BOOK REVIEW

NATIONAL SECURITY ON THE HIGH FRONTIER

SPACE AND NATIONAL SECURITY
by Paul Stares
Published by The Brookings Institution, Washington, D.C., 1987
Pp. xvii, 219; $10.95.

Reviewed By GLENN HARLAN REYNOLDS †

Over the past few years, for a variety of political and technical reasons, considerable attention has been focused on issues of space policy, both civilian and military. Although issues relating to civilian programs have not been ignored, the Reagan Administration's keen interest in all matters military has resulted in an explosion of interest in space militarization, and particularly in so-called "active" military uses of outer space, such as antimissile and antisatellite systems.

One of the analysts who has contributed the most to the discussion of space militarization over the last few years is Paul Stares of the Brookings Institution. With his latest work, *Space and National Security*,[1] Stares has produced an admirable successor to his previous work, *The Militarization of Space: U.S. Policy, 1945-84*.[2] The earlier book provided a comprehensive and well-documented history of United States military space policy from its first days; Stares' new book looks in great detail at the current U.S./Soviet military space situation, with primary emphasis on the possibility that the two nations will begin making realistic preparations for attacks on one another's satellites.

The threat of space militarization, including the use of satellites for military purposes and the possibility of attacks on satellites in response to those uses, has been addressed before by journalists, military experts, and members of the arms control and international law communities.[3] Stares' coverage of the

† Associate, Dewey, Ballantine, Bushby, Palmer & Wood, Washington, D.C.; J.D. 1985, Yale Law School; B.A. 1982, University of Tennessee. Mr. Reynolds is author (with Robert P. Merges) of OUTER SPACE: PROBLEMS OF LAW AND POLICY (forthcoming, Westview Press).

1. P. STARES, SPACE AND NATIONAL SECURITY (1987).

2. P. STARES, THE MILITARIZATION OF SPACE: U.S. POLICY, 1945-84 (1985) [hereinafter MILITARIZATION].

3. *See, e.g.*, W. BURROWS, DEEP BLACK: SPACE ESPIONAGE AND NATIONAL SECURITY (1986); D. RITCHIE, SPACEWAR (1982); Bunn, *Satellites for the Navy: Shielded by Arms Control?*, NAVAL WAR C. REV., Sept.-Oct. 1985, at 55; Gravatt, *Elements for Conventional War—Land, Sea, Air and Space*, NAVAL WAR C. REV., May-June 1985, at 2; Jasentuliyana, *Arms Control in Outer Space: A Review of Recent United Nations Discussions*, 9 ANNALS OF AIR & SPACE L. 329 (1984).

subject in the context of antisatellite (ASAT) weapons is, however, by far the best to date; in fact, it closely approaches the ideal for Washington policy analysis — though that virtue, as I will discuss further on, is not without certain accompanying vices.

The antisatellite issue has erupted into prominence as the result of a combination of technical and political developments. Antisatellite weapons are not new: the United States developed a rudimentary antisatellite capability in the 1960s, and maintained it (though at a low level of readiness toward the end) until the mid-1970s, while the Soviets started a bit later and (though they have proceeded slowly) never entirely abandoned their program.[4] Now, however, advances in guidance and detection capabilities make "kinetic-kill vehicles" (those which destroy their targets through force of impact) and various laser and particle beam weapons practical.[5] Meanwhile United States enthusiasm for eventual deployment of antimissile systems via the Strategic Defense Initiative has encouraged American efforts to prove much essential antimissile technology through development of ASAT systems, while American dependence on a relatively small number of vulnerable satellites for military purposes has encouraged the Soviet Union to work at developing the ability to attack those satellites.

Stares provides a detailed and accurate description of the current state and likely near-term future of United States and Soviet antisatellite capabilities, along with considerable detail regarding both the characteristics of various satellites likely to be targets of ASAT systems, and the different ways of interfering with those satellites. Military uses of satellites include reconnaissance (which may encompass photography, electronic intelligence, resource and crop estimates, etc.), early warning, command, control, and communications. Modern military forces in both the United States and the Soviet Union have become steadily more dependent on satellites for all of these functions, increasing the temptation for an adversary to deny them those capabilities by attacking the satellites that provide them. This temptation may be strong. Absent communications satellites, military units might be left paralyzed, unable to move without the necessary orders or information; absent reconnaissance and early warning

4. MILITARIZATION, *supra* note 2, at 106-55.

5. While there remains considerable debate about the effectiveness of such weapons as part of a "Star Wars"/SDI system, there is general agreement that the technology is up to the requirements of an antisatellite system. Although the basic technologies of antisatellite and antimissile systems are similar, as Stares notes, the challenges are of very different orders of magnitude. P. STARES, *supra* note 1, at 181-82. An antisatellite system, which must track and engage only a few targets moving over predictable paths (satellite orbits being very regular), has a much easier task than an antimissile system, which must deal with thousands of targets moving over short and unpredictable paths. *See* Hammond, *The Militarization of Space*, in INTERNATIONAL SPACE POLICY: LEGAL, ECONOMIC, AND STRATEGIC OPTIONS FOR THE TWENTIETH CENTURY AND BEYOND 235, 240-42 (D. Papp & J. McIntyre eds. 1987); Weiner, *Systems and Technology*, in BALLISTIC MISSILE DEFENSE 49, 54-63 (A. Carter & D. Schwartz eds. 1984). For more on the basic principles behind military and civilian uses of space see generally U.S. AIR FORCE, SPACE HANDBOOK (C. Cochran, D. Gorman & J. Dumoulin eds. 1985) (outlining orbital mechanics, various aspects of space technology, and U.S. military space doctrine); G. REYNOLDS & R. MERGES, OUTER SPACE: PROBLEMS OF LAW & POLICY (forthcoming from Westview Press).

satellites, commanders might be vulnerable to surprise attack or deception, or simply less able to deal with the hazards and opportunities of battle.[6]

Although satellites are not especially easy to attack, due to their high altitude and extreme speed, they are far from invulnerable. Because of their extreme speed, satellites may be destroyed simply by collision with relatively small amounts of inert matter, meaning that a handful of gravel lofted into the path of a multimillion dollar satellite can reduce that satellite to fragments. Satellites are also highly dependent on ground controllers for instructions (*e.g.*, on what to photograph) and maintenance (such as orbital correction, software modifications, etc.), meaning that interference with communications via jamming (or destruction of ground stations) can put otherwise intact satellites out of action. And satellites can be injured or destroyed by the electromagnetic pulse from a high-altitude nuclear explosion, or by laser beams or highly-concentrated microwave radiation that can damage their sensors or solar panels. As Stares reports, all of these techniques (as well, no doubt, as some others) are under examination by American and Soviet researchers. Stares' explanation of various antisatellite techniques is lucid and succinct and even those who are generally knowledgeable about the subject are likely to find it useful.[7]

After an examination of existing American and Soviet satellite systems,[8] along with a discussion of current and planned antisatellite systems, Stares proceeds to evaluate how useful such ASAT systems might be if actually put to use. The answer, surprisingly enough, is that such systems are not likely to be very useful at all. Even allowing for the highest credible effectiveness and the greatest imaginable number of launches per day, either side would require days to destroy all—or even most—of the other side's vital military satellites.[9] Clearly, under such constraints, an all-out surprise attack on an opponent's satellites is out of the question.

Of course, even lacking the ability to denude an adversary of satellites, either side might attempt to obtain local advantage by attacking a limited number of satellites supporting a given area. But such attacks would likely be counterproductive, and would pose a strong risk of escalation. Attacking

6. P. STARES, *supra* note 1, at 45-72. For a discussion of military commanders' use of satellite capabilities see Rechtin, *The Technology of Command*, NAVAL WAR C. REV., Mar.-Apr. 1984, at 5, 7-25.

7. P. STARES, *supra* note 1, at 73-141.

8. As tends to be the case in the area of military space systems, information on the nature, number, and orbital location of such satellites is both highly classified and generally available from unclassified sources. For example, although the launch dates and orbital parameters of United States military satellites are classified at a very high level, that information (apparently very accurate) is available on a poster that can be purchased through the National Air and Space Museum and which is updated monthly by *Air & Space* magazine. *See* Marshall, *A Spy Satellite for the Press?*, 238 SCIENCE 1346, 1347 (1987).

9. P. STARES, *supra* note 1, at 94, 108. In the meantime, of course, the adversary could be expected to take defensive measures (such as moving satellites into new orbits) as well as more aggressive steps such as attacking the ASAT facilities in question. The Soviet system, which requires a rocket launch (from a very limited number of launch sites) for each attack is more vulnerable than the current United States system, which uses missiles launched from specially-adapted F-15 fighters, but either would be a fairly "soft" target, and well worth attacking in order to prevent the loss of many crucial military satellites.

reconnaissance satellites before a surprise attack is itself a tip-off, and piecemeal attacks on adversary satellites invite retaliation in kind, do damage small enough that slack can be taken up by nonsatellite systems (like reconnaissance aircraft or landline communications), and might very well induce a nervous commander to fear that worse is to come, leading to an escalation of hostilities that might not be limited to outer space.[10]

Stares thus concludes that the real military usefulness of antisatellite weapons is much less than is commonly imagined.[11] Thus he recommends that the superpowers, rather than pursuing an ASAT arms race, enter into an arms control agreement limiting ASAT development, testing, or deployment.[12] He admits that "ASAT arms control cannot eliminate the threat to space systems, only bound it"[13] —for example, existing ballistic missiles could be used to attack satellites, although at great expense, considerable risk of collateral damage to friendly systems, and with modest effectiveness—and there is (as with all treaties) always the possibility of outright cheating. But Stares says that, on balance, the benefits of an ASAT arms control regime outweigh the costs and the risks. Instead of attempting to deter Soviet ASAT attacks through our own buildup, we should negotiate a limit to the development of such weapons; then hedge our bets by taking steps to ensure the survivability of existing military space systems—both by "hardening" satellites against attack and by moving away from our current policy of dependence on relatively few multifunction satellites in favor of reliance on a larger number of simpler, one-function satellites that are both easier to replace and less attractive as targets.[14]

Finally, Stares recognizes that the constraints he proposes will inevitably limit the testing of antimissile systems as well. Because the technologies for intercepting satellites and missiles are virtually indistinguishable in all important respects (except for those relating to in point defense of missile silos, which involve interception of warheads after they enter the atmosphere), a ban on flight testing of ASAT systems or components will be likely to make much (if not all) SDI flight testing illegal as well. Similarly, since any conceivable space-based

10. P. STARES, *supra* note 1, at 136-39. Indeed, the mere existence of antisatellite capabilities may cause understandably nervous military commanders, and perhaps the civilians who oversee them, to fear the worst even if a satellite is lost accidentally at the wrong time. Space analyst Daniel Deudney has warned, quotably enough, that "The Archduke Francis Ferdinand of World War III may well be a critical U.S. or Soviet reconnaissance satellite hit by a piece of space junk during a crisis." Deudney, *Unlocking Space*, 53 FOREIGN POL'Y 91, 101 (Winter 1983-84). *See also* Reynolds, *Structuring Development in Outer Space: Problems of How and Why*, 19 L. & POL'Y INT'L BUS. 433, 444-45 (1987) (antisatellite weapons most destabilizing of space military systems).

11. As Stares puts it:

> The situations in which dedicated ASAT weapons could be of some benefit to the United States appear to be confined to a narrow band on the conflict spectrum. . . . At lower levels of conflict, the risks of widening the crisis or war outweigh what are already doubtful military benefits, while the worth and relevance of ASAT attacks in a prolonged strategic nuclear exchange are questionable.

P. STARES, *supra* note 1, at 140-41. He concludes that ASATs are more likely to transform a crisis into a war, or to enlarge an existing war, than to confer any meaningful military advantage. *Id.*

12. *Id.* at 142-173.

13. *Id.* at 172.

14. *Id.* at 183-85. A shift by the Defense Department to a policy of using more and lighter satellites is also likely to provide a boost (in the form of increased demand and greater launcher flexibility) for the fledgling commercial space launch industry, which would be a valuable bonus.

antimissile system (and any ground-based system other than those designed for point defense) will unavoidably have antisatellite capabilities, any ban on ASAT deployment is likely to complicate deployment of antimissile systems.[15] However, Stares notes that space-based SDI components would be highly vulnerable to attack by ASAT systems, so that ironically the SDI might well be impractical in the absence of constraints on ASAT systems.

As mentioned at the outset, Stares' book is a first-class example of what the Washington policy establishment can produce at its best. His explication is clear, accurate, and reasonably comprehensive, and his recommendations are sensible and follow logically from his analysis. These are the virtues of the policy-analysis approach to problems, but that approach has its vices as well. Chief among those vices is the need to stay within rather narrow bounds in order to be thought acceptable, practical, and suitably hard-headed. The problem is that the need to focus on what seems "practical" induces a sort of myopia, with political and technological forecasts based primarily on ready extrapolation from existing conditions.

Weathermen have an analog to this approach, which they refer to as the "persistence theory of meteorology"—all that is required is to look out the window, see what the weather is like, and assume that it will stay that way for a while. Such an approach is relatively accurate in the very short run, but of no use in the long run, whether one is forecasting the weather or international politics. For example, only a few years ago, the policy experts scoffed at the likelihood of an agreement on Intermediate Range Nuclear Forces in Europe, particularly one based on the so-called "double zero" option. Yet changes in the superpower climate, and in the attitudes of ordinary citizens and policymakers toward nuclear war—changes induced in no small part by those considered unserious by the policy community—led to just that.

On a less dramatic plane, Stares treats the question of space militarization as one that involves only the United States and the Soviet Union. While that is largely true at the moment, several other countries—particularly India and Brazil—are on the verge of acquiring space capabilities great enough to support at least a modest ASAT system of the sort possessed by the United States in the late 1960s.[16] Such countries have been known to acquire military capabilities

15. This is about as deep as Stares' legal discussion gets, but the book does not purport to be a legal analysis. For more on this topic, see Chayes, Chayes & Spitzer, *Space Weapons: The Legal Context*, 114 DAEDALUS 193 (1985); Note, *The Legality of Antisatellites*, 3 B.C. INT'L & COMP. L. REV. 467 (1980). *See also* R. GARTHOFF, POLICY VERSUS THE LAW: THE REINTERPRETATION OF THE ABM TREATY 1-15 (1987) (attacking Reagan Administration's "broad interpretation" of ABM Treaty as permitting flight testing of antimissile systems); *U.S.-Soviet Arms Accords Are No Bar to Reagan's Strategic Defense Initiative*, HERITAGE FOUND. BACKGROUNDER NO. 421 (1985) (stating Administration view).

16. *See, e.g.*, Karp, *The Commercialization of Space Technology and the Spread of Ballistic Missiles*, in INTERNATIONAL SPACE POLICY, *supra* note 5, at 179, 182-88 (describing space programs of India, Brazil, and other third world countries as on verge of supporting military applications, which include ASAT and ballistic missile uses); Whitehouse, *Brazil Shows the Way*, SPACE, Mar.-Apr. 1987, at 4 (describing Brazilian space program, which includes acquisition of satellite design and launch capabilities, as a model for emerging third world space powers); Tefft, *The Chariot of Indra*, AIR & SPACE, Apr.-May 1988, at 33, 37-42 (describing India's progress in developing satellite launch capability, and goal of self-sufficiency in space). For that matter, the ingenious and capable Israeli aerospace industries might well be capable of duplicating the United States ASAT system and the

beyond what outside analysts consider to be their objective needs (*e.g.*, India's nuclear capability) for reasons of prestige or in order to stand up to superpowers on other fronts, and might well consider doing so in the context of antisatellite weapons. This would create problems for the United States or the Soviet Union that would in some ways be greater than those presented by a U.S./Soviet ASAT arms race; it might be, for example, that a third world nation would not be deterred by the threat of retaliation against its own satellites, either because it had none, or because it depended on them less than more advanced nations. This offers a reason for an ASAT treaty including all space powers and not just the United States and the Soviet Union as Stares advocates.

Another such reason for limiting space militarization, also not addressed by Stares, is the discouraging effect it might have on commercial activity in outer space.[17] Reflecting an unfortunate general trend, the militarization of space holds out no likelihood of actually protecting commercial space ventures from destruction—only the promise to wreak further destruction on an adversary, which is hardly a comfort to potential investors. In addition, the use (or even testing) of ASAT systems in space is likely to add to an already severe space debris problem that could make many near earth orbits dangerous or even unusable. Because of the very high velocities at which objects orbit the earth even small objects strike with enormous energy. Collision of a satellite with a golf ball-sized (about 4 cm.) fragment of material (whether an ASAT weapon or a piece of junk from prior experiments or actual attacks) can produce literally *millions* of fragments which, of course, continue to orbit and menace other satellites. At some level, such chain reactions become self-sustaining, yielding a "Kessler effect" in which satellites destroyed by fragments yield more fragments which destroy still more satellites.[18] If this seems far-fetched, readers should

necessary modifications to F-15 fighters (already possessed by Israel) to operate it. This possibility might even become a likelihood if Arab nations were (say, in another Arab-Israeli war) to make use of Soviet intelligence satellite data—or to launch their own reconnaissance satellites—something not out of the question in coming years. Recent experience certainly indicates that space-related technology, in the form of Israeli-built "Jericho 2" missiles and Chinese-built CSS-2 missiles owned by Saudi Arabia (both of which are capable of carrying nuclear warheads) has been spreading to the Middle East, perhaps presaging a general third-world trend. *See Saudi Purchase of Chinese Missiles Changes Middle East Military Balance*, AVIATION WEEK & SPACE TECH., Mar. 28, 1988, at 30; *see also Brazil's Missile Capability Alarms CIA*, Washington Post, Mar. 28, 1988, at C14, col. 1 (describing Brazil's increasing capability in the ballistic missile field and fear that it would export missiles to unstable nations such as Libya and Iraq; analysts also believe that Brazil is pursuing its own nuclear weapons program). Less capable tactical missiles, of course, have played a part for some time in the so-called "war of the cities" between Iran and Iraq, a conflict that at this writing seems to be escalating and that lends credence to fears regarding third world use of ballistic missile technologies. *See Iraq Targets Bigger Missile on Tehran*, Washington Post, Mar. 28, 1988, at A17, col. 1. Prospects for reversal of this trend seem dim, at least in the absence of concerted action by both Western and non-Western nations. Even serious and concerted efforts by the existing space powers, though, will only slow the spread of such technology, not halt it.

17. For example, a desire to maintain a monopoly on space reconnaissance photography has led to the existence of regulations that threaten to cripple the United States' civilian remote sensing industry. *See* Reynolds, *The First Amendment and Satellite Newsgathering*, AIR & SPACE LAW., Fall 1987, at 1; Merges & Reynolds, News Media Satellites and the First Amendment (forthcoming in 3 HIGH TECH. L.J. 1988).

18. The effect is named after Kessler for his pioneering article on the subject. *See* Kessler & Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*, 83 J. GEOPHYSICAL RES. 2637 (1978).

bear in mind that already—*without* ASAT testing at anywhere near the levels that would take place in an all-out space arms race—the artificial debris flux in near earth orbits exceeds the natural meteorite flux.[19] Serious testing of ASAT weapons, much less their use in combat, could thus have devastating effects on the potential for beneficial uses of space by nonmilitary ventures. Since it can take years, decades, centuries, or even longer at orbits more than a few hundreds of miles up for such debris to be removed by natural processes, the damage done could be virtually permanent, with incalculable impact on the future of mankind.[20]

Aside from giving short shrift to the above issues, Stares' book pays no attention to the broader importance of man's activity in outer space, and how that could be used to steer superpower activities in more peaceful directions, at least within the context of outer space.[21] Such a technique is not new: President Kennedy deliberately made use of civilian projects as a way of sidetracking military projects (including BAMBI—for Ballistic Missile Boost Intercept, a lineal ancestor of today's SDI—and SAINT, a satellite interception program) and promoting a general sense of space as a place for peaceful, not aggressive, endeavors.[22]

This approach might profitably be used again. A solid commitment to civilian programs would also increase the likelihood that Stares' suggestions regarding military programs would be followed: although Stares makes a good case that ASAT is a bad idea, it is an idea from which some people stand to make money. Those people are thus likely to resist efforts to negotiate an ASAT arms agreement, but that resistance will be less vigorous (or at least counterbalanced) if such an agreement is to be followed by equally-lucrative civilian programs. Whether one calls this blatant interest-group bribery or simply good politics (assuming that there is a difference nowadays), it is hard to argue with, and the lessons should be obvious for those opposing space weapons programs in general. Stares, however, does not address it.

Leaving the pork barrel aside for a moment, bold civilian space programs could have a broader, more spiritual effect. Kennedy intended the moon race, a bloodless technological competition with the Soviet Union, to serve as a moral equivalent of war and it did—until, as Freeman Dyson has observed, it was eclipsed in the public mind by the real war in Vietnam, in which we were less

19. In the volume of space near earth, a satellite is more likely to collide with pieces of man-made objects (such as fragments from antisatellite tests or accidentally-exploded rocket boosters) than with naturally occurring meteors of the same size. *See* Kessler, *Earth Orbital Pollution*, in BEYOND SPACESHIP EARTH: ENVIRONMENTAL ETHICS AND THE SOLAR SYSTEM 47, 48-49 (E. Hargrove ed. 1986) [hereinafter BEYOND SPACESHIP EARTH].

20. For an interesting and up-to-date study of the orbital debris problem see David Enrico Reibel, Prevention of Orbital Debris (unpublished manuscript presented at IAF conference in Brighton, UK, October 10, 1987) (available from Glenn H. Reynolds). *See also* Johnson, *Preventing Collisions in Orbit*, SPACE, May-June 1987, at 17.

21. Others have addressed this topic. *See, e.g.*, Deudney, *Forging Missiles into Spaceships*, 2 WORLD POL'Y J. 271 (1985) (arguing for cooperative projects in space to defuse superpower tensions); Reynolds & Merges, *The Role of Commercial Development in Preventing War in Outer Space*, 25 JURIMETRICS J. 130 (1985).

22. For more on President Kennedy's view of space see Reynolds, *Structuring Development in Outer Space: Problems of How and Why*, *supra* note 10, at 441-445 and sources cited therein.

successful.[23] More generally, the Apollo mission photographs of earth, showing our planet as a small, fragile object amid a sea of blackness and emptiness, did much to promote a view of our world as (significantly named) "spaceship earth" with consequences that have not yet been fully played out.[24] Gregg Easterbrook has proposed that the United States and the Soviet Union counter the fear of the future inspired by nuclear weapons with a measure of hope by engaging in cooperative ventures in outer space, to be financed by a one percent tax on the total of their defense budgets. At current levels that would yield about six billion dollars per year, enough for some substantial undertakings. As Easterbrook says, "If the venture reduced superpower tensions, it would surely do more to enhance United States national security than 1 percent more weaponry."[25] Easterbrook is right. The people of the world understand more clearly than their leaders—and most of those who advise them—that space represents the future of humanity, and that it should be a place of hope and aspiration, not simply a new arena for old conflicts. Leaders (and analysts) who understand this have an opportunity to make a real qualitative difference; those who do not will be consigned to picayune disputes about payload and sensor capabilities that, although important in the short run, offer no way out of the larger problems.

Stares' policy proposals should thus go beyond the "quick fixes" necessary to deal with the direct aspects of the problem and address some of the larger issues. Nonetheless, they are good proposals, based on good analysis. If the space policy field had more analysts of Stares' caliber, and more works like *Space and National Security*, it might be that our national leaders would have the wherewithal to act on a broader vision than Stares' book itself contains. Unfortunately, that vision is nowhere apparent today, and we are all the worse off for that.

23. *See* F. DYSON, WEAPONS AND HOPE 219 (1984).

24. *See* Hartmann, *Space Exploration and Environmental Issues*, 6 ENVTL. ETHICS 227-39 (1984), *reprinted in* BEYOND SPACESHIP EARTH, *supra* note 19, at 119-20.

25. Easterbrook, *Getting Back Into Space: 12 Cheap and Easy Ways*, Washington Post, Aug. 23, 1987, at B1, col. 4.