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DEVELOPING TECHNOLOGICAL CAPABILITY IN THE APOLLO PROGRAM FROM PROBLEM-SOLVING F-1 COMBUSTION INSTABILITY

Abstract

One of the monumental developments for the Apollo program was radically innovating F-1 engine thrust capability 300-fold to sufficiently launch a manned space vehicle into orbit. The study of over 100 interviews was retrieved from NASA Oral History Project that included over 1,100 interviews. The sample consisted of engineers employed in NACA's/ NASA's Mercury, Gemini, or Apollo programs. Interviews were reviewed and NVivo-coded prior to refined, manual-coding for further qualitative analysis. The purpose of the study was to show how the problem-solving approach was utilized to develop the required technology for a successful crewed lunar mission. Rocket engine complexity during Apollo program was mitigated through the extended research and development of legacy German rocketry and management. Testing operations applied aggressive and experimental engineering methods for which fifty percent of budget after three years guaranteed no performance anomalies. Complexities dormant within the different phases of the structural technology development would emerge and manifest as barriers to useful functionality. As complexity was better understood, re-designs became more focused with a one-to-one mapping of design space to problem space operations. Conclusion: Problem solving aimed to diagnose a system's deep architectural precursors of fault propagation provided the means to localize the problem space wherein design errors or omissions responsible for de-optimized system performance, resided.