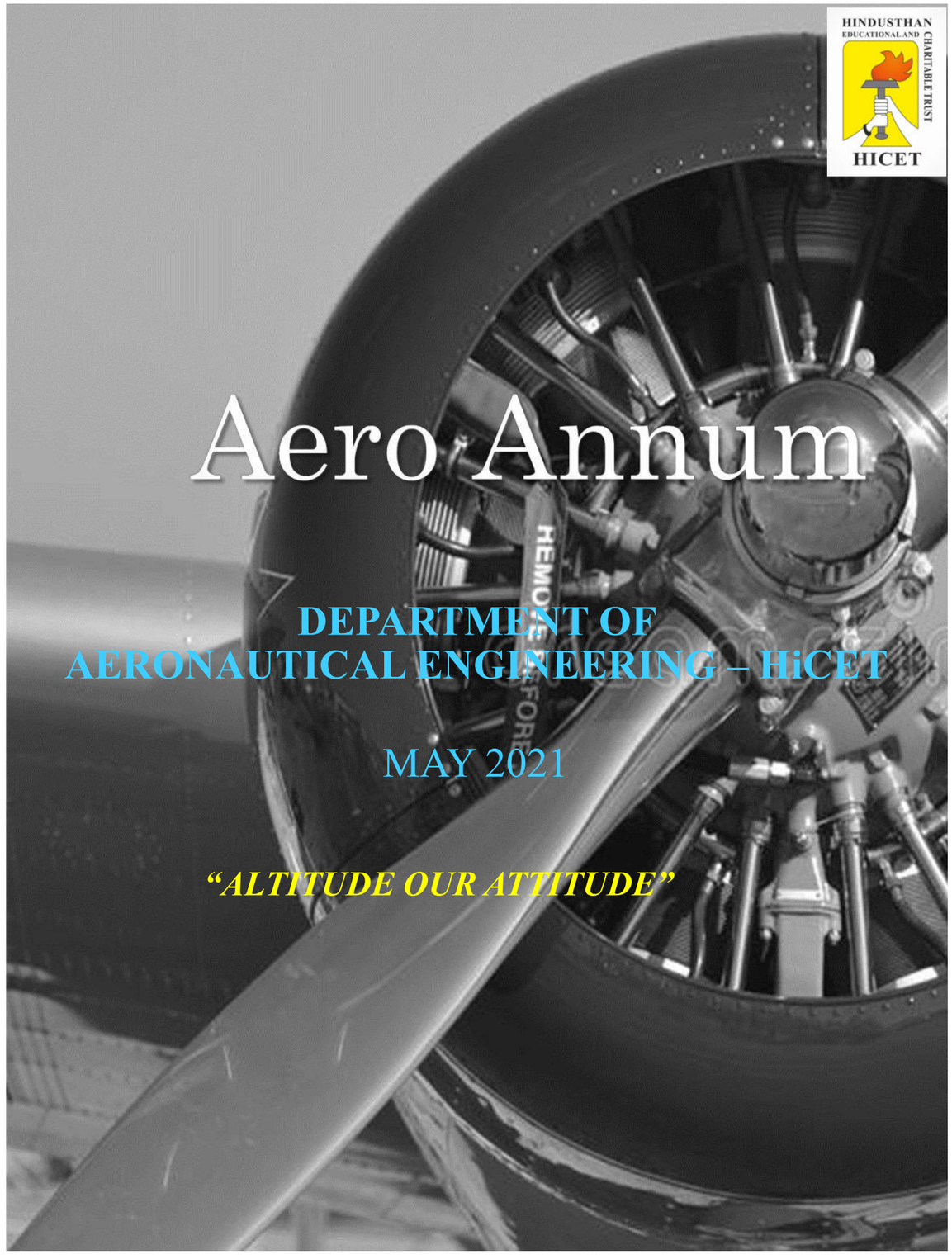

Aero Annum

DEPARTMENT OF AERONAUTICAL ENGINEERING – HiCET

MAY 2021

"ALTITUDE OUR ATTITUDE"

*Qua*lity Policy

Hindusthan College of Engineering and Technology aims at providing the best education which will mould the students as the right characters, who will cater to the needs of the society. While providing the various inputs for the best education, Hindusthan College of Engineering and Technology will constantly thrive upon continual improvement with the utmost commitment for the complete satisfaction of the customer.

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Sri Balaji S (III year)

Aero Annum

May [2021]

1 *Online Education During Lockdown in India*

3 *Advancements in Aircraft Materials*

4 *Advanced low-emission technologies*

About the Institution

Hindusthan College of Engineering and Technology (HiCET) Coimbatore, established in the year 2000 by the great Industrialist and Philanthropist, Thiru.T.S.R.Khannaiyann of Hindusthan Educational Trust whose determination and dynamism made possible the realization of this institution of excellence. Surrounded with natures pristine beauty and an excellent infrastructure coupled with dedicated and experienced faculty has made the campus a much sought-after abode of learning. HiCET is one of the premier technological institutions inculcating quality and value based education through innovative teaching learning process for holistic development of the Students. The institution is recognized under Section 2(f) and 12B of University Grants Commission (UGC) and is an autonomous institution affiliated to Anna University , Chennai with permanent affiliation for most of the programmes, approved by the AICTE and the Government of India.

The Institute is ranked 146 th in India Today Ranking and spotted as the Nodal Centre for Smart India Hackathon. One more feather in the crown is a Ford Eco sports car worth 22 lakhs gifted by Ford India and also the Best Accredited student Branch Award from Computer society of India. Further, Establishment and Innovations plays a major role in the academic year 2020-21 Centre of Excellence with Royal Enfield and Either Motors are established. The institution continues to be top in the country. HiCET conducts seminars and also invites companies to give presentations that will help our students to choose a right career for themselves and has hence contributed to the industry by successfully delivering fresh recruits who have contributed continuously to the growth of the industry by being a part of the top-notch organizations. For all these reasons HiCET has been a preferred institute for recruiting young minds

Currently, there are around 5000+ students pursuing various Undergraduate programs (B.E./B.Tech.), Postgraduate programs (M.E./M.Tech, MBA & MCA) and Ph.D. research programs in the Institution and are mentored by above 400 well qualified and experienced faculty members. HiCET nurtures future global leaders by imparting knowledge, skills and building attitudes among students to face the world in a fresh, energetic and unrestrictive work environment. In keeping view of the severity of COVID-19, the faculty members were able to gain and sustain student engagement by being creative with lectures that integrate props, student polling, and videos on online

Institute Vision

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

Institute Mission

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.

About the Department

The Department of Aeronautical Engineering was established in the year 2005 and now headed by Mr.V.T.Gopinathan**.** The Department also inaugurated the Aeronautical Students' Engineering Association (ASEA) in March 2008. The Department is directed by a dedicated team of teaching and non-teaching staff with a wide range of experience, and it has well-equipped laboratories and good infrastructure to support the autonomous curricular needs. Until now, the department has been in the forefront of advancing aeronautical education and indigenous research in the field of aeronautics. The department has received numerous funds under different schemes for various projects. On the year 2018 the UAV lab and UAV club was established to invent and support the UAV sector. Signed MoU with Government ITI, Coimbatore to train students of Drone

Department Vision

To be a global player and prepare the students with knowledge, skills, and ethics for their successful deployment in Aeronautical engineering.

Department Mission

M1:To nurture the students technically based on current trends and opportunities in the global Aerospace industry.

M2:To develop the students as innovative engineers to address the contemporary issues in the aeronautical field.

M3:To inculcate professional and social responsibility based on an innate ethical value system.

Program Educational Objectives (PEOs)

PEO 1: Graduates shall exhibit their sound theoretical, and practical knowledge with skills for successful employment, advanced education, research, and entrepreneurial endeavors.

PEO 2: Graduates shall establish deep-rooted mastering abilities, professional ethics, and communication alongside business capabilities and initiatives through lifelong learning experiences.

PEO 3: Graduates shall become leaders and innovators by devising engineering solutions for social issues in care of modern society.

Program Specific Outcomes (PSOs)

The graduates will be able to:

PSO 1: Apply the knowledge of aerodynamics, structures, propulsion, avionics, and aircraft maintenance to give solutions for complex engineering problems.

PSO 2: Use progressive methodology and tools involving design, analyze, and experiment in aircraft design.

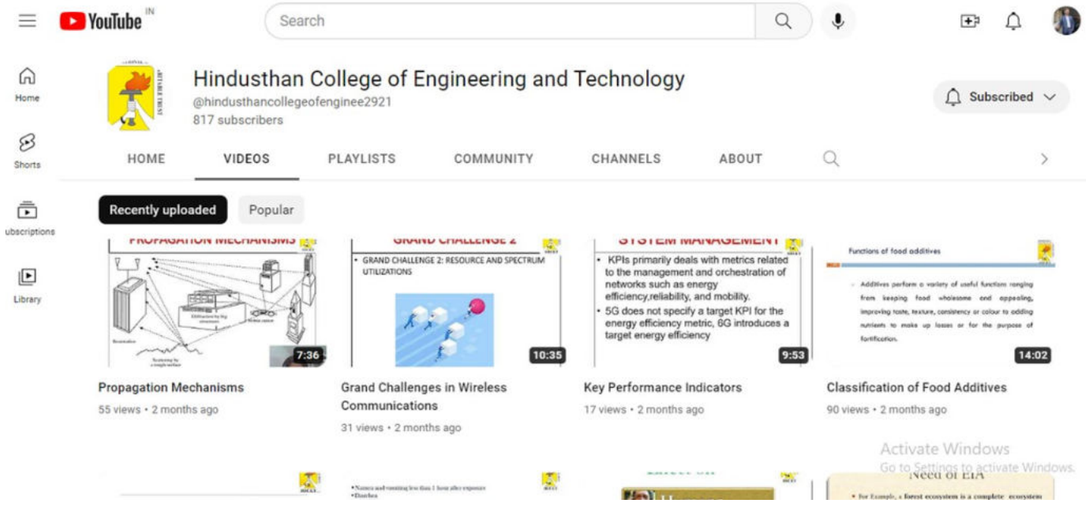
HoD's Message

"Learning is a treasure that will follow its owner everywhere"

A path for making innovations in the field of Aeronautics is laid by the Department of Aeronautical engineering of Hindusthan college of Engineering and Technology. The department has put the sincere efforts in going further in its attempts to excel the set standards and it has been involved in various effective activities supporting our country to meet all expectations in the field of Aerospace. The curriculum of the program is designed to meet the requirements of Aerospace organizations and their associates engaged in either production or R&D. The prescribed core courses cover important and exciting areas of Aeronautical Engineering including Aerodynamics, Aircraft Structures, Flight Dynamics, Propulsion, Avionics, Aircraft Design, Rockets, Missiles, Aircraft Systems, Instrumentations and Aircraft Maintenance. Aeronautical Engineering program also offers the courses in regard to the recent trends in Aerospace technology such as Unmanned Aerial Vehicle systems, Satellite technology, Cryogenics and Nano science. HICET UAV (Unmanned Aerial Vehicles) Club is a new addition which is monitoring by Aeronautical Engineering Department. It aims to train the students in design, assembly, simulation and flying of different UAV models, which make every student specialize in the area of Unmanned Aerial Systems, which will provide them additional carrier opportunities.

Mr. V T Gopinathan

HOD



E-Content was developed by most of the institutions across India to enhance the teaching-learning process

1 Online Education During Lockdown in India

Saravana Kumar

With Sudden Lockdown in India has caused serious issues to the government as well as to the Public. A/c to a report Indian Economy has faced very serious issues & lost around 4.5billion$ (around 32000 crores) Every day during its first 21 days. On the other hand, more than 10 Million daily workers lost their job in the first wave at the initial stages and during the 2nd wave, in April it was expected that 7 million+ people lost their jobs.

Many of them went through some serious mental trauma & Mental health. This can be understood by the fact that During 1st wave of COVID the search term Depression was at its peak in the last 5 years. This is a time we all could never have dreamed of. A pandemic that will sweep across the globe over time, leaving no space untouched. It will leave an unforgettable impression in the field of education.

PROS & CONS of ONLINE EDUCATION

Over the months, many of the students have learned a lot about the drawbacks and benefits of this type of education. Recognizing that the virus is not only a boon for students, everybody had to adapt to their online education sometime. The online courses felt better than before. The vibe in the classroom had completely changed.

These types of online courses can be seen in software engineers attending from home. Everybody had to adapt to their online education sometime. Describe a few advantages and disadvantages of the COVID 19 pandemic.

In general, children have an advantage here. The time in the house is not only used for watching movies or for crafts. Students should use their time to study or pursue other activities they are interested in. The best time is spent with grandparents, cousins, mother, father, and other relatives, and one should spend as much time as possible away from state norms.

You may do this in the bedroom or at the office. There is no need to leave the house to meet relatives, you can pick up the phone and call them to talk and build more family relationships. Watch a film as a family and enjoy it together, which can happen at any time.

Spend five to six hours of quality time outside of online classes. Spend time with parents to explain career planning views and discuss steps and the right features of the path. Save time by avoiding transportation and time for prayer, sports, and talking to friends. Spend at least 10 hours alone after school.

The adoption rate of online classes is 50-60% and that of classrooms is 80-90%. The biggest drawback is the huge loss of jobs and lives in the country's economy. Many poor students do not have access to laptop computers, and students are naive enough to believe that there will be no unequal education. There are a lot of adverse factors in exams where students get internal grades.

Young children in kindergarten and elementary school do not do well in these classes because they have a low concentration of power and are unable to sit for long in front of a blue screen. These factors will pre-empt the children's further lives. The impact on her career also plays a role.

With this in mind, almost every student is missing their days in school and college. Many are informed about global education and the worldwide dissemination of ideas that are available to those who seek them. There is unimaginable cooperation between all stakeholders in education, including administrators, teachers, pupils, parents, and businesses, who produce software and innovatively transmit knowledge

- Many students struggle to get the equipment they need for digital learning. Many educators are looking for alternative jobs to support their families, as they have lost their teaching jobs and their salaries will be withheld. Former teachers are trying to fit in with the professions they have to do online.

- While lunch has been a great boon for many students in India, the closure of schools due to closures means that many children are disadvantaged and malnourished. The pandemic has also challenged educational institutions, as the payment of fees is very poor. Many low-budget schools are closing.

- This will be better for educated parents if they can help their children, but it is time to understand the helplessness of parents who cannot help their children. We feel the great damage done to education in the age of the coronavirus. We can regard COVID-19 as a blessing in disguise. Maybe there is Zero chances for that life is far from normal, but life goes on & so does education

- The pandemic has also opened the door to new opportunities for more digitization. Universities' digital tools for assisting students who survived the outbreak will influence higher education's digital approach in the future. The situation requires an updating of infrastructure and knowledge to be able to respond to future events and beyond. Finding money for expert upgrades is a hurdle

- The provision of effective formative evaluations and timely feedback for online learners is an important aspect of online and distant learning. Remember Digital solutions that do not work for students and teachers will hamper the future growth of online education

- The challenges and opportunities of continuing education during the COVID 19 pandemic are summarized in the suggested manners below. Education and training are now available in most countries online, owing to the blockade of social dissociation affected during the pandemics that caused the closing of schools, training institutes, and higher education institutions

Avul Pakir Jainelabdeen Abdul Kalam was the 11th President of the country from 2002 and 2007 and is also popularly known as the 'Missile Man' of India. Born in a poor family in Tamil Nadu's Rameswaram, Kalam went on to study physics and aerospace engineering and worked with Defense Research and Development Organization (DRDO) and Indian Space Research Organization (ISRO). He also played a role in 1998 Pokhran-II tests under leadership of Atar Bihar Vajpayee. Abdul Kalam was felicitated with a Padma Bhushan in 1981, Padma Vibhushan in 1990 and then received India's highest civilian honour Bharat Ratna in 1997. He is also known for a humble and respectful attitude towards people and was called the 'People's President'. After the end of his tenure as President of the country, he went back to delivering lectures to students and writing. He died after suffering cardiac arrest while delivering a lecture at Indian Institute of Management Shillong on July, 27, 2015. He was buried in his hometown Rameswaram with full state honors.

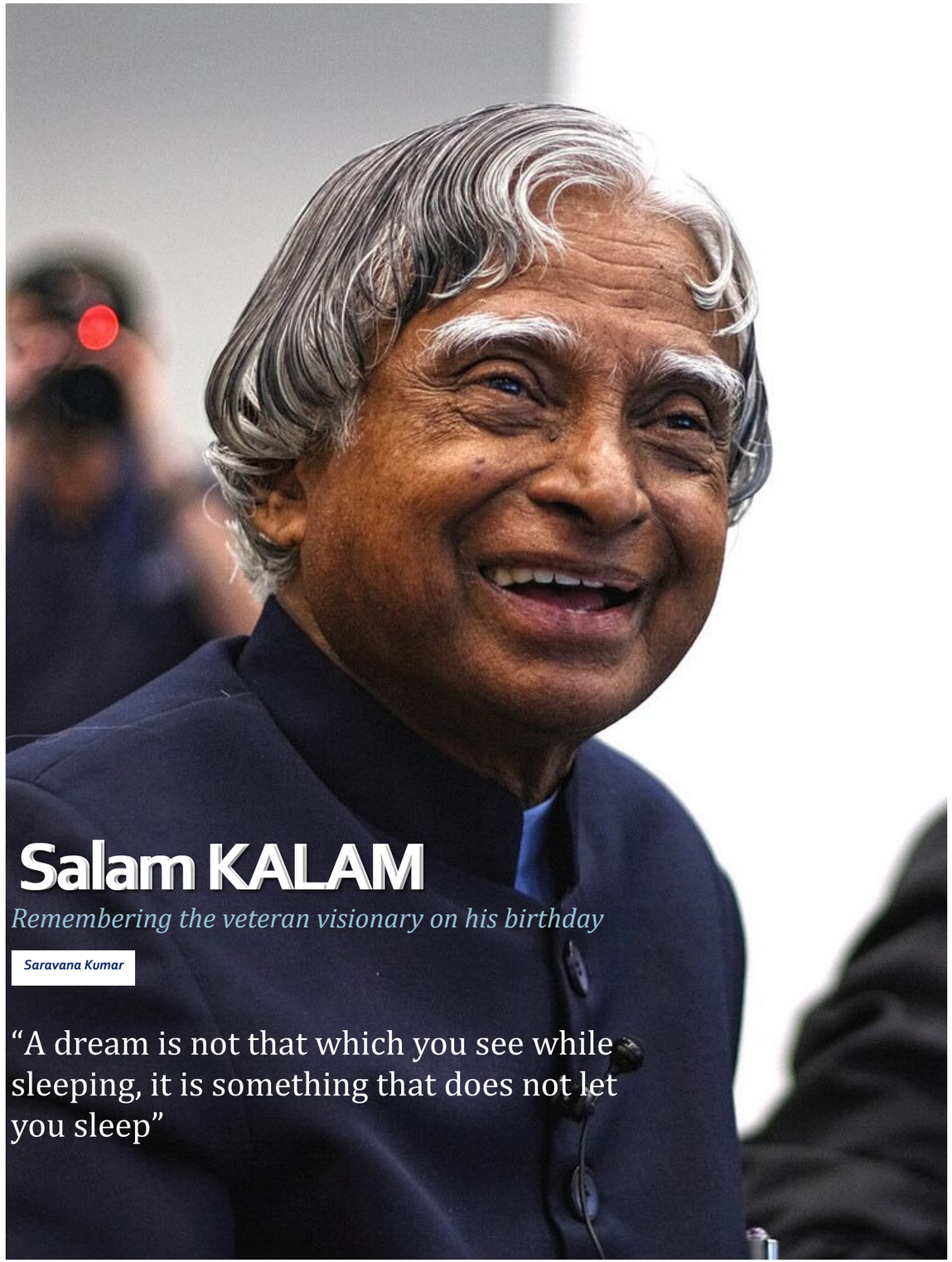
The vison of Dr. APJ Abdul Kalam has motivated many Indians to involve in space activities one such initiative is skyroot technologies in Hyderabad. Founded in 2018 by former ISRO scientists Pawan Kumar Chandana and Naga Bharath Daka, Skyroot

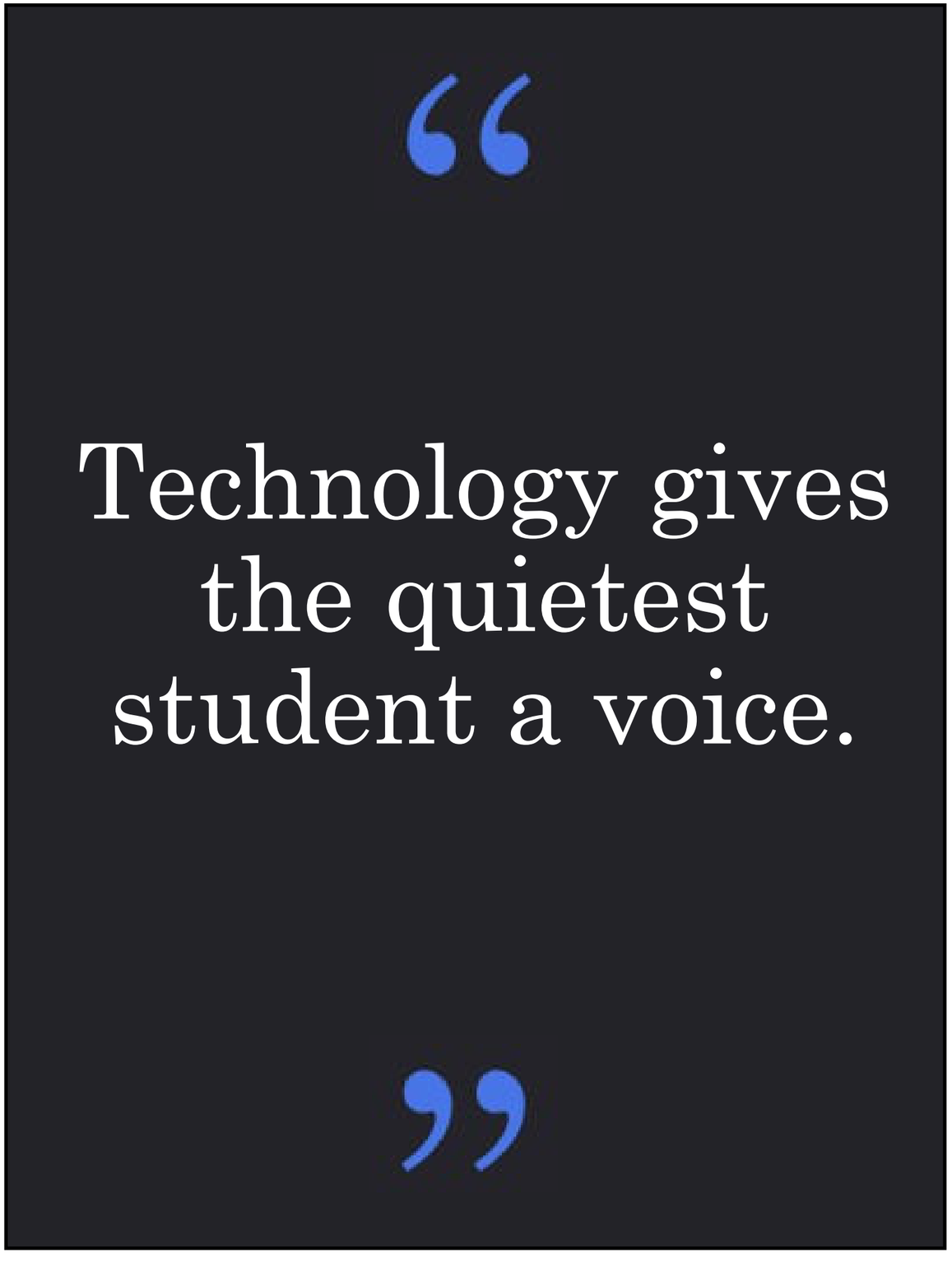
It was also the country's first startup in 2021 to sign a memorandum of understanding with the ISRO to launch its rockets. The startup has raised $68 million in total, including $51 million in a Series B round led by Singapore-based GIC in September, and has a valuation of $165 million.

The government is currently working on a new space policy to increase private participation and encourage investment in the country's space sector.

In a recent interview with TechCrunch, ISPA Director General Lt. Gen. AK Bhatt said the space policy would address some issues raised by the industry players, including a single sanction window and spectrum allocation for satellite-based communication services through the Department of Telecommunications. The industry players have also requested the government to open foreign direct investment policy and incentives on taxes, import duties and domestic manufacturing of space equipment that are yet to be addressed. "We're very excited to announce that we scripted history today by successfully launching India's first privately developed rocket Vikram-S," said Chandana of Skyroot.

Tamil Nadu announces statues for freedom fighters, Tagore, Kalam on September 8, 2021





2 Importance of ICT in Education

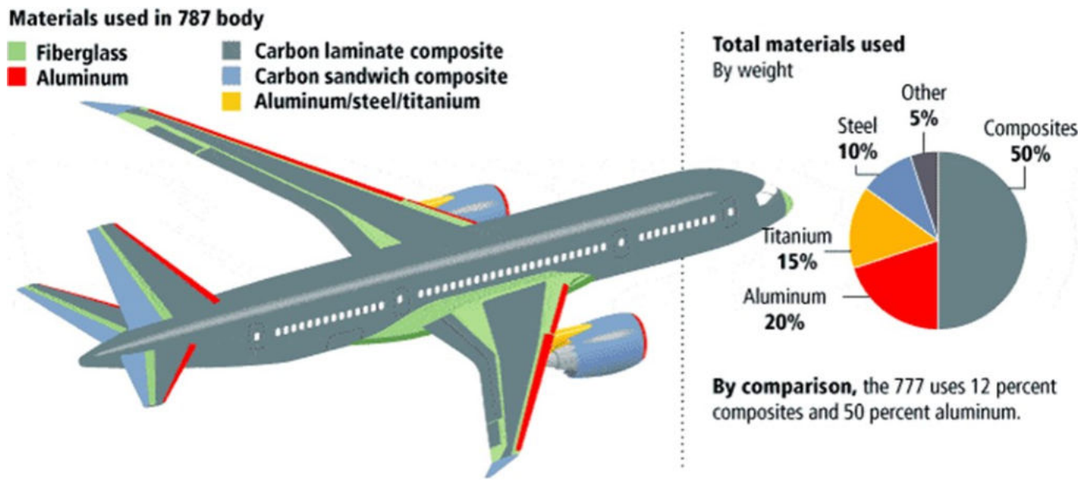
R Saravanan

Multimedia is the combination of various digital media types (e.g. images, sound, video, text) they compile an integrated multi-sensory interactive application to present the information to an audience (Neo and Neo, 2001). According to Agnew, Kellerman and Meyer (1996) multimedia means “an individual or a small group using a computer to interact with information that is represented in several media, by repeatedly selecting what to see and hear next”. Using multimedia in education results in the increasing productivity and retention rates, because people remember 20% of what they see, 40% of what they see and hear, but about 75% of what they see and hear and do simultaneously. It means, by using multimedia tools we can create a learning environment, where the communication of the information can be done in a more effective manner and it can be an effective instructional medium for delivering information.

The Information and Communication Technologies (ICT) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer, and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. When such technologies are used for educational purposes, namely to support and improve the learning of students and to develop learning environments, ICT can be considered as a subfield of Educational Technology. Education encompasses teaching and learning specific skills, and also something less tangible but more profound: the imparting of knowledge, positive judgment and well developed wisdom. Education has as one of its fundamental aspects the imparting of culture from generation to generation. Education means ‘to draw out’ facilitating realization of self potential and latent talents of an individual. It is an application of pedagogy, a body of theoretical and applied research relating to teaching and learning and draws on many disciplines such as psychology, philosophy, computer science, linguistics, neuroscience, sociology and anthropology . In view of ICT, education can be classified in three main categories- E-Learning, Blended Learning, and Distance Learning.

3 Advancements in Aircraft Materials

S Sivaraman



In recent years, much progress has been made on the development of aerospace materials for structural and engine applications. Alloys, such as Al-based alloys, Mg-based alloys, Ti-based alloys, and Ni-based alloys, are developed for aerospace industry with outstanding advantages. Composite materials, the innovative materials, are taking more and more important roles in aircrafts. However, recent aerospace materials still face some major challenges, such as insufficient mechanical properties, fretting wear, stress corrosion cracking, and corrosion. Consequently, extensive studies have been conducted to develop the next generation aerospace materials with superior mechanical performance and corrosion resistance to achieve improvements in both performance and life cycle cost. This review focuses on the following topics: (1) materials requirements in design of aircraft structures and engines, (2) recent advances in the development of aerospace materials, (3) challenges faced by recent aerospace materials, and (4) future trends in aerospace materials.

> “Smart materials are materials that are manipulated to respond in a controllable and reversible way, modifying some of their properties as a result of external stimuli such as certain mechanical stress or a certain temperature, among others.”

Advances in aerospace systems are strongly dependent on advances in materials and processing technologies. In the past hundred years of powered flight aircraft structures have evolved around advances in materials that are lighter and stronger. Aircraft propulsion systems are constantly striving to become more fuel efficient via reductions in mass and improved capability for materials to operate at higher temperatures for longer periods. Gas turbine engines that power modern aircraft are being designed to run at higher pressures and temperatures to generate more thrust per pound of engine mass. Similar considerations apply to rocket engines where the power densities are much higher. Spacecraft are designed to operate in the harsh radiation environments of outer space. In-space propulsion and power systems are key components of spacecraft and advanced materials enable these systems.

Hence it is important for aerospace systems designers to have a good understanding of how specific materials will perform in their systems. Aerospace Materials and Applications clearly shows the preferred approach to selecting materials given the unique requirements for design and construction of aerospace systems.

4 Advanced low-emission technologies

Arulmozhinathan T

Turbofan Engines are the most widely used propulsion technology in commercial transport aircraft and are directly involved in many of the environmental impacts of aviation. Advancements in turbofan technology have thus a very significant potential in reducing aviation impacts on the environment. The main technological advances currently being pursued in low-emission aircraft propulsion including combustion and thermo-fluidic enhancements, gearbox technology, lightweight materials, and intelligent engine health management systems. Particularly, historical records from the ICAO aircraft engine emissions databank are used to extrapolate current trends and progress against the ambitious targets set by international bodies. The recent analysis highlights that the sustained investments made by the aviation industry have yielded progressively diminishing returns and that the emission objectives will not be achieved at the current pace. Disruptive technological advances will therefore be required to significantly improve fuel efficiency and mitigate the environmental impact of commercial transport aircraft in the future.

> There's so much pollution in the air now that if it weren't for our lungs there'd be no place to put it all

Low emissions combustion technologies

The design of low emissions combustion technologies is a complex multi-disciplinary optimization (MDO) design challenge because although the focus is on the reduction of emissions, there are several other factors and consequences to be considered that could affect other attributes of the aircraft. The fundamental challenge is to increase engine cycle efficiency while keeping emissions at the lowest possible levels

- Casing treatments
- Inter-stage combustion and combined cycle technologies
- Thermo-fluidic improvements
- Integrated health monitoring and engine management systems
- Aircraft engine emissions trends

COVID– 19 PANDEMIC EFFECTS ON AVIATION INDUSTRY

Sharushri K (18101076)

The recent pandemic caused by COVID-19 has globally affected air transport mobility as well as the airline industry in general. Numerous restrictions have been implemented in airline transport, which is potentially leading toward severe long-term impacts on the global airline industry. In this paper, air transport mobility was analyzed regarding Europe (EU) based on the available data from the relevant sources associated with the airline industry. Data were analyzed in specific periods from January to April of 2020, which corresponded with the initialization of the pandemic in the EU and later in its full development.

Specifically, two airports were selected in Croatia as case studies to analyze the impact of COVID-19 more thoroughly on mobility together with the estimation of carbon footprint during the pandemic and the year before the pandemic state. The results revealed that COVID-19 gradually affected air transport mobility in the EU where a peak was reached in April with a reduction in the number of flights in the EU region reaching more than 89%. Cargo traffic was not significantly affected by the pandemic, and was even increased in some cases due to the supply of medical equipment in the fight against the disease. The analyzed case study revealed the reduction in air transport mobility for selected airports to be more than 96%, which directly affected the reduction of CO2 emissions to factor 1.81 for the commercial airport of Zagreb and 3.49 for the seasonal airport of Split. A normalization of air transport mobility is expected to be reached through a 1-year period with a continued reduction in the number of flights ranging from 15% to 25%, based on the projections and expectations from relevant EU associations.

The aviation sector is one of the most developed business sectors with the annual growth of passenger demands reaching about 4.2% in 2019. The aviation industry has continuously been developing with over 5000 airliners and more than 40 million flights per year.2 In the last several years, the annual growth of passenger demands has been over 7% but currently there is a decreasing trend, which was mainly caused by the global economic slowdown and strong competition in the global airline industry.3 The market values of major worldwide airliners are measured in dozens of billions (USD) and the impact of the airline industry on world GDP is an estimated 1%. The most rising markets of the airliner industry are presented in Figure 1 (domestic passenger rise in 2018), where it is evident that the Asian region is most progressive in that sense, that is, with respect to the increase in number of domestic passengers. The aviation industry is an important driver for all other associated services. Currently, there are over 1200 major international airports worldwide that serve more than 4 billion passengers per year.5 Moreover, there are many catering companies that supply airliners, or in other cases where many major airliners have their own catering services. For instance, US aviation has a catering market with an annual value of more than 6 billion USD.6 There are different airport services that count more than 1.6 million employees, such as air-traffic control, ground staff, security services, building maintenance services, with an annual rise of about 20%.7 The importance and added value of the global air industry could also be apprehended in a much wider context. Nowadays, each corner of the world is accessible in a matter of 24 hours where efficient mobility has been enabled more than ever. Moreover, the contribution of airliners in the global mobility population is crucial. Airline-based mobility significantly contributes in the development of different businesses since it strongly supports the efficient exchange of various goods between countries. One major market sector where there is a high impact of aviation services is tourism8 with a major and direct link between them. In some countries, most tourists nowadays arrive by plane and tourism has become strongly dependent on the aviation sector. For instance, Spain and France count for over 80% of visitors that arrive by plane, while globally, the number of tourists arriving by plane ranges from 35% to over 80% as it is the case in some major economies.9 Flights are becoming more economically viable and accessible making airlines an important driver for economies, in the regional and global development of countries.

Unfortunately, there are unfavorable environmental impacts associated with dense airline traffic that causes severe problems to the environment. The global contribution of CO2 emissions released by the aviation industry is about 2% and is continuously rising. Besides CO2, other pollutants are also released in the atmosphere such as NOx, SOx, HC, VOC (Volatile Organic Compounds), or finally ultrafine particles.10 The direct release of pollutants via aircraft jet engines is followed with other, that is, indirect emissions that are also present. The general rise in flights has caused an intense development of airport-associated infrastructures. The development of airport infrastructure involves high carbon industries (concrete, steel, etc.) that boost overall carbon footprints. New terminals are being built worldwide (as recent mega airports such as Istanbul or Beijing airports), runways, maintenance building facilities, shopping centers, etc. There are also recent findings that indicate the potential unfavorable impact of aircraft cabin quality on human health.13 In the previous sense, more intense research efforts are needed to investigate the long-term effects of aircraft cabin quality on human health in frequent exposures. environment.

Finally, the goal is to secure low emission combustion technologies in aviation16 and intense research efforts are being directed in that sense.

Aircraft Noise

Kalaikovan M (18101032)

Reducing the adverse environmental impact of aircraft noise emissions on population centers adjacent to major airports is an important goal of NASA. Airframe noise is a significant component of aircraft noise during approach to landing when the undercarriage and wing high-lift system are deployed. Prior aeroacoustic studies (flight tests and model scale experiments) have identified the aircraft landing gear and high-lift devices such as slats and flaps to be the most prominent airframe noise sources.1-10 NASA's Environmentally Responsible Aviation (ERA) project is vigorously pursuing the advancement and maturation of airframe noise reduction concepts that will minimize aircraft noise footprints on the ground while maintaining aerodynamic efficiency.

The joint study is a multi-pronged, multi-faceted effort comprised of:
a) high-fidelity, large-scale computations for the advancement of simulation-based noise prediction tools,
b) a series of model-scale wind tunnel tests targeting the development and evaluation of airframe noise mitigation technologies as well as the acquisition of an extensive aeroacoustic database for validation of advanced noise prediction capabilities,
c) full-scale flight tests to determine the geometric fidelity, installation, and Reynolds number effects on airframe noise sources, and ultimately to evaluate the effectiveness of the best performing noise reduction concepts in a relevant environment.

The NASA-Gulfstream joint effort began with an acoustic flight test in 2006 where the prominent airframe noise sources associated with a Gulfstream aircraft were identified and documented.10 The major noise sources are the flap side-edges, main landing gear, and nose landing gear. The tested aircraft high-lift system does not have wing leading edge slats. Gear-flap flow interaction was also identified as a potential source of noise. For the wind tunnel tests, a high-fidelity and highly-instrumented 18% scale, semi-span model of the Gulfstream aircraft deployed during the 2006 flight test was designed and fabricated at the NASA Langley Research Center (LaRC). The model was produced specifically to conduct airframe noise studies and evaluate advanced noise mitigation concepts for reducing main landing gear, flap, and gear-flap interaction noise. Aeroacoustic testing was executed in multiple stages through three entries in the NASA LaRC 14- by 22-Foot Subsonic Tunnel (14 x 22). The initial entry, lasting four weeks, was completed in November of 2010. This test was devoted to documenting the aerodynamic characteristics of the model. Global forces (lift and drag) along with steady and unsteady surface pressure measurements were acquired. Detailed accounts of model development and aerodynamic results obtained during the 2010 test are given in Refs. 11 and 12. The second 14 x 22 tunnel entry, lasting five weeks, was concluded in late March of 2013. This segment was dedicated to comprehensive aeroacoustic testing of the model in a landing configuration with and without flap/gear noise reduction devices applied. During this entry, aerodynamic and acoustic measurements were performed simultaneously. To reduce the impact of background noise and improve the quality of the collected acoustic data, the 14 x 22 tunnel was operated in an open-wall (open-jet test section with floor) acoustic configuration whereby the test section floor, raised ceiling, and side walls were treated with sound absorbing foam wedges. The acoustic measurements were obtained using a traversing microphone array in the flyover direction. The third entry, lasting four weeks, was completed in late April of 2013. Employing particle image velocimetry (PIV) and laser velocimetry (LV) techniques, this final entry was dedicated to acquiring off-surface flow measurements from the 18% scale model baseline landing configuration with

Jet noise reduction is one of the major issues concerning jet engine manufacturers. Environmental concerns and strict noise regulations around major airports have made jet noise a crucial problem in present day aeroacoustics research, as it is the jet engine exhaust that is responsible for most of the noise generation during aircraft takeoff. The importance of the problem has motivated numerous experimental and computational studies to date. Current jet noise research is directed toward three main areas: improvement in noise prediction tools, better understanding of the underlying noise generation mechanisms, and investigation of various noise reduction devices such as tabs, chevrons, micro jet injection, and lobed mixers.

Chevron nozzles have drawn a lot of attention recently due to their noise reduction benefits and are currently one of the most popular jet noise reduction devices. Chevrons typically reduce the low-frequency noise at aft angles, whereas they increase the high-frequency noise at broadside angles relative to the jet . The stream wise vorticity generated by the chevrons enhances mixing in the shear layers of the jet, which leads to a decrease or increase in noise over certain frequency ranges. The ultimate goal in chevron design is to decrease the low-frequency noise as much as possible while preventing a significant increase in high-frequency noise. Some of the parameters that can be varied for this problem are the chevron count, chevron penetration, and chevron length. Chevron count controls the spacing between the axial vortices generated by the chevrons, whereas chevron penetration controls the strength of the axial vorticity and chevron length controls the distribution of vorticity within the axial vortices.

Thus, an optimization study of several parameters is necessary to get the maximum amount of noise reduction with chevron nozzles. It appears that experimental studies of chevron nozzles still use, more or less, a trial-and-error approach, because the effects of chevrons on the flow modification in the near-nozzle region are still not clearly understood. Moreover, the absence of a large experimental database for chevron nozzles makes it difficult to extrapolate the noise from existing experimental measurements to new chevron nozzle designs. Although experiments are necessary and provide useful data for validating the computations, they are expensive and can supply a relatively limited amount of information. Thus, computational methods are attractive for studying various chevron nozzle designs in a more cost-effective manner.

Higher studies

S.No	Reg.no	Name	Name of the degree & Institution
1	16101010	AJMAL.S	Master of Science in Procurement & supply chain management at Griffith College Limerick, Ireland
2	16101057	MAGESHBABU B	Master of Science in International business Management, Sheffield Hallam University
3	16101060	MOHAMED IRSATH A R	Master of Science in Project management , Anglia ruskin university
4	16101079	RAJKUMAR B	Master of Science in Engineering Management, University of York, The Stables, United Kingdom
5	16101085	SAHANA R	Master of Business Administration in Aviation Management, CMS Business School, JAIN, Bengaluru
6	16101089	SAMSON P J	Master of Science in Procurement & supply chain management, Griffith College Limerick, Ireland
7	16101093	SOORAJ A C	Master of Science in Advanced Aerospace Eng, University of Liverpool, United Kingdom
8	16101601	DHEENATHAYALAN T	Master of Science in Mechanical Engineering, Nanyang technological university

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