UN / UAE HIGH LEVEL FORUM

SPACE AS A DRIVER
FOR SOCIO-ECONOMIC SUSTAINABLE DEVELOPMENT

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DEW & KINETIC | THE IMPACT OF NEW WEAPONRY SYSTEMS ON THE SPACE CRITICAL INFRASTRUCTURE

AN EARLY WARNING ON THE NEW THREATS FOR SPACE CRITICAL INFRASTRUCTURE:

1. DIRECTED ENERGY SYSTEMS (DEW),

2. KINETIC WEAPONS,

3. CYBER TERRORISM

USING A UNIQUE LANGUAGE ON DIRECTED ENERGY WEAPONS – DEW

- **DEW : A SYSTEM USING D.E. PRIMARILY – TO:**
  - DAMAGE, DISABLE OR DESTROY ENEMY EQUIPMENT, FACILITIES AND/OR PERSONNEL,

or

  - GENERATE COUNTERMEASURES, PROTECTION AND AVOIDANCE AGAINST VARIOUS THREATS.

(1) US ARMY FIELD MANUAL "ELECTRONIC WARFARE IN OPERATIONS" (FM3-36, Feb. 2009)

DIRECTED-ENERGY WEAPONS - DEW (III)

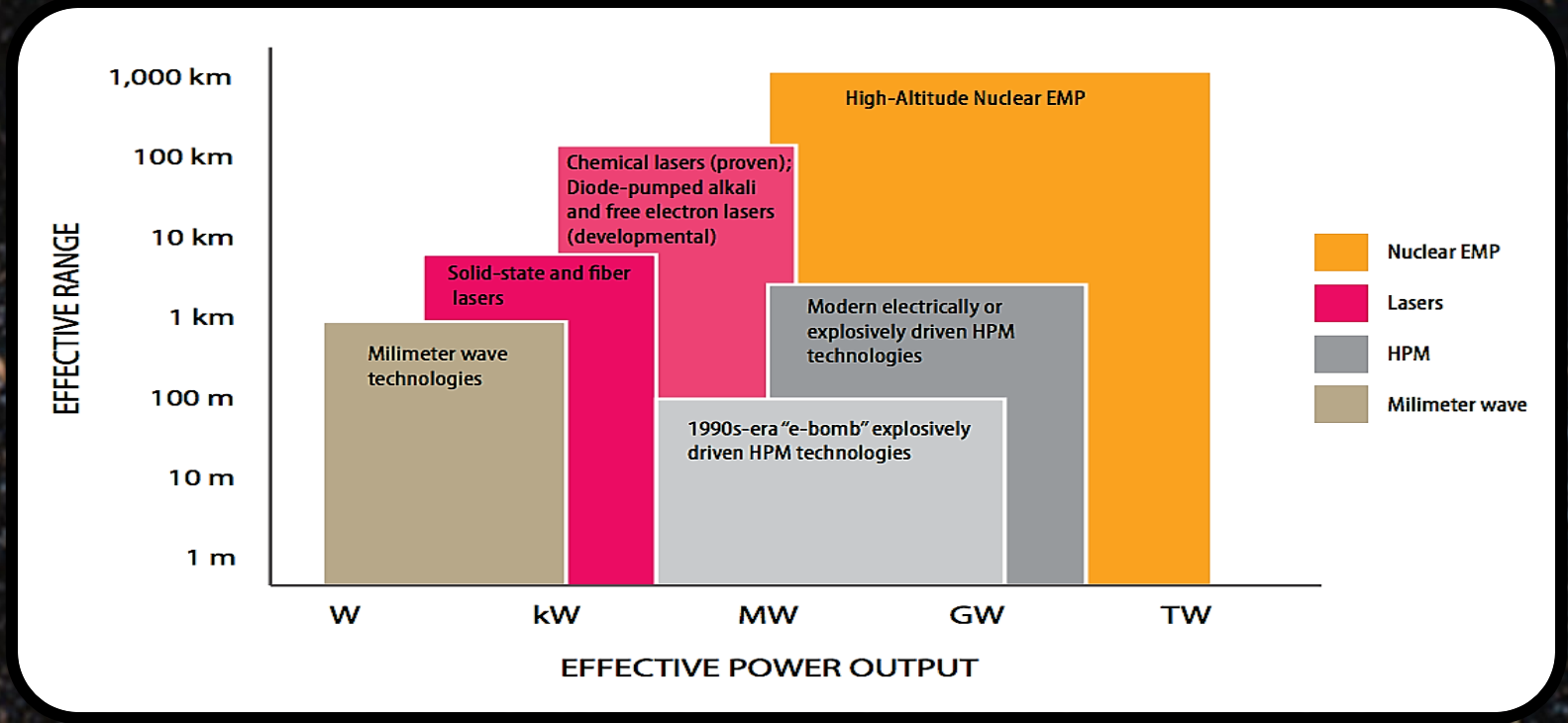


FIG. 1: EFFECTIVE RANGE vs. EFFECTIVE POWER OUTPUT for VARIOUS DEW

THE NATURE AND FORM OF LASER AND RF WEAPON EFFECTS VARY CONSIDERABLY ACCORDING TO SPECIFIC WEATHER CONDITIONS , ATMOSPHERIC EFFECTS, WEAPON EMPLOYMENT ALTITUDE AND OTHER VARIABLES

[2] Dr. Jason. D. ELLIS: "DIRECTED – ENERGY WEAPONS: PROMISE AND PROSPECTS". Center for A New American Security, April 2015.
[3] Dr. Jason D. Ellis estimation based on available DoD and other public information
[4] Dave Majumdar: "Air Force Seeks Laser Weapons for Next Generation Fighters," news.usni.org, Nov. 2013

CSI DEPENDENCY ON NETWORK-BASED SYSTEMS

- AFTER MORE THAN 3 DECADES THE DEW SYSTEMS ARE FINALLY COMING OF AGE FOR BATTLEFIELD USE.
- THE LEVEL OF VULNERABILITY OF CSI IS DEPENDENT ON :
  - TYPE OF ATTACK
  - SCOPE OF ATTACK;
  - TIME OF ATTACK;
  - DURATION OF OUTAGE.

→

1. D.E.
   - LASER - HEL
   - EMP
   - μWAVES-HPM
2. KYNETIC
3. CYBER

WHAT DO MILITARY LEADERS EXPECT FROM DEW? (I)

1. DEW POTENTIAL - A CERTITUDE, ENABLING HIGH-LEVEL DEFENSIVE & OFFENSIVE NON-KINETIC ATTACK OPTIONS
2. TO SERVE AS COST-EFFECTIVE FORCE MULTIPLIERS, OFFERING A GENERALIZED COST OF USD 1 TO USD 10 PER SHOT
3. TO BE ON CALL, CAPABLE OF RAPID AND SUSTAINED OPERATION.

WHAT DO MILITARY LEADERS EXPECT FROM DEW? (II)

4. TO BE PRECISION - EFFECT INSTRUMENTS, A NON-KINETIC FORM OF JOINT FIRES;

5. MODERN HEL & HPM SYSTEMS ARE BEST SUITED FOR DEFENSIVE SPACE MISSIONS;

6. LONGER - TERM ASPIRATIONS EXTEND TO OFFENSIVE STRIKE SPACE MISSIONS.

D E W - THE 8 MAJOR REQUESTS (I)

1. TO FIT & OPERATE FROM A VARIETY OF PLATFORMS;
2. TO BE SCALABLE, OFFERING BOTH HIGH AND LOW POWER OUTPUT;
3. TO DEMONSTRATE THE ABILITY TO OPERATE EFFECTIVELY ON A WIDE RANGE OF FREQUENCIES;
4. TO BE COMPACT AND HIGHLY EFFICIENT, TO MINIMIZE POWER, COOLING AND OTHER SYSTEMS

D E W – THE 8 MAJOR REQUESTS (II)

5. TO FEATURE MODULAR DESIGNS, THAT ARE ABLE TO ACCEPT VARIOUS MISSIONS;

6. TO REQUIRE LITTLE TRAINING OR SPECIAL HANDLING;

7. TO HAVE A LIGHT LOGISTIC TAIL AND CONSUMMABLES FOOTPRINT;

8. TO BE ON CALL, CAPABLE OF RAPID AND SUSTAINED OPERATION.

HIGH ENERGY LASERS - H E L

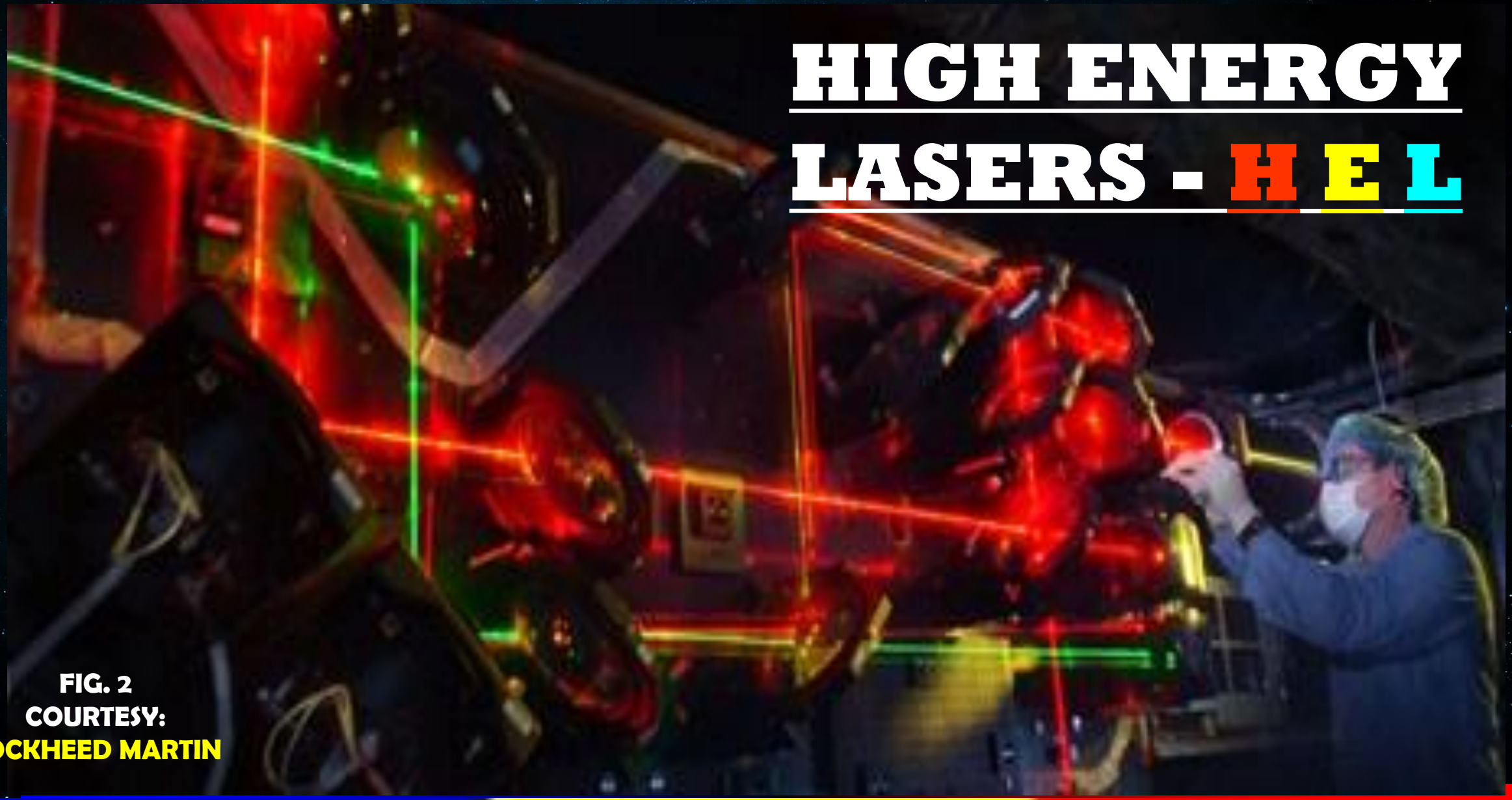


FIG. 2
COURTESY:
LOCKHEED MARTIN

HIGH ENERGY LASER WEAPON – HEL (I)

U.S. DEFENSE SCIENCE BOARD: "HIGH - ENERGY LASERS HAVE THE POTENTIAL TO CHANGE FUTURE MILITARY OPERATIONS IN DRAMATIC WAYS"

- ❑ INITIAL: GROUND-BASED TESTING OF MW-CLASS CHEMICAL LASER SYSTEM FOR ANTI-MISSILE DEFENSE. PROGRAM CANCELLED (CAN NOT FIT ON SMALLER PLATFORMS, USE OF HAZARDOUS MATERIALS).
- ❑ ALL ACTUAL R&D ACTIVITIES FOCUSED ON SOLID STATE LASERS: ELECTRICALLY DRIVEN, TIPICALLY MODULAR AND SCALABLE.

HIGH ENERGY LASER WEAPON – HEL (II)

- FREE - ELECTRON LASER (FAL) AND DIODE-PUMPED ALKALI LASER (DPAL) MAY BE ABLE TO ACHIEVE MW - CLASS LASERS (30 - 35 % EFFICIENCY) FOR BATTLEFIELD APPLICATIONS USING "SPECTRAL BEAM COMBINING"
- USING THIS NEW TECHNOLOGY YOU CAN USE AS MANY FIBER LASERS AS YOU WANT, COMBINING THEM INTO A SINGLE BEAM.

HIGH ENERGY LASER WEAPON – HEL (III)

- AT HIGHER POWER LEVELS, LASERS CAN CUT OR PENETRATE STRUCTURES OF CSI. THIS CAN BE USED, FOR EXAMPLE, TO BLIND SATELLITES' SENSORS, DESTROY MUNITION DEPOTS OR NEUTRALIZE UAVs.
- LOGISTICAL ADVANTAGE: AS LONG AS THE PLATFORM IS SUPPLIED WITH SUFFICIENT POWER, THE WEAPON REMAINS COMBAT CAPABLE. THE AMERICANS CALL THIS A "DEEP MAGAZINE".
- THE WEAPON MUNITIONS – NO NEED TO BE STORED, TRANSPORTED OR GUARDED.

HIGH ENERGY LASER WEAPON – HEL (IV)

- EVERY SCENARIO SHOULD BE CONSIDERED INDIVIDUALLY SO AS TO DETERMINE:

(1) HOW MUCH TIME IS AVAILABLE TO COMBAT AND DISTROY A TARGET ?

(2) WHAT POWER LEVEL IS REQUIRED ?

- AGAINST MORTAR SHELLS: 100 KW POWER CLASS;
- TO COMBAT AIRCRAFTS: A POWER CLASS SIGNIFICANTLY ABOVE 200 KW (SHOOTING RANGE > 4 KM).

HIGH ENERGY LASER WEAPON – HEL (V)

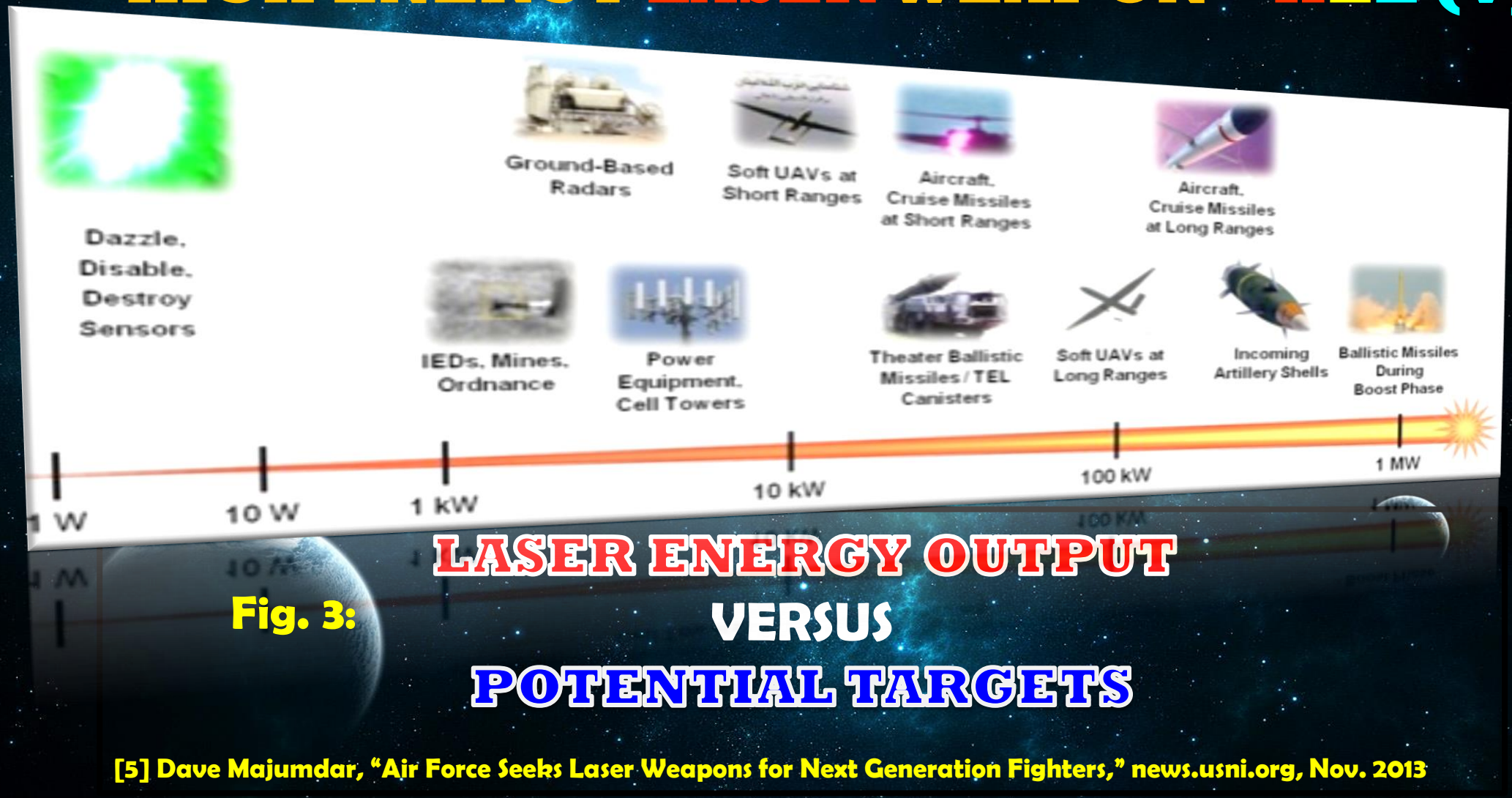


Fig. 3: LASER ENERGY OUTPUT VERSUS POTENTIAL TARGETS

[5] Dave Majumdar, "Air Force Seeks Laser Weapons for Next Generation Fighters," news.usni.org, Nov. 2013

HIGH ENERGY LASER WEAPON – HEL (VI)

- **LASER WEAPONS ALLOW:**
  - EXTREMELY HIGH PRECISION ON TARGET;
  - HIGH MULTI-TARGET CAPABILITY;
  - CAN SWITCH VERY QUICKLY BETWEEN TARGETS.
- THE COMBAT ENGAGEMENT COSTS ARE EXTREMELY LOW, THE ONLY ONE ARISING FROM ELECTRICITY GENERATION (< 1€).
- SUPPORTING THE SCENARIOS WHERE THE NOISELESSNESS REPRESENT A MAJOR ADVANTAGE

HIGH ENERGY LASER WEAPON – HEL (VII)

- LASER WEAPONS MAKE POSSIBLE THE LIMITATION OF COLLATERAL DAMAGE SIGNIFICANTLY.
- LASERS FLEXIBILITY IS ALSO UNIQUE: CAN BE SWITCHED EXTREMELY QUICKLY FROM A LOW-INTENSITY INTERFERENCE MODE TO A HIGH-INTENSITY NEUTRALISATION MODE
- USUALLY, HEL MANUFACTURERS ARE USING THE 10 KW CLASS STEEL PLATES CUTTING LASER USED BY SHIPYARDS.

ELECTROMAGNETIC PULSE EMP AS DEW (I)

- AN ELECTROMAGNETIC PULSE (EMP) IS THE BURST OF ELECTROMAGNETIC RADIATION CREATED WHEN A NUCLEAR WEAPONS DETONATED OR WHEN A NON-NUCLEAR EMP WEAPON IS USED.

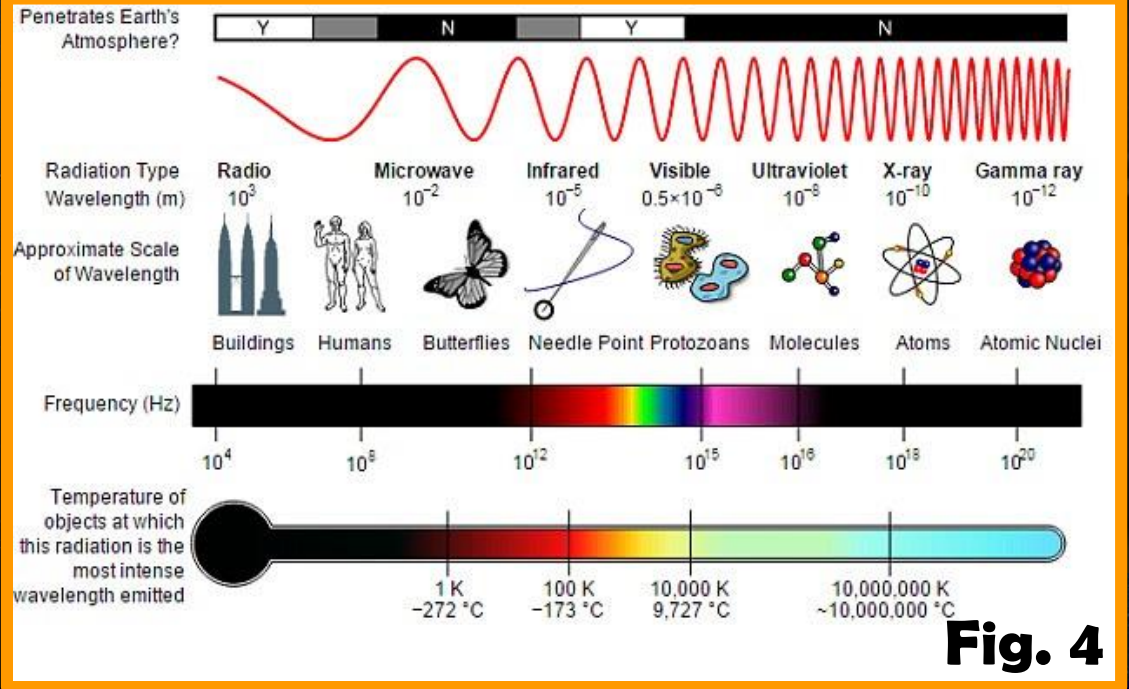


Fig. 4

- EMP's CAN BE HIGH FREQUENCY, SIMILAR TO A FLASH OF LIGHTNING OR A SPARK OF STATIC ELECTRICITY OR LOW FREQUENCY SIMILAR TO AN AURORA - INDUCED PHENOMENON.

ELECTROMAGNETIC PULSE EMP AS DEW (II)

- EMPs CAN SPIKE IN LESS THAN A NANOSECOND OR CAN CONTINUE FOR LONGER THAN 24 HOURS, DEPENDING ON ITS SOURCE.
- THE CONSEQUENCES OF AN EMP RANGE FROM PERMANENT PHYSICAL DAMAGE TO TEMPORARY SYSTEM DISRUPTIONS AND CAN RESULT IN FIRES, ELECTRIC SHOCKS TO PEOPLE & CRITICAL SERVICE OUTAGES.

ELECTROMAGNETIC PULSE EMP AS DEW (III)

- THERE ARE 4 GENERAL CLASSES OF EMPs:

1. HIGH ALTITUDE NUCLEAR EMP, WHICH RESULTS FROM A NUCLEAR DETONATION TIPICALLY 25 KM OR MORE ABOVE THE EARTH'S SURFACE AND HAS THE POTENTIAL FOR WIDE GEOGRAPHIC EFFECTS.

2. SOURCE REGION NUCLEAR EMP CREATED WHEN A NUCLEAR WEAPON DETONATES AT LOWER ATMOSPHERIC ALTITUDES THAT AFFECT A MORE LIMITED GEOGRAPHIC AREA.

Sources:
[6] Adapted from Brandon Wales, statement before the Subcommittee on Cybersecurity, Infrastructure Protection and Security Technologies, Committee on Homeland Security, U.S. House of Representatives, September 12, 2012;
[7] John A. Brunderman, High Power Radio Frequency Weapons: A Potential Counter to U.S. Stealth and Cruise Missile Technology (Maxwell Air Force Base, AL: Air University, December 1999).
[8] Philip E. Nielsen, Efects of Directed Energy Weapons (Washinaton: National Defense University Press, 1994), 206-61.

ELECTROMAGNETIC PULSE EMP AS DEW (IV)

3. SYSTEM - GENERATED NUCLEAR EMP, WHICH ORIGINATES FROM A NUCLEAR WEAPON DETONATION ABOVE THE ATMOSPHERE THAT SENDS OUT DAMAGING X-RAYS THAT AFFECT SPACE SYSTEMS (RATHER THAN EARTH - BASED INFRASTRUCTURE)

ELECTROMAGNETIC PULSE EMP AS DEW (V)

4. NON-NUCLEAR EMP, GENERATED BY EXPLOSIVELY - DRIVEN OR ELECTRICALLY - DRIVEN RF WEAPONS WITH EFFECTS ON ELECTRONIC COMPONENTS, SYSTEMS AND NETWORKS.

ACCORDING WITH THE LAST R&D RESULTS, WE CAN IDENTIFY 2 MAJOR METHODS TO GENERATE EMP's:

DEVICES & METHODS TO CREATE EMP EFFECTS IN SPACE

1. EMP GENERATED BY A NUCLEAR DETONATION - CAN RADIATE AT LONG DISTANCES, ESPECIALLY WHEN DETONATION OCCURS AS AN AIR BURST.

- WHILE AN EMP EFFECT DUE TO THE DETONATION OF A NUCLEAR MINIBOMB MAY BE LIMITED TO A FINITE AREA, LARGER DEVICES MAY GENERATE AN EMP WITH SUBSEQUENT EFFECTS AND "ELECTRONIC KILL" CAPABILITY FOR SEVERAL HUNDREDS OF KM AND IN ALL DIRECTIONS.

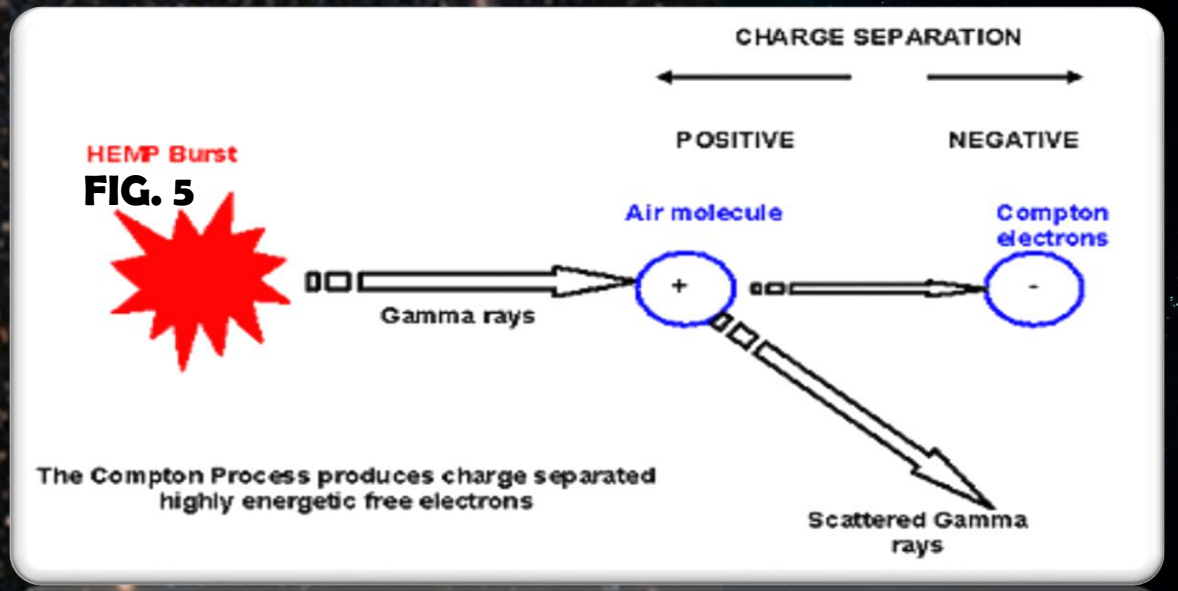
2. EMP GENERATED BY A FLUX COMPRESSION GENERATOR USED IN COMBINATION WITH A CONVENTIONAL HIGH ORDER EXPLOSIVES, WHICH IS LIGHT AND MAY BE EVEN OPERATED REMOTELY.

THE DEVICE IS SIMPLISTIC IN DESIGN AND OPERATION & REQUIRES CONVENTIONAL EXPLOSIVES, SUCH AS TNT, COPPER WIRING AND TUBING, AND CAPACITORS.

HEMP - HPM – HERF (I)

1. HEMP: HIGH ALTITUDE E.M. PULSE

- CREATED AS A BYPRODUCT OF A NUCLEAR EXPLOSION. A NUCLEAR DETONATION PRODUCES AN IMMEDIATE FLUX OF γ RAYS FROM THE REACTIONS WITHIN THE DEVICE.
- THROUGH A PHENOMENON KNOWN AS "COMPTON RECOIL" AND e^- SCATTERING, THE γ RAYS EXCITE MOLECULES OF AIR AT SOME DISTANCE FROM THE BLAST, WHICH THEN PRODUCE LARGE NUMBERS OF HIGH ENERGY FREE e^-.



HEMP - HPM – HERF (II)

- WHEN THIS OCCURS AT HIGH ALTITUDE, e^- ARE TRAPPED IN THE EARTH'S MAGNETIC FIELD, WHICH CREATES A COHERENT, OSCILLATING ELECTRIC CURRENT IN THE ATMOSPHERE.
- THIS IN TURN PRODUCES A HIGHLY CHARGED, RISING E.M. FIELD CALLED **HEMP**.

FIG. 46

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2. **HERF**: HIGH-ENERGY RADIO FREQUENCY

3. **HPM** : HIGH-POWERED MICROWAVES

ELECTRONIC EFFECTS THAT CAN BE GENERATED BY HERF

1. **UPSET**: TEMPORARY ALTERATION OF THE ELECTRICAL STATE OF ONE OR MORE NODES. NORMAL FUNCTION RESUMES ONCE A SIGNAL IS REMOVED (Ex.: JAMMING)
2. **LOCKUP**: COMPARABLE UPSET EFFECTS, BUT AN ELECTRICAL RESET IS REQUIRED AFTER THE SIGNAL CEASES (Ex.: COMPUTER REBOOT)
3. **LATCH-UP**: A SUPERIOR FORM OF LOCKUP - ELECTRIC POWER TO A NODE IS CUT OFF AND THE NODE CEASES TO FUNCTION (Ex.: A BLOWN FUSE)
4. **BURNOUT**: PHYSICAL DESTRUCTION OF A NODE (Ex.: A MELTED CIRCUIT BOARD)

[9] U.S. Air Forces Research Labs – "Classification of Electronic Effects generated by RF Systems" Manual, 2011

HIGH-POWER MICROWAVE ATTACKS (I)

- SECOND DIRECTED ENERGY WEAPON AGAINST SATELLITES: A DEVICE THAT PRODUCES HIGH-POWERED MICROWAVES (HPM) = E.M. WAVES WITH λ SHORTER THAN RF WAVES BUT CONSIDERABLY LONGER THAN VISIBLE LIGHT;
- COMMONLY USED BY RADARS.

(12) PHILIP E. NIELSE: Effects of Directed Energy Weapons, (National Defense University, 1994), http://www.ndu.edu/ctnsp/directed_ energy.ht.
(13) MICHAEL J. MUOLO et al.: Space Handbook, Volume 2 - An Analyst's Guide, (Maxwell Air Force Base, AL: Air University Press, December 1993);
(14) Office of technology Assessment, Anti-Satellite Weapons, Countermeasures, and Arms Control (Washington, DC: Government Printing Office, 1985);

HIGH-POWER MICROWAVE ATTACKS (II)

- THE METAL CASING OF THE SATELLITE ACT AS SHIELD PROTECTOR OF ITS ELECTRONIC COMPONENTS AGAINST E.M. ATTACKS;
- IN BACK DOOR ATTACKS, MICROWAVES ENTER THE SATELLITE THROUGH SMALL SEAMS IN THE CASING OR GAPS AROUND ELECTRICAL CONNECTIONS.
- MICROWAVES INTERACT WITH AND DAMAGE A WIDE VARIETY OF ELECTRONICS INSIDE THE SATELLITES.

GENERATING HIGH-POWER MICROWAVE (I)

1. MAGNETO - HYDRODINAMIC GENERATOR TECHNOLOGY MHD. (RUSSIAN FAVOURITE SYSTEM)
   - ADVANTAGES: NOT POSSESSING MOVING PARTS AND COMPACTNESS.
2. HIGH POWER MICROWAVE HPM GENERATORS: MAY BE DEPLOYED IN ANY ENVIRONMENT, INCLUDING SPACE, FOR A VARIETY OF COMBAT, SABOTAGE AND TERRORIST OPERATIONS. ALSO KNOWN AS HIGH ENERGY RF WEAPON.

GENERATING HIGH-POWER MICROWAVES (II)

3. **VIRACTOR** - VIRTUAL CATHODE - RAY OSCILLATOR: THE MOST STRAIGHT-FORWARD HPM WEAPON – WHICH CAN:

- ❑ GENERATE A POWERFUL ELECTRON BEAM;
- ❑ FOCUSED ON AN ANODE WITHIN A TUBE;
- ❑ UTILIZED TO GENERATE HPM;
- ❑ EMISSION POWER: 170 KW TO OVER 40 GW IN THE RANGE OF MICROWAVE FREQUENCIES

HIGH-POWER MICROWAVE WEAPON

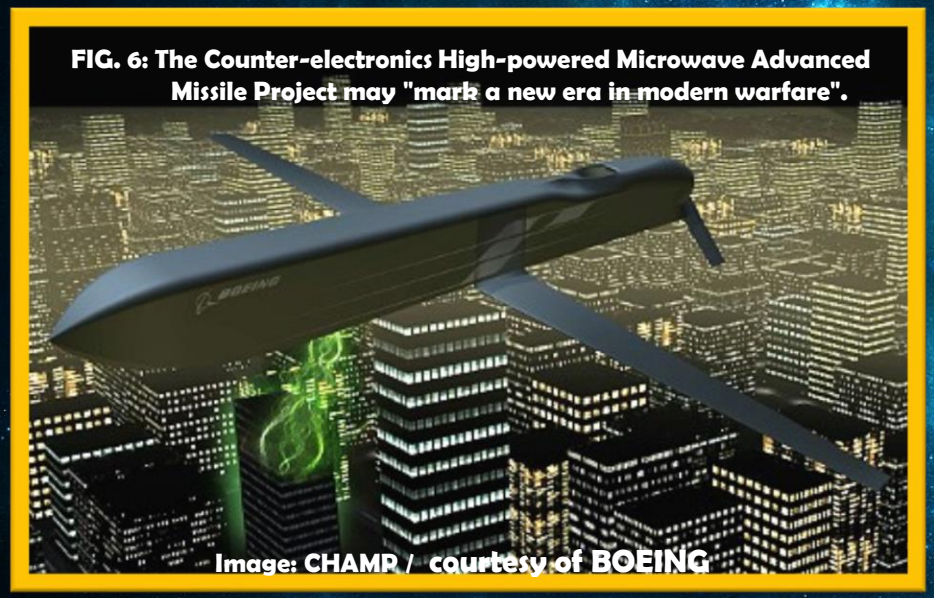


FIG. 6: The Counter-electronics High-powered Microwave Advanced Missile Project may "mark a new era in modern warfare".

Image: CHAMP / courtesy of BOEING

THIS TECHNOLOGY MAY BE USED TO RENDER AN ENEMY'S ELECTRONIC & DATA SYSTEMS USELESS EVEN BEFORE FIRST TROOPS OR AIRCRAFT ARRIVE.

FIG. 7: A NON-LETHAL COUNTER-PERSONNEL MILLIMETER WAVE **ACTIVE DENIAL SYSTEM** (USAF)

THIS DEW WEAPON USES ULTRA-HIGH FREQUEN-CY IMPULSES TO IMMO-BILISE MILITARY ELEC-TRONICS. THE GUN USES A 'REFLECTOR ANTENNA' TO FOCUS THE MICRO-WAVES CREATED BY A GENERATOR.

A 'TRANSMISSION SYSTEM' FIRES THE BEAMS TOWARDS THE TARGET.

IT WILL BE USED TO TARGET ENEMY DRONES AND APPA-RENTLY DE-ACTIVATES THE RADIOS OF UAVs & WARHEADS, CAUSING THEM TO LOSE CONTROL

THE 'DEATH RAY' CAN FRY ENEMY DRONES FROM HALF A MILE AWAY USING MICROWAVES

FIG. 8: RUSSIAN DEATH RAY

FIG. 9: RUSSIAN VERSION OF ACTIVE DENIAL SYSTEM

(11) https://youtu.be/v6RuM1UIjAU?t=2

(10) http://www.dailymail.co.uk/sciencetech/article-3838264/Russia-creates-death-ray-uses-microwaves-knock-enemy-drones-mile-away.html#ixzz4YFshhIUJ

Fig. 10

https://youtu.be/6rpO7lP_0yI?t=45

THE RAIL GUN

- RAILGUNS OR MASS DRIVERS HAVE MADE APPEARANCES IN "BABYLON 5" AS WELL AS "STARGATE ATLANTIS". EVEN BEFORE THAT, SCIENCE FICTION AUTHORS LIKE ARTHUR C. CLARKE AND ROBERT HEINLEIN DESCRIBED WEAPONS SIMILAR TO RAILGUN CONCEPT.

- WHILE WE ARE PROBABLY FEW DECADES AWAY FROM THE MILITARY OPERATIONS BASED ON THE LARGE SCALE USE OF DEW, ONE FUTURISTIC ARMAMENT HAS BECOME A REALITY:

THE RAILGUN!!!

THE LATEST KINETIC WEAPON - FROM THE NAVY INTO THE SPACE: "THE RAILGUN"

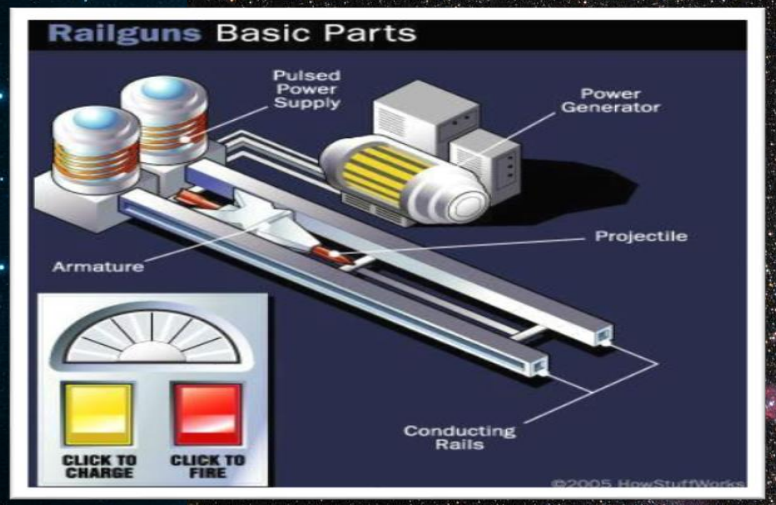


Fig. 11

THE RAILGUN USES THE **LORENTZ FORCE** TO PROPEL AN ARMATURE LOADED WITH A PROJECTILE, RATHER THAN EXPLOSIVES OR FLAMMABLE PROPELLANTS. **THE LORENTZ FORCE** IS A FORCE THAT A MAGNETIC FIELD APPLIES TO A CURRENT-CARRYING WIRE. HERE'S A DIAGRAM OF THE FORCES ON A RAILGUN:

THE DRIVING CURRENT PASSES BETWEEN THE RAILS THROUGH THE ARMATURE, WHICH GIANTIC CURRENT INDUCES A VERY LARGE MAGNETIC FIELD BETWEEN THE RAILS.

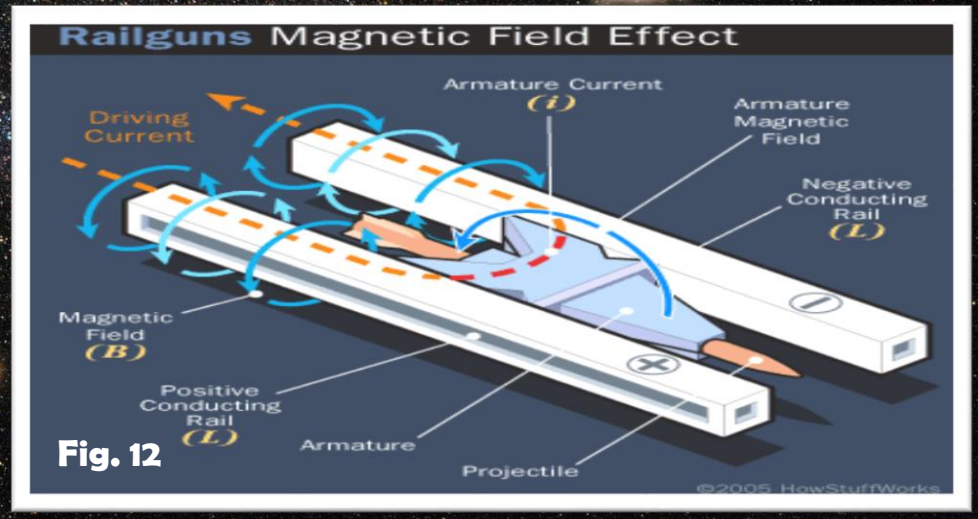


Fig. 12

HOW IT WORKS

- THE RAILGUN'S JOB IS TO FIRE THE BLASTED PIECE OF TUNGSTEN CARBIDE OUT OF ATMOSPHERE IN THE RIGHT DIRECTION.
- FROM THERE, IT'S UP TO THE PROJECTILE TO MAKE SURE IT LANDS IN THE RIGHT SPOT. AFTER IT DROPS BACK INTO THE ATMOSPHERE, THE PROJECTILE HAS A GPS SYSTEM AND THE FEATHERING AT THE BACK IS MOVABLE, WHICH ALLOWS THE PROJECTILE TO STEER ITSELF TO A PRECISELY - DEFINED GPS COORDINATE TARGET.
- GUIDANCE - GPS
- RANGE : +200 NM
- AVAILABLE ENERGY ON THE TARGET: 17 MJ

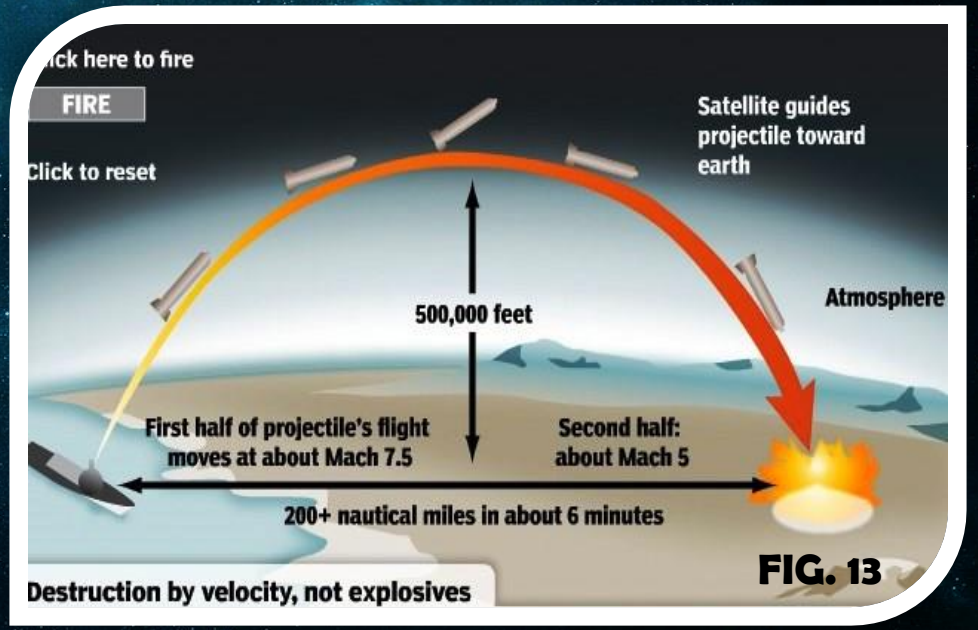


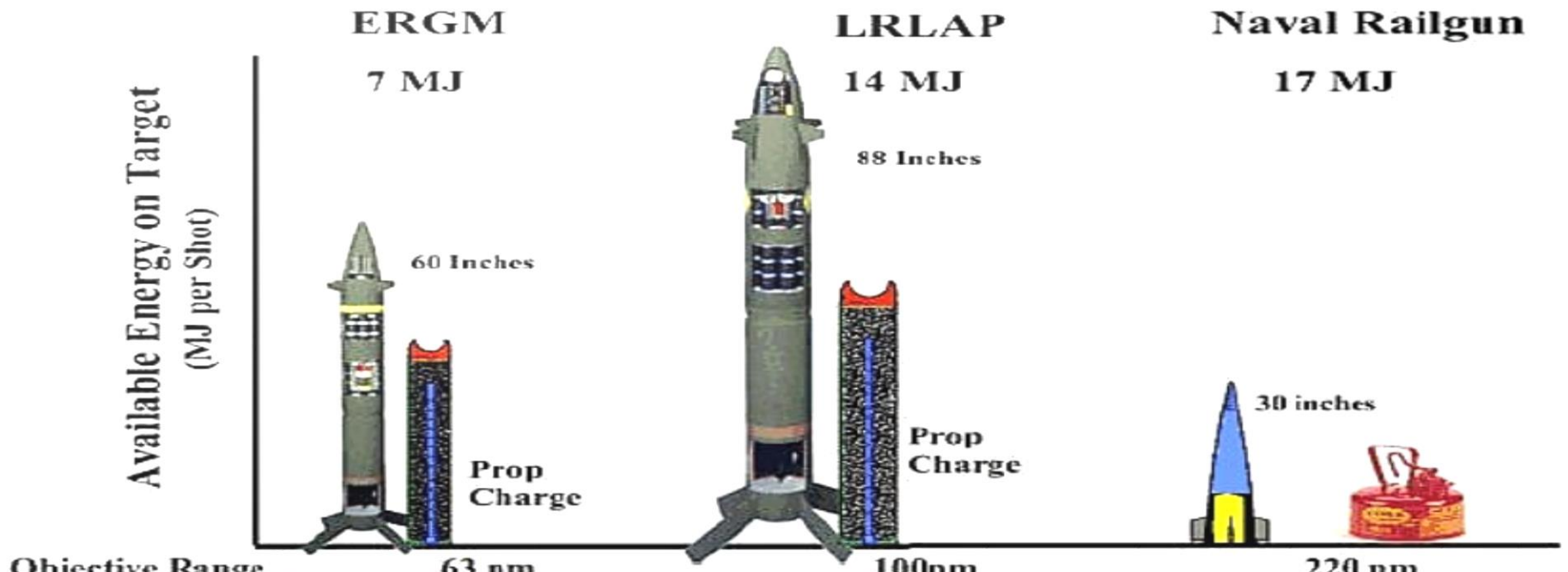
FIG. 13

https://youtu.be/6rpO7lP_0yI?t=45

NRBC

Projectile Comparisons
Available Energy on Target

FIG. 14



	ERGM	LRLAP	Naval Railgun
Objective Range	63 nm	100nm	220 nm
Flight Time	6 Minutes	6+ Minutes	6 Minutes
Weight	110 lbs + 40 lbs	260 lbs + 90 lbs	44 lbs + 3 gals
Warhead	Explosive	Explosive	Non-Explosive

Naval Research Advisory Committee

ERGM - Extended Range Guided Munition / LRLAP - Long Range Land Attack Projectile

ELECTRICAL ENERGY SOURCES & STORAGE WILL BECOME THE MOST IMPORTANT SUPPLIES FOR AN ARMY!

THE RAILGUN IN SPACE?

RAILGUNNING 4 SPACE GLORY!

YET, POSSIBLE APPLICATIONS FOR RAILGUNS GO WAY BEYOND HITTING TARGETS AT A DISTANCE, OR BRINGING DOWN ENEMY AIRCRAFTS. THEY COULD ALSO BE USED TO FURTHER SPACE EXPLORATION, OR EVEN ESTABLISH A SUCCESSFUL MINING OUTPOST ON THE MOON.

FOR INSTANCE, HERE ON EARTH, THE INSTRUMENTS COULD BE USED AS LAUNCH PADS FOR SMALL SATELLITES. ENCAPSULATED IN PROTECTIVE FAIRINGS, THE SPACECRAFT COULD BE LAUNCHED INTO LOW-EARTH ORBIT (LEO).

THEY WOULD BE PLACED DIRECTLY INTO ORBIT, ELIMINATING THE NEED FOR EXPENSIVE DELIVERY SYSTEMS THAT MAY BE PRONE TO FAILING IF A SIMPLE CIRCUIT GETS DAMAGED.

RAILGUNS APPLICATIONS SUPPORTING SPACE ACTIVITIES (II)

- THE DOWNSIDE IS THAT SATELLITE DESIGN PROCEDURES MAY NEED REPLACING, GIVEN THAT THE SPACECRAFT CURRENTLY PRODUCED ARE VERY DELICATE, AND COULD NOT POSSIBLY WITHSTAND THE ENORMOUS, SUDDEN ACCELERATION OF A RAILGUN BLAST.
- AN ADDITIONAL APPLICATION COULD BE MINING ON THE SURFACE OF THE MOON, AUGMENTING THE CAPABILITIES OF A MANNED COLONY. DUE TO THE THIN ATMOSPHERE AROUND OUR PLANET'S NATURAL SATELLITE, ESCAPING TO SPACE WOULD NOT BE TOO DIFFICULT.

RAILGUNS APPLICATIONS SUPPORTING THE SPACE ACTIVITIES (III)

- THE TASK WOULD BE MADE EVEN EASIER BY THE FACT THAT THE GRAVITATIONAL PULL OF THE MOON IS AROUND 6x LESS INTENSE THAN THAT OF OUR OWN PLANET, WHICH MEANS THAT OBJECTS ARE A LOT LIGHTER.

- SOME EXPERTS ALSO BELIEVE THAT RAILGUNS CAN BE INSTALLED ABOARD SPACECRAFT, ALLOWING THEM TO EITHER PROPEL THEMSELVES USING IT, OR LAUNCH SMALLER PAYLOADS INTO SPACE.

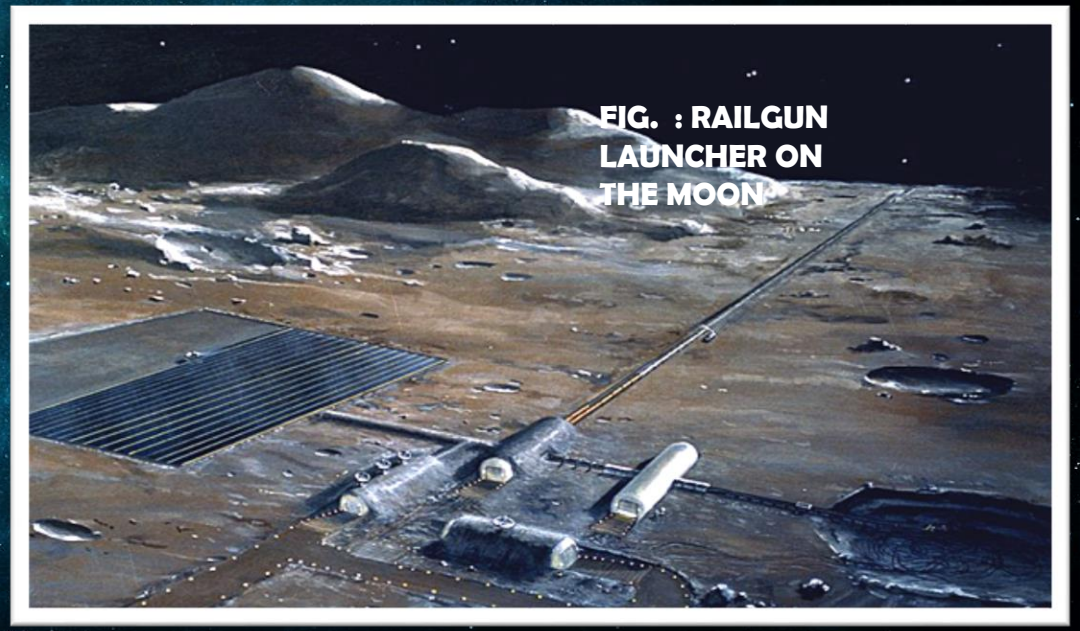


FIG. : RAILGUN LAUNCHER ON THE MOON

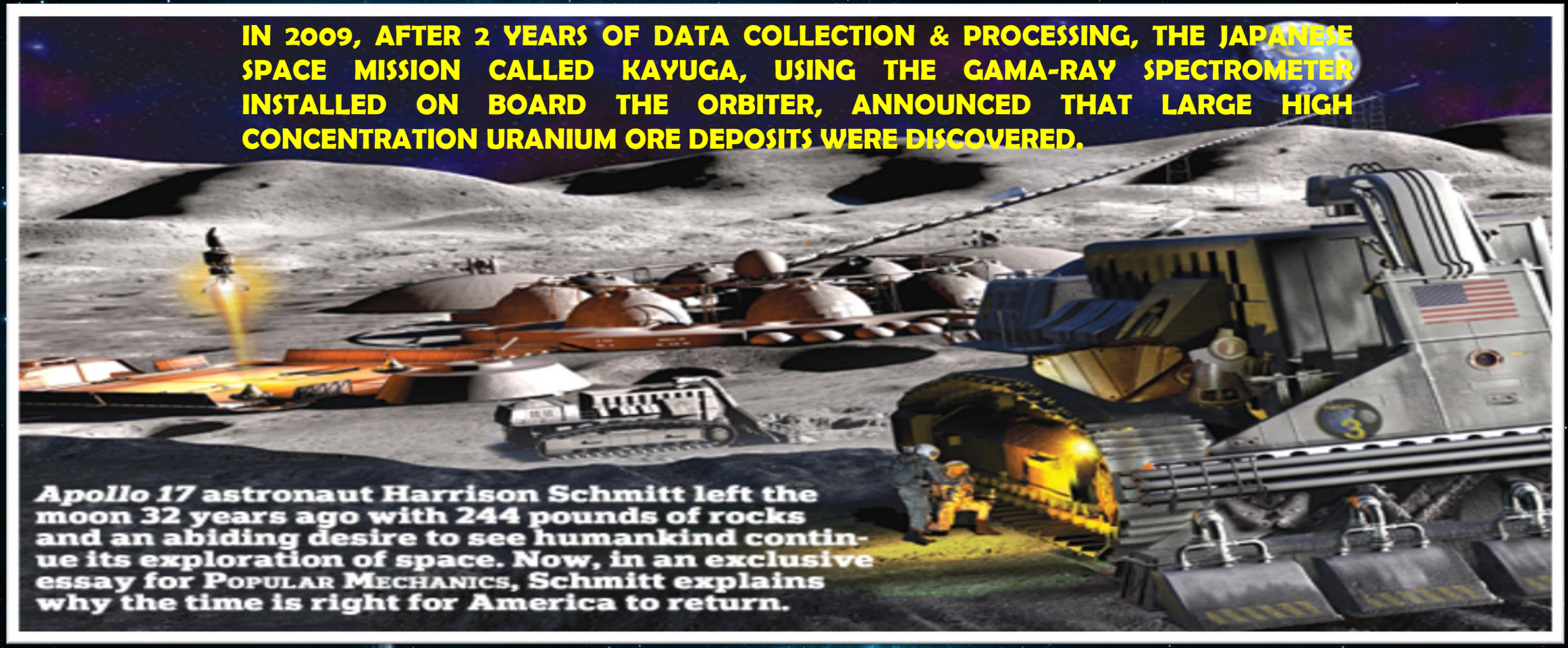


FIG. : ARTISTIC VIEW OF FUTURE MINING BASE ON THE MOON. ROBOTIC EQUIPMENT WOULD SCRAPE AND REFINE LUNAR SOIL. HELIUM-3 WOULD BE SENT TO EARTH ABOARD A FUTURE SPACE SHUTTLE OR PERHAPS BE SHOT FROM AN ELECTRIC RAILGUN.

From: POPULAR MECHANICS, Oct. 2004 – By: DR. FRANCK MARCHIS, SENIOR RESEARCHER AND CHAIR OF THE EXOPLANET GROUP, THE CARL SAGAN CENTER OF THE SETI INSTITUTE, MOUNTAIN VIEW, CA 94043

RAILGUNNING 4 A SAFE WORLD:

A SKY SENTINEL PROTECTING FREEDOM AND DEMOCRACY GLOBALLY!

INSTALLED ON BOARD OF A SPACE MISSION PLACED UNDER U.N. SECURITY COUNCIL AUTHORITY, THE RAILGUN CAN ACT AS A SENTINEL OF PEACE FOR THE FREE WORLD, READY TO INTERVENE AND STOP ANY TERRORIST ACTION IN EVOLUTION AND / OR TO SOLVE ASSYMETRICAL CONFLICTS GENERATED BY DICTATORIAL REGIMES.

NOTE: THIS PROPOSAL REPRESENTS THE PERSONAL OPINION OF THE AUTHOR AND DON'T BIND THE ROMANIAN SPACE AGENCY

SPACE AS A DRIVER
FOR SOCIO-ECONOMIC SUSTAINABLE DEVELOPMENT

THANK YOU FOR YOUR KIND ATTENTION !

General**(Ret.) Prof. Marius Eugen Opran
ROSA / EESC

SAMPLE OF NUCLEAR LAUNCH WHILE UNDER CYBER ATTAC

Yes, this is a doctored photo, used here
just to lighten a serious moment

http://www.armscontrolwonk.com/1955/missile-palooza

UN / UAE HIGH LEVEL FORUM