

Titan Historian's Corner

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The Space Culture's Uniqueness

Last year's Deep Water Horizon Oil Well/Spill disaster brought home just how unique the Culture was on the Titan Program and is on Space Programs in general. How unique? Let's first look at an example from the Titan Program and then we'll look at the Deep Water Horizon disaster in the Gulf

During the flight of Titan IVA-19, there was a burst disk failure in the Stage I Engines' Oxidizer Autogenous Pressurization System. While still in Stage 0 (SRM- Solid Rocket Motor) flight, a 500 psi burst disk (separating the Stage I Engines' super heaters from the engines' turbo pump oxidizer discharge line) opened allowing oxidizer to prematurely enter the super heaters. At the time, the line pressure was significantly below 500 psi (i.e., it should not have failed open). After detailed analysis of the burst disk's manufacturing lot's flight history, and the Stage I Engine development testing, it was determined that this was an isolated incident and that although this was undesirable, the vehicle would still fly successfully.

But, the story isn't done; this is where the Space Culture kicked in. One person was still concerned about the Titan IVA-19 flight data. Just before the burst disk failed, there was a high frequency blossoming pressure signature [i.e., something seemed to be coupling the fluid dynamics of the Stage I oxidizer propellant system with the flight environment) in the Stage I oxidizer propellant system that was still unexplained. Based on this concern, a team was formed to understand what this blossoming signature meant. A short version of the story is that the team found that there is always a gas bubble just in front of the burst disk and that under certain conditions the Titan IVA Stage 0 flight environment could cause the normal

propellant pressure fluctuations to couple with the bubble's elasticity and create a much higher localized pressure at the burst disk. This was confirmed via detail full scale simulated burst disk propellant/bubble testing and converted into an updated Stage I oxidizer propellant system model. BINGO, when the updated model was run against the un-flown Titan IVB (SRMU - Solid Rocket Motor Upgrade) environments, low and behold, the Stage I oxidizer feed line could burst during Stage 0 flight and result in a flight failure. As a result, the Stage I Engine oxidizer autogenous burst disk tubing was changed to reduce the bubble size and an active Stage I oxidizer pre-launch pressurization system was added to more precisely preset the Stage I oxidizer tank top pressure shortly prior to launch. All of these changes were added for the Titan IVA flights (before any Titan IVB flight) to confirm the predicted performance of the changes. All of this was completed prior to the next Titan IVA launch.

The Space Culture: Understand all available data and qualify all hardware (even software and analytical models) for all environments.

Now let's look at last year's Deep Water Horizon Oil Well/Spill disaster. According to a multiplicity of news (TV and newspaper) articles, web site information and published data, there were significant pressure and flow anomalies observed in the Deep Water Horizon oil flow prior to the blowout/failure. Since these anomalies didn't seem to "hurt" anything, everything must be OK. Basically, ignoring this data, proved fatal. In addition, the Blowout Preventer that was supposed to protect against significant oil spills in the event of such a failure, failed to shutoff the oil flow at the well head. This was in spite of a "redundant" system to shear the well casing (the pipe that contains the oil flow) and close/shutoff the oil flow. A review of the Blowout Preventer's design/development history didn't clarify that redundant system's hydraulic system or electrical controls were

100% redundant, or that the Blowout Preventer was ever qualified via test for all possible failure environments. Nearly a year after the disaster, the Blowout Preventer failure analysis results were released. The failure was due to a "buckled" piece of casing that was too thick for the shearing system to cut and seal/shutoff the oil flow. It's not clear that anyone knows for certain (At this time, it sounds a lot like speculation.) what caused the casing to buckle or how to prevent it from buckling, etc. As of this May 24th, there are now three new designs for the Shear Rams used in Blowout Preventers that are purported to be able to cut and seal a well's drill casing even it is buckled or twisted. In addition, there are 11 other improvements being put forward as salvation solutions. Interestingly enough, there is still no discussion of any qualification requirements/program that will insure that Blowout Preventers are fully redundant and to insure that they will work in all failure environments? It's a year later and the world still doesn't know if it can ever depend on Blowout Preventers to always seal/shutoff an oil well or depend on any oil well operator to fully understand anomalous well flow data.

The Non-space Culture: If it hasn't damaged anything, or if the design is suppose work or has worked before, everything is OK.

What a difference in Cultures!

Opinion: Had the Oil industry culture been similar to the Space industry culture, the Deep Water Horizon Oil Well/Spill disaster could have been avoided. And, a lot of people on the Gulf Coast would have a better life

I finally found a subject for this year's article; however, this is my last article unless someone gives me an idea for next year! Only you know the story(s) about unique parts and happenings in Titan's wonderful history! So, please submit any suggestions you have for future articles to "riversnco@yahoo.com", so that your story(s) can be shared with others.