

GLOBAL SURVEILLANCE

Why space-based ADS-B will transform the skies

VIEWPOINTS

Alex Bristol, CEO, skyguide

Kevin Shum, Director-General, CAAS

SPOTLIGHT

New airspace architecture for Europe

Building infrastructure in India

Acquisition excellence

Human performance

Investment in ATM



Meet us at CANSO Asia Pacific 2019
21-23 May, Fukuoka, Japan

Rethinking ATC towers

FREQUENTIS DFS AEROSENSE is actively driving the adoption and evolution of remote virtual and digital towers across the world through our intensive collaboration with our customers, our involvement in major research programs, and by driving standardisation in working groups like EUROCAE, to enable safe ATC operations.

Our remote virtual tower solutions are used at airports with complex ATC operations, safely managing IFR and VFR operations on site or from a remote location. Advanced video processing leveraging artificial intelligence makes airports of any size smarter. It will revolutionise the way regional airports are operated and bring about essential cost savings, while providing

business continuity at larger airports, meeting all capacity and safety requirements.

Our customers benefit from more than seventy years of experience in mission-critical air traffic control solutions. The desire to innovate and develop technologies that solve safety, capacity and efficiency demands is at the core of what we do.

FREQUENTIS DFS AEROSENSE is the worldwide trusted partner providing turnkey advanced remote sensing solutions for ATC combining Virtual Tower systems from Frequentis with proven operational and regulatory concepts from DFS via its subsidiary DFS Aviation Services.

IN THIS ISSUE

5 DIRECTOR GENERAL

Jeff Poole makes the case for performance-based regulation.

6 INTERVIEW

Alex Bristol, CEO at Swiss ANSP, skyguide, says that partnering towards innovation will be vital to handling the demand for air navigation services.



12 SPACE-BASED SURVEILLANCE

Space-based automatic dependent surveillance – broadcast is finally a reality offering the potential to transform airspace design.



NATS

RaportTAG Phototeam Andreas Meinhardt



16 LETTER FROM ASIA PACIFIC

Kevin Shum, Director-General, Civil Aviation Authority of Singapore and Chair, CANSO Asia Pacific, shares his thoughts on why the region should invest in its people and prepare them for future challenges.

iStock.com/CaronB
DFS Deutsche Flugsicherung GmbH

18 INVESTMENT

ANSPs need to invest significantly to handle the growth in air traffic while their business models may be evolving.

29

23

32

20 ACQUISITION EXCELLENCE

Kelly Ann Hicks, Chair of the CANSO Acquisition Excellence Workgroup, explains the importance of fully understanding and documenting all requirements in a project.

23 EUROPEAN CAPACITY

European air navigation service providers need to accelerate implementation of new technologies and concepts now if they are to accommodate the increasing demand for air transport in the long term.

29 ATM IN INDIA

The enormous surge in air traffic in India is a challenge that the national ANSP, Airports Authority of India, is welcoming with open arms.

32 HUMAN PERFORMANCE

Human performance remains the critical link in the provision of safe and efficient air navigation services. To develop their human performance, ANSPs need to consider numerous elements, which must be supportive of the organisation's vision.

Airspace No. 45
ISSN number 1877 2196
Published by CANSO, the Civil Air Navigation Services Organisation

Transpolis Schiphol Airport
Polaris Avenue 85e
2132 JH Hoofddorp
The Netherlands

Telephone: +31 (0)23 568 5380
Fax: +31 (0)23 568 5389



Subscribe ► canso.org/subscribe

Publisher: Quentin Browell
communications@canso.org

Editor: Graham Newton
communications@canso.org

Advertising: Helen Parker
helen.parker@canso.org

Design: Mark Chivers

The entire contents of this publication are protected by copyright, full details of which are available from the publisher. All rights reserved. No part of this publication may be reproduced,

stored in a retrieval system or transmitted in any form or by any other means, electronic, mechanical, photocopying, recording or otherwise, without prior permission of the publisher. The views and opinions in this publication are expressed by the authors in their personal capacity and are their sole responsibility. Their publication does not imply that they represent the views or opinions of CANSO and must not be interpreted as such. The reproduction of advertisements in this publication does not in any way imply endorsement by CANSO of the products and services referred to herein.

© Copyright CANSO 2019



Front Cover Image: CANSO/Emma King





THIS IS THE FOREFRONT OF AIR TRAFFIC CONTROL.



Technology developed on an open architecture. Flight data exchange automated and more intuitive. Controller workstations optimized for efficiency and safety. All of this is possible with NAVCANatm air traffic management solutions.

NAV CAN suite tower-automation products provide fast and reliable access to critical airport, tower and terminal control information, configurable to your operation. Integrated flight, surveillance, weather and airport data is accessible at the touch of a finger, making improved safety and efficiency well within your reach.

Experience the evolution of air traffic management with a system that controllers and airport operators trust. A system that puts you at the forefront of air traffic control.

www.NAVCANatm.ca



This year marks the 75th anniversary of the International Civil Aviation Organization (ICAO). Over these 75 years, ICAO and its Members States have played a vital role in regulating aviation and have been instrumental in building aviation's strong safety record. However, the aviation world has changed considerably since 1944 and it is therefore important that regulation keeps pace with and adapts to change.

Traditional airspace users now need to operate alongside and in an integrated fashion with drones, high altitude autonomous vehicles and balloons and commercial space vehicles. Furthermore, new technologies such as space-based surveillance, digitisation of towers, automation and artificial intelligence are changing the traditional way of doing things in air traffic management (ATM).

ICAO and regulators need to find new ways to move faster and fast enough to keep up with the rapid pace of technological developments, and to allow the industry to change the way it manages airspace. The challenge is that the regulatory process and pace is different for each State and regulatory knowledge on emerging issues and technologies is also different. In addition, regulation is often over-prescriptive, which undermines the ability of air navigation service providers (ANSPs) to innovate and perform effectively.

CANSO urges States to take a performance-based approach to regulation that emphasises what must be achieved, focusing on agreed, measurable outcomes and placing more of the responsibility and accountability with the service provider in how the performance requirements will be met. For example, there is no need to change regulatory requirements for digital or remote towers as they fulfil the same performance requirements as conventional towers.

But there is no 'one size fits all' solution for ATM regulation as there is a significant diversity among States in terms of oversight capabilities, maturity and culture. Therefore, CANSO prefers to see an incremental approach. For States with a well-established (albeit prescriptive) regulatory regime, we encourage the move to performance-based regulation (PBR) and the adoption of Better Regulation principles. These principles call for regulations to be: proportionate, accountable, consistent, transparent and targeted. For States that need to improve oversight capabilities, we need first to support the implementation of capacity building initiatives that are both innovative and effective.

If regulators were to adopt these principles, they will not need to keep ahead of developments rather than trailing them as the regulatory framework will monitor performance rather than the technologies and procedures used to achieve the performance metrics.

In September/October, ICAO Member States will be meeting at the ICAO 40th Assembly. CANSO will be presenting a range of papers on key issues and many of them depend on a performance-based approach to regulation. This is key to ensuring the ATM industry can take full advantage of new technologies, safely, quickly and efficiently. This in turn is key to addressing the industry's main challenges such as improving capacity and safely integrating all users of airspace now and in the future.

Jeff Poole
CANSO Director General

Doing the right thing right

Alex Bristol, CEO at Swiss ANSP, skyguide, tells *Airspace* editor, Graham Newton, that partnering towards innovation will be vital to handling the demand for air navigation services.



Credit: skyguide

What are your plans for skyguide over the next few years?

The main body of work is creating the right strategy for our 2035 vision. This vision is about earning the right to exist. We believe there will be strong competition in 20 years' time. To keep our *raison d'être*, we have to be lean and flexible, apply advanced technology and deliver effectively and efficiently the services our customers need.

In 2035, we will be able to operate successfully not because we are a monopoly, but precisely because we have learned *not* to think and act as monopolists. We will have developed into a company close to its customers, which knows how to meet their needs at a price with which they are happy.

To achieve that vision, we have got to start working in 2019. There must be concrete plans to implement now, not always "in five years' time".

The new Virtual Centre is fundamental to what we are trying to achieve. It will provide the next generation of controller tools and we are in the second tranche of that work now, which is migrating our operational systems on to a modern technological platform.

In 2018, thanks largely to the investment already made in the Virtual Centre during the first tranche, we were able to meet our capacity targets, one of the few European ANSPs that did so. In fact, the extra capacity gained from the Virtual Centre far exceeded



Credit: skyguide

skyguide has developed into a company that aims to meet customers' needs at an appropriate price.



Credit: skyguide

skyguide has been able to meet its capacity targets, thanks largely to the investment made in its Virtual Centre.

our expectations and we were even able to soak up some demand across neighbouring airspaces.

Swiss regional aerodrome services were liberalised in January 2019. What exactly is happening and how will skyguide respond?

Air navigation services (ANS) for regional aerodromes were partly opened up to competition in Switzerland. Actually, this is something for which skyguide has been pushing for some time. It is the right thing to do because it is in the best interest of the customer.

The problem is that skyguide is structured to deliver to the larger airports of Zurich and Geneva but is not necessarily the right fit for smaller, regional airports. We cannot use a one-size-fits-all approach any more. Bringing in a different business model will enable a better service and a better price for our customers.

States could help to make air navigation services work much more efficiently if they had the will to do so even without liberalisation. Not even national sovereignty is a legitimate reason not to liberalise. States do, however, need to let go if we are to get to our idealised concept of a Single European Sky.

The joint venture (JV) with Aviation Capacity Resources (ACR) we are planning to enter into is skyguide's response to this. The JV will be a completely separate business entity and offer services at the regional airports. The purpose is to deliver the right service at the right price.

I welcome the pressure this puts on costs and performance overall. It is a positive development.

Should all air navigation services be liberalised?

Why not? But right now, I consider this unlikely. States could help to make air navigation services work much more efficiently if they had the will to do so even without liberalisation. I see no operational or technical reason why this is not possible.

Not even national sovereignty is a legitimate reason not to liberalise – look at the Maastricht Upper Area Control (MUAC) to see how this can work. So, I think liberalisation would help to create more efficient ANS, but it is not a prerequisite. And clearly the political or ANSP will for liberalisation does not exist at the moment.

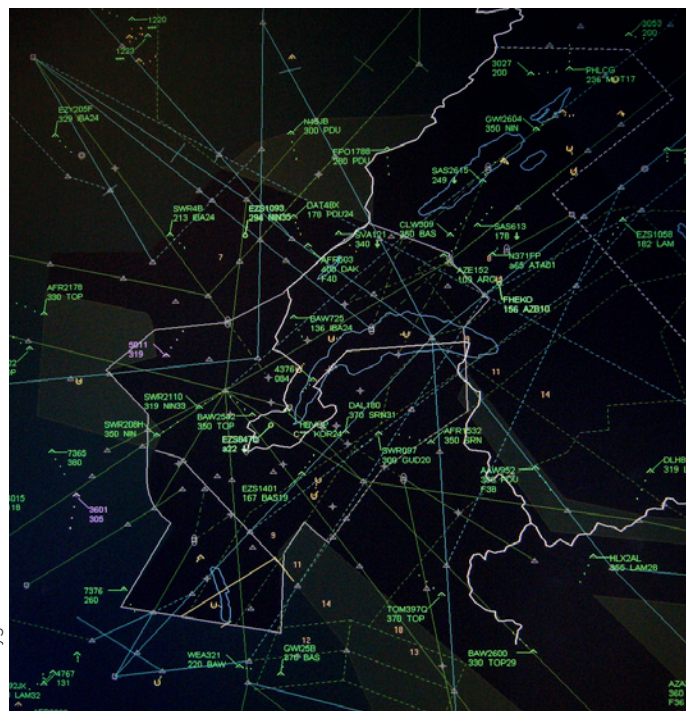
States do, however, need to let go if we are to get to our idealised concept of a Single European Sky. This is why virtual centres are so important. With virtual centres you can move sectors around and outsource them temporarily without losing sovereignty.

In some places, with airports near borders, it makes more sense for a neighbouring ANSP to take control when certain runways or air corridors are being used, as we do with our French neighbours.



Is cooperation among ANSPs strong enough for such steps to be taken?

When one ANSP works bilaterally with another, it tends to be successful. When you get to three or more it is much harder to make the partnership work especially if the only reason you are working together is geographical happenstance. The functional airspace blocks have shown that.



Credit: skyguide

skyguide at a glance

- Some 1,500 employees work at 14 locations in Switzerland
- Traffic grew 5.0% in 2018, compared with the forecast of 2.2%, equating to almost 1.3 million controlled flights
- Despite a higher volume of traffic, punctuality declined only slightly in 2018 compared with 2017; 96.5% of flights were handled punctually by air navigation services compared with 97% in the previous year
- Route delays increased from 10.1 seconds (average per flight) in 2017 to 17.1 seconds in 2018
- In 2018, skyguide increased its en-route charges 0.1%. Approach charges at Geneva and Zurich airports were reduced 0.9%, however
- Revenue increased 2.45% in 2018 to CHF 481.8 million (CHF 470.3 million in 2017)
- Operating expenses decreased from CHF 480.8 million to CHF 449.7 million, a reduction of 6.9% year-on-year
- skyguide received the Jane's ATC Award 2019 together with its development partners for its new advanced runway safety improvement (ARSI) system at Zurich Airport
- It also received a Single European Sky Award from the European Commission for the automation of communications in network management. The EC also recognised skyguide for its technological developments in the field of Service Oriented Architecture (SOA)

It is much better to work under strategic partnerships with like-minded ANSPs and suppliers that are the same point in their investment cycle. At skyguide, we collaborate for example with the UK ANSP, NATS, as we have a similar architecture and are developing along similar lines.

You see the same idea at work in the alliances. ANSPs at the same stage of development working together will help to further the industry's efficiency through greater standardisation.

What are the consequences of the criminal charges against three of your controllers?

Two controllers have been found guilty by an Upper Court and they have appealed (the other case is in the appeal process to the Upper Court). These two cases now go to the Federal Court.

If the current verdicts are upheld in these specific cases it means that in Switzerland so-called 'honest mistakes' have been criminalised. They have been treated the same way as a deliberate act and that is a nightmare for Just Culture.

It means we would have to adopt procedures that satisfy the judiciary rather than the requirements of safety regulations or airspace users. Additionally, skyguide will find it far more difficult to attract controllers and to keep the ones we do have. They will undoubtedly be worried and that does not help performance.

Most obviously, I worry that the reporting of incidents will drop in terms of volume and especially quality. It is not about Just Culture per se, but about losing the safety improvements that Just Culture brings.

No lives were ever at risk in either of these two incidents. And they were properly reported. Once the mistakes had occurred, all the relevant safety systems – the 'barriers' – kicked in and the situation was quickly remedied.

It is what the system was designed to do. As long as the system contains and manages the error, I would say that the system is doing its job, and the human part of that system should not be punished.

We can never – and should never – ask for immunity, but there is a big gap between a deliberate act and gross negligence. These were simple errors to which our system has been designed to be resilient. Our legal system does not seem to allow for this bandwidth of non-criminal errors.

We are supporting both controllers fully and both are still working. Their legal counsel is being paid for by skyguide because the cost of a guilty verdict will be far greater for skyguide and for the aviation community than the cost of any lawyer.

As an early mover into U-Space, are you confident the industry is taking the right steps to handle drones?

skyguide has moved quickly on this because we want to learn and to understand what is required. It is an iterative process and we will get better and better at enabling drone flights in all types of airspace.

We are conducting trials and we plan to have a working U-Space in place in June 2019. We can then adapt it as appropriate. Already, selected drone operators in Switzerland can request automated and manual flight authorisation to fly in two controlled airspaces – Lugano and Geneva – through the skyguide U-Space mobile application to test the system, give user feedback and help us to improve.



Nanosatellite **constellation** delivering ATM Surveillance for lowering
Aircraft separation in Oceanic and Remote locations,
including enhanced situational awareness, **efficiency** and **cost-savings**



Global Nanosatellite constellation providing
reliable and **cost-effective** ADS-B Surveillance for ATM

- Proven Satellite platforms with ADS-B reception capability
- Satellite interlink for low latency ADS-B data update
- Enabling ATM Surveillance in Oceanic and remote locations
 - Increased flight safety
 - Fuel Savings for Airlines
 - Enhanced ATM situational awareness
- 75% less expensive than large satellite constellations
- Efficient Network Operations
- Cost efficient replacement of existing ground based ATM Surveillance assets
- GADSS compliance - 15/1 min



Credit: Genève Aéroport

skyguide is hosting the CANSO Global ATM Summit and 23rd AGM on 17-19 June 2019 in Geneva, Switzerland.

Regulations will need to go hand-in-hand with this development and we are working closely with the authorities to deliver an excellent service to the customer in a safe way. Our regulator is paving the way in this respect.

Most importantly, the one thing we know for sure about unmanned aircraft system traffic management (UTM) today is that it will bear no relation to UTM in five years' time.

The new entrants will find new ways of operating we have not even thought of yet. And that in turn will feed into how skyguide thinks about ATM in general. It will help us to develop our own systems enabling us to work even more efficiently.

Registration is vital as that is where it all comes together. Our U-Space would not necessarily prevent a Gatwick-type incident, but it would help in dealing with it.

You have to create a system for those that want to play the game and then deal with the exceptions. Having the proper registration and UTM means you can separate the good guys from the bad guys and help the good guys to do everything right.

The opportunity is to make air traffic management safer and more efficient and the technology is already available to do that. The challenge is to move together and to move fast enough to make the advances relevant. The industry will have to give up some of the ideas it holds so dear. Management and ownership of the skies do not need to be one and the same, for example.

Skyguide will be offering drone pilots a registration system in summer 2019 that will lay the foundation for safely integrating commercial and non-commercial drone operations into Swiss airspace.

And we have already shown that existing telecommunications infrastructure could form the basis for a UTM network.

What are the biggest opportunities and challenges for air navigation in the years ahead?

The opportunity is to make air traffic management safer and more efficient and the technology is already available to do that.

The challenge is to move together and to move fast enough to make the advances relevant. The industry will have to give up some of the ideas it holds so dear. Management and ownership of the skies do not need to be one and the same, for example.

CANSO can help by supporting those States and ANSPs that are willing to break new ground and gently cajoling those that are not.

Does an ANSP CEO need experience of the industry?

You definitely need experience at an executive level, but you absolutely do not need to be an ex-controller to be an ANSP CEO. It is time for this industry to stop thinking it is different and that it is not possible to apply normal business practices. Because it is not, and you can!

Finally, what can delegates to the CANSO ATM Summit and 23rd AGM expect?

I would like to extend a very warm welcome to all the delegates. Geneva is a wonderful city with a beautiful setting between the mountains and the lake and I hope people have the chance to sample Swiss culture as well as engage in some interesting debates about the future of ATM.

Switzerland may be a neutral country, but I aim to bring plenty of opinion to the discussions! ➤

Space-based ADS-B lifts off

Space-based automatic dependent surveillance – broadcast is finally a reality with the potential to transform airspace design.

Space-based automatic dependent surveillance – broadcast (ADS-B) is here. In January 2019, Aireon's final 10 payloads were successfully launched into space aboard Iridium NEXT satellites.

The space-based ADS-B network – comprising 75 satellites in total, 66 operational payloads and nine spares – is now fully operational.

Don Thoma, CEO of Aireon, admits there were plenty of challenges to get to this point. Even though the original concept for ADS-B dates back to an FAA-sponsored study in 1973, the first ADS-B ground stations were only successfully demonstrated in 2001 in Alaska.



Partnerships proved to be the path to success for the space-based variant. Those ANSPs with an ownership interest in Aireon – NAV CANADA, NATS, ENAV, Naviar and the Irish Aviation Authority – have provided operational expertise and funding.

“They were also critical in supporting the new standards on separation and the European ANSPs will soon enable us to get EASA certification, which goes a long way to proving our credibility,” explains Thoma.

On the technical side, apart from Iridium’s know-how, Thoma reports the Harris payload design has “far exceeded” expectation in terms of functionality and reliability.

“So, in one sense it was simply a case of putting the partners’ work together while ensuring the timelines matched the capabilities of Iridium to put a network of satellites in orbit and also the mandates for ADS-B that were springing up worldwide,” says Thoma.

ADS-B will be mandatory in US airspace above 10,000 ft from January 2020 with Europe following six months later. NAV CANADA is pushing to make it mandatory in Canada – initially above 18,000 ft from January 2021 and then above 12,500 ft from January 2022.

Australia already has a mandate in place as does Hong Kong and Singapore and many other countries are on course to insist that aircraft flying in their airspace have the necessary avionics on board.

Thoma insists, though, that mandates are not Aireon’s driving force. “Many radar systems are reaching the end of their lifecycle and ADS-B is cheaper and superior,” he says. “There is also a major safety and efficiency bonus because an aircraft is being tracked every eight seconds at a minimum.

“That increased transparency is vital,” he adds. “Take a search and rescue operation in somewhere like Canada’s freezing remote north, for example. Rescuers have a much better chance of reaching the survivors quickly because they will have a much smaller area to cover.”

Precipice of history

Such a scenario is one of the reasons why NAV CANADA took a significant stake in Aireon from the outset. It also knew the benefits of ADS-B, having had the technology in place over the Hudson Bay area for some time.

Improved visibility and control over previously un-surveilled airspace will allow airlines to fly routes at optimal speeds and levels, delivering expected cost savings of up to US\$300 per transatlantic flight, and reducing carbon dioxide emissions by two tonnes per flight, based on an analysis conducted by NATS and the International Civil Aviation Organization.

NAV CANADA has wasted no time in employing the system and is already using space-based surveillance in the North Atlantic, and domestically over Newfoundland and parts of Alberta.

The Aireon system is expected to reduce overall flight safety risks approximately 76% in the North Atlantic according to a joint analysis by NAV CANADA and NATS – the first ANSPs to use the service.

Improved visibility and control over previously un-surveilled airspace will allow airlines to fly routes at optimal speeds and levels, delivering expected cost savings of up to US\$300 per transatlantic flight, and reducing carbon dioxide emissions by two tonnes per flight, based on an analysis conducted by NATS and the International Civil Aviation Organization (ICAO).

Use of the Aireon system over the Atlantic allows for air traffic controllers to trial the reduction of aircraft in-trail separation distances from 40 nautical miles to as little as 14 nautical miles, making the airspace more flexible, predictable and able to accommodate the immense growth predicted in the coming years.

“To know the position, speed and altitude of every ADS-B equipped aircraft in oceanic airspace – in real-time – is a transformational

Why space-based ADS-B?

Space-based ADS-B uses satellite-based global positioning technology to calculate an aircraft’s precise location, speed and direction even over oceans and remote regions. Ground-based systems left an estimated 70% of global airspace without any real-time air traffic surveillance coverage.

An Aireon report suggests that “by eliminating these global blind spots, space-based ADS-B allows for increased safety, precise aircraft locations, improved search and rescue response, reduction in gross navigation errors, improved cross-border safety and faster pilot/controller communication”.

Space-based ADS-B will also ensure compliance with the ICAO Aviation System Block Upgrades (ASBU) and the Global Aeronautical Distress and Safety System (GADSS).



Space-based ADS-B will enable real-time surveillance coverage.

Credit: NAV CANADA

We move data for **thousands** of worldwide



SWIM Data Distribution
On-Premise and in the Cloud



solace.

THINK METRON

Metron Aviation is helping the Air Traffic Flow Management industry minimize delays, reduce fuel costs and balance demand with capacity. Metron supports customers with a variety of ATFM tools and services that include decision management, post operational reporting and analysis, weather translation, environmental impact, assessment services, and advanced interactive ATFM simulation training.

To solve your ATFM challenges, think Metron Aviation.

Learn more at www.metronaviation.com



AN AIRBUS COMPANY

change to how our controllers manage air traffic,” says Neil Wilson, President and CEO of NAV CANADA. “The Aireon system provides an immediate boost to aviation safety and airlines will benefit from more fuel-efficient routings and flight levels.

“Over 95% of the North Atlantic traffic is already ADS-B-equipped so the fuel savings, along with the reduced carbon dioxide emissions will be attained very quickly.”

Exciting step

NAV CANADA is working closely with UK ANSP, NATS, on space-based ADS-B, the organisations being at similar levels of maturity, partners in the project and having adjoining airspace.

NATS is also using the technology and early results suggest the aircraft is being tracked every two to three seconds rather than the stipulated eight seconds. Juliet Kennedy, Operations Director, NATS says space-based ADS-B is “a hugely exciting step. RADAR was a big step forward in its time and the step to space-based ADS-B is similar.”

The North Atlantic is among the busiest airspaces in the world and is forecast to grow to some 800,000 flight annually by 2030. With the existing procedures in place over the ocean, it will be impossible to deal with that level of capacity. Space-based ADS-B changes the rules of the game.

“Airlines will be able to fly user-preferred routes (UPR), saving time, fuel and emissions,” Kennedy informs. “At the moment, about 60% of aircraft get to fly UPR across the North Atlantic. Space-based ADS-B will push this figure to 90%.”

Kennedy accepts that controllers will need to be re-trained due to the wealth of information they will need to process in real time “but now they will be able to see immediately if the aircraft is doing what it is supposed to be doing”.

NATS is already providing the service over the North Atlantic, including the new 14 nautical mile reduced separation standard. Other elements, such as reduced lateral separation, will be introduced in phases.

Critical mass

The next challenge for Aireon according to Thoma is achieving critical mass. Eleven ANSPs have committed to using the system and there are many more expressing interest. Early adopters include ASCENA, Isavia, the Civil Aviation Authority of Singapore, South Africa’s Air Traffic Navigation Services and the Seychelles Civil Aviation Authority (SCAA).

Aireon will spend the next few years fine-tuning the system and looking for new ways to leverage the data. ADS-B is an open

The benefits of space-based ADS-B

Space-based ADS-B should provide several advantages for ANSPs including:

- Improved service with reduction in separation minima
- Expanded access to user-preferred routes, altitude and (cost index) speeds
- Extended ADS-B surveillance coverage and visibility into neighboring FIRs
- Reduced impact from routine maintenance, weather and system outages
- Lower surveillance costs from augmenting or replacing existing infrastructure
- Improved safety, regulatory compliance and controller situational awareness
- Faster controller response time to abnormal situations, gross navigation errors and search and rescue operations
- Accurate aircraft movement, speed and altitude data for better analytics

technology and the data is there for everybody. But the key is unlocking the value of that data.

Aireon has entered into partnership with Flight Safety Foundation to action that idea. The Foundation’s Global Safety Information Program (GSIP) will develop important safety metrics and analytics using space-based ADS-B data.

Both parties are convinced that the collaboration will provide new insights into safety of operations in all regions of the world. The focus will initially be on risks in approach and landing, loss of separation and surface safety.

“We are using their knowledge to do the correct data analyses and also to action their findings,” Thoma says.

Passengers will not only benefit from this safety work, Thoma concludes. More direct routes will reduce travel times and the inherent flexibility in the system will mean fewer weather and ground delays. ➔



North Atlantic airspace structure.

Airlines will be able to fly user-preferred routes (UPR), saving time, fuel and emissions. At the moment, about 60% of aircraft get to fly UPR across the North Atlantic. Space-based ADS-B will push the figure to 90%.

Working together to advance aviation

Kevin Shum, Director-General, Civil Aviation Authority of Singapore (CAAS) and Chair, CANSO Asia Pacific, shares his thoughts on why the region should invest in its people and prepare them for future challenges.



Credit: CAAS

Today, millions of aviation professionals around the world dedicate themselves to keeping aircraft and passengers safe and efficient. However, it is not enough. The International Civil Aviation Organization (ICAO) expects that by 2036, the industry will need an additional 620,000 pilots, 125,000 air traffic controllers and 1.3 million engineers and technicians.

The rising demand for skilled aviation professionals will come at a time when there is stiffening competition for talent across the region and from other sectors. The Asia Pacific air navigation service provider (ANSP) community will therefore need to develop a pipeline of aviation professionals who are qualified and competent to operate, manage and maintain our air traffic management (ATM) systems.

Breaking new ground

The ANSPs in the Asia Pacific region are diverse. Some employ thousands of aviation professionals while others employ several dozen. Some are part of the transport ministries and civil aviation authorities while others are set up as separate organisations. However, we face the same challenge of ensuring that we have sufficient, well-qualified aviation professionals to move us into the future.

To do so effectively, our future workforce will have to be equipped to handle the challenges and technologies of the future. There are fundamental technological shifts ongoing in our industry. They include the quickening pace of digitisation, and the challenges

of cyber threats. New technologies will in turn lead to associated improvements in our concepts of operation, techniques, and procedures that will allow us to fully benefit from the benefits of technology while mitigating the associated risks.

Digital towers are one example of a technology shift. They are being explored by many Asia Pacific ANSPs such as Airways New Zealand, the Civil Aviation Authority of Singapore (CAAS), Hong Kong Civil Aviation Department (HK CAD), and AirNav Indonesia. They offer the potential for increasing capacity and safety, reducing workload, enhancing operational resilience, augmenting current ATM solutions and consolidating regional tower operations.

Having a digital tower means moving away from bricks and mortar air traffic control towers to a location where real-time surveillance of the aerodrome is done using high definition cameras. Advancements in camera technologies mean that we can improve our visibility in all weather conditions, enhance our line of sight through camera placements and enable heightened visibility at night.

However, air traffic control officers' (ATCOs) acceptance is key to the success of the digital tower concept. In CAAS, a team of 16 ATCOs participated in the design and configuration of the prototype. This ensured that the prototype met the operational requirements and incorporated insights peculiar to the aerodrome even before operational evaluation through shadow mode operations.

Innovation is key

We also need to empower our people to work together to innovate new solutions, customised to the unique circumstances of ANSPs in the Asia-Pacific. There are already many examples of this, an excellent one of which is air traffic flow management (ATFM) using a distributed multi-nodal network. This is a concept developed by ANSPs in our region that has demonstrated meaningful outcomes and is now being adopted in other regions.

The distributed multi-nodal network concept started small with AEROTHAI, CAAS and HK CAD but has since grown to include 11 Asia-Pacific ANSPs and 37 airports. Our community is committed to working together because we all recognise that the nature of international civil aviation requires that all of us to work together. This allows all partners to optimally serve air traffic within our respective areas of responsibility. I hope that more can join in as a bigger network of players has the potential to further enhance operational efficiency and increase capacity.

All the stakeholders are sharing information and tweaking their business processes to enhance demand-capacity balancing.

We need to empower our people to work together to innovate new solutions, customised to the unique circumstances of ANSPs in the Asia-Pacific. There are already many examples of this, an excellent one of which is air traffic flow management using a distributed multi-nodal network. This is a concept developed by ANSPs in our region that has demonstrated meaningful outcomes and is now being adopted in other regions.

Workshops and meetings have been held to introduce the concept to refine the existing processes; and as a platform to discuss the next steps ahead. Key partners like ICAO, CANSO, and the International Air Transport Association (IATA) have also been asked to contribute their expertise and knowledge.

Investing in our people together

There are many other opportunities for business and new collaborative models that can help us address air traffic management challenges together.

At the recent Asia Pacific CANSO CEO Committee (APC3) meeting in Madrid in March this year, Airways New Zealand took the lead to initiate a discussion on training collaboration. This stemmed from the CEO workshop we had in June last year, which among others, identified training as a means to ensure that “no ANSP was left behind”.

Insights were provided on market, digital and industry trends within an ANSP context, followed by an outline of the current state of training and the challenges. Many compelling reasons were cited as to why we should collaborate in training. We can achieve better business outcomes; have greater focus and concentration of effort; achieve benefits of scale; share costs; share on specialist expertise; leverage on technology as an enabler; and improve safety.

Two different collaboration models were raised for discussion. The first was to set up a separate training academy with shareholders

A digital tower means moving away from bricks and mortar air traffic control towers to a location where real-time surveillance of the aerodrome is done using high definition cameras. Advancements in camera technologies mean that we can improve our visibility in all weather conditions, enhance our line of sight through camera placements and enable heightened visibility at night.

and branded as a unique entity. The second was an alliance model whereby the stakeholders work together on pre-defined areas of mutual benefit but still retain their own individual branding. The CANSO Asia Pacific region is looking into both models. These have the potential to shape the future collaborative nature of training, which is an important pillar of seamless ATM for the region.

Ultimately, our people are at the core of what we do. We must continue to invest in their development and ensure a sustainable supply of skilled professionals. ➔



Air traffic control officers' acceptance is key to the success of the digital tower concept.

Credit: CAAS



Credit: iStock.com/AndreyPopov

Money management

Air navigation service providers need to invest significantly to handle the growth in air traffic while their business models may be evolving.

The effective implementation of new technologies is vital if air navigation service providers (ANSPs) are to safely and efficiently accommodate the demand for air services.

New technologies and their associated new operational and business process have a powerful role to play in transforming ATM performance but funding the necessary investments may not be straightforward.

"States have a vital role to play," says Jeff Poole, CANSO Director General. "Alongside implementing the ICAO Aviation System Block Upgrades, it is the role of States to ensure that adequate finance is available to invest in modern, efficient air traffic management (ATM) infrastructure that can manage increasing demand."

"Alongside implementing the ICAO Aviation System Block Upgrades, it is the role of States to ensure that adequate public finance is made available to invest in modern, efficient air traffic management infrastructure that can manage increasing demand."

Effective ATM requires long-term planning and stability but the necessary investments in ATM are often underfunded due to the many competing priorities for government budgets and the danger of across-the-board government budget cuts.

"It does not help that ATM is the invisible part of the aviation value chain so not always an obvious political priority compared with very visible airports and airlines," he adds. "Some States also struggle to keep pace with traffic growth because of their often lengthy, bureaucratic and costly procurement processes for new systems and equipment."

Commercial view

This is far from asking for a government handout, however. Some governments have perceived some inefficiencies in existing organisational structures and have opened up air traffic services to competition. Examples are in Switzerland, where regional aerodrome services have been put on the market, and in the UK, where DFS provides services at London Gatwick and Edinburgh through its subsidiary.

Some ANSPs such as NATS in the UK and ENAV in Italy have seized the initiative. They have already undergone a corporatisation process to enable them to take a commercial view of their operations.

Indeed, in the opinion of Maja Marciniak-Cork, Senior Consultant at aviation consultancy, Helios, "these days ANSPs are expected

to manage their investment portfolio independently of governmental investment decisions.”

Skyguide, for example, is looking to form a joint venture with ACR to supply regional services in Switzerland. And in Sweden, LFV formed a joint venture with SAAB to provide air navigation services through the use of smart tower technology.

Smart towers are another indicator of an evolving environment and are part of a swathe of digitisation initiatives, with system-wide information management (SWIM) being another example. These developments not only make the skies safer but cheaper to service too. This lower cost of entry means investments need not be so sizeable.

“Remote towers and automatic dependent surveillance – broadcast (ADS-B) infrastructure offer alternatives to the traditional investments, but the bulk of ANSP investment cost is still in their en-route ACC systems,” Marciniak-Cork suggests. “These are still very costly.”

“In an ideal world, digitisation will reduce ANS investment costs by enabling a more open architecture,” she continues. “But having said that we are still a long time away from making that happen.”

She also warns that in the past, pressure to reduce costs has led to ANSPs under-investing. There is now an urgent need to invest in systems that can provide capacity to resolve bottlenecks in the system. Not all of the required investments are yet identified, and it is important that the regulatory process – particularly during the third reference period (RP3) of the Single European Sky Performance Scheme – is flexible enough to accommodate new initiatives.

Holistic view

Marciniak-Cork agrees that this suggests governmental funding is still required to help solve investment delays. “Considerable public funding has been made available in the past but there may still be a need for further funding to support new investment initiatives,” she says. “This could be done on the basis of a strong business case, showing that the investments will have a strong impact on operational efficiency, reducing delays and enabling shorter, more direct routes.”

CANSO is helping with these business cases by raising awareness of the important role that ATM plays in increasing connectivity,

AirNav Indonesia invests

State-owned AirNav Indonesia is investing Rp 2.6 trillion to improve air navigation services. The company’s 2018 revenues are the main source for the 2019 investments. In 2018, AirNav recorded a Rp 320 billion net profit and Rp 3.2 trillion in revenues.

All 290 Indonesian airports will benefit. Software and equipment will be upgraded, and new towers and other support facilities built.

AirNav plans to invest Rp 1.1 trillion – 44% of the total investment – in automation. This will be especially important at major gateways, including Soekarno-Hatta International Airport in Jakarta, Bali and Surabaya (East Java).

AirNav also invested Rp 1.9 trillion in 2018 as it strives to cope with the increase in air traffic growth. In 2018, there were 2.4 million aircraft movements, up from 2.2 million in 2017 and 1.8 million in 2016.

enhancing capacity, improving airspace efficiency and ultimately delivering economic benefits worldwide.

“CANSO wants to ensure that all stakeholders, including States, regulators, airlines, airports and manufacturers understand the need for, and support investment in, ATM,” says Poole. “It is vital that all work together; there is no point in having modern efficient airports and airlines without modern ATM to improve capacity and performance.”

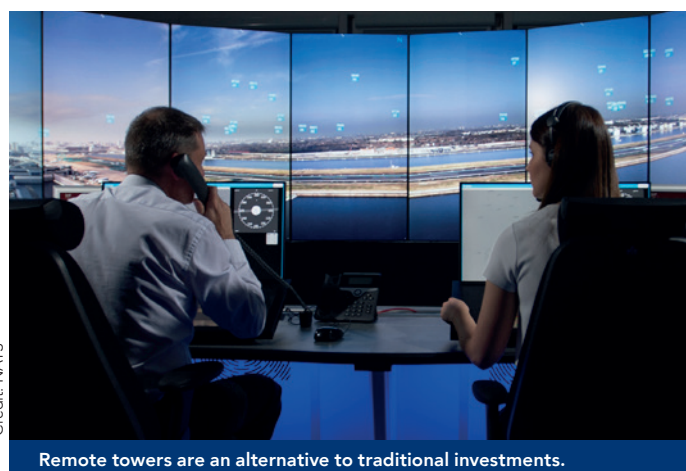
CANSO is involved in both the ICAO Industry High Level Group and the Air Transport Action Group to promote the benefits of aviation to governments around the world and the importance of States investing in infrastructure.

CANSO is also encouraging States to develop more robust ATM implementation plans to guide funding priorities. The aim is to instill the need for long-term planning and put ATM on an equal footing with other transport modes.

Finally, much of CANSO’s work is geared at developing a holistic view of ATM. Governments need to understand the importance of air traffic flow management and regional airspace initiatives, rather than just operating within national boundaries.

Though infrastructure will be predominantly planned and procured on a national basis, this does not necessarily create fragmented airspace, which tends to come about through a lack of procedural and system interoperability. This creates cost inefficiency as, for example, radar coverage and operations are often not optimised across national borders. Moreover, through alliances and other working relationships, ANSPs are increasingly making regional decisions on new system investments.

“CANSO Members have an important role to play in advocating for investment in ATM with their own governments, supported by aviation stakeholders,” concludes Poole. “We must ensure that the ATM industry is able to advocate with strong business cases for investment in infrastructure if aviation is to continue to grow safely and efficiently.” ➔



Credit: NATS

Remote towers are an alternative to traditional investments.

Know what is required

In the second of a series of articles for *Airspace* on best practice in procurement, Kelly Ann Hicks, Chair of the CANSO Acquisition Excellence Workgroup, explains the importance of understanding and documenting all requirements in a project.



Credit: NAV CANADA

As outlined in the first article in this series, *A Best Value Approach*, purchasing and supply chain functions need to work together with the aviation industry to deliver better value to their organisations.

Purchasing and the supply chain must also work closely with their internal stakeholders to develop requirements that reflect that value in order for industry to deliver what is required.

Ever expanding or changing requirements on a project greatly impacts cost and schedule and can ultimately lead to the failure of a project.

Requirement 'creep' reflects an inconsistent or undisciplined approach to requirement development. Putting in place a flexible and scalable requirements management plan is how organisations become successful in delivering projects on time and within budget.

Who to involve

The first step in developing a requirements plan is to determine who are the project stakeholders. Teams must look to the whole organisation when defining stakeholders to include individual experts and representatives of each functional domain.

For example, if you are only working with the engineering team and not the ultimate users of the product then the chances are your requirements will not be comprehensive. This jeopardises the success of the project. A well-thought-out plan will include securing the buy in of users, developers, maintainers and project sponsors at various levels of the organisation.

A successful project will include the requirement development process at the outset of the process. The earlier a team starts gathering and developing its requirements, the less impact potential changes or issues will have. If the project is well on its way, and requirements are still being defined then changes or issues to those requirements will most likely adversely affect project cost and schedule.

If a project deployment involves many stakeholders, then the supply chain or the lead function should also consider implementing a stakeholder management plan which involves identifying and classifying stakeholders in terms of influence and interest in the project and then monitoring their engagement. The better your governance of multiple stakeholders, the better your requirement plan will be.

A successful project will include the requirement development process at the outset of the process. The earlier a team starts gathering and developing its requirements, the less impact potential changes or issues will have. If the project is well on its way, and requirements are still being defined then changes or issues to those requirements will most likely adversely affect project cost and schedule.

When to start

Once the stakeholders have been identified, it is necessary to gather all the requirements. However, it is important that the lead organisation and involved stakeholders understand the project's objective and mission prior to inundating the project team with a list full of requirements.

For example, is your new enterprise resource planning system mission to improve the client experience or to drive efficiencies within the organisation? If the answer is both, then your requirements will need to reflect this duality and be aligned separately with each of these objectives especially when one objective (efficiency) can impact another objective (client experience).

There are various ways to gather information from your stakeholders, such as surveys, one-to-one meetings, or brainstorming sessions. The technique chosen should take stakeholders and organisational culture into account. An engineering group may be more receptive to a brainstorming session than a formal survey. A finance department may welcome an in-depth spreadsheet analysis of the requirements.

The task is far from done once you have gathered all the requirements. Many project teams make the mistake of including all requirements into a project's specifications – all things for all people. This can lead to unclear objectives and a multitude of conflicting project paths. Budget considerations must also be taken into account at this stage.

The team in charge of requirements must now analyse, refine and organise the requirements received into a clear project path that is aligned with the project's mission and objectives. This process is sometimes referred to as requirements definition. This phase of the process, if done well, should also reveal requirements that



Credit: iStock.com/monkeybusinessimages

Requirements planning takes time and commitment but results in a cohesive, disciplined approach, favourably impacting project delivery, cost and schedule.

were missed during the gathering initiative. Sometimes, these requirements can be as or more important than requirements that were obvious from the start.

Thoroughly aligned requirements with objectives can assist in revealing what you do not know at the outset.

Your plan should consider and include training requirements, human factors and steps involved in managing resulting change.

Formal requests for information

At every step of gathering, analysing and defining, the requirements team should be documenting the rationale behind why a requirement has made the list. If a requirement justification cannot be easily explained, then there might be a requirement that should not be there.

Sufficient and clear documentation will enable the project team to clearly track deliverables back to the requirements. This will save a lot of effort in the long run by permitting the project team to focus on the deliverables.

Many organisations use a formal request for information process (RFI) to gather and hone requirements. Expert advice from potential suppliers can be invaluable to the process. RFIs also facilitate a more formal review of existing solutions that may fulfill a project's requirements. However, if a requirements team does not start with, or spend enough time gathering input from stakeholders, then the most thorough RFI process will never produce the results that the project delivery team is seeking.

Once you are confident that you have defined requirements, traceable to deliverables, the project – and the procurement process – is ready to proceed. It is important at this stage to circle back to the stakeholders and verify that everybody has

At every step of gathering, analysing and defining, the requirements team should be documenting the rationale behind why a requirement has made the list. If a requirement justification cannot be easily explained, then there might be a requirement that should not be there.

got it right. A requirements document will change and evolve throughout the course of the process, so it is important to ensure that nothing was lost.

Stakeholders' final review and buy-in will also ensure shared accountability for the project.

In summary, an effective requirement plan should include a defined mission, a clear understanding of the current situation and the associated costs in filling gaps. Comprehensive budget forecasting exercises at the outset and understanding how requirements changes can impact cost and schedule are essential.

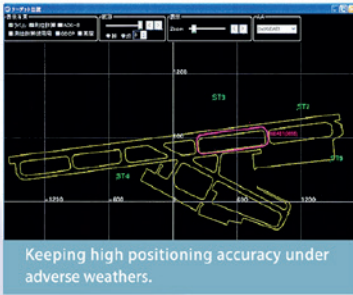
Requirements planning takes time and commitment but will ultimately result in a more cohesive, disciplined approach, favourably impacting project delivery, cost and schedule. ➤

The next article in this series will examine how to select suppliers that meet your exact needs.

Multilateration System

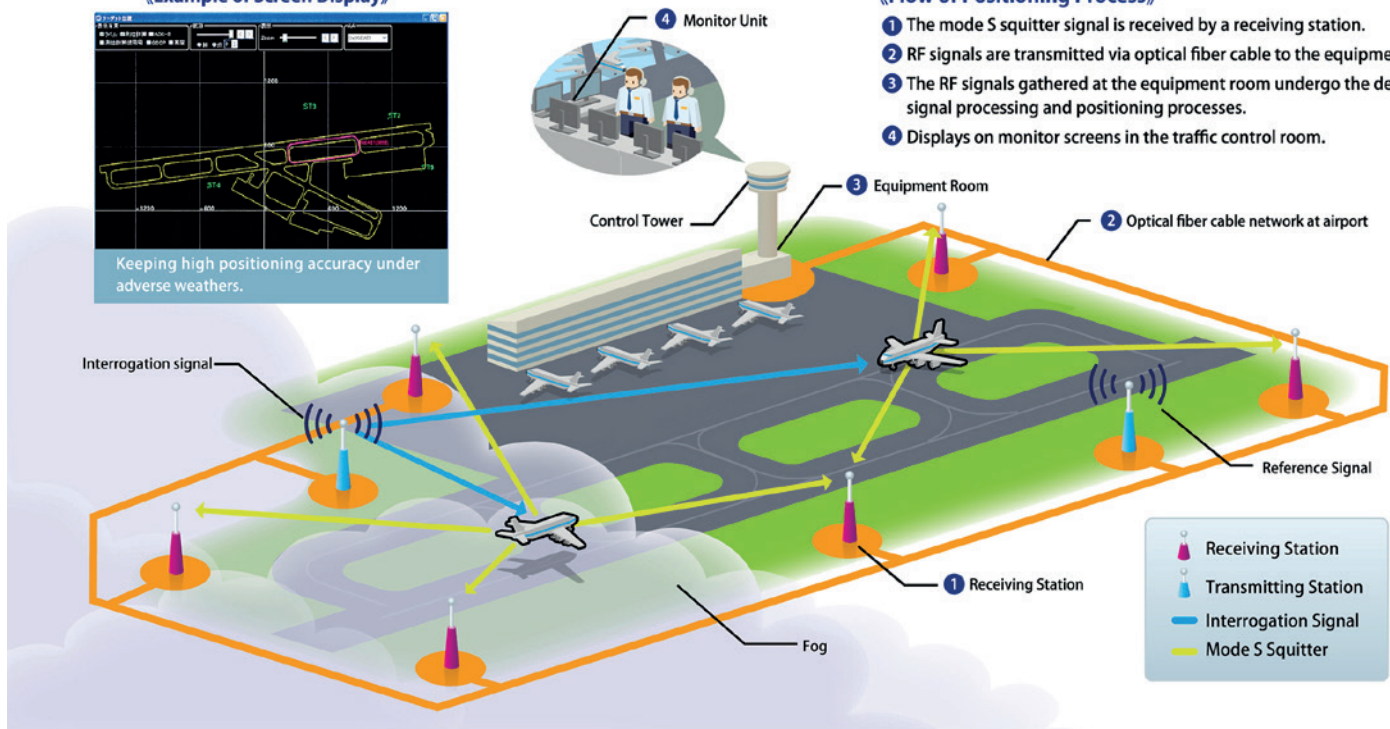
OPTIMUS MLAT Optically connected Multilateration System

《Example of Screen Display》



《Flow of Positioning Process》

- 1 The mode S squitter signal is received by a receiving station.
- 2 RF signals are transmitted via optical fiber cable to the equipment room.
- 3 The RF signals gathered at the equipment room undergo the detection, signal processing and positioning processes.
- 4 Displays on monitor screens in the traffic control room.



Japan Radio Co., Ltd.

<https://www.jrc.co.jp/eng/>

A New Line of Products by **NTT DATA**



NTT DATA Corporation

www.airpalette.net

info@airpalette.net

"airpalette" is a trademark of NTT DATA Corporation.

A time for action

European ANSPs need to accelerate the implementation of new technologies and concepts now if they are to accommodate the demand for air transport in the long term.



Data visualisation showing Western Europe air traffic flows between midnight and 09:00.

Credit: NATS

By 2037, it is forecast that 1.9 billion travellers will take to the skies annually in Europe, some 600 million more than today.

In one sense, it is a positive development. Aviation already represents approximately 4% of Europe's GDP (€730 billion) and supports 12 million jobs. By the time Europe reaches 1.9 billion passengers, it is estimated that the industry's GDP contribution will

nearly have doubled to \$1.4 trillion while about 18 million jobs will rely on air connectivity.

But Henrik Hololei, Director General for Mobility and Transport at the European Commission, was forced to ask at World ATM Congress: "Is this growth a good thing?"

Hololei's concern has its roots in the latest EUROCONTROL figures. Some 334 million travellers were affected by delays and cancellations in 2018, resulting in a €17.6 billion cost to the EU economy.

In 2018, every fifth flight in Europe was late and the European network generated a total of 19.1 million minutes of en-route delay. This is up 105% on 2017, though this should be placed in the context of 3.8% traffic growth.

Every fifth flight in Europe was late and the European network generated a total of 19.1 million minutes of en-route delay. This is up 105% on 2017, though this should be placed in the context of 3.8% traffic growth.

Nevertheless, the average en-route delay per flight for the whole year was 1.73 minutes compared with the EU-wide performance target of 0.5 minutes. Europe struggled to handle the 11 million flights in its skies and so questioning whether it will accommodate further demand is a logical line of thought. And this is without



Collaboration is required over a wider spectrum than currently, sharing essential data to assist in delivering SESAR solutions.

considering the exponential growth in drone operations and the forthcoming rise of urban air mobility and eVTOL (electric vertical take-off and landing) vehicles.

In short, Europe is nearing the end of the viability of the current airspace architecture. Even with improvements, EUROCONTROL suggests that by 2040 over one million flights will not be accommodated due to capacity constraints.

The big picture

Despite this, Hololei stressed that, for him, the “glass is half full and not half empty”. Europe, he said, is finally thinking in network terms. A number of ongoing high-level studies and projects examining the future of European skies seem to back up the sentiment. The European Commission (EC) has seized on the impasse caused by the constant revisions to the European ATM Master Plan and the outdated, unapproved SES2+ package to look again at what needs to be done.

Recently, SESAR Joint Undertaking (SJU) unveiled its Single European Sky (SES) Airspace Architecture study, which looks to boost network resilience and capacity. In parallel, the EC set up the Wise Persons Group (WPG), which has released a report on potential solutions for the short, medium and long term, taking into consideration the work already done, including the SESAR JU Airspace Architecture study and other documents such as EUROCONTROL’s 2018 study, *Challenges of Growth*. But whereas the Airspace Architecture study is a more technical

document, the WPG has concentrated on institutional and regulatory remedies.

The Airspace Architecture study will help to finally determine a fully revised ATM Master Plan although the definitive version of this document is not expected until 2020 given that a new European Commission will be in place at the end of 2019.

One interesting question related to this is who will be made responsible for implementing the recommendations. Both the Network Manager and the SESAR Deployment Manager are viable options.

By the time the question is answered, the third reference period (RP3) of the Single European Sky Performance Scheme – a regulatory tool imposing a set of ANSP performance targets for 2020-2024 covering capacity, cost-efficiency, the environment and safety – will be in place.

These short-term measures should point the way towards the aspirational goals outlined in the ATM Master Plan, for example by instilling some flexibility into the framework to account for local circumstances. It is vital that the binding local targets that flow from the EU-wide targets are realistic, achievable and appropriate for conditions.

Meanwhile, there is the European Commission’s Flightpath 2050, the long-term vision that is more about inspiring the correct research in the short and medium term.

Sharing data

CANSO has been consulted on much of the overarching work. But there is plenty for individual ANSPs to contemplate at a more granular level in the years ahead.

As Hololei put it: "There are political issues to overcome but the industry cannot sit and wait. It must be ready to move forward as soon as the political climate allows."

ATM's task, according to Simon Hocquard, Deputy Director General of CANSO, is to ensure that in 20 years' time, airspace users can fly from point A to point B, safely, efficiently, consistently, predictably, cost-effectively, using the optimal route and altitude and without delays.

"For the ATM system to support this, it needs to be a customer-focused, harmonised and seamless European airspace that is scalable and resilient," he says.

Operationally, collaboration is required over a wider spectrum than is the case today. A case in point is the agreement between EUROCONTROL and the ANSP members of iTEC (representing Germany, Lithuania, Netherlands, Norway, Poland, Spain and the UK together with technology supplier, Indra) to share essential data to assist in delivering SESAR solutions.

The partners will work together on the Flight Object Manager (FOM) and a system wide information management (SWIM) node. This will underpin the future exchange of flight trajectory data and significantly enhance consistency across system boundaries.

"With Flight Object Interoperability, the iTEC partners are working together on technologies that are decisive for the future of the Single European Sky," says Robert Schickling, Chair of the iTEC Board/Steering Group and Managing Director Operations, DFS. "All the air navigation service providers involved in guiding an aircraft from A to B will share all the information needed for this flight."

Importantly, such agreements do not require countries to lose ownership of their skies but simply show that planning decisions need to happen at a network level. Sharing data through SWIM will be a crucial enabler as Europe strives to deliver the single digital sky.

Artificial intelligence

Technology is another enabler for efficient operations. Continuous descent and climb, air traffic flow management and performance-based navigation will grow in prominence. But many other aspects

ATM's task is to ensure that in 20 years' time, airspace users can fly from point A to point B, safely, efficiently, consistently, predictably, cost-effectively, using the optimal route and altitude and without delays. For the ATM system to support this, it needs to be a customer-focused, harmonised and seamless European airspace that is scalable and resilient.

SESAR and Network Manager

The SESAR Deployment Manager (SDM) and the EUROCONTROL Network Manager (NM) will have crucial roles to play if Europe is to accommodate the growing demand for air transport, particularly during the hectic summer season.

The SDM will continue to be the cornerstone of technological advancement. It has 349 projects, 105 of which are already in operation. There are a further 19 projects planned. It is also developing data link services (DLS) to push the digitisation of ATM and expects 90% of European flights to be DLS-equipped by early 2020. This is an essential component in a proposed Single European Sky Digital Backbone (SDB).

For its part, the NM has been busy looking for solutions to ensure summer 2019 is less traumatic than summer 2018. With the NM measures fully implemented and assuming ATC strikes and technical failures are not rife, it is expected that the average delay per flight in 2019 will be about 2.5 minutes (up from 1.73 minutes in 2018).

Though the capacity of the network is expected to be less than in 2018 and traffic is estimated to increase, the NM User Forum noted two important developments that will help address the challenge of 2019: enhanced network measures will be put in place and implemented before the busy season, and collaboration and commitment to a network-oriented approach from all operational stakeholders is increasingly apparent, with all stakeholders willing to play their role within the network.

NM and virtually all of Europe's ANSPs have agreed to mutually support each other for the benefit of the network. In addition to the 30 bilateral meetings held by ANSPs between November 2018 and January 2019, approximately 250 strategic airspace organisation and utilisation measures have been agreed.

NM User Forum participants agreed to confront summer 2019 by taking a network-centric approach – managing summer and winter differently, allowing for a single view forecast, and accepting that different stakeholders face different limitations and needs.

Better management of weather information and enhanced flexible use of airspace (FUA) procedures are two specific examples of this heightened cooperation. Giving more power to Network Manager to make critical decisions affecting European airspace is an option very much on the table.

of the ATM system will likely change beyond recognition as such new technologies as augmented reality and artificial intelligence come to the fore.

"Artificial intelligence will progressively replace today's unique human input in dynamic decision making, for example in optimising airport collaborative decision making," suggests Hocquard.

"Who knows what further technological advances will have been made by 2035 but these technologies already point the way to a

A quality service from



In association with

MITRE

Comprehensive and Integrated Training

Aviation System Block Upgrade (ASBU)

Methodology and Best Practices for ASBU Implementation



More Information and Registrations
<http://mai.mitrecaasd.org>

Though there is little doubt that competition can help ANSPs to be cost effective and provide good service, it is essential to offer the right product at the right price. It is not a case of one-size-fits-all. ANSPs will need to be treated like normal businesses, free to make their own investment decisions.

digital, data-driven ATM system with a high degree of automation and machine learning.”

As equally crucial as technological advances will be organisational shifts. ANSP business models are on the cusp of change as the barriers to entry are reduced.

Greater competition in ATM and the separation of service provision and regulation is an inevitable market-driven consequence. It is already happening; there have been cooperative efforts where one ANSP has taken over a sector in another country to help deal with capacity issues.

Though there is little doubt that competition can help ANSPs to be cost effective and provide good service, it is essential to offer the right product at the right price. It is not a case of one-size-fits-all.

In general, though, ANSPs will need to be treated like normal businesses, free to make their own investment decisions. This will give them greater agility, which will be critical in such a dynamic market that is still prone to external shocks.

Again, collaboration will be vital with Hocquard noting that this “will require effective consultation across industry stakeholders in the execution and governance of service provision.” He continues: “ANSPs will need to have increased flexibility to innovate, cooperate or deliver services beyond their national boundaries building on examples, such as COOPANS or iTEC among others.”

Efficient airspace

CANSO has signed an *Efficient Airspace Declaration* together with EUROCONTROL, European Business Aviation Association, European Travel Commission and Airlines 4 Europe (A4E). The aim is to alleviate existing European bottlenecks and achieve short-term improvements on behalf of passengers and the environment through an agreed set of key principles.

“The *Efficient Airspace Declaration* has succeeded in reinvigorating enthusiasm for the vision of a seamless European sky of the future – as part of the SES initiative – and these past few months have shown that a combined effort among operational and political stakeholders is essential for real progress to occur,” says A4E’s Managing Director, Thomas Reynaert.

Tanja Grobrotek, CANSO Director Europe Affairs notes: “CANSO and its Members are working closely with the airspace users, European Commission, States, and other stakeholders to improve the resilience of the ATM network and achieve a truly seamless European sky. We look forward to continuing this collaborative approach to championing efficiency in Europe.”

Finally, alongside collaboration, technological development and new business models will be the need for people, always the bedrock of innovation. More controllers will be needed and appropriately trained for the new paradigms. The current controllers may need to be re-trained. A shift from geographical, sector-based training to a framework founded on systems will be highly desirable, says Hocquard.

Social dialogue is therefore a critical element. Simply put, ANSPs will not be able to offer airlines and passengers a better service unless that service is in full alignment with agreements with the workforce.

The involvement of staff and their acceptance and buy-in will enhance the ability of ANSPs to manage the impact of industry changes effectively, thus enhancing the benefits deriving from innovation and automation. ➤



Credit: Fraport AG Phototeam Andreas Meinhardt

The *Efficient Airspace Declaration* has succeeded in reinvigorating enthusiasm for the vision of a seamless European sky of the future.

Why Service-Oriented Architecture will succeed in defining future ATM systems?

Service Oriented Architecture (SOA) is probably one of the trendiest terms in the ATM world these days. Initiatives such as Virtual Centre or SWIM promote this architectural style as an answer to support an interoperable system for an integrated sky, and the trend is gathering speed.

Service orientation in the broad sense, especially if it is done right such as using the microservice architecture as defined by Martin Fowler, () can be the answer to one ATM's biggest challenges: the IT systems heterogeneity.

SkySoft-ATM are working with Skyguide

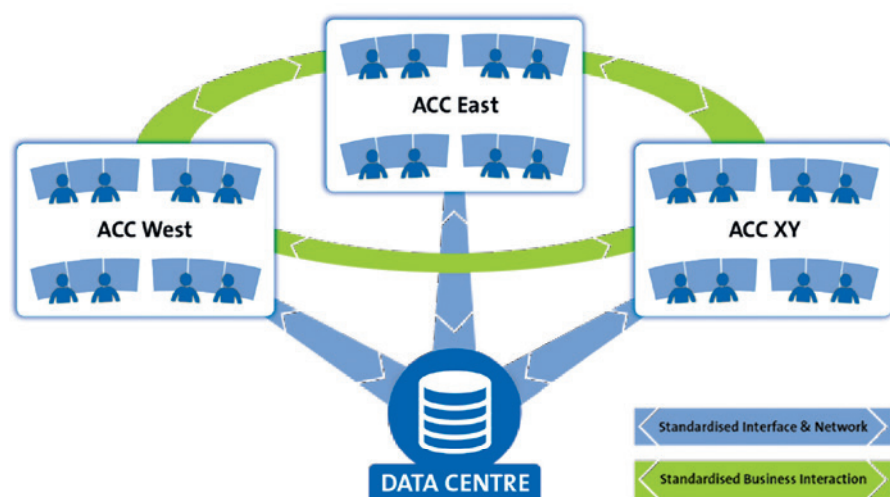
(Swiss Air Navigation) to implement a Service Oriented Architecture (SOA).

By standardizing the architecture and the interfaces between Front-End and Back-End, SOA opens data processing and supply activities up to competition. Individual Air Navigation Service Providers (ANSPs) will no longer be compelled to purchase a fully-fledged system of their own but will be able to acquire services from competitive suppliers or share equipment with other providers as long as interfaces are common and well-defined.

We can then imagine a new model where existing IT service providers establish a

service catalog. This catalog becomes the definition of a "Virtual Centre" where ANSPs can subscribe to ATM services using key SOA concepts (such as loose-coupling, location transparency).

Service orientation is first a way of thinking. However, the high level concept also hides a lot of complexity. It's a play that requires coordination at the requirements level, and a strategy for the incremental replacement of monolithic legacy systems by many lean and specialized components exposing standardized atomic services. Just another challenge to bring ATM systems into a new era!



A robust roadmap for India



Credit: iStock.com/somchaisom

The enormous surge in air traffic in India is a challenge that the national ANSP, Airports Authority of India, is welcoming with open arms.

According to the International Air Transport Association, India will become the third largest aviation market in 2024 and by 2037 will welcome 572 million travellers annually, 414 million more than today.

Similarly, Airports Council International (ACI) Asia-Pacific lists six Indian airports in its top 10 of fast-growing airports in the sub region. Delhi, Bengaluru and Mumbai are ranked first, second and third respectively.

"India is developing into a major aviation hub in the region, especially with growing routes between the Middle East and Asia," says Jeff Poole, CANSO's Director General.

Strong growth brings equally robust challenges in handling the increased demand... Airports Authority of India has a multi-pronged strategy in place to upgrade infrastructure, procedures, training and research and development.

"Air traffic management is playing an important role in enabling greater connectivity and realising the social and economic benefits of aviation for India."

Creating a roadmap

Such strong growth brings equally robust challenges in handling the increased demand. To cope, Airports Authority of India (AAI) has a multi-pronged strategy in place to upgrade infrastructure, procedures, training and research and development.

Part of the work is addressing existing shortfalls identified following a November 2017 ICAO Universal Safety Oversight Audit. But once complete, India's Directorate General of Civil Aviation (DGCA) believes the work will increase India's audit score to 74%, significantly above the world average rating.

Furthermore, the Indian Government has empowered the DGCA to regulate air traffic controllers rather than AAI, which should help improve the audit score further.

But the bulk of the strategy is about preparing India's 130 airports and 2.8 million square nautical miles of airspace for future growth. A key component is a deal AAI has signed with the US Trade and Development Agency (USTDA). Boeing will be the main technical partner, creating a 10-year 'roadmap' to enhance communications,



India recently celebrated 50 consecutive months of double-digit traffic growth which is still continuing.

expand existing systems and airspace capacity, and invest in navigation and surveillance/air traffic management.

"India recently celebrated 50 consecutive months of double-digit growth which is still continuing," said AAI chairman Guruprasad Mohapatra at the signing of the deal. "This growth has brought with it the challenge of maintaining safe and efficient aircraft operations. Hence, it was decided to draw a robust roadmap for sustained ANS infrastructure to meet the growth challenges in a planned way.

"We have entered into a grant agreement with USTDA, under which Boeing will provide the technical knowhow to develop a future roadmap for smoother and more efficient skies."

It is not the only agreement in place. AAI is also working with the Indian Institute of Technology (IIT), Madras to jointly research and improve air navigation systems. The IIT Madras experts will research potential mathematical, analytical, artificial intelligence and data mining solutions while AAI provides all-important air traffic data.

Part of the attractiveness of this Memorandum of Understanding is developing navigation equipment locally under the *Make in India* initiative, which would address import costs.

Mohapatra said: "It's high time that we focused on developing excellence through innovation and the adoption of technologies to provide safe passenger and aircraft movement."

Regional opportunities

The backbone of AAI's work to handle air traffic demand is a futuristic telecommunications infrastructure (FTI).

There is a 15-year deal in place with Harris Corporation to work on FTI. The goals of the partnership are to upgrade network operations, enhance security, and improve the overall efficiency and quality of India's ATM communications network while reducing telecommunications costs. The transition from voice to datalink should ensure uninterrupted communication with pilots across the entirety of India's vast airspace.

"The futuristic telecommunications infrastructure provides a dedicated nationwide telecommunication network to support air traffic management operations, with an emphasis on safety and high reliability and the ability to expand for growth," Mohapatra said.

FTI will play a vital role in the development of digital and remote ATC towers. AAI will soon benefit from one at Maharashtra Airport in Gujarat. The tower will be operated from Sardar Vallabhbhai Patel International Airport in Ahmedabad and is the first of its kind in India. The project includes a backup digital tower, also located in Ahmedabad.

Digital towers give India the opportunity to breathe new life into uneconomic, so-called ghost airports. Poole says the concept could be "transformative" in States like Gujarat and Andhra Pradesh where multiple small airports exist within a short distance of each other.

There are plans to revive 50 regional airports in the near future to boost connectivity between small cities. This is part of the *as ude desh ka aam nagrik* (UDAN, or Regional Connectivity Scheme) that caps air fares at an affordable level. Indian airlines are busy ordering aircraft to fly these regional routes. Vistara has narrow bodies on order worth US\$3.1 billion while IndiGo and Jet Airways also have huge multi-billion-dollar orders.

It is reported that India is looking into the regulatory requirements for remote and digital towers although CANSO argues that no changes are necessary. It says that regulation should be based on performance. Therefore as remote towers fulfil the same performance requirements as conventional airport towers, performance indicators are the same and the regulatory oversight can remain unchanged.

"Increasing pressure to reduce costs while even enhancing their service offering forces air navigation service providers to re-think the status quo and to explore new concepts such as remote and digital towers," said Mohapatra.

To further regional connectivity, eight mobile towers – which can quickly be constructed or taken down – have been acquired for

India has introduced air traffic flow management to its skies, which will help to balance capacity against demand to achieve the optimum use of airport, airspace and aircraft at every Indian airport where there is a capacity constraint. This will reduce the complexities associated with the massive growth in air traffic being experienced in the country.

use in Ambikapur, Bilaspur, Bokaro, Gujarat, Jagdalpur, Jeypore, Utkela and Vellore.

Jharkhand's Bokaro is the first city to get one of the mobiles, which have been purchased under the regional connectivity scheme. Bokaro is home to an important steel plant so there is also a plan to rehabilitate the airport. The runway, taxiway and terminal will all benefit, and it is thought Patna, Kolkata and Delhi will be among the first destinations.

Finding a balance

More generally, India has introduced air traffic flow management (ATFM) to its skies. ATFM will help balance capacity against demand to achieve the optimum use of airport, airspace and aircraft at every Indian airport where there is a capacity constraint. This will reduce the complexities associated with the massive growth in air traffic being experienced in the country.

It is expected that ATFM will not only enhance safety but also save airlines approximately US\$250 million per year in fuel costs and contribute to reducing greenhouse gas emissions.

ATFM will move AAI away from tactical adjustments to a more strategic and cooperative approach to managing system-wide resources and capacity. AAI should then be able to avoid much of the congestion and delays in the terminal and en-route airspace areas through collaborative decision-making (CDM) processes involving all stakeholders.

A supporting project will see Indian upper airspace harmonised with neighbouring airspace as much as possible. This is vital, given the constant east-west international traffic flow across Indian airspace. The work will reduce operational inconsistencies and differing rules and procedures, facilitate the flexible use of airspace and better utilise data.

Better surveillance

Other developments include ground-based augmentation systems (GBAS), automatic dependent surveillance – broadcast (ADS-B) and performance-based navigation (PBN).

GBAS is being driven by a desire to improve safety in the landing phase. It will provide a CAT-I landing minima alternative to an instrument landing system and is expected to support CAT-III operations in the foreseeable future.

Meanwhile, ADS-B has been successfully installed at 30 locations. But AAI is not stopping there. Surveillance could get a further boost as the air services provider is keen on deploying space-based ADS-B.

PBN is being implemented in accordance with ICAO's Regional Implementation Plan. The initiative brings a host of advantages, including support for AAI's flexible use of airspace plans, the enhancement of airspace capacity, and provision of optimised flight profiles. Most importantly, it makes Indian skies safer.

Hosting 500 million-plus passengers across 130 airports and nearly three million square nautical miles of airspace is an enormous task. But the work done and the work ahead ensure that India is destined to be a leading light in aviation. ➤



Hosting 500 million-plus passengers across 130 airports (Delhi pictured) and nearly three million square nautical miles of airspace is an enormous task.

Credit: iStock.com/saiko3p

Power to the people



Credit: iStock.com/18percentgrey

Human performance remains the critical link in safe and efficient air navigation service provision.

The air traffic management sector is replete with talk of automation, digitisation, augmented reality and artificial intelligence. There is no doubt that these developments will change the role of people but equally assured is that people will not be replaced.

"If the guiding principle that people create safety continues and is understood to be the basis for the excellent safety performance in the aviation industry, the interaction between operator and technology must be the focus of our efforts more than ever before," says Jörg Leonhardt, Co-Chair of the CANSO Human Performance Management Task Force and Head of Human Factors/Ergonomics at DFS Deutsche Flugsicherung GmbH (DFS).

In other words, it is becoming increasingly important to consider how the components of the overall system are aligned to ensure that safety is never compromised, and maximum benefits are obtained. That means making the most out of people.

A necessary enabler

The *CANSO Standard of Excellence in Human Performance Management*, published in March 2019, helps ANSPs tackle this important subject. The Standard is based on input and validation from 16 CANSO Member ANSPs and EUROCONTROL, steered by three CANSO Workgroup Co-chairs from NAV CANADA, NATS and DFS.

"In most ANSPs, there are activities related to human performance management, for example training, teamwork or selection," says Leonhardt. "However, it is often the case that human performance activities are carried out in different departments and the individual elements not connected. The new Standard helps enormously, since it not only measures the performance of individual components but also establishes a framework for the integration of these elements."

To assess, develop and improve their human performance management, ANSPs need to consider 12 elements (see page 33).

The necessary enabler is the first element, Policy, Strategy and Resources, which must be embedded within and support the organisation's vision. The appropriate focus and resources have to be provided to make this possible.

An ANSP will, of course, need to know how successful it has been in implementing this element before it can go any further. For this, the publication uses the same levels of maturity as those used in the *CANSO Standard of Excellence in Safety Management Systems*. These levels run from A to E (see page 34).

Level A equates to informal arrangements where human performance management considerations have not been formally embedded at the organisational level but rather depend on the individual.

There are then three intermediate steps before an organisation achieves the optimised Level E, where human performance management processes set international best practice, focusing on innovation and improvement.

The publication suggests that it is important to reach at least Level B in the Policy, Strategy and Resources element “as this reflects a maturity level where an ANSP can identify priorities and the resources available”.

This strategic understanding of human performance enables the development of a plan for establishing a human performance management system.

Integrating elements

The following 10 elements can be undertaken in any order, each bringing insight into a particular aspect of human performance that can positively affect an organisation. An ANSP should consider:

- what it already has in place
- what resources it has available
- the priorities within the business

Although it is easier to start with one or two elements rather than addressing all 10 at once, in the medium term it is necessary to consider all 10 elements. Different aspects of human performance are traditionally managed by different departments, but a key message of the publication is that all human performance activities must be coordinated.

“The Standard pointed at some gaps between various groups responsible for the 12 elements and enabled us to see where efficiency gains can be attained,” reveals Remi Joly, Co-Chair of the CANSO Human Performance Management Task

Why is a human performance management programme necessary?

People continue to be the foundation for a safe, efficient and effective air traffic management system. The *CANSO Standard of Excellence in Human Performance Management* states: “It is people that control aircraft, it is people that maintain equipment and it is people that create safety.”

Because ATM is a complex system in a state of constant change, a high level of performance from the humans in the system has never been so important. Adaptation and flexibility are key ingredients for successful ATM, and it is the people in the system that provide these qualities.

All areas that contribute to human performance must therefore be managed at a programme level in an integrated manner. The *CANSO Standard of Excellence in Human Performance Management* provides ANSPs with a means to identify an organisation's priorities for improvement and the actions that should be undertaken.

Force and National Manager, Human Factors at NAV CANADA.

“This is key to the development of an effective human performance management programme because all 12 elements of human performance management need to be integrated and managed.”

As an illustration, there is no point in implementing a state-of-the-art system if nobody knows how to use it. So, ATM equipment and support tools has an obvious crossover with operational training, leading to positive changes in operational procedures.

The impact of the change will need to be ascertained, which may drive further developments in selection, health and wellbeing or roles and responsibilities.

How the new system is working is also something that falls under the investigation and learning element while leadership is clearly vital to the overall success of the new system. In short, human performance management is a complex, interlinked business.

Nevertheless, two elements – ATM equipment and support tools and human performance investigation and learning – are offered as ideal starting points by the publication. “Addressing the former is a proactive way to improve human performance while the latter provides a better understanding of current human performance and where improvements are needed,” it states.

It is also suggested that an ANSP reaches at least Level B for each of the 10 elements rather than increasing some elements to a higher level while leaving others at Level A. Because of the close relationships that exist between them, this approach ensures a balanced approach to human performance management.

Once Level B is achieved for all 10 elements, attention can be directed at achieving Level C for those deemed most important to the organisation.

Ultimately, in line with the recommended target for the *CANSO Standard of Excellence in Safety Management Systems*, it is suggested that ANSPs get to at least Level C for each element.



Source: CANSO

The 12 elements of the *CANSO Standard of Excellence in Human Performance Management*.

This guarantees that human performance is being actively managed in a consistent manner and the benefits of that process are being fed into organisational safety and efficiency.

Delivery assured

The final element, Assurance, completes the human performance management programme. It ensures that decision makers are confident that human performance is being managed in an integrated, comprehensive fashion and delivering business and safety benefits.

The *CANSO Standard of Excellence in Human Performance Management* recommends that one individual is given responsibility for a human performance management programme or "a joint steering committee is set up to oversee the implementation".

There is naturally a requirement to commit resources, both personnel and financial, to achieve success. Though exact amounts of each will differ depending on the size and complexity of the organisation, dedicated professionals who focus on developing the appropriate elements and spreading awareness among the wider workforce are essential.

"Within NATS, we believe that people create safety and that human performance is a key component of the provision of a safe, effective and efficient air traffic management," says Neil May, CANSO



Human performance is essential to safe and efficient airspace.

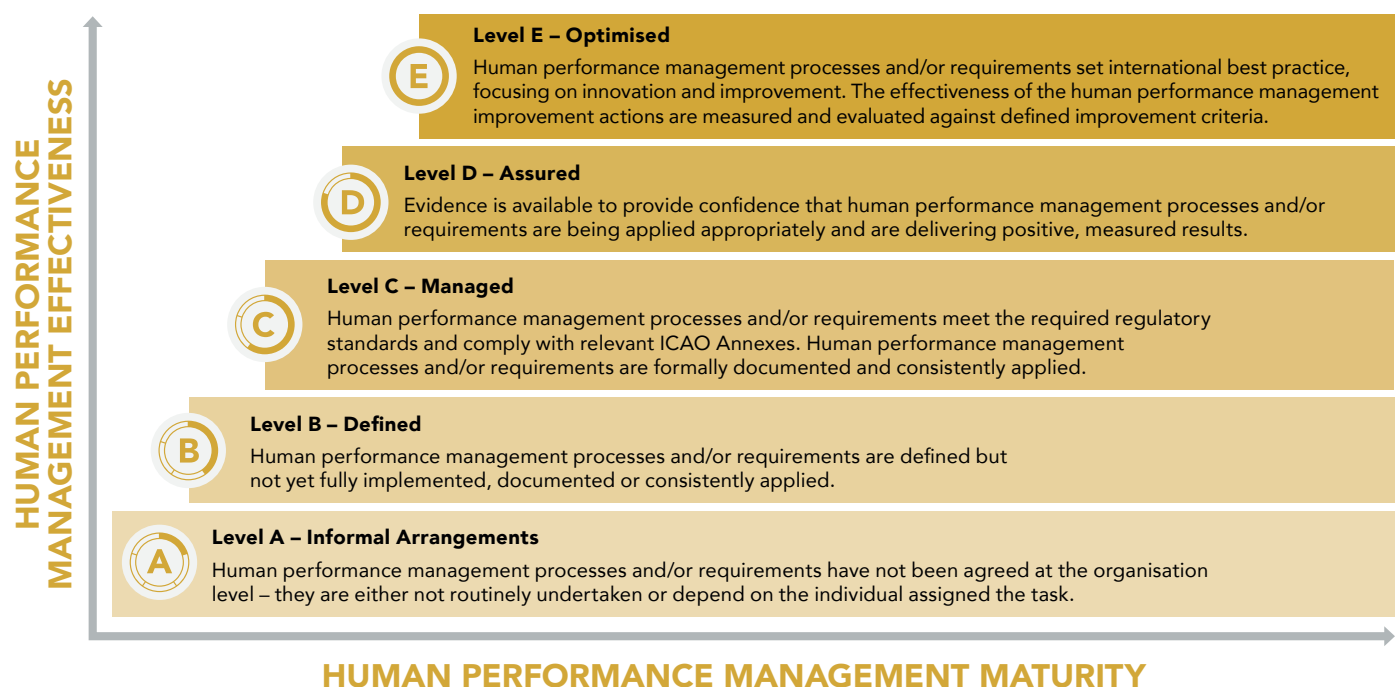
Credit: DFS Deutsche Flugsicherung GmbH

Human Performance Management Task Force Co-Chair and Head, Human Factors, NATS. "With the human remaining a critical part of the ATM system for the foreseeable future, the need to manage human performance in NATS remains a high priority and the new CANSO Standard is helping us to achieve this.

"The *CANSO Standard of Excellence in Human Performance Management* will ensure that the right human performance activities are being undertaken at the

right time with the right results, and that these activities are coordinated across organisational departments and across different operational units to get optimal human performance." ➤

The *CANSO Standard of Excellence in Human Performance Management* is available for download from the CANSO website: www.canso.org/publications



Source: CANSO

Be part of the future of air traffic management



With CANSO's Members supporting almost 90 per cent of world air traffic, CANSO is the global voice of air traffic management (ATM). Join today to help shape the future of a safe, efficient and seamless airspace.



Be heard

By governments, regulators
and key stakeholders



Be connected

Build your network through CANSO
events and digital platforms to reach
20,000 people



Be inspired

Take advantage of the
40+ publications online and
160+ presentations per year



Be active

Contribute to industry-defining best
practice and thought-leadership through
CANSO events and workgroups



Be innovative

Showcase how your technology can
help the industry and offer new ideas
to common challenges

canso.org





SPACE-BASED ADS-B
**MAKING GLOBAL AIR
TRAFFIC SURVEILLANCE
A POWERFUL REALITY**

Aireon has revolutionized the global aviation industry by deploying a global satellite-based system, able to track and monitor ADS-B equipped aircraft around the globe in real-time.

aireon.com

