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"...Tables 2-4 and 2-5 present the depth of penetration of various frequencies of electromagnetic radiation in biological tissues..."

...are not included in this reproduction. They are available

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LOW-INTENSITY CONFLICT AND MODERN TECHNOLOGY

LtCol David J. Dean, USAF, _Editor_

With a Foreword by CONGRESSMAN NEWT GINGRICH

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FOREWORD

The United States is on the verge of a dramatic change in
its ability to cope with low-intensity conflict. We must become
a great deal better in the process of fighting this kind of

"small war"; the world will not give us any choice. We may learn to adjust our current systems, procedures, and understanding quickly and intelligently, in which case we will come to cope with low-intensity conflict very rapidly. Or, we may learn this difficult art in a grudging, confused, and halting manner, in which case the next 20 years will be very painful and very expensive, both for the United States and for the case of freedom.

This book is a serious effort to make thinking about and working on low-intensity conflict easier, more understandable, and more effective. It is a major contribution to what is a growing literature and dialogue on the obligation of the United States to respond to the challenge of low-intensity conflict.

This book is needed because the United States finds itself dramatically challenged by conflict below the level of full-scale war. Unfortunately, our recent intellectual and bureaucratic traditions and systems fail to address adequately the challenge of low-intensity conflict. The organization of power in the State and Defense Departments and the relationships between the Congress, the news media, and the executive branch are all unsuited to fighting a low-intensity conflict effectively.

The United States has a long history of coping rather successfully with low-intensity threats. From the opening up of the West by the US Cavalry in the face of the American Indian to the Philippine insurrection and the turn of the century to the US Army's pursuit of Pancho Villa into northern Mexico to the US Marine Corps presence in Nicaragua and Haiti in the twenties, the United States systematically subdued low-intensity threats to America's policies.

Generally, these forces were used almost without debate or news coverage. The country went about the process of becoming more prosperous and more powerful in the pursuit of everyday life, while allowing its professional soldiers to engage quietly in dirty little wars in faraway places with almost no regard for legal nicety or the technical problems of international law. However, the dominant tradition of the American State Department,

the American news media, and the average American intellectual community was shaped not by the American experience in the West or the Philippines or Mexico and Central America, but rather by the nineteenth century tradition of European thought.

The European tradition is based on the concept of sovereignty and formal declarations of war. Sophisticated lawyers focused on the laws of England, Germany, and France. Sophisticated academicians educated in England, Germany, and France came to shape the concept of legality which had application to Europe, but totally ignored European behavior outside of that continent. In Europe, boundaries were not to be crossed by foreign armed forces without a formal declaration of war. Once the boundaries were crossed, a formal war would immediately ensure.

That practice did not pertain to most of the world. British colonial expeditions against local tribes, bandits, and guerrilla operations, for example, were routine and primarily military. These expeditions went virtually unreported except in books like those of Winston Churchill. When they were covered as spectacular adventures against backward local natives. The emphasis was almost always on the heroism of the British rather than on the use of overpowering force against clearly overmatched natives simply fighting for their own freedom. If the British campaigns against the Mahdi, the Zulu, and the Afghans in the nineteenth century were covered today, we would notice major shifts in emphasis and bias in that coverage.

The British approach to low-intensity conflict in the nineteenth century was virtually schizophrenic. This approach had no place among the legal niceties of international laws that governed sovereign states which tended to be only European. Thus, wars could be fought in the gray area between civilized and uncivilized nations without anyone noticing.

The post-World War II United Nations declared, in effect, that all of us are civilized and have human rights. The European concepts of sovereignty and international law became applicable to all people. This new approach radically changes the approach of low-intensity conflict. It requires that an entire new area of international law be developed with those situations in which one

state does not wish to declare war, but, nevertheless, finds itself engaged in violent action or facing the potential for violent action with other states.

This area of international life lacks an intellectually adequate American tradition. Our first great challenge in the area of low-intensity conflict, is the next 20 years, to invent a theory of law and structure of behavior that allows us to survive and win "small wars," with a framework that maintains certain basic rights for every human being. In addition, in the nineteenth century tradition, there was no serious consideration given to systematic organized terrorism. There were occasional acts of violence committed by specific and usually identifiable anarchists. These acts were mostly dealt with by various police forces operating quietly on the fringes of society, in situations in which the policemen were heroes. There was almost no consideration given to the possibility that a sovereign government was backing the anarchists. Thus, there was no state-backed terrorism which directly threatened a particular government.

Whether it is the Irish Republican Army, the Palestine Liberation Organization, or Islamic fanatics with direct backing from Libya, Iran, or Syria or indirect backing from Cuba and the Soviet Union, state-backed terrorism poses a new threat to the West for which we have no framework to respond. We are going to have to develop a capacity for striking at the cause of terrorism and the source of terrorist support if we are to survive in a free country. That is the second great challenge of our time in low-intensity conflict.

Finally, in the nineteenth century, there was no single empire systematically creating conflicts around the planet, looking for weaknesses in its opponents which could be exploited by new methods of warfare violence. The simple fact is the Soviet empire and its colonies have studied the West and have come to the conclusion that our greatest vulnerability is in low-intensity conflict. In this type of conflict, the Soviet Union suffers little if its client is defeated but gains greatly

if its client wins.

Since the Soviets have discovered the blind spot in our intellectual armor for competition, we can expect more and more low-intensity conflict for the foreseeable future. Only when we have developed a deterrent to low-intensity conflict as successful as our nuclear deterrent and our deterrence of conventional war in Europe will we be able to suppress Soviet efforts in this area. As long as the Soviet Union thinks it can cause the United States trouble in Central America while we do them little harm in Afghanistan, and as long as they can begin various minor wars using second and third level puppets, clients, and colonies while we are incapable of responding except by the direct use of American forces, the Soviets are going to have a great advantage. They are going to pursue this zone of international competition with great intensity and great savagery.

Intellectually, politically, and professionally, low-intensity conflict may be the most serious area of competition with the Soviet Empire over the next 30 years. The free world must find a legal, political, and diplomatic formula which enables us to cope with low-intensity conflict. Until we find a way to deal with Soviet-supported or other low-intensity conflict, we are going to remain at a grave disadvantage in the competition for survival on this planet.

This book is a serious step toward grappling with the technical, intellectual, and military problems of low-intensity conflict. The breadth of topics covered clearly indicates the complexity and range of difficulties which Americans and our allies in the free world have to explore if we are to develop a successful response to low-intensity conflict. Any student of American survival and any citizen concerned with understanding how this nation can cope with the challenge of low-intensity conflict more effectively will be served by studying this work. Its authors are to be commended for a job well done and a process well initiated.

[Original signed]

Newt Gingrich
House of Representatives

[...]

(Pages 249 to 260)

Part Two

TECHNOLOGY

THE ELECTROMAGNETIC SPECTRUM IN LOW-INTENSITY CONFLICT

By Capt Paul E. Tyler, MC, USN

Although electromagnetic radiation is familiar to everyone, the prototype being visible light, and although some magnetic and "electrical" properties have been observed for centuries (the lodestone, for example), not until late in the eighteenth century did scientists identify electromagnetism for what it really is, explore its physics, and develop rational theories for its practical use. Major contributions to this field include the experiments and studies of Harvey, Helmholtz, and Maxwell. Maxwell finally formulated the basic theory of the electromagnetic field, which Hertz later verified. Today, research on electromagnetic fields is moving in directions far different from what these pioneer scientists envisioned or attempted.

The results of many studies that have been published in the last few years indicate that specific biological effects can be achieved by controlling the various parameters of the electromagnetic (EM) field. A few of the more important EM factors can be manipulated are frequency, wave shape, rate of pulse onset, pulse duration, pulse amplitude, repetition rate, secondary modulation, and symmetry and asymmetry of the pulse. Many of the clinical effects of electromagnetic radiation were

first noticed using direct current applied directly to the skin. Later the same effects were obtained by applying external fields. Electromagnetic radiation has been reported in the literature to induce or enhance the following effects:

1. Stimulation of bone regeneration in fractures.
2. Healing of normal fractures.
3. Treatment of congenital pseudarthrosis.
4. Healing of wounds.
5. Electroanesthesia.
6. Electroconvulsive therapy.
7. Behavior modification in animals.
8. Altered electroencephalograms in animals and humans.
9. Altered brain morphology in animals.
10. Effects of acupuncture.
11. Treatment of drug addiction.
12. Electrostimulation for relief of pain.
13. Altered firing of neuronal cells.

These are but a few of the many biological effects and uses that have been reported over the past decade. There are not exhaustive and do not include many of the effects reported in the Soviet and East European literature.

As with most human endeavors, these applications of electromagnetic radiation have the potential for being a double-edged sword. They can produce significant benefits, yet at the same time can be exploited and used in a controlled manner for military and covert operations. This paper focuses on the potential uses of electromagnetic radiation in future low-intensity conflicts.

POTENTIAL MILITARY APPLICATIONS OF EMR

The exploitation of this technology for military uses is still in its infancy and only recently has been recognized by the United States as a feasible option. A 1982 Air Force review of biotechnology had this to say:

Currently available data allow the projection that specially generated radio frequency radiation (RFR) fields may pose powerful and revolutionary antipersonnel military threats. Electroshock therapy indicates the ability of induced electric current to completely interrupt mental functioning for short periods of time, to obtain cognition for longer periods and to restructure emotional response over prolonged intervals.

Experience with electroshock therapy, RFR experiments and the increasing understanding of the brain as an electrically mediated organ suggested the serious probability that impressed electromagnetic fields can be disruptive to purposeful behavior and may be capable of directing and or interrogating such behavior.

Further, the passage of approximately 100 milliamperes through the myocardium can lead to cardiac standstill and death, again pointing to a speed-of-light weapons effect.

A rapidly scanning RFR system could provide an effective stun or kill capability over a large area. System effectiveness will be a function of wave form, field intensity, pulse widths, repetition frequency, and carrier frequency. The system can be developed using tissue and whole animal experimental studies, coupled with mechanisms and waveform effects research.

Using relatively low-level RFR, it may be possible to sensitize large military groups to extremely dispersed amounts of biological or chemical agents to which the unirradiated population would be immune.(1)

The potential applications of artificial electromagnetic fields are wide ranging and can be used in many military or quasi-military situations.

Some of the potential uses include dealing with terrorist

groups, crowd control, controlling breached of security at military installations, and antipersonnel techniques in tactical warfare. In all of these cases the EM systems would be used to produce mild to severe physiological disruption or perceptual distortion or disorientation. In addition the ability of individuals to function could be degraded to such a point that they would be combat ineffective. Another advantage of electromagnetic systems is that they could provide coverage over large areas with a single system. They are silent and countermeasures to them may be difficult to develop. Assuming that electromagnetic radiation can be controlled to produce a specific adverse biological effect, the equal possibility exists that one can produce a beneficial effect such as enhancing the performance of the individuals. This development would provide personnel with enhanced capabilities in time of need. For example, if a small force is required to operate in isolation for an extended period of time, then local exposure to the right parameters of electromagnetic radiation may give this force the ability to do so with minimal rest and still maintain peak performance. One last area where electromagnetic radiation may prove to be of some value is in enhancing abilities of individuals for anomalous phenomena.

CLASSICAL THEORY VERSES RECENT THEORETICAL RESEARCH

Even though the body is basically an electrochemical system, modern science has been almost exclusively studied the chemical aspects of the body and to this date has largely neglected the electrical aspects. However, over the past decade researchers have devised many mathematical models to approximate the internal fields in animals and humans. Some of the later models have shown general agreement with experimental measurements made with phantom models and animals. Presently most scientists in the field use the concept of specific absorption rate of dosimetry of electromagnetic radiation. Specific absorption rate is the intensity of the internal electric field or quantity of energy absorbed per unit time is per unit mass. The latest

edition of the Dosimetry Handbook discusses specific absorption rate in detail.(2) Tables 2-4 and 2-5 present the depth of penetration of various frequencies of electromagnetic radiation in biological tissues according to current electromagnetic theory. However, the use of these classical concepts of electrodynamics does not explain some experimental and clinical findings. For example, according to classical physics, the frequency of visible light would indicate that it is reflected or totally absorbed within the first few millimeters of tissue and thus no light should pass through significant amounts of tissue. But it does. Also, classical theory indicates that the body should be completely invisible to extremely low frequencies of light where a single wave length is a thousand miles long. However, visible light has been used in clinical medicine to transilluminate various body tissues. The technique is particularly useful in observing the skulls of infants and the various sinus cavities.

A second area of classical theory fails to provide an adequate explanation for observed effects is in the clinical use for extremely low frequency (ELF) electromagnetic fields. Researchers have found that pulsed external magnetic fields at frequencies below 100 hertz will stimulate the healing of nonunion fractures, congenital pseudarthroses, and failed arthroses.(3) The effects of these pulsed magnetic fields have been extremely impressive and their use in orthopedic conditions had been approved by the Food and Drug Administration.

Recently, pulsed electromagnetic fields have been reported to induce cellular transcription.(4) At the other end of the nonionizing spectrum, research reports are also showing biological effects that are not predicted by classical theories. For example, Kremer and others have published several papers showing that low-intensity millimeter waves produce biological effects. They have also shown that not only are the effects seen at a very low power, but they are also frequency specific.(5)

As a result of theses and other studies, several groups of scientists have been reevaluating their concepts and looking for

new solutions. Some of the newer approaches have included the recognition that biological systems are nonlinear and rather than apply simple linear functions to the interaction of electromagnetic fields and biological systems, one must use nonlinear wave mechanics. Some researchers have even incorporated the mathematics of chaos dynamics.

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