EVENT - 2 Field visit to MCF Hassan.

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"A REPORT ON THE EDUCATIONAL EXCURSION TO THE MASTER CONTROL FACILITY (MCF), HASSAN" – 5th Semester Students

Department of Electronics and Communication Engineering
5th Semester – 'A' and 'B' Sections, 2017-2018

As a part of our academic event, we were enthralled to visit the prestigious 'Master Control Facility' (MCF), located in the lush green landscapes of Hassan. Everyone in the class was eagerly awaiting for the sights of the humungous antennae and the high - end control facilities which play a pivotal role in controlling our satellites which wander the outer space. At the end, we were not at all disappointed in anticipating them and were gifted with the knowledge of the technical aspects and challenges that are involved in controlling a satellite. The following lines in this report has been written to briefly explain the technicalities that are involved in controlling a satellite from earth and also the key role of powerful 'Microprocessors' that are present inside the abode of computers and inside the satellite, which help in processing and conditioning the signals.

The Journey to the MCF:

The two sections of 'A' and 'B' together started their journey to Hassan on 09-10-2017 i.e. on Monday. Our professors took the lead in maintaining the apt atmosphere for the students inside the vehicle and during the travel. We reached the MCF at around 11:30 in the morning. We were spellbound by the sight of the magnificent Antennae that stood in front of us and around the whole area of the campus. The security staff at the facility checked us in and we were taken to a large auditorium where a short Lecture on the works of MCF in controlling the satellites was arranged.

A senior scientist of the facility, Dr. Yesobu explained the various technical aspects that are involved in efficient controlling of a satellite and took us on an amazing journey to the world of – 'Satellites'. He explained that the MCF is involved in controlling only the geosynchronous satellites which involves the sending and receiving of Tele command and Telemetry signals to and from the satellite respectively. The exact ways in which the sub systems on a satellite work synchronously was explained. He emphasised the importance of interdisciplinary works that go in controlling a satellite. The various difficulties that are faced while launching a satellite and also during its control were explained by him. The basic laws of physics that explain launching and controlling of satellite were shown visually to us in the form of specially made videos.

After the lecture, the lunch was arranged inside the facility for all of us. Later in the afternoon, the scientist took all of us around the campus of the facility. He took us to the main – 'Control Room', where all the scientists and engineers monitor the satellites out in the space throughout the day (24X7). He explained us about the ways in which 'packets' of signals are sent through stages of Encryptions and Processing and how the signal is modulated and duly amplified and sent towards the satellite through the large antennae that cover the surrounding landscape.

At the end of the sessions and tour, we got to understand the level of complexities that are involved in controlling a satellite. We left the campus at around 5:00 in the evening. We reached back to Mysore at around 10:00 in the night, with the extremely satisfying feeling of having learnt the amazing things that go into controlling a satellite from our planet and to have spent a wonderful time with our friends and our beloved professors.

Experience inside the MCF (Lectures by Dr. Yesobu):

MCF:

Master Control Facility (MCF) at Hassan in Karnataka (and also Bhopal in Madhya Pradesh) monitors and controls all the Geostationary / Geosynchronous satellites of ISRO, namely, INSAT, GSAT, and Kalpana and IRNSS series of satellites. MCF is also responsible for Orbit Raising of satellites, In-orbit payload testing, and On-orbit operations all through the life of these satellites. MCF activities include

round-the-clock Tracking, Telemetry & Commanding (TT&C) operations, and special operations like Eclipse management, Station-keeping manoeuvres and recovery actions in case of contingencies.

Satellite Transponders:

A communications satellite's transponder is the series of interconnected units that form a communications channel between the receiving and the transmitting antennas. It is mainly used in satellite communication to transfer the received signals. It can be essentially labelled as the heart of a satellite.

The pivotal role of "on board" processing:

Whenever an uplink signal is taken up by the satellite, a handful number of steps are involved in seeing that the signal is correctly processed and conditioned and is made to work the desired task on the system. During the early years of satellite communication, due to the unavailability of advanced processors, the above mentioned tasks were quite difficult to handle inside the satellite system. The huge plethora of applications that are possible from the satellite today, are owing to the fact that the on-board processing of signals inside the satellite and also on the ground have taken a great leap forward. The complexity of the microprocessors on the on-board systems has increased and their ability of processing signals has also developed greatly.

In essence, on board processing would support services similar to those supported today in the terrestrial sector and, as commentators often put it, allow the satellite industry to truly join the Internet.

Difficulties of using processors in Space:

Though some of the explanations written above are quite far from the present observable processors which work inside the satellites, the relatively old processors still used today for "on board" processing are due to the fact that the harsh environmental conditions present in the outer space require computing modules to be strong and robust with small margins of destructibility. Not only heating and cooling effects, but the most dangerous of all is the radiation in space.

Processors used by ISRO:

As a part of 'Make in India' campaign, indigenous development of Telemetry & Tele command Processor (TTCP) has been taken up by ISRO and successfully realised. The system has been developed on an FPGA (Field Programmable Gate Array) platform taking advantage of 'System on Chip' (SOC) features. Telemetry & Tele command sections were realised as separate hardware. Telemetry input can be received at 70 MHz Intermediate Frequency (IF) and Pulse Code Modulation (PCM) level. Tele command outputs are available at PCM, Frequency Shift Keying (PSK) / Phase Shift Keying (FSK) and 70 MHz IF.

Conclusion:

The development and usage of indigenously designed processors by ISRO are still in its infancy. Though the processors used by space agencies like NASA are being replaced by their high-end counterparts, more enhancements in the processing power, power consumption and ruggedness are required. Developments in the fields of Nanotechnology, Quantum Computing and Semiconductor electronics can influx a great deal of resources into the development of superior on board microprocessors on satellite systems.

Students of ECE 'A' and 'B' Sections with faculty