# ANTHARIKSH

**The Space...**

## DEPARTMENT OF AEROSPACE ENGINEERING

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

MYLAVARAM, ANDHRA PRADESH, INDIA.

**Vision of the Department**:

**To achieve academic excellence and produce highly competent professionals in the field of Aerospace Engineering**

**Mission of the Department**:

**DM1**: To impart high quality education in Aerospace Technology through class room teaching and laboratory practice
**DM2:** To develop indigenous Aerospace Technology by carrying out research in collaboration with industry and research organizations
**DM3:** To train and inspire the student community to possess effective communication and leadership skills with ethical values
**DM4:** To harness the technological development by being consistently aware of societal needs and challenges

**Program Educational Objectives (PEOs)**

| PEOs | Statement |
|---|---|
| PEO1 | To provide students with sound mathematical, engineering and multidisciplinary knowledge to solve Aerospace and Allied Engineering problems |
| PEO2 | To prepare students to excel in higher education programs and to succeed in industry/academia profession. |
| PEO3 | To inculcate ethical attitude, leadership qualities, problem solving abilities and life-long learning for a successful professional career |

**PROGRAM OUTCOMES (POs)**

**PO1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

**PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

**PO3: Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4: Conduct Investigation of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

**PO5: Modern Tool Usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including predictions and modeling to complex engineering activities with an understanding of the limitations.

**PO6: The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7: Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9: Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11: Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12: Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

**PSO1:** To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicle design

**PSO2:** To prepare the students to work effectively in Aerospace and Allied Engineering organizations

# FOCUS AND SCOPE

*Anthariksh is a department magazine, bridges the gap between students and faculty. Typically, a department magazine consists of Technical articles, ideas, project outcomes, language skills, literary articles, technical updates, success stories, career tips, academic advice, the latest events and happenings related to campus. Cover-stories have to be written in an engaging format. We can also include interviews of former students who have achieved success through dedication and hard work.*




**PUBLICATION FREQUENCY:**

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**Send your articles to the following mail ID.**

E-Mail: **anthariksh.lbrce@gmail.com**

**Disclaimer**

# WHAT IS SPECIAL ABOUT HYPERSONIC FLOW?

Dr. P. Lovaraju,
Head and Professor.

Flow streams with Mach number about 5 are generally termed HYPERSONIC. What is scared about Mach number 5? Is the upper limit for hypersonic flow finite or infinite?. The Mach number 5 is treated as the lower limit of Hypersonic flow. This is because up to Mach number 5, any change in flow velocity is dictated by the change in flow velocity as well as the change in the speed of sound. In the accelerating supersonic flow, the change in magnitude of absolute velocity is more than the change in speed of sound. But for accelerating Hypersonic flow, the change in flow Mach number is dominated by the change in speed of sound and the flow velocity is not dominant. For example, for increase of Mach number from 5 to 7, the decrease of speed of sound is predominant compared to increase of flow velocity. In other words, it may be stated that for Mach numbers above 5 the effect of change in speed of sound **Hypes** the change in flow Mach number (the sonic effect dictates the Mach number change or the sonic effect **Hype** the Mach number change) and hence the flow is referred to as **HYPERSONIC.** The upper limit for Mach number of hypersonic flow is around 40. Flow with Mach number above 40 would experience very strong temperature effects, leading to dissociation and ionization and field is referred to as high enthalpy gas dynamics, which encompasses high-temperature and plasma flows.

**Reference:** Rathakrishnan. E, Gas Dynamics, Seventh Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2020

## DID YOU KNOW ?

### WHAT ASTRONAUTS DRINK IN SPACE…?

*Yes! That's exactly what astronauts do. If you're living on the ISS, you're going to lose a certain amount of water every time you exhale or sweat. A single breath or a drop of sweat may not be much in terms of replenishing the water supply, but the ISS is designed to support a crew of six people (plus visitors), and everyone sweats and exhales. The vapours created by these acts of exhalation and sweating help to maintain the ambient cabin humidity, and are eventually condensed and used to replenish the general water supply of the ISS. The ISS has a complex water management system that extracts every last drop of water it can access, whether it comes from people's breath, recycled shower water, residue from hand-washing and oral hygiene, astronauts' sweat and even urine! "It tastes like bottled water, as long as you can psychologically get past the point that it's recycled urine and condensate that comes out of the air," says Layne Carter, who manages the ISS water system from the Marshall Flight Center in Alabama.*



## DID YOU KNOW ?

### THERE'S A HIGHWAY IN SPACE….

*Called the interplanetary super highway, it is used to send spacecrafts around the solar system with least resistance using gravity.*

# IMPORTANCE OF RESEARCH IN ACADEMIC INSTITUTIONS

I. Dakshina Murthy
Sr. Assistant Professor

Research is a scientific and systematic investigation or inquiry especially through search for new facts in any branch of knowledge. The research and its quality in the academic institutions have become significant for its sustainable growth and development. The research in the academic institutions made enormous contribution to find the solutions for many problems of society and industries. Also, the necessity of knowledge sharing between industry and academia is being increasingly evident. At this juncture, it is pertinent to develop a system that is committed to for the excellence of both teaching and research in academic institution. However, the academic institutions always keen to develop such kind of systems. The research in the academic institution plays vital role in various accreditation process and institutional raking systems. The better research quality enhances the possibilities of accreditation by various national bodies and also in obtaining better rank in various ranking systems. The quality of the research depends on the various factors like quality of faculty members, quality of student intake, capital facilities, adequate funding, institute –industry collaborations and encouragement to the faculty from the institution. Out of all these factors the faculty members play a crucial role in carrying out the qualitative research in an institution. In general the faculty members help and assist the students in learning process by imparting the basic and applied knowledge to the students. If a faculty member is able to carry out quality research which directly imparts on to the quality of teaching and learning, there by benefiting the students. The research findings could be helpful in delivering the theoretical concepts in a better way which might fill the learning gaps. Also, the research helps the faculty member to know the current advancements in their area of specialization. Research can help in professional development of faculty and also orient and prepare them to acquire 21$^{st}$ century skills in order to implement new educational strategies, evaluation techniques in their area of specialization. To conclude, the balance among the teaching and research is very much necessary for the growth of an individual faculty member and institution.

**References:**

[1] Basu, Mayurakshi, Importance of Research in Education (October 2, 2020). http://dx.doi.org/10.2139/ssrn.3703560

[2]https://www.financialexpress.com/jobs/role-of-research-in-an-academic-institution-is-significant-heres-why/586210/

## AEROSPACE ENGINEERING

R.N.V.Krishna Pavan,
18761A2142.

It is a branch of science concerned with the development of aircraft and spacecraft. It is the overlapping of two branches: Aeronautical Engineering and Astronautical Engineering. The interaction between these technologies is known as Aerospace Engineering. As flight technology advanced to include vehicles operating in outer space, the broader term "Aerospace Engineering" has come into use. Aerospace engineering, particularly the Astronautics branch, is often colloquially referred to as "Rocket Science".

Flight vehicles are subjected to demanding conditions such as those caused by changes in atmospheric pressure and temperature, with structural loads applied upon vehicle components. Consequently, they are usually the products of various technological and engineering disciplines including "Aerodynamics, Propulsion, Avionics, Materials Science, Structural Analysis and Manufacturing". The Aerospace Engineer is armed with an extensive background suitable for employment in most positions traditionally occupied by Mechanical Engineers as well as limited positions in the other various engineering disciplines. Because land and sea vehicles are designed for optimum speed and efficiency, the Aerospace Engineer has become a prominent member of the design teams. The presence of the Aerospace Engineer in the Automobile Industry is evident from the "streamlined shapes of cars and trucks that evolved during the late 20th century". The construction of large towers, buildings, and bridges requires predictions of Aerodynamic forces and the creation of an optimum design to minimize these forces.

**Contribution:** "In 1910 Alexandre-Gustave Eiffel achieved remarkable experimental results measuring the wind resistance of a flat plate, using the Eiffel Tower as a test platform".

**Career Enhancement:** Many companies benefit not from the advanced hardware developments of Aerospace Technology but by the understanding and application of Aerospace Methodology. Companies engaged in satellite communications require an understanding of orbital mechanics, trajectories, acceleration forces, and aerodynamic heating and an overall knowledge of the spacecraft industry. Advanced aerodynamic design of airfoils and rotor systems is applied in an effort to improve the efficiency of propellers, windmills, and turbine engines. The impact of Aerospace Technology has trickled down to many companies engaged in the research and development of flight simulation, automatic controls, materials, dynamics, robotics, medicine, and other high -technology fields.

## REUSABLE LAUNCH VEHICLE- TECHNOLOGY DEMONSTRATOR

M. Cherishma,
17761A2120.

**RLV-TD** is India's first uncrewed flying test bed developed for the Indian Space Research Organisation (ISRO)'s Reusable Launch Vehicle Technology Demonstration Programme. It is a scaled down prototype of an eventual two-stage-to-orbit (TSTO) reusable launch vehicle. The RLV-TD successfully completed its first atmospheric test flight on 23 May 2016, which lasted for 770 seconds and reached a maximum altitude of 65 kilometres (40 mi).

It was designed to evaluate various technologies, and development of the final version is expected to take 10 to 15 years. The fully developed RLV is expected to take off vertically like a rocket, deploy a satellite in orbit, return to Earth, and land on a runway.

**RLV-TD USAGE IN SECOND STAGE RECOVERY:** ISRO is working on a reusable launch technology in order to recover the first and second stages of a rocket to reuse them in order to cut cost and carry heavier payloads. The first rocket stage will be recovered on a vertical landing spot on the sea like SpaceX has been doing it with its Falcon family of rockets. For the second stage, ISRO is developing a winged body like a space shuttle. This shuttle will be attached as a second stage in a rocket. It will carry the top portion of the rocket comprising a satellite or spacecraft to space. Once it injects the satellite in its orbit, the shuttle will glide back to the earth and land on an airstrip like an aircraft.

**RLV-TD** is one of the most technologically challenging endeavours of ISRO towards developing essential technologies for a fully reusable launch vehicle to enable low cost access to space. The configuration of RLV-TD is similar to that of an aircraft and combines the complexity of both launch vehicles and aircraft. The winged RLV-TD has been configured to act as a flying test bed to evaluate various technologies, namely, hypersonic flight, autonomous landing and powered cruise flight. In future, this vehicle will be scaled up to become the first stage of India's reusable two stage orbital launch vehicle. RLV-TD consists of a fuselage (body), a nose cap, double delta wings and twin vertical tails. It also features symmetrically placed active control surfaces called Elevons and Rudder. This technology demonstrator was boosted to Mach No: 5 by a conventional solid booster (HS9) designed for low burn rate. The selection of materials like special alloys, composites and insulation materials for developing an RLV-TD and the crafting of its parts is very complex and demands highly skilled manpower. Many high technology machinery and test equipment were utilized for building this vehicle.

A team of 750 engineers at Vikram Sarabhai Space Centre, National Aeronautical Laboratory, IITs and Indian Institute of Science worked on the design and development of RLV-TD and the associated rocket. RLV-TD underwent 120 hours of wind tunnel, 5,000 hours of computational fluid dynamics and 1,100 runs of flight simulation tests. RLV-TD has mass of 1.75 tons, wingspan of 3.6 meters and overall length of 6.5 meters (excluding the rocket).

## NASA INGENUITY MARS HELICOPTER PREPARES FOR FIRST FLIGHT

Sony Devakari,
17761A2104.

NASA is targeting no earlier than April 8 for the Ingenuity Mars Helicopter to make the first attempt at powered, controlled flight of an aircraft on another planet. Before the 4-pound (1.8-kilogram) rotorcraft can attempt its first flight, however, both it and its team must meet a series of daunting milestones.
Ingenuity remains attached to the belly of NASA's Perseverance rover, which touched down on Mars Feb. 18. On March 21, the rover deployed the guitar case-shaped graphite composite debris shield that protected Ingenuity during landing. The rover currently is in transit to the "airfield" where Ingenuity will attempt to fly. Once deployed, Ingenuity will have 30 Martian days, or sols,

About 5% is the astral bodies are their remaining are the rest of all the absolute darkness. In this there are two major classifications are done **1.Dark energy** ,and **2.Dark matter** these two are comes from the **Dark Universe**. Dark energy is about 75% and the Dark matter about 25% of the total universe.

# CHANDRAYAAN-2

Anandhi,
17761A2138.

**Objective of Chandrayaan-2:** Chandrayaan-2 is a complex mission, an extension of chandrayaan-1, which consists Orbiter, Lander and Rover with the goal of exploring South Pole of the Moon. Moon provides the best linkage to Earth's early history. It offers an undisturbed historical record of the inner Solar system environment. Evidence for water molecules discovered by Chandrayaan-1, required further studies on the extent of water molecule distribution on the surface, and to address the origin of water on Moon. GSLV Mk-III is a three-stage vehicle capable of launching 4-ton class of satellites to the Geosynchronous Transfer Orbit (GTO) is used in the mission chandrayaan-2.
**Orbiter, Lander and Rover:** The chandrayaan-2 consists of rover (Pragyan), Lander (Vikram) and orbiter. Orbiter is the connection between the Lander and the earth station. Orbiter has a life mission of 7 years to orbit around the moon. Vikram having Pragyan within it will land on the surface of the moon, where Pragyan is a 6-wheeled, AI-powered vehicle. It will land on the surface with Vikram and perform the required tests and gives that particular data. We choose the lunar south pole, which is dark and has the possibility of presence of water. This region may contain fossil record of early solar system due to the presence of cold traps.

**Crash Landing:** The Vikram, carrying the Pragyan, separated from the Chandrayaan-2 orbiter on 7 September 2019 and was scheduled to land on the Moon at around 1:50 a.m. IST. But the Lander's trajectory began to deviate at about 2.1 kilometres above the surface. During ISRO's live-stream show that Vikram's final vertical velocity was 58 m/s (210 km/h) from 330 meters above the surface. ISRO chairman confirmed that it had a hard landing and the location was found. Orbiter is still working and took the images of crash site, where the Vikram and Pragyan were totally destroyed.

# HOW ASTRONAUTS WRITE IN SPACE ?

D. Jobin
18761A2115

Legend has it that during the height of the space race in the 1960s, NASA scientists figured that pens could not function in space. So, they spent millions of dollars developing a pen that could write in space, while their Soviet counterparts used the humble pencil. This story has been floating around the Internet for way too long. However, it is just a myth.

**The truth:** According to NASA historians, NASA astronauts also used pencils. In 1965, NASA ordered 34 mechanical pencils from Houston's Tycam Engineering Manufacturing, Inc. at the rate of $128.89 per pencil. When the public got to know about these rates, there was an outcry, and NASA had to find something much cheaper for its astronauts to use.

**The pencil loses out:** The pencil wasn't an ideal choice for writing in space because its tip could flake and break off, drifting in microgravity with the potential to harm an astronaut or an equipment. Apart from this, pencils are flammable, and NASA wanted to avoid anything flammable aboard a spacecraft.

**And the pen?** Regular pens that work on Earth did not work in space because they rely on gravity for the flow of ink to the nib. This was understood quite early by scientists and hence astronauts used pencils. But with both the pencil and the pen creating issues, what did NASA finally resort to?

**The saviour:** Around the time NASA was embroiled in the mechanical pencils controversy, Paul C. Fisher of the Fisher Pen Co. designed a ballpoint pen that could work in space. His company invested one million dollars to fund, design, and patent the pen on its own. Fisher's pen operated seamlessly, not just in space, but also in a weightless environment, underwater, in other liquids, and in temperatures ranging from -50 F to +400 F. The company offered the pen to NASA, but the space agency was hesitant to buy it due to the mechanical pencil controversy. However, a few years later, after rigorous testing, NASA agreed to equip its astronauts with the space pen. The space agency bought 400 pens from Fisher. And a year later, the Russians also ordered 100 pens and 1,000 ink cartridges to use on their Soyuz space missions. Both NASA and the Soviet space agency received a 40% discount on bulk purchase of the pens, paying about $2.39 per pen.

Over the years, Fisher's company has created different space pens, which are still used by NASA and the Soviet space agency. If you would like to get your hands on one of these space pens, it would cost you approximately $50.

### ***DID YOU KNOW!?***

***THE COST OF SPACE TRAVEL….***

*One of the biggest hindrances to man's exploration of the solar system is the extortionate cost. It's been estimated that the total cost of the Apollo 11 mission that first put a man on the moon was $25.4 billion. In today's money, that's around $135 billion. Obviously, technological advances have since made space travel a lot less expensive, but when you realize that the cost of just one EMU, which is the special suit astronauts wear to go outside the shuttle, is $12 million, you can see how it all adds up!*

# SARABHAI's LEGACY

K V Ravi Teja Reddy
18761A2122

Vikram Ambalal Sarabhai, the man who ventured Indian space programme. He was honoured with Padma Bhushan in 1966 and Padma Vibhushan in 1972. Student of noble prize laureate the great C V Raman, he is an industrialist and mentor for missile man of India Abdul Kalam. He is the father of Indian Space Programme.

Vikram Sarabhai born on august 12, 1919, Ahmedabad. He came from one of the wealthiest family in India and his family supported Indian independence movement. Vikram Sarabhai completed his schooling in a school which was established by his mother Sarala Devi for her eight children. He joined Gujarat arts and science college, Ahmedabad, but later shifted to University of Cambridge, England, where he took tripos in natural science in 1940. Because of world War II he returned to India. After coming to India he started research in Cosmic rays under Noble prize holder C V Raman at Indian Institute of Science, Bangalore. In 1945 he returned to Cambridge to pursue a doctorate and wrote a thesis about Cosmic Ray Investigations on Tropical Latitudes in 1947. After he returned to India he founded Physical Research Laboratory in Ahmedabad. Along with involvement in scientific research, he took interest in his family business and development issues. In 1947 Vikram founded Ahmedabad Textile Industries association and after looking its affairs, He realized the need of professional management studies in India, In 1962 he established Indian Institute of Management (IIM) .

This is the start of Vikram Sarabhai's legacy. Vikram Sarabhai established Indian National Committee for Space Research in 1962, later it named as Indian Space Research organization, Also set up the Thumba Equatorial Rocket Launching Station in Thiruvananthapuram, Kerala. First sounding rocket launched from TERLS in 1964. In 1965 space science and technology centre (SSTC). After the death of Homi Babain 1966, Sarabhai was appointed as chairman of the Atomic Energy Commission of India. Sarabhai was responsible for establishment and development of India's nuclear plants. He laid the foundation for indigenous development of nuclear technology for defence purposes. Satellite telecommunication earth station set up at Ahmedabad in January 1, 1967. He initiated programs to take education to remote villages through satellite communication and called for the development of satellite based remote sensing of natural resources. TERLS dedicated to United States in February 2, 1968. INDIAN SPACE RESEARCH ORGANIZATION (ISRO) formed under Department of Atomic Energy. Vikram Sarabhai died on December 30, 1971, at Halcyon Castle, Trivandrum, Thiruvananthapuram.

**DID YOU KNOW ?**

*Neither Wilbur nor Orville attended college, but their younger sister Katherine did.*

*Milton Wright's preaching took him on road frequently, and he often brought back some toys for his children. In 1878, he brought back a small model helicopter for his boys made of cork, bamboo and paper and powered by rubber band to twist its blades, the model was based on designed by French aeronautical pioneer Alphonse Penaud. Fascinated by the toy and its mechanic. Wilbur and Orville would develop a lifelong love of aeronautics and flying.*

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