The Galileo High Gain Antenna Anomaly: An Overview of the Recovery Efforts

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Launched October 1989, the Galileo spacecraft will explore the atmosphere, magnetosphere, and major satellites of Jupiter. Arriving December 1995, plans called for Galileo to transmit all Jovian science data through a deployed, parabolic High-Gain Antenna (HGA). In April 1991, commands to unfurl the antenna proved unsuccessful. In the attempt, the antenna deployment motors drove themselves to a hard stall without reaching full deployment. Analysis of power and attitude control data concluded that three or four of the antenna's 18 ribs had stuck to the central tower. The resulting loads jammed the deployment mechanism, leaving the antenna partially and asymmetrically deployed, Analyses and ground tests concluded that frictional binding of alignment pins on the ribs to their sockets on the tower are probably responsible. In spite of numerous efforts to free it, the HGA remains undeployed.

This paper describes the efforts to determine the state of the HGA and actions to try to free it. Emphasis is given to the sequence design issues required to rapidly plan and execute elaborate and non-standard activities on a complex interplanetary spacecraft It concludes with a summary of flight software and operational redesigns to execute the Jovian mission at significantly reduced data rates through the spacecraft's low-gain antenna.