

NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.

Source: <http://sci.tech-archive.net/Archive/sci.space.shuttle/2005-04/msg00409.html>

- *From:* Andrew <hal@xxxxxxxxx>
 - *Date:* Thu, 21 Apr 2005 23:14:59 -0500
-

NASA Is Said to Loosen Risk Standards for Shuttle
By JOHN SCHWARTZ

Published: April 22, 2005

NASA officials have loosened the standards for what constitutes an acceptable risk of damage from the kind of debris that led to the disintegration of the shuttle Columbia as it was returning from space two years ago, internal documents show.

The move has set off a debate within the agency about whether the changes are a reasonable reassessment of the hazards of flight or whether they jettison long-established rules to justify getting back to space quickly.

Experts who have seen the documents say they do not suggest that the shuttle Discovery – scheduled to lift off from Cape Canaveral, Fla., on May 22 – is unsafe, but a small but forceful minority say they worry that NASA is repeating a practice that contributed to the Columbia disaster: playing down risks to continue sending humans into space.

The documents were given to The New York Times by several NASA employees, who did so on the condition of anonymity, saying they feared retribution.

Documents that had been revealed earlier showed that NASA was struggling to meet safety goals set by the independent board that investigated the Columbia accident. The new documents suggest that the agency is looking for ways to justify returning to flight even if it cannot fully meet those recommendations.

The documents, by engineers and managers for the space agency, show at least three changes in the statistical methods used in assessing the risks of debris like ice and insulating foam striking the shuttle during the launching. Lesser standards must be used to support accepting the risks of flight, one presentation states, "because we cannot meet" the traditional standards.

NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.

Paul A. Czysz, emeritus professor of aerospace engineering at St. Louis University, who read the documents at The Times's request, said they did not demonstrate that the shuttle was too dangerous to return to space or that NASA was stinting on efforts to make it safer.

To achieve a profound safety improvement, he said, NASA would need to replace the shuttle fleet, which was designed in the 1970's, with an entirely new vehicle. But Professor Czysz, who spent some 30 years with McDonnell Douglas, a NASA contractor, compared the statistical shifts to moving the goal posts at a football game. "I was amazed at how they were adjusting every test to make it come out right," he said.

NASA officials say that the shuttle is safer than it has ever been because of changes made after the Columbia accident in February 2003, and they have long acknowledged that not all debris risk can be eliminated. "There is still going to be a possibility that a golden BB could get us," N. Wayne Hale Jr., the deputy director of the space shuttle program, told reporters in briefings this month.

Two years of testing since the loss of the Columbia and its crew of seven have shown that the shuttle's skin, designed primarily to resist the blistering heat of re-entry, is far more vulnerable to debris from the external fuel tank than had been thought.

The tank is filled before launching with 535,000 gallons of liquid hydrogen and liquid oxygen fuel, and insulating foam keeps the tank from icing over. From the beginning of the program, NASA rules said no foam or ice should hit the shuttle. The investigation board found that managers played down the risks over time as the craft survived thousands of blows from small pieces of debris.

After the accident, NASA officials initially expressed doubt that the 1.67-pound hunk of foam that struck the left wing could have brought it down. But tests have since proved that a 0.023-pound piece could cause catastrophic damage under the worst circumstances. NASA now says it has reduced the size of debris that will fall off of the tank to 0.01 pound or less, but admits that the only way to know is to monitor actual launching conditions.

One of the two internal documents, dated Feb. 17, 2005, was written by John Muratore, the manager of systems engineering and integration for the shuttle program, and a colleague. It describes ways to compensate for what it calls "overly conservative" assessments of the ability of the shuttle to withstand debris impacts, including these:

¶Moving from the traditional worst-case situation certification, or "worst-on-worst" approach, to "our best estimate of actual conditions."

NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.

¶Reducing safety ratios, which measure capability to withstand expected impact.

¶Relaxing standards – measured with mathematical models similar to a 6-sigma quality-control process widely used in industry – to allow a sharply increased rate of failure.

A second presentation was prepared last month. It provides extensive tables showing the expected failure rates of the carbon composite panels on the wings' leading edges, expressed as sigma values. Sigma represents the standard deviations from the mean; in practice, the higher the sigma number, the lower the probability of failure. A traditional 3-sigma failure rate is about 1 in 800, Mr. Muratore said, a 2-sigma is 1 in 40, and a 1-sigma is 1 in 2.

Several tables describing the impact tolerance of the nose cone and panels show no tolerance for ice impact from several sources under a worst-on-worst environment. In many cases, even the best-estimate environment does not meet the impact tolerance goals without dropping from 3-sigma to 2-sigma or below, and in some cases show "no capability" of surviving impact. Several of the charts state that "orbiter certification impact threshold does not meet N.S.T.S. requirements," meaning that the designation did not meet the National Space Transportation System's safety requirements.

Mr. Muratore argues that a 2-sigma standard is "not unprecedented" – that it was used to approve the risks associated with aborting missions after an engine had failed. In an interview, he said the process was not intended to move the goal posts.

"In my entire 25-year career I've never juggled a number," Mr. Muratore said. The traditional standards of airplane quality certification are unrealistic for the shuttle, he said.

The engineering challenge is enormously complex, he said. "If you plan for the absolute worst-on-worst case, it can fake you out into thinking you can't do anything," he said.

Even after two years of research, he said, "we're just beginning to get our arms around some of these kinds of numbers."

Moving from a 3-sigma to 2-sigma "is pretty reasonable," he said, if analysis can show the likelihood of debris of the right size striking that vulnerable spot with the precise amount of force to cause severe damage is only 1 in 1000 or 1 in 10,000. He said there had been "a lot of healthy debate."

NASA is completing its analysis of 177 possible debris sources and is about to present the data to the task force evaluating whether the shuttle Discovery is safe enough to lift off as scheduled during the two-weeks beginning May 22. That group – named for Thomas P. Stafford

NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.

and Richard O. Covey, the two former astronauts who are leading it – postponed its final public meeting late last month and told NASA that it needed more information, including further details about the shuttle's ability to withstand impact from debris.

When asked whether the task force had seen the documents obtained by The Times, David Drachlis, a spokesman, said that it had not but that "essentially, all of the information you described has been presented to the task group."

NASA went back to perform additional debris reviews before making a final presentation to the Stafford–Covey group, which will then present a report to Dr. Michael D. Griffin, the agency's new administrator.

Dr. Griffin has said that NASA may return to flight without having fulfilled all the accident board's recommendations. "Accident boards make recommendations that seem good to them at the time but which may not in all cases be capable of implementation," he said last week at his Senate confirmation hearing.

The notion that NASA is declaring its evaluation tools "overly conservative" has parallels to the Columbia disaster, when NASA turned to Boeing engineers for analysis. They used a computer program called Crater, which predicted potentially severe damage, but the engineers played down the results on the ground that Crater was a "conservative" tool, and mission managers squelched further efforts to look for damage. NASA officials have said the agency now knows more about the problems of foam and ice, and has taken steps to reduce risk.

Even though it would be virtually impossible to determine the risk of a serious foam strike in time to abort a future shuttle mission, NASA is developing methods of repairing the shuttle's skin in orbit and has developed a risky "safe-haven" plan that would allow astronauts in a damaged shuttle to remain at the International Space Station for up to 45 days until a rescue mission could be attempted.

A NASA employee who provided the documents said optimism based on past success is unwarranted, and compared it to saying, "We've run the red light again and again, and we've gotten away with it."

"They haven't gotten away with it," he continued. "They've destroyed two orbiters – 14 people are dead."

James Wetherbee, a former shuttle commander and safety official who recently retired from NASA, said he had attended briefings that discussed lowering the risk standards a year ago. He expressed concern about NASA's tendency to oversimplify complex calculations and then for management to put the best face on the result. Mr. Muratore's analysis, he said, is honest – if not, it would not show so many areas of the shuttle failing traditional tests – but "the numbers came out

NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.

worse than we thought they would."

He said the shuttle should fly the limited number of missions to complete the space station, but only after NASA fully explained the risk to the American people – "and I think people would agree." He said work must continue to make the shuttle safer. "You can't simply accept lower standards and decide to go fly," he said. "You must do something else to earn the privilege," with further redesign to fix the debris problem and to toughen the leading edges.

But that it is not likely, he said.

"You know what's going to happen? They'll have no problem on this flight or the next flight," he said, and the issue "won't be on the front burner any more. We'll forget about it."

• *Follow-Ups:*

- ◆ ***Re: NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.***
 ◇ *From: James*
 - ◆ ***Re: NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.***
 ◇ *From: Joe D.*
 - ◆ ***Re: NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.***
 ◇ *From: Craig Fink*
 - ◆ ***Re: NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.***
 ◇ *From: richard schumacher*
 - ◆ ***Re: NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.***
 ◇ *From: Brian Gaff*
-
- Prev by Date: ***Re: NASA Delays First Post-Columbia Launch. New launch date for Discovery is May 22***
 - Next by Date: ***Re: \$35 Million of Equipment Missing from NASA.....***
 - Previous by thread: ***More rollout photos***
 - Next by thread: ***Re: NY Times Blockbuster: NASA Officials Loosen Acceptable Risk Standards for Shuttle.***
 - Index(es):
 - ◆ ***Date***
 - ◆ ***Thread***