

Despite that weakness, many readers will enjoy Barone's rapid, hold-on-to-your-hat histories of life in America for five of the six groups covered here. (His chapter on Asians seems cursory; perhaps he ran out of space, time, or interest.) The encyclopedic knowledge he has gained while visiting every congressional district in the country adds depth and flavor to his stories, though his periodic swipes at such policies as affirmative action

and bilingual education seem gratuitous.

The book may not live up to its subtitle, but it does provide a reassuring reminder that "the United States has never been a monoethnic nation." The American majority is made up of an ever-shifting coalition of many minorities. And yet, remarkably, out of that relentless change there emerges a unique and enviable stability.

—SANFORD J. UNGAR

SCIENCE & TECHNOLOGY

REVEALING THE UNIVERSE: The Making of the Chandra X-Ray Observatory.

By Wallace Tucker and Karen Tucker.
Harvard Univ. Press. 295 pp. \$27.95

This book might more appropriately have been called *Revealing NASA*, for there is not much here of the universe. The narrative ends as the first images are coming in from the \$2 billion Chandra X-Ray Observatory, named for 20th-century astrophysicist Subrahmanyan Chandrasekhar, and launched into Earth orbit by the space shuttle in 1999. These images, in which invisible x-rays are rendered in color, are rather less dramatic than the pictures we are used to seeing from the Hubble Space Telescope. They may be packed with valuable information for astronomers, but the average onlooker can be forgiven for thinking, "Ho, hum."

Which is not to say that the book is a "ho, hum" read. At the beginning, I was put off by an alphabet soup of acronyms (even Chandra started life as AXAF, the "Advanced X-ray Astrophysics Facility"). But as the pace picked up, I was drawn into the depiction of how the National Aeronautics and Space Administration works, technically and politically, and how an instrument such as Chandra gets built and deployed. The story is nothing short of heroic, and the Tuckers are ideal guides. He is a spokesman and she a science writer for the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, parent institution of Chandra science. They saw much of it happen, and they had access to the key players.

The universe reveals itself in every part of the electromagnetic spectrum, from low-energy radio waves to high-energy x-rays and gamma

rays. X-rays are produced by the most violent objects in the universe—black holes, colliding galaxies, exploding stars—but they are absorbed by Earth's atmosphere. Consequently, much of the fun stuff can only be seen if we heave our instruments thousands of miles into the sky.

The short wavelengths of x-rays place extraordinary demands on the optics used to focus them. Chandra's mirrors are the most perfectly shaped and polished ever produced. The fragile mirrors and detectors must be aligned to within the thickness of a few atoms, placed atop a hugely powerful rocket, and blasted into space. Perhaps never in the history of engineering has there been such a conjunction of delicacy and power. Indeed, you wonder why the astronomers and NASA managers and technicians ever bothered to try. The technical odds against success seem overwhelming—even without factoring in the political gauntlet that such a project must run before getting to the launch pad.

Lots of taxpayer dollars were riding on Chandra's success; lots of careers, too. Nearly 30 years passed between the first proposal for a large x-ray telescope and the final deployment. That's a huge chunk of one's life to devote to machinery that may never fly—and may not work if it does fly. On reaching the end of the book, readers will have a profound respect for the scientists who conceived the great space observatories and made them happen, and for the amazing skills that hide behind the flurry of NASA acronyms. The Tuckers have managed to turn a potentially dry technology tale into an edge-of-your-seat read.

—CHET RAYMO