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NEWS AND DEVELOPMENTS FROM THE INTERNATIONAL CIVIL AVIATION ORGANIZATION - VOL.72 - NO.1



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Dr. Fang Liu

ENSURING A POSITIVE GLOBAL REGULATORY FRAMEWORK FOR BUSINESS AVIATION GROWTH

 This issue of the ICAO Journal focuses on business aviation, an integral member of the civil aviation community and an important contributor to the positive socio-economic impacts which air transport helps to realize for cities, States and Regions all over the world.

This is especially the case given business aviation's well-recognized role in promoting economic growth and international trade, for instance with respect to the more than 200 billion dollars and 1.1 million jobs it generates in the United States, or the approximately 20 billion euros in gross value added (GVA) and 164,000 jobs it presently generates for the European Union.

These are very significant socio-economic contributions, and more can be done to help ensure that similar levels of positive business aviation economic influence become more globally widespread.

Business aviation also plays an important role in less developed and rural regions, including landlocked and small-island States. These are often faced with specific aviation challenges due to a lack of stable demand, infrastructure constraints, and other issues which often impede the viability of commercial operations.

In these specific circumstances especially, business aviation helps to establish vital links enabling improved connectivity. Similarly, the ability of business aircraft to make use of shorter runways contributes substantially to emergency aid and other humanitarian efforts in the aftermath of earthquakes or other natural or man-made disasters.

Effective global standards and policies for international business aviation operations must take into account users' unique requirements, regional potential, and global development priorities as a whole.

ICAO is committed to accommodating these diverse needs, and to optimizing the contributions of business aviation for enhanced global connectivity. One example of this would be the ICAO Council's recently adopted Standards in Annex 6, Part II, *General Aviation*, which now facilitate the recognition of specific approvals.

I strongly encourage ICAO Member States to adopt these new Annex 6 provisions, and also to adjust their regulatory regimes in a manner which can help to facilitate and optimize business aviation's benefits.

Another important safety-related development we pursue together with the business aviation sector concerns the importance of its data to the global safety equation. ICAO, working with the International Business Aviation Council (IBAC) and its member associations, has already begun the important work toward integrating our organizations' respective safety monitoring results.

ICAO appreciates and acknowledges business aviation's commitment to continuous safety improvement through IBAC's voluntary Industry Standards for Business Aircraft Operations and Business Aircraft Handlers (IS-BAO and IS-BAH, respectively). Both reflect relevant ICAO Standards and Recommended Practices and are model achievements for the sector. IS-BAO is now informing the work of the ICAO Safety Management Panel, and IS-BAH provides useful information to our Ground Handling Task Force.

I am sure this intensified collaboration will deliver positive benefits, both to operators and regulators, and ICAO greatly appreciates your cooperation to this end.

Other areas we have been reviewing in recent years include aircraft operations, aviation infrastructure, access to airspace

“Ultimately, effective and flexible airspace access solutions must be collaborative and fully respect the needs and concerns of every air transport stakeholder.”

and airports, environmental issues, as well as charging practices compliant with ICAO policies. All of these are essential to business aviation's sustainable operations and long-term growth.

With respect to current matters of concern for business aviation, airport and airspace access restrictions represent clear opportunities for more effective consultation and coordination. ICAO is working very hard today to mitigate capacity management challenges due to projected air transport growth, but there remains a tendency to restrict airport and airspace access for non-scheduled operators. This places serious limitations on business aviation's growth potential.

Ultimately, effective and flexible airspace access solutions must be collaborative and fully respect the needs and concerns of every air transport stakeholder. Consensus and cooperation of this nature are precisely how ICAO ensures its Standards and policies are practical and effective, and this points to the need for more harmonized treatment of the business aviation sector by States, in accordance with the Convention on International Civil Aviation.

In order to ensure a truly effective and comprehensive global regulatory framework, we clearly recognize that it must support the varied but often complementary needs of commercial and general aviation operators alike. The business aviation community is an invaluable partner as we seek to ensure this, a point which was formally established at ICAO's Sixth Worldwide Air Transport Conference.

ICAO has been very grateful for the inputs from business aviation respective of many of our recent accomplishments, including the aircraft CO₂ emissions certification standard developed by ICAO's Committee on Aviation Environmental Protection, our Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), review of the Global Air Safety and Air Navigation Plans, and our co-authored *Fatigue Management Guide for General Aviation Operations*.

We will continue to work closely with the business aviation community to make certain that your voice remains an important one around our table, and that States more fully appreciate the important socio-economic contributions which business aviation has to offer. ■

Dr. Fang Liu
ICAO Secretary General

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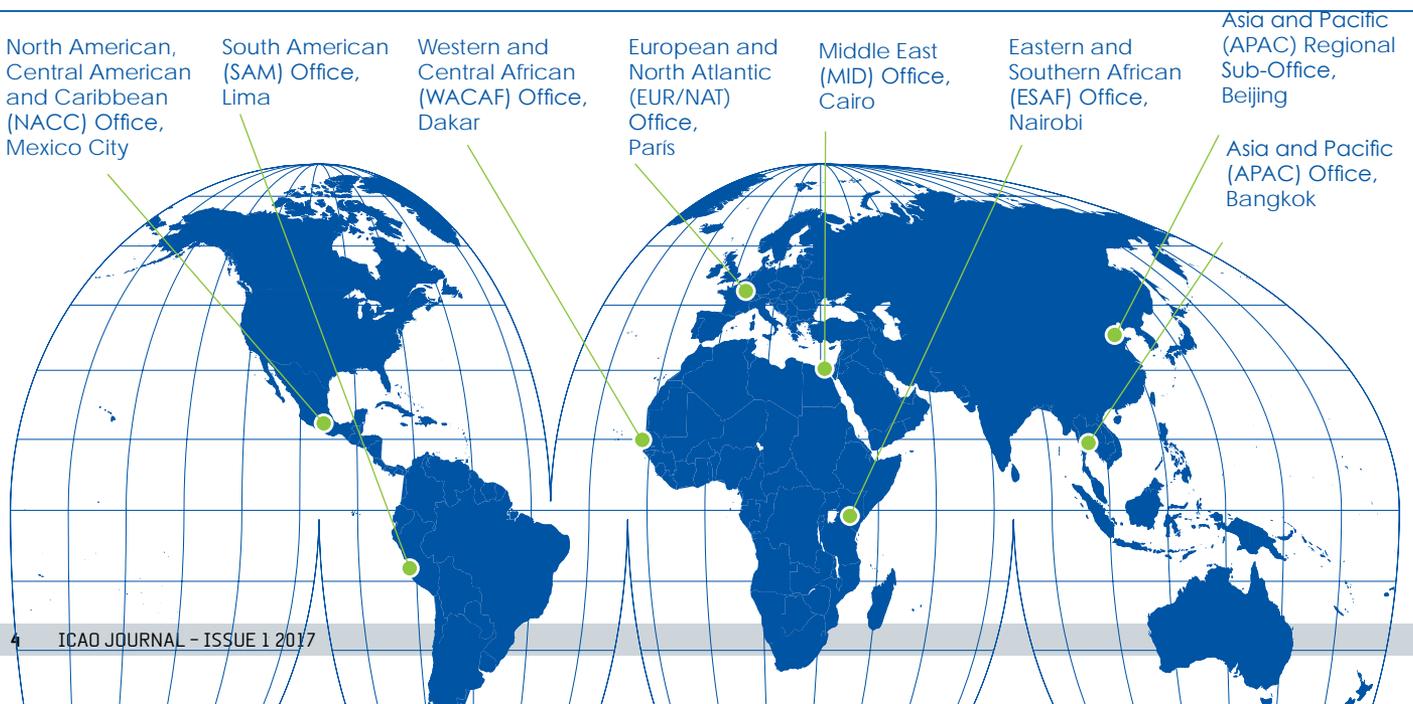
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ICAN2016

ENSURING GLOBAL EFFICIENCY FOR AIR SERVICES NEGOTIATIONS

 **More than 400 air services agreements and arrangements were signed at the 9th ICAO Air Services Negotiation Conference (ICAN2016) in December. The event in Nassau, Bahamas attracted 366 representatives from 67 States and territories who took advantage of the cost-effective, multi-negotiation framework to expand air transport liberalization and market access.**

Continued liberalization of market access creates a better operating environment for the air transport industry, which generates \$2.7 trillion for the global economy annually, and provides 63.5 million jobs globally, ICAO Council President Dr. Olumuyiwa Benard Aliu told participants. Aliu said the ICAO events “have become an important networking platform, while providing valuable opportunities for airlines, airports, tourism providers and others to conduct workshops and other business-to-business meetings which bring added benefit on the sidelines of your negotiations.”

“Safe, secure and ICAO-compliant air services have become a veritable lifeline of the global economy, facilitating access to global markets and trade flows for local producers and retailers, improving local living standards, expanding trade and tourism channels, fostering economic growth, and alleviating poverty,” he noted.

Negotiators took part in some 430 meetings during the five-day ICAN marathon in Nassau, appropriately staged at the National Stadium, site of the country’s first international

airport, the former Oakes Field. Since the event’s inception in 2008, successive ICANs have been held in every world region and have made important contributions to the liberalization of international air transport and the enhancement of air connectivity for the benefit of States, the industry, and the travelling public.

“Once ICAO-compliant air transport connectivity is established, it begins to support expanded tourism and many other local and regional socio-economic development goals for States and Regions,” remarked ICAO Air Transport Bureau Director Boubacar Djibo. “Opportunities for local citizens, businesses and producers to access foreign supplies and markets begin to multiply significantly, and further important benefits for governments and societies are realized through improvements in medical transport, emergency response and cultural exchange.”

MULTIPLE BILATERAL AGREEMENTS

Some examples of the activities at ICAN2016:

The Saudi General Authority of Civil Aviation (GACA) targeted 68 countries during the conference for face-to-face meetings with all the participating countries, according to Captain Abdulhakeem Albadur, Assistant to the President for Security, Safety and Air Transport. For example, India agreed with Saudi Arabia to increase capacity by 8,000 seats per week when Indian carriers’ utilization reaches 80 per cent. “These agreements will help keep pace with the acceleration in the growth of the air

CARIBBEAN STATES ACHIEVING IMPRESSIVE NCLB PROGRESS

At a special meeting of Caribbean States, which took place on the sidelines of ICAN2016, Council President Olumuyiwa Benard Aliu met with a group of North American, Central American and Caribbean (NACC) Member States.

The Council President praised the States for having achieved impressive progress in developing their civil aviation systems, especially in terms of ICAO's *No Country Left*

Behind (NCLB) priorities: a 300 per cent increase in the number of airports undergoing certification, a 20 per cent increase in effective implementation of security standards in four States, and a further 120 per cent increase in the resolution of a number of urgent air navigation deficiencies.

"These impressive achievements are made possible by your commitments, your

cooperation, and your close collaboration with ICAO's NACC Office," President Aliu stressed. "I am very much looking forward to this trend continuing in 2017 and that high-performing NACC States will be eager to share their best practices and lessons learned with their neighbouring States, and especially those Caribbean States and Territories which will be given greater focus next year."

Dr. Aliu undertook a series of bilateral meetings with the Bahamas' Governor General, Her Excellency Dame Marguerite Pindling; Prime Minister, His Excellency, the Rt. Hon. Perry Christie; and Minister of Transport and Aviation, the Hon. Glenys Hanna-Martin. He thanked them for hosting ICAN2016 and said the Bahamas is well positioned to support its regional neighbours as improvements continue.

The Council President emphasized ICAO's appreciation of the efforts and dedication of the governments and technical experts who have been instrumental to recent regional success. He also noted that, within the first year of the *NCLB* implementation, three countries achieved the 80 per cent or higher regional safety target for the effective implementation of ICAO's Standards and Recommended Practices (SARPs).

"These impressive achievements are made possible by your commitments, your cooperation, and your close collaboration with ICAO's NACC Office."

– Dr. Olumuyiwa Benard Aliu



transport industry and provide operational opportunities and destination points for our national carriers," Capt. Albadur said.

Civil Aviation Secretary R N Choubey said India signed Open Skies agreements with six countries – Czech Republic, Finland, Guyana, Jamaica, Spain and Sri Lanka. Memoranda of Understanding (MoU) were signed with 12 countries.

Mr. Chaubey said, "In the present scenario code shares provide seamless connectivity to the travelling passengers and make possible connectivity between far off destinations not served by direct flights.

In his keynote address, the Prime Minister of the Commonwealth of the Bahamas, Mr. Perry G. Christie, highlighted the challenges faced by Small Island Developing States (SIDS) like the Bahamas, including the requirement to provide infrastructure facilities for every island to ensure air connectivity and essential services. He also informed the delegates of the ongoing restructuring of his country's aviation industry to be more ICAO-compliant and thanked ICAO for its efforts and assistance under the *No Country Left Behind*

(*NCLB*) Initiative, which he stressed would assist many SIDS like the Bahamas to enhance safety and security while promoting the growth of air transport, trade and tourism.

During the conference, Bahamas signed agreements with Brazil, Curacao, Kuwait, New Zealand, Qatar and Singapore, as well as Turkey and the United Arab Emirates. Minister of Transport and Aviation the Hon. Glenys Hanna-Martin, said these will "open new windows" for the country's aviation industry. "This will not only mean opportunities in the aviation sector but also will impact our tourism sector as it would facilitate the movement of people, which is germane to the economic health of our country."

"The ultimate goal of these efforts is to realize a safe and efficient air transport foundation in a given State, one which is consistent with ICAO's Standards and Recommended Practices (SARPs) and Strategic Objectives for the global air transport network," said Djibo. "ICAO ICAN events have also become an important platform for air transport regulatory reform, and a useful vehicle for promoting understanding and cooperation amongst government policy makers, regulators and industry players, as well as other aviation stakeholders." ■



ICAO AND THAILAND ACCELERATE COOPERATION

The Government of Thailand is preparing for a follow-up mission by ICAO in June to resolve a Significant Safety Concern (SSC). In December, ICAO Secretary General Dr. Fang Liu and Thai Prime Minister H.E. Prayut Chan-o-cha agreed to accelerate their ongoing cooperation.

During a visit to the State, Dr. Liu commented, "Thailand is a leader in a number of areas of sustainable development in the Asia and Pacific (APAC) Region, and its international tourism growth strongly relies on its effective oversight of safe and secure global air transport connectivity." She thanked Thailand for the leadership it is demonstrating by prioritizing the air transport sector in its 20-year National Development Plan, stressing the importance of addressing its near-term safety, security and capacity priorities in aid of future sustainable growth.

Reiterating his Government's commitment to ensure ICAO-compliant air transport operations as quickly as possible, PM Prayut Chan-o-cha stressed that all required measures would be taken by the Thai Government to resolve the SSC. He also highlighted the importance of the proactive assistance Thailand is receiving from ICAO's Bangkok-based APAC Regional Office, singling out the capacity building of regulatory staff as an example of how ICAO's collaboration can have significant impacts.

During her visit, the SG held bilateral discussions with Thailand's Minister of Transport, H.E. Arkhom Termpittayapaisith, and a

high-level meeting with Dr. Samshad Akhtar, the Executive Secretary of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). Dr. Liu and Dr. Akhtar agreed that both UN agencies should enhance their efforts to encourage the prioritization of aviation within States' national developmental plans, especially given the critical importance of ICAO-compliant air transport to the achievement of the UN Sustainable Development Goals under Agenda 2030.

Dr. Liu called on Thailand to "promote the benefits of air transport to tourism and trade, and to assume a leadership role in the Association of Southeast Asian Nations (ASEAN) by facilitating smaller States' efforts to expand capacity and improve their regulatory oversight systems." ■



ICAO's Secretary General Dr. Fang Liu (left) thanked the Prime Minister of Thailand, H.E. Prayut Chan-o-cha, for prioritizing the air transport sector in its 20-year National Development Plan.

PUMPING UP ALTERNATIVE FUELS



JANE HUPE
Is ICAO Deputy Director for
Environmental Protection

“The best way
to predict the
future is to
create it.”

✈️ **“Sustainable alternative fuels are now poised to make important contributions with respect to near-term gains.” That was the hopeful message conveyed by Dr. Olumuyiwa Bernard Aliu, President of the ICAO Council, at the ICAO Seminar on Alternative Fuels in Montréal.**

The February seminar was a prelude to a planned high-level ICAO Conference on Aviation Alternative Fuels which will be convened later in 2017. The high-level conference will focus on bringing together the elements of a global vision for development and deployment of alternative fuels as one approach in the basket of measures to decrease international aviation's environmental impact.

The seminar reviewed the status of worldwide activities on the use of alternative fuels in aviation, life-cycle analysis methodologies and sustainability criteria, financing and assistance programmes, legal and regulatory frameworks, the role of biofuels in States' Voluntary Action Plans for reducing CO₂ emissions, ICAO assistance projects, and the global market-based measure (Carbon Offset and Reduction Scheme for International Aviation, or CORSIA), which was agreed by the 39th ICAO Assembly in October 2016.

“While today's commercial aircraft may be 80 per cent more fuel efficient and 75 per cent quieter than the first commercial jets, we must also keep in mind that the fuel efficiency improvements achieved, whether through new technologies or more efficient flight procedures, will likely not be enough to keep up with projected traffic growth,” said Dr. Aliu. “More must be done. We will therefore be focusing greater attention this year on policies to enhance the use of alternative fuels.”

DISTILLING THE KEY ISSUES

Presenters represented an array of stakeholders such as Sustainable Energy for All (SE4ALL), International Sustainability and Carbon Certification (ISCC), the Roundtable on Sustainable Bio Materials (RSB), Air Transport Action Group (ATAG), the U.S. Federal Aviation Administration (FAA), the European Commission, Airports Council International, Airbus, Boeing, Bombardier, Air Canada, KLM, United Airlines, Virgin Australia, and a long list of others.

In an unusual approach, presenters in the opening roundtable and delegates were asked to highlight three main issues they think should be addressed with regard to alternative fuels for aviation. The result of the “three highlights” approach was a “word cloud” which represents the aggregate of the issues tabled for discussion.

For example, Michael Gill, representing ATAG, highlighted these policy requests: ambitious policy frameworks, a level playing field with other transport modes, and “dare to be brave.”

SE4ALL's Gerald Osteheimer advocated for rewarding fuels for reducing their carbon intensity, sustainable supply chains, and de-risking investment for private sector investment in agriculture and renewable energy.



Adam Klauber of Carbon War Room identified support for infrastructure funding (such as blending capacity), subsidy parity fossil fuels, and quantifying sustainable jet fuel benefits that include economic development, air quality, climate stewardship and price volatility reduction.

ACI's Michael Rossell emphasized, "It is not about the amount of biofuel currently available at airports, but the joint commitment for the future." He said States should avoid introducing regulations which lead to market distortion and should work with all stakeholders in developing and implementing new initiatives.

Michel Wachenheim of the International Coordinating Council of Aerospace Industries Associations (ICCAIA) supported research to improve fuel efficiency and deployment "from feedstock production to distribution," and "reflection on the economic model."

The three most-mentioned issues were:

1. Reduce financial risk
2. Support a quality framework
3. Level the playing field

Other issues high on the list included public-private partnerships and sustainability in the supply chain.

PLANTING THE SEEDS

The aviation industry is the first commercial sector to commit itself to limiting carbon emissions within 20 years, including a binding mechanism (CORSIA). To achieve that goal, the industry must look at a variety of options.

Hydro-treated oils, a process of converting gases into hydrocarbons, or fermentation processes such as the one being done by biotech Amyris with French oil firm Total, produce sustainable biofuels. These fuels are largely made from plants (vegetable oils such as camellia, jatropha, sugar crops, cereals, and algae). The use of seaweed is also being researched.

However, with prices for conventional jet fuel remaining low, energy companies have little incentive to invest in new technologies. Nonetheless, 25 airlines will operate more than 5,000 flights using jet fuel mixed with sustainable alternative fuels on a trial basis this year.

United Airlines is using biofuel blends in place of conventional jet fuel on flights between Los Angeles and San Francisco, California. They plan to incorporate biofuels in all domestic flights leaving the Los Angeles hub and eventually roll it out to all flights globally. United's blend is 30 per cent bio, 70 per cent conventional, produced by Alt Air Fuels.

Hamburg airport, Germany is using renewable diesel fuel from Finnish company Neste for its ground fleet. Neste previously worked with Lufthansa to test another of its fuels, Neste Renewable Jet Fuel, on more than 1,000 flights. Boeing has also successfully tested Neste's renewable fuel.

To reach a profitable production threshold as an aviation fuel, stringent production quality and safety standards are required. Storage is necessary at low temperatures (to avoid having the fuel oxidize). And the "food versus fuel" debate often complicates government incentives support.

Robert Boyd, International Air Transport Association (IATA) and Wendy Aritenang, Indonesia Biofuels and Renewable Energy, Committee on Aviation Environment Protection (CAEP) Policy Guidance Task Group Co-Leads, said modeling studies showed that "... under special conditions, up to 100% of commercial aviation jet fuel demand can be satisfied with alternative fuel." Currently about two (2) per cent is comprised of alternative fuels. But the history of such fuels is young, and the discussion is robust. Accelerating from zero (or two) to 100 won't happen in the near-term, but it is a possible scenario – depending on the vision and policies put in place.

The best way to predict the future is to create it. ■

12th TRIP SYMPOSIUM

STRENGTHENING AVIATION SECURITY THROUGH IMPROVED TRAVELLER IDENTIFICATION



DR. NARJESS ABDENNEBI
Is Chief of the Facilitation
Section at ICAO.

 The 12th Symposium and Exhibition on the Traveller Identification Programme (TRIP) hosted 568 participants from 81 States, 15 international organizations and 50 industry partners from passport-issuing offices, aviation security authorities, civil registries, border control and law enforcement agencies, airlines, airport authorities, travel document industry members, immigration authorities and other interested parties.

With the theme of “Strengthening Aviation Security through Improved Traveller Identification,” the Symposium convened at the International Civil Aviation Organization (ICAO) Headquarters in Montréal, Canada in November 2016. This annual gathering provides an opportunity for representatives from the public and private sectors to coordinate their efforts to advance the five elements of the ICAO Traveller Identification Programme (TRIP) Strategy (see box on Page 11).

ICAO's mission in this field is to contribute to the capacity of Member States to uniquely identify individuals by providing government authorities worldwide with the relevant supporting mechanisms to establish and confirm the identity of travellers.

The planned work programme for the TRIP Strategy for 2017-2019 was newly endorsed by the 39th ICAO Assembly in October, which reinforced its continuing development and implementation.

“Another historic landmark was achieved with the unanimous adoption by the United Nations Security Council of Resolution 2309 (2016),” said Boubacar Djibo, Director, Air Transport Bureau, ICAO. “The Secretary General of ICAO, Dr. Fang Liu, addressed the Council Members, calling for closer collaboration to ensure the security of global air services, including the prevention of terrorist attacks against civil aviation. Along with enhanced screening, security checks and facility security, the Council called for strengthened cooperation and information-sharing among States and a requirement that airlines provide advance passenger information (API) to national authorities in order to track the movement of individuals identified as being associated to terrorism activities.”

The heightened cooperation between ICAO and the UN Counter-Terrorism Committee Executive Directorate (CTED) on issues related to global counter-terrorism was pointed out; the ICAO TRIP Strategy supports the fight against terrorism, cross-border crime and other threats against civil aviation as endorsed by UNSC Resolution 2178 (2014). It was also stressed how engagement in the ICAO TRIP Strategy benefits national, regional and international cooperation on border control and law-enforcement activities.

THE TRIP STRATEGY

The three-day symposium comprised seven sessions which addressed topical issues from both the regulatory and practical perspectives and provided a broad view of technical developments regarding evidence of identity, MRTD standards and best practices, document security, identification management and related border security issues.

**13th ICAO Symposium
and Exhibition on the
Traveller Identification
Programme (TRIP)**
*ICAO Headquarters,
Montréal, Canada
24-26 October 2017*

THE FIVE ELEMENTS OF THE TRIP STRATEGY



- 1 Evidence of identity** – credible evidence of identity, involving the tracing, linkage and verification of identity against breeder documents to ensure the authenticity of identity;
- 2 Machine Readable Travel Documents (MRTDs)** – the design and manufacture of standardized MRTDs, including ePassports, that comply with ICAO specifications;
- 3 Document issuance and control** – processes and protocols for document issuance by appropriate authorities to authorized holders, and controls to prevent theft, tampering and loss;
- 4 Inspection systems and tools** – for the efficient and secure reading and verification of MRTDs, including use of the ICAO Public Key Directory (PKD); and
- 5 Interoperable applications** – globally interoperable applications and protocols that provide for timely, secure and reliable linkage of MRTDs and their holders to available and relevant data in the course of inspection operations.

Panellists noted the connection between civil aviation, international tourism and migration and the fact that the TRIP Strategy helps to facilitate the travel of a growing number of air travellers while strengthening traveller identification management.

Speakers from the International Air Transport Association (IATA), the UN World Tourism Organization, and the International Organization for Migration (IOM) focused on the high expectation of passengers for smarter security processes and increased operational efficiency at airports. Florian Forster, Head, Immigration and Border Management, also noted IOM's "Principle 1," which advocates "early identification and support for migrants or displaced persons who are vulnerable owing to personal characteristics, circumstances (such as trafficking or other violence), or legal status (e.g. regular, undocumented, irregular, dependent).

The work of ICAO's Technical Advisory Group to help implement the TRIP Strategy was explained and the importance of the ICAO Public Key Directory (PKD) was reiterated as a secure and cost-effective system for sharing up-to-date, globally trusted and validated public keys, essential for verifying and authenticating ePassports to combat terrorism and crime while strengthening border security and facilitation.

How the ICAO TRIP Strategy could help combat the latest trends in fraudulent documents was discussed extensively. Fraudulent activities present a serious challenge to ensuring effective and reliable traveller identification management. Technical experts offered their operational experience to highlight current challenges and solutions relating to the different types of travel document fraud. INTERPOL highlighted its work in helping to prevent the proliferation of counterfeit currency and other security documents.

EVIDENCE OF IDENTITY

Speakers highlighted the important role played by evidence of identity in achieving the objective of enabling States to uniquely identify individual travellers. Simon Deignan and Yoran Dokovic of the Organization for Security and Cooperation in Europe (OSCE) outlined their efforts to enhance identity management, specifically through a compendium of best practices with emphasis on legislative framework and interoperability among identity actors. Hichem Chaya of the *Ministère de l'Intérieur et des Collectivités Locales Algérien* described the physically secure eID card – Algeria's Biometric and Electronic National Identity Card (CNIBE) – launched in 2015. The Head of Czechia's National Border Situation Center, National Control Authority, Petr Malovec, described implementation of a secure eID PKI Suite which is also used by authorities in Germany, Norway, Finland and Latvia.

On the topic of breeder documents, the EU ORIGINS project has analyzed the associated security challenges of the integrity of identity documents used in the passport issuance process. Credible evidence of identity involving the tracing, linkage and verification of identity against breeder documents is essential to ensuring robust traveller identification. Charles de Couëssin stated, "Stability of biometric characteristics is key to long-term recognition." Researchers suggest that iris and fingerprint should be the biometric characteristic of choice for reliable long-term recognition. However, among challenges to be solved are sensor interoperability, image quality, template ageing effects, and sensor ageing effects.

MRTDS, DOCUMENT ISSUANCE, AND CONTROL

ICAO's role in setting international standards and specifications has been enhanced through the provision of implementation assistance to States. Technology development of ePassports was addressed by experts from both States and the industry. For example, Justin

STRENGTHENING FACILITATION COLLABORATION

ICAO will continue to promote within the UN system the benefits of facilitation and identity management for States while strengthening collaboration with many international organizations in this field. As an example, a Memorandum of Understanding was signed at the Symposium between ICAO and IOM that formalizes closer collaboration on shared priorities such as enhanced global mobility and traveller identity management.

IOM Director General William Lacy Swing said, "The management of borders, travel facilitation and security, and in particular travel document security as well as identity management, are of great importance for all international travelers and among them, of course, migrants and refugees who cross international borders. Strengthened close cooperation between ICAO and IOM is a much welcome step forward."



International Organization for Migration (IOM) Head of Immigration and Border Management, Florian G. Forster (left) and ICAO Air Transport Bureau Director Boubacar Djibo celebrate the signed Memorandum of Understanding which will aid the two global agencies' efforts to respond in a coordinated way to new and emerging challenges for security and facilitation in global air travel.

Ikura of Canada Citizenship and Immigration and Tom Kinneging of the International Organization for Standardization (ISO) said, "LDS2 ePassports will include the 'missing' information that is needed to systematically clear passengers using automated border clearance (ABC) technologies. Standard, reliable and protected travel data can be leveraged to perform an on-the-spot, systematic analysis of the risk that travellers present, and detect unusual travel patterns, disconnects between entry and exit stamps, and attempts to alter travel data."

John Campbell and Brandt Wagner of the International Labour Organization (ILO) focused on the development of their Seafarer Identification Document (SID) to ensure it meets the ICAO specifications in Doc 9303, *Machine Readable Travel Documents*. "The SID helps facilitate sea trade, provides a mechanism to identify legitimate seafarers, and enables shore leave, transit and transfer," they explained. A revision to ILO's Convention No. 185 will come into force in June 2017 with SIDs being machine readable (of TD1, TD2 or TD3 size) with improved security features to include fingerprints and issuance by the State of nationality of the seafarer instead of the flag State. This case highlights how ICAO MRTDs benefit not only civil aviation but also other modes of transport.

The rapid pace and diversity of innovation in technology is seen as producing new possibilities for the way in which traveller identification can be managed. Utilized correctly, such innovations can enhance aviation security and facilitation. The importance of assistance and capacity building to help States develop and maintain robust traveller identification management was stressed in case studies.

INSPECTION SYSTEMS AND TOOLS

A key element in strengthening aviation security is to ensure that border inspection systems provide timely, secure and reliable links between travel documents, travellers and the security information held in government databases. The complexities of passenger data exchange, including advance passenger information (API) and passenger name record (PNR), were highlighted, emphasizing the need to establish successful passenger data programmes which provide tangible benefits to governments, airlines, and the travelling public.

The World Customs Organization (WCO) has shifted focus from collection of import and export duties to undertaking new activities to help protect economic and societal interests, including preventing crime and terrorism. François Remue said the WCO's security programme has "identified the need for improvement in institutional and front-line capacity, customs-to-customs communication, customs-to-police communication, information collection and intelligence sharing, and stakeholders cooperation."

The example of how European Integrated Border Management operates as a shared responsibility between Member States was presented by FRONTEX. The European border and coast guard agency's Head of Air Border Sector, Claudio Kavrecic, cautioned that electronic travel authorization does not provide an automatic authorization to enter, does not necessarily match data not aligned with database records, does not recognise all false or wrong information, and does not detect felons whose names are not recorded in databases.

For further information on the 12th TRIP Symposium, including the presentations, please visit www.icao.int/Meetings/TRIP-Symposium-2016/Pages/Presentations.aspx ■



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SINGAPORE'S MARION POON WINS IAWA/ICAO PHOTO CONTEST

✈ Marion Poon's "Superrench" photo was selected as the winner of the 2016 Photo Contest on Gender Equality and the Empowerment of Women in Aviation. The contest was conducted by the International Civil Aviation Organization (ICAO) and the International Aviation Women's Association (IAWA).

The contest provided participants with an opportunity to showcase their

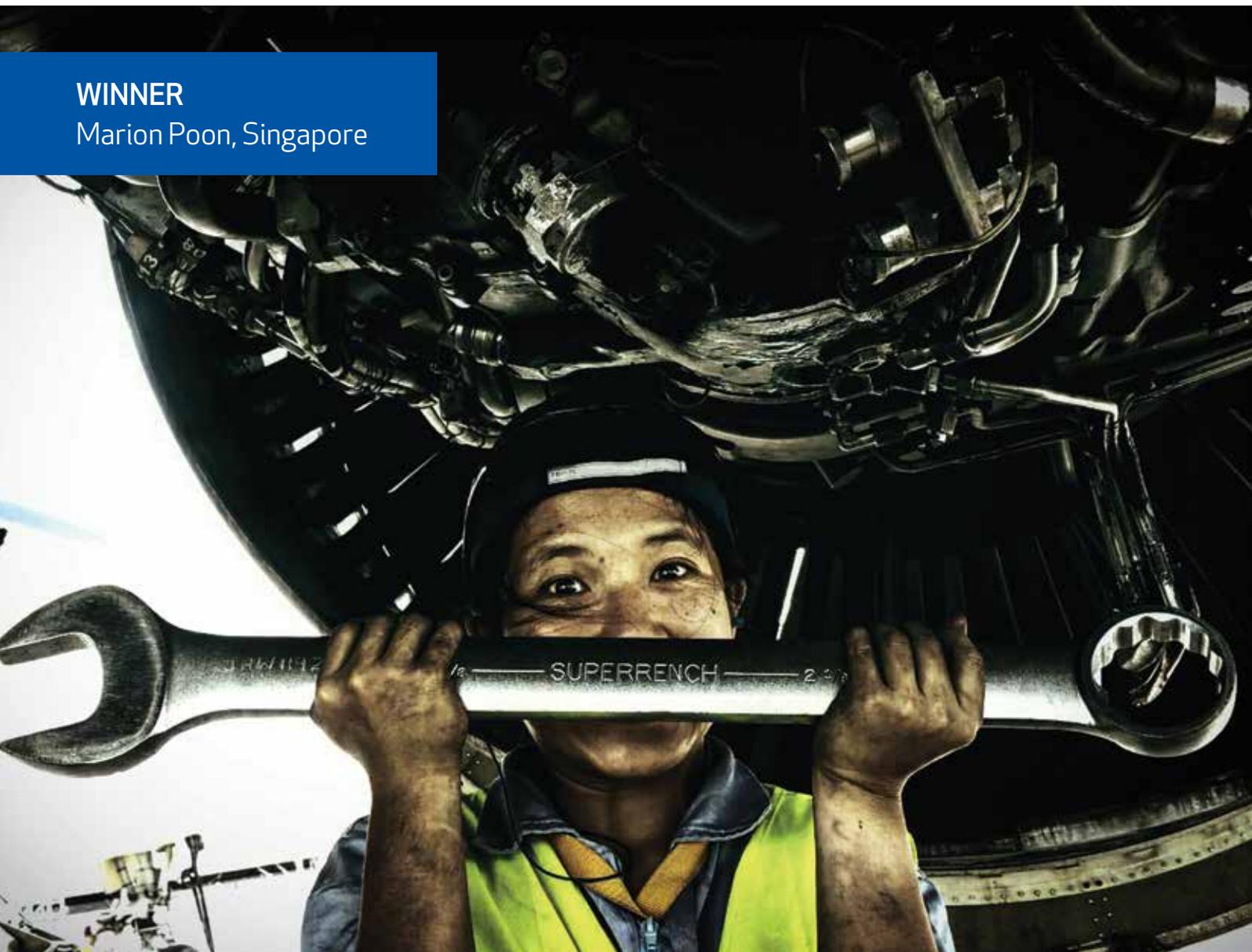
creativity and to share ideas on gender equality or to highlight women in aviation who have motivated others – role models and mentors. It was particularly inspired by the UN Sustainable Development Goal 5: *Achieve gender equality and empower all women and girls.*

The award was presented to Ms. Poon at the first IAWA/ICAO Forum on Gender Equality

in Aviation, held at ICAO Headquarters, Montréal, Canada in conjunction with the 28th IAWA Annual Conference.

A few other submitted photos are featured on the opposite page. All of the photo submissions from the 91 worldwide participants can be found at www.icao.int/Documents/photo-contest-all-submissions.pdf ■

WINNER
Marion Poon, Singapore





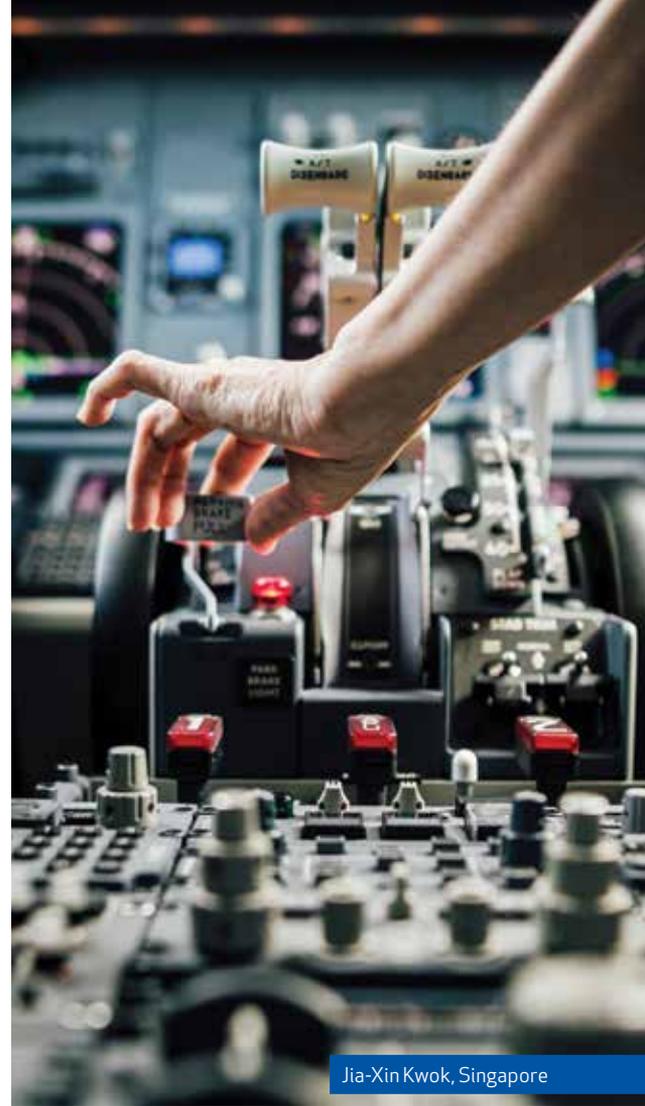
Eyitayo Abiodun Oyelowo, Nigeria



Siobhan Mandich, New Zealand



Maria Letizia Bernabeo, Italy



Jia-Xin Kwok, Singapore



Toty Amirova, Kazakhstan

Maria Hofbauer, United States



THE RIGHT NUMBERS FOR SAFETY

NEW ICAO MANUAL ON MINIMUM CABIN CREW REQUIREMENTS



MARTIN MAURINO, M.ENG
Is Safety, Efficiency and Operations Officer at ICAO. He heads the ICAO Cabin Safety Programme. Before joining ICAO, he held safety analysis and safety management roles at Transport Canada and the International Air Transport Association (IATA). Martin began his career in aviation as a cabin crew member at Air Canada.

“ICAO recommends that one cabin crew member be assigned per floor-level exit.”

 Cabin crew members play a key role in passenger and operational safety. The number of cabin crew on board, and their performance, are significant factors in the successful evacuation of aircraft. ICAO's new *Manual on the Establishment of Minimum Cabin Crew Requirements (Doc 10072)* provides guidance material to ensure the right number of cabin crew members are on board to ensure passenger and operational safety.

As demonstrated from past accidents, a minimum number of cabin crew members are required on board aircraft to effectively conduct a timely evacuation and increase the survivability of passengers during an accident. ICAO Standards related to minimum cabin crew requirements are found in Annex 6 – *Operation of Aircraft, Part I – International Commercial Air Transport – Aeroplanes*. The goal of these Standards is to allow for a safe and expeditious evacuation of the aircraft, and to enable cabin crew to carry out the necessary functions to be performed in an emergency or a situation requiring an evacuation.

The ICAO Standards do not provide a numeric value (i.e., an exact number of cabin crew) needed for the operator to comply with Annex 6 requirements. The minimum number of cabin crew members required for each aircraft type in an operator's fleet must be approved by the State.

How is the number of cabin crew on board calculated?

The number of cabin crew members on board is based on the maximum seating capacity of a specific aircraft type or the number of passengers carried on a particular flight. Most States use the 1:50 model (i.e., a ratio of 1 cabin crew member to 50 passenger seats installed). This includes the United States and States in the European Union. This method is based on the aircraft manufacturers' certificated evacuation capability, as part of the type certificate process.

Australia and Canada are examples of States using different models. Canada uses a 1 cabin crew member to 40 passengers on board ratio as a basis. However, Transport Canada Civil Aviation (TCCA) permits operations with the use of the 1:50 model. Australia requires 1 cabin crew member to 36 passengers on board. However, the Civil Aviation Safety Authority (CASA) may grant permission to large aircraft operators to transition to a 1:50 model if the competent authority is satisfied that an acceptable level of safety can be maintained as a result of implementing this model.

How are these numbers validated?

As part of the type certificate process for a new aircraft type, an aircraft manufacturer must demonstrate that the aircraft, in its maximum seating capacity, can be evacuated within a 90-second timeframe. Based on these demonstrations, or analysis based on data, aircraft are certified with a minimum number of cabin crew members in relation to a number of passenger seats.



In order to establish the minimum cabin crew complement, States may require new or existing operators to conduct an evacuation demonstration when a new aircraft type enters their fleet (in addition to the demonstration conducted by the manufacturer). The goal of this demonstration is to satisfy the State that the operator's cabin crew members are able to achieve an evacuation and ditching capability equivalent to that achieved for the same aircraft type by the manufacturer. The number of cabin crew members used by the operator to successfully complete the demonstration is used to establish the minimum cabin crew required on that aircraft type for that particular operator.

Can a cabin crew member manage two emergency exits?

Currently, one of the most-discussed topics in the field of cabin safety is the ratio of cabin crew members to floor-level exits. Operators may comply with the existing ratios but this could result in a cabin crew member being assigned to operate a pair of floor-level exits on certain aircraft types. In addition, some operators attempt to decrease operating costs by reducing the number of cabin crew carried on board, which can also lead to one cabin crew member being assigned two exits.

There are concerns that a single cabin crew member may not be able to manage two exits during a real-life evacuation. On aircraft types where the distance between a pair of floor-level exits is such that a single cabin crew member may not be able to operate or have direct view of the opposite exit, it is highly unlikely that the cabin crew member would be capable of simultaneously giving commands for the two emergency exits, including preventing passengers from opening an unusable exit (e.g., blocked because of fire outside). The crew member would also experience difficulties reaching and operating the opposite exit and managing the evacuation and the passenger flows to both emergency exits of a pair.

CABIN SAFETY EXPERTS WEIGH IN

The ICAO Cabin Safety Group (ICSG) was tasked to assist the Organization in developing the content of Doc 10072. The group

was asked to tackle the issue of the number of cabin crew members per floor-level exits. To produce an evidence-based recommendation, the group turned to past accident reports and research.

The ICSG reviewed findings from investigations which relate to evacuations, focusing on the number of cabin crew members on board, staffing of emergency exits and impacts on the evacuations and their outcomes. The group also reviewed research on the influence of cabin crew in evacuations and recommendations by aircraft manufacturers.

One of the accidents analyzed occurred in July 1992. A Lockheed L-1011 TriStar 1 on scheduled passenger flight from New York to San Francisco, with 280 passengers and 12 crew members on board, departed the runway after a rejected takeoff at John F. Kennedy International Airport and was destroyed by fire. The evacuation of the aircraft occurred within two minutes. The accident report stated that the speed in evacuating 292 passengers and crew from the aircraft was complemented by the operator's requirement for nine cabin crew members, which was three more than the minimum required by the State's regulations ... and that the nine cabin crew members were assisted by five off-duty cabin crew members and two off-duty captains who were occupying flight deck jump seats.

Another accident analyzed occurred in August 2005, when an A340-300, on a scheduled passenger flight from Paris to Toronto with 297 passengers and 12 crew members on board, overran the runway after landing at Toronto International Airport. The aircraft caught fire. The accident report stated that applicable regulations called for one cabin crew member for every 50 passenger seats, and the minimum cabin crew requirement for this flight was six crew members. However, there were nine cabin crew members on board; the availability of three supplemental cabin crew members on the accident flight undoubtedly contributed to the success of the evacuation.

In 1994, Cranfield University conducted a study, commissioned by the Civil Aviation Authority of the United Kingdom (UK CAA) and the U.S. Federal Aviation Administration (FAA) on the influence of cabin crew members on passenger evacuations during an emergency situation. Participants were tasked with performing four emergency evacuations in a cabin simulator. Incentive payments were used to motivate the participants and assist in reproducing the urgency which can occur in an emergency situation. A total of 1,307 participants took part in the evacuation tests. The results showed that the performance and number of cabin crew significantly influenced participant behaviour and evacuation rates.

Based on the review of accident investigations, research studies and manufacturer recommendations, the ICSG concluded that floor-level exits should be assigned to cabin crew members, so that they are attended in the event of an emergency evacuation. The group noted that the presence of cabin crew members at exits is needed to effectively operate them and provide passenger management during an evacuation. Based on the group's input, ICAO recommends that one cabin crew member be assigned per floor-level exit, as a means to mitigate the risk associated with unsupervised exits during emergency evacuations.

A SAFETY MANAGEMENT APPROACH TO CREW ON BOARD

Some operators may seek to modify the approved minimum cabin crew complement for specific reasons (e.g., an all-business class configuration leading to a reduction in the number of passengers carried). Although operators may need flexibility, changes must be implemented safely. Therefore, the operator proposing to modify the minimum number of cabin crew on board should demonstrate to the State that there are no significant safety differences between the current cabin safety procedures and the ones for the crew complement being proposed.

The new ICAO manual includes guidance for States to develop a process which should enable them to make an evidence-based decision. Evidence should consist of a safety risk assessment, operator documentation and a practical demonstration of the proposed changes to validate them. This recommended process provides assurance that an acceptable level of safety is maintained as a result of any proposed change to the number of cabin crew carried on board.

The ICAO Manual on the Establishment of Minimum Cabin Crew Requirements (Doc 10072) is now available to States in English on the ICAO-NET at <http://portal.icao.int/>

Copies of the accident reports and other documentation can be obtained from the ICAO Cabin Safety Library, at: www.icao.int/cabinsafety ■

ICAO LAUNCHES UAS TOOLKIT

ICAO took a further step to help minimize the risks of flying unmanned aircraft systems, aka "drones," launching a new UAS Toolkit in December. Developed through ICAO's UAS Advisory Group and in cooperation with industry and international expert partners, the toolkit can be accessed at icao.int/rpas.

Given that UAS can be mistakenly and often illegally operated around airports and other areas of controlled or sensitive airspace by less-informed pilots, the toolkit is aimed at assisting consumers and remote pilots – regardless of their skills and experience – and is much more than a starting point for learning the basics of their safe operation.

"The resources this new toolkit makes available are designed to help UAS operators of all ages operate their aircraft safely and responsibly," commented ICAO Council President Dr. Olumuyiwa Benard Aliu. "The importance of recognizing that these devices are aircraft, and of integrating their use safely with existing manned operations, should not be underestimated."

UAS today can be flown in a variety of configurations, outfitted with a wide range of payloads and sensors to support their increasing roles in humanitarian, emergency operations, infrastructure and crop monitoring, and for wide-ranging geological, geographical and climate-related research and development.

"Given the immense economic and social potential of UAS technology, and the variety of factors at play, regulations for these systems and their use must be carefully considered," said ICAO Secretary General Dr. Fang Liu. "Our new toolkit offers not only helpful information and resources, but can also serve as a platform for the exchange of global best practices, lessons learned, and effective governance approaches."



The ICAO UAS Toolkit was developed through ICAO's Unmanned Aircraft Systems (UAS) Advisory Group in cooperation with industry and international expert partners.



SPECIAL SECTION: BUSINESS AVIATION



KURT EDWARDS
*Is Director General of the
International Business Aviation
Council (IBAC)*

 Business aviation's participation in the global air transportation system plays a variety of roles to the benefit of localities, regions, and States around the world. Business aviation is a diverse community of operators, contributing to global economic activity. Worldwide, there are more than 35,200 turbine aircraft used in business aviation operations. They range in size from small single-engine to large air transport aircraft. Operationally,

these aircraft fly point-to-point on the most direct, fuel-efficient routes. The key models are corporate-operated, on-demand charters, owner-operated, and fractional owner-operated. The business aviation sector overlaps both commercial and non-commercial sides of air transport (Annex 6 Parts I and II, respectively, of the Chicago Convention).

Business aviation provides connectivity between financial and government capitals, as well as remote or underserved regions. Business aircraft allow businesses to thrive in small towns and medium-size cities and contribute to the employment of local residents, while remaining connected to commercial centers.

Business aviation activity complements the airlines. Most corporations are important clients of the airlines. Those that use business aircraft do so in a tailored manner to get to remote locations more quickly or to cover more destinations in a shorter time period.

Business aircraft operators are ideally suited to respond during natural disasters and other humanitarian crises. They can mobilize on short notice, provide aircraft types suited for specific missions, and operate into airports that are inaccessible to larger aircraft. And, most importantly, they are willing to step up.

Connectivity is a critical benefit of business aviation and is facilitated to the degree that business aircraft have access to airports. For the most part, business aircraft use small and regional airports to get where they need to go, but, in many instances, the only access point to some large cities around the world is a large, capacity-constrained airport. In some cases, small, regional airports that could alleviate capacity issues at larger airports suffer from infrastructure shortfalls, such as a lack of satellite-based navigation capabilities. The business aviation community is committed to working with ICAO and States to find access solutions that are reasonable and respectful of the needs and concerns of all air transport stakeholders.

The business aviation community is committed to continuous improvement in safety. The corporate operator community has a safety record that compares well with that of the airlines. The International Business Aviation Council (IBAC) – www.ibac.org – and the industry support the use of ICAO Standards and Recommended Practices (SARPs) to guide safety improvement in the sector, incorporating applicable SARPs and the safety management system (SMS) concept in voluntary codes of best practice tailored to the business aviation community: the International Standards for Business Aircraft Operators and Business Aircraft Handlers (IS-BAO and IS-BAH, respectively). Launched in 2002, IS-BAO has almost 800 registered operators in 35 States around the world. Launched in 2014, IS-BAH is the first industry standard to bring SMS to ground handling and has more than 60 registered facilities around the world with many more to come this year.

The business aviation community has supported work at ICAO for more than 35 years through IBAC, an official observer organization. IBAC and its member associations around the world provide expertise on all aspects of business aircraft operations and are resources for policy-makers, regulators, air navigation service providers, and airport authorities, participating in an integral manner in ICAO's work to develop civil aviation in a safe and orderly manner. ■

BUSINESS AVIATION: INTERNATIONAL ECONOMIC ENABLER

 The benefits of business aviation are most acutely felt locally, where the impacts on job creation, economic opportunities and access can literally determine where someone chooses to start a business or build a home. Business aviation is recognized around the world as a tool that promotes economic growth and international trade, providing significant and immediate economic and social benefits.

Globally, there is a broad agreement on what characterizes business aviation. Distinct from scheduled commercial air carriage, business aviation operates as an on-demand, private service whose operations, hours and destinations are based on the direct needs of its owners and clients.

Specifically, business aviation fulfils the mission-critical needs of corporations and entrepreneurs who rely on their aircraft to maintain a competitive edge and to deliver people, goods and services around the globe, including to small or remote communities. This contributes to a “virtuous cycle,” creating economic opportunities that would not exist without the access uniquely provided by business aviation.

More specifically, business aviation plays an integral role to facilitate transportation of service technicians, specialist employees, sales teams and executives to further their business initiatives and operations globally. It helps to improve productivity, customer service and retention, and enhances supply chain performance in all geographies. Business aviation provides benefits to a nation’s economy by enabling productivity improvements, efficiency gains and business development.

Business aviation:

- **may be the only effective transportation option available** for technicians and other professionals to reach remote or distant customer locations on a time-critical basis. Some of these may only be reachable by float plane or helicopter.
- **enables employees to reach multiple destinations in a single day** and return home. This increases productivity by saving time and money, and improves employee quality of life. Corporate travellers are able to set their own schedule of meetings that are best for furthering business objectives.
- **saves lives, providing medical and evacuation services, delivering emergency relief, food and medicine.** For example, in the U.S., business aviation flew more than 15,000 flights in a recent year to support missions of humanitarian purposes, according to the General Aviation Manufacturers Association (GAMA). Business aviation also provides support during other crises such as fire and flood to assist with the transport of supplies.

- **enhances productivity** by allowing employees to work together in safe, secure, private spaces. Business aviation enables transactions to occur with greater speed, offering the flexibility for parties to meet, discuss and close deals.
- **uses networks of both large and small airports** (including non-scheduled), ensuring that many locations that cannot support scheduled air service have access to a functioning airport and are connected to the air transportation network – a key factor in quality of life.
- **helps companies outperform** those that do not use business aviation, based on a variety of metrics, including shareholder value and innovation.

In an address to the 2016 Asian Business Aviation Conference, ICAO Secretary General Dr. Fang Liu said she regards business aviation as an important contributor to the positive impacts that air transport makes to the socio-economic impact of States and regions. “In less developed and rural regions, including landlocked and small-island States, where a lack of stable demand, infrastructure constraints, and other challenges can often impede the viability of commercial operations, business aviation helps to establish vital links enabling improved connectivity,” she remarked. “And in a similar vein, the ability of business aircraft to make use of shorter runways contributes substantially when emergency and humanitarian efforts are required.”

“I would also highlight the 22 billion dollars and 164,000 jobs your sector contributes to the EU, as well as the 200 billion dollars and 1.1 million jobs it generates in the United States. These are very significant socio-economic contributions, and it would be encouraging to see similar levels of business aviation economic influence becoming more globally widespread.”

Following are examples of the economic impact of business aviation in jurisdictions around the globe.

“Business aviation is an integral member of the civil aviation community.”

– Dr. Fang Liu, Secretary General, ICAO





CASE STUDY: CANADA

An example of how business aviation benefits small businesses and communities is a second-generation, family-owned manufacturing company in the town of Bradford, Ontario, north of Toronto. The business competes with firms from Asia, Europe, and the U.S. to sell its packaging materials. The company has about 75 employees (many of whom have been with the company more than 15 years) and its own research & development lab. It produces its packaging product in Ontario at a time when the province's manufacturing sector is shrinking. The company deploys its aircraft from Lake Simcoe airport, which has no scheduled service but is home to a number of business aviation and charter-related services.

Canada is a heavy user of business aviation. In 2015, an estimated 1,900 business aviation aircraft were in operation in the country, operating nearly 425 million aircraft movements. A study examined the economic impact of both operations and manufacturing – aerospace (and business aircraft in particular) is a strategic sector for Canada, ranking in the top three for international sales. Business aircraft operations and business aircraft manufacturing both provide high-paying, sustainable jobs and high economic output per worker.

Aircraft operations generated an estimated 11,500 direct person years of employment across the nation in 2015, earning over \$800 million in wages annually. The industry also generates \$1.3 billion in GDP and \$3.2 billion in economic output. Manufacturing activities contributed a further 10,800 person-

years of employment paying \$1 billion in wages and generating \$1.6 billion in GDP and \$3.6 in economic output. The combined economic impact of business aviation operations and business aircraft manufacturing in Canada are 22,300 person-years of employment paying \$1.8 billion in wages, direct GDP at nearly \$3 billion and direct economic output at nearly \$7 billion.

CASE STUDY: EUROPE

Given the growth of passenger demand and capacity constraints at a number of airports in Europe, regional airports or business aviation-specific airports are often used for business aviation flights. One example of the importance of an airport's location is London City airport. According to the report, "The Economic Impact of Business Aviation in Europe," airport representatives claim that London City is part of the reason behind the success of the Canary Wharf district. Although people do not come to London solely because of business aviation, it does make doing business there easier.

The European Business Aviation Association (EBAA) 2014 study estimated that business aviation operations in Europe generated more than 47,000 direct jobs, with employees earning €3 billion in direct wages, €3.2 billion in GDP and nearly €13 billion in economic output. The business aircraft manufacturing sector contributed a further 40,600 direct jobs, earning €2.2 billion in wages. In total, the direct employment base associated with business aviation operations and business aircraft manufacturing was nearly 88,000 jobs in Europe and €5.4 billion in wages.

France, Germany and the UK are the EU countries most impacted by the business aviation industry. Total impact of business aviation in these three countries is €12.6 billion, which represents 64 per cent of the total industry in Europe. These three countries combine extensive business aviation aircraft assembly and component manufacturing operations with high numbers of business aviation aircraft movements and registered fleets.

CASE STUDY: UNITED STATES

In the U.S., business aviation's role as a critical business tool is evident at a family-owned metals recycling company employing 60 people in Lancaster, New York. For several decades since the company was founded in 1916, the owners were able to collect all the metals they needed to stay in business from within 40 miles of their recycling plant. However, by 1970, the 20 local manufacturers that had provided scrap had been reduced to one. Faced with having to shut down or relocate out of the local community, the company turned to a small turboprop aircraft to find scrap metal providers outside its existing business base. They now rely on their aircraft to generate the metals needed to stay in business and keep contributing to the town's economy with jobs and investments. The business aircraft operations of this and other Lancaster businesses also help provide jobs to airport workers, pilots, mechanics, ramp workers and others at the local small GA airport.

A 2013 study by the National Business Aviation Association (NBAA) of the economic impact of general aviation in the U.S. reported that business aviation typically accounts for up to 80 per cent of general aviation's economic impact. The economic impact of GA in the U.S. is substantial, contributing 255,000 jobs, paying nearly \$23 billion in wages, generating nearly \$30 billion in GDP and \$75 billion in economic output. In 2013, there were over 200,000 general aviation aircraft in operation in the U.S., flying nearly 23 million flight hours. Business aviation in the United States is viewed as a national asset, with 17,000 registered business aircraft. ■

– **Authors:** Doris Mak, Vice-President, InterVISTAS Consulting and Debra Ward, Public Affairs, Canadian Business Aviation Association. Mike Tretheway, Chief Economist & Chief Strategy Officer, and Celina Estrella, Senior Consultant, InterVISTAS Consulting, also contributed to this article.

FOR FURTHER READING:

Canada: [www.cbaa-accba.ca/CBAADocs/EI%20-%20P2%20Update%20-%20FINAL%20REPORT%20\(8Sep2016\).pdf](http://www.cbaa-accba.ca/CBAADocs/EI%20-%20P2%20Update%20-%20FINAL%20REPORT%20(8Sep2016).pdf)

Europe: www.ebaa.org/documents/document/20130124163641-20081120-ebaa-finalreport.pdf

U.S.: www.nbaa.org/business-aviation/2015-general-aviation-contribution-to-US-economy.pdf

VAN NUYS

A CASE STUDY ON BUSINESS AVIATION'S ECONOMIC IMPACT

A recently completed study by the Los Angeles County Economic Development Corp. quantifies the economic benefits that one major business aviation gateway had on its local area. California's Van Nuys Airport (VNY), a 730-acre airport, has more than 100 businesses on-site. These enterprises help support a based fleet of 580 aircraft and the 217,000 annual takeoffs and landings which took place at the airport in 2015.

The study concluded that VNY's total regional economic impact in 2015 was \$2.0 billion in business revenues and \$295 million in local and federal taxes. Taxes were generated in several ways, including via fuel sales, which totaled more than 21 million gallons in 2015. Fuel taxes are one of the primary ways that business aviation contributes to U.S. aviation infrastructure funding.



The airport's activity supports nearly 10,500 jobs and \$675 million in labor income. Half of those jobs are at businesses located on the airport, ranging from fixed-base operators that support business aircraft operations to hotels and retail stores.

"VNY plays a critical role in Southern California by providing good-paying jobs and generating business revenues that benefit our neighboring communities," said Los Angeles World Airports Commissioner Jeffery J. Daar. "As Los Angeles' No. 1 business airport and a world-class general aviation facility, we are proud of VNY's significant positive contributions to our region."

RAIGARH

A CASE STUDY ON HOW BUSINESS AVIATION PROMOTED GROWTH IN INDIA

Historically, natural factors such as a source of clean water and mineral resources were the major influencers in growth of a town. Among the man-made factors, industry is the biggest factor that promotes growth of an economy, bringing with it related benefits such as electricity, better schools, and improved amenities.

Industrial development in India was triggered when the British set up the railway system. The impact of connectivity was multi-fold, and the railways and roadways are considered to be the biggest infrastructure industries of India. Government policies have been designed to support these sectors. However, the aviation industry also deserves “infrastructure status.”

The connectivity provided by business aviation, as with the railways during the industrial age, can indirectly boost the economy and growth of regions. Raigarh is one of the oldest and important towns of Chattisgarh state. It is situated on the HowrahMumbai main line of the South-East Railways with access to the mineral-rich Chhota Nagpur region. On this line is situated another district equally rich in minerals and having adequate water. The primary factor that distinguishes one from another is the availability of a 6,500-foot airfield in Raigarh.

Though the airfield belongs to a private company, the Raigarh population at large uses it. Many other industrialists have chosen to start their business and open factories within the Raigarh district due to the accessibility that the airport provides. The private company started its plant in 1991. The airport was commissioned in 2002. The expansion of the runway to its present length was completed in 2009.

In 2012, at least five new industries acquired land to establish their factories, giving rise to thousands of jobs. The district administration has also used this airport to their strategic advantage and benefited from the quick connectivity this airport provides.

Compared with the neighbouring town, Raigarh has five times as many commercial banks, more than twice as many hospital beds, 50 per cent more colleges, 20 per cent more primary schools, and a technical university. The total number of industrial units, as well as micro and small enterprises, is about eight times as many.

The Indian business aviation sector shares many of the same challenges and opportunities with other jurisdictions around the globe. With about 7,200 employed in business aviation operations and directly contributing \$325.7 million in GDP, these relatively small numbers represent regional opportunities for catalytic economic growth. Between 1990 and 2015, there has been a consistent trend in acquiring business aircraft in India.

According to the report, the “State of Business Aviation in India,” the need for a faster, convenient, flexible and private mode of air transportation led to a spurt in the purchase of business jets by India’s major corporations. Fast business jets play a key role in facilitating business and acquisitions at long distances and around the world.

– Col Sanjay Julka (Retired)



The business aviation air field at Raigarh (left) has contributed to exponential growth in the region nearby (right).

GROWTH TRAJECTORY

✈ Despite today's soft market conditions in almost all regions, forecasters agree that the market for business jets will continue to grow.

The worldwide business aircraft fleet stands at over 20,000 units. But according to several forecasts, this number is expected to climb. North America, Europe, Latin America and Greater China will be the largest markets for business aircraft over the next 10 years.

Jetnet expects that 7,380 new business jets will be produced from 2016 to 2025. Canadian OEM Bombardier Aerospace expects about 8,300 deliveries in the same timeframe. Honeywell Aerospace forecasts up to 8,600 new business jet deliveries with an estimated 65 per cent of the projected demand from North American operators. The U.S. and Canada are predominantly markets for light and medium jets; about 80 per cent of deliveries will fall in these aircraft categories.

Europe is the second-largest market for business aircraft. It is expected to receive between 1,530 and 2,580 new business jets within the next decade, so Europe's current fleet of about 1,500 bizjets will nearly double. Light and medium jets account for 60 per cent of deliveries.

Latin America is the third largest market for business aircraft. As the retirement rate is higher than other regions world, the fleet is expected to increase only from 2,015 in 2015 to 2,500 units by 2025.



The static display at the National Business Aviation Association (NBAA) annual convention.

“More than 160 countries have business jets in their registries.”

Middle East operators prefer large cabins and long range, 95 per cent of all business aircraft deliveries to this region, according to Bombardier.

“Despite ongoing regional tensions and government austerity initiatives, operator enthusiasm seems to be improving” in the Asia Pacific region, reports Honeywell. The region is expected to continue its nearly double-digit fleet growth from the past five years.

FLEET GLOBALIZATION

In the last quarter-century, business aviation has seen tremendous growth. The worldwide fleet of business jets grew from 7,300 in 1991 to more than 20,000 in 2016. The number of operators climbed from 4,500 to almost 13,000. North America is the largest market for business aircraft, but the international fleet share grew from 28 per cent in 1991 to 35 per cent in 2016. More than 160 countries have business jets in their registries.

Large cabin aircraft will be high in demand – Honeywell estimates about 85 per cent of the total valuation and 57 per cent of the units in the 2016-25 timeframe. Midsize jets will account for 21 per cent of the delivered fleet but only 10 per cent of value.

Business aircraft sales and deliveries are driven by economic drivers like national and global GDP growth, as well as the globalization of trade.

New aircraft types are spurring demand: more modern aircraft with better performance, lower fuel consumption and a more comfortable and productive cabin. Greater range is a major factor for many operators to switch to a newer model.

Replacement of older business aircraft is becoming a more pressing issue. Some of the older models, for example, cannot be modified economically to the requirements for the Future Air Navigation Systems (FANS) or other new regulations. Rising maintenance costs as well as spare parts availability are concerning existing operators of older aircraft also. ■

– By Volker K. Thomalla, CEO,
German Business Aviation Association (GBAA)

BUSINESS AVIATION HUMANITARIANS

✈ Business aviation, widely recognized as a driver of global commerce, plays a less-publicized but vital role in humanitarian support and relief efforts around the world. Business aircraft operators are ideally suited to respond during natural disasters and other humanitarian crises. They can mobilize on short notice, provide aircraft types suited for specific missions, and operate into airports that are inaccessible to larger aircraft. Most importantly, operators are willing to step up.

"I find that pilots – especially business aviation pilots – are the first to sign up whenever help is needed," said Rudy Toering, President and CEO of the Canadian Business Aviation Association (CBAA).

In spring 2016, the city of Fort McMurray, Alberta saw firsthand the value that business aviation can bring in an emergency. Located in the heart of Canada's oil sector, the area was devastated by a raging wildfire nicknamed "The Beast" by firefighters.

“Pilots ...
are the first to sign up
whenever help
is needed.”

– Rudy Toering,
President and CEO,
Canadian Business Aviation
Association (CBAA)



Doctors Without Borders relies on general aviation aircraft to get its staff and supplies to remote towns.





Business aircraft and helicopters help tame wildfires such as “The Beast” in Fort McMurray (M Rhodes Photography).

Business aviators supported emergency teams on a variety of missions from early May, when the fire started, through early July, when the fire was declared under control. “Our people’s can-do spirit has never been more evident than when business aviators worked side-by-side with rescue and firefighting teams with a level of commitment and bravery that moved the country ... and the entire world,” said Toering.

Sometimes business airplanes are used to supplement the capabilities of government agencies. For example, during wildfire season in Montana, general aviation aircraft are contracted by state firefighting agencies and the U.S. Forest Service to help keep fires under control. These airplanes take aerial spotters aloft to direct emergency and fire control services below.

EARTHQUAKE FIRST-MOVERS

The earthquake that struck the small island nation of Haiti in January 2010 provided another example of how business aircraft operators can quickly mobilize in times of crisis to help solve transportation challenges facing government agencies and non-governmental organizations (NGOs). Nearly 100 business aircraft flew the first mercy flights, providing a

key lifeline in the days immediately after a local airport re-opened. In the weeks that followed, business aircraft flew desperately needed food, supplies and medical personnel to the island.

As part of the coordination effort, the National Business Aviation Association (NBAA) developed an online registry for aircraft, other assets and volunteers available to assist in relief efforts. Nearly 400 aircraft, representing the diversity of the general aviation fleet, were included in the registry; the mercy flights were flown by piston singles and twins, turboprops, helicopters and jets. NBAA shared the registry information with the U.S. Department of Homeland Security’s Critical Incident Management Group, the agency that coordinated the American government response to the crisis. The registry also was shared with NGOs coordinating Haiti relief efforts.

An all-volunteer group, CARE (Corporate Aviation Responding in Emergencies), leveraged NBAA’s database to coordinate an air bridge to ferry supplies into Haiti. Missions originating from across the U.S. landed first at Fort Lauderdale (Florida) Executive Airport (FXE) for staging and picking up donated supplies. They then continued on to the Dominican Republic, or smaller airfields in Haiti, such as at Cap-Haïtien.

“Business aviation played a key role in both the immediate response and long-term rebuilding efforts following the earthquake in Haiti,” said Doug Carr, NBAA’s vice president of regulatory and international affairs. “The scenario was a prime example of industry’s ability and willingness to support those in need – something we see from our members every day around the world.”

MEDICAL RELIEF EFFORTS

Other missions are uniquely tailored to business aviation’s capabilities. Supporting organ transplants for children is one example. Organ replacement is highly specialized, with a limited number of medical facilities staffed with the proper professionals and tools to do the job. The number of facilities capable of handling transplants for children is even fewer. In Germany, for instance, there are just a few hospitals equipped to do the procedures, according to Volker Thomalla, CEO of the German Business Aviation Association (GBAA).

Since any organ that becomes available for transplant must be rushed from the donor to the recipient in a short time, business

aviation’s flexibility makes it an ideal logistics provider. The complexity of transplanting children’s organs often means that the same surgical team will remove it, travel with it, and implant it in the recipient. Having a multi-seat business aircraft available makes this possible.

Networks of business aviators play pivotal roles in medical-treatment transportation around the world. Since 1986, Hope Air has been providing free air transportation for financially burdened Canadians in need of medical treatment outside their communities. It also has a programme that enables operators to match available seats on scheduled business aircraft flights with a child who needs to travel to receive treatment. “Business aviation’s support of Hope Air is one example of its spirit of generosity – always ready to lend a hand and to help the less fortunate,” said CBAA’s Toering.

The industry also often steps up to ensure the flight providers can offset some of the costs associated with providing air transportation. CBAA raises \$25,000 each year for Hope Air.

As soon as the first local airport was re-opened, nearly 100 business aircraft flew the first mercy flights to Haiti after the 2010 earthquake.



In the U.S., the Corporate Angel Network (CAN) arranges free transportation for cancer patients traveling to treatment centers by using the empty seats on business aircraft – CAN celebrated its 50,000th patient flight in April 2016. The trip entailed flying a one-year-old boy from the New York area, where he receives treatment for a rare eye cancer, to his Atlanta home. CAN flights began taking the patient on the trip regularly when his local treatment options were exhausted, and a specialist located in New York City was needed.

Since CAN's first flight in 1981, the organization has provided free air transportation to people whose best treatment options are often thousands of miles from home. Volunteers and a small staff based at Westchester County Airport (HPN) in White Plains, New York, coordinate the medical travel needs of patients with the scheduled flight activity of more than 500 participating companies, including half the Fortune 100, resulting in more than 200 patient flights per month.

Business aviation plays a key logistics role in a variety of other humanitarian and charitable organizations, including the Red Cross, Honor Flight, Veterans Airlift Command, and the Special Olympics.

Doctors Without Borders relies on general aviation aircraft to get its staff and supplies to remote towns that, in many cases, are otherwise inaccessible. "I was not aware of business aviation [as an industry], but I used to travel a lot on your planes," said Bernard Kouchner, the co-founder of Doctors Without Borders and later the French Minister of Foreign and European Affairs, in an address at a European business aviation conference, adding that reaching people in humanitarian crises would be impossible without light aircraft. "Not only for medical reasons, but for all transportation," said Kouchner, "These towns have no commercial line and rely on small planes, so the development of your industry is absolutely crucial." ■

PHOENIX AIR'S CONTAGIOUS PATIENT TRANSPORTS

Working with the U.S. Centers for Disease Control and Prevention (CDC) to enable safe air transport of patients with highly contagious diseases, Phoenix Air developed the Aeromedical Biological Containment System (ABCS) – a customized, negative-air-pressure two-room chamber installed in a Gulfstream business aircraft. The ABCS isolates a contagious patient from the flight crew and medical professionals onboard.

In August 2014, at the height of an Ebola epidemic in Western Africa, the U.S. Department of State turned to Phoenix Air for assistance. Two American aid workers in Monrovia, Liberia, had contracted Ebola and were near death. Cartersville, Georgia-based Phoenix Air deployed one of its ABCS-equipped aircraft and moved each patient to Emory University Hospital in Atlanta, where both air workers received specialized care and ultimately recovered from the deadly disease.

Between August 2014 and May 2015, Phoenix Air operated more than 40 Ebola-related missions. The missions' success led to follow-on flights, which led to technology advances in transporting highly contagious patients

over long distances: a new Containerized Bio-Containment System (CBCS) can transport up to four patients and six medical attendants in a large unit carried in an all-cargo Boeing 747 or military transport.



THE ACCESS IMPERATIVE

REGIONAL APPROACHES

 To fulfill its function, business aviation needs access to large airports as well as small. To accomplish this, a greater understanding of business aviation benefits and needs is necessary among privatized airport authorities and public regulators.

Air transport is essential to the economic development and lifeblood of cities, regions and communities. As an integral part of the international air transport system, business aviation complements airline networks and plays a key role in connecting local and regional economies. As a specialized travel solution and investment facilitator, business aviation enables people to meet face-to-face when time matters most. Business aviation also fills a need where other unique travel imperatives exist.

Access problems for business aviation users at large airports tend to be related to capacity constraints and measures taken to deal with these constraints, such as congestion charges, schedule coordination and slot allocation. Regional airports, which could help alleviate these constraints, are either under-utilized due to infrastructure shortfalls, such as lack of satellite-based navigation capability, or face closure due to unfair regulatory burdens and state aid limitations.

CRUNCH TIME IN EUROPE

In Europe, the continuous growth in air transport has increased pressure on the infrastructure available for aircraft movements at certain airports where demand for takeoff and landing slots exceeds often scarce capacity. According to Eurocontrol, by 2012 the top 15 airports in Europe were saturated for more than 12 hours a day, and this is forecast to rise to 16 hours per day by 2035.

One of the ways regulators are addressing this crisis is through the overhaul of the Slot Regulation, with the intention of ensuring optimal utilization of airport capacity. But this has raised some legitimate concerns among stakeholders. There is no doubt some proposals could improve the functioning of the slot system and thus generate benefits for all airspace users. Indeed, initiatives to enhance the independence of slot coordinators and the transparency of slot mechanisms, as well as reducing abuse, are generally welcome.

Unfortunately, the specific needs and benefits of the services provided by business aviation and the role in providing a service that complements airline services is not always clearly understood. As a consequence, business aviation risks being



marginalized, if not effectively banned from operating at many primary airports throughout the continent in the near future.

As a growing number of airports become coordinated – there are currently 93 fully slot-coordinated airports in the EU – this has a huge impact on the way business aviation can access these airports. In certain instances, it has led to a dramatic loss of grandfather rights to the point that access to self-funded facilities, including aprons and hangars, is no longer possible.

REGIONAL RELIEF

The failure to grasp the specificities of non-scheduled and business aviation operators – that is, the ability to go anywhere at any time, could be detrimental to Europe's connectivity and the EU's regional development policy.

At the same time, greater access to local and regional airports can alleviate some of the burden on the main airports, while also contributing to the economic development of these areas. This can be achieved by enhancing airfield access through the greater use of satellite-based navigation at regional airports, as well as the best use of existing regional airport capacity through revised state aid allocation rules.

Business aviation is a key contributor to the accessibility of remote regions as it flies to a vast number of local destinations. In Europe, business aviation connects around 100,000 airport pairs – three times more than the airlines and 25,000 of which are not connected by any other direct means. This coverage could be further extended, but poor ground equipment at many smaller airports is a major impediment, and safe all-weather operations are therefore impossible.

SATELLITE-BASED SOLUTIONS

With existing satellite-based navigation technology, access to and safety at all airports and heliports can be improved by providing precision approach capabilities in all weather conditions without the need for any additional airport-hosted infrastructure.

ACCESS IN AUSTRALIA

With its strong economic ties to Asia and continental geography, Australia is a good example of a market where business aviation plays a key role in connecting regions and businesses – and where fair and reasonable access to large airports and is essential. While there are plenty of regional airports and airfields suitable for business aviation, many of these do not have adequate runway lengths to accommodate larger business jets. This means that international business aviation users in particular require access to the primary airports near the centres of economic activity, including Sydney, Melbourne, Perth, Brisbane, Adelaide and Darwin.

The Australian Business Aviation Association (ABAA) has worked closely with privatized primary airports around the country over the past 10 years to ensure they do not overlook the importance of the sector. Business aviation is now generally welcome at these airports; however, it is still disadvantaged at Sydney, Perth and Brisbane during peak morning and evening periods due to slot schemes that favour airlines.

Some business jet operators and most turboprop operators are happy to utilize secondary airports near the main cities. These include Bankstown in the western area of Sydney, Moorabbin in the southeastern area of Melbourne, Jandakot on the southern outskirts of Perth, Archerfield in the southwestern area of Brisbane, and Parafield in the northern sector of Adelaide.

A standout example of an Australian airport that welcomes and truly recognizes the economic benefits of business aviation is Essendon, which until 1970 was the international airport for Melbourne. Essendon is the closest airport to downtown Melbourne – only 10 kilometres via motorway – and features modern infrastructure to accommodate business aviation, including two runways, instrument landing system (ILS), and a host of economic activity.

“By increasing European airport capacity and safety, precision approach technologies will benefit all airspace users.”

Advanced Global Navigation Satellite Systems (GNSS) technologies are widely available on business aviation aircraft. When combined with EGNOS – (European Geostationary Navigation Overlay Service) – or the North American counterpart, GPS – (Global Positioning System) based procedures at airports, additional landing locations can be opened to safe, all-weather operations, including at secondary and regional airports.

It is no coincidence that in Europe today no less than 18 countries already boast airports with EGNOS-based procedures, covering close to 400 runways. Moreover, another 100 LPV (Localizer Performance with Vertical guidance) procedures are planned for implementation by 2020. This is encouraging, but it falls far short of the U.S., for example, which has already published LPV procedures for more than 3,000 runways. By relieving the pressure on major hubs and increasing European airport capacity and safety, these technologies will benefit all airspace users, from legacy carriers to regional, business, rotorcraft and general aviation.

FUNDING FACILITATION

Complementary to this is the simplification of State aid measures for regional airports in Europe. The European Union should consider the number of regional airports as a strength and the question of how to boost their attractiveness must be seriously considered. In this respect, the European Business Aviation Association (EBAA) welcomes the European Commission's initiative to accommodate realities such as the business model of the airport, based on the type of movements other than scheduled flights.

A facilitated allocation of State aid to existing regional airports will foster the full use of their capacity and hence alleviate the current pressure on major hubs. The Commission's initiative corresponds to a *de facto* recognition of the important role that regional airports play in local communities and economies.

SHARED PROSPERITY

Aircraft need access to airports. Simple. Business aircraft are no exception. While they can use local and regional airports, and in many cases this is preferred, the business aviation access imperative to major airports should be respected and accommodated.

For business aviation to play its key role in the economy, reasonable and fair access to slots at major airports must be accommodated, while a sustainable regulatory and fiscal framework is a prerequisite if regional airports are to do their part in relieving capacity constraints. ■

BIZAV WELCOMES EU-ETS EXEMPTION

✈ European officials' decision to continue exempting certain business aviation flights from the European Union Emissions Trading Scheme (EU-ETS) correctly reflects the need for a global aircraft emissions proposal, currently being developed by the International Civil Aviation Organization (ICAO). That's the opinion of major business aviation associations.

The European Commission announced in February it would retain its policy of exempting non-EU operators from the EU-ETS for international flights to and from EU nations. Flights within the EU will still need to comply with the EU-ETS.

The Carbon Offsetting Reduction Scheme for International Aviation (CORSIA), agreed by the ICAO 39th Assembly in October 2016, has a goal of capping international aviation emissions at 2020 levels. Contained in that proposal is a provision, strongly supported by the National Business Aviation Association (NBAA) and other member organizations within the International Business Aviation Council (IBAC), which limits applicability of ICAO's plan to operators producing more than 10,000 tons of carbon emissions, while operating internationally between countries participating in the plan.

"The small emitters exemption is an appropriate one, as it recognizes business aviation's innovation and voluntary efforts to reduce aviation's global carbon footprint," said Ed Bolen, NBAA's President and CEO. "We are early adopters of technology and practices that inherently reduce carbon emissions. Business aviation makes up only a small fraction of total aviation emissions."

NBAA has long opposed the EU-ETS, believing that, because aviation is global in nature, policies should be put forward by ICAO, the international aviation policymaking authority.

The ICAO CORSIA resolution states that it "does not apply to low levels of international aviation activity with a view to avoiding administrative burden: aircraft operators emitting less than 10,000 metric tons of CO₂ emissions from international aviation per year; aircraft with less than 5,700 kg [about 12,500 pounds] of maximum takeoff mass (MTOM); or humanitarian, medical and firefighting operations."

The exemptions remove all but a small number of business aircraft operators. Kurt Edwards, Director General of IBAC, estimates that a Gulfstream G650 would have to fly 2,000 hours internationally annually between participating States to reach 10,000 metric tons. The number goes up to 2,500 hours for a G550.

Edwards welcomed the approach for a global standard. "The worldwide business aviation community welcomes the decision by governments at ICAO to establish a single, global carbon-offsetting scheme for international aviation," he said. "The framework agreed at ICAO will help us meet our collective industry commitments while also taking into account the needs of small operators. Importantly, the global framework means we will avoid a patchwork of multiple measures around the world." ■



A Gulfstream G450 was the first business jet to cross the Atlantic Ocean using biofuel.

THE NEXT TECHNOLOGICAL LEAP IN BUSINESS AVIATION?

✈ Traditionally, technology flows into aviation once it has matured in other sectors because the level of safety we expect and the time required to bring innovation to market in aviation require a rigorous and methodical approach to development, in addition to significant investment. Over the last decade, developments in micro-electronics, software and battery capacities have now also resulted in significant societal changes taking shape within the aviation domain.

The business aviation industry can point with pride to a long record of improving the safety, reliability and efficiency of aircraft through incorporation of new technologies, materials and designs. Much technology in aviation has been tested, deployed and commercialized first in the general and business aviation segments. This was the case with the introduction of composite structures, winglets and glass cockpits, as examples.

Today technology again promises to address a key challenge facing aviation: how do we continue to grow in a safe, sustainable manner? The answer to this is multi-faceted, requiring changes in infrastructure, operations, and the fuel that powers the industry, among others.

INCREASED AUTOMATION

Aviation has pioneered automation since the early days. The levels of information and technology in light general aviation and business jets (fly-by-wire, enhanced vision, synthetic vision) have grown tremendously in the last several decades. For the most part, however, these systems are supplementary and backed up by the pilot or flight crew. In most modern aircraft, takeoff and landing are nearly always flown manually while the climb, cruise and approach are typically flown by automation based on pilot management. We are seeing a trend toward equipment and systems which prevent crew errors in the area of loss of control,

such as envelope protection systems which remind pilots to keep within the flight envelope when approaching the edges, much like a dutifully watching flight instructor. Technologies such as these are especially well-suited to general and business aviation, where single-pilot operation is more common.

There is growing interest in more robust levels of automation which operate across more portions of the flight envelope (including takeoff and landing) and autonomous systems that continue to operate even during certain failures or out-of-the-ordinary conditions. In this manner, the pilot can continue to concentrate on managing the extraordinary condition.



Airbus' E-Fan technology is being considered for single-passenger, self-flying air taxis, four-seat general aviation aircraft, and 19-seat business aircraft.

There is significant interest among aircraft manufacturers in "on demand mobility." Conceptually, aircraft (both conventional takeoff and landing and vertical takeoff and landing) can become more integrated into day-to-day life as the reliability and simplified operation of increased automation takes hold. While technologically these are steps forward, realizing

and integrating the full benefits for these technologies (in the form of lower training burden on pilots, simplified ratings and licencing, etc.) will require a bit of a leap and perhaps a culture change.

Recognizing the growing importance of these trends, the general and business aviation industry has begun to organize itself to address regulatory issues and to ensure that safety remains the paramount consideration as these technologies are developed and brought to the marketplace. The General Aviation Manufacturers Association (GAMA) has taken on the task of identifying and addressing areas where increased automation will likely contribute to the safety and utility of aviation and to ensure that flight crew training and licencing can be appropriately adjusted and simplified.

“Concepts for hybrid and electric propulsion are the next obvious step.”

ELECTRIFYING CONCEPTS

In the larger segments of aviation (commercial airlines and business jets) the strong desire for more range and more efficient operations has pushed many traditionally mechanical or pneumatic systems to become electrified (electric environmental systems, electric anti-ice, electric actuation, etc.). As experience is gained with these systems and as battery energy densities continue to grow, this trend for increased electrification is speeding up. In most aviation design circles, concepts for hybrid and electric propulsion are the next obvious step. In the lighter segments of aviation, there are already all-electric aircraft flying, with second generation designs coming soon.

The pressures and market forces moving the industry toward increased electrification will spur further development. The risks associated with new technologies will decrease and the safety and economic benefits will increase. Business aviation will continue to be a key testbed for and early adopter of innovative technologies.

The U.S. Argonne National Laboratory has estimated that lithium ion battery energy density has increased by 3 per cent for each of the last 10 years. While reaching the energy density of liquid fuel may still be decades away, the efficiencies and design characteristics of electric propulsion already make sense for lighter aircraft today for some applications.

And despite the enormous advances in aircraft fuel efficiency over recent decades, the aviation industry has committed to improve even further, including development and deployment of sustainable alternative jet fuel. ICAO is commendably encouraging further work.

SUPERSONIC HORIZON

One segment of aviation has retained a powerful allure: the development of a civilian supersonic airplane that would radically

redefine travel and truly shrink the globe. More than a decade after the last flight of the iconic Concorde, several ambitious new companies and established manufacturers are moving aggressively forward with what they believe are innovative technological answers to some of the most vexing and longstanding regulatory and other obstacles to civilian supersonic flight. The general and business aviation sector will soon bring to market the first civil supersonic aircraft incorporating technology to make it environmentally acceptable and thus able to fly unhindered anywhere in the world.

Technical experts from companies with competing visions and design philosophies are today working together within ICAO to come up with a coherent regulatory framework that will not only address the sensitive environmental questions of noise and emissions, but will also ensure a level playing field as competing designs move from the drawing boards to reality over the next decade. (The ICAO Council's Committee on Aviation Environmental Protection – CAEP – is continuing discussions on sonic boom measurement schemes and technical flight test procedures for future supersonic aircraft.)

WAY FORWARD

Going forward, it will be important to ensure a clear path for increased automation, electrification, supersonic and other emerging technologies across the range of aviation products. Progress in aviation has always meant increased safety, efficiency and sustainability. We are on the cusp of an era of perhaps unprecedented advances in technology. It is important that regulators, industry, and other stakeholders ensure that the focus remains on safety and there are no barriers to the development and commercialization of safety-enhancing technological advances in global aviation. ■



Supersonic aircraft are poised for a comeback in commercial aviation, initially in the business aircraft sector.

BEYOND THE RULES

VOLUNTARY PROGRAMMES DEFINE BUSINESS AVIATION'S PROFESSIONALISM

 Like all aspects of the aviation industry, business aviation's standards are established by State-level regulators. Sets of rules – such as the U.S. Federal Aviation Administration (FAA) regulations and Europe's European Aviation Safety Agency (EASA) regulations – lay out the minimum standards for every important technical and operational facet of aviation. They dictate minimum and recurrent-training requirements for pilots, maintenance technicians, dispatchers, airport operations professionals and more. They also specify the essential elements of training programmes, maintenance manuals and organizational systems, such as Safety Management Systems (SMS). Simply put, the regulations are the base upon which every business aircraft operator's standards, protocols and practices must rest.

Although minimum aviation standards establish the foundation, numerous voluntary, industry-driven programmes add layers of enhanced safety and professionalism. These programmes both complement and build upon the regulations, creating safer, more efficient and professional operations.

ORGANIZATIONAL PROFESSIONALISM

One of these industry-driven programmes is the International Standard for Business Aircraft Operations (IS-BAO). Launched in 2002 by the International Business Aviation Council (IBAC), a federation of business aviation organizations across the globe, IS-BAO promotes the use of best operating practices among business aircraft operators worldwide. Built upon and consistent with the standards and recommended practices of the International Civil Aviation Organization (ICAO), IS-BAO has been adopted by more than 700 operators in 35 countries, and is both flexible and constantly evolving. Stakeholders review the entire programme and make agreed-upon updates yearly to keep up with changes in the industry.

The complexity of IS-BAO is driven partly by the complexity of each flight operation that chooses to adopt its standards. The simpler the operation, the simpler the process for IS-BAO registration. Small flight departments should have a programme that is different than that of multi-aircraft, large departments. But IS-BAO is no less important for single-aircraft flight departments because the standard provides needed structure. For example, small flight department officials say that the change-management process outlined in IS-BAO can be quite beneficial.

As a parallel programme to IS-BAO, the International Standard for Business Aircraft Handlers (IS-BAH) is a set of global industry best practices for business aircraft ground handlers that features an SMS as its core. IS-BAH follows the structure of the IS-BAO programme, incorporates the National Air Transportation

Association (NATA) "Safety 1st" ground audit programme, and is designed to meet ICAO's coming SMS requirements for this segment of the industry. IS-BAO and IS-BAH have a common element – an emphasis on professionalism.

In the United States, the Safety Committee of the National Business Aviation Association (NBAA) has identified professionalism as the cornerstone of any SMS, which, even where not required by regulations, is generally considered vital to any aviation operation. The committee defines professionalism in aviation as "the pursuit of excellence through discipline, ethical behavior and continuous improvement," leaving room for each organization to adapt the philosophy to its specific needs and environment.

NBAA's Safety Committee has identified six characteristics of organizational professionalism:

- **Character** – including integrity, honesty, forthrightness, responsibility, diligence, ethics and consistency
- **Culture** – which encompasses service excellence, responsibility, accountability, determination, transparency, initiative, proactivity, collaboration and mentoring
- **Business performance and industry engagement** – including performance, improvement, evaluation, audit, feedback, participation and partnership
- **Competency in vocational skills** – skill, expertise, training, performance standards and communication
- **Conduct and image** – maturity, etiquette, loyalty, respect, discretion and excellence
- **Continuous improvement** – culture, management, education, debrief and resiliency

NBAA also offers its members a prototype Management Guide, which is a template for how to organize and run a professional flight department. The guide covers all essential information, including chapters on administration, flight operations, international operations and maintenance.

One of the essential functions of flight department personnel is to ensure that all company personnel appreciate and understand the operation, capabilities and value of the flight departments. Since most flight departments are parts of larger organizations not involved in aviation, the NBAA Management Guide also is a useful primer for non-aviation personnel on accepted practices and norms of the business aviation community.

INDIVIDUAL PROFESSIONALISM

The business aviation community's professional development efforts extend beyond the organizational level to the individuals



Dassault Falcon 5X

involved. The industry understands that professional development is an integral part of attracting, retaining, and improving the value of quality personnel.

One example of grassroots career development is the UK's Trailblazer Apprenticeship programme. Launched in 2014 by the UK government, the programme's goal is to empower industries to develop apprenticeships that adhere to a national occupational standard. A government guidance document on the programme explains: "By getting involved in developing the standards for occupations in your sector, you will have the opportunity to define the [knowledge, skills, and behavior] you require in your future workforce, and which training (supported by government) will help to deliver this. In turn, this will mean that apprenticeships more directly support your business to grow and prosper."

The UK aviation industry has created four apprenticeship standards so far:

- Airside operator
- Aviation ground specialist
- Aviation operations manager
- Aviation ground operative

Each standard focuses on the skills needed for specific careers, ranging from a ground handling service technician to an air traffic controller. Each set of standards was created via a collaborative effort from industry organizations, including airports, aircraft operators and aviation service providers.

In addition to building a highly professional workforce at the grassroots level, business aviation is dedicated to improving the professionalism of its existing workforce to help create tomorrow's leaders. For example, NBAA's Professional Development Programme (PDP) was launched in 1998 to prepare business aviation professionals for management roles within flight departments.

Courses are offered in five focus areas:

- Leadership
- Business management
- Human resources
- Operations
- Aircraft maintenance and facilities services

Programmes are made available through a variety of venues and online, through educational institutions and in workshops held at NBAA's many industry events each year. More than 11,000 courses have been completed under the programme so far.

"The success of programmes like PDP underscore the commitment to constant improvement that business aviation professionals have," said Jad Donaldson, vice chairman of NBAA's Business Aviation Management Committee and director of aviation for Harley-Davidson Motor Company. "NBAA and its committees work diligently on developing programmes, refining existing ones, and incorporating stakeholder input to ensure business aviation's professional development needs are being addressed from every angle."

DEVELOPING TOMORROW'S PROFESSIONALS

Numerous programmes also exist for ensuring the career-development pipeline remains full. One of the highlights of NBAA's annual convention is the Careers in Business Aviation Day for high school and university students who want to learn about the industry. Students gain exposure to professionals who are making aviation their careers, and learn about the latest trends shaping global business aviation.

NBAA also is working on additional programmes tailored to helping organizations boost recruitment and career-development efforts. One example is the recently released Internship and Career Guide. Available free on NBAA's website, the guide provides instruction on how companies, collegiate aviation degree programmes, regional business aviation associations and government entities can work together to build a business aviation career programme to support the next generation of industry leaders.

ICAO, recognizing the importance of developing future professional talent, launched Next Generation of Aviation Professionals (NGAP) initiatives in 2009 to both quantify the workforce development challenges and spearhead ways to address them. The first NGAP effort was a 29-member task force representing all industry stakeholders and tasked with several objectives, including:

- Gathering human resources planning data
- Identifying and supporting initiatives to reach out to the next generation
- Finding ways to harmonize training regulations

Now recognized as a full ICAO programme (which means its efforts are incorporated into ICAO's business plan), NGAP held its eighth full-participant meeting in December 2016. The effort now has working groups that meet regularly to focus on implementation, outreach, and strategy and planning. Among the working group accomplishments thus far is the beginning of collaboration with stakeholders to create guidance material for programmes that will attract, train and retain qualified personnel. ■

BIZAV VALUE: FLEXIBILITY, EFFICIENCY

 Flexibility sets business aviation apart from other forms of travel, making it the most efficient mode of transportation for some and enabling others to make trips that would not otherwise be feasible.

A closer look at one company's business aircraft usage underscores the value of business aviation. Honeywell International is a Fortune 100 company headquartered on the U.S. East Coast that employs nearly 130,000 people at 1,300 sites in 70 countries. It has a fleet of seven aircraft, six fixed-wing and one helicopter, split between two bases: one a dedicated general aviation facility outside New York City, the other in Arizona. The company also owns shares in a fractional ownership programme to supplement its fleet.

The company's helicopter gives its flight department an especially versatile tool for its East Coast operations, explains John Tuten, the company's chief pilot. In many cases, personnel based at Honeywell's headquarters can be shuttled to meetings in downtown New York or other nearby cities. In addition, it is not unusual for passengers from outside the region to be flown to the East Coast base aboard a company airplane, then switch to the helicopter for an expedited trip into Manhattan.

“The vast majority of the time, our passengers are working”

– John Tuten, Chief Pilot,
Honeywell



“Using our aircraft in this way is very efficient,” Tuten says. “It wouldn't be unusual for a traveler to start the day at headquarters, get flown into Manhattan for morning meetings, return to headquarters, then depart for Washington, D.C. for more meetings, and then to another city for another meeting, and then end the day on the West Coast.”

Single-day, multi-city trips are common, Tuten says. A business airplane's speed, efficiency and ability to use a wider variety of airports – from close-in downtown airfields to rural general aviation-only facilities – makes it a versatile mode of transportation.

A FLYING OFFICE

Connectivity and other onboard amenities mean that passengers can work as if they are sitting at their desks, participating in conference calls using voice-over-IP connectivity, accessing email, or working away on a laptop. “The vast majority of the time, our passengers are working,” Tuten says. “With the exception of getting some rest on long flights, our passengers treat the aircraft as a mobile office, which helps boost their productivity. It really does make the aircraft an office away from home.”

A prime example of using its business aviation fleet to maximize productivity is when Honeywell's leaders gather for board or other high-level meetings. In these cases,



multiple aircraft will be dispatched to pick up people in different locations around the country. They will all end up at the destination city for the formal gathering. Such meetings can include a dozen or more people who come from thousands of miles away.

Honeywell maximizes the use of its business aircraft fleet, aiming to have most of the company trips scheduled several months in advance. The fleet totals about 3,800 hours per year in the air – an amount that Tuten said balances the company's travel needs with its aviation department resources. Fractional ownership shares are used for overflow requests as well as trips with circumstances that would tie up company assets in a less-than-optimal way – "where it makes sense, like a one-way trip where we're going to save five to six hours of deadheading," Tuten says.

LAST-MINUTE CHANGES, NO PROBLEM

While the company-owned airplanes are typically booked one to two months in advance, schedules usually aren't locked in until two weeks to a month before trips take place. And there are times when last-minute trips are necessary. Having in-house assets and crews available makes these kinds of trips more feasible, Tuten says. Last-minute schedule adjustments, such as departing a few hours later due to a longer-than-expected meeting, are also easier to accommodate with company aircraft. "One of the biggest selling points of

our operation is flexibility," Tuten says. "We do get slides in departure times all the time – requests to leave an hour later or two hours earlier."

While last-minute trips are rare, they are often needed in critical situations. "We don't really have a lot of pop-up trips, but we do have the flexibility of having standby crews available," Tuten says. "We've scrambled airplanes with as little as three hours' notice."

LATEST ONBOARD EQUIPMENT

Most business aircraft have advanced avionics and equipment that maximize safety and efficiency. The systems on Honeywell's aircraft range from advanced navigation systems that use satellite-based systems, such as Automated Dependent Surveillance-Broadcast (ADS-B), and controller-pilot data link communications, which enables air traffic controllers and pilots to communicate without using often-overcrowded voice channels.

Besides enabling the aircraft to use the maximum number of airports, the advanced equipment also enables the company's aircraft to serve as flying demonstrators for customers. "We do a lot of customer demonstrations and media demonstrations related to Honeywell products and services," Tuten says. ■

ICING CERTIFICATION: TIME TO CONSIDER 3D CFD



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✈ Aircraft and system design and operational procedures still have not totally conquered in-flight icing problems. Flying in icing conditions continues to result in incidents and accidents, with no aircraft type, size, or configuration immune. The availability of advanced simulation tools such as 3D Computational Fluid Dynamics (CFD) can speed up the aircraft certification process, fill important gaps, predict what will eventually be seen in flight testing, and increase safety.

Despite considerable advances achieved by 3D CFD simulation of in-flight icing in the past 10 years, the aircraft certification process has failed to adopt them and remains almost at a standstill using technologies from three decades ago. The tools accepted by airworthiness authorities for certifying aircraft for in-flight icing seem to have remained almost frozen in time.

CFD tools would permit a more efficient and safer certification methodology for all types of aircraft by reducing the likelihood of ice-induced hazardous events in operation. Aerodynamicists can use CFD to examine and anticipate in-flight icing scenarios and situations that cannot be tested otherwise (with dry and wet icing tunnel testing or flight testing with artificial ice shapes), are too dangerous, or are too difficult to verify by means of natural icing flights. CFD can also play scenarios at the "white sheet" aircraft design phase.

ICE PROTECTION CHALLENGE

When the surface area of an aircraft in a cloud surface strikes supercooled liquid water droplets (the temperature of the droplet is below the freezing point, but the water is in the liquid phase), the droplets form ice – whose shape, location, roughness and dimension can lead to unexpected surface roughness and distortions in the aerodynamic profiles of lifting surfaces, control surfaces, air intakes, fan blades, rotors and propellers. Performance degradation can then occur from a combination of increased drag, reduced stall angle of attack and reduced lift. Higher weight is of secondary significance. Moreover, ice can block engine inlets and internal ducts, distorting flow. If ingested or released, ice may damage engine components, causing power fluctuations, thrust loss, rollback, flameout and loss of transient capability.

Asymmetric ice distribution can also cause significant stability and control problems, compounding already reduced aircraft performance.

Aerodynamic flow separation (stall), by itself or in combination with other effects, is most often the killer. Some current stall protection systems cannot alert the pilot that the margin between stall warning and actual stall is significantly reduced and perhaps eliminated in icing situations. Also, crew training for stall recovery has been inappropriate for airplanes degraded by ice contamination.

In-flight ice accretion can be prevented or removed. It can be prevented by adding energy in the form of heat or by chemically depressing the freezing point. It can be removed after accretion by intermittent heating or mechanical de-icing using pneumatically inflated de-icing boots or other mechanical devices that distort

the leading edge of the air foil, break the ice-surface bond and fracture the ice, allowing the ice particles to be swept away in the airflow.

Unfortunately, the total prevention of ice formation, or its complete removal, is not, and likely will never be, economically feasible because of the large amount of thermal or electrothermal energy required, the problems inherent in mechanical removal, and the weight penalties and residue of freezing-point depressant fluids.

Moreover, the controlled amount of anti-icing or de-icing hot air bled from the engines is often needed during climb, especially for smaller airplanes, and may be insufficient during descent, approach and landing because of reduced engine power settings.

In practice, therefore, while some areas of the aircraft are *anti-iced*, other areas can only be *de-iced*. Large areas are left unprotected. Such unprotected areas must be precisely determined.

WEAKNESSES OF ICING TUNNELS

The icing tunnel is one of the most important elements of the currently applied toolbox available to assess in-flight icing parameters during the ice protection system design process. One of the greatest difficulties of icing tunnels is the need for simultaneous scaling of geometric, aerodynamic and droplet characteristics, still a wide-open research area with serious limitations that cast doubt on the quantitative value of the experimental results. Another dilemma is the applicability of data obtained from scaled-down partial geometries due to the small size of tunnels.

Some of the limitations of icing tunnels:

- Test *only a portion of the aircraft (one wing)* and ignore the engine and/or propellers, which cannot be scaled to the tunnel's dimensions. Propulsive effects are then absent and their effect on the local angle of attack and flow conditions are neglected. Also, the asymmetry of icing between the left and right wings cannot be assessed.
- Test *only a portion of the span of the wing*, as it cannot fit in the tunnel; the spanwise flows over the real wing are therefore absent.
- Test *only a portion of the chord of the wing*, also because it cannot fit in the tunnel.
- Test *only a limited spectrum of droplet sizes and diameters* from the prescribed atmospheric envelope that can be reproduced in the icing tunnel.
- Test for supercooled large droplets (SLDs) using *only a small section of the vertical model* due to the gravitational settling of the heavy drops before they reach the test section.

By the time these approximations are cobbled together, the tested item bears little resemblance to reality.

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When one observes the way ice shapes are “traced” in an icing tunnel, using a cardboard and a pencil, or how water collection coefficient is measured using blotting paper and a timer, the arbitrary height at which the 2D profile of ice was measured, the non-uniformity of the droplet sizes and water content, and other uncertainties, severe doubts can be cast on published experimental ice shapes.

WEAKNESSES OF CALIBRATED CODES

The inaccuracy of icing tunnels then pollutes a large class of simulation codes (which we'll label “pseudo-CFD” codes). Most pseudo-CFD icing codes in use today are based on 1980's 2D panel methods for flow and Lagrangian tracking techniques for impingement. How is their “calibration” done? Having identified ice surface roughness as the most important parameter determining ice shapes, developers extract from hundreds of icing tunnel measurements a so-called “*heuristic analytical roughness model that will make the pseudo-CFD computer code agree with the icing tunnel.*”

Such codes are then incorrectly accepted as “validated” because they supposedly yield similar results to the icing tunnel. They are not by any measure “validated,” but are simply “calibrated.” In essence, a calibrated code is one that will regurgitate to the user, through a fancy computational procedure, a result that is preordained.

WEAKNESSES OF FLIGHT TESTS

The ultimate step in obtaining certification for flying into known icing is testing the completed prototype of the aircraft in the natural real-world environment. This is the only way to assess, for the first time, how all systems work together. Small modifications to these systems can then be suggested and corrections made, but it is certainly too late for major changes.

The airplane is flown, guided by meteorologists, to locate in nature a number of points within the mandated certification envelope. It is most desirable to attempt to find the most critical ice accretions – without exposing the pilots to danger. Such campaigns can last as little as a week or as long as several seasons, depending on the time of year and the atmospheric conditions prevailing in the country of test.

There currently exists no accepted strategy for precisely determining the critical points within these envelopes, for the particular aircraft tested, and for each of its components exposed to icing. No matter how long a natural icing test can last, the number of test points gathered is generally small and dependent on the whims of the weather. It is also extremely difficult to scientifically ascertain whether the number of points tested are sufficient or not.

A MODERN APPROACH TO ICING ASSESSMENT

A 3D CFD icing approach is essential to complement the rather weak toolbox available for in-flight icing assessment. First and foremost, it can cover all aircraft speeds and all airworthiness-specified atmospheric envelopes. It requires no scaling of geometry, and analyzes the *aircraft* and not the *airfoil*. No other experimental means are available to do that until the final natural icing testing.

With 3D CFD icing simulation, all geometric features of the airplane can be taken into account simultaneously, including appendages such as Pitot tubes, angle of attack vanes, antennae, icing probes, etc. It includes propulsive effects of the engine or the propellers. It requires no scaling of atmospheric conditions.

It also permits a multi-disciplinary approach (with aerodynamics, stress analysis, etc.), is reproducible, traceable, upgradeable, and continuously decreasing in cost. CFD simulation harmonizes the technologies, permitting icing assessment along with the aerodynamics at the “white sheet” design phase, not only at the certification phase. And it facilitates analyzing a gamut of situations that are difficult or too dangerous to test in nature.

Such 3D CFD codes can yield airflow and ice shapes over the entire aircraft, with engines, propellers or rotors running, and yield information that no icing tunnel can deliver. Ice surface roughness no longer need be heuristically deduced from ice tunnels results; it can be predicted analytically in time and in space for any component or the complete aircraft.

An emerging technology called Reduced Order Modeling can yield the behavior of the clean aircraft “throughout” the airworthiness envelope, complementing natural icing results and providing additional information for points that could not be located in nature or that would be too dangerous to fly.

WHY IS CFD NOT READILY ACCEPTED?

Will the aviation community wait for icing tunnels to produce 3D results? If icing tunnel 2D results have proven so unreliable, would 3D ones fare any better?

The practical and scientific answer is to modernise the concept of validating 3D icing codes. An analogy is the Space Shuttle; the only way to demonstrate that it works is to launch it. However, before launch, one has to ensure that every separate subcomponent that goes into the Shuttle works well independently, and then works well when all subcomponents are joined into a module. That is exactly how 3D CFD-Icing codes should be validated: one subcomponent at a time (in 2D and 3D for steady, unsteady, laminar, turbulent, transitional flows, smooth walls, rough walls, SLD, ice crystals, verifying solution and mesh convergence, degree of accuracy, etc.), then one module at a time (flow, impingement, ice accretion, heat transfer, performance degradation), progressively tying the modules together into a comprehensive CFD-Icing code.

In the final analysis, it is not the intricate details of the shape of ice that matter, but what that ice does to the aircraft. If flight-testing and predictions nearly agree in terms of photographs and observations, and in the measured inflight parameters such as lift, drag, moments, then the 3D CFD-Icing code is validated.

The use of CFD-based approaches in support of aircraft icing certification offers enormous advantages:

- No need for scaling or similitude studies;
- Exploration of a more complete icing envelope in a risk-free fashion;
- Synergy between the methods used to design the aircraft and those used to design ice protection systems;
- Elimination of experimental inaccuracies generally associated with icing tunnels (measurement and control of droplet size, relative humidity, ambient temperature, water flow rate, repeatability, start-up times).

These advantages translate into significant cost reductions, shortening of the certification process, and improving the safe operation of the air vehicle in service.

While we propose the use of 3D CFD simulation as an aid to certification, it certainly should not be the primary tool. There would be two potential dangers to do so: underestimating the adverse consequences of icing and overestimating these consequences. A rational approach should involve a methodical exploration of the icing envelope using CFD, accompanied by “focused” flight tests to verify the analysis and avoid either extreme.

It is important for the airworthiness authorities to embrace the new technology and accept or reject it on a rational and predictable basis, by experts. Only then will the OEMs be confident enough to start fully deploying technology that has been available for years. ■

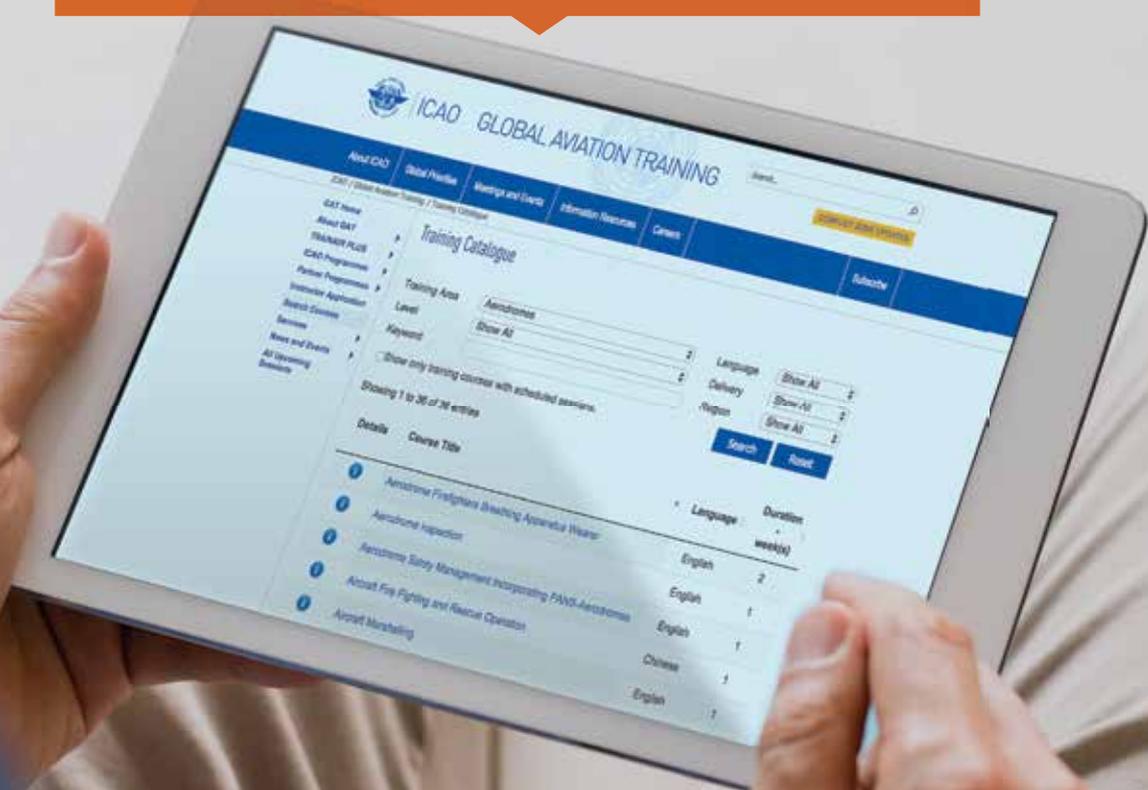


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