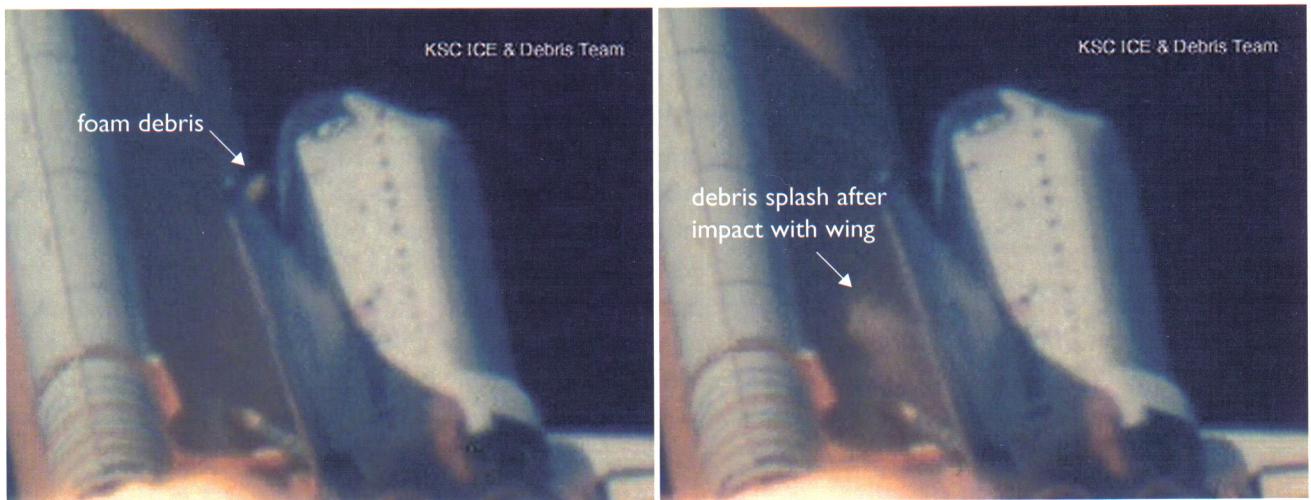


## *PowerPoint Does Rocket Science: Assessing the Quality and Credibility of Technical Reports*

NEARLY all engineering presentations at NASA are made in PowerPoint. Is this a product endorsement or a big mistake? Does PP's cognitive style affect the quality of engineering analysis? How does PP compare with alternative methods of technical presentation? Some answers come from the evidence of NASA PowerPoint in action: (1) hundreds of PP technical presentations experienced in 2003 by the Columbia Accident Investigation Board and in 2005 by the Return to Flight Task Group, (2) a case study of the PP presentations for NASA officials making life-and-death decisions during the final flight of Columbia, (3) observations by Richard Feynman who saw a lot of slideware-style presentations in his NASA work on the 1986 Challenger accident, (4) my observations as a NASA consultant on technical presentations for shuttle risk assessments, shuttle engineering, and deep spaceflight trajectories.

DURING the January 2003 spaceflight of shuttle Columbia, 82 seconds after liftoff, a 1.67 pound (760 grams) piece of foam insulation broke off from the liquid fuel tank, hit the left wing, and broke through the wing's thermal protection. After orbiting the Earth for 2 weeks with an undetected hole in its wing, the Columbia burned up during re-entry because the compromised thermal protection was unable to withstand the intense temperatures that occur upon atmosphere re-entry. The *only* evidence of a possible problem was a very brief video sequence showing that something hit the wing somewhere. Here are 2 frame-captures from a video at 82 seconds after Columbia's launch:



The rapidly accelerating Columbia in effect ran into the foam debris. Post-accident frame-by-frame analysis yields the impact velocity of the foam, 600 miles or 970 km per hour, the speed of sound. Since kinetic energy =  $\frac{1}{2}mv^2$ , the velocity-squared contribution is substantial.

In the video, 2 relevant variables are indeterminate: impact angle of incidence and impact location. Did the debris hit the insulation tiles on the left wing, or the reinforced carbon-carbon (RCC) on the leading edge of the wing? Post-accident investigation established that the foam hit the especially vulnerable RCC.