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GEORGE CHERRY AND APOLLO LUNAR MODULE GUIDANCE

Abstract

George W. Cherry (1929-2010) of the MIT Instrumentation Laboratory (MIT IL) played a key role in the development of the Apollo Lunar Module (LM) primary guidance, navigation, and control (GNC) system, both as an engineer and a manager. Cherry published four papers in the 1960s on his theoretical contributions to LM GNC, but the significance of his theoretical work and his contributions as LM GNC Project Manager have not been documented. This paper provides an overview of his career and work on the Apollo LM.

By the late 1950s and early 1960s it was recognized that analog guidance algorithms used for military missiles of the 1950s were not capable of supporting human and robotic space missions. The development of digital computers motivated engineers to examine the development of guidance algorithms for performing real-time guidance using a digital flight computer. These algorithms included approximately optimal explicit and implicit on-board guidance schemes for launch vehicles and spacecraft.

In 1962 George Cherry devised an approximately optimal explicit guidance algorithm that was later called E Guidance. Cherry applied the new algorithm to insertion into a circular orbit from either a planetary surface or a hyperbolic approach trajectory. Cherry's E Guidance method was simple, flexible, and could accommodate a variety of trajectory constraints for either orbit insertion or planetary landing.

E Guidance served as the theoretical basis for Apollo LM ascent guidance and powered descent guidance. Allan Klumpp took E Guidance and formulated a practical algorithm for lunar landing that was coded by Don Eyles. Cherry also made theoretical contributions to the design of the LM control system.

Cherry served as the MIT IL Project Manager for the Apollo LM primary GNC system and led the team responsible for programming the LM primary computer. His project management role involved him in all aspects of LM GNC. He worked closely with Dr. Richard Battin of MIT IL, Bill Tindall of NASA, and the Apollo astronauts.

Cherry eventually was appointed Deputy Associate Director of the Charles Stark Draper Laboratory (formerly MIT IL). In December 1970 he joined NASA where he served as Director of the Aeronautical Operating Systems Division and Deputy Associate Administrator for Programs in the Office of Aeronautics and Space Technology. After leaving NASA, Cherry worked in computer science, and authored several books on computer programming, including Pascal Programming Structures, Parallel Programming in ANSI Standard, and Software Construction by Object Oriented Pictures.