



Investigate Methods To Protect Against Electromagnetic Environmental Effects (E³)

Problem

Electronic infrastructure is susceptible to damaging Electromagnetic Environmental Effects (E³) that can arise from a variety of artificial (man-made) or natural environmental sources. These sources may include electro-magnetic pulse (EMP), radio frequency interference (RFI), electro-magnetic interference (EMI), or lightning. For example, a nuclear weapon detonated at high-altitude would generate an EMP similar to a very high energy radio wave that could potentially damage and destroy electronic systems over the entire continental United States.

Description of Research

Effective Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C⁴ISR) is a critical ingredient for the success of any military operation, and consequently, its reliable performance is essential to the Nation's defense. E³ is of concern in a wide variety of fixed facilities, but is of greatest concern for C⁴ISR facilities. Due to their essential nature, C⁴ISR facilities may become targets for hostile attacks. Shielding these facilities from deleterious E³ effects is vital to ensuring the continuity of critical services in a hostile environment. EM shielding is an essential component for most (if not all) critical C⁴ISR fixed facilities.

EM-shielded construction requires specific technical knowledge and expertise. The U.S. Army Corps of Engineers (USACE) is currently involved with EM-shielded construction and design development efforts for a number of C⁴ISR fixed facilities. As the Lead Laboratory for EM Shielding under the Tri-Service Civil Engineering Project Reliance, the Construction Engineering Research Laboratory (CERL) provides this unique research and development (R&D) capability for fixed facilities. Recent design and construction developments have resolved many EM-shielding problems.

Expected Products

Current CERL research is focused on the properties and behavior of ferromagnetic materials, which offer potential shielding advantages in "main shield" shielding applications where weight and size limitations are important. Other CERL-developed materials and techniques used in EM-shielding products are:

- new gasket materials and designs to improve performance and reduce application and maintenance costs of building intrusion points (e.g., doors)
- innovative uses of inherent shielding characteristics of standard construction materials (e.g., aluminum-foil-backed gypsum board and insulating sheathing, metallic-clad siding, copper foils, wire meshes, and sheet metal roofing)
- adaptations of existing application techniques (e.g., arc-spraying of molten metal, laser welding of very thin sheet metal materials)
- novel construction assembly techniques (e.g., seam joining techniques for thin sheet metals, meshes, and panels).



CERL's electromagnetic field simulator, used to test shielding against EMP intrusion.

Potential Users

Headquarters- and Installation-level planners require improved EM-shielding products in the construction, maintenance, and retrofit of a wide range of fixed DOD facilities:

- *Pentagon Renovation.* The Pentagon includes EM-shielded C⁴ISR facilities. CERL supported the Pentagon Renovation project in the area of EM shielding (as well as other technical areas), and continues to perform R&D to improve the reliability of EM-shielded doors.
- *Radar Upgrade at Clear, AK.* CERL provided technical expertise to the Alaska District for the EM shielding construction associated with the PAVE PAWS (Phased Array Warning System) radar facility at Clear, AK.
- *National Missile Defense (NMD).* Currently, USACE is involved with the design development for fixed facilities associated with the National Missile Defense (NMD) system. This project is for the Ballistic Missile Defense Organization (BMDO/JNP). The proposed designs include high-altitude electromagnetic pulse (HEMP) shielding. As part of the ERDC design review team, CERL has been reviewing the HEMP shielding design documents and construction submittals for various facilities including the Readiness and Control Building at Fort Greely, AK.

EM-shielding will form an integral part of the Objective Force/Future Combat System (FCS). Although the system emphasizes agility and mobility, the Objective Force, and the Future Combat System (FCS) will rely on fixed facilities associated with C⁴ISR Reach Back, which will provide a means for connecting deployed forces to the broader communications and information systems infrastructure. Such critical communications require reliable, secure EM-shielded construction.

Projected Benefits

The development of better quality, more cost effective EM-shielding products makes more widespread use of shielding feasible, and improves overall communications security and resistance to electromagnetic interference, upset, or failure.

Program Manager

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Participating ERDC Laboratories

Construction Engineering Research Laboratory (CERL)