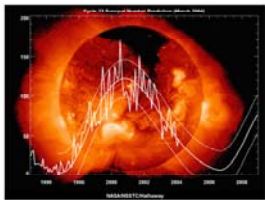


Problem: SMD- or MHD-EMP-generated GICs in power systems.

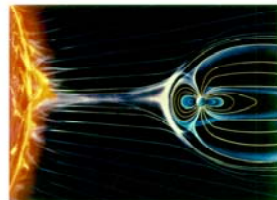
Ground-Induced Currents (GICs) occur in response to variations in the solar wind or bursts of nuclear weapons. These large-scale common-mode currents couple into man-made systems such as power transmission lines, pipelines, railways, and telecommunications cables and interfere with their operation and maintenance.

Physics: $V = -dB/dt$, $I=V/Z$

Solar Magnetic Disturbance (SMD)

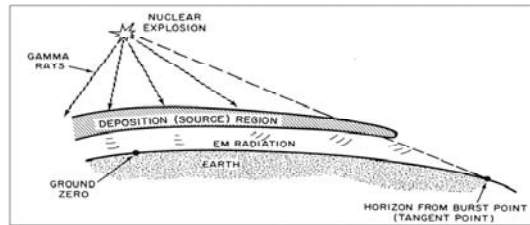


At any point in the 11-year solar cycle, coronal mass ejections (CMEs) can occur.

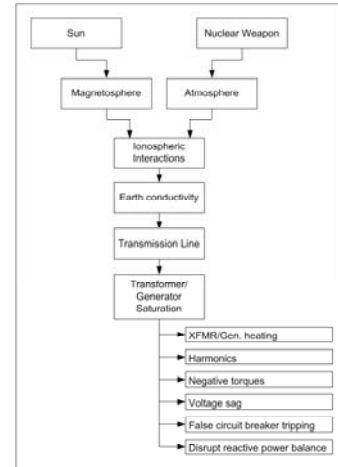
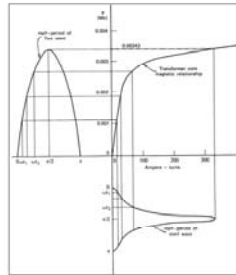
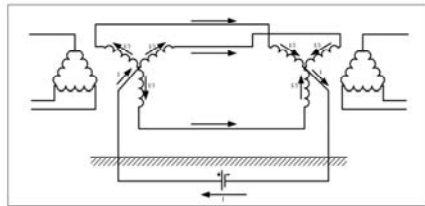
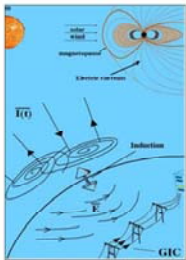


CMEs travel through space, intersect Earth's orbit, and interacts with Earth's magnetic field.

Magnetohydrodynamic Electromagnetic Pulse (MHD-EMP)

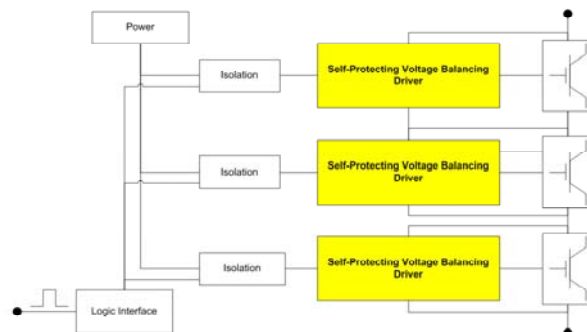
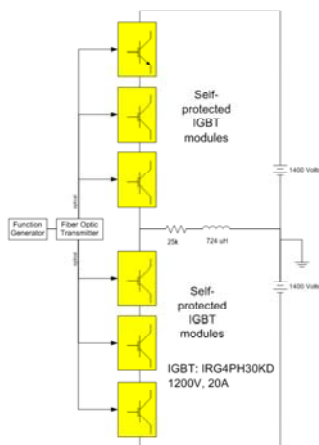


A similar phenomenon is caused by the time-varying MHD-EMP effect of an expanding and uplifting highly ionized fireball of a high altitude nuclear weapon that causes Earth magnetic field variations.



Either SMDs or MHD-EMPs creates an Earth-surface potential that drives a quasi-direct current through man-made conductors then returning through the conductive ground. This current saturates power system transformers causing heating, harmonics, negative torques, voltage imbalances, etc.

Solution: Self-powered High Voltage Switched-Mode Power Supply (HV SMPS) driving a current through transformer winding. This is enabled by our HV Switch Self-Protect Drivers.



Disclaimer
The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.



Acknowledgements
This project was developed with funding from the United States Army Space & Missile Defense Command Contract numbers DASG60-01-C-0017 and DASG60-02-C-0066.