RPSEA TAC Meeting
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RPSEA Project 08121-1502-01
Coil Tubing Drilling and Intervention System (CTIS) Using Cost Effective Vessels

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Project Team

RPSEA Operator Advisory Committee
Anadarko • Chevron • Shell • ConocoPhillips

Subcontractors
INTECSEA • NOV CTES • General Marine Contractors
GE Vetco • Tidewater • Huisman • University of Tulsa

Industry Advisors
Halliburton • Baker Hughes • Rolls Royce
Technical Work by The Team

All tasks & deliverables are complete
- Technology status assessment
- System architecture & design basis document
- Analysis & conceptual design, & component definition
- Operational plans & procedures
- HAZID
- Interface designs – using small vessels, CT, & SSR together
  - Riser installation equipment & motion isolation equipment
  - Seafloor shutoff & tree interface –smaller, faster, simpler
  - Deck arrangement for optimum tubing fatigue life
- Vessel requirements

Reports are on RPSEA web page
System Architecture

Self Supporting Riser on tree
Seafloor Shutoff Device
Riser connector & retention valve
Low cost stress joint
6 5/8” drill pipe for riser casing
Buoyancy modules
Quick disconnect segment
  • Near surface shear & seal
  • Disconnect connector
  • Shearing retention valve
Riser Extension
CT Equipment Configuration

- Reel on deck
- Injector above riser extension
- Standard well control equipment below injector
  - Packer stripper
  - Quad BOP
  - Slip rams below BOP or below buoyancy
The Technology Is Not New

Self Supporting Riser
Low cost vessels
• Install SSR & deploy coiled tubing
CT equipment

What Is New Is Using Them Together
Building on Previous SSR Program

• Computer simulations, validated by wave tank tests
• Built & installed prototype in 3,400-foot depth in 2006
• Demonstrated installation on a wellhead (no hydrocarbons)
• Inspected in 2008 and 2010 after hurricanes & eddy current
• Global Challenger mobilized on May 9, 2011 to recover riser
Well intervention for less than half the cost of using MODU
- Including mobilization, riser installation, down-hole work, & riser recovery
- Cost ratio is even better for longer jobs
- Same CT capability as from a jack up or onshore site

Improved environmental protection
- SSD for isolation at the seafloor, can disconnect & recover riser
- Quick disconnect with additional shear & seal
- Standard BOP quad at surface, no special training to use it
- Smaller vessels for reduced emissions

Safer
- Fewer people onboard
- Faster response to closing weather window
- Fewer reentries
- Riser is not transferred from vessel to vessel at sea
Survival in Gulf Stream current
- Operations in current are limited by ROV capability

Meeting regulatory requirements
- Reservoir isolation, safety, testing
- Met with BOEMRE in New Orleans
- Requested more detail
- Saw no problems with architecture
- Said ‘appears to be doable’

Use on both conventional and horizontal trees
- Crown plugs for 5-in. completions can be pulled through 6 5/8-in. casing
- Crown plugs for 7-in. completions require larger casing
  - 7-in. uses same SSD & disconnect segment

Met All Project Objectives
Riser Features

Low first cost
Re usable modular components on call
  • Use & recover, inspect, track fatigue, refurbish, warehouse, & reuse

Advanced buoyancy design
  • Improved buoyancy/displacement ratio
  • Double barrier & dropped object protection
  • Always at ambient pressure
  • Buoys can be set at any depth

Connects to a tree like the completion riser
  • Can also moor to an anchor

Riser casing can be 6 5/8” drill pipe
  • Readily available, high strength
  • Familiar, proven installation tooling
Riser Features

Fast, low cost installation
Simplified installation from small vessel
  • Tooling for installation by 260-foot vessel of opportunity
  • Run & recover through 15-foot moon pool
Greatly simplified recovery
  • Reverse the installation procedure
Connects to tree like the completion riser
Buoyancy reduces forces on tree & well casing
SSR Performance Features

Can be installed in advance & left unattended
- Facilitates installation by light construction vessel
- Ready for CT intervention
- Is not affected by hurricanes
- Suitable for gulf stream conditions
- Is not a hazard to navigation

Requires no maintenance while installed
Use in any water depth
Brings the seafloor up to convenient depth
- SSR allows shallow water riserless intervention vessels to work in any water depth
Riser Features

Double containment to the surface
Use with both wire line & CT
Less load on vessel’s motion isolation system
Easy to move away from tree for equipment transfers
Stress joint allows big watch circle
CT intervention vessel can:
  • Disconnect & move off riser at any time
  • Relocate riser to an anchor or between trees
  • Leave riser for recovery by construction vessel
Fast reservoir isolation and disconnection in emergency
Near surface disconnection allows vessel to maneuver
Cut CT can be hung below buoyancy to avoid fishing
SSR Installation, Use, & Recovery

Light construction vessel outfitted to install riser

Riser Installation Can Be Separate from Use

Riser can be left unattended

CT Intervention vessel works through SSR

Light construction vessel recovers riser
260-ft ROV vessel
  • DP 2
  • ROV
  • Moon pool
  • Crane or winch line to lower joints as assembled

Handling equipment on deck
  • Dedicated or mobilized to vessel of opportunity
SSR Installation

Casing joint installation starts. Skate move to centerline of deck and prepares to receive riser joints

Joint handler places riser joint on the skate
SSR Installation

Skate presents joint to tower

Elevator accepts upper end of the riser joint
SSR Installation

Elevator upends riser joint and aligns it with previously installed riser joints

Tongs engage riser joint to previously assembled joints
Elevator lifts string to release slips, lowers string, and hangs new joint in slips (as seen from operator’s cabin)

Skate is parked and moon pool cover is made ready for buoyancy module
SSR Installation

First buoyancy module moves to approach moon pool

Weight of previously assembled joints is transferred to spider in moon pool, moon pool cover opens, and rails are swung into place over moon pool
SSR Installation

Buoyancy module moves over moon pool
(uppermost buoy with near surface shear and seal is illustrated here)

Elevator engages top of joint that runs through the buoyancy module
SSR Installation

Elevator lifts buoyancy module, trolley moves back, and moon pool opens

Joint through buoy is connected to the previously assembled string and elevator lifts weight of string off the slips
SSR Installation

Elevator lowers string through moon pool while guide rails on spider keep the buoy centered in the moon pool until it clears the keel.

Injector support frame moves over the moon pool for CT operations.
CT Intervention Vessel

Any existing intervention vessel
Outfit a small vessel for simple jobs
  • Size for sea state
Shallow water riserless system vessels
  • Can work in any water depth
Nominal vessel requirements
  • DP 2
  • ROV
  • Moon pool
  • Crane or winch line to relocate riser extension
  • CT system
Extended Tubing Fatigue Life

Analyzed different deck arrangements
• Arch allows heave, pitch, & roll
• Fewer bends per trip
• Fatigue life is better than when using bending guide onshore
• Reduces side load on riser

Onshore Application of Tubing Arch
Multiple well control provisions
  • Full function CT BOP at surface
  • Near surface shear & seal above buoy
  • Seafloor shutoff device above tree

Control of seafloor shutoff
  • Umbilical for SSD & tree
  • ROV override

Valves on standard tree can be closed
  • After coiled tubing is pulled or sheared
Use Existing CT Well Control Equipment

- CT contractor’s standard equipment
- Equipment & methods refined by years of use
- Crews are trained & experienced on this equipment

- Bending guide
- Injector
- Stripper
- Quad
- Flow cross
- Dual ram blind shear
- Slip rams & tubing rams
Safety & Environmental Protection

Near surface disconnection
- Emergency disconnection for DP drive off
- Routine disconnect to transfer equipment or supplies
- Closures prevent loss of fluid

Seafloor Shutoff Device
Disconnection Segment

Disconnect above buoyancy
Shear both sides of disconnect
  • 2 cuts ensure separation
  • Same shear rating as seafloor shutoff
Isolate riser
Retention for riser extension
Disconnect between shears
Umbilical control
ROV hydraulic override
Calibrated dial position indicators

7-3/8 inch minimum ID provides clearance to recover crown plugs from horizontal trees with 7-inch completion tubing
Seafloor Shutoff Device

Tested to shear 3 1/2-in. tubing
- In tension or compression
- With logging cable
- 10,000 psi rating
- Fast acting
- FMEA completed

7-3/8 inch minimum ID provides clearance to recover crown plugs from horizontal trees with 7-inch completion tubing
Seafloor Shutoff Device

Umbilical control & ROV override
Calibrated dial position indicators
Energy for close, open, & re-close
Packaged in conventional frame
  • 17-ft high high & 14-ft diagonal
  • Same dimensions as a buoyancy module
Less than 25 Tons
Faster response to weather advisories
  • Not necessary to recover riser before vessel departs

Winter weather fronts
  • Disconnect from riser ahead of the front
  • Go back to work when the worst passes
  • Chose larger vessel to improve availability in winter

Faster response to named storm warning
  • Named storms can form in Gulf of Mexico
  • Disconnect and abandon riser on short notice
  • Fewer precautionary abandonments so fewer reentries
  • Abandoned riser is not affected by hurricane
  • Can survive 100 year gulf stream current
Safety & Environmental Protection

Buoyancy designed for safety

• Steel gas-can with double water barrier
  • Liner provides second barrier against flooding
  • Steel hull protects from marine hazards
• Multiple compartments
• Pressure equalized to reduce risk of structural failure
• Dropped object protection
• Light weight buoyancy modules
  • Safer handling on deck
Isolate reservoir at any time by closing SSD

- Red circle nearly 300-ft radius in 5,000-ft water depth

Emergency disconnection in seconds

- Isolate reservoir with seafloor shutoff device
- Close and seal above buoyancy
- Release riser extension connector
- Vessel is free to maneuver
- Leave SSR in place

Routine disconnect for weather or equipment problems

Move off for equipment transfers

- Pull CT or wire line
- Close SSD or tree valves
- Disconnect riser extension
- Leave SSR in place
HAZID

Professional facilitator
More than 24 subject matter experts
  • Reviewed procedures & contingencies
  • Identified risks
Results were assessed and risk ranked
  • HAZID report issued by facilitator
Action was taken
  • Procedures were updated
  • Improved designs were documented
  • More work is planned during detailed design

HAZID found no hazards beyond normal for down-hole work

Practical solutions have been found for all identified items
Questions

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