

What Really Worried Me About the Shuttle

By Richard D. Blomberg

ALMOST a year ago, just after my tenure as chairman of NASA's Aerospace Safety Advisory Panel had come to an end, I testified before Congress about the safety of the space shuttle program. My remarks contained both praise and concern, and I closed with a warning: No danger was imminent, but the risk for future missions would almost certainly increase if NASA was unable to pursue its long-term safety strategy.

Since the horror of last Saturday, I have been asked if my fears were realized and whether my warning was ignored. I do not believe so. Several disturbing trends had developed by the time of my testimony, but not once in my 15 years on the panel did I doubt NASA's dedication to safety or its vigilance in maintaining it. I was more worried about the federal government's commitment to supporting NASA's manned spaceflight efforts.

In the years between the Challenger disaster in 1986 and last Saturday, NASA and the space shuttle program underwent numerous structural changes. But the one principle that remained in the forefront among everyone who worked on the shuttle was the drive for safety; after the Challenger the mantra was, "Never again." There were many assaults on

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this steadfast position, like the need to spend money on the International Space Station, but they were never allowed to supplant safety.

After the post-Challenger return to flight, however, political interest in the space shuttle seemed to wane. In an era of government cutbacks and diminished public attention, generous NASA budgets could not be sustained forever. The space station was an ambitious program that required a large part of NASA's budget. Other programs like the X-33 experimental space plane, which were specifically required by Congress, diverted funds from the shuttle.

In response, NASA and its contractors found ways to do more with less — always with an eye to safety. We on the panel monitored their efforts and marveled at their ability to continue to meet all requirements while having their resources repeatedly cut.

Eventually, however, there wasn't much more that could be taken from current operations. The unexpected costs of the space station worsened the situation. Thus the only choice for those in charge of the space shuttle was to reduce or delay expenditures meant to assure the long-term health of the program.

For example, the aging infrastructure on the ground, much of it a legacy from the Apollo program, was neglected. The stated rationale was that, since the space shuttle was scheduled to be replaced by about 2012, long-term investment was not cost effective. Yet no replacement vehicle was even on the drawing board, and no new technologies were available to support the development of a radically different and

safer vehicle.

By the turn of the century, it had become clear to those of us on the panel that a potential safety problem was emerging. Aging shuttles can be safely flown as long as necessary if they are carefully maintained and appropriately upgraded to avoid obsolescence. As safety advocates, we became uneasy at the deferral or cancellation of safety improvements. Make no mistake: flight safety still received the highest priority. But opportunities to reduce future risk even further were slipping away.

Safety remains a priority at NASA, but planning isn't.

Meanwhile, the NASA budget continued to be squeezed, and delays in the construction of the space station made it clear that the shuttle would be needed until at least 2020 and beyond; there simply was no other vehicle that could do the job. In early 2001, the panel recommended that NASA adopt more realistic long-term plans so that more safety upgrades could be initiated. NASA welcomed the proposal but allowed it to languish; it simply did not have enough money to do very much about it.

My concerns grew. I knew how good the NASA team was, but I also

knew it couldn't go on pulling rabbits out of a hat forever. Also, the window of opportunity for addressing the long-term issues was beginning to close. Upgrades to the shuttle take years to plan, engineer, execute and certify. In order to reverse this distressing trend, Congress, the White House and NASA would all have to work together, first to allocate more money and then to use it wisely.

The House hearing last spring provided me with the chance to make this point. I wasn't predicting an imminent accident; I was providing an early warning. That the Columbia tragedy happened less than a year after my testimony was an unfortunate coincidence.

Now is not the time for recriminations. Once we know how the accident happened, we can ask why. After that we can ponder what I — and everyone else on the panel and at NASA and in Congress — could have done. Then we should all do whatever we can to help rekindle the nation's support for the shuttle so that brave flight crews and dedicated ground personnel can get back to doing what they do better than anyone else on the planet: putting humans into space and returning them safely to Earth. □

COLUMNS

Trying to manage risk

Shuttle safety balances real with ideal

On Feb. 1, FLORIDA TODAY published an editorial entitled "Putting safety first" that expressed this concern:

"NASA is fixed on the May launch (of the first post-Columbia shuttle flight) even though it still hasn't proven that all required technical and program improvements have been put in place and are solid."

While that is a valid fear, there is another equally important side to the picture. Rather than getting "launch fever," NASA may be getting gun shy.

The longer they wait to fly, the more corporate memory and critical skills will be lost as key knowledge-holders retire or leave the program because of the inactivity. This can result in an insidious increase in risk that is far more worrisome to me than future damage to tiles or wing leading edges from foam impacts.

Also, experience has shown that while independent reviews are valuable, redundant assessments provide little additional benefit and can even be counterproductive.

Any human spaceflight vehicle such as the space shuttle is complex and inherently dangerous. While NASA cannot be cavalier about safety, it also cannot apply an unrealistically low risk threshold.

The three keys to successful risk management are:

■ Understanding the risks.

All of the shuttle risks will never be fully known or quantified, but NASA has a reasonably good picture of the true risk level based on its own analyses



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and the work of the Columbia Accident Investigation Board, or CAIB.

■ Establishing a reasonable level of acceptable risk.

If too much risk is accepted, safety is obviously compromised. On the other hand, the current political climate appears to be totally risk averse. Because zero risk is never achievable, its pursuit can lead to a sense of futility.

■ Controlling risks to achieve the target level.

NASA and contractor engineers know how to do this best for a given level of resources. The continuing problem is that NASA doesn't have nearly the wherewithal to implement the lowest risk they know how to achieve.

This leaves NASA the choice of keeping the shuttle grounded — which is unthinkable to someone who has dedicated his or her life to human spaceflight — or flying at the lowest risk level that can be achieved with what they have.

These alternatives are inherent in all high risk endeavors. The problem for the space shuttle is that its budget has been squeezed for many years resulting in the deferral of many identified safety improvements.

As long as NASA funds needed for shuttle and International Space Station safety con-

tinue to be diverted to politically expedient but easily postponed programs, the shuttle flight risk will be higher than necessary no matter how long NASA waits to fly.

It is also worth noting that in a situation such as the recovery from the Columbia accident and shuttle grounding, it is important to work towards a specific return to flight date. If the shuttle is not ready by that date, the pre-launch reviews will not permit it to fly.

The intensity associated with a firm target date helps focus everyone — management and workforce — on the task at hand.

Finally, the CAIB and other review teams have made many good recommendations that unfortunately have been taken as dictum rather than as constructive suggestions. While most of the advice is sound, not all of it should be given the foremost priority.

Each suggestion, regardless of its source, must be considered in light of all the shuttle and space station safety needs, whether or not they are related to the causes of the Columbia accident, and the available resources.

The bottom line is that you cannot guarantee safety. You can only work hard and smart on risk reduction with the resources available and hope you have done enough. ■

Blomberg is past chairman of the Aerospace Safety Advisory Panel, an oversight group that monitors NASA's human spaceflight program for Congress.

Fear of Flying

By Richard D. Blomberg

AS NASA prepares for its first space shuttle launching since the Columbia disaster, the question on everyone's lips is this one: Is the shuttle safe? My answer, as the former chairman of the NASA Aerospace Safety Advisory Panel, is that there is no such thing as safety. Spaceflight will always be risky. But that doesn't mean we shouldn't do it.

NASA officials were understandably shaken by the disintegration of the Columbia as it returned from a science mission in 2003. The posture they adopted as a result, however, was overly conservative. NASA's management and engineers focused on the parts of the shuttle that were

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implicated in the accident, specifically the external tank and the leading edges of the orbiter's wings. They also questioned the agency's "safety culture" at various levels of management.

These measures were prudent and reasonable. But NASA hobbled its shuttle program by deciding to adhere to all of the recommendations of its Columbia Accident Investigation Board before resuming flights.

Although the board and other review teams made many good recommendations, these should have been viewed as constructive suggestions or even as "stretch goals," rather than as dictates that required 100 percent compliance. Adm. Hal Gehman, the head of the board, noted recently that he and his fellow investigators never intended their recommendations to become a "poison pill" for the shuttle program.

Nonetheless, in its effort to reduce risk, NASA grounded the shuttle for almost two and a half years. During that time, something crucial was lost. Because the space shuttle

wasn't flying, its valuable and unique human resources languished.

In my consulting work over the last 37 years, I have evaluated many complex human-machine systems. None depends more heavily on a specially qualified and experienced workforce than the space shuttle.

Because the shuttle is unique, the NASA program is the only comprehensive training ground for its operating personnel. Military or commercial aviation experience is valuable, but it is far from sufficient qualification for human spaceflight operations. Simulations and training exercises provide vital practice and help sharpen seldom-used skills, but they cannot completely substitute for actual launching and flight experience.

Since the Columbia accident, NASA and its contractors have lost experienced people. Some have retired. Others resigned when NASA announced it would end the space shuttle program in 2010. Flying the shuttle is the only way to rebuild the skills and experience that were lost

with these departures. But for more than two years, no shuttle has flown.

Of course NASA must not knowingly operate the shuttle with a correctable safety defect. But if we are to expand our knowledge and maintain our skills, we must accept that a certain degree of risk is inherent to

How to make the shuttle safer: launch more missions.

spaceflight, and that the goal of totally eliminating risk is both unreachable and potentially demoralizing to the program's work force.

There are, however, precautions that can be taken, and some of them have not been addressed because of budgetary constraints. The emphasis on politically expedient but easily

postponed programs like those for the Advanced Solid Rocket Motor and the X-33 experimental space plane has squeezed the shuttle's budget for many years. During that time, some safety improvements, including main engine health monitoring and a new auxiliary power unit, have been deferred, rendering the risk of flight higher than necessary.

The shuttle is far from perfect. It lacks a way for the crew to escape in a disaster, for example. But it is the only human-operated spaceflight vehicle NASA has. The agency has two choices. It can ground the shuttle and sacrifice some or all of its goals for supplying and building the International Space Station, or it can fly at the lowest risk level achievable with its budget.

I believe that, provided NASA does all it can to maximize safety, the risk of shuttle flight is worth taking. This is not only because of the work the shuttle can do, but also because the more frequently NASA accepts the risks and flies the shuttle, the lower the risk will actually become. □