EMP Network Resilience

STEP – Sustainability in Telecom: Energy & Protection Committee
PEG – Protection Engineers Group

ATIS EMP Standards/Best Practices
New Novel Approach for Telecommunications

(this same model can be applied to other critical infrastructure industries)

This is a growing industry threat; How shall we deal with it?

Telecommunication Industry has several hundred thousand commercial buildings/shelters/huts/cabinets

Hype / Fiction vs Facts, follow the science to create an innovative practical solution for the industry.

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Irwin Gerszberg AT&T Fellow and Distinguished Inventive Scientist for AT&T Labs in Middletown, NJ is responsible for Advanced RF Research technologies on Department of Defense 5G mobility projects, AT&T network resilience, research on new low-cost novel methods to help protect critical infrastructure against nuclear electromagnetic threats, solar flares/geomagnetic threats, network timing threats from GPS jamming and manipulation.

He holds a bachelor's degree and a master's in computer science from the New Jersey Institute of Technology and Stevens Institute of Technology. He joined AT&T Bell Labs in 1978 where he spearheaded AT&T's first speech response/voice recognition system. After joining AT&T Labs Wireless unit, he was responsible for the development of numerous advanced wireless technologies and services. Over the years Irwin has made key fundamental contributions to Science and Technology in Digital Subscriber Line, voice over DSL, IP based cable telephony, broadband wireless, broadband over powerline, microcells, satellite, fixed wireless, high-definition Voice, IP telephony, and a vast array of emerging broadband infrastructure initiatives.

He holds an amazing record, 682 patents with the United States Patent Office on advanced technologies covering wireless, wired, and emerging broadband technologies.

In 2001 Irwin received AT&T's Science and Technology medal.

In 2002, Irwin was inducted into the New Jersey Inventors Hall of Fame by the Governor of the State of New Jersey for his innovations and contributions to science and technology in the telecommunications industry.

In 2004, Irwin was awarded AT&T's highest honor: The AT&T Fellow Award for his long-term career in pioneering contributions and innovations in telecommunications.

In 2014 he led a research team that invented Project AirGig™ which is a technology that enabled Gigabit data transmission on existing electric utility power lines globally.

In 2019 he built and still runs today, the AT&T Science and Technology Innovation Center in Middletown NJ which houses 148+ years of the telecom industry innovations that changed the world and tells the history of innovation from the Alexander Graham Bell telephone to todays modern day infrastructure.

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What

Today we protect against Cyber. Other Emerging threats will create widespread physical equipment damage & disruption of services:

Threats from Mankind

- EMP High altitude (affects large areas of the United States/North American population)
- EMP Surface and Low Altitude, Directed Energy Weapons (can target cities)
- EMP Terrorist briefcase weapons (Target high-rise buildings in cities)
- EMP Damage to GPS Network Timing (Satellites and land based Atomic clock locations)

Natural Solar Threats Guaranteed to Happen at Anytime

- Solar Flare (Same effects as EMP)
- Corona Mass Ejection (Geomagnetic Over-voltage, similar to EMP)

Why

- Chaotic World events, violence and terrorism on the rise
- We protect against Cyber attacks, Weather events, Physical attack; what about Solar and EMP events which we know will happen?
- Prevent/minimize Network Damage & Customer Outages
- Prevent/minimize Revenue Loss, Maintain Shareholder Value
- Create / Lead new commercial industry resilience standards with support of government

How

- *Get knocked down, get up, dust off, and immediately get operations running automatically*
- New novel technology & methods = reasonable costs & time

Who

- ATIS leads the industry working with CISA / DHS / DTRA:
- White House Senior Technology Threat Advisor
- CISA - Cybersecurity and Infrastructure Security Agency
- DHS - Department of Homeland Security
- DTRA - Defense Threat Reduction Agency

Where / When

- 3Q25: Complete initial 25 sites with before and after measurements
- 4Q25: Complete 1st ATIS 2025 EMP working draft
- 4Q26: Complete 500 PoC critical sites & re-start network validations
- 1Q27: Release ATIS 2027 EMP specification

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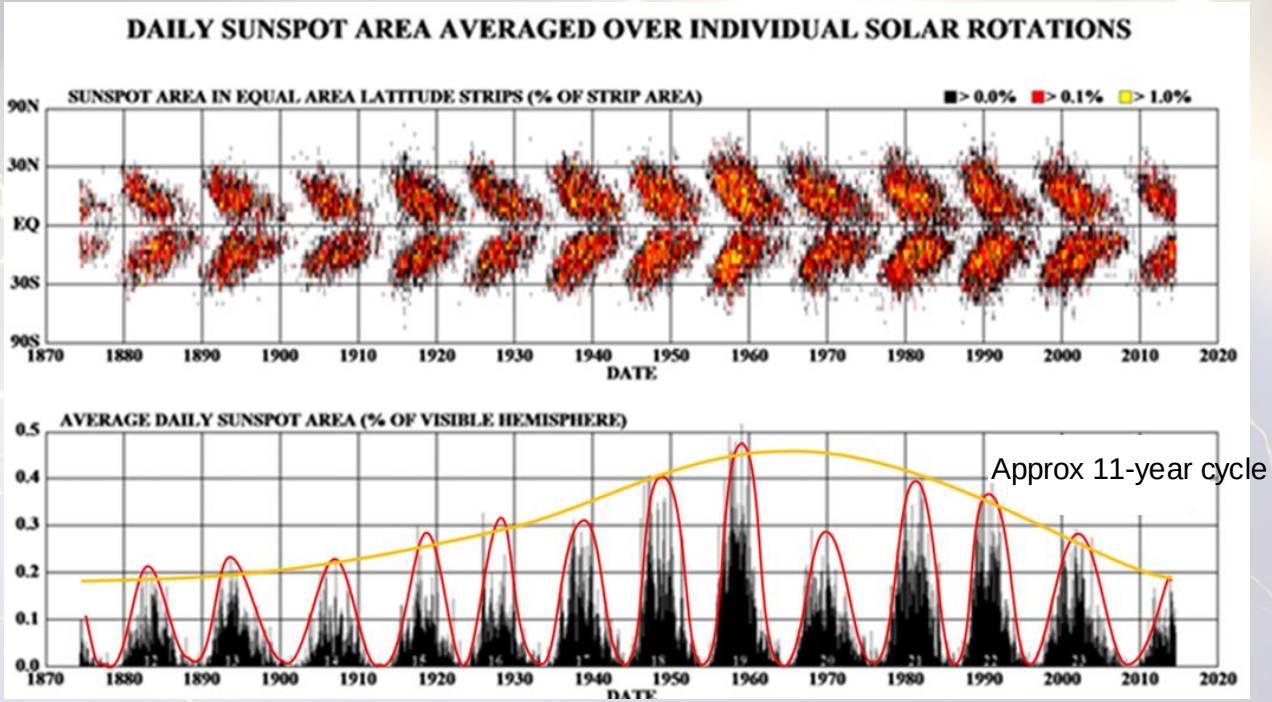
Solar Cycles and Patterns

Our Bright Sun that gives us life also has a dark side



The sun is a ball of super-hot plasma, roughly 890,000 miles across; a million Earths would fit within its volume. At the Sun's core is an ongoing fusion reaction that has been continuously converting 5 million tons of hydrogen to helium, every second, for the last 4.51 billion years

1859 – Carrington Geomagnetic storm, most intense in recorded history – so far

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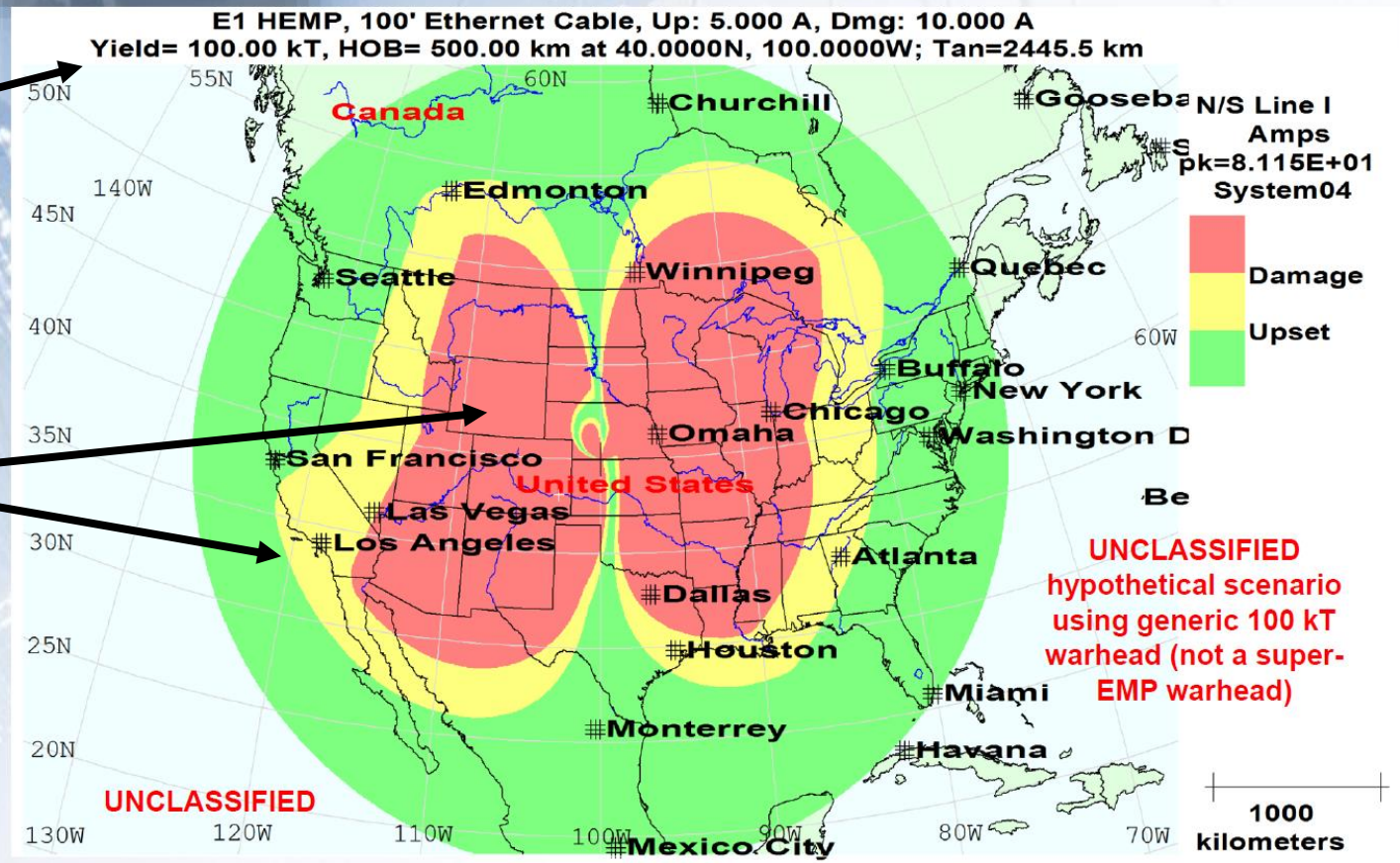
Possible HEMP upset/damage zones for devices connected to 100’ of North-South oriented Ethernet cable in a building

Russia has multi-megaton weapons

Commercial EMP Protection Areas



1 December 2017 Kevin Briggs DHS/NPPD/NCCIC/NCC

kT = kilotons; HOB = Height of Burst; Up = Upset; Dmg = Damage; A = Amps

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2019 Trump Presidential Executive Order - 13865

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

Section 1. Purpose. An electromagnetic pulse (EMP) has the potential to disrupt, degrade, and damage technology and critical infrastructure systems. Human-made or naturally occurring EMPs can affect large geographic areas, disrupting elements critical to the Nation's security and economic prosperity, and could adversely affect global commerce and stability. The Federal Government must foster sustainable, efficient, and cost-effective approaches to improving the Nation's resilience to the effects of EMPs.

Sec. 2. Definitions. As used in this order:

(a) "Critical infrastructure" means systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters.

(b) "Electromagnetic pulse" is a burst of electromagnetic energy. EMPs have the potential to negatively affect technology systems on Earth and in space. A high-altitude EMP (HEMP) is a type of human-made EMP that occurs when a nuclear device is detonated at approximately 40 kilometers or more above the surface of Earth. A geomagnetic disturbance (GMD) is a type of natural EMP driven by a temporary disturbance of Earth's magnetic field resulting from interactions with solar eruptions. Both HEMPs and GMDs can affect large geographic areas.

(c) "National Critical Functions" means the functions of government and the private sector so vital to the United States that their disruption, corruption, or dysfunction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof.

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Proposed New Approach for Non-Military Critical Infrastructure

Use existing buildings as is, with minor updates "Re-Start vs Harden to Mil Standard" - revolutionary low cost-effective approach

Military standard Mil-Std-188-125-1A does not allow any interruption or downtime in equipment function, but ***commercial and industrial critical infrastructure is not operating in battlefield conditions***, so the design objective of this approach is to enable commercial networks to survive an electromagnetic attack without damage but with very short-term momentary disruption being acceptable.

In simple terms, the goal is to enable an operator to "get knocked down, get up, dust itself off, and immediately get its network up and running automatic" with minimal downtime at reasonable cost via software (SW) auto network re-start.

Protect Networks only to a level that prevents physical equipment damage

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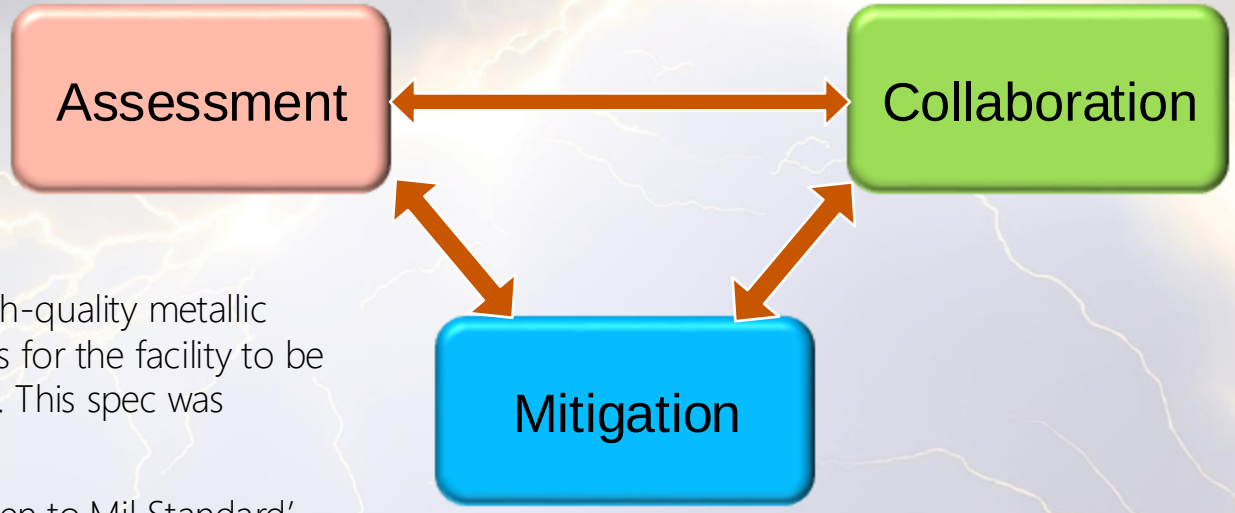
Overview

DHS view on EMP/Solar lists 5 critical areas, all interrelated, that must be addressed to mitigate a disaster:

- Power
- Communications ✓
- Transportation
- Food & water
- Logistics



EMP Protection - Legacy Approach

MIL-STD hardening approach says "locate the entire building within a high-quality metallic shield; protect each penetration through the shielded barrier". This allows for the facility to be populated with commercial off-the-shelf (COTS), unhardened equipment. This spec was developed by the Defense Threat Reduction Agency (DTRA).

New Proposed Telecommunications Industry Approach: 'Re-Start' vs 'Harden to Mil Standard'

- Use novel approach to improve survivability of Telecommunication networks:
- *Get knocked down, get up, dust off, and immediately get operations running automatically*
- Use existing buildings as is, with minor cost-effective updates - revolutionary low-cost effective approach
- With help from CISA, DHS, DTRA make this the new standard for the telecom industry and other critical infrastructure

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New Technique – Rapid Restart vs Harden to Mil Standard - 10 step plan Summary

1. "Re-Start " vs "Harden to Mil Standard" makes this economically feasible for the telecom industry, working with Government
2. This problem is industry-wide and affects all critical infrastructure; education / training material needed
3. Commercial Building power - protect against Lightning + EMP at every network location
4. For Re-start to work, hardware (HW) watchdog timers required on all network elements, as end to end network validation needed. (Automatic alternate bldg. re-routing needs to be the end-state architecture across all Networks)
5. ATIS EMP working group leading / partnering with CISA, DHS, DTRA, & DoD approved EMP partners
6. Develop industry rapid re-start protection standard for all service providers protecting against EMP + Solar threats, update ATIS standard. 40db vs 80db (MIL Spec) building isolation over time via nanoparticle paint, fabrics, ceiling/roofing.
7. Create New EMI standards for vendor equipment (Power, RF, Transport, Switching, Data Centers, Fiber, Devices, etc)
8. Work with DHS to create training for the industry on the rapid recovery technique and new network architectures
9. Create financial models or policy for Government credit and re-imbursement that is equitable to all
10. Work with DHS on weapons yield projected advancements over 20 years to ensure EMI equipment protection over time via improved silicon

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