Burton G. Cour-Palais
April 18, 1925-July 20, 2004

The orbital debris community has lost another member whose contributions helped shape current orbital debris research. Burt Cour-Palais died on July 20, 2004. Most people will remember Burt for his internationally recognized contributions to hypervelocity research; however, few likely realize that Burt also help set the stage for what eventually grew into the orbital debris program of today.

Burton G. Cour-Palais

Burt was born a British citizen in India, where he also attended college. After graduating, he worked for several aircraft companies in England and Canada as a structural engineer before coming to NASA/Langley in 1960. The next year he transferred to what would eventually be known as the Johnson Space Center (JSC) in Houston, where Burt began his meteoroid and hypervelocity research.

In 1961, the hazards to man in space from meteoroids were unknown; one of the first experiments at JSC to help understand that hazard was to lay a space suit on the ground and shoot it with a shotgun. While this experiment may not have provided any useful results, it is a reflection of the state of the art when Burt began his research. One of the first things Burt did was to provide the design and requirements for the "west wing" of JSC Building 31, which became the original hypervelocity laboratory at JSC. It was here that Burt was able to conduct the many experiments that helped lead to the equations still used today to describe the effects of hypervelocity impacts on aluminum bumper configurations.

During the early 1960's there were two very different models describing the meteoroid environment. One, based on what was known as acoustical sensors, predicted a large hazard for manned missions. The other, based on penetration sensors, predicted only a moderate hazard for the then-planned missions. Perhaps because of Burt's knowledge of hypervelocity penetrations, he was one of those who believed the lower hazard was correct. To test that belief, he organized and participated in the examination of the surfaces of the recovered Mercury spacecraft for hypervelocity impacts, especially the window on the spacecraft. These examinations supported the lower hazard. At the same time, Burt's responsibilities increased: in 1964, Burt was appointed Assistant Chief of the Meteoroid Environment Section; in 1965, Manager of Apollo Subsystem Meteoroid Protection; and in 1967, Chief of the Meteoroid Sciences Branch; members included Herb Zook and Don Kessler, who could both point to Burt as inspiring their interest in the field.

As Manager of Apollo Subsystem Meteoroid Protection, Burt established the basis of the meteoroid/debris risk assessment process. That process formulated the protection requirements for the Apollo vehicles (CM-SM, LM) and the astronaut's space suit from the meteoroid & lunar surface secondary environment models and hypervelocity impact models. The process included developing ballistic limit equations and the use of extensive hypervelocity testing to understand the response of spacecraft structures to meteoroid impact, and to identify what needed to change in order to meet requirements. This process is followed to this day by all space faring nations.

In 1966, NASA headquarters identified a need for a "monograph" describing the meteoroid environment. The purpose of this monograph was to establish the best interpretation of all meteoroid experiments and a baseline meteoroid environment for all spacecraft operations. Burt was asked to write it, which he did with the help of an ad hoc committee. It was published as NASA SP-8013, "Meteoroid Environment Model – 1969 (Near Earth to Lunar Surface)". This environment became the recommended meteoroid environment model for all spacecraft for the next 25 years. It was supplanted during the design of the International Space Station, where Burt's environment was replaced with a slightly modified environment model with roots in research conducted by members of Burt's Branch. Burt encouraged Branch members to conduct independent research; he was always more concerned about determining scientific truth than receiving credit.

In late 1969, Apollo 12 returned parts of the Surveyor 3 spacecraft that had been placed on the moon 2-1/2 years earlier. Burt was requested by JSC management to lead a team to examine those Surveyor parts for meteoroid impacts. The results of the examination confirmed Burt's lower meteoroid environment model predictions on the lunar surface. In October 1970, JSC management abolished the Meteoroid Sciences Branch, commenting that its members had done such a good job defining a lower spacecraft hazard that they were no longer needed.

Burt was able to continue limited meteoroid research for a few years before being transferred to the Environmental Effects Project Office, headed by Drew Potter. There, Burt was responsible for defining and documenting the environmental concerns in the Earth's troposphere that the Space Shuttle program would cause. To do this, Burt conducted a large workshop, and published the results of that workshop. Those results became part of the Shuttle Environmental Impact Statement that was required by new federal law. It was in this office that Don Kessler and Burt began work on their own initiative to describe the environmental impact of leaving debris in orbit. This initial debris work was published in the Journal of Geophysical Research in 1978 … just after the Environmental Effects Projects Office, having completed its assigned task, was abolished by JSC management.

Burt was then transferred to the Technical Planning Office, under Joe Loftus. Part of his responsibility there was to prepare a 10-year program plan for orbital debris research in an attempt to get funding from NASA Headquarters. The next year, the program was approved by the JSC Center Director and orbital debris research found its home under Don Kessler within the newly formed Space Sciences Branch, headed by Drew Potter. Later that year, NASA Headquarters approved the first funding for the program. In 1983, Burt transferred to the Space Science Branch, and began working with Jeanne Crews and Eric Christiansen who were rebuilding the hypervelocity gun facilities at JSC, and beginning to test composite materials. Once again, after 13 years, Burt was able to

conduct the hypervelocity research that he loved. Burt, Jeanne, and Eric began researching new ways to design spacecraft shielding, and discovered the innovative shield design using several layers of a ceramic fabric as a bumper material in place of aluminum.

Caricature of Burt by Pat Rawlings
Presented to Burt at his retirement party

Burt retired from NASA in 1989, but he didn't retire from hypervelocity work. For the next five years, he worked for McDonnell Douglas supporting the design of the shields for the Space Station. After that, he continued to consult with NASA on hypervelocity issues through Southwest Research. In 1996, Burt received the Distinguished Scientist Award from the Hypervelocity Impact Society. When he died, he was enthusiastically compiling a reference list of important hypervelocity research for Southwest Research as well as reviewing the ballistic limit equations used in BUMPER code to assess Shuttle meteoroid/orbital debris risks.

Burt will be missed by many. We owe him a debt that can best be repaid by our continuing the quality of work he maintained, the enthusiasm he exhibited, and the giving of our best for the love of the job.