AWESOME stories

THE INSULATION PROBLEM

In this still-shot from a video which *Columbia's* crew was recording during the final moments of Mission STS-107, we see the hot glow of reentry outside the orbiter's windows. At this moment in time—on the 1st of February, 2003—none of the astronauts aboard *Columbia* knew that their shuttle had a gaping hole in the left wing. Image online via NASA.

When the insulation fell off the shuttle's external tank, its impact on the orbiter's left wing could have damaged the black ceramic heat tiles that protect the ship during reentry. Those tiles are critically important since they can withstand significantly greater temperatures than the aluminum skin of the ship.

If too many tiles are missing, or damaged, the protected shuttle surface under the tiles would be exposed. The shuttle's surface, without the thermal protection system, would deform at reentry.

If the shuttle's surface warped, or deformed, ceramic heat tiles could peel away in a chain reaction. If too many tiles peeled away, the shuttle would be without protection. If *Columbia* had insufficient protection at reentry, the ship would disintegrate and fall to the Earth in a fireball.

Did those series of catastrophic events occur to *Columbia*? Or ... did the debris strike the leading edge of the orbiter's wing, which was protected by reinforced-carbon-carbon? If debris struck the wing, what type of damage could result?

No one, during the initial stage of the investigation, could be sure. But as Ron Dittemore, NASA's Space Shuttle Program Manager, said in an early press conference:

> *We're making the assumption from the start that the external tank was the root cause of the problem that lost Columbia. That's a fairly drastic assumption and it's sobering.*

It's "drastic" and "sobering" because if that sequence of events could doom *Columbia*, what would prevent it from catastrophically happening again?

Damaged heat tiles were previously found on *Columbia*, as well as other shuttles, when they successfully returned to earth - all without performance difficulties. And during a 1992 launch of *Columbia*, a piece of external-tank insulation broke loose, damaging the orbiter's wing.

But ... for insulation to rip away twice (STS-112 and STS-107) during three successive launches, one could wonder - as Dittemore verbally did - whether something had changed?

At the time mission controllers discovered the *Columbia* event, however, no one had enough experience with the phenomenon to immediately believe it was a potentially fatal problem. According to the NASA press briefings, engineers studied the issue and wrote a short report on Day 12 of the sixteen-day mission.

The report observed there was "the potential for a large damage area to the tile," but concluded the video reviews had shown no apparent "burn-through and no safety-of-flight issue."

On the other hand ... about 23 hours before *Columbia* disintegrated ... Jeffrey Kling (a flight controller in Houston who was thinking about possible worst-case scenarios related to the launch incident) sent an email (scroll down to page 7 of 27) about an issue which worried him.

If "hot plasma" penetrated the shuttle's wheel wells, landing gear temperatures would rise. If data from the landing gear area disappeared altogether, Kling's team would recommend:

> *to set up for a bailout (assuming the wing doesn't burn off before we can get the crew out).*

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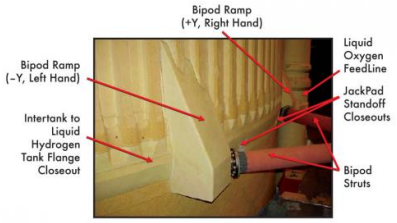

Source of Debris Which Struck Columbia

NASA Photo.

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