HWCG - Helix Well Containment Group
Member Operators

...Deepwater operators in the Gulf of Mexico who have come together with a common goal of quickly and comprehensively responding to a well control incident to protect people, property and the environment...
Helix Fast Response System (HFRS)
Well Containment – What’s it All About?

“Responding to and Re-Establishing Control of Well Source”

Response Objectives:
• Safety of Personnel – First and Foremost
• Minimizing Risk to the Environment
• Saving the major assets – rig, resources, and infrastructure
• Minimizing Financial Liability & Reputational Impact
## Well Incident Response Schedule (generic)

### WELL CONTAINMENT ACTIVITY SCHEDULE

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
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<tbody>
<tr>
<td>1</td>
<td>Permit Approval</td>
<td>0 days</td>
<td>Mon 4/1/13</td>
<td>Mon 4/1/13</td>
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<tr>
<td>2</td>
<td>Drill To Production Zone</td>
<td>0 days</td>
<td>Mon 4/1/13</td>
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<tr>
<td>3</td>
<td>RESPONSE</td>
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<td>Incident</td>
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<td>Mon 4/1/13</td>
<td>Mon 4/1/13</td>
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<td>5</td>
<td>Initial Site assessment By Vessel Of Opportunity</td>
<td>2 days</td>
<td>Wed 4/3/13</td>
<td>Tue 4/9/13</td>
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<td>6</td>
<td>Notifications</td>
<td>0 days</td>
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<td>Mon 4/1/13</td>
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<td>7</td>
<td>BOEM/USCG</td>
<td>0.1 days</td>
<td>Mon 4/1/13</td>
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<td>8</td>
<td>Helix</td>
<td>0.1 days</td>
<td>Mon 4/1/13</td>
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<td>9</td>
<td>Primary Contractors</td>
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<td>10</td>
<td>Site Preparation</td>
<td>5 days</td>
<td>Sat 4/6/13</td>
<td>Sat 4/11/13</td>
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<tr>
<td>11</td>
<td>Subsea Utility IV&amp;OC System</td>
<td>6 days</td>
<td>Sat 4/6/13</td>
<td>Sat 4/11/13</td>
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<tr>
<td>12</td>
<td>Mobilize IV&amp;OC Hardware</td>
<td>4 days</td>
<td>Sat 4/6/13</td>
<td>Sat 4/11/13</td>
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<tr>
<td>13</td>
<td>Mobilize IV&amp;OC Vessel</td>
<td>4 days</td>
<td>Sat 4/6/13</td>
<td>Sat 4/11/13</td>
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<tr>
<td>14</td>
<td>IV&amp;OC System in Field</td>
<td>3 days</td>
<td>Sat 4/6/13</td>
<td>Sat 4/11/13</td>
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<td>15</td>
<td>Subsea Utility IV&amp;OC System Deployed</td>
<td>3 days</td>
<td>Mon 4/8/13</td>
<td>Sat 4/13/13</td>
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<tr>
<td>16</td>
<td>Dispersant System</td>
<td>4.0 days</td>
<td>Mon 4/8/13</td>
<td>Sat 4/13/13</td>
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<td>Mobilize Dispersant Hardware</td>
<td>1 day</td>
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<td>19</td>
<td>Dispersant System in Field</td>
<td>1 day</td>
<td>Wed 4/10/13</td>
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<td>2 days</td>
<td>Wed 4/10/13</td>
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<tr>
<td>21</td>
<td>Debris Removal</td>
<td>53.6 days</td>
<td>Mon 5/13/13</td>
<td>Mon 5/13/13</td>
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<td>22</td>
<td>Mobilize Debris Removal Hardware</td>
<td>3 days</td>
<td>Fri 5/3/13</td>
<td>Fri 5/3/13</td>
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<td>23</td>
<td>Transport Debris Removal To Fluid</td>
<td>1 day</td>
<td>Wed 5/1/13</td>
<td>Wed 5/1/13</td>
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<tr>
<td>24</td>
<td>Mobilize ROV Support Vessel</td>
<td>2 days</td>
<td>Thu 5/2/13</td>
<td>Thu 5/2/13</td>
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<tr>
<td>25</td>
<td>Mobilize Construction Support Vessel</td>
<td>2 days</td>
<td>Thu 5/2/13</td>
<td>Thu 5/2/13</td>
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<td>26</td>
<td>Debris removal Plan developed</td>
<td>2 days</td>
<td>Thu 5/2/13</td>
<td>Thu 5/2/13</td>
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<td>27</td>
<td>Debris Removal Activities</td>
<td>12 days</td>
<td>Wed 5/1/13</td>
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<td>28</td>
<td>LMRP or BOP Removed</td>
<td>0 days</td>
<td>Mon 5/13/13</td>
<td>Mon 5/13/13</td>
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<tr>
<td>29</td>
<td>Well Capping (On Won)</td>
<td>16 days</td>
<td>Fri 5/10/13</td>
<td>Fri 5/10/13</td>
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<tr>
<td>30</td>
<td>Mobilize Tested Well Cap System</td>
<td>1 day</td>
<td>Thu 5/2/13</td>
<td>Thu 5/2/13</td>
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<tr>
<td>31</td>
<td>Transport Well Cap System To Deck</td>
<td>1 day</td>
<td>Thu 5/2/13</td>
<td>Thu 5/2/13</td>
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<td>32</td>
<td>Transport Well Cap To Site</td>
<td>1 day</td>
<td>Thu 5/2/13</td>
<td>Thu 5/2/13</td>
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<td>33</td>
<td>Offload Well Cap And Prepare For Deployment</td>
<td>1 day</td>
<td>Fri 5/3/13</td>
<td>Fri 5/3/13</td>
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<td>34</td>
<td>Deploy Well Cap In Safe Zone</td>
<td>2 days</td>
<td>Mon 5/6/13</td>
<td>Mon 5/6/13</td>
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<td>35</td>
<td>Blend By on Debris Removal</td>
<td>4 days</td>
<td>Mon 5/6/13</td>
<td>Mon 5/6/13</td>
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<td>36</td>
<td>Position, Land, and Test Well Cap</td>
<td>1 day</td>
<td>Tue 5/14/13</td>
<td>Tue 5/14/13</td>
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<td>37</td>
<td>Shutt In Well</td>
<td>1 day</td>
<td>Wed 5/14/13</td>
<td>Wed 5/14/13</td>
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<td>38</td>
<td>Monitor Well For Stability</td>
<td>1 day</td>
<td>Thu 5/16/13</td>
<td>Thu 5/16/13</td>
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<td>39</td>
<td>Proceed With Flow and Capture</td>
<td>0 days</td>
<td>Thu 5/16/13</td>
<td>Thu 5/16/13</td>
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<td>40</td>
<td>General Top Hat</td>
<td>11 days</td>
<td>Sat 5/11/13</td>
<td>Sat 5/11/13</td>
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<tr>
<td>41</td>
<td>Modify and Mobilize Top Hat</td>
<td>4 days</td>
<td>Sat 5/11/13</td>
<td>Sat 5/11/13</td>
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<tr>
<td>42</td>
<td>Transport Top Hat To Field</td>
<td>2 days</td>
<td>Sat 5/11/13</td>
<td>Sat 5/11/13</td>
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<tr>
<td>43</td>
<td>Make up Top Hat on 6.0”” Riser</td>
<td>1 day</td>
<td>Sat 5/11/13</td>
<td>Sat 5/11/13</td>
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<td>44</td>
<td>Run Top Hat and Riser</td>
<td>1 day</td>
<td>Sat 5/11/13</td>
<td>Sat 5/11/13</td>
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<td>45</td>
<td>Land and Adjust Flow Rate</td>
<td>3 days</td>
<td>Wed 5/11/13</td>
<td>Wed 5/11/13</td>
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<td>46</td>
<td>Early Capture to Q-4000</td>
<td>0 days</td>
<td>Sat 5/11/13</td>
<td>Sat 5/11/13</td>
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<tr>
<td>47</td>
<td>Well Kill</td>
<td>20.1 days</td>
<td>Mon 5/13/13</td>
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<tr>
<td>48</td>
<td>Mobilize Pumping Services</td>
<td>4 days</td>
<td>Mon 5/13/13</td>
<td>Mon 5/13/13</td>
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<td>49</td>
<td>Mobilize Q-4000 To Location</td>
<td>6 days</td>
<td>Mon 5/13/13</td>
<td>Mon 5/13/13</td>
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<td>50</td>
<td>Mobilize Test package to Q-4000 and Test</td>
<td>4 days</td>
<td>Mon 5/13/13</td>
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<td>51</td>
<td>Prepare IRS For Deployment</td>
<td>1 day</td>
<td>Sat 5/11/13</td>
<td>Sat 5/11/13</td>
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<tr>
<td>52</td>
<td>Deploy IRS in Safe Zone and Stand By</td>
<td>3 days</td>
<td>Sun 5/12/13</td>
<td>Sun 5/12/13</td>
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<tr>
<td>53</td>
<td>Move Over Well and Land IRS To Well Cap</td>
<td>2 days</td>
<td>Sun 5/12/13</td>
<td>Sun 5/12/13</td>
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<tr>
<td>54</td>
<td>Perform Well Kill and Abandonment Scope</td>
<td>2 days</td>
<td>Sun 5/12/13</td>
<td>Sun 5/12/13</td>
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<tr>
<td>55</td>
<td>FLOW and Capture</td>
<td>7.1 days</td>
<td>Sun 5/3/13</td>
<td>Sun 5/3/13</td>
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<td>56</td>
<td>HPI Operational</td>
<td>0 days</td>
<td>Sun 4/28/13</td>
<td>Sun 4/28/13</td>
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<td>57</td>
<td>HPI Mobilization</td>
<td>5 days</td>
<td>Sun 4/28/13</td>
<td>Sun 4/28/13</td>
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<tr>
<td>58</td>
<td>HPI On Location (With Tanker)</td>
<td>0 days</td>
<td>Sun 4/28/13</td>
<td>Sun 4/28/13</td>
</tr>
</tbody>
</table>
Value to Noble as Responsible Party

- Evaluate NEI Management Systems
- Enhance preparedness & operational procedures
- Expand personnel training & familiarization with WCP
- Manage Risk through Risk Assessments, HAZID/HAZOP
- Find the Gaps – Collaborate with BSEE/USCG/mutual aid participants

Acronyms:
WCP – Well Containment Plan
BSEE – Bureau of Safety, Environmental & Enforcement
USCG – United State Coast Guard
Deployment Objectives: BSEE – Noble/HWCG
(met or exceeded expectations)

- Ensure safety for all participants
- Deploy and Test Capping Stack
- Verify functionality of WCST / modeling process
- Incorporate Source Control into ICS
- Document decisions and actions using ICS
- Establish a Common Operating Picture Platform

Acronyms:
- WCST – Well Containment Screening Tool
- ICS – Incident Command System
What was the Deployment?

Test Stump Adapted to Suction Pile for Deployment Demonstration – 5,062’ WD in GC 723
Seafloor Isometric View – GC 723

Area for suction pile > 5000' WD

GC 723 # 1 ST1 actual well location

Isometric view of seafloor with the proposed 723-E Amended location and anchor zone
Capping Stack Deployed on Wire from Intervention Vessel
ROV Operated Function & Pressure Testing
Noble Command Post
Unannounced Deployment Exercise

- Initiated - 0730hrs April 30, 2013
  - Government Representatives arrives at Noble’s office to deliver blowout scenario
  - Noble activated response teams & equipment, and HWCG member company Mutual Aid personnel
  - Day 1 – Surface oil spill response portion concluded as defined by BSEE
  - Day 2 to Day 8 - Transitioned to remote Source Control Center (manned 24/7, involving 140 personnel)
COP – Common Operating Picture

Web based “Dashboard” containing:
Weather Data, Vessel Locations, Streaming Videos,
Reference Data, Equip / Personnel, GIS info, Etc...
GoM – HWCG Deployment
Remote Source Control Center

- 9,000 sq ft
- 23 Flat Screens with independent computers
- 12 Overhead Projectors
- 7 Printers / 2 Plotters
- VTC & Phone System
- Supplied breakout rooms for gov’t agencies
Pressure Data Acquisition System (PDAS)

“Redundancy”

Data Capture

- Direct Hydraulic
- Acoustic

Pressure Sensors

- Upper Ram
- Lower Ram
Well Integrity Analysis Process Flow

Starts with Pre-Drill well data and conditions:

- Update Pre-Drill with **actual well data** and well conditions
- Determines well classification as “Shut-in” or “Flow & Capture”
- Provides for **appropriate approvals** of the well shut-in procedure to retain well integrity
- **Execute the shut-in procedure** constantly monitoring adherence to the model.
- **Significant deviation** may require another assessment of the WCST and the ability to shut-in the well or flow/capture.
Well Integrity Pressure Boundary Analysis

Soft Shut-in Pressure Response Curves

Models:
- Prosper
- Gap
- Mbal
- OLGA

Models:
- Prosper
- Gap
- Mbal
- OLGA

Vertical Line Definitions:
- Main Bore - Start Closure
- Main Bore - End Closure
- Choke #1 - Start Closure
- Choke #1 - End Closure
- Choke #2 - Start Closure
- Choke #2 - End Closure
Lessons – Critical Success Factors

- **Communications**
  COP / Visual Displays / SCC layout greatly aided response and communication.

- **Command Structure**
  Source Control Integrated into ICS and Section Chief added to Unified Command.

- **Pressure Data Acquisition**
  Redundant Pressure Data Acquisition, high resolution data rate.

- **Well Integrity Analysis**
  Well Integrity Pressure Boundary Analysis chart successfully exhibits the safe operating range to non-technical personnel.
Response Strategies

• Develop WCPs “in alignment with” Company Management Systems

• Drilling teams understand the significance of response planning during well design & operations (i.e. retain Well Integrity).

• “Pre-established” Partnering (Operators, Gov’t Agencies, & Contractors)

• Ensure Competency of Response Personnel

• Manage Reputational Risk - set expectations with all stakeholders.
Capping Stack Deployment Lifecycle
Risk Assessment vs. Managing Risk

Planning v. Reality

Risk Assessments identify hazards & controls and assumes controls are established, in place and effective.

Risk Management is the verification and assurance that controls are established, in place and effective.

Where applicable management of situations were controls are ineffective.
Preparedness

• Properly Identify Risks “prior to” and “during” response.
• Build trusting relationship with Gov’t Agencies.
• Personnel must be familiar with response equipment & “How to respond”.
• Define Well Specific categorization – “Shut-in” or “Flow & Capture”.
• Review Rig Specific equipment - opportunities and/or limitations.
• Evaluate Mutual Aid Response needs – personnel, rigs, vessels, air craft.
• Engage in HAZID sessions with core Contractors.
• Develop Procedures for all stages of an incident response.
Readiness

• Operator is prepared for a credible scenario.
• Access to well specific data, response plan, notification process, etc...
• Source Control team trained in ICS protocols.
• Personnel are qualified for and familiar with their specific roles.
• Table Top Exercises have tested all stages of a comprehensive response.
• Ensure that adequate ER facilities are ready (ICC & Source Control).
• Ability to set up Common Operating Picture “COP”.
• Identified response contractors are “pre-approved” with agreements in place.
Global Response Organizations

- **Global:** (excluding GoM)
  - **OSRL,** 4 Capping Stacks, 2 Subsea Incident Response Toolbox (Flow Back Containment equipment delivery late 2014)
  - **WWC,** 1 Capping Stack (1 additional ordered)
  - **Other,** 7 independent operator ownership of Capping Stacks
  - Working solutions for Caribbean and Pemex GoM
- **GoM:** (equipment dedicated to GoM)
  - **HWCG,** 2 Capping Stacks, 130,000 BFPD Flow Back Capacity
  - **MWCC,** 2 Capping Stacks, 100,000 BFPD Flow Back Capacity

- **Total Capping Stacks as of Dec. 2013:** 16 + estimated
Global Response Equipment

[Images of various equipment]
Various Containment Systems
What is the BIG Picture?

Delivering Life-Cycle Well Integrity through

• Competency and Cultural Discipline
• Identifying and Managing Risks
• Detailed Well Design & Response Readiness
• Following the Operational Plan
• Adherence to MOC Process – governs changing risks

BEWARE of COMPLACENCY
Questions

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Global Operations & EHS&R

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“Energizing the World, Bettering People’s Lives”