Defense Intelligence Reference Document

April 2001
NGIC-1867-0285-01

(U) Assessment of Chinese Radiofrequency Weapon Capabilities

Regraded UNCLASSIFIED on
13 September 2010
by USAINSCOM FOI/PA
Auth para 4-102, DOD 5200-1R

(U) COPYRIGHT WARNING: Further dissemination of the photographs in this publication is not authorized.

(U) DESTRUCTION NOTICE: For classified documents, follow the procedures in DoD 5220.22-M, National Industrial Security Program Operating Manual, Chapter 5, Section 7 or DoD 5200.1R Information Security Program Regulation, Chapter IX. For unclassified, limited documents, destroy by any method that will prevent disclosure of contents or reconstruction of the document.

(U) Individual portions are marked to indicate specifically the classifications and control markings applicable to their content.

(U) Requests for additional copies should be forwarded through command approval channels, as appropriate, to the Commander, National Ground Intelligence Center, 220 Seventh Street, NE., Charlottesville, VA 22902-5396, ATTN: IANG-IL.

DISSEMINATION CONTROL MARKINGS

NOFORN (NF)	Not Releasable to Foreign Nationals
ORCON (OC)	Dissemination and Extraction of Information Controlled by Originator
PROPIN (PR)	Caution—Proprietary Information Involved
FGI	Foreign Government Information
REL ...	Authorized for Release to ...
DS	DEA Sensitive
RD	Restricted Data
FRD	Formerly Restricted Data
CNWDI	Critical Nuclear Weapons Design Information
FOUO	For Official Use Only

Defense Intelligence Reference Document

(U) Assessment of Chinese Radiofrequency Weapon Capabilities

Information Cutoff Date: 28 February 2001

This document is published under the auspices of the Department of Defense Intelligence Production Program (DoDIPP). It is produced by the National Ground Intelligence Center (NGIC) as the designated DoDIPP producer for this subject.

Prepared by:

b6

This responds to Naval Air Systems Command production requirement D028-00-0079/I.

DoDIPP Record Identification #RB01-0285

Derived from: Multiple Sources
Declassify on: X1

NGIC-1867-0285-01

(Reverse Blank)

(U) Assessment of Chinese Radiofrequency Weapon Capabilities

(U) Key Judgments

(U) The Chinese are conducting research on high-power RF generation, susceptibility, and propagation that is relevant to the development of RF weapons.

(S//NF) b1
b1

(C) b1
b1

(S//NF) b1
b1

(C) b1
b1

(C) b1
b1

Information Cutoff Date: 28 February 2001

Derived from: Multiple Sources
Declassify on: X1

NGIC-1867-0285-01

(Reverse Blank)

(U) Contents

(U) Key Judgments iii

(U) Foreword vii

(U) ASSESSMENT OF CHINESE RADIOFREQUENCY WEAPON CAPABILITIES 1

- (U) Introduction 1
- (U) Research on High-Power Radiofrequency Generation 1
- (U) Research on High-Power Radiofrequency Susceptibility and Propagation . . . 4
- (U) Evidence for Radiofrequency Weapon Development Programs 6
- (U) Postulated Chinese Radiofrequency Weapons 7

(U) Figures

1. (U) Virtual-Cathode Oscillator Experiment at Northwest Institute of Nuclear Technology 2
2. (U) Design and Radiation Pattern for Biconical Ultra-Wideband Antenna at Southwest Institute of Applied Electronics 3
3. (U) Data on Computer Susceptibility to Single Radiofrequency Pulses Published by Northwest Institute of Nuclear Technology 5
4. (U) Artist's Concept of Radiofrequency Weapon Based on Megawatt Radar. 8
5. (U) Russian High-Power Microwave Radar in the United Kingdom. 9
6. (U) Power Densities From Existing and Postulated High-Power Radiofrequency Systems 10
7. (U) British Dipole Radiofrequency Source With Battery Pack 11

(U) Assessment of Chinese Radiofrequency Weapon Capabilities

(U) Foreword

(U) This paper assesses Chinese capability to develop radiofrequency weapons. Chinese research on high-power RF generation, susceptibility, and propagation is summarized; the intelligence data on Chinese interest in RF weapons is evaluated; and projections of Chinese RF weapons for various missions are made.

(U) Constructive criticisms, comments, or suggested improvements are encouraged and should be forwarded to the Commander, National Ground Intelligence Center, 220 Seventh Street, NE., Charlottesville, VA 22902-5396 (ATTN: IANG-OPS).

(U) ASSESSMENT OF CHINESE RADIOFREQUENCY WEAPON CAPABILITIES

(U) Introduction

(S/NF) Although the Chinese have written about the use of radiofrequency (RF) weapons for waging information warfare and government officials have been quoted as stating that RF weapons that would defeat the enemy's electronics are among those weapons that the Chinese military will need in the 21st century, China is not believed to have deployed any RF weapons at this time. The Chinese are, however, developing high-power radiofrequency devices that could form the basis for some types of RF weapons. b1 In addition the Chinese are studying the effects of RF pulses on electronics as well as the propagation of RF energy through the atmosphere. Below we summarize the available data on the status of Chinese high-power RF research and on indications of Chinese interest in the development of RF weapons; and we then make projections of Chinese RF weapons for various missions that may be feasible in the near (present to 5 years), mid- (5 to 10 years) and far (more than 10 years) timeframes.

(U) Research on High-Power Radiofrequency Generation

(U) Most of the research in China related to high-power radiofrequency generation, effects, and propagation is conducted at these six facilities:

- (U) Northwest Institute of Nuclear Technology (NINT), Xi'an.
- (U) National University of Defense Technology (NUDT), Changsha.
- (U) University of Electronic Science and Technology of China (UESTC), Chengdu.
- (U) Southwest Institute of Fluid Physics (SWIFP), Mingyang.
- (U) Southwest Institute of Applied Electronics (SWIAE), Mingyang.
- (U) Institute of Applied Physics and Computational Mathematics (IAPCM), Beijing.

(U) The latter three of these are part of the China Academy of Engineering Physics (CAEP) in Chengdu, a management structure that oversees the work of subordinate institutes.

(S/NF) For most battlefield applications, RF weapons based on high-power microwave (HPM) generators would have to produce peak powers of at least several hundred megawatts. The first significant Chinese publications on HPM generation appeared in the early 1990s, but this initial work seems to have encompassed only three types of source: the virtual-cathode oscillator (VCO), the relativistic backward-wave oscillator (BWO), and the free-electron laser. Most of these early devices produced single narrowband pulses with peak powers ranging up to approximately the 100-MW level. b1

This VCO, which is still the highest peak power microwave source reported by the Chinese, operated at about 9-GHz frequency and 30-ns pulse duration. In terms of average *vs.* peak radiated RF power, the most impressive HPM source known to be available to the Chinese is a relativistic BWO developed by NINT and first described at an international conference held in June 2000. This system produced 1.1-GW/9.4-GHz/23-ns pulses at a 100-Hz repetition rate, and was driven by an electron-beam machine designated SINUS-881 that had been purchased from the Russians. The BWO structure, however, was built by the Chinese and had been optimized to increase output power.

SECRET//NOFORN

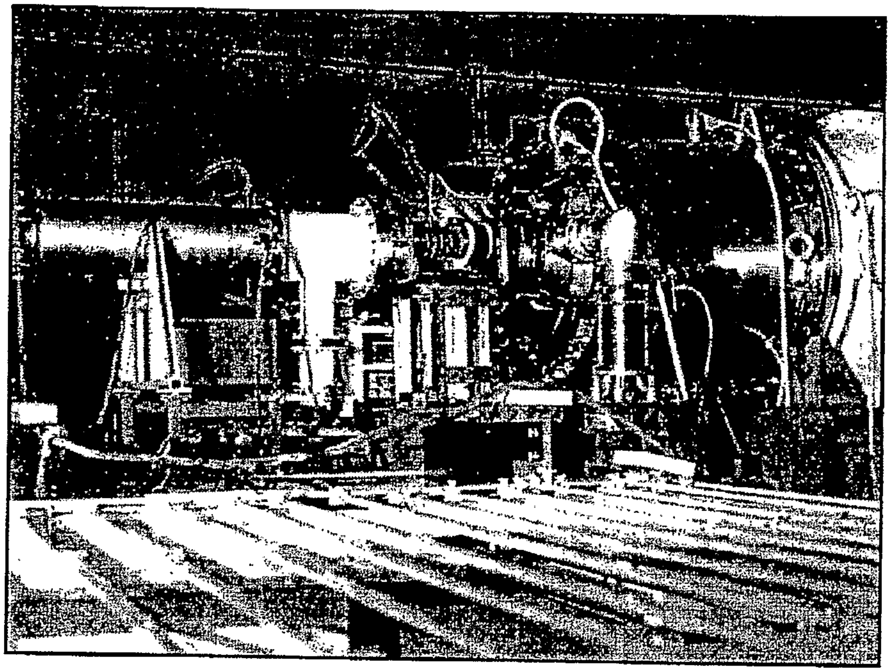

Figure 1. (U) Virtual-Cathode Oscillator Experiment at Northwest Institute of Nuclear Technology

(S//NF) Over the past few years Chinese scientists have started to investigate other HPM devices to include relativistic klystrons and magnetrons, and the multiwave Cerenkov generator (MWCG). The latter is a variant of the relativistic BWO that employs an oversized waveguide, and the Russians have built MWCGs capable of supplying multigigawatt powers, but 100 MW from a 10-GHz MWCG developed at NUDT is the highest output power the Chinese have claimed to date for this source. A relativistic magnetron producing 430 MW at S-band frequency has been built at UESTC, and at IAPCM simulations of a related device known as the magnetically-insulated line oscillator (MILO) have been performed and suggest that powers exceeding a gigawatt should be possible.

b1

Finally, a collaboration between IAPCM, SWIFP, and SWIAE has resulted in a relativistic klystron amplifier with an output of about 500 MW near 1.3-GHz frequency.

(S//NF) In addition to these narrowband sources, the Chinese are also beginning to study ultra-wideband (UWB) generation. At NINT and SWIAE the emphasis is on the creation of very short high-voltage pulses that when applied to an appropriate antenna will generate UWB signals. [redacted] b1 The SWIAE effort involves a biconical antenna (figure 2) and has resulted in 100-MW pulses delivered at a rate of 100 Hz and having most of their energy in the 150-MHz to 1-GHz frequency range. In the UWB case it is convenient in some cases to cite not the peak power produced by the source but rather the electric-field amplitude at a given distance from the antenna. The field at any other range may then easily be calculated. For most UWB radiofrequency weapon concepts, field strengths on the order of at least 1 kV/m on target delivered repetitively rather than in single pulses would be needed. Of particular note in this regard is a 1999 paper from SWIAE describing a half-paraboloid impulse radiating antenna that supplied an electric field of 13 kV/m at 30-meters distance and a 100-Hz repetition rate. Since electric-field amplitude decreases linearly with distance, this figure corresponds to 1 kV/m at about 400 meters range

UNCLASSIFIED

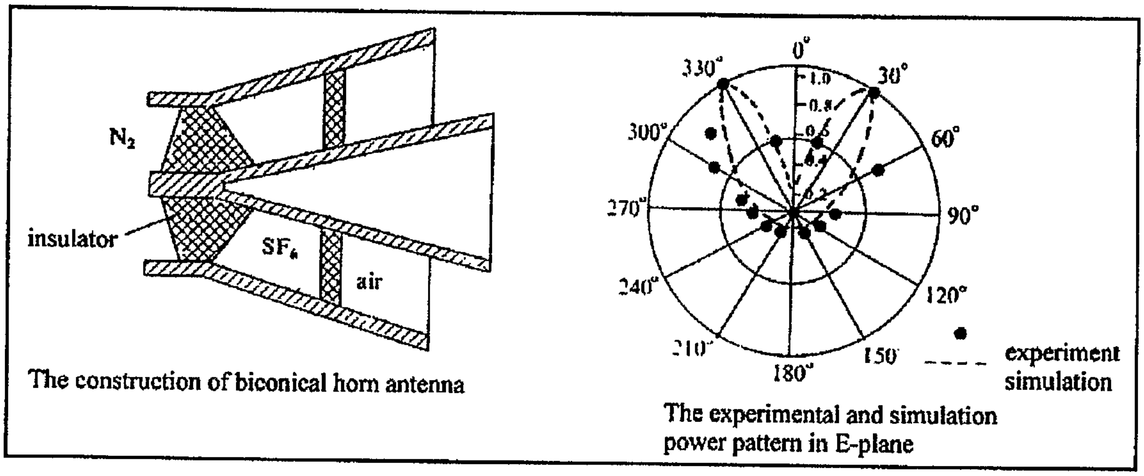

Figure 2. (U) Design and Radiation Pattern for Biconical Ultra-Wideband Antenna at Southwest Institute of Applied Electronics

(S//NF) An alternative to a single spark-gap switch for providing the high voltages and short pulse durations needed for creating UWB pulses is multiple semiconductor switches. Russian researchers at the Institute of Electrophysics (IEF) in Yekaterinburg have developed silicon opening-switch (SOS) diodes that may potentially be stacked together to drive ultra-wideband antennas at repetition rates up to a kilohertz and produce peak powers approaching a gigawatt. [redacted] b1 Like the UWB systems built by NINT and SWIAE, the RADAN relies on a spark-gap switch.

(S//NF) [redacted] b1

b1

(U) Research on High-Power Radiofrequency Susceptibility and Propagation

(S//NF) Chinese plans for the MWCG at the Southwest Institute of Applied Electronics are not known, but besides gaining insights into the design of very powerful HPM generators the Chinese might have intended to use this system to carry out the susceptibility and/or propagation experiments that would be part of any comprehensive RF weapon development program. b1 Scientists at NINT have also published theoretical papers on the coupling of HPM pulses into cylindrical structures. These studies are probably designed to simulate the penetration of HPM radiation into a generic shape representative of a tactical missile: small holes and slots in the structure would correspond to openings in a missile such as for the seeker or the stabilizing fins.

(U) Some of the same individuals at NINT are also investigating the propagation of HPM pulses through waveguides. This work involves numerical simulation of microwave breakdown inside rectangular waveguides filled with gas, and the purpose is clearly to estimate the fraction of microwave power that may be transmitted from an HPM source to a radiating antenna as a function of gas pressure and the background density of free electrons. The latter initiate breakdown when they are accelerated by the microwave field and gain enough energy to cause ionization of gas molecules. Very recently there have been publications from NINT presenting the results of experiments on HPM breakdown in free space as well as in waveguides. This work is obviously relevant to the transmission of RF energy through the atmosphere from a source to a target.

(U) Interest in developing RF weapons to defeat digital electronics is evident from a NINT paper that appeared in the October 1999 issue of a Chinese technical journal and that describes measurements of the microwave power density required to upset a computer as a function of microwave pulse duration. An unspecified computer was tested with an S-band microwave source supplying single and repetitive pulses with durations up to a microsecond, and the upset threshold was found to decrease as both the pulse width and the pulse repetition rate increased. In the curve of upset threshold *vs.* pulse width (figure 3) there is an inflection region, i.e., a point at which the upset threshold reaches a plateau and no longer decreases as pulse width increases. The authors note that these results provide insight into the design of high-power microwave sources, and that since there is only a gradual change in upset threshold with pulse length below the inflection point, it would be permissible to choose a shorter pulse width if for these narrower pulses the microwave source output power could be rapidly increased.

UNCLASSIFIED

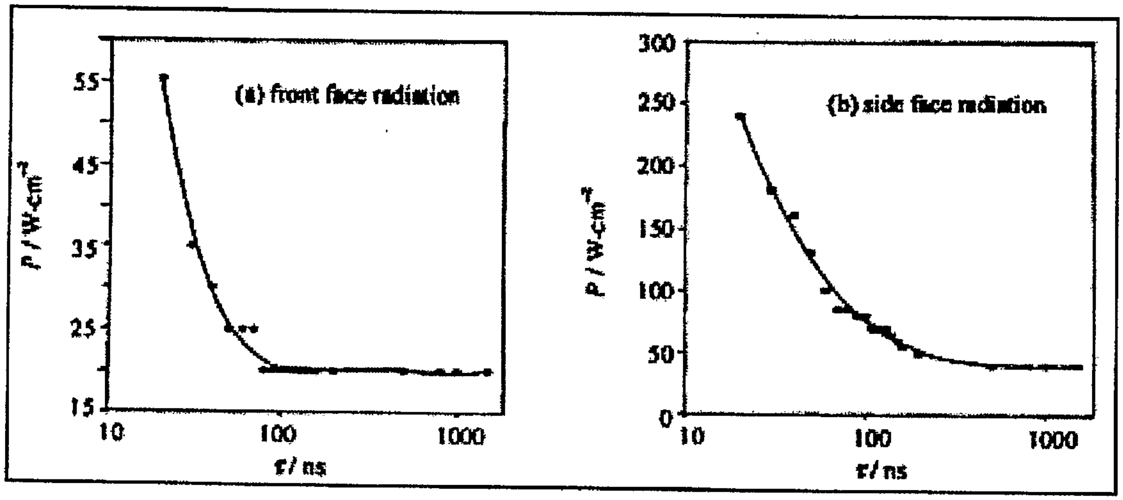

Figure 3. (U) Data on Computer Susceptibility to Single Radiofrequency Pulses Published by Northwest Institute of Nuclear Technology

(U) Clearly the purpose of the NINT measurements is to determine the optimum operating parameters for RF weapons designed to upset computers. In the same vein, an earlier paper from the National University of Defense Technology described experiments in which gigawatt HPM pulses from a VCO were used to induce upset and damage in computer components—a microprocessor, two sets of binary counters, and individual transistors and CMOS devices—but not entire computers. The NUDT authors state explicitly that their purpose is to gain a better understanding of HPM effects on electronics in order "to develop high-power microwave weapons and harden our vulnerable components." Besides computers, the Chinese are also exploring the possibility of predetonating electronically fuzed mines with RF pulses. A 1999 article in a military journal presented the results of tests in which a 900-kW/6-GHz microwave source was used to radiate mines and to deliver a flux sufficient to induce an electric current in the fuze and cause the mine to detonate. The authors, who are with the Engineer Corps, write that they are investigating the application of high-power microwaves to minesweeping. Other susceptibility research is conducted at the Southwest Institute of Applied Electronics, where a modeling code is employed to predict the response of silicon diodes to HPM pulses. And at the Institute of Applied Physics and Computational Mathematics, the techniques of fuzzy mathematics are used to calculate probability distribution curves for HPM susceptibility and survivability of electronic systems.

(S//NF) [redacted] b1 It is likely that in addition to the tests described above employing narrowband sources, the Chinese have begun to utilize ultra-wideband systems that they have developed indigenously or have acquired from Russia to measure the effects of UWB radiofrequency pulses on electronics. A comprehensive susceptibility test program will require them to explore an extensive RF parameter space, i.e., various combinations of peak power, frequency, pulse duration, pulse repetition rate, etc. It is not necessary for the Chinese to have high-power RF systems that cover this entire parameter space, however, since laboratory tests carried out at short range and using existing RF sources having modest output powers will provide data relevant to the effects of very powerful RF weapons on targets at the longer ranges that would be expected for some engagement scenarios.

(U) Evidence for Radiofrequency Weapon Development Programs

(S//NF) The Chinese are clearly investigating the feasibility of radiofrequency weapons. b1 The unclassified publications discussed above leave no doubt that the Chinese are contemplating the development of RF weapons to defeat computers and electronic mines, and in this section we discuss intelligence data indicating Chinese interest in RF weapons for air defense and for antisatellite applications. b1 and articles in unclassified technical journals may be interpreted to conclude that the Chinese are also pursuing explosively driven RF weapon concepts that could be relevant to a number of different missions and deployment scenarios.

(S//NF) b1

(S//NF) b1 The most likely configuration is a system consisting of one or more large antennas that would beam HPM pulses from the earth's surface toward a satellite in an attempt to negate onboard sensors. Other possibilities are an RF missile warhead launched on a direct-ascent trajectory and an RF satellite carrying an HPM transmitter that would be placed in orbit and then upon command would maneuver into the vicinity of the target satellite.

(U) There appears to be an effort at the Southwest Institute of Fluid Physics to develop the technology for explosively driven narrowband RF warheads. Such warheads are intended to radiate an HPM pulse that would negate electronics at a greater range than that at which a conventional warhead would cause blast/fragmentation damage. The primary components of an RF warhead are a prime-power source, a power-conditioning network, and an HPM generator. The prime-power source that may be the most promising for this application is the magnetocumulative generator (MCG), a device in which the detonation of an explosive charge gives rise to a voltage pulse which may be used to drive an HPM generator. One of the critical issues for RF warheads is coupling the MCG to the HPM device. Magnetocumulative generators tend to produce electrical pulses of relatively low voltage and long risetime, whereas most HPM generators require high voltages and short pulse risetimes. Scientists at SWIFP have performed numerical simulations on the use of electro-explosive opening switches to increase MCG voltages and sharpen risetimes in order to efficiently drive HPM devices, and claim to have determined optimum parameters for the power-conditioning network.

(S//NF) b1

b1

b1

b1

If correct, this is the first known instance in which indigenous Chinese research has resulted in the creation of significant levels of RF energy *via* an explosive pulsed-power supply.

(U) Postulated Chinese Radiofrequency Weapons

(U) In this section we will postulate Chinese radiofrequency weapons that are assessed to be technologically feasible from now through the far term, and we will also address RF weapon concepts that have been discussed extensively in the unclassified literature but that require significant advances in technology before they may be brought to fruition. We will not attempt to give detailed operating parameters for all the RF weapon concepts that may be envisioned, but will in most cases suggest only general RF weapon characteristics and concentrate on those RF weapon concepts for which there is evidence of Chinese interest. Our judgments of approximate timeframes for earliest likely deployment of Chinese RF weapons are determined by the dates by which the Chinese could be expected to develop indigenously or to otherwise acquire the requisite technology.

(U) Although above we have emphasized Chinese research on generating high-power, i.e., at least 100-MW pulses, it must be pointed out that the first systems functioning as RF weapons that the Chinese have the capability to deploy would not require the exotic RF technologies that have only been developed in recent years and that in many cases are not sufficiently mature to support weaponization, but rather RF devices operating at peak-power levels from kilowatts to a few megawatts and that have been available throughout the world for decades. Such **commercial-off-the shelf (COTS) radiofrequency weapons** would not be suitable for most battlefield applications but could be effective for launching attacks at short range against critical elements of civilian and military infrastructure including electric-power distribution facilities, telecommunications networks and satellite ground terminals. Figure 4 is an artist's concept of an RF weapon that is based on a radar operating at the megawatt level and that is concealed inside a truck so that it may be employed covertly.

UNCLASSIFIED

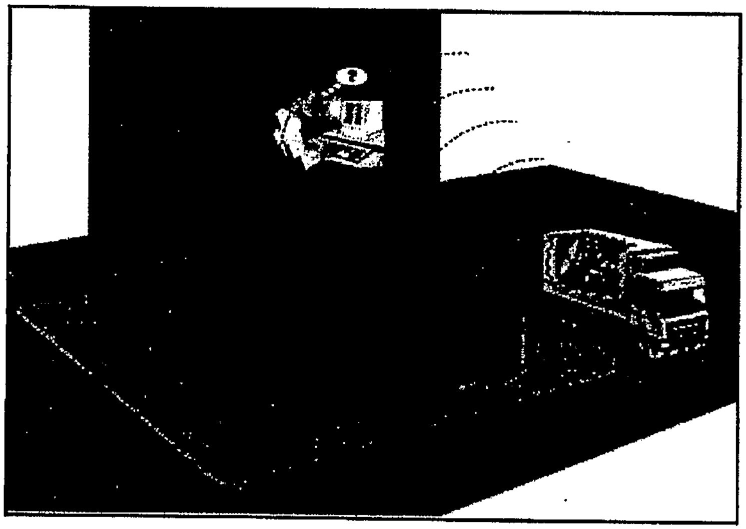

Figure 4. (U) Artist's Concept of Radiofrequency Weapon Based on Megawatt Radar

(S//NF)

b1

The effective range of briefcase RF weapons is only a few meters, but this might be adequate to attack, e.g., civilian infrastructure targets that are dependent on computer networks and that have few restrictions on personnel entry. The Chinese could assemble COTS radiofrequency weapons at any time, and may have already done so without our knowledge since it is unlikely that fabrication of such devices would be detected by standard intelligence methods.

(S//NF) Another category of RF weapons based on existing technology that the Chinese could develop within the near-to-mid term, but which does have a battlefield application and in which they have clearly expressed interest is **countermine radiofrequency weapons** intended to dud or predetonate mines with electronic fuzes. This is a relatively undemanding mission because the distance between the RF transmitter and the target will be meters rather than kilometers and so it is possible to produce a substantial RF flux on target with a system having modest output powers. As noted above the Chinese have already demonstrated predetonation of electronic mines using a 900-kW/6-GHz microwave source. The Chinese approach involved heating the bridgewire that detonates the explosive charge, and is actually among the more difficult ways to defeat mines by means of microwave energy. Experiments in the United States and Russia have shown that relatively low fluxes will suffice if the RF signal has the proper parameters to upset the fuze fire logic. The most likely configuration for a countermine RF weapon is an RF transmitter carried on an armored vehicle, although an airborne system is another option

b1

(S//NF) We will address in more detail the subject of Chinese **air-defense radiofrequency weapons**, which appear feasible for the mid-to-far timeframe. Here the goal would be to defeat missiles or aircraft by negating electronics in guidance, altimeter, fire control, communications, navigation, or other critical subsystems. In most engagement scenarios RF weapon ranges of at least a few kilometers would be desirable. This requirement effectively eliminates ultra-wideband RF systems from consideration because it is not possible to deliver significant levels of UWB energy, b1 b1 to kilometer ranges using antennas of reasonable size, and we will restrict our discussion to narrow-band HPM systems.

(S//NF) b1 Neither is there such evidence for any other country. In 1985, however, the Russians built an X-band high-power microwave radar that was based on a SINUS accelerator driving a repetitively-pulsed relativistic backward-wave oscillator and that operated at the 500-MW peak-power level. The purpose of this system was to detect airborne targets with low radar cross sections. The Russians have recently built a similar system, pictured in figure 5, for the British under contract. The HPM energy is supplied by equipment inside the trailer and radiated through the larger of the two antennas on the roof, a parabolic dish 1.2 meters in diameter; the smaller 0.9-meter antenna is for reception of the reflected pulse.

SECRET//REL TO USA, AUS, CAN, GBR and NZL

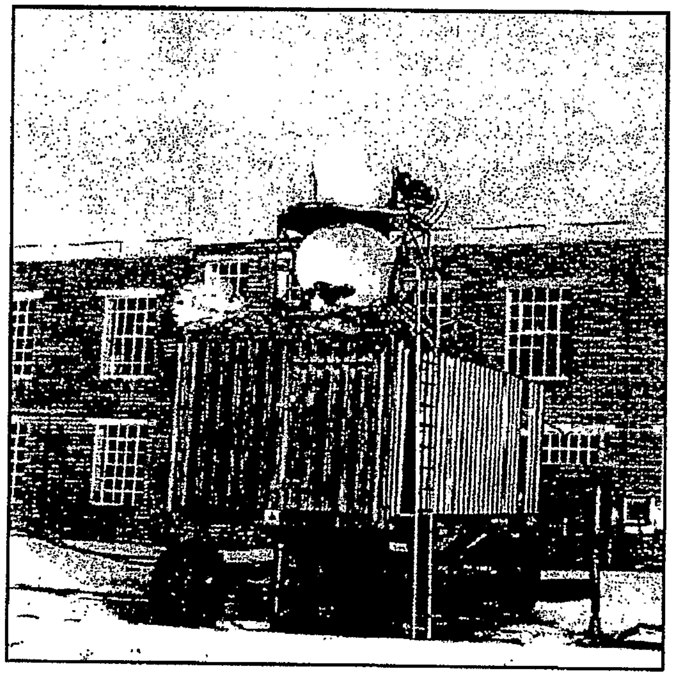

Figure 5. (U) Russian High-Power Microwave Radar in the United Kingdom

(S//NF) We cite this Russian HPM radar in the present context because it is an example of a high-power RF system that could easily be acquired by the Chinese and because its operating parameters approach those needed for an air-defense RF weapon. In figure 6 we have plotted the flux from this system (the line labeled

500 MW/1.2-m antenna) as a function of distance on a graph that includes estimated bounds for causing upset and damage to electronic subsystems in existing U.S. manned aircraft. It must be emphasized that these bounds are *approximate* and are extrapolated from limited measurements conducted by U.S. defense laboratories. These measurements included exposure of entire aircraft to high-power RF pulses, and also tests of individual aircraft subsystems such as radar-warning and GPS receivers.

b1

It must be noted that most of the measured data from which these susceptibility bounds were extrapolated are for repetitive pulses and that in general electronics failure levels are expected to be higher—perhaps by an order of magnitude—for single pulses. Although the susceptibility bounds given in figure 6 are for manned aircraft, the levels for guided missiles are roughly comparable and also span orders of magnitude in RF power density needed to induce effects.

SECRET//NOFORN

b1

Figure 6. (U) Power Densities From Existing and Postulated High-Power Radiofrequency Systems

(U) In figure 6 we have also plotted the RF fluxes as a function of range for two postulated dedicated air-defense RF weapons. The middle line is for a system based on existing Chinese HPM technology: the 1.1-GW/9.4-GHz relativistic BWO that NINT scientists described at a conference in 2000, coupled to an antenna 3 meters in diameter. The upper line is for a much more robust system based on a 10-GW/10-GHz HPM source driving a 5-meter antenna. The Chinese are not yet known to possess a repetitively-pulsed 10-GW HPM generator, but devices producing single pulses at this power level were developed in Russia in the mid-1980s and therefore a Chinese air-defense RF weapon with these characteristics being available in the far term is not out of the question.

(U) It must be emphasized that figure 6 is intended to serve as a guide to air-defense RF weapons that *could* be developed by the Chinese in the mid-to-far term, but at this time we have no reason to believe that systems with these characteristics *will* be developed. It must also be emphasized that the actual electronics susceptibility levels for more modern aircraft, not to mention those currently still in the R&D stage, could be quite different from the approximate levels for older aircraft as depicted in this graph. High-power RF susceptibility levels depend on the system response to a large number of parameters in addition to power density—including frequency, pulse duration, and pulse repetition rate—and the only method of obtaining reliable RF effects data for any specific aircraft is to carry out actual measurements.

(S//NF) We will now turn to another RF weapon concept that also appears technologically feasible for the Chinese in the mid-to-far term but for which there are at present no data indicating a research effort. This is a **counter-C⁴I radiofrequency weapon** in an airborne platform. We refer here not to a single-shot explosively driven RF warhead, which we will address below and for which as we have already noted there is evidence of Chinese interest, but to a repetitively-pulsed RF system deployed in a cruise missile or unmanned aerial vehicle flying at low altitude and that is used to attack ground targets such as air-defense sites and command and control infrastructure.

b1

[redacted]

Figure 7. (U) British Dipole Radiofrequency Source With Battery Pack

(S//NF) b1 The rationale for this judgment is that the basic radiofrequency generation mechanism here is not exotic but is merely a special application of high-voltage pulsed-power technology that has been in existence for many years and is well understood throughout the world. The difficulties the Chinese would face are in reducing the power supply to a size compatible with an airborne platform, and of course in integrating the dipole antenna and the prime power into a suitable aircraft.

(S//NF) There has been considerable discussion in the unclassified media of **explosively driven radiofrequency weapons** that would be configured as missile warheads or even artillery shells, and the impression has been given that building this type of system is almost a trivial exercise requiring little in the way of expertise or resources. We wish to state clearly that this is not the case. b1 [redacted] b1 There is no reason to believe, even given what may be initially favorable results at one of the CAEP institutes in Mingyang as described above, that the Chinese will be any more successful in the foreseeable future.

(S//NF) [redacted] b1 —it is not clear those would suffice for an RF weapon that would be an attractive option for military planners.

(S//NF) The critical issue is that for single-shot *vs.* repetitively-pulsed RF systems, a much higher flux on target is required to negate electronics; [redacted] b1 Given that in addition to RF energy the employment of explosively driven RF weapons will involve the creation of ballistic fragments that could pose a hazard to nearby personnel, i.e., these weapons are not nonlethal, the limited ranges do not seem to offer an attractive alternative to existing conventional weapon systems such as multiple submunitions dispensed from a single carrier vehicle. Furthermore, if the target were inside an enclosure that attenuated RF energy, the effective range would be even less. In summary we believe it is unlikely that, even if they are eventually demonstrated to be technologically feasible, the Chinese will be able to deploy explosively driven RF weapons powerful enough to have military utility before the far term.

(S//NF) [redacted] b1 An ASAT mission is undoubtedly one of the most technically stressing RF weapon applications. For a ground-based system beaming RF energy into space, simple calculations involving estimated satellite electronics susceptibility levels and the inverse-square law for electromagnetic propagation indicate that HPM sources operating at very high power levels as well as large transmitting antennas having high gain would be required. For an RF weapon delivered *via* a direct-ascent missile or deployed as an orbital system, there are severe constraints on system size and mass and also the question of competitiveness with other ASAT systems that must approach the target. Even if the Chinese commit resources to a major development program, we judge that they will not be able to deploy any type of antisatellite RF weapon for at least 10 years and possibly much longer.