Shuttle Rocket Plan Under Fire

NASA safety panel says plan to spend $1.2 billion on a solid rocket factory in Yellow Creek, Mississippi, will not improve the shuttle's safety; a boost for liquid boosters?

"We stepped right into the middle of a big commotion" at the National Aeronautics and Space Administration (NASA), says Joseph Sutter, chairman of NASA's top safety panel and a retired Boeing vice president. Actually, he caused it. NASA was going quietly about its business until Sutter delivered a load of unwelcome advice at headquarters on 28 March, calling a major part of the shuttle program a waste of money.

Sutter told the top brass—including James Fletcher, the departing NASA administrator, Richard Truly, his apparent successor, and James R. Thompson, Jr., slated to be Truly's deputy—that NASA ought to consider scrapping a $1.2-billion plan to rebuild the shuttle's rocket boosters.

It will take at least 5 years to develop the new solid-fueled rockets, Sutter says, and 10 years to certify them as safe. If used before then, they would make the shuttle riskier to fly. A better strategy, according to Sutter, would be to spend the $1 billion to $2 billion on innovative liquid engine technology or on a big unmanned cargo bay for the shuttle.

If NASA wants to spend $1 billion improving the safety of the shuttle, the Sutter panel suggests that instead of building new rockets, it might move quickly to reduce stresses in the overpressured main engines. Why not speed up plans to replace the big valves that control fuel flow between the main tank and the orbiter? These problems have not received as much attention as the rockets, but they deserve it, the panel says.

In making this case, Sutter gave the unanimous view of NASA's Aeronautics Safety Advisory Panel, but he did so at an awkward moment. NASA seems inclined to reject the advice. The decision has strong backing in Congress, and, according to NASA officials, the $1 billion to $2 billion worth of final contracts are due to be awarded "in a week or two." A hearing on the decision is scheduled tentatively for 17 April in the Senate subcommittee on science, technology, and space, chaired by Albert Gore (D–TN).

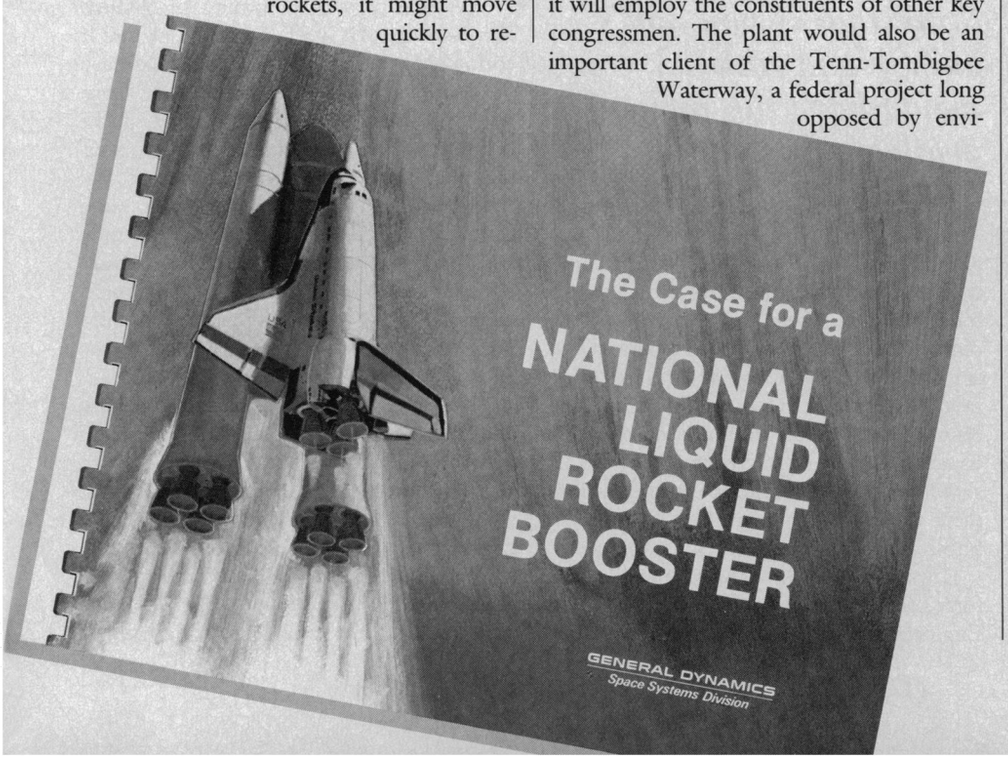
Members of this subcommittee heaped praise on the agency earlier this year for deciding to build the new factory and choosing to place it at Yellow Creek, Mississippi. The spot's political geography is indeed golden. It is an unused nuclear power site belonging to the Tennessee Valley Authority, located in the northeast corner of Mississippi, abutting Alabama and Tennessee. The factory will fall in the district of Representative Jamie Whitten (D–MS), chairman of the House Appropriations Committee, and it will employ the constituents of other key congressmen. The plant would also be an important client of the Tenn-Tombigbee Waterway, a federal project long opposed by environmentalists as unnecessary.

Sutter and his committee have been criticized, in a sense, for rudely interrupting the wedding just as the vows were about to be spoken. A congressional aide was quoted in *Aviation Week and Space Technology* as saying: "Where's the panel been for the last 2 years? They've never approached us with their concerns?" Sutter's response: "We said the same thing in last year's report."

This year's advice was presented to NASA in a session that was downright "raucous," says the panel's staff officer Gilbert Roth. "We had people sitting on tables, ledges, filling the room; we had to turn 30 or 40 away. . . . There was a lot of give and take." Sutter regrets that he made "a rude remark about Congress" and its meddling in technical matters. But he is adamant in his view that going forward with the Advanced Solid Rocket Motor (ASRM) project would not be a good way to improve the shuttle's safety.

His concern is that while a new design may remove old flaws identified as causes of the Challenger accident (the O-rings, for example), it would introduce new ones. On a statistical basis, a tested rocket is much safer than an untested one, and scores of the old rockets will have been tested on live flights before the first of the new rockets will be ready for lab checkout in 1994. The Sutter panel argues that NASA has already done something about problems on the solid rockets, having spent more than $1 billion to fix them. Now it should focus on other things.

NASA's view, according to shuttle propulsion chief Russell Bardos, is that much work remains to be done on the solid rockets, and that it can be done best by starting with a "clean sheet of paper" rather than tinkering with the existing motors. If a fundamental redesign is permitted, as would be possible if the Yellow Creek plant goes through, 25% of the "critical one" failure modes on the rocket that could lead to catastrophe can be eliminated. In addition, if



A liquid launch. *General Dynamics is promoting liquid-fueled boosters as a safer, cleaner alternative to solid rockets.*

Jerry Grey: *Spending another $1.2 billion on solid rockets is "dead-end development."*

the new rockets increase the power as much as expected, it may be possible to do away with the need to throttle the main engines on launch, eliminating 175 other lethal failure modes on the whole shuttle system.

As to the charge that the new system will bring in new risks, NASA's Thompson, chief of the Marshall Space Flight Center and chairman of the board that will make the Yellow Creek contract award, said in a hearing last year that the first new rocket off the production line will be safer than the 200th rocket from the old line. His view is based on the anticipated improvements in manufacturing, which will bring a shift from the old handmade, batch process to a fully automated system that will presumably make a more consistent product.

Myron Uman, a plasma physicist who was staff director for the National Research Council group that advised NASA on the redesign of the old rockets, says it is impossible to compare the risks of the two systems because one of them does not yet exist. Predictions about the Yellow Creek rockets depend a great deal on the quality of the manufacturing process, which remains an unknown.

The safety panel is not alone in doubting the value of the ASRM project. It is "a turkey with a capital T," says an independent government analyst of space propulsion technologies who requests anonymity. He claims the Yellow Creek factory was funded because "Congress and the American public wanted to beat up on Morton Thiokol," the company that made the solid rockets that blew up on the Challenger. It is still the "sole source" supplier of rockets for the shuttle. According to this official, people said: "Punish Thiokol." NASA responded: "How can we? It's a monopoly." Congress said: "Fix it!" NASA then came up with a $1-billion to $2-billion fix, calling for construction of a brand new, government-owned factory.

The goal was to give NASA more leverage over rocket manufacturing. If NASA were displeased with its solid rockets again, it could boot out the contractor and find a new one. At present, it cannot because Morton Thiokol owns its plant. If the new federal factory is built, Thiokol surely will be out anyway. An indication that this is so is that, after competing in the first round of studies on the Yellow Creek concept, Morton Thiokol decided to withdraw from the field last spring. Alan McDonald, the engineer who designed the upgraded solid rockets Thiokol makes today, says: "We backed out because we wanted to put all our energy into a successful shuttle launch last fall. Politically, it was going to be difficult to win the ASRM contract anyway."

Jerry Grey, science and technology policy director for the American Institute of Aeronautics and Astronautics, says that although the Yellow Creek project may improve the shuttle's performance, he nevertheless regards it as "dead-end development." He believes the next generation of transport systems will rely mainly on liquid-fueled engines, as the European Ariane rockets and the Soviet heavy lifter Energia do. "Look at the designs that have been submitted for the ALS [Advanced Launch System]," he says,

NASA's Russell Bardos says: "It is a fiction to think that if you don't build [solid rockets] you would have the money available for other things."

referring to the Air Force's multibillion-dollar effort to create a radical new space transportation system by the end of the century. "There are no big solid boosters on any of the designs, just small ones like those used on the Delta." Grey testified before the House space science and applications subcommittee on 4 April, arguing that NASA should invest more in liquid engine development than it has thus far, and less in solid boosters.

Lawrence Mattson, chairman of a task force of the American Society of Mechanical Engineers and an employee of TRW, Inc., gave similar testimony. "We think NASA should take another look at the liquid rocket booster before they run off on full-scale development of the ASRM," says Mattson. Liquid engines provide more flexibility at launch, because they can be powered down or turned off if trouble appears, while solids cannot. They also offer some redundancy, in that a liquid system with several engines can tolerate a failure of one or two on launch. Finally, liquid rockets do not dump 40 tons of hydrochloric acid into the atmosphere on each launch as the shuttle solid boosters do.

The new interest in liquid rockets is inspired partly by a sales campaign mounted by the General Dynamics Company. It was hired by NASA after the Challenger accident to look into options for using liquid rather than solid boosters. After spending about $14 million on preliminary "Phase A" studies, NASA is now setting aside the research on liquid motors and focusing on the ASRM. General Dynamics won a small $400,000 extension to carry its studies through the year, and program manager Paul Bialla hopes to persuade decision-makers in Washington that liquid boosters deserve a second chance.

One of Bialla's appealing arguments is that a NASA liquid booster program could be combined with the Air Force's liquid ALS program. The size, thrust, and weight requirements are virtually the same. Why not divert the $1.5 billion from the ASRMs into a joint NASA–Air Force program, he asks, creating a development account of roughly $4 billion? It would provide the shuttle with 21st-century booster technology, speed up the Air Force program, and possibly create an engine with other civil and military applications.

The short answer, according to NASA's Bardos, is that "it is a fiction to think that if you don't build an ASRM you would have the money available for other things." Congress approved the program on a very specific basis, and any new expenditure, whether on liquid motors or accelerated safety changes, would have to undergo the same close scrutiny. Bardos also thinks the time and cost estimates given for the liquid boosters are unreliable. In his view, it would take at least 8 years to develop a liquid booster, as opposed to 5 years for the ASRM, and considerably more money.

The pros and cons of liquid rockets have been argued many times. But now that NASA's safety panel has thrown its vote in with the liquid systems, they are likely to get some more attention. The question at the moment is whether NASA will delay the solid rocket contract award for Yellow Creek for a more careful review or plunge forward.

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