



H. O. HAVEMEYER COLLECTION/BEQUEST OF MRS. H. O. HAVEMEYER/1929/PUBLIC DOMAIN

THE OCEAN, depicted here by Hokusai in his famous early-19th-century print *The Great Wave off Kanagawa*, remains one of the least understood environments on Earth. This copy of the print is held by the Metropolitan Museum of Art in New York.

Even underwater, money talks

The older I get, the stranger it seems to me that my undergraduate education in physics and astronomy included virtually no instruction in fluids. I suspect I am not the only physicist who feels that way. But there is another lacuna in my education, which I was unaware of until reading Naomi Oreskes's new book, *Science on a Mission: How Military Funding Shaped What We Do and Don't Know About the Ocean*. The role of physicists in oceanography.

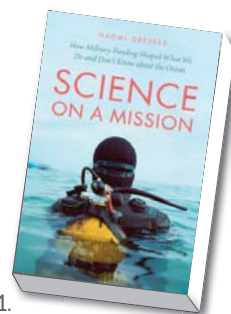
Ostensibly a text that uses oceanography as a vehicle to think through the military's role in science, *Science on a Mission* also serves as a history of how physicists helped create the field of modern oceanography. The result is a book that will be of interest to both historians and scientists.

Oreskes is clear from the start about the question her book addresses: "What difference does it make who pays for science?" The conclusion we are led to is inevitable: Money matters. But, as we learn along the way, so do the personalities and motivations of those doing the science. As with all scientific achievements, understanding the physical structure of the universe inside our oceans is a tale filled with false starts, compelling but wrong ideas, strong personalities, and political imperatives.

To tell the full story, Oreskes spends time explaining the scientific ideas under consideration at various points of historical significance. Examples of such moments include major geopolitical events like the end of World War II, but also critical junctures within the scientific

Science on a Mission
How Military Funding Shaped What We Do and Don't Know About the Ocean

Naomi Oreskes
U. Chicago Press, 2021.
\$40.00



community itself, such as changes in the funding sources and challenges to the leadership at major research facilities like the Scripps Institution of Oceanography. In other words, Oreskes's history is—happily—not discovery oriented but focused on highlighting the way scientific work was shaped by its political and economic environments. The book closes with a helpful look at oceanography's turn toward climate change research and nonmilitary funding sources.

Oreskes does not take any shortcuts with the science. Indeed, *Science on a Mission* is so detailed in its descriptions of technical ideas that there were moments

when I began to feel impatient. But those feelings were significantly tempered when I recognized that Oreskes has performed an enormously important service to the community: Anyone who really wants to understand Cold War-era oceanography now has a definitive text to turn to. Not only does the book provide extensive explanations of the plethora of ideas that have circulated about one of the least understood environments on Earth, but the bibliography alone is a significant contribution that will be useful to scholars in the field.

It would have been helpful for the book to open with a cast of characters as part of its front matter, because there are so many key players that come up repeatedly across its hundreds of pages. Indeed, picking up the book requires a serious commitment: The main text consists of 502 pages spread across nine chapters, to which 145 pages of notes are appended. The font is also on the smaller side, which is to say the text is dense. The endnotes are long but often interesting. To put it bluntly: The book is long, and it took me a while to get through it. At times I got lost reentering the text, and readers who have a hard time tracking complex and large amounts of information would have been better served if Oreskes had broken the content into more, shorter chapters.

Ultimately, the task of *Science on a Mission* is to describe how the military's financial prowess affected what we know about the ocean and how we came to know it. And the text succeeds in that mission. But it is so much more than that. What shines through is Oreskes's utter fascination with the community she decided to study. On some pages it almost felt like I was reading not just history but an actual ethnography.

Science on a Mission makes a strong case for thinking in terms of not just money but power. Oreskes demonstrates that big personalities with sufficient social capital can be incredibly influential—and can even determine how and when military funding produces specific scientific outcomes. Moreover, regardless of whether she intended it, Oreskes makes a strong case for why histories of physics must now encompass oceanography.

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To minimize interference in the radio spectrum, the National Radio Astronomy Observatory employs a fleet of electronics-free vintage cars, such as the Checker Marathon pictured here, for site maintenance.

JAREK TUSZINSKI/CC BY-SA 3.0

The golden age of radio astronomy

Although it originated in the 1930s, radio astronomy reached maturity during the latter half of the 20th century. One of the major sites of radio astronomy during that period was the US National Radio Astronomy Observatory (NRAO). In *Open Skies: The National Radio Astronomy Observatory and Its Impact on US Radio Astronomy*, Kenneth Kellermann, Ellen Bouton, and Sierra Brandt tell the story of that august institution, warts and all: from the NRAO's genesis in the mind of NSF's first director, Alan Waterman; through the growing pains it faced during its early years; to its current status as a world-class radio astronomical facility.

A weighty tome of over 600 pages, the book begins with three chapters describing the early history of radio astronomy before delving into the NRAO's history in chapter 4. In that section, the authors introduce us to the first radio telescope erected at the NRAO's site in Green Bank, West Virginia: a 30 MHz interferometer that saw first light a year before the Green Bank site officially opened in October 1957.

From the start, the plan was to erect 85-foot and 140-foot radio telescopes at Green Bank. But a turf war quickly broke out between two committees involved with the observatory's design. Even after

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Ellen N. Bouton,
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they agreed on the size of the larger telescope—140 feet—there were heated arguments about the type of mounting to be used and the surface accuracy of the parabola. Construction of the 140-foot telescope wasn't finished until 1965, five years later than planned.

While that project was stalled, the NRAO managed to secure about \$1 million in funding from NSF for a simple 300-foot radio telescope with an inexpensive altazimuth mounting. Funding was approved in 1961, and in record time the 300-foot telescope was finished. The NRAO finally was an international-class radio astronomical facility.

Given the focus on instrumentation, people, and politics, *Open Skies* contains little discussion of the major research accomplishments of the NRAO and its