Nine falsehoods about beam weapons

by Steven Bardwell

This table was prepared by Steven Bardwell, plasma physicist, EIR *military editor, and editor-in-chief of* Fusion *magazine.*

For the past several years, a faction in the scientific community led by Costa Tsipis of the Massachusetts Institute of Technology has promoted the idea that beam weapon technologies are "impossible." Here we consider some of the most frequently mentioned objections, and their scientific refutation. In most cases, it is useful to note that scientists who claim that beam weapons are impossible are at least five years behind in terms of the scientific literature and current experimentation.

In brief, the Fusion Energy Foundation has proposed the following two-step research program, and the leading objections to the feasibility of a beam weapons program are answered in the chart below in terms of both a first-generation and a second-generation system.

1) Using technologies that have already been demonstrated in the laboratory, the United States could develop a first-generation directed energy beam weapon defense system within the next five years. This would be a hybrid system with a chemical laser based on a mountaintop and a focusing mirror in near-earth orbit. Such a hybrid system would minimize the physics and engineering problems involved, and would provide defense against an accidental launch of a hostile missile or a launch by a runaway third party.

2) A second-generation beam weapon system would be completely space based, utilizing a short wavelength laser. The nuclear-pumped x-ray laser is a natural choice, and such a system would make possible the area defense of the United States, a goal that we could begin to meet with the deployment of the first x-ray laser satellite in the early 1990s.

Every technology for the first-generation system exists today in prototype form; it is simply an engineering problem to put these technologies together into a weapons system—a problem that we can solve successfully in about five years' time. It is a formidable problem, but it does not require anything unknown. Such a first-generation system will probably never be built, however, because once the research starts on it, scientists and engineers will find better ways of doing almost everything involved, if we have the right kind of broad-based, broadly oriented research program. This chart proves that even in the worst case, if we have to operate with what we have on hand in our laboratories today, beam weapons development is entirely possible.

Objection	**Reply to Objections**	
	First-generation system	**Second-generation system**
1) The power levels required for a laser cannot be produced today either economically or efficiently. The fuel is too expensive or too heavy.	A 2.2 megawatt chemical laser already exists. To scale it up to 10 megawatts is a straight-forward engineering task, and there is no laser scientist who believes that this cannot be done. Ten megawatts is the power level recognized in general, and by Tsipis, as the minimum required for a laser beam weapon. For a ground-based system, the amount and mass of the fuel required is irrelevant, since the laser does not have to be put in orbit.	Short wavelength lasers, specifically the free-electron laser and the x-ray laser, have inherently high power densities, their brightness being about 2 or 3 orders of magnitude greater than the minimal chemical laser.
2) A laser beam of the type required cannot be propagated, because the beam would be so greatly attenuated by either moisture in the atmosphere or dust clouds generated in the course of a military engagement that the energy from the laser would never reach the target.	If the laser is based on a mountaintop above 12,000 feet, less than 10 percent of the beam will be lost. The critical point to be made is that all media, including the atmosphere, have a large number of windows through which lasers can propagate. To	Thermonuclear power sources are used to pump the x-ray laser and free-electron laser, so this objection is also irrelevant here because of the power densities of these lasers.

	flatly assert that lasers cannot propagate through the atmosphere ignores the results of experiments with plasmas during the past five years.	
3) It is impossible to produce a mirror good enough and accurate enough to be capable of focusing a beam that is powerful enough to destroy a missile. And even if such a mirror could be produced, it would be so delicate and so vulnerable that it would be unusable in a military system.	The generally agreed specification for a first-generation mirror is between 5 and 10 meters in diameter. This is within our technological capabilities today, and according to *Aviation Week*, two companies have expressed willingness to build such a mirror. If it were impossible to construct such a mirror, Mount Palomar observatory, which has a 5-meter mirror, would not exist! As to the fragility of such a mirror, the basic point is that a first-generation system would not be subject to countermeasures by a technologically capable opponent. The system is no threat to the Soviet Union and it would be pointless for them to try to destroy it, since the only function of such a system is to prevent an accidental or third power launch.	These systems have no optics.
4) There are no technologies available that can point such a mirror accurately enough to hit a target at a range of 1,000 to 2,000 kilometers (the range required for the strategic task of destroying missiles).	The mirror has to be pointed with the accuracy of 0.1 microradian in order to hit the target. This is done routinely with space satellites, and will be done with the existing Space Telescope.	The same applies to the pointing of the X-ray lasing medium.
5) Even if such a mirror could be aimed accurately, the technologies do not exist to track missiles long enough for the beam to destroy them—a tracking accuracy of .1 microradian per radian per second.	The required tracking capability has been demonstrated by fourth generation gyroscopes in the laboratory. It is now an engineering problem to put these on a telescope and make them usable for a laser system.	The problem of tracking is irrelevant for these systems, because the lasers are so bright that they blast the target in micro-seconds, virtually without any dwell time.
6) The sensing technologies do not exist to distinguish between decoys and armed missiles. Since decoys are lightweight, cheap, and easy to build, this gives the advantage to the offense, which can saturate the defense with decoys, thus aiding the penetration of the armed missiles.	The technology exists—long wavelength infrared telescopes—to distinguish the infrared emission of missiles at several thousand kilometers. This emission is dependent on how heavy the missile is, and therefore provides the capability of distinguishing between decoys and armed ICBMs in the boost phase, which is the purpose of these first generation systems. With re-entry vehicles, the task is much more difficult.	The same applies.
7) Given the constraints of focusing and tracking, there are a series of simple and cheap ways to defeat beam weapons, such as using missiles with a reflective coating, or an ablative coating, or rotating the missile so that the laser energy is spread out so much that it will not be able to destroy the missile.	The various countermeasures that have been proposed to defeat a first-generation beam weapon system are strategically irrelevant at this point since the Soviet Union is not going to retool its existing missiles to defend them from a weapon that doesn't threaten them. In the future, scaling up the power density of the laser beam by a factor of 10 would defeat all passive defense systems mentioned—such as reflective coatings, ablative surfaces, and space mines.	Passive defenses are totally helpless because of the intense brightness of the short wavelength lasers, which can burn through anything.
8) The cost of developing a beam weapons system for protection against all-out attack is so great as to make it impossible.	As we have proposed it, to develop a first-generation system would cost no more than \$20 billion, and the deployment of such a system would be a small multiple of this.	The X-ray laser is smaller, more efficient, and much less costly to deploy for protection against an all-out nuclear attack than would be a scale-up of a chemical laser system to achieve this goal.
9) Beam technologies would be used for offensive purposes.	The amount of energy involved that the beam delivers is actually tiny; it could never be a weapon of mass destruction, but might perform a selective surgical delivery of energy.	These systems could be used offensively, like most weapons. Their technological superiority shifts the advantage to the defensive, however.