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Author: Dr. Andrew Erickson

Naval War College/Harvard University, United States, andrew.sven.erickson@gmail.com

BEYOND MISSION CONTROL: THE UNTOLD STORY BEHIND APOLLO 13'S "LUNAR
LIFEBOAT" RESCUE**Abstract**

During the Apollo 13 mission, the Grumman Aerospace Corporation's Lunar Module saved three astronauts by becoming a lifeboat and tugboat. Contrary to the movie Apollo 13's haphazard misportrayal, but true to its conservative design philosophy, Grumman had added additional consumables to power the LM as a sustainment of last resort. The LM's linchpin role was anticipated overall, unanticipated in some specifics, and enabled by systematic preparations. Throughout the four-day crisis, LM Program Director Joe Gavin manned his post in NASA's Mission Control Center, managing Grumman's three-tiered support system to provide urgent assessment and application of the LM's capabilities for this emergency assignment and participating directly in key decision-making. The foresight of Grumman exceeded that of NASA, whose otherwise extremely detailed contractual scenarios never envisioned a LM rescue mission; Grumman would earn no incentive rewards for helping to save the day. Gavin, virtually all of his colleagues and contemporaries, Grumman itself in its original form, and many other under-recognized contributors have subsequently departed from the scene. Recent popular commemorations such as the movie Apollo 13 were made without consulting them, leaving their lifesaving legacy largely forgotten. This paper draws on archival documents as well as interviews with, and personal materials from, key participants to offer a richer, even more redeeming history. Reflecting on Grummanites' finest hours reveals many important factors behind the "lunar lifeboat" rescue. Gavin and his team were influenced by pioneering pilot-engineer-founder Leroy Grumman. Reaction Control System Project Leader Ozzie Williams overcame racial prejudice—including being barred from many Houston hotels in the early Apollo era—to make pioneering contributions to the LM's rocket thrusters, which literally helped steer Apollo 13 safely Earthward. Guiding from Headquarters in Bethpage was LM Chief Engineer Tom Kelly, summoned from an MIT sabbatical by midnight phone call that made him place his eldest son in charge of five younger siblings so Kelly's wife could drive him to Logan Airport. Gavin coordinated LM operations from Houston, getting only two hours' sleep over four days. Beyond Grumman itself, the Instrumentation Lab at Gavin's alma mater MIT—with which Gavin and his team worked closely and which contributed greatly to the resilience that saved Apollo 13—may well have made its own singular input through Margaret Hamilton, responsible for the Apollo On-Board Flight Software as Director of IL's Software Engineering Division, training astronaut Jim Lovell in navigation troubleshooting during Apollo 8. Countless others made critical contributions as team spirit triumphed.