Relief Well Ranging Strategy
Relief Well History

Santa Barbara oil spill occurred in January 1969 in the Santa Barbara Channel in Southern California.

According to Dr. Preston Moore the first relief well ever was for this problem and the objective was to penetrate and produce the reservoir to blowdown the pressure and thus “stop” the flow, e.g., RELIEF WELL “relieved” the pressure in the reservoir.
Why do we drill relief wells?

Answer: Because we have to!

If there is another solution, it is taken because time is the driving factor in any well control event.

SOLUTION MUST BE SOONER RATHER THAN LATER IN ALL CASES.
GOM Event 2007
Off-bottom Kill Objective
N. America HTHP Land
Lake Maracaibo crater circa 1988
Swamp Barge Rig Marea after a few hours of exposure to fire
Dewi9 on TNE5 with RW in the background

Big crocodiles!
How Does Ranging Fit Into the Project

RELIEF WELL TEAM

WELL PLANNING

PROXMINITY LOGGING (Ranging Runs)

FLOW ASSURANCE / HYDRAULIC MODELING

DIRECTIONAL DRILLING / MWD-LWD

INTERCEPTION / COMMUNICATION

Survey Mgt.

LWA Aug-10
Overlapping responsibilities
OVER ALL OBJECTIVE – STOP THE FLOW – STABILIZE THE WELL

- Incident begins
- Corporate Image
- Quality of Press Releases with pre-plan
- Image with a pre-plan
- Quality of Press Releases sans pre-plan
- Image sans pre-plan
- Time
- Time Savings
- Flow stopped
- Flow stopped
- Quality of Press Releases

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IMPACT OF TIME

- **Pre-Plan BCP**
- **Pre-Planned Project Curve**
- **Normal Project Curve**

- Incident begins
- Flow stopped
- Pollution stopped
- Production Lost / Pollution

- Cost of Control
- Time
- Cost Savings
- Time Savings
- Production Lost / Pollution
- Pollution saved
OBJECTIVES

• Allow communication for a pump to kill operation
• Least risk per ALARP (as low as reasonably possible)
• Least time possible (time = exposure in blowout)
The “real” Objective

• Hit a VERY small target and make a communication:
Proximity Choices: WL (active) or MWD (passive)

- Why choose one over the other?
- Both have strength and weaknesses
- Active has greater range (in most cases)
- Passive uses tools that are already in the hole (MWD) – no trip out to obtain data (provided you are within the detection range)

LOGICAL ANSWER: Use both
Relief Well Plans are now part of the Emergency Response Plan ERP for high risk (pollution)
Angle Impact
(Incident and EOU's size)
Large Incident Angel
Small EOU
Low Incident Angle
Large EOUs
Ranging in small EOU

Well Separation

Sum of Surface + RW + Blowout Well

Uncertainty 28m (diameter)

MWD Proximity Range
24m (diameter)

Change in azimuth

Sweeping thru the ellipse to locate Blowout Well Casing
Large Incident small EOUsl
Small EOU but high Incident angle

Major Axis x Vertical
@ 9-5/8" Casing Shoe
118 x 46m

Active 35 deg Incident angle

EOU Combined
Major Axis x Vertical
@ 9-5/8" Casing Shoe
155 x 70m

Passive
9-5/8" 43.5 lbs/ft

LWA Sept-15
LWD/MWD Ranging

Trace across the ellipse of uncertainty

Well Planning Extends Range-of-Detection
Sweep thru the EOU holding angle
Example Strategy for Ranging

8-¾” Phase Blowout
Vertical section

NOTE: Hold trajectory is maintained until casing is detected with proximity logs.

Detection, mapping of relative position SEE NOTE

MWD Bit Sub Anti-collision

Line up to parallel AZ 176°

Match AZ and parallel @ 4 to 7 m separation

Hold AZ 166° Inc 81°

Nudge away if needed to avoid unplanned collision

End Hold @ far side of EOU AZ 166° Inc 81°

Check shots

Drill out with slim BHA and hit well to communicate

Line up to intercept 4-6° attack angle

Case well after lined up to hit

PUMP TO KILL WELL CONTROLLED

NOTE: Hold trajectory is maintained until casing is detected with proximity logs.
ABEL Generalized Ranging Strategy

• Aim at a point where the EOU is manageable (not all that big if possible)
• Use near-bit inc. and MWD as anti-collision and ranging
• Drill to that point where calcs say detection should have happened
• If no go Log the hole with WL and or EMS run or continuous MWD to increase detection range
USE DEMMING MODEL

Emergency Event

Identify Real Problems

- Assess risks v. benefits
- Evaluate Available Resources

No

- Improve future response capabilities

Yes

Monitor Results

Problem Solved?

Determine Possible Actions

Identify Actions

Get It Done

- Identify personnel roles
- Determine desired activities
- Request resources

Use ICS systems

Stop work & record activities

- Ensure safety of personnel
- Communicate Actions Clearly

Hazards to people/environment?

- Damage to property
- Incident Response Needs
- Timeframe
END OF PRESENTATION