Dean R. Chapman

NASA Ames Hall of Fame

One of the marks of an exceptional, rather than simply competent, scientist is the ability to look beyond the obvious, to draw comparisons and make connections in new and unimagined ways. It's these moments of insight by the exceptional scientist that point the way to entirely new ways of thinking and understanding. Dean Chapman is one such scientist, and his contributions span both basic and applied science.

A major question in the early days of the space age concerned the physics of reentry aerodynamics. Exactly how did natural objects such as meteors survive their fiery plunge into Earth's atmosphere? How did the reentry process change various materials? Did some materials hold up better than others to the ordeal of the atmospheric friction of reentry? The answers to these questions would point the way to designing spacecraft which could also withstand reentry. Dr. Chapman's work in hypersonic heat transfer, skin friction and aerodynamic pressures naturally led him to the consideration of these crucial problems. Using Ames' 1 x 3 foot supersonic tunnel and arc jets, he subjected various materials to hypersonic flow, studying their physical transformation under enormous aerodynamic heat friction and the wave patterns that formed as the materials melted and ablated. One of the most valuable results of his work on atmospheric reentry is the Chapman equation, a tool still used today by designers of reentry vehicles. Chapman's studies of meteorites provided further clues to the effects of atmospheric reentry.

But it was a stunning moment of insight which provided Chapman with his most famous achievement. On a visit to an English natural history museum in 1960, he became fascinated by the unusual objects called tektites, dark glassy objects which had been found all over the Earth for centuries but whose origin remained a mystery. Chapman immediately realized that there were marked similarities between tektites and the objects he had created by aerodynamic heating in Ames' arc jets. Could the tektites have been formed likewise: by the very same processes which accompanied atmospheric reentry?

He decided to find out. After cutting open tektites and discovering that their interiors displayed the characteristic wave patterns and flow lines of aerodynamic reentry heating, he set out to confirm the connection by creating his own tektites. The new arc jet tunnels at Ames gave Chapman the tool he needed, and using the same materials which composed the natural objects and subjecting them to the same forces and heat which he believed had formed the natural tektites, he succeeded in artificially creating his own tektites. This confirmed his theory that the objects found scattered over the face of the Earth had been formed in the fires of atmospheric reentry, rather than by the geological processes which had formerly been accepted to explain their strange nature.

Yet another question remained: even if the glassy, smooth shape of tektites was a result of atmospheric reentry, where did the objects originate? Most theories suggested that tektites were flung from volcanoes or ejected from the high-velocity impact of meteorites. Chapman had a different idea. After analyzing the probable reentry trajectories and chemical composition of a particular series of Australian tektites, he realized that they were made of material from the Moon, ejected uncounted years ago by the impact of a huge iron-nickel meteor which formed the Tycho crater. Challenged by his boss Harvey Allen to be even more specific, Chapman was able to narrow the tektites' point of origin to the Rosse ray of the Tycho crater. Although only the actual return of samples from the Rosse ray could definitely confirm Chapman's theory, his ingenious scientific detective work made him the very first Ames employee to earn the NASA Medal for Exceptional Scientific Achievement.

Under Dr. Chapman's guidance as director of Ames' Thermo and Gas Dynamics Division, and later Director of Astronautics, Ames developed thermal protection systems for the Space Shuttle, Galileo Jupiter probe and many other vehicles. His creation of the computational fluid dynamics branch at Ames in 1970 assured the center's preeminence in that new and exciting field of research. Dr. Chapman's imagination, willingness to pursue new ideas and outstanding scientific leadership have all been essential in securing Ames' reputation as a leading center of aeronautical research.