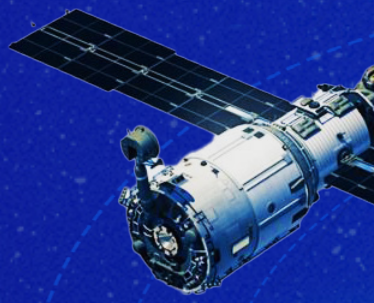
IEEE | AESS Bangalore Chapter | IEEE SPACE 2026 | IEEE BANGALORE SECTION | AESS

(SPace, Aerospace and defenCE Workshop)

SPACE 2026

WORKSHOP BOOKLET



July 19, 2026

Sheraton Grand Bengaluru
Whitefield Hotel & Convention Center

www.ieeespace.org

SPACE WORKSHOP SCHEDULE

JULY 19, 2026 (SUNDAY)

Time (IST)	Amaryllis	Petunia	Scarlet 1	Scarlet2	Scarlet 3	Zinnia	Poinsettia 2
08:00-09:00	**W4:** Bistatic and Passive Radar Detection of Space Objects - Phenomenology and Techniques-I	**W5:** Radiation-Hardened RTL Design Techniques for FPGA-Based Systems	**W1:** Control Under Uncertainty - From Trajectory Optimization to Adaptive Control-I	**W10:** Satcom System design	**W7:** Model Based System Engineering and AI-I	**W9:** Human Space Flight & Space Medicine-I	**W21:** Phased Array Antenna Technology
09:00-10:00	**W4:** Noise & Polarisation in Antennas						
10:00-10:30	**TCBN1:** Tea/Coffee Break & Networking						
10:30-11:30	**W4:** Bistatic and Passive Radar Detection of Space Objects - Phenomenology and Techniques-II	**W15:** IEEE Antenna Measurement Standards and Overview of IEEE Std 1720	**W1:** Control Under Uncertainty - From Trajectory Optimization to Adaptive Control-II	**W12:** Realistic modelling of End-to-End Radar & Communication System Simulation	**W7:** Model Based System Engineering and AI-II	**W9:** Human Space Flight & Space Medicine-II	**W22:** AI in Radar Processing Chain
11:30-12:30	**WS16:** AI-Native Space-Air-Ground Networks: From Low Altitude Economy to Interplanetary IP						
12:30-13:30	**LBN1:** Lunch Break & Networking						
13:30-15:30	**W8:** Design and Safety Management for Aerospace	**W6:** Next-Generation RF and Photonic Technologies for EW and Space Communication Systems	**W2:** High Altitude Platforms as Disaster Recovery Networks and Early Warning Systems	**W13:** Electro-Optics Payload System Design	**WS17:** From RF to Flight Dynamics: End-to-End Full-System HIL Concept for Space, Aerospace, and Defence Missions	**W9:** Human Space Flight & Space Medicine-III	**W23:** Next Gen Amplifier & Mixer Analysis Techniques by incorporating AI for Smart Measurements
15:30-16:00	**TCBN2:** Tea/Coffee Break & Networking						
16:00-17:00	**WS18:** Converged Networks and Ubiquitous Connectivity	**WS19:** Machine Learning-Assisted Design and Optimization of Antennas for Space Systems	**W3:** Space-Air-Ground Integrated Networks for Autonomous Air Mobility Services	**W14:** Spaceborne SAR-System Design and Tradeoff Studies	**W11:** Engineering the Future of Aerospace MRO: Digital Twins, Simulation & AI for Intelligent Maintenance	**W9:** Human Space Flight & Space Medicine-IV	
17:00-18:00		**WS20:** Satellite TT&C - Glimpse					
18:00-18:15							

W1: Control Under Uncertainty — From Trajectory Optimization to Adaptive Control

Room: Scarlet 1 | **Time:** 08:00 - 12:30

Abstract

Future aerospace missions increasingly operate in environments where nonlinear dynamics, tight performance constraints, and uncertainty are central design drivers. This workshop presents a unified framework for control under uncertainty, with direct application to spacecraft operating in cislunar space, close-proximity and formation missions, and hypersonic vehicles subject to severe state and control constraints.

In cislunar space, spacecraft motion is governed by multi-body gravitational dynamics that exhibit sensitive dependence on initial conditions and long-horizon instability. Trajectory design in this regime requires sophisticated numerical methods, while feedback stabilization near libration point orbits demands control laws that respect nonlinear structure and limited actuation. Uncertainty in ephemerides, environmental disturbances, and model mismatch further complicate mission design. Close-proximity operations introduce additional layers of complexity. Rendezvous, docking, on-orbit servicing, and formation flying must satisfy strict safety constraints, including collision avoidance, plume impingement limits, line-of-sight requirements, and actuator saturation. These missions demand trajectory planning methods that rigorously handle state and control constraints while maintaining robustness to estimation and modeling errors. Hypersonic vehicles present a different but equally challenging regime. Strong aerodynamic coupling, rapidly varying atmospheric conditions, thermal constraints, and limited control authority create tightly constrained, highly nonlinear control problems. Robust guidance and control architectures must account for parametric uncertainty, unmodeled dynamics, and state-dependent performance limitations.

This workshop develops unified perspectives that bridge trajectory optimization, nonlinear feedback design, stochastic optimal control, and adaptive control methodologies. Emphasis is placed on understanding how structure in optimal control problems including Hamiltonian formulations and value function geometry can be leveraged to design computationally tractable, robust controllers for safety-critical aerospace applications. By integrating numerical optimal control, dynamical systems theory, stochastic control, and adaptive methods, the session provides participants with conceptual and computational tools for addressing uncertainty within advanced aerospace vehicle guidance and control problems. At the end of the tutorial session, participants will be able to:

1. Formulate constrained nonlinear optimal control problems arising in cislunar spacecraft missions, proximity operations, and hypersonic flight.
2. Connect dynamical systems concepts and Hamilton–Jacobi theory to the synthesis of nonlinear feedback control policies.
3. Evaluate and design control strategies that explicitly account for parametric and non-parametric uncertainty using stochastic and adaptive control methods.
4. Integrate open-loop trajectory optimization with robust feedback design in safety-critical aerospace applications involving state and actuator constraints.

Abstracts for Talks:

Numerical Methods for Trajectory Planning: Speaker: **Maruthi Akella and Puneet Singla**

The session will begin with fundamental principles of indirect optimal control, emphasizing state-of-the-art numerical techniques for solving two-point boundary value problems. Both classical formulations and modern computational strategies will be discussed, with attention to practical implementation challenges. The

application of these methods to design ballistic trajectories for space vehicles in multi-body environment and trajectory planning for high-speed vehicles under state and control constraints will be demonstrated.

Dynamic System Theory for Optimal Feedback Control Speaker: **Roshan Eapen**

This session will explore the deep connections between dynamical systems theory and optimal feedback control. Leveraging Hamilton–Jacobi theory, we will examine how optimal control policies emerge from canonical transformations and discuss implications for nonlinear model predictive control.

Adaptive Control Speaker: **Maruthi Akella**

This Session will address control under uncertainty, covering both stochastic optimal control and adaptive control methodologies. Approaches for handling parametric and non-parametric uncertainty will be presented, along with insights into robustness and learning-based adaptation.

Speaker Biographies

Dr. Maruthi Akella

Dr. Maruthi Akella is a professor in Aerospace Engineering and Engineering Mechanics at UT Austin where he holds the Cockrell Family Endowed Chair in Engineering. He is founding director for the Center for Autonomous Air Mobility and faculty lead coordinator for the controls, autonomy, and robotics area at UT Austin. His research encompasses coordinated systems, learning, adaptation, and vision-based sensing. His research group contributed for the onboard guidance algorithm for the Intuitive Machines IM-1 mission – the first U.S. moon landing in more than 50 years since the Apollo era. The major impacts of Dr. Akella's work have been recognized through the AIAA Mechanics and Control of Flight Award, the AAS Dirk Brouwer Award, the IEEE-CSS Award for Excellence in Aerospace Control, and the Judith Resnik Space Award from the IEEE Aerospace and Electronic Systems Society. Dr. Akella is Editor-in-Chief for the Journal of the Astronautical Sciences and a Fellow of the AIAA, IEEE, and AAS. In October 2024, the International Astronomical Union designated asteroid number 5376 – a nearly 5-mile diameter-sized minor planet from the main asteroid belt – as "Maruthiakella" honoring Dr. Akella's contributions to "many successful applications in astrodynamics."

Dr. Roshan Eapen

Dr. Roshan Eapen is an assistant Professor of Aerospace Engineering at the Pennsylvania State University. His research interest lies at the intersection of Dynamical Systems Theory, Astrodynamics, and Computational Vision with specific focus on semi-analytic satellite orbit and attitude theories, optimal control of spacecraft, sensor modeling, light-matter interaction, and vision-based navigation. He runs the Computational Astrodynamics Research and Experiments (CARE) lab which host the Penn State University Dynamial observatory (PSUDO), a 0.6m telescope observatory and ground station. He is a JN Tata scholar (2015) and the recipient of the Heep Graduate Fellowship from the Hagler Institute of Advanced Studies.

Dr. Puneet Singla

Dr. Puneet Singla is the Harry and Arlene Schell Professor of the Aerospace engineering at the Pennsylvania State University (PSU). Dr. Singla's research interface nonlinear dynamics with approximation theory, sensing, uncertainty analysis, and optimal control. He significantly advanced data-driven approaches for a diverse range of highly complex problems such as space domain awareness (SDA), guidance navigation and control (GNC) of hypersonic vehicles, and accurate prediction of toxic plume dispersions. His research related honors

include the IEEE AESS's Judith A. Resnik Award, NSF CAREER award, the AFOSR Young Investigator award, the Penn State Engineering Alumni Outstanding Researcher Award, the University at Buffalo's "Exceptional Scholar" Young Investigator Award and the Texas A&M University's Young Aerospace Engineering Distinguished Alumni Award in recognition of his scholarly activities. He is IEEE AESS's distinguished lecturer since 2024. He is a fellow of American Astronautical Society (AAS) and American Institute of Aeronautics and Astronautics (AIAA).

Format & Duration

This tutorial session will be approximately 4 hours in duration. The workshop is structured into a single session comprising multiple key topics: Numerical methods for trajectory planning, optimal feedback control, optimal stochastic control and adaptive control. The first major talk, Numerical Methods for Trajectory Planning, will cover fundamental aspects of the indirect optimal control and state-of-the-art methods for solving two-point boundary value problems. This will be followed by Dynamic System Theory for Optimal Feedback Control, which will focus on the connections between dynamical system theory and optimal feedback control while leveraging the Hamilton Jacobi theory to solve for optimal control policy. The third talk, Adaptive Control will address key methodologies for control under parametric and non-parametric uncertainty. The session will conclude with a discussion segment, allowing participants to engage with the speakers, ask questions, and explore practical implications of the presented topics.

Target Audience

Practitioners looking for advanced techniques in trajectory planning, guidance and control for aerospace vehicles. Researchers looking for new ideas and the connection between theory and practice; students and early career professionals looking for better understanding of the foundation of optimal control theory and the development of optimal guidance strategies; Defense space professionals focused on control of high speed vehicles under memory and computational constraints will gain insights into operational challenges like how to accommodate different kind of uncertainties while designing optimal control policy.

Session / Topic
Introduction and Opening Remarks
Numerical Methods for Trajectory Planning
Dynamic System Theory for Optimal Feedback Control
Adaptive Control
Discussion and Audience Interaction

W2: High Altitude Platforms as Disaster Recovery Networks and Early Warning Systems

Room: Scarlet 1 | **Time:** 13:30 - 15:30

Abstract

This workshop on "High Altitude Platforms as Disaster Recovery Networks and Early Warning Systems" is structured into three comprehensive sections, each led by an expert in the field.

Dr. Deepak Mishra will begin by examining how High Altitude Platforms (HAPs) offer a transformative solution for resilient disaster recovery networks and early warning systems, particularly when terrestrial infrastructure is compromised. He will introduce the technical foundations of HAP-enabled emergency communications, focusing on coverage-aware deployment, optimal altitude selection, and relay- assisted architectures. By leveraging analytical frameworks for UAV hovering localisation, energy- efficient relaying, and semi-Markov traffic modelling, he will highlight strategies to maximise throughput, coverage probability, and long-term operational sustainability. The role of low-power wide- area technologies such as LoRa, including emerging direct-to-satellite and LEO-integrated IoT paradigms, will be examined to enable robust, large-scale connectivity in disaster-affected regions. Hybrid HAP–UAV architectures, cooperative relaying, and energy harvesting mechanisms will be further explored to ensure prolonged network availability under constrained power conditions. These system- level modelling, stochastic geometry, and optimisation-driven design insights will be synthesised into a cohesive framework for scalable, adaptive, and energy-aware aerial communication systems supporting disaster resilience and early warning operations.

The second segment, presented by Dr. Ganesan Thiagarajan, will focus on the foundational engineering principles and practical considerations underpinning HAP-based networks. He will discuss physical- layer aspects, including propagation models, link budget analysis, and spectrum allocation, which are essential for ensuring reliable high-altitude communications. He will also evaluate the economic feasibility of deploying such systems at scale, address hardware requirements for advanced beamforming technologies, and provide insights into system design considerations that influence both performance and cost-effectiveness. This section aims to bridge the gap between theoretical models and real-world deployment scenarios, highlighting the trade-offs and decisions faced by engineers and planners.

The final section, presented by Dr. Sanjeev Gurugopinath, will focus on advanced system-level strategies that integrate multiple cutting-edge technologies. He will explore how HAPs can be seamlessly integrated with communication techniques such as Non-Orthogonal Multiple Access (NOMA) to improve spectral efficiency and connectivity in disaster scenarios. The session will also highlight the role of HAPs and drones acting as relays, enabling flexible and scalable network architectures that extend coverage and enhance resilience when ground infrastructure is compromised. Furthermore, he will discuss the application of joint radar and communicationtechniques for simultaneous tracking and data transmission, which is vital for real-time situational awareness and coordination in emergency response. The workshop will conclude by synthesising these approaches into a unified framework, emphasising their collective potential to deliver robust, adaptive, and effective disaster recovery and early warning solutions.

Target Audience

System architects, and Communication engineers in space, aerospace, and defence sectors seeking practical, deployable system for Disaster Recovery. The focus aligns with the IEEE SPace 2026 themes on non-terrestrial networks, integrated sensing and communication, and resilient space-enabled infrastructure.

Speaker Biographies

Dr. Deepak Mishra

Dr. Deepak Mishra is a Senior Lecturer and Deputy Director of Postgraduate Academic Studies in the School of Electrical Engineering and Telecommunications at the University of New South Wales (UNSW), Sydney. He is also the Co-Founder and CTO of GinigAI Pty Ltd, a UNSW-based startup focused on embedded radio intelligence for precision human and asset safety. He received his Ph.D. in Electrical Engineering from the IIT Delhi in 2017. Before joining UNSW, he was a postdoctoral researcher at Linköping University, Sweden, and has held visiting research positions at Northeastern University and the University of Rochester (USA), Huawei Technologies (France), Southwest Jiaotong University (China), and Queen's University Belfast (UK). He is a recipient of competitive awards, including the ARC Discovery Early Career Researcher Award, the Raman– Charpak Fellowship, and the IMB Ph.D. Fellowship. His research interests include AI-enabled wireless sensing, green communications, cybersecurity, signal processing, and system-level design for resilient non- terrestrial networks. His work has been published in over 300 peer-reviewed journal articles and conference proceedings. He serves as an Associate Editor for multiple IEEE journals and has received numerous Exemplary Reviewer and Editorial Awards for his contributions to the research community.

Dr. Ganesan Thiagarajan

Dr. Ganesan Thiagarajan received his M.Sc.(Engg.) and Ph.D. from Indian Institute of Science in Electrical Communication Engg., in 1994 and 2014 respectively. He is a co-founder, and ex-director, CTO of MMRFIC Technology Pvt. Ltd, Bangalore. With more than 30 years of experience in telecom/semiconductor industry, he had delivered multiple products in WLAN, Cellular infrastructure, and mm-wave Radar systems. He assumed various roles at Motorola, Texas Instruments, Arraycomm,USA and Morse Micro, Australia – as System architect, Algorithm lead and R&D lead. Before starting MMRFIC, he worked in the Kilby R&D Labs of Texas Instruments as a technologist. He was elected to Senior Member of Technical Staff (SMTS) in 2015 during his tenure at Texas Instruments. He holds 25 granted patents in USPTO and several Indian Patents. He has published his research in several IEEE journal and conference papers. His research interests are mm-wave communication systems, Joint Radar Communication, Machine learning for Signal processing and Quantum error correction codes. He is a senior member of IEEE and was chair for IEEE ComSoc Bangalore chapter in 2022. He delivered an invited talk on "Massive MIMO for IoT" in IEEE 5G WF 2020. In IEEE 5G WF 2021, he organized a topical vertical on "Reflecting Intelligent Surfaces for 5G and Beyond 5G" and delivered a talk on "Convergence of radar, communication and user localization in B5G using RIS". He currently lives in Sydney, working as a consultant.

Dr. Sanjeev Gurugopinath

Dr. Sanjeev Gurugopinath (Senior Member, IEEE) received the Ph.D. degree in electrical communication engineering from the Indian Institute of Science Bangalore, Bengaluru, India, in 2015. Since 2022, he has been with MMRFIC Technology Pvt. Ltd., Bengaluru, where he is currently the engineering Director (AI/ML). He is also a Professor with the Department of Electronics and Communication Engineering, PES University, Bengaluru, where he leads a research group focused on signal processing and artificial intelligence for communications and has successfully supervised four Ph.D. dissertations. His current research interests include integrated sensing and communication systems, systems engineering, signal processing, powerline communications, underwater acoustics, and speech signal processing. Dr. Gurugopinath was the corecipient of the best paper awards at several peer-reviewed IEEE conferences.

W3: Space-Air-Ground Integrated Networks for Autonomous Air Mobility Services

Room: Scarlet 1 | **Time:** 16:00 - 18:00

Abstract

The tutorial will begin by motivating Space–Air–Ground Integrated Networks (SAGINs) as a communication backbone for Autonomous Air Mobility (AAM) services, explaining how LEO satellites, UAV/HAPS platforms, and 5G/6G terrestrial networks are integrated into a unified multi-tier architecture for resilient command-and-control and payload connectivity. It will articulate the specific requirements of AAM scenarios such as drone deliveries, air ambulances, and air taxis across urban, rural, and tribal environments, and introduce the three core networking themes that structure the tutorial: OTFS-based modulation, advanced resource allocation, and trajectory-aware handover management.

The first part will cover the space layer, focusing on how LEO satellites act as a low-latency backbone within SAGIN for AAM. This portion will discuss waveform design and evaluation for Doppler-rich LEO channels, with particular emphasis on OTFS versus OFDM, and will present models and techniques for joint satellite–air–ground resource allocation under QoS and power constraints. It will also outline how these physical- and link-layer designs can meet the reliability and latency requirements of safety-critical AAM communications.

The second part will address the air layer, concentrating on heterogeneous autonomous aerial platforms ranging from low-altitude drones to higher-altitude air taxis operating in AAM corridors. This segment will cover 3D channel characterization for mid-band 5G and satellite links at different heights and velocities, and then move to trajectory-aware handover management, including both horizontal and vertical handovers between space and ground anchors. The tutorial will show how mobility management algorithms can incorporate flight paths, network topology, and traffic demands to minimize outages and ping-pong events while honoring strict latency and reliability guarantees.

The final part will focus on the ground layer and its role in supporting AAM within SAGIN. It will describe how terrestrial 5G/6G infrastructure is extended to high-altitude, high-mobility users and how it coordinates with the LEO space segment for coverage, redundancy, and load balancing. This section will present resource allocation schemes that jointly determine subcarrier assignment and power allocation in OFDMA/OTFS-based systems to meet heterogeneous QoS targets for both aerial and ground users and will discuss how these mechanisms tie into emerging standards for integrated space–air–ground networks.

Speaker Biographies

Kamesh Namuduri

University of North Texas

Kamesh Namuduri, is an Electrical Engineering Professor at the University of North Texas (UNT), Denton, TX 76203, USA. He has done his B. Tech in Electronics and Communications, Osmania University, Hyderabad, India, August 1984, M.S. in Computer Science, Central University, Hyderabad, India, August 1986 and Doctor of Philosophy in Computer Science and Engineering, University of South Florida, Tampa, December 1992. Currently, he is serving as the Director for Autonomous Systems Laboratory at UNT. His research interests are Emergency Communications, Airborne Networks, and Image and Video Communications. He has authored a book "UAV Networks and Communications" by the Cambridge University Press and 6 book chapters. He has 38 journal articles and 72 conference papers to his credit.

Sai Prakash Sakuru

National Institute of Warangal

K L V Sai Prakash Sakuru, Associate Professor, Department of ECE, National Institute of Technology, Warangal since 1992. Earlier to this, he worked at Indian Institute of Technology, Kharagpur as Junior Scientific Officer. He has done his B. Tech from SRKR Engineering College (Andhra University), Bhimavaram, M. Tech from Regional Engineering College (Kakatiya University), Warangal, and Ph.D. from National Institute of Technology, Warangal. His research interests include IoT & CPS, Machine Learning and Smart System Design, ML/DL-based Resource Allocation in Space-Air-Ground Communication Networks, Adhoc and Sensor Networks. He has 35 journal and conference papers to his credit and three best paper awards.

Arun Sampath

Tata Consultancy Services

Arun kumar Sampath is currently employed in Tata Consultancy Services (TCS) as a Principal Consultant and Global Head, Software-Defined Vehicles (SDVs) and eVTOL Aircraft/Urban Air Mobility (UAM) in the Manufacturing Business Group. He has 28 years of experience in the gamut of automotive and aerospace/defense fields including Sustainable Mobility, 5G Networks, AI & Edge Computing. He has written 35 technical articles on advanced technologies including 5G networks, Fuel Cells, Cybersecurity, Urban Air Mobility, Drive by Wire Electric Vehicles, Edge Computing, AI/ML, Gen AI, and Next Gen Computing.

W4: Bistatic and Passive Radar Detection of Space Objects – Phenomenology and Techniques

Room: Amaryllis | **Time:** 08:00 - 11:30

Abstract

Bistatic radar and passive radar systems are emerging as powerful tools for detecting and characterizing space objects, offering flexible and cost-effective alternatives to traditional monostatic radar architectures. Unlike conventional systems where the transmitter and receiver are co-located, bistatic radar separates these components, while passive radar is a bistatic radar which relies on non-cooperative transmitters such as commercial broadcast or communication signals. This tutorial introduces the fundamental phenomenology underlying how electromagnetic waves interact with satellites, debris, and other orbital targets in these configurations. Key topics include scattering behavior, radar cross-section variability, orbital geometry effects, and the influence of signal wavelength and polarization. Understanding these principles is essential for interpreting detection signatures and optimizing system performance in increasingly congested orbital environments.

Building on this foundation, the tutorial explores practical techniques used to detect and track space objects using bistatic and passive radar. We will examine signal processing methods such as cross-correlation, Doppler analysis, and time-delay estimation, along with strategies for mitigating noise and interference in real-world scenarios. The session also highlights system design considerations, including transmitter-receiver geometry, waveform selection, and sensor network integration. Case studies and examples will illustrate how these methods are applied in space domain awareness (SDA), particularly for tracking small debris and objects in low Earth orbit. By the end of the session, attendees will gain a clear understanding of both the theoretical and operational aspects of these radar approaches, equipping them with the knowledge to evaluate and implement advanced detection techniques.

The tutorial will cover a comprehensive set of concepts that underpin bistatic and passive radar detection of space objects, beginning with the geometric and physical differences between monostatic, bistatic, and multistatic configurations. Participants will explore the phenomenology of electromagnetic scattering from satellites and debris, including how radar cross section varies with aspect angle, material properties, and signal frequency. The session will introduce key measurement domains, such as range, Doppler, and angle, and explain how these are extracted in non-cooperative sensing environments where the transmitter is separated or unknown. Core signal processing techniques such as matched filtering, cross-ambiguity functions, time-delay estimation, and Doppler shift analysis will be discussed in the context of detecting weak targets against clutter and interference. The tutorial will also address the role of illuminators of opportunity, such as FM radio, digital TV, and satellite communications, and how their waveform characteristics influence detection performance. Additional topics include synchronization challenges, calibration strategies, and the impact of orbital dynamics on observation geometry and revisit rates. Finally, the session will touch on data association and tracking methods, highlighting how measurements from distributed sensors can be fused to support space situational awareness and improve the detection of small or otherwise difficult-to-observe objects.

After attending the tutorial session, the participants will be able to:
Understand the fundamental phenomenology governing bistatic and passive radar interactions with space objects; Analyze radar signatures using range, Doppler, and angle measurements in non-cooperative sensing scenarios; Apply signal processing techniques such as cross-correlation and time-delay estimation to detect weak targets; Evaluate system design trade-offs, including geometry, waveform selection, and

illuminators of opportunity, and Integrate measurement data to support tracking and space situational awareness applications.

Session Organization

Phenomenology and Theory Session

- Monostatic, bistatic, and passive radar architectures and their operational implications
- Electromagnetic scattering mechanisms and radar cross-section variability for space objects
- Effects of orbital geometry and relative motion on bistatic measurement observables
- Influence of signal properties, including wavelength and polarization, on detection performance

Signal Processing and Applications Session

- Signal processing techniques (e.g., cross-correlation, Doppler analysis, time-delay estimation)
- for detecting and tracking space objects
- Noise, interference, and clutter mitigation in passive and bistatic radar environments
- Design and evaluation of system configurations, including transmitter–receiver geometry and waveform selection
- Integration of multi-sensor data and analysis of case studies for space domain awareness (SDA) applications

Speaker Biographies

Professor Ram Narayanan
Pennsylvania State University

Distinguished Professor Ram Narayanan received his B.Tech. from IIT Madras in 1976 and his Ph.D. from UMass Amherst in 1988, both in electrical engineering. During 1976–1983, he was an R&D Engineer at Bharat Electronics Limited, India, where he developed microwave communications equipment. During 1983–1988, he was a Graduate Research Assistant at UMass. From 1988 to 2003, he was a faculty member at the University of Nebraska-Lincoln, last serving as the Blackman and Lederer Chair Professor. During 2003–2025, he was a professor of electrical engineering at Penn State University, where he currently serves as a distinguished professor of electrical engineering. He has coauthored over 200 journal papers and 500 conference publications and has supervised 110 graduate students toward thesis completion. His current research interests include radar target detection, radar imaging, harmonic and nonlinear radar, noise radar, cognitive radar, medical radar, quantum radar, radar networks, compressive sensing, and machine learning. He is currently a member of the IEEE Committee on Ultrawideband Radar Standards Development and the IEEE Committee on Down-the-Road Radar. He is the recipient of the 2017 IEEE Warren White Award for Excellence in Radar Engineering, and 2023 IITM Distinguished Alumnus Award. He is a Fellow of IEMA, IEEE, SPIE, and IETE.

W5: Radiation-Hardened RTL Design Techniques for FPGA-Based Systems

Room: Petunia | **Time:** 08:00 - 10:00

Abstract

FPGAs are widely used in space, aerospace, and defense systems for mission-critical control, communication, and on-board processing tasks. However, radiation effects such as Single Event Upsets (SEUs), Single Event Transients (SETs), and configuration memory corruption pose a significant challenge to FPGA reliability. This hands-on tutorial presents practical RTL-level techniques to harden FPGA designs against radiation, focusing on methods that engineers can directly implement and verify. Participants will gain insight into TMR, safe FSM design, error detection and correction (EDAC), temporal redundancy, and configuration memory protection. Through RTL simulation and live demonstration, attendees will see fault injection and mitigation in action, understanding the impact of radiation-induced errors and how hardened designs recover automatically. The session also introduces verification best practices, including fault injection strategies and radiation-aware testing. By the end of the tutorial, participants will have actionable templates and a clear methodology to develop and validate robust FPGA designs for SPACE applications.

Speaker Biographies

Hariprasad Bhat
M.tech, BITS, Pilani

Hariprasad Bhat is a seasoned professional with over 13 years of rich experience in RTL Design & FPGA implementation domain, seamlessly blending this expertise with hands-on embedded hardware design skills His extensive career spans protocol-specific RTL IP development, hardware schematic design, and system bring-up activities. At Lekha Wireless, Hariprasad played a pivotal role in developing wireless radio technology for defense and avionics applications. Following the merger, he now leads the RTL design–FPGA implementation team at CoreEL Technologies in Bengaluru, building reliable and robust wireless communication systems. Prior to his tenure at CoreEL Tech, Hariprasad contributed significantly to iWave Systems for over half a decade. During this time, he gained comprehensive exposure to advanced communication protocols such as USB3, DisplayPort, HDMI and PCIe Gen3, among others. Additionally, he served at Granite River Labs, where he was instrumental in defining the architecture of the USB4 compliance solution. Beyond his professional endeavors, Hariprasad is an active volunteer and serves as an Executive Committee member of the IEEE CAS Bangalore Society. As a senior IEEE member, he frequently contributes to workshops aimed at enhancing the skills of young professionals in the VLSI domain. Currently, he is the Vice-chair, IEEE CAS, Bangalore section. Hariprasad holds a BE (E&C) degree from Srinivas Institute of Technology, Mangalore, graduating in 2012. Currently, pursuing MTech in VLSI & Microelectronics from BITS, Pilani.

Target Audience

FPGA designers, system architects, and engineers in space, aerospace, and defense sectors seeking practical, deployable techniques for radiation-tolerant RTL design.

W6: Next-Generation RF and Photonic Technologies for EW and Space Communication Systems

Room: Petunia | **Time:** 13:30 - 15:30

Abstract

The rapid evolution of defence and space communication systems is driving a convergence of radio frequency (RF), microwave, and photonic technologies to meet the demands of ultra-wideband operation, low latency, and adaptive spectrum utilization. Traditional electronic approaches are increasingly constrained by bandwidth limitations, electromagnetic interference, and scalability challenges, motivating the integration of photonic and emerging quantum technologies into RF system design. This tutorial provides a structured introduction to next-generation RF and photonic technologies, covering fundamental principles, enabling hardware such as photonic integrated circuits (PICs), and advanced receiver architectures including photonic and quantum RF receivers.

The tutorial/workshop is designed not only to build foundational understanding but also to expose participants to emerging research directions in microwave photonics, quantum sensing, and wideband RF systems. By connecting theory with practical system architectures used in electronic warfare (EW) and space communications, it aims to inspire new ideas for research and innovation in areas such as ultrawideband sensing, photonic signal processing, and hybrid RF–quantum systems.

Talk 1: Foundations of RF and Photonic Systems

This lecture introduces the fundamental concepts of RF and microwave engineering alongside the basics of photonic systems, establishing a common platform for understanding their integration. It begins with an overview of RF signal characteristics, microwave components, and system-level considerations such as bandwidth, noise, and linearity. The discussion then transitions to photonics, covering optical signals, modulation techniques, and key components including lasers, modulators, and photodetectors. The lecture concludes by highlighting the limitations of conventional electronic systems and motivating the use of photonic technologies for high-bandwidth, low-loss, and interference-resilient signal processing. This foundational understanding is essential for appreciating the role of photonics in nextgeneration RF systems.

Talk 2: Photonic Integrated Circuits and Microwave Photonics

This lecture focuses on photonic integrated circuits (PICs), which are central to enabling compact, high-performance photonic systems for RF applications. It introduces PIC platforms such as silicon photonics and compound semiconductor technologies, followed by a detailed discussion of key building blocks including waveguides, optical modulators, and photodetectors. The lecture further explores microwave photonics, where RF signals are processed in the optical domain to achieve functions such as filtering, delay, and frequency conversion. Emphasis is placed on the advantages of PIC-based implementations in terms of size, weight, power, and bandwidth. The session also connects these technologies to real-world applications in electronic warfare and space communication systems.

Talk 3: RF, Photonic, and Quantum Receiver Architectures

This lecture presents a comprehensive overview of receiver technologies, tracing the evolution from classical RF receivers to photonic and quantum-based approaches. It begins with conventional RF receiver architectures, discussing their operational principles and inherent limitations in bandwidth and frequency agility. The lecture then introduces photonic RF receivers, where RF signals are directly mapped onto optical carriers, enabling ultra-wideband operation and low-loss signal transport. Building on this, the session explores quantum RF receivers, particularly those based on atomic sensing mechanisms such as Rydberg

atoms, which offer unprecedented sensitivity and new paradigms for signal detection. A comparative analysis of classical, photonic, and quantum receivers is provided to highlight their respective strengths, limitations, and application domains, offering insights into future receiver technologies.

Talk 4: Wideband Antennas and System-Level Integration

The final lecture focuses on wideband antennas and the integration of RF, photonic, and advanced receiver technologies into complete system architectures. It begins with the design principles and operational characteristics of wideband antennas, including log-periodic, Vivaldi, and spiral structures, with emphasis on their role in multi-band and broadband sensing applications. The lecture then expands to system-level considerations, illustrating how antennas interface with RF front-ends and photonic or quantum receivers in modern electronic warfare and space communication systems. Emerging trends such as cognitive RF systems, AI-enabled spectrum awareness, and photonic beamforming are also discussed. This lecture provides a holistic view of how individual technologies combine to form scalable, adaptive, and high-performance communication and sensing systems.

Speaker Biographies

Talk Title: Foundations of RF and Photonic Systems

Shri Umakant Goyal

Scientist G, SSPL, DRDO, New Delhi

Umakant Goyal (Member, IEEE) received the B.Tech. degree (Hons.) in electronics and electrical communication engineering from IIT Kharagpur in 2003, and the M.E. degree in microelectronics from IISC Bengaluru in 2009. In 2003, he joined the Defence Research and Development Organization (DRDO) as Scientist-B. He is currently a Senior Scientist with the Solid State Physics Laboratory (SSPL), DRDO. He is working in the field of high-power GaAs and GaN-based MMIC design, catering to frequency applications up to the Ka band. His research interests include device modeling and PDK development. He was a recipient of the Alumni Gold Medal from IISc Bengaluru. He is also a recipient of the Mrs Minoti Baghchi Memorial scholarship during his BTech at IIT Kharagpur for extraordinary performance. Presently, his area of interest is in semiconductor devices, circuits and quantum RF receivers. He has published more than 30 papers in various international and national journals and conferences. He has filed two patents for his work in GaN technology. At present, he is heading the MMIC division at SSPL, DRDO, Delhi. He serves as a reviewer for various national and international conferences.

Talk Title: Photonic Integrated Circuits and Microwave Photonics

Dr. Sunil Sharma

Scientist F, SSPL, DRDO, New Delhi

Sunil Sharma received the M.Tech. degree from IIT Kharagpur in 2004, and a PhD degree from IIT Delhi in 2020. In 2004, he joined the Defence Research and Development Organization (DRDO) as Scientist-B. His research areas are GaAs, GaN and various semiconductor materials and devices for RF and photonics applications. He published several papers in national and international journals.

Talk Title: RF, Photonic, and Quantum Receiver Architectures

Dr. Ashish Jindal

Scientist E, SSPL, DRDO, New Delhi

Dr. Ashish Jindal has over 11 years of rich experience in the field of analog MIC/MMIC design and has completed his PhD from the Indian Institute of Technology Delhi in the domain of analog RF MIC/MMIC circuit design. His areas of interest include microwave MMIC circuits, such as power amplifiers, LNAs, switches, filters, as well as photonic integrated circuits (PICs). He completed his B.Tech in Electrical Engineering from the Indian Institute of Technology Ropar and was honoured with the prestigious President's Gold Medal. His exceptional technical expertise has been recognized by the Solid State Physics Laboratory (SSPL), where he received the Scientist of the Year Award in 2018 at the lab level and again in 2020 at the DRDO level. He also has more than 10 national and international publications, along with 2 patents.

Talk Title: Wideband Antennas and System-Level Integration

Dr. Rajesh K. Singh

Asst. Prof., DIAT Pune

Rajesh K. Singh received a B.Tech. degree in Electronics and Communication Engineering from UPTU, Lucknow, India, in 2010, and an M.Tech. degree in Microwave Electronics from Delhi University South Campus, Delhi, India, in 2013. He received his PhD degree in Microwave Engineering from the Indian Institute of Technology Delhi (IITD), New Delhi, India, in 2018. He was an RF consultant at Chipwire Technologies Pvt. Ltd. (August 2018 – December 2018). He was a Postdoctoral Researcher at the Department of Information Engineering, University of Pisa, Pisa, Italy (Feb 2019 – Dec 2021). He has been working as an Assistant Professor at the Department of Electronics Engineering, Defence Institute of Advanced Technology (DIAT), Pune, India, since January 2022. His research interests include Microwave Passive and Active Circuits, Wideband Antennas for EW Systems, Active Integrated Antennas (AIAs), RFID, EMI/EMC, Reconfigurable/Smart 2D and 3D antennas, Smart Gloves, and Antenna modules for Automotive. He has published more than 70 international journal articles and conference contributions. He published a book titled "Reconfigurable Active and Passive Planar Antennas for Wireless Communication Systems" in 2022. He is the Editor of the IETE Journal of Research. He is a senior member of IEEE and URSI. He is an active reviewer for various journals, including IEEE Transactions and Letters. He served as Chairman (2016-18) and Treasurer (2014-16) of the IEEE MTT-S Student Branch Chapter of the Indian Institute of Technology Delhi, India. He is serving as Faculty Advisor of the IEEE Student Branch chapters, AP-S, and EMC at DIAT Pune. Dr. Singh received the 'Young Scientist Award' for the International Union of Radio Science (URSI) General Assembly and Scientific Symposium (GASS) 2020 and the 'Distinguished Service Award' for RFID-TA 2019. Dr. Singh received the 'Teacher of the Year Award' for the year 2024-25 for his significant contributions to teaching at the Postgraduate level at DIAT Pune. He received the "Outstanding Researcher in RF and Microwave Engineering" Award in 2025 by The Venus International Research Awards (VIRA).

W7: Workshop on Model Based System Engineering and AI

Room: Scarlet 3 | **Time:** 10:30 - 12:30

Abstract

MBSE and AI no longer buzzwords but a fact if life. Many are adapting MBSE in their workflows in the aerospace industry. Along with that is the component of Artificial Intelligence in terms of Large Language Models, Chatbots and Neural Networks. EASA is doing much work on standardizing the application of AI. The future of Systems Engineering 2035 envisages a world with AI helping systems engineers and using system engineering for developing systems using AI components. This workshop brings together both these components together. Model Based Systems Engineering uses open-source tools like Capella, and some online tools are helping aerospace engineers develop systems. Commercial software like System Architect, System Composer, Cameo for SYSML is also being used in the industry. There is a systematic way to develop these models. In the early 1960 code was developed in a haphazard way. The community came together and looked at better ways to develop software. This is very important in the way models are being developed.

Similarly, AI in the form of LLMs are being used to generate models and code. AI is experimented with in form of Neural Networks for image processing in side a system context. A strong set of requirements, models, constraints are necessary to ensure that the AI circuit works well within the bigger system context. This workshop brings together both these with an exposure to the different techniques being used by the practitioner, the lessons learnt from having seen failures in the system development process. Some terms in AI and MBSE have been utilized very frequently without fully understanding the word in its depth. A taxonomy of MBSE terms, hands on demo on some tools, the correct way of performing Systems Engineering in the context of AI and MBSE will be covered in 4 hours.

Speaker Biographies

Dr Yogananda Jeppu

Dr. Yogananda Jeppu is a Fellow at Boeing. He has over 38 years of experience in the field of Control System Design and Implementation, Simulation of Aerospace Systems, Verification and Validation of safety critical systems. He is a BE in Electronics and Communication, from Mangalore University, and a Postgraduate in Missile Guidance and Controls from Pune University. He has a PhD in Certification of Safety Critical Control Systems using Model Based Techniques from IIT Bombay. He has several publications on Formal Methods, Randomized Testing, Orthogonal Array Testing, Model Based Systems Engineering, Missile Guidance and Control and Teaching. He has been awarded US patents for innovations in UAV and Radar. He has been awarded for his contributions to the Indian LCA Flight Controls program and the Indian Integrated Guided Missiles Program. He is the recipient of the 2023 INCOSE Systems Engineering Influencer Award – for significant contributions and community outreach in adoption of systems modeling and model-based systems engineering in industry and academia in India. He started his career in 1987, working on Missiles and Indian LCA program with Defense R&D Organization.

Dr Ramakrishnan Raman

Ramakrishnan Raman received B.Tech and MS degrees from IIT Madras, and Ph.D. from IIIT-Bangalore. He is a certified Six Sigma Black Belt, INCOSE Certified Expert Systems Engineering Professional – ESEP, Fellow – Indian Society of Systems for Science & Engineering (ISSE) and an IEEE Distinguished Lecturer. He has to his credit several publications in refereed international conferences & journals on complex systems architecture design and artificial intelligence – machine learning and has also received best paper awards. He is active in professional societies, including IEEE, INCOSE and SAE, and has held leadership positions in these societies, and has received multiple awards for his contributions. He has also served as Technical Committee Chair for many prestigious conferences including INCOSE International Symposium, IEEE CONECCT and SAE AeroCON. He is currently Senior Chief Engineer at Eaton. Prior to joining Eaton, he was Fellow at Honeywell Aerospace.

W8: Design and Safety Management for Aerospace

Room: Amaryllis | **Time:** 13:30 - 15:30

Abstract

Multi Sensor Datafusion (MSD) for Fifth Generation Aircraft

Speaker: Dr Sudesh Kashyap and Sanketh Ailneni

Multi-sensor data fusion (MSDF) combines inputs from different on-board sensors (such as Radar, IRST, MAWS, RWR) and Datalink into a single, clear picture, which improves situational awareness and helps pilots understand the threat more effectively. It enhances target detection and tracking accuracy, reduces pilot workload by simplifying complex information, and increases reliability by cross-verifying data from multiple sources. Additionally, it improves survivability by enabling quicker threat detection and response, while also supporting better coordination with other aircraft and systems. MSDF is essentially a must-have for 5th and 6th generation fighter aircraft.

Presently MSDF is implemented on F-35, Rafale, Su-30 fighter aircraft. The MSDF technology used in these aircraft is not available either offline or online. So there is a need to develop such technology for our modern fighter aircraft such as LCA-Mk2 and AMCA.

In CSIR-NAL, various work on design and development of MSDF for LCA Mk2 and AMCA is under progress with following objectives to be made:

- Design and Development of Level-1 MSDF (Own Aircraft Sensor Fusion).
- Design and Development of Level-2 MSDF using Data Link (Aircraft Teaming).
- Implementation of developed algorithms on real-time Hardware Processing Unit (PU).

Frequency Selective Surfaces for Aerospace Applications: Radome, Antennas, and RAS

Speaker: Dr Shiv Narayan

Frequency selective surface is a two dimensional passive array which shows filter characteristics for Electromagnetics wave impinging on its surface. Due to its spatial filter characteristics, FSS is widely used for aerospace applications such as antennas, radomes, and RAS. FSS is basically used in the design of antenna and radome to enhance their EM performance within the specified band and out-of-band RCS reduction. It is also used to design thin and broadband radar absorbing structures (RAS). In order to design FSS-based antennas, radomes, and RAS, it is essential to understand the fundamentals of FSS structure and its EM design methodologies for a particular application. In view of this, the present talk includes the fundamentals of FSS structures followed by its detailed applications to radomes, antenna, and RAS.

Generative AI for the Design of Metasurfaces

Speaker: Mrs. Vineetha Joy

The des ign of metasurfaces traditionally relies on computationally intensive full-wave simulations and iterative optimization, limiting scalability and speed. This talk presents generative AI approaches for direct synthesis of meta-atom geometries from desired electromagnetic responses. Physics-aware strategies integrating surrogate electromagnetic models to ensure accurate and physically consistent designs will be highlighted. Key challenges such as one-to-many mappings, dataset imbalance, and conditional fidelity will also be discussed. Experimental validation through fabrication and measurements demonstrates that these methods enable rapid, high-fidelity metasurface design, reducing turnaround time from months to seconds.

Model-Based Safety Analysis Certification Framework

Speaker: Dr Manju Nanda

The presentation will talk model-based safety framework which enables the designers, certification agency and safety engineers an effective approach to capture, implement and validate safety features of an airborne system. Techniques such as STPA, software safety assessment and the test case generation using AI techniques will be discussed. Further the certification approach will be mapped to the framework.

Speaker Biographies

Dr Sudesh Kashyap

Dr Sudesh Kumar Kashyap is presently working as a Chief scientist, Group Head of System Identification and Data Fusion group and Deputy Head at Flight mechanics and control division of CSIR-NAL, Bangalore. He has done his BE in Electronics, ME in Electrical and PhD in Electrical & Electronics. He was key member of various projects sponsored by different DRDO labs for the design, development and evaluation of advanced algorithms for Multisensor Multitarget tracking and fusion for Air defence applications such as Real Time Flight Safety Expert System (RTFLEX) and RF Seekers based tracking of homing target. His core expertise is in the area of Kalman filtering, Multisensor data fusion, gating and data association and tracking of targets with evasive maneuvers. He has also contributed to develop a concept proving Fuzzy-Bayesian based expert system to assist the pilot by providing enhanced situational awareness and threat levels in Beyond visual range (BVR) air-to-air combat scenarios. His other important contribution is a consistent effort for a decade towards the development of Enhanced and Synthetic Vision System (ESVS) for the regional transport aircraft (RTA). This vision based technology provides enhanced situational awareness of external world to pilot perspective in poor or degraded visual environment such as fog during taxi, take-off and landing operations. He has developed a ground based facility "ESVS Flight Simulator" to carry out research on ESVS and evaluation of flight data. His other contributions are INS-GPS fusion for attitude estimation of UAVs, development of symbology for Head-up display for RTA, trajectory estimation of stores of fighter aircraft during pit, captive & drop test, enhancement of target height estimation accuracy using various ground based 2D/RD radars for Indian Air Force, CSIR-NAL & CSIR-CSIO's Joint development & integration of Head-up display (HUD) with civil aircraft simulator and development of algorithms for Infrared Search and Track system(IRST) etc. He is current working on development of Multi Sensor Data Fusion algorithms for LCA-MK2 and AMCA platforms, project sponsored from ADA, Bangalore. He has number of National and International journal/conference papers published. He is recipient of the "Young Scientist of the Year Award" by CSIR-NAL. He got the CSIR-NAL Excellence Award in the field of 'Technology' for "LCA Stores Separation Trajectory Estimation". He was awarded CSIR, India Software copyright on "Data Acquisition Software for EVS Flight Experiment".

Dr Shiv Narayan

Dr Shiv Narayan obtained the Ph.D. degree in Electronics Engineering from Indian Institute of Technology (IIT-BHU), Banaras Hindu University, Varanasi, India in August 2006. He is associated with the Centre for Electromagnetics (CEM) of CSIR-National Aerospace Laboratories (CSIR-NAL), Bangalore, India since May 2008. Currently, He is holding the position of Senior Principal Scientist at CEM, CSIR-NAL. Earlier, he held the position of Scientist-B in SAMEER (Society for Applied Microwave Electronics Engineering and Research), Kolkata, India, during the period March 2007-May 2008, where he was actively involved in the pattern synthesis of planar phased array antennas. His research interests are broadly in the field of Electromagnetic applications and the topics include: Frequency selective surfaces (FSS), RAS, Radome, metamaterials, numerical methods in electromagnetics, antennas, pattern synthesis of antenna array, and EM material characterizations. Particularly, he is working on the design and analysis of FSS structures based on advanced numerical techniques (i.e. MM-GSM, TLTMM, and FDTD method) for aerospace applications for the last eight years. Dr Shiv is the author/co-author of over 125 technical documents including peer reviewed journal and conference papers. He has published Technical Briefs (Books) with Springer on various topic such as 'FSS Technology for the Design of High Performance Antennas' and FDTD modeling inside Microwave Cavities. Recently Dr Narayan edited a handbook entitled "Handbook of Metamaterial –Derived Frequency Selective Surfaces" published by Springer Singapore (ISBN: 978-981-16-6440-3).

Dr Narayan was awarded with "Excellence Award in Research" for the year 2018-19 from CSIR-NAL for his significant contributions to the Electromagnetic Design and Development of FSS structures for Airborne Applications such as radomes, RAS, and antennas. He was awarded with prestigious CSIR- Raman Research Fellowship for the

year 2019- 20 and visited College of Engineering, San Diego State University, San Diego, CA, USA. Recently He was awarded with IETE Dr Sudhakar Rao Award for the year 2022 for significant contributions in the area of FSS technology for aerospace applications. He is the reviewers of several prestigious International Journals published by IEEE Transactions on AP, IEEE AWPL, IEEE MTT, IEEE Sensors, Elsevier, Cambridge University Press, Springer Nature, and Tech Science Press, etc.

He is a Fellow member of IETE, Life Senior member of WAMS Society, and life member of ISAMPE, India.

Mrs. Vineetha Joy

Mrs. Vineetha Joy is currently working as Principal Scientist at Centre for Electromagnetics of CSIR-National Aerospace Laboratories, Bangalore, India. She obtained B. Tech in Electronics and Communication Engineering with Second Rank from University of Calicut (2011) and received M. Tech in RF & Microwave Engineering with First Rank from Indian Institute of Technology (IIT), Kharagpur (2014). Mrs. Vineetha Joy is actively involved in various R&D programs of strategic importance spanning domains like generative AI for aerospace applications, EM design & development of stealth technologies including low RCS electronic warfare antennas, Active RCS reduction, metasurface based radar absorbing structures and radar absorbing materials. She is also involved in research activities related to computational electromagnetics, EM design and performance analysis of radomes, hybrid numerical techniques for scattering analysis, in-house development of computationally efficient software for RCS prediction and EM optimization and EM characterization of potential materials for airborne structures. She has participated in various sponsored/ grant-in-aid projects in these areas as principal investigator as well as contributing team member. She has authored/co-authored more than 250 research publications including 2 books, 5 book chapters, 11 refereed international journal papers, 42 papers in conference/symposium proceedings, 166 project documents, 57 test reports, and 2 special publications. In recognition of her significant contributions towards the indigenous development of broadband radar absorbing structures for aerospace applications, Mrs. Vineetha Joy was awarded the Institution of Electronics and Telecommunication Engineers (IETE-IRSI) Young Scientist Award for the period 2020-2021. With respect to academic collaborations, she closely associates with reputed universities by undertaking mutually beneficial research work involving graduate and post graduate students in various areas pertinent to applied electromagnetics for aerospace applications.

Dr Manju Nanda

Chief Scientist CSIR-NAL

Group Head, Safety Critical Embedded Software Group Head

Professor, AcSIR (Academy of Scientific and Innovative Research)

PhD Software Engineering, MSc Electronics Science, 28+ years of CSIR Experience in Aerospace safety critical software & embedded system design, development & qualification

Area of Expertise: Safety critical embedded system and software design-development, enabling software technologies, and certification

Specialization: Design development of safety systems, software technologies for critical systems, model-based systems engineering, formal methods, and developing certification framework. Have rich experience in Software engineering process such as techniques-methods, model-based design & development, verification & validation process, embedded system design-development & certification, formal methods (for safety & security applications), software safety assessment, systems engineering life-cycle, certification of software as per RTCA DO-178B/78C, DO-333, compiler validation, tool qualification, Verification & validation of complex electronics hardware as per RTCA DO-254 .

W9: Human Space Flight and Medicine: From Physiology to Extravehicular Activity Simulation

Room: Zinnia | **Time:** 08:00 - 18:30

Format: Lectures + group workshops + simulations | **Participants:** Whole group + parallel small groups | **Facilities:** Large conference hall + 2 workshop rooms

Program

Human in Space

Topic: Human Spaceflight Medicine: From Gagarin to Mars Missions

Content:
- History of human spaceflight medicine
- ESA & ISS medical operations overview
- Challenges of long-duration missions
- Future of lunar and Martian healthcare

Learning goals:
- Understand evolution of space medicine
- Recognize major health risks in space
- Identify mission medical constraints

Space Physiology Fundamentals

Topic: How Microgravity Changes the Human Body

Content:
- Cardiovascular adaptations
- Bone density loss
- Muscle atrophy
- Neurovestibular system
- Immune system changes
- Real astronaut medical case studies

Workshop – Mental Health in Extreme Environments

Topic A: Psychological Health in Isolation

Content:
- Psychology of long-duration missions
- Conflict management
- Communication under isolation
- Leadership in confined teams
- Polar and Mars analog case studies

Exercise: Mission conflict simulation scenario

Topic B: Telemedicine and Autonomous Medical Systems

Content:
- Remote diagnosis systems
- AI-assisted healthcare
- Health monitoring wearablesMedical kits for Mars missions

Exercise: Design a Mars mission medical kit

Group Simulation – Elements of Astronaut Selection

Topic: Be like an Astronaut – Competition

Scenario-based exercise:
Participants must:
- Perform cognitive tests
- Make decisions with limited resources
- Communicate with remote medical team
- Document results

Skills developed:
- Astronaut training
- Team communication
- Resource management
- The winner will donn the real spacesuit at the end of the workshop

Workshop – Systems Engineering for Human Spaceflight Missions

Topic: Why Systems Engineering Matters in Human Spaceflight

Content
- What makes human spaceflight uniquely complex
- Why failures happen (Apollo 1, Challenger, Columbia)
- Definition of Systems Engineering: Systems Engineering = managing complexity across the full lifecycle of a system.
- Image of ISS as “system of systems”
- Complexity diagram of crewed spacecraft
- Case study about space medicine experiment on ISS – MXene in LEO

Human safety in space

Topic: Human Spaceflight as a System-of-Systems

Spacecraft subsystems overview:
- Life Support (ECLSS, BLSS)
- Power
- Thermal control
- Communications
- Guidance, Navigation & Control
- Structure
- Crew Systems

Human Spacecraft = System of Systems

Interfaces between: humans, environment, technology

Mini Activity (5 min)

- What happens if thermal control fails but life support works?
- Discussion goal: interdependency of subsystems.

Life Support Systems (ECLSS)

Topic: Human-Centered Systems

Content:

- Environmental Control and Life Support Systems:
- Oxygen generation
- CO_2 removal
- Water recovery
- Waste processing
- Temperature regulation
- Microbial control

Closed-loop vs open-loop systems

Examples:

- ISS ECLSS
- Biosphere concepts
- Mars mission constraints

Key Insight

- Life support is not one device – it's a network of interacting processes.

Group Activity — Astronaut Data Analysis

Topic: Astronaut Health Monitoring

Content: Participants analyze:

- Heart rate variability
- Oxygen saturation
- Sleep cycles
- Stress biomarkers

Tools: Sampleastronaut biomedical datasets

- Wearable monitoring examples

Team Challenge — Mars Habitat Survival System

Scenario: Design a minimal human survival system for a 4-person Mars habitat operating for 30 days

Participants are divided into small groups (3–5 people).

Task Requirements

Each group must define:

- Mission Objective
- Critical Requirements
- Key Subsystems
- Interfaces
- Failure Risks

Constraints

- Crew: 4 people
- Duration: 30 days
- Limited resupply
- Power limited
- Mass limited
- Must support:
  1. Breathing
  2. Water
  3. Temperature
  4. Waste

Template (Give to Groups)

Mission Goal:

Top 5 Requirements:

1.
2.
3.
4.
5.

Subsystems Needed:

- Life Support
- Power
- Thermal
- Communication
- Structure
- Other: _____

Major Risks:

Expected Learning Outcomes

- Requirements engineering
- Trade-offs
- System boundaries
- Failure thinking
- Human spaceflight is systems engineering at its extreme.
- Every subsystem affects crew survival.
- Requirements drive design.
- Redundancy saves lives.
- Systems thinking enables exploration beyond Earth.
- Reliability engineering
- Fault tree analysis
- Risk matrices
- Human factors engineering
- Autonomous systems
- Digital twins

Wrap-up Session, Presenatation of the space suit, certificates for participants

Summary topics:

- Lessons learned
- Future of space medicine
- Earth applications of space medicine
- Demonstration of the space suit.
- Characterisation of the structure, materials and subsystems
- Donning the suit by the winner of the competition
- Certification and group photos

Speaker Biographies

Matt Harasymczuk

CEO, Analog Astronaut Training Center, Poland

CEO of AATC, Astrotech, and Micropura; director of the project OTTER (Orbital Technologies and Tools for Extravehicular Research) for the International Institute for Astronautical Sciences; and lead instructor in neutral buoyancy and underwater EVA training and scientific diving, with prior roles at European Space Agency and major public and private institutions, over 100 organizations consulted, and 32k+ people trained in aerospace, software and marine engineering. Holds an M.Sc. in Aerospace Engineering from Polish Air Force Academy, BSc in Software Engineering and multiple postgraduate diplomas (Extreme Medicine, Geophysics, Analytical Chemistry, Radiobiology and Air Space Management), currently pursuing a PhD on underwater habitats at Polish Naval Academy.

Recipient of the Copernicus Medal for creating foundations for human-spaceflight in Poland. CCR and cave diver, highly certified technical trimix diving instructor across multiple agencies, with additional training in aviation, combat medicine, and astronautics. Leads development of HabitatOS, co-designed advanced pressurized spacesuits and underwater systems, and conducted centrifuge and high-altitude testing for human subject in spacesuits for ascent and re-entry profiles. Experienced analog astronaut, ESA collaborator, and parabolic flight participant. Author of several books spanning AI, software engineering, astronaut training, and geophysics. DAN and EFR emergency medicine instructor. ACLS and CPR microgravity procedures researcher.

Agata Kołodziejczyk

Director of Scientific Projects, Analog Astronaut Training Center, Poland

Agata is a neuroscientist, astrobiologist, and innovator. Both her M.Sc. thesis at Jagiellonian University in Cracow and PhD thesis at Stockholm University focused on the influence of light on signal transformation in neurochemical circuits of nervous systems in various animal species. She discovered an internal eyelid in the insect's compound eye and presented this discovery in the Concurrent Design Facility at the European Space Agency, aiming to revolutionize the construction of future modular space telescopes.

After completing her PhD, she worked as a postdoc on the neurobiological mechanisms of aggression at Jagiellonian University, and later secured a position in biomimetics at the European Space Agency in the Advanced Concepts Team. There, she developed a prototype lighting system to synchronize biological clocks and provide non-invasive treatment for jet lags. While abroad, she started various projects in Poland. These include organizing international "Meet the Space" conferences, founding Europe's first Analog Space Research Station named Lunares, and conducting lunar and Martian analog simulations with specific scientific projects on board. Her particular interest lies in time architecture, especially time illusions in isolated areas.

Additionally, Agata works on photosynthetic biomaterials and aquaponic systems to initiate reliable and sustainable terraforming processes in isolated spaces. Recently, together with collaborators, she developed a new method for in-situ clothes production in space. Agata is a multiple award winner, including the best scientific experiment in the Global Space Balloon Challenge for detecting stress in biological organisms in the stratosphere, the scientific Rojszczak Award, a Golden medal for the initiative of creating the first habitat in Poland, and even public recognition as "One of the most powerful women in Poland." She was a co-founder of Space Garden Company and Chairman of Lunares Scientific Council.

Agata is a Board Member of the World Research Centre and Director of Advanced Concepts at the private space agency The Valles Marineris. Currently, she is focused on accelerating human spaceflight research worldwide.

W10: Workshop on Satcom System Design

Room: Scarlet 2 | **Time:** 08:00 - 10:00

Overview

Starting with Sir Arthur C Clarke's idea of the Geostationary satellites providing global communications, the evolution of satellite communication has been phenomenal and has been time-tested over almost six decades as a significant means of communication beyond the horizon. With the advent of High Throughput broadband Satellites and LEO Constellations in the New Space regime, a revolution has taken place in recent years, anticipating a prospect of its growing into a multibillion-dollar industry in recent future. Like in the other space related activities, the recent reforms in space sector in India has opened up numerous possibilities for the private initiatives, startups and academia to participate actively in the field of satellite communication. The present workshop will introduce the fundamental principles of designing a satellite communications system, covering all the significant elements viz, Orbit Geometry of satellites, On-board bus and payload systems, Ground systems, Signal structure & Digital modulations, RF Link engineering including propagation effects, interference effects, usage of RF spectrum, advance systems of High Throughput Satellites and LEO Constellations.

Upon completion of this course, the attendees will be able to:

- Understand the basics principles behind satellite technology and applications.
- Understand the key features, analysis, design and engineering of communications systems & subsystems.
- Analyse the functional architecture of satellite communications.
- Apply the systems engineering methods in the context of satellite communications.
- Integrate and apply the key principles of satellite communication such as issues related to frequency spectrum, digital modulation techniques, Performance objectives, Figures of merit of the receive and transmit systems, constellation diagrams, link budget design, RF systems, antenna principles etc.

Format

Total duration of the session will be 2 hours, divided into four sessions, each of 30 minutes. The first session to cover introductory part including the communication architecture, Orbit geometry, on-board systems. The second session to cover the Payload RF elements and their characteristics and the Earth stations. The third session will introduce the essentials of RF Spectrum, communication signal structure & digital modulations, concept of link design & figures of merit. The fourth session will address the advanced concepts of HTS and LEO constellations and various types of applications with use cases. Each session will be followed by a brief question-answer session.

Target Audience

This workshop is designed for an audience group of students, professionals working in the field of Satcom engineering and also for the start-ups in this field.

Session Organization:

Introduction & Basic Elements of Satcom Systems

- Introduction to Satcom Systems
- Communication System Architecture
- Orbit Geometry: LEO, MEO, GEO, HEO
- On-board System elements: Bus & Payloads

Communication Payload & Earth Station Elements

- Elements of Generic Communication Payload
- Types of Transponders: Transparent & Regenerative
- Antenna Systems: Reflector based, Phased Arrays
- Frontend Systems & Receivers
- RF Filters & Multiplexers
- Transmitters & High-Power Amplifiers
- Earth Station Elements

RF Spectrum, Propagation Effects, Digital Modulations & RF Links

- RF Spectrum for Satcom
- Orbital locations and Frequency Co-ordination-ITU
- RF Signal Propagation Effects
- Essential Elements of Digital Modulations
- RF Link Analysis

Advanced Systems & Applications

- Concepts of GEO based HTS/VHTS/UHTS
- LEO Constellations
- Applications:
  - VSAT, DTH & Boad-band, Mobile and D2D Systems
  - Defence/Civilian Applications
- Use-cases.

Speaker Biographies

Shri Sumitesh Sarkar

superannuated as Associate Director and Distinguished Scientist at Space Applications Centre (ISRO)

Shri Sumitesh Sarkar, superannuated as Associate Director and Distinguished Scientist at Space Applications Centre (ISRO), Ahmedabad, has more than 38 years of experience in the development of satellite communication payload systems. He has done B.E. in Electronics & Telecommunications from the University of Calcutta and M. Tech from Indian Institute of Science, Bangalore. He joined Space Applications Centre of ISRO, Ahmedabad in 1987. He has played key roles in the definition and development of the payloads GSAT-6, 7, 7A and GSAT-19 and also in the realization of NAVIC Payloads. He led the development of the communication payload for the first Indian High Throughput Satellite (HTS), GSAT-11. He has also guided payload development activities of GSAT-20, the first Ka-band HTS of ISRO. He is a recipient of ISRO Merit Award and ISRO Team Excellence Awards.

W11: Engineering the Future of Aerospace MRO: Digital Twins, Simulation & AI for Intelligent Maintenance

Room: Scarlet 3 | **Time:** 16:00 - 18:00

Abstract

India is rapidly positioning itself as a strategic global hub for Aerospace Maintenance, Repair and Overhaul (MRO), driven by expanding aviation demand, defence modernization, and national self-reliance initiatives. To compete globally, the MRO ecosystem must evolve beyond conventional maintenance practices toward intelligent, software-defined operations.

This interactive 2-hour workshop gives a glimpse of how Digital Twins, Physics-Based Simulation, AI/ML, Predictive Analytics, and Software Platforms are transforming Aerospace MRO worldwide.

Global leaders such as Siemens, Ansys, GE Aerospace, IBM, and Palantir demonstrate the value of intelligent maintenance platforms and digital engineering ecosystems. The workshop will also have a Guest Speaker from the Aerospace field.

Participants will gain insights into how digital engineering technologies can enable:

- Virtual asset replication for health monitoring and predictive maintenance
- Simulation-driven fault diagnosis and what-if maintenance planning
- AI-assisted prognostics, and remaining useful life estimation
- Intelligent scheduling and optimization of maintenance operations
- AR/VR-assisted technician support and digital work instructions
- Fleet-wide reliability analytics and decision support systems

The workshop will additionally explore AI strategy for MRO systems, including selection of suitable approaches such as physics-informed AI, computer vision, time-series forecasting, anomaly detection, reinforcement learning, and generative AI copilots—along with guidance on where each model class best fits within the maintenance lifecycle. Beyond technology exploration, the session will include structured collaborative ideation to identify high-impact software/product opportunities for India's emerging aerospace MRO ecosystem and validate practical implementation pathways.

Designed for professionals, researchers, startups, entrepreneurs, and students, the workshop aims to foster participation in early-stage innovation programs, prototype development, and internship-led proof-of-concept initiatives that can shape next-generation intelligent MRO solutions.

Speaker Biographies

Dr. Aloknath De
Founder and CEO, TechCrafter.cps
Former CTO & CVP, Samsung; and MD, ST-Ericsson

Dr. Aloknath De is Founder and CEO of TechCrafter.cps with thrust on AI-enabled deep-tech solutions for Med-health, Manufacturing and Mobility sectors. He has been Corporate Vice-President of Samsung Electronics, S.Korea and Chief Technology Officer of Samsung India. Dr. De has thirty-six years of industry and research experience including BEL, Nortel, Hughes, ST-Ericsson and Samsung. In last 20 years, he has also been Adjunct or Visiting Professor with IISc, and IITs in Jodhpur, Delhi and Roorkee. He holds Ph.D. from McGill University, Montreal; M.E. from IISc-Bangalore; and B.Tech and Distinguished Alumnus of IIT, Kharagpur. Dr. De is Fellow of IETE, IEI and INAE, where he is also Governing Council member. He served, for three years (2022-'25), as Chairman for Ministry of Electronics and IT (MeitY)'s National AgriTech program. He is a recipient of 'Alexander Graham Bell Prize' in Canada. He has received 'IETE Memorial Awards', IDC Insights Award for 'Telecom Innovation', Zinnov Award for 'Intrapreneurship', Assocham Award for 'Çorporate Tech Leadership', Nasscom 'AI Gamechanger', IESA 'Innovative Product', TechCircle for 'Business Transformation', IEEE 'MGA Innovation' and India Council '2024 Technologist of the Year' Awards.

Dr. Adishesha CS

Sr. Technical Fellow, Collins Aerospace

Chair-Elect, AESS Bangalore Chapter

W12: Realistic Modelling of End-to-End Radar & Communication System Simulation

Room: Scarlet 2 | **Time:** 10:30 - 12:30

Abstract

This workshop delivers a comprehensive, end-to-end virtual modelling framework that seamlessly connects theoretical foundations with real-world radar and communication system implementation. Participants will dive deep into cutting-edge radar system modelling and rigorous communication system performance evaluation, using simulation methodologies that faithfully replicate the complexity of real-world signal environments with exceptional fidelity.

The workshop culminates in a forward-looking exploration of how Large Language Models (LLMs) are emerging as powerful tools for next-generation radar and communication system design.

Attendees will walk away with:

- Mastery of advanced simulation methodologies that mirror the complexity of real-world signal environments
- Experience with high-fidelity radar and communication system modelling tools
- Insight into how LLMs are reshaping the future of system design

This workshop also lays a powerful foundation for **Electronic Warfare (EW) Analysis**, equipping participants with the skills and frameworks needed to tackle sophisticated EW challenges head-on.

Workshop Agenda

#	Module	Topics Covered
01	Real-World Radar System Modelling	• Modelling Radar interacting with target, clutter, and environment • Modelling of Radar Return based on Pulsed LFM / FMCW waveforms • Generation of Raw IQ data, Range-Doppler maps and SAR / ISAR images
02	End-to-End Communication System Performance Evaluation	• Basics of Baseband, RF Front-End and RF Communication Channel • Importance of Antennas, Phased Array and MIMO in communication • Effect of Modulation and dynamic RF multipath on communication system • SNR and BER on End-to-End Communication Channel with dynamically moving targets
03	LLMs for Next-Gen System Design	• AI-assisted radar & communication system modelling • Generative modelling for new-generation systems

Speaker Biographies

Nijas Kunju

PhD., RF Architect at Ansys Part of Synopsys

Nijas specialized in the domain of RF, Antennas, Radar, and Multiphysics simulation. Nijas has been working with Ansys from the last 10 years. He provides technical assistance for RF components, Antennas, Phased arrays, Radar, Automotive and 5G/6G applications. He has been interacting with different Aero and Space customers on various communication, Radar, and EWS system development through virtualization and digital engineering. Before he joining ANSYS he worked as a Research Consultant at GE Global Research in Bangalore in the area of Wireless Power Transfer and microwave material sensing for detecting different materials in Crude Oils. Nijas did his Master's degree in Electronics Science and PhD under Prof. P. Mohanan from Cochin University of Science and Technology, Cochin, Kerala. He holds 20+ International publications and 20+ national and international

Vishal Tripathi

Digital Mission Engineering (DME)

He support the Digital Mission Engineering (DME) suite, including STK, TETK, ODTK, Scheduler, and SOLIS. He supports the Asia-Pacific region, providing technical pre-sales support, product demonstrations, and solution guidance to customers and partners. With 3.5 years of experience in aerospace and robotics, and an academic background in Aerospace Engineering with R&D work in underwater robotics, Vishal applies his technical expertise to mission-focused modelling and simulation. At Ansys, he has contributed to key multi-physics and mission-level projects such as hypersonic blackout analysis, satellite collision assessment with ISAR imaging, and chaff effectiveness evaluation

Hardik Asawa

Technical Leader in A&D at Ansys part of Synopsys

He is with over 17 years of experience across RF engineering domains of Digital Mission Engineering, RF Test & Measurement, RF Simulations, and EMI/EMC, he focuses on using digital engineering methodologies to reduce gap between theoretical modelling & field performance, and thereby ensuring field readiness of complex and intelligent Aerospace & Defence Solutions. He has worked on several RADAR, Satcom, Data link projects. He has been instrumental in delivering several solutions for RF algorithmic prototyping & validation, RF system level validation, RADAR target generators, RADAR Synthetic Data Generation for SAR/ISAR and RF Channel Emulators using COTS hardware and Simulation tools. His recent areas of interest include AI-ML based design optimizations, and synthetic data generation for cognitive algorithm R&D. He has completed his B. Tech. in Electronics and Communications Engineering from VNIT Nagpur in 2009.

W13: Electro Optical System Design for a Satellite based Optical Remote Sensing

Room: Scarlet 2 | **Time:** 13:30 - 15:30

Overview

In the present scenario of India's new policy on space program, a lot private companies and startups are ventured into or actively involved in synergizing the existing business with the space program, investing in the development of technology on various satellite systems and involved in the innovation on niche segment of space technology. Satellite-based earth observation, navigation and communication are the three major space segments. Earth observation from space provides a synoptic view and global coverage which helps in monitoring, forecasting and managing earth resources, urbanization and other activities taking place on earth. It is estimated that the global space economy will be around 1.8 US$ Tr in 2033 and further it has been ambitiously projected that new space policy of India over a decade will lead to a cumulative annual growth rate (CAGR) of 28% in earth observation segment from the 0.5 US$ Bn of 2022.

Remote sensing is a method of acquiring information about an object or its phenomena without making a physical contact. The interested object or phenomena are mostly inferred by measuring some other parameter that object or phenomena exhibits rather than that itself. Observation of earth from space can be made through the measurement of properties of electromagnetic radiation interaction with its surface. The earth's atmosphere plays a significant role in the selection of electromagnetic spectrum for sensing. In general, optical remote sensing is represented by observation carried out over the wavelength span from 400 to 900 nm of electromagnetic spectrum. In the beginning, this Workshop introduces the concept of signatures in remote sensing, a certain aspect of electromagnetic radiation, fundamental of radiometry, and influence of Sun and atmosphere in earth observation.

Based on those introductions, the Workshop will touch upon remote sensors classification and further categorization of it such as spatial, spectral, radiometric and temporal resolution. Subsequently the participant gets to know sensor parameters that specifies the performance of those categorization and thematic applications. With a brief introduction of various major modules namely optical, detector, electronics and mechanical, and their salient parameters that define an optical remote sensor, the Workshop will give a practical experience of system design of remote sensor for a given thematic application. Further the derived system requirements and specifications on various modules of remote sensor are explained to the participants. The Workshop will also introduce the participant to various aspects, requirements and specifications in general, for a space borne optical remote sensor. This Workshop will also bring out various aspects that require trade-off study in arriving at a practical remote sensor.

After attending the Workshop session, the participants will be able to:

- Understand the principal behind the optical remote sensing and space borne remote sensing
- Identify various possible thematic applications of optical remote sensors
- Generate remote sensor parameters and specifications required for a given application
- Understand various modules of an optical remote sensor and the required functionalities
- Carry out system design of a remote sensor, trade-off studies and arriving at a final sensor specification.
- Define requirements and design optical remote sensor for a space borne platform.

Session organization, Schedule and Format:

- The Workshop is divided into two sessions of ~45 minutes each,
- The first session covering Introduction to optical remote sensing includes electromagnetic interaction of matter, fundamental of radiometry, aspects of remote sensing of earth and classifications of remote sensors and,
- The second session covering optical remote sensing for various thematic applications, modules of optical remote sensor, aspects of system design with a select thematic applications, requirements for optical remote sensor for space borne platform.
- End of each session planned to have a 10 minutes interaction and clarifications on those aspects covered in Workshop with participants.

Target Audience:

This Workshop is designed to give not only basic understanding on electro optical sensor for space borne remote sensing but also to give practical aspects of sensor system design. In view of present scenario on space program in India, the Workshop will attract participation of professionals of private industry/ startup who engaged or intended to engage in space borne as well as ground based optical remote sensing. Further this Workshop provides an opportunity to graduate and post graduate students and researcher in field of engineering physics, optical engineering, solid state physics, electronics and mechanical to get practical aspects of academic learning on the electro optical sensor for space. Overall, the Workshop will likely to attract those who are looking to build confidence on their ongoing effort on electro optical sensor development, and for enrichment or broaden understanding on building of earth observation system.

Speaker Biographies

Dr. M. Senthil Kumar

Space Applications Centre, ISRO, Ahmedabad, India

M. Senthil Kumar received his Doctorate in the area of Optical Engineering from Indian Institute of Space sciences and Technology (IIST), Thiruvananthapuram, M. Tech in Applied Optics from Indian Institute of Technology (IIT), Delhi and M.B.A from BK school of Business Management, Gujarat University Campus, Ahmedabad. At present, he is a 'Distinguished Scientist' and the 'Deputy Director' of the Human Spaceflight and Advanced Technology Area at Space Applications Centre, ISRO, Ahmedabad. He is leading activities of satellite based Optical & Quantum communication, Atomic Frequency Standard for the on-board clock of the navigation satellite and also activities of human space crew-cabin technology of missions of Gaganyaan and Bharathiya Antriksh Station. He is the Lead Principal Investigator for the Technical Group named Satellite based Quantum Key Distribution system of National Quantum Mission of India. Prior to the current assignment, he has contributed to design and development of several electro optical sensors for Earth observation, Meteorology and Planetary satellite missions for nearly three decades. He was a project manager (Optical System) for sub-meter class payload and later the Associate Project Director (Payloads) of foot class very high-resolution payload of Cartographic Satellites. Recipient of 'ISRO Team Award for Cartosat-2 mission' in 2007 and 'ISRO Team Award for the development and realization of meter class aperture high quality optics for the high-resolution cartographic satellite Cartosat-3' in 2018 from ISRO, Dept. of Space. Recipient of 'Excellence in Spacecraft and related Technology-2021' by Astronautical Society of India in 2024. He has more than 35 publications in Peer reviewed journals, national and international conferences. He is the chairman of Indian Society of Remote Sensing (ISRS) Ahmedabad Chapter (AC) for Session 2022-24.

W14: Spaceborne SAR - System Design and Tradeoff Studies

Room: Scarlet 2 | **Time:** 16:00 - 18:00

Overview

Satellite systems comes with constraints of power, payload size and volume and data rate. In contrast user requirement is always best possible resolution, widest possible swath and best sensitivity. The SAR system designer has to meet best possible aspirations of users with technically feasible SAR configurations which can be accommodated within a satellite bus with reasonable complexity and accommodation constraints. This tutorial will address these two contrasting and demanding aspects with a feasible system design of a Spaceborne SAR system.

Speaker Biographies

Dr. Tapan Misra

DS & Former Director, SAC

Mr Tapan Misra started his career in Space Applications Centre, ISRO in 1984 and since then played a pivotal role in growth of Microwave Remote Sensing payloads and allied technologies in SAC and in India.

He is widely known for the design and development of C-band Synthetic Aperture Radar (SAR) of the RISAT-1 in 2012. He steered the development of RISAT-2 series of high resolution X-band SAR systems. He conceptualised and led development of highly miniaturised Dual Frequency (L and S band) SAR (DFSAR) for Chandrayaan 2 orbiter (2019). He was also the principal designer of Ka band radio altimeter which enabled smooth landing of RLV and Chandrayaan 3 lander. He is also the principal architect of the novel sweepSAR of NISAR (NASA-ISRO SAR), launched in 2025. He was a key contributor for system engineering of Multi-frequency Scanning Microwave Radiometer (MSMR) payload for Oceansat-1 during 1995-1999 and Scanning Scatterometer of Oceansat-2 in 2009. He was appointed as Director of Space Applications Centre (SAC) in February 2015. For a brief period he had additional charge of Director, Physical Research Laboratory, Ahmedabad from June 2016 to February 2017.He also headed the Office of Innovations Management, ISRO, Bangalore. Tapan Misra was appointed as a Senior Adviser to Chairman of ISRO in July 2018. He superannuated from ISRO in January 2021.

Presently he is holding the position of Founding Director and Consultant Chief Scientist of a deep tech startup, named SISIR Radar Pvt Ltd, based out of Kolkata. Under his leadership, SISIR Radar has emerged as one of the very few key Deep Tech start ups in India, specializing in developing miniature SAR System, ultra wide band GPR systems and innovative Spaceborne SAR. Presently Sisir Radar manufactures and sells world's highest resolution foliage penetration SAR on drone borne platforms. Sisir Radar is going to launch the first of its L band SAR constellation by 2027. He received Vikram Sarabhai Research Award in 2004 and ISRO Merit award in 2008 for his contribution to the development of SAR technology. He was elected as Fellow of Indian National Academy of Engineering in 2007. He was elected Corresponding Member of International Academy of Astronautics in 2008.

He is also elected Fellow of IETE and ISRS. He was awarded DSc (Hon.) in 2016 and Distinguished Alumnus award in 2017 by his Alma Mater, Jadavpur University. He chaired CGMS 2018 (Coordination Group for Meteorological Satellites) in Bangalore, represented India as Principal to CEOS (Committee on Earth Observation Satellites) in Paris in 2017 and participated as team member of Indo-US Strategic Dialogue on Space Cooperation in Washington DC in 2016 and 2018. He also taught at IIT Kharagpur and IIT Jodhpur as Adjunct Professor. He holds eight granted patents. He has five copyrights and more than fifty five papers to his credit.

W15: Introduction to IEEE Antenna Measurement Standards and Overview of IEEE Std 1720

Room: Petunia | **Time:** 10:30 - 12:30

Overview

Accurate antenna measurements are essential for the development, verification, and qualification of modern wireless, aerospace, satellite, defense, and communication systems. As antenna technologies continue to evolve toward higher frequencies, wider bandwidths, electronically steered arrays, integrated platforms, and over-the-air system testing, the need for well-defined, traceable, and technically sound measurement practices becomes increasingly important.

This short course provides an introduction to antenna measurement practices in accordance with IEEE Std 1720 and IEEE Std 149, as promoted by the IEEE Antennas and Propagation Society Standards Committee. The course combines theoretical foundations with practical implementation guidance, emphasizing range and method selection, measurement objectives, accuracy requirements, traceability, and uncertainty evaluation. Contributors directly involved in the development of these standards will present key clauses, explain their technical rationale, and share practical insights into current best practices.

The course will introduce the principal antenna measurement methods covered by the IEEE standards, including near-field measurement techniques with regular and non-regular scanning and transformation approaches, as well as far-field measurement methods based on direct and indirect techniques such as compact antenna test ranges and plane wave generator systems. The respective strengths, limitations, and application areas of each method will be discussed, with emphasis on how to select an appropriate measurement approach based on the antenna under test, frequency range, required accuracy, and available facility constraints.

Participants will also receive an introductory overview of over-the-air measurement techniques, radar cross section measurement fundamentals, anechoic chamber and absorber requirements, advanced post-processing methods for data correction, transformation, and imaging, and the role of uncertainty estimation and traceability in antenna measurement practice. While the course will cover the major topics addressed in IEEE Std 1720 and IEEE Std 149, selected sections will be presented by invited experts who contributed as working group leaders to the development of these standards.

The course is intended both for students and engineers seeking an entry point into the field of antenna measurements and for experienced practitioners interested in an updated overview of modern measurement techniques and best practices as reflected in the IEEE antenna measurement standards. A basic understanding of electromagnetic theory and measurement principles is helpful but not required.

At the end of the short course, participants will be able to:

- Understand the scope and purpose of IEEE Std 1720 and IEEE Std 149 and their relevance to antenna measurement practice.
- Identify the main near-field and far-field antenna measurement techniques and understand their respective advantages, limitations, and areas of application.
- Select appropriate measurement methods based on antenna characteristics, measurement objectives, accuracy requirements, and facility constraints.
- Recognize the importance of traceability, uncertainty estimation, and measurement validation in achieving reliable antenna measurement results.
- Gain awareness of related topics including OTA testing, RCS measurements, anechoic chamber design, absorber requirements, and advanced post-processing techniques.

This course forms part of the IEEE APS Standards Committee outreach initiative to promote awareness and adoption of IEEE antenna measurement standards. A limited number of copies of IEEE Std 149, donated by the IEEE APS Standards Committee, will be awarded to attendees through a lottery at the conclusion of the course.

Abstracts for Talks

Introduction to IEEE Antenna Measurement Standards and Overview of IEEE Std 1720

Speaker: Lars Foged

This session will introduce the role of IEEE antenna measurement standards within the broader activities of the IEEE Antennas and Propagation Society Standards Committee. The presentation will provide an overview of IEEE Std 1720, which addresses near-field antenna measurements and related transformation techniques. Key topics will include the purpose and structure of the standard, range and method selection, scanning geometries, probe considerations, transformation methods, uncertainty evaluation, traceability, and practical guidance for applying the standard in modern antenna measurement facilities.

Overview of IEEE Std 149

Speaker: Prof. Manuel Sierra Castañer

This session will provide an overview of IEEE Std 149, which addresses antenna measurement procedures with emphasis on far-field measurements and general antenna characterization. The presentation will discuss the scope and structure of the standard, fundamental measurement quantities, far-field range requirements, direct and indirect measurement approaches, compact antenna test ranges, instrumentation considerations, absorber and chamber requirements, and best practices for achieving accurate and traceable antenna measurement results.

Speaker Biographies

Lars Foged

Lars Foged received his M.S. degree in Electrical Engineering from the California Institute of Technology, USA, in 1990. He is currently Vice President of Research and Development at Microwave Vision Group (MVG), where he has been involved for many years in the development of advanced antenna measurement systems and techniques. His technical work focuses on antennas, antenna measurement techniques, near-field and far-field measurement systems, over-the-air testing, and advanced post-processing methods. He is the author of two books and numerous scientific papers in the field of antennas and measurements. His work has received several distinctions, including Best Technical Paper Awards at AMTA in 2013 and EuCAP in 2021. Mr. Foged has held several leadership positions within the IEEE Antennas and Propagation Society, including Chair of the Industry Initiatives Committee and current Chair of the Antenna Standards Committee. In 2023, he received the IEEE AP-S Industrial Innovation Award. He has also served as Vice-Chair of EuCAP in 2011 and 2022, and is a course organizer and board member of the European School of Antennas. He served as President of the Antenna Measurement Techniques Association in 2023 and is an AMTA Fellow and Distinguished Achievement Award recipient.

Prof. Manuel Sierra Castañer

Manuel Sierra Castañer received the Telecommunication Engineering degree in 1994 and the Ph.D. degree in 2000, both from the Technical University of Madrid (UPM), Spain. After working with the cellular communications company Airtel from 1995 to 1997, he joined academia, first at Universidad Alfonso X and subsequently at UPM, where he has held research and faculty positions and is currently Professor. His research interests include array antennas, planar antennas, reflectarrays, and antenna measurement techniques. He has directed several research projects, published more than 40 papers in scientific journals, and supervised 8 Ph.D. theses. He has been a visiting researcher at Tokyo Institute of Technology and EPFL, and a visiting professor at Tokyo Tech. Prof. Sierra-Castañer is an IEEE Fellow, an AMTA Fellow, and the recipient of the 2024 AMTA Distinguished Achievement Award. He received the IEEE AP-S Schelkunoff Prize Paper Award in 2007 for the paper "Dual-Polarization Dual-Coverage Reflectarray for Space Applications," as well as several conference paper awards. He has served in several leadership roles within the European antenna community, including leader of the EurAAP Working Group on Measurements, EurAAP Regional Delegate for Portugal, Spain, and Andorra, and Vice-Chair of EurAAP. He has represented UPM on the Board of the European School of Antennas and has coordinated several editions of the ESoA course on antenna measurements in Madrid, Paris, Shanghai, and Beijing. He also served as Vice-Chair of EuCAP 2010 and EuCAP 2015, and as General Chair of EuCAP 2022 in Madrid.

WS16: AI-Native Space-Air-Ground Networks: From Low Altitude Economy to Interplanetary IP.

Room: Amaryllis | **Time:** 11:30 - 12:30

Abstract

The rapid expansion of the Low Altitude Economy (LAE), including UAV corridors, eVTOL mobility, aerial sensing platforms, disaster-response drones, and autonomous logistics, is redefining connectivity requirements across vertical airspace domains. These systems require ultra-reliable, low-latency, and seamless communication across terrestrial and non-terrestrial layers to ensure safety, resilience, and scalability. In parallel, Non-Terrestrial Networks (NTN) are evolving under 3GPP Rel-17/18 and emerging 6G research from isolated satellite links into fully integrated components of mobile infrastructure. Open RAN (O-RAN) architectures further enable programmability and AI-native control through RIC-based orchestration, allowing NTN-aware optimization, cross-layer mobility management, and slice continuity across space-air-ground domains. Beyond near-Earth integration, the IETF Taking IP To Other Planets (TIPTOP) Working Group is examining how existing IP protocols must be profiled and adapted for lunar and deep-space networking environments characterized by long, variable delays and intermittent connectivity.

This session presents a unified architectural vision connecting AI-native NTN-TN orchestration, O-RAN evolution, multi-orbit satellite integration, transport protocol profiling (including QUIC), DNS considerations in disrupted networks, and control-plane harmonization from terrestrial systems to deep space. Together, these elements define a research-forward pathway from UAV corridors to lunar surface networks and future interplanetary IP infrastructure.

Brief Agenda

Introduction & Motivation	Overview of the Low Altitude Economy (LAE), emerging 6G space-native networking, and the need for unified space–air–ground architecture spanning terrestrial, orbital, and deep-space domains
Low Altitude Economy & 6G NTN–TN Convergence	Connectivity requirements for UAV corridors, eVTOL mobility, and autonomous logistics; evolution of 3GPP NTN; integration of Non-Terrestrial Networks with terrestrial systems; role of O-RAN and AI-native orchestration in enabling programmable, resilient networks.
Multi-Orbit Satellite Architecture & Space Networking Challenges	LEO/MEO/GEO coordination, Doppler and latency considerations, intermittent connectivity, and the architectural differences between terrestrial and space-based IP networking
Interplanetary IP & Protocol Profiling	IETF TIPTOP objectives; profiling of transport protocols such as QUIC; DNS considerations in disrupted environments; control-plane harmonization across terrestrial, orbital, and deep-space systems.
Unified Blueprint & Research Directions	Architectural convergence from LAE to lunar and future Mars-ready networks; key research gaps toward 6G and space-native IP
Q&A	Audience engagement

Speaker Biographies

Nishant Tiwari

Principal Product Manager, Fujitsu Research

Nishant Tiwari is a Senior Member of IEEE and Principal Product Line Manager at Fujitsu Research, driving AI-native 6G, Open RAN, and autonomous network innovation. With 18+ years of global leadership and 20+ product launches generating over $100M in business impact, he actively contributes and participates at 3GPP, TM Forum, and the O-RAN Alliance. A Business Patent Filer and Reviewer for the various O-RAN Research Report, Nishant bridges innovation, standards, and commercialization. He has spoken at Mobile World Congress, IEEE Future Networks, India Mobile Congress, IEEE ANTS, Bharat 6G Summit, and IEEE O-RAN 6G RRSA Hybrid Event, shaping programmable, secure, and intelligent nextgeneration networks.

Shailesh Prabhu

Senior Technical Specialist, Nokia.

Shailesh Prabhu is a seasoned research professional with over 8 years of expertise in cuttingedge technologies, including 5G, Software Defined Networking (SDN), and Optical Wireless Communication. He has a robust portfolio of over 18 U.S. patent applications, with 8 patents granted in key 5G-related domains, showcasing his innovative contributions to the field. He is an active contributor to standardization at the IETF, where he has authored 7 Internet-Drafts. Shailesh has authored and presented 3 papers at prestigious international conferences and has also delivered tutorial sessions at premier IEEE conferences including IEEE ANTS 2020-2023, and National Conference on Communication (NCC) 2019, hosted by IISc, Bangalore. He has also been actively involved in showcasing global 5G solutions at world-renowned events, such as the Mobile World Congress 2019 in Barcelona and the India Mobile Congress. A graduate of Manipal Institute of Technology (MIT), Manipal, in Electronics and Communication Engineering, Shailesh continues to drive advancements in next-generation networking technologies, combining his deep technical expertise with a passion for innovation.

WS17: From RF to Flight Dynamics: End-to-End Full-System HIL Concept for Space, Aerospace, and Defence Missions

Room: Scarlet 3 | **Time:** 13:30 - 15:30

Workshop Agenda

- Hardware in Loop – from Concept to Practice for validation of Embedded Controllers
- Driving Spectrum Superiority with the RF Hardware in Loop concept for Electromagnetic Spectrum Operations
- A true Iron Bird or Mission System Integration rig – with all Electro-mechanical, Electronics and RF Systems

Abstract

Modern space and defence platforms—from spacecraft and launch vehicles to manned and unmanned aircraft—integrate tightly coupled avionics, propulsion and RF subsystems that must operate in congested and contested electromagnetic environments. Hardware-in-the-loop (HIL) testing connects real controllers and embedded computers to real-time simulations of the surrounding physical system, enabling early, repeatable validation of embedded software and system behaviour without waiting for full prototypes or range access.

This workshop shows how to extend classical controller-centric HIL to RF subsystems and build end-to-end mission-level simulation benches that bring the complete space or defence system into the lab, shifting system-level verification much earlier in the lifecycle and reducing dependence on expensive, risk-prone range campaigns. Participants will learn how a modular PXI-based platform combines wideband RF instrumentation and real-time simulation to generate high-fidelity, dynamic RF environments—including multi-emitter threat scenarios, radar target emulation and record-and-playback of complex IQ data—synchronised with full avionics and flight-dynamics simulation. By integrating FPGA-based signal processing and custom EW / COMINT algorithms into this loop, engineers can rigorously validate ELINT/COMINT receivers, cognitive radio payloads and broader EMSO capabilities against realistic, repeatable threats in the safety of the lab, accelerating delivery of mission-ready systems while significantly reducing cost and risk

Speaker Biographies

Mr. Abhishek Tiwari

Mr. Abhishek Tiwari is a seasoned professional with over 15 years of experience in the Aerospace and Defence sector. As a Principal Business Manager at National Instruments (NI), he drives strategic growth across radar, electronic warfare (EW), communications, navigation, surveillance, and RF test applications for aerospace and defense customers in the APAC region. Abhishek focuses on expanding NI's market presence by cultivating key partnerships and aligning advanced test solutions with evolving industry demands. Prior to NI, Abhishek served as a Product Manager at MathWorks, where he led strategy and product development for antenna, RF, radar, and sensor fusion products, working closely with engineers across 5G and EW domains.

Earlier in his career, he contributed to the development of radar hardware and software systems at Bharat Electronics Limited (BEL) and the Electronics and Radar Development Establishment (LRDE), DRDO, specializing in mission-critical radar and radio systems for Indian defence programs. Abhishek holds a bachelor's degree in electronics and telecommunication from NIT Raipur and an MBA in Leadership and Strategy from the Indian School of Business (ISB), Hyderabad.

Mr. Vinit Bansal

Vinit Bansal brings over 12 years of experience at the intersection of aerospace, defence, and advanced electronics. He graduated in Electronics from BITS Pilani in 2014 and joined National Instruments (NI), where he began as an Applications Engineer and later progressed to a Field Technical Consultant, supporting complex test and validation projects across satellites, ground stations, and semiconductor applications. In 2023.

Vinit co-founded PierSight Space and served as CTO, architecting Synthetic Aperture Radar (SAR) satellite platforms and leading the successful launch of the company's first technology-demonstrator satellite. After scaling the startup, Vinit rejoined National Instruments in 2025 as Principal Business Manager for Aerospace and Defence, where he now acts as a Subject Matter Expert and drives growth strategy across APAC, focusing on electronics and electromechanical test and validation systems for next-generation space, aerospace, and defence programs.

WS18: Converged Networks and Ubiquitous Connectivity

Room: Amaryllis | **Time:** 16:00 - 18:00

Introduction

Cellular networks have evolved since 1980. Today, cellular networks connect over half the world's population only. Since introduction in 1995, Wi-Fi (IEEE 802.11) networks have become very popular as they use unlicensed bands but they are not widely deployed and have low coverage. LEO satellites (e.g., Starlink, Kuiper) are being deployed to augment the existing GEO and MEO-based non-terrestrial infrastructure to provide wider coverage even and higher bandwidth. However, the end devices are not well equipped to connect to satellite networks and there are handover issues. Hence, there is a lack of ubiquitous connectivity, interoperability, and co-existence.

Converged Networks play an important role in providing secured and seamless connectivity to the end users as they move around various access networks, lose connectivity to the existing network and connect to new networks. Converged networks provide desired quality of service to the first responder community and mission critical users as they make transition from one network to another network. However, there are various challenges with deployment of converged networks, namely interference management, complex network management, seamless handover, resource allocation, extended threat landscape, quality of service management, virtualization and slicing management among others.

Converged networks are different than traditional networks in terms of performance metrics, topology, mobility, backhaul, down link vs. uplink data rate. IEEE 802.21 and 3GPP ATSSS have defined standards to address some of these issues. While each of the access technologies is making progress in its vertical domain, there is a need to solve the interoperability and co-existence issues before ubiquitous connectivity becomes a reality.

This workshop will discuss some of the opportunities and challenges associated with converged networks based on the current state of deployment and will look into some of the use cases where converged networks can be most useful.

Topics

1. 6G is envisioned as a vertical network consisting of various heterogeneous access networks
2. Target innovation based on emerging technologies to develop good solutions ?
3. Target use-cases that can help both urban communities and rural/edge communities
4. Societal, economical and environmental sustainability need resilient service and user experience
5. Innovate, contribute, communicate, collaborate, define and design, build narrative and ecosystem to support and facilitate Inclusion, safety, trust, opportunity, innovation, prosperity
6. Convergence between wireline and wireless access technologies as well as between 3GPP access and Wi-Fi remains critical in future
7. 5G was designed with the vision of a single core network in mind, making integration of various access technologies easier and more cost effective
8. This single core network vision should remain the guiding principle for 6G.

Speaker Biographies

Tom Coughlin

Title: Storage and Memory in Space Communications

Tom Coughlin, President, Coughlin Associates is a digital storage analyst and business/ technology consultant. He has over 40 years in the data storage industry with engineering and senior management positions. Coughlin Associates consults, publishes books and market and technology reports and puts on digital storage and memory-oriented events. He is a regular contributor for forbes.com and M&E organization websites.

He is an IEEE Fellow, 2024 IEEE President, Past-President IEEE-USA, Past Director IEEE Region 6 and Past Chair Santa Clara Valley IEEE Section, and is also active with SNIA, SMPTE and CNSV. For more information on Tom Coughlin go to www.tomcoughlin.com.

Ashutosh Dutta

Title: Storage and Memory in Space Communications

Ashutosh brings in a unique blend of industry and academic experience. He is currently Chief 5G Strategist at The Johns Hopkins University Applied Physics Labs and serves as associate research professor and the director of Doctor of Engineering program at Johns Hopkins University in addition to his teaching. His past career spanning more than 30 years, includes Director of Technology Security and Lead Member of Technical Staff at AT&T, CTO of cybersecurity company NIKSUN, Senior Scientist in Telcordia Research, Director of Central Research Facility at Columbia University, and Computer Engineer with TATA Motors. Ashutosh has published more than 110 papers, IEEE-Wiley book on Handoff Optimization, 6 book chapters and has 31 issued patents. As a Technical Leader in 5G, Ashutosh has served as the founding Co-Chair for the IEEE Future Networks (https://futurenetworks.ieee.org/), IEEE Connecting The Unconnected (ctu.ieee.org) and IEEE 5G/6G Innovation Testbed (testbed.ieee.org).

Ashutosh is a Distinguished Alumnus of NIT Rourkela with BS in Electrical Engineering, MS in Computer Science from NJIT, and Ph.D. in Electrical Engineering from Columbia University under the supervision of Prof. Henning Schulzrinne. Ashutosh is a Fellow of IEEE, Distinguished member of ACM, Fellow of AAIA, and Member of National Academy of Artificial Intelligence.

Dilip Krishnaswamy

Title: Exploring Non-Terrestrial and Terrestrial Solutions to enable Ubiquitous Connectivity

Dilip Krishnaswamy has led the architecture, design, and development of engineering platforms & products at Intel Corp, Qualcomm Research, IBM Research, and Jio Platforms. He received his PhD degree in Electrical Engineering from the University of Illinois at Urbana-Champaign.

He is an alumnus of IIT Madras where he received a B.Tech. degree in Electronics and Communication Engineering. He is an inventor on 80+ granted patents and has authored 80+ research publications. He is presently serving as Executive Vice-President at C-DOT (Centre for Development of Telematics), Bangalore, India, where he is leading Advanced-5G Engineering and 6G Innovation efforts.

Tushar Vrind

Title: LAP-Based Aerial Cells: Building Blocks for Converged Networks

Tushar Vrind is a Senior Technical Director at Samsung Semiconductor India R&D (SSIR), where he leads the Feature development work portfolio in the Modem Software Development Group. In addition, he also leads strategic initiatives of architecture, product, and technology differentiation in the System LSI (SLSI) System on Chip (SoC) Lab. With over 25 years of professional experience in wireless communication, ranging from 2G to 5G, and a specialization in embedded domain, Tushar has played a crucial role in the development of the Exynos System on Chip (SoC) at Samsung Semiconductor.

Throughout his career, Tushar has secured over 50 applied patents and 30 plus granted patents worldwide in the areas of embedded systems and wireless protocols. His expertise has been widely recognized, and he has co-authored over 40 technical contributions, papers, and journals with 3GPP and IEEE. He is also a Senior Member of IEEE, and member IEEE ComSoC. Tushar holds a bachelor's degree in computer engineering from Birla Institute of Technology, Mesra, India, Master of Science (Research) and PhD in Wireless Communication and Networks from the International Institute of Information Technology (IIIT), Bangalore, India. He also participated in Stanford Ignite, a certification in Entrepreneurship and Innovation from the Graduate School of Business, Stanford University.

Gnanapriya Chidambaranathan

Title: AI-Powered Intelligent Networks for Beyond-5G/6G: Bridging Terrestrial and Non-Terrestrial Domains

Gnanapriya Chidambaranthan is an Associate Vice President, Unit Technology Officer, Communications, Media, HiTech (CMT) Industry vertical in Infosys. She has 33+ years of experience in Telecom & IT and contributes to CMT unit strategy, drives technology adoption for business solutions across varied programs globally.

She leads AI strategy, Agentic AI, AI Native Telco, AI led Modernization, Digital Transformation, Enterprise Architecture, 5G, B5G / Edge, 5G Use Cases & Industry solutions, Blockchain solutions & Software Marketplaces, Data Modernization, Industry Innovations, guiding varied transformation & modernization programs. As part of 5G / 6G Eco System integration, her focus areas include, 5G Network slicing, 5G, B5G & Edge vertical industry use cases, Telco / Network Cloud automation, Telco Marketplace. She focuses on powering digital transformation leveraging 5G, Edge, AI / ML, IoT and emerging technologies. She has contributed to India 6G vision paper.

She holds Bachelor's Degree in Electronics & Communication Engineering, Master's degree specializing in Communications Engineering, Business Administration.

Under her guidance & drive, Infosys has won 19 Outstanding Catalyst Team Awards in TM Forum, she received Individual Recognition Award @ Industry TM Forum, serving as TMForum Technology Advisory Committee. She had contributed to TMForum OpenAPIs, ODA, 5G, B5G, Edge, Software Marketplaces, Blockchain, technology reports, reference architectures.

She is a speaker in multiple Industry and Technology Forums. She received 'Best Technical Presentation' award in SPE. She is a Senior IEEE member, IEEE ComSoc Bangalore Chapter Vice Chair, IEEE WIE member, IETE Fellow, The Institution of Engineers (India) Fellow, Governing Board of LF Networking (2023 – 24). She has co-authored book on Digital Signal Processing I, II editions published by McGraw Hill, International edition and translated to Mandarin.

WS19: Machine Learning-Assisted Design and Optimization of Antennas for Space Systems

Room: Petunia | **Time:** 16:00 - 17:00

Overview

This workshop on Machine Learning-Assisted Design and Optimization of Antennas for Space Systems introduces emerging ML-driven approaches for next-generation antenna engineering. It begins with an overview of key machine learning algorithms and their relevance to electromagnetic design problems. Participants will explore representative antenna configurations and specimen designs tailored for space applications. The session further covers optimization techniques, including evolutionary and ML-based strategies, for enhancing antenna performance. Sample design problems will be discussed to demonstrate practical implementation and challenges. A short hands-on session will provide exposure to basic ML-assisted design workflows. The workshop aims to equip participants with both conceptual understanding and practical insights for applying ML in antenna design.

Speaker Biographies

Ravi Kumar Arya

Ravi Kumar Arya is the Director of the Xiangshan 5G/6G Laboratory at the Zhongshan Institute of Changchun University of Science and Technology (ZICUST) in China. He earned his Ph.D. in Electrical Engineering from Pennsylvania State University, USA, under the supervision of Prof. Raj Mittra. He completed his M.Tech in RF and Microwave Engineering at the Indian Institute of Technology (IIT) Kharagpur, advised by Prof. Ramesh Garg, and holds a B.Tech from Delhi Technological University, India.

Dr. Arya's career spans both industry and academia, having held roles at organizations including ECIL (India), C-DOT (India), Ansys Inc. (USA), and ALL.SPACE (USA), along with academic appointments at NIT Delhi and JNU in India. He currently serves as an Editor on the Editorial Board of the IETE Journal of Research. Dr. Arya has authored over 130 peer-reviewed publications, seven book chapters, and four patents. His research focuses on antenna design, computational electromagnetics, 3D modeling, machine learning applications in electromagnetics, and RF system modeling.

WS20: Satellite TT&C – Glimpse

Room: Petunia | **Time:** 17:00 - 18:00

Overview

TT&C System onboard a Satellite is a very vital communication link providing:
- Data regarding the health of various subsystem
- receiving Command signals from Ground Stations
- Ranging from any visible station

The antenna coverage is omnidirectional to take care of various orientation of the satellite during the initial phase of operation and curtailed on orbit if necessary. The tutorial aims at providing a glimpse of various subsystem involved in the TT&C System and also provide some details about the actual system used. It is emphasized that irrespective of the satellite mission TT&C System is mandatory and good knowledge about it is very essential.

Block diagram of the Transponder with some details and the antenna system commonly used would be highlighted.

Format:
The session is about one hour with 50 minutes presentation and ten minutes for QA.

Target Audience:
Students willing to take up satelite projects and starters to get an insight into this important system.

Speaker Biographies

Prof. V.Mahadevan

Group Director (R), Communication Systems Group URSC, Bangalore | Sci.H (Retd.) ISRO, Professor, PESIT, BANGALORE

Shri. V. Mahadevan obtained his B.Tech (Hons) in Electronics & Communication from IIT Kharagpur and M.E. in Communication Engineering from IISc Bangalore. He joined ISRO Satellite Centre in the Communication Systems Group and contributed in the design and development of Antenna & Passive Systems flown in all the spacecrafts. One of the major contribution is in the development of Active Phased Array Antennas which was successfully flown and is being adopted for many future spacecrafts.

He was appointed as Associated Project Director for CATF (Compact Antenna Test Facility) and the same was established in ISRO Bangalore in a record time. He held a number of posts in various satellite projects and finally appointed to the post of Group Director, Communication Systems Group, ISRO Satellite Centre, Bangalore. He retired on superannuation in April 2010 and is presently serving as Professor in the Dept. of Telecommunications at PESIT (An autonomous Engineering College under VTU and UGC Delhi), Bangalore.

He received NRDC award from Govt. of India for his contribution on Handheld Antenna for Satellite Telephone, Team Award For Cartosat-2 Satellite from President of India, ISRO Award for Phased Array Antenna System, and IRSI-IETE 2007 Award for Contributions on Spacecraft Omni directional and Phased Array Antenna System. He holds two Patents, one Handheld Antenna System and the other on UltraLow Sidelobe Antenna. He is a Senior Member of IEEE, Life Member ASI (Astronautical Society of India) and Life Fellow Member IETE, Member IET and has published a number of papers in international and national journals.

WS21: Phased Array Antenna Technology

Room: Poinsettia 2 | **Time:** 08:00 - 10:00

Overview

Phased array antennas represent one of the most advanced and rapidly evolving technologies in modern electromagnetics, with significant impact across radar, wireless communications, electronic warfare, and space systems. The state-of-the-art trends are driven by the need for higher performance, flexibility, and integration. The state-of-the-art in phased array technology is moving toward highly integrated, intelligent, multi-functional, and cost-effective systems. These advancements are essential to meet the demands of next-generation radar, 6G communications, autonomous systems, and space applications. The talk is going to cover the basics of phased arrays and cover trends and technologies pertaining to Active Electronically Scanned Arrays (AESA), Wideband and Multi-Function Operation, Millimeter-Wave and Terahertz Arrays, Digital and Hybrid Beamforming, Sparse and Aperiodic Arrays, Advanced Materials and Packaging, AI/ML Integration, Conformal and Flexible Arrays, Calibration and Mutual Coupling Mitigation and Software-Defined and Reconfigurable Systems. The key topics covered in this talk include Core Principles, Hardware Innovations, Industry Applications and Emerging Technologies.

Speaker Biographies

Dr. Ashutosh Kedar
Senior Member IEEE, Fellow IETE, Life Fellow WAMSS, Life Member ACES, Member AMTA
Sc - 'G', Electronics & Radar Development Establishment (LRDE), DRDO, MOD
Project Director

Ashutosh Kedar received his B.Sc., M.Sc., M. Tech and PhD in Physics, Microwave Electronics and Electronic Science from University of Delhi (DU), India. He has fulfilled his duties as lecturer at Department of Electronics Science (DOES), DU, from Sept 1999 till April 2003 and later as Research Associate (CSIR-DU) from April 2003 till Nov 2003.

He joined Electronics and Radar Development Establishment (LRDE), Defence Research & Development Organization (DRDO), Bangalore, in 2003. He has contributed over there in design, development and realization of first active phased array radar (APAR) in the country. He has been leading since then the realization of active phased array antennas (APAA) for several projects at LRDE. He has been awarded "Technology group award' for realization of first APAR and first four-walled search on move APAR in 2011 and 2018, respectively.

He has more than 100 technical publications including 45 in IEEE journals/magazines/conferences to his credit. He has published a book on 'Sparse Phased Array Antennas: Theory and Applications' from Artech House, USA. He has also contributed a chapter on Phased Array Antennas in Handbook of Microwave and Meterology, Springer Nature. He has an Indian patent on 'Radiating element for phased arrays'.

He is a Life fellow of WAMS Society, Fellow IETE, Senior Member IEEE, Life Member ACES, Member AMTA and Member SMART-L. He has supervised more than 40 Undergrad and Post Grad thesis and is currently supervising a PhD thesis. He at present is with the 'Directorate of Radar Antennas and Microwaves' of LRDE and leading a project on Advanced RF and Microwave Technologies related to radar applications.

Dr. Kedar is a recipient of 'Hari Ramji Toshniwal' Award-2023 from IETE, India. He also received Best paper awards in ICMARS-2100 at Jodhpur, ATMS 2018, Pune, WAMS 2020 and Viterbi/CMI Vitesse Award in WAMS 2023 at Rourkela and Ahmedabad; and 'IETE CDIL 2024' Award at Bhopal. He received MTT-S 2025 Outstanding volunteer award. He has delivered more than 80 invited talks at various forums.

At present he is serving as an Editor of IETE Journal of Research, and is serving as reviewers for various IEEE periodicals including Transactions on Antennas and Propagation, Antennas and Propagation Magazine, Transactions on Microwave Theory and Techniques, Transaction on IOT, Transaction on AESS, OJAP and ACCESS

and for Wiley periodicals, etc. He is serving as Guest Associate Editor for IEEE OJAP (MAPCON Special Edition). His name is listed in IEEE AP-S 200 Top Reviewers 2024 and 2025.

He is an active volunteer of IEEE sine more than 15 years and served as IEEE AP/MTT Jt. Chapter Secretary 2023-24, Vice Chair 2025, Secretary IEEE AESS Chapter and Execom Member, IEEE Bangalore Section. Present serving as Chair of the IEEE AP/MTT Jt. Chapter, Bangalore, Bangalore. He is presently serving as Chair, IEEE MTT-S India Business Committee. He is also presently serving as executive committee member for MAPCON and WAMS societies. Under his leadership the chapter received best chapter awards from AP-S and MTT-S societies in 2026.

He was the TPC and Industry chair of flagship conference of IEEE AP and MTT societies, MAPCON 2022 at Bangalore, TPC Chair for flagship edition of IEEE SPACE 2024 and served as Track chair of CONECCT-2022, CONECCT-2023 conferences of IEEE Bangalore Section, Track Chair and Special Session Chair for MAPCON -2024. He also served as TPC chair for IEEE SPACE 2025 and IEEE Conecct 2025. He served as Co-Chair for MAPCON-2025.

WS22: AI in Radar Processing Chains

Room: Poinsettia 2 | **Time:** 13:30 - 13:45

Overview

The tutorial focuses on AI applications in radar processing chains, emphasizing advancements in signal detection, resource allocation, tracking accuracy, classification, and sensor fusion. It highlights AI-enhanced detection of low signal-to-noise ratio (SNR) targets using machine learning (ML) alternatives, as well as deep learning applications for robust track-before-detection (TBD) schemes in complex cluttered environments.
The tutorial also addresses challenges in resource allocation and multi-target tracking in modern multi-function phased array radars, discussing deep learning and reinforcement learning–based solutions to these problems. In addition, AI applications in multi-sensor environments are explored. Furthermore, the tutorial highlights hybrid cognitive radar architectures, swarm-based multi-static radars, and the role of explainable AI in ensuring reliability and validation for mission-critical systems. These innovations position AI as a transformative force multiplier in modern military radar systems, enabling enhanced performance against emerging threats while addressing computational complexity.

Speaker Biographies

Dr. M Justin Sagayaraj

Dr. M Justin Sagayaraj is an accomplished defense technology leader with over three decades of expertise in real-time embedded software design for mission-critical military radars and Independent Verification & Validation (IV&V). He currently serves as Associate Director at Electronics and Radar Development Establishment (LRDE), DRDO, where he leads the Quality Assurance directorates. A pioneer in designing safety-critical radar tracking software for complex radar systems, he was the head of LRDE's first Artificial Intelligence group, spearheading its strategic AI roadmap and AI/ML integration. Over his distinguished DRDO career, he has served as Head of AI group, Head of IV&V group, and Real-Time Software Development Lead, for airborne, naval, and ground radar systems. An alumnus of IIT Madras (M.Tech) with a Ph.D. in Cognitive Radar applications from VTU, he has over 15 publications, received the Silicon Medal and won multiple Technology Group Awards. He is an IPMA Level B certified project manager and a speaker at IEEE and INCEMIC conferences.

WS23: Next Gen Amplifier & Mixer Analysis Techniques by incorporating AI for Smart Measurements

Room: Poinsettia 2 | **Time:** 13:30 - 13:45

Overview

This workshop session covers amplifier characterization (gain, gain compression, MFGC, harmonics, distortion), mixer measurements (scalar/vector analysis, dual LO capability), and antenna testing (passive/active device characterization, phased array validation). It also covers Multiport and signal integrity topics include PCB/interconnect analysis and automated multiport measurements, while mm Wave testing extends to banded measurements with coverage up to 1.1 THz.

Advanced techniques such as pulsed measurements, AM/AM and AM/PM distortion analysis, and optical VNA extensions for E/O and O/E devices are also discussed. Finally, the webinar demonstrates how VNAs accelerate receiver stress testing and compliance validation through AI-driven automation, with practical guidance on amplifier and mixer setups emphasizing repeatability, software integration, and measurement confidence.

It will also highlight the advanced capabilities of modern Vector Network Analysers (VNAs) in characterizing active RF, microwave, and next-generation communication devices. AI-enabled architectures simplify complex setups, enhance measurement accuracy, and automate calibration routines such as SOLT and LRL across broadband and millimeter-wave domains.

Speaker Biographies

Sadanand Bhatt

Associate Director – Solution Engineering | Anritsu India

Sadanand Bhatt is a seasoned technology leader at Anritsu India, with extensive experience in electronic test and measurement solutions for the Aerospace, Defence, Semiconductor, and Electronics industries.

Over the course of his career, he has worked closely with customers to address complex validation and performance challenges, enabling next-gen product development for RF, optical and high-speed technologies. Recognized for his deep technical expertise and customer-centric approach, Sadanand is a frequent speaker at industry forums, where he shares practical insights into RF and microwave testing, wireless communications, emerging standards, and the evolving role of AI in accelerating innovation.

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