Collective Misgivings

Strategic Defenses and Soviet-American Relations. SAMUEL F. WELLS, JR., and ROBERT S. LITWAK, Eds. Ballinger (Harper and Row), Cambridge, MA, 1987. xvi, 219 pp., illus. $29.95; paper, $16.95. A Wilson Center Book. From a conference, Washington, DC, March 1986.

The SDI Challenge to Europe. IVO H. DAALDER. Ballinger (Harper and Row), Cambridge, MA, 1987. xvi, 185 pp. $19.95.

The technology of new weapons is what most often captures our attention and imagination. Yet weapons programs are as much political and social phenomena as they are technological. President Reagan's Strategic Defense Initiative (SDI) is a case in point. The SDI sprang not from an identifiable technological innovation but from the President's diffuse and irrepressible confidence that there must be a technological solution to a profoundly political problem, the East-West nuclear confrontation. The strategic purpose of the program is equally diffuse. As Albert Carnesale remarks in one of these volumes, "I do not yet know exactly what it is we are talking about." While the President and his Secretary of Defense continue to speak of a revolutionary transformation in the foundation of Western security, technical advisers speak in more measured terms only of bolstering our current structure of retaliatory deterrence. Because the SDI has had a shifting strategic purpose, it also has been marked by a shifting technological focus. Indeed, one technology that supposedly encouraged the President's vision—x-ray lasers powered by nuclear explosions—now promises to be far better as an anti-defense weapon than as a defense.

Anyone who has watched these twists and turns and has puzzled over the SDI as a political phenomenon will find these two books engaging and informative. The volume by Wells and Littwak assembles six papers and panel commentaries from a conference on the SDI held at the Woodrow Wilson International Center for Scholars. The papers cover a wide but sensible span of SDI topics. Desmond Ball of the Australian National University argues that the history of U.S. missile defense programs reveals a lack of conceptual or methodological bases for judging what mix of defenses and offenses would best serve security. Benjamin Lambeth of RAND suggests that the SDI undermines the political influence the Soviets derive from their offensive forces and hence that they will probably counter with an offensive buildup rather than simply imitate the SDI. Kevin Lewis of RAND questions whether the United States ever could or should relax its modernization of offensive nuclear forces as it makes its way to a world of SDI defenses. William Kincade of Georgetown University argues that we will need concepts of arms control as revolutionary as the emerging offensive and defensive technologies if we are to cope with the SDI. Michael May of Lawrence Livermore Laboratories surveys the topography of SDI technologies, noting the substantial problems and the distance between current achievements and the performance required for effective defense. Charles Glaser of MIT analyzes the formidable challenges involved in changing from security dependent on offensive retaliation to security resting on defensive immunity. Brief commentaries follow by Carnesale, Glenn Kent, and David Yost.

These authors are strikingly diverse in backgrounds and affiliations. If there is a sentiment that nonetheless appears to unite them, it is a deep-seated skepticism about where the SDI is taking us. The skepticism is not presented as doubts about SDI technologies per se. Though the authors may well have such doubts, this volume is not another debate on how many kinematic kill vehicles can sit on an orbiting space platform. The skepticism is linked more to perceptions of weapons programs as socio-political events. Lambeth worries that the United States, having provoked the Soviets into an offensive buildup, will then abandon the SDI, leaving the Soviets with a redoubled preponderance in offensive strategic forces. Michael May suspects that the United States will abandon the SDI after provoking a Soviet *defensive* buildup. Kincade suggests the SDI will not be abandoned so much as it will fragment, dissolve, and vanish into a myriad of other earth- and space-based weapons bearing little resemblance to the original SDI vision. The implication of this collective skepticism is that the United States might be better off trading the SDI for arms control limits on Soviet offensive weapons now, while the SDI still has exchange value.

Perhaps the finest essay in this excellent collection is Glaser's careful analysis of how a transition from offense to defense dominance might be managed. The Reagan Administration has voiced its hope of achieving a transition by negotiated arrangement with the Soviets, or that failing, by going it alone. Glaser persuasively argues that neither a hostile nor a negotiated transition is likely to be stable. Inherent in any cooperative venture between two distrustful superpowers is the temptation to prepare for the moment when cooperation breaks down. Along the way, each side will overestimate the opponent's military capacities and underestimate its own. That dynamic, coupled with the recognition that maintaining an advantage in nuclear weapons is, after all, a useful mode of political coercion and insurance, is likely to unravel any cooperative transition. Glaser is not alone in reaching such conclusions. What distinguishes his essay is that he works his way through the issues with the same clarity and thoroughness that two decades ago made Thomas Schelling's work on security and arms control so accessible, influential, and even enjoyable.

Daalder's book on the European dimensions of the SDI is also written with clarity and force. It is a nice companion piece to the Wells and Littwak volume and, if both are to be read, is perhaps better read second. Daalder is a Dutch national who has done advanced degree work at Oxford, Harvard, and MIT, so he is well prepared to help Americans understand the Europeans. Daalder sees three challenges to Europe in the SDI: the political challenge of dealing with an American ally whose understanding of and sensitivity to conflicting European views is not always profound; the strategic challenge of anticipating a world in which the United States but not Europe might become immune to nuclear attack; and the technological challenge of keeping pace industrially with the United States as it pours billions of dollars into research on future technologies. The Europeans have discovered that rising to one challenge means succumbing to another: they have gambled that the way to keep pace technologically is to bid for SDI contracts, even though the SDI goals are in many ways hostile to European political and security interests. The gulf that separates American concerns from European is underscored by Daalder's careful discussion of the anti-theater ballistic missile (ATBM) defense issue, a matter of considerable importance to Europeans and barely recognized in the United States.

Daalder's conclusion is sobering but persuasively argued: alliance cohesion is incompatible with the pursuit of Reagan's SDI vision. The SDI seeks to nullify the Soviets' offensive strategic arsenal; the Europeans see such ventures as provocative, destabilizing, and ultimately fruitless. The SDI seeks

to abandon deterrence based on retaliation; the Europeans believe their security and freedom of action rest on the vulnerability of the superpowers to nuclear attack. The SDI requires abrogation of the Anti-Ballistic Missile Treaty; the Europeans insist the treaty be preserved. Daalder is an excellent guide through complicated territory. He knows how to lay the analytical groundwork for the reader and when to step aside and let the flavor and color of European opinions emerge from the words of Europeans themselves. This is a first-rate book.

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Star Systems

Stellar Populations. COLIN A. NORMAN, ALVIO RENZINI, and MONICA TOSI, Eds. Published for the Space Telescope Institute by Cambridge University Press, New York, 1987. x, 245 pp., illus. $32.50. Space Telescope Institute Symposium Series, 1. From a meeting, Baltimore, May 1986.

In 1979 the International Astronomical Union held a colloquium on scientific research with the Space Telescope. At that time, the expected launch date was 1983; it is now late 1988 or early 1989. *Stellar Populations* contains the invited review papers from a meeting on that subject held at the Space Telescope Science Institute in May of 1986. This is an area of research in which the Space Telescope is sure to make great contributions and exciting discoveries. One's first impression on comparing this volume with the proceedings of the 1979 symposium (*Scientific Research with the Space Telescope*, U.S. Government Printing Office) is that tremendous progress has occurred within the past decade, even though astronomers have been largely limited to observations with ground-based telescopes. Because of the continuous improvement in the quantum efficiency of detectors and in the speed of computers, which in turn affects the ability of astronomers to analyze, interpret, and model their data, many of the problems outlined in 1979 have begun to be resolved. Further rapid ground-based progress is sure to occur, given recent projects for the construction of ever larger telescopes and the improvements in "seeing" that have been achieved by proper attention to thermal characteristics inside telescope enclosures and by the location of astronomical observatories at sites with extremely stable atmospheric properties.

The concept of stellar populations was most clearly enunciated by Walter Baade in the mid-1950s. The papers by Searle and by Sandage provide excellent summaries of the history of this idea. Baade divided the contents of stellar systems into two major classes, the regions of active star formation where the mean age of the stellar constituent is very young (perhaps only a few hundred thousand years) and the tranquil old system of stars in which nothing significant has happened for the past ten billion years (beyond the gradual aging of the individual stars). In our own Galaxy, the Galactic disk with its extensive gas clouds and its clusters of hot, massive, and very young stars is the prototypical example of Population I, whereas the collection of globular clusters that resemble for our Galaxy a system of small artificial satellites orbiting the earth is the archetype of the much older Population II objects.

This now seems simplistic; real galaxies contain a continuum of stars with related kinematic properties, chemical abundances, and age. The details of the relationships are still obscure, and fierce debates rage about whether any particular component is discrete or the tail of one of the three more or less standard and universally accepted constituents of galaxies: a flattened disk, an approximately spherical halo, and a central bulge. It is unfortunate that in many of the areas of greatest controversy, only one of the combatants was actually present at the May 1986 meeting. In the case of the question of the "thick disk" whose existence within our own Galaxy was proposed by Gilmore a few years ago, neither of the strongest proponents for or against this idea was present at the conference.

The papers by Mould, by Aaronson, and by Sandage present useful summaries of our current knowledge of the stellar content of the central bulge and halo of our own Galaxy, that of our nearest neighbors (the Magellanic Clouds), the dwarf galaxies (rather puny satellites of our Galaxy), and our nearest neighbor of a size comparable to typical luminous galaxies, M31 (the Andromeda nebula). They illustrate the immense difficulties faced by astronomers working in this field—we still do not know the distance to our closest neighbors, the Magellanic Clouds, within an uncertainty of 25 percent in spite of decades of work by many people. The theoretical uncertainties in stellar evolution (the modeling of the properties of a star, its luminous output, its radius, and so forth from the time it condenses out of a cloud of gas until its nuclear fuel is exhausted) are gradually beginning to yield to persistent efforts but remain a serious problem, as is summarized by O'Connell. Even worse, and far less tractable, are the uncertainties in the relative number of stars of different masses that are formed at a given time (the initial mass function), a subject reviewed by Larson, where the theory is so complex and there are so many variables that little progress can realistically be expected without guidance from observers, and observations are extremely difficult, since they require star-by-star counting and age dating within our own and other galaxies. The initial mass function may well be dependent on local conditions, complicating things still further, yet it is an essential parameter in trying to characterize galaxies that are so distant that only the composite light of all their stars together can be measured. Even with the power of the Space Telescope, it will be impossible to see stars as faint as our own sun, even in a galaxy as close as the Andromeda nebula.

I found this book a useful summary of current knowledge. In it one encounters the many questions that will undoubtedly dominate the study of the subject for years to come. The papers present thoughtful reviews of recently published work and of studies in progress by the authors and their collaborators. Unfortunately, the book does not include any of the numerous interesting results that were presented in the poster sessions.

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Modern Zoophytology

The Growth and Form of Modular Organisms. J. L. HARPER, B. R. ROSEN, and J. WHITE, Eds. Royal Society, London, 1986. 250 pp., illus., + plates. £43. First published in *Philosophical Transactions of the Royal Society of London*, series B, vol. 313, no. 1159. From a meeting, London, June 1985.

Modular Organisms: Case Studies. Papers Relating to a Discussion Meeting [London, June 1985] on Growth and Form in Modular Organisms. Royal Society, London, 1986. 116 pp., illus., + plates. Paper, £12.75. *Proceedings of the Royal Society of London*, series B, vol. 288, pp. 109–224.

Although his *scala naturae* had no place for evolutionary convergence, Aristotle commented at length on the often striking similarity of marine invertebrates and plants. Indeed, until 1740, when Abraham Trembley demonstrated that the green hydra (*Chlorohydra viridissima*) was in fact an animal, colonial marine invertebrates were collectively referred to as "zoophytes." The remarkable architectural similarity of plants and clonal animals, beautifully illustrated on the frontispiece of the first of these sympo-