Letters

Space Flight: Manned Versus Unmanned

James A. Van Allen's Perspective "Myths and realities of space flight" (30 May, p. 1075) is a contribution to the present national debate on means and ends in the U.S. civilian space program. I am writing to present a different view. Van Allen's critiques of present policies, and of the space shuttle as a launcher of unmanned satellites, contain much with which I agree. What I respectfully disagree with is his central thesis that increasing human activity in space is a will-of-the-wisp, attractive as romance and entertainment but, in this century at least, a drain on resources better used to support unmanned activities.

In my view, the choice is not between manned and unmanned activities, but between an intelligently planned, developing program containing both elements and one that lacks these virtues. To take one pointed example, the prices for launching satellites on Ariane are not appreciably lower than those for the space shuttle, although Ariane is an unmanned system specifically developed for this purpose. No doubt both launch systems have been subsidized, but I see no evidence that this is much more true of one than the other. The unmanned science missions now waiting to be launched, particularly Galileo and the Hubble Space Telescope, are very expensive. Some of this high cost can be blamed on our manned launch system, but most of it, I believe, is due to a mix of technical and institutional problems that have grown steadily worse since the days of Apollo.

Van Allen cites with approval a quotation from William Fowler on the drive of the human mind that underlies science, the drive to understand the world's mysteries. Why does he reject so sharply, in this context, the drives to travel, to explore, to build and develop, and to create wealth, which are just as basic to our nature and which have built the resources that support science, music, and all other cultural endeavors?

Is a reference to Christopher Columbus so inappropriate? Since I am fond of quoting Ferdinand Columbus's biography of his father (*1*), Van Allen touches a tender place here. The wealth and technical resources of the late 15th century were minute by the standards of the late 20th century. Columbus was derided in his lifetime for his useless and expensive discoveries; in his son's lifetime it was otherwise. The parallel seems to me potentially a close one. The reader is referred to Freeman Dyson's analysis (*2*) for a more detailed, and illuminating, economic comparison of space with earlier exploring and colonizing efforts.

The scientific fields of molecular biology, materials science, and computer science flourish in part because they are seen to be full of promise and hence attract resources and bright young people, but at least equally because they are capable of creating new wealth and new jobs. Space science has the first of these virtues, but so far not the second. I believe it will come.

We do have to start afresh, and we do have to make choices. Those choices must take into account a broad range of goals, as well as hard economic and technical realities. The best current source of guidance for strategy seems to me to be the just-issued report of the Presidential Commission on Space (*3*). A brief preface to that report, "Looking fifty years into the future," should be read and pondered by all concerned with space policy. I agree with the commission (and with Van Allen) particularly on the urgency of developing lower-cost, more reliable launching and space propulsion techniques. There are exciting possibilities.

If this can be done, I think some of the "futuristic proposals for space flight" that Van Allen lists will come into being quickly enough and make space, like other advanced technologies, a source of wealth rather than a sink. These are likely to be followed by others that neither he nor I can now imagine. And one of the prime beneficiaries of such developments will be space science.

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REFERENCES

1. F. Colon, *The Life of the Admiral Christopher Columbus, by His Son Ferdinand*, S. E. Morrison, translator (Rutgers Univ. Press, New Brunswick, NJ, 1959).
2. F. Dyson, *Disturbing the Universe* (Harper & Row, New York, 1979).
3. *Pioneering the Space Frontier, The Report of the Presidential Commission on Space* (Bantam, New York, 1986).

I was surprised that Van Allen failed to include two of the most pernicious myths about space flight:

1) The myth that the space program exists mainly for the purpose of scientific research.

2) The myth that if manned space flight can be curtailed or stopped altogether, the money saved will be turned over to scientists for their work.

The U.S. space program's primary motivations are, and always have been, political and economic. Scientific research has been necessary and useful. Any member of AAAS cannot help but be thrilled at the wonders of new knowledge we have gained from space science. But the hard fact is that if the manned space program were killed, the space science program would die with it.

The American taxpayer is not willing to spend billions for space science *by itself*. The taxpayer has supported, and will continue to support, space science as part of a larger program of exploration and commercial development of space. Instead of narrowly pleading for his own special interests, Van Allen should be supporting the broad and vigorous program outlined by the National Commission on Space. That is the best way to ensure a strong and continuing scientific research effort in space.

Incidentally, as a science fiction writer, I resent Van Allen's insinuation that science fiction is misleading. The world of today is quite well described in science fiction stories written three and four decades ago. Even narrow-minded scientists who stand in the way of progress are depicted in some of those stories!

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As a former employee of the Jet Propulsion Laboratory (JPL), I was delighted to read Van Allen's perspective. His excellent remarks about the mythology of space flight are long overdue and should be given the broadest publicity. On the other hand, anybody who has had the privilege of observing the immensely important contributions of JPL at close distance and the "fallout" of its work for industry cannot help but admire greatly how much has been accomplished with a moderate budget and no risk for the life of the staff.

The comparison between unmanned and manned space development becomes more striking if one considers the effect on the federal budget. How could Medicare and Medicaid, public education, medical research, the old, the poor, and so forth have benefited if the mostly wasted billions spent on manned space flight had been allocated instead to them?

Very few, if any, of the so-called accomplishments of manned space flight are outside the reach of unmanned space technology in its present state of the art or future development. It is indeed high time that the space policy of our country be scrupulously examined and revised by a highly competent group of impartial experts.

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Response: Reactions to my Perspective (*1*) have ranged from those that are thoroughly supportive of my views to those that are

fervently critical of them. I appreciate the former and will make brief comments relative to the latter.

At the present time, the United States has several billion dollars worth of unmanned, high-priority spacecraft in its launching queue, and the queue grows longer month by month. The list includes a comprehensive mix of spacecraft for commercial, applicational, scientific, and military purposes.

The true national urgency is to reestablish a diverse and resilient launching capability as quickly as possible. Because of massive and complex safety considerations (of which the well-known O-ring problem is only the tip of the iceberg) in requalifying the shuttle for the flight of human crews, we can best do this by returning to primary dependence on combinations of expendable launch vehicles.

There is no comparable urgency to resuming manned shuttle flights, and there is even less urgency to developing a large space station. One may recall that no U.S. manned flights were conducted for nearly 6 years—July 1975 to April 1981—yet this period was one of the most fruitful in the history of space exploration and exploitation.

For the more distant future, we can derive guidance from the recent report of the National Commission on Space (*2*) and its many kindred antecedents (*3*) and from the forthcoming report of the National Academy of Sciences (*4*).

But I find it extremely difficult, if not impossible, to foresee any substantial real growth in the federal budget for civilian space purposes during the next decade of prospective fiscal restraint.

Meanwhile, our dedication must be to use the best means at our disposal, limited though they will be, to ensure that our national space effort produces the maximum possible yield of truly significant results.

That is my point.

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REFERENCES AND NOTES

1. My Perspective was essentially a condensation of a lecture that I gave at a Coe College convocation on 1 November 1982 and later elsewhere. I invite the reader's attention to my article, "Space science, space technology and the space station" [*Sci. Am.* **254**, 32 (January 1986)], which was written in the autumn of 1985 and contains a fuller development of my views.
2. *Pioneering the Space Frontier, The Report of the National Commission on Space* (Bantam, New York, 1986).
3. W. Ley and C. Bonestell, *The Conquest of Space* (Viking, New York, 1951); W. von Braun, *The Mars Project* (Univ. of Illinois Press, Urbana, IL, 1953) (Translation of *Das Marsprojekt*, 1951); *Colliers* **129**, 22 (22 March 1952); W. von Braun, *ibid.*, p. 24; W. Ley, *ibid.*, p. 30; F. L. Whipple, *ibid.*, p. 32; J. Kaplan, *ibid.*, p. 34; H. Haber, *ibid.*, p. 35; O. Schacter, *ibid.*, p. 36; F. L. Whipple and W. von Braun, *ibid.* **130**, 38 (25 October 1952); W. Ley, *ibid.*, p. 46; F. L. Whipple, *ibid.* **133**, 21 (30 April 1954); W. von Braun and C. Ryan, *ibid.*, p. 22; S. B. Kramer and R. A. Byers, *Proposal for the Assembly of a Multi-Manned Satellite* (LMSD-48347, Lockheed Missile Systems Division, Sunnyvale, CA, 18 December 1958); *The Challenges of Space*, H. Odishaw, Ed. (Univ. of Chicago Press, Chicago, IL, 1962); *The Post-Apollo Space Program: Directions for the Future, Space Task Group Report to the President* (Government Printing Office, Washington, DC, 1969).
4. Space Science Board, *Major Directions for the Space Sciences: 1995–2015* (National Academy Press, Washington, DC, in press).

Erratum: A number was inadvertently omitted from the News and Comment article "Pentagon plans new antisatellite tests" by R. Jeffrey Smith (25 July, p. 409). In a discussion on page 410 about potential Soviet evasion tactics (second column, second paragraph), the numeral 2 was omitted from the following sentence: "The problem stems in large measure from the fact that target coordinates for the weapons must be supplied more than 2 hours before an attack."

Erratum: The Voyager 2 spacecraft is powered by radioisotope thermoelectric generators. A decrease in output by this power source, not solar batteries (This Week in Science, 4 July, p. 7), may at some future time bring an end to the effective operation of the Voyager 2 spacecraft.