BOOK REVIEW

THE HIGH ROAD. By Ben Bova. Boston: Houghton Mifflin Co., 1981. Pp. 289. $11.95.

The people of Boston, in 1979, showed no particular interest in the space program. With fewer dramatic missions being launched, and the economy demanding more immediate attention, the Viking, Voyager and Pioneer missions were barely registering on the national consciousness. It was Boston's collective disinterest in the space program, manifested by the meager attendance at a speech on the subject, that inspired Ben Bova to write THE HIGH ROAD, a manifesto for the continued use of space technology. (P. 7.)

The timing of the book's release was fortuitous, coming as it did between the first and second test launches of the space shuttle program and therefore on the crest of a renewed national interest in space travel and technology. Even the Boston of Bova's discontent had changed as far as such things can be measured; on the afternoon of the second shuttle's landing, several hundred people gathered around television screens in the Boston Museum of Science and cheered the successful touchdown.[1]

Because the shuttle program is also subject to constant and severe attacks and because the Reagan Administration seeks further targets for budget shearing, Bova's book continues to be timely as an instrument for persuasion that a vigorous space program is necessary.

Unfortunately, Bova is at his weakest when he attempts to persuade, an endeavor which occupies the first third of his book. The thesis of the book is, in fact, simple. Bova contends that the world's problems are caused by a fixed resource base and an increasing population. (Pp. 13-20.) The solution lies in space travel. The universe is filled with raw materials which can be mined and brought back to Earth. The minerals will decrease our dependence on oil for fuel, bringing increased wealth to the world. With increased wealth, the world's population will decrease. (Pp. 75-82.) Bova rejects the thinking of people like Donella and Dennis Mead-

1. This reviewer observed the televised landing while at the Boston Museum of Science on November 14, 1981.

ows, Jorgen Randers and William Behrens, authors of *The Limits to Growth*,[2] who urge conservation and limitation of production. In Bova's world, there is no need to cut consumption because the resource base is infinite.

Such reasoning is engagingly simple, but presented at such an emotional level and filled with so many leaps of faith that it is difficult to take this author seriously. His reasoning with respect to population reduction is illustrative. The world's poorer nations have higher rates of population growth than the wealthier nations. As proof he offers one of the more offensive anecdotes that mar his book: "I know one nationally prominent television personality of Puerto Rican ancestry who had twenty-one brothers and sisters. 'You should see our family reunions,' he says, grinning." (P. 18.) Because wealthier nations have lower population growth rates, increased wealth for poor nations will therefore reduce their population rates, reasons Bova.

The rhetorical, science-fictionalized style of THE HIGH ROAD undoubtedly stems from Bova's background as a science fiction writer and editor of *Omni* magazine. With such a serious argument to make, however, this style is self-defeating. Bova describes the consequences of increasing population: "[b]illions of human beings will die. The survivors will be reduced to a medieval standard of living or worse. Superdisaster." (P. 15.) At various points in the book, Bova wholly abandons logic in favor of litany. For example:

"To solve the problems of poverty, we must create new wealth.

"To solve the problems of scarcity, we must create new wealth.

"To solve the problems of overpopulation, we must create new wealth.

"To protect human freedom, we must create new wealth." (P. 74.)

The heart of the book, a nugget of fascinating reading amidst so much astrophysical fluff, is Bova's collection of concrete proposals for the use of space and space technology and a progress report on each. Some of the technology he discusses is not new and only remotely related to space travel. Magneto-hydrodynamics ("MHD") for example, is the study of the interaction of ionized gases with magnetic fields and offers a more efficient means to generate electricity than conventional methods. (Bova archly notes that the United States abandoned MHD research in 1965 due to the com-

2. D.H. MEADOWS, D.L. MEADOWS, J. RANDERS & W. BEHRENS, THE LIMITS TO GROWTH (1972).

plexity of the technology but that the Soviet Union adopted the project and now has an operating pilot plant.)

MHD technology is related to space only in that some of our understanding of the science was gained during work on reentry problems for spacecraft. Other projects have a more immediate connection. The solar power satellite, conceived by Peter Glaser in 1968, is one such project. As its name suggests, the satellite would be placed in a high orbit where it would be continuously exposed to the sunlight. Solar energy would be stored in solar cells aboard the satellite. Microwaves would transmit the energy to a field of receiving antennae, dubbed a rectenna farm, on Earth. The energy would be converted into electricity and transmitted through ordinary channels.

Although his description of the solar power satellite is illuminating, Bova is unconvincing when he addresses the criticisms which have been directed at Glaser's proposal. Will the microwaves present a danger to the terrain surrounding the rectenna farm? Bova asserts that they will not. Yet the only proffered basis for such assurances is that "when Glaser shows slides depicting the rectenna farm, there is always lush green grass growing between the metal poles, with cattle grazing on it." (P. 146.)

The more exotic the program, the stronger the book becomes. It is for these glimpses of the future that this book is worth reading. We could, for example, conduct industrial operations in space. The heat of the sun could replace smelters and extremely cold temperatures could be attained by shielding an area from sunlight. The vacuum in space would insulate hot areas from cold ones, permitting processes requiring high and low temperatures to be conducted in close proximity. In a gravity-free environment, chemicals could be combined more efficiently than on Earth because heavier elements would not tend to sink downward. No mixing container—which tends to contaminate certain processes—would be needed in such gravity-free environments.

Bova envisions the raw materials for such space factories coming from the surface of the Moon (aluminum, titanium, carbon, silicon and oxygen), or from asteroids (gold, silver, platinum, iron, nickel, copper, manganese, carbon and potassium). The water will come from the polar caps of Mars. Not only do these outer space sources expand the Earth's resource base, but it would be cheaper to process materials brought from outer space than from the Earth, due to the great energy expenditure required to escape the gravitational pull of the Earth.

Although Bova asserts that these extraterrestrial treasures will improve the entire Earth's standard of living, he dismisses the political conflicts inherent in the distribution of such resources. He rejects the two treaties which make a tangible effort at dividing this future wealth. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies ("Outer Space Treaty"),[3] ratified by seventy-seven countries including the United States and the Soviet Union, addresses this issue. The prologue declares: "[t]he State Parties to this Treaty . . . , Believing that the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development . . . , Have agreed on the following: . . ."[4] The relevant portion of the body of the treaty is Article II which states: "[o]uter space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[5] This treaty, however, only limits claims of sovereignty over the territory itself, not claims of ownership over the minerals in the territory.

In contrast, a second treaty, the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies ("Moon Treaty"),[6] grants to all nations a joint ownership in celestial minerals.[7] It therefore requires any one nation profiting from extraterrestrial mining to share those profits. The United States has refused to ratify the treaty and it is not currently in force.

Echoing the United States' objections to the Moon Treaty, Bova argues that a requirement of sharing will dampen the enthusiasm of private investors—the same investors who are, he contends, necessary to the success of a space mining program. He also rejects arguments by Third World nations that past imperialist exploitation of their human and natural resources entitles them to some of the wealth from space. Writes Bova: "[a] glance at history shows that these nations were poor five hundred years ago, when Europeans first colonized them. They were poor two thousand years ago, long before European discovery; read their own histories or examine the

3. Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 (1967).

4. Jan. 27, 1967, 18 U.S.T. 2410, 2411, T.I.A.S. No. 6347 at 3, 610 U.N.T.S. 205, 206 (1967).

5. Jan. 27, 1967, 18 U.S.T. 2410, 2413, T.I.A.S. No. 6347 at 4, 610 U.N.T.S. 205, 208 (1967).

6. 34 U.N. GAOR, Supp. (No. 46) 77, U.N. Doc. A/RES/34/68 (1979).

7. *Id.* at 79.

lifestyles behind their mythologies." (P. 270.) Bova should know better.

Having rejected direct division of the wealth accumulated in outer space, Bova also fails to explain how this wealth will accomplish the grandiose goals he has set for it. He argues only that capitalism spreads wealth quickly, perhaps referring to his pop lesson in economics given earlier in the book. "Every dollar spent on space has a multiplier effect in the national economy. . . . The money is spent here. Over and over again." (Pp. 219-20.)

Although ostensibly about space exploration and technology, the book is enlightening for the insight it yields into the political and social mindset of a significant group of the nation's science buffs. Bova, for one, has an almost mystical faith in technology. He divides the world into the "Prometheans" (named, of course, for the mythical Prometheus, who brought fire to mankind), and the "Luddites" (whose name derives from that of a group of English handicraftsmen who destroyed the textile machinery that was displacing them in the early nineteenth century). The Prometheans are those who embrace new technology as a solution to the world's problems, while the Luddites are those who view technology as the root of the problems. Bova includes himself among the Prometheans and categorizes the country's environmentalists with the Luddites. Referring often to misunderstood visionaries in history and using poster-quotes, Bova portrays the Prometheans as fearless users of knowledge. "Remember that Columbus was brought back to Spain in chains," he reminds himself with a poster on his wall. (P. 21.) "People do not lack strength, they lack will," he quotes Victor Hugo at the beginning of Chapter Seventeen. (P. 116.)

To be sure, Bova's Luddite/Promethean dichotomy is more complicated than a simple for-or-against dialectic on the uses of technology. Bova also links the Luddite mentality to a distaste for the power resting in large corporations. He attributes environmentalists' wish to use solar energy in part to its decentralized nature. While Bova does not exactly embrace concentrated corporate power, he thinks it necessary to develop more complicated technology. Ultimately, he asserts as a matter of faith that space technology will lead to greater individual freedom and permit humans to escape the concentration of power of corporations.

The constellation of Bova's beliefs also includes a fervent belief in the supremacy of the United States over the Soviet Union and a corresponding fear of Soviet power. The Soviets, for example, be-

gan to examine MHD technology at about the time the United States abandoned it in 1965. Progress, however, has been slower than projected by American scientists. Bova's explanation is posed as a rhetorical question: "[i]s this because of the inherent difficulties with the technology, or political decisions within the USSR, or simply that the Soviets cannot move as fast we can—once we make up our minds to move?" (P. 102.)

Despite his belief that the United States holds an ideological edge over the USSR, Bova fears that Soviet technological advances may outpace ours. This fear lurks tangibly behind all other reasons Bova offers for accelerating development of space: "[e]ven if Americans do not take part in this cosmic awakening, other people will: the Europeans, the Japanese, the Chinese, the Russians. The Russians." (P. 278.)

The ever-present US-USSR conflict leads to an enlightening, if somewhat simplified, discussion of the development of international law with respect to the militarization of space. The Outer Space Treaty provides the basic covenant in Article IV: "States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner."[8]

The reach of Article IV is not all-inclusive. Bova notes that, although weapons cannot be placed into orbit, the treaty does not reach inter-continental ballistic missiles which are based on the ground, but are launched into space. Nor does the treaty cover submarine-launched ballistic missiles. The fractional orbit ballistic system ("FOBS"), which the Russians began testing shortly after the Outer Space Treaty was signed, traverses space but again does not violate the treaty. The FOBS warhead completes only a partial orbit of the earth and thus is excluded from Article IV's prohibition.

The developing technology of weapons has also outstripped the Outer Space Treaty. At the time it was ratified, "weapons of mass destruction" meant nuclear weapons. Since 1967, however, lasers and particle beam weapons have been developed. These weapons are not weapons of "mass destruction" but rather weapons of pinpoint accuracy and therefore are not forbidden by the language of the treaty.

8. Jan. 27, 1967, 18 U.S.T. 2410, 2413, T.I.A.S. No. 6347 at 4, 610 U.N.T.S. 205, 208 (1967).

Bova does not offer any real alternative to the Outer Space Treaty, but rather resorts again to the hope of increased wealth from space as a means to reduce world-wide tensions.

An insight into the subculture of science and science-fiction buffs is offered by Bova's list of grassroots organizations which are being formed to promote space exploration. Patterned after the environmental movement, the organizations are devoted to educating the public as to the benefits of a space program, maintaining interest in space and applying political pressure to spend more on space. The Viking Fund, for example, consists of private contributions to finance the continued operation of the instruments from the Viking exploration programs. Although its primary goal is to keep the equipment in use, the fund also serves to demonstrate the depth of public support for space spending.

It is not surprising that Bova's catalog of organizations that support an accelerated space program includes fan clubs devoted to the television series *Star Trek*. Bova venerates science fiction as much as he admires space technology. In fact, throughout THE HIGH ROAD, the author gives tremendous credit to science fiction writers as the true inventors of the most innovative of space projects. Arthur C. Clarke is credited with inventing the idea of the communications satellite and Robert A. Heinlein is seen as the inspiration for America's flight to the moon. Bova gives himself credit for predicting that the Russians would be the first into space.

Perhaps it is best, therefore, to read this book as a form of visionary science-fiction rather than as a serious work purporting to deal with all the objections to an expanded space program. THE HIGH ROAD appeals to emotion rather than logic. It relies on hyperbole rather than close factual analysis. Taken on its own terms, the book can be informative and entertaining. For a more substantive approach to the challenges of space exploration, however, the reader should look elsewhere.

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