

Tuesday, March 31, 2009

4:00 pm

in Room 303 MAE-A

**CHALLENGER AND COLUMBIA INVESTIGATIONS AND  
THE ROLE OF THE CRATER PROGRAM****Allen J. Richardson**

Retired Space Shuttle Engineer

University of Florida Graduate, BSME 1956

**Abstract**

The writer, who worked on the space shuttle from its inception, was in a unique position of being integrally involved in both the Challenger and Columbia shuttle accident investigations and presents an inside view of these epochal events. The shuttle orbiter Thermal Protection System (TPS) is composed of the tiles, the wing leading edge Reinforced Carbon Carbon (RCC) material and the windows. It is critical to safe operation of the shuttle and a Debris Team was established to monitor the debris damage to the TPS on a per flight basis. One team function was and is to view the video camera launch photos from 42 cameras to establish the source of debris striking the orbiter TPS. The Debris Team was called on during the Challenger investigation, and successfully applied their launch video viewing expertise to determine the cause of the accident. The writer, a member of the team, recounts details of this part of the investigation.

From the outset, the Columbia accident investigation centered on the impact of an oversized piece of foam debris on the left wing of the vehicle and its effect on the TPS. As a former member of the Debris Team the writer was brought in from retirement as a consultant to assist with the investigation. Early in the investigation the Forensic Team deduced from vehicle wreckage that the thermal damage to the left wing interior was probably the result of a large hole in the leading edge. The writer, working in parallel with the Forensic Team, headed a team which derived an analysis method which showed that the foam impact could have done such damage. The details of this joint effort are documented.

The Crater Program was through out the Shuttle Program the engineering predictor of projectile impact damage to the TPS tiles. It was applied by engineering while the Columbia vehicle was on orbit to assess the hazard the foam impact posed to the mission. The assessment resulted in an erroneous safe to reenter conclusion. Early in the investigation the Columbia Accident Investigation Board implied that the Crater Program contributed to the erroneous assessment. The writer, who was the responsible engineer for the Crater Program, identifies the actual causes of the erroneous assessment, and describes events following the investigation which have led to the Crater Program being the current engineering tool for prediction of projectile impact damage to the shuttle tiles.

***Refreshments served in 303 MAE-A beginning at 3:50 pm***

## **Biography**

### **ALLEN J. RICHARDSON**

Mr. Richardson was born March 26, 1929 in Ft. Wayne, Indiana. He served two years in the U. S. Army Corps of Engineers. His college education was obtained at the University of Florida in Gainesville where he graduated in 1956 with a Bachelors Degree in Mechanical Engineering, with honors. From 1957 to 1963 he was employed as a structural designer and stress analyst at General Nuclear Engineering in Dunedin Florida, headed by Dr. Zinn, of Manhattan Project fame. He took part in the successful design of a prototype nuclear superheating power reactor built in Puerto Rico.

.In 1963 he joined the North American Aviation Corporation in Downey, California assigned to work on the Apollo Project as a structural analyst. He was responsible for computing the meteoroid hazard to the Command Module and Service Module lunar vehicles. He headed a group which successfully completed that task, for which he received the Silver Snoopy award. In the process of performing the hazard analysis the Discrete Particle Analysis method was developed which was the forerunner of current methods for predicting damage to spacecraft structures by hypervelocity projectiles.

Mr. Richardson joined the Space Shuttle team at the onset heading a group responsible for strength of the Crew Module and the Orbiter Mechanisms. He also was a member of the NASA/Contractor Debris Team which monitored the projectile impact damage to the Orbiter Thermal Protection System, and was the engineer responsible for developing analysis methods for predicting damage, including the Crater Program. The latter assignment involved him in both the Challenger and Columbia accident investigations. As a consultant to Boeing he was responsible for developing an analysis method for predicting foam projectile damage to the shuttle wing leading edge which was a key to determining the cause of the Columbia accident.

Mr. Richardson appeared in the 2008 PBS NOVA documentary on the Columbia Disaster and is the author of an opinion piece on their website which makes a case for saving the Space Shuttle Program. He is spokesman for the Shuttle Advocates Team a group of retired shuttle engineers..