NAIC-ID(RS)T-0089-96

NATIONAL AIR INTELLIGENCE CENTER

REVIEW AND PROSPECTS OF THE UNITED STATES DIRECTED-ENERGY WEAPONS TECHNOLOGY DEVELOPMENT IN 1994

by

Zhang Yaping

19960715 038

Approved for public release: distribution unlimited

DTIC QUALITY INSPECTED 1

HUMAN TRANSLATION

NAIC-ID(RS)T-0089-96 18 June 1996

MICROFICHE NR:

REVIEW AND PROSPECTS OF THE UNITED STATES DIRECTED-ENERGY WEAPONS TECHNOLOGY DEVELOPMENT IN 1994

By: Zhang Yaping

English pages: 8

Source: Cama, China Astronautics and Missilery Abstracts, Vol. 2, Nr. 4, 1995; pp. 41-43

Country of origin: China
Translated by: Leo Kanner Associates
F33657-88-D-2188
Requester: NAIC/TASC/Richard A. Peden, Jr.
Approved for public release: distribution unlimited.

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT *ANY* ANALYTICAL OR EDITORIAL COMMENT STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE NATIONAL AIR INTELLIGENCE CENTER.

PREPARED BY:

TRANSLATION SERVICES
NATIONAL AIR INTELLIGENCE CENTER
WPAFB, OHIO

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

Review and Prospects of the United States Directed-Energy Weapons Technology Development in 1994

Zhang Yaping

Directed-energy weapons are new-generation weapons developed on the basis of the new concept of replacing conventional bullets with high-energy-density beams. Technically, directed-energy weapons can be divided into three branches, namely: (1) laser weapons, which can destroy or destabilize targets by using electromagnetic radiation energy beams with a wavelength of less than 1 millimeter; (2) radio-frequency weapons, which can destroy or destabilize targets with radiated electromagnetic energy within the radio spectrum range (the wavelength is more than 1 millimeter and radio frequency less than 300 gigahertz); (3) particle beam weapons, which are capable of destroying or destabilizing targets with neutral high-energy atomic particle beams (usually hydrogen, deuterium and tritium) or charged high-energy atomic or subatomic particle beams.

Judging from its present technological level and the development tendency of directed-energy weapons, the United States will continue to maintain its position as world leader in this area. With constant technological development and ever increasing maturity of such weapons, the United States directed-energy weapons development program is coming into the demonstration stage rather than staying at the technological development stage. The three branches of the United States Armed forces and the Ballistic Missile Defense Agency are planning an advanced technology demonstration (ATD) and a key

test, to demonstrate the military practicability of the specific arrangements and/or technical preparation for full-scale development.

In Fiscal Year 1994 the United States spent $212 million for research on directed-energy weapons technology, out of which approximately 80% was used for development of laser weapons technology, 15% for radio frequency weapons technology while the remaining 5% was for particle beam weapons technology.

The three areas of directed-energy weapons are focused on the development of technologies which can disable ballistic missiles and cruise missiles at any stage of their flight. Also, there is an effort to provide an air control capability of disabling satellites by using directed-energy weapons.

At present, the United States has opened up new prospects for jointly developing directed-energy weapons by the Ballistic Missile Defense Agency and the three branches of the US Armed Forces.

1. Laser Weapons

(1) The Ballistic Missile Defense Agency places its emphasis on supporting space-based Alpha chemical laser weapons

The space-based Alpha chemical laser weapons technology appears to be the most developed technology ever in the area of strategic defense-oriented directed-energy weapons.

So far, high quality beams at a megawatt level have already been obtained in Alpha fluorine hydride chemical laser weapons. In the areas of laser beam control and transmission system technology, a four-meter diameter polyhedral compound mirror, available for active control, has been constructed, which can be enlarged to an even greater size by scaling. An all-round test

program on the Alpha/large reflector initiative (ALI) is currently underway, and another comprehensive high-power test is scheduled to start in mid 1996.

According to the Star Lite program which is supposed to be implemented in 1997, an integrated operation of acquisition, tracking, pointing and fire control systems (ATP/FC) is to be verified in a complete aerospace flight structure under an ALI high-power laser beam and high-altitude balloon experiment (HABE).

In Fiscal Year 2000, a space-based laser device space platform at an integrated weapon level will be demonstrated with ground facilities and in Fiscal Year 2001, its flight demonstration for ground software demonstration will be carried out. It is estimated that several constellations (six satellites) are to be constructed for a combat application-oriented space-based laser system.

As far as high-altitude balloons are concerned, the research staff are planning, corresponding to the foregoing accomplishments, to complete the following missions: the design and engineering flight in Fiscal Year 1995; the passive tracking flight with an infrared sensor, an active telescope with 60-centimeter diameter and an additional optical system in Fiscal Year 1996, and an active tracking and pointing operation in Fiscal Year 1997.

(2) The United States Air Force is concentrating its effort on development of a large airborne oxygen-iodine chemical laser device

The United States Air Force has selected the airborne laser device arrangement as the technical means to defeat ballistic missiles in its theater. In that case, however, the Air Force had to give up its kinetic energy kill technique arrangement,

which is intended for the same purpose. It is widely believed in military and industrial circles that the airborne laser device is the most powerful boost-stage interception approach.

In May 1994, the United States Air Force signed, respectively, a competitive "Dual-Agreement" contract valued at $21 million with Boeing Corporation and Rockwell Corporation. Through this competition, a winner company will be chosen in 1997 as the major contractor to be responsible for development of a demonstration prototype system, intended for the demonstration stage. According to some information sources, a kill effect demonstration test and a number of risk-decreasing experiments, conducted last October, prove that a para-combat type airborne anti-missile laser system is likely to be constructed and tested late in this century, which is designed for a test interception of ballistic missiles at their boost stage, and that the purchase will be made early in the next century. In addition, a combat-oriented airborne laser device is expected to be developed in the year 2005 to be mounted in four or even more aircraft.

(3) The United States Navy is centered on development of ship-borne deuterium fluoride high-energy laser weapons

The United States Navy has already been developing ship-borne deuterium fluoride high-energy laser weapons for over 20 years attaining significant achievements. Currently, the U. S. Navy is planning to mount a modularized deuterium fluoride laser weapon system in vessels. As scheduled, they undertook a point defense test of the effectiveness of the deuterium fluoride laser device in defense against antiship cruise missiles in 1994, and in 1995, they will verify its kill power against attacking cruise missiles and tactical ballistic missiles. Before that, however, a technical demonstration test will be carried out in advance to verify the compatibility between such laser weapons and the ship-borne electronic warfare systems. It is estimated that a modular device will be developed in 2000, which is designed for compact

deuterium fluoride laser air defense and which is compatible with the ship-borne electronic warfare system.

(4) The United States Army is centered on the development of general, local defense-oriented and comprehensive anti-missile laser weapons

Based on its technological advancement of laser weapons, the U. S. TRW Company developed, specially for Army, a leading edge mobile defense system, called the general local defense-oriented comprehensive anti-missile (Gardin) laser weapon system. This system is intended to compensate for the inadequacy of Army medium-range and long-range anti-missile weapon systems. Mounted on wheeled or tracked armored vehicles, it can be used to strike low-altitude attacking concealed targets at distances of 10 kilometers in the last minute.

The foregoing system, consisting of a 400-kilowatt deuterium fluoride high energy laser device and a 70-centimeter diameter directional device/tracker, is used to intercept a mobile target with an 100g gravitational acceleration overload. More than this, it can, once locked on a target, keep irradiating the target with laser beams until the target disintegrates. It can produce such a high precision kill effect that none of the conventional missiles is able to match it. Moreover, other battlefield air currents, including smoke and haze, will not create any thermal blooming that may affect laser beam quality. Severe weather conditions will cause at most a longer laser irradiation time, approximately an additional 0.1 second in every second, to kill a target, compared with the time during fine weather. This weapon system features, with approximately 1 second response time, 20-50 times/min emission rate and a cost of about $1000 for a single emission.

Research shows that this Army laser weapon system requires a power which ranges from 100 kilowatts to 1 megawatt, and around

500 kilowatts for mobile defense in forward positions. It is reported that the system can severely damage the radar casing of a missile target 4 kilometers away, and an optical system 10 kilometers away. According to the present arrangement, the U. S. Army will deploy 2-4 general local defense-oriented comprehensive anti-missile laser weapon systems to protect one war zone.

(5) The United States Air Force is secretly developing anti-satellite laser weapons

The U.S. Air Force is secretly developing a land-based laser system, which is capable of tracking and destroying a satellite in orbit.

It is reported that the U. S. Air Force has approved an advance comprehensive beam control demonstration, which is to be implemented with a 3.5-meter diameter telescope in the "Spark" optical test range located at Kirtland Air Base, New Mexico. This test is designed to demonstrate the feasibility and integrating properties of a land-based laser beam control and atmospheric compensation system, which is needed for a land-based anti-satellite (ASAT) laser weapon system. It is estimated that the air control combat type land-based laser weapon system is likely to be constructed in 2005.

2. Radio Frequency Weapons

At present, both wide-band high-power microwave (HPM) and narrow-band radio frequency directed energy weapon systems are under development in the United States. The Air Force is working on widely inclusive research projects in the areas of their interest, while the Army and Navy are focused on development and research of radio frequency weapons to meet their respective special missions, as well as limited technical development to satisfy requirements from special missions that are not included in the Air Force program. The Army is taking the lead in the

development of the consolidating technology of ordinary radio frequency directed-energy weapons. The National Defense Nuclear Weapons Agency research is progressing from small-scale technical development to system level experiments in the years to come. The technical development program undertaken by the Ballistic Missile Defense Agency is scheduled to end in late 1994 fiscal year. The Lawrence Livermore National Laboratory, the Sandia National Laboratory and the Los Alamos National laboratory, all under the Energy Department, play a supplementary roll in the Defense Department program.

Up to now, the U. S. Department of Defense has drafted the goals and progress of development of radio frequency weapons up until the year 2000. Specifically, its technical goals include: greatly increasing source output energy, pulse repetition frequency and average power; reducing the size and weight of the system to make it compatible with the military-oriented platform; increasing the power processing ability of antenna feed to a considerable extent.

According to information sources the U. S. Department of Defense already planned a key experiment and an advance technical demonstration, which will serve as a significant means to ensure transition from laboratory research to field testing, verifying the technology maturity, the mission validity as well as the full scale development preparation. According to the schedule, the Army will conduct a key anti-ammunition experiment late in Fiscal Year 1994; the Air Force will undertake a number of key experiments in aircraft self-defense (Fiscal Year 1998), space control (Fiscal Year 1998), enemy-suppressing air defense (Fiscal Year 1999) and combat command and control (Fiscal Year 2000); a key experiment involving active technology is planned to start from 1994 through 1995 fiscal years together with an advanced technology demonstration to be carried out late in Fiscal Year 1995. Apart from foregoing experiments, the National Defense

Nuclear Weapon Agency will accomplish an experiment on how to deal with a consolidated target in Fiscal Year 1996.

3. Particle Beam Weapons

In recent years, the U.S. Department of Defense has been supporting development of three particle beam technologies, namely: neutral particle beams for space applications; laser guided charged particle beams for outer atmosphere applications and charged particle beams for ground applications or near-ground atmosphere applications. However, due to their limited practicability, the laser-guided charged particle beam project was ended in Fiscal Year 1992, and the neutral particle beam project was terminated in early Fiscal Year 1994. The in-atmosphere charged particle beam research is currently directed to exploring how to make the energy inside a target accumulate sufficiently to cause disastrous damage (for instance, how to make high energy materials such as high explosives or fuels burn; how to cause inertial media to evaporate or burn up electronic equipment). Applications of interest include underground mine clearance and anti-cruise missile vessel defense.

The specific goals and progress worked out for neutral particle beam weapon technology are: advancing kill effect criteria for TNT mines before 1995; constructing a 9.5 electronic megavolt and 10 kiloampere compact type spiral accelerator before 1996.

Technically, the major knotty problems involved include the predictable and stable atmospheric particle beam transmission for long-distance application of charged particle beam weapons technology; development of small accelerators with heavy current (kiloampere) and high kinetic energy (>100 megaelectron volts) needed for other applications.