EMP: ENTERPRISE MANAGEMENT PROTOCOLS

WHICH NETWORK MANAGEMENT PROTOCOL WORKS BEST IN YOUR ENTERPRISE? THAT IS THE QUESTION!!

ElectroMagnetic Pulse & Coronal Mass Ejections (EMP & CME)

A DISCUSSION ON WHAT AN EMP IS AND HOW IT DIFFERS FROM CME'S PROTECTION FROM EMP/CME

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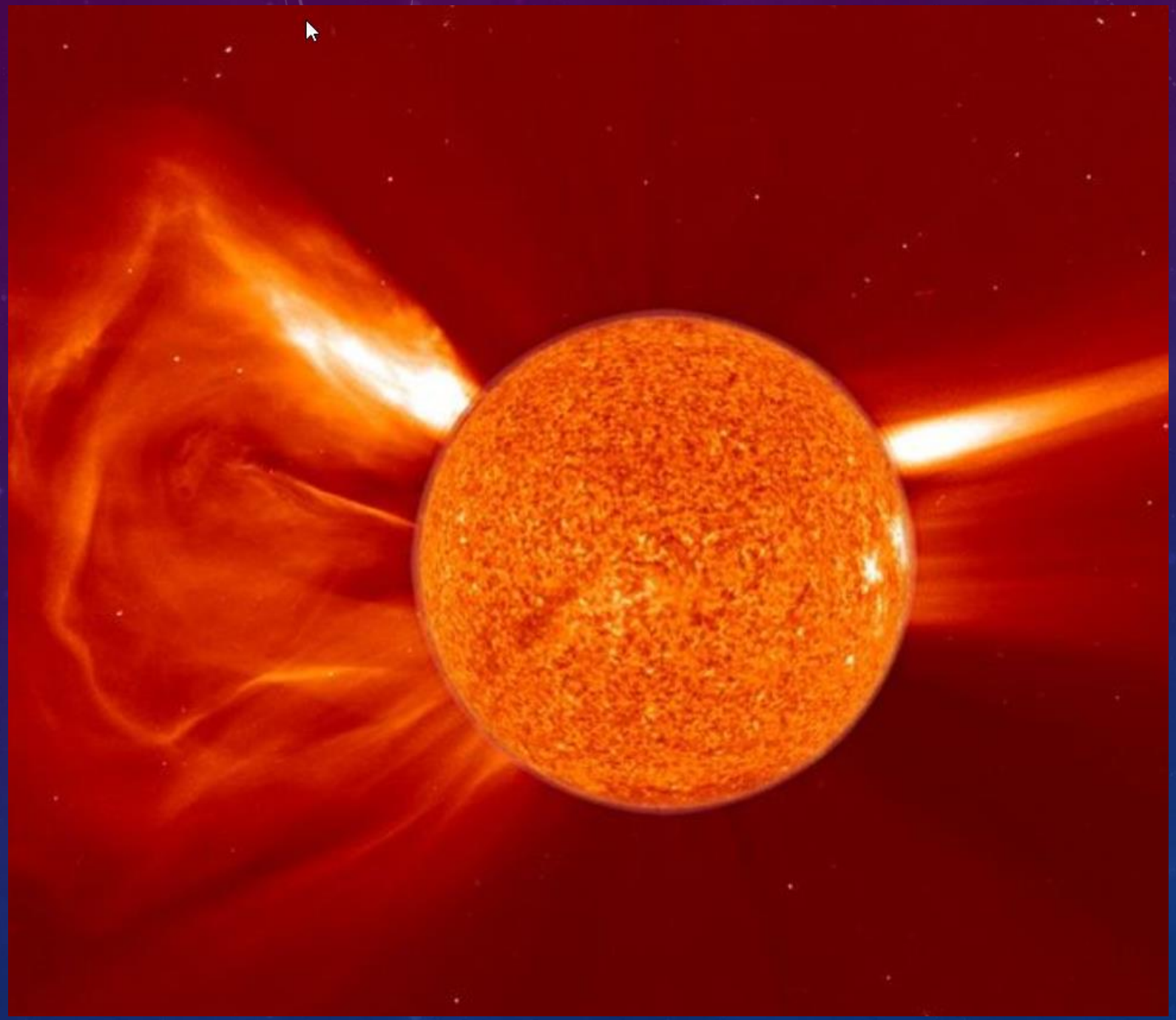
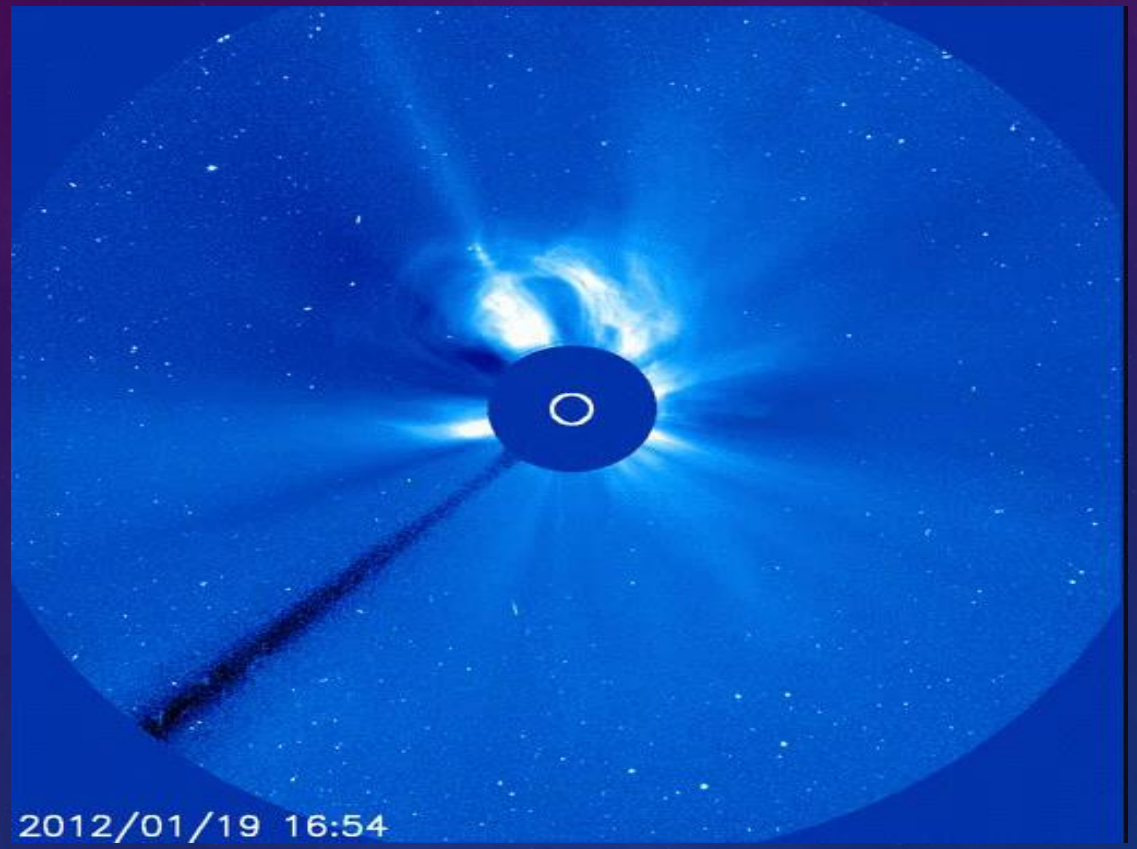
WHAT IS AN ELECTROMAGNETIC PULSE?

- An EMP is an ElectroMagnetic Pulse caused by a detonated nuclear weapon.
- An HEMP is similar but the nuclear device is detonated in the high altitude, some 150-300 miles above the earth's surface. This is known as a High-altitude ElectroMagnetic Pulse.
- There are three parts or kinds of "waves" that are produced during an EMP pulse.
- These waves are called E1, E2 and E3

WHAT IS A CORONAL MASS EJECTION?

- A Coronal Mass Ejection (CME) is a significant release of plasma and accompanying magnetic field from the solar corona.
- They often follow solar flares and are normally present during a solar prominence eruption.
- The plasma is released into the solar wind and if directed towards the earth, produces E3 type of waves.

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WHAT IS THE DIFFERENCE BETWEEN AN EMP AND CME?

- Since both types of events produce electromagnetic waves, only the EMP (and HEMP) produce E1 & E2 waves.
- Both EMP's and CME's produce E3 waves.
- Both types of events can bring the electrical grid completely down… requiring potentially years to rebuild.

E1, E2, & E3 WAVE DIFFERENCES

- What are the E1, E2 and E3 waves?
  - The following graph describes the three parts to an EMP pulse.
  - The generic waveforms for the full HEMP waves are showing a double logarithmic scale showing both INDUCED voltage amplitude per meter versus TIME in seconds.

$10^5 = 100{,}000$

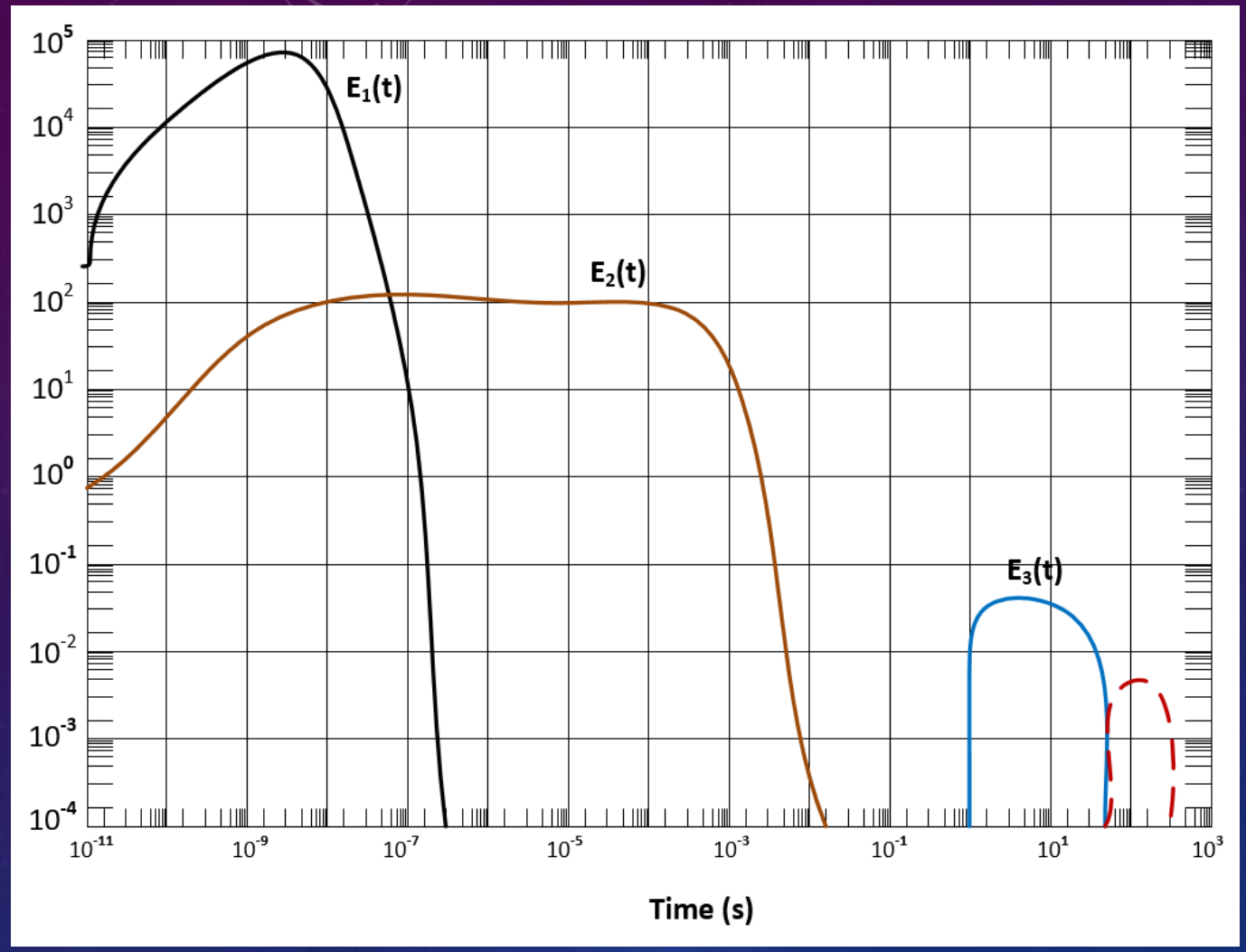
$10^3 = 1{,}000$

Volts/meter

$10^0 = 1$

$10^{-3} = 0.001$

$10^{-4} = 0.0001$
1 one ten-thousandth



This data is for an EMP produced by nuclear detonations in the 80's and 90's.

Today countries have thermonuclear devices 10 times more powerful.

$10^{-11} = 0.00000000001$
$1/100^{th}$ of a nano-second

$10^{-9} = 0.000000001$
1 one-billionth
1 nano-second

Duration

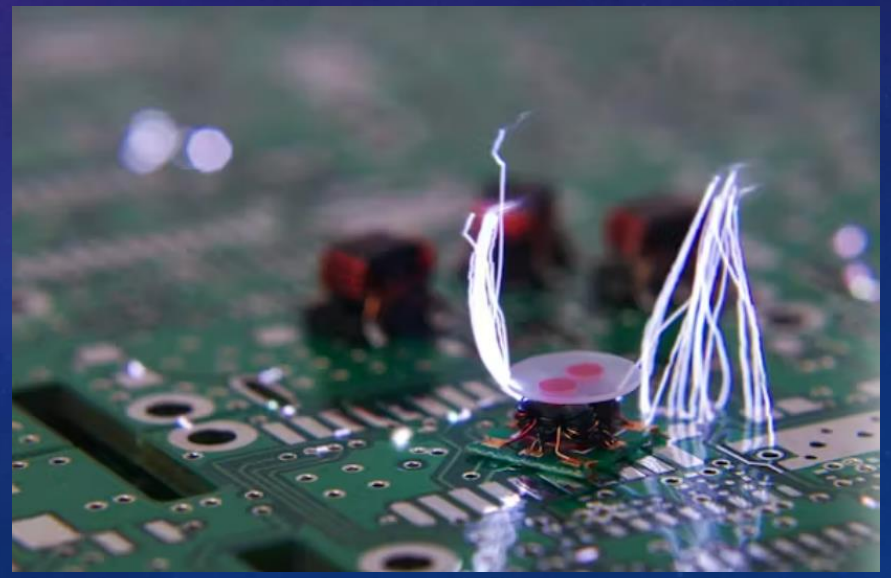
Prefix	Abbreviation	Relationship to Basic Unit	Exponential Relationship to Basic Unit
mega	M	1,000,000 x basic unit	10^6 x basic unit
kilo	k	1,000 x basic unit	10^3 x basic unit
deci	d	1/10 x basic unit	10^{-1} x basic unit
centi	c	1/100 x basic unit	10^{-2} x basic unit
milli	m	1/1000 x basic unit	10^{-3} x basic unit
micro	μ	1/1,000,000 x basic unit	10^{-6} x basic unit
nano	n	1/1,000,000,000 x basic unit	10^{-9} x basic unit
pico	p	1,1000,000,000,000	10^{-12} x basic unit

THE E1 PULSE

- The initial (***early time***) E1 wave is what destroys electrical transmission lines, transformers, electronic and electrical equipment WHETHER CONNECTED TO THE GRID OR NOT.
- It has the wave shape of a double exponential with an extremely fast rise time of about 5 nanoseconds, and a mid-level decay time of 150 nanoseconds.
- It can induce up to 50,000 volts-per-meter^2 on electrically conductive material at ground level.

THE E1 PULSE

- E1 produces the Compton effect and the resulting current is called the "Compton current".
- The stripped electrons move ~90% of the speed of light.
- This produces a large radial pulse of electric current.



THE E2 PULSE

- The initial part of the E2 (***intermediate-time***) wave overlaps the E1 curve and resembles a lightning strike lasting one to two seconds.
- It can induce about 100 volts/meter^2 in conductive material.
- According to the United States EMP Commission, the main potential problem with the E2 component is the fact that it immediately follows the E1 component, which may have damaged the devices that would normally protect against E2.
- The E2 produces quasi-DC currents on AC equipment (power grid transformers).

THE E2 PULSE

DC CURRENT ON AC EQUIPMENT?

WHAT COULD GO WRONG?

THE E3 PULSE

- The E3 (***late-time***) wave resembles an energy surge lasting several minutes.
- This surge can affect electrical equipment if connected to the power grid.
- This is the portion of the EMP that mimics a CME.
- The E3 wave is easiest to protect against (normally).

THE LAST TIME WE HAD A SIGNIFICANT CME

- The 1859 Carrington Event – Largest known recorded CME
- Induced current made it possible to work the telegraph WITHOUT any manmade power supply for hours after the event.

THE EMP CAUSE FOR ALARM

Our fun, secure, and almost worry free life in America would cease!

THE EMP CAUSE FOR ALARM

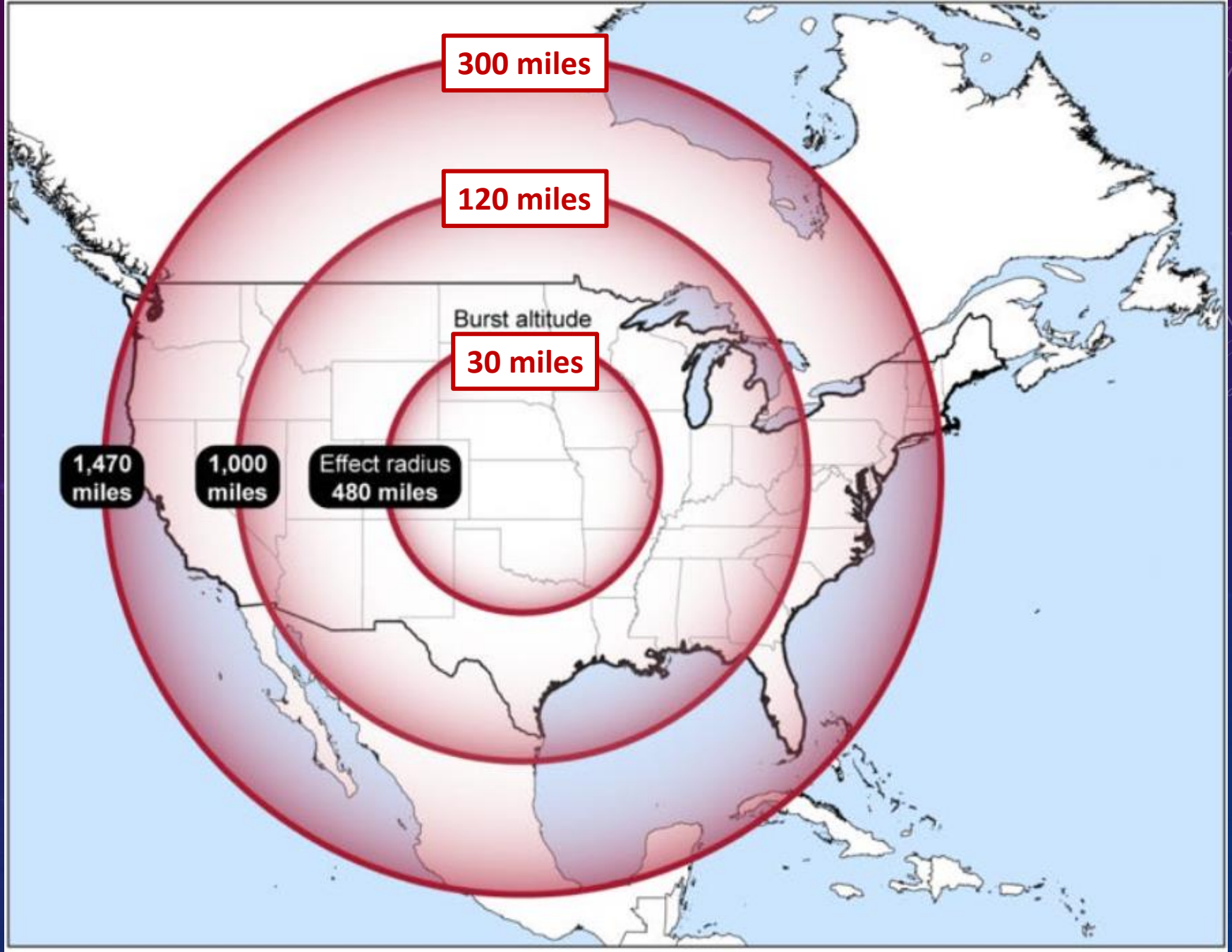
- Dr. William R. Graham, former science advisor to President Ronald Reagan and chairman of: “The COMMISSION TO ASSESS THE THREAT TO THE UNITED STATES FROM ELECTROMAGNETIC PULSE (EMP) ATTACK”, testified to congress that, within just one year of an attack, **70** to **90** percent of Americans would be dead from starvation, disease or from freezing to death and our civilization would be set back at least to the 1800s.

NATIONAL RECOVERY FOLLOWING AN EMP (OR CME) EVENT

- Recovery from an EMP attack could be very slow.
- We rely on outside sources for our inside infrastructure!
- Who thought that was a good thing?!!

EMP COVERAGE AREA

- The area of EMP coverage depends on the altitude which the detonation occurs.
- Even though it can be expected that not all EMP strikes will be successful or that they will be detonated directly overhead, one should plan as though they will be.



Source: Gary Smith, "Electromagnetic Pulse Threats," Testimony before the House Committee on National Security (July 16, 1997); MapInfo (map). | GAO-18-67

MIS-INFORMATION GALORE!

- There are dozens and dozens of YouTube videos that discuss EMP's.
- Some sources are from people who are famous.
- Some sources are from people who have believed these uninformed sources and continue to propagate misinformation.
- An example highlights this…

DENNIS QUAID & TUCKER CARLSON INTERVIEW

As well intentioned as Dennis is, he is a Hollywood actor and not the right person to be discussing EMP's or CME's.

DENNIS QUAID & TUCKER CARLSON INTERVIEW

- 2:40 – "…they predict within a year about 90% of the population would be dead from starvation and disease…"
- Dennis is conflating CME's with EMP's.
- "Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack"
- Although CME's would cause much damage to the electrical grid, it does not cause damage like EMP's cause damage.
- The good thing that Dennis has done is to produce awareness!!

HOW DO YOU PROTECT YOURSELF AGAINST AN (H)EMP OR CME?

- Well, you can’t.
- Just kidding ☺
- $$$$$ - Soooo, you must identify critical devices
- These critical items must remain operable.

HOW DO YOU PROTECT YOURSELF AGAINST AN (H)EMP OR CME?

- Your list of critical devices will be different than my list.
- Much will (must) be sacrificed.
- Large items including fridges, air conditioners, and vehicles.

HOW DO YOU PROTECT YOURSELF AGAINST AN (H)EMP OR CME?

- To protect electronic equipment you must use Faraday Cages.
- Faraday Cages suppress the EMP pulse strength down to a tolerated level.

SO WHAT'S THE POINT?

"Damn, if that thing is so bloody destructive, what good would it do to keep some electronics going, when everything else is trashed. What would my devices connect to?"

THE E1 PULSE

- The ***fast rise-time*** of the E1 pulse, the ***physical length*** and the ***electrical conductivity*** of the target equipment *determine the voltage level that could be inducted into the equipment*.
- For example, without shielding, a simple 6 foot long electrical cord could receive up to **100,000** volts on it by such a pulse.
- A 4 inch cell phone could receive as much as a **5,128** volt pulse.
- The E1 pulse is too fast for “normal” commercial transient spike protectors to handle.

THE E2 PULSE

- The initial part of the E2 (intermediate-time) wave overlaps the E1 curve and resembles a lightning strike lasting one to two seconds.
- It can induce about 100 volts/meter^2 in conductive material.
- Because of the similarities to lightning-caused pulses and the widespread use of lightning protection technology, the E2 pulse is generally considered to be the easiest to protect against.
- The ***main potential problem*** with the E2 component is the fact that it immediately follows the E1 component, which may have damaged the devices that would normally protect against E2.

THE E3 PULSE

- The E3 (late-time) wave resembles an energy surge lasting several minutes.
- This surge can affect electrical equipment if connected to the power grid.
- The E3 pulse is the kind of pulse that is produced by a CME (Coronal Mass Ejection).
- Unplugging the device from the power grid and reducing anything that can act as an antenna is usually enough to protect the devices.
- BUT! Is the device already toast?

HOW MUCH IS ENOUGH?

- The amount of suppression of a signal is typically expressed in decibels (**dB**) and can be calculated by the following logarithmic equation: **SEdB = 20 Log10 (amplitude ratio) = dB**.
- In this case the "***amplitude ratio***" is the amount the signal is attenuated by the container.
- Example: If the EMP is **50,000 volts per meter²** and we would like the container to reduce it inside to **5 volts per meter²**, then the amplitude ratio would be **(50,000 v/m)/(5 v/m) = 10,000**.
- Putting this into the equation we get:

SEdB=20 Log10 (10,000) = 80 dB

of suppression required to do this.

SE = Shielding Effectiveness

HOW MUCH IS ENOUGH?

TABLE 1. DB AND VOLTAGE SUPPRESSION CALCULATIONS

dB	Amplitude Ratio	Volts/Meter	Volts/Foot	Volts/Inch
100	100,000	0.5	0.152	0.0127
90	31,623	1.58	0.482	0.0402
80	10,000	5.0	1.52	0.127
70	3,162	15.8	4.82	0.402
60	1,000	50	15.2	1.27
50	316.2	158	48.2	4.02
40	100	500	152	12.7
30	31.62	1,580	482	40.2
20	10	5,000	1,520	127
10	3.162	15,800	4,820	402
0	1	50,000	15,200	1270

HOW MUCH IS ENOUGH?

- **EXAMPLE #1:** If a 4 inch long cell phone is placed in a container which has only 30 dB of shielding effectiveness, then the phone would receive an induced voltage equal to **160.8 volts**. [40.2 volts/inch x 4 inches long]
- The microchips in the phone and similar equipment are typically good for up to 10 volts.
- The phone would be destroyed!

HOW MUCH IS ENOUGH?

- **EXAMPLE #2:** If a power hand drill one foot long (with the power cord wrapped around it) was placed in the same container as example #1, then it would receive a pulse equal to **482 volts** [482 volts/foot x 1 foot long].
- This item would probably survive at this voltage level depending on the nature of the equipment.

HOW MUCH IS ENOUGH?

- **EXAMPLE #3:** If however the drill had a cord 7 feet long and it was not wrapped around the drill and it was put in the same container as example #1, then the cord would act as an antenna and the induced voltage would be 3,856 volts! [482 volts/foot x 7 + 1foot].
- If the insulation on the motor coils within the drill and on the cord is good to 600 volts, then an arc could occur, damaging the drill.

HOW MUCH IS ENOUGH?

- **EXAMPLE #4:** If the same drill (with cord wrapped around it) is placed in a 55 gallon barrel with a 76 dB suppression, the drill would see a pulse between 1.5 to 4.82 volts, well within the insulations rating and below the 120 volt operating voltage of the drill.

SIZE, TYPE OF EQUIPMENT & CONTAINER SUPPRESSION LEVELS MATTER!

- ***All three parameters*** must be taken into account to insure the protection of the equipment.
- If an object is placed in multiple containers, then the resulting protection is the ***sum of the suppression of each container***.
- While the above examples consider EMP's of 50,000 volts/meter^2, several of our enemies have announced Super EMP's capable of producing ***200,000 volts/meter^2***.
- The secure position is to choose the ***combination of containers*** which yield the highest suppression possible for the size and type of equipment you are protecting.

HOW ELECTROMAGNETIC SHIELDS WORK

- The “**whole**” issue with shielding comes down to the size of the “**hole**”.
- EMP pulse shielding requires equipment to be surrounded by a continuous electrical conducting metallic container with very few if any holes.
- For example, a container consisting of **1mil** thick aluminum foil can provide up to **94 dB** suppression ***provided there are zero holes allowing leakage***.
- The amount of leakage of energy into the container is primarily determined by the **signal wavelength** and the ***relative size of the holes*** **in the shield**.
- The sum of the size and number of holes in the shield must be hundreds of times smaller than the wavelength of the signal in order to suppress an E1 pulse sufficiently to protect the equipment inside.

HOW ELECTROMAGNETIC SHIELDS WORK

- This can be understood by examining the glass door of a microwave oven. The door window contains about **50 holes/inch^2**.
- These holes have a diameter of about **1.2mm**.
- **Table 2** indicates why visible light can easily pass through the door screen with their very short wavelength, yet very little of the longer microwave oven signal can get through.

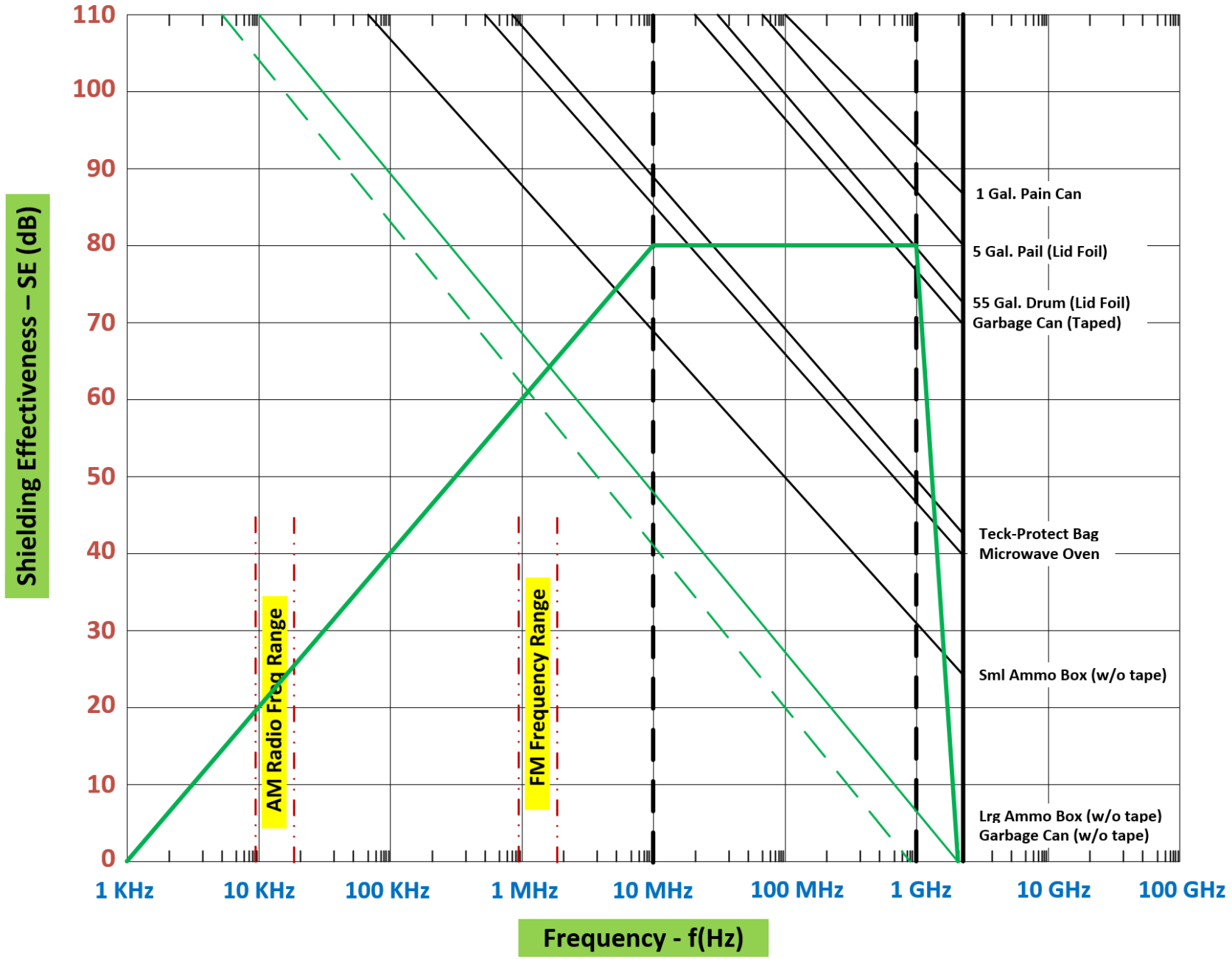
HOW ELECTROMAGNETIC SHIELDS WORK

TABLE 2. Effects of Hole Size and Frequency on Signal Suppression

Item	Frequency	Wave Length	Ratio of: Wave Length To Oven Hole Size
Visible Light (Violet)	789 GHz	0.38mm (0.015 inches)	0.317
Microwave oven	2.45 GHz	122.4 mm (4.8 inches)	100
Cordless Phone	1.92 GHz	156mm (6.15 inches)	130
Cell Phone	0.824GHz	364mm (14.3 inches)	330.3
F.M. Radio	1.0 MHz	300 meters (984 feet)	250,000
A.M. Radio	10 KHz	30,000 meters (98425 feet)	25,000,000

HOW MUCH SHIELDING IS REQUIRED?

- The above table shows that, in order to determine the signal suppression of a faraday cage, it is necessary to examine the ***effective frequency and wave length*** of the signals versus the ***size and quantity of holes*** which allow leakage.
- In other words, the **size of the holes**, the **frequency of the pulse**, and the **quantity of holes** which allow leakage will determine the effectiveness of a Faraday cage.
- The military has defined the minimum dB shielding required at different frequencies.
- The following diagram illustrates this.



Measured Suppression of Containers vs. Frequency and the MIL-STD-183-125-1 Requirements

WARNING #1

- Several persons have posted videos on the Internet demonstrating their measurements of metal garbage cans when used as Faraday cages. They put their AM or FM radio in the metal garbage can, closed the " tight fitting lid" and the radio stops playing.
- They conclude that they have demonstrated their metal garbage can is a good Faraday cage for EMP's.
- **NOT SO!!!**
- Their garbage can will be worthless in protecting against the higher EMP frequencies in the range of **10 MHz** to **1 GHz** and as a result, the contents inside will be fried by any typical EMP.
- The good news is that their destroyed devices will *ALREADY* be in the garbage can.

INSULATION IS REQUIRED

- An EMP can induce a 50k v/m on the walls of the container.
- Table 1 shows that if a container has 80 dB of shielding, then the contents inside would remain at 5 v/m.
- This is a ***45k v/m difference*** between the two (remember this).
- Typically a difference of ***10k to 30k volts*** can ***arc across a one inch air gap*** depending on air pressure, particulate content and humidity.
- A difference of 3k volts can arc between two items when separated by only .2 inches (5mm).

INSULATION IS REQUIRED

- Therefore the internal contents must be surrounded by anti-static or other very high-resistance materials to prevent arcing between them and the container wall.
- The lid need not be insulated provided there are **two or more inches** of space between the equipment inside and the container lid.
- If however, the container is filled to the top, then the metal lid must also be isolated from the contents inside.
- Anti-static pail and drum liners made of high or of low density polyethylene ***15 to 24 mil thick*** and having extremely high surface resistivity of ***10^{11} ohms per square*** (meeting MIL-B-81705-c) are available.

WARNING #2

- Nearly all Faraday cage articles on the Internet indicate that the insulation between the container wall and the contents inside can consist of a simple cardboard or equivalent materials.
- ***Cardboard insulation is not much better than air***, which is insufficient when one considers the high voltage differences.
- Also, using these materials, the container floor, lid and wall coverings are separate pieces of cardboard with only air in the space between where they come together. There is no single, continuous, high-resistance anti-static barrier which encircles the equipment inside protecting it from an arc originating at the metal container surface.
- Electronic equipment stored with only cardboard insulation will likely be destroyed by any high voltage EMP.

PRACTICAL CONSIDERATIONS FOR FARADAY CAGES

- Due to the high frequencies of the E1 wave (***100 KHz to 1.0 GHz***), containers of solid metal, having virtually no holes, ***are required*** in order to achieve the required suppressing levels.
- Any and all holes in the metal shield must be covered with a conductive material such as aluminum foil tape.
- If it will hold water in any position, it will also hold out most of the EMP wave energy.
- ***A Note About Aluminum Tape:*** Most aluminum tapes available in hardware stores are either too narrow, too thin and too weak or they are so sticky they are impossible to remove without the use of a razor. Using the wrong type can cause one to spend hours removing it before the container can be resealed.

PRACTICAL CONSIDERATIONS FOR FARADAY CAGES

- A very good tape for sealing containers is: "***Ideal Seal 2000***" or ***Ideal Seal 587A/B***, from Ideal Tape Co., Inc. It is 2 ½ inches wide, strong, sticks well and comes off clean when being removed.
- If the stored equipment is being used ***frequently***, the containers must be easily opened and closed while reliably maintaining the level of EMP suppression.
- If not easily opened and closed, then tools and equipment being used on a regular basis will not end up being stored back into their protective container.
- This equipment is not essential for equipment being put into long-term storage.

PRACTICAL CONSIDERATIONS FOR FARADAY CAGES

- Containers of different sizes and shapes are required for the different equipment, purposes and suppression level requirements.
- Electronic equipment containing ***micro-chips*** require much more protection than do ***electric motors***. See Table 1.
- The containers must be rugged enough that they will not become ineffective when handled roughly. This obviously eliminates aluminum-foil lined paper show boxes which are being promoted by some persons on the Internet.
- All items stored within the container must be ***electrically insulated*** from the containers lid, walls and bottom.
- The containers and associated liners must be readily available and inexpensive to purchase.
- It is best to ***not ground the containers to earth ground since grounding can appear to the EMP pulse as an antenna***. Note that airplanes are metal containers having no grounding, and they are generally unaffected when struck by lightning.

DESCRIPTION & EVALUATION OF VARIOUS CONTAINER TYPES

EASY ACCESS CONTAINERS MEETING MIL-STD-188-125

- **One-Gallon Metal Pain Can with Standard Friction Type Lid**
  - These have a measured signal suppression of 87 dB at 1.92 GHz (93 dB @ 1 GHz)
  - The friction lids are easily opened with a screwdriver and closed with a rubber mallet.
  - They are small but large enough for many small electronic devices.
  - Their suppression should reduce the inside voltage to about 1 v/m, which is sufficient for microchip electronic equipment.
  - They are rugged.
  - New paint cans are very inexpensive. $1.58 to $2.50
  - Anti-static liner bags having high resistance are available in many sizes.

EASY ACCESS CONTAINERS MEETING MIL-STD-188-125

- **Open-Top Steel 3.5 & 5 Gallon Pails w/ Quick Release Lever Lock Lid**
  - These provide 80 dB signal suppression at 1.92 GHz (86 dB @ 1 GHz)
  - The lids are easy to remove and close
  - They are large enough for larger electronics as well as most electric hand tools.
  - Their EMP suppression reduce the inside voltage to 2 v/m, which is sufficient for microchip electronics.
  - They are rugged.
  - New open-top pails are available at most barrel supply stores for about $5 to $6 each.
  - Anti-static pail liners made of high or low desity polyethylene having 15 mil thickness are available for $2 to $3.

EASY ACCESS CONTAINERS MEETING MIL-STD-188-125

- **Open-Top Steel 55-Gallon Drums with Quick-Release Lever Lock Lid**
  - With the rubber gasket removed from the lid, wrapped in aluminum foil and the replaced back in the lid, they provide 76 dB of suppression at 1.96 GHz (81 dB @ 1 GHz).
  - The lids are easy to open and close.
  - These containers provide convenient storage for many larger items that would be used on a daily basis. They can also hold up to 28 1-gallon cans if the additional protection is desired.
  - Their suppression should reduce the inside voltage to around 4 v/m, which is sufficient for microchip electronic equipment.
  - They are rugged.

EASY ACCESS CONTAINERS MEETING MIL-STD-188-125

- **Open-Top Steel 55-Gallon Drums with Quick-Release Lever Lock Lid**
  - Clean used drums (including the lid and lever-lock rings) in good condition and without rust are often available through classified add sites including KSL.com/classified for about $20.
  - Anti-static drum liners of 15mil – 24 mil thick are available for $10 to $14 at CDF Corp and other sites on the web.

CONTAINERS USED FOR LONG TERM STORAGE NOT REQUIRING MIL-STD-125

Large 4'x3'x3' Sheet-Metal Container With Edges Wrapped With Aluminum Tape

1-A metal box was built by a sheet metal shop using "slip & lock" techniques to connect all sides at the edges. All edges were then taped over with aluminum foil to block signal leakage. The 4' x 3' front opening allowed 2" X 3" wood boards to be inserted inside around the opening. This enabled a front plate to be tightly attached to the container using screws. The front face plate edges were then taped over. This resulted in a measured suppression level of 60 dB at 1.92 GHz, i.e. 66 dB at 1 GHz.

2- The container is used for long term storage since it cannot be easily opened and closed.

3-The container provides a protected storage place primarily for large motor driven equipment. This includes as large electric power generators, small refrigerators, and spare kitchen appliances including microwave ovens, grain mills, blenders and juicers. The stored equipments are not intended to be used until after an EMP strike.

4-The suppression provided should reduce the inside voltage to about 20 volts/meter which is sufficient for motor driven equipment. It is insufficient for electronic equipment containing micro chips unless they are also nested within additional containers. By nesting, the suppression requirements of MIL-188-125 can be satisfied for microchip electronic equipment.

5-The container is made of heavy gauge sheet metal and is very rugged

6- A container of this type can be built by most metal shop for about $175

7-The stored equipment will sit on an inside wood floor and will be stored away from the sides of the containers to prevent arcing.

CONTAINERS USED FOR LONG TERM STORAGE NOT REQUIRING MIL-STD-125

Large 6'x3'x1' Used Steel Cabinets And Book Shelves With Edges Wrapped With Aluminum Tape

1-Tall, all metal bookshelves, when provided with doors or a sheet metal front plate and aluminum foil tape to block signal leakage at all sides and corners, can be used for long-term storage and protection of solar panels and other tall items. These containers have not yet been measured for EMP suppression level. Based upon tests of the other containers, it is expected they will measure about 50 dB to 60 dB at 1 GHz.

2- The suppression level provided by these type containers should reduce the inside voltage to around 50 to 160 volts/meter which should be sufficient for protecting solar panels. Note: The solar panel controllers contain electronics requiring 80db or more protection therefore they need to be stored separately in a 5 gallon pails to achieve this level of protection.

3-This container is made of heavy gauge sheet metal and is very rugged. It will need to be bolted to a wall for support and taped.
4-Used containers of this type can often be purchased at stores which sell used items (including the DI stores) for $15 to $20.
5-The containers are large enough that my solar panels inside can be spaced several inches away from all sides of the container. Also anti-static sheet material can be wrapped around them to protect against arcing.

WARNING #3

- Some have claimed that solar panels do not need protection from EMP pulses; however this has not been proven and there is little to no evidence that they won't be damaged.
- Solar panels typically have a very large conducting surface with many solder points connecting the individual cells. They also contain reverse-current diodes which can easily be destroyed by high voltages.
- When in use, they are connected to a long cable which then connects them to a controller. This cable acts as a large antenna.
- The controller is full of electronics.
- In order to have any hope of any type of protection, all parts must be disconnected.

SMALL CONTAINERS WHICH HAVE EASY ACCESS BUT NEED TO BE NESTED WITH OTHERS

Microwave-Ovens (Large And Small) With Nesting Of Other Faraday Bags/Cages But Without Aluminum Tape

1-These have a measured signal suppression of approximately 40 dB at 1.92 GHz, i.e. 46 dB at 1 GHz with cord attached.

2-The doors are easily opened and stay closed after being closed, unless damaged

3-They can be used as convenient storage place for small equipments used frequently

4- The suppression provided should reduce the inside voltage to around 200 to 300 volts/meter which is insufficient for microchip electronic equipment. Nesting the equipment with other containers such as paint cans and faraday bags can be done to satisfy the suppression requirements of MIL-188-25 if this is required. The larger ones can hold several paint cans

5-These are rugged but are very hard to handle since they are heavy, bulky and waste storage space. While they help protect items inside, they themselves will probably not operate following an EMP strike since their electronics are outside the protected area.

6-Used ovens are often available from used-equipment stores (such as DI) for $20 to $40 depending on size and condition. The power cord should be removed so as to not function as an antenna.

7-Anti-static bags will be required unless the inside of the oven and the doors are non-conductive material

SMALL CONTAINERS WHICH HAVE EASY ACCESS BUT NEED TO BE NESTED WITH OTHERS

Ziploc Faraday/Mylar Bags Nested with Other Faraday Bags But Without Aluminum Tape

1-These have a measured signal suppression of 30 to 44 dB at 1.92 GHz i.e. 36 to 50 dB at 1 GHz depending on type, size and brand.
2- The Ziploc bag is easy to open and close
3-The easy access allows equipment stored inside to be used on a daily basis, however care must be taken to insure the Ziplock is closed tightly each time the equipment is returned to storage.
4- The suppression provided should reduce the inside voltage to around 150 to 1000 volts/meter which is insufficient for both microchip electronic and motor driven equipment. Depending on the bag, several levels of nesting may be required to satisfy the suppression requirements of MIL-188-125. A single TeckProtect bag inside another does satisfy the 80 dB requirement.
5-These are made of several layers of Mylar and aluminum foil which make them fairly rugged, but not as rugged as steel containers
6-These are available through TeckProtect, 3M, and Emergency Essentials from $2 to $100 depending on size and quality.
7-Some, but not all, of these are anti-static bags which need no additional insulation

SMALL CONTAINERS WHICH HAVE EASY ACCESS BUT NEED TO BE NESTED WITH OTHERS

Cans with Slip-Type Lids Nested With Faraday Bags But Without Aluminum Tape

1-A 2-gallon popcorn can with slip type lid was tested and found to have suppression of 38 dB at 1.92 GHz, i.e. 44dB at 1 GHz. without aluminum tape. With tape, the suppression was measured at 85 dB at 1.92 GHz, i.e. 91 dB at1 GHz.

2-.Containers having tight fitting slip type lids are sometimes hard to open without bending them and modifying the suppression.

3-The slip-on lid on some containers allows limited access due to the difficulty of removing the lid

4-Their suppression is insufficient (without being taped) for microchip electronic equipment; however faraday bags could be nested inside these to reach the 80 dB suppression requirement and still allow access to the equipment

5-These are usually made of thin metal which can be bent if handled roughly

6-They can be purchased on the internet for a few dollars

7- No insert liners have been identified; however anti-static bags could be used for inside insulation

CONTAINERS WHICH MUST BE TAPED, THUS RESTRICTING ACCESS

Cans With Slip-On Type Lids With Aluminum Tape

1-A 2-gallon popcorn can with slip type lid was tested and it had suppression of 38 dB at 1.92 GHz and 44dB at 1 GHz. without aluminum tape. With the tape the suppression was measured at 85 dB at 1.92 GHz, and 91 dB at1 GHz.

2-.Containers having tight fitting slip lids are a generally a bit hard to open without bending them

3-The slip-on lid on some containers allows limited access due to the difficulty of removing the lid without bending the can

4-Their suppression is not sufficient by themselves for equipment containing micro chip electronics; however faraday bags could be used with these to reach the 80dB suppression requirement

5-These are usually made of thin metal which can be bent if handled roughly

6-They can be purchased on the internet for a few dollars

7- No insert liners have been identified; however anti-static bags can be used for inside insulation

CONTAINERS WHICH MUST BE TAPED, THUS RESTRICTING ACCESS

Metal Garbage Cans

1-By taping over all holes, including the handle connections on both the lid and on the sides, the gap between lid and can, and the seams on both sides and on the bottom, and by using two bungee cords to hold the lid tight, the measured signal suppression was 72 dB at 1.92 GHz frequency, i.e. 78 dB at 1 GHz. Without the aluminum tape, the one I tested leaked terribly, even with a tight fitting lid. It would be hard to find one of these that would provide even 5 dB of signal suppression at 1 GHz.

2-The lid is not easy to open and close since it must be re-taped each time the lid is opened and closed

3-They are useful only for equipment which is not being used frequently.

4-They could possibly be used for certain electronic equipment, but they do not meet the minimum 80 dB requirement even with tape

5- The garbage can itself is rugged but the lid attachment method is not. Also, heavy weight items can cause the bottom of garbage cans to bend downward opening it up to possible energy leakage. They will need a floor support if heavy items are stored in them.

6-These are available at most hardware stores for $20 to $30 dollars

7-There appears to be no anti-static, high resistant inserts available for this type container making them problematic unless some type of large anti-static liner or bag can be found which fit them.

CONTAINERS WHICH MUST BE TAPED, THUS RESTRICTING ACCESS

Ammo Boxes

1-Two standard ammo cans were measured without being taped. The smaller box was 3 ½"wide and the other was 6"wide. The smaller box had a very tight lid and measured 24 dB of suppression at 1.92GHx, i.e. 30 dB at 1 GHz. The larger box lid was not as tight and measured 5 dB of suppression at these frequencies.

2-The boxes were easy to open and close due to the lid type

3-Ammo boxes come in many sizes. Measurements show that as the box size increases, so does the signal leakage. Also their shape and size limits the type and amount of equipment that can be stored in them.

4-Without being taped, these type containers do not have sufficient signal suppression to be used for protecting micro chip electronics even with nesting. Aluminum tape could possibly bring the suppression levels up near to 80 dB mark but this makes them no longer easy to open and close. Neither of the cans were measured with tape.

5-Ammo boxes are very rugged

6-Ammo boxes are readily available at army surplus stores for around $10 to $30 depending on size and condition

7-No anti-static liners for these was found, however anti-static sheeting or bags do exist which could be used with these.

CONTAINERS WHICH MUST BE TAPED, THUS RESTRICTING ACCESS

Open Ended Mylar Food Storage Bags

1-By taping the top of these with aluminum tape, they provide measured signal suppression of about 36 dB at 1.92 GHz frequency, i.e. 42 dB at 1 GHz.

2-They are not easily opened and close since they must be re-taped each time they are closed.

3-They are useful only for small equipment which will be used infrequently.

4-They could possibly be used for certain electronic equipment in long-term storage, but they do not meet the minimum 80 dB requirement without being nested with other containers

5- These are made of several layers of Mylar and aluminum foil which make them fairly rugged, but not as rugged as steel containers

6- These can be purchased through LDS dry pack centers for about $0.30

7- These are not anti-static bags but they could be nested with anti-static bags for the required insulation

USING YOUR FARADAY CAGES

- Your Faraday cage should become the primary storage place for all equipment which you would like to use following an EMP event.
- Your easy-access containers will hold equipment you use frequently.
- Once an item is removed from the container, the lid should be sealed again in case the EMP occurs while using the device. This will prevent damage to the remaining devices in the container.
- If an item is critical to one's life after an EMP event, then multiples of that item should be obtained with each stored in different Faraday cages.
- It would be wise to wait for several days after an attack before opening any Faraday cages. Having redundant critical equipment stored in different Faraday cages could possibly save at least some of them.

FARADAY CAGE WARNINGS

- Faraday cages which are stored on a non-conducting surface such as wood or carpet or which are on rubber wheels could hold an electrical charge for some time following the EMP event.
- It would be wise to discharge any residual charge before touching the metal surface.
- This can be done using a grounding wire and touching it to the container to bleed off the charge.
- While some of the Faraday cages can be stacked, this will increase the size/length of the conducting cages increasing the volts/meter induced on the stack of cages. A single 5 gallon pail is about 1/3 of a meter while a stack of three is one meter resulting in three times the voltage induced. Best to keep the size small.

MEASURING THE EFFECTIVE SUPPRESSION (ES) OF YOUR FARADAY CONTAINER

YOU TOO CAN MEASURE THE ES

- Certifying that a piece of equipment shielding satisfies the requirements of MIL-STD-188-125 requires very expensive test equipment which can generate test signals having controlled signal strength at a specified distance and throughout the specified frequency range.
- Without such controls, the results will be erratic and inaccurate.
- The cost of such equipment is far out of reach for the average person; however one still needs a way to at least approximate the dB suppression levels of the containers in order to insure they are going to protect the equipment.

YOU TOO CAN MEASURE THE ES

- An inexpensive way to do this is to obtain two containers which have a known dB suppression levels over the required frequency range and to use these as a standard against which to compare the suppression levels of other containers being tested.
- A signal source is needed which consistently generates the same frequency and signal strength each time it is used.
- The signal frequency needs to be at, or slightly above, the 1.5 GHz identified by the military as the upper bound of the EMP frequency.
- A physical test location is needed which will remain constant.
- The test location must be sufficiently large so as to allow measurement of the SE of both of the measurement standards.

YOU TOO CAN MEASURE THE ES

- For a detailed description of how J. T. Smith performed and measured each container, please read his work labeled, “BUILDING EMP FARADAY CAGES THAT WORK”, Sept 30, 2014.

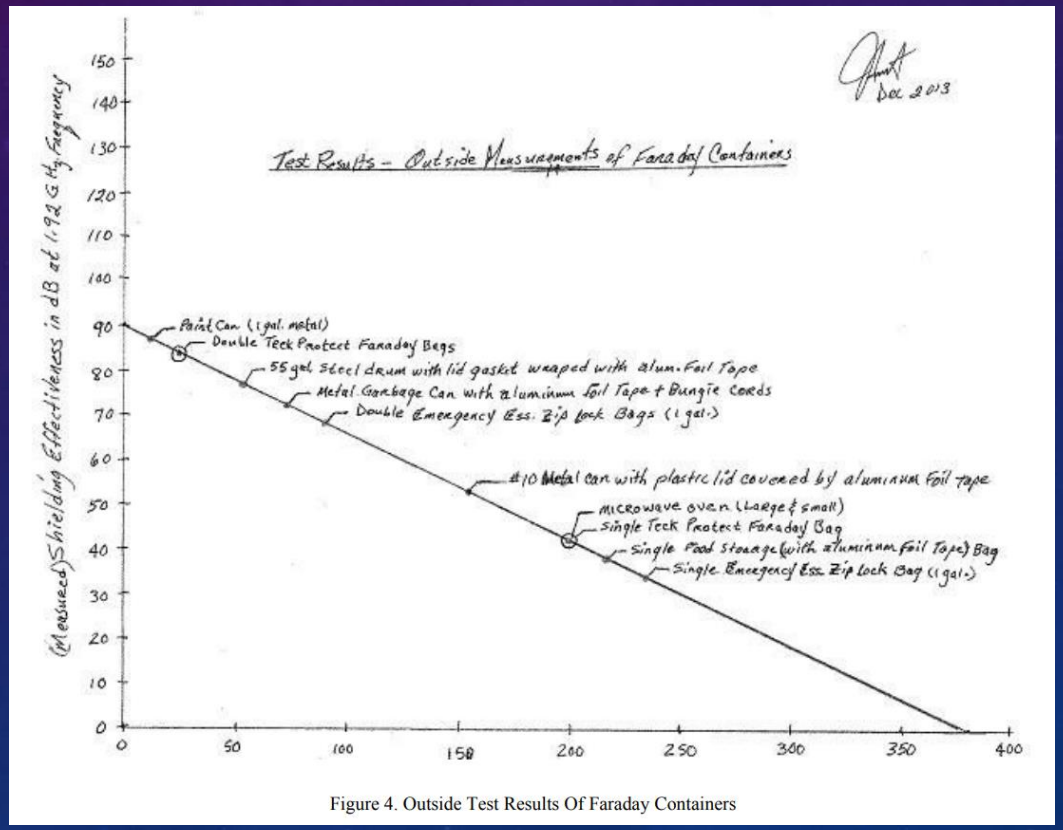


Figure 4. Outside Test Results Of Faraday Containers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QUESTIONS?

MISINFORMATION FROM DENNIS QUAID

Points of inaccuracies from Dennis:

- 0:56 – “our sun generating what they call a GMD and which is a solar storm “
- 1:30 – “it fried out entire telegraph system. The whole system had to be replaced.”
- 2:33 – “food would melt in our refrigerators…”
- 2:40 – “they predict within a year about 90% of the population would be dead from starvation and disease”
- 6:41 – “It’s only the transistors, and anything electrical…”
- 8:12 – “85 volts / meter”
- 8:12-8:57 – Dennis has no clue as to what he is saying. He is just regurgitating things he thought he heard. Tucker Carlson has a look of confusion because what Dennis is saying is simply word salad and jiberish.
- 12:01 – “and uh how that would what they call a super EMP which is electromagnetic pulse which is the same thing as a Geo thermal event” What?
- 12:13 – “if you send up a missile a nuclear uh with a nuclear uh bomb on it it exploded at 400 kilometers above the Earth in space basically you won't you won't see it you won't see the explosion because it's in a vacuum of space…” Huh?