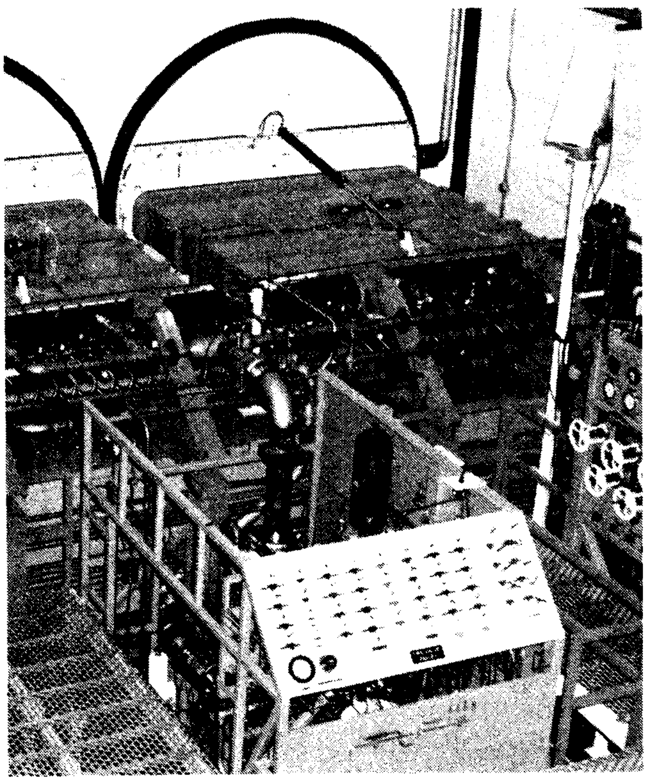
Laboratory programs show near-term feasibility of directed-beam weaponry

by Robert Gallagher

A review of the state of U.S. lab and defense contractor programs to develop laser and particle beam weapon technologies demonstrates that tomorrow morning we can begin to construct the first phase of a beam weapon anti-ballistic missile (ABM) system to prevent launchings of nuclear missiles by third powers from leading to all-out thermonuclear conflict. Such a limited system could also protect U.S. or Soviet retaliatory capability while a complete beam weapon defense was being developed. Technology for this program has been developed in spite of outright sabotage by previous civilian Defense Department officials.

This first phase system requires:

- Chemical lasers sited on mountaintops to reduce power loss in beam transmission through the atmosphere. Required power for such a laser is 5 to 10 megawatts.
- Orbiting optical mirrors for accepting the beam and focusing it on its ballistic missile targets. The required diameter for such mirrors is 4 to 10 meters.
- The technology to point the beam at a range of hundreds of kilometers with the accuracy of a fraction of a microradian.
- The technology to track, or follow, the moving target with the beam for a fraction of a second to ensure target kill.


U.S. Navy

The U.S. Navy Mid-Infrared Chemical Laser.

All these technologies exist today as the result of beam weapon programs managed by the U.S. Air Force, Army, and Navy.

The TRW mid-infrared chemical laser

A U.S. Navy program named SeaLite, in conjunction with TRW, Inc., has developed the most powerful existing laser in the Western World. (The Soviet Union and Japan have both developed more powerful lasers.) The laser in question is the Mid-Infrared Chemical Laser (code-named MIRACL), a continuous-wave deuterium-fluoride high energy laser with a wavelength of 2.7 microns. MIRACL is capable of producing a laser beam of 2.2 megawatts power. According to Defense Department officials, if this laser were lengthened, it could put out 5 or more megawatts of power. If its nozzle were organized in a cylindrical configuration, it could put out over 10 megawatts.

The Navy is developing this laser as a potential weapon for defense of aircraft carrier task forces and as a ground-based anti-satellite laser weapon. The latter deployment is more demanding than one in which it serves as a ground-based laser coupled with orbiting mirrors in an ABM system.

Pointing and tracking technologies

The mirror technology required is also in hand. Two years ago, United Technologies Corp. proposed a schedule and *fixed price* for a contract covering delivery of a suitable 10-meter diameter mirror. A four-meter glass mirror is now under development by Corning, Perkin-Elmer, and Itek/Kodak for the Defense Advanced Research Projects Agency.

Pointing and tracking technologies have been developed by Lockheed for the National Aeronautics and Space Administration (NASA) and by Hughes Aircraft for the U.S. Air Force Airborne Laser Laboratory and the U.S. Navy SeaLite program.

One of the most dramatic demonstrations of required technology is NASA's Space Telescope, developed by Lockheed. The telescope spacecraft—scheduled for launch on the Shuttle—includes systems for finding stars billions of light years away from earth and for maintaining with precision the telescope aperture pointing at such objects as the telescope orbits our planet! This technology is at least within a factor of two of that required for space-based laser systems. However, according to the Senate Intelligence Committee, the Lockheed system for NASA has pointing systems four-times more accurate than that required for a space-based laser.

The principal USAF laser program today is the Air Force Airborne Laser Laboratory, a modified Boeing NKC-135 cargo aircraft equipped with a 400-kw. 10.6-micron carbon dioxide laser. In January 1981, then-U.S. Air Force Secretary Hans Mark—now deputy administrator of NASA—announced that the results of the recent test of the USAF/Hughes Aircraft pointing and tracking systems aboard the AF Airborne Laser Laboratory demonstrated that it was possible tc "now think about shooting down the other fellow's ballistic missiles without using nuclear warheads."

In summary, we have the laser and the mirror and the pointing and tracking technologies for the first phase system within grasp.

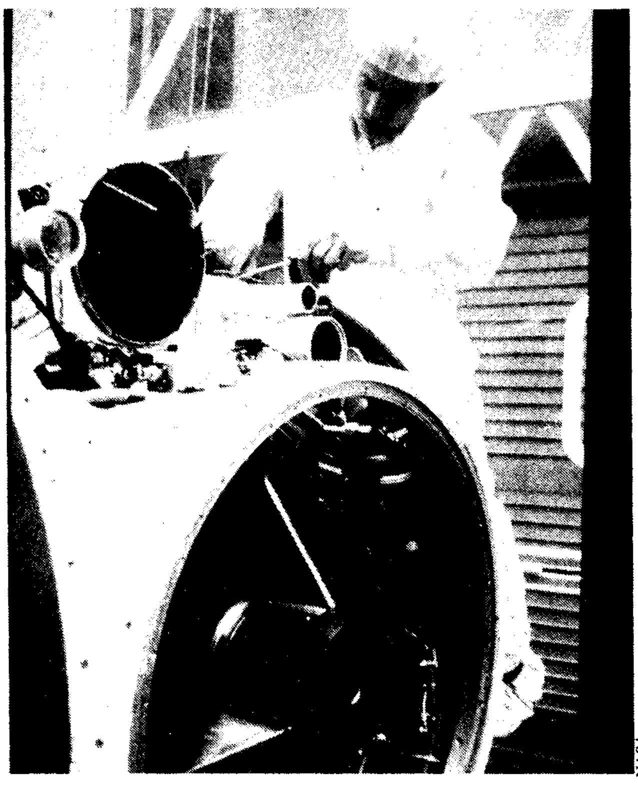
In 1981, Sen. Harrison Schmitt presented a far more optimistic assessment. He asserted that there was no need for an in-orbit demonstration; it was only necessary to build the device:

> We have already demonstrated that to some degree, and by the end of the year, ALL [Airborne Laser Laboratory] will reach test objectives with lethality demonstrations against air-to-air missiles. The only thing to demonstrate is guidance and tracking technology and we can do that on the shuttle.

The pointing and tracking technologies discussed here are directly applicable to a fully space-based laser ABM, such as the x-ray laser under development at Lawrence Livermore Laboratory. However, the x-ray laser itself will produce a beam so powerful that target destruction will not require target tracking. (Previous issues of *EIR* have provided full descriptions of the Lawrence Livermore x-ray laser program.)

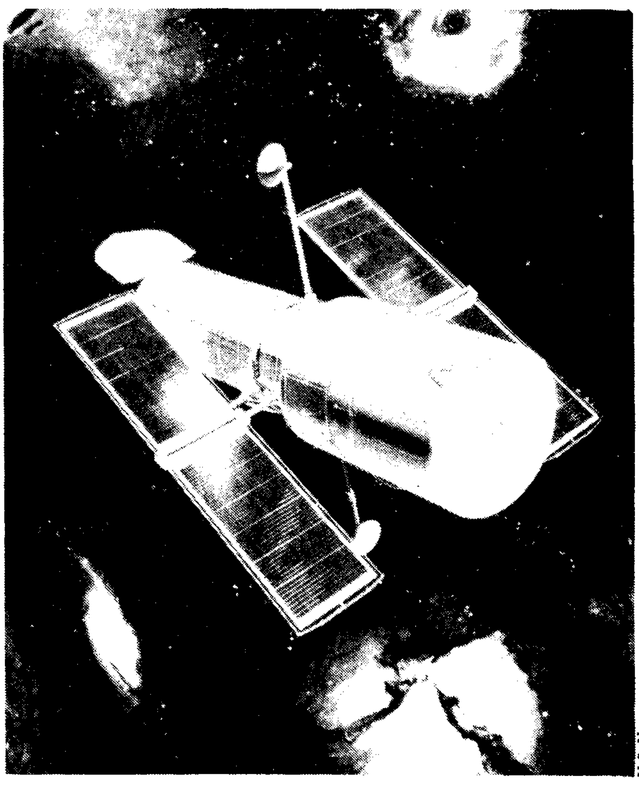
U.S. particle beam weapon programs

The U.S. Army Ballistic Missile Defense Command (BMDC) and DARPA manage a program for development of a neutral particle beam weapon for space-based ABM systems code-named White Horse, at Los Alamos National Lab. This program and also the Navy-initiated charged particle beam weapon program are based on application of a device called the radio frequency quadrapole accelerator, developed in 1978-80 from sketchy information provided in Russian



NASA

NASA's space telescope, ready for Shuttle launch.



U.S. Navy

SeaLite mirror tracking technology is in operation.

medical literature. The device is also in use by the U.S. fusion energy program.

The radio frequency quadrapole accelerator, known as the Dudnikov accelerator after its inventor, V. G. Dudnikov of the Institute of Nuclear Physics at Novosibirsk, is compact and lightweight, and therefore especially suited for space-basing.

In late 1978, the Army BMDC announced that White Horse could be ready for launching as an anti-satellite weapon between 1981 and 1983. The program had advanced to the stage of construction of laboratory hardware and required additional funding to continue the pace of the effort. The funding never came. DARPA assumed management of the program and its pace has since slowed.

The White Horse first test machine (known as the Accelerator Test Stand) will produce a 5 MeV hydrogen ion beam and be operational this year or early 1984. Phase II of the program is projected to construct a 50 MeV to 100 MeV machine for operation in 1987 or 1988 to achieve the actual energy levels required for defending spacecraft, or anti-satellite missions. A further machine projected to produce a 500 MeV beam will achieve energy levels required for space-based ABM systems.

U.S. Navy e-beam program

The U.S. Navy and DARPA manage a program, known as Chair Heritage, to develop electron-beam (e-beam) weapons for two applications: defense of aircraft carrier task forces and defense against nuclear missile re-entry vehicles, i.e., the warheads themselves. Development of a powerful ground-based beam weapon to destroy or disarm warheads hardened for re-entry through the atmosphere is critical to a complete ABM system that must destroy any warheads from missiles that have penetrated space-based defenses.

Chair Heritage developed the Experimental Test Accelerator (ETA), a 5 MeV electron beam accelerator located at Lawrence Livermore National Laboratory (LLNL). The machine has reached 90 percent of its design goals in beam current and is the basis for the Advanced Test Accelerator described below. It is driven by a 2.5 MeV pulsed power beam injector.

ETA is a diagnostic experiment on the shape of an e-beam pulse in propagating through low-pressure gas. According to DARPA, data from the program has been extrapolated to predict stable e-beam propagation at higher powers through gas of full atmospheric densities.

The second phase of the Chair Heritage program is development of the Advanced Test Accelerator (ATA), which reportedly has just recently become operational at Lawrence Livermore. Producing a 50 MeV beam, ATA will be the most powerful accelerator outside the Soviet Union. It is designed to be capable of producing five 21-meter pulses per second or a burst of 10 pulses at 1 millisecond intervals. The ATA will extend the ETA tests of e-beam propagation in the atmosphere.

Interview: Uwe Parpart-Henke

An end to MAD: the strategic possibility

The following interview with the research director of the Fusion Energy Foundation, Uwe Parpart-Henke, was conducted on March 28 at the CBS-TV studio in New York City, after Parpart-Henke appeared on the national television "Today" show.

EIR: Let's begin with some of the strategic policy objections that have been raised against a policy of directed-energy weapons for ballistic defense. An overall objection is that this will be a highly destabilizing development.

Parpart-Henke: I think that is totally wrong. The first generation of such a system could not and should not be expected to defend the country as a whole against a full-scale ICBM attack, so there can be no question of providing ourselves with a foolproof system in the initial phase, a system which would then allow us to launch a first strike on the Soviet Union with impunity.

What a first system could be reasonably expected to do is provide point defense for certain potential targets, in particular land-based missile systems, and thus make them more "survivable." This would *restabilize* the land-based missile force as a principal element of deterrence.

Secondly, such a first-generation beam weapons system could defend against accidental launch by either side, by either Soviet missiles or U.S. missiles. Finally, it could be expected to defend against third-country launch, if some smaller power other than the Soviet Union or the United States sought to engage in a missile attack on an adversary which could trigger a full-scale confrontation between the superpowers. The Soviet Union and the United States could explicitly agree not to permit such launches.

Thus, in the first phase, we are not talking about a complete coverage of the continental United States against full-scale Soviet attack, but we are counting on being able to deploy a system five to seven years from now which in the first instance would allow a certain significant restabilization of the present strategic situation.

In the second phase, we could and should expect to move to full area defense of the United States and possibly the allies of the United States against full-scale attack. Presumably, well in advance of the deployment of such a system one would have entered into negotiations with the Soviet Union, and I think it would be most desirable to come to some form of agreement in which parallel development and deployment

new scientific and for a real defense

of such a system would occur.

Such negotiations could simultaneously begin to develop a formula for actually phasing out offensive nuclear weapons over a certain period of time, ridding ourselves once and for all of these offensive weapons systems.

Some people have raised the objection that if that were to occur, then, especially in Europe, the conventional superiority of the Soviet Union would become an overwhelming factor in the strategic situation. I do not want to discount the Soviet capabilities in the conventional field. I think that if nothing else were to occur except simply installation of defensive systems against ballistic missile attack, this would be a very real difficulty that we would have to confront.

However, the technologies involved in developing the strategic defensive systems also hold a significant promise of allowing us to make defenses in the tactical arena much more effective. There are many tactical applications of directed-energy weapons, which will make it much, much more difficult for a conventional attack to succeed.

You have to see this as essentially one piece; you cannot ultimately make a strict distinction between tactical and strategic considerations. They are closely linked from a technological standpoint, and necessarily closely integrated from the standpoint of military doctrine.

In regard to the proposal made recently by the President and the one made by Mr. LaRouche a year ago, specific technical objections are irrelevant. Both of them have rejected a strategic doctrine—Mutually Assured Destruction—that will ultimately lead us to war, and have called upon the scientific community to develop the required technology to defend ourselves. President Reagan, in fact, did not use the word "laser," or "beam" in his policy speech on March 23. The President is talking about a shift in strategic doctrine, and not a specific technology. It is precisely this shift that is provoking all the outbursts.

As to technical objections, they generally fall into two classes: First of all, the question of whether this kind of technology exists at all, or whether it's something that's purely pie in the sky. The answer should be that the United States has had programs in this area on a significant scale for at least 10 years, and is actually probably spending close to $500 million annually on these kinds of programs. To achieve a first-generation system would principally involve the task of taking potential components which now exist as disparate items, integrating them into a system, and simultaneously scaling them up to the necessary size. This would not involve any brand-new technologies.

More specific technical objections to a first-generation beam weapons system involve such issues as the ability of ground-based lasers to penetrate the atmosphere, the possible countermeasures that could be used to defend missiles against laser attack, and the countermeasures that could be used to actually destroy the beam weapons system itself—especially the space-based portion of it. Finally, there is the question of the accuracy with which one can aim these systems, and whether such accuracies over thousands of miles can actually be achieved.

As for the first objection, it's really a matter of basic physics to select the most appropriate wave-length for a laser system which will optimize propagation through the atmosphere, and minimize energy loss. It appears quite feasible to have a situation in which much less than 10 percent of the intensity is lost in propagation above the 3-kilometer level.

Secondly, in terms of providing passive defenses for the missiles, in every case this involves significant retooling of the missiles concerned. In the time it takes to overhaul the entire arsenal or a substantial portion of the missile inventory, more powerful lasers will be developed quite easily, to deal with that contingency.

EIR: The mass media have repeatedly stated that space-based laser-beam systems could be knocked out by killer satellites and so forth. . . .

Parpart-Henke: A first-generation beam weapons system would pose no threat to the Soviets, so they would have no incentive to attack it. A second-generation system could be defended over a distance greater than the range of destructive capability of such killer satellites. Almost any attacking weapon could be hit by ground-based lasers bouncing off mirrors before it could reach its target. The systems are self-defending. Anything that comes within several hundred kilometers can be destroyed.

For the second generation, the ultimate defense is not to launch the system weeks or months in advance, but at the last moment, so they are not sitting up there vulnerably. These are not large, cumbersome systems, and they can be launched just as an attack is anticipated.

EIR: Another frequently raised objection is that it would be very difficult to verify whether the defense system has achieved its missile "kills."

Parpart-Henke: To make kills completely verifiable after the boost phase, the systems would have to blow up the missiles rather than simply inflicting internal damage.

It is also possible to discriminate by weight between targets and decoys, using infrared sensing. As for the argument that the second generation of defensive systems could be used offensively against enemy airfields and other ground targets—in the case of x-ray lasers, they are not very effective in penetrating the atmosphere on the way down.

But this question really has nothing to do with technology. Any technology can be used to build a defensive or an offensive weapon, or to provide great economic benefits to the human race. Take for example, nuclear explosives. The only use for these most people know about is as offensive weapons. This is because the MAD doctrine imposed a freeze on their use for anything else in the early 1960s. But these explosives can also be used peacefully, to dig canals and harbors needed around the world, or defensively, as we see today in the x-ray laser, or in the old anti-missile missile program 20 years ago.

In other words, all this talk about how something can always be used offensively is based on a military doctrine—MAD—that bars any other use, that has prevented any other use, the military doctrine the President threw into the dustbin last week.

Our proposal is to negotiate a treaty with the Soviets to build and deploy these beam systems side by side. We combine this with a proposal for collaboration in "Great Enterprises," or development projects in the developing sector, such as those proposed by Mitsubishi Research, to remove the basis for conflict.

EIR: It has been mentioned that a reflective coating can defend nuclear missiles against laser beams.

Parpart-Henke: Of course, reflective coating will reflect a substantial portion of the laser. One can overcome that by depositing a larger amount of energy on the target. If we are talking about a second-generation system, the x-ray laser will not be subject to such countermeasures.

The pointing and tracking technologies are being developed chiefly in the civilian research context of the large space telescope, and either have or will, in the very near term, have achieved the necessary accuracies to point a space-based telescope at a distant star or galaxy. If you know how difficult it is to achieve that kind of pointing in astronomy, you'll appreciate that once that can be accomplished, the relevant pointing accuracy for these systems is well within reach.

A lot of these components have been developed; they have to be integrated into a system, and a decision has to be reached at some point in the not-too-distant future on what type of initial system one wants to put together. And then provisions have to be made for systems testing.

I think that it should be mentioned in this context that at a future point, to effectively pump lasers of any kind, it would be highly desirable to be able to avail oneself of fusion energy technology.

A word should be said about particle beams. The possibility has been raised of using a spaced-based laser system as a first line of defense, and then using ground-based particle beam systems to shoot down anything that the laser misses. People have objected that charged particle beams cannot really shoot straight (they're deflected by the Earth's magnetic field), or that particles don't propagate through the atmosphere for any significant distance. Neither of these objections holds water. The Earth's magnetic field in the local situation, relative to the powers of the particle beam system, is not significant. As far as propagation is concerned, most of the objections are based on thinking of particle beams as a collection of individual particles, behaving very predictably in the way single particles behave. It is precisely the so-called collective effects involved in beam propagation and the role of interaction of the atmosphere that need to be studied further, but already allow for the conclusion that propagation is possible far beyond what had been assumed on the basis of simple-minded theoretical assumptions.

On the side of strategic doctrine, there are a number of things to be said. The decision to move toward ballistic missile defense by directed-energy weapons reflects what I would consider the most important and most profound weapons technology decision since the initiation of the Manhattan Project. It contains the very real possibility of, at least for a reasonable period of time, giving the advantage to defensive over offensive systems, both in the strategic and tactical arena. This is not a guarantee into the indefinite future, but certainly something that would give us a tremendous amount of breathing space to solve other problems which actually lead to possible conflict.

EIR: How effective is the current policy of Mutually Assured Destruction, or MAD?

Parpart-Henke: The present U.S. strategic doctrine of Mutually Assured Destruction (MAD) makes certain assumptions about the intentions and rationality of the potential adversary. I think that ultimately the MAD conception of defense or deterrence is not acceptable. You can only be as secure in your military defenses as is possible on the basis of the capabilities you can field yourself, rather than having to rely upon the potential adversary to add his good will into the equation. That is the broadest issue involved.

More specifically, MAD is based on the assumption of the substantial invulnerability of the strategic systems, meaning the submarine force, the bomber force, and the land-based missile force. Questions have been raised, rightly, about the correctness of this assumption in all three cases.

Especially, major advances in the accuracy of intercontinental ballistic missiles and intermediate-range ballistic missiles to circular error probabilities of 50 meters and below, created a situation in which it is very difficult to see how any land-based system could be regarded as secure.

Secondly, there have been important advances in anti-submarine warfare techniques, from the standpoint of both searching for and destroying submarines, which in the very near future will make the once seemingly very secure underwater basing of strategic systems highly vulnerable.

And of course the bomber force has been a questionably "survivable" force for quite some time already.

Add to this the situation that would arise involving the face-off of SS-20s and Pershing IIs, both of which are quite accurate and allow for very little warning time after they are fired, and it becomes clear that the doctrine of MAD converges ever more significantly on assured destruction.

EIR: The question has been raised about what this will do to arms control discussion. The systems will at best come on line 5 to 7 years from now, and a fuller system 10 to 12 years from now. What happens in the meantime?

Parpart-Henke: Two things happen. First, a point of perspective, a strategic goal has been obtained. That will allow a coherent negotiating strategy to emerge, which is not based simply on various and sundry game-theoretical considerations, but actually based on a clear and well-defined strategic objective, and that by itself will provide a stabilizing influence on the strategic situation and arms control discussions.

Secondly, we would introduce a new factor into this whole question of negotiations which could truthfully become the basis for an actual reduction-of-armaments proposal. At present, such proposals are not really credible, because billions of dollars have already been spent on installation of some kinds of offensive systems, whose dismantling will always, almost of necessity, lead to a situation of lesser security. It has been pointed out that in the era of multiple warheads installed in a single missile, actual reduction of missiles simply reduces the number of targets and makes it easier to disable the target.

Beyond that, I reject any proposals that amount to reversing the technological developments that lead to multiple warheads and so forth.

In conclusion, I think one should say something about this from the standpoint of a broader philosophical issue. The people who are talking about arms control and arms reduction from the standpoint of deploring the destabilizing influence of the technology that has come on line for offensive weapons in the last 10 years are not raising an arms control issue but are raising a broader strategic issue. The question is whether advances in technology themselves are in some strange sense to be regarded as destabilizing and threatening. The implication here seems to be that to have a stable mutually assured destruction system, we have to freeze technology and ultimately we have to freeze knowledge at existing levels.

I think that that is impossible, and it is, more importantly, highly undesirable.

This is where the bottom line is reached on the strategic issue: people who are advocating a world system based on some form of equilibrium of strategic forces at some fixed level of population and resources, advocating convergence on zero economic and population growth; versus people who believe that it is the essential destiny of mankind to develop human knowledge to the highest degree of perfection, and to exploit all possible opportunities that are inherent in that for making our world safer, more liveable, and more adequate for human purposes.