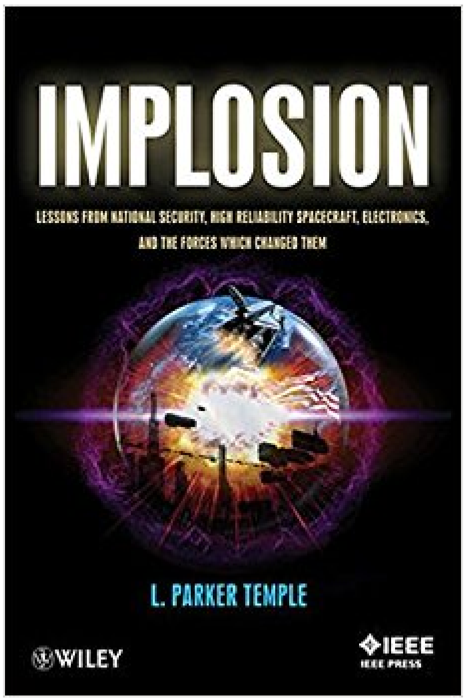
Implosion: Lessons From National Security, High Reliability Spacecraft, Electronics, And The Forces Which Changed Them



Synopsis

Implosion is a focused study of the history and uses of high-reliability, solid-state electronics, military standards, and space systems that support our national security and defense. This book is unique in combining the interdependent evolution of and interrelationships among military standards, solid-state electronics, and very high-reliability space systems. Starting with a brief description of the physics that enabled the development of the first transistor, Implosion covers the need for standardizing military electronics, which began during World War II and continues today. The book shows how these twin topics affected, and largely enabled, the highest reliability and most technologically capable robotic systems ever conceived. This riveting history helps readers: Realize the complex interdependence of solid-state electronics and practical implementations in the national security and defense space programs Understand the evolution of military standards for piece parts, quality, and reliability as they affected these programs Gain insight into the attempted reforms of federal systems acquisition of security- and defense-related space systems in the latter half of the twentieth century Appreciate the complexity of science and technology public policy decisions in the context of political, organizational, and economic realities Written in clear, jargon-free language, but with plenty of technical detail, Implosion is a must-read for aerospace and aviation engineers, manufacturers, and enthusiasts; technology students and historians; and anyone interested in the history of technology, military technology, and the space program.

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Customer Reviews

"It has elements of all four, but its real value is in theÃ Â amalgamation of these divergent elements into a meaningful whole." (Quest: The History of Spaceflight, 1 March 2013)

Solid-state electronics enabled the amazing transformation of life on Earth in countless ways during the second half of the twentieth century. This technology has become so ubiquitous that people worldwide take it for granted and, more often than not, never contemplate what the world would be like without it. In Implosion, historian Parker Temple captures in remarkable detail the evolutionary complexity of one aspect of that technological transformationÃ¢â ¬â •the requirement for and the acquisition of highly reliable solid-state electronics for mission assurance in U.S. national security and national defense space programs. From the incorporation of strict military specifications and standards for proliferating solid-state devices during the 1950-1960s to the inability of those specifications and standards to keep pace with the evolution of electronics in the 1980sÃ¢â ¬â •1990s, Dr. Temple weaves an elaborate narrative. He explains how military standards advanced the quality of solid-state electronic devices generally, even as demands for more capabilities engendered greater complexity, until concern about rising costs in the waning years of the twentieth century politicizedÃ Â change and resulted in the entropic unraveling of an optimized production system. Engineering instructors, students, industrial leaders, government procurement officers, administrative policy makers, and legislators all might benefit from contemplating Dr. Temple's critical analysis of how the optimized production system for highly reliable electronics came about, what sustained it over time, why it fell apart, and whether a satisfactory replacement might again ensure delivery of highly reliable electronic devices. History holds many lessons for those who are willing to pay attention, and Implosion reminds the attentive few that technological complexity can harbor the seeds of its own collapse.Ã Â As Dr. Temple correctly acknowledges, it took decades to evolve an optimized production system that once ensured highly reliable solid-state electronic devices for U.S. rocket and space programs; it likely will take decades before a fully acceptable replacement system emerges. Well informed, historically astute participants, playing many different roles, can help 'stay the course' that leads to that new production system. Ã¢â ¬â •Rick W. Sturdevant, Ph.D., Deputy Director of History, HQ Air Force Space Command

Solid-state electronics transformed human existence in the latter third of the twentieth century. Taking it for granted, most Americans use technologies based on this type of electronics every day. One cannot use a computer, telephone, television, or a host of other everyday devices without employing solid-state electronics. In this fully-documented study L. Parker Temple, a longtime space policy analyst and technologist, offers a useful history of this technology but even more hones in on the national security origins and evolution of this field before presenting a set of lessons learned and prescriptions for movement forward with this aspect of high technology.Temple begins in Implosion by exploring in quite useful detail the evolutionary nature of this complex technological transformation. It originated as a requirement for U.S. national security space efforts. The proliferation of applications for solid state electronics in the early Cold War era revolutionized the manner in which war would be waged ever after. Moreover, this technology had myriad applications beyond military equipment and changed the nature of consumer electronics as well.This is much more than a narrow study in the history of technology. The author focuses on the broad interrelationships of technology, innovation, systems, and policy to develop a useful analysis of technological leap-frogging more than a generation into the future. In the process he offers lessons that will be of merit to engineers, project managers, military officers, and other technology professionals in addition to historians. I was especially entranced by TempleÃƒÂ¢Ã â ¬Ã â„¢s complex analysis of the evolution of military standards and practices for technology ranging from individual parts to whole systems. Temple also draws out the immensely significant but largely unfathomable system of acquisition within the federal government, as well as the mjor policy that changed these practices over time.All of this suggests that L. Parker TempleÃƒÂ¢Ã â ¬Ã â„¢s work, ÃƒÂ¢Ã â ¬Ã Å“Implosion,ÃƒÂ¢Ã â ¬Ã Â• is more than a history, more than a policy analysis, more than an engineering study, and more than a management tome. It has elements of all four, but its real value is in the amalgamation of these divergent elements into a meaningful whole.

"Implosion: Lessons from National Security, High Reliability Spacecraft, Electronics, and the Forces which Changed Them" by L. Parker Temple tells the complicated but crucially important story of how high reliability electronics, vital to modern spacecraft, evolved. Written as a history, starting with vacuum tubes and the invention of the transistor, and continuing through integrated circuits (IC) and very large scale integration (VLSI), the military and intelligence demands of the Cold War are shown as driving the creation of high reliability parts. High reliability was not a "nice to have" feature, but crucial to expensive satellites that could not be maintained once placed in space, and operating in extreme conditions that had no terrestrial parallel.Implosion is not just a technical history, but a public policy and business management story as well. The author describes a complex, highly coupled system of government agencies, military services, prime contractors, subcontractors, universities, national laboratories, and Federally Funded Research and Development Centers

(FFRDCs) that initially created and then sustained the capacity to create electronics that could function in space at previously unheard of levels of reliability. This was the result not only of research into fundamental physics and engineering, but of standards, manufacturing and test processes, and economic incentives that created deep levels of "intellectual capital" in the U.S. military-industrial complex.Historical treatments of aerospace and defense subjects typically focus on men or machines, such as decisions by political leaders and descriptions of space missions and the most visible hardware. Notable recent exceptions have been David Mindell’s Digital Apollo and Julianne Mahler’s Organizational Learning at NASA: the Challenger and Columbia Accidents. Mindell’s work described the evolution of man-machine dynamics and integrated circuit chips that led to the Apollo flight guidance computer. Mahler’s work analyzed lessons learned and then forgot between its two Shuttle accidents, treating the agency itself as a complex, highly coupled system that sought to achieve high reliability. Like Digital Apollo, Implosion explains of the technical and organization challenges in creating the high reliability electronics necessary to ICBMs and space-based intelligence systems. Like Organizational Learning, it also describes how hard won lessons were forgotten, this time in the 1990s as an unintended result of post Cold War defense acquisition reforms.Acquisition reforms sought to do away with costly, over prescriptive military standards in order to reduce costs. It was felt that commercial standards and industry "best practices" (developed in part by Cold War needs) would be good enough. Unfortunately what was true for commercial available items such as "toothpaste and tissue paper" was not true for high reliability electronics for satellites that had no commercial counterpart. It was not just old standards that were lost, but the information used to track every step in the creation of a high reliability electronic part. A series of launch and satellite failures ensued and the nation is only just now recovering from those losses - and has arguably not yet recreated the government intellectual capital it once had. As Dr. Temple states,"A critical mistaken impression contributed to the problems affecting high reliability satellite acquisitions. The acquisition reformers counted on contractors maintaining the same level of performance using equally rigorous (albeit commercial) processes wen the motivation for compliance was removed. Marketplace forces drove economizing to least cost despite increased risk. Production of high reliability satellites... was the result of a complex mixture of many different entities. Trying to fundamentally alter one portion of this complex mixture was playing with fire since..."Portions of the reading, especially early on, can be rough going for persons without technical backgrounds or familiarity with U.S. defense and intelligence history. The work would benefit from a glossary, chronology, and perhaps a technical appendix to help the reader keep straight the many threads of this complex story. Nonetheless, the insights afforded in the concluding chapter make it very worthwhile. This work is a comprehensive contribution to an underappreciated area in the history of technology - high reliability spacecraft electronics. It paints a broad picture that helps the reader see the bureaucratic, political, and economic forces that created and then diminished a specialized technical capacity vital to U.S. national security.