

**Secondment by: Nalini Kanta Mukherjee**

**Host: IIT Madras**

**Duration: 19/10/2014-20/01/2015**

As per our TANGO project contract, fellows are supposed to attend a secondment for minimum of two months. Being predominantly involved in the mathematical modelling of the combustors at Keele University, I thought of getting involved into some sort of experimental work. The IIT Madras trip and work with Prof. Sujith, was basically, a result of that plan.

I decided to start experiments from the month of October, keeping the weather cycle of Madras, in my mind. The weather gets really hot and humid in summer. That is why, planning a secondment in winter, was a reasonable plan. I was allotted a hostel room within IIT Madras campus and was offered the dining facility, like other international students.

When it comes to experimental work, the setup was already prepared and used by one of the current PHD scholar Vishnu at Aerospace department at IIT Madras. However, because of increasing number of students and current space constraint, the setup was moved from Aerospace department to the Applied Mechanics department, with the approval from Prof. Sujith. The setup behaved little bit erratically at the beginning, as we had a tough time in finding proper alignment of the flame holder with respect to the combustion chamber wall and attaining V-flame symmetry. The fuel flow measuring analogue device (rotameter) was also found to be insensitive to the incoming flow. However, because of constant supervision from Prof. Sujith and regular help from Dileesh, we managed to start the experiments soon. During experiment, we observed the presence of low and high amplitude limit cycle for the first time in a ducted laminar V-flame combustion chamber. The presence of secondary bifurcation, as well as, the hysteresis was found by us during the experiments. We also performed high speed imaging of the V-flame using a Phantom camera from Prof. Sujith's lab. The spectacle of the dancing flame in a slow motion, with exquisite details of the flame contour, was marvellous to witness. We also made an attempt to do thermal imaging of the combustion chamber with a large wavelength infra-red camera and found that the flame is transparent to the infra-red of large wavelength. Thus, the only time we could capture a thermal image was when we heat up a solid surface using the flame. We could, hence, generate image of the combustion chamber wall and not of the hot flow inside. As a result, thermal imaging served our objective partially.

Talking about non-technical aspects, the IIT Madras campus is full of wildlife. A green campus like that was a real pleasure to witness and stay in. Students are not allowed to drive within the campus to keep it pollution free and ensuring a peaceful environment for the wild creatures. The campus has got multiple sports and gym facilities, which I used to make use of, on a regular basis. The all in one retail outlet named Gurunath, is one of the top destinations for all the students. Besides, there are plenty of food outlets, serving a wide range of cuisines day and night. Sometimes, when we performed experiments at night, myself and my partner in experiment, Samadhan, used to go out for a walk around the campus, once in a while, and enjoy warm food at one of those outlets. I also took the opportunity to go for some site-seeing during Christmas vacation. I paid a visit to the old city of Hyderabad and also, had a day out at the Bay of Bengal beach of Mahabalipuram. Moreover, I will carry some fond memories of having dinner every night with some of my close friends there. Overall, I believe, it has been a trip full of pleasant experiences for me and I would like to wish plenty of good luck to my TANGO project team-mates to garner identical experiences during their secondments, as well.