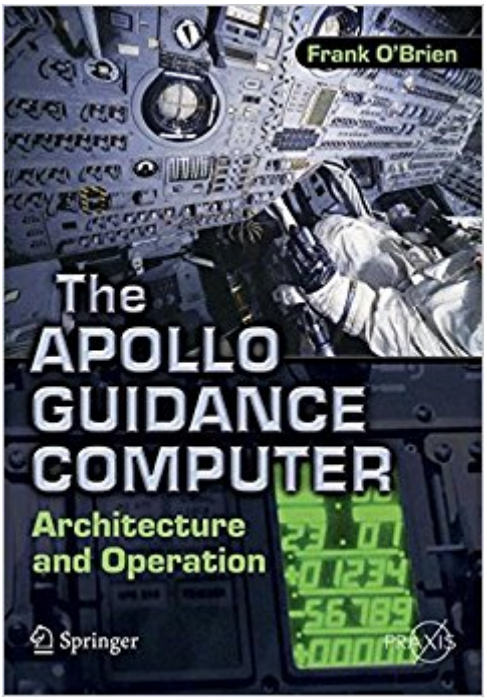
The Apollo Guidance Computer: Architecture And Operation (Springer Praxis Books)



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.Ã Â 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

From the reviews:Ã¢â ¬Å“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. Ã¢â ¬Â¦ This excellent reference will form a model for teaching and learning historical Computer Architectures and Software so that future Computer Scientists can understand and learn the original ideas that today guide their field.Ã¢â ¬Â• (Ira Laefsky, , September, 2010)

By today’s standards, the on-board computer used by the Apollo astronaut’s was a primitive affair, but in an age when most computers filled an entire room, this was small, required little power, and incorporated several technologies that were revolutionary for its time. This is the first book to fully describe the Apollo guidance computer’s architecture, Executive software, and the programs used by astronauts. It describes the full range of technologies required in order to fly the Apollo lunar missions, and whicn enabled the astronauts to fly to the Moon - and back!

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). Before reading this chapter, I was unaware that the lunar lander had an autopilot (or that the crew refused to use it).AppendixesThe appendixes contain an incredible amount of detail, and provide a great deal of "value added" information.The subject matter of this work may not be for everyone, but those who have some interest will not be disappointed if they pick this gem up!

You've heard it before, "There's more computing power in my microwave than in the computer that put man on the moon!" Well, you're microwave may have a bit faster processor, but that's not the whole story. In reality, the Apollo Guidance Computer (AGC) is more like a very slow version of a modern smartphone, bringing together data from myriad sensors and calculating maneuvers to keep track of where the spacecraft was and where it was going. This book pries the lid off the first computer to use solid-state hardware and guides you from the wire-wrapped chips to the "corded" core ROM, to the inertial instruments that allowed everything to stay pointed at the moon. In addition to the computer engineering details (if your into assembly you'll love this) the book also provides an excellent walkthrough of a typical Apollo mission according to what programs had to be run as the mission progressed, including those run on the identical computer in the lunar module to land on and return from the moon.I got a little bogged down in the description of memory banking--mainly because the MIT wizards had to modify the design part-way through and it got convoluted--but aside from that I fully enjoyed every last page.If you're not into computer engineering, you can skip a bunch of the architecture stuff and focus on the hardware, programs, and mission segments and probably still get a lot out of this book

Excellent book. Goes into great detail about the Assembly code and speaks in detail about the creative design decisions software engineers made with the limited hardware of the time. On many pages I just had to write "re-read" and move on because the near machine code language of Assembly can be pretty tough to follow on the first try. I'm glad the detail was there though.I thought the most interesting part was the detail and background in the operational procedures; the sequence of events for the launch from earth, lunar landing, and rendezvous are described in great detail. The book gives insight on the backups upon backups, the ability to safely abort at all times,

and the well-reasoned planning and design decisions that made it a success. All of this just makes the reader realize how impressive this actually was, and although it was difficult, it was well within the realm of our possibility.Also knowing little things like the commander could take complete control of the Saturn V during launch are ridiculously cool. That would be any test pilot's dream.

If you've ever wondered how the Apollo Guidance Computer really worked, this is the book for you. Written by an engineer for engineers, this book is still highly readable and entertaining. It covers all details of the AGC, from how the core memory was constructed, to the design tradeoffs in the machine architecture, to the core instruction set, including how the virtual machine worked (yes, the AGC had a virtual machine with its own instruction set.) By the end, you feel you could almost write your own BURNBABY routine to fire the lunar descent engine. An illuminating book on an important milestone in computer history.

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