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

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.

Send your articles to the following mail ID.

E-Mail: anthariksh.lbrce@gmail.com

Disclaimer

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.

FROM HOD's DESK

MULTITASK

The amount of new knowledge in certain fields is increasing so rapidly that everything you know about your line of work is probably becoming obsolete. The only solution is to keep absorbing new knowledge as rapidly as possible. Many of the skills I use in my business today didn't even exist five years ago. The best way I know to keep up is to multitask whenever possible by reading and listening to audio programs. Multitasking shouldn't be used where it will significantly degrade your performance on a crucial task, but it should be intelligently used to take advantage of excess capacity. Take real breaks when you need them, but don't waste time in a state of partial effort. It's more efficient to cycle between working flat out and then resting completely. Multitasking allows you to take your productivity to a new level. You might think it would be draining, but many people find it has the opposite effect. For me it was tremendously energizing to be getting so much done. The harder you work, the greater your capacity for work, and the more restorative your rest will be.

Dr. P. Lovaraju

ZERO-FUEL AIRCRAFT

Mohammad Arshad Shaik
20761A5647

Airbus recently revealed three concepts for the world's first zero-emission hydrogen commercial aircraft, which could enter service by 2035. These concepts each represent a different approach to achieving zero-emission flight by exploring various technology pathways and aerodynamic configurations in order to support their ambition of pioneering the decarbonization of the entire aviation industry. All of the concepts presented by Airbus rely on hydrogen as a primary power source – an option

which they believe holds exceptional promise as a clean aviation fuel and is likely to be a solution for aerospace - and many other industries - to meet their climate-neutral targets.

"This is a historic moment for the commercial aviation sector as a whole and we intend to play a leading role in the most important transition this industry has ever seen. The concepts we unveil today offer the world a glimpse of our ambition to drive a bold vision for the future of zero-emission flight," said Guillaume Faury, Airbus CEO. "I strongly believe that the use of hydrogen – both in synthetic fuels and as a primary power source for commercial aircraft – has the potential to significantly reduce aviation's climate impact."

The three concepts – all codenamed "ZEROe" – for a first climate neutral zero-emission commercial aircraft include: A turbofan design (120-200 passengers) with a range of 2,000+ nautical miles, capable of operating trans continentally and powered by a modified gas-turbine engine running on hydrogen, rather than jet fuel, through combustion. The liquid hydrogen will be stored and distributed via tanks located behind the rear pressure bulkhead.

A turboprop design (up to 100 passengers) using a turboprop engine instead of a turbofan and also powered by hydrogen combustion in modified gas-turbine engines, which would be capable of traveling more than 1,000 nautical miles, making it a perfect option for short-haul trips.

A "blended-wing body" design (up to 200 passengers) concept in which the wings merge with the main body of the aircraft with a range similar to that of the turbofan concept. The exceptionally wide fuselage opens up multiple options for hydrogen storage and distribution, and for cabin layout.

"These concepts will help us explore and mature the design and layout of the world's first climate-neutral, zero-emission commercial aircraft, which we aim to put into service by 2035," said Guillaume Faury. "The transition to hydrogen, as the primary power source for these concept planes, will require decisive action from the entire aviation ecosystem. Together with the support from government and industrial partners we can rise up to this challenge to scale-up renewable energy and hydrogen for the sustainable future of the aviation industry." In order to tackle these challenges, airports will require significant hydrogen transport and refueling infrastructure to meet the needs of day-to-day operations. Support from governments will be key to meet these ambitious objectives with increased funding for research and technology, digitalization, and mechanisms that encourage the use of sustainable fuels and the renewal of aircraft fleets to allow airlines to retire older, less environmentally-friendly aircraft earlier.


Turbofan design


Turboprop design


Blended-wing design

MY TEACHING PHILOSOPHY

I. Dakshina Murthy
T590

The Motive:

It was during my post-graduation when I became enthusiastic about the teaching while listening to one of my professors, who later became mentor of my life. Also, during my graduate studies, one of my professors, the way he taught the courses, I developed my interest on Thermal and Fluid Sciences in Mechanical Engineering. Hence, I realized that a good teacher could make someone to become passionate about the courses as well as teaching. In my experience, I also understood that the students will always follow a good teacher to get succeed. I believe that Teaching is a noble profession since it is about making the students thirsty towards learning the skills for their holistic development.

The Introductory Lecture:

When I joined in my teaching profession in 2012, I had the opportunity to teach undergraduate students of Aerospace Engineering Department. The first course that I taught was 'Aircraft Systems and Instruments'. I started delivering the course contents directly and after a couple of classes I sensed that the students are not showing interest towards the course. That is the moment when I realized that this might not be the proper way to start the course. After discussing with the senior fellow faculty, upon my own analysis, and feedback from the students, I came to know the importance of ***"Introductory Lecture" (Integrated with course objectives, course contents, engineering applications, real-life applications, questionnaire (the answers will be provided/known/understood as the course progresses) and course outcomes)*** about the course which in turn makes the students connected to the course. Thereafter I used to open any course with a ***"Introductory Lecture"*** which helps in improving the students' interest towards the course, I believe.

The Methodology:

To carry forward the interest created in the introductory lecture the delivery methodology plays a crucial role. The methodologies include ***chalk & talk, a presentation, tutorial session, laboratory demonstration, and filed/industry visit***. The selection of a methodology is based on the content/ topic to be discussed. The following are the few examples

- The course like Thermodynamics is more contended with conceptual knowledge. So, the ***Chalk & Talk method*** is more suitable for these kinds of courses. In addition, this course also involves understanding the concepts by problem solving. Hence more ***tutorial sessions*** are helpful along with the chalk & talk sessions.
- The courses like Fluid Mechanics, Applied Thermodynamics and Gas Dynamics equipped with the contents those can be demonstrated in the laboratory. For instance, the concept of U-tube manometer in Fluid Mechanics, internal combustion engines in Applied Thermodynamics and nozzle flow physics in Gas Dynamics course can be better understood by the laboratory demonstration
- The courses like Aircraft Systems & Instruments and Instrumentation & Measurements in Fluids involve learning the Operating Principles and working of various systems & instruments. Hence while delivering the Lectures, the presentation (PPT/Video) is more suitable for these kinds of courses. However, a field/ industry visit, where the students can see the working/operation of various instruments and systems, might be helpful to get the complete understanding.

To summarize, all/few methodologies stated above may be used during the course delivery. However, according to a specific course a/couple of methodologies might dominate the other to enable better learning.

The Role of Cognitive Abilities:

The teaching methodologies those stated in the previous section are helpful to improve the low-level cognitive abilities of the students like Remember, Understand, Apply and Analyze. These abilities of the students will be evaluated through the term examinations and semester end examinations, which are time bound. To make the students to achieve the high cognitive levels of learning like Design and Create in any course, as the instructor, a set of questionnaires (Assignment) those are prepared will be supplied to the students. The student in turn must submit the answers to those questions (which are not time bound). The answers might be of text form, presentation (flipped classroom), prototype, and working model too. The following are

* In Thermodynamics course, I may ask the student(s) to prepare a model/prototype to demonstrate the Zeroth law of Thermodynamics and First law of Thermodynamics.
* In Fluid Mechanics course, I may ask the student(s) to prepare a model/prototype to demonstrate the Pascal's Law. Also, I might ask the students to prepare a set up to conduct the Reynold's Experiment, verify the Bernoulli's theorem etc.
* In Elements of Aerospace Engineering, I may ask the students to prepare a Monogram/ prototype of an aircraft component which will tap the student ability in soft skills and interest towards the program.
* In Instrumentation & Measurements in Fluids, I may ask the students to construct an instrument to measure a parameter in fluid flows.

The Ability of Students:

As my teaching carrier progresses, I understood that every student learns differently because of their own abilities. Consequently, the score they gain will also differ from each other. Based on their score in the first assessment of each course that I taught and with my keen observation I used to classify the students as Fast Learners and Slow Learners. Though I deliver the lecture without any discrimination among the students, I will always try to deliver in such a way that the Slow Learner is able to grasp the content and apparently the Fast Learner. Apart from the regular teaching, the following are the things that I will do for both the groups of students.

Fast Learners:

⇒ I will encourage them to do certification courses offered by various universities parallel to the course and hence they will be globally competent

⇒ I supply a questionnaire that will help them to enrich their conceptual knowledge and problem-solving ability

Slow Learners:

⇒ A special concertation will be made on this category of students during the tutorial sessions to ensure that they can cope up with the problem-solving abilities

⇒ A professionally written study material/videos lectures will be supplied to ensure the improvement in the conceptual knowledge.

The importance of personal interaction:

I strongly believe that the learning process is greatly influenced by the relationship between the teacher and student. For instance, and true, we used to give utmost respect for the words/talk of a person with whom we are in a particularly good relationship, I believe personally. Also, to create a positive learning environment in the classroom the students should feel like the teacher is supportive and caring (supportive teacher). The personal interaction between the student and faculty will lead to a relationship. When the relationship builds and became strong, the teacher can motivate the student to learn and hence the personal and professional development of the student is assured. A good relationship will create a positive learning environment in the classroom. That certainly impact students interests in classroom and therefore their level of learning and achievement(s).

References:

[1] "Outcome based pedagogical principles for effective teaching" an online certification course offered by Indian Institute of Technology Kharagpur through NPTEL, India during Aug-Sep, 2018 https://nptel.ac.in/courses/121105010

[2] "Effective Engineering Teaching in Practice" an online certification course offered by Indian Institute of Technology Madras through NPTEL, India during Feb-Mar, 2018 https://nptel.ac.in/courses/121106012

[3] da Luz, Fredson Soares dos Reis. (2015). The Relationship between Teachers and Students in the Classroom: Communicative Language Teaching Approach and Cooperative Learning Strategy to Improve Learning. In BSU Master's Theses and Projects. Item 22. Available at http://vc.bridgew.edu/theses/22

FACT AHEAD!!!

A surprising phenomenon is that cold water heats up faster than hot water! This is known as the Mpemba effect.

Passion for Aircraft: Inspiring the Next Generation of Engineers

Aircraft are among the greatest achievements of engineering, combining innovation, science, and technology to connect the world. For engineering students, developing a passion for aircraft means embracing curiosity, creativity, and continuous learning. Every aircraft reflects the combined efforts of aerospace, mechanical, electrical, electronics, and computer engineers working together to solve complex challenges.

Studying aircraft inspires students to understand aerodynamics, propulsion, structures, avionics, and flight systems while encouraging problem-solving and innovation. With rapid advancements in sustainable aviation, unmanned aerial vehicles (UAVs), and space exploration, today's engineering students have exciting opportunities to shape the future of flight.

A passion for aircraft is not just about admiring airplanes—it is about dreaming big, learning continuously, and transforming ideas into technologies that make aviation safer, smarter, and more efficient. The sky is not the limit; it is the beginning of endless possibilities for every aspiring engineer.

DID YOU KNOW ?

The Sun is gradually expanding. By this time in 2.3 billion years, it will no longer be safe for life to persist on Earth - It'll be too hot

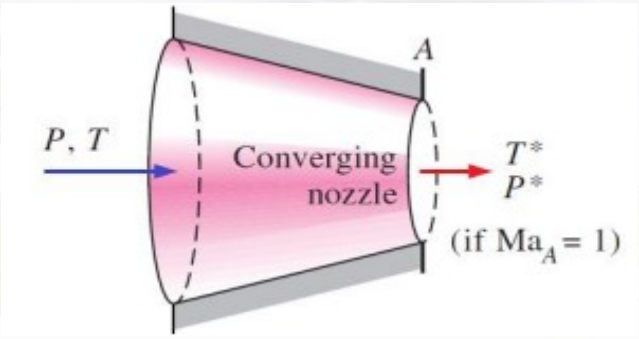
NOZZLE FLOW PHYSICS

Kurapati Ruby
20761A5629

Nozzle is a flow accelerating device. In the domain of Aerospace, we generally come across three major types of nozzles, namely Convergent, Divergent and Convergent-Divergent. It calls for an individual study on the flow behavior across each of these three nozzles, as they impose various exit conditions depending upon the pressure ratio set across and the regime of flow (subsonic or supersonic) entering into them.

The Convergent Nozzle:

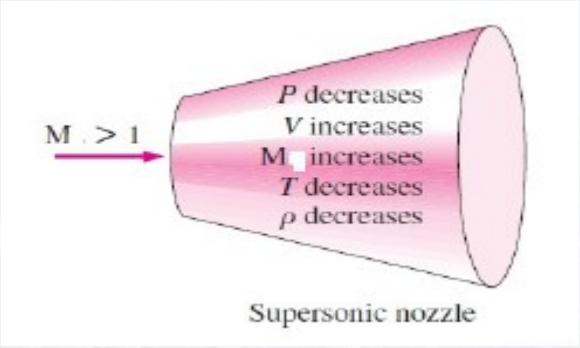
A convergent duct acts as a nozzle only when a subsonic flow enters into it (since Area* Velocity is a constant for subsonic flows) and acts as a diffuser if it were a supersonic flow entry.



- The flow would be initially at rest when there is no pressure difference across the nozzle. Air starts flowing across it, once we start decreasing the back pressure. As the back pressure is further lowered, the Mach number (Local flow speed/Local speed of sound) and the mass flow rate gradually increase.
- On further reducing the back pressure to such a magnitude that the ratio of exit pressure to inlet pressure (P/P0) becomes 0.528 (if air), the nozzle no more exceeds its mass flow rate and Mach number, on a further decrease in back pressure. The Mach no. reaches to a maximum of 1(since the pressure ratio 0.528 corresponds to M=1 by isentropic relations of compressible flow) at the exit and the nozzle is said to be choked.

The Divergent Nozzle:

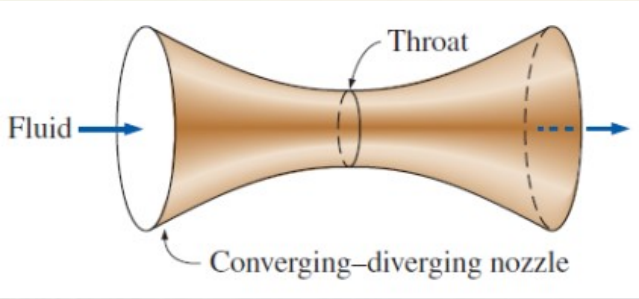
A Divergent duct acts as a nozzle only when a supersonic flow enters into it (since Area/Velocity is a constant for supersonic flows) and acts as a diffuser if it were a subsonic flow entry.



- Although it is physically not possible for a supersonic flow to enter into any duct due to the formation of a bow shock, if a complete supersonic, isentropic flow were established inside a diverging area duct, the flow would get accelerated to further supersonic.
- If the flow entering into it is subsonic, it acts as a diffuser that further decelerates the flow. In this case the flow inside the duct cannot even attain a Mach number of 1, though the pressure ratio set across it is 0.528.

The Convergent-Divergent (CD) Nozzle:

A CD nozzle consists of a convergent portion followed by a throat (min. area) and a divergent portion. So far, it is the only nozzle, capable of generating supersonic flow at its exit.



[P.T.O]

The ratio between the local area and its choking area (Area ratio, A/A*) is the key parameter which dictates the local Mach no. that has to be generated at that particular location inside the nozzle. The relation between the Area ratio and the local Mach no. is as follows:

$$\left(\frac{A}{A^*}\right)^2 = \frac{1}{M^2}\left[\frac{2}{\gamma+1}\left(1+\frac{\gamma-1}{2}M^2\right)\right]^{(\gamma+1)/(\gamma-1)}$$

This relation unveils the fact that any CD nozzle can generate supersonic flow of only a single Mach no. But the above relation gives us two Mach numbers for an area ratio when solved- a subsonic and a supersonic Mach number, the occurrence of which will be seen in the subsequent lines. Thus, the area ratio acts as a design parameter for any CD nozzle.

Let us try to understand the flow behavior across a Mach no. 1.75 CD nozzle connected to a reservoir at 68atm. At the exit, the nozzle has A/A*=1.386. Listed and detailed below are the cases that would occur by and by as the back pressure is gradually decreased.

Case 1:A subsonic flow is established across the nozzle, when we start decreasing the back pressure. Say, to 60atm (since it is more than the maximum back pressure to choke the nozzle), which is also equal to the exit pressure, since the flow is subsonic.

- The flow accelerates from inlet to throat and decelerates into an even lower subsonic Mach no., as it traverses from throat to the exit.
- This happens over a range of back pressures until the nozzle chokes.

Case 2:

When the back pressure is reduced to 58atm, which is the maximum back pressure to just choke this Mach 1.75 nozzle for the given stagnation conditions, the flow behavior is as follows:

- The flow is subsonic in the convergent portion and accelerates in the downstream direction. The nozzle chokes at the throat for the first time and continues to choke for any further decrease in back pressure (=exit pressure).

- Since the flow is completely isentropic in the duct, every location in the flow field has the same choking area location. It is the throat that has to choke because, choking occurs at the location of minimum area in the duct (since dA/A=0 for M=1).
- The flow decelerates to an even more subsonic regime in the divergent portion. The subsonic roots from the Area ratio - Mach number relation, now occur on either sides of the choked throat.

Case 3:

On further reducing the back pressure, a Normal Shock wave prevails inside the divergent portion, ahead of which, the flow is supersonic and is subsonic behind it.

- The shock moves downstream for every small reduction in back pressure from thereon, making the flow across it irreversible-adiabatic. It consequently demands for a separate analysis of this particular flow field without involving isentropic relations.

- The throat of the nozzle no more acts as the choking area location of the isentropic flow behind the shock wave.

- When the back pressure is reduced to a magnitude of 43.53atm, the normal shock stands at the exit of the CD nozzle and the back pressure is still equal to the exit pressure. From the throat to the exit, the nozzle contains continuous supersonic flow with Mach numbers corresponding to the area ratio of that particular location.

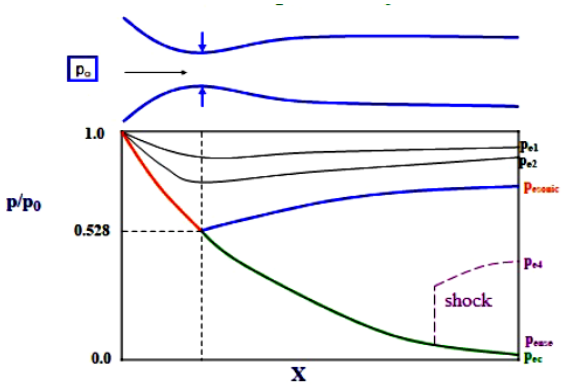
Case 4:

Any small further reduction in back pressure, pushes the normal shock out from the exit, generating the supersonic Mach no. it is designed for (M=1.75 in this case).

- There would be no change in the properties of flow inside the duct, once the desired supersonic Mach no. comes out. The changes only happen near at the exit.

- The levels of expansion the flow undergoes are:

1. Over-Expansion (exit pressure<back pressure).
2. Correct-Expansion (exit pressure=back pressure): It occurs when the back pressure is reduced to 12.78atm for this nozzle and is different for every area ratio.
3. Under-Expansion (exit pressure>back pressure).



LATEST HAPPENINGS

ONE WEB INDIA-1 MISSION

B. Kusuma
20761A5606.

Oneweb/ LVM3-M2 confirmed the successful deployment of 36 satellites launched by NewSpace India Limited (NSIL), from the Satish Dhawan Space Centre (SDSC- SHAR) in Sriharikota, India. This launch by ISRO and NSIL is one of the biggest commercial orders by India's premier space organization, and the first using the LVM3 rocket.

The lift-off took place on Sunday, 23rd October

2022 at 00.07hrs local time,the Bengaluru-headquartered Indian Space Research Organization (ISRO) . OneWeb's satellites separated successfully from the rocket and were dispensed in nine phases over a period of 1 hour and 15 minutes, with signal acquisition on all 36 satellites confirmed.

All 36 satellites are operational, bringing OneWeb's total Gen 1 LEO constellation to 462 satellites. Launch 14 from the Satish Dhawan Space Centre SDSC-SHAR, Sriharikota, India marks the first dedicated commercial launch for NewSpace India Limited (NSIL) using the LVM3 rocket. With this successful launch, the LVM3 has become a catalyst for the Indian Space Programme, opening new vistas for heavy payloads to the LEO. LVM3 was earlier called GSLV Mk III.LVM3-M2 is a three-stage launch vehicle consisting of two solid propellant S200 strap-ons on its sides and core stage comprising L110 liquid stage and C25 cryogenic stage.

The newest rocket is capable of launching a four tonne class of satellite to Geosynchronous Transfer orbit.

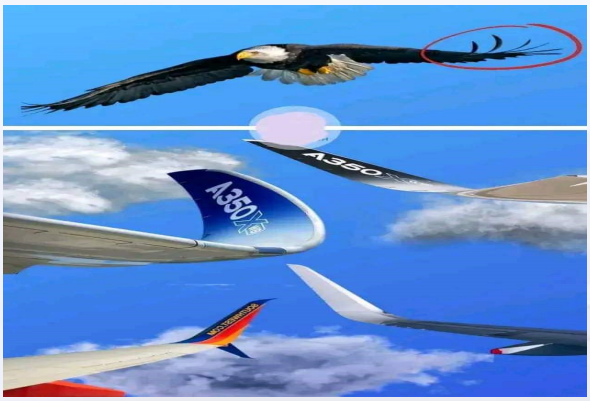
"In the coming days integration of (the) cryogenic upper stage of the launch vehicle and integration of payload fairing with 36 satellites will take place," NSIL had added.ISRO mentioned that It is the first LVM3-dedicated commercial launch on demand through NSIL .

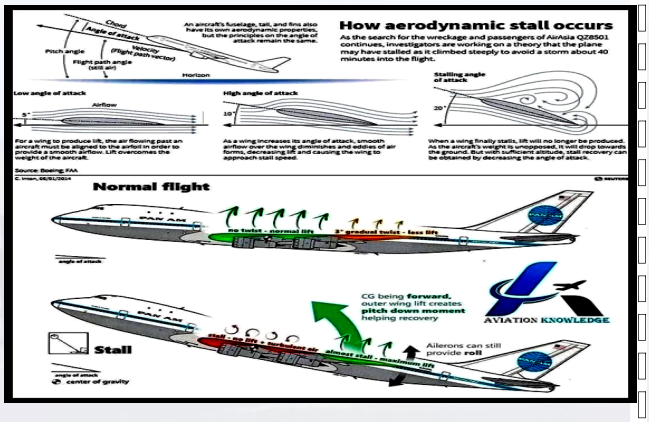
This contract with M/s OneWeb is a historic milestone for NSIL and ISRO.LVM3 is a three-stage vehicle with two solid motor strap-ones, a liquid propellant core stage and a cryogenic stage. India's Bharti Enterprises is a major investor and shareholder in OneWeb.

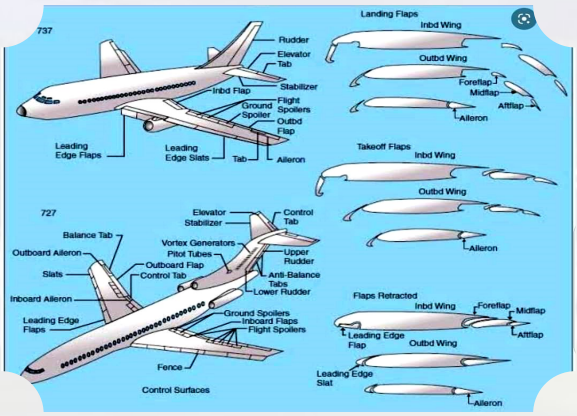
The satellites are a part of the 468 satellite constellation of OneWeb released into Leo Earth Orbit to provide Internet access to areas which are

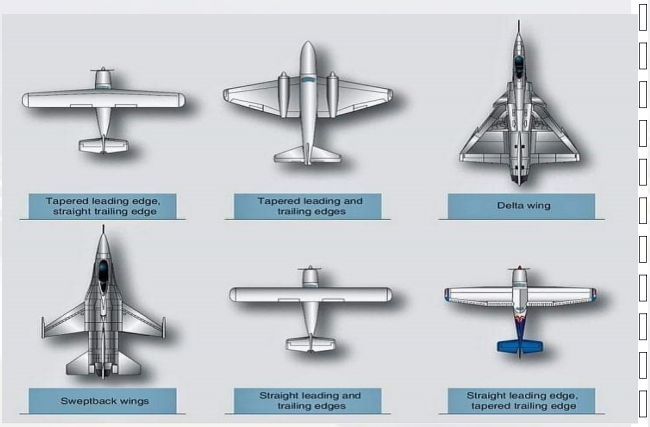
impossible to provide. OneWeb had penned a deal worth more than Rs 1000 crore for the launch and another GSLV launch carrying OneWeb payload is expected in January of 2023The sole reason behind changing the name of the vehicle from GSLV to LVM is that the rocket will not deploy the satellites in the geosynchronous orbit. The OneWeb satellites operate in Low Earth orbit (LEO) at an altitude of 1,200 kilometers. The geosynchronous orbit, on the other hand, is located 35,786 kilometers above Earth's equator. ISRO'sheaviest vehicle, LMV3,is also dubbed as one of the heaviest for its ability to carry satellites up to 8,000 kg.

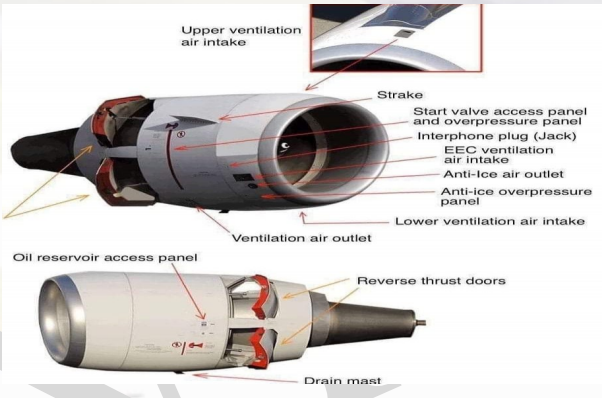
PHOTO GALLERY

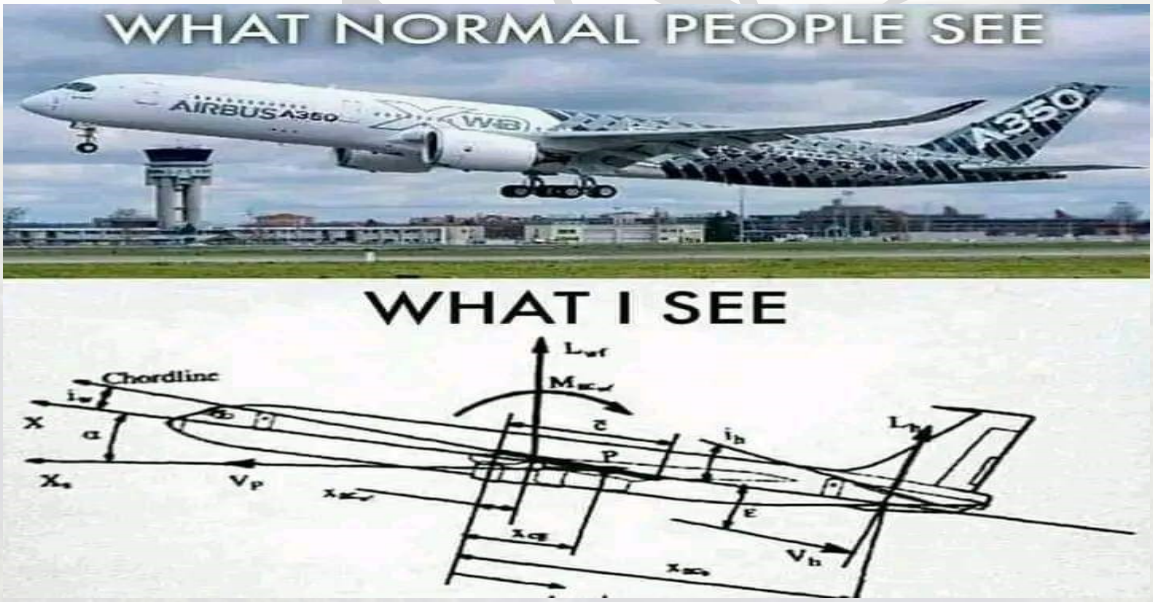












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