White Paper

Introduction

By Simphiwe Thobela, ATNS board chairman

The theme for AviAfrique 2018 is breaking barriers in the aviation industry through innovation. This year we look at innovation in the context of digital aviation, which is increasingly important during a rise in global air passenger traffic. In 2018, this number rose by 6,5%, bringing the total number of passengers to 4,36 billion. That number is projected to grow by 50% in the next three decades.

According to the Digital Aviation Research and Technology Centre (DARTeC), digital aviation – which includes everything from unmanned traffic to next-generation air traffic control – steadily increasing air traffic density should be a top priority addressed collaboratively by airports as well as aerospace and air traffic management companies.

During this unprecedented period passenger safety, security, and convenience are paramount. That makes innovation one of the most important considerations. There is a need for a global cyber security centre of excellence that can explore the gaps in technology innovation in the context of aviation safety and security and seek ways to close those gaps to prevent exposure to cyber criminals.

More than four billion passengers put their safety in our hands. We must also remember that we contribute to the growth of global economies. Gatherings like these help us explore ways to move forward in the digital age. It is important to have access to critical content shared here for future conversations.

We have face-to-face discussions but we live in a technology era with access to one another as and when we please so we hope this is an ongoing process that doesn't end here but continues until we meet again at the next summit.

Collaboration is important as we seek new ways to conduct business by including entrepreneurs, government departments, non-government organisations, commercial organisations, and OEMs - we must all work together.

Our industry has no rigid boundaries. We must take a view to a single African air travel market context, which is why we have created this platform for collaboration, sharing, and innovation.

Guest Speaker

SKA as a Global Science Initiative: achieving harmony with aviation-based spectrum usage

Dr Adrian Tiplady head: strategy and business systems at SKA

Dr Tiplady said that it is the hope of the scientists at the Square Kilometre Array (SKA) to detect signals travelling from the beginning of the universe itself. "In a few years we may be able to show the birth of the universe over the past 13 or so billion years."

He said it is their desire to host an advanced science facility like the SKA to show the world that South Africa is a great destination for long term investment and infrastructure development. It would show the world that South Africa is capable of more than building stadiums to host the 2010 Soccer World Cup over a six-week period at a cost of "…over a billion dollars or so…" and that South Africa is more than, "…a great place for a safari."

The SKA, he says, is internationally funded. "It is the most important science facility in 50 years. SKA is about developing the knowledge economy in South Africa and moving away from a resource-based economy exporting gold and diamonds…"

The SKA site in the Northern Cape was chosen for its low population density, which equates to low radio frequency interference (RFI). Everything from car radios to cellphones, welding equipment, petrol engine vehicles and even standard power lines interfere with, and may even damage or destroy, the highly sensitive radio frequency (RF) SKA receivers.

Aircraft, too, carry equipment that interrupts or may damage or destroy SKA receivers. Dr Tiplady says SKA personnel are actively engaging many stakeholders in an effort to cohabit with numerous groups, organisations, communities, and commercial operations, including general aviation (GA), commercial and military air traffic.

It is important to note, too, he says, that the South African government recognises the strategic advantages of SKA since in 2007 it created the Astronomy Geographic Advantage (AGA) Act that gives the Minister of Science and Technology the power to protect areas of strategic national importance for astronomy and related scientific endeavours.

"It is important, during this process, that the minister develop regulations for these areas. Aviation has been excluded from the applicability of these regulations," he says. "We engaged the Department of Transport to create provision of critical aviation-related services but still allow the SKA to operate. We are engaging with all stakeholders in the declared area in the Karoo, which is about 500km across. That includes railways, electricity generation, communities, the military, aviation, and many more."

He says it is key to ensure cooperation through memorandums of agreement (MoA) and that SKA wishes to imminently sign one with the Department of Transport and other entities.

Delegates, however, raised numerous issues that challenge the unimpeded operation of the SKA. "Is SKA a vanity project," one asked. He added that speculation and rumour about the impact of SKA are rife and that industry needs clear understanding of what is expected of the aviation community in respect of the SKA.

Dr Tiplady responded that there are numerous options to explore regarding mitigating environmental risks to the SKA's operation, such as reducing the number of radio frequencies used nearby the SKA, transmission power, or perhaps the duration of those signals.

The distance the SKA is looking to limit RF interference is in a 16 nautical mile (nm), to 26nm ring around the facility. "That covers two air routes at this time but we need to talk to the aviation sector about that. We certainly do not want to restrict everything within 1000km."

Asked whether SKA understood the impacts of aircraft transponders prior to the SKA's construction, transponders which must, by law, transmit permanently and which, according to Dr Tiplady, may damage or destroy SKA equipment, he responded that SKA is currently undergoing another design process to explore how it can make receivers more robust. "We expect a final system design review in the next year," he said. He adds that SKA does take several factors into account and seeks to mitigate risks from all possible alternatives.

Dr Tiplady also noted the collaboration and communication concerns of another delegate who claimed to be on the technical committee established to interface between the aviation industry and SKA. Engagement, he says, and collaboration with all affected entities was an ongoing concern for SKA that seeks to consult with all affected parties to reach an equitable solution.

Guest Speaker

Mr Parthy Chetty, Executive Director: Eskom Expo for Young Scientists

I was intrigued about what the Eskom Expo has to offer to a forum like this. A small non-governmental organisation (NGO) often flies below the radar so I hope that you take our message back to your organisations.

Let me take you on a journey we embarked on to innovate in the 21st century. Many of you are at the forefront of innovation dealing with graduates and scientists and engineers. But what if everyone suddenly retires? Will it happen? We talk of the Fourth Industrial Revolution, which I feel should actually be called the First Digital Revolution. Regardless of the name, you may have questions on what we are doing in South Africa and Africa to deal with this. We have to use it to answer our own challenges. And we start by taking control of our future. Here's a quote to set the scene: "The only way to predict the future is to have the power to shape it." - Eric Hoffer, American moral and social philosopher.

In conventional societies we live and act within constraints and that means we will maintain the status quo year in and year out. But we need to create next-level innovators, who right now are in grade 4 or 5. Very few of our future innovators are currently in grades 10 to 12. Many sitting here probably have teenage children so you'll know that they know everything. By the time they're in grade 10 they know it all. So we have to start shaping them to be innovators at the right age, when we can still influence them in a positive way, because they will change our future, they will create jobs that don't exist today, they will be the technologists who will solve problems that don't exist yet. And we will be the ones who create those problems. But shaping the minds of those children today is the best investment we can make in the future.

Let me share some proudly South African facts with you. First, Basil Schonland. During the Second World War South Africa was an important territory but we had no radar, nor was equipment shippable from the western allies. Schonland had to build a radar transmitter which he did by being innovative with spare parts. Some say his transmitter was actually more efficient than the heavier, bulkier, and more expensive systems developed by the high-tech people back in England. Maybe. But he created something out of necessity.

Next was Dr Trevor Lloyd Wadley who developed the tellurometer [microwave distance measuring equipment], which sold a few hundred thousand units worldwide. That was back in 1957.

We must also include Elon Musk of SpaceX. He did, after all, graduate from Pretoria Boys High School and went on to develop a rocket engine that is more efficient than the conventional ones used until then.

The lithium ion battery was developed right here at the CSIR, about 25 years ago. Without that the laptops and smartphones we all use today would not run for the entire day. It revolutionised how we work with technology and the value it brings us.

And now I want to mention two younger ladies. Claire Reid was a 16-year-old who, in 2002, created the Reel Gardening Kit while doing a school project. She went on to university then started a company in 2010 after she graduated. Her system saves 80% water when planting seeds. She used cake flour and water and stuck seeds to paper and buried them to a specific depth that resulted in her product - a young school girl started an industry because she had a platform to showcase her invention.

Another 16-year-old old school girl, Kiara Nirghin developed a super absorbent polymer using orange peel and avocado oil which can retain over 600 times its weight, which is better than the existing technology that offers 300 times. She won a Google science fair challenge and $50 000. She beat the best in the world. This is the calibre of learners we have in our schools and I know there's debate about performance in our school system.

But where do these bright young minds come from? They are in our schools but they need a platform to showcase their excellence because one day you will want to employ one of these young scientists or engineers. And, as I always tell my children, if you are not among the best then nobody will want to hire you.

So how do we start? Thirty-eight years ago Dr Derek Gray came to South Africa and hosted the first Eskom Expo of Young Scientists at Pretoria Boys High where he was a chemistry teacher. He wanted children to do science, to get them interested in experiments, mixing chemicals and blowing up stuff. What could be more exciting to children to stimulate their interest? It would create the desire for innovation and create the right state of mind.

A month ago our Department of Science and Technology released the draft White Paper on Science, Technology, and Innovation (STI) for public comment. It seeks to accelerate inclusive economic growth to improve peoples' everyday lives. It's our responsibility to unpack that in our own areas so we can contribute. In keeping with theme of innovation, how we can be innovative? Sometimes, as adults, we take things for granted but children will often do the unconventional. We need them to grow up being allowed to do the unconventional.

The Eskom Expo is a platform incorporating 35 regions across South Africa, various African countries, and includes Mexico. It gives our learners the opportunity to do a little more, to make a difference, and we co-exist with the school system. This is a national initiative, funded and supported by the Department of Basic Education, the Department of Science and Technology, and the Department of Public Enterprises. It's available in any school, from government to private. We are mandated to develop future scientists and engineers in conjunction with the private sector.

The World Economic Forum (WEF) recently ranked South Africa number 140 out of 144 in its competitiveness report but there was no statistical survey conducted. That was just the opinion of select CEOs. Here's another view of that competitiveness ranking. We sent 25 of our children, from seven countries, 14 of them previously disadvantaged and 13 females, to the international science fair. They won 15 awards, six of them were previously disadvantaged and 11 were female. We also sent five grade 11 girls to China, selected from 600 other South African learners, where they entered projects in the 2018 Beijing Youth Science Creation Competition. They all won gold or silver awards. And that's a sign; this is no longer a male-dominated field. Another child through our Expo hails from Limpopo. He won a bursary that he says makes him the first person in his village to go to university. That's a heart-warming story. There are many such children out there.

One of the questions industry wants to answer is how to take graduates and bring them into their businesses and get them performing right away. Well, we must ask where does innovation start? It starts young.

Some of you may recognise the name Siyabulela Xuza (Siya) who changed what we thought was possible for a young kid from Transkei to achieve. He won a Harvard Scholarship and he's now an icon in Africa. He came to the Expo in 2006 and won gold. Mark Shuttleworth was there talking to our learners that day. And Mark Shuttleworth came through the Expo before that as a young learner himself. Siya's a young face among us. When we asked him what he's doing he told us he's researching energy storage devices. This is not a battery. It's something else entirely that he will reveal soon. In 2006 he presented an alternative rocket fuel when he won the Harvard scholarship. He went on to do a stint at NASA. Who would have thought a Transkei kid would achieve that? He did because he had the platform he needed to get there. There are diamonds in the rough out there. These young, bright stars need the platform to be judged and rewarded. And they can change the way our organisations operate. They are the ones who will destabilise your mindset but in a positive way.

So how do we innovate? First, we must set unrealistic goals. When you do that you think you cannot achieve the goals but curiosity gets you creative. You can also create your own job or role if yours doesn't fit into existing moulds. Be disruptive, challenge things, don't accept traditional approaches. Believe in a vision, and that means having a long attention span, because rarely will you succeed the first time. You also need to know if your idea is new or innovative, if there are gaps in the market, and know what the market needs.

None of these are concepts taught at university or school. All of those focus on content knowledge. I challenge you, in your organisations, to reflect on these issues and start testing whether or not you become more efficient and productive. There's no harm in changing what we do. Do the same thing repeatedly and you will get the same results. So, start something fresh. Give the job to youngsters in your organisation and let them fail so they can learn and return more successful. As a country, South Africa can thrive on the efforts of these young learners.

Keynote Speaker

Securing talent for aviation safety

Dr George Simataa – Secretary to The Cabinet, Office of The Prime Minister, Windhoek, Republic of Namibia

"How do we secure talent for aviation safety?" Dr Simataa says he provides a guideline if not a definitive process. "We know that people are our most important asset," he says, "and they provide competitive advantage."

He says that it is therefore crucial to develop people from the time we begin recruiting them to into their retirement. "There are four streams of thought in the talent management school," he says.

The first is that HR is recruitment. The second is that we must develop pools of talent to create a pipeline for sustainability. The third is the idea of developing inherent talent and classifying capabilities with a view to retaining and promoting the right talent within our organisations. The fourth is properly examining the strategic positions in our organisations and, in this case, the roles in aviation safety.

We must also acknowledge, he says, that some people have a natural talent, a bent, or inclination to fulfil their roles. We must also determine if roles contribute to strategic management of our organisations by asking if the organisation will continue if the role does not exist. "You can lose a toe," he says, "and still live a normal life. But you cannot lose your heart."

We must also determine if the skills are available in the market to fill roles that are strategic to our organisations. Integrity and skills are crucial in officers filling roles throughout aviation safety, which necessitates making the positions attractive to candidates, which requires the involvement of professionals from the industry.

How we advertise for specific people to fill specialist roles is a significant factor in attracting talent. Shortlists are also important to sift through candidates and get to the right people. Interviewers must also possess the requisite skills to conduct professional interviews that ascertain the finer qualities of candidates and their suitability to the intended roles.

The induction process is crucial as it absorbs people into the organisational culture and sets the stage for their careers in the business, organisation, and industry.

"Succession management is an important issue," he says. Managers and leaders must foster the talent pool to secure succession. By way of example, he spoke about a project at the Directorate of Civil Aviation in Namibia at the time he completed his PhD. "ICAO provided some professionals we required at the time but, because there was no mentorship, when they left we went back to square one." Mentors, he says, are an integral part of the chain of succession and sustainability.

Retaining talent once you have it is also an important consideration. "Safety officers are highly competent people. Investing in them with the right training makes them worthwhile participants in our organisations," he says. That perception of self worth is a critical element in retaining their services. So too is the market perception of the brand for which they work. By way of example, he says, "Nobody wants to work for VBS bank."

Quality leadership is an equally important criterion to attract and retain top talent. "Leaders who take the time to acknowledge their employees, even a simple thank-you for a cup of coffee, are important," he says. Many people leave organisations because they are treated poorly by their leadership. Highly skilled people, he says, do not tolerate incompetent supervisors and managers. "You do not want to make enemies of the stars in your organisations," he says.

Dialogue

Aviation industry systems are becoming more connected (integrated) and cybercrime threats are becoming a reality

Ms Sandrine Gnassou, Air Navigation Service Safety Oversight Inspector (ANS-CNS) Autorité Nationale de l'Aviation Civile (ANAC) de Côte d'Ivoire

The number of cyber attacks are increasing, the damages of which will cost up to $6 trillion annually by 2021. They are real and serious in aviation. The British Airways app and website were breached in September 2018, compromising the payment details of customers. The effects of such breaches are growing because systems are more interconnected now than ever before and we have fewer isolated architectures. The increasing use of commercially available IT systems also exposes organisations to risk.

Cyber security comprises technology, processes, and control. The goal is to ensure integrity, availability, and confidentiality of data and services. It is important to remember it's about technology but also people.

Cyber resilience is an organisation's ability to continuously deliver the intended outcome of service despite adverse cyber attacks. Threats are any identified effort to exfiltrate, manipulate, or impair integrity of systems' confidentiality, security, or availability of data or applications.

There are also a wide variety of cyber threats ranging from spam to data breaches. There are also varying levels of sophistication of attacks that range from vandalism to espionage to warfare.

In aviation we face two specific threats. The first is attacks that could lead to a loss of life or unsafe aircraft operations. The second is politically or criminally motivated attacks for economic gain. Aircraft, airports, airlines, and air traffic management (ATM) are all targets of this type of attack.

Examples of specific threats to ATM include injecting false information in controller-pilot data communications links, or login usurpation on ATC systems, CNS data spoofing or data corruption, spoofing ADS-B radio signals, injecting malware during maintenance, spoofing GPS time, or denial of service (DDoS) attacks on aeronautical information services.

How can aviation be resilient to these threats? There are five key elements:

1. We must identify critical infrastructure.
2. We must understand the risk.
3. We must protect ourselves according to the risk and monitor to detect cyber attacks when they start.
4. We must respond to attacks.
5. And we must be able to recover from attacks.

ICAO AFI (Africa-Indian Ocean region) initiatives include the AFI Planning and Implementation Regional Group (APIRG) Infrastructure and Information Management (IIM) sub-group's Communication Project 5: the assessment of AFI aeronautical networks cyber security.

It aims to assess and prevent internal and external cyber threats that impact availability, reliability, integrity, and continuity of aeronautical networks in Africa. It also seeks to develop and implement a global cyber security policy for aeronautical telecommunications systems in Africa.

The project is currently in the second phase, which is assessing cyber resiliency.

Cyber security is a tough responsibility throughout the industry and all its sectors, and we must, first and foremost, all be fully cyber aware.

Mr Thsepo Peege, Representative of South Africa on the Council of ICAO, Montreal, Canada

Looking at cyber issues I would like to reflect on the Chicago Convention (The Convention on International Civil Aviation, established 1947), which says the future development of civilian aviation can help create and preserve friendship among nations and peoples of the world yet its abuse can become a threat to internal security. This is the foundation of what ICAO is.

Annex 17 (Security - Safeguarding International Civil Aviation against Acts of Unlawful Interference) says it is of critical importance to international aviation to secure against the unlawful seizure of aircraft, sets out the basis for ICAO civil programme to safeguard civil aviation and facilities against interference, and it's critically important the measures ICAO takes prevent and suppress acts of unlawful interference against civil aviation worldwide.

Resolution 39-19 addresses cyber security specifically, making mention of the highly complex and integrated nature of technology critical to safety. It notes that aviation is increasingly reliant on communication technology systems for data availability and integrity. It also notes that the cyber threat scenarios constantly evolve and the impacts of cyber threats include malicious intent, interrupting business continuity, and theft of information for political, financial, and other purposes.

We need an end-to-end approach in response to these challenges to improve our resiliency in a way that supports all stakeholders. And we have to consider governance and technical aspects and we must leverage commercially available technologies and methods to do this quickly and affordably.

All aviation organisations and stakeholders have come together to request ICAO to work with states, industry, and international organisations to develop a globally harmonised aviation trust framework that includes governance, policy, training, and overall technical performance requirements to allow the realisation of an information-rich and resilient aviation system.

Comment from the moderator and the floor

What about UAVs? We must consider unlawful interference coming from small two-kilogram drones such as was used in Venezuela to attack the president, our philosophy may have to consider the future too.

A commentator noted that we need a curriculum to advance cyber security skills in Africa, where there is a dearth of skills.

The moderator posed the question: What is hackable on an aircraft or at ATC? "Anything that's connected," came the response. "And many systems are using off the shelf software now and that means they're connected to the manufacturers and that means they're hackable."

Digital Transformation

How digital transformation disrupts and reshapes whole sections of the aviation economy and of the ATM extended industry

Francois-Xavier Richard, Senior Business Development, Air Traffic Management at Thales

Digital transformation impacts the entire aviation world and the industry is under pressure from numerous trends. Air traffic will double by 2035 bringing new passenger expectations and intermodal competition. Air service providers, infrastructure providers and aircraft providers will all be challenged and we can expect numerous technology disruptions.

Air navigation service providers (ANSP) and air traffic management (ATM) providers will have to evolve to deal with a new competitive environment that will lead to new model adaptations, including partnerships, for all the different stakeholders. It will result in competitive service provision.

"Thales seeks to be ANSPs' preferred partner to ensure their long-term success," says Richard. To do so, he says, Thales perceives digital priorities for ANSPs will focus on five areas:

1. A reliable platform that is secure and scalable for growth;
2. Agile, safety-grade solutions capable of regular and seamless upgrades;
3. Productivity-boosting automation providing the best possible user experience;
4. More dynamically connect all stakeholders via ATFM and UTM for civil and military aviation coordination and operational optimisation using AI and ML; and
5. Provide data-enabled, service-based, performance oriented digital business models.

Thales, says Richard, has been investing at group level in digital transformation for more than four years. These investments have been in big data and analytics, artificial intelligence (AI), a safety cloud platform, cyber security and data protection, and connectivity and the Internet of Things (IoT).

"This allows us to transform our businesses alongside our customers' businesses," he says. "It supports our ambition of being a global leader in all markets. And it leverages our global and disruptive innovation capability."

Thales has also created a digital factory to aid in its transformation, product and service delivery. It includes a digital centre of excellence, a digital platform, a start-up incubator, a digital academy, and transforming Thales at its core. And in 2017, Thales joined STATION F to accelerate the future of cybersecurity, by partnering with the most expert start-ups in this field and providing support in their development.

The company's digital acceleration programme supports growing regulatory complexity, data-driven optimisations, new business models, innovation to address emerging needs, improved speed, cost and quality, flexibility and agility to support growth, and digitises customer community access.

"Thales is ready to become the digital partner to support ANSPs' success in their digital transformation," says Richard. This partnership caters more than 34 different challenges, including military ATM, UTM, ATFM, interoperability, flexible use of airspace, and safety, among others.

"You need an actor able to undergo these accelerations with no compromise on safety," he says.

Thales seeks to reinvent ATM alongside customers in order to meet future requirements. Richard says customer success will stem from digital transformation through openness and partnership for digital ATM innovation around data-centric applications.

"There cannot be digital transformation without trust but there can be no trust without cyber security," he says. "We must be cyber ready. You can never be one hundred per cent protected so we must seek to be resilient in critical domains and know how to recover from a cyber attack."

Keynote Speaker

Collaboration between African ANSPs, with specific reference to the recent ATNS/CANSO/ASECNA agreement with CANSO

Mr Mohamed Moussa Director general of ASECNA (represented via live link by his deputy)

[ASECNA is an air traffic control agency in Senegal that manages the collaboration between member African and Madagascar ANSPs covering more than 16 million square kilometres of airspace, which is larger than the whole of Europe, and includes six information flight regions (IFR).]

At ASECNA we see that air traffic is going to increase in the near future. That will put more pressure on safety which is why we have been investing in safety technologies such as radar, communications, and surveillance.

But to achieve our aim of a single African sky we must collaborate between African ANSPs to develop our aviation infrastructure. That means we must exchange information on programmes and projects currently underway. We must exchange personnel and expertise. We must interconnect our aeronautical systems through VSAT infrastructure to provide AFTN/AMHS, IDC and ATS/DS, and surveillance. And we must improve air traffic service operations between ATNS and ASECNA. We must also provide the most cost-effective solutions for the interconnection of networks with low maintenance overheads, with ab-initio training and employee development. Peer review and technical cooperation are crucial.

In pursuit of a single sky for Africa, ASECNA has connected IFRs across Africa, the Indian Ocean, and South America. It has also developed regional and inter-regional telecommunications infrastructure for aviation and improved air navigation services across Africa through VSAT network interconnections.

ASECNA has achieved this by exchanging information on programmes and projects, sharing research results and personnel between ANSPs, and has thereby improved air traffic service operations.

New areas of collaboration seek a single, integrated regional infrastructure, interoperability of VSAT networks, cyber security assessments, and spectrum protection across the Africa-Indian Ocean (AFI) region.

We have a MoU across the Gulf of Guinea and memorandum of cooperation with Algeria, an MoU with DSNA, and an MoU with ONDA to share information. These MoU help build a better infrastructure for Africa because we share radar coverage data in West Africa and we are in the process of sharing with NAMA, the Roberts FIR, and Ghana.

A challenge today is security of communications. That is why ASECNA has moved quickly to implement VSAT and VHF in ASECNA airspace, such as Morocco. ATNS and other airspaces in Africa are of the same view to have VSAT ANSPs.

We aim to achieve a single African sky by 2030 but to do so we must identify all the new technologies for an integrated architecture that will enable this view all the way to flight level 600. We need the same navigation procedures for all areas.

New satellite-based augmentation systems (SBAS) promise new capabilities in this regard but we are restricted, for security reasons, in some areas. That means the next phase will be implementing a common surveillance and communication technologies in those areas.

We see this as an opportunity to cooperate with all ANSPs in Africa to improve and sustain air navigation services and create a framework for users' needs. We know the future means working together, united, because alone we cannot achieve our goals. We believe Africa can have safe skies as in all parts of the world.

Panel discussion 1

Can barriers in the aviation industry be overcome by innovative technology without sacrificing the level of safety?

Moderator
- Ms Poppy Khoza, SACAA DCA

Panel
- Dr Francois Maasdorp, Senior Research Engineer at CSIR
- Ms Aarti Panday, Business Development Manager Strategic Engagements and Corporate Relations, TIA
- Mr Arthur Bradshaw, owner of Air Traffic Management System Advisors
- Ms Lisa Tele, Planning engineer at ATNS
- Mr Chris Zweigenthal, AASA CEO
- Mr Sam Twala, Technical Director at NTSU Aviation Solutions

Khoza (moderator): These technologies come with their own risks and challenges. We have come a long way as an industry and it's proper that we admit we have a record to ensure the advancement in technology doesn't compromise safety and security and enhances operational effectiveness and general systems. If we think of where we come from, it can only be realised through advances in technology. So, can barriers in the aviation industry be overcome by innovative technology without sacrificing the level of safety?

Maasdorp (CSIR): I do believe so. My presentation yesterday was about passive radar, which is an up and coming technology being researched now. It's a disruptor because it's cost-effective which will make airspace control so much more cost-effective.

Bradshaw (ATMS Advisors): Yes, but it's not only yes, it simply has to be that way too, along with the rollout of the ATM operational concept from ICAO, which also guides various plans, from global to regional plans and more. And those are of course in pursuance of efficiencies and better safety due to the number of aircraft that will populate the skies, doubling in the next 10 or 15 years, which will create tremendous user requirements that will demand serious innovation. Whether they are disruptive or passive is neither here nor there. There will be new demands. The development of these innovations will demand safety cases. Whatever users require cannot be implemented unless it is done so safely.

Zweigenthal (AASA) – Definitely yes. In fact, new technology should not detract from safety. We need regulations where safety is concerned, and one issue with new technology, we must understand what it means when it is introduced and ensure the regulations are put together with our understanding of what's required of the new technology to ensure safety is not impacted. We need to understand, and get understanding from manufacturers, to what extent we can confidently advise whether new technology will impact safety. An old example, we were taught to shut down mobile phones and computers during critical stages of flight. We were never told why, just that thou shall shut down everything at landing and take-off. Was that for safety or precautionary? We never got a definitive answer. So, we must understand the potential safety issues properly. Another aspect we must bear in mind, we must ensure when putting regulations in place, that our neighbour states will be able to do the same so we cannot create regulations that leave them unable to integrate with us to perpetuate safety standards.

Tele (ATNS): I believe that, yes, innovative technologies are important, important, important. It is imperative that we become innovative. Earlier we discussed cyber security and without technologies and innovations we open ourselves and industry to threats and being attacked. We really need to be open to this. It's a solution.

Twala (NTSU Aviation Solutions): Definitely, yes, it is possible to balance innovation and safety. That's not something completely new. We have the Annex 19 model there, where it says there must be a good balance between the two. Placing too much emphasis on one or the other will lead to an airline, for example, going under. Too much focus on safety will erode profits, and too much focus on profits will erode safety. It is the same for any organisation in our industry. You must have balance.

Khoza (moderator): How do you strike the balance? There are demands from the commercial side that want to push the competitive edge and efficiencies, but we find regulators who have to put the frameworks in place, how do you collaborate and ensure the regulators don't stifle growth yet the industry gets the efficiencies it desires?

Zweigenthal (AASA): New technology must become standardised through ICAO and international legislation. We must account for all stakeholders in the process. New technologies may not be ready to be simultaneously implemented worldwide. So we may need a phased approach to account for different standards in different regions. We need a coordinated discussion between the service providers, OEMs, and operators to ensure they are ready. We must also be ready to procure equipment to measure implementation of standards. It's an important part of the planning process that needs a realistic timeframe. Otherwise, if everyone is not ready to implement new standard technologies at the same time to maintain a global standard then we find ourselves having to issue waivers and exemptions. Without coordination we cannot realise all the benefits of the new technology, such as ADS-B [that the US wants to begin implementing by 2020].

Khoza (moderator): The role of research cannot be over emphasised in this sector that pushes boundaries. How do we ensure our efforts promote efficiencies and socio-economic development in the country? We are already talking Fourth Industrial Revolution and some corners have mentioned that bringing in technology will undermine labour - how do you manage that balance?

Maasdorp (CSIR): From my perspective, on the research side, and socio-economic development and growth, we must consider the classical arrangement of three entities: academia, industry, and institutes. We must also consider transformation and then also bring the regulators into this process. Academics do research. Institutes identify the blue sky research topics, and then mature those technologies to a certain extent. The industry takes that on to develop products and further direct research.

When we develop new products questions flow from the developers all the way through the chain to users and then back again. That ultimately improves the products. And we can involve students to bring academia into the picture. Human capital development comes into play when industry gets the research that flows into products and results in better products. So, I leverage the strengths of all role players in a collaborative way. And the regulators can churn out superior products to improve human capital development programmes for socio-economic growth.

The second part of the question: Labour versus machine. We need to do a few things. We must upskill our technical workforce. We must also get to foster and stimulate innovation and must strive for superior products. That delivers value throughout the chain. Innovative people and a tech-savvy workforce allows industry growth and new business, which stimulates employment, and machines stimulate our manufacturing capacity for cheaper products.

Khoza (moderator): Standards are key to industry so to manage technology development considering different countries are involved; how do we maintain consistency?

Bradshaw (ATMS Advisors): Collaboration, collaboration, collaboration. If one looks at the ICAO phrase, nobody left behind, and tie that to operational concepts to roll out by 2025 and adopted globally, which informs the global plan, which then informs the regional plan, and the national plan, and entities' plans. All plans must talk to one another. We cannot have any contrary plans. Everything must be harmonised throughout. The whole ATM community must have the same timeframe in their heads of where we are going, what we are doing, and how we are going to get there. ICAO is saying nobody must be left behind so the days of silos are over. We are all members of the ATM community, which has a job of work to do and makes its requirements known to the CMS side of the industry. We must communicate with our neighbours on how to do that. We need to ensure they have the same plan as us and they are not left behind when they develop their national plans. I am happy to say that in South Africa the wisdom of the Department of Transport (DoT) ensured the ATM implementation committee, which helps, because all elements that come out of this need direction and these issues are being thrashed out at expert level. This has to be a two-way street, and I believe there are mechanisms in place, people need to understand the ATM concept that says technology does not drive the system. ATM must make plans to move the right number of aircraft safely given a timeframe and CMS must provide the solutions, and then let's talk across the different levels of the plan.

Khoza (moderator): So, what happens in an imperfect world? Some countries end up having to deal with the emergence of these plans in their own way - how do we deal with this? Also, in the context of the Fourth Industrial Revolution, who knows what it will bring?

Bradshaw (ATMS Advisors): We know we must incorporate UAVs and ICAO must incorporate their effects. It is a two-way street. Some things are starting to roll out at Mach 2 and we know the future is changing and it's up to us now to inform ICAO about our successes, what we are finding and what must be looked at. I'm glad the workgroup is dedicated to UAVs. There are other workgroups who could benefit from the successes of the UAV workgroup, and vice versa. I believe we have made a start and are really starting to learn. Now

we need to take those lessons and pump them upstream to other countries and we also need to learn from them.

Khoza (moderator): What role do stakeholders and communications play in overcoming the barriers?

Zweigenthal (AASA): We are all in favour of new technology but there remains the necessity to be aligned. Communications with all stakeholders is important. The regulators, the service providers, operators, all of those people must be on the same page. Collaboration to me means communications and that means alignment of purpose. We all have different expertise, individually, and we need experts involved to assist us with specific information. But the interchange of information is essential. We must all learn and when we talk about this new technology cost is an issue, maybe lead times too, training, and others. Across the region - one of the important things in SADC is the civil aviation committee with all 15 states talking about new developments and new technologies. They deal with common issues, like cyber security. Those are important forums to share information and that's crucial to being synchronised between regions.

Khoza (moderator): Do you think regulators are up to speed to meet the demands of industry and, if not, what must be done?

Tele (ATNS): Regulators in the industry take a leading role in order for all stakeholders to provide safe and expeditious service so I think, because of rapid growth of technology and advances, I see we already have artificial intelligence (AI) breaking in and Internet of Things (IoT) coming into our industry, so I think the manufacturers tend to adapt very early to these new technologies, in any industry and especially in ours, so the regulators, in my opinion, they learn, and mainly because the regulators need to ensure their sustainability and there is an investment. So, they need to be up to speed with advances. Technology is driven by socio-economic developments and regulators are expected by government, as their agencies to develop regulations around technology in aviation, but because of challenges such as rapid technology advances, regulators create regulations that are expected to be developed over two to three years before they even get published and they are expected to be in place for a number of years for sustainability reasons, so regulators are challenged to step up their game.

Khoza (moderator): Technology and profits, versus safety, which comes first? You talked about an airline closing down, it must be profitable, but it also wants to enhance its own systems and stand out to be counted as the best, which requires the right technologies, but there's this aspect that cannot be neglected and that's safety.

Twala (NTSU Aviation Solutions): I mentioned the concept of balancing profits and safety is not new. It's always been a part of aviation, if you are aware of Annex 19, talking of innovation, it has a direct relationship to profit. It means we can look at innovation and profit versus safety. ICAO creates the right standards and practices but implementation still rests with the regulator and stakeholders to get the balance right. ICAO doesn't tell you how to do it. One of biggest expenses in aviation is fuel. If we look at technology advances over the past few decades we can see they have also tried to ensure that this big expense, the cost of fuel, is lower and lower. So technology has improved the situation without adding negatives. In another example, remotely piloted systems are new entrants to our field and they reduce the costs of certain activities even further. But does it necessarily mean they are unsafe?

There must be a balance, we cannot forget one or the other. In Europe they moved away from prescriptive regulations and looked instead at outcomes-based regulations. That's a way forward for regulators. For example, there was always a requirement for every aircraft to have a compass. But we didn't need aircraft to have compasses, we needed pilots to be able to find their way. So, we can move away from that type of prescriptive regulation and instead focus on the outcome, ensuring that pilots have a means, and a backup, of locating their aircraft geographically. Yesterday, Dr Malinga mentioned air taxis to me. These craft defy all the rules in the book but it does not necessarily mean they are unsafe. There are enormous benefits for certain parties to introducing air taxis and profits will also be higher for the operators.

Panel discussion 2

How can the industry leverage off innovative technology for advancement, taking into consideration the operating working environment? Is CDM the answer?

Moderator
- Mr Simon Zwane, SM ATM planning at ATNS

Panel
- Ms Sandrine Gnassou, Air Navigation Service Safety Oversight Inspector (ANS-CNS) Autorité Nationale de l'Aviation Civile (ANAC) de Côte d'Ivoire
- Ms Boni Dibate, Director of Africa affairs at CANSO
- Mr Eddy Kioni, Executive Director and deputy CEO at Regie des Voies Aeriennes s.a., Democratic Republic of the Congo
- Mr Hein Reid, Senior Manager: Operations (North) at ATNS

Zwane (moderator): Why CDM? It is estimated that in the US and Africa air traffic is expected to be double the numbers that we see today. IATA estimates that about 274 million passengers will come to Africa and that makes it important for us to have a robust plan to cope with the expected growth. We must also be mindful of new systems such as drones coming through. We have to use the tools at our disposal, such as technology, and we must be innovative in our thinking. What is ideal today may not be tomorrow. Our plans cannot be isolated. We keep mentioning partnerships so to exist in future there is a great call for partnership between ANSPs but also regulators. How do you see technology as a benefit and enhancer within CDM for industry?

Kioni (Regie des Voies Aeriennes s.a): The main topic of the summit is technology innovation. We have three types of innovation: product, process, and business model. And we must be prepared for all three. Technology is fine but I must highlight that it is just one pillar on which we need to build our objective of a seamless airspace, which is what CDM is about. We must be sure that we build an environment where collaboration will be the key. We want to say technology cannot drive development alone, we must also consider all the people and stakeholders involved. We must ensure that, at political level, there is common understanding of objectives. The environment in Africa may not be homogenous and that must be taken into account. The processes must be developed to choose the right technology. We must be innovative enough in the way we choose the technology to consume and produce it to fit our context and environment and to be able to share the main layer of technology to the benefit all members. Based on their own needs and constraints, members should be able to contextually add layers as necessary. Technology is a must.

Zwane (moderator): We know technology and the focus on future in terms of personnel in the workplace, robotics is coming; what's your view on the investment in people in this aspect? Are people an important factor or should we rather invest more in robotics?

Reid (ATNS): We often suffer from confusing our priorities in the sense that if we are to drive technology to new heights and not invest in humans I think it would be less than optimal. Of course you can see that the other way around too. We cannot just invest in humans. But at end of day the human has no kilowatt or megabyte restrictions.

Zwane (moderator): Talking of prioritising, from the regulatory perspective, what's your view in terms of a CDM, is it something we should be doing more with?

Gnassou (ANAC): From the regulatory perspective, we must take into account CDM for review for our implementation plan but there is no regulatory framework to encourage implementation of this crucial information sharing operational system with partners, so I suggest CAAs develop a regulatory framework for implementation of such a platform.

Zwane (moderator): For CDM and air traffic flow management to be more efficient and effective and global interoperability of air transport, CDM has been implemented in many different counties, South Africa being one, and others are in the process. If implementing, it needs to be implemented regionally and globally. What is CANSO's regional perspective of CDM?

Dibate (CANSO): First, I would like to clarify that CANSO is the association of ANSPs, like IATA for ANSPs. At the recent air navigation conference in Montreal, where the discussion was around how to take air traffic management forward, one of the conclusions or decisions was that globally we need to implement seamless

skies. A decision was taken there to ensure seamless upper air management. CANSO implements what ICAO recommends, so CANSO has been supportive of these goals. We have supported many collaboration exercises in Africa and globally. We are currently developing a guide to help with implementing CDM and a CDM. We have workshopped in Uganda, South Africa, and in Mombasa, Kenya, and the outcomes were important. We have come up with a document we call MOMBAA ATFM Implementation and in there are the stakeholders who came together with a plan to implement ATFM, which will bring CDM and a CDM. I invite participants from this forum to read it as soon as it is available. That plan will help come up with guidelines on how to integrate the whole of Africa, and ensure that compartmentalised ATFM is properly implemented. Adding to what my colleague said, yes, there's no regulation, we emphasise more collaboration, however, and the discussions occurring together.

Zwane (moderator): CDM is all about partnership and sharing information being a critical aspect, would you think it's necessary if there's efficiency in it being shared with industry and why would it be necessary?

Reid (ATNS): As demand grows on the national or regional air traffic systems, decision-making becomes more important. And one could argue that the quality of decisions is based on the information you base it on. There's the business case for sharing information as widely as possible. The flipside of course is it brings risks when integrating all these systems. That said, we must have access to each other's information, to the extent such as when dealing with adverse weather or other operational conditions, that we can recover as quickly as possible. In the commercial air navigation environment it is important that customers keep on flying and that we get them back in the air as rapidly as possible following any such event, so access to information is paramount and a key enabler.

Zwane (moderator): What are some of the benefits of a mature CDM?

Kioni (Regie des Voies Aeriennes s.a): CDM is more cost-effective. It ensures we can collect and share information in a more efficient way and use it when needed in a way that will involve cyber privacy. CDM is simply the best way to extract what the industry is supplying, such as a sub-system in an environment, so if we approach an activity with a system approach we must make sure all stakeholders access as quickly as possible the right information to make decisions, bearing in mind it will affect the other stakeholders.

Zwane (moderator): I like that you say it must be a systematic approach. We know not all African states are members of CANSO, and CANSO is rolling out plans to incorporate more members, so how does CANSO intend reaching out to those other stakeholders?

Dibate (CANSO): We are at 33 members now. We intend bringing onboard the others who are not members; we have partnered with ICAO to implement the plan to include the other 21. We are then going to ensure the work we do is aligned to all ICAO processes because what we started was informed by ICAO. That will be an implementation of ICAO decisions and ICAO is an organisation that goes with recommended practices in our industry so I assume the other 21 will come onboard.

Zwane (moderator): Sharing information among each other was many times seen as competition; is that your view or do you have a different view? It was maybe seen that you are equipping others for unfair competition.

Reid (ATNS): I think it's all collaboration, collaboration, collaboration. There's information that's necessary for the system to be optimised rather than one role-player in the system and that should be available at pubic level. If organisations have the ability to gain economic leverage off information that is in the public domain then I suppose that's where entrepreneurs come in but for me there's a component of public information and then maybe there's commercially sensitive information.

Panel discussion 3

Integration of Remote Piloted Aircraft Systems into South African Airspace

Moderator
- Jeoffrey Matshoba, Executive ATM/CNS Planning and Standards at ATNS

Panel
- Mr Patrick Ndlovu, Business Development Executive at Denel
- Mr Zia Meer, Flight Operations Inspector at SACAA
- Mr Simon Zwane, SM ATM planning at ATNS
- Mr Sam Twala, Technical Director at NTSU Aviation Solutions
- Dr Kaven Naidoo, competence area manager: aeronautics systems at CSIR
- Diphak Lalla, Manager: CAMU at ATNS

Matshoba (moderator): The 2011 ICAO circular 238 seeks to:
- Apprise states of the emerging ICAO perspective on the integration of UAS into non-segregated airspace and at aerodromes;
- Consider the fundamental difference from manned aviation that such integration will involve; and
- Encourage states to help with the development of ICAO policy on UAS by providing information of their own experiences associated with these aircraft.

Unpack this please.

Meer (SACAA): We have regulations that speak to remotely piloted aircraft systems that came into effect in June 2015. We have experience in its operation. The systems are aircraft, whether they are small or large, they are aircraft and therefore piloted. RPAS in the ICAO context are remotely piloted. Our regulations aim to identify or group into three separate components the use of unmanned systems. Commercial use of RPAS, is if you a business that charges someone to operate the RPAS or you operate it on their behalf. If you are a business and you use it for your own business then you are a corporate RPAS. Or if you are a non-profit for something like search and rescue then you are classified non-profit. There's another classification and that's private but that's not subject to the same stipulations or regulations. To be commercial you need to go through the certification process. That entails many elements. The only thing corporations or non-profits are exempt from is the air services licence. We have five schools in the country to provide RPAS training. After going through the process you get a certificate and operator specification stating your privileges. We have about 32 certified operators in South Africa, it changes all the time, and they operate in anything from the movie industry to land surveying.

Matshoba (moderator): Can we get a view on the challenges being experienced at the moment?

Naidoo (CSIR): From the CSIR perspective, we are an R&D organisation, we look at early stage R&D novel technologies and test and exploit them for commercial benefit. We have applied to the CAA for a research licence. And this is a big opportunity for us which allows us to operate for non-commercial purposes and is an efficient mechanism for experimental development. Under that framework we can test new technologies and ideas for products because we are not commercial and would like to, when the proof of concept is proven, make the technology accessible and available to private companies, SMMEs, and entrepreneurs. The CSIR administration has been a bit slow but the CAA has enabled this opportunity. In future I think we are going into unknown territory with fully autonomous systems. Remotely piloted systems are catered for under regulations today. Fully autonomous unlocks the real value of the technology, which stems from decision-making, understanding failure modes and how to recover; that's where the opportunity in future lies and we need to look at R&D there as a group, as an industry, as a consortium, leaving no stakeholder behind.

Ndlovu (Denel): Denel manufactures these devices and we call them UAS. A challenge we have is considering the current environment, we definitely need a minimum equipment standard. It's an issue for the market that there is no minimum standard for equipment because we get all sorts of equipment brought into the country to the point that it may taint the image of the RPAS sector. I saw a video the other day where a small quad copter flew into the path of a 747 taking off. That's a direct issue of it not being visible because there is no minimum equipment standard.

Lalla (ATNS): From the ANSP perspective the biggest challenge is the knowledge and operations behind it. When the regulations were introduced a lot of information was shared around the regulations but not how these vehicles operate. In ATC they fear the unknown. These systems are unknown to them and as a result they don't want to accept them. So, from our point of view, the information shared was difficult for us to accept. We share airspace with the whole country, and we have to protect a lot of interests and the safety of passengers and crews so we tend not to give approval. ACSA wants to survey hangars using drones but the controllers are hesitant to approve that because the controllers don't know how these systems operate in close proximity to widebody aircraft.

Matshoba (moderator): Will you share with us what we should look at to better operate these systems? A challenge is the exclusion of private operators. Should we be developing low hanging fruit?

Twala (NTSU Aviation Solutions): We must consider that the regulations came into effect in 2015 and its been a little over three years. At the time when the regulations were developed they were based on theoretical situations. They were put in place as a placeholder. By today we have learned a lot after gathering much data and we understand what stakeholders need. We are now in a position to say we have done part one and can perhaps start from the beginning and see what works and what doesn't.

Back then [in 2015] there was consultation but people didn't really participate so now we need all role-players in one room for discussions. People have different views and ideas. Until we are together we will remain with our own opinions. We must, as a country, start discussion around operations and how we will operate UAVs and how we will regulate them. That will make it clear to all.

Meer (SACAA): A challenge we face is that this is a rapidly evolving field in constant R&D. In our industry things have been static pretty much since World War Two. That shaped our thinking in the beginning. It is difficult to apply manned regulations to unmanned aircraft. Manned has a lifecycle of 30 to 40 years, the unmanned ones can be shortened to months. In this changing environment the regulators and ICAO are all changing the standards. One and a half years ago ICAO started to press heavily on the distinction between the different systems. There's a challenge being faced by all nations on Earth - RPAS are remotely piloted systems, they have a pilot, so all our certified systems in South Africa are piloted. You can give the same instructions for a normal aircraft to an RPAS because they are piloted by humans, even if those humans are not sitting in the aircraft. But what about everything else? We require the distinction because you can't deliver packages for DHL and Amazon if they need to pilot every one of those drones. In China right now there are over 60 000 drones doing package delivery. Right now. They don't have one pilot. Because you cannot use small drones delivering blood samples or monitoring infrastructure if every one of them needs a pilot. So already 101 doesn't talk to that because it mentions pilot licences and operators and so on. Our regulations do speak to the future for certain elements but not others. We need to understand the difference between autonomous versus automated. Boeing and Airbus use terms like autonomous but we need to be careful because that means a system that nobody monitors. ICAO has an issue with that because its regulations say we don't allow autonomous operation in civilian airspace. So, we need to change the definitions. The NASA representative suggested a novel or elegant solution. In the past we said when a human has full input to a system it's just automated. The pilot can tell the autopilot what to do. When you say autonomous it means the machine does its own thing. But we can't have systems doing their own thing in civilian airspace. There are cases when you need to control airspace and can't have machines doing their own thing. So, we change the definition to unpiloted with predictable outcomes. We need these definitions so we can get the interoperability right and enable us to write the regulations correctly.

Matshoba (moderator): How do we integrate RPAS into civilian airspace, what's currently there from Denel's perspective, and will we see air taxis operating from Mamelodi to Pretoria?

Ndlovu (Denel): From our perspective from an operations point of view, the amount of challenges we have in industry with RPAS; in our research we figured out there are about four types of unmanned aerial systems, these small to medium-sized multi-copters, and then also air mobility vehicles (air taxis), and internationally this is expected to be close to a $5 billion industry. So, it is coming, and it would see air taxis fly over Johannesburg and ferry people. And then there's the stuff that's long range, long endurance, capable of high-altitude flight from 10 000 feet to 60 000 feet, as well as unmanned balloons and support infrastructure that fly very high. It's a common misconception that when we talk RPAS we are only talking 400 feet. But our UAVs can fly 250km and reach 30 000 feet where you typically find the widebodies. So, the integration problem is a considerable one. It's not a simple issue with a simple solution. I think it requires thorough thought from all stakeholders.

Zwane (ATNS): I am an air traffic controller by training. At ATNS we follow a total inclusive approach for integrating systems. We use the ATM CNS implementation committee that adopted RPAS as one activity in

our groups, and the matter being as we have heard that it has been silos, everyone is doing their own thing, so the first approach is to bring everyone together and we intend to do that.

Matshoba (moderator): There is still a lot to be done. We tend to refer to other nations and their capabilities and capacities. We just heard that there is a lot of a work being done in manufacturing this kind of technology. We think our industry can work towards this to ensure we produce our own and show the world we are capable of producing our own technology.

Conclusion

Dr Sandile Malinga, COO of ATNS

Dr Sandile Malinga thanked all delegates and many supporters, from countries as far afield as the Democratic Republic of the Congo (DRC) to Côte d'Ivoire and even Namibia, from industry including Thales and Lee Dee. He praised the support of other government, institutional and non-profit organisations including ASECNA, IATA, ICAO, CSIR, ASSAf, TIA, SANSA, CANSO and even Weather Service.

"None of our successes would have been possible without the keen support of our panellists, our moderators, and our MCs," he said. "This seventh edition, so generously attended by many women from aviation, has continued the tradition of growing to be more inclusive."

He praised the diversity of topics speakers, moderators and panellists covered, as well as their passionate contributions, expertise shared, and frank thoughts openly discussed.

"We have explored topics of drones, UAVs, and remotely piloted vehicles operating in our airspaces and within close proximity to commercial aviation. Dr Tiplady shared his desire for the SKA's cooperation and collaboration with aviation stakeholders. We were expertly briefed on what steps have been taken and, indeed, what must still take place, to achieve the vision of a single African sky integrated with the rest of the world," he said. "Cyber security was another issue that deserves serious consideration as does the talent development and management to meet current and future needs."

"Discussions were once again robust among all stakeholders and there was a spirit of cooperation with a strong desire emerging to collaborate," he said. "I want to thank everyone who has been with us for the past couple of days. We value your presence and support and we applaud your participation."

"We have much to be proud of in terms of how far we have come in seven years and we are achieving our goals to collaborate at this innovative platform that is inclusive of all sectors in the aerospace field," he concluded.