



IEEE Hyderabad Section MTT/AP/EMC Joint Chapter

Presents

An half day Tutorial on" Application of Advanced Microwave Technologies to Military Systems"

"Design of Guidance Radar system for a Quick Reaction Short Range Surface to Air Missile (SAM) & "Vulnerability of commercial satellites to Electronic jamming"

By

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(Former Director DLRL Hyd. Ministry of Defence)*

On

28-08-2010 at 0945hrs

VENUE

NERTU-SEMINAR HALL
O.U. Campus, Hyderabad.

About the Speaker:

Prof G. Kumaraswamy Rao obtained BE in 1966 and M.E in 1968 with First Rank from Osmania University. He studied Radar Engineering Course in Holland in 1985. He has also undergone Management courses in Indian Institute of Management Bangalore and Satellite course at IIT Kharagpur. Prof Rao was the Director of Defence Electronics Research Lab (DLRL) C.G.Lines, Hyderabad. He rendered meritorious service to Defence Research and development Organization, Ministry of Defence for 36 years in all capacities from Scientist to Director. Prof. Rao was one of the Board of Directors of Electronics Corporation of India Limited (ECIL).

Prof Rao when he was Director DLRL received the Best Performance Lab Award from the hands of honourable Prime Minister of India Dr Manmohan Singh at Vigyan Bhavan, New Delhi in 2005. Prof Rao designed and developed many missile guidance electronic systems for Trishul, Prithvi and Akash missiles and contributed in making India self reliant in the field of missile Technology. He was the chief designer for the ground guidance electronic system for India's first short range Surface to Air missile "Trishul" and number of production proto types were successfully proven to hit the target aircrafts.

During his service in DLRL he has successfully developed number of ESM & ECM systems that are presently in operation with Indian Navy and Airforce. He guided and managed as Program Director Indian Army's most ambitious mega Program Integrated Electronic Warfare System encompassing COM & RADAR EW systems . As Director he steered the Navy's EW projects which are now deployed on many of the platforms including submarines.

Prof Rao published number of technical papers in International Conferences and Journals.

Design of Guidance Radar system for a Quick Reaction Short Range Surface to Air Missile(SAM)

In a combat war strategic locations like military establishments, communications centres, nuclear sites, power plants Airports/seaports, parliament house, country's financial institutions, industrial complexes etc., are the most vulnerable places which will be attacked by hostile aircraft with lethal bombs. Enemy bombers strafe moving military convoys/troops and cause extensive damage. Anti ship missiles are launched from long distances to attack military ships. One of the methods to protect these target areas is to deploy interceptor aircrafts to shoot down the incoming enemy aircrafts. But the interceptors are expensive and some times cost more than the bombers themselves. A much cheaper solution would be to use Guided Surface to Air Missiles called SAMs to shoot down the intruding aircrafts before they reach the intended location. These have been successfully used in wars like Desert Storm, Iraq War, Afghan War etc. India in its efforts to indigenize weapon systems embarked on the design and development of short range quick reaction surface to air missile as part of an Integrated Guided Missile Development Program under the inspiring guidance of Dr A P J Abdul Kalam. SAMs were not available for sale in the World Market. It took 10/12 years to design and develop a ruggedised military SAM under the code name of THRISHUL. Three versions of Thrishul weapon systems were developed tested successfully against flying live targets. The three versions are (i) Combat Vehicle mounted on a tanker for protecting mobile military convoys (ii) Wheeled Trishul to protect fixed installations and (iii) An Anti sea skimmer missile to protect naval ships. The weapon System developed was comparable and in some cases superior to the existing SAMs like Rolland,, Crotale, Barak in the World. Some advance technologies which were not there at that time were used viz(i) Ka band tracking and guidance (ii) three Beam Guidance (iii) Weapon system platform stabilization while on move etc. The Ka band Guidance Radar with its associated guidance computer uses a Command line of sight of guidance(CLOS) and guides two missiles in air concurrently. It has the capability of engaging low flying aircrafts at tree top height and the naval version has the sea skimming capability. The presentation describes the design challenges/problems faced by the group of 12/15 DRDO Scientists who worked together and developed a SAM Weapon Guidance System in spite of many odds. All the subsystems were designed for the first time in the Country and integrated. Technical literature on SAMs is classified as secret by the MTCR(Missile Technology Control Regime) countries. This posed a big handicap to the designers. Complex simulation models using MATLAB involving 6 DOF(direction of Freedom) were developed, upgraded and fine tuned, as flight trails continued. They became lifeline for further incremental developments with completion of each flight trail. In the end of the lecture simulation studies made on the vulnerabilities of the three microwave links to enemy jamming is analyzed.

Vulnerability of commercial satellites to Electronic jamming

Globalization of commerce and interlinking of economics of all the countries in the world have changed the configurations of local/national/regional Communication links. They have now become global network centric. Satellite communication nets play a very vital role in this network central global links. Satellite communication links offer flexible data transmission for ground, sea and airborne units. For military, these satellites have enhanced their capabilities with better co-ordination of command and control. Military Satellites use more expensive, complex and jam resistant technologies to reduce their vulnerability to jamming. As of now large number of countries including India does not have a full fledged Mil-Satellite. Even advanced countries used the existing Commercial Satellites by leasing the transponders in times of need like in Desert storm, Iraq war, Afghan war etc. Commercial satellites use FDM-FDMA, FDM-TDMA modulations, which are vulnerable to jamming unlike the Mil-Satellites which use spread spectrum, EHF frequencies, multiple beam transmitting and receiving antennas with mulling capabilities against jamming, processing transponders etc. There are number of instances where in the rogue states and terrorists have disrupted communication. This has become a key concern for military and civilian governments. The subject for presentation is to assess the vulnerability of these links considering the satellite parameters like location, distance, frequency, type of modulation, power transmitted/received, antenna size, polarization, figure of merit, C/N ratio, link margin, bit rate etc. The present day Anti Jamming techniques and the protection of target satellite from anti-satellites will be briefly discussed.

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IEEE Student members;
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PROGRAMME SCHEDULE

0900-0930hrs :	Registration
0930-0945hrs :	Inauguration
0945-1100hrs :	Design of Guidance Radar system for a Quick Reaction Short Range Surface to Air Missile (SAM)
1100-1130hrs:	Tea
1130-1245hrs:	Vulnerability of Commercial Satellites to Electronic Jamming
1245-1300hrs:	Feedback & conclusion
1300-1345hrs:	Lunch follows

**Dr M. Lakshminarayana
Chairman, MTT /AP/EMC Joint Society Chapter**