

BOOKS & ARTS

Powers of observation

A perceptive history documents the many remarkable people who envisioned, built and launched the Hubble Space Telescope, explains **Robert A. Brown**.

The Universe in a Mirror: The Saga of the Hubble Space Telescope and the Visionaries Who Built It

by Robert Zimmerman

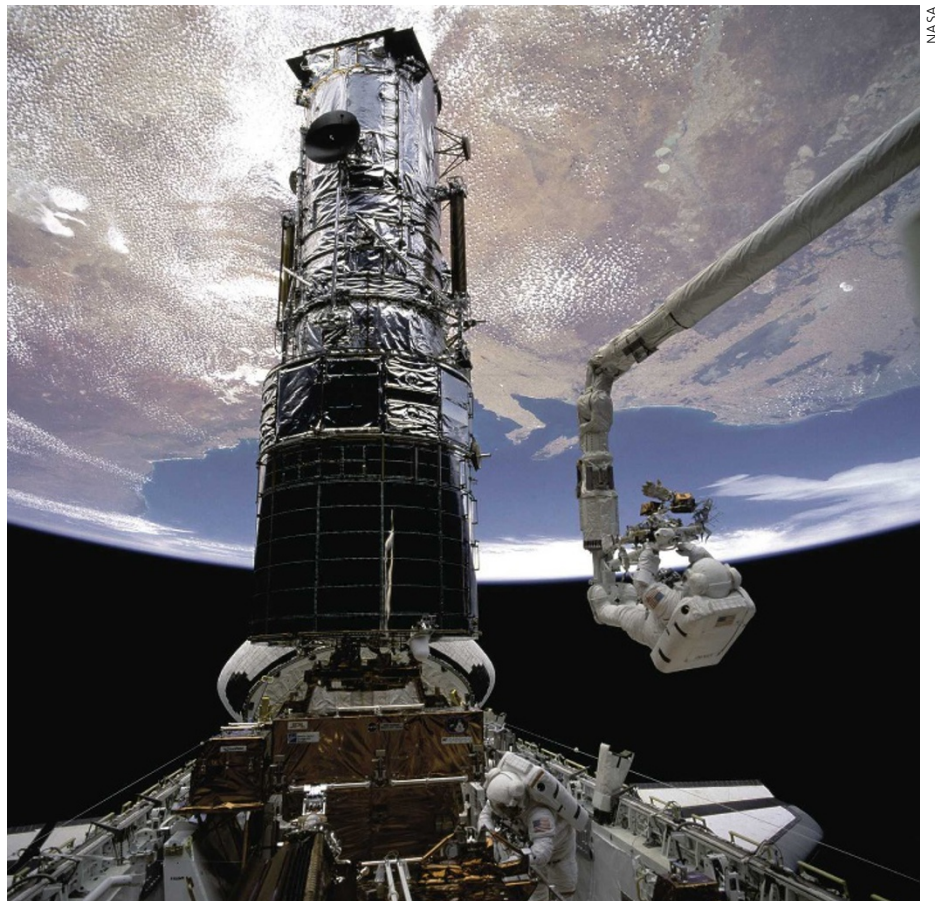
Princeton University Press: 2008.

320 pp. \$29.95, £17.95

Since the winter of 1610, when Galileo discovered the phases of Venus and the moons of Jupiter, telescopes have changed human perspectives. Galileo's telescope proved Copernicus correct — that the Sun, not Earth, lay at the centre of the Solar System, playing no small part in the scientific revolution. Advanced telescopes continue to overturn received wisdom in favour of observational fact. In his history of the Hubble Space Telescope, *The Universe in a Mirror*, science writer and historian Robert Zimmerman states that the telescope “lifted a curtain from our view of the Universe, changing it so profoundly that no human can look at the stars in the same way again”.

The Hubble Space Telescope's cornucopia of breathtaking pictures has shown us the age of the Universe, monster black holes at the hearts of galaxies, vortices roaming the cloud belts of Jupiter, dark matter structuring the Universe, the acceleration of cosmic expansion, and early galaxies merging and growing. The scope and grandeur of Hubble's accomplishments, and the magnificent spectacle of its in-orbit repair and upgrade by heroic astronauts, beg the descriptions that this book superbly answers, about the manner of men and women that did this, how it happened and where it will lead.

Former US president John Quincy Adams may be the only progenitor of the Hubble Space Telescope that Zimmerman does not acknowledge in his telling of the story, which has more dramatis personae than a Russian play. In his first annual message to Congress in 1825, Adams requested public funds for what would have been the first astronomical observatory in the United States. He called it a “lighthouse of the sky”, a concept he pursued throughout his life. Physicist Lyman Spitzer lit his torch from that flame 120 years later, and rightfully takes centre stage in any account of Hubble's origins. Through decades of ups and downs, Spitzer tirelessly promoted the benefits of such a lighthouse — a space telescope with access to the entire spectrum and an image quality limited only by the size of the optic. Even after



NASA

Visionary plan: Hubble was designed to be repaired and upgraded by astronauts while in orbit.

Hubble's launch in 1990, Spitzer was hands-on, helping to devise a comprehensive solution to the tragic problem of spherical aberration in the main mirror, which meant the telescope could not focus adequately. At one point, he conferred daily on the prescription of the coin-size corrective mirrors that astronauts installed in 1993, which fixed the problem perfectly. Zimmerman portrays Spitzer's many dimensions as a technologist, physicist, astronomer, rock climber, visionary and gentleman, revealing a lifetime of outsized opportunities that was tempered with some major disappointments.

The human history behind Hubble is only known because the Smithsonian National Air and Space Museum and the American Institute of Physics arranged for hundreds of players to sit for exhaustive interviews about themselves and their work. Judging from Zimmerman's bibliography, he read them all, and conducted

36 more interviews of his own besides.

The written outcome might have been a pastiche with no convincing verisimilitude to real people, settings and actions. The opposite is true in this book. Zimmerman brings the cast to vibrant life, anchors them in Spitzer's sustaining vision, and sets them to re-enacting their parts in the drama of Hubble struggling towards reality. Each individual, however flawed or gifted, felt they were a part of something big, and fervently hoped for the success of the telescope. They wondered about what Hubble might discover, about our surrounding Universe and our origins in it. For the project managers, engineers, administrators and astronomers alike, Hubble seemed to promise a new relationship with the sky.

If there is a dark character in the book, it is the smoke and mirrors of budgeting and approving high-technology mega-projects.

For years, the official budget for building and operating Hubble for one year was US\$300 million, a number that NASA administrator James Fletcher seemingly “picked out of the air with no connection to actual cost”. Combined with a NASA culture at the time of suppressing problems, this underestimation led to successive budget crunches — but perhaps not, as Zimmerman suggests, to the three washers placed in error on the reflective null corrector of the Hubble test setup at optics company Perkin-Elmer, which ultimately caused the main mirror’s spherical aberration. Not every event has a deep original cause, nor happens because it was not prevented.

We don’t know exactly how the pyramids of Egypt were built; as with Hubble, the planning was probably not linear, and people may well have temporized and played games with the budget and schedule. For better or worse, the planning process works because honest and well-motivated people participate. Fixing

the system, except to better accommodate uncertainties, is not always realistic when unique projects demand the highest performance and operate at the limits of technology.

It is unrealistic to suggest that the scientists, contractors and bureaucrats could have warned Fletcher of the infeasible budget, and either accepted the telescope’s cancellation or forced him to seek more funding. No one knew what Hubble would cost in 1974, and a simple working agreement on a large budget was a form of success. Everyone involved knew where this project was going — they were glad to be part of it and believed that it would be a game-changer.

Hubble has operated for 18 years and counting. Another servicing mission planned for October 2008 will bring it two new instruments and other replacement modules. To the limits of its 2.4-metre aperture, the telescope has revealed the visible Universe to the scientific community and a worldwide public.

What grand vision will motivate the telescope’s successor in the visible-wavelength range? To many, the compelling answer is a Hubble-like telescope some eight times larger, with exponentially greater power to observe fainter objects and in finer detail. Equipped with multiple instruments, including a wide-field camera to detect the wobbling of stars caused by orbiting planets, and a coronagraphic spectrometer to detect atmospheric oxygen and water on faint sources, it could find and characterize potentially habitable planets around hundreds of nearby stars, looking for signs of life. Answering the question ‘Are we alone?’ by means of a telescope is now an obtainable goal, a point that we have reached because of all the people and drama that Zimmerman brings to life in this terrific book. ■

Robert A. Brown is an astronomer at the Space Telescope Science Institute, 3700 San Martin Drive, Baltimore 21218, Maryland, USA.
e-mail: rbrown@stsci.edu

Living Googles?

Representing Autism: Culture, Narrative, Fascination

by Stuart Murray

Liverpool University Press: 2008.

288 pp. £50

Representing Autism examines how we use the word autism and what this reveals about how we think about it. A form of literary criticism or cultural anthropology, this original book fills an important gap. Too often, scientists believe that they have direct, unmediated access to the object of their study. Stuart Murray reminds us that autism is not an unambiguous ‘natural kind’: our scientific taxonomy is also prone to biases.

Autism lies on a spectrum, and comprises two major subgroups: people with classic autism and those with Asperger’s syndrome. These groups share the combination of social-communication difficulties, narrow interests (pejoratively called obsessions) and a love of sameness (known clinically as resistance to change). In classic autism, language development in children is also delayed and they can have additional learning difficulties. Autism and Asperger’s syndrome are genetic in origin, affecting how the brain develops and thus affecting mind and behaviour. The terms ‘autism’ and ‘Asperger’s syndrome’ are medical diagnoses, applied when the defining features interfere with an individual’s ability to function, causing them to suffer.

According to Murray, whether we are making a film or writing a scientific paper about autism, we are superimposing categories on to it. For example, the major charity for families and individuals with autism in Britain, the National Autistic Society, was founded in 1962 as the Society for Psychotic Children. This shift in the name could have affected what we looked for and what we saw. Similar

shifts occurred in the first scientific journal for autism research. Now called the *Journal of Autism and Developmental Disorders*, it began as the *Journal of Autism and Childhood Schizophrenia*. These changes signal how we used to believe autism was just the childhood form of schizophrenia, and how we used to think this condition only affected children.

We now know that autism and schizophrenia are distinct. For example, schizophrenia typically causes delusions, hallucinations and ‘thought disorder’ whereas autism does not. And schizophrenia may entail a rather loose



Dustin Hoffman (seated, centre left) played a card-counting autistic savant in the 1988 film *Rain Man*.