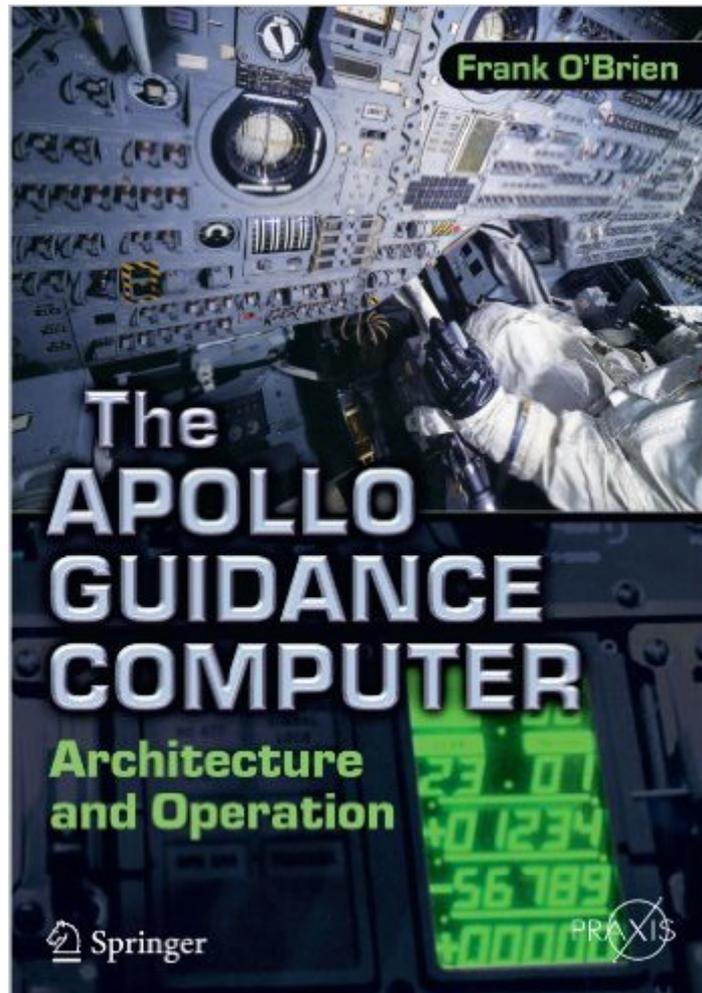# The book was found

The Apollo Guidance Computer: Architecture And Operation (Springer Praxis Books)

Synopsis

Designing a mission for a flight to the Moon requires balancing the demands of a wide array of spacecraft systems, with the details of tending each component generating complex and often contradictory requirements. More than any other system in the Apollo spacecraft, the Apollo Guidance Computer drove the capabilities of the lunar missions. In the 1960's, most computers filled an entire room yet the spacecraft's computer was required to be compact and require little power. When compared to modern systems, the AGC's design limitations and lack of speed presented formidable challenges. Yet, hardware and software engineers overcame these difficulties, and their creation was able to guide a new and complex spacecraft and its precious human cargo away from the safety of Earth and towards a new world. Although people today find it difficult to accept that it was possible to control a spacecraft using such a 'primitive' computer, it nevertheless had capabilities that are advanced even by today's standards.The Apollo Guidance Computer: Architecture and Operation is the first comprehensive description of the Apollo computer, beginning with its internal organization to its user interface and flight software. Particular emphasis is placed on the instruction set, Executive capabilities, the Interpreter and the detailed procedures for mission application software. Launch, landing on the Moon and entry back on Earth are explained in rich detail and show how the computer was an integral part of the spacecraft operation. As a comprehensive account, it spans the disciplines of computer science, aerospace engineering and spacecraft operations. The Apollo Guidance Computer: Architecture and Operation is an essential reference for space historians and engineers, and serves well as a complementary text for computer science courses.

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Customer Reviews

"The Apollo Guidance Computer: Architecture and Operation" by Frank O'Brien is an extremely rare book: it actually says something new about Apollo while clarifying myriads of technical points that engineers, programmers, and pilots have been wondering about for decades. The book puts the history and development of the Apollo Guidance Computer (AGC) in historical perspective, and discusses the primary hardware, software, and programming features that made the system operate. From a modern perspective the AGC seems cumbersome and archaic, yet in the 1960's it was truly state of the art, featuring huge developments in integrated circuits, and amazing flexibility in a compact package that could fit in the Command Module (CM) and Lunar Module (LM.)The book really does start from the beginning, discussing everything from floating point numbers, binary and octal notation, instruction formats and the like. Not being a programmer, this was the most difficult part of the book for me, and I read it quite slowly to make sure I grasped the salient points before proceeding. The book then delves into the unique core memory architecture of the AGC and the structure of the various registers, timers, and basic logic. Following that O'Brien gets into concepts more familiar to me such as the Inertial Measurement Unit (IMU) and the various I/O devices involved with spacecraft navigation. He covers the basics of cislunar navigation, and discusses how the inputs were made (generally on the DSKY,) and explains the significance of all the annunciations on the DSKY and related areas. He has a particularly strong grasp of the perils of gimbal lock, and gives excellent explanations of the phenomena and the resulting problems (i.e.

The embedded computer that traveled with the Apollo astronauts was not only an important component of the navigation and control system for the historic lunar landings; it was an infinitely important landmark in the development of the microcomputer and embedded real-time systems which today inhabit our cars, homes and entertainment equipment. It was also the first important step in developing inexpensive real-time systems for control and ubiquitous computing. While other works such as Mindel's "Digital Apollo" and Eldon C. Hall's "Journey To The Moon" have described this system as a component of the overall Apollo system and in a first-person account of the development process, only this important textbook gives the modern student of computer architecture and embedded real-time systems the technical detail to understand how this first

microcomputer system worked in practice. Exquisite detail and explanation is given of the Hardware and Logical Design Architecture of this systems, as well as the principles and practice of the historic Forth-like language interpreter and Real-Time Executive Software.This exceedingly valuable work will give present day Computer Science students the background to understand how the dramatic breakthroughs in Logical Design, Computer Architecture, Computer Language Interpreters and Real-Time Executive Software was invented, and how it worked in practice. Detailed Scenarios are also given of how this software and hardware architecture functioned in the astronauts computation of Navigation and Guidance.

I purchased the Kindle edition, and found it to be well formatted with clear images and text. I was surprised by how much I really liked this book -- Frank O'Brien knows his stuff, and this book is a real pleasure to read.This book is divided into five main chapters, plus a set of appendixes:Chapter 0 - The state of the artThis chapter lays the groundwork, briefly covering the early history of computing and manned flight. This chapter also covers the concept of computer "power", and how well a computer with very limited hardware can really perform.Chapter 1 - The AGC hardwareThis chapter describes the physical computer, how it evolved from the requirements of a manned mission to the moon, and how every bit of functionality was squeezed out of it. Before reading this book, I envisioned the Apollo Guidance Computer as a glorified calculator, but it was actually a complex and advanced computer in many ways.Chapter 2 - The Executive and InterpreterThis chapter describes the instruction set and programming language of the Apollo Guidance Computer. It also goes into some detail regarding the various interfaces inside the spacecraft as well as telemetry back to Earth. As a computer programmner, this section was especially interesting for me.Chapter 3 - The basics of guidance and navigationThis chapter covers the spacecraft sensors and the problems of navigating the spacecraft. This might sound like a very dry subject, but the author is able to make it interesting and understandable.Chapter 4 - Mission programs and operationsThis chapter covers the entire Apollo mission (launch, navigating to the moon, lunar landing, lunar orbit rendevous, and return to the Earth).

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