

Realities of Drilling that Geologists Need to Know*

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Abstract

The operations workflow in most E&P companies involves discipline-centric teams, drilling, completions, production and geology, working in isolated groups with limited communication occurring between the teams. While these teams typically act as if they were individual groups of consultants, the reality is they are working for a common employer with what should be a common goal: maximizing return on a portfolio of resources. Unfortunately, it often does not look like a common goal exists at the implementation level, particularly when it comes to geosteering. Drilling engineers, geologists and field personnel seem to drill and steer wells in spite of companies' workflows, instead of because of those processes.

While different goals and measures of success will obviously exist from discipline to discipline, the fact that each group rarely understands the reasoning behind other team's decisions leads to a fractured and inefficient drilling process. Each team has a reason for their basis of design and how they manage real-time processes and optimization of wells' performance. These reasons are generally not communicated or understood outside that particular discipline team. This presentation discusses the dynamic between geologists, engineers and field personnel from a drilling engineer's perspective. It covers the common problem areas and dissimilarities in goals which are the root of most differences between these three groups. The typical goals or metrics by which drilling engineers and field personnel make decisions will be discussed. The presentation is not designed to be a lecture on drilling basics. Instead, it will use the geosteering process as an example to foster a practical discussion on how to understand and subsequently utilize the differences that exist within E&P companies' operational teams to improve the well construction process.

The Drilling Engineer – Geologist Dynamic

**Also called “What I Wish My
Geologist Knew about Life and
Drilling”**

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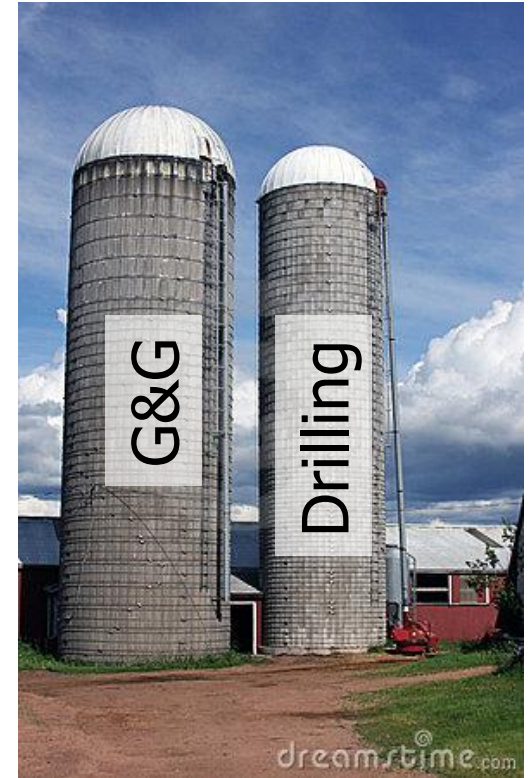
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The “Team” Concept

<https://youtu.be/R55e-uHQna0?t=35s>

What is the Problem?

- Disciplines are “siloed”
- Differing “local” goals and metrics
- Lack of knowledge
 - Operational and technical
 - What are the consequences of decisions?



Is There a Solution?

- Communication
 - Drilling Engineer
 - Field
- Education
- Not necessary to organize into asset teams or rig teams



What Exactly Are We Doing Here?

Geologist Definition

Geologists locate, recover, and ~~maintain~~ the world's oil and gas supplies. They are the innovators who use cutting-edge technology to create new methods of discovering and drilling for oil. Although there are various job descriptions, Geologists all serve one function-to provide the world with energy, while safeguarding the environment for future generations.



What I Wish Geologists Knew: Engineering Knowledge

- Mathematics & Physics of:
 - Wellbore stability, hole cleaning
 - Getting from point A to point B (directional drilling calculations)
 - Torque and Drag

Why these specific things?

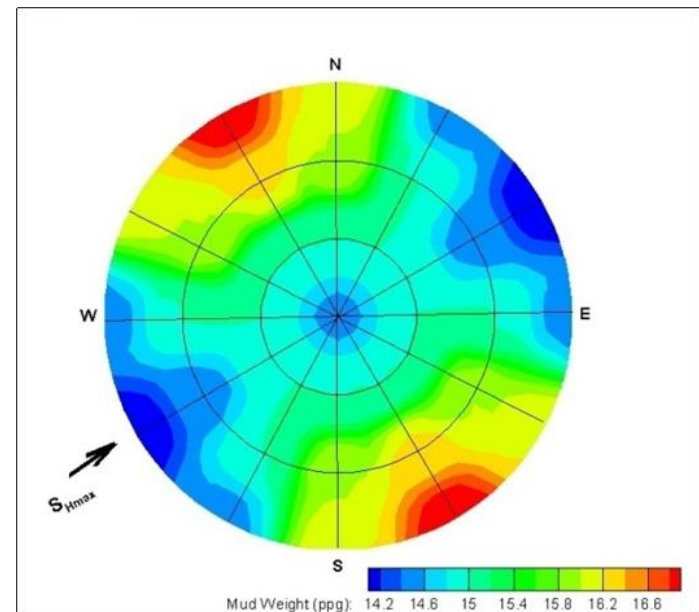
They all are an affect on or due to wellbore trajectory

What I Wish Geologists Knew

Wellbore Stability and Hole Cleaning

Wellbore stability and hole cleaning are dependent on

- Mud properties
- Operational practices
- Angle of well in formation
- Stress in rock



What I Wish Geologists Knew

Directional Drilling

- It is an art
- Know basic math (and what it means operationally)

2 - D Directional Planning Equations:

$$\Delta TVD = \frac{5730(\sin(I_2) - \sin(I_1))}{BUR}$$

$$\Delta VS = \frac{5730(\cos(I_1) - \cos(I_2))}{BUR}$$

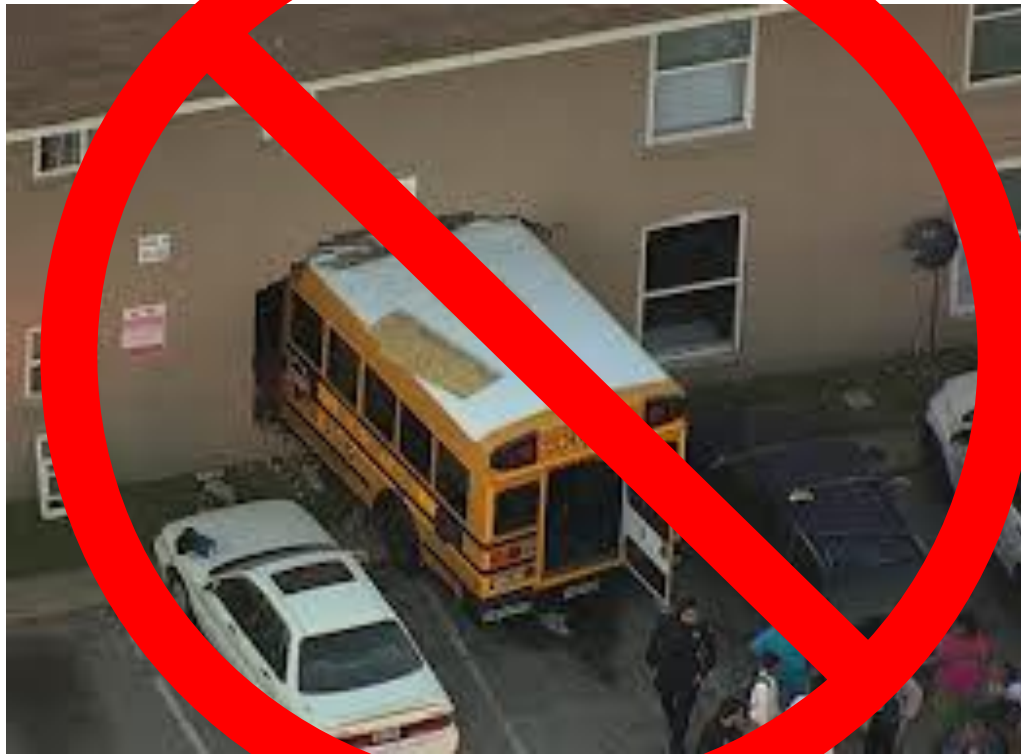
$$\Delta MD = \frac{I_2 - I_1}{BUR}$$

What exactly is a projection?

What is A Projection?



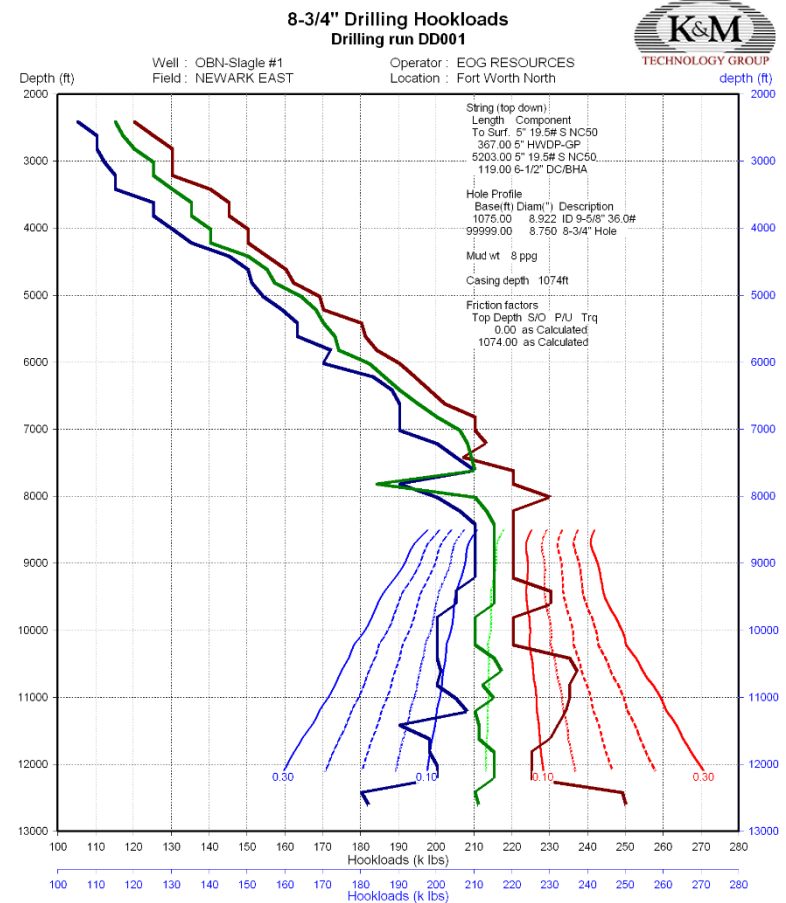
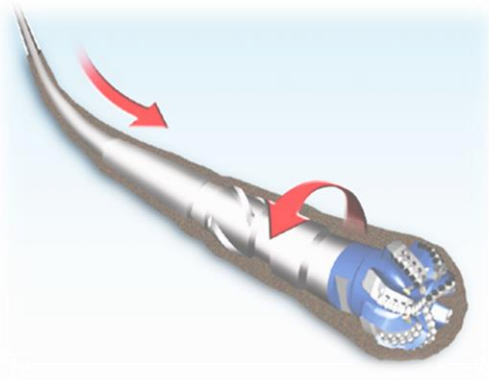
What is a Projection?



What I Wish Geologists Knew

Torque and Drag

- Torque: force to turn the drill string
- Drag: resistance to axially moving the pipe.



What I Wish Geologists Knew

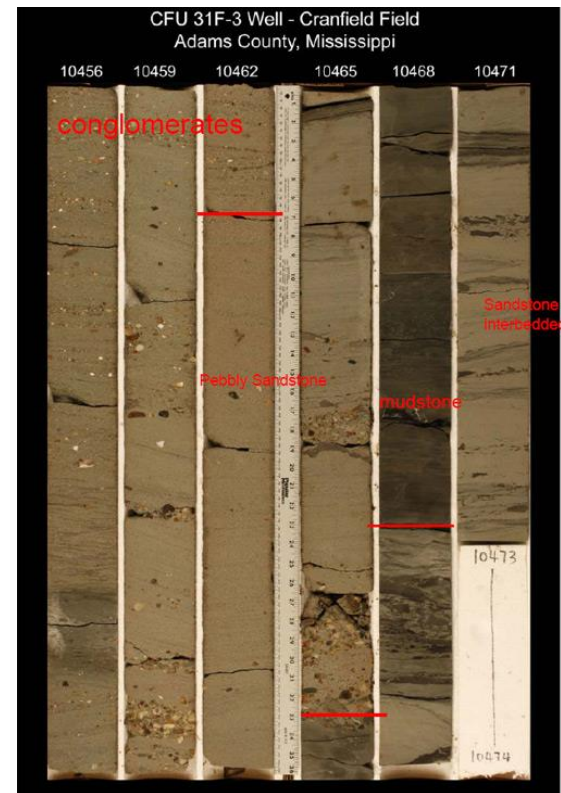
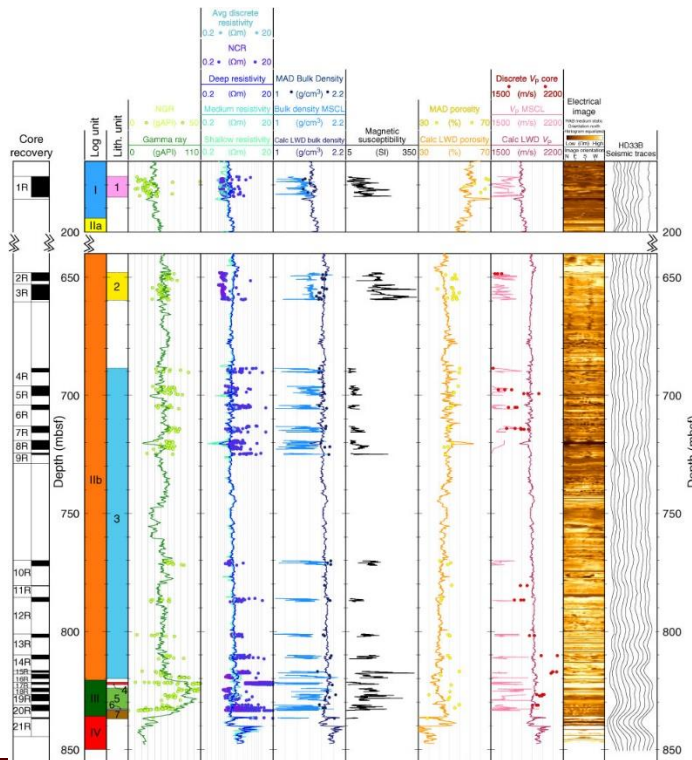
There are consequences to your actions



What I Wish Geologists Knew

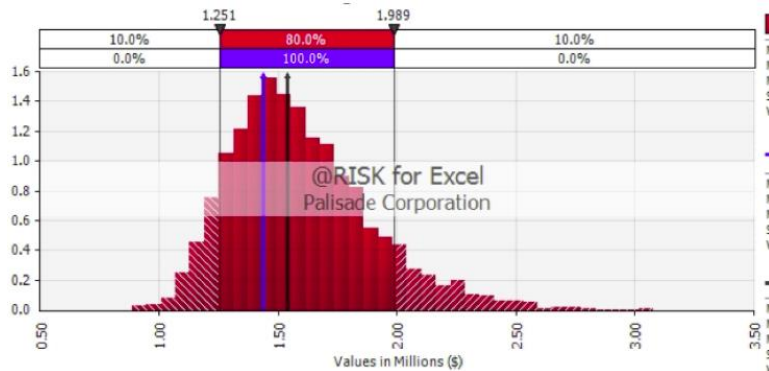
The True Cost of Data

- Operational (day rate, etc)
- Risked Cost



What I Wish Engineers Knew

- Uncertainty, uncertainty, uncertainty
- Engineers (and humans) are a deterministic species



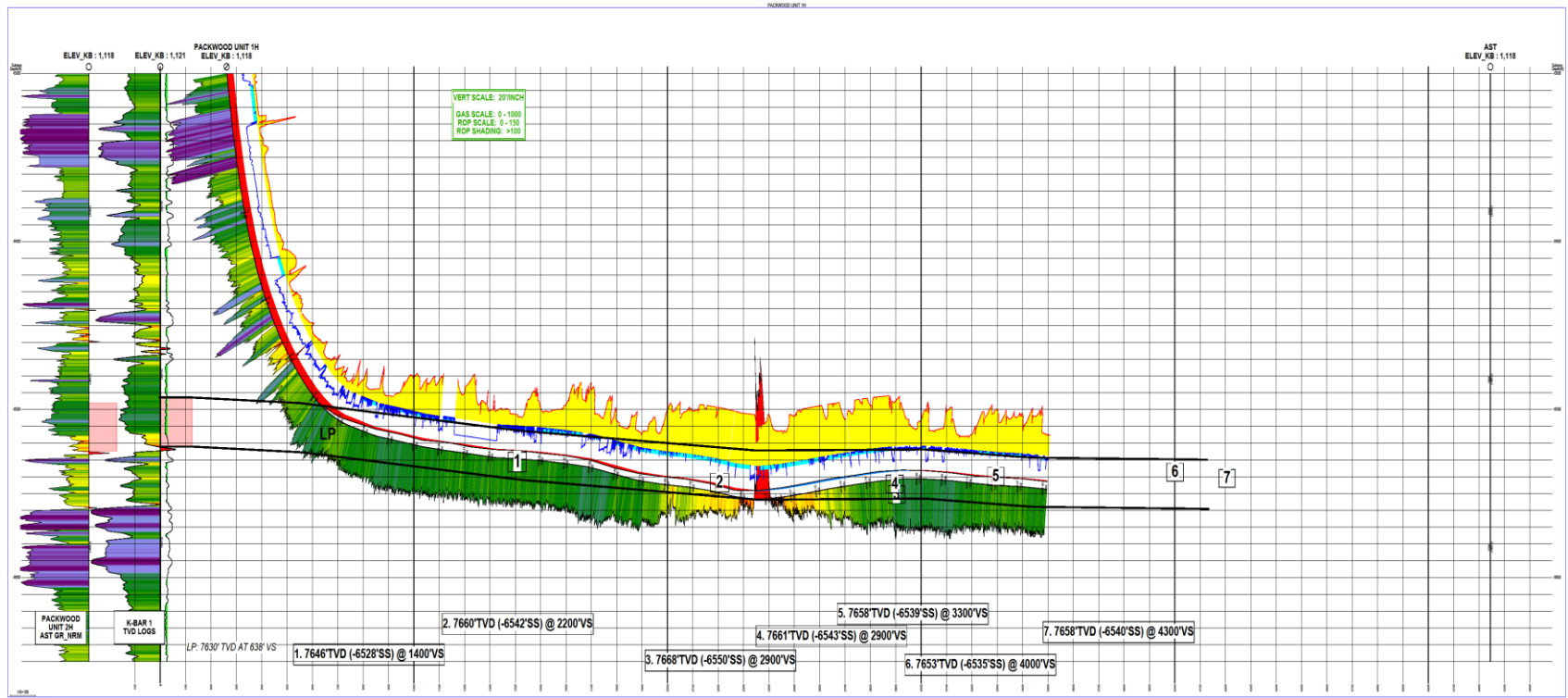
- Need to understand the uncertainty (and thus the risk)

How Is Success Measured?

- ~~• Production and overall economics (F&D, ROR, IRR, NPV, etc)~~
- Ops geologists: % in zone, number of stages left out
- Drilling engineers: Cost and speed



What Should It Look Like?



What Should It Look Like?

Communication: which one are you?



Or



What Should It Look Like

Education

- Drilling Engineers
 - Petroleum Engineering degrees
 - Non-petroleum degrees
- Geologists



What Should It Look Like

Organization

Silos have advantages, especially in improving technical skills



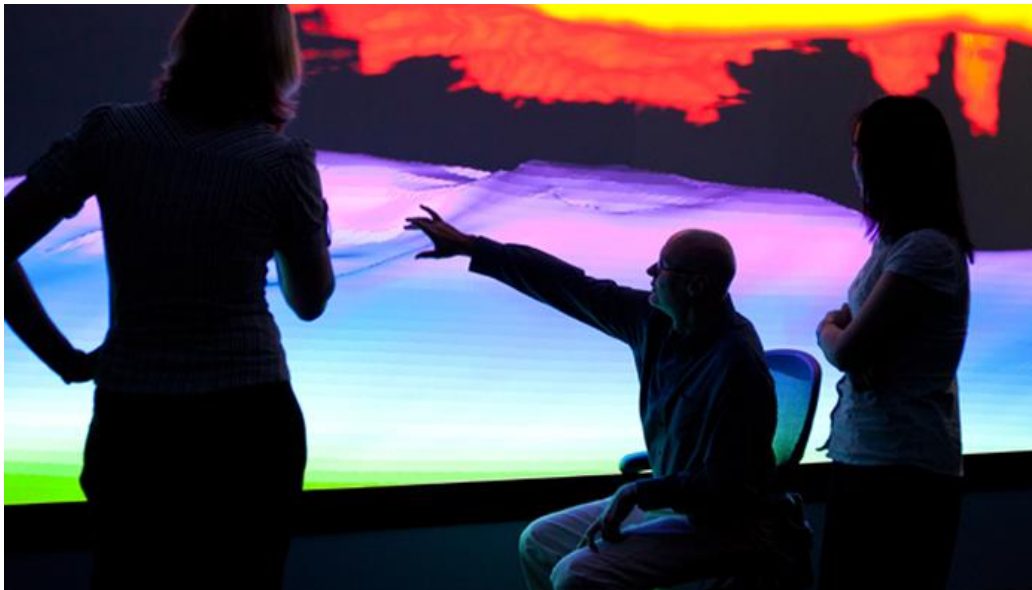
Asset teams are good for operations but limit technical personnel

But We're Already Doing This!

- Answer: *Are you really?*
 - If you're doing just enough to get the job done then you're doing just enough to be average.
 - Look at the average companies right now vs those that perform (wells drilled in fast and in zone)
-

Questions to Ask Yourself:

- Are you training geologists in drilling or do they learn as they go?
- Do you explain decisions to office and field teams and empower or do you pass down edicts?



Questions to Ask Yourself:

- Do you understand why the “other side” pushes back on a decision or request you made?
- **Does your geosteering process leave money on the table?**



Thank You

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