TABLE I --
EMP IN 1986 *versus* EMP IN 2001

	1986	2001
Ways to initiate an Electromagnetic Pulse (EMP) attack	Fire a nuclear missile and explode it at a high altitude (For better results, use a *thermo*nuclear warhead and explode it at an even higher altitude)	Nuclear missile Sophisticated non-nuclear "E-bomb" Homemade/ low tech non-nuclear "E-bomb" Mobile, re-usable non-nuclear EMP generator
Countries with ICBMs *and* nuclear warheads	U.S., U.S.S.R., China	U.S., Russia, China ... North Korea? /nuclear warheads *suspected]*
Countries with ICBMs only	----------	North Korea?
Countries with nuclear warheads and *potential* for ICBMs	Britain, France, India ... Israel? /nuclear warheads *suspected]*	Britain, France, India, Pakistan ... Israel? Iraq? /nuclear warheads *suspected]*
Worst single terrorist attack in last 10 years	Hundreds dead	Thousands dead
Most sophisticated terrorist weapons used in last 10 years	Explosives in cars and vans	Large, *terrorist-piloted* jet aircraft Nerve gas

DJS/djs
September 24, 2001

INCIDENTAL BENEFITS OF EMP SHIELDING

Although the case for action on EMP centers on improving the odds for national survival -- and individual survival -- in the years ahead, some potential "fringe benefits" of EMP shielding should also be noted.

(1) Effective EMP shielding has to "plug all the holes" through which an Electromagnetic Pulse might enter a piece of electronics equipment. In the process of keeping outside electromagnetic energy from *entering* the equipment, the EMP shielding will also keep the equipment's internal energy from *exiting* the equipment. This will ease the known problem of electromagnetic "leakage" from one piece of equipment that impairs the functioning of another piece of equipment. In this regard, the U.S. military's TEMPEST program could be taken as a model.

(2) For the same reason, EMP shielding will greatly reduce the incidence of *human and animal* exposure to electromagnetic "leakage". Although vigorous debates continue, some scientists and statisticians have contended that electromagnetic leakage -- from above ground power lines, but also from microwave ovens and other household appliances -- can be harmful to human beings and, perhaps, to other species as well. *If* there is actually a risk to human and animal health from electromagnetic leakage, EMP shielding should reduce that risk by reducing the exposure to such leakage.

(3) EMP shielding can reduce the risk to electronics equipment from solar flares. While such flares are most dangerous for electronics equipment based in outer space, the peak levels of future solar flare activity are still largely a matter of speculation. There is, therefore, some chance that peak solar flares could, at some point, become powerful enough to affect Earthside electronics equipment -- in which case the required EMP shielding could "do double duty".

SUMMARY OF PROPOSED RULE ON SHIELDING OF EQUIPMENT AGAINST ELECTROMAGNETIC PULSE

In response to the rapidly growing potential for access to EMP-generating devices by terrorist groups and/or "rogue states", we have prepared the draft of a proposed rule which can serve as a starting point for FCC deliberations on this issue.

The actual text of the proposed rule is set forth below, in the next portion of this NPRM Petition. In addition, a 1-page Outline of the proposed rule has been attached to this Petition as **Appendix A** and a proposed timetable for its implementation has been set forth in **Table II.**

The proposed rule is built around a basic, phased-in mandate for shielding of all electronics equipment that is subject to the Federal Communications Commission's jurisdiction. Unless otherwise classified, all such electronics equipment is subject to one generic performance standard and two different compliance deadlines.

The basic performance standard is shielding sufficient to permit the effective, uninterrupted functioning of electronics equipment following an Electromagnetic Pulse of 100,000 volts per meter. 100,000 volts per meter is twice the estimated EMP from a single high-altitude nuclear explosion, but we have added a "safety margin" to guard against the possibilities of *multiple* high-altitude nuclear bursts and/or of higher intensity EMP from a *terrestrial* "E-bomb" or EMP generator, fired in close proximity.

The basic compliance deadlines, for electronics equipment which is not otherwise classified, are as follows:

(1) In the case of newly *installed* equipment, regardless of whether it is newly manufactured or re-used, such equipment must be in compliance for all such installations performed more than 18 months after the date of issuance of the Commission's final rule on EMP shielding;

And

(2) In the case of equipment installed *before* the compliance deadline for newly installed equipment, upgrading, retrofitting and/or replacements to meet the standard must be completed within 60 months after issuance of the final rule.

This is the general standard and timetable, but the proposed rule allows for exceptions -- in both directions.

In terms of more stringent requirements, all electronics equipment which is subject to this rule must meet the 18-month deadline for newly installed equipment. However, in the case of equipment which is "otherwise classified" -- as higher priority -- all upgrades, retrofits and/or replacements must be completed within 24 months, rather than the otherwise applicable time frame of 60 months.

This mandate for accelerated retrofitting is limited to equipment:

(3) Whose failure would be life threatening;

(4) Which is used, or intended for use, in outer space;

And/or

(5) Whose failure would endanger the lives of military personnel and/or the national security of the United States and/or its territories and/or its allies.

Where equipment qualifies for more than one classification, the classification with the most stringent performance standard shall be applicable.

In keeping with the accelerated retrofitting deadline, high priority classes of equipment also face a more demanding performance standard. Rather than assuring

that electronics equipment is shielded to survive an EMP of 100,000 volts per meter, users of high priority equipment must assure that it is shielded against EMP to the maximum extent that is technologically feasible. However, in the case of "life or death" equipment and/or space-based equipment, the applicable compliance costs are "capped" to the extent they would otherwise cause a boost of 20% or more in the cost of producing the equipment. In such cases, the most protective technology available must be used *up to the point* at which production costs would rise by 20% or more.

In addition, given the possible logistical challenges of retrofitting or replacing equipment in outer space, extensions of the accelerated retrofitting deadline are available for space-based equipment under certain circumstances.

Further, outright exemptions from the EMP shielding mandate are available, by rule or order, to the extent Petitioners certify and demonstrate that:

(6) Portions of the equipment are composed of fiber optics, which are impervious to EMP (although other portions of the same equipment, which are *not* composed of fiber optics, shall remain subject to the shielding mandate);

And/or

(7) The equipment in question is "luxury" equipment, which is not necessary for maintaining either the life, health and basic living standards of individuals *or* the viability of any government, non-profit and/or private sector services and/or facilities which are vital for sustaining the nation's basic infrastructure.

Further, in the case of electronics equipment in general -- that is, equipment which is neither exempted from the basic mandate *nor* classified as high priority equipment that must meet higher standards -- a special "cost-based

adjustment" is available. When and if a Petitioner certifies and demonstrates that full compliance with the basic shielding mandate would cause the costs of producing the applicable equipment to rise by 5% or more, due to the EMP shielding alone, the Commission may grant a reduction in the otherwise applicable performance standard *up to the point* at which any directly related increases in production costs have been "capped" at 5%.

Optimistically assuming that our NPRM Petition is treated by the Commission as an urgent matter, worthy of expedited consideration, we urge the Commission to set January of 2003 as its target date for issuance of a final rule on EMP shielding.

With a January 2003 date of issuance, the final rule -- if patterned after our proposed rule -- would work as indicated in **Table II.**

TABLE II –
PROPOSED TIMETABLE FOR EMP SHIELDING

January 2003	**Final rule on EMP shielding is issued.**
February 2003	**Affected equipment users may begin submitting applications for exemptions, extensions and/or cost-based adjustments.**
July 2004	**All electronics equipment *which is installed this month or hereafter,* falling within the FCC's jurisdiction *and* not specifically exempted, must meet one of 3 performance standards for EMP shielding compliance:** **(a) *General Rule* – Protection up to 100,000 volts per meter.** **(b) *"Life or Death" Equipment* and *Space-Based Equipment* – Maximum shielding that is technologically feasible, up to a "cost cap" of 20%.** **(c) *High Priority Military Equipment* -- Maximum shielding that is technologically feasible.**
January 2005	***"Life or Death" Equipment, Space-Based Equipment* and *High Priority Military Equipment*, if installed before July 2004, must be upgraded, retrofitted and/or replaced to meet the applicable performance standard. (Deadline extensions may be available, under certain conditions, for users of certain space-based equipment.)**
January 2008	**All other equipment installed before July 2004, falling within the FCC's jurisdiction and *not* otherwise exempted, must be upgraded, retrofitted and/or replaced to meet a performance standard of 100,000 volts per meter.**

DJS/djs
September 24, 2001

As we noted earlier, the text of the proposed rule is set forth in the portion of this Petition which follows. In addition, an Outline of the proposed rule is attached as **Appendix A.**

TEXT OF PROPOSED RULE ON SHIELDING OF EQUIPMENT AGAINST ELECTROMAGNETIC PULSE

We present to the Commission the text of a proposed rule for shielding of electronics equipment against acts of war or terrorism involving the hostile use of EMP. The numbering of Sections and subsections is arbitrary, for purposes of illustration.

We cannot claim infallibility and, therefore, we cannot claim that this proposed rule is beyond any possible improvement. We *can* claim, however, that the text has been carefully conceived, considered and re-considered by the Co-Petitioners. We offer it as a viable starting point for deliberations by the Federal Communications Commission.

SECTION 101. *SHIELDING OF ELECTRONICS EQUIPMENT AGAINST ELECTROMAGNETIC PULSE (EMP).* All electronics equipment which is subject to this rule shall be shielded effectively to function reliably, and without interruption, following exposure to an Electromagnetic Pulse.

SECTION 102. *SCOPE OF EQUIPMENT COVERED.*

(a) *JURISDICTIONAL SCOPE.* Electronics equipment is subject to this rule if:

(i) The manufacture and/or licensing of the equipment is subject to the jurisdiction of the Federal Communications Commission, either directly or indirectly; and/or

(ii) The equipment is used, or intended for use, in an activity which is subject to the jurisdiction of the Federal Communications Commission, either directly or indirectly.

(b) *DEFINITIONAL SCOPE.* For purposes of this rule, the term "electronics equipment" includes:

(i) Individual pieces of equipment;

(ii) Individual parts and components of pieces of equipment;

(iii) Systems which link together pieces of equipment; and/or

(iv) Any related equipment which is necessary for the effective functioning of equipment that is directly subject to this Section.

(c) *FIBER OPTICS EQUIPMENT.* Since fiber optics are naturally impervious to an Electromagnetic Pulse, any electronics equipment shall be exempt from this rule to the extent that it is certified and demonstrated to be composed of fiber optics. However, any portion of such equipment which is not composed of fiber optics, and which is otherwise subject to this rule, shall remain subject to this rule.

SECTION 103. *GEOGRAPHICAL SCOPE OF EQUIPMENT COVERED.*

(a) *POINT OF MANUFACTURE.* Any electronics equipment which is otherwise subject to this rule shall remain subject to this rule, regardless of whether or not the equipment has been manufactured, upgraded, repaired or recycled within the United States and/or its territories.

(b) *POINT OF USE.* Any electronics equipment which is otherwise subject to this rule shall remain subject to this rule, even if:

(i) The equipment has been used outside the United States and/or its territories in the past, and is now being transported into the United States and/or its territories; and/or

(ii) The equipment has been used within the United States and/or its territories in the past, and is now being transported outside of the United States and/or its territories for use by a public, private or non-profit entity which is subject to the laws of the United States and/or its territories.

SECTION 104. *MINIMUM STANDARDS FOR SHIELDING OF ELECTRONICS EQUIPMENT.*

(a) *GENERAL RULE.* At a minimum, electronics equipment which is subject to this rule shall be shielded effectively to function reliably, and without interruption, following exposure to an Electromagnetic Pulse of 100,000 volts per meter.

(b) *SPECIAL RULE FOR "LIFE AND DEATH" ELECTRONICS EQUIPMENT.* In the case of any electronics equipment which is subject to this rule, and whose failure would be life-threatening, such equipment shall be shielded effectively to the maximum level which:

(i) is technologically feasible; to the extent that it

(ii) will not increase the otherwise applicable cost of producing the electronics equipment by more than 20 percent, not including the purchaser's rate of return on the equipment (if any).

(c) *SPECIAL RULE FOR EQUIPMENT DEPLOYED IN OUTER SPACE.* In the case of any electronic equipment which is subject to this rule, and which is used or intended for use in the vacuum of outer space, such equipment shall be

shielded effectively to the maximum level which:

(i) is technologically feasible; to the extent that it

(ii) will not increase the otherwise applicable cost of producing the electronics equipment by more than 20 percent, not including the purchaser's rate of return on the equipment (if any).

(d) *SPECIAL RULE FOR CERTAIN MILITARY EQUIPMENT.* In the case of equipment whose failure would endanger the lives of military personnel of the United States and/or its territories and/or its allies, and/or would endanger the viability of military operations by the United States and/or its terrorities and/or its allies, and/or would otherwise jeopardize the national security of the United States and/or its territories and/or its allies, such equipment shall be shielded effectively to the maximum level which is technologically feasible.

SECTION 105. *TIMETABLE FOR COMPLIANCE WITH THIS RULE.*

(a) *EQUIPMENT PLACED IN USE AFTER THE DATE OF ISSUANCE OF THIS RULE*. In the case of any electronics equipment which is subject to this rule, and which is installed for use (or otherwise placed in use) following the issuance of this rule, such equipment shall be in full compliance with the minimum standards of Section 104 no later than 18 months after the date of issuance of this rule. This subsection shall apply to all such equipment, regardless of whether the equipment is being used for the first time or re-used.

(b) *EQUIPMENT PLACED IN USE BEFORE THE DATE OF ISSUANCE OF THIS RULE.*

(i) *GENERAL RULE.* In the case of any electronics equipment which is subject to the shielding standards of Section 104(a), and which was installed for use (or otherwise placed in use) before the date of issuance of this rule, such equipment shall be upgraded, retrofitted and/or replaced to be in full compliance with the minimum standards of Section 104 no later than 60 months after the date of issuance of this rule. This subsection shall apply to all such equipment, regardless of whether the equipment is being used for the first time or re-used.

(ii) *SPECIAL RULE.* In the case of any electronics equipment which is subject to the shielding standards of Sections 104(b), 104(c) or 104(d) of this rule, and which was installed for use (or otherwise placed in use) before the date of issuance of this rule, such equipment shall be upgraded, retrofitted or replaced to be in full compliance with the minimum standards of Section 104 no later than 24 months after the date of issuance of this rule.

SECTION 106. *EXEMPTIONS, EXTENSIONS AND ADJUSTMENTS.*

(a) *FIBER OPTICS EXEMPTION.* In accordance with Section 102(c), the Commission shall grant, by either a generic rule or a case-specific order, an exemption from coverage under this rule when and if a Petitioner certifies and

demonstrates that some or all portions of specific electronics equipment are composed of fiber optics. Nothing in this subsection shall be construed to affect the legal status of any portions of such equipment which are not composed of fiber optics.

(b) *OUTER SPACE EXEMPTION OR EXTENSION.*

(i) *EXEMPTION.* In the case of any electronics equipment which is subject to the shielding standards of Section 104(c), the Commission shall grant, by a case-specific order, an exemption from coverage under this rule when and if a Petitioner certifies and demonstrates that no maintenance or other servicing of the equipment is currently planned or was planned when the equipment was initially placed in outer space. Any such exemption shall be voided automatically when and if maintenance or servicing of the equipment is initiated following the issuance of the exemption.

(ii) *EXTENSION.* In the case of any electronics equipment which is subject to the shielding standards of Section 104(c), for which maintenance or servicing of the equipment is currently planned or was planned when the equipment was initially placed in outer space or is currently planned, the Commission shall grant, by a case-specific order, extension of the compliance deadline in Section 105(b)(ii) when and if a Petitioner certifies and demonstrates that the maintenance or servicing was previously scheduled to occur at a time following the compliance deadline. Any such extension shall be voided automatically when and if maintenance or servicing of the equipment is initiated prior to the extended compliance deadline.

(c) *"LUXURY" EXEMPTION.* In the case of any electronics equipment which is subject to the shielding standards of Section 104(a), the Commission may grant, by either a generic rule or a case-specific order, an exemption from coverage under this rule when and if a Petitioner certifies and demonstrates that the equipment in question is "luxury" equipment, which:

(i) is not necessary for sustaining the life, health, employability (including commuting and telecommuting abilities) and/or basic living standards of individual purchasers and/or users; and

(ii) is not necessary for sustaining the viability, reliability and/or permanence of basic government and/or non-profit services, including but not limited to military defense, police services, fire services, public health services, religious institutions, public sector educational institutions, food distribution services, housing services, mail service, rescue operations, Amateur Radio Service emergency communications, mass transit and similar commuting services, intercity transportation services, transportation maintenance and maintenance of essential public and/or non-profit facilities; and

(iii) is not necessary for sustaining the viability, reliability and/or permanence of other basic modern infrastructure, including but not limited

to radio and television broadcasting, the Internet, telephones, energy production and distribution, food distribution, housing, private sector educational institutions, private sector mass transit and similar commuting services, private sector intercity transportation services, private sector transportation maintenance and maintenance of facilities which are privately owned but nevertheless essential for the well-being of the general public.

(d) *COST-BASED ADJUSTMENT.*

(i) *GENERAL REQUIREMENTS.* In the case of any equipment which is subject to the shielding standards of Section 104(a), the Commission may grant, by either a generic rule or a case-specific order, adjustment of the otherwise applicable shielding standards when and if a Petitioner certifies and demonstrates that the unadjusted shielding standards would increase the otherwise applicable cost of producing the electronics equipment by more than 5 percent, not including the purchaser's rate of return on the equipment (if any).

(ii) *DOCUMENTATION REQUIREMENTS.* In meeting its burden of proof, the Petitioner shall provide documentation of bids from at least 3 competing providers of the electronics equipment in question. Where less than 3 competing providers are available, the Petitioner must submit:

(A) as many competing bids as possible; in addition to

(B) an objectively conducted, well-documented cost analysis prepared by a well-qualified independent firm which has no official or functional ties to the Petitioner.

(iii) *LIMITATIONS ON POSSIBLE COST-BASED ADJUSTMENTS.* Any adjustments which are granted under this subsection shall not reduce the shielding standards below the maximum level which:

(A) is technologically feasible; to the extent that

(B) it will not increase the otherwise applicable cost of producing the equipment by more than 5 percent, not including the purchaser's rate of return on the equipment (if any).

SECTION 107. *PENALTIES FOR NON-COMPLIANCE WITH THIS RULE.*

(a) *GENERAL RULE.* In the case of non-compliance with the shielding standards of Section 104(a), the mandatory penalty for a first offense shall be an amount equal to 10 percent of the retail purchase price of *all* equipment which was left unshielded, or inadequately shielded, as a result of the non-compliance. In the event of a second offense, or of a first offense which the Commission determines was knowing and systematic, the mandatory penalty shall be an amount equal to 20 percent of the retail purchase price of *all* equipment which was left unshielded as a result of the non-compliance.

(b) *SPECIAL RULE.* In the case of non-compliance with the shielding standards of Sections 104(b), 104(c) and/or 104(d), the mandatory penalty for a first offense shall be an amount equal to 50 percent of the retail purchase price of *all*

equipment which was left unshielded, or inadequately shielded, as a result of the non-compliance. In the event of a second offense, or of a first offense which the Commission determines was knowing and systematic, the mandatory penalty shall be an amount equal to 100 percent of the retail purchase price of *all* equipment which was left unshielded, or inadequately shielded, as a result of the non-compliance.

SECTION 108. *LEGAL LIABILITY FOR FAILURE OF EQUIPMENT DUE TO NON-COMPLIANCE WITH THIS RULE.* In any lawsuits which may be filed as a result of the failure of equipment due to non-compliance with Sections 104(a), 104(b), 104(c) and/or 104(d) of this rule, the Federal Communications Commission shall stand in support of any finding by a court of law that the lack of shielding against an Electromagnetic Pulse, or the lack of adequate shielding against an Electromagnetic Pulse, constitutes in itself grounds for a rebuttable presumption of legal liability.

SECTION 109. *OTHER MATTERS.*

(a) *"COST CAP" AND COST-BASED ADJUSTMENT CALCULATIONS.* In calculating estimated increases in production costs, for purposes of applying the "cost cap" in Section 104(b) and (c) and/or petitioning for the cost-based adjustment in Section 106(d), equipment users, equipment manufacturers and any other parties involved with these calculations shall include *only* those costs which are directly related to compliance with this rule and can be so documented. Inclusion of any other costs whatsoever in these calculations shall be construed by the Commission as a violation of this rule and shall render any and all responsible parties subject to the full force of the penalties in Section 107.

(b) *CLASSIFICATION OF EQUIPMENT BY THE COMMISSION.* The Commission may, by a generic rule or a case-specific order, determine for itself, based upon the provisions of Section 104 and Section 109(c), the particular Section 104 category in which particular equipment shall be classified.

(c) *CLASSIFICATION OF EQUIPMENT BY THE EQUIPMENT OWNER.* Where particular equipment has not been classified by the Commission on the date of installation, upgrading, retrofitting and/or replacement, the owner of the equipment shall determine for itself, based upon the provisions of Section 104 and Section 109(c), the particular Section 104 category in which particular equipment shall be classified. In such cases, the equipment owner shall be responsible for assuring compliance with the standards of Section 104 by all parties involved with any aspect of the installation, upgrading, retrofitting and/or replacement. The Commission may conduct random samples of equipment, initiate unannounced inspections and/or take other reasonable steps to assure that the equipment owner's classification has been accurate.

(d) *EQUIPMENT WHICH CAN BE CLASSIFIED IN ONE OR MORE OF THE CATEGORIES IN SECTION 104.* When and if equipment can be

accurately classified in more than one of the equipment categories in Section 104, the equipment shall be classified within the Section 104 category which has the most demanding performance standards.

SECTION 110. *SEVERABILITY CLAUSE.* If any part of this rule is invalidated by a court of law, all remaining parts of the rule shall remain in full effect.

CONCLUSION

For the reasons which have been set forth by the undersigned Petitioners -- as supplemented by the documents appended to this Petition, and also by the Petition and other documents which were filed in FCC Docket RM-5528 -- the Petitioners urge the Federal Communications Commission to proceed, expeditiously, with issuance of the proposed rule for the shielding of electronics equipment against the hostile use of an Electromagnetic Pulse.

Respectfully submitted,

Donald J. Schellhardt, Esquire
Member, Virginia Bar & Connecticut Bar
B.A. Wesleyan; J.D. George Washington

Co-Petitioner, FCC Docket RM-5528 (1986)
Co-Petitioner, FCC Docket RM-9208 (1997)

45 Bracewood Road
Waterbury, Connecticut 06706
Connyanks@aol.com
203/756-7310

Nickolaus E. Leggett per djs

Nickolaus E. Leggett
N3NL -- Amateur Radio Extra Class Licensee
General Radiotelephone Operator Licensee
Private Pilot Single-Engine Licensee
Aero-tow Glider Licensee
B.A. Wesleyan; M.A. Johns Hopkins

Co-Petitioner, FCC Docket RM-5528 (1986)
Co-Petitioner, FCC Docket RM-9208 (1997)

1432 Northgate Square
#2A
Reston, Virginia 20190
Nleggett@earthlink.net
703/709-0752

Dated: September 25, 2001

September 25, 2001

Inquiries or other communications related to this document should be addressed to:

Donald J. Schellhardt, Esquire
45 Bracewood Road
Waterbury, Connecticut 06706
Connyanks@aol.com
203/756-7310

OUTLINE OF PROPOSED RULE
TO SHIELD ELECTRONICS EQUIPMENT
AGAINST ELECTROMAGNETIC PULSE

September 24, 2001

Section: 104 Type Of Equipment	*104* Shielding Standards	*104,106* Cost Cap	*105* Compliance Deadlines	*107* Fines For Violations	*106* Exemptions
All electronics equipment subject to FCC jurisdiction, *except* where otherwise classified -- or exempted	100,000 volts per meter	5% rise in cost of producing equipment (Must petition for)	(Newly installed equip.) 18 mos. (Other) 60 mos.	10% of retail value of affected equipment (Cost cap X 2) *1st time*	Fiber optics portions of equipment "Luxury" equipment
Equipment whose failure would be life-threatening	Maximum technol. feasibility	20% rise in prod. cost (Automatic)	(New) 18 mos. (Other) 24 mos.	50% of equip. value (Cost cap X 2.5) *1st time*	Fiber optics portions of equipment
Equipment used in outer space	Maximum technol. feasibility	20% rise in prod. costs (Automatic)	(New) 18 mos. (Other) 24 mos.	50% of equip. value (Cost cap X 2.5) *1st time*	Fiber optics portions of equipment
Equipment whose failure would risk military lives &/or national security	Maximum technol. feasibility	*None*	(New) 18 mos. (Other) 24 mos.	50% of equip. value (Cost cap X 2.5) *1st time*	Fiber optics portions of equipment

Donald J. Schellhardt, Esquire
45 Bracewood Road, Waterbury, CT 06706
Connyanks@aol.com
203/756-7310

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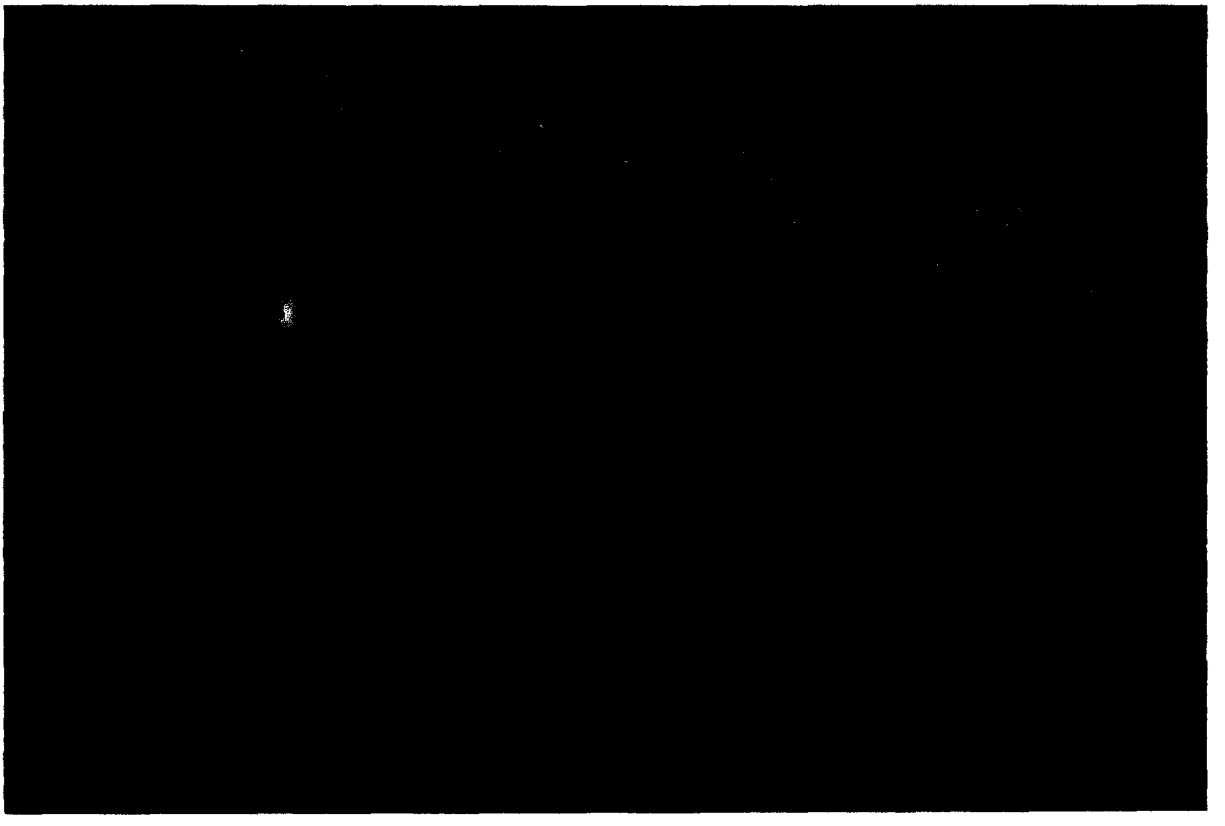
In the blink of an eye, electromagnetic bombs could throw civilization back 200 years. And terrorists can build them for $400.

BY JIM WILSON

Lead illustration by Edwin Herder



The next Pearl Harbor will not announce itself with a searing flash of nuclear light or with the plaintive wails of those dying of Ebola or its genetically engineered twin. You will hear a sharp crack in the distance. By the time you mistakenly identify this sound as an innocent clap of thunder, the civilized world will have become unhinged. Fluorescent lights and television sets will glow eerily bright, despite being turned off. The aroma of ozone mixed with smoldering plastic will seep from outlet covers as electric wires arc and telephone lines melt. Your Palm Pilot and MP3 player will feel warm to the touch, their batteries overloaded. Your computer, and every bit of data on it, will be toast. And then you will notice that the world sounds different too. The background music of civilization, the whirl of internal-combustion engines, will have stopped. Save a few diesels, engines will never start again. You, however, will remain unharmed, as you find yourself thrust backward 200 years, to a time when electricity meant a lightning bolt fracturing the night sky. This is not a hypothetical, son-of-Y2K scenario. It is a realistic assessment of the damage the Pentagon believes could be inflicted by a new generation of weapons--E-bombs.

The first major test of an American electromagnetic bomb is scheduled for next year. Ultimately, the Army hopes to use E-bomb technology to explode artillery shells in midflight. The Navy wants to use the E-bomb's high-power microwave pulses to neutralize antiship missiles. And, the Air Force plans to equip its bombers, strike fighters, cruise missiles and unmanned aerial vehicles with E-bomb capabilities. When fielded, these will be among the most technologically sophisticated weapons the U.S. military establishment has ever built.

There is, however, another part to the E-bomb story, one that military planners are reluctant to discuss. While American versions of these weapons are based on advanced technologies, terrorists could use a less expensive, low-tech approach to create the same destructive power. "Any nation with even a 1940s technology base could make them," says Carlo Kopp, an Australian-based expert on high-tech warfare. "The threat of E-bomb proliferation is very real." POPULAR MECHANICS estimates a basic weapon could be built for $400.

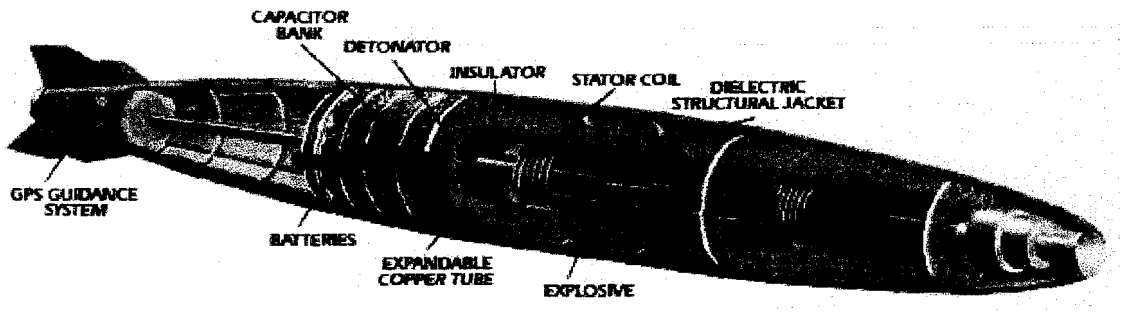
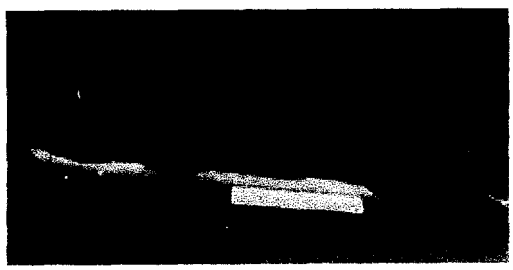


ILLUSTRATION BY JOHN BATCHELOR

An Old Idea Made New

The theory behind the E-bomb was proposed in 1925 by physicist Arthur H. Compton--not to build weapons, but to study atoms. Compton demonstrated that firing a stream of highly energetic photons into atoms that have a low atomic number causes them to eject a stream of electrons. Physics students know this phenomenon as the Compton Effect. It became a key tool in unlocking the secrets of the atom.



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In the 1980s, the Air Force tested E-bombs that used cruise-missile delivery systems.
PHOTO BY AVAIATION WEEK & AEROSPACE TECHNOLOGY

Ironically, this nuclear research led to an unexpected demonstration of the power of the Compton Effect, and spawned a new type of weapon. In 1958, nuclear weapons designers ignited hydrogen bombs high over the Pacific Ocean. The detonations created bursts of gamma rays that, upon striking the oxygen and nitrogen in the atmosphere, released a tsunami of electrons that spread for hundreds of miles. Street lights were blown out in Hawaii and radio navigation was disrupted for 18 hours, as far away as Australia. The United States set out to learn how to "harden" electronics against this electromagnetic pulse (EMP) and develop EMP weapons.

America has remained at the forefront of EMP weapons development. Although much of this work is classified, it's believed that current efforts are based on using high-temperature superconductors to create intense magnetic

fields. What worries terrorism experts is an idea the United States studied but discarded–the Flux Compression Generator (FCG).

A Poor Man's E-Bomb

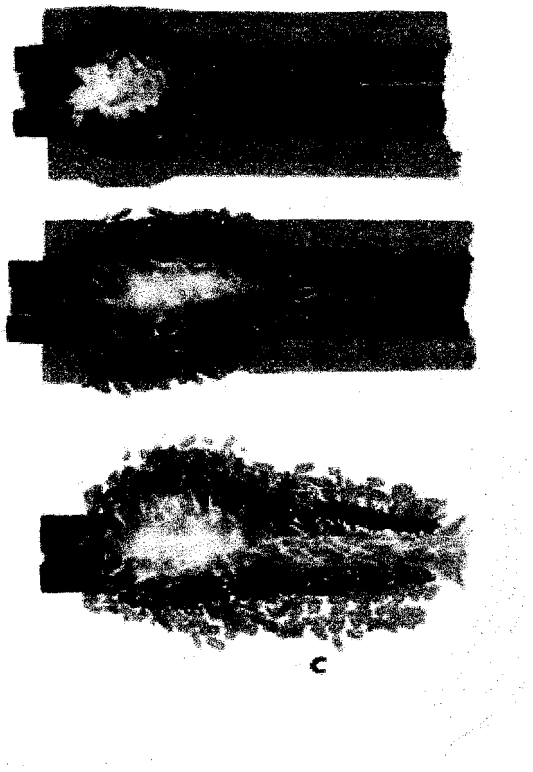
An FCG is an astoundingly simple weapon. It consists of an explosives-packed tube placed inside a slightly larger copper coil, as shown below. The instant before the chemical explosive is detonated, the coil is energized by a bank of capacitors, creating a magnetic field. The explosive charge detonates from the rear forward. As the tube flares outward it touches the edge of the coil, thereby creating a moving short circuit. "The propagating short has the effect of compressing the magnetic field while reducing the inductance of the stator [coil]," says Kopp. "The result is that FCGs will produce a ramping current pulse, which breaks before the final disintegration of the device. Published results suggest ramp times of tens of hundreds of microseconds and peak currents of tens of millions of amps." The pulse that emerges makes a lightning bolt seem like a flashbulb by comparison.

An Air Force spokesman, who describes this effect as similar to a lightning strike, points out that electronics systems can be protected by placing them in metal enclosures called Faraday Cages that divert any impinging electromagnetic energy directly to the ground. Foreign military analysts say this reassuring explanation is incomplete.

The India Connection

The Indian military has studied FCG devices in detail because it fears that Pakistan, with which it has ongoing conflicts, might use E-bombs against the city of Bangalore, a sort of Indian Silicon Valley. An Indian Institute for Defense Studies and Analysis study of E-bombs points to two problems that have been largely overlooked by the West. The first is that very-high-frequency pulses, in the microwave range, can worm their way around vents in Faraday Cages. The second concern is known as the "late-time EMP effect," and may be the most worrisome aspect of FCG devices. It occurs in the 15 minutes after detonation. During this period, the EMP that surged through electrical systems creates localized magnetic fields. When these magnetic fields collapse, they cause electric surges to travel through the power and telecommunication infrastructure. This string-of-firecrackers effect means that terrorists would not have to drop their homemade E-bombs directly on the targets they wish to destroy. Heavily guarded sites, such as telephone switching centers and electronic funds-transfer exchanges, could be attacked through their electric and telecommunication connections.

Knock out electric power, computers and telecommunication and you've destroyed the foundation of modern society. In the age of Third World-sponsored terrorism, the E-bomb is the great equalizer.



To ignite an E-bomb, a starter current energizes the stator coil, creating a magnetic field. The explosion (A) expands the tube, short-circuiting the coil and compressing the magnetic field forward (B). The pulse is emitted (C) at high frequencies that defeat protective devices like Faraday Cages. ILLUSTRATIONS BY JOHN BATCHELOR

DON SCHELLHARDT
Attorney At Law
45 Bracewood Road
Waterbury, Connecticut 06706
(203) 756-7310
E-Mail: *Connyanks@aol.com*

Solo practitioner of legislative, regulatory & family law
seeks payrolled position in law, business or politics.

GOALS

Full-time advocacy to shape legislation & regulations ... AND/OR commercial or transactional promotion of "clean energy" (such as solar power, fuel cells, natural gas, coal gas/fuel cell combos, Alternative Fueled Vehicles) or other new technologies. Western U.S. location a plus. Travel (especially Pacific Rim) a huge plus.

CREDENTIALS

J.D. George Washington University, Washington, DC (1975)
B.A. Government & English, Wesleyan University, Middletown, CT (1971)

Admitted: VA (1975), CT (1994), U.S. Courts for Western & Eastern VA (2000)

12 years legislative & regulatory advocacy on energy & environment: American Gas Association (AGA), Arlington, VA (Several posts in Government Relations Group, 1978-1990, including: Director, Legislative & Regulatory Affairs ... Director, State, Local & Coalition Relations ... Assistant to Vice President, Government Relations) ... CT regulatory filings to shift proposed powerplant to fuel cells and/or coal gas (Now)

3 years legislative & regulatory advocacy on communications: Co-Petitioner, FCC Docket RM-5528 (1986) ... Co-Petitioner, FCC Docket RM-9208 (1997) ... The Amherst Alliance, Waterbury, CT (Founder & 1st National Coordinator, 1998-2000)

3 years Congressional staff experience: House Republican Research Committee (Legislative Analyst for energy & environment, 1973-1974) ... U.S. Rep. Matthew Rinaldo, retired (Legislative Counsel for Energy & Commerce Committee, 1975-1977)

2 years regulatory agency experience: U.S. Environmental Protection Agency (EPA), Washington, DC (Policy Advisor on global warming, 1990-1991) ... Consultant to EPA, NARUC & 3 state Public Utility Commissions, Alexandria, VA (Gas & electric utility Demand Side Management/Integrated Resource Planning, 1991-1992)

5 years court experience: Superior Court, New Haven, CT (Staff, 1995-1998) ... Blue Ridge Legal Services, Harrisonburg, VA (Attorney, 1999-2000) ... Solo Practice, Bridgewater, VA & Waterbury, CT (Family law & regulatory law, 2000-Now)

SKILLS: WHAT CAN I DO FOR YOU -- FROM DAY ONE?

LOBBY --	State Legislatures, Congress, regulators
WRITE --	testimony, speeches, briefing papers, articles
SPEAK --	testimony, speeches, briefings, one-on-one
ANALYZE --	energy, environment, communications
ORGANIZE --	online, in person, large groups, small groups
MARKET AND/OR MOTIVATE --	ads, direct mail, brochures, presentations
NEGOTIATE AND/OR MEDIATE --	agreements, consensus & coalition building
LEARN NEW SKILLS --	quickly
LEARN NEW SUBJECTS --	quickly

SELECTED ACHIEVEMENTS: WHAT HAVE I DONE FOR OTHERS?

NATURAL GAS PRODUCTION -- At AGA, helped to shape FERC regulations carrying out wellhead pricing mandates of Natural Gas Policy Act. Developed special expertise on deep gas (>12,000 feet), tight sands gas & enhanced recovery. Became AGA's leading expert on wellhead pricing clauses in gas supply contracts. (1978-1985)

NATURAL GAS CONSUMPTION -- At AGA, negotiated key terms of Congressional compromise that reformed Fuel Use Act & repealed incremental pricing. 1st major energy bill in 15 years to pass Congress unanimously. (1987)

NATURAL GAS & ELECTRIC VEHICLES -- At AGA, successfully advocated fleet vehicle mandates in CA, AZ, TX, OK, LA. Joined Advisory Board to South Coast Air Quality District (CA). Helped to add U.S. mandate to Clean Air Act. (1985-1990)

NEW ENERGY -- As Congressional aide, boosted fusion power R&D by $40 million. (1976) At AGA, helped to extend funding for CA demonstration powerplants: Coolwater (medium Btu coal gas, cleaner than natural gas) & Solar One. (1983-1987)

ENERGY EFFICIENCY -- At EPA, served on 3-person team that designed & marketed EPA's popular, voluntary Green Lights energy efficiency program. Recruited 1st Fortune 500 companies. Several thousand companies participate today. (1990-1991)

LOW POWER RADIO -- Co-filed Petition For Rulemaking that triggered FCC rulemaking on Low Power Radio (<100 watts). Founded & led The Amherst Alliance: a Net-based citizens' group. Out-lobbied Fox, Disney, others. After greatest volume of public comments in its 65-year history, FCC authorized Low Power Radio. (1997-2000)

CHILDREN & OTHERS -- As trial lawyer, removed children from abusive homes. Won Protective Orders for endangered spouses & children. Handled divorces, including negotiation and drafting of property settlements. Led & organized new, local Autism Action Task Force in VA. (2000-Now)

Nickolaus E. Leggett

1432 Northgate Square, Apt. 2A
Reston, VA 20190-3748
(703) 709-0752
nleggett@earthlink.net

Summary:

Over 15 years of experience in research, analysis, and writing. Developed online help systems. Wrote user's guides and functional descriptions. Invented and patented several hardware devices. Published papers in peer-reviewed journals. Presented papers to technical conferences on space engineering. Private pilot.

Skills: Analysis, inventing, writing, developing, mathematical modeling, and research.

Software: Interleaf, Microsoft Word 97, Microsoft Word 2000, FrameMaker, RoboHelp, Windows98, UNIX, QBASIC

Employment History:

New Era of Networks (PaperFree Systems) Vienna, VA 1999 – 2001
(purchased by Sybase)

Senior Technical Writer

Developed online help and hard copy documentation for electronic commerce software applications.

Cisco Systems Herndon, VA 1999

Senior Technical Writer

Developed hard copy documentation for the configuration of communications systems and the installation of communications hardware.

Alcatel USA Ashburn, VA 1981 – 1998
(This firm was previously, Alcatel Data Networks, Sprint International, and GTE Telenet)

Senior Technical Writer

Developed hypertext online help systems and hard copy documentation for the Alcatel Network Management System (NMS) and for Alcatel communications switches. The NMS and the switches support Frame Relay, ATM, and X.25 protocols.

- Invented proprietary hardware device for communications switches. This device facilitates the design, construction, operation and service of large communications switches and computers.
- Designed and developed hypertext online help systems for Fault Management. This set of online help systems uses over 1000 screens and 2500 hypertext links to provide context sensitive information to the network operators. These online help systems significantly improved the usability of the NMS and decreased the required training time.
- Wrote operator's guides for System Administration and Fault Management. This included the entire process of conceptualizing, designing, writing, producing, reviewing, and testing the documents.

Technical Writer

Documented communications switches, user interfaces, and the NMS.

- Wrote functional descriptions for Alcatel communications switches.
- Composed functional descriptions of switch level and link level software.
- Produced endpoint user guides for data concentrators.
- Wrote configuration guides for X.25 switches directly from the template source code.

International Research and Technology Corporation **1974 – 1981**
(Flow General Corp.) **McLean, VA**

Senior Analyst and Analyst

Researched, analyzed, and wrote reports on energy and environmental research projects. Mathematical modeling of energy systems and their emissions. Developed modules for the Materials Process Product Model (MPPM) of industrial processes and their emissions.

Private Research Efforts:

Ongoing research, publication, and conference presentations on controlled environment agriculture, electronics, and space technology.

Petitions to the Federal Communications Commission for the enhancement of communications systems. Docket No. RM-5528 on the protection of communications networks from electromagnetic pulse (EMP). Docket No. RM-9208 petition for low power neighborhood broadcasting service – this docket has become FCC regulations for low power broadcasting.

Patents/Inventions:

- Ground effect machine (U.S. Patent) – hovercraft vehicle using the Magnus effect.
- Ground effect vehicle (U.S. Patent) – hovercraft vehicle using air deflection system
- Proprietary device for communications switches for Alcatel USA (Patent Pending)

Certifications:

- Certified Electronics Technician – International Society of Certified Electronics Technicians
- Technician Class 1 – The National Association of Radio and Telecommunications Engineers, Inc.
- General Radiotelephone Operator License – Federal Communications Commission
- Amateur Radio Extra Class Operator – Federal Communications Commission
- Pilot (balloons, gliders, and single-engine airplanes) – Federal Aviation Administration

Education:

MA Political Science – The Johns Hopkins University (Baltimore, MD)
BA Government – Wesleyan University (Middletown, CT)
Continuing photography and darkroom courses – Smithsonian Institution (Washington, DC)
Ongoing education on computer troubleshooting, hardware, and software

Sample:

A link to one of my published papers is listed at the following URL:
http://www.arrl.org/rfsafety/arrlpubs.html