

STORY: JENNY BAER-RIEDHART/RAY MORGAN

Check Your Ego At The Door, Please

by Jenny Baer-Riedhart & Ray Morgan



ABOUT THE AUTHOR



Jenny Baer-Riedhart is the Deputy for the

Public Affairs, Commercialization and Education (PACE) Office at the NASA Dryden Flight Research Center. Before that she was the Program Manager for the ERAST Program in charge of technology flight testing for Unpiloted Aerial Vehicles. She has worked her entire career at Dryden, starting out in propulsion engineering on the first computer-controlled jet engine for the F-111 project.

A New Way of Doing Business

The Environmental Research Aircraft and Sensor (ERAST) Project was a new way of doing business for NASA. New in that it was not a typical contractual relationship between NASA and the companies involved. ERAST was a Joint Sponsored Research Alliance (JSRA) to develop Unmanned Aerial Vehicle (UAV) technology. NASA had been involved in JSRAs before, but they were all university-led; this was the first industry-led JSRA.

The alliance consisted of four companies who were partnering with NASA. Each brought a unique focus to developing a UAV, and had already at least partially developed high-altitude UAVs that were potentially suitable for NASA's stratospheric science missions. NASA hoped to leverage these aircraft and their technologies to demonstrate the viability of UAVs for atmospheric science, and to provide a "kick-start" for a commercial UAV industry in the U.S. Demonstrating useful missions with these unproven, developmental aircraft upped the ante for everyone. For all practical purposes, if you crashed one time it would be impossible to recover, and in two cases experience bore this out.

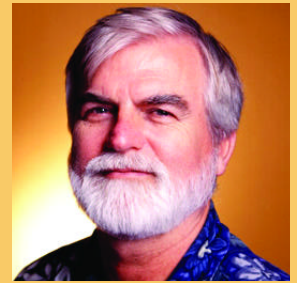
Because this was a different way of doing business, we had to tailor almost everything about the project, and that included how we did the reviews. In a typical contractual arrangement, you wouldn't rely on the contractor standing up to say, "We're okay to go on," while NASA just nods its head and says okay, but basically that's what we did. The companies could invite NASA to their reviews, or they could say get lost. However, the stakes were high enough that no one company's ego was going to shut out NASA entirely. The approach we agreed on was for NASA to provide oversight and control of range safety, but the companies were free to accept NASA's advice or ignore it in so far as mission success.

One problem these small UAV companies tended to have was they would attack each task as if they were the first ones to try and solve that problem. As a consequence, the industry as a whole was plagued with stupid mistakes, and duplication of problems that had been encountered and solved 50 to 60 years before. The alliance was intended to help open the doors a bit, creating some "cross-pollination" between the companies and NASA, so that not everyone had to make all the same mistakes for themselves.

The way the reviews were conducted, NASA would bring in people who had experience in a particular area of aircraft development and testing, even though they might have no prior background in UAVs, specifically. The point was that NASA had within its ranks a wealth of experience and know-how in developing and testing unique



air vehicles, particularly at high altitudes (some of the review team had taken the X-15 to over 300,000 feet in the 1960s — we were aiming at a fraction of that altitude). Even though they were not familiar with these particular types of light wing structures, these were still experts in physics and engineering, and the atmosphere we were operating in was the same. Many times they provided the most value by simply asking questions.

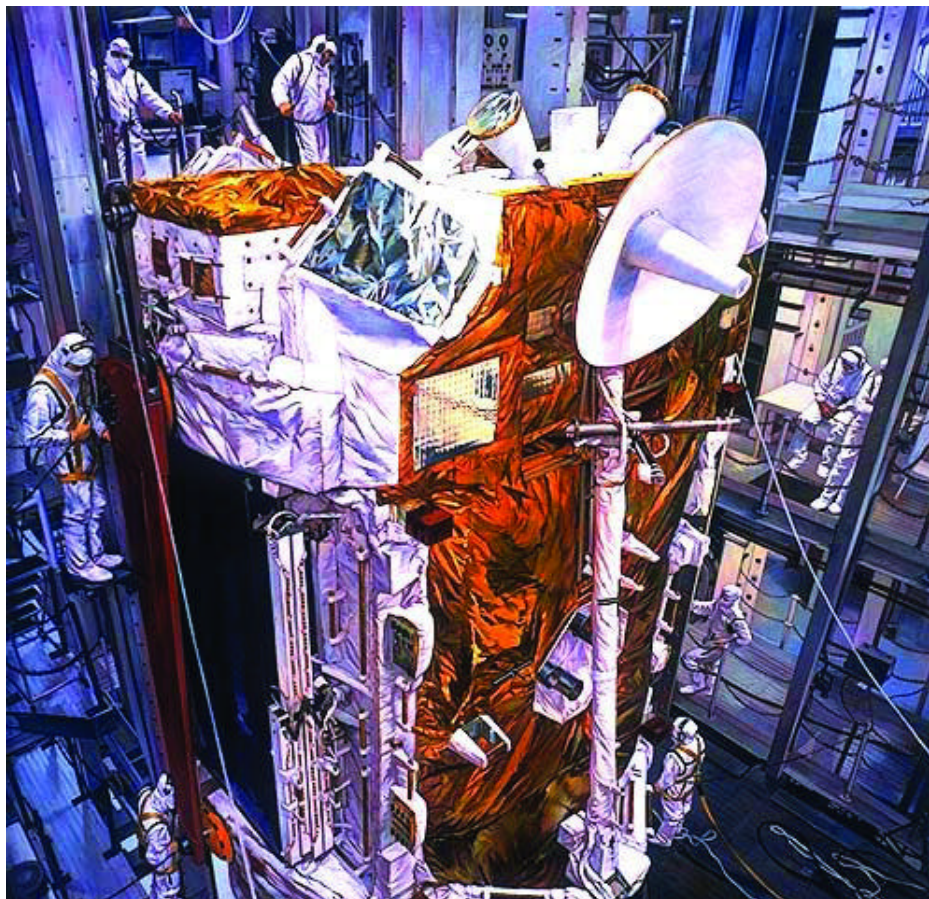


ABOUT THE AUTHOR



Ray Morgan has recently retired as Vice

President of AeroVironment, Inc., where he established the Design Development Center in 1980, the division of AeroVironment that develops and produces its aircraft, serving as Director until April 2000. Mr. Morgan has overseen more than 75 projects and the development of over 50 unique vehicles, including over 35 Unmanned Aerial Vehicle's (UAV's) in his tenure at AeroVironment Inc. AeroVironment has been globally recognized as a pioneer in solar powered and electric aircraft, and has placed 5 of its vehicles in the Smithsonian Museums.



“Preparing GRO,” oil by Nathan Greene depicts the Gamma Ray Conservatory being hoisted to a test cell in the Vertical Processing Facility at the Kennedy Space Center.

Check Your Ego At The Door, Please (cont'd.)

Listen and You Will Learn

One company in the alliance, A, achieved far more success with its solar powered UAV, Pathfinder, than the other companies did with their UAVs. The best example of why is probably how A allowed NASA to participate in its reviews. In the reviews it was clear that A was willing to embrace NASA as a partner. Unlike the other companies, A had been developing UAVs for over 12 years, and had seen all the ways to crash them, and recognized from experience that learning from others was perhaps the only way to avoid repeating their mistakes. The other alliance members had relatively little experience in developing UAVs or aircraft with complex control systems, and probably didn't have as much appreciation for processes and learning from the past.

A was NOT one of the two companies who crashed. However, it could have been.

In the first prototype of their UAV, built in the early 80's, A relied on single thread systems across every major component of the UAV. This means there was only one of any given component, and if that one component failed then the whole UAV would likely fail. As A began focusing on system optimization, and from practical experience with other UAVs, it recognized the need for redundant control systems throughout. However, it lacked the experience that NASA possessed with redundant flight control systems.

NASA provided A with valuable advice about how best to implement redundant systems in its critical components, particularly with sensors, when the system must automatically determine which sensors are working properly and which are not. A didn't have a lot of experience with triple redundant sensors, but NASA did. In some ways, while NASA did not know much about UAV technology, it did have a lot to teach the companies about basic airplane technology.

NASA also brought to the table its vast experience in risk management. This was something A had never formally done before, but was old hat to the NASA Dryden Flight Research people. Assigning a quantitative measure to subjective judgment of risk is a difficult concept, but must be done to conduct flight tests safely. Heretofore, it was joked that UAV manufacturers put "more holes in the desert than Arnold Palmer". But for these large, expensive, one-of-a-kind UAVs with NASA logos and public scrutiny, crashing could not be taken lightly, and death or injury was out of the question.

The outcome: well, A's UAV did not crash. But that is only part of it. One and a half years into the Alliance, Pathfinder set a world high-altitude record for a solar powered UAV. Two years later it beat its own record in two, back-to-back flights of first 67,500

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feet, then 70,000 feet plus. In 1998, A again returned to the air with another version of the same UAV, an enhanced aircraft, which set the current solar record of 80,000 feet. By the time you read this, A may have beat that record again by flying to 100,000 feet with the Helios solar aircraft, higher than any non-rocket propelled aircraft has flown in level flight.

Don't Listen and Pay the Price

The companies who were not as open about accepting NASA's advice fared worse in this alliance. One of these companies we will call X. On paper X was a superb company. Employee for employee, every one of them was a genius in his or her own right. Still, despite their superior IQs and their brilliance, they crashed their UAV. Twice, actually.

The unfortunate thing is that their crashes might well have been avoided had they been willing to listen to what NASA had told them. When X crashed its UAV, the precipitating cause was the failure of a single thread component that was known to have poor reliability, yet was key to the flight control system functioning. NASA (and A) spotted this and warned them of the catastrophic consequences of not replacing this with a redundant system. Unlike A, X ignored the advice. When this component failed during a flight test, the UAV predictably flew out of control. With no backup means of recovery short of an act of God, the UAV was doomed to crash, and so it did. Twice, as we said.

Had X been open to what NASA's experts pointed out during the reviews, they might well have kept from crashing. Generally, their attitude towards NASA was not to discuss their problems, not to give up any information, and that reviews were something they had to get through rather than something they might learn from.

Company Y, another in this alliance, also crashed their UAV. They too rejected NASA's advice on developing a redundant system for a critical component. In this case, their UAV had two data links. To conduct one particular operation during flight, they had to switch from the regular data link to the back up data link. Every time they switched between the data links, the data coming down disappeared for about 6 seconds. When a critical component failed, the pilot on the ground noticed no data was coming down and switched from the regular link to the backup. After 6 seconds he was still not receiving data. Here again NASA pointed out that using a redundant system would safeguard against a catastrophic turn of events should the critical component in question fail. It was too late by the time the pilot realized the lost data was not merely the result of the switch between the regular data link and the backup. At

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this point the UAV was pointed straight down and could not be recovered. No one can claim that the success or the failures were solely due to the reviews. However, the story clearly supports the notion that a review can be a source of vital learning and that arrogance is the number one enemy of learning.



Question

Stories like this demonstrate that pride/arrogance on the part of a manager, or management team, can jeopardize an entire project. How important is it to “leave your ego at the door” when you are undergoing a review, and why do you feel it is difficult for some managers to do this? Or, tell us about a similar case as described in this story that happened to you.

Lessons

- + A review can be a source of vital learning.
- + With the right attitude, a contractor can use the government as an asset, that is, the government can help the contractor.
- + Cooperation between the government (NASA) and a contractor is essential for the success of a project. When coupled with the right mechanisms of planning and control, this cooperation can make for the best use of taxpayer money.