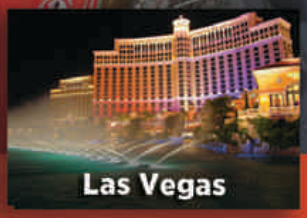
Shared Horizons

U.S. - India Aviation Cooperation Program : " A Win - Win Partnership"

Inside

Special Issue -Volume 13 - July - March 2018

Train in the USA, Fix Jets Worldwide



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Message from the Co-chairs

We are pleased to present to you the July 2017 – March 2018 issue of "Shared Horizons".

The highlights of the period were AIM's "Award Dinner" in partnership with ACP, our celebrations of "Diwali Nite" and ACP's "10 years anniversary partnership". This period also achieved a new sub - committee on Aviation and Aerospace Skills Development and grant signing ceremony of a Sustainability Master plan for Kolkata and Lucknow Airports.

On August 31, ACP's "Innovation in Aviation" workshop with MOCA allowed for open discussion on existing and proposed projects that provide training and technical expertise in close cooperation with MOCA, DGCA, AAI and BCAS.

We are very excited to welcome the latest new member to the ACP, Astrophysics Inc.

The ACP looks forward to discussing, designing, implementing and delivering additional civil aviation projects in 2018, as India makes its transition from legacy platforms to futuristic aviation systems and takes its place as a leader in the civil aviation sector.

The U.S. – India Aviation Summit is now around the corner. The ACP looks forward to further strengthening the relationship between the U.S. and India during this event scheduled for May 9 – 11 in Mumbai.

(Neelu Khatri)

(Thomas M. Miller)

ACP Milestones

2017

- Creation of Sub-committee on Aviation and Aerospace Skills Development
- Celebration of ACP's "10 years Anniversary Partnership" on December 8, 2017 at New Delhi
- Grant signing ceremony of Sustainability Master plan for Kolkata and Lucknow Airports on September 11, 2017
- ACP's "Innovation in Aviation" workshop with Ministry of Civil Aviation on August 31, 2017 at New Delhi
- Eminent Speaker Series 2017 - Blockchain Technology & its effect on the Aviation Industry
- Aero India 2017 at Bengaluru
- ACP & RGNAU partnership to bring the first Executive Development Program (EDP) for Aviation in India

2016

Memorandum of Understanding Signing: ACP & Rajiv Gandhi National Aviation University (RGNAU)

- Grant Signing Ceremony: GAGAN Extension Business Case
- Memorandum of Cooperation (MOC) Signing: ACP & National Skill Development Corporation (NSDC)
- ACP project workshop with Ministry of Civil Aviation (MOCA)
- Memorandum of Cooperation (MOC) Signing: ACP & Bhogapuram International Airport Company Ltd., (BIACL)
- India Aviation 2016 at Hyderabad
- Grant agreement signed for Aviation Safety Technical Assistance Phase – II

2015

- Aero India 2015 at Bengaluru
- Grant agreement signed for ProVision Body Scanner System Pilot Project

2014

- India Aviation 2014 at Hyderabad
- Grant agreements signed for ASETEP & India Regulatory Oversight Assistance

2013

- Grant agreements signed for PBN, DGCA officers' training Phase-II and Airport GIS
- U.S. - India Aviation Security Seminar
- U.S. - India Aviation Summit, Washington D.C.

2012

- Grant agreement signed for Total Airspace and Airport Modeler (TAAM)
- India Aviation 2012 at Hyderabad

2011

- Grant agreements signed for DGCA officers' training Phase-I & launching GBAS at Chennai Airport
- U.S. - India Aviation Summit, New Delhi

2010

- Grant agreement signed for Helicopter Safety Technical Assistance
- Automatic Dependent Surveillance – Broadcast (ADS–B) & Ground Based Augmentation System (GBAS) Seminar
- India Aviation 2010 at Hyderabad
- Roundtable Discussion on Airport Regulatory & Financing Best Practices

2009

- Grant agreement signed for Aviation Standard Technical Training
- U.S. - India Aviation Partnership Summit, Washington D.C.

2008

- FAA conducts Air Traffic Management Training Program (ATMTP)
- AAI Air Traffic Control Officers (ATCO) Manpower Assessment Study
- Air Traffic Flow Management (ATFM) Seminar

2007

- MoU between: U.S. Department of Transportation, U.S. Trade & Development Agency and Ministry of Civil Aviation
- U.S. - India ACP Inaugural Session: ACP Formed
- U.S. - India Aviation Partnership Summit, New Delhi

ACP
In Partnership with

Ministry of Civil Aviation
Government Of India

Directorate General of Civil Aviation

AIRPORTS AUTHORITY OF INDIA

BUREAU OF CIVIL AVIATION SECURITY

ACP Ongoing Projects

- Business Case for GAGAN Extension
- Aviation Safety Technical Assistance Phase – II
- ProVision Body Scanner System Pilot Project
- Aviation Security Equipment Testing & Evaluation Program (ASETEP)
- GBAS Pilot project at Chennai Airport
- Sustainability Master plan for Kolkata and Lucknow Airports

ACP Past Successes

- Aviation Safety Technical Assistance Phase – I
- Technical, Management and Operational Development Training (TMODT) Phase – I
- Total Airspace and Airport Modeler (TAAM)
- AAI Air Traffic Control Officers (ATCO) Manpower Assessment
- Helicopter Aviation Safety Technical Assistance
- Technical Training for Aerospace Industry
- Technical, Management and Operational Development Training (TMODT) Phase – II
- Airport Geographic Information System (AGIS) for Indian Airport

Misson

The U.S-India Aviation Cooperation Program (ACP) was established in 2007 as a public-private partnership between the U.S. Federal Aviation Administration (FAA), the U.S. Trade and Development Agency (USTDA), other US Government agencies and U.S. Companies.

The ACP supports the growth of the Indian civil aerospace sector by working directly with the Government of India (GOI) to identify and execute projects that encourage collaborations between US and Indian stakeholders, in the area of aerospace technology and best practices.

Objective

- Promote greater engagement between US and Indian Government agencies and industry to enhance civil aviation in India.
- Undertake projects that advance Cooperation in domains such as aviation safety, security, regulatory oversight and management.
- Provide training and technical assistance to accelerate excellence in aviation operations.
- Within India, increase awareness of, and facilitate access to, US expertise, technology and best practices to assist India's aviation growth.

India Aviation Reverse Trade Mission-A Readout, next steps

By Mehnaz Ansari, Country Representative-South Asia, USTDA

In September 2017, the U.S Trade and Development Agency (USTDA) hosted the India Aviation Safety, Security and Airport Infrastructure Reverse Trade Mission in the United States. As India aims to invest $120 billion in civil aviation over next ten years, this visit occurred at an opportune time for decision-makers to meet with the U.S. stakeholders to consider potential partnership opportunities, and to obtain leading best practices that can allow India to leapfrog the growth trajectory of its aviation sector. The itinerary was designed to support India's aviation infrastructure goals, while at the same time inform U.S. businesses of upcoming aviation opportunities in India.

Led by India's Secretary of Civil Aviation, Mr. Rajiv Narayan Choubey, the high-level delegation included Chairman of the Airports Authority of India (AAI) Dr. Guruprasad Mohapatra, Director-General of the Bureau of Civil Aviation Security (BCAS) Mr. Rajesh Kumar Chandra, Executive Director (ANS) of AAI, Mr. Sylvester Israel and CEO of AAI's Cargo Division, Mr. Keku Gazdar. The delegates participated in three days of meetings with U.S. government stakeholders including the Federal Aviation Administration and the Transportation Security Administration. The itinerary involved tours of FAA's Air Traffic Control System Command Center and the Metropolitan Washington Airports Authority (MWAA) based at Reagan National Airport.

Bilateral meeting in progress

In addition to meeting with U.S. government representatives, the delegation engaged with U.S. industry attending sites at Boeing, Honeywell Aerospace, and United Technologies. Additionally, the General Aviation Manufacturers Association (GAMA) hosted an industry roundtable where the delegates presented on upcoming procurements and their aviation infrastructure goals.

High-level delegation site visit at Boeing

The visit supported business engagement between two countries, as well as strengthened existing relationships, marking the beginning of yet another successful chapter of cooperation between the U.S. and India in civil aviation. In fact, during the visit, USTDA awarded a grant to the Airports Authority of India (AAI) for an airport sustainability master plan project that will be carried out by U.S. firm, Landrum and Brown.

Grant signing ceremony of Sustainability Master Plan for Kolkata & Lucknow Airports

Following the visit, the Chairman of India's Airports Authority indicated that though he traveled frequently on such missions all over the world, he was impressed with such successful outcomes and follow-ups after this mission. Only four months after the visit, we can already see signs of new partnerships forming. In fact, FAA invited AAI to its Command Center in January 2018. Also, AAI teams have visited the Boeing and Honeywell Centers of Excellence in Bangalore and Madurai to strengthen their cooperation.

Guiding the two countries engagement is the U.S.- India Aviation Cooperation Program (ACP), which provides a platform for stakeholders to discuss shared challenges and set goals for the future. Through the ACP, USTDA has sponsored more than two dozen activities in India's civil aviation sector. Through projects, programs, workshops, and summits, the U.S. and India have partnered on strategic areas of aviation safety, security, and airport infrastructure. The cooperation continues to produce outstanding results where ACP member companies have worked on capacity building efforts for DGCA and BCAS and improvement of Air Navigation Services of Airport Authority of India.

Currently, USTDA is working closely with the Ministry of Civil Aviation to prepare for the sixth ACP Summit, set for summer 2018 in Mumbai. At the Summit, stakeholders will come together to discuss shared successes and continue setting ambitious goals to strengthen India's civil aviation sector in the years to come. We look forward to seeing you there!

General Aviation Manufacturers Association

The General Aviation Manufacturers Association (GAMA), an international trade association founded in 1970, exists to foster and advance the general welfare, safety, interests and activities of the global business and general aviation industry. This includes promoting a better understanding of general aviation manufacturing, maintenance, repair, and overhaul and the important role these industry segments play in economic growth and opportunity, and in serving the critical transportation needs of communities, companies and individuals worldwide. GAMA represents over 100 of the world's leading manufacturers of general aviation airplanes and rotorcraft, engines, avionics, components and related services. GAMA's members also operate repair stations, fixed based operations, pilot and maintenance training facilities and manage fleets of aircraft. GAMA has offices in Washington, DC, and Brussels, Belgium.

Mission

The General Manufacturers Association (GAMA) exists to foster and advance the general welfare, safety, interests and activities of the global business and general aviation industry. This includes promoting a better understanding of general aviation manufacturing, maintenance, repair, and overhaul and the important role these industry segments play in economic growth and opportunity, and in serving the critical transportation needs of communities, companies and individuals worldwide.

Vision

Our vision is to be recognized as the most effective trade association in business and general aviation, aerospace manufacturing, and in the maintenance, repair and overhaul domain through:

- Enhancing Safety through innovation and the promotion of quality training
- Facilitating improvements in certification, audit and regulatory processes
- Fostering sustainable general and business aviation growth
- Promoting the economic impact and societal benefits of general and business aviation
- Achieving organizational excellence

Learn more by visiting www.GAMA.aero & find us on Facebook, Twitter, Instagram and LinkedIn.

GAMA President and CEO
Pete Bunce

GPS Aided Geo Augmented Navigation (GAGAN): Transforming Indian Navigation

By Amber Dubey, Partner and Head – Aerospace and Defence, KPMG

1. Introduction

1.1. Rise of global navigation systems

Transport navigation has come a long way, since the introduction of Global Navigation Satellite Systems (GNSS). With the United States introducing the world's first GNSS in the late 70s, began the race to finding accurate navigation solutions for the growing air, surface and marine traffic.

Today, there are only two other entitieswho have establishedtheir own GNSS: Russia's GLONASS conducting its first launch in 1982 and the European Union's Galileo, launched its first satellite in 2011.Asian countries such as China and India have initiated their own navigation satellite systems, known as "BeiDou" and "NAVIC" respectively.

1.2. Enhancing GNSS: Satellite-based Augmentation System (SBAS)

SBAS is a system whichaugments GNSS signals at a regional level, through the use of additional satellite-broadcasting techniques. The system consists of multiple ground stations located at pre-surveyed reference points. These stations measure the GNSS satellites' signals and the environmental factors impacting signal delivery to the users. SBAS uses themeasurement of the satellite signals, creates messages and relays it to the GNSS satellites, in turn broadcasting it to the end usersequipped with SBAS receivers, with very high accuracy.

As of 2017, there are only four SBAS systems available in the world. These are:

1. **United States:** Wide Area Augmentation System (WAAS)
2. **European Union:** European Geostationary Navigation Overlay System (EGNOS)
3. **Japan:** Multi-functional Satellite Augmentation System (MSAS), and
4. **India:** GPS-Aided Geo Augmented Navigation (GAGAN)

2. GAGAN: The future of India'sair navigation

The GAGAN project was initiated by the Indian Space Research Organisation (ISRO) and Airports Authority of India (AAI) with an investment of$120 million. The first transmitter was operationalised in 2010 through GSAT-4. GAGAN's objective is to deploy and certify satellite based augmentation systems so as to ensure safe navigation applications. The technology has been developed such that it is inter-operable with other SBAS systems. By operationalising GAGAN, India has put in the final piece of the jigsaw to ensure global SBAS coverage.

GAGAN's architecture is essentially based on three elements:

1. **Space-based assets:** This segment consists of three main geostationary satellites
2. **Ground based assets:** 15 reference stations installed throughout India, three uplink stations and two main control centres
3. **User segment:** This includes GAGAN-enabled receivers for civil aviation and non-aviation applications

AAI, through a grant provided by United States Trade Development Agency (USTDA) had appointed KPMGto create a business case for the use of GAGAN within Indian aviation and across non-aviation sectors, examining its varied applications and provide cost benefit analysis. KPMG was also tasked to provide a detailed implementation plan for GAGAN in the civil aviation sector. On the basis of the cost benefit analysis that was presented to the industry, the Directorate General of Civil Aviation (DGCA) has issued mandates for forward fit of GAGAN equipage on aircrafts that are to be registered in India from 01 January 2019.

2.1.Civil Aviation: What GAGAN brings to the table

Implementing an SBAS system is a long-term investment for India, which will go a long way in bringing operational efficiencies in the civil aviation environment. GAGAN brings numerous advantages to the table for all stakeholders in the civil aviation industry. Some of these are:

2.1.1. Cost savings for airline operators and airport operators:

Using GAGAN allows for usage of Localiser Performance with Vertical Guidance (LPV) procedures, greatly improving precision and allowing tremendous fuel savings for aircraft operators. GAGAN would also be able to providedirect routing between two locations with fewer variations allowing operators to save significantly on fuel costs.This, in turn, results in significant operating cost savings for airlines, enabling airlines to pass on the benefits to the end consumers via greater flexibility and reduced fares, leading to greater access to air travel for passengers.

Airport operators also tend to gain tremendously from this as they won't be required to maintain expensive precision ground infrastructure which adds to their operating and maintenance costs on an annual basis. Implementation of GAGAN benefits AAI with respect to the RCS scheme by the government, where they would not be required to maintain expensive ground infrastructure for precision approaches. Also, it allows operators to geo-fence airports and aprons, giving them a precise real-time awareness of the movement of aircraft and equipment at the facility.

Use of SBAS also brings great cost efficiency for ground operators at airports, as ground service equipment can be easily geo-tagged such that it may be used for safer and more efficient utilisation, reducing the scope of doubts and allowing precise tariff calculation.

2.1.2. Reduced workload and seamless airspace management

With India's aviation market growing at 20% annually, there is a need to manage the burgeoning air traffic. Air traffic controllers generally tend to have an approximate idea about an aircraft's precise location, compelling them to have wide margins of aircraft separation, to ensure safety. This becomes a challenge for ANSPs especially when around a high concentration of restricted or prohibited airspaces, allowing very limited room to manoeuvre.

GAGAN allows ANSPs to

accommodate more aircraft within a given airspace through reduced aircraft separation, giving controllers the precise location of the aircraft at all times. This in turn also benefits the airport operators as a combination of precision approaches and real-time awareness of aircraft allows airports to drastically reduce delays, diversions and flight cancellations even in adverse weather conditions.

2.1.3. Ensuring sustained growth

As India copes up with the happy problem of burgeoning aviation demand, it faces critical shortage of air infrastructure. In 2017, the government launched its ambitious Regional Connectivity Scheme (RCS) with the aim to see fourfold increase in access to smaller cities with flights offering affordable fares for the masses.

GAGAN has a major role to play here, as this would allow greater airspace management and lower costs for air carriers, airports and the passengers. A GAGAN-enabled ecosystem therefore adds to the government's long-term aim of providing air travel access to alarger segment of India's population.

2.1.4. Increasing ground time efficiencies

The role of airports is getting increasingly critical in India with wider domestic airline expansion, industry-friendly rules and liberalised international bilateral air services. This means that Indian airports now have to manage their limited infrastructure efficiently.

Airport scan see quicker turnarounds as air traffic management becomes more efficient, thereby allowing more aircraft to clear different stages of controlled airspaces. This results in reducing carbon footprint for both airports as well as the national government, which has international carbon footprint commitments.

2.2.Non-aviation transport: What lies ahead

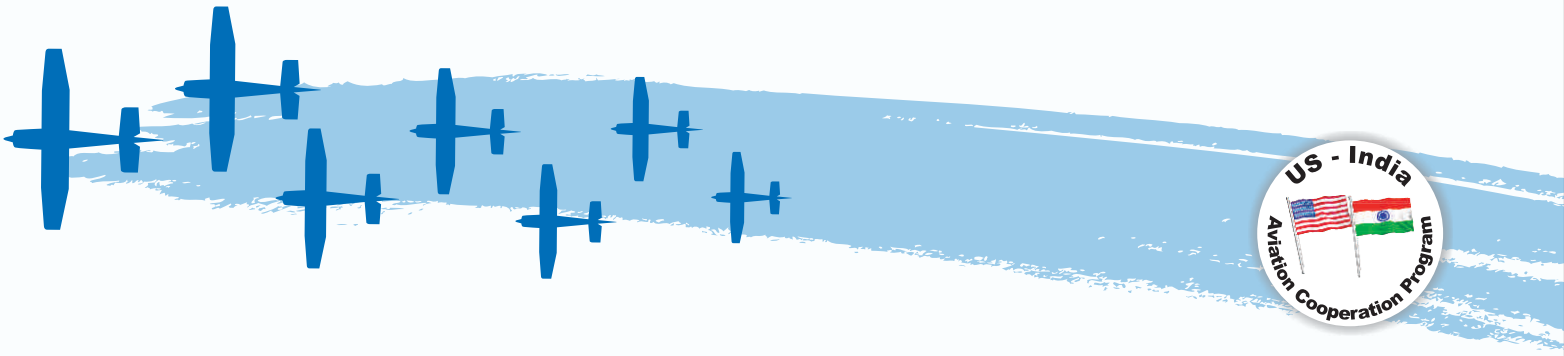
Satellite navigation today has become more common across all modes of transport. Therefore, in addition to the tremendous cost and efficiency benefits seen in the civil aviation sector, GAGAN also has a host of non-aviation benefits for other modes of transport, such as:

1- **Road transport**
2- **Railways**
3- **Maritime and shipping**
4- **Agriculture management**
5- **Disaster management and emergency rescue**
6- **Telecommunication**
7- **Utilities**

Road transportation and public utilities

Public transport is one of the key potential benefactors of GAGAN. With the demand for more urban modes of public transportation, installation of GAGAN-capable receivers and a centralised monitoring system would allow authorities to:

1. Enable preparation of accurate mapping for monitoring of road infrastructure and its maintenance
2. Enable unmanned aerial assets to be used for monitoring the development of major infrastructure projects in real-time, including development of expressways



across the country
3. Permit real-time tracking of all vehicles in real time and allow toll centres to collect toll through an automated mobile application

Railways

Railways are the lifeline of India's public transport system. Being the second largest rail network on earth requires significant monitoring, surveillance and tracking capabilities, which is currently managed by archaic technologies.

Implementing GAGAN across Indian Railways would enable officials to track trains in real-time and enable pre-empting of track maintenance. As the position of every train in a particular zone would be known, the warning system and road crossings can be automated, reducing fatal accidents and enabling greater safety.

In areas of anti-collision safety, GAGAN can be linked to a centralised train control system, which could be further automated to pre-empt collision probabilities and stop trains on their tracks remotely.

Maritime and Shipping

Maritime and shipping form the backbone of India's trade with rest of the world. With the inclusion of GAGAN in the shipping sector, it is possible to have real-time tracking of ships, ensuring safety and traceability in a specific oceanic zone.

Enabling GAGAN would further allow ships to be able to track intermodal containers, thereby optimising the transfer process of cargo across all modes of transport. It can also play an essential role in managing coastal security and tracking of merchant ships, particularly in conflict hotspots such as the Gulf of Aden, as well as areas of low visibility and restricted zones.

Agriculture management

Despite being one of the largest agricultural producers in the world, India remains behind when adapting smart technologies in better managing agriculture when compared to numerous other Asian countries.

The enabling of GAGAN-enabled UAVs will enable farmers to accurately map soil humidity, develop virtual fencing techniques and through linking GAMES with meteorological services, update farmers of on weather conditions.

Disaster management and emergency rescue

GAGAN messaging system (GAMES), can be highly relevant for state and central disaster management agencies.

Vessels fitted with GAGAN receivers will be able to transmit their precise locations, enabling rescue agencies to quickly locate and commence SAR operations. The use of GAGAN would also enable Indian Meteorological Department to access real-time information about land deformation and help in predicting disasters such as tsunami.

Telecom sector

With telecommunication industry relying more on customisation of packages, spreading beyond their

traditional markets and offering more exclusive products, GAGAN has a major role to play in this sector as well. GAGAN can help provide accurate timing information for network synchronization and ensure data accuracy for users.

As GAGAN can provide real-time location of users, it can help telecom companies provide customised service packages, widening the products on offer. Additionally, the SBAS can also help in providing the location of distress callers, including in areas with otherwise-limited connectivity.

Utilities

Public sector works can greatly benefit from the manifold uses of GAGAN. Assets such as drones can be fitted with sensorsto monitor progress of large-scale infrastructure projects. Synchronisation of internal clocks, protection units and other equipment can assist in detecting faults in power systems.

Furthermore, in sensitive projects such as dams, real-time measurement of erosion or degradation in structures and critical land-forms can be assessed at hydel facilities.

Opportunities for stakeholders

The introduction of GAGAN across India's transportation and public utilities system presents a tremendous techno-commercial opportunity for surveillance and receiver manufacturers.

As GAGAN's coverage extends to India's extended neighbourhood across Asia, the usage and application of GAGAN services in the region's civil aviation sector would ensure a large market. By 2035, Asia Pacific region is expected to have over 16,000 aircraft deliveries.

In non-aviation segments, the use of GAGAN has a multiplier effect. With many countries in Asia showing the promise of economic growth, urban development and rapid infrastructure requirements, promoting GAGAN as a service for areas such as road and urban transport management, infrastructure development monitoring, weather and terrain mapping, emergency rescue and disaster warning etc. can provide a significant market.

India's strategic location, coupled with a strong internal potential market, as well as future opportunities from a large adjoining regional market in the Southeast Asia and the Middle East, presents a never-before opportunity for India and her strategic partners in this venture to transform Asia's transport and urban management system, in ways which were never thought of until the advent of SBAS technology.

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The Gold Key Service (GKS) arranges pre-screened one-on-one appointments with potential business partners. The GKS services includes: up to five appointments with pre-qualified distribution channel firms, appropriate government officials, or other contacts; possible escort by a U.S. Commercial Service staff member for meetings;and possible assistance with travel and accommodation at preferred rates.

International Company Profile

An International Company Profile (ICP) is a due-diligence check that helps U.S. companies evaluate potential business partners. An ICP provides a detailed background report, based on a variety of research sources; including an on-site visit by a Commercial Specialist, listing of the company's senior management, comments from company references, banking and financial information and CS India insight on whether the prospective partner can meet your business needs.

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U.S. companies can benefit fromcustomized trade counseling that can provide information on marketopportunities, market entry recommendations, regulatory issues, and other vital information.

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MOOG

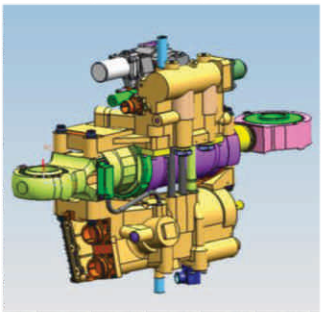
Moog is a global designer, manufacturer and integrator of precision motion control products and systems, and is a world leader in flight control systems and critical component control applications. Moog has had a local presence in India for more than two decades, and Moog's India Technology Center (MITC) in Bangalore includes a staff of nearly 230 people providing engineering, design, test and certification for mission critical aerospace and defense systems.

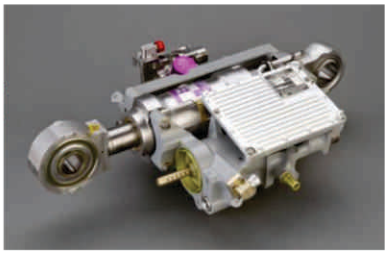
Moog Bangalore Technology Center

MITC Provides Software, Electronics & Mechanical Design Support and Qualification Testing for Commercial and Business Jets

Moog provided lateral control electronics (LCE) for Boeing 747-8, Level A software for flight control systems on the Gulfstream G280 and G650 business jets, system analysis and independent verification and validation (IV&V) to support the overall system certification. MITC was also engaged in supporting Boeing B787-8, Airbus A350-900, A350-1000, Embraer E190, Comac C919, Gulfstream G500 and G600 aircraft programs in mechanical detailed design and electronics system design activities.

Design of Moog Components for Commercial and Business Jets

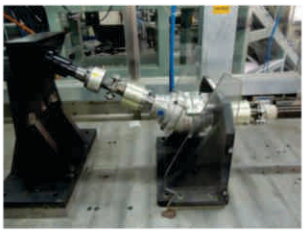


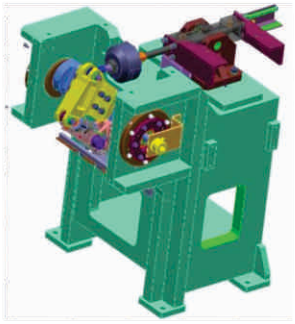


Typical Hydraulic Flight Control Actuator Model & Hardware

MITC team extensively supported in design and analysis of commercial flight control actuation system hardware consisting of primary flight surfaces on the airplane, as well as the spoilers and horizontal stabilizer, and includes a mix of electrohydraulic (EH) and electromechanical (EM) servoactuators and all associated control electronics. The secondary flight control high lift system is comprised of discrete assemblies including: power drives, electronic controls, trim controls, geared rotary actuators, rack and pinion roller assemblies, transmission shafts, gearboxes, sensors and accessory components.

Test Equipment Design and Qualification of Moog Components





Typical Test Fixture & Test Rig Model

Over this period, Moog has grown from a high technology component manufacturer to become a leading supplier of integrated flight control systems. We are continuously investing to extend the depth of our product expertise while simultaneously expanding our capabilities to take on the challenges and responsibilities of a changing industry. As a result, we are positioned today on virtually every aircraft in the marketplace, supplying reliable flight control systems and specialized control products that are highly supportable and add significant value for our customers.

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ACP Activities Over The Period

(L-R) Neelu Khatri, ACP Co-Chair (Industry) & President, Honeywell Aerospace-India; Jayant Sinha, Hon'ble MoS, MOCA; Henry Steingass, Regional Director-South & Southeast Asia, USTDA; J. Robert Garverick, Minister Counselor-EEST, U.S. Embassy at ACP's "10 years Anniversary Partnership" on December 8, 2017 at New Delhi

Celebration of ACP's "10 years Anniversary Partnership" on December 8, 2017 at New Delhi

Celebration of "ACP Diwali Nite" on October 06, 2017 at New Delhi

ACP Activities Over The Period

Grant signing ceremony of Sustainability Master plan for Kolkata and Lucknow Airports on September 11, 2017 at Arlington, VA

ACP's "Innovation in Aviation" workshop with Ministry of Civil Aviation on August 31, 2017 at New Delhi

AIM's "The Award Dinner" in partnership with ACP on July 14, 2017 at New Delhi

Boeing's discussion with JS Rawat, Joint Director General, DGCA in partnership with ACP on Airport Construction Codes + Specifications and 777x Airport Compatibility on July 4, 2017 at New Delhi

Aviation Institute of Maintenance (AIM)

By La Vern Phillips, Director - Business Development , AIM

The most important aspect of air travel is the safety of the passengers and the flight crew. Flight and cabin crew members receive current and recurrent training in the model flown on a regular basis. Passengers even receive a safety briefing before each and every flight. But who ensures that the aircraft itself is safe for flight? That's the job of the aircraft maintenance professional who makes his or her contribution toevery flighttaking place around the world. Safety begins with these maintenance professionals and inthe USA, they are known as FAA mechanics with a rating in airframe and powerplant, aviation maintenance technicians, or just A&Ps. In Europe, and in other parts of the world, these same aviation professionals are called aircraftmaintenance engineers, AMEs, or just engineers. Where do these maintenance professionals learn about safe maintenance practices and all the complex systems that make flight possible? It begins with basic maintenance training.

Aviation Institute of Maintenance (AIM) owns and operates eleven Aviation Maintenance Technician Schools (AMTS) certificated by the U.S. Federal Aviation Administration (FAA). AIM schools are located throughoutthe United Statesin the major metropolitan areas of: Atlanta, Dallas, Houston, Indianapolis, Kansas City, Las Vegas, Orlando, Philadelphia, San Francisco, Virginia Beach and Washington DC. As the world's largest trainer of these licensed technicians, we take safety seriously from the very beginning. Students learn the hazards and dangers of working on and around aircraft. Throughout their training program, safe working practices are embedded into their training, to the point they become inherent.

To ensure that newly certificated (licensed) aviation technicians are properly trained, the FAA curriculum is defined in Federal Aviation Regulations (FAR) Part 146, Appendixes in three separate areas: General,Airframe and Powerplant.

General Subjects: FAR 147, Appendix B

Basic Electricity; Aircraft Drawings; Weight and Balance; Fluid Lines and Fittings; Material and Processes; Ground Operations and Servicing; Cleaning and Corrosion Control; Mathematics; Maintenance Forms and Records; Basic Physics; Maintenance Publications and Mechanics Privileges and Limitations.

Airframe Subjects: FAR 147, Appendix C

Part I – Airframe Structures
Wood Structures; Aircraft Coverings; Aircraft Finishes; Sheet Metal and Non-metallic Structures; Welding; Assembly and Rigging and Airframe Inspections.

Part II – Airframe Systems and Components
Aircraft Landing Gear Systems; Hydraulic and Pneumatic Power Systems; Cabin Atmosphere

Control Systems; Aircraft Instrument Systems; Communication and Navigation Systems; Aircraft Fuel Systems; Aircraft Electrical Systems; Position and Warning Systems; Ice and Rain Control Systems and Fire Protection Systems.

Powerplant Subjects: FAR 147, Appendix D

Part I – Powerplant Theory and Maintenance
Reciprocating Engines; Turbine Engines and Engine Inspection.
Part II – Powerplant Systems and Components
Engine Instrument Systems; Engine Fire Protection Systems; Engine Electrical Systems; Lubrication Systems; Ignition and Starting Systems; Fuel Metering Systems; Engine Fuel Systems; Induction and Engine Airflow Systems; Engine Cooling Systems; Engine Exhaust and Reverser Systems; and Propellers.

Throughout the course of their instruction, students get hands-on, practical training of about 1,000 hours during their 22 months of classes. Classes are taught four days per week, six hours per day allowing Friday to be available for making up material missed during scheduled class time and for assisting those that may need additional practice or instruction, which is free of charge.

After 2,040 hours of classroom instruction, practice labs and actual return to service experience, students are prepared to enter the workforce and continue their training on specific model aircraft, engine or systems as needed by their employer. Before that happens, they need to obtain their FAA Mechanic's Certificate with a rating in Airframe and Powerplant. The FAA requires each applicant pass three written exams (General/ Airframe/Powerplant) and an Oral and Practical (O&P)Exam administered by a Designated Mechanic Examiner (DME), who is a representative of the FAA. The O&P is a full day exam that demonstrates the practical application of the knowledge, skills, and abilities learned at an AMTS. Once the DME is satisfied that the applicant is qualified, he or she receives their temporary license that day, and in about two weeks, they receive their official Mechanic's Certificate with the appropriate ratings.

AIM also assists graduates in obtaining employment after graduation. Airlines(major and regional); Maintenance, Repair and Overhaul (MROs); and repair stations begin to interview students weeks prior to graduation for entry level positions. The employer of the newly licensed technician provides the on-the-job-training (OJT) on specific aircraft models, or systems they manufacturer or operate. Some international graduates find employment in the United States, but most return to their home country to seek employment.

AIM also offers a short course to assist experienced engineers in attaining their FAA Mechanic's Certificate (license) with a rating in Airframe, Powerplant, or

Airframe and Powerplant under Part 65 of the Federal Aviation Regulation. With documentation supporting work experience in at least 50% of the areas listed in FAR 147, Appendixes B, C and D, the FAA will provide authorization to take the required written exams and then the O&P required to earn an FAA license. AIM spends one week in review of each area: General, Airframe and Powerplant. After each week of classroom and lab, candidates take the FAA written exam and prepare for the O&P exams. Following the initial three weeks of classroom review and testing, the final two weeks are for scheduled O&P exams conducted by the FAA's DME for the school location as listed on the FAA website.

Other aviation programs offered at AIM are: Aircraft Dispatcher (FAA license), Aviation Maintenance Technician – Helicopter (advanced turbine helicopters), Aviation Maintenance Technical Engineer (avionics) and an avocational course for Flight Attendant. Housing assistance is provided for full time students and for the experienced engineers seeking the FAA license.

Each campus location is approved to participate in the Student Exchange Visitor Program (SEVP) and issue the I-20 that permits qualified international students to attend higher education in the United States. Housing assistance is also available to international students. Student Services, as well as Career Placement assistance, is available. This cultural exchange experienced at AIM broadens students' cultural awareness and prepares them for a global career in aviation maintenance.

For additional information, please contact:
Deepti Jain, Phone +91 (971) 700-2261, or Email: CountryAdviserIndia@AviationMaintenance.edu
4455 South Boulevard, Virginia Beach, VA 23452

Landrum & Brown

By Debayan Sen, Associate Director – India, L&B

Landrum & Brown (L&B) is a leading global consultancy specialising in aviation planning and development for close to seventy years. You could say that airports and aviation are in our DNA.

L&B is a global organisation that has worked on projects in every continent. In an industry as international and dynamic as aviation, our clients benefit from our unsurpassed breadth of international experience as well as our local and regional presence. We are proud to saythat we have worked across all seven continents, including Antarctica.

Airport infrastructure and operations are technically complex with multiple stakeholders, different ownership models, business needs, emerging technologies and wide ranging, economic and community impacts. L&B's range of capabilities offers an integrated solutions approach to our clients.

Our team members range from technical planning and architectural design professionals to economic, financial and environmental specialists.

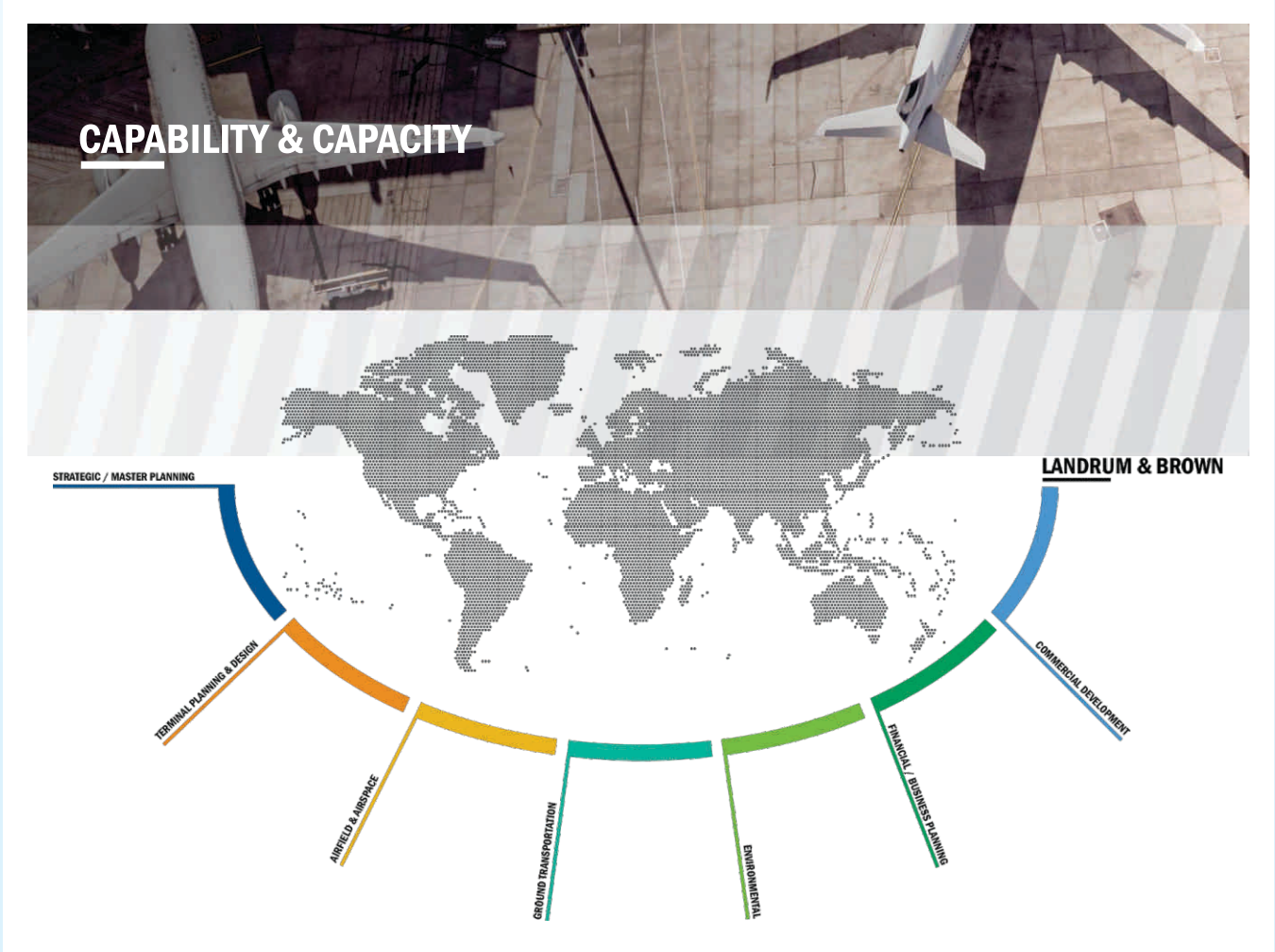
L&B's Asia Pacific regional presence is unsurpassed in the airport consulting industry. The Asia Pacific headquarters in Melbourne was established in the year 2000 closely followed by the China regional office in Shanghai.

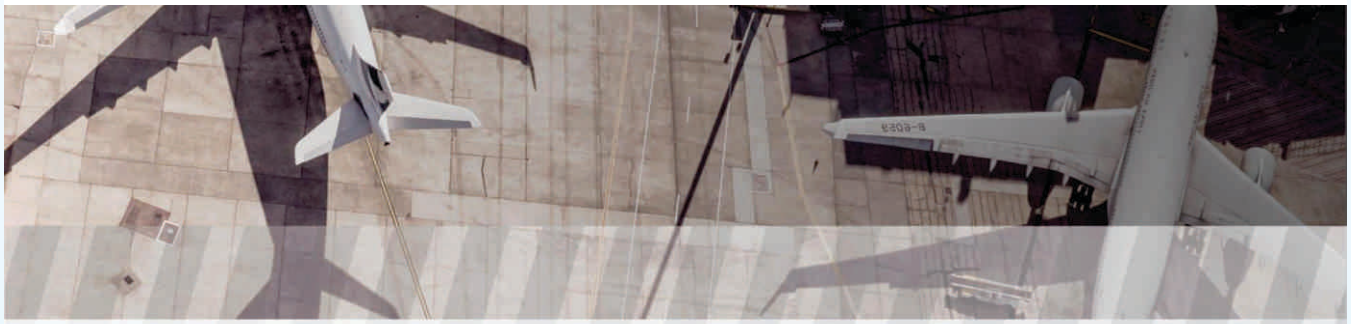
Other offices have been established in India, Bangkok, Hong Kong, the Middle East and South Africa. Over 50% of L&B global business is now accounted for in these regions. We adopt a deliberate strategy to continue building our capabilities, addressing high growth markets by growing and broadening resources. To that end, L&B recently acquired the Ambidji Group, a highly respected Melbourne based air transport consultancy. This acquisition adds valuable skill sets to L&B, including airspace planning, air traffic management system development, aviation policy regulation and strategy development, airport business analysis and transactional advisory services for investors in aviation infrastructure. We have also enhanced our capabilities to integrate design services with terminal planning. This offers our clients a 'one stop shop' approach during early design stages, thus allowing for a higher level of terminal and commercial development, supported by communicative and evocative visualizations.

With over a decade of experience in the India market, Landrum & Brown (L&B) have completed multiple airport consulting assignments for all the major privatized airports in India. L&B's in depth knowledge of the Indian market is unparalleled and L&B staff are often calledon to provide commentary on policy initiatives and regulatory issues and invited to speak at leading airport conferences and participate intraining of senior executives in the Indian

government and industry.

L&B staff based in Mumbai and Delhi continuously research and track trends in the India market. Related macro issues such as economics, demographics, consumer trends, regulatory developments and technology are researched and updated. The highly skilled team of analysts provide intelligence in a variety of areas covering not only aviation but also related macro issues such as economics, demographics, consumer trends, regulatory developments and technology.





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L&B services extend well beyond the airport boundary to encompass aviation sector-wide planning, regulatory strategy development and policy reform.

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INDIA

BOEING: Partnering India's Aerospace Growth Story

By Ashmita Sethi, Director - Communications & Corporate Affairs, Boeing India

Boeing has been a strong partner of India's aviation sector for more than 75 years.

India has been using Boeing products since World War II, when it acquired DC-2 and DC-3 airplanes. Since then, Boeing has been the mainstay of India's commercial aviation sector, providing the country's airlines with the most fuel-efficient airplanes.

Boeing's relationship with India on the defense front dates back to the 1940s, when the Indian Air Force enlisted two Boeing aircraft: the T-6 Texan, or Harvard Advanced Trainer, made by North American Aviation and the C-47 Skytrain military transport, a military variant of the DC-3, made by McDonnell Douglas.

Today, Boeing continues to play an important role in the mission readiness and modernization of India's defense forces. India has 10 C-17 Globemaster strategic airlifters, eight P-8I maritime surveillance aircraft in operation with four more on order, 22 Apache and 15 Chinook helicopters on order. The Indian Army has also received clearance to purchase six Apaches by the Defence Acquisition Council.

Boeing in India has 1,200 employees, and more than 7,000 people work on dedicated supply-chain jobs with several Indian suppliers across manufacturing, engineering and IT sectors. Boeing continues to increase its footprint as supply-chain, sourcing, engineering and hiring activities continue to grow.

Supporting The Growth of India's Civil Aerospace Sector

Boeing is committed to offering the most efficient commercial airplanes and world-class services to airlines in India.

Air India (originally Indian Airlines) has been a Boeing customer since 1960, when it acquired its first 707 jetliner. The airline also inducted the 737 Classic in the 1970s and over the years operated the 747-400, 777-200LR (Long Range), 777-300ER (Extended Range) and the Next-Generation 737. In 2006, Air India signed a contract for 68 Boeing airplanes. Since September 2012, Air India has continued to receive its fuel-efficient 787 Dreamliners. The Next-Generation 737 is the workhorse of airlines such as Jet Airways, Air India Express and SpiceJet.

Jet Airways, a Boeing customer since the 1990s, operates 737s and 777s. At the Dubai Airshow in November 2015, Jet Airways confirmed an order for 75 737 MAX airplanes, its largest fleet order.

SpiceJet began its operations in 2005 with two leased Next-Generation 737-800s. Today, the 737 is the backbone of SpiceJet's fleet. In January 2017, Boeing and SpiceJet announced a deal for up to 205 airplanes that includes 100 new 737 MAX 8s, SpiceJet's current order for 42 737 MAXs, 13 additional 737 MAXs and purchase rights for 50 additional airplanes. At the Paris Air Show in June 2017, Boeing and SpiceJet signed a memorandum of understanding for 40 737 MAX airplanes.

In 2018, Boeing signed a contract

with the Airport Authority of India (AAI) for a mega Airspace Optimization project. In the near term, the project will include Radio Network Controller (RNC) solutions for Mumbai airport, charting and navigation for the Delhi airport and Ground Based Augmentation System training in Chennai. As long term deliverables, Boeing will also provide solutions such as Communication Navigation and Service/Air Traffic Management (CNS/ATM) systems, Total Airspace & Airport Modeller (TAAM) and Curb-to-Gate solutions to key airports across the country.

Supporting India's Defense Modernization

Boeing's military aircraft and services businesses have played an important role in the modernization and mission-readiness of India's defense forces.

Recently, Boeing announced the establishment of a new local entity called Boeing Defence India (BDI). With BDI, Boeing will expand its engagement with India to deliver advanced capability and readiness to India's military customers and to develop a competitive supplier base in-country that is integrated into Boeing's global supply chain. With a local sustainment footprint, indigenous execution and local training, BDI will ensure high availability of platforms to Boeing customers for missions at a competitive cost structure.

Eight P-8I's and 10 C-17 Globemaster III's have provided valuable support to the Indian armed forces across a range of mission profiles and humanitarian aid and disaster relief missions. The soon to be inducted AH-64E Apache and CH-47 Chinook will greatly enhance India's capabilities across a range of military and humanitarian missions.

Through a wide portfolio of products and services that span Harpoon missiles, unmanned systems, security solutions, services and support, and network-centric operations systems, Boeing is prepared to support future mission requirements of the Indian armed forces.

Partnering Indian Industry

When Boeing looks at advantages across the world in quality, capability and cost, India is an obvious partner. Make in India is a core element of Boeing's business strategy. Therefore, Boeing has accelerated its pace of investments, capitalizing on Indian capability and talent. Boeing's sourcing from India has quadrupled in recent years and now stands at close to $1 billion a year.

An example of this is the joint venture with Tata Advanced Systems Ltd. (TASL) which resulted in the establishment of the TATA Boeing Aerospace Limited (TBAL) production facility in Hyderabad. The facility will eventually become the sole producer of AH-64 Apache fuselages in the world. Future collaboration will also be explored for advanced defense manufacturing and potential

integrated-systems development opportunities, including unmanned aerial vehicles.

Boeing's existing industrial partners are raising the bar to deliver world-class quality, cost-efficiency and productivity as they become an important part of the company's worldwide supply chain for some of the most advanced aircraft in the world.

University Partnerships

Boeing's research and development (R&D) presence in India was established in 1995 when collaborative research in aerodynamics began at the National Aerospace Laboratories (NAL) in Bangalore. This has developed into a series of projects in aerodynamics and advanced analysis methods at NAL, Indian Institute of Science (IISc) and Indian Institute of Technology (IIT) Kanpur.

Boeing also has two evolved partnerships with IISc and IIT Bombay.

The Aerospace Network Research Consortium (ANRC), was set up with IISc involving other industry partners, HCL Technologies and Wipro. This consortium has conducted research and co-developed technologies related to wireless aerospace networks. This involved regular interaction between researchers in India and Boeing experts in the United States and has resulted in several doctorate theses and a number of research reports. In October 2016, Boeing and IISc celebrated the 10th anniversary of this successful partnership.

In collaboration with IIT Bombay and the Department of Science and Technology, Boeing conceptualized the National Centre for Aerospace Innovation and Research (NCAIR) in 2009 to support world-class research and manufacturing development in aerospace, with the objective of applying this capability to the aerospace industry in India.

The work at NCAIR has led to 20 patents and technology breakthroughs, and more than 30 specialists have been trained and developed by the NCAIR. Key areas of research for NCAIR include modeling and simulation, where the researchers have generated new insights on methods to improve efficiency of machining titanium and aluminum alloys. Recently NCAIR inaugurated an Advanced Machining Excellence Cell on its campus.

Both NCAIR and ANRC have proven their worth in using technology to spur entrepreneurship and innovation in India's aerospace industry to encourage its startup culture.

Boeing India Engineering & Technology Centre

Boeing India Engineering & Technology Center (BIETC) in Bengaluru is leveraging a talented pool of employees to support Boeing's engineering growth in strong global markets. BIETC engineers undertake high-quality, advanced aerospace technology-driven work that supports areas as diverse as test and evaluation; development of advanced, environmentally friendly coatings; data analytics for next-

generation airplane health management; innovation in labs on Internet of Things and Digital Transformation; and development of software tools that enable airlines to improve their operations and work with airports to help with de-congestion and navigation, at reduced costs.

Building A Skilled Aerospace Talent Pipeline

Boeing invests in an externship program with IITs and top engineering colleges every year to select students to work with our industry partner Cyient. The program introduces students to world-class aerospace engineering projects and related best practices, thus resulting in high-tech career paths for talented students.

As an aerospace leader, Boeing plays a role in inspiring the next generation of engineering talent in India. Boeing launched a national aeromodeling competition for engineering universities across India in 2013. This annual competition is now organized in the form of four zonal events, with a grand finale culminating in Delhi. During the events, Boeing provides training to students and helps them design, build and fly their airplanes, encouraging them to take to aerospace careers. More than 813 participants from 300 colleges across India participated in the competition in 2017.

In a recent effort to address the critical and growing need for skills development in the Indian aerospace sector, Boeing is partnering with the Nettur Technical Training Foundation (NTTF) to provide vocational training to Indian students and industry. Boeing-funded curriculums and initiatives have already been launched along with relevant aerospace partners such as Rossell Techsys, TAML and Jaivel. These curriculums and initiatives will help train workers on aerospace-relevant skills. Several frontline workers have already been employed with Boeing suppliers after completing their training. This is helping fill the gap in "industry training" and in increasing the employability skills of prospective candidates.

Boeing, in partnership with Air India Engineering Services Limited and the Ministry of Civil Aviation, has also announced the launch of an Accelerated Apprenticeship Program for aircraft maintenance engineers (AME). The key objectives of the program are to improve the employability of AMEs through training and hands-on experience with actual aircraft.

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General Aviation on The Cutting Edge of Technology and Innovation

By Edward T. Smith, Senior Vice President - International and Environmental Affairs, GAMA

As the general aviation industry has developed over the years, the General Aviation Manufacturers Association (GAMA) has been in the forefront of coordinating and providing leadership for new entrants, new technologies, including safety-enhancing ones, and technology disruptions. GAMA was founded in 1970 as an offshoot of the U.S. Aerospace Industries Association (AIA) to provide general aviation more regulatory, legislative and political support. Over the years, GAMA expanded from several dozen members to currently over 110 full and associate members. The association expanded from a U.S.-only association to representing the global GA industry, with members in the U.S., Canada, Brazil, Europe, Israel, China, and India (Mahindra Aerospace). In total, GAMA's membership spans 15 countries and five continents. GAMA has also expanded its membership to accept rotorcraft manufacturers and certain maintenance, repair and overhaul companies and other service providers. Most recently, in 2015, GAMA established a new category of associate member andcreated a committee to address issues in the most innovative and cutting-edgetrends and technologies in the growing field of electric and hybrid propulsion and innovation and simplified vehicle operations. Today, many of GAMA's traditional member companies, along with 14 new associate members, are charting a new path for the breakthrough technologies that will revolutionize aviation. The GAMA Electric Propulsion and Innovation Committee (EPIC) works to enable certified hybrid and electric propulsion and increased automation in general aviation design, production, maintenance, and operations across key global aviation regulators.

The Electric Propulsion & Innovation Committee considers likely developments and technologically mature innovations that can support the growing safety and utility of general aviation. The committee focuses efforts on creating an environment conducive to efficient design and production certification. Key technological considerations include:

- Hybrid/Electric Propulsion & Increased Electrification
- Simplified Vehicle Operation & Increased Automation
- On-Demand Mobility Concepts

This committee also maintains relationships with key research entities to facilitate the rapid industrialization of enabling technologies.

Since GAMA began efforts to support the development of electric aircraft there has been significant movement in the regulatory environment to enable hybrid and electric propulsion. Regulatory authorities such as the FAA's Engine and Propeller Branch and the Small Airplane Innovation Branch are studying the expected path for the certification of electric

propulsion motors and installations. GAMA has maintained a summary of the regulatory design environment to date. In 2016 the electric propulsion community developed GAMA Publication 16 (https://gama.aero/wp-content/uploads/GAMA-Publication-No-16-Hybrid-and-Electric-Propulsion-Performance-Measurement-1.pdf) to provide a common operational context for aircraft that utilize electric propulsion. One of the key issues debated during these initial discussions was the development of appropriate operational reserves for electric aircraft including both fixed wing and vertical take-off and landing (VTOL). Since we now have more experience and understanding of what is possible and appropriate in the field, there is a need to revisit the common industry agreement on what is an appropriate reserve requirement for these aircraft. For example, one area where new requirements are called for is in the specific area of electric vertical take-off and landing (eVTOL) minimum energy reserve for aircraft design certification (as opposed to an operational minimum on a particular flight). At the same time, there is ongoing research into battery technology, including addressing the specific needs of aviation such as lithium ion (Li-ion) chemistries that prioritize weight-based energy density, flammability, and operational temperature, as opposed to the historical focus of the surface transportation industry which prioritizes cost, volumetric energy density, and weight energy density.

In addition to the significant research going on in the above areas, the industry is also examining related areas such as charging and storage for electric aircraft. There are broad efforts underway to address items such as charging systems, but broader issues like identifying power requirements within traditional airport locations have yet to be broached. GAMA's Electric and Hybrid Propulsion and Innovation Committee is discussing key charging, battery storage and equipment support issues which need to be addressed to ensure hybrid and electric aircraft can operate efficiently within airport, helipad and vertiport locations.

There is a consensus among key regulators that single engine rated pilots can fly single engine electric airplanes. However, issues related to specific training for electric propulsion,and the appropriate rating and training for electric airplanes thatmay have distributed thrust, are less certain. There are designs which utilize a single throttle control (or potentially speed control) for which multi-engine training wouldn't be applicable but may currently be required.

Operationally as well, electric aircraft may not perform in ways which air traffic control would expect as compared to traditional aircraft. For example, because energy onboard may be more limited, it may be necessary to slow to best efficiency or range speed more often during IFR procedures and electric aircraft might be less able to accept changes to IFR flight plans that would add

significantly to flight time. It will be important to understand how electric aircraft will be able to perform traditional IFR terminal and approach procedures. It is important to identify any issues in following traditional operational requirements or expectations as soon as possible so we can begin working to mitigate these issues.

The electric and hybrid propulsion and innovation space has attracted huge interest and several non-traditional high-tech, well-financed entrants who are challenging the traditionalconceptand definitions of aircraft, airspace, mobility, and other areas. As On-Demand Mobility (ODM) and eVTOL markets have begun to mature, it is vital to understand these vehicles and future operations in more detail.

Non-aviation, non-traditional companies like Uber and Amazon, along with industry giants like Airbus, Boeing, and others, are devoting much effort and resources into developing not only new vehicles and propulsion systems, but also new business models for aviation. For example, many members of GAMA's EPIC are developing electric aircraft which may enable new regional markets because of the efficient nature of electric operations. The potential growth and higher airspace density of the electric aircraft sector threaten to upend the traditional model for air traffic control, even after moving to a satellite-based system. While low density operations of eVTOL and regional aircraft can initially increase in uncontrolled airspace, over time these aircraft might reach a level which no longer allows for visual separation. Further, it is likely that key regulators such as the FAA will be hesitant to take on new air traffic control infrastructure just as the decade long ADS-B out mandate is nearly completed (2020).

There are those who are thinking outside this box, however. For example, 4Gand 5G mobile network services might provide a backbone for voluntary aviation networks, which could supplement visual operations initially and which could enable more complex operations once the benefits of such a voluntary network were proven out.

Given that one of the key benefits of electric propulsion in aircraft is its environmental sustainability, it is also important to undertake research related to the life-cycle cost of the electrical energy which will power electric aircraft of the future. These life-cycle analysis (LCA) studies could be very useful to enable the expanded operation of electric aircraft in many markets around the world and potentially in justifying fiscal incentives and improving public understanding of, and support for, sustainable aviation.

It is an exciting time in the global general aviation industry, and GAMA is proud to be leading the way.

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