

## Past Editor's Viewpoint "Communicate or Else!"

There is an intriguing parallel to our own industry getting a lot of press lately. The recent loss of two of NASA's Mars probes with a reported price tag of over \$200 million has put that agency's funding and personnel policies under a very public microscope.

Most of the rhetoric has centered on the effects of budget cutbacks and how the failures must be a consequence of NASA's mandate to explore "faster, better, and cheaper". Meanwhile, oil and gas exploration, among other endeavors, is providing a living, breathing example of an industry that has survived economic pressures by adopting exactly those three adverbs. Much economic growth in the last decade has been linked to gains in productivity while staffs are being trimmed. So the technology is available. The problem must be in using it and sharing the results.

In 1998, after Lockheed Martin, a contractor for NASA, suffered three back-to-back satellite losses, "independent panels of experts concluded that ... a loss of experienced personnel (was) largely at fault." (1). Part of the problem was that senior mission specialists were being retired or laid off to meet staffing and salary reduction goals. As a result, operating procedures for older "legacy" systems, and "institutional memory" regarding the location and use of crucial older data was being lost. Sound familiar?

Even more interesting is the failure rate that generated all this concern. When the first investigation was ordered, 63% of launches with Lockheed components had performed without problem. Compare that with probabilities of economic success for technically complex drilling projects. Wildcatting is the only job other than weather forecasting where being wrong more times than not makes a legend. Obviously steering taxpayer-funded vehicles to other planets has a much lower failure tolerance.

But the most telling information is in the technical details. Anyone who has wondered about incorrect mileage

provided by a foreign crew working in the Gulf of Mexico can smile at this. In working with spacecraft data, "NASA did not specify the actual units, but would have wanted newtons. The values provided in pound force would have been too large by a factor of 4.45" (2). This comes from an analysis by the Institute of Electrical and Electronics Engineers (IEEE), which is close to home for those who work with seismic data. How many data loaders in the business today can look at a histogram of trace data and tell whether it is IEEE or IBM floating point format? And how many surveys have been loaded inaccurately, because, again from the report: "there is no really gross mismatch in the scale of calculations made ...that can provide an intuitive hint that something doesn't add up... the unintentional substitution of one for the other apparently rang no warning bells."

The more senior workers that are now missing would presumably ring those warning bells, and further investigation of the NASA SNAFU showed that some technicians might have noticed the problem. Chief investigator Arthur Stephenson indicated during a press conference that while some on the navigation team "continued to express concern.... they did not use the existing formal process for such concerns". He stated "JPL has a special form...and the navigators did not follow the rules about filling out that form." Imagine, a government project literally crashing because somebody didn't do the proper paperwork!

Stephenson also admitted "inadequate... staffing was a contributing factor to the accident ... they were responsible for three separate missions at the same time. This was a problem of transition from the era of very large teams to when teams are very small." And "their training in team operations was inadequate" (2). Take a look at the decentralized "asset management teams" that are making multi-million dollar decisions in our companies today. How many missions are they

watching simultaneously? And how much team operations training do they have? Are we missing a critical educational need here?

Several cases have been documented where the lack of a geophysicist experienced enough to visually discriminate between State Plane feet and UTM meters has led to the mispositioning of seismic surveys. Later review showed that some staff had suspected an error, but were not comfortable enough with procedures to communicate their misgivings to other team members. Remember when a Boeing 737 crashed into the frozen Potomac because a copilot didn't assert his concerns? His last words were "that doesn't seem right." (3) We may not lose expensive vehicles or lives, but I would be willing to bet that a few wells have been drilled in less than optimal locations because of similar problems.

The lesson here is that communication, and a lot of it, is essential in a highly technical field. No one wants a plaque on a dry hole with a quote from Cool Hand Luke: "What we had here, was a failure to communicate!"

- 1) ROBERT LEE HOTZ,  
Science Writer  
Los Angeles Times  
Sunday, December 26, 1999  
*Are Failed Mars Probes the Price of Cost-Cutting?*
- 2) James Oberg  
Why the Mars Probe went off course IEEE Spectrum  
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Complete text available at: <http://www.spectrum.ieee.org/pubs/spectrum/9912/mars.html>
- 3) Flight Safety Digest  
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