Top Kill

Diagnostics Program
Can we kill the well?

Pumping
1. Mud Momentum Kill
2. Partial Bridge & Continue Mud Momentum Kill
3. Seal & Continue Mud Momentum Kill

Prerequisites Before Starting:
- Model Confirms We Can Kill Well
- 18” Casing Set on Relief Well
- Casing Shears re-closed
- Dispersant Approval
- Kit for Riser Cut
- Containment Tool Kit on Bottom
- HC Connector on DII Stack

Is the Well Dead?
- Flow at Mudline? Not Dead
- Static Head
- Suction Head?

Pump Cement
Top Kill Sub-Sea Layout
Diagnostic Objectives

- Ability to Kill Well
  - Functionality of valves
  - Blockages in system
  - Number of access points

- Identify ?P
  - BOP and LMRP
  - Confidence to kill well
  - Preferred route to pump

- Identification of Closed Chambers
  - Drill pipe or not
  - Ram seals or not

- Restrictions or Limitations to Pump Kill
  - Alternatives or backups to path
  - Verify installed equipment pressure drops
System Pressure Limitations

Boost line Pressure
2600 psi

Lower Stack Pressure
3400 PSI (5/20)

BOP

Heavy Mud

Oil

16" Seal Assembly
Burst Disks

9-7/8"
7"

16"

Reservoir 1,550 psi

Estimated SM Pressure 3,400-3,500 psi
Top Kill Pump Schedule Boundaries

- Do not enter Red Zone during kill operation
- Operate as required in Green Zone

Disk 1 | Disk 2 | Disk 3 | End of Job
--- | --- | --- | ---
Barrels Pumped | 300 | 600 | 750 | 8300
Minutes (App) | 6 | 15 | 20 | 210

bp
Assumptions: 10,000 STBO/D, 400 psi differential in BOP's, Deep flow restriction
50 BPM for 6 minutes then 40 BPM until finished pumping

Work by: Dr. Ole Rygg, Thomas Selbekk, Kirt Mix, Mike Mullen
The Fleet for the Top Kill

**Heliomatrix Sting Star III**
- **Length**: 200 ft
- **Beam**: 50 ft
- **Fuel Capacity**: 8,970 gal
- **Propulsion**: 12,000 hp
- **Power**: 61,100 BHP (8 pumps)

**Q4000**
- **Accommodation**: 133 people
- **Length**: 312 ft
- **Beam**: 204 ft
- **Fuel Capacity**: 300 TPD
- **Deck Capacity**: 6,000 TPD

**HOS Stingray**
- **Accommodation**: 52 people
- **Length**: 181 ft
- **Beam**: 72 ft
- **Displacement**: 13,920 lb
- **Discharge Rate**: 50 gal/min
- **Liquid Mud Storage**: 31,170 gal
- **Helematrix Kill & Circulation EDDI**: 60 gal/min (Outpur 19,000 bbl)

**HOS Centurion**
- **Accommodation**: 67 people
- **Length**: 305 ft
- **Beam**: 72 ft
- **Displacement**: 13,920 lb
- **Discharge Rate**: 50 gal/min
- **Liquid Mud Storage**: 31,170 gal
- **Helematrix Kill & Circulation EDDI**: 60 gal/min (Outpur 19,000 bbl)

**BJ Services Blue Dolphin**
- **Accommodation**: 45 people
- **Length**: 300 ft
- **Beam**: 60 ft
- **Fuel Capacity**: 11,000 gal
- **Power**: 26,000 hp
- **Power**: 26,000 hp
- **Fuel**: 61,100 BHP (8 pumps)

**Top Kill Surface Operations Layout**

BP-HZN-2179MDL00993073
Key Decisions

- Go/No Go
- Can we kill the well?
- Is the well dead?
- Bridging & Sealing BOP
- Cementing
- BOP on BOP
- Cut Riser
- Weather Impacts
- Changing to BU boat
- Riser kink failure
- Working the hours of darkness
Top Risks

? Broach at the Seabed
  ➢ 15% SF on Burst Disk
  ➢ Pump Schedule

? Do Not Kill Well, More Oil Flowing
  ➢ Erosion/Kink

? People, Pressure, SIMOPS
  ➢ Operational Control
  ➢ Organization
  ➢ Communications

? Pressure Data Reliability
  ➢ 5 Sources SS
  ➢ Surface to SS Pressure Relationship  Finger Printing

? Impact Relief Well Success

? Public Perception of Failure
<table>
<thead>
<tr>
<th>Option</th>
<th>RITT 1</th>
<th>RITT 2</th>
<th>(A) RITT 3</th>
<th>Hot Tap</th>
<th>Top Hat End of Riser</th>
<th>(B) LMRP Cap</th>
<th>BOP Cap</th>
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<tbody>
<tr>
<td>Location</td>
<td>Operational</td>
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<td>?Collection is not 100%</td>
<td>?Drill and seal tap</td>
<td>?Crimp Riser</td>
<td>?Seals</td>
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<td>Option</td>
<td>(C) BOP on BOP</td>
<td>(D) Flex Joint or BOP Overshot</td>
<td>Swing Valve on LMRP</td>
<td>Cap Stack on LMRP</td>
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Potential Flowrate Multiplier

Proportional Increase In Rates
Current WHFP vs Seabed Ambient Pressure

Flowrate Multiplier

Flow in Annulus, No Drill String, Skin = 0
Flow in Annulus, No Drill String, Skin = 50
Flow in Annulus, Drill String, Skin = 0
Flow in Annulus, Drill String, Skin = 50
Flow in Casing, Skin = 0
Flow in Casing, Skin = 50