

Virtual Interaction Session with Prof. B. N. Raghunandan

It is known that Aryaan Study Circle believes and offers holistic quality education to their students. In order to motivate and inspire the students, our Director Sir Vyankatesh Prabhudessai (VPD) goes out of the way and puts meticulous efforts and invites experts of world-class repute to interact and share their practical insights with the students.

With the commencement of the new term, we the students of MAHSS got an opportunity to participate in a special expert session on 10th May 2021. It was a special session as VPD Sir had invited his teacher and role model Dr Raghunandan, a buoyant personality who has significantly contributed to the comprehensive field of Aerospace and research and has been the renowned alumnus of IITB and IISc Bangalore and has 55+ years of rich experience. We were privileged to have Dr. Pant, who had been a mentor to VPD Sir at IIT Bombay, as the guest of honor for the session.

Sir VPD heartily welcomed and introduced the distinguished guests of the session.

Dr. Raghunandan graduated from IIT Bombay in Aeronautical Engineering in 1971 and obtained his Doctorate from IISc Bangalore after his B.Tech in 1976 without doing his Masters degree. As a specialist in the area of Aerospace Propulsion and Combustion, he served on the faculty of Aerospace Engineering, IISc Bangalore for 38 long years. He has mentored more than 80 graduate level students for their M.E. and Ph.D. thesis and has published over 250 research articles in reputed journals and conferences. Among the important academic positions Prof. Raghunandan has held at IISc Bangalore are Dean, Faculty of Engineering; Chairman, Division of Earth and Environmental Sciences; Chairman, Department of aerospace

Engineering and Chairman of Centre for Application of Science & Technology to rural; Convener at IISc Space Technology Cell.

Prof. Raghunandan has contributed almost five decades of his life to aeronautics. He has been a visiting scientist at some of the top Universities in the U.K. including the University of Leeds and Imperial College of London. He was also an international scholar and visiting Professor in Hisao University in Tokyo, Japan and has widely travelled on academic missions and for technical lectures across the globe. He received alumni award of excellence in research in IISc and also held Satish Dawan Chair Professorship. He was the Director, Centre of Propulsion technology at IIT Bombay. Prof. Raghunandan is the fellow of Indian National Academy of Engineering and also Aeronautical Society of India. He had also served on many important committees of ISRO, DRDO, DST, CSIR, KSCST and many academic institutions. From 2009 till January 2020 he was a advisor to Director, IISc piloting the development of second campus of IISc Bangalore. He currently is the Chairman of the trust of National Committee of Air Breathing Engines and he is also associated with several engineering institutions in advisory capacity.

Prof. Raghunandan started his presentation and impressed us right in the beginning by his opening slide named "Reminiscences" since he planned to share with us his pathway to success. Prof. Raghunandan mentioned that he grew in the small town. However, he consistently had an excellent academic record which led him to pursue Aeronautical Engineering in the first batch at IIT Bombay. He always regarded his accomplishment as a privilege which brought about his humble nature. He also shared his ideology of being contended with whatever came his way.

In his talk, Prof. Raghunandan shared his experiences of yester years at IIT Bombay. He gave us an essence of life at IIT campus and gave us a glimpse of academic activities from different departments. He

gave us an insight of his academic and research contributions at IISc Bangalore which is the quintessential science institution and is predominantly a post graduate institute. Made by the confluence of vibrant minds in various sciences, IISc provides a competitive research environment giving young minds an opportunity to interact with the celebrity scientists hereby ensuring global reach. Prof. Raghunandan's academic career in IISc has been from the research scholar, faculty member to his role at high positions as Chairman and Dean. Prof. Raghunandan mentioned that many post graduate and research students from IISc Bangalore joined IIT Bombay as faculty.

He believes that academic institutions are seed beds of new ideas and innovation. He described his work years as slew of opportunities abroad which included assignments in UK, Japan, Syria, Canada, USA, and representation in ISABE. Prof. Raghunandan inspired us as he stated that he believes young minds are the future of science. Referring to the scientists as the best fertile minds being intensively engaged in learning and questioning; he regarded young aspirants as continuous flux of thinking always wanting to break the routine.

Prof. Raghunandan educated us about the attributes of current academic system which essentially comprised of teaching and mentoring; research/guidance and publications; development and industrial consultancy; national / international reviewing and technical administration. He emphasized that research is an important and essential component of academics. He emphasized that to be counted among the best one has to enable mentoring with authority beyond the books along with mastering the tools of research. He mentioned that remaining competent and competitive especially in lieu of rapid obsolescence and build-up infrastructure for the long career ahead is another characteristic of a futuristic researcher.

He motivated and enlightened us by presenting few of the case studies from his research & development work which included the following:

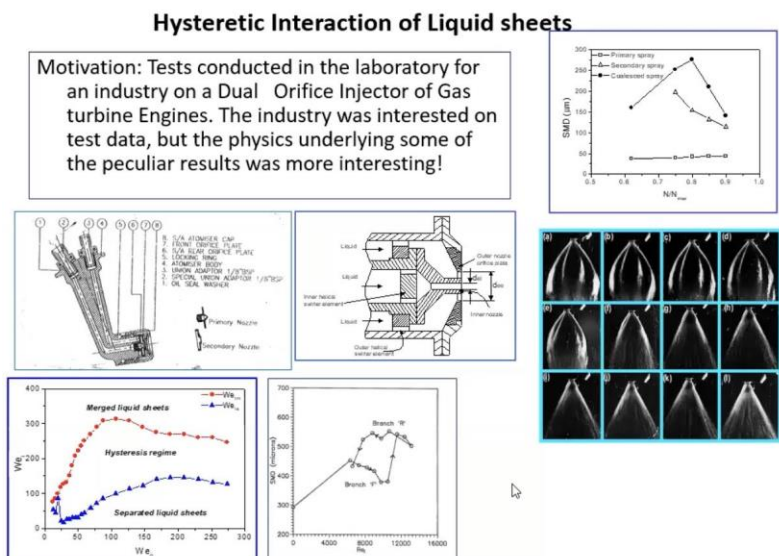
- **Velocity overshoot in flames**



In this study, light chopper and slide projector generated particle streaks by which he could measure the velocity overshoot in flames.

Prof. Raghunandan taught us that we may not always get the best facility but we should make the best use of what we have.

- **Hysteretic interaction of liquid sheets**

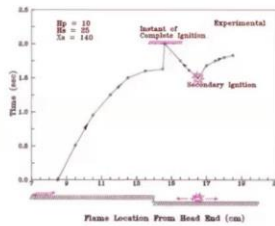
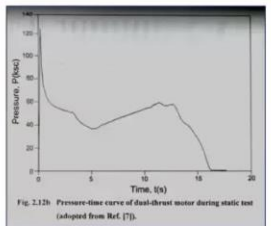
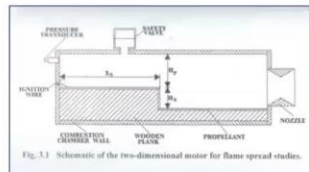
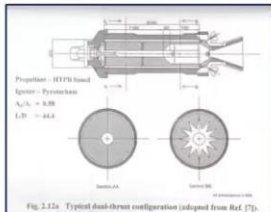


This study was very productive which involved measurement of oil particles which gave rise to a lot of research and hysteretic interaction of liquid sheets.

- **Ignition transient in solid propellant rockets**

The Problem of Ignition Transient in Solid Propellant Rockets

A rather uncomfortable feeling while explaining ignition and igniter charge estimation (particularly, in a short term course at SHAR!) was the beginning.

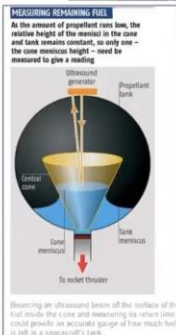
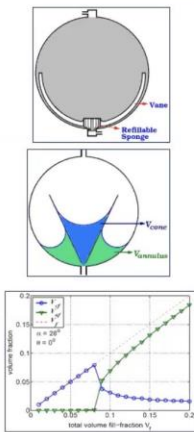


This study focused on ignition and igniter charge estimation.

- **Propellant gauging in spacecraft**

A Configuration for Propellant Gauging in Spacecrafts

Prediction of residual life time of satellites is indeed a million dollar question! The current techniques have limitations of becoming inaccurate towards the end-of-life. Question posed: Is there an alternative?



"Is 4 minutes (or possibly up to 8, if absolutely required) long enough to test your fuel gauge approach? About how many flights would be required to truly advance development on this approach to fuel measurement?"

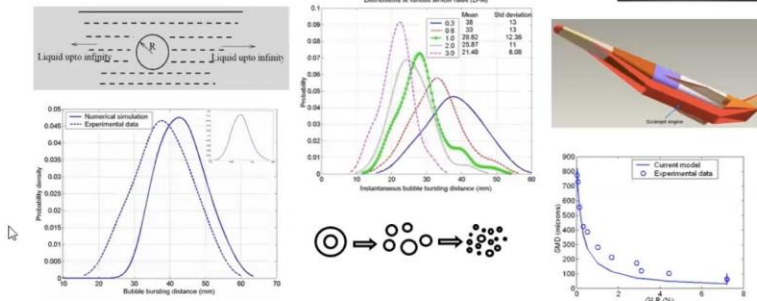
Three years of computational effort to answer this simple question

This study was done to measure the end life of a satellite.

- **Nature of effervescent atomization**

Physics of Effervescent Atomization

Question:
 The efficiency of aerospace engines tend to degrade at off-nominal operating conditions – one of the causes being the coarseness of fuel/propellant spray. Can we exercise active control on mean drop-size?
 The industry interest arose in the middle of the study by a 'chance' discussion!

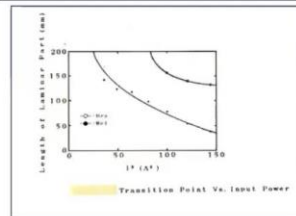
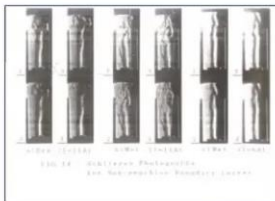
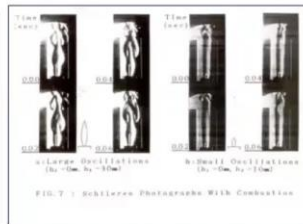
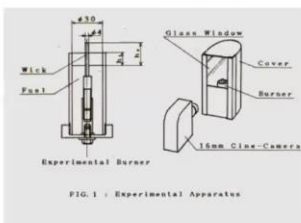


Prof. Raghunandan explained this study in terms of difference in the pressure affecting the size of the oil droplets.

- **Flickering of wick flames**

A simple observation at home
 (Thanks to the frequent power shut down in Bengaluru of 80's!)

What is the **intense** flickering due to ?



This objective of this study was to look into the reason of intense flickering of light.

Moving on Prof. Raghunandan also showed us pictures captured with the former President Dr. A. P. J. Abdul Kalam. He also cherished his long association with ISRO and DRDO. Also describing his ASTRA experiences, he described his work years as slew of opportunities like Assignments abroad - Eg. UK, Japan, Syria, Canada, USA etc and Representation in ISABE. His serendipitous work opportunities included collaborative research along with setting up NCCRD & Pratt & Whitney Centre Sir, motivated us to go for higher studies and develop the scientific attitude.

“All that begins well ends well..” thus came to an end very inspiring and informative interaction session. At the end of the session, Naisha Asnani, a student of XIth standard, summed up the session and proposed the vote of thanks on the behalf of the institution.

On the behalf of MAHSS students, I would like to thank Sir VPD for offering us an opportunity to learn from such a amazing talk.

We are grateful to Prof. Raghunandan for taking time out of his very busy schedule and having this interactive session with us. It certainly makes a mark in our minds and instills confidence to constantly commit to self improvement and aim to succeed in life.

By
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(students of class XI)