

## **Boeing Delta III Investigation Identifies Probable Cause For Premature Engine Shutdown**

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Boeing officials said today that they have identified a probable scenario for the premature shutdown of the second-stage engine during the May 4 Delta III flight. The unexpected event resulted in a communications satellite being placed into a lower than planned orbit.

"We reviewed considerable data to re-create the events leading up to and after the flight anomaly," stated Dr. Russell Reck, Boeing Investigation Chairman. "While we are still pursuing several scenarios, the most likely one appears to be a breach in the engine combustion chamber that resulted in an explosive-type event."

Telemetry data and analyses indicate that the failure occurred in the region of a combustion chamber joint.

"The flight data indicates that there were two shocks: The first unexplained shock 4.5 seconds after the first ignition of the second stage, then a much larger shock 3.5 seconds after the second ignition.

Data on the second larger shock is similar to that observed during separation of the first and second stage on Delta III which uses an ordnance system for that separation which shears the metal between the stages. We saw a similar shock environment when the engine shutdown," Reck added.

In re-creating the sequence of events, the team now believes that the turbo machinery rotated for several milliseconds after the second larger shock, and that the shock event caused the turbo machinery to stop.

"At the time of the larger shock there was an impulsive force applied, that caused the vehicle to tumble. We now understand that the source of that impulse would have to be very close to the center of the vehicle. Only two things are that close to the center, the combustion chamber and the injector head," Reck continued.

Following the larger shock event, equipment near the engine showed an increase in temperature, then an immediate decrease in temperature. "The increase may have been caused by exposure to hot gas escaping from the combustion chamber, followed by cold exposure, probably from a cryogen propellant breach," said Reck.

The investigation team is currently pursuing root causes for the loss of the thrust chamber including the structural integrity of the chamber itself and possible external forces induced by gimbaling loads or the exit cone. They are reviewing the analyses and quality inspections performed on the engine, and are in the process of conducting tests and additional analyses to better understand the problem and identify the root cause.

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