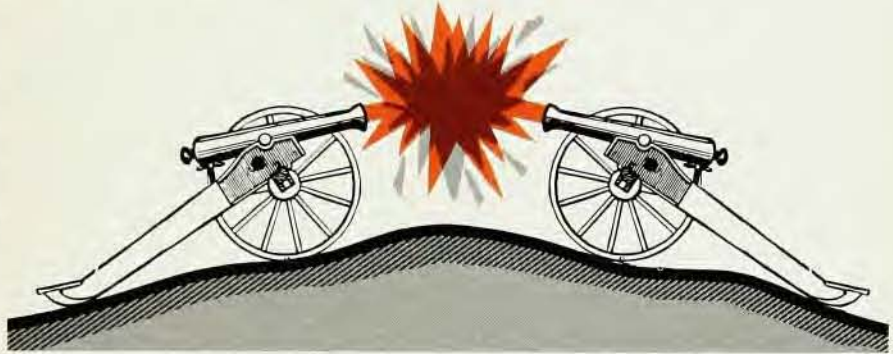


Role of strategic space forces in a non-nuclear world

Freeman J. Dyson

Unfortunately for humanity, the purging of nuclear weapons from the Earth is too big a job for technology to do alone. The dream of the omnipotent celestial laser-beam patrol fails on technological grounds. The space-based antimissile system has many technical weaknesses. Even if death-ray weapons could be aimed and focused with perfect accuracy and could deliver a sufficient concentration of energy to destroy a missile, they would still be at a great disadvantage in terms of vulnerability. A missile is vulnerable to death-ray attack only for a few minutes while it is in flight; a death-ray machine in space is vulnerable all the time. A death-ray machine is a large and delicate piece of apparatus; a single pebble colliding with it at orbital velocity would have a good chance of putting it out of action. The same technology that allows us to aim the death ray with the necessary precision also allows us to aim the pebble. When the experts play their little games, with ground-based missiles on one side and death-ray machines in space on the other, the ground-based side almost always wins. It is of course possible to adjust the numbers of weapons on the two sides so as to make it an even game, but then the cost of the space weapons is outrageously high compared with the cost of the ground weapons. These imaginary battles ignore many aspects of the real world, but they lead us to a clear conclusion: So long as large land-based or sea-based missile forces exist and are not subject to severe political constraints, there is no technological magic by which space-based weaponry can disarm them. The extension of the technological arms race into space cannot by itself make ground-based missiles obsolete or ineffective. For this reason I call the future in which space weapons proliferate without end the technical-follies future. It is an extension into the future of the same folly which gave us the MX. It is a future of double folly, the small-scale folly of



militarily useless weapons, and the large-scale folly of unattainable strategic objectives.

The arms controllers' future makes space a peaceful sanctuary and leaves us to deal as best we can with our strategic problems on the ground. The technical-follies future makes space a battleground and does nothing to make the problems on the ground more tractable. But there is a third possible future, a future in which nuclear weapons are legally banned from the Earth and from space, and in which the resources of non-nuclear technology are used in an energetic fashion to help make the ban effective. This third future I call the defense-dominated future. In the defense-dominated future, weapons of mass destruction are disarmed, not by defensive technology alone, but by legal and political restraints strengthened by the active intervention of technology.

So long as we maintain overwhelmingly destructive nuclear forces on Earth, we would be wise to keep space disarmed so far as possible. But if we can ever achieve drastic disarmament on Earth, a deployment of appropriately designed space weaponry may help us to push the negotiated reduction of nuclear arsenals all the way to zero. These are the premises of the defense-dominated future: The Earth becomes a non-nuclear sanctuary stabilized by substantial military forces in space; space forces are specifically designed to allay fears and to diminish incentive for secret or open nuclear rearmament. To achieve these purposes, the space forces would not need

to attempt the almost impossible task of nullifying a full-scale onslaught of the present-day Soviet or American missile forces. It would be sufficient for the space forces to be capable of nullifying much smaller threats. The smaller threats of a non-nuclear world would be either residual nuclear forces concealed by a country secretly violating a disarmament treaty, or embryonic nuclear forces deployed by a country openly abrogating the treaty, or forces belonging to smaller countries which had never acceded to the treaty. Space forces which could defeat these smaller threats are not beyond the realm of technical possibility. Such forces would not by themselves remove all danger of breakdown of the non-nuclear regime, but they would powerfully strengthen the political and institutional structures on which the durability of the regime would depend.

What kind of space forces would the defense-dominated future require? Certainly not space battleships, and probably not death-ray generators or high-energy lasers. One of the primary requirements for an effective space force is to be itself inconspicuous and invulnerable. The most likely shape for the space force would be a multitude of small vehicles, scattered in orbits around the Earth, carrying telescopes and sensors of various kinds. The purpose of these vehicles would be to collect accurate and timely information. In a defensive battle, information is more important than exotic kill-mechanisms. If the defense has adequate information, it can relay the

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information to small non-nuclear interceptors, either ground-launched or in orbit, which can use their own sensors to home onto a flying missile and kill it by direct impact. The idea of a space force of this kind is not new. It was proposed in the 1950s and given the name BAMB I (Ballistic Missile Boost Intercept). It was then rejected as technically impracticable and prohibitively expensive. During the subsequent twenty years, sensors and microcomputers have become enormously more capable and also cheaper. If the world ever decides to move along the road toward the defense-dominated future, it is possible that space forces of the BAMB I type can be built at reasonable cost, and that they can be effective enough to help stabilize the world against backsliding into nuclear terror.

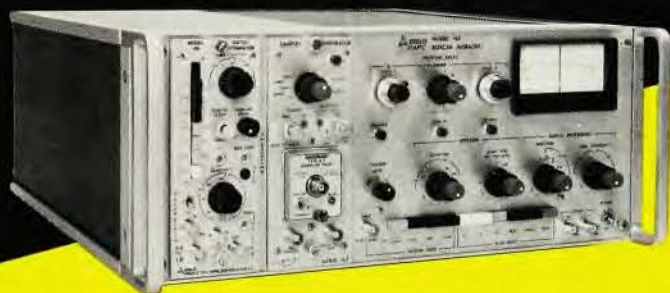
In the defense-dominated future as I have described it, the space forces play a modest role, patrolling the Earth inconspicuously and serving as an adjunct to earthbound political arrangements. These forces could probably operate most efficiently without a single air-force officer in orbit. It is a far cry from the Deep Space Bombardment Force, or from the Galactic Empire space force we saw in the *Star Wars* film. And that is all to the good. . . . Space forces, like air forces, should be firmly harnessed to the strategic needs of earthbound humanity.

In the end, the goals of the arms controllers' future and the defense-dominated future are the same, and only the means are different. The goal of both futures is a stable world with a minimum of nuclear armament. The arms controllers' future chooses first to disarm space and to leave nuclear offensive forces on the ground intact, in the hope that a stable regime of nuclear deterrence will allow gradual steps toward disarmament. The defense-dominated future chooses first to disarm nuclear forces on the ground and to let space forces grow, in the hope that a disarmed world will settle down more comfortably if it has space forces providing substantial protection against the risks of surprise attack. Both futures, if they fulfill their promise, converge to a common end. The real future, if we are wise, will probably lie somewhere in the middle between the arms controllers' and the defense-dominated extremes. If we are unwise, the technical-follies future is there, waiting for us to stumble into it.

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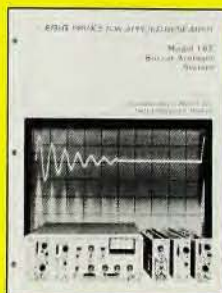
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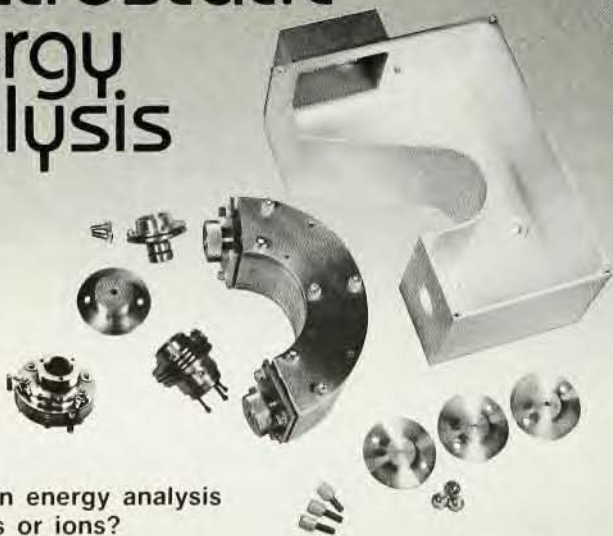
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