Special section

Threshold Limits on ABM and ASAT Systems

Editor's Comment

LASER BRIGHTNESS VERIFICATION

The article below was the first open technical analysis of the possibility of verifying a ban on the testing of high-powered ground-based lasers in an antisatellite (ASAT) or ballistic-missile–defense (BMD) mode through the detection of light scattered from the laser beam by atmospheric aerosols. The authors submitted a first draft of this article to *Science & Global Security* in 1988. Since that time, other studies have been launched—first a study commissioned by the Federation of American Scientists by a group chaired by Ronald Ruby of the University of California, Santa Cruz* and then (at the behest of the US Congress) a study by the US national laboratories.

The study led by Ruby agrees with the conclusion of Braid et al that, for laser tests at power levels capable of damaging satellite structures, near-site monitors could detect the laser light scattered from atmospheric aerosols. The report also analyses the detectability of laser-ASAT tests at such power levels using monitoring satellites and obtains mixed results.

However, the report points out that the ability to detect full-power tests of ASAT lasers may not provide sufficient protection against the sudden break-out of an operational laser-ASAT capability. While a successful test series for a new antisatellite missile would have to be followed by a multiyear program of production and deployment before the system could have significant operational capability, a successful test series for a laser ASAT could convert it quickly into an operational facility.

The Ruby report therefore suggests that a ban on laser ASATs be extended from their testing to their construction. A clandestine laser-ASAT facility would have a nearly unique signature: a large facility with lots of activity but no production coming out; large power capability (in the form of electric power or fuels) and large waste-heat handling capability; buildings with apertures or domes that can open and provide good sky access; elaborate command and

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* Ronald Ruby (chair), Richard Garwin, Freeman Hall, Thomas Karr, Paul Kelley, Norbert Massie, Donald McNeill, George Rieke, and David Spergel, *Laser ASAT Verification: Report of a Workshop Held at the University of California, Santa Cruz, 15–17 August 1989* (draft, 30 July 1990). The final version of this report is expected to be available in late 1990 both from Ronald Ruby, Physics Department, University of California, Santa Cruz CA 95064, and from the Federation of American Scientists, 307 Massachusetts Ave NE, Washington DC 20002.

control links; and possibly a nearby space-tracking radar. All this would be at a site that would probably be in a desert area because of the need for good atmospheric transmission a very large fraction of the time. Such a facility could almost certainly be picked out from satellite imagery for closer examination—as the US intelligence agencies picked out the Soviet laser-tracking facility at Sary Shagan. If the detecting side was concerned enough, it could request an on-site inspection—as occurred at the Sary Shagan facility (see *Science & Global Security* **1**, 1–2 (1989), pp.165–170.

Thus, there appear to be three levels at which one can approach the laser-ASAT verification problem:

- *The multibillion-dollar approach*—the traditional US and Soviet approach—would involve building huge elaborate satellite telescopes designed to detected scattered light from laser ASAT tests in the atmosphere or against target satellites
- *The multimillion-dollar approach*, which is the one explored by Braid et al, would involve establishing monitoring stations around facilities suspected of containing high-power lasers to detect scattered light from any tests in the atmosphere
- *The 10,000-dollar approach* (the price of air tickets), which would involve a group of inspectors checking the inside of any facility which had the external features of a laser ASAT facility to make certain that it did not have ASAT capabilities.

The last approach, which has already been successfully tested at Sary Shagan, is obviously the one to be preferred for reasons of cost and effectiveness. However, it is important to know what the alternatives are if that approach is blocked.

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chairman of the US board of editors