



AOC Electronic Warfare Europe

Radio Frequency Weapons Potential Uses and Limitations

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US Aircraft Tests

★ **Very significant impacts**





Stuck in the Driveway for Security

*Emergency Radio System
at Fort Detrick*

Jams Garage Door Openers

Washington Post

February 27, 2005



Rail Traffic Halted

- ★ **Commuter rail passengers in Maryland and Virginia faced cancellations and delays yesterday after the signal and dispatching systems for the CSX tracks in Jacksonville, Florida were knocked out of service.**
- ★ **This was a nationwide shutdown**
- ★ **August 21, 2003**
- ★ **Washington Post**



FEDERAL COMPUTER WEEK

APRIL 13,
1998

Volume 12, Number 10
www.fcw.com

AIR FORCE

Rogue transmitter knocks out GPS signals

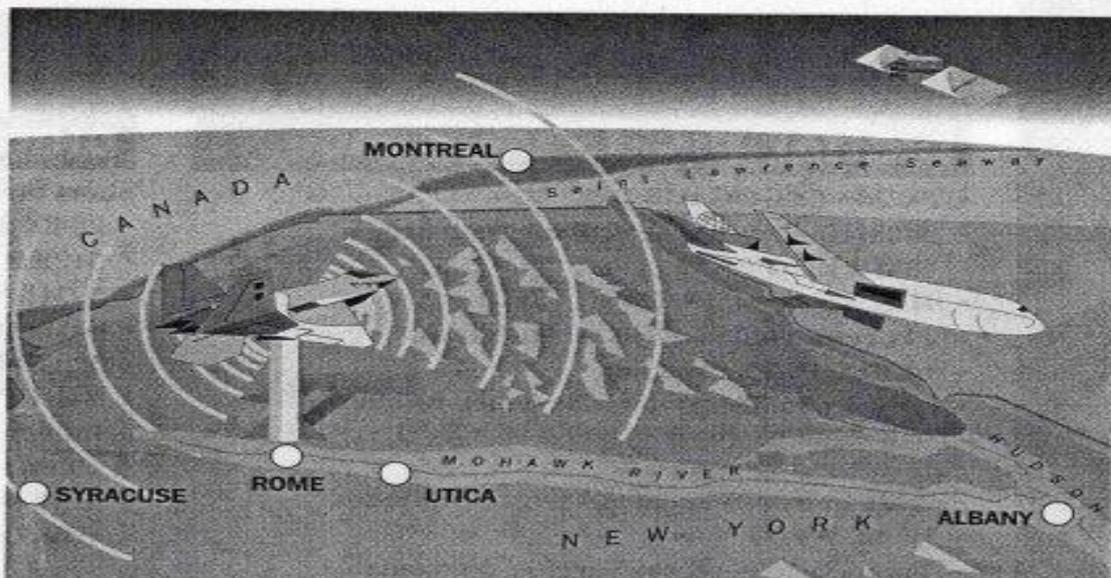
*Trans-Atlantic flights
lose nav aids over N.Y.*

BY BOB BREWIN

An errant Air Force transmitter in upstate New York jammed Global Positioning System satellite navigation signals for two weeks earlier this year, with at least one Continental Airlines flight reporting a total loss of GPS signals and a dozen other GPS-equipped aircraft filing interference reports, according to officials from the Federal Aviation Administration and the Defense and Transportation departments.

Last year the President's Commission on Critical Infrastructure Protection (PCCIP) cited in a report concerns about the vulnerability of the GPS system to jamming by adversaries or terrorists and questioned FAA plans to rely solely on satellite-based aerial navigation and landing systems sometime after 2003. Gary Kosciusko, a staff member of the PCCIP, speaking at a DOT-sponsored GPS conference last week, said the upstate New York incident served as a real-world example "of the kinds of issues we are con-

See GPS, Page 6



All Jammed Up

Workers testing a GPS transmitter on a pylon-mounted aircraft at an Air Force laboratory near Rome, N.Y., interfered for two weeks with the navigational instruments on commercial flights within a 300-kilometer radius, including a Continental Airlines DC-10 during its descent into Newark, N.J.

GRAPHIC BY JEFF LANGKAU AND ALLISON MILLER



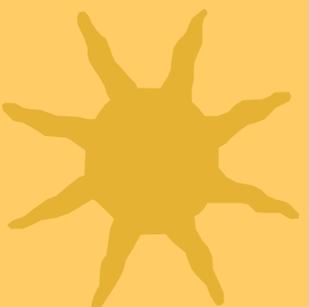
Heathrow-Jan 17, 2008

- ★ Boeing 777 aircraft crash landed
- ★ Both engines died simultaneously
- ★ Plenty of fuel remaining
- ★ Fuel icing essentially ruled out
- ★ Pilot error ruled out
- ★ This is a great mystery said Bill Voss the President of the Flight Safety Foundation





USAF Tests



★ **CLASSIFIED**



Congressional Report 8/9/2008

- ★ **Report is 181 pages on EMP attack**
- ★ **Infrastructure could be damaged for months or a year**
 - ★ ***75,000 Dams and reservoirs**
 - ★ ***168,000 drinking water facilities**
 - ★ ***19,000 wastewater treatment centers**





NPS Example

★ WATER SUPPLY SYSTEM





Mass Outage

IEEE • The Little Virus That Could...Make a Transistor p. 3

SPECTRUM

NOVEMBER 2003

WEAPON X

Intense blasts of microwaves can black out cities and knock out computers—but leave people and buildings standing. Is this the future of warfare?

PLUS

HOLIDAY BUYING GUIDE: THE YEAR'S



Sustained Power Outage

TOTAL CHAOS

- ★ **No heating or cooling in homes or workplaces**
- ★ **No water for drinking, bathing, flushing toilets**
- ★ **No vehicular traffic**
- ★ **Gas stations can't get or pump gas**
- ★ **No public transportation..Metro or airports**
- ★ **Food, medicine, life sustaining systems etc?**
- ★ **No radio, TV, internet, cell phones**





Current Status

RF Weapons

both

**standard and explosive
are reaching maturation**

**CAN BE PURCHASED
ON OPEN MARKETS**



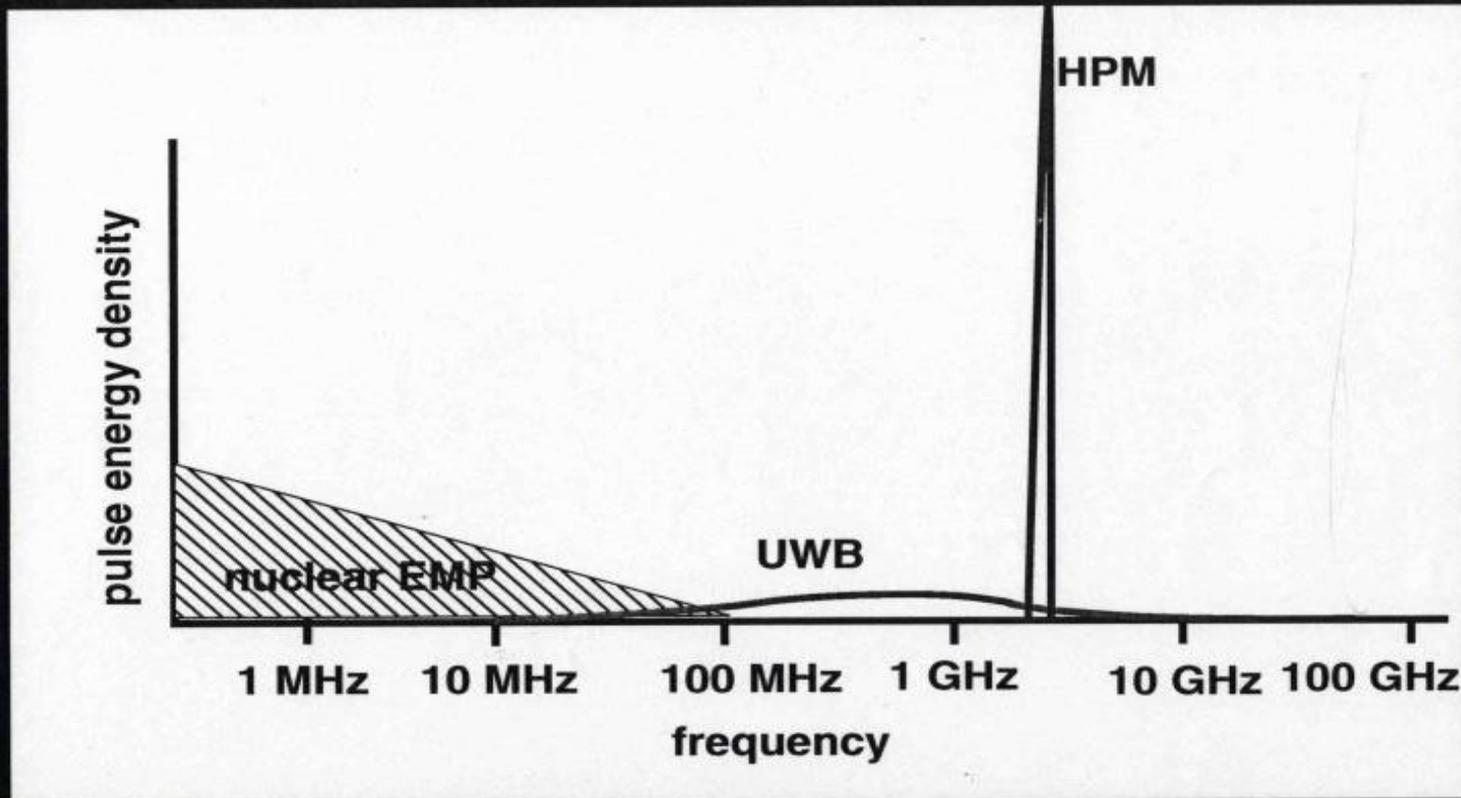


Two Major Functions

- ★ **Anti personal and crowd control**
- ★ **Equipment**
 - **disruption**
 - **manipulation**
 - **destruction**



HPM vs. UWB Energy Spectrum





Active Denial System





Active Denial System Concept

- ★ **Non-Lethal Anti-Personnel
Directed Energy**
- ★ **Heats Skin, Causes Intense Pain**
- ★ **Does not damage person**





ACTIVE DENIAL SYSTEM



Show Active Denial CD

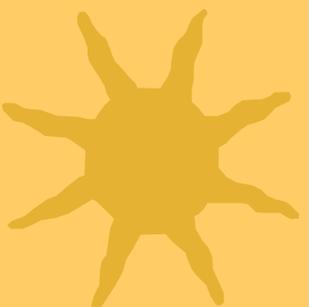


Army Research Labs-1995

Computer experiments

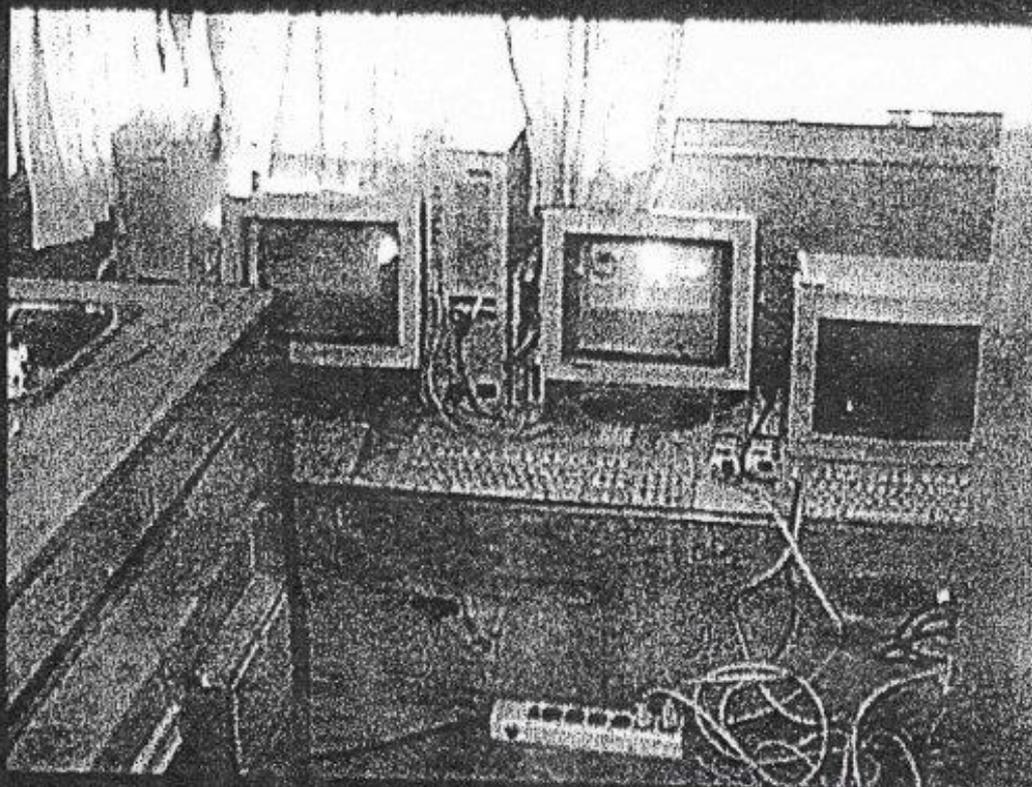


- ★ **Various computer lock-ups**
- ★ **Floppy disk ejections and lock-ups**
- ★ **CDROM system lock-ups**
- ★ **Tape control problems**
- ★ **Hard drive upsets and burn out**
- ★ **Multiple monitor problems**
- ★ **Power levels < 20 milliwatts/CM²**





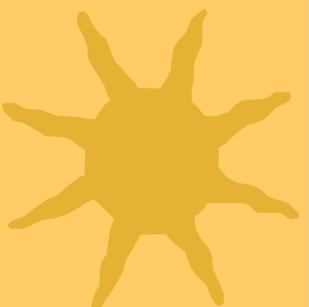
Beta LAN in the Trailer



- Macintosh Computers #1-3 (left to right)
- Macintosh #4 not visible around right corner
- All assumed to be fully functional



Wideband RF AF Summary



★ Screen distortion	3
★ CPU locked/applications froze	64
★ Rebooted	20
★ LAN disrupted	7
★ Keyboard locked up	70
★ Keyboard dead	1
★ Mouse locked up	6
★ Mouse killed	4
★ I/O card damaged	11
★ Mother board damaged	1



SCADA Networks

- ★ Extremely vulnerable
- ★ NPS student project



Truck-mounted RFW





IED related

- **NIRF**
- **Sparrow**
- **Blowtorch**
- **RELOC**



- **OTHER**
- **Champ**
- **Cruise missile**



M R T I & R D S O B O R O N E X P O R T P R E S E N T

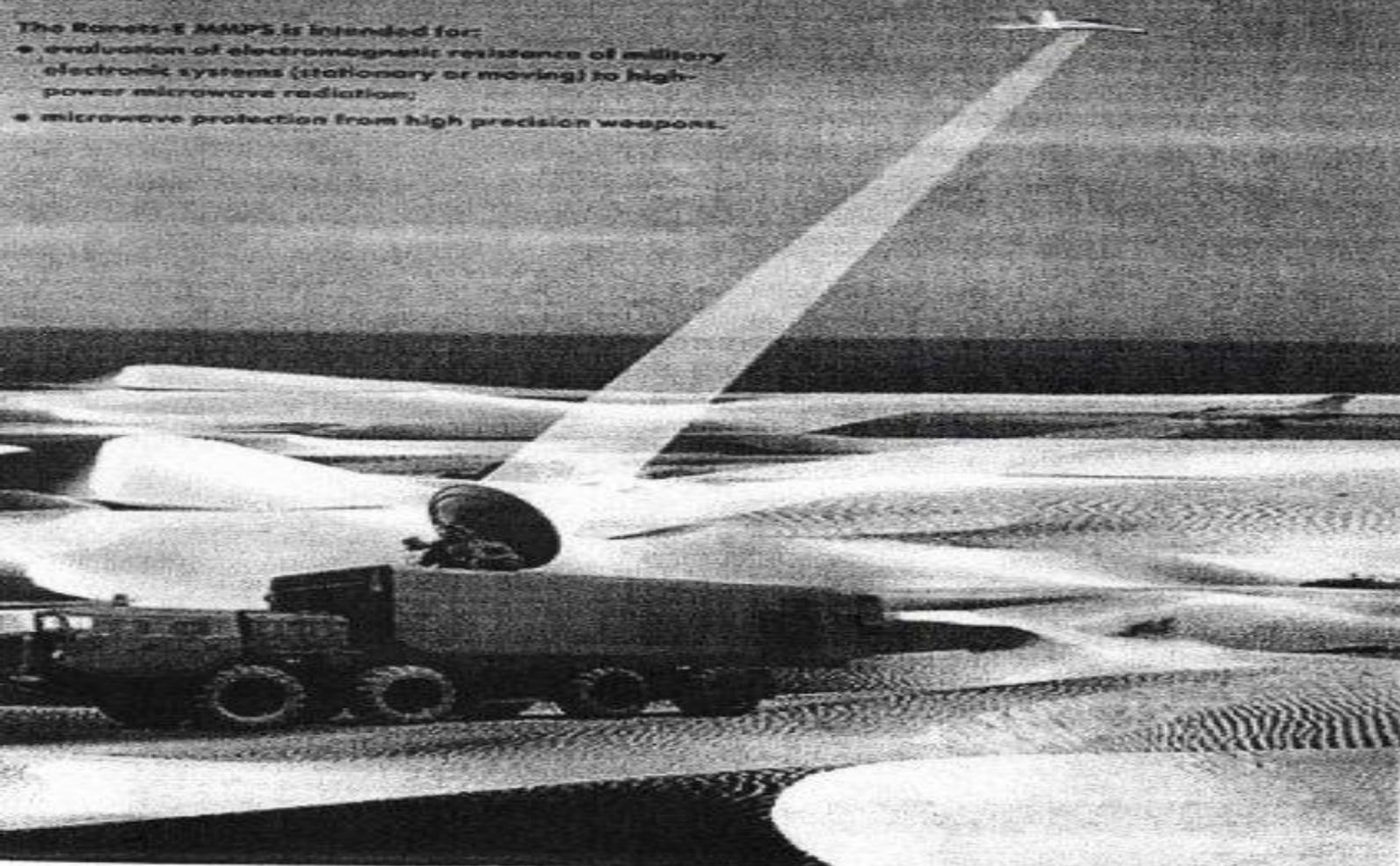
RANETS-E *Mobile Microwave Protection System*

Purpose

A research and development project is proposed to create a mobile microwave protection system (MMPS) - Ranets-E.

The Ranets-E MMPS is intended for:

- evaluation of electromagnetic resistance of military electronic systems (stationary or moving) to high-power microwave radiation;
- microwave protection from high precision weapons.



UNCLASSIFIED



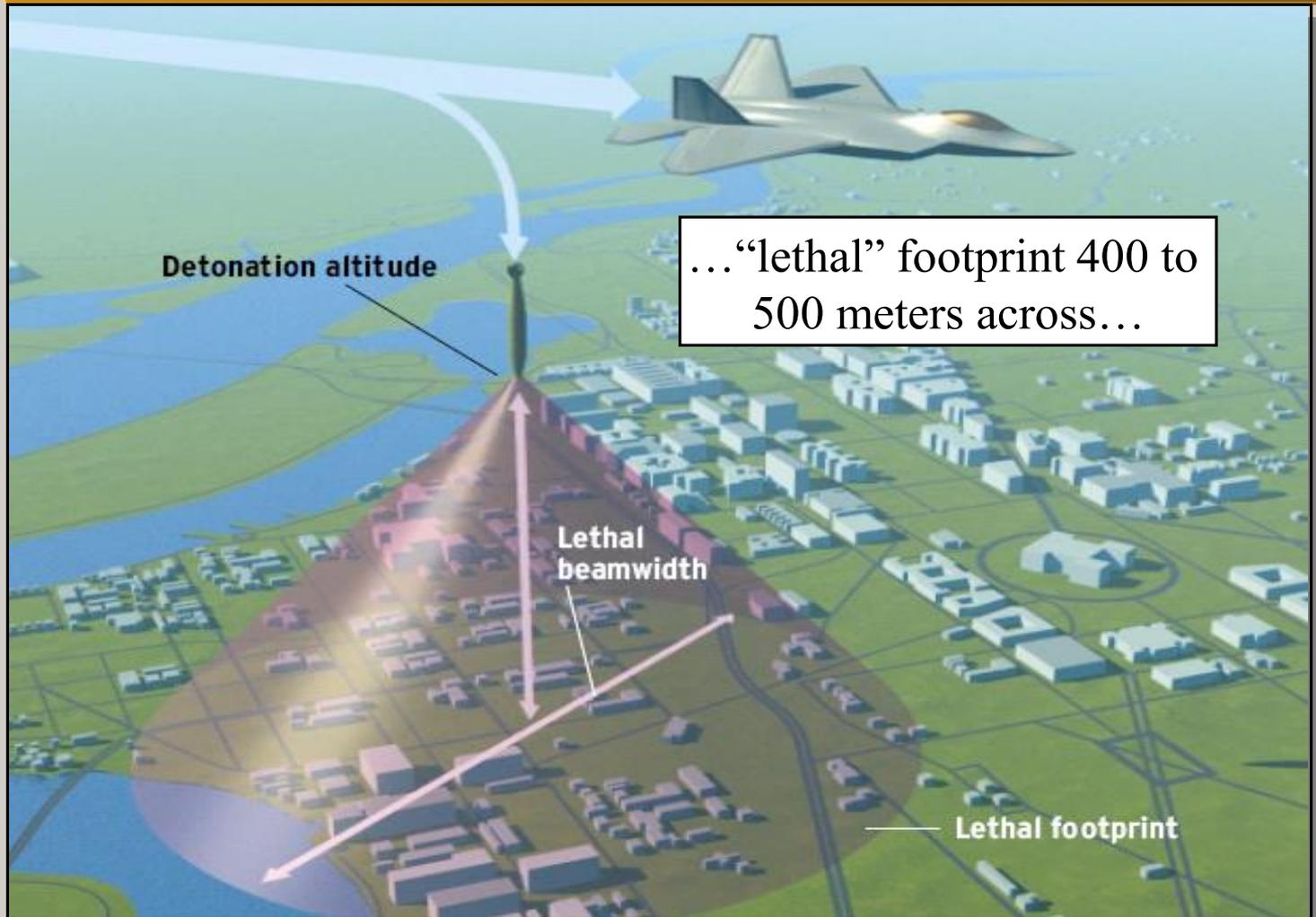
Raytheon's High-Power Pfaser Microwave Weapon Downs Drones



**APPROVED FOR PUBLIC RELEASE
DOD REF: 16-S-2049. OCTOBER 5, 2016**



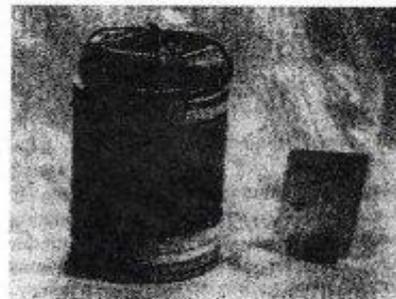
Explosive RF e-bomb



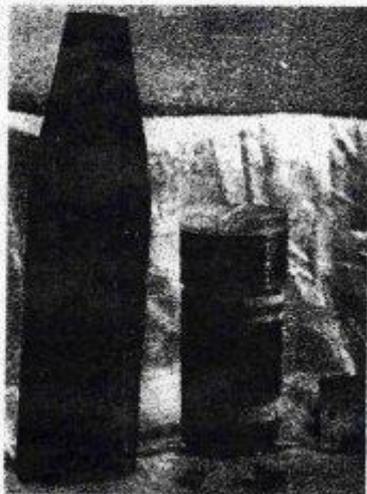
Russian Radiofrequency Munitions Devices



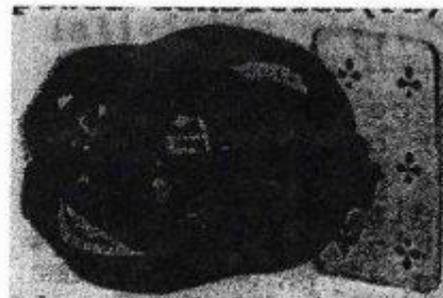
implosive magnetic frequency generator



explosive magnetic frequency generator



cylindrical shock wave source



spherical shock wave source



TECHNOLOGY CONCERNS



- ★ **Packing densities increasing**
- ★ **Component sizes in nanometers**
- ★ **Heat dissipation major problem**
- ★ **Voltage levels decreasing**
- ★ **Systems can be very vulnerable**
- ★ **COTS systems not shielded**





Solutions

- ★ **RF Weapons can be defeated**
- ★ **Know thy enemy**
- ★ **Requires cooperation**
IC, Military, DHS,
Private Sector



