Talking Points from Fred Dupriest:

-We need to first determine what elements really drive "total system reliability", and more importantly which of these can actually be significantly changed. The regulatory assessment process in the nuclear industry is a very good model.

-I think reliability in our industry is more about how we do the work (70%), and not the equipment (30%) reliability. There's nothing wrong with making the equipment better, but we also don't want this to be a red herring. For example, how much will proposed changes in equipment really effect the overall total system reliability. Even when equipment plays a big role, reliability still depends mostly on there also being recognition, analysis, and response. We need to be honest about this.

-We want change in reliability, and in the end that can only happen if someone actually changes how they do their work. Engineers should map that out for all proposed changes in how someone works, including how they might use digital data. Changing the way people work is not simple. We cannot simply demand change to new practices, as we can demand compliance with existing practices. But we can enable it. The Limiter Redesign workflow developed by ExxonMobil is an engine for change and consistent application of the principles has clearly separated them from the industry in terms of their ability to drill very complex wells very fast. The change process is generic for any activity that is dominated by workflow, as I believe our total system reliability is. I used a change in how we might do negative pressure tests as an example of what we might do differently if we redesigned the workflow, and if we used digital data to do that. But the generic process is the same for any limiter.

1. <u>Identify what really limits</u> the desired performance (the "Limiter")
2. <u>Develop a deep understanding of the physics and new physics-based practice consistent with the new knowledge</u>. Without new knowledge, you will never end up with a new practice, and change can only come if someone does the work differently. Do not use statistics to design practices, understand and design practices deterministically based on a deterministic understanding of the work.
3. <u>Ask the person doing the work what risk</u> (concerns) they have with the new way you are asking them to work. The prima fasciae change is rarely what bothers them. It's a collateral, high risk, affect you may not be aware of. That's what you have to redesign in order to get them to make the prima fasciae change. They are just trying to do the right thing, and engineers need to take full

responsibility for the full range of effects their proposed changes may have. Given the potential risks of many collateral affects, anything less is irresponsible engineering.

4. Demonstrate management support for the change. This is not a signature on a piece of paper. It's a demonstration of support that the person doing the work is aware of, and proof that leadership honestly believes in the change. Change takes courage and it's about emotion. Managers must create an emotionally resonant sense of purpose for any programmatic effort to get people to change the way they work.
5. Provide very specific step by step procedures and training in the new way of doing the work. You must teach a certain level of underlying physics all the way down to the person on the break handle if you want change. This is not true if you want perfect execution of an old practice, but it is true when we're trying to get the initial change. The detailed field procedure is usually best developed through well-organized field trials with only one team. Your first procedure will always be wrong or severely incomplete. Once it is mature enough that one team has a high level of confidence in what they are doing, it is then rare for other teams to have large issues with it.
6. Develop a metric to show that people actually have changed the way they work. Do not use ROP, trouble time, footage per day, safety statistics, or any other secondary metric. The metric should prove that the work is being done in the new way. If you have the workflow right, the result you want will follow.

-Stop obsessing with trouble time and the failure even itself. Failure in system reliability works just like fatalities in the safety pyramid. For every significant event, there were always a very large number of near misses. In reality, we need to be considering redesign or changes in workflow to eliminate all near misses, and we would have not significant events. Since most near misses are actually due to workflow or recognition and response, the redesign of near misses is almost always very cheap (unlike equipment, which actually has less impact on total system reliability in drilling). See SPE 134580 for discussion of near miss recognition and response practices in drilling. The practices are applied to performance, but the process and philosophy would be very similar for total system reliability.

-No matter what we do, there is no substitute for teaching the people who do the work more about the physics of what they are doing. The central change in Limiter redesign is to stop just telling people what to do. Drilling is extremely dynamic and unpredictable and constant recognition and response is required. People who have just enough knowledge to respond by understanding the physics perform

much better than people who respond with standard practices, so called best practices, or dogma. Our drillers do not necessarily understand who swab, surge, wellbore ballooning (breathing) or thermal expansion during negative pressure tests physically work. And yet they manage these every day.

The barrier philosophy in API RP 96 is expressed in terms of total system reliability. RPP 96 is the deepwater engineering design and operational practices developed by the industry after Macondo and adopted by BESEE. You may want to take a look at the Barrier discussion in that. Over 60 companies participated in this. You can see that the industry understands that workflow and people are important in total reliability, but we haven't done much to rigorously engineer those things. It's very difficult due to specific difference in rigs, well behaviors, crew experiences and other factors. RP96 went as far as it could in providing some standardization to most key processes. One way forward is to look at each work process described in RP96 and ask:
How would digital data be used in this process to further improve total system reliability?
The next question would be, would total system reliability be best served if this was done on-site or off-site?
And finally, would total system reliability be best served if it was done through design and surveillance responsibilities assigned to the well's engineer, or through responsibilities assigned to an offsite 24 hr digital surveillance team.

Altogether, in order to assess the potential value of offsite data centers, we actually need to start with asking what really determines total system reliability, and also what is actually the lowest hanging fruit with the greatest potential impact. There are hundreds of things anyone could do that would improve reliability. But some have little actually numerical impact if you look at what actually determines total system reliability. Realistically, we need to focus our resources on those with the greatest impact, and also the greatest achievability. That's how we will move the numbers the most.