

Overview of Collaborative Efforts over Several Decades in Pulse Power and Antennas

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Abstract—This paper is submitted for the special session titled SS3: Dave Giri - Life and Legacy. We have collaborated on many projects for US DoD and other agencies. We document some representative projects that we have jointly worked on. The first author's training and work experience is in designing and fabricating state-of-the-art pulse power machines. The second author is an expert in applied electromagnetics, designing large electromagnetic facilities such as HEMP E1 simulators. There is also the area of pulser-antenna or pulser-transmission line interfaces. The pulser is not merely a high voltage generator but is to be treated as part of a wave launching system. The two authors' individual expertise has resulted in many successful facilities delivered to sponsors, that became work horses for various US Govt agencies, as well as in western European countries.

Keywords- pulse power, HEMP E1 simulators, Marx driven helical antennas

I. INTRODUCTION

Greetings to the attendees of GLOBALEM2022, from Ian Smith. I am very pleased indeed that GLOBAL EM is honoring the career and times of Dave Giri. My own career has been in the field of pulse-power, which has provided the high-power drive for many of the electromagnetic systems that Dr. Giri has helped to create, and that combination has led to many collaborations with him.

In 1960 I joined the group of Charlie Martin in the UK that launched pulse-power, then I moved to the USA to help its great development. The application of pulse-power to EMP simulators soon brought me into contact with Dave Giri, and I enjoyed collaborations with him that lasted over more than 40 years before I retired in 2014. It is a pleasure to recall some of those collaborations today.

When I went to the USA I joined Physics International Company, and there I built 1.5 MV pulsers to drive the Airforce Weapons Lab's Research EMP Simulators, RES, R, E, S, for short. RES 1A and 1B were long resistively loaded antennas, one horizontal and one vertical, carried aloft by helicopters. Although I knew Dave had contributed to the design of these antennas, I think I did not meet Dave till I supplied a similar pulser called High Altitude Generator 1, or HAG 1, which provided 1.8 MV with a few ns risetime to the ground based HPD, or Horizontally

Polarized Dipole antenna, that he was helping design at the Airforce Weapons Lab in Albuquerque. After that I interacted with him at many meetings about other EMP simulator systems he was involved with.

To describe another type of project Dave and I collaborated on, I will jump ahead to the mid-1990s. By then I had left Physics International and co-founded the company Pulse Sciences, Inc., or PSI—the “I” stood for Ian. Dave was instrumental in designing Impulse Radiating Antennas, and PSI built pulsers to drive two of these. The first was a 120 kV, 100 ps risetime pulser driving a transmission line that terminated at a paraboloidal reflector. That could create a 100 ps full-width-half-max impulse with a (range x field) product of 1.2 MV. Then we collaborated on the more powerful JOLT, which was driven by a megavolt and had a corresponding parameter of 6 MV. PSI's pulsers used switches with hydrogen or flowing oil and had repetition rates of hundreds of pulses per second. The Impulse Radiating Antennas were projects of the Air Force Research Lab, as the Airforce Weapons Lab had become known.

Pulse Sciences grew to well over 100 people, and was bought by Titan Corporation, who bought Physics International and placed it under PSI to form Titan Pulse Sciences Division. This was later bought by L3 Communications. Under these ownerships PSI worked with Dave on projects that included in 1998 “VERIFY”, a vertically polarized guided-wave EMP simulator driven by 600 kV with a 1 ns risetime, that we exported to Switzerland. They also included a transportable source of high-power microwaves, which were produced at many specific frequencies by spiral antennas designed by Dave and driven by our repetitive 2 MV Marx generator—that was in 2009.

Over these decades, I saw Dave contribute to many other electromagnetic systems, too numerous for me to recall. And I can't address his contributions in other areas, for instance in electromagnetic effects. He was not only a great colleague but a good friend. He and I were big cricket fans; I recall the time we travelled, together with my wife Sheri, to the San Francisco Peninsula to see Sunil Gavaskar, the great Indian batsman, probably the best in the world. He was visiting to play in a local match. It is a great pleasure for me to have a part in the GLOBAL EM session that honors Dave Giri and his splendid career.