That is to no longer remediate or treat hydrates, but to remove the opportunity for hydrate blockages to form in the first place.

Ashpaltene, paraffin and sand remediation must also be factored into this proposed flow assurance philosophy.

Conclusion – the First Step Toward Flow Assurance

As a first step, Wright's in conjunction with other service companies is advising its clients on identifying and placing strategic connection points on their assets during ***pipeline construction or rehabilitation*** to allow for direct interfacing with the system.

Conclusion – Faster Deployment is the Key to Flow Assurance

By applying its proven technology, which can clear multiple blockages in miles of pipeline at a time, Wright's can respond at the first sign of a problem and immediately eliminate a possible hydrate rather than deploying after the asset is completely blocked.

The system can also be enhanced so as to lay dormant subsea, adjacent to the asset for even faster deployment.

Questions?

Thank You

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