WORKSHOP ON

AIRCRAFT HEALTH MANAGEMENT

Theme: Prognostics of Aircraft Systems

24 & 25 Jun 2022

Venue:
Aeronautical Development Agency (ADA), Bangalore

EVENT DIRECTORY

www.saeindia.org

INDEX

ABOUT THE WORKSHOP

Health management of aircraft systems, is an important design feature of the 4+ generation aircraft onwards, with an objective of improving aircraft availability by reducing the maintenance. Diagnostics and Prognostics methodologies play an important role in the identification of faults much before their occurrence and ensuring the aircraft availability meeting the expected requirements of Maintenance Free Operation Period (MFOP).

As ADA is developing the future next generation aircraft, development of prognostics technologies with improvement of the available diagnostics has become one of the major area to focus and efforts have been initiated for Aircraft Health Management.

This workshop focuses on the Integrated Vehicle Health Management (IVHM) technologies development and implementation by the eminent experts in the field from academia, R&D labs and industry.
The workshop updates are available at website URL: https://www.ada.gov.in

About Organisers

ADA, Bangalore

Aeronautical Development Agency (ADA), Ministry of Defence, is nodal agency for the development of military aircraft in the country.

After successful completion of development of Light Combat Aircraft (LCA) Tejas, Mk1 with activities for Mk1A in progress, ADA is presently working for the development of LCA AF Mk2, Advance Medium Combat Aircraft (AMCA) for Indian Air Force and initiation of Twin Engine Deck based Fighter (TEDBF) for India Navy.

ADA works with the academic institutions, government and private, R&D and manufacturing industries for the development of Indigenous aircraft with increasing indigenous content. website: https://www.ada.gov.in/

DD- AeSI

Design Division-AeSI (DD-AeSI) was formed in year 2017 as a dedicated chapter under the aegis of The Aeronautical Society of India. DD-AeSI is committed to the advancement of Aircraft Design and Associated Technologies in the country.

To further it's objectives, DD-AeSI conducts a number of activities viz providing training to the scientists/Engineers working in the field of Aircraft Design & development through periodic workshops, provide a National/International platform for knowledge share among aeronautical organisations in the country and elsewhere through seminars and lectures. Conduct design competition to inculcate Systems level thinking & Design thinking among students. Facilitate active interconnect among Indian aerospace community through round table meet to discuss organization specific technical issues. website: https://www.aerosocietyindia.co.in/

SAEINDIA is a premier professional society that serves the mobility Engineering Community engaged in the design, manufacturing and service of self-propelled vehicles and systems that move in land, air, space and sea. It has a glorious track record of 25 years in service to the mobility community.

It has 4,000+ professional members and 40,000 student members. SAEINDIA is the largest strategic alliance partner of SAE International. Website: www.saeindia.org

Messages

Dr. Girish Deodhare

Distinguished Scientist, Director General
Aeronautical Development Agency

After successful development of Light Combat Aircraft (LCA) Tejas, ADA is focusing on the design and development of LCA AF Mk2, Advanced Medium Combat Aircraft (AMCA) and Twin Engine deck based Fighter(TEDBF).

Aircraft Health Management (AHM) helps in improving the availability of aircraft by usingdiagnostic and prognostics technologies for all aircraft systems. Although diagnostics of all major systems in aircraft have matured to a large extent, major effort is still required to prognostics schemes and technologies to assess the Remaining Useful Life (RUL) with high reliability. These shall help in optimal decision making for maintenance and LRU management.

Efforts have been initiated at ADA to understand these technologies related to AHM and maintainability for their use in the platforms ADA is working on. This two day workshop on AHM with a theme on Prognostics for Aircraft Systems is aimed at creating a platform for all contributing participants of AHM to look into these aspects and to discuss and deliberate on areas for future research.

ADA is fortunate to partner with DD-AeSI and SAEINDIA in organizing this important event at ADA on 24 and 25 June. I am hopeful this workshop will evolve the roadmap for developing a futuristic AHM system for all the future aerospace programs in the country.

The tremendous response received from various agencies for the workshop shows the prominence of AHM and the interest in this field among various groups working in the country. It is a privilege to welcome all participants at ADA for a fruitful two day workshop on AHM.

डॉ. टेस्सी थॉमस
Dr. Tessy Thomas
विशिष्ट वैज्ञानिक
Distinguished Scientist
महानिदेशक - वैमानिकीय प्रणाली
Director General - Aeronautical Systems

भारत सरकार, रक्षा मंत्रालय
Government of India - Ministry of Defence
रक्षा अनुसंधान तथा विकास संगठन
Defence Research & Development Organisation
एडीई कैम्पस
ADE Campus
न्यू तिप्पसन्द्रा पोस्ट, बेंगलूरु-560 075
New Thippasandra Post, Bengaluru - 560 075

MESSAGE

I am happy to learn that the workshop on Aircraft Health Management with the theme "Prognostics of Aircraft Systems" is being organized jointly by Aeronautical Development Agency (ADA), AeSI and SAEINDIA from 24th – 25 June 2022

I understand that this workshop is specifically focused on Integrated Vehicle Health Management Technologies and Implementation., this is a very relevant topic.

Timely identification and diagnosis of aircraft systems issues improves performance and operational efficiency. The areas of focus identified for this workshop i.e modelling simulation, wireless sensors and AI/ML algorithms etc. become very relevant, in view of the induction of Light Combat Aircraft in service. Diagnostics and prognostics methodologies play an important role in identification of faults much before their occurrence which assists in making maintenance decisions and improving safety and reliability.

I am sure the workshop will assist in in improving the reliability, safety for the existing and next programs of ADA and by providing a forum for professionals to present innovative ideas to enrich the knowledge and find solutions to the challenges in aerospace activities in the country.

I extend my greetings and good wishes to the organizers and the participants.

(Dr. TESSY THOMAS)
DS & DG (AERO)

Delhi Office : Room No. 28 B-wing, DRDO Bhawan, Rajaji, New Delhi-110011
कार्यालय दूरभाष/Office Telephone : + 91 080 2528 3021 / 2251 1402, फैक्स/Fax : 080 2528 3028, 2528 3022
ई-मेल/e-mail : dgaero.hqr@gov.in

Dr. Kota Harinarayana

Former PGD, ADA & Chairman, Design Division, AeSI

IVHM is a promising technology that has profound influence on the way the aircraft is maintained and operated. This technology has also significant impact on the design of the aircraft.

The benefits of IVHM include reduction in cost of maintenance, increase in reliability, safety, performance leading to reduction in cost of operation and increase in availability.

I am glad that Aeronautical Development Agency, Design Division, AeSI and SAE, India have come together to organize this 2day workshop on Aircraft Health Management.

Glad to know that the specialists from academia, R&D institutions, Industry and operators are coming together to share knowledge, address issues related to development of technology elements, understand the challenges faced by operators leading to enhancing maturity of these technologies and incorporation in the new systems and aircraft.

I do believe the participants would be immensely benefited.

I convey my best wishes to organizers and participants.

Shri Ravishankar R Mysore
Chair, SAEINDIA Aerospace Forum

Integrated Vehicle Health Management (IVHM) is one of the key capabilities that will help in reducing maintenance and operational costs of an aircraft substantially, while improving the overall safety. I am happy that Aeronautical Development Agency(ADA), Aeronautical Society of India(AeSI) and SAENDIA have come together to conduct this two-day workshop on aircraft health management with focus on prognostics. Aircraft health management is a multidisciplinary activity bringing together best of mechanical, electrical, electronics, software engineering and data science disciplines. This workshop will help in bringing government and private companies, aerospace OEMs, Tier 1/Tier 2 suppliers, operators to discuss and share the best practices. India is poised for tremendous growth in aerospace sector in both defense and commercial segments.

IVHM will help in accelerating the pace of growth in aerospace industry. SAEINDIA is happy to inform you that AeroCON 2022 an international conference in aerospace held at HAL Management Academy had a dedicated plenary session on IVHM. This workshop will further reinforce and accelerate the knowledge sharing across aerospace professionals which is critical in building the next generation advanced aircraft systems which are smart, connected and intelligent. This will help in improving the overall efficiency across the ecosystem.

I wish ADA and the organizers all the best for the workshop. May this become one of the important milestones for ADA in their journey towards creation of next generation technologies for the country.

Dr. AK Ghosh
Project Director (AMCA),
Aeronautical Development Agency

Integrated Health Management of any aircraft is a crucial requirement of which is aimed at improving the aircraft availability. Diagnostics & Prognostics technologies along with maintainability aspects play an important role while designing each system. Assessment of health, Remaining Useful Life and prediction of faults at component level to system level and at aircraft level are the needs of hour to build an efficient Health Management. This is a multidisciplinary activity and is required to the made available from the beginning of flight test.

This work shop is aimed at creating an awareness to all design teams working in the field of aircraft systems development to dwell upon on these aspects. This type of platforms will create a networking among the working groups for exchange of thoughts and make a way for collaborations for future activities.

I wish the delegates to have a good time at ADA during the workshop with meaningful discussions.

Day 1: JUNE 24, 2022	
Title	**Speaker**
Inauguration	
Session 1 : IVHM for Aircraft Industry, Goals and Roadmap	
Session Chair : Dr. Girish Deodhare, DG ADA	
Inaugural Lecture: Evolution of IVHM from LRU Level to Vehicle & Beyond	Dr. Kota Harinarayana
Tea Break	
Session 2 : IVHM Scenario for Aircraft Industry, requirements and benefits	
Session Chair : Sri S Krishna Kumar, GM ARDC-HAL	
HUMS: Key To Enhance Aircraft Maintainability	Gp Capt Amit Sharma, IAF PMT, ADA
Maintenance Philosophies for Next gen Aircraft	Shri Rammohan V Kaki, QASEG-ADA
Analytics based Asset Maintenance and Monitoring: GE Aviation Experience	Dr. Sundar K, GE
A Platform for Integration, Monitoring and Analytics of Large Systems	Prof Vyas- IIT Kanpur
Lunch Break	
Session 3 : Structural Health Monitoring	
Session Chair : Dr K Vijayaraju, ADA	
Structural Health Monitoring For Aircraft Sub Systems: Past Initiatives And Future Trends	Prof S Gopalakrishnan, IISc
Structural Health Monitoring of Aircraft Composite Structures Using Fiber Optic Sensors: Offline & Online Approach	Shri Nitesh Gupta, ACD, NAL
Non Contact SHM Studies	Prof D Roy Mahapatra, IISC
Tea Break	
Session 4 : Panel Discussion	
Session Chair: Dr. Girish Deodhare, DG ADA	
Diagnostics and Prognostics for Aircraft Systems	AVM KVR Raju VM, IAFPMT, ADA
	Prof S Gopalakrishnan, IISc
	Shri Adishesha S, M/s Collins
	Air Cmde (retd) PK Choudhary, ADA
Snacks Break	
Session 5: IVHM Implementations on Aircraft Platforms	
Session Chair: Dr GVV Ravi Kumar, Infosys	
Smart Sensors and Data Communication for IVHM – Progress & Opportunities	Shri Adishesha S S - Collins
Use of IVHM Systems for Airworthiness Credits	Dr. Ravi Rajamani, FSAE, FIMechE
Diagnostics and Prognostics Efforts for IVHM for Aircraft Systems	Shri Wyatt Pena, Ridgetop Group

Day 2: JUNE 25, 2022	
Session 6 : Monitoring in Engine, Power Generating Equipment	
Session Chair: Sri MZ Siddique- Dir. GTRE	
Title	**Speaker**
Multi-Sensor Information Fusion Framework for Health Monitoring and Diagnosis of Aero Engines	Shri AN Viswanatha Rao, GTRE
Powering the Future of Flight - Next Gen technologies	Shri D Umamaheshwar, GE
Health and Usage Monitoring System for Helicopter Maintenance	Shri Prashant Kumar, MCSRDC, HAL
Tea Break	
Session 7 : Health Monitoring of Aircraft Systems and Interfaces	
Session Chair : Shri. Sankaraiah Mada,TD (GS)	
Model-Based Development of Health Monitoring Functions for Aircraft Hydraulic Systems	Prof. Singaperumal, (Retd) Mech, IIT Madras, Chennai
Integrated Health Management of Landing Gear Systems	Dr GVV Ravi Kumar, Infosys
	Dr ES PadmaKumar, Dy Director, VSSC
Sensors for Health Monitoring: Concerns and Way forward	Prof. MM Nayak – CeNSE, IISc
Lunch Break	
Session 8 : IVHM - Implementation Elements	
Session Chair : Dr AK Ghosh, PD AMCA	
Airplane Health Management	Dr. Seema Chopra, Boeing India
IVHM & Emerging Prognostic Reasoners for Future Systems	Shri Pradeep M, Honeywell
AHM- Implementation aspects and Challenges	Dr. V Sudhakar, ADA
Tea Break	
Session 9 : Panel Discussion	
Session Chair : Dr Kota Harinarayana	
Prognostics: Benefits, Impact on Maintenance for Improvements of Aircraft Availability	Rep, CSDO
	Prof Vyas, IIT Kanpur
	Shri S N Giri, RCMA
	Dr GVV Ravikumar, Infosys
Concluding Session	

Speakers Profile
&
Abstract

Dr. Kota Harinarayana
Chairman, Design Division, AeSI

Title: Evolution of IVHM from LRU level to Vehicle & Beyond

Dr Kota Harinarayana is currently chairman, BOG, IIT(BHU), Chairman, Design Division, AeSI and honorary fellow at CSIR-NAL. He did his bachelor degree in mechanical engineering at IIT(BHU); masters in aeronautical engineering at IISc, Bangalore and PhD at IIT, Bombay. He also holds a bachelor's degree in law from Bangalore University. He was a distinguished Scientist at DRDO during 1995-2003. He was the programme director and chief designer of India's Light Combat Aircraft(Tejas) during 1986-2002. As Rajaramanna fellow at National Aerospace Labs, he initiated work on development of New generation regional passenger aircraft (2005-2010). Earlier he was the Chief designer of Nasik division of HAL during1982-85. He was also Vice chancellor of Hyderabad Central University during 2002-2005. He received number of awards including National Aeronautics prize, Distinguished Alumni award of Indian Institute of Science and IIT, Bombay. He received lifetime achievement award from National Academy of Engineering and DRDO. He was awarded Padmashri by Government of India in the year 2002.

Abstract: IVHM aims to ensure that the aircraft functions as it is intended, without failure, thus increasing the availability of the systems, and reducing the cost and time involved due to unplanned maintenance activities. IVHM aids the use of data from the various systems, not only for the purpose of diagnosis and prognosis that help CBM but also for optimizing the troubleshooting activities. For this purpose, IVHM makes use of emerging technologies in the fields of sensor technology, systems and control engineering, communications technology, and Artificial Intelligence.

However, there is still a lack of health monitoring systems that could function at the vehicle level to detect and isolate faults, that cascade between the systems before it is too late. In order to identify the root cause of a fault that has affected another system and predict its cascading effect, the health monitoring system needs to reason through data from multiple systems in a vehicle, consider the causal relationships of the systems, assign priorities, and resolve conflicts. In short, the IVHM system requires an intelligent reasoning system that could analyse and make decisions regarding any system fault, its root cause and the effect at the vehicle level. The focus of IVHM systems is moving from the LRU level to the vehicle level and further to fleet level. The talk covers some of the key technologies involved in this journey.

Gp Capt Amit Sharma
IAF PMT, ADA

Title: HUMS: Key to Enhance Aircraft Maintainability

Gp Capt Amit Sharma is an Aeronautical Engineer serving with Indian Air Force. He is trained on MiG 23 and Mirage 2000 aircraft and has more than 30 years of experience on aircraft maintenance at operator level as well as Depot level MRO. He is trained on Mirage engine health monitoring and optimization at France and has actively participated in Mirage midlife upgrade project.

Abstract: Integration of HUMS on Aircraft has gradually enabled shifting of aircraft maintenance philosophy from preventive operations based maintenance to predictive interventions. Today, availability of smart sensors and advanced computation provides an opportunity to develop HUMS which computes accurate matrix from big data and triggers conditioned based maintenance. Aim is to take full advantage of airborne electronic systems by implementing sharp interventions and troubleshooting along with onboard fault analysis for minimal downtime.

Shri Rammohan V Kaki

TD (QA & SEG)

Title: Maintenance Philosophies for Next Gen Aircraft

Rammohan V Kaki completed his Bachelor of Engineering (Electrical) from Walch and College of Engineering, Maharashtra. He joined ADA in 1996.

He has principle expertise in conducting System Safety Assessment, Reliability Analysis, Maintainability, Quality Assurance, Airworthiness, FRACAS for Combat Aircraft & its systems and Airworthiness including all weather clearance for indirect effects of lightning for Combat Aircrafts. Additionally, he has initiated number of System Design activities for technology driven projects of Electrical Power Generating & Distribution for Combat aircraft and its associated work centers. He is the Chairman and Member in number of project review and investigation committees for LCA & RUSTUM for ADA & DRDO programs.

He is involved in establishing the process for System Safety Assessment leading to Risk Assessment for Combat aircrafts. He has also established Lightning Protection Plan, Environment Map and Electrical load Analysis for Combat Aircrafts. He has also published a number of papers and presented in many workshops.

Abstract: Reliability and Maintainability are synonymous terms for any Reliability & Safety Engineers and for combat aircraft it is not an exception. Hence for combat aircraft, Design goals have always been aimed to realize a Line Replaceable Units (LRUs) with acceptable level of failures and reliability of the LRUs are based on the MTBF and accordingly the Reliability of the system is ensured for the specified time. In order to ensure the same, Maintenance activities need to be carried on an equipment But with host of experiences in realizing fleets and life cycle cost associated for managing a fleet, which in turn is dependent on operating, maintenance & support cost, MTBF seems to be an unrealistic representation for true behavior for a unit or system in field. Basically MTBF concept assumes the fact that there shall be failures in the system/equipment i.e. failures are evident, which may need mission abort situation or unscheduled maintenance. Hence as part of maintenance requirement, preventive maintenance (Time based) action are carried out to ensure availability of the aircraft. In many of instances the preventive maintenance is on condition based maintenance actions. However, these concepts have their own pros and cons. Pros can be increased longevity of assets, optimized asset performance, avoiding unscheduled maintenance and lesser cost, but leads to cons like additional unplanned expenses and loss on productivity.

In order to steer clear of the Concept of failures (basically MTBF) as a design driver, Reliability & Safety engineers in aerospace industry made a paradigm shift in the way the systems are realized with the concept of Acceptable level of Success. With the envisaged goal of Acceptable level of Success, the following aspects are targeted:
Better availability of a product with better Mission Reliability (Probability of Success)
Minimization of personnel involved in maintenance activities
Minimization of equipment involved in maintenance activities i.e. minimum logistic footprint.

Lastly, but not the least, minimizing the expenditure for realization of fleet.

In order to realize above earmarked goals, the concept of 'Maintenance Free Operating Period (MFOP)' by Aeronautical Engineers. It is a period where no emergency or unscheduled maintenance is needed. It needs to be noted that the failure of missions are not allowed during this period, thus preventing major unscheduled maintenance activities. However, Turn around Servicing (TRS) is allowed viz. refueling, rearming and critical safety related checks can be carried out during this period. Thus, MFOP allows preventive maintenance rather than corrective maintenance to achieve a mission.

Preventive maintenance allows set of activities including scheduled maintenance and routine checks that need to be carried out to achieve Failure Free Operation (FFO). Hence, each MFOP is followed by a Maintenance Recovery Period (MRP) in which preventive maintenance, scheduled maintenance and routine checks can be carried out. The purpose of an MRP after each MFOP is to ensure that the system is recovered to complete the subsequent MFOP cycle.

Dr. Sundar K
Consulting Engineer, GE Aviation

Title: Analytics Based Asset Maintenance and Monitoring: GE Aviation Experience

Sundar Krishnaswami is a consulting engineer at GE Aviation. He has been with GE Aviation since 2000. Sundar is a certified Six Sigma black belt, and in his role as a black belt, Sundar has conducted several waves of Six Sigma Green belt as well as Black Belt training programs. In his current role, Sundar has been engaged in adopting data sciences and analytics for supporting the fielded products and has been a contributor to the development of some of the analytics for hot section components. Sundar is the Chair of "Data Science and Applied Statistics" competency for GE Aviation. Sundar is actively engaged in expanding the application of data science methods in supporting MRO and supply chain operations. Sundar has a Ph.D. in combustion and propulsion, has over 10 peer reviewed journal publications, a trade secret to his name and is a senior member of AIAA.

Abstract: This talk will focus on how AI/ML approaches are being used at GE aviation to support commercial fleet. The talk will trace the GE journey in this area and describe the need for digital innovation, importance of sources of variation, putting various streams of data together to derive insights, the importance of infrastructure for driving large scale analytic deployment and will close with some of the lessons learned by GE thru this journey

Prof. Nalinaksh S. Vyas
IIT-Kanpur

Title: A Platform for Integration, Monitoring, and Analytics of Large Systems

Nalinaksh S. Vyas has a Ph.D. (Mechanical Engg.,1986, Indian Institute of Technology Delhi), M.Tech. (Mechanical Engg.,1983, Indian Institute of Technology Delhi) and B.Tech. (Mechanical Engg., 1980, Indian Institute of Technology Bombay), and has been a Faculty Member at the Indian Institute of Technology Kanpur (Department of Mechanical Engineering), since 1987. He also functioned as the Chairman of the Technology Mission for Indian Railways, for the Government of India, till April 2022. The major areas of activities in this role has included implementation of Industry 4.0 protocols for rail coach design and manufacturing, on-board diagnostic capabilities in rolling stock and Deep Learning technologies for rail asset management. At IIT Kanpur, he has been the Head of Mechanical Engineering Department, Nuclear Engineering Department, Centre for Mechatronics and the Innovation Laboratory. He has also been a Visiting Professor at Virginia Tech, USA; INSA Lyon, France; Lulea University Sweden and National Chung Cheng University, Taiwan. He served as the Vice Chancellor of Rajasthan Technical University between 2013-15. His research interests lie in Machine Dynamics, Nonlinear Parameter Estimation, Instrumentation and Integrated Health Monitoring of Machinery and AI / ML applications in Smart Infrastructure domains. He has supervised fifteen Ph.D. and ninety M.Tech. theses and has more than hundred research publications to his credit. He has executed major projects for organisations like the Aeronautical Research & Development Board, Department of Science & Technology, Indian Space Research Organisation, Ministry of Railways, TATA Consultancy Services, Larson & Toubro, Scooters India, Hindustan Aeronautics Limited, Gas Turbine Research Establishment, among others. He has been the National Coordinator for an earlier Technology Mission on Railway Safety, Govt of India; Chairman, Automotive Parc, National Program on Smart Matls& Structures, Govt of India; Project Coordinator, Nano-Satellite, JUGNU Project with ISRO; Consortium Leader, Automotive Electronic Stability Program, Core Group on Automotive Research; Member, Expert Task Force on IVHM of LCA (Light Combat Aircraft); Editor, ISSS Journal (International Society of Smart Systems); Editor, Advances in Vibration Engineering; Member, Indo-US Task Force on Embedded Systems; Founding Director, International Society on Asset Management, Australia. He has also been on the Board of Governors of IIT Jodhpur and on the Executive Council of the All India Council for Technical Education.

Abstract: Monitoring and management of Large Systems present multiple challenges in connecting Operational Technology (OT) with Information Technology (IT). There is critical need for development of need-based, unified platform which enables plug-and-play of various hardware protocols and data acquisition in a form that can be readily processed for developing analytical codes. Large Systems comprise several sub-systems, each with various individual components. While condition monitoring activity at individual component level has been quite vigorous through model based, data driven and hybrid techniques, challenges posed at the sub-system level and the system level increase exponentially, both in terms of hardware complexity and the enormity of data collected by sensors. This talk will focus on a recent experience of developing an indigenous Industry 4.0 platform for manufacturing in a large public sector unit. An IT-OT integration platform that enables secure system interoperability by unifying and structuring disparate and multiple IT and OT data sources into a single and common format, will be discussed. Discussion will include data exchange features for data to flow from field networks to data centres where it can be fully exploited by combining, synchronising and organising multiple-source data and pushing via support of necessary APIs and communication protocols, both on IT and OT sides. For a large engineering system, condition monitoring in a highly integrated way requires integrated analytical tools to handle big data which is intense, unstructured, uncertain and with hidden relationships. Possibilities of developing a Deep Learning Software Paradigm of extensive highly interconnected complex processes of input-output mappings foreknowledge extraction and decision making for diagnosis and possible prognosis will be further discussed.

Dr. S Gopalakrishnan

Dept of Aerospace Engineering, IISc

Title: Structural Health Monitoring for Aircraft Sub Systems: Past Initiatives and Future Trends

Prof. Gopalakrishnan received his BE degree from UVCE, Bangalore, Master's Degree in Engineering Mechanics from Indian Institute of Technology, Madras, Chennai and Ph.D. from School of Aeronautics and Astronautics from Purdue University, USA in the year December 1992. Before proceeding for USA for his doctoral studies, Prof. Gopalakrishnan briefly worked at NAL Bangalore in the Structures Division. After his Ph.D. he was a Postdoctoral Fellow in the department of Mechanical Engineering at Georgia Institute of Technology. In the year November 1997, he joined the Department of Aerospace Engineering at Indian Institute of Science Bangalore, where currently he is a Senior Professor. His main areas of interest are Wave Propagation in complex media, Computational Material Science, Computational Mechanics, Smart Structures, Structural Health Monitoring, MEMS and Nano Composite Structures. He is a proud alumnus of Vijaya High School, where he graduated in the year 1976.

Prof. Gopalakrishnan has extensively published his work on many top-rated international journals. He has a total of 218 international journal papers, 6 graduate level textbooks, two undergraduate books, 13 book chapters, and 160 international conference papers. He has an h-index of 51 in Google scholar with nearly 9200 citations, which is highest in India for any researchers in Aerospace domain. He is in the editorial board of 6 international journals and is the Associate editor for Smart Materials and Structures and Structural Health Monitoring international journals. Prof. Gopalakrishnan is decorated with many awards and honors, which include, International Structural Health Monitoring person of the year awards 2016 instituted by SAGE Publications, Fellow of Indian National Academy of Engineering, Fellow of Indian Academy of Sciences, Associate Fellows AIAA, Distinguished Alumnus Award, Indian Institute of Technology, Madras, Chennai, Satish Dhawan Young Scientist Award by Government of Karnataka, Biren Roy Trust award of Aeronautical society of India, Alumni Award of excellence in research at IISc in the year 2013 and the Royal Academy of Engineering, UK Distinguished visiting Fellowship. Recently He was elected Fellow of Institute of Mechanical Engineers, UK.

Prof. Gopalakrishnan is one of the highly cited Aerospace researchers in the country. His notable contribution is in popularizing Spectral Finite Element as an analysis tool for wave propagation in complex media and wave propagation-based modeling tool for Structural Health Monitoring. In the years 2020 and 2021, he made it to the list of top 2% of scientists in the world published by Stanford University, USA. Prof. Gopalakrishnan was the head of the Aerospace Project assessment and Review Committee of the National Programme of Micro and Smart Systems (NPMASS), DRDO, Government of India, where he was responsible for delivering many micro devices required for many aircraft/spacecraft and missile platform of the country. He was also a member of the Structures panel of the Aeronautical Research & Development Board, Government of India, and the President of Institute for Smart Structures and Systems. He was the member of NAL Research Council between2013-2015. He has attracted research funding to the tune of 10 Million US dollars from top Aerospace Companies, which include Being Aircraft Company, Pratt & Whitney Corporation, USA, Office of Naval Research, USA, Airforce office for Advanced Research, Tokyo, and the Aeronautical Research and Development Board. Within the IISc, he has held various administrative positions. He was the Chair of Department of Aerospace Engineering (2015-2019), Associate Chairman for Center for Scientific and industrial Consultancy and was the founder Chairman of Intellectual Property cell. He was also a Resource Executive at Society for Innovation and Development (2003-2018) and currently, he is the convener for the Pratt & Whitney Center at IISc. He has guided 27 Ph.D's, 7 M.Tech (Research) and 23 M.E students.

Abstract: Structural Health Monitoring (SHM) has become one of the essential features to be incorporated in design of any future generation aircrafts. Future generation aircrafts will be lean and green designed with lower design margins with advanced sensor instrumentation for continuous monitoring features over a long period of time. Over the years, SHM has undergone a sea change in its implementation due to challenges faced both by designers as well as researchers in tackling huge number of uncertainties such as sensor placements, sensor measurements, sensor integrity, environmental conditions etc. to name a few. Previously, most of the SHM systems in aircrafts was limited to damage diagnosis and prognosis and this did not yield desired results in terms of repeatability since the SHM approaches were based on physics-based models coupled with measured experimental results, cannot handle all the uncertainties associated with measured signals. This is one of the reasons why an on-line SHM in aircrafts is still not in place in aircrafts. The current trend is to move towards data-driven approaches for SHM, wherein use Artificial Intelligence techniques such as Deep and Machine Learning approaches for both diagnosis and prognosis. Hence, I will present my talk in two parts. The first part will outline the previous initiatives taken by DRDO through NPMASS program and the second part will outline how data drive approaches based on Machine and Deep learning can be implemented in the context of aircraft subsystems.

Shri Nitesh Gupta

Head, Advanced Composites Division, CSIR-NAL

Title: Structural Health Monitoring of Aircraft Composite Structures Using Fiber Optic Sensors: Offline & Online Approach

Nitesh Gupta completed his B.Sc. (Electronics) Honors from Nagpur University and M.Sc. (Electronics) Honors and M.Tech. (Instrumentation) from Devi Ahilya University, Indore, MP. He joined CSIR-NAL in 2001 and presently working as Senior Principal Scientist at Advanced Composites Division of CSIR-NAL. He is involved in the Research and Technology development for Structural Health Monitoring using fiber optic sensors & Image processing. He has received a number of awards and accolades which include: CSIR-NAL's Excellence Award, 7th National Awards for Technology Innovation in Petrochemicals & Downstream Plastics Processing Industry, National Instruments (NI) Engineering Impact Award, Top 30 finalists in India Innovation Growth Programme (IIGP) and many more.

He has published over 20+ journals, 40+ conference/ workshop related papers and guided more than 15 batches of BTech & MTech Project Students.

Abstract: Composite materials have been in use for aerospace applications for more than two decades these materials exhibit the unique properties of high strength-to-weight ratio, high stiffness and corrosion resistance. Aircraft and spacecraft are typically weight sensitive and hence composite materials are well suited for these applications. Damage tolerant and fail-safe design of aerospace structures requires a substantial amount of inspection and maintenance adding significant amounts to their lifecycle cost. To detect and repair various structural damages that can occur during the service life of the aircraft, a thorough inspection schedule is implemented through conventional visual and Non-Destructive Evaluation (NDE) methods. Such scheduled inspections lead to considerable increase in maintenance cost & down-time of the aircraft. The lifecycle cost of aircraft and aerospace structures can be reduced significantly if continuous and autonomous condition based structural health monitoring (SHM) systems can be integrated into their design.

A structural health monitoring (SHM) system consisting of well-designed sensor networks incorporated in the structure along with necessary hardware and software can provide information about the health and usage of the structure, thereby leading to reporting of flaws or damages.

Presentation will discuss about the Fiber Bragg Grating (FBG) based online and Distributed Fiber Optic Sensors (DFOS) based offline approach of SHM system being developed at Advanced Composites Division of CSIR-NAL. Various aspects of fiber optic sensor technologies, their instrumentation and real time implementation challenges and few case studies will also be presented.

Shri Adishesha Sivaramasastry
Technical Fellow, Director -Technology & Innovation
Collins Aerospace

Title: Smart Sensors and Data Communication for IVHM – Progress & Opportunities

Adishesha (Adi) is a Technical Fellow in Collins Aerospace, a subsidiary of Raytheon Technologies. At present he is responsible for deploying Systems Engineering processes & practices, development of advanced technologies and driving Innovation across Global Engineering & Technology Centers. He has made significant contributions to development of Aircraft Sensors and Connectivity Solutions.

Over 30 years in the industry Adishesha has contributed to the country's most prestigious missions of ISRO and DRDO in the capacities of System Manager, Deputy Project Director, and Deputy Mission Director before he switched over to the businesses in Philips and Honeywell.

Adishesha holds a Bachelors in Instrumentation from Bangalore University and Masters in Electronics & Controls from BITS, Pilani (On campus program). He is a Senior Member of IEEE, Fellow of Institute of Engineers (India), Member of RTCA & SAE Standards Committees and Reviewer for IEEE, PED & SAE International Journals. He has 24 patents, 2 Trade Secrets and 20 publications.

He is recognized with several awards for technical leadership, Product development and Innovation, including – DRDO award for Path breaking Research & Technology Development given away by Prime Minister of India.

His current interests include introducing new age technologies like Smart sensors, AI/ML, Data Analytics and Wireless communication for real time monitoring and prediction of Aircraft health, leading to IVHM.

Dr. Ravi Rajamani
PhD, FSAE, FIMechE

Title: Use of IVHM Systems for Airworthiness Credits

Ravi Rajamani is an independent consultant working on applying model-based and data analytical solution techniques to complex engineering system problems. He has published six books including Unsettled Issues Concerning Maintenance Credits and IVHM Systems and Condition-Based Maintenance in Aviation: The History, The Business and The Technology. In addition, Ravi is the author of many book chapters, journal papers, conference proceedings, and patents. Prior to his current job, Ravi worked at Meggitt, UTC and GE. He has a PhD from University of Minnesota, an MBA from University of Connecticut, an MSc from IISc, Bangalore, and a BTech from IIT, Delhi. He is active within various SAE standards-setting technical committees and serves as the chair of the IVHM steering group. He is the current Editor in Chief of the SAE International Journal of Aerospace and is part of the editorial board of two other journals. He is a visiting research professor at the University of Connecticut, and has been elected a fellow of SAE and of IMechE.

Abstract: The IVHM community (through SAE and MPIG) is developing standards for achieving airworthiness credit using health management functions in a consistent way. We are working on two major standards (ARP5987 / ARP7122) which will complement MSG guidance (MSG-3/IP-180) for getting regulatory approvals for IVHM functions. We will briefly discuss the history of IVHM standards, what we are doing today, and what the future of IVHM certification looks like.

Shri Wyatt Pena
Director of Operations,
Ridgetop Group

Title: Diagnostics and Prognostics Efforts for IVHM for Aircraft Systems

Wyatt Pena is the Director of Operations at Ridgetop Group and has been with the company for approximately 6+ years. By utilizing his strong background in systems engineering and project management, Wyatt oversees day-to-day operations to ensure that engineering and business development activities are in direct alignment with the interest of Ridgetop's customers, shareholders, and overall company mission. Wyatt has played a key role in managing all aspects of product design, development, and deployment of multifaceted Ridgetop solutions comprising hardware, firmware, and software elements. Wyatt has most recently been leading the transition of Ridgetop IP to commercial products and solutions that are being utilized around the globe. Prior to becoming the Director of Operations, Wyatt has served as a Project Manager, Systems Engineer, and Test Engineer on numerous government and commercial contracts. Other core strengths include an in-depth understanding in engineering management, cost estimation, supply chain management, as well as prototype design and manufacturing of CBM, PHM, and IVHM solutions.

Abstract: Physics of failure analysis, advanced diagnostics, predictive analytics are essential elements of IVHM and modular PHM frameworks can be used to develop a customized prognostic solution. Solutions aim to increase safety, efficiency, and operational performance while also reducing maintenance and sustainment costs with the most innovative products and technology for aerospace, defense, transportation, energy, and industrial applications. This presentation from Ridgetop presents case studies related to power supply prognostics, electro-mechanical actuators, gearbox systems, composite structures, battery management systems, and several other key systems deployed in critical equipment and vehicles.

Shri A N Viswanatha Rao

Associate Director (Controls & Instrumentation)

Project Director (FADEC)

Gas Turbine Research Establishment

Title: Multi-Sensor Information Fusion Framework for Health Monitoring and Diagnosis of Aero Engines

A N Viswanatha Rao completed his B.E in Electronics from Bangalore University and ME in Aerospace Engineering from Indian Institute of Science. He is working on the aero engine control system development for the past 20 years at various levels. His research areas include Embedded Systems (System Architecture and Integration), Engine control and operability, Engine health monitoring systems, Engine flutter diagnosis and indicating systems. He has received Agni award from DRDO, RAC medal from DRDO and Science day oration medal. He has more than 30 publications in national and international journals.

Abstract: The propulsion system of an aircraft is not only the flight critical system but also one of the complex systems encompassing various disciplines of science and technology. Gas turbine aero engines are a specific class of turbo machinery wherein compression system and turbine are realized as spinning discs on an interconnecting shaft. The health of the propulsion system is of paramount importance and is handled by a combination of on-board and ground-based engine health and usage monitoring systems.

As a part of this short talk, various sensors used for health management and their information fusion framework for detection of various engine faults would be presented. Five different types of health monitoring sensors i.e. Casing vibration, casing wall static high bandwidth pressure sensors, rotational blade stain gauge instrumentation with slip ring, blade tip timing non-contact blade vibration sensors and casing to blade tip clearance sensors have been used to assess the developmental aero engine health status. The frame work which employs feature extraction, data fusion methodologies have been developed and would be discussed.

In the conclusion the talk proposes an engine developmental testing approach which has extensive instrumentation to start with and progressively reduce it by suitable information fusion methodologies so that only the casing mounted vibration sensors alone are sufficient to detect and quantify various engine faults during engine operational phase of engines.

Shri Uma Maheshwar

Chief Consulting Engineer, GE Aviation

Title: Powering the Future Flight –Next Generation Technologies

Uma Maheshwar is the Chief Consulting Engineer for 700+ members GE Aviation India engineering team at Bangalore. The team is involved in the design & development of next generation propulsion systems, support of aircraft engine fleet and development of customized digital and engineering software. Uma has 30 years of experience in setting up & leading large organizations in Engineering, Research & Development Sector.

Uma joined GE Aviation in 2001 and since then held many leadership positions in Aviation Engineering. He was instrumental in setting up & leading 200+ member world-class Advanced Technology teams at Bangalore for GE Aviation. Uma played key role in design & development of 7 new aircraft engine programs covering full life cycle Engineering.

Prior to GE, Uma held positions with Larsen & Toubro (L&T) for 8 Years. During his association with L&T, Uma lead engineering of 25 mega plants for Oil& Gas, Fertilizer, Power, Petro-chemical, Defense, Nuclear sectors involving design, manufacturing, and commissioning.Uma has set up and lead Advanced Design & CAE team at L&T's largest manufacturing plant-Hazira works. He was one of the Management Representative to set up Engineering Services Company for L&T.

Uma holds Aerospace MBA from Toulouse Business School-France and M.E in Mechanical Engineering. He has presented papers/publications/keynote sessions in 200+ National & International conferences. Uma was recognized with many awards and is a member of Global ASME Committee, SAEINDIA Aerospace Board, NAFEMS India Board, NASSCOM Engineering, R&D Council, Aerospace Skill Council, and industry bodies and academic boards.

Abstract: GE Aviation is a world-leading provider of commercial, military and business, and general aviation jet and turboprop engines and components as well as avionics, electrical power and mechanical systems for aircraft. GE has a global service network to support these offerings. GE and its customers are also working together to unlock new opportunities to grow and deliver more productivity beyond traditional services. GE Aviation is becoming a digital industrial business with its ability to harness large streams of data that are providing incredible insights and in turn, real operational value for customers.

Nearly 75 years ago, GE introduced the country's first jet engine and brought America's aviation industry into the jet age. Then, we developed an entire family of fuel-efficient turbofan engines, accumulating more flight hours than any other commercial aircraft engine in history. Now, GE Aviation Commercial is continuing to build on that legacy with next-generation commercial engines, innovative flight efficiency systems and a dedicated worldwide services network.
With more than 40,000 commercial engines in service, GE Aviation powers some of the world's leading commercial airframes. And with a $1B annual investment in research and development, GE continues to deliver best-in-class performance, reliability and cost of ownership with every engine.

GE Aviation is developing products and services to make commercial aviation smarter, simpler and more efficient. From advanced avionics to Flight Efficiency Analytics, GE Aviation's commercial systems offerings are taking operational efficiencies to a new level.

For nearly six decades, GE Aviation has been helping commercial aircraft operators keep their fleet at peak performance and revenue generation. Offerings include a global technical support network and maintenance services backed by industry-leading performance guarantees and turn times.

The invited lecture covers the state of art technologies and products which is propelling aviation industry for today and future.

Shri Prashant Kumar
MCSRDC, HAL

Title: Health and Usage Monitoring System for Helicopter Maintenance

Mr. Prashant Kumar completed his B.Tech in Electronics and Communications from NIT Allahabad in 2008 and pursuing M.Tech. in Software Systems from BITS, Pilani. He is working as Senior Manager (Design) in the MCSRDC division of Hindustan Aeronautics Limited. He has worked for various Design & Development Projects for fixed and rotary wing platforms such as Jaguar DARIN-III Upgrade, Mirage-2000 upgrade and LCH. He is primarily involved in the design and development of navigation and guidance algorithms, Sensor integration and sensor fusion. Currently, he is working in the field of Artificial intelligence based Automatic Target Recognition and Prognosis for the health of helicopter critical components.

Abstract: Maintenance of Helicopter components is carried out based on Fixed Time before Overhaul (TBO) irrespective of the condition of components. This causes increase in helicopter down time&spares for inventory and finally higher maintenance cost. To overcome these issues, Health and Usage Monitoring System (HUMS) for Helicopter Maintenance has been developed which facilitates Condition Based Maintenance (CBM) instead of Fixed Time before Overhaul (TBO) based maintenance. It results in reduced helicopter downtime, enhanced fleet availability and safety.

The system uses helicopter on board recorded vibration data and processes it to compute various Condition Indicators (CIs) such as FM4, SI, SLF, Kurtosis etc. for its critical components such as Gear, Bearing and Shaft.

These Condition Indicators (CIs) are then processed and ranked based on their sensitivity towards the degradation in the critical components. The relevant CIs are then used by the Artificial Intelligence based algorithm to compute the Remaining Useful Life of critical components.

Prof. M. Singaperumal
Professor Emeritus (Retired)
Indian Institute of Technology Madras

Title: Model-Based Development of Health Monitoring Functions for Aircraft Hydraulic Systems

Dr. M. Singaperumal, Retired as Professor – Emeritus from the Department of Mechanical Engineering, Indian Institute of Technology Madras, after serving for more than four decades.

After his graduation in Mechanical Engineering from Bangalore University in the year 1966, he obtained his M. Tech degree in Machine Design in 1969 and Ph.D. in 1986 for his work in the field of Micro hydraulics both from IIT Madras.

Prior to joining IIT Madras in 1972, he worked for about three years at the Electronics and Radar Development Establishment, Ministry of Defence, Bangalore. His responsibilities included Mechanical integrity testing of defence electronic equipment under simulated service environment for improving their reliability of operation.

Prof. Singaperumal has made significant contributions in the areas of Precision Engineering, Instrumentation and Control, Fluid Power, Mechatronics and System Simulation. He has guided a large number of Research and Masters Theses. 3 Patents have been filed jointly with DRDO. Prof. Singaperumal has also published over 150 technical papers in International Journals and Conferences of repute.

Prof. Singaperumal was awarded the German Academic Exchange Fellowship through the Government of India for research work at Technical University, Hannover. Subsequently, he has been extended re-invitation fellowships for research work at various German Universities. He was also awarded scholarships by Musashi University, Japan and the Japan Fluid Power Systems Society.

Prof. Singaperumal has executed many Consultancy and Sponsored Research Projects. His contributions to projects pertaining to indigenization efforts of Defence, Missile Program, Space and Technology Development Mission Programs have been significant. His innovative ideas and advice have helped RCI to successfully carry out technology demonstration and Production of Aerospace qualified Electro Hydraulic Servo Valves of Flapper Nozzle and Jet Pipe Designs to meet mission requirements. He continues to be on several review committees of DRDO projects.

Prof. Singaperumal has served as Dean Administration - IIT Madras, Director - Tamilnadu Small Industries Corporation; Chairman – Robotics Sectional Committee, Bureau of Indian

Standards; Member – Technical Advisory Committee, Fluid Control Research Institute; and Member – Board of Governors, NIT Trichy. Currently, he is serving as a member on the Fluid Power Systems Sectional Committee PGD 36, Bureau of Indian Standards.

Abstract: A model-based health monitoring of the components is desirable to prevent costly operation interruptions of aircraft. This presentation will focus the application of Bond Graph models of system components to derive their behaviour at considered fault modes with several extents. Based on the model, how sensibility of system states to faults can be analyzed and conclusions on the optimal placement of sensors obtained.

The method allows finding an optimal set of sensors that enables the detection and isolation of system component faults. The system model is used further for the creation of a simplified steady-state nominal model, which is required for feature generation. Based on these features, fault detection and isolation as well as diagnosis of the actual fault extent can be predicted.

Some examples of faults in Hydraulic components and their implementation in the Bond Graph is discussed.

Dr. Ravi Kumar G.V.V

Associate Vice President and Head Advanced Engineering Group,
Infosys Limited, Bangalore

Title: Integrated Health Management of Landing Gear Systems

Dr. Ravi Kumar G.V.V is Associate Vice President and Head Advanced Engineering Group (AEG) of Engineering Services, Infosys. He has led numerous innovation and applied research projects over the past 20 years. His areas of expertise include mechanical structures and systems, knowledge-based engineering, composites, artificial intelligence, robotics, autonomous systems, AR, VR and Industry 4.0. He is involved in the development of commercial products like AUTOLAY (CADDS-COMPOSITES), Nia Knowledge - a knowledge-based engineering platform and KRTI 4.0 - an operational excellence framework. He contributed to many Industry 4.0 implementation projects and played a key role in the development of Industry 4.0 maturity index under the umbrella of Catechu, Germany. He is involved in design and development of advanced robotics and autonomous systems including India's first autonomous golf cart. He is a member of the HM-1 and Chair of G-31 technical committee of SAE International contributed to aerospace standards development. Dr. Ravi Kumar has published over fifty technical papers, five patents - two granted and three filed. He has a Ph.D. and an M.Tech in Applied Mechanics from IIT Delhi, and a BE (Honors) from BITS Pilani, India. He won many awards including James M. Crawford Executive Standards Committee outstanding achievement award from SAE International and Corporate Excellence Award from American Society of Engineers of Indian Origin.

Abstract: Integrated aircraft health management is one of the key capabilities that will help in reducing both maintenance and operational costs of an aircraft, while improving the overall safety. Aircraft health management requires a multi-disciplinary approach bringing together the best of mechanical engineering, sensor technologies, communication, and data analytics. Aircraft landing gear is one of the most critical systems in an aircraft which requires the substantial maintenance effort, next only to the propulsion system. The talk aims to presents integrated health management aspects of a landing gear system for a typical transport aircraft. It provides an end-to-end perspective of landing gear health management from failure modes, sensors, connectivity, data capture, diagnostics, and prognostics. Some of the best practices in implementing the landing gear health management through smart faults trees will also be discussed.

Dr. M. M. Nayak
Emeritus Professor, Centre for Nano Science and Engineering,
IISc, Bangalore

Title: Sensors for Health Monitoring: Concerns and Way forward

Manjunatha Nayak received D.IISc. and Ph.D.(Engg) degrees in Electronic Design Technology and Instrumentation respectively from IISc Bangalore prior to his Bachelor's degree in Electrical Engineering from BMS College of Engineering Bangalore. He was awarded the Ph.D. degree of IISc for his thesis on "Sputtered Thin Film Strain Gauges & Pressure Transducer" in the year 1994. Subsequently, he carried out his Post-doctoral research in the area of MEMS at University of DELFT & TWENTE – Netherlands under INSA Invitation fellowship programme, and at Toyohashi University of Technology, Japan under JSPS fellowship. He served in ISRO, Dept. of Space for nearly 40 years since 1971 in various capacities and held dual positions as Deputy Director, Semi-Conductor Laboratory, Chandigarh and Director, Launch Vehicle Programme Office, ISRO HQ Bangalore. During his service at ISRO, he has developed and productionised space qualified pressure, temperature, level and depletion sensors for PSLV, GSLV, gsLV M3, IRS, INSAT and Chandrayaan missions. In recognition of his outstanding contributions to ISRO's programmatic activities, he was awarded ISRO MERIT Award in 2008. He has also received several other awards for his academic excellence. He has more than 101 publications in refereed international journals, 9 patents and guided 10 Research students. Superannuated from ISRO in June 2011, currently he is an Emeritus Professor at the Centre for Nano Science and Engineering, IISc, Bangalore, further pursuing his research activities in MEMS and Sensors for strategic, aerospace and biomedical applications.

Abstract: Sensors play a key role in Health monitoring as the sensing at identified location provides the way to determine the state of that system using the algorithms. The sensor characteristics that are key in health monitoring such as reliability, accuracy, calibration which are ensured by the design and development of a sensor are explained through a MEMS pressure sensor example, will be presented. Wireless sensors and sensors required for harsh environments like high / low temperatures like Engine, Brakes, and tires are the requirements for the future. Intelligent sensors with derived outputs, indicating the possible causes, and sources in case of unhealthy signatures shall be the requirement of future technologies which are key inputs for the IVHM technologies. Sensors with high sample rates, self-health assessment, auto calibration will be discussed.

Dr. Seema Chopra
Boeing India

Title: Airplane Health Management

Dr Seema Chopra is a Chief Data Scientist / Technical Fellow at Boeing Research and Technology, India. She has recognized as the part of Boeing Technical Fellowship and became Boeing India's first 'Technical Fellow' for Artificial Intelligence and the first one outside US. Seema has 17 patents, 8 trade secrets and, over 35 publications in various International / National Journals and conferences, to her name and authored a book chapter on smart manufacturing using AI. She has been recognized by several awards for her leadership and technical expertise including 2021 Safety & quality award & Technical replication Innovation award, 2021 IEEE TEMS Women Achiever Award, BDS Global Team of the year award, 2019 IEEE Women in Engineering Achiever Award, PHM Expertise award from President & CEO, GE Power Gen Services and GE Impact award from CEO of GE, for volunteering on Mid-Day meal. She was listed as one of top 51 Indian Women Achiever and her contributions to STEM are published in e-Book on "Indian Women in STEM " by CII Tamil Nadu Technology Development & Promotion Centre (TNTDPC).

Prior to this role, she was with GE as a PHM (Prognostic Health Management) Technical Leader and was involved in design and developing prognostic health management technologies to enable strategic growth for Condition Based Maintenance for Gas turbines. She is certified Black belt - DFSS Lean Six Sigma, senior member &Exco Member of IEEE. Seema earned her doctorate degree in Control engineering from IIT Roorkee, India and the focused area was to design Fuzzy Controller with Intelligent Design Approaches with reduced rule set.

Abstract: This talk will focus on Boeing Airplane Health Management (AHM) capabilities using data analytics. AHM is a decision support tool to make faster and data driven maintenance decisions. This technology can improve repair efficiency and reduce occurrences of unscheduled aircraft maintenance. Unscheduled maintenance occurs due to unexpected incipient or known faults. These faults can cause flight delays and cancellations which increases operational costs to airlines. In this presentation, we will also discuss about opportunities using AI/ML, big data, Cloud and path going forward for next generation AHM technologies.

Shri Pradeep Mahalingaiah
Honeywell Technology Solutions Lab Pvt Ltd

Title: IVHM & Emerging Prognostic Reasoners for Future Systems

Pradeep Mahalingaiah is currently working as Sr. Systems Engineering Manager at Honeywell Technology Solutions Lab Pvt Ltd. He is a Masters in Avionics graduate, published technical papers in international editions and holds six patent grants in the area of IVHM. He has significant experience on IVHM technology and has developed systems and software solutions for several of platforms.

ABSTRACT: The evolution of IVHM @ Honeywell in aviation has spanned several generations and aircraft types. Honeywell IVHM systems have been successfully designed, developed and deployed in vehicles of Air Transport, Business, Regional and General Aviation, Military and Automotive segments. Aircraft Health Management encompasses set of activities that are performed in order to identify, predict / mitigate and resolve faults with the vehicle. While these can be performed manually, Integrated Vehicle Health Management (IVHM) System provides an opportunity to augment the activities using automated systems. Honeywell Diagnostic reasoners built and deployed on several platforms have resulted with huge maintenance cost reduction for customers. Newer technologies such as AI/ML, Digital Twin are being leveraged towards conceptualizing efficient Prognostics reasoners. This talk will cover the definition and evolution of Honeywell IVHM systems for varied platforms with special emphasis on Diagnostics and Prognostics.

Dr V Sudhakar

GD (HUMS) & Dy Head (IVHM)

Aeronautical Development Agency, Bangalore

Title: AHM-Implementation Aspects and Challenges

V Sudhakar, PhD from Aerospace Dept, Indian Institute of Science (IISc), Bangalore, carried out the research in the area of wave propagation studies of sandwich structures.

He is presently working as Sc/Er 'G' in Airframe Directorate at Aeronautical Development Agency, Bangalore. He worked for the development of Health and Usage Monitoring System (HUMS) for LCA Tejas and presently, working for the development of Aircraft health Management technologies for LCA AF Mk2 and AMCA.

Abstract: Aircraft availability is one of the essential parameters for both civil and military aircraft for achieving the desired design goals. Aircraft Industry has been working towards avoiding the faults, thereby reducing unanticipated maintenance efforts and also moving from scheduled maintenance to condition based maintenance. Integrated Vehicle Health Monitoring (IVHM) technologies provided the solution to aircraft industry through Diagnostic assessment and Prognostic predictions with preventive & predictive maintenance and estimating Remaining Useful Life (RUL) as the resulting outcomes.

All Aircraft Industries have started to adopt IVHM technologies and concerted efforts involving data generation for such technologies are in progress. Design methods, Modelling & Simulations studies, Test Rigs and Data analysis techniques along with development of algorithms for processing the acquired data for health assessments are essential elements of Prognostic technologies.

Maintenance is the crucial, costliest phase of the aircraft life cycle and AHM solutions have been promising. Elements of AHM technology for implementing on aircraft will be discussed in the presentation highlighting a paradigm change in maintenance aspects and some of the technical challenges.

SAEINDIA
Society of Automotive Engineers INDIA

No 1/17 Ceebros Arcade,
3rd Cross, Kasturba Nagar,
Adyar, Chennai - 600 020.
+91 44 4215 2280

Reach Us

www.saeindia.org