ASME | MEEd

REVA UNIVERSITY
Bengaluru, India

ENGINEERING EDUCATION SEMINAR & WORKSHOP ON DRONE TECHNOLOGY

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EXECUTIVE SUMMARY

ASME's Mechanical Engineering Education (MEEd) Seminar and Workshop on Drone Technology was held on February 14, 2026 at REVA University, Bengaluru. This forum convened academicians and industry professionals to share insights on drone technology and its evolving role in modern industry, particularly regarding the continued rise of artificial intelligence. The audience included a diverse mix of students, faculty, and professionals, which fostered a highly interactive learning environment. More than 100 students attended day-long sessions featuring a gamut of presentations and workshops tailored to their specific levels of experience and technical perception.

In collaboration with REVA University, ASME provided a platform for faculty to gain perspectives from frontline industry professionals. These discussions aimed to bridge the gap between academic curricula and current industrial requirements. By the conclusion of the seminar, participants reached a unilateral agreement: engineering education must move away from isolated core subjects in favor of a multidisciplinary approach. Expert speakers highlighted that modern engineering careers are no longer as binary as they were perceived in the past.

Drones embody this paradigm shift. The adoption of Unmanned Aerial Vehicles (UAVs) across sectors such as Agriculture, Healthcare, Defense, Logistics, and Urban Planning is well-documented in recent success stories. The academic sessions established that the design and development of UAVs require multidisciplinary expertise. The development process tests an engineer's proficiency in Aerospace, Mechanical, Electrical, and Software engineering simultaneously. Consequently, a balanced curriculum of theory and hands-on practice is essential to equip students with the tools required for the modern workforce.

The rewards for mastering these skills are significant. The drone market is expanding rapidly, with a projected size of $846.94 billion and an annual growth rate of 20%. Furthermore, various government initiatives, such as the Drone Shakti Scheme and the Namo Drone Didi Scheme, provide additional support for aspiring professionals seeking to build fruitful careers in this sector.

EVENT SUMMARY

The seminar and workshop achieved a high level of engagement, with **138** participants attending out of **150** total registrations.

Total Registered
150 (Paid: 125)

Total Attendees
138

Students
111

Professionals
27

INSTITUTIONAL PERSPECTIVES: ASME AND REVA UNIVERSITY

ABOUT ASME

Address by Mr. Madhukar Sharma

President and Director, ASME India Private Limited and Ms. Avni Malhotra, Deputy Director, ASME Foundation India

The American Society of Mechanical Engineers (ASME), established in 1880, is a not-for-profit society comprising more than 85,000 members across 135 countries. ASME's mission is to address real-world challenges for the betterment of humanity through the advancement of engineering professions and practices.

ASME provides a foundation for technical knowledge and global safety through its codes, standards, publications, and professional development programs. In 2020, ASME formed the International Society of Interdisciplinary Engineers (ISIE) LLC, a for-profit subsidiary designed to bring innovative products and services to the engineering community.

In his address, Mr. Madhukar Sharma highlighted ASME's achievement in establishing over 700 standards. These standards are developed by the same professionals and researchers who serve on ASME committees. Historically, ASME was formed in response to the frequent boiler accidents of the late 19th century. The US government mandated specifications for safe construction and operation, leading to the creation of the standards that ensure safety in modern engineering.

Today, ASME's learning and development programs help engineers apply these international standards. These programs are certified by the International Accreditation Council and governed by industry leaders. ASME operates on a core principle of reinvesting 100% of its earnings back into society. The society is member-governed, with boards composed of members to whom the sta report.

ASME is organised into 50 divisions across eight segments, many of which operate in India. These divisions collaborate to host major technical conferences where researchers and practitioners present research, industry applications, and case studies. These findings are published globally to drive the advancement of new materials and solutions.

The International Mechanical Engineering Congress & Exposition (IMECE) has traditionally been held in the United States. However, India became the first country to host the event outside the US with an introductory conference in Hyderabad in 2025. The inaugural IMECE India saw 2,100 attendees and over 700 papers presented. This year's IMECE India conference is expected to attract an estimated 3,000 participants, including innovators, faculty and industry leaders.

ASME'S WORLDWIDE NETWORK

ASME operates two entities in India. ASME India Private Limited, established in 2012, focuses on developing and evolving codes to keep pace with rapidly advancing technologies, delivers learning and development programs to disseminate this knowledge, and actively drives technical community groups across India. ASME Foundation India, established in 2024, focuses on philanthropic programs including student and faculty development, STEM education, and women's empowerment.

Address by Mr. Madhukar Sharma

Mr. Sharma emphasised that the seminar was designed to provide knowledge on a subject that is inherently interdisciplinary. He encouraged students to engage actively with the expert speakers. "The more you ask, the more you can take away from this session," he noted, reflecting on his 18-year journey with ASME.

Standards & Certifications Data

ASME Foundation India

The ASME Foundation India is a not-for-profit organisation registered under Section 8 of the Indian Companies Act 2013. Its mission is to empower the next generation of engineers to build a sustainable world, leaving no brilliant talent behind. The Foundation introduces underserved school children to STEM education and empowers women through EWSEI (Empowering Women through Social and Engineering Innovation) programs.

Events such as EFx and E-Fests help students develop organisational skills and teamwork while receiving feedback on their technical innovations. The Mechanical Engineering Education Summit (MEEd) specifically aims to bridge the gap between academic training and industry expectations, ensuring the next generation of engineers possess workforce-ready skills.

> "We bridge the gap between what industry expects from mechanical engineering graduates and what academia actually prepares them for."
>
> **Ms. Avni Malhotra, Deputy Director, ASME Foundation India**

Academic and Industry Synergy

Address by Dr. K S Narayana Swamy, Pro Vice Chancellor, REVA University

Dr. Swamy thanked ASME for collaborating with REVA University to advance the engineering curriculum. He emphasised that degrees alone are insu□cient for future success. Modern engineers require the "5 Cs": Communication, Collaboration, Critical Thinking, Creativity, and Competency.

He noted that with over 1.5 million engineers graduating annually in India, competition is fierce. Furthermore, Artificial Intelligence is expected to disrupt current job roles significantly. Dr. Swamy urged students to use the workshop to redefine their learning habits. He also stated that universities must remain open to industry feedback when designing curricula and assessment patterns.

ASME Learning & Development (L&D)

Address by Mr. Hari Balachandran, Deputy Director – Learning & Development, ASME India Pvt Ltd.

The Foundation of Safety and Compliance

Since 1914, ASME's Boiler and Pressure Vessel Code (BPVC) has pioneered modern standards for public safety and technological advancement. These codes are now utilised in 100 countries and are considered essential in the electric power generation, petrochemical, and transportation industries.

Understanding these codes is essential for any professional involved in the design, fabrication, or maintenance of critical systems. For instance, mistakes in welding or pressure piping can lead to catastrophic failures, risking both lives and assets. ASME's L&D courses provide the technical solutions required to maintain code compliance and ensure the safe operation of complex mechanical systems.

Advanced Technical Training and NDE

As technology moves at an accelerating pace, ASME's role in Nondestructive Evaluation (NDE) has expanded. Traditionally focused on material characterisation through techniques like ultrasonics and radiography, the NDE division now provides technologically sound information that defines risk versus reward in new discoveries. These programs are designed to prepare globally competent leaders who can navigate the scientific shifts occurring in Industry 4.0.

Bridging Industry 1.0 to Industry 4.0

Mr. Balachandran noted that we are currently in Industry 4.0. While ASME has been a leader since Industry 1.0, the society continues to evolve as new materials are discovered. He specifically highlighted the importance of ASME Y14.5 (Geometric Dimensioning and Tolerancing). He argued that every mechanical engineer must master metrology and tolerances, citing the precision of modern consumer electronics like the iPhone as a benchmark. ASME is currently developing new programs aligned with the National Academic Credit Framework to ensure these essential skills are integrated into student development.

EXPERT PRESENTATIONS: TECHNICAL INSIGHTS AND INDUSTRY TRENDS

Artificial Intelligence in Drones and UAV Systems

Dr. CM Ananda, Chief Scientist & Programme Director (Civil Aircrafts), NAL

Institutional Overview of CSIR-NAL

The National Aerospace Laboratories (NAL), a constituent of the Council of Scientific and Industrial Research (CSIR), serves as India's premier hub for aerospace research and aircraft technology development. Dr. Ananda detailed NAL's mandate to manage the entire lifecycle of aircraft design, development, and certification. While NAL primarily focuses on civil aviation, it also develops critical technologies for military applications.

Key Civil and Strategic Aircraft Programmes

NAL manages a diverse portfolio of aircraft, spanning from current deployments to projects planned through 2040:

- Hansa-NG: India's first all-composite ab-initio trainer aircraft, designed for flight training and sport flying.
- SARAS: A 19-seat multi-role light transport aircraft designed to enhance commuter connectivity under the UDAAN scheme.
- HAPS (High Altitude Pseudo Satellite): A solar-powered system bridging the gap between UAVs and satellites to provide long-duration surveillance and disaster management capabilities.

UAV Development and Technical Specifications

Dr. Ananda highlighted that modern drones share the same architectural complexity as traditional aircraft, requiring real-time health monitoring and sophisticated management systems.

- NAL Quad-04: An indigenous all-composite quadcopter.
  - Flight Duration: 40 minutes.
  - Maximum Payload: 0.5 kg.
  - Primary Use: Surveillance and multispectral imagery.
- NAL Q-Plane: A lightweight, all-electric vertical take-o and landing (VTOL) UAV.
  - Range: Up to 20 km.
  - Autonomy: Fully autonomous cruising.
  - Design: Detachable, composite structure for portable field operations.
- Loitering Munition (LM) UAVs: Tactical systems designed to loiter over target areas for extended periods, combining the features of UAVs and missiles.

Regulatory and Educational Vision

The presentation noted a significant surge in drone registration, with over 38,500 drones and 40,000 DGCA-certified pilots currently contributing to the Viksit Bharat 2047 vision. However, Dr. Ananda emphasised the urgent need for robust certification and regulatory frameworks to manage flight operations near restricted red zones. He advocated for integrating drone theory and design into the multidisciplinary engineering curriculum as early as the third semester.

FROM FIELD FAILURES TO FLIGHT INTELLIGENCE: SOLVING REAL-WORLD PROBLEMS

Mr. Abhishek Burman, Co-Founder & CEO, General Aeronautics

Challenges in Agricultural Drone Adoption

Mr. Burman addressed the complexities of the Indian agricultural landscape, noting that the prevalence of small-scale farmers necessitates a service-based model rather than a direct-sales approach. He highlighted “Trust” as a major barrier; for example, traditional farmers are often skeptical of switching from 200 liters of water per acre to just 8 liters of concentrated chemical spray.

Operational Logistics and Reliability

The transition to drone fleets introduces unique coordination challenges, particularly in rural areas where hyper-local factors vary between states like Karnataka and Punjab. Mr. Burman identified several operational risks:

- **Insurance Discrepancies:** Di□culty in identifying specific drones within a fleet leads to increased premiums for owners.
- **Sensor Vulnerabilities:** Uncalibrated altimeters can cause crashes over wells or depressions, while electromagnetic interference from high-voltage lines can disrupt onboard compasses.
- **Energy Optimisation:** Battery performance is not a standalone factor but a function of multiple design parameters.

The Entrepreneurial Journey: Bridging the Technocrat Gap

Mr. Burman shared a candid account of the founding of General Aeronautics. Despite having 17 years of experience in fighter aircraft design, the founding team of “pure technocrats” initially struggled with business execution. He admitted that their early assumptions failed because they lacked the “heart of doing business.” By pivoting from “larger birds” to “smaller birds” (drones), the company found success. He urged students to look beyond just using technical tools and focus on the “art of connecting the dots” to understand why a solution is being implemented.

AI ON EDGE IN DRONES: ENGINEERING AUTONOMY UNDER REAL-WORLD CONSTRAINTS

Mr. Zain Saeed, Co-Founder & COO, Enord

Onboard Intelligence and Future Applications

AI on Edge represents the next evolution in drone autonomy, allowing for real-time data processing directly on the aircraft. Mr. Saeed explained that while current drone utilisation is limited to a few sectors, edge intelligence will allow UAVs to enter new industries. These autonomous systems will perform tasks that were previously impossible for humans due to physical or environmental limitations. the dots" to understand why a solution is being implemented.

Principles of Onboard Intelligence

- Onboard Vision Systems: High-resolution cameras, LiDAR, and event-based sensors enable drones to map environments and detect objects in real-time.
- Sensor Fusion: The combination of IMU, altimeters, and magnetometers—refined by Kalman and particle filters, ensures robust navigation.
- Optimisation Techniques: Methods such as model quantization and pruning are utilised to run neural networks on hardware with limited power and size.

Strategic Applications and Resilience

Mr. Saeed explained that processing data onboard allows drones to operate in GPS-denied environments and areas with low communication bandwidth. In agriculture, these drones monitor crop health and pests independently. In defense, they perform intelligence and reconnaissance missions in denied areas with minimal human intervention.

Pilot Shortage and Autonomous Solutions

A critical insight shared by Mr. Saeed was the acute shortage of certified drone pilots across Indian states and government departments. He argued that the industry cannot rely solely on manual piloting. Instead, the focus must shift to developing autonomous systems that can adapt to specific requirements with minimal human intervention.

Human Capital and Ecosystem Development

Reflecting on his journey from an educational background to drone technology, Mr. Saeed noted that he entered the industry without prior technical knowledge of UAVs. He emphasised the importance of executive ability and streamlining ideas. He expressed a strong vision for retaining Indian talent within the domestic ecosystem, noting that many leading drone professionals abroad are of Indian origin.

MULTIDISCIPLINARY ENGINEERING IN MODERN UAV DESIGN

Dr. Subrata Nayak, Technical Head (R&D), Idea Forge Technology Ltd.

Market Leadership and Mission Reliability

IdeaForge ranks third globally among dual-use drone manufacturers and dominates the Indian security and mapping markets. Dr. Nayak reported that an IdeaForge drone takes o every three minutes, with over 850,000 successful missions recorded.

Technical Portfolio for Defense and Logistics

- Q6 V2: A small-category UAV designed for large-scale mapping and land surveying.
- ZOLT: A tactical UAV built for conflict zones.
  - Features: VTOL versatility, GPS-denied autonomy, AI-powered threat detection, and an 80 km secure data downlink.
- YETI: A heavy-lift logistics drone designed for extreme environments.
  - Payload Capacity: Up to 200 kg.
  - Applications: O shore delivery, medical evacuations in disaster zones, and high-altitude logistics where roads are non-existent.

From Classroom to a Listed Company

The presentation detailed the origin of IdeaForge, founded by three IIT graduates who evolved a classroom project into a globally recognised UAV company. Their first quadcopter won a prestigious award at a college event, similar to the MEEd seminar. This success led to a demonstration for the Indian Army. Dr. Nayak proudly noted that IdeaForge drones supported the Indian Army during Operation Sindoor by scouting militants in logistically challenging border areas. The company's motto remains: "If you have an idea to solve a problem, immediately forge it into a product."

ALIGNING AEROSPACE ENGINEERING EDUCATION WITH THE UAV INDUSTRY

Dr. M Sivapragasam, Professor (Department of Aerospace and Automotive Engineering), M.S. Ramaiah University of Applied Sciences

Global and Domestic Market Dynamics

The aerospace market is projected to reach $1,185.07 billion by 2030, driven largely by increased defense spending. Dr. Sivapragasam cited India's agreement to procure 114 Rafale fighter jets as a testament to this growth. Domestically, the drone market is growing at a Compound Annual Growth Rate (CAGR) of 20.3%, fueled by commercial adoption in agriculture and services. The Indian aviation, defense, and space market is valued at $19.81 billion, with a projected growth to $26.32 billion by 2030.

Government Initiatives and Manufacturing

Significant government support is driving this growth. The Drone Shakti Scheme promotes indigenous design and fabrication. Furthermore, the liberalisation of drone rules encourages startups to meet the demand accelerated by the Production Linked Incentive (PLI) Scheme. Dr. Sivapragasam noted that the PLI Scheme is the backbone of India's vision to become a leading global industrial economy.

Educational Reform and Multidisciplinary Careers

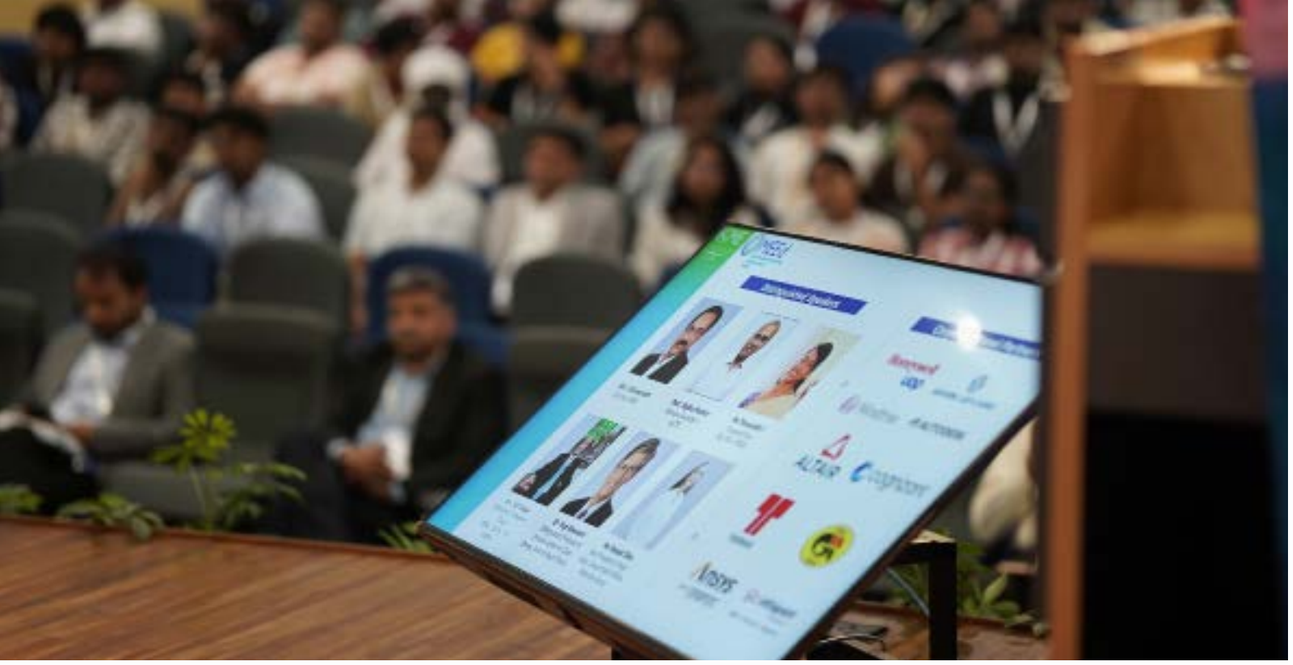
The industry transformation is currently outpacing academic reform. Dr. Sivapragasam urged a shift toward hands-on upskilling. With over 900 drone startups in India, graduates have diverse opportunities in design, aerodynamics analysis, and flight testing. He emphasized that aerodynamics is an applied science that only becomes meaningful when a design successfully takes to the skies.

Career Pathways for Engineering Graduates

With over 900 drone startups registered in India, the industry o□ers diverse roles for multidisciplinary engineers:

The Thrill of Practical Design

Reflecting on the evolution from the 1903 Wright Flyer to modern stealth aircraft, he emphasised that aerodynamics is only meaningful when applied to practical design. He described the "unexplainable thrill" of seeing one's own design take to the skies, encouraging students to view aerospace as a field that now encompasses Urban Air Mobility, e-VTOLs, and autonomous systems.



DRONE TECHNOLOGY AS AN ACADEMIC OPPORTUNITY: STRENGTHENING ENGINEERING EDUCATION THROUGH APPLICATION

Dr. Manjunath S V, Head of Aeronautical Engineering, MITE and Founder & CEO, Lakshya Pinnacles Pvt. Ltd.

The Historical Evolution of Unmanned Systems

Dr. Manjunath provided a historical perspective, noting that the concept of inanimate objects performing missions dates back to 1849 with Austrian air balloon bombs. The term “drone” was coined in the 1930s to describe pilotless aircraft directed by remote control. Today, these systems have evolved into strategic assets, such as the Nagastra drone used in Operation Sindoor to neutralise terrorist targets.

Institutional Investment and Research

Major defense research bodies like DRDO and HAL are investing heavily in drone technology for surveillance and border security. Simultaneously, private companies are driving innovation in logistics and infrastructure.

Digital Twinning and Future Research

The presentation introduced Digital Twinning as a critical frontier in drone technology. This involves creating a virtual representation of a physical drone that uses real-time data to simulate behavior and performance.

Next-Gen Research Areas: Solar-powered UAVs, fuel-cell energy sources, and advanced airspace tra□c management systems.

The Mandate for Integrated Education

A primary takeaway from Dr. Manjunath’s presentation was the need for universities to o□er integrated courses. These should include:

- Swarm drones and control systems
- Embedded electronics and navigation principles
- Certifications and hackathons for hands-on experience

Building Engineers, Not Just Teaching Subjects

Dr. Manjunath concluded with a call to action for the academic community. He argued that subjects are currently taught in isolation, which limits the integration required for modern engineering. He challenged educators to bridge the gap between academic branches and real-world challenges. His vision is for students to not only seek placements in top industries but also to have the capability to launch their own startups in their core domains. “We must ask ourselves,” he stated, “are we teaching subjects, or are we building engineers?”

STRATEGIC WORKSHOPS: PRACTICAL METHODOLOGIES AND TOOLS

Accelerating Drone Innovation Through Multiphysics Simulation

Mr. Gokul Raj M, Technical Accounts Manager, Infinipoint Technologies Pvt. Ltd.

The Role of Simulation in Human Advancement

Ansys provides the simulation power necessary for next-generation research, from sustainable transportation to advanced semiconductors. By using advanced simulation, industries can innovate more designs in less time, perform rapid design exploration, and gain detailed insights into real-world product performance before physical prototyping.

Breaking Engineering Silos

Mr. Raj emphasised that simulation tools are no longer categorised by traditional branches like “Mechanical” or “Electronics.” Modern engineering requires an integrated approach where software depends on principles across multiple domains. He noted that this multidisciplinary shift forges new career paths; for example, Ansys tools now utilise Python, allowing Computer Science students to have a significant stake in the hardware ecosystem.

The Ansys Structural Analysis and UAV Suite

To address common challenges in drone development—such as safety, regulatory compliance, and energy e□ciency—Ansys o□ers a specialised suite of tools:

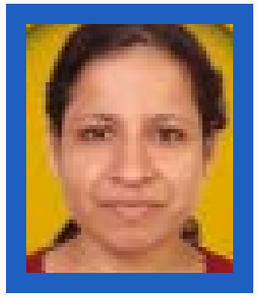
- Ansys Forming: Simulates metal stamping tasks through an end-to-end workflow on a single platform.
- Ansys Motion: Analyses rigid and flexible bodies via a multibody dynamics solver to evaluate physical events accurately.
- Ansys Sherlock: Provides life predictions for electronic hardware at the component and system levels during early design stages.
- Ansys Autodyn: Calculates material responses to short-duration, severe loading, such as impacts or explosions.
- TwinAI: Dedicated to creating and managing Digital Twins.
- Discovery: A tool for rapid 3D design and conceptualisation.

Strategic Recommendations for Students

Simulation is a process of trial and error. Mr. Raj suggested that students should focus on reducing the number of physical tests through theoretical and experimental simulation. He warned that the fast-paced drone industry does not allow time for post-graduation “on-the-job” familiarisation with these tools; therefore, a multidisciplinary, software-ready approach must be integrated into their current academics.

ENABLING NEXT-GEN DRONE DEVELOPMENT WITH MATLAB & SIMULINK

Dr. Richa Singh, Application Engineer, MathWorks



The Philosophy of Model-Based Design (MBD)

MathWorks aims to accelerate the pace of discovery and innovation through a Model-Based Design workflow. This methodology allows engineers to scale production by addressing challenges from initial requirements through to implementation and integration.

Core Tools for System Architecture

- MATLAB: A high-level computing environment used for technical and numeric computing, data analysis, and algorithm development.
- Simulink: A block-diagram environment for the simulation and Model-Based Design of multidomain and embedded engineering systems.

Operational Workflow and Safety

Dr. Singh highlighted a methodical industry workflow:

System Requirements → Architecture → Component Design → Implementation → Operations.

She cautioned against “jumping directly to hardware”. Instead, rigorous testing within the software environment is a safer and more cost-e□ective approach, as it prevents the loss of expensive hardware components during the development phase.

Scenario Simulation with Unreal Engine

MathWorks tools now integrate with the Unreal Engine (Epic Games) for scenario simulation. This allows users to:

- Configure prebuilt virtual scenes.
- Simulate camera and radar sensors on vehicles.
- Verify the performance of perception, path planning, and control algorithms in a photorealistic simulated environment.

The Engineering Mindset

Dr. Singh concluded by encouraging students to “fall in love with the problem” rather than just the technology. By using the right set of tools to automate manual steps and coding, engineers can focus more on the creative and analytical aspects of their operations.

PHYSICS-INFORMED MACHINE LEARNING FOR UAVS

Mr. Anand Nagarajan, Senior Lead Engineer & Data Scientist, Airbus & Mr. Unnat Mankad, Principal Engineer, Baker Hughes

The Hybrid Approach: Physics-Informed Learning

Mr. Nagarajan discussed the evolution of mechatronic systems in automobiles and aircraft. He introduced Physics-Informed Learning as a niche hybrid distinction that merges traditional Physics-based modeling with Data-driven approaches. While standard neural networks are “data-hungry” and require massive datasets, Physics-Informed models can explain behavior through mathematical equations when data is scarce.

Generative AI and Surrogate Models

The workshop addressed the impact of Generative AI on aerodynamic design:

- Small Language Models (SLMs): Mr. Nagarajan recommended using several specific SLMs for targeted tasks rather than a single Large Language Model (LLM), as specific models yield more accurate results for specialised engineering cases.
- Surrogate Models: These are data-driven models that define the “design space” (parameters like pressure, temperature, and location) where a drone operates, ensuring it is ready for any scenario within its operational domain.
- Prompt Engineering: Detailed prompts can now generate overall aerodynamic designs in seconds - a process that previously took hours of manual derivation.
- TwinAI: Dedicated to creating and managing Digital Twins.

Ethical AI and the “Sparring Partner” Concept

He emphasised that AI should be viewed as a “sparring partner” or a learning partner. He used a fitness metaphor: “If you go to the gym and let someone else lift the weights, there is no point.” Engineers must use AI correctly and responsibly to enhance their own capabilities rather than replace their fundamental understanding.

The ASME Cyber Physical Systems (CPS) India Group

Mr. Unnat Mankad introduced the CPS India Group of ASME, which focuses on empowering Indian engineers to lead safely and ethically in an AI-driven future. The group operates across three verticals:

- Standards and Architectures: The fundamentals of physical systems.
- Deployments and Use Cases: Real-world applications.
- AI/ML Application: Integrating intelligence into Cyber-Physical systems.

NPS Score

(Following the seminar's objective, sessions, presentations, contents and speakers)

Promoters	17
Passives	5
Detractors	0

CONCLUSION

Workforce Readiness

The mission of the CPS India Group is to accelerate workforce readiness by equipping students and professionals with digital, data, and AI capabilities. By upholding safety, ethics, and engineering excellence, ASME ensures that the next generation of engineers is not only digitally fluent but also future-ready to advance engineering for the benefit of humanity.