ANTHARIKSH

The Space...

DEPARTMENT OF AEROSPACE ENGINEERING

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

MYLAVARAM, ANDHRA PRADESH, INDIA.

FOCUS AND SCOPE

Our departmental magazine bridges the gap between the students and the faculty. Typically, it consists of technical articles, ideas, project outcomes, language skills, literary articles, technical updates, success stories, career tips, academic advice and the latest events and happenings in the institution. Cover-stories are published in an engaging format. We also include interviews of former students who have achieved success through dedication and hard work.

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send your articles to the following mail ID.

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<u>Disclaimer</u>

Some of the contents published in this magazine are from open sources. The contents of this magazine are for information purposes only, enabling the faculty and students to have easy and quick access to information and do not have any legal sanctity. This magazine is intended for circulation among students of the Department of Aerospace Engineering of LBRCE only.

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

FROM HOD's DESK

Experiment

Everyone is different, so what works for you may well be different than what works for everyone else. You may work best in the morning or late at night. Take advantage of your own strengths, and find ways to compensate for your weaknesses. Whenever you come up with a wacky new idea for increasing your productivity, test it and see what effect it has. Don't dismiss any idea unless you've actually tried it. Partial successes are more common than complete failures, so each new experiment will help you refine your time management practices. Even the ongoing practice of conducting experiments will help condition you to be more productive.

Dr. P. Lovaraju

NASA'S PROPOSAL TO TACKLE SPACE JUNK

K. RUBY
20761A5629

Our planet has a huge space debris problem. The International Space Station, constantly having to move out of the way of space junk, the space debris crisis has prompted concern from governments and businesses, as well as the scientific community. Writing in the journal *Science*, scientists have called for a legally-binding international treaty to govern the deployment of satellites, taking inspiration from the recently ratified UN High Seas Treaty.

The scientists propose that such an agreement should implement producer and user responsibility for satellites and debris from the time they launch. Also, according to them, the agreement should take into account the commercial costs of these responsibilities and should incentivize accountability. But not producing any more space junk is only solving a part of the problem. The main concern is the space junk that is already out there. NASA is studying two solutions, and one of them is literally using ground or space lasers.

USAGE OF LASERS TO CLEAR SPACE JUNK

Lasers can exert force on debris in space without making any physical contact. In its report, NASA focused on two different laser technologies to help manage space junk from a distance—photon pressure and ablation.

Using Photon Pressure on space junk:

In Photon Pressure technology, lasers nudge debris to ensure that collisions don't occur. A photon is an elementary particle that represents a quantum of light. They have no mass. However, they do carry a small amount of momentum. When a photon bounces off an object, it transfers a small amount the momentum it has, to the object. The thrust obtained from this method is too little to de-orbit any kind of debris, but is just enough to help nudge it away from a collision.

ABLATION- USING A POWERFUL LASER TO CUT INTO SPACE JUNK:

As the name suggests, a more powerful laser would be used in ablation method to

strike space debris in order to ablate (erode) it. When this is employed, the debris will eject the material from one side, generating thrust in the opposite direction and causing it to move. According to NASA, this ejected material will be a combination of hot gas and plasma and should therefore not contribute any new debris to the environment.

Compared to the photon pressure method, ablation requires more powerful laser beams and much higher precision. Simulations conducted by the space agency indicate that this method can be used to de-orbit the debris instead of just redirecting it.

[continued…]

SPACE-BASED OR GROUND-BASED LASER:

If a laser is to be used to tackle space junk, the next step is to decide whether it should be a ground-based solution or a space-based one. One disadvantage with a space-based laser compared to one on the ground is that it will be able to generate much less power because it must produce all that power while in orbit.

But using it also has advantages. One of them is the fact that a space-based laser's beam will not pass through the atmosphere, meaning it will lose less power. Chances of the beam being deformed are also less, allowing it to be more accurate. Further, since a space-based laser will be much closer to the debris, it will be easier to accurately target the debris for the intended consequence–whether it is de-orbiting the debris or ablating it.

USAGE OF A SWEEPER SPACECRAFT

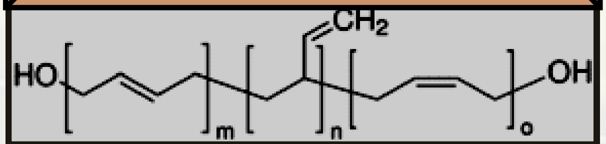
NASA is also considering a concept that is slightly more domestic in its inspiration—using a sweeper. These sweepers will be large "shields" in orbit that will reduce the amount of space junk by capturing them, slowing them down, or breaking them apart. This method will be especially useful for debris that is too small to be tracked.

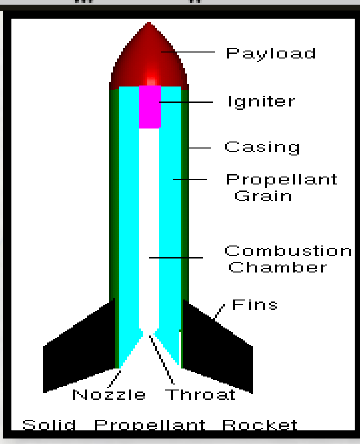
Such a sweeper can be made with a variety of possible materials, including aerogels, foams, clothes or fabrics. The material itself might need to be a little supple because otherwise, there is a chance of it sending the debris flying in different directions, exacerbating the problem rather than solving it. Since NASA is mainly considering the use of such a sweeper solution for small and medium-sized debris that cannot be tracked, they can have either an active propulsion mechanism, or they can move passively. This has to be divided based on how well such a sweeper can maneuver away from larger tracked debris while continuing to affect the smaller debris.

DID YOU KNOW ..?

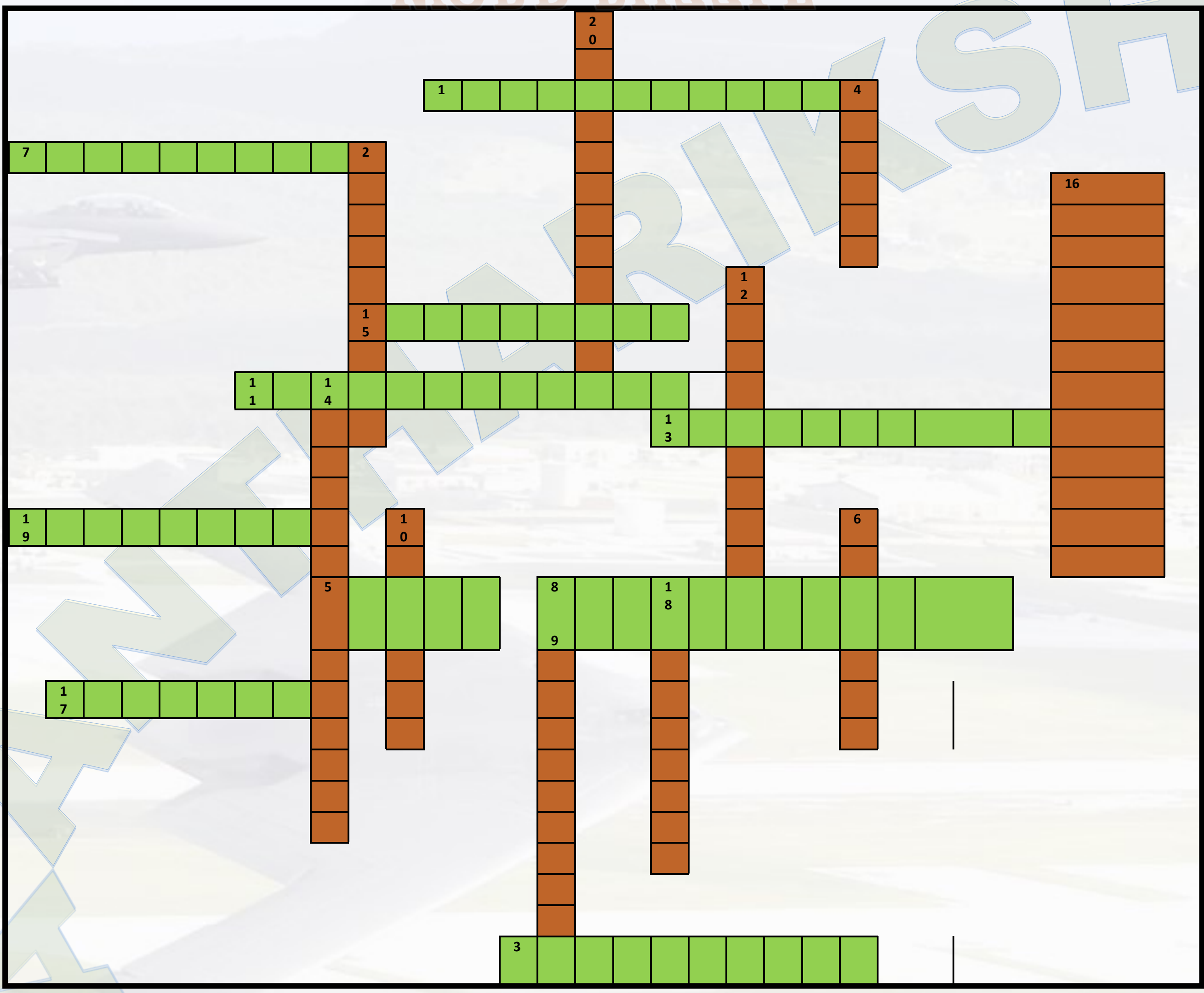
NH_4ClO_4

Commonly used propellant mixtures include ammonium perchlorate composite propellant (APCP), hydroxyl-terminated polybutadiene (HTPB), and various combinations of metal powders with oxidizers.





WORD PUZZLE



HOW TO ANSWER ?

You people can send your responses through the given link.

First 10 Students with correct responses will be featured in next volume of our Magazine

1.Just answer the puzzle on a white paper, take a picture of it.

2.Click on the google form link.

https://forms.gle/mktFrTfEVVBSz9Cs5

Across

1.________ is the way objects move through air.

3.Reversible Adiabatic flow is called ________ process.

5.The second law of motion give us a measure of which physical quantities______.

7.who was the first to state the principle of floatation_________.

9.Weather and clouds exist in the __________.

11.When the fluid is in motion the actual pressure exerted by the fluid is known as________.

13.Which device measures the fluid pressure by height of a liquid column__________.

15.What was added to a purely monocoque structure to support larger more and powerful aircraft________.

17.Mach number is generally used to define the speed of _________.

19.________ is a device consisting of a wheel having much of its mass concentrated around the rim, mounted on a spinning axis.

Down:

2.In PSLV, S is abbreviated as__________.

4.The phenomena 'Great White Spot' is associated with which planet? ________.

6.What is the ratio of change in configuration to the original configuration called as __________.

8.Missile Women of India is _________.

10.________ is the forward force that moves an aircraft through the air.

12.Which engine provides the greatest amount of thrust for their weight? _________.

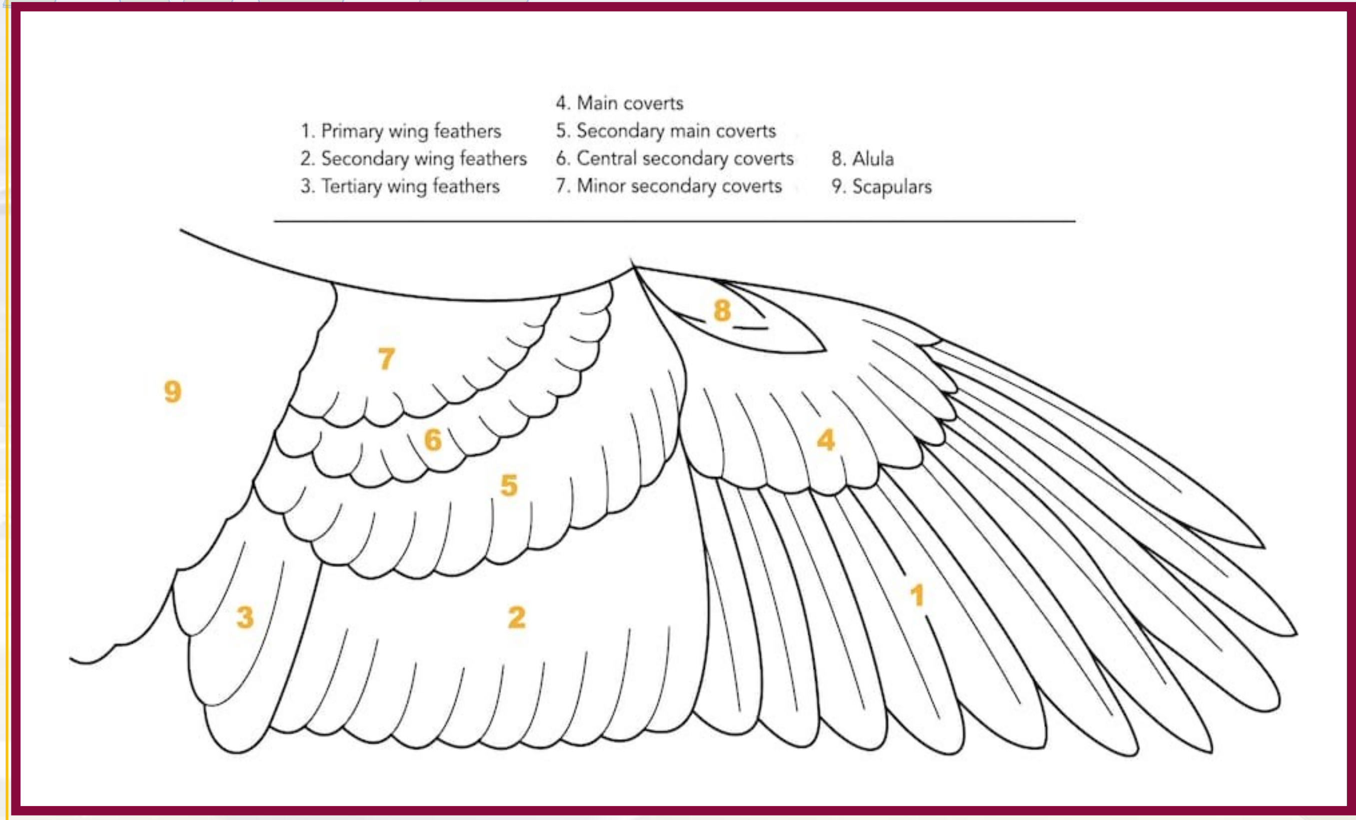
14.What is the angle called which is connected between the chord line and the relative airflow________.

16.Which scale is extremely accurate for measurement? __________.

18.Conpressive stress in liquids is called________.

20.Which control surfaces are present in V-tail configuration? _________.

KNOWLEDGE CHECK.!!!



ONEWEB INDIA-2 MISSION

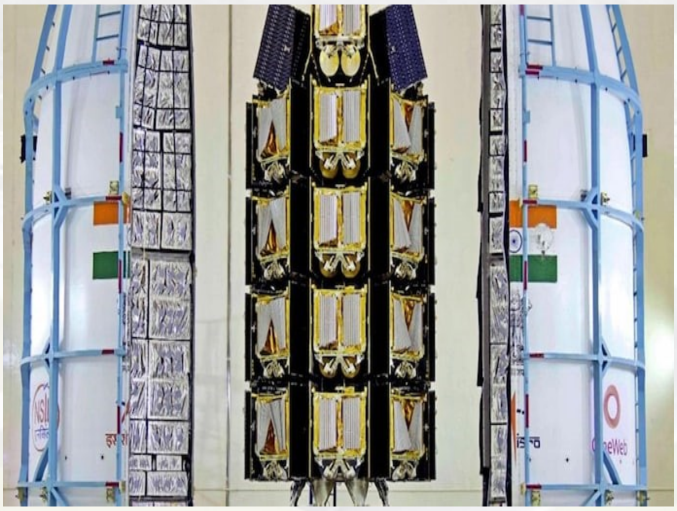
Indian Space Research Organisation's (ISRO) LVM-3, in its second commercial launch on Sunday, placed 36 OneWeb satellites in orbit, completing the first-generation constellation enabling the UK-based company to initiate global coverage this year. Sundays was the sixth launch for India's heaviest rocket LVM-3 – which includes the launch of Chandrayaan-2 in 2019 – and the second one where it demonstrated the capability of launching multiple satellites in low earth orbit. **OneWeb India-2 Mission** will be a major milestone for the London-based company because this launch will complete OneWeb's Gen-1 (first generation) constellation to fulfil its goal of enabling global coverage in 2023. The mission would make OneWeb the first low-Earth orbit operator to reach this milestone. The 36 satellites were placed in orbits in nine batches of four satellites each. The satellites in total weighed 5,805 kg. After the burn of all three stages of the rocket, taking the satellites to around 450-km circular orbit, the first batch of satellites was injected into orbit just over 19 minutes after lift-off. The fourth batch was placed in orbit at around 33 minutes after lift-off. The other five batches were injected into orbit when Indian ground stations did not have their eyes on the craft. The launch of all the satellites was later confirmed when on-board data was received by the ground-stations after a 43-minute black-out period.

The satellites were also placed at a lower 450-km circular orbit in the current mission, as against the 600-km orbit during previous missions. Consequently, the satellites were at a higher velocity at launch. This is a challenge for the mission as the separation must be sequenced in such a way that the satellites do not crash into each other. Sunday's was the second launch that ISRO did for the United Kingdom-based company, which is backed by the government of UK and India's Bharti. The company, in its first-generation constellation, plans to use 588 active satellites – placed in 12 rings of 49 satellites each with every satellite completing a full trip around the earth in 109 minutes – to provide high speed, low-latency global connectivity. This was the eighteenth launch of OneWeb satellites, and the third this year, bringing the total number of satellites in the constellation to 618.

"OneWeb already has connectivity solutions active today in key geographies across the globe and is bringing new areas online. OneWeb's high-speed, low-latency solutions will help connect communities, enterprises, and governments around the world, demonstrating the unparalleled potential of LEO (low earth orbit) connec-

tivity," the company said in its release. It added, "Across India, OneWeb will bring secured solutions not only to enterprises but also to towns, villages, municipalities and schools, including the hardest-to-reach areas across the country."

Network Access Associates Ltd, United Kingdom (OneWeb Group Company) has signed an agreement with ISRO's commercial arm NewSpace India Ltd to launch 72 satellites into Low-Earth orbits (LEO). On 23 October 2022, ISRO had launched 36 satellites of OneWeb. It was the first satellite deployment collaboration between the



two organizations. According to OneWeb, Sunday's launch would be the 18th launch and third this year and it would be completing the first generation of LEO (Low Earth Orbit) constellation. For ISRO this is the second launch in 2023 after the successful launch of SSLV-D2/EOS07 mission in February."OneWeb will soon be ready to roll out its global coverage", the Indian space agency said.

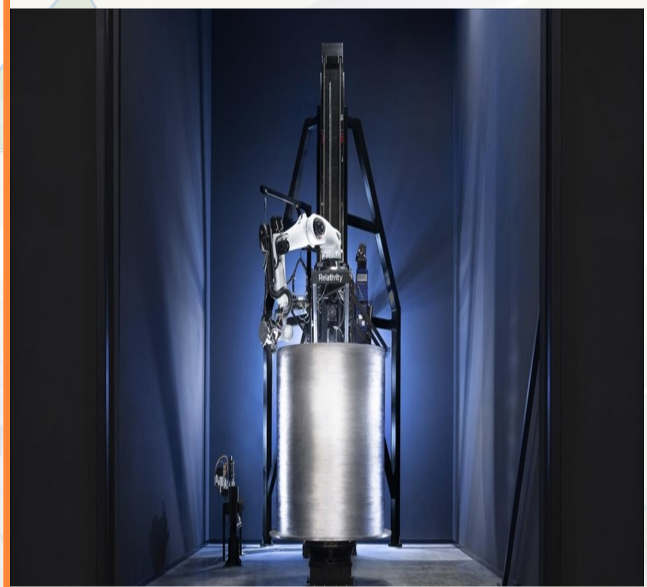
The heavy launch vehicle entered the commercial market in October last year when it launched the first batch of 36 OneWeb satellites. After opening the space sector to private players in 2020, India has been focusing on increasing its share in the global commercial space market. Despite being one of the major space-faring countries, India accounts for only 2% of the commercial market at present.

WORLD'S FIRST 3D-PRINTED ROCKET

B. KUSUMA
20761A5606

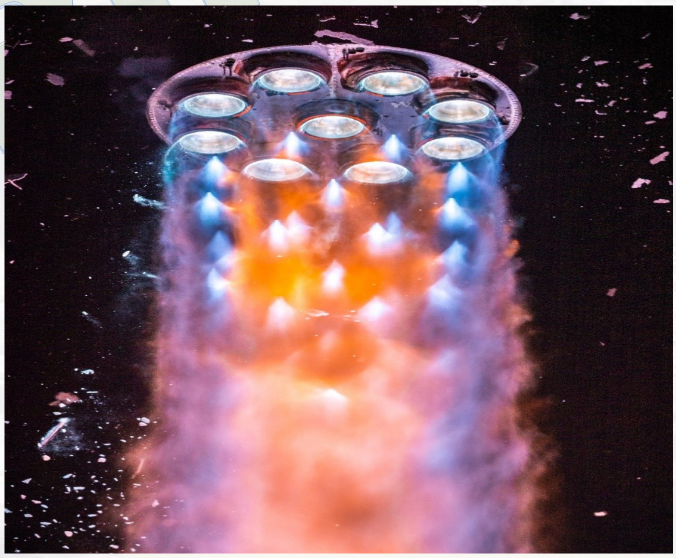
The world's first 3D-printed rocket is scheduled to blast off from Florida on Saturday on the maiden flight of an innovative spacecraft billed as being less costly to produce and fly. Lift-off of the Terran 1 rocket, built by California aerospace startup Relativity Space, had been set for Wednesday at Cape Canaveral, but last-minute propellant temperature issues forced a postponement.

The new launch window is from 1:00 pm to 4:00 pm (1800 GMT to 2100 GMT) on **Saturday (March 11),** though the company warned that weather conditions were a concern. Terran 1 is set to reach low Earth orbit eight minutes after blast off on a voyage intended to gather data and demonstrate that a 3D-printed rocket can withstand the rigors of lift-off and space flight. If the



rocket manages to attain low Earth orbit, it will be the first privately funded vehicle using methane fuel to do so on its first try, according to Relativity. Terran 1 is not carrying a payload for its first flight, but the rocket will eventually be capable of putting up to 2,755 pounds (1,250 kilograms) into low Earth orbit. The rocket is 110 feet (33.5 meters) tall with a diameter of 7.5 feet (2.2 meters). Eighty-five percent of its mass is 3D printed with metal alloys, including the engines.

It is the largest ever 3D printed object, according



to the Long Beach-based company, and is made, it says, with the world's largest 3D metal printers. Terran 1 is powered by Aeon engines using liquid oxygen and liquid natural gas -- the "propellants of the future," capable of eventually fueling a voyage to Mars, Relativity says. Vulcan rockets being developed by United Launch Alliance and SpaceX's Starship use the same fuel. Terran 1 has nine 3D-printed Aeon 1 engines on its first stage and one 3D-printed Aeon Vacuum engine on its second stage.

Mach diamonds aplent in 3d printed
Built in 60 days

Relativity is also building a larger rocket, Terran R, capable of putting a payload of 44,000 pounds (20,000 kgs) into low Earth orbit. The first launch of a Terran R, which is designed to be fully reusable, is scheduled for next year from Cape Canaveral. A satellite operator can wait for years for a spot on an Arianespace or SpaceX rocket, and Relativity Space hopes to accelerate the timeline with its 3D printed rockets.

"Long-term, a major benefit of 3D printing is the ability to more rapidly democratize space due to the incredible cost effectiveness, radical flexibility and customization," the company said. Relativity said its 3D printed rockets use 100 times fewer parts than a traditional rocket and a Terran 1 and a Terran R can be built from raw materials in just 60 days. Relativity has already signed commercial launch contracts worth $1.65 billion, mostly for the Terran R, according to CEO Tim Ellis, who cofounded the company in 2015.The first launch of a Terran R, which is designed to be fully reusable, is scheduled for next year from Cape Canaveral. A satellite operator can wait for years for a spot on an Arianespace or SpaceX rocket, and Relativity Space hopes to accelerate the timeline with its 3D-printed rockets.

Aircraft Engines

G V SURYA NARAYANA
Asst. Professor

Aircraft engines are among the most sophisticated engineering systems ever developed, combining advanced materials, aerodynamics, thermodynamics, and digital technologies to deliver high performance, reliability, and fuel efficiency. Modern aircraft propulsion systems are designed not only to generate thrust but also to reduce fuel consumption, emissions, and noise while ensuring maximum safety.

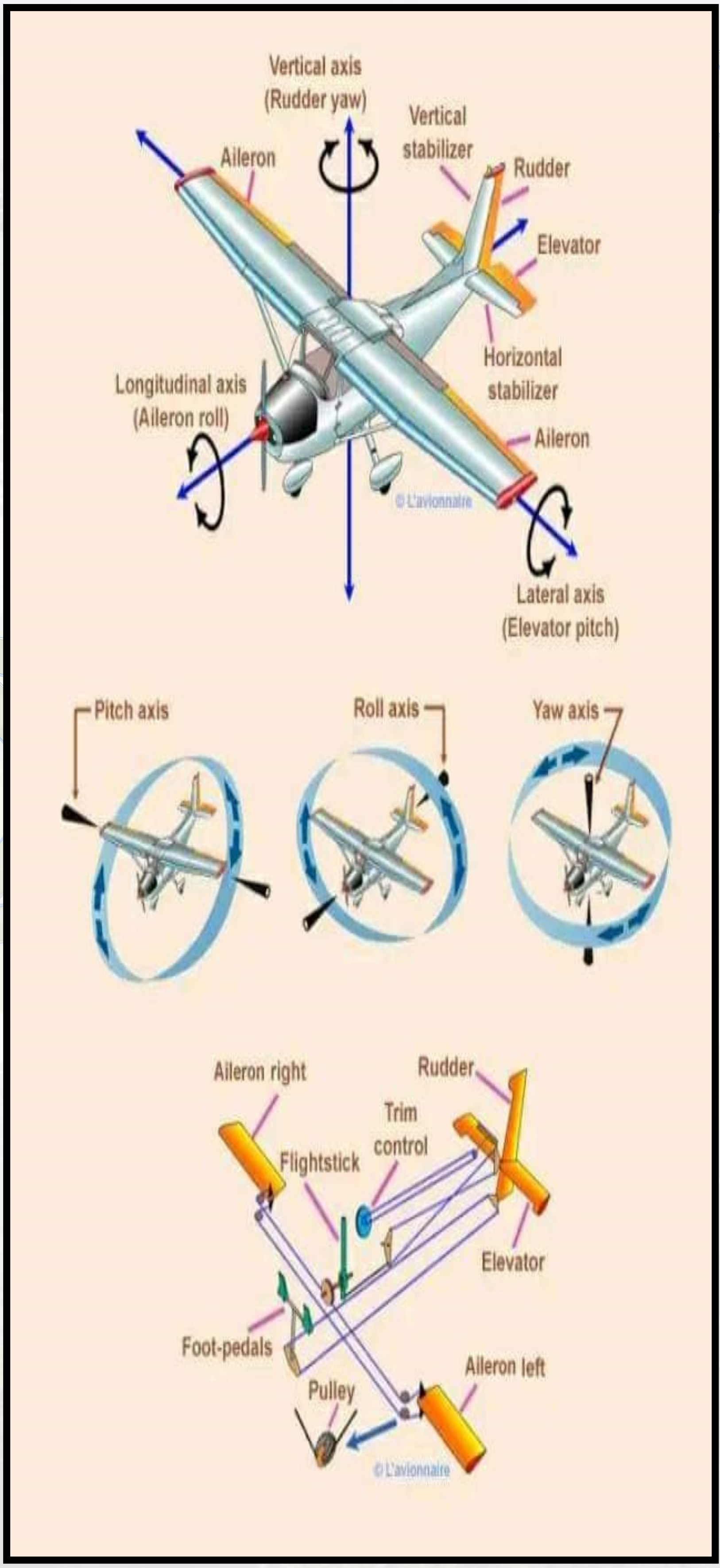
The latest commercial aircraft primarily use high-bypass turbofan engines. These engines provide greater fuel efficiency by allowing a large volume of air to bypass the engine core, producing thrust with lower fuel consumption and reduced environmental impact. Advanced compressor and turbine blade designs, manufactured using single-crystal superalloys and ceramic matrix composites (CMCs), enable engines to operate at extremely high temperatures, improving thermal efficiency and durability.

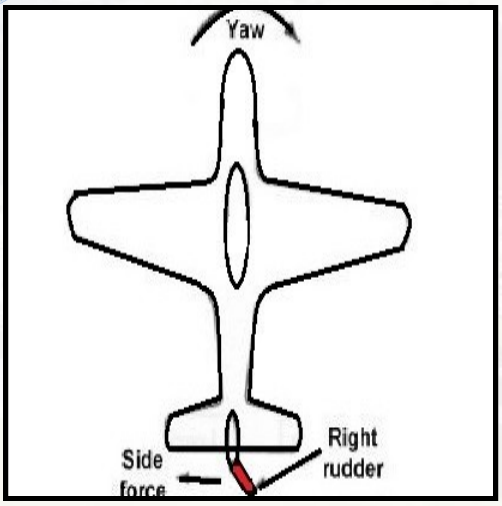
Digital engineering has revolutionized aircraft engine development. Full Authority Digital Engine Control (FADEC) systems continuously monitor and optimize engine performance by controlling fuel flow, airflow, and other operating parameters. Integrated sensors and predictive maintenance technologies use real-time data and artificial intelligence to detect potential faults before they become critical, reducing maintenance costs and increasing aircraft availability.

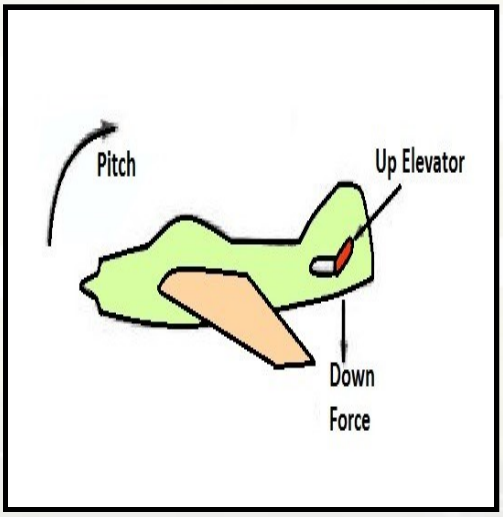
Additive manufacturing (3D printing) has transformed the production of complex engine components. Lightweight parts with intricate internal cooling passages can now be manufactured with greater precision, reducing weight and improving performance. Computational Fluid Dynamics (CFD) and Finite Element Analysis (FEA) are extensively used to optimize airflow, combustion efficiency, and structural integrity before physical prototypes are built.

Future aircraft engines focus on sustainability through hybrid-electric propulsion, hydrogen-powered gas turbines, and Sustainable Aviation Fuel (SAF). Researchers are also developing open-rotor and ultra-high bypass engines to further improve fuel efficiency and lower carbon emissions. Smart materials, advanced coatings, and autonomous health monitoring systems are expected to play a significant role in the next generation of aircraft propulsion.

AEROPLANE CONTROLS & MOTIONS







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