AN HISTORICAL SKETCH OF HIGH-POWER ELECTROMAGNETICS (HPEM)

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In the context of the world's first atomic test in Alamogordo, NM, USA on July 16, 1945, Nobel laureate physicist Enrico Fermi tried to calculate the possible electromagnetic fields that would be produced from the nuclear explosion. This can be considered as the birth of the study of HPEM. HPEM is a comprehensive acronym to include EM waveforms such as natural lightning, nuclear electromagnetic pulse (NEMP, High-Power Microwaves(HPM) etc. [D. V. Giri and F. M. Tesche, "Classification of Intentional Electromagnetic Environments (IEME), *IEEE Trans. EMC*, Aug. 200] Dr. Baum played an important role in the evolution of HPEM [C. E. Baum, "Reminiscences of High-Power Electromagnetics", *IEEE Trans. EMC*, May 2007, pp 211-218. Major Milestones of HPEM, especially in the last 5 decades can be summarized as follows.

1945	TRINITY - Fermi's attempt to estimate NEMP
1951-1962	Additional nuclear tests and measurements (crude compared to today's standards)
1962	Partial Test Ban Treaty (PTBT)
1962-1990	Underground tests, development of EMP simulators and sensors
1978	First NEM meeting, followed every even year
	Special Issue on NEMP in IEEE Transactions on AP-S and EMC
1980-1989	Special Issues in IEEE Journals on Lightning, HPM, EMP 201 (short course);
	HPEM technical sessions in various meetings, URSI Statement
1990	URSI Commission E, forms a HPEM working group
1993	IEC issues 61000-2-9 - Radiated HEMP Environments
1994	EUROEM Conference in France
1995	High-Power Short Pulse (IRA) technology development
1996	Russian Scientists participate in AMEREM 1996
1999	URSI Statement on IEMI
2004	U.S. Congressional Committee publishes its first Report on EMP [W.R. Graham
	(Chairman, EMP Commission) et al., "Report of the Commission to Assess the Threat
	to the United States from Electromagnetic Pulse (EMP) Attack," Volume 1, Executive
	Report, 2004]
2004	Special Issue on IEMI in IEEE Trans on EMC
2008	EMP Commission report on threats to Critical Infrastructures

The first decade of the 21st century has seen real and anecdotal evidence of RF Terrorism and IEMI HPEM source/antenna systems are being developed in many nations and also becoming commercially available. Developments in pulse-power technologies driving conventional and newer RF devices will lead to improved and more powerful source/ antenna systems. An EMP attack is an example of RF terrorism by rogue countries and non-state actors, and the national infrastructure can be at risk. Infrastructure is a hyper system or a system of systems such as electric power, telecommunication, banking & finance, energy, transportation, food, water, emergency, space, and Government. In addition, cyber threats from hostile governments, terrorist groups and disgruntled employees are on the increase as well. It is prudent for civilized societies to asses such threats and take pro-active and precautionary actions. As an example, if someone had foreseen a threat scenario wherein commercial airliners can be turned into missiles by hijackers, perhaps Nine-Eleven could have been avoided. In the case of Nine Eleven, the pro-active step would have been to install bullet-proof cockpit doors to deny entry to unauthorized persons.