

# Shared Horizons



A Biannual Publication of the US-India Aviation Cooperation Program



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**DR. DINESH KESKAR**  
ACP Co-chair (Industry) and  
President, Boeing India



**AARON E. WILKINS III**  
ACP Co-chair (USG) and  
FAA Senior Representative

We are proud to deliver the second issue of "Shared Horizons". This edition covers our focus and progress in 2010 and also gives you a peak into the future.

ACP started in late 2005 with the combined vision of the honorable Indian Minister for Civil Aviation, Shri Praful Patel, and the then US Secretary of Transportation, Norman Mineta. Their inspiration and leadership led to ACP's leadership where the US Government agencies and US industry today engage closely with the Government of India and our customers and partners in the region.

ACP's projects and events cover a broad waterfront for aviation cooperation between India and the US, and further the mission: to support the growth of the Indian civil aerospace sector through projects that encourage collaboration between the US and India in the areas of air traffic management and its regulatory aspect, aerospace technology and best practices.

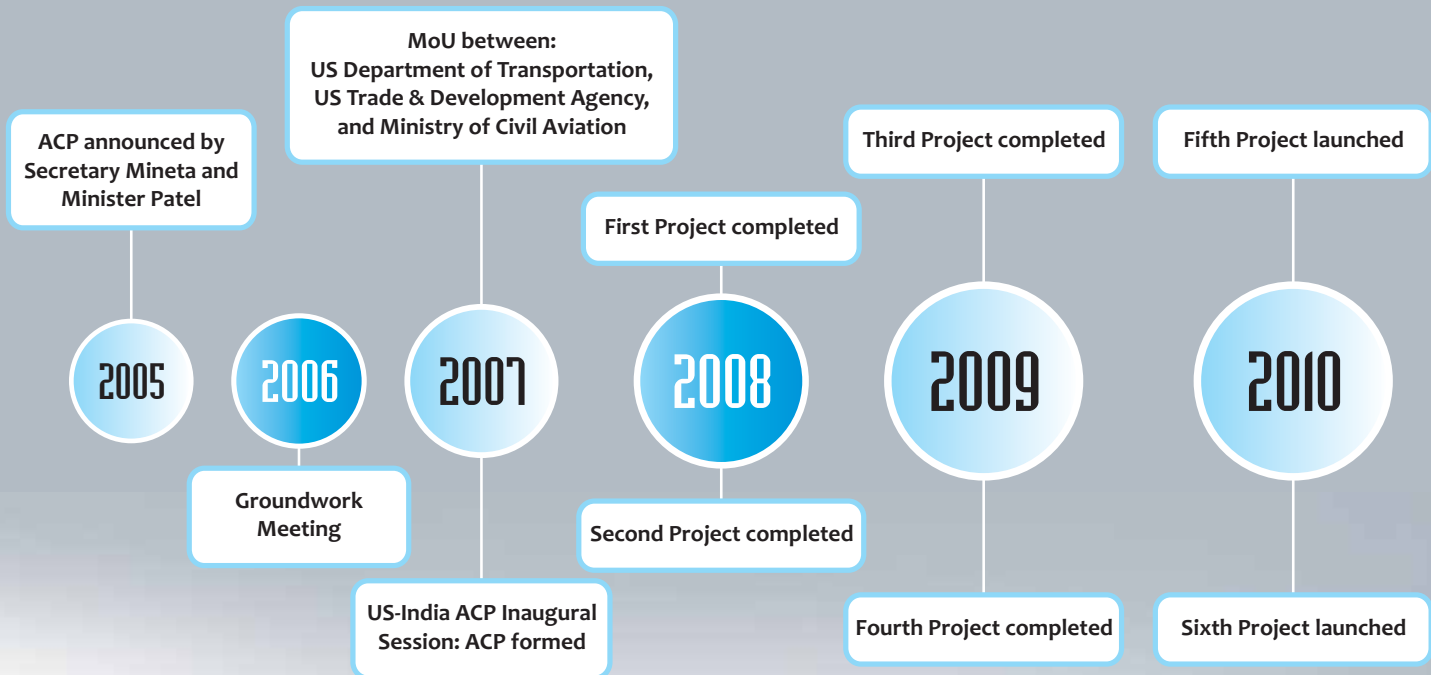
This year, ACP has completed the ADS-B one seminar, GBAS half-day seminar and roundtable conference on Airport Financing and Regulatory Best Practices. And, we have five key projects underway: Helicopter Aviation Safety Technical Assistance, Technical Training for the Aerospace Industry, TMODT, GBAS Pilot project Chennai airport and AAI ATCO capacity assessment. Other projects have also gained traction and are currently with USTDA. ACP had a strong presence this year in events such as the India Aviation 2010 Airshow Hyderabad.

ACP is built on the pillars of technical support from the US Federal Aviation Administration, financial backing of the US Trade and Development Agency and stakeholders, and the instrumental participation of over 33 companies from the US industry. But the ACP's anchor is its customers within the Government of India and the leadership within the Ministry of Civil Aviation, Director General of Civil Aviation, and Airports Authority of India. For their partnership, we are deeply grateful.

We are encouraged by what lies ahead of us in 2011 and are enthusiastic about our future as an association. The "Shared Horizons" ahead looks truly limitless.



## HISTORY



## FOCUS AREAS

- Air traffic management modernization
- Airspace and airport analysis, development and planning
- Aviation support industry development
- Aviation human resources
- Aviation safety
- Aviation security



## OBJECTIVES

- Promote greater engagement between the US and Indian Government agencies and industry to enhance civil aviation in India
- Undertake projects that advance cooperation in domain, 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

## MISSION

The US-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 U.S. Government agencies and the U.S. companies.

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



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- Color-coded switches easily identify controls (water, foam, dry chemical, clean agent)
- Cab space – 275 cubic ft. (7.8 cubic m)

“

Creation of aeropolis or airport city, houses five-star hotels, restaurants, shopping complexes, conference centres and special high-speed train connectivity to the airport and to the main city centres generate considerable opportunity.”



M. Madhavan Nambiar, Secretary of the Indian Ministry of Civil Aviation

“

Recent trends in domestic capacity adjustments by Indian carriers have brought the supply-demand equation into better balance. For three months in a row this year, the airlines are making profits.”



Dr. Dinesh Keskar,  
ACP Co-chair (Industry) and President,  
Boeing India

# India needs 400 open next few years to meet India Aviation 2010, Hyderabad





# Operational Airports and 3,000 Aircraft in Meet Air Travellers' Needs: Praful Patel





## Indo-US Aviation Cooperation Program: A Boon to India's Civil Aerospace Sector

The US-India Aviation Cooperation Program (ACP), which was initiated in 2007 as a public-private partnership between the US Federal Aviation Administration (FAA) and the US Trade and Development Agency (USTDA) along with the other US government agencies and companies, aims to support the growth of the Indian civil aerospace sector.

The program works directly with the Indian Government to identify and execute projects that encourage collaboration between the US and Indian stakeholders with a focus on aerospace technology and best practices.

The Indian side in the program is represented by the Ministry of Civil Aviation, Director General of Civil Aviation (DGCA) and Airports Authority of India (AAI). In particular, the program seeks to advance cooperation in domains such as aviation safety, security, regulatory oversight and management. Yet, another thrust area of the program is providing training and technical assistance to speed up excellence in aviation operation. More importantly, it facilitates the access to the US expertise to assist India's aviation growth.

As part of the ongoing Helicopter Aviation Safety Technical Assistance, it is planned to review high-density procedures and emergency services. Further, it seeks to increase the volume of helicopter operations in India through regulatory training and examination of composite regulatory framework based on international



L to R: Dr. Arjun Singh, Program Director, US-India Aviation Cooperation Program; Aaron E. Wilkins III, ACP Co-chair (USG) and FAA Senior Representative; and Timothy J. Romer, US Ambassador to India

Praful Patel, Indian Minister for Civil Aviation, has said that the bidding process for the construction of the new airport at Mumbai would be completed within a year. Speaking at the India Aviation 2010 Exhibition and Conference at Begumpet Airport (Hyderabad), Patel expressed optimism over the growth of the civil aviation sector as it grew by a robust 18% CAGR (compounded annual growth rate) in civil aviation in 2009, despite the global slowdown.



L to R: M. Madhavan Nambiar, Secretary of the Indian Ministry of Civil Aviation; Praful Patel, Indian Minister for Civil Aviation; and Aaron E. Wilkins III, ACP Co-chair (USG) and FAA Senior Representative





standards. The DGCA has also received an American grant for making helicopter flight in India a safe and reliable operation. Another significant ongoing program that has as its objective is the growth of the Indian aerospace manufacturing sector through training in international aerospace manufacturing standards, process, procedures and best practices. The training will involve multiple sessions taught by the US industry for the benefit of the Indian manufacturing sector active in the area of civil aviation and aerospace.

One of the important projects that has already been accomplished under the project is Air Traffic Management Training Program. This four-phase project involved visits by the US and Indian Air Traffic Management (ATM) professionals to each other's countries to identify the near and long-term opportunities for enhancing ATM operations. The project focused on the high-density air traffic operations between India's two busiest airports – New Delhi and Mumbai. Interestingly, the Indo-US Aviation Cooperation Program came into being after a Memorandum of Understanding (MoU) was signed between the US Department of Transportation, US Trade and Development Agency and India's Ministry of Civil Aviation in 2005. In the ultimate analysis, the focus areas of this initiative include air traffic management and modernization, air space and airport analysis, development and planning, aviation human resources as well as aviation security and safety.

The inaugural session of the airshow was also addressed by Timothy J. Roemer, US Ambassador to India; Jerome Bonnafont, French Ambassador to India; and Dr. Dinesh Keskar, Chairman, FICCI Aviation Committee.



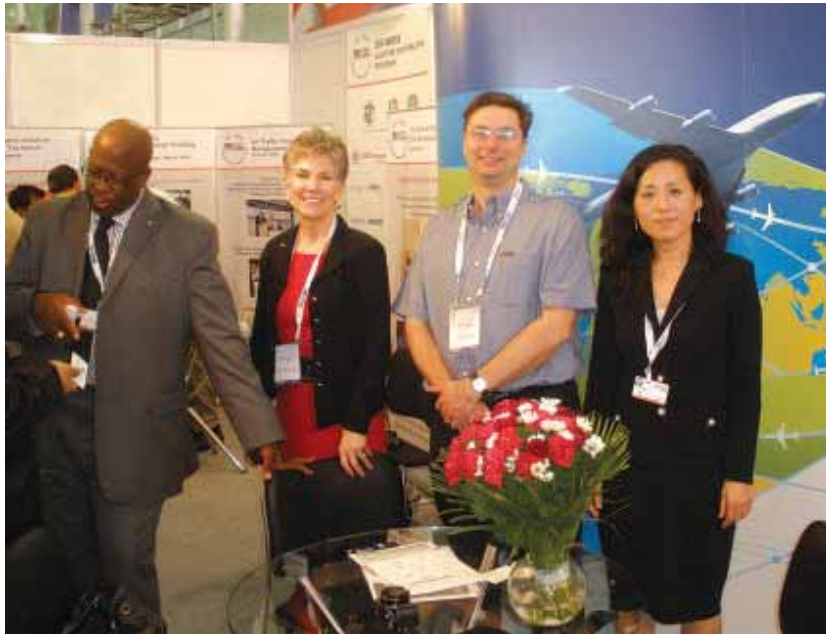
L to R: Dr. Atulan Vijaya Raghvan, COO, System Insights; Timothy J. Roemer, US Ambassador to India; and Carmine D. Alosin, Minister-Counselor for Commercial Affairs

"We have been able to weather the thunderstorm that struck the world with composure and I am looking at 2010 with caution and am hopeful that the worst will be over this year," he told a capacity audience, over 200 of whom have flown in for the air show from overseas reflected the recognition that the India civil aviation sector had arrived on the world map.

Dr. Dinesh Keskar, President, Boeing India, pointed out that the recent trends in domestic capacity adjustments by Indian carriers have brought the supply-demand equation into better balance. For three months in a row this year, the airlines are making profits. Optimization of revenue, he said, was the key to achieving profitability goals. This would call for improving network and schedule quality.

***Domestic and international passengers are expected to increase at annual rates of 20% and 16%, respectively, resulting in an overall increase of over 19% per year.***





L to R: Aaron E. Wilkins III, ACP Co-chair (USG) and FAA Senior Representative; Lind M. Schuessler, WCG; Peter Stettler, Ricondo & Associates; and Mimi L. Dobbs, MITRE

M. Madhavan Nambiar, Secretary, Union Ministry of Civil Aviation, suggested the creation of aeropolis around airports. Aeropolis or airport city, houses five-star hotels, restaurants, shopping complexes, conference centers and special high-speed train connectivity to the airport and to the main city centers. He said, Indian airports not only have the potential to place India as an important international trade hub in the coming years but also to significantly develop the domestic air freight market. India's vast geographic expanse, a large population base and the potential for consolidation in the transport sector offered a considerable opportunity.

Nambiar urged all the stakeholders to work in the spirit of cooperation and collaboration, rather than competition to enable the country to play a pivotal role in the civil aviation sector.

In his remarks, Nambiar said that upgradation and modernization on non-metro airports offered significant opportunities for the participation of domestic and foreign private players. In addition, greenfield airports offered substantial scope for private sector participation through the PPP route right from the development of airports to their maintenance and operations. He further said that India had great potential for becoming a global hub for air cargo logistics triggered primarily by the impressive growth of the economy. For facilitating the development of India as an air cargo hub, there is a need to develop the concept of cargo village at selected international gateways. This, he said, would act as a catalyst to compete with major international airport hubs like Dubai, Singapore and Bangkok.



L to R: Dr. Arjun Singh, Program Director, US-India Aviation Cooperation Program; Ajay Kumar, Sr. Specialist, FAA; and Aaron E. Wilkins III, ACP Co-chair (USG) and FAA Senior Representative



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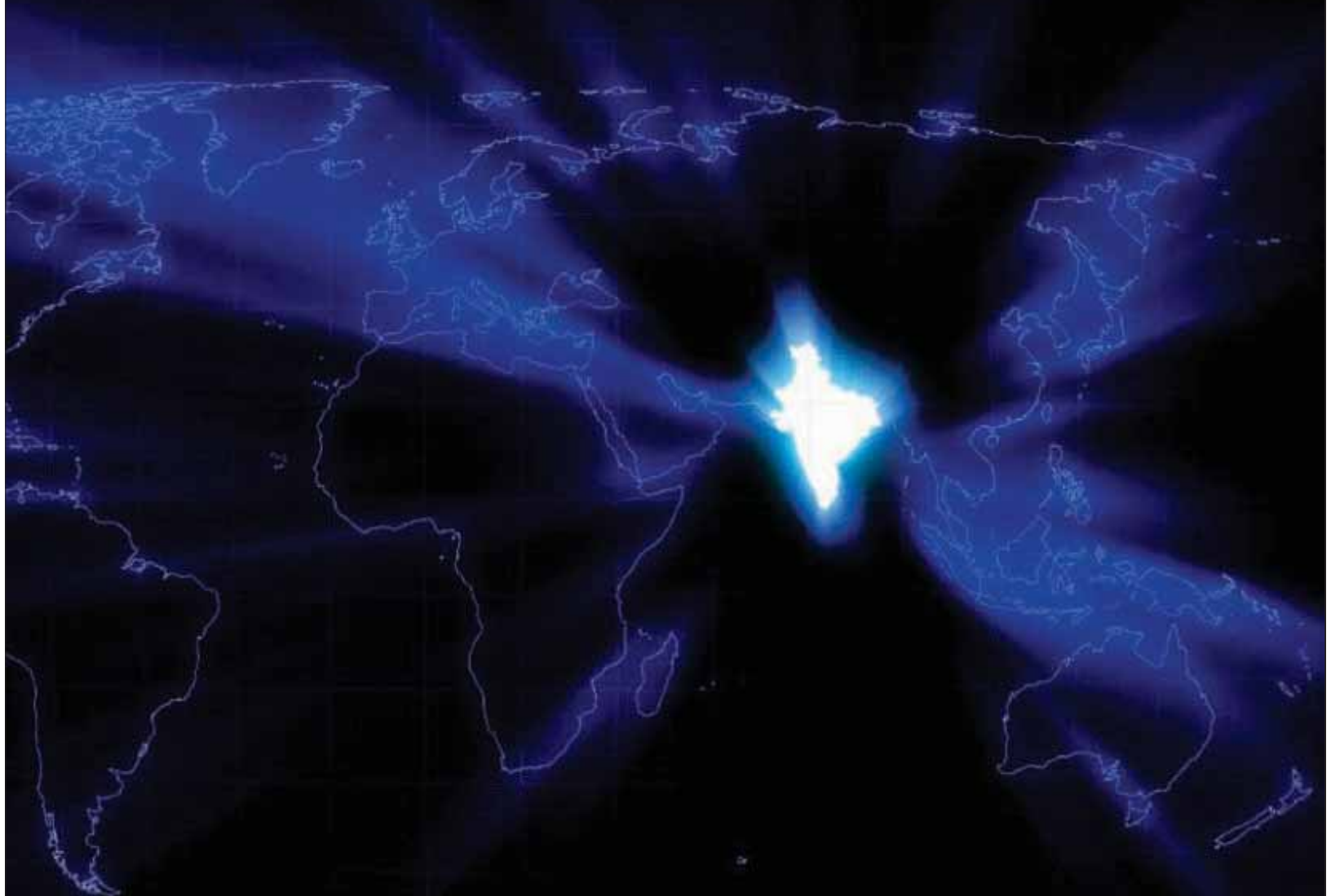


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# Roundtable Discussions on “Airport Regulatory & Financing Best Practices”



L to R: Chuck Kohli, Advisor, PAS; Sidharath Kapur, CFO, GMR Airports; P. Seth, Member (OPS), AAI; James White, Director, FAA; Peter Stettler, Director, Ricondo & Associates; Carmine D'Aloisio, Minister-Counselor for Commercial Affairs, US Embassy; Aaron E. Wilkins III, ACP Co-chair (USG) and FAA Senior Representative; Yashwant Bhawe, Chairman, AERA; V.P. Agrawal, Chairman, AAI; Henry Steingass, Regional Director, USTDA; Sandeep Prakash, Secretary, AERA; S.C. Chhatwal, Member (Finance), AAI; Sudhir Raheja, Member (Planning), AAI; and Manish Chheda, Associate Director, SDG

US-India Aviation Cooperation Program (ACP), in association with Paulk Aviation Services (PAS) and Strategic Decisions Group (SDG), organized a high-level roundtable discussion on “Airport Regulatory & Financing Best Practices”. This roundtable discussion was held on March 2, 2010 at the Marriott Hotel in Hyderabad.

The objective of this roundtable discussion was to bring together key stakeholders and experts from the United States and India to discuss airport regulatory and financing best practices to enhance the development of Indian aviation infrastructure, especially in the regional (non-metro) context.

The audience comprised of representatives from multiple stakeholder entities such as regulators, aviation and related service providers, consultants, etc.

The high-level roundtable discussion opened with the panel emphasizing the opportunity for Indo-US cooperation towards developing regional airport infrastructure in India.

This was followed by a summing up of the current aviation infrastructure landscape in India and highlighted the opportunities and challenges, followed by presentations on airport financing in the US and the role played by the Federal Aviation Administration. Post these presentations, there was a free exchange of opinions and suggestions amongst the stakeholders.



L to R: Chuck Kohli, Advisor, PAS; Peter Stettler, Director, Ricondo & Associates, Sidharath Kapur, CFO, GMR Airports; Carmine D'Alosin, Minister-Counselor for Commercial Affairs, US Embassy; and James White, Director, FAA

## Perspective

- A large and growing aviation market exists in India which has led to greater demand on metro and non-metro airports. According to a survey by the Airports Council International (ACI), India will be the fastest-growing market at 10% in the next 20 years. However, under-investment in the Indian airports network has resulted in massive infrastructure gaps.
- There are 575 airports in India (136 defense airports, 158 state government airports, 61 private airports and 220 AAI airports). A large number of these airfields are not operational and are not being effectively used.
- Key challenges in re-opening some of these airports include: low volume of traffic (thereby undermining financial viability), land constraints, difficult terrain, etc. Land grants by state governments, city side real estate development, enhanced commercial activities within the terminal; SEZ airports, low-cost airports, etc. will be needed to make some of these airports viable.
- All these factors have necessitated the need for greater investments and increased private sector participation in airport development, which has traditionally been in the public sector.



L to R: V.P. Agrawal, Chairman, AAI; Yashwant Bhawe, Chairman, AERA; P. Seth, Member (OPS), AAI; S.C. Chhatwal, Member (Finance), AAI; Sudhir Raheja, Member (Planning), AAI; and Sandeep Prakash, Secretary, AERA



Yashwant Bhawe, Chairman, AERA

## Indian experience

- With the belief that the metro airport business model will be successful, stakeholders believe that time is ripe for the next round of investments focused on regional airports.
- While the bond market in India is not as robust as in the US, funding can be accessed through strong Indian banks. Infrastructure bonds can also be explored as a source of financing.
- Significant progress is being made on the regulatory front (through entities such as AERA) which is encouraging from a private sector developer perspective.
- The AERA Act mandates the regulator to take into account the viability of the airport while determining the tariff for aeronautical services. Parameters such as traffic forecasts, expected return on investment and equity and service level expectations are critical in tariff determination.
- In the Indian context, single till model is deemed to be most appropriate by AERA.



Sidharath Kapur, CFO, GMR Airports



V.P. Agrawal, Chairman, AAI



James White, Director, FAA



Peter Stettler, Director, Ricondo &amp; Associates



Henry Steingass, Regional Director, USTDA

## US experience

- In the US, the municipal bond market acts as a significant source of airport financing. Bonds whose maturities are almost as long as the life of the project are issued for financing the project.
- FAA's Airport Improvement Program (AIP) has an annual budget of USD3.5 billion. Funds are granted to airports on the basis of rigorous due diligence of the business case put forward by the airport to the FAA.
- While regulation in the US is flexible, i.e. regulation is aligned to the airport's internal and external environment, stability in the regulatory environment has ensured that airports in the US never defaulted on their bond payments.

## Action Plan

- There is a clear consensus on the need for investment in aviation infrastructure, establishing a regulatory framework, exploring innovative financing / partnership options and ensuring sustained adequate return on investment.
- With this backdrop, it has been agreed in principle that:
  - AAI and ACP identify a non-metro airport as a 'live' case study
  - ACP, under the auspices of AAI, formulate a development strategy for this non-metro airport which will include:
    - o Developing a viable business model for the airport
    - o Providing recommendations on financing options
    - o Providing inputs for the regulator



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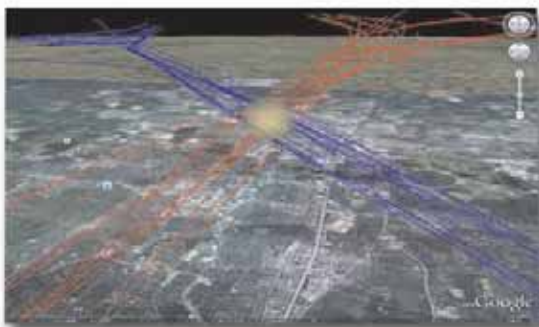
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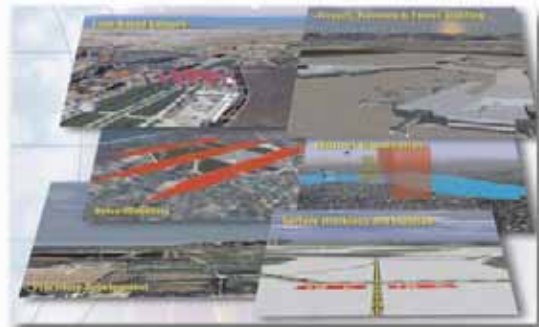
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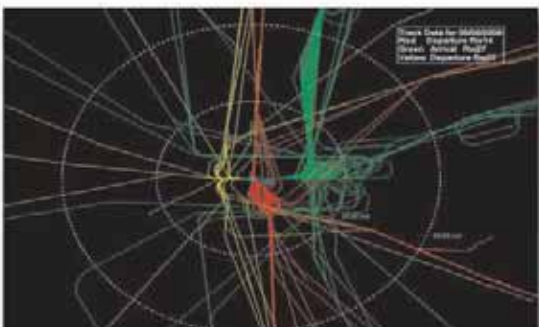
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# New Oshkosh Striker Aircraft Rescue and Fire Fighting Vehicle introduced at FDIC and Interschutz

Oshkosh Airport Products, a division of Oshkosh Corporation [NYSE: OSK], displayed the new Striker® Aircraft Rescue and Fire Fighting (ARFF) vehicle at Interschutz in Leipzig, Germany, the world's largest fire and emergency show. Unveiled at the Fire Department Instructors Conference (FDIC) in April, the new Striker features a wide range of industry-leading innovations.

"The new Oshkosh Striker is a global product that is engineered to meet the growing emergency response needs at airports of all sizes. One look and you know this is an extraordinary ARFF vehicle," said Jim Johnson, Oshkosh Corporation Executive Vice-

President and President, Fire & Emergency. "Airport fire chiefs and firefighters from around the world – including those from Asia, Portugal, the U.S. and South America – assisted the Oshkosh Airport Products team in developing the new Striker. The positive feedback we've received from the industry reaffirms our three-year development program investment."

The new Striker delivers innovative fire suppression technology; unmatched chassis performance; advanced safety systems; unsurpassed reliability and durability; and smart design.



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## NEW STRIKER STANDARDS

The new Striker delivers innovative fire suppression, unmatched chassis performance, advanced safety systems, unsurpassed reliability and durability, and smart design. So you can take on ARFF hazards like never before.

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- 24/7/365 support

### Smart Design

- Color-coded switches easily identify controls (water, foam, dry chemical, clean agent)
- Cab space – 275 cubic ft. (7.8 cubic m)





# 'Civil Aviation: Creating Sustainable Growth'

The Indo-American Chamber of Commerce (IACC) organized a highly focused conference on topics including Regional Airport Development and Financing, Future Air Traffic Management, Role of ACP in Indian Civil Aviation, Green Aviation: CSR, General Aviation and MROs was held on 29-30 July 2010 at New Delhi. The welcome address was delivered by Mr. Atul Sharma, Vice-President, IACC (NIC), New Delhi. He invited Dr. Dinesh Keskar, President, Boeing India, ACP

*Domestic market size is expected to cross 60-70 million and international traffic 40 million by the end of 2010. With the fastest-growing number of airline passengers in the world, the Indian aviation sector is seeing a rapid increase in its capacity requirement*

Co-chair (Industry), to present the industry perspective. Dr. Keskar emphasized on the growth / profitability of the Indian Airlines which decides the sale of the Boeing aircraft in future to the Indian aviation sector. In his concluding presentation, he predicted a 20% profit in the airlines.

Dale N. Tasharski, Commercial Counselor, US Embassy, presented the US Government's perspective and mentioned about various MOUs, agreements, Joint Aviation Steering Committee, US-India Aviation Cooperation Program (ACP), etc.

V. P. Agrawal, Chairman, Airports Authority of India (AAI), delivered the special address and mentioned that India had become the ninth-biggest aviation market in the world and will most likely be the fifth-biggest aviation market in the world in the coming years. At the same time, India was still one of the least penetrated markets, even lower than Sri Lanka, Pakistan and Nigeria. Metro airport modernization and the development of regional / non-operational airports would aid in avoiding this bottleneck. Government had



L to R: Dr. Dinesh Keskar, President, Boeing India; V.P. Agrawal, Chairman, Airports Authority of India; M. Madhavan Nambiar, Secretary of the Ministry of Civil Aviation; Atul Sharma, Vice-President, IACC (NIC); and Dale N. Tasharski, Commercial Counselor, US Embassy



approved 12 new greenfield airports. Liberal FDI policy in infrastructure development along with other opportunities (in air cargo, MRO, hotel/motel and other passenger-related amenities) would pave the way for the same. The Indian airspace is controlled by AAI and the implementation of Central Air Traffic Flow Management (ATFM) System, GPS-aided GEO Augmented Navigation (GAGAN), would augment the airspace capacity, improve upon air route and airways.

The Indian aviation sector, like any other economy, had witnessed booming growth over the past few years. Air traffic had grown at over 15-20% in the last decade. According to a survey by the Airports Council International (ACI), India would be the fastest-growing market in the aviation sector at 10.4 % rate in the next 20 years. As per Center for Asia Pacific Aviation (CAPA), for domestic market, the Government of India is targeting a growth greater than 8% in the year 2010-11, and at least 9% for the next five years until 2015. This could result in sustained growth of 15% or more per annum over this period. The global forecast states that India will be the fastest-growing aviation market in the world over the next 20 years, with sustained compounded annual growth rate of approximately 10% per annum over this period. This would result in India emerging as the third-largest aviation market in the world by the early 2020's. Steady growth of the Indian economy and liberalization has propelled the sector and it has experienced an unprecedented growth in the last few years. The domestic market size is expected to cross 60-70 million and international traffic 40 million by the end of 2010. With the fastest-growing number of airline passengers in the world, the Indian aviation sector is seeing a rapid increase in its capacity requirement.

The keynote address was delivered by M. Madhavan Nambiar, Secretary, Ministry of Civil Aviation (MOCA), and emphasized that there is a great opportunity for MROs as currently there are approx. 775 aircraft in the country and the number is expected to become 1,500 to 2,000 in the next 20 years. Environment sustainability should also be taken care of for which India has set norms to be achieved by 2025-50. He also stressed the need to improve the airport infrastructure and air traffic services facilities, hub development, improved security and human capital management.



**M. Madhavan Nambiar**  
Secretary of the Indian Ministry of Civil Aviation



**Dr. Syed Nasim A. Zaidi**  
Director General of Civil Aviation



**Prashant Narain Sukul**  
Joint Secretary, Indian Ministry of Civil Aviation



**V. P. Agrawal**  
Chairman, Airports Authority of India



L to R: P. D. Bahukhandi, Executive Director (QC); Vijayant Singh, Director Regional Marketing, GE Aviation; Dr. Syed Nasim A. Zaidi, Director General of Civil Aviation; Atul Sharma, Vice-President, IACC (NIC); and Dr. Shrinivasan Achanta, LLC Honeywell



L to R: Ravi Radha Krishnan, Manager, Reliance Aviation Infrastructure; M. S. Chidananda, Program Director, NAL; B. S. Singh Deo, Managing Director, Bell Helicopter; R. K. Tyagi, Chairman, Pawan Hans Helicopters Ltd.; Kapil Kaul, CEO, CAPA; and Prof. K. C. Gandhi, University of Petroleum and Energy Studies

The first technical session on “Regional Airport Development and Financing” started with a brief note and the first speaker of the session Vidya Basarkod, CEO, Reliance Aviation Infrastructure, emphasized about the need for regional airports and their development in India. She felt that the development of tier-2 and tier-3 cities airports is a victim of discriminatory attitude. She mentioned the key challenges about five Reliance airports in Maharashtra which are facing constraints from all fronts and sought some aid from the stakeholders, including the central and the state governments, but nothing concrete seems to have been achieved so far.

Manish Chheda, Managing Director, Auctus Partners, presented a paper on the financing of regional airports through debt financing and Municipal Bonds etc. He further mentioned that in the USA and Europe airports are owned by local governments and municipalities. Municipal bonds can be a good option in India as it would give pleasure to the people to develop their own airport. The only shortcoming of the municipalities is that they do not have good credit rating from banks for their ability to repay the bond money.

The last speaker of the session Atul Sharma, Vice-President, IACC, discussed about the legal perspective in the Indian aviation sector and emphasized on the flexibility to the airport developers with respect to laws in vogue.

The second technical session on “Future Air Traffic Management” was chaired by P. K. Kapoor, Executive Director, CNS (OM), AAI, who briefed about the topic. The first speaker of the session N. V. Atale, Joint General Manager (ATM), AAI, presented a paper on the Performance Based Navigation (PBN) concept based on the use of Area Navigation, i.e. RNAV & RNP. The various benefits of PBN include: Establishment of Structured and De-conflicting traffic flow, Fuel savings and environment, and Flexible routing. GAGAN and GBAS Landing System (GLS) are the aids to the PBN which will increase the airspace capacity substantially.



**R. K. Tyagi**  
Chairman, Pawan Hans  
Helicopters Ltd.



**Lola Gulmova**  
Commercial Officer,  
US Embassy



**Bala Krishnan Kalyanaraman**  
USTDA



**Dr. Dinesh Keskar**  
ACP Co-chair, (Industry), and  
President, Boeing India





**Vidya Basarkod**  
CEO, Reliance Airport Infrastructure



L to R: Dr. Arjun Singh, Program Director, US-India Aviation Cooperation Program; P. K. Kapoor, Executive Director, Airports Authority of India; N. V. Atale, Joint GM, Airports Authority of India; and Karlos Rodriguez, Harris Corporation



**Wg. Cdr. B.S. Singh Deo**  
Managing Director,  
Bell Helicopter India

The second speaker of the session on “Radio Networking” was Carlos Rodriguez, from Harris Corporation, who presented the company profile and Harris technology of the area. He further shared the experience with FAA model of radio networking being implemented in the US. Radio networking is the step to support Nex-Gen technology, which is the future ATM Modernization plan and will act like one transport system for all kinds of data.

“ATM Interoperability” was presented by Dr. Arjun Singh, Program Director, US-India Aviation Cooperation Program (ACP), on Global ATM Operational Concept, single sky and seamless sky. In this concept, air navigation services provided on the major traffic flows in a uniform fashion of the high quality with application of the same standards, leading to a global ATM system. Lastly, he mentioned free-flight which is a safe and efficient flight operating capability under instrument flight rules (IFR) in which the operators have the freedom to select their path and speed in real time. Air traffic restrictions are only imposed to ensure separation, to preclude exceeding airport capacity, to prevent unauthorized flight through special use airspace, and to ensure safety of flight. He also discussed various worldwide initiatives taken in this regard and concluded with remarks that a lot more needs to be done in this area.



**Kapil Kaul**  
CEO, CAPA

The last session of the day was panel discussion on “Benefit to American and Indian Industry” due to the presence of US-India Aviation Cooperation Program (ACP), chaired by Prashant Sukul, Joint Secretary, Ministry of Civil Aviation, and the panelists were Lola Gulomova, Commercial Officer, US Embassy; K. Balakrishnan, Country Representative - India, USTDA; and Dr. Arjun Singh, Program Director, ACP.

The second day conference on July 30, commenced with the first technical session on “Green Aviation: Corporate Social Responsibility”, which was moderated by Dr. Syed Nasim A. Zaidi, DG, DGCA - India. In his address, he highlighted the amount of pollution caused by aviation activities and then moved on to the ICAO's work done for reduction in noise pollution and also mentioned that through fuel efficiency carbon emissions can be minimized and goals have been set to achieve the same. In this context, a country



making unilateral agreements but ICAO is insisting on global framework and India is supporting ICAO. A Group on Climate Change has been set up by ICAO consisting of 15 members and India is one of them. He further mentioned that a website and committees in this regard have been set up in DGCA, to monitor the adherence of stakeholders' activities and circulars have been sent to all airlines to achieve reduction in carbon emission targets (voluntarily). Finally, each and every stakeholder has to contribute in order to reduce pollution.

The first speaker of the session Dr. Shrinivasan Achanta, LLC Honeywell, was invited for his presentation on Bio-fuels which is a global leader in advanced technology products, services and solutions. He further stated that global energy demand was growing at >2% per year and there are global concerns over sustainability and greenhouse gas emissions which necessitate their latest innovation of SPK (green jet fuel). This fuel is formed through inedible oils like rapeseed, Jatropha, camelina, greases and many more. But at the same time it causes concern over "first-generation" feedstock – food vs. fuel, deforestation and the need to develop larger-scale "second-generation" feedstock. The Bio-fuel has been tested on various aircraft, including Boeing, and some airlines, e.g. Japan Airlines aircraft, Continental Airlines aircraft, KLM, etc. When compared with costs, capital expenditure is similar to that of Jet A-1 and operating expenditure is subject to feedstock cost, but can be competitive with Jet A-1. This fuel is more efficient in terms of flash point and freezing point. It concluded that aviation bio-fuel faces various challenges before it is to become green.



**Dr. Shrinivasan Achanta,**  
LLC Honeywell

Vijayant Singh, Regional Marketing Leader, GE Aviation, spoke on "Aviation - Investing in Technology for a Greener Future" and his initial presentation emphasized on carbon emissions which depends a great deal on the engine technology and fuel efficiency. Hence, GE is trying to manufacture green-compliant engines which are more fuel efficient and cause least emissions and their main aim is to reduce fuel consumption, emissions, noise, maintenance, and disruptions. Hence, GE has come up with their new inventions which include GEnx (installed in 787, 747-8) and LEAP-X aircraft engine. On the operational front, he further emphasized for the reduction of carbon emissions by the direct descent approach preferred over step-down approach. In the direct descent approach, the aircraft continuously descends and then lands on the runway. It is concluded that there was a need for alternate fuel as well as green aviation engine in the aviation.



**P.K. Kapoor**  
Executive Director,  
Airports Authority of India

P. D. Bahukhandi, Executive Director (QC), Indian Oil Corporation Ltd., presented a paper on "Global Aviation Fuel Scenario and Corporate Social Responsibility" and pointed out that specifications for jet aviation fuel varied from country to country which need to be harmonized for availability of common JET fuel worldwide (open access system) better yields with less and friendly emissions, flexibility in operations / logistics, import / export, better aviation economics and enhanced flight safety. He further emphasized about the benefits of bio-fuels and their importance to aviation and environment. The second-generation bio-fuels exceed Jet A-1 specifications and it is more economically viable, essential, sustainable, cleaner and practical than the fossil fuels. Bio-fuels will prevent devastating consequences of global warming, he concluded.



**Manish Chheda**  
Managing Director,  
Auctus Partners

Atul Sharma, Vice-President, IACC, spoke on "Legal and Regulatory Issues related to Airport Noise Pollution" and emphasized on the legal issues pertaining to carbon emissions and noise pollution in which there are no laws governing noise pollution and carbon emissions inside the airport premises. The Government of India has to make rules for governing the ambient air quality standards, prescribing limits of noise in certain areas, differentiating resident/silent zones and limiting playing loudspeaker after certain hours, etc. ICAO proposed a few measures to



reduce noise pollution and carbon emissions such as noise preferential routes, airport curfews, engine run-up operations, noise mitigation, noise monitoring system, and noise level limits. On this issue, Dr. Zaidi said that 21 measures have been taken up at DIAL to mitigate noise pollution.

The second technical session of the day was “General Aviation”, chaired by R. K. Tyagi, Chairman, Pawan Hans Helicopters Ltd. He invited the first speaker of the session Wg. Cdr. B. S. Singh Deo, Managing Director, Bell Helicopter India, to present his paper on “Rotary Wings” scenario in India. He remarked that the use of helicopters in India is limited not only to personal use but extends to emergency medical services, movie work, search and rescue, fire-fighting, repair services, leisure, tourism, etc. Owing to its virtue of vertical lift, helicopter is the hero in disaster management relief work. The future of aviation lies in helicopter as it requires minimal air infrastructure when compared to air carriers. He emphasized on the development of infrastructure for helicopters in accordance with ICAO/DGCA regulations which will further help in the growth of aviation and further explained the prerequisites for building heliports in India. He introduced a new concept known as “Vertiport” which includes various modes of transportation and ancillary facilities under one roof. The biggest impediment to helicopter use is noise pollution. To overcome this problem, new helicopters have been designed whose noise limits are less than the prescribed limits. Two heliports were constructed in Delhi to cater to the Commonwealth Games requirement.

The second speaker of this session Kapil Kaul, Center for Asia Pacific Aviation (CAPA), spoke on “General Aviation”. He stated that the total number of fleet in India is 674 which included 277 helicopters and 117 business jets. He also mentioned that the expected fleet growth would be 10.5% by 2014-15 and 14% by 2015-20. He remarked that there is tremendous growth in helicopters and very light jets in the next 15-20 years and there is no general aviation industry in India. The reasons include poor financial framework [lack of funding, high interest rates (14-15%)], poor infrastructure (airspace issues, no separate terminal, limited night facilities, manpower planning difficulty), lack of regulatory framework, high cost of fuel, legislative and safety issues. He recommended that M/s. Pawan Hans Helicopter Limited will have to take the leading role in general aviation activities, e.g. framing the policies and development of integrated platform in the next 5 to 10 years, and manufacturers should invest in technology.

M. S. Chidananda, Programme Director, Civil Aviation Programme, National Aerospace Laboratories (NAL), Bangalore, India, spoke on “Role of National Aerospace Laboratories (NAL) in General Aviation”. He started his presentation by giving an overview of NAL including the mission, objectives and its contribution to the aviation industry. He also mentioned that NAL is into manufacturing composite parts of the aircraft and its technology, major R&D disciplines, flight mechanics and control technology, aero elastic testing of aerospace structures, flight simulators, failure analysis and accident investigation. He then mentioned about various defense aircraft manufactured by NAL which included LCRA (Light Canard Research Aircraft), HANSA-3 and SARAS. The development of 80-seater regional aircraft is in the pipeline.

Prof. K. C. Gandhi, University of Petroleum and Energy Studies, Dehradun, presented his paper on “Future of General Aviation” in India. He mentioned that general aviation covers a large range of activities, both commercial and non-commercial such as private flying, flight training, air ambulance, police aircraft, aerial firefighting, etc. Aircraft with general aviation have increased from 168 in 2005 to 460 in 2010. He concluded that GA faced two major challenges, i.e. infrastructure and manpower requirements.



**Vijayant Singh**  
Regional Marketing Director,  
GE Aviation



**Atul Sharma**  
Vice-President,  
IACC (NIC)



**Dr. Arjun Singh**  
Program Director,  
US-India Aviation  
Cooperation Program



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# Radio Networking Jeff McCown



What happens when an Air Navigation Service Provider (ANSP) wants to replace aging radio equipment, or upgrade to the new digital and/or IP radio standards, but can't afford to do a wholesale change out of all radios at one time – whether for economic or operational control reasons? What happens when an ANSP wants to start planning for dynamic resectorization by moving radio resources between controllers, towers and/or Area Control Centers (ACCs)? How does an ANSP begin to take advantage of new data communications technologies, and their associated cost benefits, when the currently installed radio equipment does not conform to the new data communications protocol standards?

These are three very important questions facing ANSPs today.

Harris has developed the solution to these issues with its new product the Integrated Radio Equipment & Network Adapter (IRENA). This small



footprint device (3RU) provides a migration path to your network that allows existing devices to stay in place on the outside edge of your network while preparing your system for the next generation of technology!

The IRENA is a gateway device that is used at the core of the network, at the control centers, and at the edges of the network. The existing air-to-ground radios do not have to be replaced since they can connect to an IRENA gateway. The radio voice messaging and control can be carried across the network in traditional Time Division Multiplexing

(TDM) fashion, or it can be converted to a digital format enabling communications across a private packet network. Therefore, the traffic from that site can be optimally transferred across a Wide Area Network back to the controlling location. The traffic can even be put into IP format and transferred across a private packet network. The IRENA also works at the control centers and is compatible with any voice communication and control system (VCCS) and PBX system. It is a gateway for legacy voice and command/control communications and connects them to the radio network.

The advantages gained in putting the traffic onto a packet network are significant.

- Efficiency in how much traffic can be run over a network line to a site
- Clarity in voice messaging
- Ability to run digital messaging to the site
- Monitoring capabilities
- Resectorizing of resources
- Path redundancy to the site

Let's take a look at some of these points, specifically how they can work to your advantage while you modernize your voice communication system.

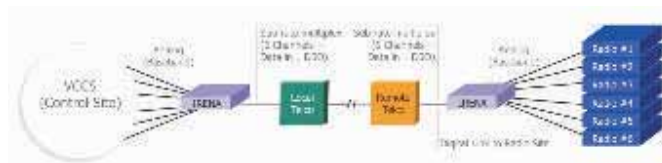
Efficiency of digital traffic versus analog traffic is significant. Voice traffic can be originated as Voice over Internet Protocol (VoIP) at the controlling site and sent directly to the radio location through the

***The existing air-to-ground radios do not have to be replaced since they can connect to an IRENA gateway. The radio voice messaging and control can be carried across the network in traditional TDM fashion, or it can be converted to a digital format enabling communications across a private packet network.***





IRENA. The IRENA translates the VoIP to an analog format for delivery to a legacy analog radio. The IRENA is capable of translating analog traffic from the radios to a number of different digital standards available today to be sent back across the network (G.726, G.728, G.729, etc.). The use of digital translating provides up to a 6-to-1 traffic savings on the network. Due to the voice messaging being in a digital format across the Wide Area Network (WAN), the clarity of voice is not lost over long distances. The diagram below shows an example system architecture utilizing the IRENA on both ends of the



#### WAN:

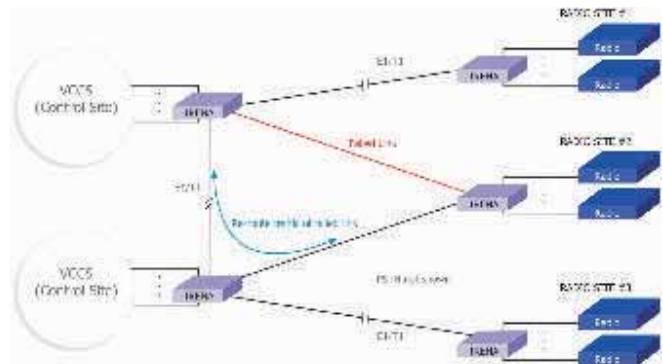
Digital messaging is converged onto the WAN connections through the IRENA. Ethernet can now share the link to the site providing all the advantages of having a Local Area Network (LAN). SNMP monitoring is used to check for any alarms occurring in the hardware, and testing is run from a centralized Network Operation Center (NOC) facility, if necessary.

The IRENA is a very high-density device with a number of ports available on the back of the chassis. The cards in the chassis can be configured with Ethernet, Voice (2W or 4W), E1/T1, ISDN, RS232, and/or V.35 interfaces. Loopback testing is available on any of the ports on the IRENA. Additionally, there are dry contact closure points on the back of the chassis enabling monitor and control capabilities for older legacy devices at site.

Resectorization of the network is a growing trend. With an IP-based digital network, the IRENA can be configured to resectorize (re-home) its connections to another location. This provides the ability of maintaining radio coverage in all areas even though personnel may not be located in the specific facility connected to those radios. If a facility closes in the evening hours, the IRENA can resectorize its

connections to other manned facilities providing radio coverage and cost savings to the operations.

Path and hardware redundancy are the cornerstones to having a critical network available at all times. The IRENA has redundant power supplies and cards in the chassis that are always in a hot-standby mode. If there is a failure, the redundant hardware is made active and the alarm is sent back to the management station for attention. The cards and power supplies are hot-swappable in the chassis which preserves the site's uptime. The IRENA can be configured for several different WAN topologies such as mesh topology or "loop" type. In either type of topology, the IRENA has the capability to drop-and-insert traffic for its own location, or it will route the information destined to another location. This is used to provide backup links on the WAN in case of a telephony line failure. This again can provide cost savings by eliminating the need for redundant lines. The backup line can be used to another IRENA location providing resiliency in the



network by supporting not only the one site, but the others connected to it as well, as illustrated in the figure above.

With IRENAs in the network, newer radios can be purchased and installed, as needed. Newer VoIP radios can now be put in place as older radios begin to fail. This provides you the ability to transition over to the newer technology without having to do it all at once. Both old and new technology radios can now exist at the same site. With IRENA in place, the ANSP can adapt to the latest network technologies available from the service provider resulting in lower network costs. In addition to being the answer to the three questions posed at the beginning of this article, the IRENA provides significant technology advantages and cost savings for your voice communication systems.





“where do I find thinkers

who keep the world connected?”



– **Ted Gavrilis**, Former President  
Commercial Space Systems  
Lockheed Martin  
Class of 1969

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# Airport Financing in the United States

Peter C. Stettler, Director, Ricondo & Associates, Inc.

As the aviation industry in India continues to expand, industry leaders are seeking ways to finance the development of the country's urgently needed airport infrastructure to keep pace with the growing demand for commercial airline service. Airports are capital-intensive enterprises, requiring significant resources to fund land acquisition, airfield development, terminal development, and supporting infrastructure to successfully meet the operational demands of the airlines and the service demands of the traveling public. The methods employed to finance airports around the world vary, encompassing both private and public sector participation. This article focuses on the financing methods used to develop aviation infrastructure in the United States (U.S.), as well as the

*Airports are capital-intensive enterprises, requiring significant resources to fund land acquisition, airfield development, terminal development, and supporting infrastructure to successfully meet the operational demands of the airlines and the service demands of the traveling public.*

underlying operational structure that supports the industry's ability to raise the capital necessary to maintain the extensive network of U.S. commercial airports.

Commercial airports in the U.S. are mostly owned and operated by municipal entities, such as cities, counties, states, or independent authorities, rather than the federal government. However, the U.S. federal government plays a vital role in the industry through the Federal Aviation Administration (FAA), which operates the air traffic control system, provides oversight and enforces regulations regarding airport planning and safety, and distributes grant funding through the Airport Improvement Program (AIP). Airports that receive AIP grant funding must adhere to the FAA's grant assurances, which, among other things: (1) prohibit the granting of exclusive rights to a particular carrier at an airport; (2) require an airport operator to properly operate and maintain airport facilities; (3) require an airport operator to make the airport available on fair and reasonable terms without unjust discrimination (oversight of airport rates and charges); and (4) require all airport-related revenue to be used solely for airport purposes (cannot be taken off-airport to pay for general municipal services).





While the U.S. has a well-developed network of airports, they still require substantial capital resources to maintain and expand to meet the continuing demand for air travel. In its 2009 Capital Development Survey, Airports Council International – North America estimated that airports in the U.S. expected to undertake \$94.3 billion in capital improvements between 2009 and 2013.<sup>1</sup> Commercial airports accounted for \$80.7 billion, or 86 percent of the total, with non-commercial airports representing the remaining \$13.6 billion.

Airports Council International – North America estimates that the capital resources to fund the \$80.6 billion of projects to be undertaken will be comprised of the issuance of airport revenue bonds at 30.0 percent, passenger facility charge (PFC) revenue at 21.7 percent, and FAA AIP grants at 22.2 percent, with the remainder raised through a mix of other sources such as state grants, local sources, airport sponsor equity (cash), Transportation Security Administration grants, and customer facility charges (a fee levied on rental cars to finance consolidated rental car centers).

Of the major financing sources, FAA AIP grants and PFC revenues are most similar to other airport financing sources around the world. The FAA AIP grants represent a basic federal governmental funding stream that funded through a ticket tax. AIP grant funding is established on an annual basis by Congress, usually through a multi-year authorization of the FAA with an annual appropriation of funds. AIP grants are then disbursed under two mechanisms, an “entitlement” portion to each airport based on the volume of enplaned passengers and a “discretionary” portion which is distributed by the FAA based on established criteria. The FAA may provide a “letter of intent” regarding the application of discretionary funds over a period of time to a particular project, subject to annual congressional appropriation process.

The PFC is an airport charge levied on a per enplaned passenger basis that is collected and remitted by the airlines as part of the airfare. The FAA oversees the PFC program, with the current maximum allowed rate being \$4.50 per enplaned passenger. Airports must

apply to the FAA for both permission to collect a PFC and to use a PFC to fund an eligible capital project (eligibility under a PFC is generally the same as under the AIP grant program, which typically excludes revenue producing projects, e.g. a parking garage). PFC revenue may be used directly to fund a project on a “pay-as-you-go” basis, or be used as security for an issuance of debt. Such debt may be solely secured by PFC revenues, or by a pledge of PFC revenues with an additional pledge of general airport revenues.

The largest source of capital funds identified in the Airports Council International – North America survey is the issuance of municipal bonds. Most local governments in the U.S. may issue bonds for capital purposes, subject to the provisions and restrictions of their individual state laws. Such debt may be secured either by their general taxing power (usually property taxes) or a specified revenue stream. Municipal owners and operators of commercial airports in the U.S. generally issue bonds secured by the general revenues generated by the airport enterprise, without recourse to the general taxing powers of the sponsor. The pledge of airport resources is usually granted on a “net” basis, which is defined as including all airport revenue less the payment of operating and maintenance expense. Other forms of security include PFC revenues, customer facility charge revenues, and AIP letter of intent monies.

General airport revenue bonds are typically structured as long-term, fixed-rate bonds. Principal payments are usually made on an amortizing basis over the 30-year maturity of the debt. Municipal bonds in the United States typically provide for a 10-year per call at the option of the issuer, which provides the issuer flexibility to respond to changing market conditions over time.

The U.S. municipal bond market is a well-established and liquid market, with approximately \$2.4 trillion of debt outstanding as of the second quarter of 2010, as estimated by the United States Federal Reserve.<sup>2</sup> Municipalities of all types have a strong history of repaying their debt, and commercial airports are no different as there is no record of an instance of default in the airport industry.<sup>3</sup> In the five years ended 2009, airports in the U.S. borrowed a total of \$9.4 billion through the bond market in support of various capital improvements.

In general, interest on airport revenue bonds, like most municipal debts, is exempt from the federal





income tax. However, interest on a significant portion of airport issued bonds is subject to the provisions of the federal alternative minimum tax. Also, an airport may occasionally issue bonds on a taxable basis. Major investors in municipal bonds include individuals seeking tax-free income, either through the direct purchase of bonds or through a mutual fund, and insurance companies. Other participants shaping the market include federal regulators, to the extent permitted under the securities laws, underwriters and investment bankers, financial advisors, bond counsel, feasibility consultants, and the three large bond rating agencies: Fitch Ratings, Moody's Investor Service, and Standard & Poor's Rating Service.

There are two key documents that control an airport's relationship with its investors and airline tenants which contribute to the strong credit history of airports in the United States. The first is the governing bond legislation, which can take the form of an indenture, a resolution, or an ordinance, among others. The legislation establishes, among other things, the pledge of security for the bonds, the status of the lien granted versus other outstanding indebtedness (on parity with, superior to, or subordinate to other obligations), the flow of funds (priority of payments), the timing of payments, covenants of the airport - including a rate covenant (a typical rate covenant provides that an airport will set rates and charges sufficient to generate net revenues equal to at least 1.25 times annual debt service payments), restrictions on or tests required regarding the issuance additional debt, and the events of default and bondholder remedies.

The second document is the use and lease agreement, which establishes the business arrangement between an airport operator and its airline tenants. The use and lease agreement reflects the historical development of airports in the U.S., which, while owned by public entities, have largely been developed jointly with the airlines. The use and lease agreement establishes the framework under which an airport operator conducts its financial operations, including: (1) the methodology for establishing rates and charges; (2) the manner of allocating and managing aircraft gates; and (3) the limits of airline oversight of capital improvement programs.

Historically, airport use and lease agreements were effective for a long period of time, typically around 30 years. This lengthy term reflected the highly regulated nature of the U.S. airline industry and the airlines'

ability to pass costs on to passengers that existed prior to deregulation of the industry in 1978. Since deregulation, the term of airport use and lease agreements, has significantly shortened. Many agreements are now effective for just five years, and several airport agreements have provisions that allow either the airline or the airport operator to terminate the agreement upon 30-days' notice. The shorter length of the use and lease agreement evolved in response to increasing volatility in the airline industry, as both airport operators and airlines sought greater flexibility to adjust their operations, and the agreements that governed them, as warranted by economic conditions.

One critical feature of the use and lease agreement is the rate setting methodology. In the United States, airports are generally operated under what is known as a "residual" rate-setting methodology (similar to the "single-till" methodology outside the United States), a "compensatory" rate-setting methodology (similar to the "dual-till" outside the United States), or a combination of the two, which is referred to as a "hybrid" rate-setting methodology. In a residual agreement, all non-airline revenue (from concessions, parking, etc.) at the airport is used to offset operating expenses, with the airlines either charged or credited any difference (or residual amount). At the end of each year, the airport enterprise settles with the airlines by either: (1) rebating or crediting back to the airlines in the following fiscal year any excess airline revenues generated, or (2) charging the airlines directly or including an additional requirement in the subsequent year's rates and charges to recover any shortfall in airline revenues.

In a compensatory agreement, the airport operator sets airline rates and charges to cover the costs of the facilities used and/or leased by the airlines without consideration of nonairline revenues. Excess revenues are generally either held by the airport enterprise, or split with the airlines in a revenue-sharing arrangement. Hybrid agreements are generally based on the compensatory rate-setting methodology for terminal facilities and the residual rate-setting methodology for the airfield.





Historically, most agreements followed the residual model, particularly in the era of airline regulation. Since deregulation, which enhanced the cyclical nature of the airline industry, airport operators have sought more control over their facilities with the compensatory or hybrid rate-setting methodologies becoming more accepted. Residual agreements are still prominent at connecting hub airports, allowing the airport operator to pass the majority of operating costs to the airline(s) that place the most demand on the facility, while also providing a measure of protection should the airline(s) falter. Compensatory agreements are favored at airports that largely serve demand created by the underlying market and are less reliant on any one airline.

An additional feature of the use and lease agreement is the provision regarding the use of terminal gates. Historically, most gates were assigned to an airline on an exclusive-use basis for the term of the agreement. However, in response to the need to better utilize airport infrastructure in the deregulated era, most U.S. airport operators now provide gates on a preferential or common-use basis. Preferential-use provisions provide an airline with many of the benefits they held under exclusive-use provisions. These provisions also protect the airport by establishing minimum use requirements

to assure efficient use of gates, allowing the operator to retake gates to accommodate another airline if these requirements are not met, and give an airport operator the ability to assign additional airlines to a particular gate should space be available at the needed time. Common-use gates provide an airport operator almost complete control over its gates, as it may assign any airline to a gate at a particular time.

A final feature of some use and lease agreements is a majority-in-interest (MII) provision, which ensures that airlines have input regarding the airport operator's capital program. In residual agreements, where the airlines typically guarantee an airport the revenue necessary to make its debt payments, the MII provision is typically strong (from the airline's perspective) granting airlines' significant control over an airport operator's ability to undertake a capital program. However, this level of control over an airport's capital program may limit the ability of the airport operator to accommodate demand, accommodate new entrant airlines, or otherwise implement improvements in a timely manner to enhance airport operations. As a result, as airport operators have gained greater control over nonairline-generated revenues, they have also sought to reduce airline MII control over airport capital programs.

<sup>1</sup>Airport Council International – North America, Airport Capital Development Costs 2009-2013, February 2009.

<sup>2</sup>Board of Governors of the Federal Reserve System, Flow of Funds Accounts of the United States, Flows and Outstandings, Second Quarter 2010, September 17, 2010.

<sup>3</sup>Fitch Ratings, Municipal Default Risk Revisited, June 23, 2003; Moody's Investor Service, Moody's US Municipal Bond Rating Scale, November 2002; Standard & Poor's, U.S. Public Finance Rating Characteristics, March 7, 2008.



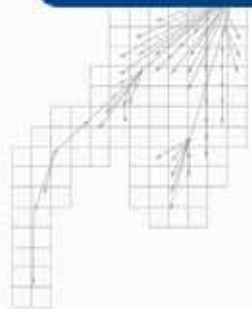
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$$\mu_k < M_k - \sigma_k$$

$$M_k - \sigma_k \leq \mu_k \leq M_k + \sigma_k$$

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OF DELAYS ELIMINATED  
**+ 186** MILLION LITERS  
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$$d(v, w) = \sqrt{\sum_{k=1}^n \frac{(v_k - w_k)^2}{\sigma_k^2}}$$

**= 573** THOUSAND METRIC TONS  
OF CO<sub>2</sub> EMISSIONS CUT  
**= 6.3** BILLION DOLLARS  
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## GPS Ground-Based Augmentation System: A New Approach for Precision Landings

***The next generation of precision navigation is here... and it has the potential for significant fuel and cost savings for airlines***

In the early 1930s, passenger air travel evolved and grew at a rapid pace. So did the need for a reliable method for providing a precision approach path for reduced-visibility landings. The Instrument Landing System (ILS) had already begun operational tests in 1929. This new technology had its first true test during a snowstorm on January 26, 1938 in Pittsburgh, Pennsylvania, with the first scheduled passenger aircraft landing using only ILS.

Now, more than 70 years later, the ILS technology used today is basically the same as that used that snowy day in Pittsburgh. Technology advancements have dramatically increased the capabilities of today's modern aircraft, and when coupled with continuous growth in air travel, 70-year-old ILS technology simply cannot meet future air traffic management demands. Not only does ILS have technical limitations that impact flight path

flexibility and airport throughput, it is also susceptible to signal interference by weather and obstacles (including other aircraft in flight or taxiing) which can cause significant disruptions to airport traffic and resulting delays. ILS suffers from a number of technical limitations such as VHF interference, multipath effects (for example, due to new building works at and around airports), as well

***ATFM considers the entire network of airports and available airspace, considers constraints caused by high volumes of traffic or weather, and allows managers to adjust airplane flight plans accordingly.***



as ILS channel limitations. Due to these limitations with current ILS equipment, airports routinely lose capacity as visibility decreases. In the United States alone, 15 of the top airports experience greater than 25 percent reduced capacity when ceilings are below 200 feet. In these situations, aircraft are often forced to circle in holding patterns, burning more fuel, or even worse, are diverted to alternate airports.

### **The Future of Precision Navigation has Landed**

Ground Based Augmentation System (GBAS) to Global Positioning System (GPS), harnesses the capabilities of the global positioning system and provides a precision approach signal that is more accurate, more flexible and less susceptible to error sources than the 1930s-era ILS currently in operation. GBAS technology utilizes a ground system installed at an airport to identify and correct small errors in GPS satellite signals and then transmit this information to arriving and departing aircraft. This high-integrity, extremely precise positioning data can provide precision approach capability to all

runway ends, maximizing airport capacity in all visibility conditions and minimizing delays and diversions – ultimately saving fuel and reducing emissions while also contributing to a safer operating environment.

### **SmartPath™: the First and Only FAA-Approved GBAS**

Honeywell's SmartPath™ Precision Landing System is the first and only GBAS technology to receive the Federal Aviation Administration's (FAA) System Design Approval. It provides a cost-effective solution to increase airport capacity, reduce delays and diversions, decrease air traffic noise and reduce weather-related delays. To achieve FAA System Design Approval, Honeywell's SmartPath was fully audited, reviewed and inspected by the FAA in a multi-year process.

The SmartPath Precision Landing System is already certified and available and in use today for Category I precision approach and landing operations. The Category I designation allows for aircraft to land in conditions where there is at least a half-mile visibility at a 200-foot decision height on approach. The SmartPath precision landing system will ultimately fulfill the extremely high requirements for accuracy, availability and integrity necessary for Category II and III precision approaches. Additionally, it





## Honeywell: A Leader in GBAS Technology

Since demonstrating the first GPS-based auto-land in conjunction with NASA in 1989, Honeywell has been the industry leader in the design and development of GBAS precision landing systems. Honeywell's industry leadership includes:

- First GBAS landing with a production civil aircraft: Qantas 737, Sydney Australia, 2005 and GBAS autoland on A380 test flight in Sydney Australia 2007
- Honeywell GBAS used by NASA for Space Shuttle training since 1998
- Selected by the Port Authority of New York and New Jersey to install a SmartPath system in Newark to improve airport capacity in the congested New York air corridor
- Chosen for the first installation in Latin America for Brazil's Rio de Janeiro Galeao International Airport
- Over 2,300 passenger revenue landings using Honeywell's Sydney Australia SmartPath installation

## Part of the FAA's Blueprint for the Future

The FAA's National Airspace System (NAS) Enterprise Architecture (EA) is the blueprint for transforming the current NAS to the NextGen ATM. The GBAS precision approach is one of the investment programs that provides solution to "Increase Flexibility in the Terminal Environment" in the NextGen implementation plan. The FAA plans to replace legacy navigation systems with satellite-based navigation technology, and has determined that GBAS is the only cost-effective alternative to existing Instrument Landing Systems (ILS) by providing terminal, non-precision, and CAT I/II/III precision approach capabilities in the NAS. Some of these existing ILS systems will be phased out over time as GBAS are installed. A number of ILS facilities are expected to remain operational, to continue to provide precision approach service as a backup in the event of unavailability of GBAS services.

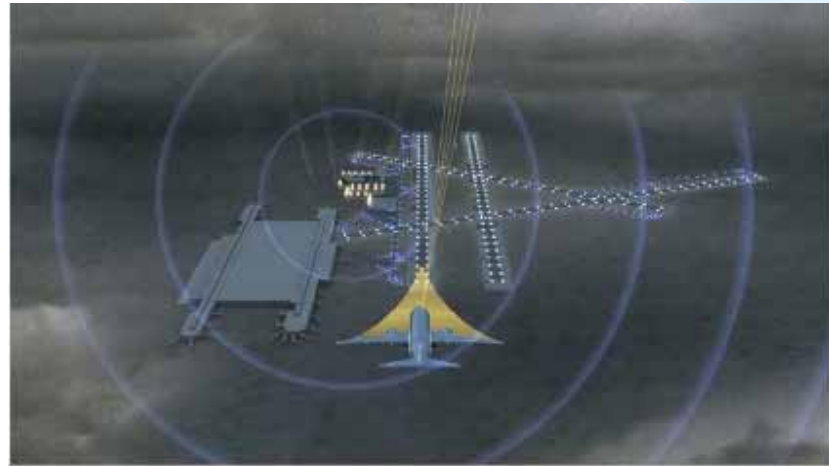


Figure 1 – Variable Glideslope and Displaced Threshold



Figure 2 – Clear-Zone Elimination

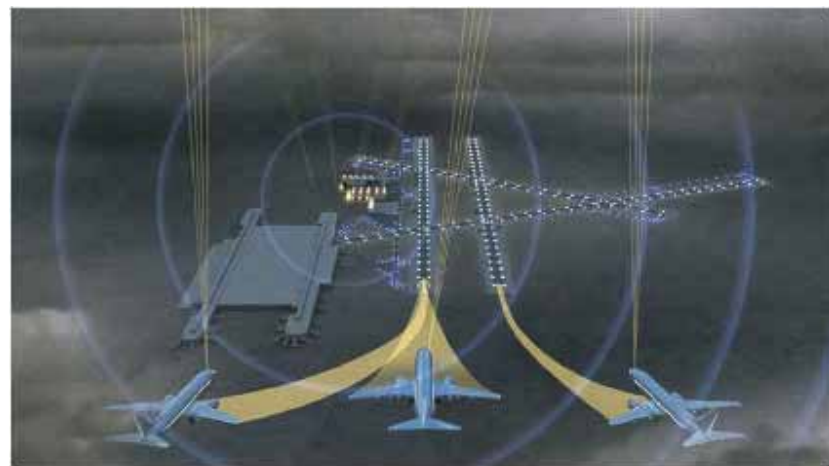


Figure 3 – Multiple Concurrent Operations





provides the ability for more flexible, curved approach paths and more precise terminal area and airport surface navigation. Current GBAS systems have demonstrated accuracy of less than one meter in both the horizontal and vertical axis.

The SmartPath Precision Landing System is easy to install, and unlike ILS where one system (comprised of a glideslope system and a localizer system) is required for each end of each runway, it can cover all runways at an airport, with only a fraction of the required infrastructure and ground space needed. Airports and Air Navigation Service Providers (ANSPs) can benefit from substantial savings in acquisition cost, maintenance and flight inspection. Each SmartPath can broadcast up to 26 unique approach paths, allowing flexibility for simultaneous independent approaches, variable glideslopes or displaced thresholds. The SmartPath Precision Landing System can be flexibly placed anywhere on airport property. GBAS can also bring precision approach capability to airports that cannot otherwise install ILS for terrain or economic reasons.

#### **SmartPath™ at Work**

Over the past decade, Honeywell SmartPath Precision Landing Systems have been installed and tested at a number of airports worldwide. Certified SmartPath systems are already in operation or being installed at Bremen, Sydney, Memphis, Newark Liberty International Airport, and Malaga, Spain.

Qantas Airlines has received approval by the Australian Civil Aviation Safety Authority (CASA) to use SmartPath at the Sydney International Airport for satellite-based landings on their A380 aircraft. Airservices Australia, with whom Honeywell has worked on SmartPath Precision Landing System GBAS in a coordinated effort, has been actively engaged in the use of GBAS technology since 1999 and has been operating the Honeywell SmartPath GBAS ground station in Sydney since November 2006. Qantas had previously been approved to fly GBAS approaches with their Boeing 737 fleet, recording more over 2,300 GBAS landings in Sydney to date with precision guidance provided by SmartPath.

The SmartPath Precision Landing System is designed for aircraft equipped with GPS landing system capabilities. Boeing 737s, Airbus A380s, and Airbus A320s are already coming off the production line with the necessary avionics to support GBAS, and can immediately realize the benefits of GPS-enabled landings. Boeing's 787 and 747-8 will be equipped for GBAS as well, and plans are in place for upgrades to most production Boeing and Airbus aircraft. Airlines now flying GBAS-equipped aircraft include Qantas, Continental, Delta, Emirates, and Air Berlin. These airlines understand the value of GBAS and the benefits it brings in schedule reliability, reduced holding delays and increased capacity in Category I conditions.

#### **SmartPath™ in India**

Airports Authority of India (AAI) understands the potential for GBAS to increase capacity, efficiency and safety at India's airports and is in the process of initiating a project to install a SmartPath GBAS at Chennai airport. In parallel with AAI's procurement and installation of GBAS at Chennai, the ACP is kicking off a project to support DGCA and AAI in assessing and approving the equipment and installation.

The primary activities included in the ACP GBAS project are: a site assessment – identifying the optimum location for the Chennai installation; system design approval – preparing and reviewing the materials needed to approve the SmartPath system for operation in India; and facility approval – evaluating that the Chennai SmartPath installation meets the performance requirements for safe operations.

Through this project, FAA and other resources involved in the FAA's approval of SmartPath will be able to share their experience with counterparts in DGCA and AAI. This will lead to a more robust understanding of the technology within the Indian regulatory community and a more rapid availability of GBAS for enhancing the safety and performance of India's airports. In the process, AAI is continuing to position themselves among the global leaders in deploying advanced ATM technologies and reaping the benefits provided by their operation.



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# Realizing the NextGen and SESAR Operational Concepts

Robert Humbertson, *The MITRE Corporation, Center for Advanced Aviation System Development (CAASD)*

India has been cited as one of the biggest emerging markets to date, surpassing that of China, with the potential to drive or at least significantly influence the world economy. As part of the nation's strategy to develop its aviation industry, the government of India as well as the private sector has invested heavily in airport infrastructure, including construction of modern airport terminal buildings and provision of modern state-of-the-art equipment in the areas of communications, navigation, surveillance and air traffic management (CNS/ATM). For this modernization to continue to meet demand, they must have a clear vision and a long range modernization plan. India should take advantage of the concepts and implementation plans of the United States and European Union in modernizing their air transportation system infrastructure.

The United States and Europe (the 27 states of the European Union {EU}) are in the process of modernizing from today's legacy air traffic management (ATM) paradigm into a more robust, highly automated and integrated digital environment. Under this paradigm, aircraft are considered a key component of the system. These two complex modernization programs are now in their implementation and deployment phases and are influencing much of the global harmonization activities taking place in other states and regions such as within the India Flight Information Region. This article is based on numerous comparisons of timing, policy, technologies and procedures that have been completed over the years that summarize several overarching attributes for the two concept documents and their supporting implementation plans that are enabling the transformation.

The Next Generation Air Transportation System (NextGen) and the Single European Sky for Aviation Research (SESAR) concepts were developed following the fundamental guidelines and building blocks contained in various ICAO documents including the Global Air Traffic Management Operational Concept (Doc 9854), the Global Air Navigation Plan for CNS/ATM Systems (Doc 9750),

the Manual on Air Traffic Management System Requirements (Doc 9882), and the Manual on Global Performance of the Air Navigation System (Part I – Performance-Based Transition Guidelines (Doc 9883).

The basics of both concepts allow for an evolution of technology, policy and procedural improvements in ground and airborne-based communications, navigation, surveillance (CNS), and automation capabilities where needed. Both concepts also describe and realize that changes in the roles and responsibilities of system users and service providers will need to change to achieve the required transformation. Elements of both concepts can also be applied outside of the US and Europe.







NextGen and SESAR support the current ICAO approach to transformation. In general terms, the aspirations within these overarching concepts are consistent. However, even though NextGen and SESAR follow the guidance contained in the ICAO operational concept, both are regionally focused and neither implementation plan is packaged in a way that can easily be understood or efficiently used by other states and regions. Both describe modernized ATM systems that will address the state/regional challenges related to increased demand/capacity imbalances, security, safety, environment, decision support system shortfalls and the diversity of airspace participants. Both concepts describe an integrated ATM system wherein automated tools, data network infrastructures, improved surveillance and weather capabilities, and advanced net-centric information services are implemented through a portfolio of technology, policy and procedures and changes in roles and responsibilities.

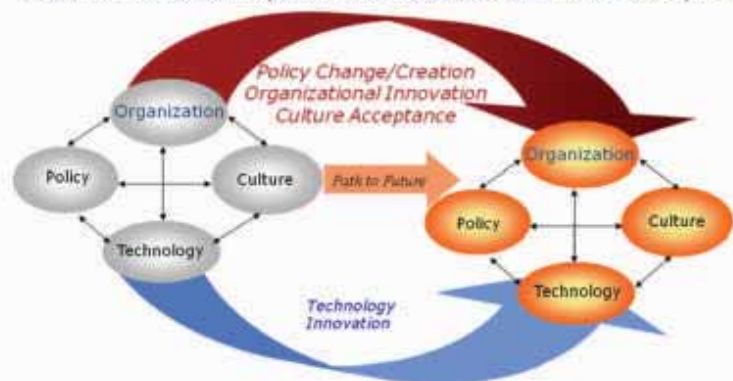
Transformation of the systems supports the evolution of the current system limitations, many caused by the fact that service providers and users have mainly verbal communications methods to draw upon. The concepts are explicit in the call for continuous and robust data communications between all assets within the system. Each highlights the importance of security for the overall system and each highlights the need for continued emphasis on safety. For example:

- Both concepts rely heavily on the development and fielding of an advanced network and data communications supporting ground, surface, and air assets regardless of physical location.
- Both concepts are focused on ATM system transformation via collaborative services, automation supported decision making, trajectory-based operations, and net-enabled information exchanges.
- Both systems embrace a network-centric infrastructure with shared services and

distributed data environments interacting semi-autonomously to achieve system-wide efficiencies. A key element of both NextGen and SESAR is System Wide Information Management (SWIM), which is a focus on how the technologies and systems will enable shared awareness for operations.

- Both the US NextGen program and the European Commission's Single European Sky initiative are predicated on the wider use of these satellite-based technologies to meet the future safety, environmental, capacity and efficiency needs of their air traffic management systems.
- The planned technology deployment is very similar: ADS-B, Data Link, Extended Conflict Detection and alerting, ground and spaced-based augmentation systems, etc. However, the timing of deployment and funding mechanisms for some technologies can be very different based on needs and requirements.
- There are many ATM technologies and procedures being implemented in both systems to enhance international aviation safety as well as achieve efficiency and environmental benefits. The applications being implemented include:
  - Aircraft Performance Based Navigation (PBN) specifications for Area Navigation (RNAV) and Required Navigation Performance (RNP) as the basis for precision navigation, instrument procedure design, and resultant air traffic separation standards;
  - Approaches with Vertical Guidance (APV) as the preferred instrument approach standard where precision approaches are not available;

*Global Harmonization Requires Innovation Across All Lines of Development*

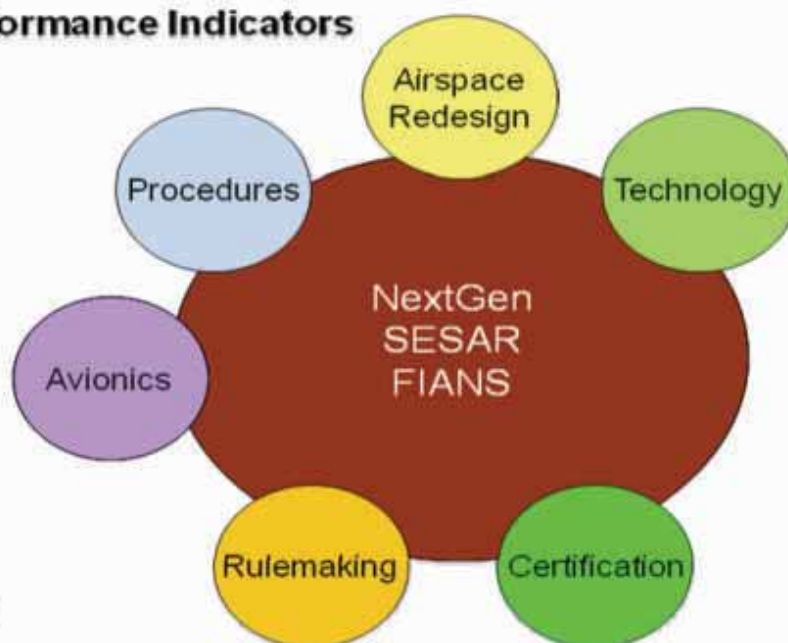




- Use of ADS-B OUT for air traffic control surveillance and traffic information services;
  - Introduction of ADS-B IN (ADS-B reception by aircraft) as a pilot situational awareness tool and enabler of new operations using Airborne Separation Assistance Systems (ASAS);
  - Deployment of Advanced Surface Movement Guidance and Control Systems (A-SMGCS) at major airports; and
  - A wider carriage of Airborne Collision Avoidance Systems (ACAS).
- Both systems recognize the primacy of air-ground data communications to the cockpit and amongst ground systems ("voice by exception"), while maintaining the requirement for voice for emergency purposes, backup, and the realization that both concepts must allow for a long-term mixed equipage environment as transformation occurs.
  - Both systems emphasize the increased use of underutilized airports. However, there are minor differences. For example, NextGen discusses an airports preservation program to "increase community support and protect against encroachment of incompatible land use", while SESAR states that capacity goals can be met in airspace but that airports are a limiting factor.
  - Both systems call for taking advantage of advanced avionics and the implementation of Performance Based Navigation (RNAV/RNP) and advanced procedures such as delegated spacing.
  - Both concepts and implementation call for advanced training for pilots and controllers to enable full use of the aircraft as part of the system.
  - Both systems describe a collaborative process among the air navigation service provider (ANSP), flight operators, airport operators, and other stakeholders, to manage objectives for capacity management, flow contingency management, and trajectory management. This collaborative process is the means by which flight operator objectives and constraints are balanced with overall system performance objectives.
  - Both systems call for the implementation of trajectory operations and trajectory management. Trajectory operations, procedures and management represent the use of such things as 4D trajectories as the basis for planning, executing and managing all flight operations supported by the ANSP.

### ICAO ATM System Performance Indicators

- Access and Equity
- Capacity
- Cost Effectiveness
- Efficiency
- Environment
- Flexibility
- Global Interoperability
- Predictability
- Safety
- Security
- Participation by the ATM Community







The US and the EU acknowledge the differences in their operational needs and implementation timing as well as the business models and constraints they are operating under within their regions.

- NextGen is closely tied to Federal Aviation Administration (FAA) and other government agencies in a top-down structure. SESAR/JU (Joint Undertaking) and the EU operate more on a bottom-up approach with industry consortiums.
- SESAR key focus is on air traffic management and currently has a nearer term for completion.
- NextGen, while having a slightly longer timeline to implement, takes a broader perspective to transform the entire air transportation system, including passenger curb-curb considerations.
- Both systems acknowledge the requirements of harmonizing globally, but also acknowledge that global leadership in aviation of their respective nations for economic reasons is a goal.

Both the US and Europe, as well as many other regions are increasingly adopting new technologies and procedures to ensure that the safety of their air traffic management system is enhanced, while retaining ground-based infrastructure such as radar and are deploying Multilateration systems and procedures to allow for smooth transition and a robust ATM system in the future. Government agencies and industry must continue to invest in modern air navigation infrastructure, including satellite technology, to further enhance aviation safety and meet future air transportation system demand. The application of supporting technological applications offers efficiency and environmental benefits to the aviation industry and local communities.

When other states and regions such as India, in development of their Future India Air Navigation System (FIANS) follow the NextGen and SESAR concepts and implementation sequence, they must realize that the concepts are addressing challenges in their own particular regions and that they are:

- *Not single projects . . . they are the integration of many projects, concepts, and technologies that support an evolutionary process of operational improvements.*
- *Not a program plan . . . they are the integration of many programs and implementation plans to deliver new service capabilities to meet increasing demand.*
- *Not simply new systems and technologies . . . they are the integration of new systems, new technologies, new procedures, new aircraft performance capabilities, new supporting infrastructure and a new way to do business in consideration of the total Air Transportation System.*

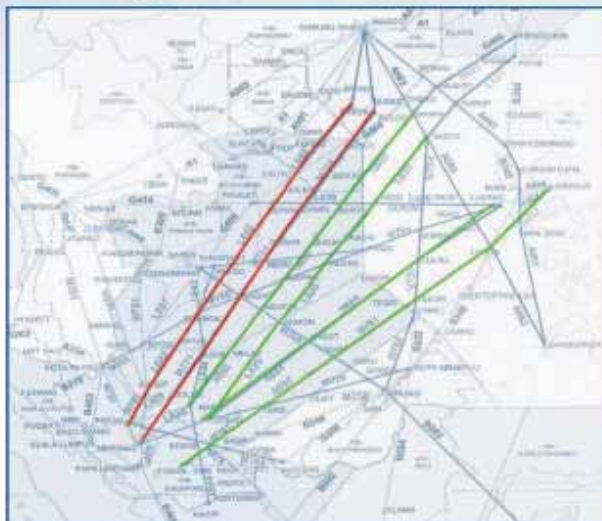
As previously stated, India is in the midst of major transformation of its aviation system to accommodate the unprecedented aviation growth and associated operational challenges. The Airports Authority of India (AAI) must rapidly deploy new CNS/ATM - infrastructure including new systems, procedures, advanced airspace design and route concepts, throughout the Indian airspace. This all must be done within limited resources. Timely and systematic deployment of solutions that will work not only to solve the current and near-term operational issues but to also provide concrete foundation for the FIANS mid- and long-term challenges is a key to meet India's aviation needs.

Following ICAO's lead, governments are lining up and are committed to enhancing international best practices in air traffic management. Improved coordination across government agencies and consultation with industry and other states and regions on future air transportation system policy and transformation directions must take place. The forums for these discussions are already established through ICAO and other organizations such as CANSO, RTCA, EUROCAE and other policy, standards and implementation groups. The identification of a set of products or builds, comprised of common elements of both the NextGen and SESAR programs which affect global aviation will be important in achieving the call for globally harmonized systems and meeting our 21st-century ATM system requirements.

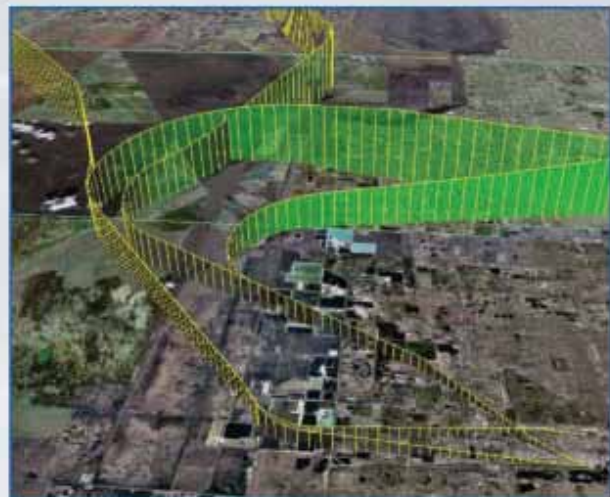
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- ✦ Civil Aviation Authority of Singapore (CAAS)
- ✦ NavCanada

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# Air Traffic Management Solution

January-December 2010



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One central fact of global air travel is that the friendly skies are fast becoming the crowded skies. Air traffic – the combination of commercial, cargo and general aviation aircraft – is projected to grow at an unprecedented rate; a rate faster than existing Air Traffic Control (ATC) systems can expand to handle the growth. In the foreseeable future, current ATC systems will be overwhelmed, gridlock in the skies will be inevitable, and safety could be compromised.

Something fundamental has to be changed. In the United States, the Federal Aviation Administration's (FAA) answer is the Next Generation Air Transportation System (NextGen), not simply an upgrade or an expansion of the present system since the system no longer has much room for further expansion – but an entirely new system built around new technologies. This new system will move us from the current human-centric Air Traffic Control system, to a more automated and technology-based Air Traffic Management system.

NextGen will safely allow more aircraft to fly closer together on more direct routes, reducing delays, and providing unprecedented benefits for the environment and the economy through reductions in carbon emissions, fuel consumption, and noise.

A new technology at the heart of the NextGen system is Automatic Dependent Surveillance – Broadcast (ADS-B). Essentially, it is a technology that allows an aircraft to constantly determine its own location using the satellite Global Positioning System (GPS) and then requires the aircraft to constantly broadcast its precise position and other flight characteristics both to air traffic control and to other nearby aircraft. The ADS-B system will ultimately become the FAA's primary surveillance system, providing faster and more accurate information to allow the air traffic control system to safely handle a significantly greater number of aircraft in the same airspace.







ADS-B stands for:

**Automatic** - It is always on and requires no operator intervention.

**Dependent** - It depends on an accurate Global Navigation Satellite System (GNSS) signal or a Flight Management System (FMS) for positional data.

**Surveillance** - It provides "radar-like" surveillance services to determine the position of an aircraft.

**Broadcast** - It continuously broadcasts aircraft position and other data to any properly equipped aircraft and ground station.

Most significant about ADS-B technology is the movement away from disconnected and incompatible information systems to a scalable network-centric architecture in which everyone has easy access to the same information at the same time. ADS-B is a vital element of a modernized air transportation system and enables numerous benefits outlined below:

#### **Lower Cost, Higher Accuracy, and More Frequent Updating of Information:**

ADS-B infrastructure consists of relatively simple radio stations, which are significantly cheaper to install and maintain than traditional radar that requires significant mechanical infrastructure and signal processing. ADS-B is also more accurate at identifying aircraft and determining position. The ADS-B System is updated by aircraft every second, compared to once every 12 seconds for en route radar systems. And ADS-B provides three-meter accuracy, which combines for increased operating efficiency in areas of dense traffic.

#### **Full Airspace Coverage:**

ADS-B equipment can be installed in areas where it is not feasible to establish radar-based surveillance equipment. For instance, ADS-B equipment will be installed on oil platforms in the Gulf of Mexico - a large body of water in the United States - delivering substantial safety and efficiency benefits to air traffic flying over the area.

#### **Improved Cockpit Safety:**

ADS-B equipped aircraft will be able to receive and display in the cockpit the position of all other ADS-B equipped aircraft in the area. Until all aircraft can be

fully equipped, the Traffic Information Services Broadcasts (TIS-B) will provide situational awareness to ADS-B equipped aircraft by identifying radar targets of non-ADS-B equipped aircraft. The FAA's ADS-B concept also provides Flight Information Service - Broadcast (FIS-B) to provide pilots with current weather information and awareness of meteorological conditions that might impact flight.

#### **Increased Airspace Capacity and Efficiency:**

ADS-B provides a vehicle for increased cockpit involvement in the air traffic control process. This may represent the most significant potential benefit of ADS-B in terms of airspace capacity and efficiency. The ability of aircraft to have a cockpit display of all surrounding traffic enables air traffic control procedures that begin to involve the participation of the cockpit crew. Several applications of this capability have been defined and are in the process of achieving operational certification. For instance, Cockpit Based Merging and Spacing can allow a pilot to lock onto a proceeding aircraft and to maintain a very precise spacing interval. This offers the ability to optimize the arrival spacing at busy terminal areas and to make maximum use of Continuous Descent Arrival (CDA) arrival procedures delivering fuel savings and reduced emissions.

The FAA has begun the installation of the new NextGen surveillance system and has chosen a team organized and led by ITT Corporation to design the architecture and provide the infrastructure of the new ADS-B based system; to engineer, locate and install the 794 ground stations that will comprise the ADS-B downlink and uplink structure of the new network; to develop and bring on-line the data processing centers that will be the heart of the new system, and to operate and maintain the system through 2025.

Nationwide implementation of the ADS-B ground infrastructure in the United States will be completed by the end of 2013. ITT reached its first Segment 1 milestone in September of 2008, when it achieved a successful FAA In-Service Decision (ISD) for ADS-B essential services in southern Florida. The essential services capability means that the broadcast (uplink) of air traffic, weather and aeronautical data from 11 ADS-B ground stations is now available. This means that any aircraft equipped with ADS-B "In" capability can receive these informational services.



ITT completed Segment 1 of the national rollout in September 2010, when the FAA the achievement of this major ISD milestone for critical services which means that air traffic controllers can now more accurately separate aircraft in the United States with ADS-B coverage by displaying aircraft tracked by radar as well those tracked through ADS-B technology.

"We are extremely proud of ITT's role in this achievement. ADS-B technology will not only enable greater airspace efficiencies through better coordinated takeoffs and landings and more direct routes that shorten flight times, but it will also enable airlines to conserve millions of gallons of fuel and eliminate millions of pounds of CO<sub>2</sub> emissions every day. We have kept to an aggressive rollout schedule with an outstanding performance track record, and are honored to be a key partner with the FAA at the forefront of air traffic management modernization," said Steve Loranger, ITT Chairman, President and Chief Executive Officer. "As the last major milestone for the ground infrastructure between now and completion of nationwide rollout, this achievement opens the door for ADS-B data to be put on controller's displays nationwide."

The commissioning of the system follows the successful ADS-B implementation by ITT at four key sites in Alaska, the Gulf of Mexico, Louisville and Philadelphia. Extensive testing was conducted at the key sites to verify that the system meets its requirements and is safe and secure. Those sites were chosen by the FAA because they provided target-rich environments for operational testing or presented different challenges reflecting the complexity of the nation's airspace. These installations have been a part of the broader program under which ITT has already installed more than 300 of the approximate 794 ADS-B ground stations that will comprise the entire network. Nationwide ADS-B coverage in the United States will be complete in 2013.

ITT is meeting the FAA's very aggressive schedule for ADS-B deployment. The essential services In-Service

Decision (ISD) milestone recognizes the successful completion by the FAA of a systematic and exhaustive validation that the ADS-B essential services deployed by ITT meet operational, functional, and performance requirements, are safe and secure, and are supportable as a part of the U.S. National Airspace System.

ITT's performance on the ADS-B program is outstanding – fully meeting requirements and expectations on schedule and on budget. Throughout the world, steps are now being taken towards the "harmonization" of the future global air traffic management system. ITT is ready to play a leadership role in this effort, which includes building and maintaining ADS-B systems throughout the world. ITT brings credibility through FAA endorsement and worldwide interest; experience as the only U.S.-approved ADS-B operator; and technological leadership through the complexity of dual-link frequencies, extreme geographical site engineering and heavy air traffic density areas.

ITT strives to be the international provider of choice in ATC surveillance. As a global, full-service system integrator, ITT offers customized surveillance architectures, whether customers require ADS-B only or mixed ADS-B and radar environments; "bundled" add-ons, including weather, voice/data communications, airport and operator services; and end-to-end integration services, from equipment supply, to engineering services, to technology development.

Innovative networked solutions are key to solving today's – and tomorrow's – challenges. As a trusted partner and integrator of complex technologies, ITT has the expertise to create sophisticated systems that work together seamlessly. For more information on ITT and ADS-B technology, visit [www.itt.com/adsb](http://www.itt.com/adsb).





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A close-up, low-angle shot of the tail of an American Airlines aircraft. The tail is white with a blue and red stripe. The word "American" is written in large, red, stylized letters along the side of the tail. The aircraft is flying against a clear blue sky.

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American Airlines, Inc. (AA), a subsidiary of the AMR Corporation, is the third-largest airline in the United States by traffic, serving 250 cities in 40 countries worldwide with, on average, more than 3,400 daily flights.

### **India Operations**

Starting in November 2005, American is set to complete 5 years of operations in India with conveniently timed daily nonstop overnight services to Chicago, offering swift onward connections to some 150 destinations throughout the Americas. Flights are operated with B777-200ER aircraft, offering 3 classes of service, including the Flagship Suite in First Class, new lie-flat seats in Business Class, and entertainment-on-demand in all three cabins.

American Airlines has maintained its commitment to providing a slew of quality products and services that its customers value in an effort to enhance the travel experience. For this reason, American Airlines has continued its focus on investing in the travel experience for international premium travelers – many of whom are frequent travelers on American.

### **In-Flight Services**

Ensuring optimum passenger comfort during the flight, the airline strives to offer discreetly attentive service and enough space to relax, work or sleep. The onboard entertainment facilities include an in-seat personal video system in First and Business Class with choices of films, TV programs, custom audio programs and video games for both the classes. The Overhead monitors in Economy Class, play a wide variety of programs including 2 Bollywood channels especially for the Indian sector.

With an award-winning First Class Wine Cellar and an in-flight menu created by the American Airlines Chefs' Conclave, the meals served in American Airline flights are carefully chosen keeping in mind the passenger needs and tastes. The selection of food is based on regional preferences and local tastes. The airline offers a choice of Indian meals on all its Delhi-Chicago flights with a menu that has been finalized in consultation with the American Airlines 'Indian Employee Resource Group'. In First and Business, the airline also offers the option to choose meal times. There are a variety of entrees from which to choose and the Dine Upon Request® service allows those with work to enjoy all of the meal items at the same time.

Of course, there's far more to an American Airlines flight than touching down at the final destination. The airline prides itself on its outstanding and innovative service before, during and after your flight. In India, American Airlines offers Premium Class Passengers access to the Kingfisher Lounge, at the new terminal 3 of The Indira Gandhi International Airport, New Delhi.

### **AAdvantage® program**

The AAdvantage® program is American's travel awards program. It was the original travel awards program, established more than 25 years ago, and today is the world's largest program. AAdvantage members earn mileage credits by flying on American Airlines, American Eagle, AmericanConnection carriers and oneworld carriers, as well as other participating airlines. Members also earn mileage credits by purchasing products and services from more than 1,000 participating non-airline businesses, including car rental, hotel, telecommunications and financial service companies.

American Airlines continuously focuses on its ability to develop and deliver a high-quality travel experience – built around products, services, routes and exceptional customer service – which continues to be a focal point for the airline's progress and service culture.



## Bell Helicopter - India Operations

Bell Helicopter started its operations in India in 1995 by setting up a liaison office in New Delhi. The fleet has grown from two helicopters in 1994 to 115 as of today. Since selling its first helicopter into India back in 1956, Bell has delivered a variety of models to India and has grown its market share to be the leader with over 42% of the commercial market. Bell Helicopter is the world's leading helicopter manufacturer in the world and the trend follows in India. The company dominates both in the single and the twin engine fleets in India. The USP of Bell is Safety and World's Best Customer Support. (Professional Pilot magazine has voted for Bell #1 in Customer Support for 16th year in a row).

The ownership of Bell helicopters in India is distributed amongst corporate houses, State Governments and operators. The major corporate houses owning Bell helicopters are Escorts, Arki Aviation, Hindustan Construction, Reliance Industries, ESSAR, Bharat Forge, Punj Lloyd, Garware Wallrope, Raymond, VSL Mining, and Jai Prakash Industries, Abir Construction, GMR, Navyuga Engineering, among others.

State Governments of J&K, Madhya Pradesh, Uttar Pradesh, Tamil Nadu and Andhra Pradesh also own Bell helicopters. Private operators include Span Air, Global Vectra Helicorp, United Helicharters, Deccan Aviation and Transbharat Aviation.

Bell 407 is the fastest-growing single engine helicopter fleet in the world and the trend follows in India. There are more than 1,000 Bell 407s flying all over the world and 33 of them are operating in India. Bell 407 is the first Indian aircraft (of Pawan Hans Helicopters) and world's first 407 to fly in Antarctica in Jan 99. Bell 407 has landed at the density altitude 23,000 ft. in India.

The Bell 412 offers operators the highest dispatch reliability of any twin-engine and is designed with rupture-resistant fuel cells, energy-absorbing crew seats and a resilient fuselage. With rugged military-grade components and exceptional utility operations the 4-bladed Bell 412 employs high cruise speeds and low noise signatures. Since its inception in 1981, advancements in technology have yielded 412 upgrades with greater performance and endurance, making it one of the most mission-ready medium utility helicopters available in the market.

Bell Helicopter, a Textron Inc. (NYSE: TXT) company, brought its 429, the world's newest helicopter, in India to demonstrate its best-in-class capabilities to customers attending India Aviation 2010. Bell pilots introduced customers and government officials to the 429's state-of-the-art cockpit, spacious cabin and powerful flight performance. The 429 was certified in 2009 to the latest safety standards and its maintenance program is unmatched among helicopters.

Jubilant Enpro Ltd is the sole Independent Representative and Air Works Engineering India and Deccan Technical Services are the appointed Customer Service Facilities.

### About Bell Helicopter

Bell Helicopter, a wholly-owned subsidiary of Textron Inc., is an industry-leading producer of commercial and military, manned and unmanned vertical-lift aircraft and the pioneer of the revolutionary tiltrotor aircraft. Globally recognized for world-class customer service, innovation and superior quality, Bell's global workforce serves customers flying Bell aircraft in more than 120 countries

### About Textron

Textron Inc. is a multi-industry company that leverages its global network of aircraft, defense, industrial and finance businesses to provide customers with innovative solutions and services. Textron is known around the world for its powerful brands, such as Bell Helicopter, Cessna Aircraft, Jacobsen, Kautex, Lycoming, E-Z-GO, Greenlee, and Textron Systems.

<http://www.bellhelicopter.com>

Bell Helicopter, Post Office Box 482, Fort Worth, Texas 76101





### Boeing in India

The close relationship between Boeing and India goes back over 60 years when India entered the jet age on the wings of Boeing commercial jetliners. Boeing jets continue to be the mainstay of the country's domestic and intercontinental commercial fleets. New opportunities for partnership have also emerged in the area of defense. In January 2009, the Government of India selected the P-8I to fulfill its long-range maritime reconnaissance and anti-submarine requirements. In March 2009, Boeing opened the Boeing Research and Technology center in Bangalore to advance aerospace innovation. Boeing is also focused on long-term strategic partnerships and on creating sustainable value in the Indian aerospace sector. Boeing has developed important relationships with suppliers in India and is actively pursuing technical and business partnerships with Indian companies and institutions. Boeing is also uniquely positioned for growth in the burgeoning aircraft services and support market.

Boeing established a wholly owned Indian subsidiary - Boeing International Corporation India Private Limited (BICIPL) in 2003 to support the growing demands of India's aerospace industry. Boeing also has Field Service offices in Mumbai and New Delhi and a representative office in Bangalore. In 2008, Boeing subsidiary Aviall established its presence in India and has opened India's first aircraft parts distribution center in Noida near New Delhi. Another Boeing subsidiary Jeppesen, a provider of flight navigation solutions, has also announced plans to establish its presence in Hyderabad.

### Boeing Commercial Airplanes

Air India has been a Boeing Commercial Airplanes (BCA) customer since 1960, when it acquired its first 707 jetliner. Since then, Boeing aircrafts are flown by Air India, Jet Airways and Spice Jet. Indian carriers continue to enlarge their fleet with Boeing airplanes like the 747, 777, 737 and the 787 series. Additionally, the Indian Ministry of Defense operates four 737-200s and three new 737 Boeing Business Jets.

In 2006, Boeing and Air India signed an order agreement for 68 Boeing commercial jets, the single largest commercial airplane order in India's civil aviation history, with a value of more than \$11 billion at list prices.

Boeing's 2010, Current Market Outlook for India forecasts that the Indian aviation market will require 1150 commercial jets valued at approximately \$130 billion over the next 20 years – a market representing more than four percent of Boeing Commercial Airplanes' worldwide forecast.

### Boeing Defense, Space and Security

On January 1, 2009, the Government of India signed a contract with Boeing Defense, Space and Security (BDS) to purchase eight P-8I long-range maritime reconnaissance and anti-submarine aircraft. The P-8I is an India-unique variant of the U.S. Navy's P-8A Poseidon. The deal is the largest defense contract to have been signed by the Indian government with a US company.

BDS has a rich portfolio of products and services to offer India, such as the combat-proven F/A-18IN Super Hornet multi-role strike fighter, the Harpoon missile and the CH-47F and MH-47G heavy-lift Chinook helicopters and AH-64-D Apache attack helicopters. The BDS portfolio extends to the C-17 Globemaster III strategic-lift cargo plane, C4ISR platforms, and Airborne Early Warning and Control systems. BDS is also a leading provider of aerospace support systems and Network-Centric Operations systems.

### Industry Partnerships

Boeing is continually exploring new business and investment opportunities, as well as potential research and development partnerships in India. Boeing believes that 'Productivity' can be a strategic discriminator to ensure global leadership in the aerospace industry, as it attracts investors, provides value to customers and creates opportunities for growth. Boeing values the productivity opportunities that Indian partners can bring while leveraging the uniquely comprehensive capabilities of the whole Boeing enterprise.

Since 1997, Boeing has worked with India's premier software development companies, including HCL, Infosys, Wipro and Tata Consultancy Services (TCS) on numerous information technology projects including systems reengineering and development, web enabling, e-business applications and long-term application maintenance. In 2005, Boeing began using engineers from Infosys and TCS on a variety of knowledge-based engineering and data analysis projects. It has also contracted for engineering services with TCS and Infosys to support aircraft design activity.

Boeing's relationship with Hindustan Aeronautics Ltd (HAL) began in 1991 with HAL becoming the single source producer of 757 Over Wing Exit Doors. HAL is currently contracted to manufacture the 777 Gear Uplock Box, 777 flaperons and the F/A-18 Gun Bay Door with more projects to follow in 2010 as part of the \$1 billion MOU signed between Boeing and HAL in 2007.

Boeing has also contracted with Tata to manufacture 787 Floor Beams at a new facility in Nagpur. Companies like BEL will play a large roll in Boeing's industrial strategy in 2009 and beyond. Boeing is also looking at ways to partner with numerous Small and Medium Enterprises throughout India.

In addition to direct work placement, Boeing collaborates with Indian industrial partners on Lean manufacturing techniques and Boeing's Program Management Best Practices as part of its drive to bring the best of Boeing to India and the best of India to Boeing.

### Research & Technology and University Partnerships

Boeing values India's leadership in research and technology and is investing in R&D and university partnerships to leverage and enhance India's and global aerospace capability and skill base.

In 2005, Boeing entered a research partnership with the Indian Institute of Science (IISc), Bengaluru. The Boeing-IISc partnership focuses on research in nanotechnologies, structural alloys, composites, smart materials and structures, process modeling and simulation, manufacturing technologies, prototyping through substructure fabrication and testing. The strategic alliance with the IISc—the first of its kind at Boeing in the area of materials science—will spur aerospace innovation and contribute to the advancement of Boeing's aircraft design capabilities.

Boeing has also reached out to four other Indian universities to explore opportunities in research and development. These universities are the Indian Institute of Technology (Chennai), Indian Institute of Technology (Kanpur), Indian Institute of Technology (Kharagpur) and Indian Institute of Technology (Mumbai).

On March 31, 2009, Boeing opened its Boeing Research & Technology-India centre, which marks a major milestone for Boeing's aerospace research and technology activities in India. The centre will be the focal point for all Boeing technology activities in India, collaborating with Indian R&D organizations, including government agencies and private sector R&D providers, universities, and other companies. It will work with strategic research and technology partners to develop high-end technology, particularly in the areas of aero structures and avionics. This is Boeing's third advanced research centre outside of the U.S. Others are in Europe and Australia.

Boeing will continue to invest in India through prominent technology outreach programs. Combining Indian talent and technical excellence with Boeing's experience and leadership in the aerospace industry will help Boeing assimilate new ideas and innovative processes and help grow the capabilities of the Indian R&D community to meet the emerging needs in country.

### Boeing Investment in Indian Aviation

Boeing is investing in India to support the development of air transportation infrastructure. It benefits Boeing both directly and indirectly to participate in developing a system to accommodate many new Boeing products and services.

Boeing Commercial Aviation Services (CAS) provides products and services to support customers by helping them to improve fleet utilization, reduce costs and ensure passenger well-being. Aviall and Jeppesen, two subsidiaries of CAS will directly support the growth of Indian aviation through world class supply chain management services and flight navigation solutions. CAS also plans to invest significantly in India for training facilities, most of which will go to pilot training.

Boeing will also build a maintenance, repair and overhaul (MRO) facility in Nagpur.

### Boeing – A Responsible Business leader

As a responsible business leader Boeing is committed to improving the quality of life for the communities in which we operate. Boeing has contributed and will continue to support various health and human services in India.

Boeing is deeply committed to protecting the global eco-system. As a technology leader, the company continues to pioneer environmentally progressive products and services. Boeing is also working with its suppliers and customers around the world to address environmental concerns.

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Continental Airlines ([continental.com](http://continental.com)) is the world's fifth-largest airline, with more than 2,700 daily departures. Continental serves 132 U.S. and 137 international destinations – more than any other airline in the world.

Continental is the leading U.S. carrier across the Atlantic in terms of the number of cities served operating up to 308 departures weekly from 30 airports in 16 countries to its U.S. gateway hubs at New York and Houston, with onward connections to more than 200 cities throughout North America, Latin America and the Caribbean.

From India, Continental operates a daily Boeing 777 non-stop service between Delhi and New York Liberty and a daily Boeing 777 non-stop service between Mumbai and New York Liberty.

Continental Airlines is a Star Alliance member, the largest and most comprehensive airline alliance in the world. Overall, the Star Alliance network offers more than 21,050 daily flights to 1,167 destinations in 181 countries. Continental customers benefit from an expanded network of destinations, simplified air travel, more choice of connections, access to more airport lounges and an even more valuable frequent flyer programme.

Continental offers its award-winning BusinessFirst cabin service on all flights to and from Europe, the Middle East and India. Extra-wide electronic sleeper seats feature a 55-inch/140-cm seat pitch, a 156-degree recline and adjustable winged headrests. (BusinessFirst seats on Continental's Boeing 777 fleet feature enhanced seat width and recline. A personal entertainment system offers a selection of the latest movies and a variety of audio channels. An award-winning wine and champagne selection is served to complement excellent cuisine. A specially selected and trained corps of more than 300 Concierges provides individualised pre-flight and post-flight services for BusinessFirst customers at 35 key international airports worldwide. BusinessFirst was named Best Executive/Business Class at the OAG Airline Industry Awards 2009, based on voting by frequent flyers around the world.

And that's not all. Continental has recently launched a new, flat bed seat for the BusinessFirst cabins, nearly 50% fleet has new flat bed seats. The new seat, reclining 180-degrees and providing 6 feet 6 inches/1.98 metres of sleeping space in the fully extended position i.e. 6 feet 4 inches, which is one of the widest business-class seats in the air, measuring up to 27 inches/68.5 cm when the adjustable armrest is positioned flush with the seat cushion on the 777. Electronic controls enable customers to easily move the seats to the custom position most comfortable for them. The seats provide more individual storage space for personal items. Laptop power, headset and USB plugs are conveniently tucked above the customer's shoulder. iPod connectivity allows each customer to view their personal videos and enjoy their music, all while their iPod is charging. Flat bed seats on all aircraft feature a 15.4-inch/39-cm video monitor for customers to enjoy on-demand movies, music and games and have a privacy shell that allows for seclusion from other travelers.





FedEx Express is the world's largest express transportation company, providing fast and reliable delivery to more than 220 countries and territories. FedEx Express uses a global air-and-ground network to speed delivery of time-sensitive shipments, usually in one to two business days with the delivery time guaranteed.

FedEx Express set up operations in India in 1984 through a Global Service Participant (GSP) and has had direct presence in India since 1997. Today, with a team of 2800 employees, a delivery fleet of over 300 vehicles and Mumbai, Delhi and Bengaluru as gateways, FedEx has 21 direct weekly flights connecting India to the world.

#### Milestones in India:

- 2002: FedEx appointed Prakash Air Freight Pvt. Ltd (PAFEX) as its new Global Service Participant (GSP).
- 2005: FedEx launched increased East- and Westbound flights, offering unrivalled connectivity to Asia Pacific, Europe and the Americas.
- 2006: FedEx acquired its Indian service provider Prakash Air Freight Pvt. Ltd (PAFEX).
- 2007: FedEx marked 10 years of direct operations in India by inaugurating India's most sophisticated gateway hub in New Delhi.
- 2009: FedEx introduced FedEx International Economy® services and announced the launch of a next-business-day domestic service for the Indian market.
- 2010: FedEx launched new flights from Bengaluru connecting South India to Europe, Middle East and the USA and the expansion of its premium domestic express service.

#### Mission in India:

FedEx has three core elements linked to its mission in India: To establish itself as a Carrier of Choice, an Employer of Choice and a Neighbor of Choice.

- **The Carrier of Choice:** FedEx Express is committed to improve access to world markets, move things faster and create smarter and better solutions for Indian customers facilitating their growth into the global business environment. Strategic investments coupled with the company's extensive presence of direct sales coverage in 100 cities and operational coverage in 600 cities across India has helped FedEx to reach out to more and more customers across the country.
- **The Employer of Choice:** FedEx Express, since inception, has put its 'People First' - both because it is the right thing to do and because it makes good business sense. The People-Service-Profit (P-S-P) philosophy underpins all business decisions. The Company's progressive policies, innovative programs and benefits have created a stimulating work environment that has encouraged career development of every employee. For seven successive years, FedEx has been the only express transportation company to rank among the top 25 best places to work in the globally recognised Great Places to Work Survey (GPTW) in India.
- **The Neighbour of Choice:** FedEx Express also extends the P-S-P philosophy to the communities it operates in. FedEx cares about them and is dedicated to effective corporate citizenship, leading the way in charitable giving, corporate governance and a commitment to the environment. FedEx is committed to making a positive contribution to the community through a combination of financial and in-kind support for educational, cultural, civic and humanitarian causes. In India, FedEx has had long standing partnerships with Safe Kids Foundation, CRY, ORBIS, Smile Train and United Way to offer assistance in making a difference.



### **Story of India's first Multinational Aerospace Operations**

In 1998, Goodrich Corporation opened a 100% wholly-owned subsidiary in Bangalore, India. The facility was originally opened as a service center for emergency evacuation slides. In 2000, the company embarked on the strategy to transition its facility from a service center to a manufacturing operation. Manufacturing began with aviation life rafts and slowly expanded to evacuation slides for narrow body aircrafts.

To allow for continued expansion the operations moved to a built to suit facility in Whitefield in 2005. The city of Bangalore was selected because of its history in indigenous aerospace industry. The operations have since grown to a large manufacturing, engineering & supply chain activity. Recent expansion has resulted in a footprint of 3, 50,000 sq. ft

Currently, manufacturing operation encompasses manufacture of complete range of Goodrich evacuation inflatable assemblies, aircraft interior & exterior lighting assemblies, aircraft motor assemblies & cargo sub-assemblies like Power drive units & latch relay units.

The engineering center currently employs in excess of 490 engineers, supporting engineering needs of various businesses across enterprise.

The sourcing activity supports various businesses of the organization in their efforts to develop Indian vendors for various commodities. The focus is on developing vendors for machine components, forging, composites & electronic assembly. The local team assists in selecting, qualifying and managing the India supply base in addition to supporting tier I suppliers in establishing operations in India

The Goodrich facility in Bangalore was the first US-based aerospace manufacturing operations in India, providing Goodrich with a distinct advantage to serve the region as well as leverage the technical & manufacturing skill set of the country. Having a manufacturing & design facility in India has helped Goodrich in meeting the challenges of costs, time to market, as well as resource availability.

The various businesses of Goodrich India today are able to leverage low-cost operations to support manufacturing, design & sourcing initiatives. The operations in India have been able to improve margins on products & deliver better results to the shareholder; in addition, Goodrich is well positioned to better serve the burgeoning Indian market.

Continuous Improvement (CI) is ingrained in & embraced throughout the Goodrich India facility. To ensure consistency across the enterprise, Goodrich India has provided support through training & best practices sharing with its employees.

Through the use of CI tools, Goodrich India has achieved significant productivity gains on product transferred, reduced labor hours required to manufacture the inflatable assembly of an evacuation system by 25% across all product lines. By continuously evaluating scrap & waste, raw material consumption has been reduced by 20% & indirect materials have reduced by 5%. CI is also deployed in the administrative area to improve efficiencies of back office operations

Developing multi-skilled operators is another important contributor to the success of GR India & its CI activities. Each operator is encouraged to acquire more skills by providing opportunities for Job rotation through the product cells.

Idea boards are in place in the product cells & administrative areas to capture employee suggestions for improvement. In addition, teams have been established to focus on key objectives of EH&S, quality, culture & sports.



Hampson is a dynamic, international Group serving the global aerospace market, has established a new state-of-the-art, low cost manufacturing facility in Bangalore, India.

Hampson provides added-value solutions in tooling systems, manufacturing and supply chain. Our mission is to provide global competitive advantage to our key customers through the use of innovative thinking in engineering and the integration of technology-driven manufacturing and supply chain strategies to create value that stands apart.

We provide fully integrated manufacturing solutions for:

- Precision tooling systems for large, composite aerostructures
- Complete automated assembly tooling solutions
- Composite and metal aerostructures, components and assemblies

Hampson's horizontally-integrated range of unique processes and capabilities offers our global customers total manufacturing solutions from large tooling systems to aerostructure components, from a single point of service

For customers who wish to fully leverage the efficiency savings available from the fully-integrated supply model, Hampson is able to offer a complete solution from traditional aerospace alloys to lightweight, advanced composite materials, plastics or transparencies and whether as kits of highly-engineered details components, integrated sub-assemblies or full structural assemblies.

Our integrated structure provides seamless, single interface for all projects, making Hampson a versatile, single source solution

#### Our Principal Markets:



**Global leader** in provision of large, **tight-tolerance** composite tools and **tooling systems** for defense, commercial aerospace and space/satellite industries



Leading supplier of **high temperature composites**, **hybrid metallic-composite structures** and transparencies



**Global leader** in the manufacture of **laminated and solid shim** components used in airframe assembly

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## Yesterday, Today & Tomorrow—Harris is There

### Global, Mission-Critical Communications for Growing Nations

Harris has engineered some of the world's most reliable, mission critical systems and is fully committed to the modernization of India's aviation communications infrastructure. From system design to installation and training, Harris provides comprehensive turnkey solutions from small, mobile towers and command shelters, to the world's largest Area Control Center's (ACC) and networked communications systems.

Harris enables dependable communications for air traffic control in some of the harshest environments on earth — from Antarctica, to the Amazonian rainforest, to the Middle Eastern deserts and beyond. Regardless of the environment or the operating requirements, our products ensure that critical information will be reliably exchanged in the air and on the ground for both civil and military applications.

At any given moment, thousands of planes are in the skies — over 100,000 aircraft each day. Harris enables air traffic controllers around the world, to manage air traffic safely and securely with state-of-the-art communications technology. A trusted partner to the global air traffic control community — Harris has successfully designed, developed, integrated, and operates some of the most advanced communications systems in the world.

One such success is the Federal Aviation Administration (FAA) Telecommunications Infrastructure (FTI), which provides the network backbone for air traffic control operations and administrative functions for the U.S. National Airspace System (NAS). Harris' network communication infrastructure systems and services provide the heartbeat for voice and data communications — around-the-clock and around the globe.

In FTI, Harris met the challenge to design, develop, deploy, and operate a telecommunications infrastructure that replaced and modernized the legacy multilayer combination of government-owned, leased, operated, and separately managed and maintained systems with a single communications solution and service for the FAA. FTI is not simply a replacement initiative. Approximately 20 percent of the program includes additional requirements such as networking in new control towers and communications services. Now more than 50,000 users, 20,000 services, 4,000 facilities, and a nationwide network later — FTI is online, bringing a scalable communications network to the FAA that will save more than \$600 million over the 15-year life of the program.

Harris is setting the standard for government performance-based service programs. The FTI enterprise network not only serves to provide secure and efficient transmission of voice, data, and video communications critical to the NAS today, but also establishes the platform for the net-centric NextGen programs of tomorrow. By leveraging the FTI network investment, the FAA is able to accelerate NextGen, minimize service duplication, reduce life-cycle cost, and ultimately achieve the vision of a seamless information infrastructure — a goal collectively strived for by the global ATC community.

Our vast domain knowledge of global ATC communications, technologies, and proven integration capabilities position us as a leader in the ATC market. We strive to become a trusted partner to India's Civil Aviation delegation. Harris is prepared to transform India's existing ATC communications infrastructure into India's NexGen of tomorrow.

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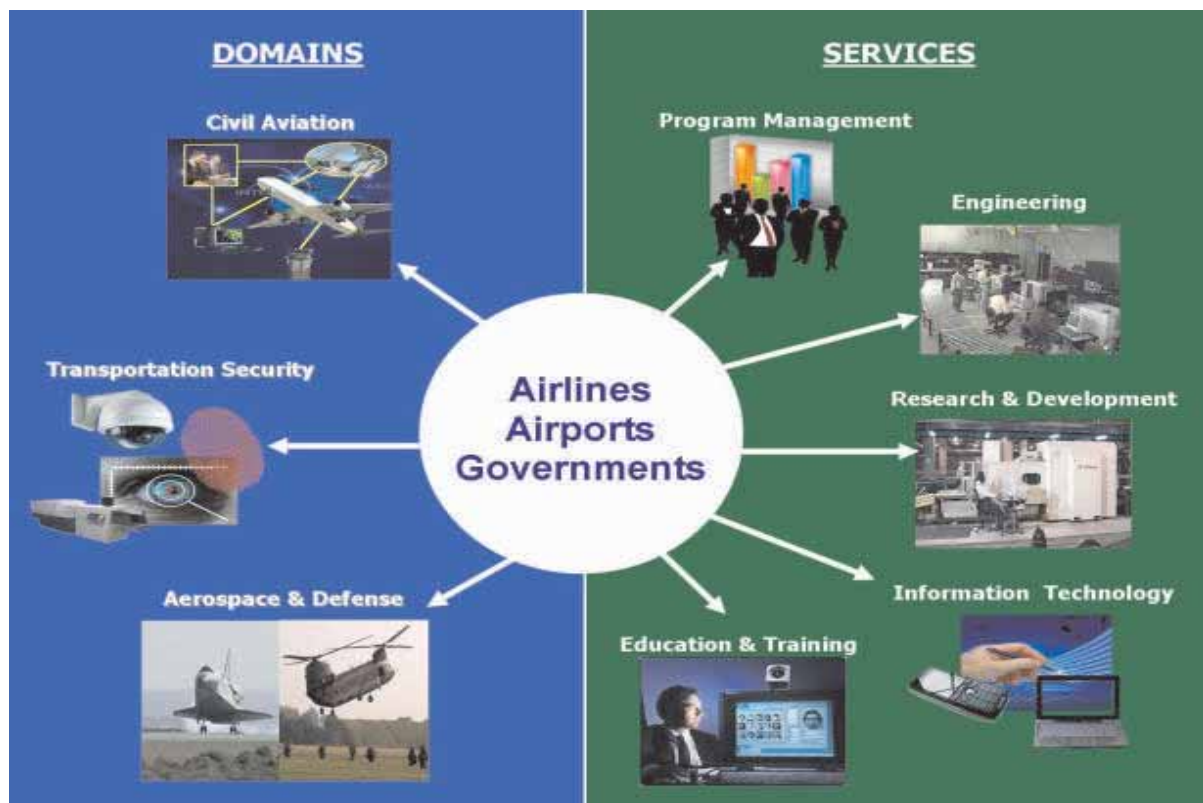


**Integrity \* Experience \* Reliability**

## Hi-Tec Systems, Inc.

Hi-Tec Systems, Inc., founded by Mr. Tribhuvan Singh, an Indian American, is a thriving business providing high technology Engineering, Research, Management, IT, and Training support to the U.S. Government in the fields of Civil Aviation, Homeland Security, Aerospace and Defense. Hi-Tec has its headquarters in New Jersey and regional office in Washington DC. Since inception in 1995, Hi-Tec has supported numerous contracts or delivery orders, 20 of which are presently active and valued at approximately \$110 million. As a result of its commitment to excellence and outstanding contributions to civil aviation industry, Hi-Tec has been recognized with numerous state and national level awards including national recognition by the former U.S. Secretary of Transportation, Norman Mineta. This year, Hi-Tec is proudly celebrating its 15th anniversary as a successful Federal contractor.

Hi-Tec is currently leading four U.S-India Aviation Cooperative Program (ACP) projects to provide support to DGCA and AAI in technical, operational and management training, aviation safety, and in the development of airport geographic information systems. Working collaboratively with the U.S-India ACP, Mr. Singh, Hi-Tec's President & CEO, is poised to bring the company's 15 years of experience and subject matter expertise to the Airlines, Airports, and Government of India through its newly registered company, Hi-Tec Aviation Safety and Security Pvt. Ltd.



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## Company Profile: IBM India & South Asia

### Mission

IBM is the innovation partner for the Aviation and Aerospace Industry with a differentiating portfolio of business services, software and systems for innovation, growth and efficiency. At IBM Global Business Services, we collaborate with our clients, bringing together business insights, advanced research and technology to give them a distinct advantage in today's rapidly-changing environment. With our integrated approach to business design and execution, we help turn strategies into action. IBM operates in more than 170 countries, with over 400,000 employees worldwide.

### Smarter Solutions for the Aviation and Aerospace Industry

IBM offers a comprehensive range of differentiating solutions to address the major industry themes and support clients in the Airports, Airlines and Aerospace industry to design, deploy and manage their on demand infrastructure while positioning their enterprises for the future. Examples of solution areas for airports, airlines and aerospace industry in India are:

- Airports and Airlines Commercial Growth
- Smarter Airport Operations & Stakeholder Collaboration
- Aviation Customer Insights & Passenger end-to-end Air Travel Experience
- Intelligent Multi-modal Transportation & Collaboration
- Supply Chain Excellence
- Aviation Maintenance, Repair and Overhaul (MRO)
- Managed Business Process Services
- Hosted Aviation Solutions
- IT Infrastructure Optimization

Our clients in the Aviation and Aerospace Industry include public and private Airports, full service and low-cost Airlines, Express and Logistics Services Providers, Rail and Metro Operators and leading manufacturers of Aerospace equipment.

### More Information

Additional information about IBM Aviation and Aerospace Solutions and Industry Point of Views: [www.ibm.com/travel](http://www.ibm.com/travel)

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### ITT Defence International - Company Description

ITT Defence International is a top-10 U.S. defence contractor and a leading supplier of sophisticated solutions for defence and security. With our broad portfolio of technologically advanced solutions and strong local presence, we are ideally positioned to help India defend its soldiers, citizens and borders. ITT is one of the world's leading defence contractors and a leading provider of night vision equipment, battlefield communications systems, air traffic management solutions, space-based sensors, and radar and sonar technologies to protect ships, planes and coastlines. We are committed to supporting the military and defence requirements needed by our Indian customers to protect this important region of the world.

As India continues to modernize its most vital military, security and homeland affairs capabilities, our sophisticated and robust defence technologies will greatly accelerate the country's forward progress. India is a nation on the rise, and we are dedicated to taking its defence infrastructure and air traffic management systems further into the 21st century. Our commitment to India is unwavering. We have an established presence in Delhi and are partnering with local companies to develop solutions aligned with India's current and future needs. During the past seven decades, we have earned a reputation for breakthrough defence technologies and services.

ITT is the lead system integrator for the development and deployment of the Automatic Dependent Surveillance - Broadcast (ADS-B) system in the United States, a key component to improving the U.S. air transportation system. ADS-B will reduce the dependence on ground-based secondary surveillance radar systems by collecting GPS-derived position reports from aircraft and transmitting the data to ground stations. From there, the information will ultimately be relayed to air traffic control facilities to use for air traffic management. Our solution is flexible and scalable anywhere in the world.

Today, we're proud that the India Ministry of Defence — which commands the second-largest military in the world — depends on ITT as a primary provider of mission-critical technologies. Our core values of respect, responsibility and integrity guide the way we do business everywhere in the world, and make ITT a trusted partner to our customers in India. ITT has a long history of providing breakthrough solutions to the world's largest and most demanding defence customer: the United States. Now we are bringing that same level of support to the world's second-largest armed forces operation and foresee a long history of providing India with the best technologies for its people and its long-term prosperity.



## Jacobs Consultancy

For over 60 years, Jacobs Consultancy has provided a full range of industry-leading business and planning advisory services to meet the evolving needs of the aviation industry. We have built our practice around the concept of combining demand-based facility planning with creative business and financial planning to deliver technically superior, financially viable results. Our range of services includes financial, business, commercial, and strategic planning, as well as airfield and airspace planning, terminal and landside planning, and environmental management and planning.

Our clients include the sponsors of many of the industry-leading airports worldwide. Jacobs Consultancy also works with leading private airport managers and developers, financial institutions, national governments, and the airlines to help deliver solutions to the airport industry that can be implemented effectively and efficiently.

Recent or ongoing assignments include advisory work at some of the busiest and fastest growing airports around the world—Abu Dhabi, Atlanta, Bahrain, Bangalore, Denver, Chicago O'Hare, Incheon, London Heathrow and Gatwick, Los Angeles, Mumbai, and New Delhi.

Jacobs Consultancy operates from offices in the United States, Canada, United Kingdom, and in India as a Division of Jacobs Engineering India Private Limited.

For further information, please visit our website at [www.jacobs-consultancy.com](http://www.jacobs-consultancy.com) or contact us by phone +44 (20) 7087 8700 or e-mail [inquiry@jacobs-consultancy.com](mailto:inquiry@jacobs-consultancy.com)



System Insights delivers revolutionary software to achieve dramatic improvements in manufacturing shop floor and supply chain performance. System Insights' flagship product vimana, is the first and only software product that combines a comprehensive real-time data solution with multi-dimensional, complex reasoning technology to deliver predictive manufacturing solutions for machining-based discrete manufacturing industries. vimana combines the scalability of cloud computing with its own revolutionary complex event processing and learning engine to achieve dramatic improvements in shop floor performance, environmental efficiency, and supply chain integration. With vimana, users can classify and understand the causes of production losses on the shop floor, including machine breakdowns, poor quality, material starvation, and incorrect machine usage. With vimana, energy use is optimized and the environmental impact of the manufacturing enterprise reduced. vimana enables distributed manufacturing by providing full traceability and record-keeping for compliance with critical Aerospace and other regulatory requirements. vimana goes beyond simple data aggregation, and helps manufacturers increase shop floor utilization, decrease environmental impact, reduce supply chain risk, and improve profitability. As a cloud-based solution, vimana can be deployed on-premises or as a SaaS offering to fit the IT and economic requirements of enterprises, large and small. For more details, please visit <http://www.systeminsights.com>.





Founded in 1995, Metron Aviation pioneered the advancement of Air Traffic Flow Management (ATFM), working with the Federal Aviation Administration (FAA) to develop the industry's first Collaborative Decision Making (CDM) platform for optimizing system-wide traffic flow. Metron Aviation provides concept engineering, advanced research, software development, traffic flow management, surface operations management, airspace design and environmental research and analysis solutions to the global aviation industry. Metron Aviation fuses advanced science and mathematics with unparalleled subject-matter expertise to turn groundbreaking Air Traffic Management (ATM) research concepts into next-generation operational capabilities.

Recently, Metron Aviation was the recipient of the largest small business award in FAA History, System Engineering 2020 (SE-2020). Additionally, South Africa's Air Traffic and Navigation Services (ATNS) began live operations with Metron Aviation's ATFM solution this year, while Airservices Australia is in the process of deploying the ATFM solution to support its long-term gate-to-gate CDM vision.

The efficiency and optimization benefits of ATFM are measurable, verifiable and undeniable. For more than 10 years, the FAA command center has relied upon Metron Aviation to support its core systems and deliver innovations including the industry's first real-time advanced ATFM platform, CDM-based slot substitution and Airspace Flow Programs (AFP). The FAA's ATFM system has saved over 68 million minutes of delays, 186 million liters of fuel, 573 thousand metric tons of CO<sub>2</sub> emissions and U.S. \$6.3 billion in operating costs, since system-wide deployment in 1999.

SE-2020 is the FAA's strategic program for implementing the Next-Generation Air Transportation System (NextGen). The ten-year contract awarded to Metron Aviation has a value of U.S. \$1.15 billion, making it the largest single award to a small business in FAA history. Metron Aviation, as prime contractor, has assembled a proven team of industry leaders with unmatched domain expertise in all aspects of the National Airspace System (NAS) to provide the full breadth and depth of aviation expertise across all SE-2020 functional areas.

The ATNS Central Airspace Management Unit (CAMU) looked for proven ATFM solutions that could dynamically balance capacity and demand, while providing a CDM capability to allow airlines to effectively utilize available capacity for the maximum benefit of their business, operations and passengers.

The Metron Traffic Flow system provides the CAMU with comprehensive ATFM capabilities to model and implement all traffic flow initiatives for both aerodrome/airport and airspace volumes in South Africa. Traffic flow initiatives are used to dynamically balance air traffic demand with capacity to keep traffic flowing as smoothly and efficiently as possible. The system interfaces with ATM production systems, including

Thales' airspace monitoring tool, EUROCAT, and other software systems, through a scalable, event-driven data gateway.

Airservices Australia will initially deploy Metron Traffic Flow to provide the foundation for ATFM and regional coordination to enhance the capacity, efficiency and safety of the Australian airspace. The contract covers a 15-year period, with all options exercised, and provides the framework for future collaboration. Metron Traffic Flow will be used to manage traffic flow and capacity for all controlled airspace, including those flights originating from outside of Airservices Australia's area of responsibility and entering Australian airspace.

The system provides CDM capabilities for Airservices Australia's operations groups, airlines and regional stakeholders. Metron Traffic Flow will be deployed at the National Operations Center (NOC) in Canberra, control towers, area control centers and airline operations centers as well as being used by Australian military units.

Metron Harmony, Metron Aviation's complete Integrated-ATFM (I-ATFM) solution, provides proven products for strategic planning, pre-tactical and tactical management of traffic flows to maximize the available capacity of system-wide operations. The full-spectrum I-ATFM solution includes:

- \* Strategic, pre-tactical and tactical traffic flow management through slot allocations and Calculated Takeoff Times (CTOT)
- \* Pre-tactical and tactical departure management for merging into an en route stream or to a common departure fix
- \* Pre-tactical and tactical aircraft sequencing, scheduling and runway allocations to meet airport arrival operating constraints
- \* Pre-tactical and tactical airport surface management for optimizing operations
- \* Fuel, emissions and noise impact modeling, monitoring and reporting

The latest Metron Harmony solution is Metron Harmony for Airlines. Metron Harmony for Airlines is the industry's First Air Traffic Flow Management Solution for Airlines. Metron Harmony for Airlines integrates a real-time and predictive view of air traffic conditions with airport surface operations to dramatically improve on-time performance, reduce tarmac delays, lower operating costs and provide better service to passengers. In the past, airline operations lacked visibility into airport, regional and nationwide traffic demand and were thus unable to optimize departure and arrival operations affected by these conditions. With Metron Harmony for Airlines, users get a comprehensive view of current and future air traffic conditions. For the first time, airlines can predict future congestion events, such as gate conflicts, to optimize pushback times, reduce surface gridlock and improve operations.

# MITRE

The MITRE Corporation (MITRE) operates five Federally Funded Research and Development Centers (FFRDC) for the U.S. Federal Aviation Administration (FAA), the U.S. Department of Defense, the Department of Homeland Security, the Internal Revenue Service, Department of Veteran Affairs and the U.S. Federal Judiciary. Other MITRE U.S government sponsors include NASA and the U.S. Trade and Development Agency. Backed by a workforce of 7500 professionals, MITRE's work is routinely presented at major conferences, professional publications and is represented through numerous patents.

As part of the MITRE mission to serve in the public interests, MITRE has assisted over 45 nations including Argentina, Belgium, China, Egypt, France, Italy, Japan, Korea, Mexico, The Netherlands, Singapore, Spain, Taiwan, and Thailand, as well as international aviation organizations (ICAO, CANSO, IATA).

MITRE's Center for Advanced Aviation System Development (CAASD) is dedicated to improving the capacity, safety, security and efficiency of aviation worldwide. MITRE has worked closely with the FAA and international customers for over 50 years.

MITRE's aviation work focuses on advancing global harmonization, solving challenging operational problems, assisting aviation infrastructure development, and prototyping new technology. The work effort includes, among other things, aviation safety and security; Performance Based Navigation (PBN) implementation; the development of advanced decision support tools, and global infrastructure for communications, navigation, and surveillance, and aviation weather. Additionally, MITRE works on measures to increase airport and airspace capacity, while minimizing environmental impacts, and conducts collaborative research with the aviation industry. MITRE's expansive laboratory capabilities combine the newest technology with sophisticated modeling and simulation to help solve customer challenges.

MITRE's work within India for the Indian Space Research Organization (ISRO) and Airport Authority of India (AAI) includes: providing system engineering support during the development and implementation of Satellite-based CNS/ATM systems within India that are fully compliant with International Civil Aviation Organization (ICAO) concepts; assisting with the implementation of Geostationary-Augmented Navigation (GAGAN) system; supporting the U.S. – India Aviation Summit and Technical Symposium; and developing airport and airspace capacity enhancements and RNAV/RNP Procedures at airports in Delhi and Mumbai.



The Washington Consulting Group, Inc. (WCG) has established itself as a leader in the international aviation community in the areas of air traffic management, operations and training. Our senior consultants have in excess of 100 years experience in senior executive and managerial positions within the FAA including policy formulation and execution; management and technical training; and technology applications. We provide consulting services, operational support and training for virtually every element that is critical to the operation of an air traffic system for both domestic and international clients. Our business model assures these services are developed and provided within the unique requirements of each client and designed to blend transparently within their organizations. Our commitment is to continue to enhance that leadership position within the domestic and international aviation communities with a focus on pacing the rate of developing technology and growing economic demands on the aviation industry at large.

WCG has two principal corporate objectives that we consider to be corporate imperatives:

- The continuous improvement in our product and services
- A commitment to our clients' success; their goals and assuring their role in a safe and efficient world-wide air traffic system

WCG has been a critical asset in providing management, certification and proficiency training for air traffic systems throughout the world. We take great pride in our service record with the domestic and international aviation industry and our part in its safe operation and success. We chose to become members of the India-U.S. Aviation Cooperation Program during its early stages of development because we not only realize the opportunities represented by such a program but are greatly impressed by the expanding role India is playing in the growth of international aviation. We look forward to continuing our record of success by becoming partners in India's aviation program and leveraging our assets to assure their success. This will be accomplished by accepting the challenge of the future for international aviation and bringing innovation and creativity to the management, operation and training processes that enhances India's growing role in the international aviation community.



Moog Inc. is a worldwide designer, manufacturer, and integrator of precision motion control products and systems. Moog's high-performance systems control military and commercial aircraft, satellites and space vehicles, launch vehicles, missiles, industrial machinery, wind energy, marine applications, and medical equipment.

### **World Leader in Flight Control Systems and Critical Control Products**

For over 50 years, Moog has developed a reputation throughout the world as a company whose people and products are at the forefront of the aerospace industry. We are known for our successful solutions to motion control challenges that are viewed by others as impossible. This directly reflects the creativity, work ethic and remarkable attention to purpose of our people.

Over this period, Moog has expanded its capability base to become a leading supplier of integrated control actuation systems for civil and military aircraft. We are continuously extending the depth of our systems capability while simultaneously expanding our core component expertise to take on the challenges and responsibilities of a changing industry. As a result we are positioned on virtually every platform in the marketplace, supplying reliable actuation systems that are highly supportable and add significant value for our customers.

### **Unrivaled Mix of Systems and Component Expertise**

Moog has been supplying High Reliability Designs and Cost Effective Solutions to the Large and Regional Transport markets for over five decades. As a result, our products are on nearly every commercial platform in operation today. Moog offers a broad range of solutions from complete Fly-by-Wire flight control systems through control actuation subsystems to specialty controllers and utility actuators.

Our system solutions leverage a comprehensive design, integration and certification capability. With an unrivaled mix of system and component expertise, we are uniquely qualified to create solutions optimized around the customer's goal for cost, weight, reliability and performance.

Our product based solutions draw upon our extensive actuation and control heritage. With the broadest range of actuation and control technology available in the market we are able to address the most challenging applications with proven time tested building blocks.

### **Our Offering**

- Stick-to-Tail Systems      ● Primary and Secondary Flight Controls      ● High-Lift
- Control Electronics      ● Actuators and Components

### **Our Heritage:**

- Boeing 787, 777, 767, 757, 747, 737
- Airbus A350 XWB, A380, A340, A330, A320

### **System Provider for the Boeing 787 Dreamliner and Airbus A350 XWB**

Moog is providing the design, integration and certification support for the Primary Flight Control Actuation System on the Boeing 787 and Airbus A350XWB. The Moog system controls all of the primary flight control surfaces on the airplane. The system controls 21 flight surfaces and includes a mix of electrohydraulic (EH), electromechanical (EM) and advanced electrohydrostatic (EHA) servoactuators and all associated control electronics. Separately, Moog is also providing leading edge slat actuation components to the Dreamliner and the Trailing Edge actuation system for the A350 XWB including the Power Control Unit, inboard and outboard Geared Rotary Actuators, Gearboxes, Wing Tip Brakes and other miscellaneous components as part of the High Lift systems team.

### **Moog's products will feature:**

- More electric actuation technology      ● On board electronics for actuator power and control
- Highly integrated assemblies to meet challenging envelope constraints



# OSHKOSH CORPORATION

ISO 9001 CERTIFIED

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## Oshkosh Introduction



**Oshkosh Corporation**, a U.S. Fortune 500 company, is the world's largest manufacturer of fire and emergency vehicles and Aerial work platforms.

As the global leader in the Aviation Equipment Industry, many of the world's best airports are built using Oshkosh Aerial Work Platforms and when these airports become operational, they are protected by Oshkosh Aircraft Rescue and Fire Fighting (ARFF) Vehicles.

Major Airports in Asia such as Beijing Capital Airport, Korea Incheon Airport, Indonesia Soekarno-harta Airport and India's busiest airport Chhatrapati Shivaji Int'l Airport in Mumbai are protected by Oshkosh ARFF vehicles.

Oshkosh and its subsidiary JLG are recognized as the most reliable and most trusted brand names in the Aviation Industry; for Aviation fire protection, working at extreme heights or maintaining the airport building infrastructure and aircraft maintenance and repair operations.

Oshkosh Corporation has been working with the India market for the past twenty years and is proud to be associated with India and the emergence of India as a global economic power house. We are committed to India and its development and have established our India headquarters at Rectangle 1, Commercial complex D, Saket, New Delhi, India.

Our local team of sales and service specialists stand ready to serve India and its booming Aviation Industry. We look forward to contributing to India's Aviation success through safe airports, safe and highly productive methods of building airport infrastructure and safe aircrafts via proper use of tools in Aviation MRO.

Oshkosh is proud to be a member of US-India ACP and will continue to participate and actively contribute by bringing the latest industry best practices and professional networks into India.

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# Pratt & Whitney: An Overview



Pratt & Whitney, a United Technologies Corp. company (NYSE: UTX), is a world leader in the design, manufacture and service of aircraft engines, industrial gas turbines and space propulsion systems. Pratt & Whitney reported an operating profit of \$1.84 billion in 2009 on revenues of \$12.58 billion. The company's 36,000 employees support more than 11,000 customers in 195 countries around the world.

Pratt & Whitney was founded in Hartford, Conn. in 1925 by Frederick Rentschler. Pratt & Whitney's first aircraft engine was the 410 horsepower, air-cooled Wasp, which delivered unprecedented performance and reliability for the time and transformed the aviation industry. Pratt & Whitney has been leading change ever since.

Pratt & Whitney builds engines for front line fighters, like the F-15 Eagle, F-16 Fighting Falcon, F-22 Raptor and F-35 Joint Strike Fighter, as well as the C-17 Globemaster III military transport.

Pratt & Whitney Canada has produced more than 60,000 engines which power corporate jets, regional aircraft and helicopters around the globe.

Pratt & Whitney's large commercial engines power more than 30 percent of the world's passenger aircraft fleet. The company continues to develop new engines and work with its partners in International Aero Engines and the Engine Alliance to meet airline customers' future needs.

Pratt & Whitney's broad portfolio of businesses includes industrial gas turbines that light cities and power ships. Our PureCycle® power system converts heat from geothermal resources, oil and gas wells and other sources into clean electricity.

Pratt & Whitney Rocketdyne has been the power behind over 1,600 launches and has been a key engine provider to the U. S. space program since its inception. That service continues today with the Space Shuttle Main Engines and the engines for the current Delta and Atlas launch vehicles. The U.S. return to the moon and innovative missile defense products will also be powered by Pratt & Whitney Rocketdyne engines.

Pratt & Whitney is developing game changing technologies for the future, such as the PurePower® PW1000G engine, with patented Geared Turbofan™ technology, for next generation of passenger aircraft and hypersonic propulsion systems for aircraft that will travel more than six times the speed of sound. Through Pratt & Whitney Global Service Partners, Pratt & Whitney is also developing innovative new services that will delight customers around the globe. Pratt & Whitney Global Material Solutions is the first OEM to re-engineer, certify and manufacture both gas-path and life-limited parts for the CFM56-3 engine.

For more information, visit Pratt & Whitney's Web site at [www.pw.utc.com](http://www.pw.utc.com)

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## MAJOR PRODUCTS

### Commercial Engines

PW2000 for Boeing 757  
PW4000 for Boeing 747, 767 and 777  
and Airbus A300, 310 and A330  
PW6000 for Airbus A318  
GP7000 for Airbus A380  
V2500 for Airbus A319, A320 and A321  
PurePower PW1000G engine for  
Mitsubishi Regional Jet  
Bombardier CSeries Aircraft and  
Irkut MC-21 Aircraft

### Military Engines

F100 for F-15 Eagle and  
F-16 Fighting Falcon  
F117 for C-17 Globemaster III  
F119 for F-22 Raptor  
F135 for F-35 Joint Strike Fighter

### Small and Medium Engines

Pratt & Whitney Canada builds 10 families of engines used in a variety of applications, including the PW307A for the Dassault Falcon 7X and the PW600 family for a new generation of Very Light Jets.

### Space Propulsion

Pratt & Whitney Rocketdyne powers the Space Shuttle, supplies booster engines for Delta II rockets and supplies boosters and upper stage engines for Atlas V and Delta IV rockets.

### Power Systems

Pratt & Whitney Power Systems (PWPS) is an industry leader in providing solutions to the power generation market through its industrial gas turbines and aftermarket services. Its gas turbines serve as mobile, easily assembled and highly efficient power generation systems. These systems can deliver as much as 60 MW of safe electric power. PWPS has installed more than 2,000 industrial gas turbines in more than 50 countries worldwide.

PWPS is also growing its alternative and renewable energy portfolio. With its PureCycle® product and the purchase of Italy-based Turboden in July 2009, Power Systems is expanding globally into Organic Rankine Cycle (ORC) power generation using biomass, geothermal and industrial waste heat.

## COMPANY PROFILE

### Financials

Revenues: \$12.58 billion (2009)  
Operating Profit: \$1.84 billion (2009)

### Current Employment

36,000 employees worldwide

### Customers

More than 600 customers operate Pratt & Whitney large commercial engines in 140 countries.

Nearly 30 customers operate aircraft powered by Pratt & Whitney military engines.

More than 9,000 regional airlines and other operators fly with engines made by Pratt & Whitney Canada.

Overall, Pratt & Whitney serves more than 11,000 customers in 195 countries.



**Pratt & Whitney**  
A United Technologies Company



**Ricondo & Associates, Inc. (R&A)** is a full-service aviation consulting company specializing in airport consulting in support of airport owners and operators, airlines, and federal and state agencies. Since its inception in 1989, R&A has been dedicated to solving the challenging problems facing the airport and airline industries. The company is owned and operated by its senior officers and has no other business interest except airport and aviation consulting. R&A is headquartered in Chicago and has established offices in northern and southern California, Cincinnati, the Dallas/Fort Worth area, Denver, Honolulu, Miami, Orlando, Phoenix, the Washington, D.C., area, and an international office in Abu Dhabi, United Arab Emirates. The company employs more than 100 full-time staff, including more than 80 professional aviation consultants.

What distinguishes R&A in airport consulting is our sole focus on the aviation industry, our responsive approach to delivery of services, and our commitment to supporting our clients, beginning with preliminary planning and continuing through design support, federal processing, financing, and project construction. R&A's management philosophy places our first priority on client needs and the delivery of services in a way that builds long-term successful client relationships. The company's approach to service delivery emphasizes working with clients to ensure that products and recommendations are responsive to their goals and objectives. This partnership approach is a critical aspect in achieving client satisfaction and one of the reasons for our success. Nearly 90 percent of R&A's assignments are from repeat clients, evidence of the quality of services we provide, our professional reputation, and the relationships we've built.

The diverse backgrounds of our senior staff, along with their individual expertise, qualify R&A to provide comprehensive aviation consulting services at airports of all sizes. The company's officers average over 23 years of commitment to the aviation industry, having worked as consultants and problem solvers for airport sponsors and airlines, as well as for the Federal Aviation Administration (FAA) and the Transportation Security Administration (TSA). The consulting services offered by R&A range from broad problem-solving consulting to specialized technical analyses in the following areas:

- Airfield Analysis and Planning
- Airport Business and Financial Services
- Airspace Analysis and Planning
- Credit Rating Support
- Environmental Services
- Forecasting
- General Advisory Services
- Land Use and Development Planning
- Landside Planning
- Management Support Services
- Noise Analyses
- Operations Research
- Regulatory Assistance
- Strategic Planning
- Sustainability Services
- Terminal and Other Airport Facilities Planning





Strategic Decisions Group

Business Strategy

Risk Management

Portfolio Optimization

Partnering

SDG, is a global strategy consulting firm renowned for applying leading-edge decision theory to uncover opportunities for creating shareholder value. Founded in 1981, SDG has roots in the engineering and business schools of Stanford University. We guide our clients to find innovative, creative strategies to thrive today, while also helping them build internal competencies to meet competitive challenges in the future.

We have worked with over a third of the Fortune 100 companies, assisting them on their most important and pressing issues. We continue to help large corporations manage uncertainties by applying our leading edge decision analysis framework to corporate decision-making, strategy development, and risk management. Our work spans across sectors and boasts of an impressive clientele.

**We have supported our aerospace and transportation clients in managing complex issues like large capital investments, portfolio optimization, regulatory uncertainty and competitive pressures**

In India, we have worked with some of the fastest growing companies in aerospace and transportation and we have supported our clients in this sector across:

- Strategy for large capital investments
- Bidding
- Portfolio optimization
- Managing regulatory and competitive uncertainty

We continue to help companies in this sector find innovative strategies to face today's challenges, and prepare for the future.

We believe that our global pedigree, unique capabilities, a team of highly qualified and experienced consultants, and strong understanding of the Indian market environment ideally positions us to support the Aviation Cooperation Program in India.



#### A Brief Overview of SDG India

Presence in India for over 12 years with offices in **Mumbai, Delhi, Bangalore and Chennai**

Focus sectors: **power, mining & minerals, oil & gas** (upstream and refineries), **airports, transportation, construction, private equity** and **life sciences**.

Key clients: **IDFC, GMR Group, Archeon Group, OPG Group, Murugappa Group, Rubamin, FLSmidth, Tata, L&T, Jubilant, Citibank, Infosys, GTI & Airworks, Sona Group and Coromandel**

#### Contact Us

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Founded in 1932, and located in New York City in the United States, Vaughn College of Aeronautics and Technology offers graduate, undergraduate and certificate programs in the fields of aviation, engineering, technology and management. The institution is accredited by the Middle States Commission for Higher Education (MSCHE) in the US. Programs in engineering technology are accredited by the Technology Accreditation Commission (TAC) of Accreditation Board for Engineering Technology (ABET) and management degrees by the International Assembly for Collegiate Business Education (IACBE).

As part of its global initiative, Vaughn College of Aeronautics & Technology has been successfully offering three of its degree programs in India in collaboration with SREENIDHI Institute of Science and Technology (SNIST) Hyderabad since 2007. These programs are approved and recognized by All India Council on Technical Education (AICTE), India and MSCHE, US.

Vaughn College's vision is to be the international institution of choice by providing outstanding comprehensive training and higher education programs in the field of aviation and related fields, through collaboration with regulatory agencies, industries and academic institutions. Vaughn's international mission is to provide world-class training and education to current and future global aviation professionals, and assist them in achieving their fullest personal and career potential.

Today at SNIST in India, nearly 400 students are enrolled in Vaughn's programs pursuing Bachelor of Science programs in avionics, airline and airport management. The first cohort of students will be graduating in May of 2011. Based on this success, Vaughn has plans to expand our program offerings to other parts of the Indian subcontinent, as well as other parts of the world.

**Vaughn College / SNIST programs offered to Indian students are:**

- BS in Airline & Airport Management ( Dual Major )
- BS in Airline Management
- BS in Electronics Engineering Technology (Avionics)

These degree programs are replicated and offered at SNIST in a manner that is consistent with Vaughn's accredited degree programs, including Vaughn's educational purposes and objectives, admission criteria, academic standards, curriculum, content of courses and programs, instructional methods, academic support services, outcomes assessment criteria and procedures, and instructional methods. Vaughn works with SNIST to identify the qualifications necessary for faculty who teach the Vaughn-developed courses.

SNIST provides the necessary infrastructure, library and qualified core faculty and staff for three fourths of the credits required for the award of BS degree by Vaughn College. Vaughn College's visiting faculty teach one fourth of the credits in specialized core courses in India. Students also have an option to take one fourth of the credits at Vaughn College's campus in New York.

Visit [www.vaughn.edu](http://www.vaughn.edu) for further information about Vaughn's international programs, or contact the director of distance learning and international programs, Mr. Ray Axmacher at [ray.axmacher@vaughn.edu](mailto:ray.axmacher@vaughn.edu).

**Vaughn College of Aeronautics and Technology**

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# TEXTRON

Textron is a \$10.5 billion (2009) global multi-industry company with market-leading brands serving the General Aviation, Aerospace & Defense, Industrial and Commercial Finance markets. Founded in 1923, Textron has grown into a network of businesses with revenues of \$10.5 billion and around 32,000 employees in 25 countries serving the global customer base. Textron is ranked 220th on the Fortune 500 list (2009) and continues to grow as an industry leader with strong brands such as Bell Helicopter, Cessna Aircraft, Textron Systems in the aviation & defense sector besides several leading industrial brands like Kautex, E-Z-Go, Greenlee & Jacobsen.



#### **Bell (27% of 2009 revenues)**

Bell Helicopter is a leader in the global helicopter industry and the pioneer of tiltrotor aircraft. Single engine Bell 407, light twin engine Bell 429 and medium twin engine Bell 412 are extremely versatile helicopters providing excellent support to Indian customer for all operations.



#### **Cessna (32% of 2009 revenues)**

Cessna Aircraft Company, having produced more than 200,000+ aircraft is the world leader in Business Jets (Citation series) & variety of single engine aircraft including highly popular Caravan & Cessna trainers. Citation CJ 2+ & XLS + are preferred options for Indian customers.



#### **Defense and Intelligence (18% of 2009 revenues)**

Textron Systems has been providing innovative solutions to the defense, homeland security and aerospace communities for over 50 years. Textron Systems is known for its precision smart weapons, intelligent battlefield systems, piston engines, armored vehicles, motor life boats and unmanned aircraft systems.



#### **Industrial (19% of 2009 revenues)**

The Industrial segment consists of leading industrial brands including Kautex (plastic fuel systems for automotive), E-Z-Go (electric golf-carts and utility vehicles), Greenlee (professional tools) & Jacobsen (turfcare equipment).



#### **Finance (4% of 2009 revenues)**

Textron Financial is a commercial finance company providing financial solutions for Textron customers in Aviation & Golf segments.

Textron India, a 100% subsidiary of Textron Inc. USA was established at Bangalore in December 2006, under the chairmanship of Mr. NR Mohanty- a renowned technocrat, former Chairman of Hindustan Aeronautics Limited and a recipient of Padmashree award. The objectives of the Textron India are as follows:

- To provide high-end engineering support to Textron operating units across the world through Textron Global Technology Center.
- To promote Textron brands as partners in India's growth offering best value proposition to the Indian consumers & industry and to meet multiple and concurrent business objectives of Textron BUs in India.
- To develop Indian sourcing partners for cost effective supply chain solutions to Textron BUs.

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ProMark Associates is a global provider of innovative, cost-effective air purification solutions designed to maximize the return on the customer's investment in filtering and conditioning air. Through advanced engineering, ProMark delivers a technology that captures and destroys contaminants in indoor air. Total Spectrum® Air Purification System shifts the paradigm from dependence on ventilation with outside air to high quality indoor air achieved with recirculation of purified air.

**A value proposition that delivers an ROI and clean air** by recirculation of conditioned air. Less demand on conditioning also reduces energy usage leading to an ROI in 2 years. The result is clean, green, indoor air for the 21st century.

**ProMark's mission in India** is to bring the benefits of sustainable air purification technology to large buildings, with a special focus on airports, healthcare and commercial buildings. Our first project in India is a specially designed Total Spectrum® Air Purification System for Terminal 3 of Indira Gandhi International Airport.

**Additional initiatives** under consideration include:

- Retrofitting Total Spectrum® APS to existing buildings with serious IAQ issues. Many buildings are surrounded with polluted air from vehicles, power plants, industrial manufacturing gases, and airborne pathogens such as viruses, bacteria and allergens. These challenges make using outside air undesirable above the very minimum.
- Integrating Total Spectrum® APS into new and existing buildings for energy conservation.
- Forming a distributor joint venture to explore manufacture in India and assure supply chain excellence; work with local suppliers to utilize Indian content where possible. Provide after-purchase support to customers in India through well-educated and trained Indian engineers.
- Provide training and education in indoor air quality best practices, especially the capabilities of air purification.

**ProMark's range of services and products includes:**

- Engineers help staff diagnose air quality problems and achieve the best possible IAQ with reduced energy and maintenance costs
- Assistance to help optimize existing HVAC and integrate air purification technology into sustainable, whole building design
- Technical support including design specifications, engineering, installation, commissioning, on-site training and service classes
- Laboratory services that include corrosion measurement, testing of filtration media remaining life, and environmental monitoring
- Full range of products for gas phase filtration including proprietary media, filter housings, and patented filter modules

**ProMark, founded in 1988, has been providing clean, safe indoor air in some of the most challenging environments**, such as refineries, mining, power plants, paper mills, and airports where odors, toxic gases, and corrosion can threaten people and sensitive electronics. Our work has provided control room protection and avoided catastrophic accidents. Commercial installations include healthcare facilities, casinos, museums, hotels, restaurants, and offices. International clients are found in North and South America, the Middle East, and now India. ProMark is guided by industry standards such as ASHRAE and quality/process oversight such as ISO. As a company we are committed to sustainable practices and products.

The capability of providing clean indoor air is significant and the health and financial benefits are immense and quantifiable. ProMark's growing partnership with India is an opportunity to transform the built environment of the 21st century.

# Honeywell

Honeywell began its investment in India over 40 years ago, with a vision to strengthen both our presence in India and our strategic relationships with Indian industry. Today, Honeywell has grown from 1,000 people in 2002 to more than 10,000 in locations throughout India. We remain deeply dedicated to the success of India's aerospace sector.

Superior technology, products, solutions expertise and customer relationships make Honeywell one of the most valued aerospace names in India and across the globe. With our nose-to-tail and gate-to-gate integration capabilities, Honeywell consistently delivers innovation that meets the needs of our customers for higher performance, enhanced reliability and safety and reduced costs. Our complete product portfolio of aircraft systems helps ensure mission readiness and aircraft safety.

Our contributions to Indian engineering, manufacturing, research and technology development capabilities continue to expand as we support the growing demands of India's aviation, aerospace and defence industries. Honeywell's team of engineers is developing critical technologies for customers across the globe, while aircraft with Honeywell parts fly throughout the skies of India. From commercial airliners to business jets and general aviation planes, our products keep pilots – and passengers – safer and more comfortable. India's commercial aerospace industry is changing, and we're changing with it, developing avionics solutions that make flying safer and mechanical solutions that make operating aircraft more cost effective. Because our products combine strong performance with dependability and efficiency, they do more than perform in the air – they perform for their owners and operators as well, providing increased value for their aviation investment.

Our products reach beyond everyday travelers. While the people of India are sleeping at night, India's borders are secured by fighters containing our high-technology products; products that are made in India, by Indians. Today, Honeywell engine technology is ready to support the next generation of Indian Air Force aircraft, with the F125IN engine for the Jaguar fighter. It's only the latest chapter in the story of our collaboration with India.

We are committed to continuing to advance India's indigenous technology, from development through to production. Over 40 years ago, we began a partnership with Hindustan Aeronautics Limited (HAL) to manufacture and support high technology products in India. Then, we created history, enabling HAL to build our TPE 331 10/12 turboprop engine and to export it to the world market, making HAL a global aerospace engine exporter for the first time. Honeywell technologists across India develop innovative solutions for our aerospace customers worldwide, while our manufacturing facilities make products that are used in India, and around the world.

Honeywell's commitment to India and its aerospace industry is demonstrated in the most important of ways – by ensuring that our high performing products and services keep India's passengers, pilots and people safe and secure. From our first engagement with HAL to the innovative F125IN engine, we've been part of the history of Indian aerospace – even if you didn't know we were there.

For more information about Honeywell and Honeywell Aerospace's activities in India, please click: [www.honeywellforjaguar.com](http://www.honeywellforjaguar.com).



CSSI, Inc. has 20 years of experience providing superior technical solutions to global aviation organizations in both the government and commercial sectors. Our domain expertise in aviation safety management, airspace procedures, and flight operations, combined with our technical skills in operations research, systems engineering, applied research and development, modeling and simulation, and information technology, have served as the foundation for many successful aviation programs and projects. Some of our recent contributions to aviation safety and operational efficiency include involvement in the following global initiatives: Reduced Vertical Separation Minimum (RVSM), performance-based navigation (PBN), safety management system (SMS) implementation, safety data collection and analysis (including collision risk modeling), airspace procedure design, and route simulation and evaluation tools for terminal airspace. Furthermore, we are among the select companies assisting the U.S. Federal Aviation Administration in its effort to implement Next Generation Air Transportation System (NextGen) capabilities.

CSSI is familiar with aviation operations in the Asia/Pacific Region and our experts have worked with the region's civil aviation authorities (CAAs) and air traffic service providers (ATSPs) for many years, primarily related to separation standards. They are intimately familiar with ICAO's Standards and Recommended Practices (SARPs), Regional Supplementary Procedures (DOC 7030), and State regulatory affairs. Furthermore, they actively participate in numerous global and regional meetings, including the Separation and Airspace Safety Panel (SASP) and sub-groups of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG). Among our many corporate capabilities available to international customers, CSSI has two of the world's leading experts in performing collision risk modeling (CRM) and airspace safety assessments. This internationally-recognized and proven method for the evaluation of airspace safety is especially important when States consider making changes to separation standards. With more than three decades of experience performing CRM, CSSI's experts – along with numerous support staff that specialize in safety analysis and monitoring – provide CAAs and ATSPs with safety assurance and risk management services.

We are committed to providing superior technical services to India's aviation sector. An undisputed leader in global aviation with increasing airspace capacity demands, India offers CSSI an opportunity to provide the type of technical services that have supported enhanced operational safety and efficiency in U.S. airspace – the largest, most complex airspace system in the world. Our technical support services have helped government and commercial organizations achieve the highest levels of operational safety, quality, and efficiency. CSSI's unique combination of capabilities are well-suited to India's current efforts to modernize its air navigation system, increase operational efficiency through advanced procedure design, conduct operational data analysis to support safety risk management (SRM) for proposed system changes, and implement comprehensive safety management systems for aviation service providers. We look forward to providing our high quality professional and technical services to India so that it may achieve its aviation safety and operational efficiency performance objectives.



## India's Weather Needs

- Nationwide Met Network
  - Sensor Stations
  - Data Collection & Distribution
- Aviation Met Weather
  - For Rural Airports
  - Provide Aviation Access
- Serving India
  - Weather Forecasting
  - Aviation Access to Rural Communities
  - Emergency & Disaster Relief



**ONE SYSTEM CAN PROVIDE ALL**

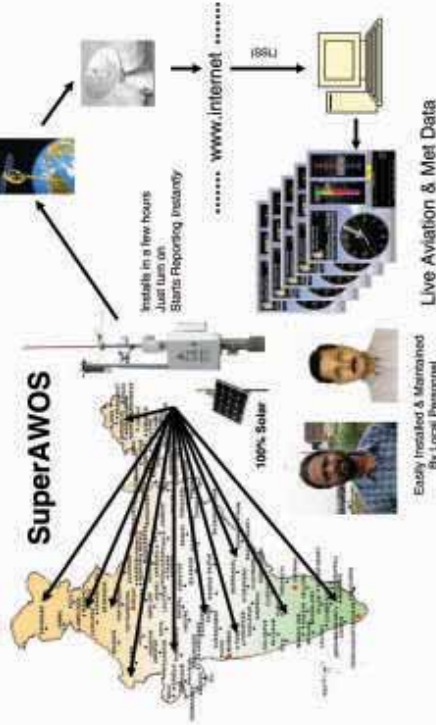
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Data Collection + Communication + Distribution

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- **Independent of Local Infrastructure**
  - Available 100% Solar Powered
  - Sends weather & equipment data *by Satellite*
- **Easily**
  - Installed by Local Personnel
  - Maintained by Local Personnel
- **Extremely**
  - High Reliability
  - Low Maintenance



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- Serving Rural and Community Airports
- Many Unique & Patented Safety Features
- Proven 10+ Year Track Record
- High Reliability
- Low Maintenance



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Thank You



UPS or United Parcel Service is the world's largest package distribution company that provides express delivery and logistics services to more than 200 countries and territories across the globe.

UPS entered the Asia Pacific region 17 years ago and serves more than 40 countries and territories in the region. In November 2000, UPS and Jetair Limited – India's largest General Sales Agency, entered into a joint venture to form UPS Jetair Express Pvt. Ltd. in India.

In 2007, UPS Jetair Express announced a strategic alliance with AFL Pvt. Ltd. that has significantly expanded accessibility to UPS services in India while providing export capabilities to AFL. With 180 AFL WiZ Express Centres across India and UPS's global network that serves more than 200 countries and territories, the alliance benefits all business and consumer segments especially the SMEs.

UPS' network in India comprises the company's fleet of iconic brown vehicles that UPS is known for worldwide, centralized call centre, trained service providers and superior technology applications. What adds to UPS' credibility is that the company employs stringent training practices and ensures the best service standards, thereby aiming to create a benchmark in the industry. UPS operates its own fleet of aircrafts with eight weekly flights to and from Mumbai. It serves the five major airports including Mumbai, Chennai, New Delhi, Bangalore and Cochin.

UPS provides international express delivery services in India and offers a comprehensive range of cost-effective solutions including export and import of express documents and packages throughout more than 200 countries and territories worldwide. Some of its specialized products include those for express documents and medium sized shipment patterns, which will cater to the high value category. These essentially benefit manufacturing industries, essentially those involved in high value and time sensitive shipments.

Technology today has become one of the basic requirements to effectively delivering business needs of customers. UPS's sophisticated technology infrastructure ensures the smooth delivery of 15.5 million packages a day. Today technology also means the Internet, and UPS is using its technological expertise to offer e-commerce solutions to businesses worldwide.



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Harris is an international communications and information technology company serving government and commercial markets worldwide. Headquartered in Melbourne, Florida, the company has approximately \$5 billion of annual revenue and 15,000 employees—including nearly 7,000 engineers and scientists. Harris is dedicated to developing best-in-class *assured communications*® products, systems, and services. Founded in 1895, Harris now serves customers in more than 150 countries.

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**Deliver more**

# flying high



**Our ideas, like our technologies,  
take flight over India every day.**

More than 10,000 Honeywell employees are at work here helping to build a world that is safer and more secure, more comfortable and energy efficient, more innovative and productive. Today their ideas are at work all around you in products for homes, offices and industries. Tomorrow they will advance technology to new heights to solve the challenges of the future.

## Honeywell

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exported from India each year | 25 years of partnership with India's  
aerospace industry | Global R&D hub in Bangalore

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**DR. ARJUN SINGH**  
Program Director

US-India Aviation Cooperation Program



## Looking Forward

Passengers carried by domestic airlines in January-August 2010 were approximately 34 million as against 28.5 million in the corresponding period (January and August) of year 2009, thereby registering growth of +19.3%. The international passenger traffic during the same time has registered a growth of 11.7%. This substantial growth presents numerous opportunities for ACP member-companies.

The Government of India had accorded “in-principle” approval for the setting up of a greenfield airport at Mopa (Goa), Navi Mumbai, Sindhudurg (Maharashtra), Bijapur, Gulbarga, Hassan, Shimoga (Karnataka), Kannur (Kerala), Pakyong (Sikkim), Durgapur (West Bengal), Dabra (Madhya Pradesh), Palladi (Rajasthan), and Itanagar (Arunachal Pradesh), and a totally private greenfield airport is coming up at Karaikal, near Puducherry.

Having concluded its first three years of operation, the ACP has made a remarkable progress, completed five projects, ongoing four projects and three projects under process. It has also been engaged in numerous events to help in reshaping a favorable outlook of Indian civil aviation and increasing credibility and capability by cooperating with USG agencies and 33 US companies.

The ACP will set its sight on developing quality projects in the key areas, e.g. development of regional airports, participation in the development of 80-seater regional aircraft, implementation of ATFM, ADS-B, development of human resources for regulatory oversight and assessing manpower requirements for critical area of CNS/ATM, etc. The continued growth of the Indian civil aviation sector will provide an opportunity to do more marketing about their technologies as well as also to open up the new untouched market of General Aviation, Green fuel and Airport Environment issues, etc. The ACP will certainly be willing to shape the Indian aviation and aerospace sector in such a way as to match the global campaigns of ICAO.

A handwritten signature in black ink, appearing to read "Arjun Singh".

(DR. ARJUN SINGH)



# US-INDIA AVIATION COOPERATION PROGRAM

## US Government



## US Industry







## ONE PARTNERSHIP. ENDLESS POSSIBILITIES.

60 years ago, India chose to take to the skies with Boeing as its partner. Today this partnership has only grown stronger. Whether it's to deliver a modern fleet to our partner airlines, or offer them solutions from fleet utilization to maintenance and training, the result is greater efficiency and comfort for flyers. As this partnership soars, the possibilities of what it will achieve are, indeed, endless.

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