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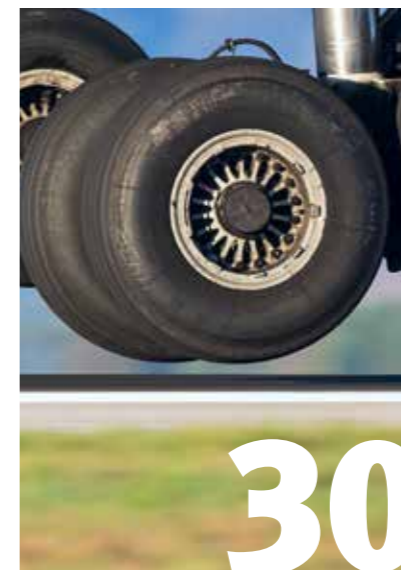


#120



ISO focus

January-February 2017



ISOfocus January-February 2017 – ISSN 2226-1095

ISOfocus, the magazine of the International Organization for Standardization, is published six times a year. You can discover more content on our Website at iso.org/isofocus, or by staying connected with us on:



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Russian aviation plans *to fly higher*

The dissolution of the Soviet Union sent Russia's civil aviation into a tailspin, with only a handful of planes rolling off its production lines. Now, the Russian government is in the process of rebuilding the country's civil aviation industry based on stronger partnerships and global standards.

Only ISO can (and should) be the leader of standards development at this new stage in the aviation industry.

The Irkut MC-21, which is expected to fly for the first time in 2017, is Russian aviation's new star. Light and aerodynamic, with a 10% greater carrying capacity than other planes, it will be able to compete with the Airbus 320 and the Boeing 737. Russia's aviation industry is bouncing back after a painful period of decline following the dissolution of the Soviet Union. The country had a proud history in aviation with an impressive portfolio of military and civilian aircraft and hundreds of airfields reaching out to the far corners of Siberia. Now, with new competitive designs, it hopes to become the third largest aircraft manufacturer in the world by 2025. For the Russian Federation, which traditionally counts aviation as one of its key industries, ensuring the safety, quality and competitiveness of its aircraft and aviation equipment has been a priority for many years. Compiling a powerful normative base of relevant requirements and high-tech solutions with respect to aviation technology, development processes and aircraft components has been one of its main tools to achieve this. Over the past 50 years, we have maintained a unique industry-specific repository of more than 23,000 standards that followed the evolution curve of Russian aviation science and technology.

The dynamic political and economic changes of the 1990s intensified the need for international cooperation and synergies, which would not have been possible without worldwide harmonization of requirements for aviation equipment and adjoining industry sectors. Hence in 1991, GOST R, the Russian Federation's national standards body and ISO member for the country, established its national technical committee TC 323 on aviation vehicles and equipment. TC 323 is also our national mirror committee to ISO technical committee ISO/TC 20, *Aircraft and space vehicles*.

Today, standardization in the aviation sector faces a number of challenges as aircraft manufacturers are pushed out of their comfort zone of intra-industry competition, dominated by a limited number of large national and global players, in which industrial aerospace standards were based substantially on market leaders' achievements and offered advantages to leading companies in the market.

Globalization, whether technological, economic or social, depends on aviation. New and fresh approaches are underway to solve the global challenge of innovation faced by many industries today. The issue is to bring the capabilities of the rapidly advancing telecommunication and ICT technology to the aviation sector in a coherent and coordinated manner. Some of the new large-scale technological innovations do not have an explicit evolution in history. They are brought about by unexpected change resulting from systemic interactions, i.e. when problems, prospects and successful development in one area of the economy or technology are transferable to situations in other areas.

Helping the aviation industry make the transition to the digital economy requires an interdisciplinary mentality, capable of integrating knowledge spanning the whole spectrum of society, science, business and public administration. Thus, the development of today's aviation industry follows not only the emergence of specific technologies, but also the adaptation of technological solutions developed in other sectors. In the foreseeable future, the advances in information technologies will determine the level of technology in any industry. No doubt, future market competition between aircraft manufacturers and information product developers will take place on the "home turf" of information industry companies.

The absence of "boundary" standards in the aviation industry leaves the field open to new groups of players



Alexey V. Abramov, Head, Federal Agency on Technical Regulation and Metrology of the Russian Federation (Rosstandart).

from innovative sectors such as unmanned aircraft systems, the manufacturing of 3D-printed parts and components by additive technologies and the so-called "flying cars". Hence why GOST R sets great store by the development and implementation of such standards.

The development time of new products and services is shorter than ever before. It is therefore essential that standardization "keep pace" with the fast emerging new methods, products and technologies. The aviation sector relies on multiple standards bodies and consortia to develop standards and specifications that meet the needs of developers and manufacturers, but only ISO can (and should) be the leader of standards development at this new stage in the aviation industry. For only ISO/TC 20 can work closely with all these organizations – pooling the efforts of high-level experts from across the globe – to ensure interoperability and avoid duplication. ■



**T H E
F U T U R E
O F
A I R P O R T S**

by Elizabeth Gasiorowski-Denis

Development of airport infrastructure has lagged behind travel growth. Traffic at some major airports is already exceeding planned capacity while other airports are starting to experience congestion. With airport infrastructure under massive pressure, preparation is crucial. To understand what this means, we reached out to several people across the industry. Here's what they had to say.



Have you ever heard the phrase, “getting there is half the fun”? The right airport can complement a great travel experience by making it easy for passengers to make their way through check-in, bag drop and security to their departure gate. The right airport also provides good opportunities to eat, shop and relax along the way.

The expectation? An airport that elevates both the passenger experience while maximizing revenue potential. That's why the infrastructure surrounding an airport – the roads, parking spaces, walkways and transit facilities – and the infrastructure underneath the airport, such as the utilities and drainage, are so important. They are often the first things that passengers experience and that make a big impact, and a lasting one, on first impressions.

The reality? For passengers, it is one of frustration, with crowded terminal concourses, increasingly common flight delays, long queues for take-off, and circling of aircraft in stacks prior to landing. The growing scarcity of suitable landing and take-off slots is leaving airports unable to cope with further expansion. This, in turn, is having a knock-on effect on airlines, with nowhere for them to operate their newly delivered aircraft.

Boom... and bust

Worse still, if you think that the skies are congested, then consider this. According to a new report from the International Air Transport Association (IATA),



IATA expects 7.2 billion passengers to travel by air in 2035.

passenger numbers are likely to surge in the next couple of decades. IATA expects 7.2 billion passengers to travel by air in 2035, a near doubling of today's 3.8 billion level. Its forecasts, published in the Group's 20-Year Air Passenger Forecast report, are based on an annual compound growth rate of 3.7% a year, led by booming growth in Asia.

This doubling in growth of air travel is placing extra strain on airports that are already creaking at the seams. New challenges include handling the increasing number of passengers, freight and baggage in an efficient and cost-effective way, as well as creating environmentally friendly solutions and products, plus satisfying the rising security standards now required worldwide.

These challenges have thrown into relief the inefficiencies of airport infrastructure. Most airports were designed and built decades ago to accommodate traffic demand at the time, and although most have been overhauled to meet modern-day demands, many are falling woefully short. As a result, the seamless travel experience, which we all expect, has become a gruelling one, leading to low passenger evaluations.

Is this bumpy ride likely to continue? Alexandre de Juniac, IATA's Director-General and CEO, speaking at the World Passenger Symposium in Dubai, painted a bleak picture. He said that no matter how much or how quickly we innovate processes, "there is no getting around the need to be both smart and quick in growing airport and airspace capacity". He cited rising congestion, particularly in Europe, while pointing to fast-growing areas in the Gulf region and China. "I fear that we may be headed for an infrastructure crisis that will impact air travellers," he said.

De Juniac added that the capacity crunch will also have an adverse impact on the global economy. "Inadequate infrastructure negatively impacts the passenger experience in the form of flight delays, longer routes and inefficient schedules. Then there is the cost to economies of lost business opportunities, employment and social development. Remember, aviation is a critical catalyst for economic and social development, supporting 63 million jobs and some USD 2.7 trillion in economic impact."

Beyond borders

It is clear that maintaining and enhancing airport infrastructure is critical and is one of the greatest challenges for airport owners and operators. They need to identify priorities, assess costs and deliver projects on time and budget, while keeping operations running smoothly.

Switzerland, for all its renowned clockwork-like efficiency, is not immune to these challenges. Despite a brisk growth in recent years (driven by increases in population and economic wealth), current airport infrastructure inadequacies are putting a brake on fully capitalizing on this growth.



The solution is to bring an airport's entire infrastructure up to standards and keep it there.

At Geneva's international airport, for instance, an estimated 25 million passengers are expected in 2030. According to the team responsible for infrastructure and planning, the airport, in its current configuration "is reaching saturation and its operations, while mostly optimal, are no longer sufficient to provide the required level of service".

However, in true Swiss fashion, the airport is rising to the challenge. The Infrastructure and Planning Team composed of Ilham Hikmi, Nicolas Gaspoz and Guy Marguet say large-scale projects and renovation work have been carried out in the past years to meet growing demand and the team is now looking ahead. "Future development projects and renovation work is planned in accordance with master plans that define relatively accurately the development needs beyond ten years."

Such spectacular construction projects involve structural changes and require careful coordination as ongoing airport operations must be maintained while the work is underway. Alongside major refurbishment, short- and medium-term management activities will ensure the smooth functioning of operations, keeping passengers happy. These include organizational initiatives to support developments and meet the growing demand.

State-of-the-art design

In the coming decade, there is a vast amount of planned capital investment in airport-related infrastructure, with global growth in airport investment estimated at 2.6% a year. This amounts to a cumulative investment of USD 750 billion between 2015 and 2025, based on a study by PricewaterhouseCoopers and Oxford Economics.

With the lead-time for new airport construction taking anything from five to 20 years, depending on location, future-proofing airports for ever-busier times is a huge dilemma. So, where is the best place to start? Strangely enough, despite our hi-tech, whiz-bang, electronic age, we have to go back to basics. Wilson N. Felder, former Director of the US Federal Aviation Agency's William J. Hughes Technical Center in Atlantic City, says the most pressing upgrades to airports have to do with bricks and mortar, not sophisticated electronics. The centre is known for its world-class laboratories and high-fidelity aviation system test facilities.



Inevitably there is a wide variety of airport capabilities out there, and while digital systems may be important in Europe and North America, there are other places around the world where things like basic runway and taxiway construction are of primary importance. When the leader of a delegation of seven Southern African Civil Aviation Authorities was asked about his priorities for the national infrastructure some years ago, instead of radar systems and air traffic control automation, he responded with “paved runways”.

However, Felder says that airports are also highly developed and sophisticated systems existing across a wide spectrum of different levels of technology. At the bottom end are uncontrolled dirt strips with minimal infrastructure (and, in some cases, no infrastructure). At the top end are large, multi-runway international airports with substantial traffic loads which must be prepared to integrate aircraft coming from different points of origin across the globe.

Up in the air

Decent runways are one way of keeping the big wheels turning, but what about regulations? In our ever smaller and highly interconnected world, it is a sad fact there is no consistency in regulations. Airport projects are particularly complex because they involve such a wide variety of stakeholders and revenue sources. Frequently, there is a lack of integration among airport users and equipment. Although these all comply with International Civil Aviation Organization (ICAO) guidelines, there is considerable variation in how those guidelines are implemented, leading to potential operational difficulties.

What’s more, the respective actors in the overall airport organization are subject to different standards regimes. These include aircraft maintenance, flight operations, ground handling (including fuelling), security services, airside services and air traffic control. Even when some of these processes are frequently done by the same organization, they are usually subject to different systems, standards and safety cultures.

According to Felder, large and sophisticated airports operate in a variety of standards regimes. Take, for instance, aircraft avionics. These are built to internationally coordinated standards brought



This doubling
in growth
of air travel is
placing extra strain
on airports.

into effect, for example, by the Radio Technical Commission for Aeronautics (RTCA) in the US and the European Organization for Civil Aviation Equipment (EUROCAE) in the European Union. Physical structures are the domain of civil engineering as practised in the airport’s national environment; and signage, lighting and navigation are subject to ICAO rules. As the world’s airways become more crowded and the building of new sites more challenging, standardization clearly is on the radar.

Flightpath for standards

The recently created subcommittee SC 17, *Airport infrastructure*, within ISO technical committee ISO/TC 20, *Space and aircraft vehicles*, is expected to give a much clearer picture of the entire scope of the problems. The end result will be the development of International Standards for airport infrastructure, such as:

- Grooving of landing and take-off lanes
- Asphaltic ecologic paving
- Vertical signalling with painting and electronic boards (painted and lighted signage)

**The amount of
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between 2015
and 2025.**





As the new Chair of the subcommittee, Felder believes that the window of opportunity is wide open – from a technical point of view. This, in turn, will be of benefit to the regulations that are still lacking today. “One of the most sensitive tasks for the standardization of airport infrastructure is adjudicating the role of the various standards-setting entities with interest and jurisdiction in the airport environment,” he said. “From the ISO/TC 20/SC 17 point of view, the main objective needs to be ‘not to attempt to do too much too soon’. We need to understand where the greatest

advantage in standardization may be and focus on that.” Felder says the most critical upgrades to airport infrastructure are things like improved pavement, end-of-runway arresting devices, and approaches to tackle environmental issues such as water-quality impact from fuelling, de-icing and aircraft servicing. Other important advances include digital infrastructure for surface guidance, lighting, and data collection on aircraft position on the taxiways, which is an important missing element in air traffic control.

Not all of these improvements are within the charter of ISO/TC 20/SC 17, Felder adds, but says collaboration with other organizations is necessary to ensure they are dealt with, while ISO identifies the areas that are most pressing within its sphere of responsibility.

Cleared for take-off

There’s no question that in a world of open borders and global connections, the airport sector will continue to encounter testing times. It will require a lot of juggling to make existing resources work harder and faster as demand grows relentlessly. The challenge is to manage this growth efficiently, securely and safely.

The solution is to bring an airport’s entire infrastructure up to standards and keep it there – from take-off and landing to ticketing, from the safety and security of passengers and equipment to energy and ground transport. These are complex tasks that demand International Standards.

As the airport industry continues to grow, standards will help to fix current infrastructure problems, make airports more environmentally friendly and, most importantly, turn them into places where travellers actually want to spend time.

There is a saying in the aviation community that goes: “If you have seen one airport, you have seen one airport.” This is intended to emphasize the uniqueness of each airport. Airports can, and do, vary significantly in terms of the amount of activity that takes place there and the infrastructure that is required to support that activity.

There is one thing, however, that all airports must have in common : being prepared for future growth and increasing demand, while not creating operational or safety issues for aviation. Until then, it’s “ground stop”. ■

Discover how biometric standards impact security at airports.



Airports in numbers

More than **3.5 billion** passengers travelled by air in 2015.

6.7 billion postal parcels are sent every year and air mail plays an essential role in their delivery.

In 2015, airlines transported **51.5 million** metric tonnes of goods valued at nearly **USD 6 trillion**.

World passenger air traffic (in revenue passenger kilometres) has increased by **5%** annually.

7 billion passengers are expected annually by 2034.

Nearly **10 million** people manage a fleet of **26 000** aircraft over a global network of **51 000** routes.

100 000 flights take to the sky every day and land without incident.

The aviation industry supported **63 million** jobs in 2015.

USD 5.7 trillion worth of international trade was shipped by air in 2015.

Source : IATA, SITA, ICAO



HOW TECHNOLOGY IS SHAPING OUR SKIES

by Ann Brady

From fly-by-wire to supersonic and hypersonic, technology is heralding a new age of air travel. And with the number of air passengers set to rocket over the coming decades, how are aircraft shaping up to meet the challenges of the 21st century?

Meet George Jetson! Some of you may already know him, but for those who don't, George is the head of the cartoon space-age family *The Jetsons*, "the family of the future". Briefly in the 1960s and then in the 1980s, George and his family zoomed around our TV screens in their bubble aerocar. They lived in a futuristic, push-button world of robotic contraptions and labour-saving household gadgets. And why do we need to meet George? Because the Jetsons' candy-coloured world, with all its "hi-tech" devices – from their "smart" watches for teleconferencing to their "smart" transporters, domestic robots and home computers – has turned out to be remarkably prescient. The Jetsons had their own Internet of Things; they just didn't call it that.

Fast forward to today, and in our own increasingly interconnected world we, too, like the Jetsons, think nothing about hopping on to (decidedly clunkier-looking) aircraft and zooming around the globe, from daily short-haul commutes to long-haul destinations. We want to reach our destinations quickly, as cheaply as possible and – of paramount importance – safely. And advances in the material properties used in aircraft manufacturing, which have improved and enhanced the performance and operations of aircraft, have indeed helped us to travel more quickly and inexpensively around the world. Commercial aviation is a rapidly expanding business. The International Air Transport Association (IATA) says the airline industry is progressing from carrying 3.8 billion passengers today to 7.2 billion passengers in 2035. The commercial aircraft fleet, which now numbers 100 000, has had to keep up to match demand. According to the International Civil Aviation Organization (ICAO), by 2036 about 94% of the commercial aircraft fleet will be new-generation technology.

Growing demand

One big challenge for the aviation industry is how to meet this growing demand with fuel efficiency that delivers lower carbon emissions. As the demand for air transport has grown, and with safety the predominant requirement, we have dramatically changed the way aircraft are designed, operated and powered. Aircraft are now 70% more fuel-efficient than in 2010 (IATA's Vision 2050 report). We're not in the Jetsons' league yet, but we're getting there.

The major aerospace companies are aware that, as the aviation industry continues to grow, so does their responsibility to ensure that the environmental impact is kept to a minimum. So how are the big players tackling the challenge of meeting the rapid growth in air traffic with fuel efficiency that eliminates aircrafts' carbon footprint? What steps are they taking to develop aircraft that are lighter, smarter and greener?

Composite materials play a significant role, as they enable lighter and more fuel-efficient aircraft. Take Boeing, for instance. The aerospace giant has been using composite materials in 50% of the airframe structure of its B787 Dreamliners, compared to about 5% in the original Boeing 747, from the late 1960s. And, to further underscore its commitment to a greener industry, Boeing recently commended the ICAO adoption of a carbon-offset system that will help the international aviation industry achieve its goal of reducing emissions. Boeing said: "The market-based carbon-offset system and CO₂ standard are integral to the four-pillar approach the industry is taking to stop the growth of emissions by 2020 and cut them in half by 2050 relative to 2005 levels."

Continually innovating

Of its own products and services, Boeing said it is continually innovating to improve their efficiency and environmental performance. "The 787 Dreamliner family reduces fuel use and CO₂ emissions by 20% to 25% compared to the airplanes it replaces. The 737 MAX, with first delivery expected in 2017, will reduce fuel use and emissions by 20% compared to the original Next-Generation 737."

And Airbus, another world aerospace leader, is doing its part by using innovative solutions to improve the economic efficiency and environmental performance of commercial aviation. Séverin Drogoul, Airbus Group's Vice-President of Business Improvement & Quality, says the Group's goal is eco-efficiency – building aircraft that minimize environmental effects. He said: "To meet our goals, we are looking at the whole life cycle of our aircraft, from design to manufacture, in-flight operations to end-of-life, and at each stage in the life of an aircraft we are finding the solutions to improve our environmental performance."

Drogoul says Airbus is finding solutions to these challenges through new ideas, technologies and processes. To that end, eco-efficiency is "embedded" in all Airbus product development, industrial operations and services.



Materials matter

This holds great promise for the future, but how can we be sure that the passenger – and the planet – is being best served? ISO's new subcommittee on materials, ISO/TC 20/SC18, goes some way to answer this.

The scope of the new subcommittee will cover the standardization of materials and related processes used by aircraft and engine manufacturers. As a result, designers will be driven to make greater use of International Standards, thereby reducing the use of different national, regional and company standards. As well as specifying industrial requirements for materials in the form of International Standards, the proposed standardization will consider the environmental aspects. This is intended to anticipate the obsolescence and renewal of products used by the aircraft and engine manufacturers as they are replaced by new technical solutions.

Given the accelerated emergence of new products and materials in the aviation industry, there is no better time for standardization of composite materials used by the aircraft and engine manufacturers. It will not only address the urgent need to improve technical communication within the supply chain, but also with the airworthiness certification bodies on the acceptable defects. Clearly, with the major aerospace players being competitive in all areas, the new subcommittee has a key role.

New opportunities

The aviation industry is also participating in the circular economy. Plant-based fibre products are being used to drive weight savings and increase opportunities to recycle and virtually all aircraft interior materials are now made of recycled components. Thanks to nanotechnology, aircraft cabin interiors are also lightweight and "self-freshening" so they always appear to be "new".

EasyJet, for example, was one of the first commercial airlines to use a "nano-coating" on its planes, a polymer coating that repels dirt and dust to reduce drag, cutting fuel consumption by as much as 2%.

As mentioned earlier, the Jetsons had their own version of the Internet of Things (IoT). But what will its impact be on the aviation industry today and in the future? Peter Ryan, Honorary Fellow within Australia's Defence Science and Technology Group's Aerospace Division, said: "Aviation is highly regulated, slow to introduce change, and highly focused on safety. A strong business case would be needed for a wholesale change to IoT technologies." Therefore, he sees a gradual introduction of IoT for aviation in the next five years, mainly in ground operations such as baggage handling (already in use in some airports).

The flightpath for the aviation materials sector has never been more exciting.



THE AIRCRAFT OF THE FUTURE TAKES ITS FLIGHT

RECYCLING

Today, 80% to 85% of an aircraft can be recycled.



ECOLOGY

A gentle approach to landing can save a further 100 kg to 150 kg of fuel.

FUEL EFFICIENCY

Aircraft are 80% more fuel-efficient today than the first jet aircraft.



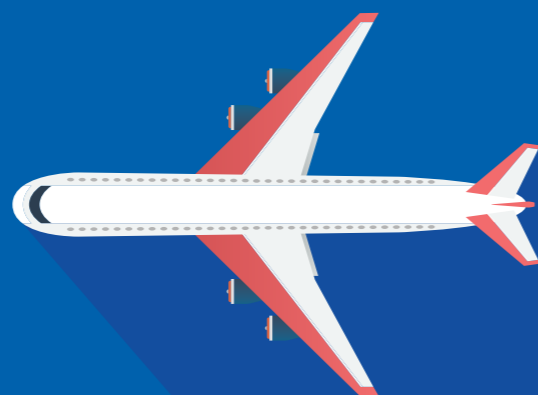
ECODESIGN

By 2036, roughly 94% of the world's commercial aircraft fleet will encompass new-generation technology.



AIRCRAFT PILOTING

Reducing take-off speed by 10 km/h to 15 km/h saves 40 kg of kerosene.



AIR TRAFFIC MANAGEMENT

Plotting the most efficient route based on aircraft and weather conditions can save over 30 tonnes of CO₂ on a single transpacific flight.



LIGHTWEIGHT MATERIALS

Each 10 kg saved using lightweight "smart" materials (for seats, trolleys, glasses, trays...) curbs CO₂ emissions by about 4 tonnes a year.



Enhancing efficiency

From 2020 to 2025, Ryan reckons IoT will play a more significant role in airline logistics and aircraft maintenance, and from 2025 to 2030, he sees IoT being introduced into flight operations to improve aircraft performance. IoT will also improve aircraft efficiency. Ryan says aircraft system monitoring will be enhanced by IoT devices providing diagnostics on performance. Modern engines, for instance, currently have up to 200 sensors; future engines could have 5000 sensors collecting vast quantities of performance data. This will enable engines to run more efficiently.

And from the safety viewpoint, Ryan says, when aircraft are connected to each other, they can avoid accidents and calculate optimal flight trajectories to reduce travel time and fuel. At present, aircraft positions are mainly monitored from the ground and only flight controllers have a full picture of where aircraft are located (although satellite tracking is now coming into play). Airlines are already using or trialling technologies such as:

- Wearable or implanted devices for aircrew recording physiological data like heart rate and blood pressure to assess workload
- Sensors embedded in seats informing flight staff about passenger experience and providing data for future improvements in technology (such as the quality of entertainment) and in-flight service (for example, quality and timing of meals)
- Smart luggage with GPS tracking and IoT sensors for transmitting locations to speed airport processes

Ryan adds that IoT devices could also enhance piloting skills, giving instant feedback not only on the pilot's own aircraft's position and status but also on nearby vehicles. They can also give advance warning of extreme weather risks.

Pushing boundaries

As it happens, Boeing celebrated its hundredth anniversary in 2016. In the July 2016 issue of *Frontiers* magazine, Boeing painted its own vision for the next hundred years, a vision based on "our spirit of adventure and continuous desire to explore the universe". Brian Tillotson, Systems Technology Chief Engineer at Boeing Research

and Technology, envisions a space colony for families of the future. "It's really about how you do the plumbing, mow the grass and raise and educate children in that environment." Remind you of anyone?

Another colleague, Kevin Bowcutt, Boeing's Chief Hypersonics Scientist, says he is determined to build a hypersonic aircraft, which can traverse the globe in a few hours. He says it would fit perfectly into what he says will be our perfectly automated world. "You could type in 'Paris' on your mobile phone and an unmanned car comes to your house, your phone beeps and you go out and hop in. It takes you to the airport and it takes out your luggage and you get on an airplane or some hyper-tube-type thing that takes you across the ocean."

Looking skywards

Airbus has also been busy working on its vision for the future. As Drogoul points out, by 2030, 60% of the world's population will live in cities, which is 10% more than today. Traffic jams will become even more horrendous, taking a huge toll on the economy. To tackle this challenge, it's no surprise that the experts at Airbus are looking skywards "to develop radical concepts that will relieve urban congestion". Working with A3, its innovation outpost in, where else, Silicon Valley, Airbus is pursuing a project called Vahana, which Drogoul describes as "an autonomous flying vehicle platform for individual passenger and cargo transport".

And Sir Richard Branson, the Virgin Group founder, announced recently that he was planning new supersonic passenger flights across the Atlantic, unveiling a prototype aircraft that can fly London to New York in three-and-a-half hours. He has joined up with Boom, a Denver-based start-up company. Blake Scholl, the founder and CEO of Boom, said: "Sixty years after the dawn of the jet age, we're still flying at 1960s speeds. Concorde's designers didn't have the technology for affordable supersonic travel, but now we do."

From fly-by-wire to supersonic and hypersonic, the flightpath for the aviation materials sector has never been more exciting. So, settle back, fasten your seatbelt and prepare for take-off. You might just find George Jetson in the next seat. ■



Geneva

soars to new heights with ISO 55001

Following a long and intensive effort to improve the performance of its infrastructure, Geneva's international airport achieved ISO 55001 certification, thereby enabling it to streamline its expenditure, strengthen its credentials and future-proof its facilities. We spoke to the Geneva airport team to find out more.

Genève Aéroport is a major piece of infrastructure linking the Geneva region to the rest of the world.

Asset management can be a powerful weapon in a company's arsenal for saving time, money and lots of executive headaches. Using ISO 55001, Geneva's international airport rolled out a model for asset management and, today, is soaring to new heights. It is the first airport in continental Europe and the second Swiss company to become certified to ISO 55001.

Nearly every organization needs or wants to achieve more with its assets, not only how to minimize downtime or lost production, but also how to spend money well to deliver added value. Tangible results of an asset management system include improved control of day-to-day activities and business efficiencies, reduction of risk-related costs, compliance in regulatory activities and reduced failure rates.

The airport, which operates under the name of Genève Aéroport, reinforced its credentials among airlines that see ISO 55001 as solid evidence of an airport's reliability to handle increased passenger throughput while staying profitable and maintaining safety – giving the hub a competitive advantage when opening new air routes. In an interview with *ISOfocus*, the Geneva airport team¹⁾ in charge of the ISO 55001 project shares its main findings on the journey to certification and the airport's readiness to meet the air traffic demands of tomorrow.

***ISOfocus*: Genève Aéroport was awarded the ISO 55001 certification for the high-quality management of its technical assets and infrastructure. What does this mean?**

Achieving certification was not the ultimate purpose for implementing the asset management requirements according to ISO 55001. The approach taken by Genève Aéroport was to focus on improving our asset management practices, methods and processes. The airport sought certification once its eligibility had been fully acknowledged on the basis of the maturity level that had been reached. Certification came as a reward for the progress made, confirming the relevance of the initiatives and projects we had undertaken since initiating the process. It is also a credit to the efforts made day in and day out by all players across the airport to provide adequate and sound management of the airport's assets in accordance with the Genève Aéroport Charter, its stakeholders' expectations and the regulations governing airport activities.

What attracted you to ISO 55001?

We became interested in asset management long before ISO 55001 came into being. Our early forays in this area began with PAS 55, which offered generically applicable good practices in the optimized management of physical assets through a structural framework and a continual improvement model. Established in 2004 by BSI, ISO's member for the United Kingdom, this publicly available specification was one of the base documents that served as the foundation for the ISO 55000 series of International Standards, developed under the auspices of ISO.

1) Ilham Hikmi, Industrial Asset Manager; Nicolas Gaspoz, Infrastructure and Planning Manager; Guy Marguet, Head of Projects and Methods Coordination.



Genève Aéroport expects 25 million passengers by 2030.

The advent of ISO 55001 in 2014 captured our attention as it promised broader applicability of the standard to all types of physical and non-physical assets and the international seal of the ISO label. The transition to the new standard was a logical continuation and well warranted by the consistency that existed between the two standards (PAS 55 was one of the base documents used in the development of ISO 55001, with many of its concepts informing the set of requirements of the ISO standard) and the ease with which we were able to switch from one to the other.

What are, in your opinion, the benefits of the standard?

The primary goal of our asset management initiative in Genève Aéroport was to improve existing practices within a structuring and structured framework that would guarantee the sustainability of our facilities for decades to come. ISO 55001 lets us achieve this objective while meeting the needs and constraints in terms of cost, operation

and regulatory requirements. Airport and aviation activities possess their own specific challenges, in particular as regards the complexity and prevalence of the notion of risk as it pertains to security and safety.

Traditionally, decisions are a trade-off between cost and performance, but integrating risk in order to achieve a more balanced scorecard is more appropriate to our context and activities. In addition to the cross-functional aspect and other requirements of the standard, the above-mentioned elements will allow us to strengthen the legitimacy of our actions from top management right through to their execution at ground level and vice versa.

Can you explain what the management of your technical assets and infrastructure involves?

Genève Aéroport is a major piece of infrastructure linking the Geneva region to the rest of the world and it must contribute to the economic, social and cultural development of its catchment area.

The region's growth is a real opportunity for the airport, whose proximity to the city of Geneva has greatly contributed to the area's international profile. At the same time, it offers a range of services, through its infrastructure and assets, in a highly specialized context fraught with space and regulatory constraints that can limit its operational flexibility.

These challenges will be even greater in the future due to the increased demand (25 million passengers are expected by 2030), more stringent quality standards and requirements, and the developments in risk mitigation. In this context, airport managers – in particular, asset managers – must always be on the look-out for clever, innovative and optimal solutions that meet both our short- and long-term needs for infrastructure and assets in compliance with applicable standards, while ensuring sound financial management.

Can you give some concrete examples of achievements or improvements made possible by the standard?

ISO 55001 is relatively recent. So, although our work in this field began in 2012, we didn't make the transition to the new standard until 2014. That said, we are already seeing notable improvements. As regards asset knowledge, first of all, we now have a structured asset register identifying all the assets under our management. This first step will be followed by the creation of an integrated asset reference plan.

Our asset management implementation strategy based on ISO 55001 focuses on processes and methodologies. This enables us to improve our decision-making process by introducing trade-offs at each life-cycle stage. Criticality analysis has enabled us to identify our most critical asset systems and we are now in a position to create an appropriate management plan. By way of example, our baggage handling system has been examined in terms of operational and financial performance.

As part of a major project, life-cycle costing (LCC) has enabled us to identify the impact of infrastructure costs on aviation charges and constitutes a more advanced basis for a financial profitability analysis. As regards the operational aspect, a programme is underway to improve measures for system performance monitoring. Similarly, an operational availability analysis of our retractable boarding bridges and de-icing system helps improve the way our associated level of service is perceived and enables us to adapt and optimize our maintenance plans with greater accuracy.





The aforementioned benefits were obtained thanks to the involvement of players with various functions and areas of expertise, both internal and external. Synergies and shared interests are identified and working groups are formed on specific subjects. Future work will undoubtedly strengthen interdepartmental collaboration.

What are the important areas you will be working on in the near future?

Our efforts to improve our asset management system paid off around mid-2016 when we were awarded the “initial” certification to ISO 55001. This is the first step, which recognizes company competence backed by an implementation and development plan. For Genève Aéroport, accessing the next steps on the maturity scale means, firstly, implementing an improvement plan based on the audit results and, secondly, adapting and implementing the 2017-2018 asset management plan.

At the same time, we will continue to fine-tune our methods and processes to further integrate the asset management system into the company’s overall operation. Key areas for development, now and in the future, include expanding our asset register in line with asset costing, creating an asset reference plan, improving performance indicators, optimizing maintenance costs and integrating airport planning, and prioritizing investments.

Airports are enterprises with a high asset value that operate in a complex environment.

In what way do airports benefit from using ISO 55001? What advice would you give to those that are not using it yet?

Airports are enterprises with a high asset value that operate in a complex environment comprising diverse business activities and systems, and subject to strict requirements in terms of risk mitigation. They have to meet exacting, sometimes restrictive, international regulation as well as the increasing need to optimize costs while maintaining the highest levels required by quality standards.

Because an airport’s activity is highly dependent on the state of its infrastructure and assets, any malfunction or deterioration, especially of its most critical assets, is a potential risk to the fluidity and continuity of operations. This could even lead to operations coming to a halt, with the negative or disastrous repercussions this would have for the “passenger

experience” and the airport’s image as a whole.

Having an asset management system in place according to ISO 55001 reduces uncertainties and contingencies because the standard requires the implementation and monitoring of an asset management plan. This must be aligned with the enterprise’s activities and strategic objectives based on a good knowledge of its assets – and their current and future condition – and the integration of a risk/cost/performance balance. Some airports have already adopted similar approaches in response to targeted problems. Others are thinking of using ISO 55001 but have not yet taken the plunge. Having said that, there is no denying the interest of European airports in certification and Genève Aéroport has already received the visit of several specialists from airports wanting to find out how we went about implementing the standard. ■

ISO AND SAE INTERNATIONAL IN COLLABORATION DRIVE

ISO and SAE International have announced an agreement to develop technical standards for road vehicles and intelligent vehicle systems. The new Partnership Standards Development Organization (PSDO) cooperation will apply in two areas: road vehicles (ISO/TC 22) and intelligent transportation systems (ISO/TC 204).

"This important agreement is a response to the transformational changes taking place in many global industries, including mobility engineering. Increasing technological complexity must be addressed through collaborative efforts in standardization to avoid duplication and reduce cost across the global network of automotive business partners," said David L. Schutt, CEO of SAE International. "We look forward to a successful collaboration with ISO."

Standards highlighted for joint development include those related to wireless charging, vehicle interoperability, automated vehicle-level definition and automotive cyber security. Their development will consider both SAE and ISO processes for balloting and approval. In addition, the standards developed will benefit from the combined expertise of ISO and SAE and optimize stakeholder resources, making the standards more effective and relevant to the market.

"ISO's aim is to bring together experts to share knowledge and develop market-relevant International Standards to provide solutions to global challenges," said ISO Acting Secretary-General Kevin McKinley.

INSPIRING INNOVATORS: DARE TO DREAM BIG

They are flying across oceans without fuel, giving ordinary people "super strength" and growing crops in the desert. A new series of ISO videos looks at these inspiring feats and how standards helped our greatest innovators push the limits and reach new places.

Solar impulse – Nobody thought that, one day, we would fly airplanes powered only by the sun. Yet this is exactly what Solar Impulse has achieved, breaking record after flight record.

Discover how standards were instrumental in helping this team of 180 people work together. "Without [standards] we would never have been able to understand each other," says André Borschberg, pilot and co-founder of Solar Impulse.

Cyberdyne – People with gait disorders may no longer be confined to wheelchairs thanks to an innovative wearable cyborg-type robot from Cyberdyne. The Japanese automation company has also developed a robot that can give ordinary people "super strength", by protecting our backs so that we can lift heavy loads in safety. Learn about the ISO standard that played a key role in allowing this unprecedented innovation to reach new markets. "ISO is very important for promoting new designs," says Prof. Yoshiyuki Sankai, founder and CEO of Cyberdyne, "we couldn't have done it without ISO".

Netafim – Could drip irrigation be the answer to solving water scarcity, desertification and food security? Find out why this company thinks it might be. But to make this water-saving technology available to all, standards are needed. "The developing world deserves to get the best, and the best is achieved if you follow the standards," concludes Netafim Chief Sustainability Officer Naty Barak.



Discover our ISO videos:



From top left to bottom right: **John Walter**, ISO President-elect, **Scott Steedman**, ISO Vice-President (policy), **Piet-Hein Daverveldt**, ISO Vice-President (technical management) and **Bronwyn Evans**, ISO Vice-President (finance).

NEW OFFICERS TAKE THE HELM

ISO is pleased to welcome four new officers at its helm, who will take up their posts as of 1 January 2017.

John Walter (Canada) has been appointed President of ISO for the 2018-2019 term and will serve as President-elect in 2017. He was Vice-President (policy) from 2014 to 2016. John is currently, at the national level, Chief Executive Officer of the Standards Council of Canada (SCC), Canada's member body to ISO.

Scott Steedman (United Kingdom) has been appointed ISO Vice-President (policy) for 2017. He has worked widely with standards during his career and is currently Director of Standards at BSI, ISO's member for the United Kingdom. Scott is a Board Director of the BSI Group and recently completed six years as a non-executive Director on the Board of the Port of London Authority.

Piet-Hein Daverveldt (The Netherlands) has been appointed ISO Vice-President (technical management) for the 2017-2018 term and served as ISO Vice-President elect (technical management) in 2016. He is currently the Managing Director of the Royal Netherlands Standardization Institute (NEN), ISO member for the country, and has held this position since 2012.

Bronwyn Evans (Australia) has been appointed ISO Vice-President (finance) for the 2017-2018 term. She is CEO of the ISO member in Australia, Standards Australia. Bronwyn has over 30 years' experience as a leading business executive in the fields of medical devices, engineering education, standards development and power generation.

For the complete biographies, please see www.iso.org.

FRAMEWORK FOR CREATING GLOBAL ADDITIVE MANUFACTURING STANDARDS

ISO and ASTM International have jointly crafted the Additive Manufacturing Standards Development Structure, a framework which will help meet the needs for new technical standards in this fast-growing field. Additive manufacturing (AM), also known as 3D printing, is the process of joining materials layer upon layer, as opposed to "subtractive manufacturing" methods such as machining.

"This coordinated approach to standards development in AM is crucial to building out robust standards at all levels," said Jörg Lenz, Collaborative

Projects Coordinator at Electro Optical Systems and Chair of ISO technical committee 261 on additive manufacturing (ISO/TC 261). "Standards developers can see how this new structure allows them to come together, leading to further innovation in fields like aerospace, medical, and automotive, and also other benefits such as a platform for certification activities."

This structure was jointly approved by F42 and ISO/TC 261 after a July meeting in Tokyo. This reflects progress under the Partner Standards Developing Organization agreement signed five years ago between the two globally-respected standards development organizations. In creating this document, both groups reviewed past, existing and planned standards development efforts.



REDUCING INSURANCE LOSSES WITH STANDARDS

Can the use of ISO standards help manage risk for the insurance industry? That was the issue under discussion at the stakeholder forum organized in London by ISO's Committee on conformity assessment (CASCO). Moderated by *Evening Standard* correspondent Anthony Hilton, the event included international speakers from Zurich, Mitsubishi Corporation, INAIL, Intertek and WADA as well as UK-based experts from Z/Yen Group, Liberty Global, Pyrology and Howden Insurance Brokers.

The conclusion? There are clear positive benefits from the use of standards, emphasized participants from industries as diverse as anti-doping laboratories and car manufacturers. For example, according to

Mr Takahiro Ono of Mitsubishi Corporation Insurance, accredited certifications of business continuity systems following ISO 22301 and ISO 22313 resulted in more attractive loans and insurance premiums from the Development Bank of Japan.

By encouraging firms to build resilience and control risks, the bank could better manage its risk exposure. Matt Baker, for his part, explained why Howden Insurance Brokers set up a scheme for UKAS-accredited organizations. With robust standards in place, and a clear process for demonstrating conformity, the company can offer discounts on premiums and enhanced policy coverage.



ICAO's flight plan takes off

Air transport has become essential to our global society. In fact, it would be difficult to envisage a world without aviation. Here, Fang Liu, Secretary-General of ICAO, looks at the industry's recent developments and unveils the plans to tackle the future.

The air transport industry has roughly doubled in volume every 15 years.

Air travel around the world has seen a marked change in the way the aviation industry functions. From its inception, when flying was considered a risky proposition, air travel has now emerged as the preferred means of transportation for long distances between major cities.

The number of passengers passing through the world's airports has grown while the real cost of flying has fallen by 60% over the last 40 years, making it more accessible to more people. During the same period, aircraft have become more energy-efficient and quieter.

In the midst of all this, technology and strict compliance with standards have helped the International Civil Aviation Organization (ICAO) to weather the storms and ensure continuous improvement in air transport safety and security. Can this be sustained given the growth in air traffic and environmental pressures?

ISOfocus caught up with ICAO's Secretary-General, Fang Liu, to discuss how air travel has transformed over the years. Here, Fang Liu looks at how the industry has met the challenges of the recent past and unveils ICAO's new measures to meet the challenges of the future. Above all, she explains why collaboration and partnership with ISO is of such vital importance in building a resilient global security framework.

ISOfocus: The air transport sector today carries more than 3.5 billion passengers and 51 million tonnes of freight annually, and it is expected to grow significantly in the years ahead. To what extent is ICAO addressing these future needs and what role are ISO standards playing in ICAO's efforts?

Fang Liu: The air transport industry, both in terms of passengers and freight, has roughly doubled in volume every 15 years over the last half century. This has been despite various economic slowdowns, pandemic crises, wars, or security crises such as 9/11, and we have no reason to expect anything different over the next 15 years.

If you add to that the fact that we are safer and more efficient as a global network than we have ever been, by any measure – and certainly when rated against other forms of transport – it is clear that a continuous improvement process is being undertaken.

Many of these gains have been brought about by improved technology and a universal compliance with strict standards, which cover all aspects of aviation design, manufacturing and operation. There are some strict safety and security regulations and other standards which are generated by ICAO itself, standards that member states bring to our attention from their own processes. At the same time, industry-specific standards organizations, such as SAE International, the Radio Technical Commission for Aeronautics (RTCA) and the European Organization for Civil Aviation Equipment (EUROCAE), develop specialized aviation technical specifications. Other standards-making organizations, such as ISO, develop more important generic standards, which we all comply with. These all come together as parts of the total system that is realizing such good results today.

For the future, we can expect much more of the same continuous improvement. While air traffic is increasing, the available airspace and airport capacity is not. This means we need to find new ways to enhance the performance of the system to accommodate smaller distances between aircraft in a wide range of scenarios, while maintaining or improving our current safety records.

The good news is that we have a plan for that called the Global Air Navigation Plan and, within that plan, there are a wide range of aviation system block upgrades – or ASBUs, as we refer to them. In each of those ASBUs, you can find the necessary upgrade roadmaps with respect to technologies, procedures, training and, of course, the standards that will be required.

ISO already has an Unmanned Aircraft Systems Committee up and running (ISO/TC 20/SC 16), which will provide vital standards for the future implementation of remotely piloted aircraft operating in non-segregated airspace, one of the key ASBUs in the Global Air Navigation Plan.

Aviation safety is a team sport and international cooperation is absolutely essential.



Fang Liu, Secretary-General of ICAO.

Aviation is one of the fastest-growing sources of greenhouse gas emissions. What action is being taken by ICAO to reduce aviation emissions and develop measures with a global reach?

The year 2016 has, in fact, been the most historic in aviation's history in terms of progress on emissions reduction from our sector. International aviation presently contributes 1.3% of global anthropogenic carbon dioxide (CO₂) emissions, but we also recognize that our sector continues to grow given its much appreciated contributions to global trade and the socio-economic objectives of many states and regions.

Most importantly, ICAO forged historic and pragmatic consensus on a new global market-based measure (GMBM) to mitigate international flight emissions, namely the Carbon Offsetting and Reduction Scheme for International Aviation, or CORSIA.

CORSIA is a world first for any industry sector. And while some had presumed that our states would agree to it only in principle and not in practice, we were greatly encouraged at our 39th Assembly when states representing more than 86% of international traffic proactively volunteered to participate in the scheme from its earliest pilot phase.

In early 2016, ICAO also developed and recommended a new global CO₂ standard for aircraft. This is the first CO₂ emissions standard for any industry sector, and with the 39th Assembly welcoming this development, we can now look forward together to a greener generation of aircraft entering service as of 2020.





More than 2000 delegates attended ICAO's 39th General Assembly in Montreal, Canada.

I would note that these developments serve to complement the progress already being achieved by air transport under the Basket of Measures which our member states agreed to pursue at our 37th Assembly, in 2010, to begin limiting aviation-related emissions. This includes four elements, namely: new and innovative aircraft technologies; streamlined operational improvements to reduce aircraft noise and fuel burn; the wider deployment and use of sustainable alternative fuels; and the recently agreed GMBM which will now complement the progress being made in all other areas.

These measures were seen as the primary means by which the international air transport sector would seek to achieve its aspirational goals, also agreed through ICAO, of a recurring 2% annual fuel efficiency improvement and carbon-neutral growth from 2020. Each category of measures has already made important contributions, which are helping aviation to surpass its 2% annual target, while still holding out potential for further emissions reductions in the years ahead.

The first ever Global Aviation Safety Plan was designed to serve as a strategic coordination tool. Where do you see the role of international cooperation and ISO standards with respect to ICAO's safety priorities?

Aviation safety is a team sport and international cooperation is absolutely essential to effect any enhancements to the system. The Global Aviation Safety Plan acts as the blueprint to make that happen. It identifies where our areas of weakness might be in the system and steers us in the direction to make effective improvements.

For example, in some areas we still need to focus on compliance with the current safety standards to gain those improvements, whereas in others we need to transition to a performance-based model that requires the implementation of safety management systems and state safety programmes to effect the necessary incremental changes to risk profiles.

Again, international cooperation between all the industry players is essential and ISO is an integral part of the team. For example, the commonly known ISO 9000, *Quality management systems – Fundamentals and vocabulary*, is a critical element in our requirements for the provision of aeronautical information services at the compliance level and its provisions are also instrumental in giving us the robust data that is needed for the integrity of safety management systems.

ISO has been a very close partner in some of ICAO's most important contributions.



A global market-based measure for international flight emissions was signed at ICAO's 39th General Assembly. From left: ICAO Secretary-General Fang Liu, ICAO's 39th General Assembly President, Azharuddin Abdul Rahman, and ICAO's Council President, Dr Olumuyiwa Benard Aliu.

A major factor threatening security, not only in the skies but also on the ground, is acts of terrorism against civil aviation. How successful has ICAO been in this regard?

We have been very successful and, in many respects, ISO has been a very close partner in some of ICAO's most important contributions to a more resilient global security framework. I would also stress that our 39th Assembly has asked ICAO to fast-track the development of a new Global Aviation Security Plan.

In travel document standardization, the technical specifications sections of ICAO Doc 9303, *Machine-Readable Travel Documents*, have received the endorsement of ISO as ISO/IEC 7501, *Identification cards – Machine-readable travel documents*.

This endorsement is made possible by means of a liaison mechanism through which manufacturers of travel documents, readers and other technologies provide technical and engineering advice to the ICAO Technical Advisory Group on the Traveller Identification Programme (TAG/TRIP) under the auspices of ISO/IEC. Through this working relationship, the ICAO specifications have achieved, and are expected to continue to receive, the status of worldwide standards by means of a simplified procedure within ISO.

The ICAO liaison mechanism with ISO has been successfully applied not only to the endorsement of new specifications for travel documents as ISO/IEC standards, but also to the approval of amendments to the specifications. Subsequent revisions to Doc 9303 will, therefore, be processed for endorsement in precisely the same manner.

This arrangement between our two organizations has been in place since the 1980s and has been fundamental in underpinning the development and maintenance of the heavily relied on international ICAO specifications for machine-readable travel documents.

With some 12000 standards and recommended practices covering safety, air navigation, security, environmental protection and many other areas of air transport activity, ICAO continues to actively collaborate with ISO as a liaison member to many of its committees (since 1989). How would you describe this collaboration?

I would describe this collaboration as a partnership. Each organization has a different role to play but both are absolutely critical to the total system. ICAO cannot operate as a stand-alone standards-making organization and would be out of its depth in terms of both capacity and capability where the subject matter entrusted to other standards-making organizations is concerned.

We have an Aviation Standards Roundtable that is intended to make sure that the different organizations are coordinating their work efficiently, and to ensure we aren't leaving any gaps unaddressed concerning the standards required to deliver the ASBUs, our travel document provisions and other aviation initiatives.

Partnerships are essential to almost everything we do in ICAO and it is worth reiterating that cooperation has been the hallmark of our progress in international civil aviation since ICAO was established in 1944. ■

Mexico aims high to boost aerospace

The dynamic growth of Mexico's aeronautics industry has placed the country on track to become an international leader of its field. Here, Jesús Lucatero Díaz, Deputy General Director of Operation at DGN, ISO's member for the country, says the sky's the limit for Mexican aerospace.

MEMBER EXCELLENCE



Photo: DGN

Jesús Lucatero Díaz, Deputy General Director of Operation at DGN.

With an average annual growth of 17.2% in the last ten years, Mexico's aerospace and defence (A&D) sector is set to rank among the top aerospace suppliers by the end of the decade. Development in the industry owes much of its momentum to a network of regional clusters – partnerships connecting in the same confined space, such as an industrial park, producers, research and development, design and engineering, universities and technical schools. Around 300 aerospace companies and support entities operate across five Mexican states, employing more than 45 000 high-level professionals. Most are certified to AS9100 and NADCAP for quality management systems in the aerospace industry. If all goes to plan, in years to come, Mexico will be the anchor of a bustling aerospace industry capable of handling the

entire aircraft cycle, from the design and engineering of airframe and engine to their development and final assembly, followed by aircraft maintenance, recycling and/or refurbishment at end-of-life. The Mexican Federation of Aerospace Industries (FEMIA) predicts there will be 450 companies working in the field by 2020, representing 110 000 jobs and over USD 12 billion in export sales. As the country's aerospace supply chain continues to develop, there will be many opportunities for companies to become part of the North American Free Trade Agreement (NAFTA) market. Mexico is the NAFTA country with the lowest-cost services and reaps great logistical advantage from its geographical proximity to the United States, the top market for commercial and military aviation, which enables companies

operating on Mexican soil to successfully compete in the NAFTA region and worldwide. As Mexico strives to consolidate its place as a global aviation hub, Jesús Lucatero Díaz, Deputy General Director of Operation at DGN, ISO's member for the country, tells of the country's ambition to establish itself as a nucleus of strategic added value for the global aerospace industry.

Building strategies

The next stage of development in Mexico's A&D industry will focus on creating regional strategies by identifying and promoting the production "vocations" of the country's different aerospace clusters. These strategies seek to develop poles of competitiveness by combining and harmonizing existing capabilities, specificities and industrial niches.

As a government agency, we believe we must contribute to the development of International Standards – over and above the existing NADCAP and AS9100 certifications – that open opportunities to companies with industry potential. To this end, DGN recently joined ISO technical committee ISO/TC 20, *Aircraft and space vehicles*, which gives us access to international best practice in the field, while sharing the outcomes of our budding aerospace hub with potential customers, technical experts and stakeholders. Our Mexican Space Agency (AEM), established in 2010, serves as coordinator of ISO/TC 20 and contact point between the industry and higher education and research institutes.

Living labs

Standards provide a natural safety net for the aeronautics business, so Mexican stakeholders are keen to promote those areas of standards development that have the greatest impact on the safety and reliability of aerospace products, such as management responsibility, quality systems, design control, product traceability, inspection and testing, and non-conformity issues, among many others.

The AEM has a National Space Activities Programme, which focuses on five major strategic areas related to standardization, namely:

- Industrial and business development and competitiveness in the space sector
- International affairs, standards and security space issues
- Scientific research and space technological development
- Financing, organization and information technologies on space issues
- Human capital training in the space field

Each area defines goals, strategies and a course of action. Some of the projects involve the establishment of an international standards framework that will help Mexico improve its national practices for the standardization and certification of products, testing and technology development.

There are also plans to establish standardization laboratories, as part of the National Center for High Technology

Certification and Standardization, which should help strengthen business competition in the space sector, obtain international certifications and Mexican adoptions (NMX), establish certified laboratories and train up human resources.

An enviable location

Mexico's privileged manufacturing can be partly credited to geography and the fact that our country has a common border with the United States, one of the largest markets in the world. Today, the US is low on human capital, which has opened opportunities for Mexico to become a strategic partner in the A&D industry. More importantly, budget cuts in the US have forced many aerospace companies, especially those under contract with the US government, to seek more competitive options abroad.

These circumstances have created highly competitive aerospace poles that operate in a certified ecosystem. The Bilateral Aviation Safety Agreement (BASA) with the US is a clear example. It allows the Directorate General of Civil Aeronautics (Dirección General de Aeronáutica Civil, DGAC) to certify parts, components, aviation systems, even a full aircraft, which is manufactured and/or assembled in Mexico and exported to the US or other markets according to the relevant regulations. Mexico has reached the tipping point, which has placed it as a reputable and affordable alternative for the aerospace sector. This comparative/competitive advantage has also made it an ideal place to produce dual-use goods and restricted technologies, i.e. products and services that have both civilian and military applications. A regulatory framework now exists to ensure the responsible use and final destination of sensitive goods produced in Mexico by aeronautical manufacturers.

Universal aspirations

The growth of the Mexican aerospace industry has been unprecedented, especially in the last decade. By 2014, the industry's exports had reached USD 6.366 billion and are on target to achieve USD 12.26 billion in 2020 (an average annual growth of 14%), according to the Strategic Program of the Aerospace Industry 2010-2020 conducted by our Ministry of Economy. Currently, 72% of the companies working in the A&D industry in Mexico are manufacturing companies, a figure to be slightly eroded by the stronger growth of maintenance, repair & overhaul companies (11% to 14%) by 2020.

These impressive statistics are sure to attract investors. Mexico's fledgling space agency has devoted considerable effort to international collaboration and signed agreements with space agencies and private companies around the world. But the AEM will not be sending astronauts into space or building its own rockets. Rather, its goal is to help the country develop a space policy and stimulate investment in aerospace by choosing technologies where it can develop expertise – so that Mexico can compete at the global level within ten years. ■



We look forward to increasing our collaboration with ISO.

Clear skies ahead for China's aviation industry

Amid fears of an economic slowdown in China, there is one sector that is spreading its wings. The Chinese aviation industry has continued to enjoy sustained growth following the global financial crisis of 2008.

The state-owned Commercial Aircraft Corporation of China Ltd. (COMAC) is building China's first 168-seat narrow-body aircraft C919, which is scheduled to make its maiden flight in early 2017. The ambitious project is part of President Xi Jinping's master plan "Made in China 2025" to take the country from world manufacturer (of shoes, toys and electronics) to aviation superpower. According to the first ever 20-year passenger growth forecast¹⁾ released by the International Air Transport Association (IATA) in 2014, the country is poised to surpass the United States as the world's largest aviation market, with passenger numbers reaching 7.3 billion by 2034.

The industry's success is largely driven by economic factors. Living standards have a known effect on the propensity to fly and China's nascent middle class is spearheading the travel boom with over a hundred million outbound tourists. Airbus' 2016-2035 Global Market Forecast estimates the country will need

around 6000 new passenger aircraft and freighters in the next two decades, for a total market value of USD 945 billion, to meet the rising demand.

But the country is also looking to International Standards to realize its ambition. Global aviation is a complex system of interacting elements, many of which require regulations based on global standards to function optimally. Here, Mr Gu Xi, Deputy Director of the China Aero-Polytechnology Establishment (CAPE), an aerospace standardization and research organization, tells us why he believes ISO standards will give Chinese aviation the wings to fly high.

Putting safety first

China is today an acclaimed global leader in air safety. It is universally accepted that air transport must be premised on "prevention first", with standards aiming to tackle the growing incidence of air collisions around the globe. With this in mind, the Chinese government, airworthiness authorities and airline companies have enforced rigorous compliance with standards that ensure the safety, comfort and economy of aviation operations in all aspects of production, operation and management.

1) The report by the new IATA Passenger Forecasting Service, which analyses passenger flows across 4000 country pairs for the next 20 years, forecasts passenger numbers by way of three key demand drivers: living standards, population and demographics, and price and availability.

China's nascent middle class is spearheading the travel boom with over 100 million outbound tourists.



By implementing national and international standards that span the entire aircraft production process, our aviation industry is developing a more harmonized and sustainable approach to safety. For example, the Advanced Regional Jet ARJ21, China's first passenger aircraft to be produced in strict accordance with international airworthiness regulations, was developed using thousands of standards, including ISO standards. It has just been granted its airworthiness certification.

Apart from the tangible efforts related to the physical safety of aeronautical equipment, human and environmental factors have also been gradually incorporated beyond the aircraft itself (fuel efficiency, aircraft maintenance, carbon emissions trading). To benchmark their approach in these and other aspects of an aircraft's performance, many Chinese airlines have chosen ISO 9001 (quality management) and ISO 14001 (environmental management), building upon the synergies between quality and environmental systems.

To synchronize links between the domestic and international systems of safety regulations, we are now working closely with international and foreign standardization bodies to develop open, state-of-the-art standards that will guide research and development (R&D) in aviation equipment and aircraft operation. Meanwhile, with the help of SAC, ISO's member in China, we are putting together an Aviation Standardization Plan to promote our own Chinese aviation standards at the international level.

Flying international

China's status as the world's second largest economy has long been mismatched by its low-level position in standards development. That's why the Chinese government has recently begun to bridge the gap by reforming its national standards system and leveraging the power of international standardization. Linking our national standards regime to the international arena represents a critical step in forcing local aircraft manufacturers to upgrade and adapt to the rigours of airworthiness certification in world trade.

A true breakthrough was achieved in the realm of civil aviation standards with the Chinese-proposed ISO 12384, *Aerospace – Requirements for digital equipment for measurements of aircraft electrical power characteristics*, which became the new benchmark for the digital equipment measuring of aircraft electrical powers. For the first time in Chinese civil aviation history, its national code is universally acknowledged as the best candidate for other aviation authorities in terms of reference and practical implementation.

ISO standards have featured prominently in Chinese aviation. Alongside the C919, Chinese aircraft projects such as the ARJ21 regional jet, the turboprop MA700, the "flying boat" AG600 (reportedly the largest amphibious aircraft currently being

built) and China's biggest civilian helicopter, the Avicop-ter AC313, all incorporate ISO standards for terminology, aerospace fluids, common parts, avionics, materials and test methods at every stage – from design to final assembly to testing, and beyond. What's more, according to SAC/TC 435, China's national committee on aircraft, the country has adopted – or is about to adopt – ISO 1151 (flight dynamics), ISO 5843 (aerospace terminology) and over 40 other standards by ISO/TC 20, *Aircraft and space vehicles*, as Chinese national standards.

China's contribution

To help its domestic enterprises get the latest in advanced manufacturing and R&D, China is speeding up cooperation with countries at the cutting edge of aeronautics. In particular, the CAPE, the secretariat of ISO/TC 20's Chinese mirror committee, is helping to formulate coherent national positions for the country.

As the sole organization in China dedicated to research in aviation standardization, CAPE is helping the industry to understand and deploy relevant and essential International Standards and has been actively cooperating with standards organizations to promote the development and implementation of standards, nominate Chinese experts to ISO technical committees and encourage Chinese enterprises to get involved in standards development.

We are keen to increase our contribution to the activities of ISO/TC 20 and its different subcommittees in the areas of

advanced composite materials, high-end standard parts, basic and structural elements, smart manufacturing, green energy, emission and noise reduction, civil unmanned aircraft systems, and many others. Two standards currently in development are ISO 20949 (smart contactors for aircraft) and ISO 21895 (categorization and classification of civil unmanned aircraft systems).

Winners all round

China still has plenty to learn from the international aviation community in such fields as basic technology, aviation equipment R&D and aircraft operation services and is working hard to be recognized as a full participant in globalized standards development. Gradually, our country can be expected to have more sway in the standards world, not simply because of the rapid expansion of its airlines, infrastructure and aviation market, but because of a growing standards-setting ability learned through indigenous innovations and foreign collaboration. I fully envisage an open, state-of-the-art standards system to be in place by the end of 2020 to meet the development needs of Chinese aviation equipment.

In the meantime, China will continue to adopt international and foreign standards while promoting its own technical standards at a high level to benefit the world economy. We look forward to increasing our collaboration with ISO, for the mutual advancement of Chinese and international aviation. ■



NEWLY UPDATED ICS (INTERNATIONAL CLASSIFICATION FOR STANDARDS)

The system used to classify ISO standards has changed to better reflect new fields of work and industrial, technical and scientific progress. The International Classification for Standards (ICS), a system for organizing standards into sectors and subsectors, is used by ISO at the international level, and by many regional and national bodies publishing and distributing standards, to find the documents they are looking for.

As the industries covered by standards evolve continuously and new technologies emerge, it is also necessary to

evolve the ICS. Many new categories have been introduced – such as nanotechnologies, governance and ethics, forensic science and biofuels – which reflect new work or a growing body of work in those sectors.

The revision of the system was undertaken by a group of ISO members, the IEC and CEN/CENELEC, under the leadership of DIN, ISO's member for Germany, and went live on 29 October 2016.

For a full list of ICS codes and an explanation of how it works, please refer to the pdf ICS Version 7.



MEMBERS MEET AT MARCOM



More than 70 delegates representing 29 ISO national member bodies congregated in Geneva, Switzerland, last November for the ISO Marketing & Communication Forum (MARCOM), a networking event where members were able to discuss their challenges, share successes and learn from each other's experiences in the fields of marketing and communication.

With participation from countries as far afield as Kenya, Canada and Moldova, to name a few, the diversity of opinions was matched only by the originality of the ideas presented. Alongside external keynote speakers from Geneva-based organizations, such as Swiss International

Air Lines and CERN, home of the largest particle physics laboratory in the world, the two-day event allowed members to present innovative projects.

Whether the "gamification" of standards learning through an app developed by NEN, Danish Standards' interactive tool to show businesses how standards can help them prosper, or BSI's approach to leading organizational change and effectiveness through strategic communication, each participant brought a fresh perspective. ISO's marketing and communication teams also shared their expertise through a series of roundtable discussions in what was deemed a productive event.

KEY ROLE FOR ISO IN CLIMATE CONFERENCE

At the 22nd Conference of Parties (COP22) to the United Nations Framework Convention on Climate Change (UNFCCC) in Marrakech, Morocco, in November 2016, ISO joined CDP Worldwide and Climate-KIC in a side event themed "Unlocking ambition: How non-party stakeholders are contributing to the low-carbon transition". The aim was to highlight the tools available to stakeholders and address gaps where new tools are needed.



IMANOR, the Moroccan Standards Institute and ISO member for the country, hosted a stand in the pavilion of the Moroccan Ministry of Industry and Commerce, which oversees the institute.

At the conference, governments worked on defining measures to realize the 2030 Agenda for Sustainable Development and accelerate the transition to a green economy. "Standards constitute solutions for implementing actions effectively," said Kevin McKinley, Acting Secretary-General of ISO.

INTERNATIONAL YEAR OF SUSTAINABLE TOURISM

Many ISO International Standards support the objectives of the 2017 year of Sustainable Tourism for Development. Well-designed and well-managed tourism makes a significant contribution to sustainable development, employment and cultural understanding. Taleb Rifai, Secretary-General of the United Nations World Tourism Organization (UNWTO), said: "It is a unique opportunity to advance the contribution of the tourism sector to the three pillars of sustainability – economic, social and environmental – while raising awareness of the true dimensions of a sector which is often undervalued."

ISO standards provide practical, internationally harmonized solutions and best practice to help make these goals a reality. ISO 50001 for energy management systems, for instance, can be used by organizations to optimize their energy use. The recently published ISO 20121 for sustainable event management can make sports events, concerts, festivals, conferences and many other activities "greener". And the use of environmental standards, such as ISO 14001, can help stakeholders in industry – whether hotels, tour operators, food and other service providers – to take care of our planet.

ISO has a committee developing standards specifically for the tourism industry. ISO/TC 228, *Tourism services*, is currently working on standards for adventure tourism (safety and information to participants), diving, natural protected areas and spas, to name a few.

FINANCIAL SERVICE PROVIDERS MEET IN GENEVA

Sibos brought together 8000 business leaders, decision makers and topic experts from a range of financial institutions, market infrastructures, multinational corporations and technology partners in Geneva, Switzerland, in September 2016.

The financial services annual event, organized by SWIFT, offered plenty of opportunities to meet with clients, prospects and fellow peers as well as attend workshops and seminars and discuss recent market trends. The conference explored the evolving payments and securities industry, the latest on financial crime compliance, innovation, opportunities and challenges in technology, disruptive competition and cultural shifts, as well as other hot topics impacting the financial landscape – including a discussion on the role of standards.

Speaking at a panel moderated by Karla McKenna, Chair of ISO technical committee ISO/TC 68, *Financial services*, on the future of standardization in Fintech, Kevin McKinley, Acting Secretary-General of ISO, raised the importance of community engagement in standards development. "We are an NGO; we are neutral and bring different players to the table and we need to involve stakeholders because they are the key," he said.





Sky's *the limit*



Air traffic management faces an environment that has been getting more and more complex in recent years. These factors are putting new challenges in the spotlight. Here, Indra explains how standards provide the solutions to air traffic management and safety.

Over the past decade, global air traffic has increased exponentially. If such trends continue, then how is safety – the aviation industry's number one priority – to be assured?

Many countries are investing in advanced technology to improve and modernize airspace management so they can meet future challenges. And some of them are reaching out to Indra, one of the world's main global consulting and technology companies with headquarters in Spain, to innovate their air traffic management systems.

As a leading company in the international market of air traffic management and control systems, Indra knows that improving on current air traffic safety targets is now extremely demanding. With over 4 000 installations in more than 160 countries, including systems deployed in the main area control centres in Europe, standards are the key to its air traffic management systems around the world.

As demand for air transport is predicted to double over the next two decades, Indra is on a flightpath to bolster a robust safety culture and to champion the adoption of the latest standards. Here, Peter Rudolph, International Civil

Aviation Organization (ICAO) Consultant to the Indra Group and member of the ICAO Information Management Panel, tells us how Indra is helping to meet this challenge.

Innovative solutions

Safety and security are the key goals of the Indra Group and innovation is at the heart of all its operations. The large and value-based innovative offering of Indra around the world covers equipment for the air traffic management market, including the most recent project to strengthen air traffic surveillance in eight South-Pacific islands and the commissioning of the ITEC system at Prestwick Air Control Centre that is already managing the whole upper airspace in Scotland.

Indra has always been committed to developing proprietary technologies and solutions with a differential value for the various sectors in which it operates. Standards have been an important enabler for a safer, more efficient global airspace, allowing us to penetrate new markets as well as harness the synergies that arise from applying the capabilities developed in one sector across all other sectors.



This flexibility in the provision of solutions for such a wide range of clients in air traffic control, airports and airlines requires the usage and applicability of standards to safe investments as well as ensuring future interoperability when systems are upgraded.

From technology to development

Being a forerunner in information technology, Indra is aware that it is only through the use of standards that the requirements of interconnectivity and interoperability can be assured. Consequently, ISO's work is highly significant as it impacts the Group's systems "by enhancing the quality of our products and services" and providing assurance of a safe and high return on investment.

In addition to innovation, Indra believes that its solutions and services are excellent tools for contributing to development, not only for the benefit of its clients but also, in a much wider sense, for the benefit of society and the communities in which it operates.

This also applies to Indra's commitment to sustainable development as the main value in its environment policy. This has been boosted by the implementation and certification of the environmental and energy management system for its facilities and emissions-reduction strategy. Indra's environmental management system is certified under ISO 14001. One of the system's objectives is to promote and lead the way regarding the adoption of environmental standards, regulations and best practices as a tool for improving sustainability.

Prepare for take-off

The big test for the industry in general is to implement reliable information and data management systems, together with trusted products and processes. To this end, the air traffic management branch of Indra and its specialized company Avitech, a leading international developer of IT systems for the aviation industry, are currently supporting a new ICAO concept that complements

human-to-human with machine-to-machine communication, to improve data distribution and accessibility in terms of quality of the data exchange.

In this regard, Indra adopts ISO standards like the ISO 19000 family on geographical data exchange, ISO 19142 on Web feature services, ISO 19128 on Web map services and ISO/IEC 19464 for advanced message queueing protocol, among many other standards for interoperable service implementations. These ISO standards help optimize our investment and form the basis for worldwide interoperability, which is needed to ensure that complex aeronautical information management systems can work together.

With the rapid and ongoing advances in technology, the use of standards for data structures and interoperability requirements is critical to ensuring safe and secure flights. Given the increasing importance of data on aviation safety, Indra is building products based on standards that maintain safety and security – the Group's top priorities. In this area, the ISO/IEC 27000 family on IT security techniques offers a comprehensive approach to managing information security and strengthening resilience to security threats.

Taking the smart approach

In our digital age, the challenge is no longer the hardware component but the smart set-up of processes to cope with the amount of data, to smartly interpret the data and provide standardized formats. Based on experience so far, ISO activities related to data, information, technology and geospatial standards will continue to be of great value to the aviation industry.

It is fair to say that the sector has mostly benefitted from standardization. Besides the obvious, such as access to technology, compatibility and interoperability, simplified product development and speeding time-to-market, standards in aviation are a big supporter of safety for air navigation. They not only make the work efficient but are also a condition of the industry itself. Without standards, aviation as we know it would not be possible.

Indra expects further enhancement in its collaboration with ISO through national standards bodies. This means the industry can create better products to support evolution and innovation in aviation and that all the actors can work together towards a common goal – a safe, secure, high-quality, pragmatic, yet futuristic, system-wide information management. ■

Without standards,
aviation as we
know it would not
be possible.



Making dreams fly: the Solar Impulse story

Solar Impulse made history by circumventing the entire world using only solar energy. The daring designers of electric aircraft have made a lot of progress recently and such experimental models will one day bring electric propulsion technology to aviation. It's only a matter of time.



Bertrand Piccard (left) and André Borschberg – two pilots pioneering clean flight technologies.

A new series of ISO videos looks at how standards helped our greatest innovators push the limits. Discover Solar Impulse and more at:
www.iso.org/sites/innovators

Solar Impulse made aviation history when it completed the longest solo solar-powered flight ever achieved without fuel or any polluting emissions. The revolutionary plane flew around 40 000 km in 17 months, including one leg that lasted five days non-stop, using only the energy of the sun. The vision of initiator Bertrand Piccard was to embrace clean technologies and energy efficiency to explore the unknown, while providing a benefit for the whole world. Together with co-founder and CEO André Borschberg, he made that a reality, looking beyond the realm of aviation to find the solutions they needed.

From the materials required to build an ultra-lightweight plane to the electronics necessary to create the most efficient motor, standards played a key role in this aviation feat. Solar Impulse was a core team of 150 people, 80 partners and 80 companies. Here, we talk to André Borschberg about how they turned their vision into reality and how standards gave them the foundation on which to build their dream, using their expertise and entrepreneurial spirit to fly where no-one has ever flown before.

ISOfocus: Nobody thought they could fly on solar power alone. The success of Solar Impulse is a technological feat. Where did the imagination and inspiration behind this technology come from?

André Borschberg: Solar Impulse is not revolutionary in terms of technology; it is revolutionary in the way we use technologies.



Materials are extremely important when you want to make a light airplane.

It pools the expertise of engineers from different backgrounds and skill sets to integrate these technologies, which is the key for us. It is also about pushing the limits to understand where we need to go and how we are going to get there.

Interestingly, in the case of Solar Impulse, the aviation industry told us they believed it was impossible. Often, you don't have the solutions you need within your industry in order to make developments. You have to find them outside. For us, they came from partners from different worlds. The world of chemistry, for example, because materials are extremely important when you want to make a light airplane.

In what way did standards play a role?

To develop something like this, you have to go to the limits – and to go to the limits, you need a very solid base. That's where ISO standards come in: they provide that solid base that allows us to exchange between partners, in fact between all the people involved in finding solutions.

We had to manufacture a lot of our parts using external suppliers. Many were handmade so we had to have really good drawings that people in the workshops could work from. For this, there needs

to be a standardized language so that the drawings can be understood by suppliers across the board. Standards were essential in providing that common language. They were also essential in areas like material definition, tolerances and welded parts.

What is the future of this technology? Where to from here?

The Solar Impulse prototype showed us how we can use "clean tech" to make our world more efficient. But this energy efficiency isn't just for airplanes... it can be used in your home, in your car and in the appliances you buy. It is about how we use the technologies we have available to reduce energy consumption. We have learned that this can be done everywhere – if we can do it in airplanes, we can do it on the ground.

What this extraordinary adventure has done is open up the potential for using electric propulsion. Electric propulsion is extremely efficient, it's light, it isn't noisy... you can imagine what it could do for airplanes if we were ever able to master it. And it has already started. Today, we see that big corporations like the US space agency NASA are launching big projects in this direction. The ball is starting to roll, which is great! ■

