



Instrumentation has Gone Mainstream...

Have You?

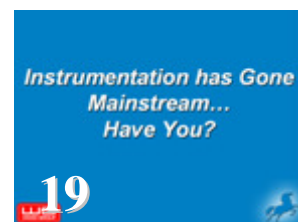
By Bill Higgs

Wow! I have really been looking forward to visiting with you on how to take over the world...it is within your grasp!

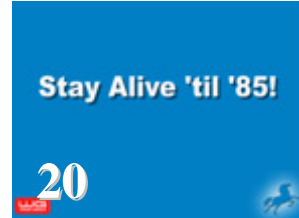
I would like to thank Jack Jennings for inviting me to speak today. We go back to pre-Mustang days when I was sizing control valves with a Fisher slide rule. He has watched the Mustang story unfold and felt parts of that history would be interesting to share. Plus you may learn some things about upstream project execution.

I have also spent some time with Bob Zerda of Chevron discussing philosophies and execution strategies for automation projects. He was very interested in how you apply "concrete and steel" project execution methodologies to automation. Thanks Bob for your support of this talk.¹⁹

Now, you have to understand that my background is Upstream, offshore (as in over



water) projects. When we started Mustang in 1987, the oil patch was about dead and ready for a toe tag. ²⁰“Stay alive ‘til ‘85” did not work and layoffs had cut deep; every neighborhood had multiple foreclosures up and down the street. If you finished a project at an engineering firm you were let go, so there was no loyalty between companies and people. Obviously, this environment was not conducive to executing great projects.



So, we had some goals when we started. We wanted to be the best project execution company, such that we could do any job in order to keep our teams together. You will notice a theme as I proceed...it is all about PEOPLE²¹...project execution and profitability will follow that dedication. We wanted to build strong teams that worked back to back projects so their manhours reduced, making them more competitive for future work. We called this ²¹“Steady work for Steady People” with a focus on repeat work. We wanted a ²¹“Just Do It” mentality with an understanding that engineering is



a “necessary evil” to get into procurement and construction. That is a pretty strong concept coming from the owner of an engineering firm...Engineering is a necessary evil. We wanted to ²²re-use prior work to help get ²²engineering off the critical path. That is a huge statement...getting engineering off the critical path. I had a major oil company say we couldn't do it on an upstream project due to all the changes...BUT WE DID!



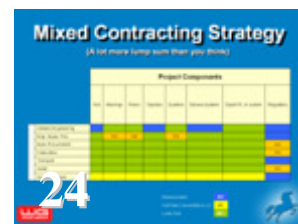
So even though we would be reimbursable, we would cut our manhours with great execution strategies and ²³just do more projects. At the same time we wanted a ²³hero making mentality directed towards our vendors, clients and other Mustangers such that everyone wins and their attitude spirals up, the flywheel of good projects started spinning!



These were the easy things 😊 then we wanted to move the industry towards an EPCM strategy where the engineer and client sit on the same side of the table and figure out how to deliver the projects from industry resources.

Let me take a moment to show you a slide on how an EPCM strategy is actually executed. EPCM stands for Engineer, Procure, Construction Manage. Independent Project Analysis (IPA) calls this a mixed strategy where engineering and project management are reimbursable. This takes money out from being between the client and the engineer. Then all equipment, construction and installation is bid lump sum with well-defined scoping documents. Many companies think of EPCM as a total reimbursable project and feel you need a large team to manage everything.

²⁴This slide shows a typical deepwater project. The scope is across the top; hull, moorings, riser, etc. Activities are down the left side; engineering, equipment procurement, fabrication, installation, etc. You can see from the color coding that only 8% is reimbursable and, that part actually gives the client an “Engineer-down-the-hall” to help overcome obstacles. 4% of the scope is awarded unit rate, then converted to lump sum to help schedule. The

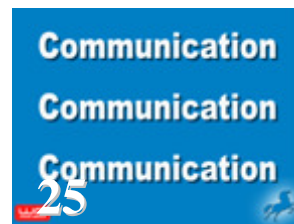


rest is bid and awarded lump sum. The beauty in this strategy is a 26% reduction in cost versus turnkey EPC, better overall schedule and benchmarked best first year up time!!! OK, I'll get off my soapbox and back to Mustang's vision.

Finally, we wanted to move the offshore industry from a fixation on structural and hull design to a focus on the facility design. In our mind the hull and structure are no more than very expensive pipe supports!²⁵ And, they did not see the need for a lot of coordination. Facilities people had to coordinate 50 vendors...communication, communication, communication!

We wanted facilities to go mainstream and drive the projects for better coordination, lower cost and shorter schedules. Engineering does drive project success.

Well, it has all happened. We were the fastest growing engineering firm²⁶ in the United States over the first five years. In 1996, all the major oil companies gave us a tough project to do with the



“Mustang Motion” and each set a new benchmark in their company. From 1997 to now, Mustang has worked on over half of the deepwater projects worldwide and facilities engineering is driving these successes.

Now, obviously, Mustang has changed significantly²⁷ from the first 20 people to the current 2100 and from 500 manhour projects to over one million manhour size projects. These changes have been critical in capturing the dream and are directly applicable to this instrumentation and automation audience. Let’s look at your evolution.

In the early days of Mustang, the instrumentation scope of an offshore project was small and generally done by a mechanical engineer. I remember my partner Paul Redmon and I going in on a Saturday to size the instruments, do data sheets and vendor tear sheets for a 30 MSCFD gas platform. We had fun designing the control panels because it was binary logic – either there was air or there wasn’t. When we went offshore for hookup

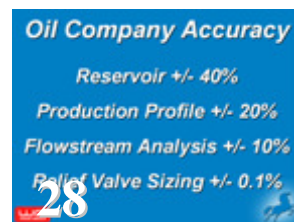


you could blow through the tube (demonstrate) and know you were hooking the right things up.

If you even mentioned using an electronic instrument like was prevalent in refineries they jeered you off the platform.

But then we progressed to oil platforms and bigger more complex gas platforms. We entered what I called the “black box” era of simple PLCs. Generally, each skid had its’ own box and we had to connect them. With the black boxes came the hiring of real instrument engineers who could run as many calculations as a client wanted.

Let me tell you a little story...have you ever heard the term Governmental accuracy? This is where you measure something with a micrometer, mark it with a piece of chalk and then cut it with an axe. Well, take a look at this slide on Oil Company accuracy²⁸. Here you’ll see that I’ve generously said the reservoir is a $\pm 40\%$ proposition, from which we get a $\pm 20\%$ production profile to a $\pm 10\%$ flowstream analysis to $\pm 0.1\%$ relief valve sizing.



| Oil Company Accuracy | |
|----------------------|----------|
| Reservoir | +/- 40% |
| Production Profile | +/- 20% |
| Flowstream Analysis | +/- 10% |
| Relief Valve Sizing | +/- 0.1% |

Now, of course, the engineer will enjoy the challenge of developing a spreadsheet to do 36 calculations for each of the 800 relief valves and tie them to instrument data sheets. Pride in accuracy will ensure that every time the process engineer sneezes, all the calculations will be redone, while the vendor continues to wonder what exactly is being bought and eventually the contractor wonders where the relief valves are.

I remember moving whole projects around the instrument folks because they just could not get on the same sheet of paper with the rest of the team. Providing a robust facility to produce oil & gas on a schedule was not the focus as the instrument engineer worked to make their area perfect, despite constant changes.

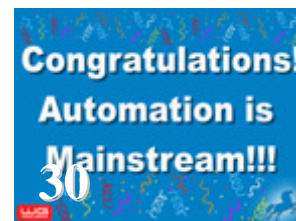
But the industry didn't slow. We moved to huge domestic projects and to large international jobs. The digital age that had been controlling downstream projects for years finally made the jump to upstream.

But that jump caused a tremendous trainwreck²⁹ that we could not see coming. Downstream automation had been doing upgrades where the process is well defined and pennies are tight. We were putting these people into upstream projects where the P&IDs are being finished as the project is being towed offshore for installation.



We were in the thick of this industry transition because we had brought in a 40 person automation team that had been together for 20 years in downstream.

The landscape had changed. It used to be that if your quarters building and power generation worked, you could move through an offshore startup. Now, it was clear that for an offshore startup the power generation, quarters and automation systems were the critical path...causing the client to open their checkbook if they were not ready.



³⁰Da Da!!! Congratulations folks you are now mainstream! Mustang realized its dream to make

facilities engineering the driving force in mega projects and automation had become the linch pin now setting up overall project success.

So, now that you have realized your dream, how do you ensure that you can deliver? The first thing you must do is bridge³¹ the gap between the concrete and steel portion of the project and the instrumentation/control portion.

The best way to bridge this gap is to change from burying yourself in technology to burying yourself in the project. The objective is not the most innovative latest and greatest control system you can imagine. We call this silo mentality³²...delivering your cost and schedule without regard to other people's requirements. The objective is to be up and running producing hydrocarbon with a robust system. Understanding the tools concrete and steel people use to control a project is critical for you to set up your part to deliver flawlessly.



³⁴How can you do “Fit-for-Purpose” and leave flexibility in case the reservoir grows or shrinks during project development?

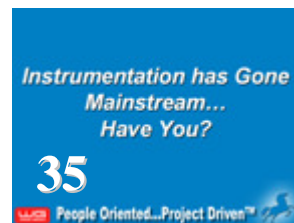
³⁴How can you set up your design process to be predictable in manhours, schedule and final product? Who do you need input from?

You are mainstream so you are connected to every piece. In deepwater this means facility, drilling, hull, subsurface and pipeline. Understand their design and interface plan.

Get out of your office and communicate!

I’ve been amazed at what I’ve seen our Automation folks do in mapping out the functionality required, agreeing screens with the operations folks, and then executing to a schedule and budget with flawless startup. It took a change in attitude...a desire to be a key part of a bigger team and be wanted by the concrete and steel people.

³⁵I’m here to congratulate y’all on going mainstream in Upstream. And I challenge you to



reduce engineering scope, get off the critical path
and deliver.