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Digital information may be key to finding cause of the breakup

Most of the shuttle was likely incinerated, experts say
Lack of large pieces will preclude physical reconstruction

By Frank Kummer
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The investigation into the space shuttle Columbia disaster will focus on gigabytes of electronic data, technical reports from contractors, and frame-by-frame reviews of video as much as on any physical evidence left by the spacecraft, experts say.

Although some people in Texas reported that they found chunks of debris, chances are that most of the craft burned up in the 2,000-degree or higher heat generated during the ship's descent and disintegration.

That leaves the painstaking task of reconstructing what went wrong in a highly sophisticated machine mostly from digital information stored in NASA's computers.

Temperatures generated at the shuttle's speed of 12,500 m.p.h. would have been so high that most parts would have burned up, said Cengiz Camci, a professor of aerospace engineering at **Pennsylvania State University**.

Camci, who teaches aerospace propulsion, which includes space shuttle engines, compared the shuttle at the point of breakup to a meteorite.

"Once it starts falling apart, there's no design for that," Camci said. "You're gone. It will incinerate. It's not like an aircraft accident, where they'll put the pieces in a hangar and have a visually reconstructed aircraft."

Such an investigation is likely to take months, experts say. It took a presidential commission investigating the Challenger explosion in January 1986 five months to release its findings.

"It's going to take us some time to work through the investigation and analysis," said Ron Dittemore, NASA's shuttle program manager. "We will be poring over that data 24 hours a day for the foreseeable future."

Dittemore suggested that part of the investigation was likely to focus on a piece of foam insulation from an external fuel tank that came off during takeoff Jan. 16 and struck the left wing.

Ground crews lost all data from sensors in that wing just before the spacecraft disintegrated yesterday about 9 a.m. Eastern Standard Time. But Dittemore said that it was too early to announce a cause.Two separate investigations have been launched. The government appointed an independent board, which includes the Air Force, the Navy, and the Department of Transportation. NASA will conduct its own investigation.

The investigations will likely tap the expertise of scientists and engineers from a variety of disciplines, from engine design to airframe specialists, **Penn State**'s Camci said.

Bringing in scientists from outside NASA could be critical for their different perspectives, Camci said.

Mel Burkart, a professor emeritus of aviation science at St. Louis University, agreed.

"I would be dumbfounded if they tried to do any reconstruction," said Burkart, who teaches aviation accident investigation. "My guess is that they will find some debris. How much is going to be another story altogether."

Burkart said that investigators would begin by reviewing flight data sent by telemeter from the shuttle's sensors to NASA ground crews. Other sources of information would be military and commercial satellites, and videos shot from the ground.

The data itself might show an apparent cause, he said. Or, the scientists might be able to compare data from similar points in Columbia's other flights to data from yesterday. Any anomalies could point to a cause, he said.

Derek Pitts, chief astronomer for the Franklin Institute, said a fuel explosion might quickly be ruled out, given that most, if not all, fuel would have been used during reentry into the Earth's atmosphere.

"All the shuttle is supposed to do at that point is glide to a landing," Pitts said. "There's no fuel involved. There's no plan for engines to be used on reentry. But there is a lot of energy involved. It has a lot of velocity."

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