

# QUEST



**THE HISTORY OF SPACEFLIGHT**  
**Q U A R T E R L Y**



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APOLLO-SOYUZ, RUTH BATES  
HARRIS, AND NASA'S  
RHETORIC OF COOPERATION**

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THAT NEVER WAS:  
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*International Space Station Expedition 35:* Flight engineers Chris Cassidy (pictured) and Tom Marshburn (out of frame) completed a spacewalk at 2:14 p.m. EDT 11 May 2013 to inspect and replace a pump controller box on the *International Space Station's* far port truss (P6) leaking ammonia coolant. The two NASA astronauts began the 5-hour, 30-minute spacewalk at 8:44 a.m. Credit: NASA

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## LETTER FROM THE EDITOR

Hello and welcome to *Quest* 22:1! In this issue we dive deeply into NASA history.

University of California, Santa Barbara, graduate student Eric Fenrich starts us off with his look at the ways the agency dealt with increasing the percentage of minority and female employees within NASA's ranks while simultaneously opening up to the possibility of cooperating with its former space competitor, the Soviet Union. Fenrich, the 2014 winner of the Sacknoff Prize in Space History, argues that these two goals moved in opposite directions. He uses the Apollo-Soyuz mission and the career of Ruth Bates Harris, an African American woman, to show how the agency's "rhetoric of cooperation" did not live up to the reality of expectations.

Daniel Dupuis, a George Washington University graduate student, writes about the failure of one person in a senior position to push his vision for space exploration. In the excitement following the Moon landings, NASA Administrator Thomas Paine tried to convince President Richard Nixon that the next step was for the United States to develop nuclear-powered space shuttles and a space station and then go to Mars. Paine, though, failed to achieve his vision because, as Dr. Melvin Kranzberg pointed out in his fourth law of the history of technology, "nontechnical factors take precedence in technology-policy decisions." These non-technical factors affecting Paine's success, Dupuis argues, included Nixon himself, Paine's alliances in the administration, and the Moon landings.

Our oral history this issue is with Roger Easton, one of the engineers at the Naval Research Laboratory (NRL) credited with the idea of using radio signals coming from space to determine specific locations on Earth, a technology that today has many more uses than anyone could have imagined when it was first conceived. Easton, who joined during World War II, worked on the earliest satellite tracking system, Minitrack before getting the idea to put an atomic clock in a satellite to use for space-based navigation, demonstrating the concept using a major commuter route. We have reproduced a page of Easton's US patent for the system. But, Easton asserts, non-technical decisions had as much to do with the development of the system as technology did in the system becoming GPS.

In our "From the Archives" section, we have a look at the way two NASA leaders in 1970 saw the future of the space program. Acting NASA Administrator George Low tried to convince the US Senate there was nothing to recent Soviet robotic Moon landings. Deputy Associate NASA Administrator Charles Mathews reveals to an audience the "future" of space transportation, including the "reusable nuclear shuttle" NASA considered at the time. These two pieces contrast nicely with a look at the new National Air and Space Museum exhibit on extravehicular activity.

We finish with several book reviews, including one on a new book about the development of the Global Positioning System.

Cheers,



David Christopher Arnold

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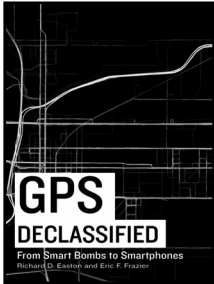
deserve attention by anyone interested in the science, technology, and engineering of reconnaissance satellites used during the Cold War. Furthermore, the interaction among the CIA, USAF, and Perkin-Elmer as they designed, built, and operated the Hexagon satellites provides key and useful insights for people interested in the interaction between agencies and corporations during the Cold War. Last, Pressel skillfully achieves his objective of honoring the work he and his colleagues did in building

and operating the last film based photoreconnaissance satellite for the United States. Yet he does it in a way that contributes greatly to the historical and technical understanding of space-based photoreconnaissance satellites systems.

Sean N. Kalic  
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## BOOK REVIEW

### GPS DECLASSIFIED: FROM SMART BOMBS TO SMARTPHONES



By Richard D. Easton and Eric F. Frazier  
Foreword by Rick W. Sturdevant

University of Nebraska Press, 2013  
ISBN: 978-1-612344-08-9  
Pages: 328  
Price: \$34.95, hardcover

It's an age-old problem. How do you know where you are on the Earth, in the air, or in the universe? Humans have been trying to solve that problem for eons, and some of the solutions are ingenious. *GPS Declassified* is an attempt to tell the fascinating story of space-based navigational systems. Originally established by the Department of Defense, the global positioning system (GPS) relies on 24 satellites in medium orbit around the Earth coupled with several ground-tracking stations, and receivers on vehicles or with a handheld device. It is essentially a passive system as receivers make contact with at least four satellites and triangulate positions. Coupled with computer aided systems this can provide real-time data about location, movement, altitude, and the like.

As Richard D. Easton and Eric F. Frazier make clear, space-flight engineers realized very early the potential of this type of navigation system. In the latter 1950s scientists and engineers established that the Doppler shift of radio transmissions could help establish the location of a terrestrial receiving station. This became the basis of the US Navy's Transit satellites navigation system for SLBM submarines to improve missile accuracy. That system proved the concept, and there were even some civilian uses that emerged in the latter 1960s.

In addition, the US Navy and the Air Force first competed and then collaborated on an approach called TIMATION (Time and Navigation) that used the precise timing of signals from numerous satellites to fix an accurate position. According to this book, it was TIMATION that formed the basis in 1973 of the NAVSTAR GPS (Navigation Signal Timing and Ranging Global Positioning System) program managed by the US Air Force. Co-author Richard Easton has an ax to grind here, and he does so effectively. For years there has been a debate over who should receive credit for originating GPS. Roger Easton, the co-author's

father, was intimately involved in the TIMATION system and insisted that the Naval Research Laboratory and he were responsible for the GPS architecture. Brad Parkinson, the USAF officer who headed the project for his service insisted that the lion's share of the credit should go to the Air Force and himself. Richard Easton presents here a good defense of his father's position.

Whether one cares about this debate over origins or not, the result of GPS has been profound. The first NAVSTAR satellites, launched between 1978 and 1985, transformed military navigation. I remember seeing aircraft tracked on a big screen in the Command Post using this system while historian at the Military Airlift Command (MAC) between 1987 and 1990. It was remarkable for all involved to be able to track the progress of every MAC aircraft worldwide 24/7.

Within a short time, in no small measure because of the shoot-down of flight KAL-007 in 1983 by the Soviet Air Force after the aircraft entered Soviet airspace, Ronald Reagan directed the extension of this capability to be available to everyone. Once this occurred, the civilian use of GPS exploded, with a huge range of applications, utilizing both the positioning and precision time signal capabilities of the system, becoming embedded in the civil and commercial infrastructure and the social fabric of everyday life. As the system became more capable, its uses widened. At present it is viewed as an indispensable resource for all manner of navigational needs. It has replaced printed maps as the navigational tool of choice for virtually everyone, and the fine art of map reading has become something of a lost art for a generation of children born since the 1980s.

Richard Easton and Eric Frazier offer in this book a solid basic history of the subject. As an introduction it is quite useful. It also seeks, in the authors' minds, to correct what they view as errors and omissions in the GPS origins story. Finally, it tells quite a number of stories about the uses of GPS and how the technology has changed our lives, and then they go on to project possibilities for uses yet to be realized. This is a useful work about a complex topic. It is not the final word on the subject, however. Indeed, I don't believe that a final word on anything can ever exist.

Roger D. Launius  
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Smithsonian Institution  
Washington, DC



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QUARTERLY

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