The E-bomb - A Weapon of Electrical Mass Destruction

Bassem
Introduction:

- It is a Future weapon i.e. more suitable weapons than conventional weapon to achieve shock effect over large target sets with small attacking forces.

- Electromagnetic bombs (E-bombs) can perform such a role.

- The objective is to paralyze the enemy’s communication systems as quickly as possible.
E-bomb Technology Base:

- Power source - Explosively pumped Flux Compression Generator (FCG).
- FCG invented by Los Alamos Labs during the 1950s.
- FCG can produce tens of Mega Joules in tens to hundreds of microseconds.
- Peak current of an FCG is 1000 X that of a typical lightning stroke.
The Physics of the FCG:

- Fast explosive compresses a magnetic field

- FCG transfers mechanical energy into the magnetic field

- Peak currents of Mega Amperes demonstrated in many experiments
FCG start current is provided by an external source:

- High voltage capacitor bank
- MHD (magneto-hydrodynamic) device
- Any device that generates mega amperes current pulse.
Explosive Lens Plane Wave Generator

- Armature Tube
- Dielectric Structural Jacket
- Insulator Block
- Stator Winding
- Stator Input Ring
- Explosive (Machined PBX-9501)
- Stator Output Ring

TIME

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FCG Internals:

- Armature - Copper tube / fast explosive
- Stator - Helical heavy wire coil
- Initiator - Plane wave explosive lense
- Jacket - Prevents disintegration due magnetic forces
FCG Operation:

- External power source pumps FCG winding with start current.
- When start current peaks, explosive lense fired to initiate explosive burn.
- Explosive pressure expands armature and creates moving short
- Moving armature compresses magnetic field
High Power Microwave (HPM) Sources:

Higher lethality than low frequency FCG fields, many device types:

- Relativistic Klystrons
- Magnetrons
- Slow Wave Devices
- Virtual cathode oscillator (Vircator)
Coupling Modes:

**Front Door Coupling** through antennas.
- Destroys RF semiconductor devices in transmitters and receivers

**Back Door Coupling** through power/data cabling, telephone wiring
- Destroys exposed semiconductor devices
- Punches through isolation transformers.
Semiconductor Vulnerability:

- Semiconductor components using CMOS are destroyed by exposure to tens of volts of electrical voltage.
- High speed - high density semiconductors are highly vulnerable due small junction sizes and low breakdown voltages.
Damage Mechanisms:

- Low frequency pulses produced by FCG create high voltage spikes on fixed wiring infrastructure.
- Microwave radiation from HPM devices can couple directly through ventilation grilles, gaps between panels, poor interface shielding - producing a spatial standing wave inside the equipment cavity.
Example Scenario:

- Footprint has diameter of 400 - 500 meters with field strengths of kilovolts/meter.

Fig.- E-bomb lethal radius
Maximising Bomb Lethality:

Lethality is maximized by maximizing the power coupled into the target set.

- Maximize peak power and duration of warhead emission (using powerful FCG).
- Maximize coupling efficiency into target set.
HIGH POWER MICROWAVE E-BOMB – GENERAL ARRANGEMENT MK.84 PACKAGING WARHEAD USING VIRCATOR AND 2 STAGE FLUX COMPRESSION GENERATOR
Targeting E-bombs:

- Geographically fixed (buildings, radar and comm. sites) identified by conventional methods like satellite, radar etc.
- Radiating mobile / hidden targets (ships, mobile air defence equipment) detected using ESM (electronic support measure).
- Non radiating mobile / hidden targets - use Unintentional Emissions (UE).
Delivery of E-bombs:

- Missile installations must supply 100% of weapon priming energy from own supply.
- Bomb installations - weapon can be precharged before release from aircraft.
LETHAL FOOTPRINT OF LOW FREQUENCY E-BOMB IN RELATION TO ALTITUDE
Defenses Against E-bombs:

- Destroy the delivery vehicle or launch platform
- Electromagnetically harden important assets
- Hide important assets
Vulnerability Reduction (Hardening):

- Convert computer rooms into Faraday cages.
- Use optical fibers for data.
- Isolate power feeds with transient arrestors.
Military Applications of the E-bomb

Doctrine and Strategy
Electronic Combat

- The objective is to paralyze the opponent’s communication systems as quickly as possible.
- The E-bomb enables rapid attrition of enemy electronic assets over large areas.
- The E-bomb offers important force multiplication effects compared to the use of conventional weapons.
E-bomb Advantages in Strategic Warfare

- Not lethal to humans.
- Negligible collateral damage.
- No mass media coverage of bombing casualties (broadcast equipment destroyed) will reduce the threshold for the use of strategic air power and missile forces.
Punitive Missions

- The E-bomb is a useful punitive weapon as it can cause much economic and military damage with no loss of civilian life.

- E-bombs could be profitably used against countries which sponsor terrorism.
Conclusions:

- E-bomb is a WEMD.
- High payoff in using E-bombs against fundamental infrastructure, resulting in substantial paralysis.
- E-bombs will become a decisive capability in Strategic Warfare and Electronic Combat.
- E-bombs are a non-lethal weapon.
- The critical issues for the next decade are the deployment of E-bombs and the hardening of fundamental infrastructure.