addition they are telling the White House that their Israeli assets put them in the best position to deal with the Begin government. Finally, Fed Chairman Paul A. Volcker has informed the White House that he will promote the erroneous forecast of year-end recovery in the economy and marginally lower interest rates, all for electoral purposes in exchange for White House concessions on post-November economic policy.

What Kissinger has already accomplished

Kissinger's manipulation of these administration vulnerabilities has already yielded results and promises.

On Thursday July 22, the U.S. Senate, under year-long pressure from Volcker and major New York commercial banks and investment houses, passed a three-year tax increase of $99 billion, the largest tax increase in history, completely undercutting Reagan's "supply-side" tax cut. This package was pushed through the Senate by the White House. But according to sources close to the White House, Volcker's price for verbal support of the administration policies, made public on national television July 25, will be the elimination of the third installment of Reagan's individual tax cut after the November elections.

On July 23, pandemonium broke out at a meeting of the Committee for a Free China in Washington, D.C. when the Committee's leadership exposed a personal letter recently sent to the leadership of the People's Republic of China by President Reagan in which the P.R.C. is assured that U.S. arms shipments to Taiwan will not continue indefinitely. Committee members told me that they are convinced that a July 23-24 series of private meetings between Kissinger, Shultz, West German Chancellor Helmut Schmidt, and Singapore Prime Minister Lee Kuan Yue at the Bohemian Grove hideaway in California represents the final touches being put on a post-November reinvigoration of the "China Card."

At those meetings it is also believed that Kissinger offered Schmidt help in securing his domestic political position in exchange for West German acquiescence to Kissinger's Trilateral economic plans. While Schmidt's response is not yet clear, White House sources told me that Schmidt's domestic vulnerabilites were uppermost in his mind while in the United States.

These Kissinger initiatives are only the beginning. Next week we will disclose Kissinger's "secret policy agenda" for the post-election period. The following week, we will reveal how Kissinger and his friends sold Reagan a November electoral disaster in 1982, which will include an analysis of the upcoming elections. Finally, we will examine the truth behind the "conservative " counterattack to the Trilateral coup, who is manipulating it, and why it is leading to a civil war in the Republican Party.

Science & Technology

The promise of U.S. x-ray laser defense

by Charles B. Stevens
and Steven Bardwell, Military Editor

Recent, still-classified experiments at U.S. weapons laboratories have convinced many scientists that a new technology—the so-called x-ray laser—could be perfected within the next five years for use as a first- or second-generation defense system against ballistic missiles.

The x-ray laser is complementary to the optical frequency (chemical) lasers and particle-beam weapon technologies currently under investigation in the United States and Soviet Union for ballistic-missile defense; its specific advantages include extreme flexibility in technological development, a very high power-to-weight ratio, relatively low cost, and a high rate of repeatability.

These scientists have privately called for an accelerated research program in x-ray laser defense systems, at an estimated cost of $100 million per year. Such a program could prove the feasibility of an x-ray laser defense system in two to three years, and lead to a deployable ballistic-missile defense satellite using x-ray lasers within five to eight years.

Over the past year Dr. Edward Teller has been quoted by leading defense officials as stating that a new discovery achieved by the Lawrence Livermore Laboratory "is the most significant development in strategic war-fighting since the H-bomb." According to Teller, the x-ray laser "will tip the battle in favor of the defense for the first time in the history of the nuclear age." Teller has stated publicly that "the United States could have an effective shield against the terrible threat of thermonuclear holocaust within the next several years if we but invest another $100 million a year in an accelerated program for perfecting this defensive system."

Teller has emphasized that if the government classifications he has vehemently opposed were lifted, he is certain that the American people, presented with the facts about the x-ray laser defense system, would demand that it be built.

Nuclear war-fighting

For the past three decades the world has increasingly faced the prospect that, in the event of all-out war, most of its major metropolitan areas would be incinerated by hydrogen bombs within a few hours. And it has been argued in great detail that no foolproof efficient means of defense of large cities against nuclear-tipped ballistic missiles could be perfected. In every case the anti-ballistic missile system (ABM) under consideration was incapable of meeting two conditions: resiliency in the face of offensive countermeasures, and unit cost-effectiveness. For each of these systems, unit improvements in the ballistic missile offense were much cheaper than unit improvements in the ABM defense. The x-ray laser provides qualitatively new approaches to the solution of these basic requirements for a ballistic-missile defense system.

The development of a laser operating in the x-ray wavelength has been the subject of much theoretical and experimental research for the past two decades. In the fall of 1980 this author was informed that experiments to demonstrate such a laser were about to begin. In the Feb. 23, 1981 issue of *Aviation Week and Space Technology*, Clarence A. Robinson, Jr. reported that scientists from Lawrence Livermore Laboratory had successfully conducted such tests at the Nevada test site.

The components of the Livermore x-ray laser consist of thin metal rods a few meters in length, in which x-ray lasing action is induced by a burst of x-rays or neutrons generated by a small nuclear-fission explosive. The resulting x-ray laser beam travels in the same direction as that in which the metal rod is pointed. As reported by Robinson, the x-ray wavelength is at .0014 microns. The beam intensity is several hundred trillon watts, with a length of a few billionths of a second. With an energy of about one million joules per rod, this is equivalent to 250 grams of TNT in terms of crude energy. The fission explosive itself is quite small, ranging from 100 to 1,000 tons of TNT equivalent. Each fission explosive is capable of simultaneously pumping approximately 50 lasing rods each capable of independent targeting.

In nuclear explosions most of the energy generated emerges from the nuclear fireball in the form of intense x-rays. During explosions within the atmosphere, this x-ray burst is quickly absorbed by the molecules within a hundred meters of air surrounding the fireball.

The x-ray laser, thus, requires no fragile optics—mirrors, lenses, beam polarizers, etc. Lasing efficiency and beam quality are determined by the composition of the rod, the mixture of radiation from the nuclear charge, and the latter's timing. Theoretical beam divergence can be extremely small, so that the x-ray laser beam can remain concentrated over extremely great distances in space. It is possible in principle for the perfected Livermore x-ray laser to destroy hardened targets as far away as the moon.

Taken together the above parameters of improvement mean that the x-ray laser can begin at a very crude level—possessing a kill range of 500 kilometers and effectiveness only against the thin skin of rocket boosters which can be targeted within the first few minutes of the missiles launching—and then be rapidly improved to the point that it can destroy the most hardened warheads from ranges up to 100,000 kilometers. At the same time the number of assured kills per x-ray laser module can be increased from two or three to hundreds.

The cost per unit missile kill of the x-ray laser ABM in space is the smallest of any proposed beam weapon system. And since any offensive missile or anti-satellite rocket interceptor directed against an x-ray laser unit will always cost orders of magnitude more than the x-ray laser unit itself, the strategic defense in nuclear warfighting is at a great advantage.

The theoretical physical basis for the inherent advantages of the nuclear-explosive-pumped x-ray laser all derive from its great energy densities.

The energy released per atom by ordinary chemical processes is of the order of a few electron volts (one eV = 1.6×10^{-19} joules), while nuclear fission generates over 200 million eV per atom. Therefore nuclear fission can provide a pulsed energy source millions of times more efficient, pound for pound, then any type of chemical fuel. The specific form of energy released by fission is in itself millions of times energy-denser than those forms generated by chemical or ordinary electric processes.

The nuclear-pumped x-ray laser maintains all the energy per weight advantages noted above—by a factor of at least several billion—while simultaneously requiring a minimal unit weight of about 10 to 20 kilograms. This is hundreds of times smaller than any chemical, solar, or nuclear reactor power system.

In terms of deployment, defensibility, replacement rate, and cost, these factors of kills per unit weight deployed and unit scale are crucial for determining the cost and battle-effectiveness of any space-based system. It is a simple fact, even given the success of the Shuttle, that a substantial portion of the cost of any space-based system is determined by the weight which must be placed in orbit.

Killing nuclear-tipped missiles requires not only effective weaponry but also the capability to identify the targets, aim at them, and determine whether an effective hit has been achieved.

Today there are a number of early-warning systems for detection of all types of missile launchings. These consist of: optical telescopes; ground- and space-based radars—both over-the-horizon and direct line of sight; infrared detectors which pick up the hot rocket exhausts; laser radar; long-wavelength infrared telescopes which are far more sensitive to heat than the type of infrared detectors utilized in the first early-warning satellites (these telescopes can pick up small, cold objects over thousands of kilometers in space and the upper atmosphere and even discriminate between heavy warheads and light decoy balloons which have the same external characteristics as the heavy warheads); and finally, various x-ray and gamma-ray detectors currently deployed in satellites to detect nuclear explosions.

Because of its lethality and operating characteristics, the x-ray laser requires minimal levels of target acquisition and tracking. Once fired, the x-ray beam travels at the speed of light to the target. During the 10 milliseconds it takes the beam to arrive at the targeted missiles over a range of 500 kilometers, the missile has moved at most a few meters. This is particularly true during the booster stage of the launch, when the missile is still accelerating to its maximum velocity. If the million-joule x-ray beam pulse hits the large booster stages of the missile, it will produce a large shock and destroy the interior of the rocket fuel and engine. Since the beam pulse is but a few billionths of a second long, the missile moves only a few millimeters during the time that it is absorbing the x-ray pulse.

First-generation components and operation

In terms of minimizing the technical requirements needed in terms of target acquisition, pointing and tracking, and in terms of the perfection of the x-ray laser operation itself, the best mode of deployment for the first generation of a space-based x-ray laser ABM system would consist of hundreds of individual x-ray lasing units placed in orbit together with a separate system of targeting and surveillance satellites. The system would be directed toward detection of nuclear-tipped missiles and their destruction in the booster stage of their launching. Each x-ray laser unit would shoot at 10 to 100 individual missiles within the first few minutes after their launching. The minimum effective kill range for such a system of orbiting x-ray lasers would be about 500 kilometers from the x-ray laser to the targeted missile.

Ten to 20 shuttle flights could deploy upwards of 500 x-ray laser units into orbits such that at all times all possible launch points on earth are covered with a sufficient number of x-ray lasers to kill thousands of missiles taking off from one specific area.

The targeting requirements for such a global ABM system are probably within the scope of existing technologies. Basically the system would have to be capable of detecting thousands of targets and providing targeting coordinates to an accuracy of a microradian at most within a period of two to three minutes. The system would also have to determine which targets have survived and will have to be fired at again. Other types of ABM intercept systems, such as mid-range and terminal intercept with conventional rockets, other types of directed beam weapon systems, and even the old-style nuclear-tipped ABM rockets, could function as backup defense layers to kill those missiles and warheads that "leak" through the first line of defense.

While some targeting and sensor equipment would be emplaced on each laser unit, the actual surveillance and targeting system would consist of a net of satellites much like that envisioned by Gen. Daniel Graham in his High Frontier proposal for a global ballistic missile defense system, a proposal based on conventional rocket intercept of boosters and state-of-the-art technology. The cost for this system and its deployment, comprising both command, control, and communications and sensor and targeting, would be about $3 billion. The cost for 500 x-ray units and their deployment would be in the range of $3 to $5 billion.

Rate of development and bottlenecks

The current status of the x-ray laser, as noted, is that it has been scientifically demonstrated in principle. U.S. experiments with underground nuclear tests are slowly proceeding at a rate of one test shot every three to six months. The current estimate is that 20 to 30 carefully planned test shots will be needed to perfect a workable x-ray laser. The basic philosophy of this current program is that a high probability of success must first be assured before an expensive nuclear underground explosion is carried out. Furthermore, the complex data from these test shots must first be unscrambled and analyzed before another test is carried out. Therefore, this low-risk R&D program will probably arrive at a perfected x-ray laser within the next 5 to 10 years.

In the meantime, information is circulating in intelligence circles that the Soviet Union has mounted a serious x-ray laser development program.

Dr. Edward Teller and Dr. Lowell Wood have insisted that given a high-risk effort, in which tests are carried out in parallel and without more than a 10 percent confidence level for success, a perfected x-ray laser can be realized within several years after up to about 100 test shots.

All counter-arguments to which this author has been exposed concerning an x-ray laser crash development program have simply boiled down to the contention that "public opinion would not favor such an effort at this time. It's nuclear. It blows itself up. The targeting and tracking problems are horrendous. It means nuclear bombs in orbit."

The nuclear-pumped x-ray laser is not a weapon of mass destruction and therefore would not come under the existing space treaties. If the Soviets also deployed such a system, this would increase world stability since neither side could be confident of a successful offensive sneak attack. Furthermore, these systems could provide the basis for an effective defense against other nations utilizing nuclear-tipped rockets in military confrontations. While the x-ray laser would not completely eliminate the danger of nuclear weapons proliferation, it would go a long way toward neutralizing its most hazardous form, the nuclear-tipped ballistic missile.