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A View from IFATSEA
Global

DR. DANJUMA ADAMU ISMAILA

RECTOR AND CEO, NIGERIAN COLLEGE OF AVIATION TECHNOLOGY

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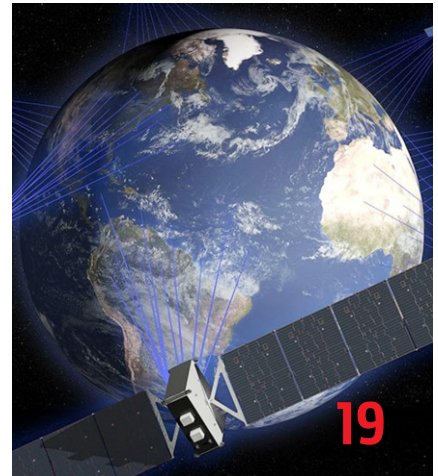
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INTERROGATING THE NUANCES AND AFFORDANCES OF MODERN TECHNOLOGIES



One point that typifies existing and emerging digital technologies is, without doubt, the fact that as the utilities, nuances and affordances of these innovative technologies proliferate so also are the innuendos and concerns that characterize their applications in various aspects of human engagement. This is just not only the plain fact but also a fate, which any industrial system that is wont to press forward with the adoption of innovative technologies must learn to grapple with.

The aviation system, of course, is one industrial system that is wont to press forward with the adoption of innovative technologies in a frenzied attempt to continue to up the game in terms of operational homogeneity and interoperability, operational safety and security, operational efficiency, and sustainability. From digitalization to automation and virtualization technologies, the global aviation system's flirtatious embrace of exotic technologies seems to know no bounds, precipitating immense challenges. The imminence of a large-scale incursion of artificial intelligence (AI) technologies into the aviation terrain is also, to put it mildly, threatening to further harden the plasticity of the challenges.

And this is coming with a price, a price that aviation stakeholders seem to have accepted to pay, albeit not without a determined battle. This is, perhaps, why there is scarcely no aviation undertaking – be it at the national, sub-regional, regional and global levels or at any given aviation gathering – where the focus has not been riveted on devising strategies or defining roadmaps for confronting the innuendos and concerns that naturally follow in the wake of aviation's flirtatious romance with the new technologies. These innuendos and concerns actually relate to a wide variety of areas. One is the aspect of cybersecurity and the growing concerns regarding the increasing vulnerability of the aviation system.

It may really look very amazing to fathom the amount of energy that the industry is devoting to cybersecurity issues today. For example, the 53rd General Assembly of the International Federation of Air Traffic Safety Electronics Associations (IFATSEA) holding in South Africa's picturesque city, Cape Town, from 9 to 14 November 2025 will be looking at "Addressing cyber threats against CNS/ATM systems through collaboration, training, system thinking and data-driven decision-making". The Fourteenth ICAO Air Navigation Conference, which held at the ICAO headquarters in Montreal, Canada from 26 August to 6 September 2024, also had its fair share of discussions regarding cybersecurity as several White Papers and Information Papers targeted the subject-matter. The IFATSEA's Information Paper (AN-Conf/13-WP/173) presented at the conference made a case for a proactive approach to air navigation services (ANS) cybersecurity issues and information system resilience such that air navigation service providers (ANSPs) are able to proactively address cybersecurity challenges, leveraging the readiness and the competence of air traffic safety electronics personnel (ATSEP) in relation to tactical and strategic overtures to cyberattacks with a view to safeguarding critical ANS systems. There is also the Argentina Working Paper (AN-Conf/14-WP/125), which was supported by 19 members of Latin American Civil Aviation Commission (LACAC). The paper made a strong case regarding the design of mechanisms to support ANSPs in managing cyber threats and cyber events, whilst also inviting the Conference to, among other things, "develop and/or implement technologies, procedures and arrangements that enable controllers to provide air traffic services (ATS) safely and recover operations promptly in the case of a cyber event." One downside of the Argentine paper is that it addressed ATM systems' users rather than those whose responsibility targets the installation, maintenance, and operation of these systems. The IFATSEA White Paper (A42-WP/353), presented at the just concluded 42nd Session of the ICAO General Assembly in Montreal, Canada, recommended an update to ICAO DOC 10057 (*Manual on Air Traffic Safety Electronics Personnel Competency-based Training and Assessment*) to incorporate cybersecurity and AI as a distinct and essential training domain.

Another area of concern, which is the focus of *Air Traffic Safety Electronics International's* Context in this edition, is the growing occurrence of GNSS anomalies, particularly in conflict zones of the world. Two working papers at the 2024 ICAO Air Navigation Conference – AN-Conf/14-WP/76 and AN-Conf/14-WP/78 – actually interrogated different dimensions of the GNSS debacle, recommending appropriate rationalization and mitigation measures.

Given the increasing adoption of innovative technologies in the aviation ecosystem, it seems quite reasonable to argue that multi-stakeholder and multi-jurisdictional approaches are essential to designing appropriate mitigation strategies. This is more so given the global ramification of the aviation system. ■

Adeyinka Olumuyiwa Osunwusi, PhD.

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**DR. DANJUMA ADAMU
ISMAILA**

RECTOR AND CEO, NIGERIAN COLLEGE OF AVIATION TECHNOLOGY (NCAT)



AIR TRAFFIC SAFETY ELECTRONICS INTERNATIONAL'S
Aviation Executive of the
Year 2025

Dr. Danjuma Adamu Ismaila, the Rector/Chief Executive Officer of the Nigerian College of Aviation Technology (NCAT), has carefully mastered the art of bearing his faculties quite enviably particularly when it comes to enhancing the fortunes of an institution like NCAT with a proud legacy of over 50 years in delivering top-notch aviation training. Ever since assuming office as NCAT Rector/CEO, Dr. Ismaila has been directing his attention towards driving a number of strategies for positioning NCAT as a leading force in global aviation training.

To be sure, the nearly decade-long membership of the College on the International Civil Aviation Organization (ICAO) TRAINAIR PLUS Programme has been nothing but simply impressive and eventful, culminating in NCAT's recognition as an ICAO TRAINAIR PLUS Platinum Training Centre of Excellence. And what's more: the College's Platinum Centre of Excellence status was renewed recently, effective 1st January 2025 to 31st December 2027, at the ICAO Global Implementation Support Symposium (GISS) 2025 in Abu Dhabi, UAE.

Aside from this, NCAT's footprints on the terrains of ICAO-endorsed training packages (TPs) remain clearly indelible. Over the years, the College's prestigious Instructional Systems Design Unit (ISDU) has developed a total of nine ICAO-recognised TPs, eight of which target competencies in the air traffic safety electronics personnel (ATSEP) domain.

Established through Act of Parliament No. 31 of October 23, 1964 as the Nigerian Civil Aviation Training Centre (NCATC) Zaria, the College assumed its present name by virtue of Decree No. 41 of 1990. The establishment of NCATC came under a joint programme of assistance between the Federal Government of Nigeria, the United Nations Development Programme (UNDP) and ICAO, which lapsed on 31st December, 1974.

Today, NCAT continues to provide world-class aviation training and boasts a total of six schools: Flying School, Aeronautical Telecommunication Engineering School, Aircraft Maintenance Engineering School, Aviation Management School, Air Traffic Services/Communication School, and Airport Emergency Training School. One of the most impressive achievements recorded by NCAT is in the realm of delivering a wide-range of ICAO STP courses, including Training Instructors Course (TIC) Part 2, Training Developers Course (TDC), and Training Managers Course (TMC). NCAT's portfolio of ATSEP-specific and NCAT-developed TPs comprise one online ATSEP Basic Member-Developed ICAO Training Package (M-ITP) and seven Standardized Training Packages (STPs), namely: ATSEP-Airport Power Systems and Facilities Maintenance Course, ATSEP-Communication Equipment Maintenance Course, ATSEP-Data Processing and Automation Course, ATSEP-Surveillance Equipment Maintenance Course, ATSEP-Systems Monitoring and Control Course, ATSEP-Pre-On-the-Job Training Course, and ATEP-Navigation Aids Equipment Maintenance Course.

But, delivering ICAO STP courses is just one of the avenues NCAT is leveraging to maintain its Platinum Centre of Excellence status as well as position the College – and its faculties – as both an African and a global aviation training hub. Dr. Ismaila, as a matter of fact, is working assiduously on a number of innovative

strategies to institutionalize a faculties-wide, sustainability-imperative, enduring, and standards-based aviation training ecosystem in NCAT. And here's why he is Air Traffic Safety Electronics International (ATSEI) Aviation Executive of the year 2025.

As part of ATSEI's Special Edition for the annual General Assembly of the International Federation of Air Traffic Safety Electronics International (IFATSEA), the 2025 edition of which is scheduled to take place in Cape Town South Africa from 9 to 14 November 2025, Dr. Ismaila shared his insights regarding a wide variety of issues revolving around the global aviation training ecosystem and NCAT's strategic objectives with *Air Traffic Safety Electronics International* Managing Editor, Adeyinka Olumuyiwa Osunwusi. Here's what he had to say:

As the Rector/Chief Executive Officer of the Nigerian College of Aviation Technology (NCAT), an ICAO TRAINAIR PLUS Platinum Training Centre of Excellence, how would you describe the aviation training ecosystem today both from the African and global perspectives?

As the Rector/Chief Executive Officer of the Nigerian College of Aviation Technology (NCAT), and as a proud member of the ICAO TRAINAIR PLUS Programme with Platinum Centre of Excellence status, I can affirm that

the aviation training ecosystem is undergoing a significant transformation both in Africa and globally.

From a global perspective, the aviation training landscape is evolving rapidly in response to emerging technologies, sustainability imperatives, and changing operational requirements. Innovations such as artificial intelligence, unmanned aircraft systems (drones), data-driven flight operations, and next-generation air traffic management are reshaping training curricula. There is also an increasing shift towards competency-based training and assessment (CBTA) in alignment with ICAO standards. Furthermore, post-COVID recovery has emphasized the need for flexible, digitally enabled learning models, including remote instruction, e-learning, and virtual simulations.

In Africa, we are witnessing growing recognition of the critical role training plays in supporting the continent's aviation growth. There is a surge in demand for qualified aviation professionals—pilots, engineers, air traffic controllers, flight dispatchers, and safety inspectors—to support expanding route networks and modernized infrastructure. However, the continent still faces challenges such as uneven access to state-of-the-art training resources, high costs, and regulatory disparities. Institutions like NCAT, in collaboration with ICAO and other



I CAN AFFIRM THAT THE AVIATION TRAINING ECOSYSTEM IS UNDERGOING A SIGNIFICANT TRANSFORMATION BOTH IN AFRICA AND GLOBALLY.

international partners, are working hard to bridge these gaps by promoting standardization, localization of training content, and capacity building through the TRAINAIR PLUS framework.

Overall, the ecosystem is more interconnected than ever before. As NCAT continues to lead in this space, our goal is to ensure that African aviation professionals are not just keeping up, but are actively contributing to global aviation excellence through world-class training, innovation, and partnerships.

NCAT has been providing top-notch aviation training in the past 50 years or so. What is your vision regarding the continuing provision of top-notch aviation training by NCAT and what strengths are you bringing to NCAT in terms of increasing the college's fortune and visibility in the global aviation training community?

Indeed, the Nigerian College of Aviation Technology has a proud legacy of over 60 years in delivering high-quality aviation training, not just for Nigeria, but for the African continent and beyond. As Rector/Chief Executive Officer, my vision is to build on this strong foundation and position NCAT as a leading force in global aviation

The third aspect is building a high-performance culture. With a passionate and experienced team, we are promoting excellence in instruction, research, and operational standards. We are also investing in instructor development and retaining top talent across all disciplines. Fourthly, we are focused on internal capacity building and we intend to achieve this by investing significantly in the training and retraining of our instructors to ensure they remain aligned with the evolving dynamics of the global aviation industry. By equipping our faculty with up-to-date knowledge and skills in emerging technologies, operational procedures, and international best practices, we ensure that our graduates are prepared not just for today's aviation environment, but also for the challenges of tomorrow.

The fifth core strategy is the acquisition of world-class training facilities. NCAT intends to strategically expand its training infrastructure by acquiring state-of-the-art simulators, modern training aircraft, and other advanced instructional tools. These facilities will enable us to broaden our course offerings, enhance practical training, and give our students hands-on experience that meets ICAO and other international standards. This deliberate expansion will further solidify NCAT's place as the premier aviation training

dimensional, cutting across infrastructure, regulatory alignment, access to resources, and talent development. Firstly, there are challenges in the area of infrastructure and technological gaps. Many training institutions across the continent still operate with outdated equipment, simulators, and aircraft. This limits their ability to deliver training that meets current global standards, particularly in areas such as advanced avionics, next-gen air traffic systems, unmanned aircraft systems (UAS), and sustainability practices. Funding and affordability constitute another growth challenge. Aviation training is capital-intensive. Limited public funding and high operational costs make it difficult for institutions to expand or upgrade. This also affects affordability for aspiring professionals, leading to a shortage of skilled personnel across the continent.

Another big growth challenge is regulatory fragmentation. Inconsistent regulatory frameworks and limited harmonization across African states pose significant challenges. For training organizations to be globally competitive, there needs to be regional standardization aligned with ICAO guidelines, particularly in adopting competency-based training and assessment (CBTA). There is also the issue of the retention and development of talent. Attracting and

OUR COMMITMENT IS TO SUSTAIN AND ENHANCE THE QUALITY OF OUR TRAINING IN LINE WITH ICAO STANDARDS AND BEST PRACTICES. THIS INCLUDES DEEPENING OUR IMPLEMENTATION OF COMPETENCY-BASED TRAINING AND ASSESSMENT (CBTA), INTEGRATING EMERGING TECHNOLOGIES INTO OUR CURRICULA—SUCH AS UNMANNED AIRCRAFT SYSTEMS (UAS), DATA ANALYTICS, AND AI—AND EXPANDING OUR OFFERINGS IN SAFETY, SECURITY, AND AIRSPACE MODERNIZATION.

training—agile, future-ready, and internationally competitive.

Our commitment is to sustain and enhance the quality of our training in line with ICAO standards and best practices. This includes deepening our implementation of Competency-Based Training and Assessment (CBTA), integrating emerging technologies into our curricula—such as unmanned aircraft systems (UAS), data analytics, and AI—and expanding our offerings in safety, security, and airspace modernization.

To increase NCAT's visibility and fortune globally, I am focused on six core strategies. The first is strengthening international collaborations. We are enhancing our partnerships with ICAO, IATA, AATO, and other global institutions to ensure that our training programmes remain relevant and impactful. We also actively participate in international forums and capacity-building initiatives to showcase NCAT's capabilities. The second strategy pertains to investing in infrastructure and innovation. We are modernizing our simulators, aircraft fleet, laboratories, and digital platforms to support both traditional and e-learning formats. The aim is to create an advanced learning environment that meets the demands of next-generation aviation professionals.

institution in Africa. Lastly, we are keying into the establishment of outreach centres. Recognizing the growing demand for accessible, flexible, and world-class aviation training, NCAT is working towards establishing outreach centres in Abuja and Lagos. These centres will bring our training closer to our clients across Nigeria and the West African sub-region, reducing barriers to participation while strengthening our presence in key aviation hubs.

As someone with both technical knowledge and strategic leadership experience, I bring a deep understanding of the aviation value chain, policy direction, and global training trends. I am committed to leveraging these strengths to steer NCAT toward greater relevance, recognition, and resilience in the dynamic world of aviation.

In summary, my vision is to ensure that NCAT not only remains a centre of excellence but becomes a global benchmark in aviation training for decades to come.

What would you say are the biggest growth challenges for African aviation training organisations today?

The growth challenges facing African aviation training organizations today are multi-

retaining qualified instructors remains a challenge. Many experienced professionals migrate to more developed markets, creating gaps in instructional quality and continuity.

A yet another growth challenge is limited digital transformation. The post-COVID world demands greater flexibility in training delivery—e-learning, remote simulation, and digital courseware. Yet, many institutions still lack the infrastructure and expertise to make this shift effectively.

Despite these challenges, African aviation training organizations—like NCAT—are making significant progress. Through strategic partnerships, targeted investment, and alignment with international standards, we are gradually overcoming these barriers. With coordinated regional efforts, support from stakeholders, and a clear vision, African aviation training can not only grow but also lead innovation in certain niches of the global aviation sector.

And what more needs to be done to address these challenges?

To effectively address the challenges facing African aviation training organizations, a



NCAT HAS A SOLID FOUNDATION AND A DEDICATED WORKFORCE. WHAT IS NEEDED NOW IS TARGETED INVESTMENT, INNOVATION, AND A RENEWED DRIVE TO ALIGN MORE CLOSELY WITH THE EVOLVING NEEDS OF THE GLOBAL AVIATION INDUSTRY.

coordinated and sustained effort is required at multiple levels—national, regional, and international. Firstly, there is a need for increased investment in infrastructure and technology. Governments and private sector stakeholders must prioritize funding for the modernization of training facilities—aircraft, simulators, laboratories, and digital platforms. Without this, institutions cannot effectively train the next generation of aviation professionals to meet evolving industry standards. Policy harmonization and regulatory support are also required. There's a pressing need for greater regulatory alignment across African states, particularly in implementing ICAO's Competency-Based Training and Assessment (CBTA) framework. A unified regional approach would facilitate mutual recognition of certifications, enhance mobility of trainees, and foster collaboration among training organizations. The third aspect is the strengthening of public-private partnerships. Collaborations between training institutions, airlines, regulators, OEMs, and international organizations such as ICAO, IATA, and AATO are crucial. These partnerships can help bridge gaps in expertise, technology access, and curriculum development.

Capacity building and instructor development is another area. We must invest in developing and retaining highly qualified instructors. This includes opportunities for international exposure, continuous professional development, and better incentives to reduce brain drain. Digital transformation and e-learning integration are also imperative. Institutions must embrace digital learning solutions to expand access, increase flexibility, and reduce training costs. This includes virtual simulations, remote instruction, and interactive courseware aligned with global trends.

Lastly, attention should be given to awareness and career promotion. Encouraging young people to pursue aviation careers through outreach, scholarships, and mentorship programs is also vital. Without a strong pipeline of passionate learners, the system cannot grow.

Ultimately, it will take leadership, innovation, and collaboration to ensure African aviation training organizations not only overcome these challenges but also compete effectively on the global stage.

How would you describe your assessment of NCAT on assumption of office?

Upon assuming office as the Rector/Chief Executive Officer of the Nigerian College of Aviation Technology (NCAT), I undertook a comprehensive assessment of the institution's strengths, challenges, and opportunities. What I found was a college with an impressive legacy and prospects—over six decades of producing highly skilled aviation professionals for Nigeria, Africa, and beyond. NCAT's status as an ICAO TRAINAIR PLUS Platinum Centre of Excellence is a testament to the dedication of its staff, the quality of its training, and its commitment to international standards.

However, like any forward-looking institution, NCAT also faces areas that require strategic attention. These include modernization of infrastructure, curriculum updates to reflect emerging trends such as drone operations, cybersecurity, and sustainable aviation, as well as greater integration of digital learning technologies. There's also the need to deepen our engagement with the global aviation community and expand our visibility and partnerships.

My assessment, therefore, is one of great potential. NCAT has a solid foundation and a dedicated workforce. What is needed now is targeted investment, innovation, and a renewed drive to align more closely with the evolving needs of the global aviation industry. I am committed to building on the college's legacy, addressing gaps, and positioning NCAT as a truly world-class aviation training institution.

The buzz of discussions regarding the growing shortage of competent instructors in NCAT is getting louder by the day. Just how real is this buzz and what are your thoughts regarding the measures that should be put in place urgently in order to nip the ongoing brain drain in the bud?

The concern about a growing shortage of competent instructors in NCAT is not without merit and it reflects a broader trend across the aviation training industry, both within Africa and globally. As aviation technology evolves and demand for skilled professionals increases, retaining qualified instructors has become more challenging, especially in the face of global competition, better remuneration abroad, and emerging opportunities in private industry.

At NCAT, we acknowledge this reality. While we still maintain a strong core of highly experienced instructors, there is an urgent need to strengthen our instructor base to ensure continuity, relevance, and the highest standards of training delivery.

To address this, several key measures are being prioritized. The first measure relates to competitive welfare packages. We are reviewing and advocating for improved incentives, working conditions, and career development pathways to make instructional roles more attractive and sustainable within the College. Secondly, we are focusing on instructor development programmes. We are scaling up continuous professional development, certification support, and exposure to international best practices. NCAT instructors must remain globally competitive—not just in

qualifications, but in instructional methods, use of technology, and industry relevance. The third focal point targets the recruitment of industry experts and alumni engagement. In this respect, we are opening doors for seasoned aviation professionals—including NCAT alumni—to return as part-time or adjunct instructors. This model allows the College to tap into a broader talent pool while building bridges with the industry.

We are also focused on technology-enabled instruction because by integrating e-learning and simulation-based training, we can ease the workload on instructors while maintaining quality. It also allows us to deliver more flexible, scalable training. Another measure that we are prioritizing is retention through recognition. In this respect, we are working on institutional mechanisms to recognize and reward excellence in teaching. Valuing our instructors publicly and professionally is key to retention.

Brain drain is a serious issue, but it is not insurmountable. With a strategic and proactive approach, we can not only retain our best minds but also attract new ones—ensuring NCAT remains a center of instructional excellence for years to come.

How feasible, from your perspectives, are some of these measures, specifically the area relating to improved remuneration for NCAT staff across the board?

Improved remuneration for NCAT staff—particularly instructors and technical personnel—is not just desirable; it is essential if we are to retain top talent and maintain our status as a centre of excellence in aviation training. However, I must be candid: while the need is clear, implementation involves navigating institutional, regulatory, and budgetary frameworks, especially as NCAT operates under government funding and public service structures.

That said, I believe the goal is feasible—with a phased, strategic, and well-justified approach. We are actively engaging with relevant authorities to review the remuneration structure, particularly for roles that require rare expertise and global competitiveness. Benchmarking NCAT's compensation packages against similar international training institutions is part of this effort.

In the meantime, we are also exploring non-monetary incentives—such as international exposure, professional development opportunities, recognition programmes, and improved working

conditions—to boost morale and retention while broader policy changes are being pursued. The key is demonstrating the return on investment: that better-remunerated staff

directly translate to improved training outcomes, international partnerships, and ultimately, a stronger aviation sector for Nigeria and the region.

So, while not an overnight fix, I am optimistic that with sustained advocacy, stakeholder collaboration, and strategic prioritization, we can make meaningful progress in improving staff welfare across the board.

Taking a broader look at the global civil aviation operations, what do you think about the increasing digitalization, automation and virtualization of aviation

FROM A GLOBAL PERSPECTIVE, THE AVIATION TRAINING LANDSCAPE IS EVOLVING RAPIDLY IN RESPONSE TO EMERGING TECHNOLOGIES, SUSTAINABILITY IMPERATIVES, AND CHANGING OPERATIONAL REQUIREMENTS. INNOVATIONS SUCH AS ARTIFICIAL INTELLIGENCE, UNMANNED AIRCRAFT SYSTEMS (DRONES), DATA-DRIVEN FLIGHT OPERATIONS, AND NEXT-GENERATION AIR TRAFFIC MANAGEMENT ARE RESHAPING TRAINING CURRICULA.

systems and operations vis-à-vis the need to ensure the adequate alignment of training processes with the changing techno-operational realities?

The increasing digitalization, automation, and virtualization of civil aviation systems and operations represent both a remarkable leap forward for the industry and a critical challenge for aviation training institutions worldwide. From artificial intelligence in air traffic management to fully automated cockpits, remote tower operations, data-driven maintenance, and virtual flight simulations, we are witnessing a paradigm shift in how aviation is planned, executed, and regulated.

This transformation demands that training processes evolve at the same pace—if not faster—to ensure that aviation personnel are not only competent but future-ready. Traditional training models, while foundational, must now be recalibrated to incorporate technological fluency, data literacy, and systems thinking across all areas of aviation—from flight operations and

curricula are being reviewed and progressively updated to integrate next-generation concepts, including Competency-Based Training and Assessment (CBTA), virtual reality (VR) and simulation-based learning, as well as emerging domains such as unmanned aircraft systems (UAS), cybersecurity, and sustainability.

Moreover, digitalization also allows us to enhance accessibility and flexibility in learning through e-learning platforms, hybrid courses, and performance analytics, which benefit both instructors and trainees. The key going forward is alignment—ensuring that our training philosophies, instructional methods,

and technological tools are closely aligned with real-world operational requirements. This means maintaining strong links with industry stakeholders, adapting quickly to regulatory changes, and investing consistently in infrastructure and instructor development.

In summary, digitalization and automation are not future concepts—they are the present reality. The institutions that will lead the next era of aviation are those that not only recognize this, but embed it into every layer of their training ecosystem. NCAT is firmly committed to being one of those institutions.

And what is NCAT doing or planning to do in order to ensure that training programmes across the entire spectrum of the college's competencies are properly aligned with the changing faces of technological, operational, and regulatory realities?

At NCAT, we fully recognize that the aviation industry is evolving rapidly—driven by technological innovations, shifting operational paradigms, and continuously updated regulatory frameworks. To remain relevant and competitive as a premier aviation training institution, our approach is proactive and multifaceted.

Firstly, we are undertaking a comprehensive review of all training programmes—across piloting, aircraft maintenance, air traffic services, aeronautical telecommunications, flight dispatch, and aviation management—to ensure they reflect current and emerging global standards. This includes the integration of Competency-Based Training and Assessment (CBTA), as endorsed by ICAO, which focuses on practical performance outcomes aligned with real-world job roles.

aircraft maintenance to safety oversight and airspace management.

At NCAT, we see this as both a challenge and an opportunity. Our training

THE GROWTH CHALLENGES FACING AFRICAN AVIATION TRAINING ORGANIZATIONS TODAY ARE MULTI-DIMENSIONAL, CUTTING ACROSS INFRASTRUCTURE, REGULATORY ALIGNMENT, ACCESS TO RESOURCES, AND TALENT DEVELOPMENT.

conditions—to boost morale and retention while broader policy changes are being pursued. The key is demonstrating the return on investment: that better-remunerated staff



At NCAT, we view this evolution not as a distant possibility but as an immediate strategic priority. We fully understand that to remain relevant in the global aviation training landscape, we must prepare professionals not only to operate in enhanced environments but also to help shape and secure them. To this end, we are actively exploring the development of

AI-targeted and cybersecurity-related training programmes. These will be designed to equip aviation personnel—across disciplines—with foundational knowledge in AI concepts, data analytics, automation systems, and cyber risk management.

Our approach will be multi-layered. Our first approach will be curriculum enrichment. We are reviewing existing programmes to integrate AI and cybersecurity awareness modules where applicable—for example, in air traffic control, avionics, aircraft maintenance, and aviation management. The second approach will capture the area of Specialized Courses as plans are underway to develop standalone short courses and certifications focused on AI in aviation operations, data-driven decision-making, and aviation cybersecurity, tailored to regulators, airline staff, engineers, and ICT personnel.

Thirdly, we are looking at Partnerships and Capacity Building. We are seeking strategic partnerships with tech institutions, AI researchers, and cybersecurity experts, both locally and internationally, to support curriculum design, instructor training, and practical exposure.

The fourth approach will target the aspect of Infrastructure and Simulation. As part of our digital transformation agenda, we aim to integrate AI-based tools and cybersecurity scenarios into our simulation platforms, giving trainees real-world insights into emerging challenges and technologies.

AI and cybersecurity are no longer optional—they are mission-critical to the future of aviation. NCAT is committed to taking the lead in Nigeria and the African region by developing forward-looking training solutions that will prepare aviation professionals to thrive in this rapidly changing ecosystem.

Now, let's talk about air traffic safety electronics personnel (ATSEP) and the growing need for innovative, cost-effective and competency-based training programmes for the purpose of developing the competence and honing the skills of modern day ATSEP. What types of ATSEP related courses does NCAT offer at the moment? And how are these courses meeting the needs of industry stakeholders?

At the Nigerian College of Aviation Technology, we offer a comprehensive

portfolio of competency-based training programmes for Air Traffic Safety Electronics Personnel (ATSEP), aligned with the structured training phases outlined in ICAO Doc 10057—namely: initial, unit, continuation, and development training phases. Our curriculum is underpinned by the ICAO Competency Framework detailed in Doc 9868, ensuring our graduates meet globally recognized standards of technical and operational competence.

As air navigation technologies evolve rapidly in step with global trends, NCAT remains committed to delivering training solutions that are industry-relevant, workplace-transferable, and cost-effective. We are currently undertaking a strategic repositioning of our faculties, instructional workforce, and training infrastructure, with an emphasis on fostering dynamic, technology-driven learning environments. Our training methodology integrates a continuous improvement cycle—from formative and summative assessments to post-training impact evaluation—yielding both qualitative and quantitative insights that help optimize trainee performance and institutional effectiveness. These efforts reflect our broader goal of enhancing service delivery, closing skills gaps, and supporting regulatory and service provider stakeholders across the aviation ecosystem. Through this commitment, NCAT continues to strengthen its role as a regional centre of excellence for ATSEP training in Africa and a trusted partner for international collaboration.

From your perspectives, how have the training needs of service providers who are NCAT's clients been changing in recent times?

In recent years, there has been a noticeable shift toward more specialized, adaptive training solutions that respond to rapid technological innovation and evolving regulatory frameworks. While foundational training remains essential, service providers increasingly require customized programmes that address emerging technologies and system upgrades in communication, navigation, surveillance, and cybersecurity.

Notably, the renewed interest from the Nigerian Air Force in our ATSEP training programmes reflects an encouraging trend of enhanced civil-military collaboration in aviation safety and capacity development. This reinforces the strategic importance of NCAT's role in strengthening the technical readiness of stakeholders tasked with safeguarding the airspace.

And would you say that NCAT has been responding to these changing needs adequately?

Absolutely. At NCAT, we maintain an unwavering commitment to continuous improvement. Our approach is rooted in active engagement with our client organizations—civil and military alike—ensuring that their evolving human capital needs are met in a timely, relevant, and sustainable manner. We continue to take bold steps to upgrade our curriculum, expand instructional capacity, and invest in both physical and digital infrastructure. Just as

Secondly, we are investing in modern training technologies—including upgraded flight and maintenance simulators, virtual learning tools, and interactive courseware—to support both traditional and digital delivery modes. These upgrades are particularly essential in preparing students for digitalized and automated aviation environments.

Thirdly, we are strengthening partnerships with industry players, aviation regulators, OEMs, and international bodies like ICAO, IATA, and AATO. These collaborations help ensure our curricula stay aligned with operational realities, and they provide valuable input into curriculum design, instructor development, and research priorities. We are also focusing on instructor upskilling, ensuring that our faculties are not only certified but continuously exposed to the latest trends, technologies, and teaching methodologies. This ensures that knowledge transfer remains current and relevant.

Additionally, we are working closely with the NCAA and other relevant bodies to ensure that our training programmes comply with the latest regulatory developments, both nationally and internationally.

In essence, NCAT is not waiting for the future to arrive—we are actively building towards it. Our goal is to ensure that every graduate from NCAT is not only competent but also technologically and operationally ready to thrive in the next era of global aviation.

There is also much buzz today in the aviation industry regarding the imminence of a large-scale adoption of AI (artificial intelligence) technologies in virtually all spheres of global aviation operations. What are your thoughts regarding the possibility of NCAT responding to this via the development of AI-targeted and cyber security-related training programmes?

The growing buzz around artificial intelligence (AI) in aviation is well-founded. We are on the cusp of a significant transformation where AI will increasingly power everything from predictive maintenance and flight planning optimization to air traffic management, passenger experience, and safety systems. Alongside this, cybersecurity has become an equally critical domain, as increased digitalization brings heightened vulnerability to cyber threats.

importantly, NCAT collaborates closely with regulatory authorities, industry professionals, and international partners to ensure that both safety-critical and safety-related training initiatives remain accessible and future-focused.

While we acknowledge that there is always room to grow, we are proud of the proactive strides we've taken to remain at the forefront of aviation training in Africa.

As a TRAINAIR PLUS member, NCAT, through the College's instructional system development unit (ISDU), has developed a good number of training packages (TPs) for ATSEP, comprising STPs and an M-ITP, which have been validated and approved by ICAO. How many of these TPs has NCAT delivered so far?

As a proud member of the ICAO TRAINAIR PLUS Programme, NCAT—through its Instructional Systems Development Unit (ISDU)—has developed a total of nine ICAO-recognised Training Packages (TPs). Of these, eight are directly aligned with the ATSEP (Air Traffic Safety Electronics Personnel) domain, comprising Standardised Training Packages (STPs) and one Member-Developed ICAO Training Package (M-ITP). These courses have already been delivered a number of times to both our local clients within Nigeria and international participants from across Africa and beyond.

The feedback from these deliveries has been very encouraging, as participants consistently attest to the high quality, relevance, and applicability of the training to real-world operational environments. This validates our commitment to providing top-notch training that meets ICAO standards and industry needs.

That said, based on our capacity, international recognition, and the sheer size of

the market, our projection is that the level of patronage should be far higher. We believe that more airlines, civil aviation authorities, and the global aviation community stand to benefit significantly from these training packages.

In addition to these, NCAT has hosted the delivery of over 34 ICAO-certified training packages across various aviation disciplines, serving domestic and international clients. These courses are designed to meet ICAO standards, ensuring that participants gain competency-based, workplace-relevant skills. NCAT continues to actively engage with service providers and stakeholders to expand the uptake of ATSEP qualification STPs, recognizing their transformative impact on operational efficiency and the performance indicators of ANSPs and regulatory bodies alike, improve the work place performance and their respective operational indicators.

Still talking about NCAT's membership within the framework of the global ICAO TRAINAIR PLUS community, how significant do you find this membership particularly in the context of NCAT's unrelenting drive for training excellence?

NCAT's long-standing participation in the ICAO TRAINAIR PLUS Programme, and its elevation to Platinum Member status, stands as a testament to its dedication to high-quality, standards-driven training delivery. Our nearly decade-long uninterrupted membership not only signifies maturity and credibility, but also reflects our deep integration with global best practices in instructional design and implementation.

This distinction reinforces our role as *primus inter pares*—"first among equals"—within the aviation training community in Africa and beyond. It comes with the responsibility to lead by example, a role we

have consistently embraced through continuous innovation, quality assurance, and knowledge exchange within the TRAINAIR PLUS network.

Overall, how do you see NCAT growing in the next five years?

Looking ahead, NCAT's strategic ambition extends beyond being a world-class aviation training provider. Our vision is to evolve into a regional hub for aviation technology and innovation, leveraging our institutional mandate to support not just capacity development, but also research, design, and deployment of emerging technologies. In line with this, we have continued to expand our training portfolio with state-of-the-art facilities that directly address industry needs.

Notably, NCAT now operates a Boeing 737 Full Flight Simulator for type rating training, enabling operators to access high-quality, cost-effective pilot training without the need to go abroad. We have also commissioned a full-fledged Firefighting Simulator, which provides realistic, hands-on training for aviation fire and rescue practitioners—one of the most advanced facilities of its kind in the region.

Together with our broader strategy, these additions place NCAT at the forefront of preparing for the safe integration of unmanned aerial systems (UAS) into civil airspace, advancing next-generation simulation technologies, and developing cross-disciplinary training solutions that address the needs of a rapidly evolving aviation ecosystem. Anchored in our enabling Act, this transformative agenda is designed to keep NCAT future-ready, globally competitive, and a driving force for sustainable growth in the aviation industry. ■

AIR TRAFFIC SAFETY ELECTRONICS INTERNATIONAL READERS



The immediate past General Secretary of the Ghana Air Traffic Safety Electronics Association (GhATSEA), Theophilus Joe Quaye (left hand side), and GhATSEA's immediate past President, Mahama Asunga Abdulai (right hand side), receiving copies of Air Traffic Safety Electronics International from the President of Nigeria's National Association of Air Traffic Engineers, Selzing Miri (middle), during the 52nd IFATSEA General Assembly, Las Vegas, USA in October 2024.

MULTIPLE ACCESS TECHNIQUES IN TELECOMMUNICATIONS NETWORKS: APPLICATIONS, LIMITATIONS, TRADEOFFS

By Adeyinka Olumuyiwa Osunwusi, PhD



Radio frequency spectrum is both a limited and valuable intangible spectral resource. This fact underscores the need for the efficient and cooperative use of electromagnetic spectrum such that a large number of users are able to share an allocated spectrum in an efficient manner in order to achieve high capacity and increased spectral efficiency. Typically, the multiple users seeking to use a single channel simultaneously are geographically dispersed with each of them making sporadic attempts to execute communications at the same time. From the perspective of service or operation, there are three distinct types of communication directions – often referred to as duplexing techniques – when it comes to access operations in telecommunications networks, be they wired or wireless.

The first is what is called *simplex* operation, which defines a one-way communication with only a forward channel and no response channel. The second is *half-duplex*, which defines a two-way operation, albeit transmission generally takes place only in one direction at a given time. Thirdly, there is the *full duplex* operation, which defines a two-way service characterized by simultaneous transmissions in both directions. *Duplexing* allows telecommunication users to send and receive information simultaneously. Duplexing techniques can take a number of forms including FDD (frequency division duplexing) and TDD (time division duplexing).

Two methods allow for the efficient sharing of access by multiple potential communicators in telecommunications networks: *multiplexing techniques* and *multiple access schemes*. Access sharing, talking from the perspective of digital data communications, can also be based on a multiple access protocol and control mechanism, known as Media (or Medium) Access Control (MAC).

Multiplexing as a sharing method involves combining several signals into a composite signal, specifically at the IF band or what is often referred to as the baseband level. Multiplexing essentially provides the means for ensuring the efficient sharing of a communications channel in frequency, time and space through the process of combining multiple signals into a composite signal known as a *multiplex*. One unique thing about multiplexing is that the combined multiple signals remain distinctly independent of one another with a particular signal not interfering with other signals sharing the same signal spectrum.

There are several techniques of multiplexing signals today. These include Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Code Division Multiplexing (CDM), Polarization Division Multiplexing (PDM) and Wavelength Division Multiplexing (WDM) – which enjoys wide application in optical communications – and Space (or Spatial) Division Multiplexing (SDM). FDM finds

application typically in analogue transmission systems while TDM finds useful application in digital systems. There is also the Orthogonal Frequency Division Multiplexing (OFDM) on which the L-Band Digital Aeronautical Communications System's (LDAC) modulation is based. Orbital Angular Momentum Multiplexing (OAMM) is an emerging multiplexing technique, which is being explored for millimeter wave communications. With characteristic orthogonal beams that are defined by a different OAM (orbital angular momentum) state number, OAMM uses the helical phase front property of an electromagnetic wave to multiplex multiple coaxial beams.

Multiple access techniques, on their part, are implemented at the RF band level. A multiple access scheme defines the access method that is employed to allow multiple telecommunication users –through the use of an appropriate multiplexing technique – to access and share a common communications channel typically in a wireless telecommunication network. Multiple access schemes are typically applicable to multiple channel per carrier (MCPC) access scenarios as opposed to single channel per carrier (SCPC) applications. Although a huge number of sharing methods have been developed and are also been actively explored, the multiple access techniques that have been garnering the highest usage across telecommunication networks are Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA), which are defined by access schemes that are based on the frequency domain and the time domain respectively. There is also the Demand-Assigned Multiple Access (DAMA) scheme, which is unique to satellite communications.

Code Division Multiple Access (CDMA) – a generic access method like FDMA and TDMA – and Multi Frequency-Time Division Multiple Access (MF-TDMA) are also finding increasing applications in the telecommunications industry. For some applications, the Orthogonal Frequency Division Multiple Access (OFDMA) and the random multiple access Carrier Sense Multiple Access (CSMA) – which has been finding increasing applications in LANs – are also exhibiting their capabilities, while an OFDMA variant, the Non-Orthogonal Multiple Access (NOMA), continues to be actively explored, particularly for 6G technology applications. There are also less common multiple access techniques such as the Polarization Division Multiple Access (PDMA) and the Space (or Spatial) Division Multiple Access (SDMA), which is still under development. These access schemes make use of resources such as frequency, time, and space. In many telecommunications applications, a

combination of the resources is usually featured in order to increase capacity as well as enhance flexibility and efficiency. The implication, therefore, is that meeting the ever-changing demands of digital telecommunications will require a combination of multiple access techniques rather than the use of a single access technique.

ACCESS BASED ON FREQUENCY AND TIME DOMAINS

The FDMA, which is traditionally an analogue system, is typically used in satellite communications and 5G cellular technologies. Historically, FDMA is the multiple access method for cellular systems and it is usually implemented in narrowband systems. It is somewhat related to Wavelength Division Multiple Access (WDMA) – widely used in optical communications systems – where wavelengths are used for propagation within a single optical fiber.

As a frequency domain assigned access technique, FDMA allows multiple users to share an allocated spectrum at the same time by dividing the spectrum into separate frequency bands and assigning each user a dedicated frequency slot for communication. Access is generally on a single-channel-per-carrier (SCPC) basis or multiple-channel-per-carrier (MCPC) basis. All users are, thus, able to communicate simultaneously and continuously on their assigned channels. This fact presupposes the importance of filtering (using bandpass filters) with respect to the frequency domain in order to ensure interference-free signal separation, a requirement that is unnecessary in TDMA systems. One problem, though, remains that of spectral resource idleness as an assigned FDMA channel cannot be used by other users in the network when that particular channel is not in use.

The Nigerian Aeronautical Satellite Telecommunication Network, which is an integral part of the Satellite Telecommunication Network for Central and Western Africa (now known as the AFISNET network) operating at the C-Band (6/4 GHz) based on the INTELSAT Standard B/ Standard F1 configurations at 64 kb/s using $\frac{3}{4}$ Forward-Error-Correction techniques, for example, is anchored on the FDMA scheme. Operating on a transponder aboard Intelsat 10.02 satellite, the network's usable bandwidth of 36 MHz is subdivided into smaller bandwidths that are assigned to users. The 36 MHz bandwidth occupies one of the 12 segments (or transponders) of the total satellite bandwidth, which is typically 500 MHz for a C-band, Ku-band or Ka-band satellite system. With an IF of 70 MHz, a total of 1600 channels are made available for a terminal. Given a bandwidth of 36 MHz and an IF of 70 MHz $\pm$ 18 MHz,

$$\begin{aligned} 1 \text{ channel} &= 36 \text{ MHz} / 1600 \\ &= 22.5 \text{ kHz.} \end{aligned}$$

The step or spacing of each channel within the dedicated 36 MHz is, therefore, 22.5 kHz. For a typical GSM cellular use case, however, the useable frequency of 25 MHz is divided into 124 carrier frequencies that are spaced at 200 kHz to yield a total of 125 channels.

Frequency management is an important requirement in an FDMA operational terrain. The FDMA, in spite of its wide application, has limitations in terms of channel capacity and operational flexibility with a fixed bit-rate per channel. However, capacity can be increased considerably in FDMA systems by implementing a robust digital coding scheme as well as lowering information bit rate. Given the limitation of frequency spectrum, there is the problem of frequency slot saturation where the population of potential users outstrips the number of available frequency slots. In terms of system complexity, FDMA requires the implementation of dedicated MODEM at the baseband level for each of the communicators thus creating difficulty in terms of cost-effectiveness. However, FDMA systems are advantageous when it comes to hardware simplicity and the simplicity of channel assignment as they are not as complex as the time-domain assigned TDMA. In satellite applications, there are also disadvantages regarding intermodulation products problem and the inability to maximize the use of the power of the satellite transponder. Thus, the need for a close coordination of uplink power levels becomes constantly imperative. In other words, a transponder cannot be operated at maximum power without facing the need to back off the input, thus downgrading capacity and efficiency.

The industry, however, continues to devise techniques for mitigating the disadvantages of FDMA. One is the effective reuse of frequency slots in order to accommodate as many users as possible. In cellular applications, multiple users are located in separate cells within a frequency slot and can simultaneously make use of the frequency segment provided the users are sufficiently geographically dispersed in an attempt to preclude the signal of one cell from affecting the signal of another cell using the same frequency segment.

The TDMA, on its part, is a time domain-assigned multiple access technique where timing synchronization is a crucial factor. This timing requirement necessarily requires the implementation of a centralized monitoring and control station which not only transmits a periodic TDM-format reference burst in the form of a frame divided into time slots but also ensures that each user in the network transmits at its individual assigned time slot. This synchronization, though, is not a

requirement for FDMA operations. The configuration of a TDMA frame – consisting of a number (N) of time slots – is such that each time-slot usually integrates user data bits, bits for synchronization, guard times, control, and so on. Sufficient guard times are inserted between each user's transmissions to mitigate crosstalk and clock instability effects.

TDMA is also a largely digital access scheme, which typically employs both phase shift keying modulation and time division multiplexing at the baseband level. Its application covers both wireless and wired digital communications terrains. In TDMA, the signals of different multiple users are separated and assigned separate time segments in a sequential manner and on a one-user-per-slot basis, albeit a user can make use of multiple slots. Although all the communicators in a TDMA system operate on a single carrier frequency, different non-overlapping time slots are allocated for transmission and reception using TDD. This effectively makes the implementation of duplexers unnecessary. Unlike FDMA, TDMA is superior in terms of capacity and flexibility as accesses are quite re-configurable at any time and different numbers of time-slots per frame can be assigned to different communicators. Transmission is also non-continuous in TDMA systems unlike FDMA where transmission takes place continuously and simultaneously.

In satellite communications applications, TDMA allows the transponder to be operated at full power as each user has exclusive and complete use of the frequency band during its assigned time slot, an advantage that FDMA lacks. Additionally, TDMA removes problems associated with overlapping and intermodulation interference among individual carriers. This notwithstanding, TDMA suffers from negligible time delays as communications are stored or queued in a buffer on occasions where the number of requests for time slots to use a communications channel from potential users outstrips the number of available time slots. Two notable disadvantages of TDMA, particularly for cellular system applications, are problems associated with the requirement for guard space (especially when used with FDMA) for user-separation and complex time synchronization. There is also the limitation of a high peak power demand on the uplink which elevates power consumption and shortens battery life. A growing number of mobile networks are, therefore, embracing using TDMA in combination with FDMA or SDMA in order to boost the population of users.

The demand-assigned multiple access (DAMA) is typically applicable to the satellite communication terrain. Because the access method is in the frequency domain, DAMA can be categorized as a subset of FDMA as it allows for bandwidth-

sharing such that multiple users are granted access to the sharing of a pool of resources or channels available for assignment on demand. In this manner, a single transponder is used to support several users strictly on call-by-call basis. When a user activates a request, a network control system validates the request and assigns a channel for communication. Upon the completion of a call on the assigned channel, a notification to this effect is received by the control system and the channel is returned to the pool of channels for reassignment on demand.

The MF-TDMA effectively combines the affordances of both the FDMA and the TDMA. The idea is to divide the available frequency band into separate frequency sub-bands with each frequency sub-band further divided into time-slots. Multiple users are then assigned, in a dynamic manner, specific time slots and frequency sub-bands for communications. This assignment is necessarily predicated upon the demands and the bandwidth capabilities of individual users. Although FDMA is noted for permitting simultaneous and continuous transmission, the time domain dependency of MF-TDMA prevents the multiple users on the network from transmitting simultaneously in the same frequency band. This is necessary for precluding interference. The multiple carrier frequencies, though, can be operated with different power levels.

The OFDMA – an upgraded variant of the OFDM technique – is another frequency – and time-domain access scheme that divides the available channel into a number of independently modulating subcarriers and assigns each user a subset of the closely-spaced and orthogonal subcarriers, thus allowing multiple users to communicate simultaneously. This allows for improved network efficiency and increased capacity through low latency and the elimination of network congestion, albeit OFDMA exhibits a great deal of sensitivity to frequency offset. The defining characteristics of OFDMA are its robust spatial diversity, receiver circuit simplicity and intrinsic orthogonality. Additionally, it is possible in OFDMA systems to dynamically change the allocation of subcarriers to users. Another important advantage of OFDMA is the capability of the scheme to combine the use of a multiplicity of low data rate subcarriers (with long symbol duration) with the insertion of cyclic extension or cyclic prefix to address issues surrounding multipath interference.

The OFDMA finds growing applications in cellular standards such as WiMAX and LTE (Long Term Evolution). It is also a crucial feature of Wi-Fi 6/Wi-Fi 7, WMAN (wireless metropolitan area network) and the futuristic air-ground broadband digital datalink system known as L-Band Digital Aeronautical Communications System (LDACS), which utilizes the OFDM modulation technique. The LDAC protocol

stack's physical layer, though, supports the Forward-Reverse transfers of data using a combination of OFDMA and TDMA schemes. On the forward link, an LDAC ground station supports the continuous transmission of a stream of OFDM symbols as well as bi-directional communication links to multiple air traffic, while, on the reverse link, multiple traffic can transmit discontinuously, transmitting a combination of TDMA and OFDMA radio bursts in frequency and time in accordance with the slots assigned to the different traffic on demand by the ground station.

CODE SEQUENCE-DEPENDENT ACCESS TECHNIQUES

CDMA allows multiple users to simultaneously share a common bandwidth at the same time with each user assigned a unique pseudorandom identification code or user-specific signature that is modulated with the useful information such that the useful information in the signals transmitted by the users are extracted by the receivers using the unique codes in the signals, which are essentially orthogonal to each other. This process involves the multiplication of the signal by the code sequence.

This multiplication process effectively spreads the power of the transmitted signal over a larger bandwidth, increasing the bandwidth efficiency of CDMA in a network with several users. This spread spectrum technique – with its intrinsic characteristics including asynchronous access capability and significant immunity to unauthorized interception and multi-path propagation distortion – explains why CDMA is sometimes called spread-spectrum multiple access (SSMA), a somewhat frequency-time matrix access technique.

CDMA is robust in terms of its flexibility. However, CDMA requires the deployment of complex receivers. There is also the need for complex power control intervention to mitigate near-far problem, specifically in relation to mobile technology. This power control intervention is not associated with TDMA where inter-user interference is mitigated using frequency and time-slot allocation.

NEXT-GENERATION MULTIPLE ACCESS SCHEMES

One emerging multiple access scheme that is being actively developed is the Non-Orthogonal Multiple Access (NOMA), which allows multiple users to communicate simultaneously in the same frequency band using superposition coding. The access is anchored on non-orthogonal resource assignment just like SDMA (Space Division Multiple Access). The SDMA technique, on its part, is a space-domain assigned multiple access scheme that is being explored for satellite

communications and 6G technologies. It implements spatial division multiplexing involving multiple spatially separated aperture pairs for the uplink and downlink paths. In SDMA, a given space is segmented into smaller sectors which are assigned to different users in the form of spatial locations based on beam forming schemes. SDMA is essentially a multi-antenna system, which uses multiple antennas to provide multiple data streams – via the superposition of several spot beams – to different users simultaneously in the same channel. In satellite communications, the footprint of each spot beam is on a different region. Although SDMA is a top-notch technique in terms of high spectral efficiency, the scheme has a number of disadvantages including its characteristic inflexibility, and relatively poor synchronization. The utility of the scheme can, however, be very robust when used in combination with CDMA, FDMA, OFDMA or TDMA.

Another technique worth mentioning is PDMA, which is being largely explored for satellite communications. It is also a multi-antenna system using separate receivers and separate antennas with different polarizations. PDMA modulation does not involve frequency, amplitude or phase modulation. Rather, it uses the electromagnetic wave's circular propagation characteristic for modulation.

CONCLUSION

Multiple access schemes provide the means for allowing multiple telecommunications users to communicate on a single channel using one or a combination of resources such as time, frequency and space. Given the frenzied evolution of technology and the growing demands for more efficient, scalable and robust telecommunications networks, it is becoming increasingly apparent that a single multiple access scheme cannot meet existing and emerging operational realities. This is, expectedly, driving a paradigm shift towards the implementation of multiple access schemes that combine the affordances of at least two multiple access techniques.

It is worth noting that in terms of the fundamentals of access in relation to resources as well as assignment and control mechanisms, FDMA – and also CDMA and TDMA – are the same in both satellite and cellular technology applications. However, there are marked differences when it comes to the aspects of affordances, limitations, and parameter configurations. ■

SERVICES

CABO VERDE OPERATIONAL WITH AIREON ADS-B DATA

ASA, the air navigation service provider for the West African island nation of Cabo Verde has joined the growing league of Aireon's customers with the operationalization of Aireon's space-based automatic dependent surveillance-broadcast (ADS-B) data over the country's 1.3 million square kilometer Sal Oceanic Flight Information Region (FIR) for air traffic surveillance purposes.

The Aireon ADS-B data has the potential to unlock a number of safety and operational benefits for Cabo Verde, particularly in the context of the island nation's predominantly international and oceanic flights. The operationalization of the Aireon ADS-B data solution also has the potential to position Cabo Verde as a strategic player in the transatlantic corridors between Europe and South America, improving safety and operational efficiency as well as contributing to the reduction of emissions.

"Congratulations to ASA, Cabo Verde ANSP, for their quick and efficient work to bring the Aireon data into operational use," said Michele Carantente, Aireon Vice President of Air Traffic Services. "Aireon stands ready to support the ANSP in their safety and operational goals."

"ASA remains committed to the modernization of air navigation services and, through this innovation, in partnership with Aireon, we take another important step towards our strategic objectives of ensuring the highest levels of safety and operational efficiency in the airspace under the responsibility of Cabo Verde (Sal Oceanic FIR), while minimizing the impact of the environment," said Moisés Monteiro, CEO of ASA.

CANSO AND METRON AVIATION ANNOUNCE COMPASS LAUNCH

The Civil Air Navigation Services Organisation (CANSO) and Metron Aviation, a subsidiary of Stratify Aerospace, have reached an agreement to launch a digital platform, COMPASS, by early 2026. Under the partnership, CANSO will work directly with regional aviation stakeholders to establish the COMPASS regions, with Metron Aviation providing, operating and maintaining the platform at no cost to CANSO and its members, thus ensuring global accessibility and long-term value for all stakeholders.



COMPASS – CANSO Operational

Messaging Platform for Air Traffic Flow Management Sharing and Synchronisation – is a digital platform designed for the purpose of improving situational awareness and collaborative decision-making across the aviation community, transforming the way air navigation service providers (ANSPs) and other aviation stakeholders (airports and airlines) share information and make decisions. The platform, which will promote global harmonization and support future-ready operations by enabling automation, synchronization and data-drive decision-making, will transition from existing regional platforms, such as the Americas' CADENA OIS, towards a single, globally harmonized solution.

"COMPASS is a major step forward in building globally harmonized, resilient, and efficient ATM operations," said Simon Hocquard, CANSO President and CEO. "By providing this platform free of charge, Metron Aviation has shown true leadership and a long-term commitment to supporting enhanced collaboration that will improve operations."

"Stratify Aerospace, together with our subsidiary Metron Aviation, is pleased to partner with CANSO on the development of COMPASS, a platform designed to strengthen collaborative decision-making, enhance shared situational awareness, and enable the global ATFM community to share information more effectively," said Gene Hayman, CEO of Stratify Aerospace.

SITA LAUNCHES ITS SITA ATC BRIDGE SOLUTION

SITA, the global leader in air transport technology, has introduced an innovative and easy-to-use Software as a Service (SaaS) cloud-based digital platform – the SITA ATC Bridge – which has the potential of supporting civil aviation authorities (CAAs), air navigation service providers (ANSPs), and regulators who require fast, dependable, and scalable communication across the ICAO Air Traffic Services Message Handling System (AMHS).

SITA ATC Bridge is designed to provide support for global air traffic communication in a modern, agile way that ensures operational efficiency. The platform is specially tailored for fast deployment, budget-conscious procurement, and modern operational needs, where the exchange of large and frequent messages is becoming more mission critical.

"Across the industry, air navigation service providers are being asked to do more with less: handle growing traffic volumes and modernize systems, often with tight budgets," said Martin Smillie, Senior Vice President of Communications and Data Exchange at SITA. "Legacy communication systems make that harder by being expensive, rigid, and complex to maintain. SITA ATC Bridge changes that. By moving to a secure, cloud-based platform, we're giving aviation authorities the flexibility, speed and resilience they need to collaborate across borders and keep pace with the demands of modern air traffic management."

TECHNOLOGY

ROHDE & SCHWARZ ROLLS OUT NEW FREQUENCY MODELS

Rohde & Schwarz has announced the addition of new high-frequency models of up to 54 GHz for the R&S ZNB3000 vector network analyzer, which was introduced in February 2025. The new frequencies of 32 GHz, 43.5 GHz and 54 GHz will be available by the end of 2025. Designed to combine precision and speed in a scalable platform, the R&S ZNB3000 vector network analyzer helps researchers and engineers accelerate innovation in high-performance RF applications and signal integrity testing.

By extending the maximum frequency up to 54 GHz, Rohde & Schwarz addresses even more applications with the R&S ZNB3000, including advanced RF component testing for SATCOM applications in the Ka and V bands, such as filters, mixers, amplifiers, switches, and beam formers, which operate at these high frequencies.

The R&S ZNB3000 offers best-in-class RF performance with a high dynamic range of up to 150 dB, high output power, and low trace noise of less than 0.0015 dB RMS.

CONTRACTS & AGREEMENTS

EUROCONTROL AND ICAO SIGN A NEW MEMORANDUM OF COOPERATION

On the sidelines of the 42nd General Assembly of the International Civil Aviation Organization (ICAO) in Montreal, Canada, EUROCONTROL Director General, Raúl Medina Caballero, and ICAO Secretary General, Juan Carlos Salazar, signed a new Annex to the Memorandum of Cooperation (MoC) between the two organisations.

The new Annex broadens and reinforces the scope of cooperation between EUROCONTROL and ICAO across a wide range of areas for aviation's future, including supporting ICAO's global cybersecurity strategy and awareness initiatives, benchmarking and harmonizing performance frameworks and coordinating regional and national air navigation planning, sharing European experiences and fostering the global uptake of new technologies, assisting States with ICAO Standards and Recommended Practices, and so on.

"This gives a new impulse to our longstanding cooperation with ICAO," said Raúl Medina Caballero, EUROCONTROL Director General. "By bringing together ICAO's global reach and EUROCONTROL's operational and technical expertise, we are better equipped to tackle the major challenges facing aviation – from sustainability and digitalisation, to safety, cybersecurity and the integration of new airspace users. This partnership is about



building a safer, greener and more innovative global aviation system, and we are proud to contribute with our knowledge and experience to benefit the entire international aviation community."

"ICAO and EUROCONTROL are joining forces to help countries implement the latest tools and technologies in air traffic management. Deliver joint training for aviation professionals, and share operational data to improve airspace management," said Juan Carlos Salazar, ICAO Secretary General. "Through this new agreement, ICAO will strengthen cybersecurity, support sustainable aviation fuels, and help integrate new airspace users like drones and space vehicles. This partnership puts practical solutions in the hands of States and industry, helping to build a safer, more secure, sustainable, and more efficient global aviation system."

ERA SIGNS PARTNERSHIP AGREEMENT WITH AIRBUS



The Czech company ERA, a leading provider of passive surveillance technologies for air defence, and Airbus Defence and Space have announced the signing of a Framework Cooperation Agreement, which is aimed at enhancing Airbus' existing command and control solutions as well as strengthen its offerings in the field of Integrated Air and Missile Defence (IAMD).

The Framework Cooperation Agreement also aims to explore future cooperation opportunities between both companies in the field of IAMD, including possibilities of enhancing their respective products.

"Partnering with ERA allows us to investigate options for true IAMD and see how full integration of passive surveillance with our C2 solutions can make a difference," says Jens Reynders, Head of Defence Digital Germany and International at Airbus Defence and Space GmbH.

"Passive surveillance systems are recognized as an important part of air defence operations. We are proud to become a partner of Airbus, working together on new capabilities," says Ondřej Chlost, CEO of ERA.

ACAMS AS SIGNS A MAJOR CONTRACT WITH CISCEA



ACAMS AS has signed a major upgrade contract with CISCEA, the Brazilian Airspace Control System Implementation Commission. Under the contract, ACAMS, working with Brazil-based ATC Systems, will complete the upgrade of the Integrated Control Tower Systems at twelve Brazilian airports.

The twelve towers included in the project are located at the Natal, Maceió, Porto Velho, Rio Branco, Boa Vista, Porto Seguro, São Luís, São José dos Campos, Santa Maria, Canoas, Porto Alegre, and Taubaté airports.

"This contract reaffirms our long-standing relationship with CISCEA and the confidence they have in our technology," said Odd Thodesen, Co-founder and Director Business Development of ACAMS. "We are proud to contribute to the Brazilian airspace program by providing integrated tower solutions that enhance safety, operational efficiency, and readiness for future demands across these important airports."

"This upgrade project is part of CISCEA's strategic commitment to modernizing Brazil's air traffic control capabilities. Our continued collaboration with ACAMS and ATC Systems ensures we maintain operational excellence with a unified solution throughout the airports and benefit from the latest technological advancements, fully tailored to our national needs," said Major Brigadeiro Alexandre Arthur Massena Javoski, President of CISCEA.

INDUSTRY

NIGERIA RE-ELECTED INTO THE ICAO COUNCIL

Nigeria was re-elected as a Part 2 member of the 36-member ICAO (International Civil Aviation Organization) Council – the governing body of ICAO – for another three-year term during the elections which took place on 30 September 2025 at the 42nd Session of the ICAO General Assembly in Montreal, Canada. The Part 2 elections pertained to ICAO Member States which make the largest contribution to the provision of facilities for international civil air navigation. Other ICAO Member States elected into the ICAO Council under Part 2 are Argentina, Colombia, Denmark, Egypt, India, Mexico, Saudi Arabia, Singapore, South Africa, Spain, and Switzerland.

Elections of members into the ICAO Council are conducted during the General Assembly of ICAO in accordance with the designations spelt out in Article 50 (b) of the Convention on International Civil Aviation. Article 50 (b) to the Convention designates three elective parts: Part 1 (States of chief importance in air transport), Part 2 (States making the largest contribution to the provision of facilities for international civil air navigation, and Part 3 (States not otherwise included whose designation will ensure that all the major geographic areas of the world are represented on the Council).

ICAO Member States elected under Part 1 are: Australia, Brazil, Canada, China, France, Germany, Italy, Japan, the United Kingdom, and the United States of America, while the Part 3 categorization comprises Angola, Belize, Cuba, Ecuador, Equatorial Guinea, Malaysia, Mali, Morocco, Poland, Qatar, Republic of Korea, Uganda, the United Arab Emirates, and Uruguay.

GNSS Anomalies: Implications for Global Airspace Safety and Efficiency

By Adeyinka Olumuyiwa Osunwusi, PhD



THE MEDIA FLURRY WAS INSTANTANEOUS AND INFECTIOUS, ECHOING THE SHEER GRAVITY OF THE SAFETY OCCURRENCE. THE AURA SURROUNDING THE NEWS WAS EQUALLY ALMOST PALPABLE, WITH ACCUSING FINGERS POINTING UNMISTAKABLY TOWARDS THE KREMLIN. IN THE AFTERNOON OF SUNDAY, 31ST AUGUST, 2025, AN AEROPLANE CARRYING THE PRESIDENT OF THE EUROPEAN UNION (EU), URSULA VON DER LEYEN, WAS HIT - ENROUTE PLOVDIV, BULGARIA - BY SUSPECTED RUSSIAN GPS JAMMING, WHICH DISABLED GPS NAVIGATION SERVICES AT THE BULGARIAN AIRPORT, FORCING THE AIRCRAFT'S PILOTS TO RESORT TO LANDING THE AIRCRAFT USING CONVENTIONAL PAPER MAPS.

That was the news. But, what remains to be said is that the 31 August 2025 incident underscored not only the significance of the increasing threats posed by Global Navigation Satellite System radio frequency interference (GNSS RFI) to global aviation safety but also the need to interrogate the continuing utility of conventional navigation infrastructure in a world where progressive increases in the adoption of innovative technologies are driving a paradigm shift towards a phased decommissioning of legacy navigation systems and procedures, with implications for the retention of the Minimum Operating Networks (MONs) required for mitigating and managing GNSS vulnerabilities. It is one thing to desire a global airspace where GNSS becomes the prime option for reliable and efficient positioning, navigation and timing procedures. It is also a different ballgame to ensure the availability of fallback ground-based navigation aids (GBNA), particularly for scenarios where the integrity, availability and reliability of satellite-based positioning, navigation and timing (PNT) services become questionable due to unintentional events as well as intentional interference events from state and/or non-state actors.

"IFATSEA supports ICAO's Resolution 41-8C, which calls for ensuring the resilience of

CNS/ATM systems against GNSS interference. We also think that there is urgent need for redundant systems, including ground-based navigation aids and robust augmentation systems, to mitigate reliance on satellite signals, which is quite vulnerable," says Frank Kofi Apeagyei, President of the International Federation of Air Traffic Safety Electronics Associations (IFATSEA). "In fact, these GNSS anomalies should be viewed as a new operational reality which requires systemic resilience, technical vigilance, and global coordination."

GROWING THREATS TO AVIATION SAFETY

The safety occurrence of 31 August 2025 involving a high-profile diplomat underlines the sheer

anomalies, such as jamming and spoofing. The increase of GNSS interference occurrences worldwide highlights the possible threats to aviation safety, even though specific incidents in South Africa are not frequently reported," says Thomas Chauque, the Executive President of the South African Air Traffic Safety Electronics Personnel Association (SAATSEPA). "Even though there haven't been any GNSS interference occurrences in South Africa that have been made public, the rise in these instances worldwide and the region's vulnerabilities make preventative actions crucial. Important actions to protect aircraft operations in South African airspace include putting in place reliable monitoring systems, strengthening

plane holding eight satellites, the GLONASS' constellation of satellite operate on different frequencies.

BeiDou is designed to provide high-accuracy PNT services worldwide. The GNSS system features an orbital constellation of 35 satellites, comprising three geosynchronous satellites in inclined geosynchronous orbits, five geostationary satellites and 27 medium-earth-orbit (MEO) satellites. The BeiDou system features multi-frequency navigation signals, whilst also integrating navigation and communication, PNT, search and rescue, satellite-based augmentation and ground-based augmentation functionalities.

GPS – the most used and most popular GNSS system – currently features a constellation of 31 satellites positioned in six medium earth orbit (MEO) planes at an altitude of 20,200 km, inclined at 55 degrees to the equator. GPS is used for a wide variety of applications from space application to science applications. Aside from the traditional PNT applications serving a wide variety of users in the civil aviation, maritime and land navigation realms, GPS is also finding increasing applications for space communications, geographic information system (GIS), geodesy, photogrammetry, and autonomous spacecraft operations.

Galileo is a public, civilian-controlled GNSS system designed for the purpose of providing highly accurate and reliable global PNT services. The GNSS system – which has been operational since December 2016 – is interoperable with both GLONASS and GPS, albeit it provides better accuracy than GPS and GLONASS. Galileo currently features a constellation of 26 satellites positioned in three circular medium earth orbital planes at an altitude of 23,000 km and an inclination of 56 degrees to the equator. The system achieved aviation certification in 2023.

Aside from these big four – GPS, GLONASS, BDS, and Galileo – there are other regional navigation satellite systems. Japan's QZSS (Quasi-Zenith Satellite System) – also known as the 'Japanese GPS' – is a good example. Designed essentially to be highly compatible with GPS and operating primarily in the Japanese region, the QZSS constellation boasts four satellites, comprising one geostationary satellite and three geosynchronous satellites in slightly elliptical, highly inclined orbit, with asymmetrical figure-of-eight orbital patterns.

THE FACES OF GNSS RFI

In terms of typologies, GNSS RFI is generally classified as unintentional and intentional. It is worth noting that what qualifies as an anomaly or a normal behavior with respect to GNSS signals is a function of the requirements attached to specific GNSS applications. Unintentional interference can be due to malfunctioning or incorrectly configured systems as well as unintentional interference due to terrain reflecting or refracting signals, space weather events such as solar storm, ionospheric scintillation and multipath effects. Also, because GNSS signals are extremely weak,

QUITE A NUMBER OF GNSS PLATFORMS HAVE BEEN SUCCESSFULLY DEPLOYED IN RECENT TIMES. THESE INCLUDE: RUSSIA'S GLOBAL NAVIGATION SATELLITE SYSTEM OR GLOBALNAYA NAVIGAZIONNAYA SPUTNIKOVAYA SISTEMA (GLONASS), CHINA'S BEIDOU NAVIGATION SATELLITE SYSTEM (BDS), UNITED STATES' GLOBAL POSITIONING SYSTEM (GPS), AND EUROPE'S GALILEO NAVIGATION SATELLITE SYSTEM

significance of the threats that malicious actions towards GNSS operations posed to the safety of the global airspace. It also underscores the importance of interference-free GNSS operations to flight safety.

"GPS jamming and spoofing have emerged as significant threats to global aviation safety and their implications for the airspace are increasingly concerning," said Sam Mahlangu, IFATSEA Regional Director for Africa, in a recent interview with *Air Traffic Safety Electronics International*. "Given the critical role GNSS plays in everything from aviation to telecommunications and emergency services, we have seen the impact this is starting to have on the safe operation of flights."

There is unanimity among aviation experts who spoke with *Air Traffic Safety Electronics International* regarding the global ramifications of GNSS utility and the cascading effects of GNSS RFI. The question, however, remains the quantum of the burden that Africa – a grossly under-monitored continent when it comes to GNSS anomalies – shares currently.

"Africa's aviation sector is expanding rapidly, with increased reliance on satellite-based navigation systems for efficiency and safety. However, the continent's vast and often remote airspace can make it challenging to detect and mitigate GPS interference promptly," Mahlangu added. "While specific incidents in African airspace have been less frequently reported, the global nature of GPS signals means that disruptions elsewhere can have cascading effects. Moreover, the potential for malicious actors to exploit vulnerabilities in less monitored regions cannot be overlooked."

"Indeed, there is a genuine and growing threat to South African airspace from Global Navigation Satellite System (GNSS)

regulatory frameworks, and preserving alternate navigation capabilities."

UNDERSTANDING GNSS

The term GNSS (Global Navigation Satellite System) integrates different satellite-based navigation systems providing PNT services worldwide. Consisting of Russia's GLONASS, Europe's Galileo, United States' GPS, and China's BeiDou – all of which transmit signals in dedicated GNSS frequency bands – GNSS integrates a ground segment including master control and monitoring stations, a space segment consisting of satellite constellations, and a user segment consisting of user terminals and application systems. The four GNSS systems feature constellations with a total of 89 satellites.

GNSS TYPOLOGIES

Quite a number of GNSS platforms have been successfully deployed in recent times. These include: Russia's GLObal Navigation Satellite System or G L o b a l n a y a N a v i g a z i o n n a y a S p u t n i k o v a y a S i s t e m a (GLONASS), China's BeiDou Navigation Satellite

System (BDS), United States' Global Positioning System (GPS), and Europe's Galileo Navigation Satellite System.

GLONASS – featuring a constellation of 24 satellites that operate in circular orbits with an orbital radius of 19, 140 km – is designed to provide highly accurate positioning, navigation, and timing (PNT) services worldwide. The system is designed to provide global coverage and reliable positioning and timing data aside from offering high accuracy and a high level of interoperability with the other GNSS systems. Positioned in three orbital planes, with each



Sam Mahlangu, IFATSEA Regional Director for Africa

it is possible for any equipment to unintentionally disrupt these weak signals.

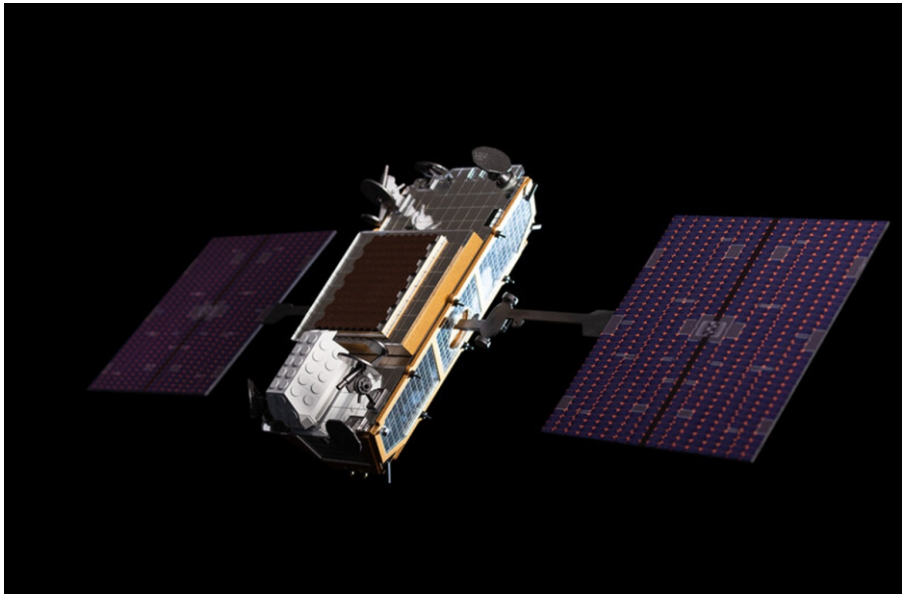
Intentional interference can be due to cyber events affecting the performance of onboard avionics. However, there are two main sources of intentional interference: jamming and spoofing. Jamming involves the interruption of GNSS signals through RFI that is intentionally used to overwhelm or drown out the GNSS signals. The consequence is that the signals are overwhelmed to the extent that they are rendered unusable, resulting in a denial of service condition. Spoofing, which is rather more harmful than jamming, involves the transmission of fake GNSS signals that looks somewhat authentic. Three types of GNSS spoofing attacks have been identified in the academic literature: synchronous spoofing attack, asynchronous spoofing attack and meaconer attack. Synchronous attack, which is more complex in terms of its execution, involves the transmission of signals that are identical to the authentic GNSS signals, deceiving the receiver into transitioning to the spoofer's signals without any disruption to signal tracking. Generally, in a synchronous attack, the power of the interfering signals is higher than the power of the GNSS signals. For an asynchronous attack, a disruption to signal tracking is necessary and the spoofer's power should also be higher than the power of the GNSS signals. In a meaconer attack all that is required is to record and reproduce the GNSS signals.

GNSS RFI: A GROWING GLOBAL THREAT

There is no gainsaying the fact that GNSS interference events are being reported across the globe at an alarmingly increasing pace. According to IATA GNSS RFI Safety Risk Assessment (Version 4, September 2024), members of the IATA flight data exchange (FDX) program, which is based essentially on aircraft-recorded data, experienced over 580,000 instances of GPS signal loss of around 18.4 million flights processed by the FDX program from August 2021 to June 2024. The data regarding the trend of GNSS outages per 1000 flights reveal that in the first half of 2024, GPS signal losses per 1000 flights jumped to 50.8, up from the 30.8 outages per 1000 flights recorded for 2023. These figures represent significant increases when juxtaposed against the 2021 and 2022 figures of 28.1 and 30.5 loss rates per 1000 flights respectively. The IATA Safety Risk Assessment publication further made reference to EASA Safety Information Bulletin Operations' (ATM/ANS SIB NO. 2022-02R3) observation to the effect that "GNSS RFI has become a significant safety risk, particularly in geographical areas surrounding conflict zones and the eastern Mediterranean, Middle East, Baltic Sea, and Arctic area, where RFI can increase pilots' and air traffic controllers' workload."

The localization of GNSS RFI in specific geographical areas notwithstanding, it is a known fact that for a specific traffic the effects of the interference can linger even beyond the interference hotspot areas, precipitating serious degradation of navigation position integrity for the rest of the flight.

The global dimension of the prevalence of GNSS RFI events is, perhaps, no longer open to debate, although certain regions



Satellite used for space-based ADS-B. Photo Credit: NavCanada.

of the world need to invest greater efforts in order to develop meaningful management and mitigation strategies. "While GPS jamming and spoofing have been more prevalent in certain global hotspots, the interconnected nature of aviation systems means that no region is immune," Mahlangu opined. "For Africa, proactive measures, technological investments, and regional cooperation are essential to safeguard its airspace against these evolving threats."

A GLOBAL, MULTI-JURISDICTIONAL RESPONSE

Industry stakeholders agree that a global, multi-stakeholder approach is needed in order to adequately mitigate the challenges surrounding GNSS signal interference. Sam Mahlangu is of the opinion that ensuring the reliability and resilience of GNSS services is not the responsibility of either a single party or an isolated response plan.

"Yes, I fully support the growing call for a multi-stakeholder approach to mitigating the challenges surrounding GNSS signal interference," said Mahlangu. "Collaborative efforts involving Member States, industry stakeholders, researchers, and international bodies are essential to develop robust policies, share best practices, advance technological solutions, and coordinate effective responses to both unintentional and intentional interference. A unified, cooperative strategy is the most effective way to safeguard GNSS infrastructure and maintain global trust in its integrity."

In recent times, various interventions have been made regarding GNSS RFI by industry stakeholders at the national, sub-regional, regional, and international levels. The ICAO GNSS Manual (Doc 9849), for example,

specifies a wide array of mitigation measures for GNSS RFI events. The International Air Transport Association (IATA) has also made a number of interventions recently. IATA, for example, presented a Discussion Paper (DGCA – 60/DP/04/15) at the 60th Conference of Directors General of Civil Aviation Asia Pacific Regions, which took place in Sendai, Japan from 28 July to 1 August 2025. The paper discussed the growing

incidence of GNSS RFI in Asia-Pacific and the impacts on civil airspace users.

Two of the Working Papers – AN-Conf/14-WP/76 and AN-Conf/14-WP/78 – presented at the 14th ICAO Air Navigation Conference, which took place in Montreal, Canada from 26 August to 6 September 2024, also addressed different perspectives of GNSS RFI challenges. AN-Conf/14-WP/76 –

jointly presented by IATA, International Business Aviation Council (IBAC), International Coordinating Council of Aerospace Industries Associations (ICCAIA), International Federation of Airline Pilots' Associations (IFALPA), International Federation of Air Traffic Controllers' Associations (IFATCA) and International Federation of Air Traffic Safety Electronics Associations (IFATSEA) – proposed actions for the purpose of ensuring the reduction, to the extent possible, of intentional GNSS RFI events. AN-Conf/14-WP/78 – jointly presented by IATA, International Federation of Air Traffic Controllers' Associations (IFATCA), International Coordinating Council of Aerospace Industries Associations (ICCAIA), International Federation of Airline Pilots' Associations (IFALPA), International Federation of Air Traffic Safety Electronics Associations (IFATSEA) and International Business Aviation Council (IBAC) – presented a revised version of



Thomas Chauque, SAATSEPA Executive President



IATA/IFATCA/ICCAIA position regarding GBNA and MONs, whilst proposing the pragmatic rationalization of GBNA such that regional MONs of conventional navigation aids are established by States in order to mitigate GNSS RFI risks.

MITIGATING GNSS RFI

The manifestation of GNSS RFI events comes in different forms and shapes. They can manifest in

arduous task. However, multi-stakeholder and multi-jurisdictional approaches – involving Original Equipment Manufacturers (OEMs), civil aviation authorities (CAAs), national, regional and international organizations, specialized research organizations, airline operators, and so on – are being stepped up to develop effective mitigating options to guarantee GNSS integrity on a global scale.

On the OEM front, a growing army of



Intelsat IS-22 702MP satellite. *Courtesy of the Boeing Company*

the form of spurious terrain awareness and warning system (TAWS) alerts as well as false ADS-B out position reporting. They can present significant errors in navigation positions as well as abnormal differences in Ground Speed and Airspeed. They can lead to the loss of safety-critical information, such as weather information, to the flight crew. They can also come in the form of a complete unavailability of GPS service due to a transmitter emitting signals in the GPS frequency as was the case in January 2022 around the vicinity of United States' Denver International Airport.

Guaranteeing the continuing integrity of GNSS PNT services remains an

industry players are developing and offering innovative technologies for managing and mitigating GNSS RFI. One of these players is the Leuven Belgium-headquartered Septentrio, with its AIM+ (Advanced Interference Mitigation) solution featuring adaptive notch filtering, pulse blanking and wide band interference mitigation. GPSPATRON is another formidable player. The company specializes in the localization of the sources of GNSS RFI using its innovative Time Difference of Arrival (TDOA) solutions to measure the difference in the arrival times of a signal at multiple points, with the deployment of precise time synchronization of all signal reception points to determine the coordinates of

an RFI source. GPSPATRON also showcases a GNSS interference detector, the GP-Probe, which measures the parameters of GNSS signals and sends the generated data to a web-based application, known as the GP-Cloud, for analysis.

Aireon LLC, a global space-based ADS-B service provider, is another big player, especially in the realm of identifying and mitigating intentional GPS interference worldwide using ADS-B datasets. The company currently serves over 20 air navigation service providers (ANSPs). It will be recalled that in its Industry Roundup in the 2023 October/December Edition, *Air Traffic Safety Electronics International* reported that South Africa's Air Traffic and Navigation Services (ATNS) and Aireon have agreed to collaborate and advance space-based automatic dependent surveillance-broadcast products and services in Africa.

Aireon is noted in the industry for leveraging its extensive ADS-B dataset to build applications that allow for the identification and mitigation of GPS interference. Using its global independent position estimator, *RefTrack*, Aireon has also been providing the industry with reliable data on aircraft locations particularly in scenarios where GNSS position data are unavailable.

Research organizations are by no means left out in the race for devising techniques for mitigating GNSS RFI. The German Aerospace Center (DLR) is, unarguably, at the forefront of global GNSS RFI R&D with its GNSS signal anomaly detection techniques using differential code bias (DCB) of GPS satellites and Machine Learning algorithms. Under the European Space Agency's (ESA) NAVISP programmes, GMV NSL Ltd has also developed the COLOSSUS (Crowd-Sourced Platform for GNSS Anomaly Identification, Isolation and Attribution Analysis) system for the identification, isolation and detection of GNSS anomalies. The system, which is essentially cloud-based, has demonstrated continuous, automatic, real-time processing and fault detection capabilities as well as generated performance reports for Galileo, GPS and GLONASS systems.

GOING FORWARD

Quite a number of management and mitigation techniques are required in order to ensure the reliability, integrity and availability of GNSS-based PNT services. The army of OEMs, particularly those specializing in onboard avionics need to invest in research and development (R&D) with a view to developing operational avionics that can deal with jamming and spoofing at the scale being experienced presently.

Although, the increasing occurrence of GNSS RFI events and its implications for safety is forcing a paradigm shift towards the development of alternate positioning, navigation, and timing (APNT) options, it seems proper to concede that implementing meaningful APNT options does not look like a viable alternative in the nearest foreseeable future. The industry, therefore, may well focus more on upgrading existing GNSS RFI mitigation and management techniques as well as addressing issues surrounding the continuing availability of fallback GBNA. ■



“The International Federation of Air Traffic Safety Electronics Associations (IFATSEA) stands as the global and authoritative voice for Air Traffic Safety Electronics Personnel (ATSEP), championing excellence in aviation safety through harmonized training, innovation, and advocacy.”

LETTER FROM THE PRESIDENT

Distinguished ATSEPs, Delegates, and Esteemed Industry Partners,

It is with great honour and enthusiasm that I invite you to the 53rd IFATSEA General Assembly Meeting, taking place from 9–14 November 2025 in Cape Town, South Africa, a vibrant city known as the gateway to Africa and the meeting point of oceans and cultures.

The International Federation of Air Traffic Safety Electronics Associations (IFATSEA) stands as the global and authoritative voice for Air Traffic Safety Electronics Personnel (ATSEP), championing excellence in aviation safety through harmonized training, innovation, and advocacy. Our vision is clear: a world where safe skies are maintained by skilled, empowered professionals operating within resilient and interoperable systems.

To realize this vision, our founders established the General Assembly as a platform for ATSEP professionals and aviation stakeholders to convene, exchange ideas, and address both technical and operational challenges. For over five decades, these gatherings have delivered immense value to the global aviation community.

This year's Assembly promises to be more than a meeting. It will be a celebration of our collaboration, knowledge-sharing, and progress. Delegates from across continents will unite to explore emerging technologies such as Artificial Intelligence, cybersecurity, CNS/ATM systems, and evolving ATSEP training models and regulatory frameworks. The conversations in Cape Town will shape how we work, train, and innovate in this new technological era.

We look forward to welcoming seasoned experts, rising professionals, and new member associations alike. Your presence will reflect the strength of our global community and the shared commitment to excellence that defines IFATSEA.

Please, join us in Cape Town for an unforgettable Assembly, one that will spark new ideas, forge lasting partnerships, and reaffirm our dedication to safe and efficient air navigation services.

Ake sihlangane eKapa! Tukutane Cape Town! Kom ons ontmoet in Kaapstad!

Ing. Frank Kofi Apeagyei
IFATSEA President

A Special 53rd IFATSEA General Assembly Supplement to



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- ◆ Kenya Air Traffic Systems Engineering Association (KATSEA) (Kenya)

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<https://dextermarie.com/air-traffic-safety-electronics-international/>

A PEEP INTO THE IFATSEA EXECUTIVE BOARD

The International Federation of Air Traffic Safety Electronics Associations (IFATSEA) is governed by an eight-member Executive Board, made up of the President, the Vice-President, the Executive Secretary, the Treasurer, and four Regional Directors overseeing the affairs of the four regions of IFATSEA Global, namely Africa, the Americas, Asia Pacific and Europe. The eight-member composition of the Board was a consequence of the constitutional changes adopted in 2013. Each member of the Executive Board is elected to serve a four-year term, with a constitutional right to seek re-election. The Executive Board's operational and governance framework is partitioned into two distinct committees: the Operations Committee, integrating the President, the Executive Secretary and the Treasurer; and the Strategic Committee, comprising the Vice-President and the four regional directors.

CURRENT IFATSEA EXECUTIVE BOARD OFFICERS



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Carlos Aguirre (USA)
VICE PRESIDENT



Meaghan Olmstead (Canada)
EXECUTIVE SECRETARY



Nikola Cojic (Montenegro)
TREASURER



Sam Mahlangu (South Africa)
REGIONAL DIRECTOR - AFRICA



Michel Gaulin (Canada)
REGIONAL DIRECTOR - AMERICAS



Umesh Kumar (India)
REGIONAL DIRECTOR - ASIA PACIFIC



Costas Christoforou (Cyprus)
REGIONAL DIRECTOR - EUROPE



THE THORSTEN WEHE IFATSEA AFRICA AWARD



The Thorsten Wehe Africa Award was conceptualized by the immediate past IFATSEA (International Federation of Air Traffic Safety Electronics Associations) Africa Regional Director – now the President of IFATSEA – Ing. Frank Kofi Apeagyei as an annual award to be conferred during the annual General Assembly of IFATSEA. The award, which was birthed on 27 August 2022 during the 12th IFATSEA Africa Region Meeting in Dar Es Salaam, Tanzania, is in honour of the former President of IFATSEA, Thorsten Wehe, who died on 22 February, 2022. The award, which is dedicated to well-deserving individuals who have contributed immensely to the development of the air traffic safety electronics profession, covers a wide spectrum of achievement areas, including academic research, leadership, activism, change championing or any other progressive interventions aimed at advancing the ATSEP profession. The award made its debut in Prague, Czech Republic in 2022 during the 50th IFATSEA General Assembly.

THE 2022 THORSTEN WEHE AWARDEES (50TH IFATSEA GENERAL ASSEMBLY, PRAGUE, CZECH REPUBLIC)



Late Thorsten Wehe
(Posthumous Award for Leadership Excellence)



Ing. Frank Kofi Apeagyei
(Lifetime Leadership Award)

THE 2023 THORSTEN WEHE AWARDEE (51ST IFATSEA GENERAL ASSEMBLY, BUENOS AIRES, ARGENTINA)



Engr. Adeyinka Olumuyiwa Osunwusi, PhD.
(Exemplary Academic Research Award)

THE 2024 THORSTEN WEHE AWARDEES (52ND IFATSEA GENERAL ASSEMBLY, LAS VEGAS, USA)



Ing. Charles Ebo Kraikue
(Exemplary Leadership Award)



Abani Mohamed Lamine Moustapha
(Exceptional Leadership Award)



NAAE: TRANSFORMING THE GLOBAL AIR TRAFFIC SAFETY ELECTRONICS LANDSCAPES

From the perspective of membership strength and the scale of development of the air traffic safety electronics competence, training and certification landscapes to the timespan of its attainment of the prestigious membership of the International Federation of Air Traffic Safety Electronics Associations (IFATSEA), Nigeria's National Association of Air Traffic Engineers (NAAE) is unarguably at the forefront of the African air traffic safety electronics professional realm, garnering accolades for its strategic moves which are contributing tremendously to the transformation and modernization of the Nigerian CNS/ATM working environments. NAAE remains the brand African and other affiliates of IFATSEA are wont to make reference to when it comes to issues surrounding competence, standardization and the depth of certification and licensing in relation to air traffic safety electronics personnel (ATSEP). Little wonder, then, that NAAE has not only been expanding its global presence in the air traffic safety realms but has also been playing major roles in the context of the IFATSEA African regional office's governance framework, contributing novel ideas, landing significant deliverables and contributing to the maintenance of the vision of keeping Africa at the forefront of global air traffic safety electronics practices.

As a leading aviation industry's professional association, NAAE played a monumental role not only in the entrenchment of an ATSEP licensing/certification regulation in the Nigeria Civil Aviation Regulations (Nig. CARs) but also in the development and implementation of a robust ATSEP training, assessment and licensing regime, which has been in place for over 15 years. Thus, leveraging on the Nigerian long-standing experience in the realm of ATSEP licensing and certification, NAAE currently occupies a pride of place as the chair of the IFATSEA Region Africa ATSEP Licensing Template Task Force, which also includes affiliate associations of Burkina Faso, Ghana, Kenya and Uganda.

But NAAE's role within the framework of IFATSEA Africa Regional Office's governance framework is by no means limited to its involvement in the

ATSEP licensing team. NAAE is also playing major roles in the IFATSEA Regional Office's Africa Regional Director (ARD) Advisory Council and the Africa Region Affiliates Committee (ARAC) as well as the Regional Office's Research Council; handling the onerous responsibility of conducting research on the impact of radiation on ATSEP within the various CNS/ATM working environments.

Officially registered in Nigeria as a professional association under



Engr. Selzing Miri, NAAE President.

Nigeria's Companies and Allied Matters laws on 10 January, 1992, NAAE's engagement under the IFATSEA umbrella dates back to the 1980s, with a vision which has remained riveted on professionalism, competence, service delivery excellence, efficiency, strategic collaboration, and integrity.

BOLSTERING NAAE's INTER-ORGANIZATIONAL COOPERATION

Aside from the primary role of promoting the ATSEP profession as well as enhancing all the elements relating to excellent service delivery, competence, and operational efficiency, interactions, strategic partnerships and collaborations remain key elements of NAAE's organisational philosophy, which is directed towards the actualisation of the association's core vision. For this,

NAAE has adopted a strategy that is premised upon advocacy, mutual respect, safety information sharing, symbiotic partnerships and a collaborative assessment of emerging industry best practices across multiple competencies.

Aside from maintaining close contacts with African and other affiliates of IFATSEA, NAAE is actively deepening its relationship with sister associations in Nigeria, including the Nigerian Air Traffic Controllers Association (NATCA), the Aeronautical Information Management Association of Nigeria (AIMAN), and the National Airtraffic Communicators Association of Nigeria (NACAN). Notably, NAAE took this inter-organisational cooperation drive to a new level by engaging the Nigerian Air Traffic Controllers Association (NATCA) in a collaborative retreat, which took place in Port Harcourt, Nigeria from 14 to 16 April 2025.

"It's actually a collaborative meeting to strengthen our relationship that has not been too good in the past. So, the Port Harcourt retreat has actually put some hope in the drive to unite the two professional bodies," says Engr. Selzing Miri, NAAE National President. "The major take-home from that retreat is that these two professional bodies have agreed to work together in the interest of the aviation industry, focusing on collaboration in ensuring that the necessary enabling environments are given to members of the associations to discharge their duties creditably. So, the retreat came up with a communique that highlighted some very important points for the management's consideration. What I can say here invariably is that there is a brighter hope for greater collaboration between the two associations resulting in greater benefits to the aviation industry. What I can also say is that better days lie ahead for both the management of the Nigerian Airspace Management Agency (NAMA) and the two professional bodies as we now have a better working relationship among ourselves."

AHMED UMAR FAROUK:

RE-ENGINEERING THE TRANSFORMATION OF AIR NAVIGATION SERVICE PROVISION IN NIGERIA

The global air navigation service community, just like the global aviation ecosystem, is in a state of flux, characterized by dramatic changes in techno-operational, regulatory, and business models. With the increasing digitalization, automation and virtualization of the air navigation services/air traffic management (ANS/ATM) landscapes as well as growing concerns regarding cyber security threats and the imminence of a large-scale incursion of artificial intelligence (AI) technologies into the ANS/ATM terrains, the need is certainly growing for the deployment of a pragmatic model of airspace management that is premised upon clear safety and efficiency objectives, whilst leveraging innovative technologies and the human components of aviation operations. And that is exactly the approach that Engr. Ahmed Umar Farouk, the Managing Director/Chief Executive Officer of Nigerian Airspace Management Agency (NAMA), has been latching onto for the continuing re-engineering of the monumental transformation of NAMA.

Ever since taking up the reins of office as the CEO of Nigeria's air navigation service provider (ANSP), Engr. Farouk has covered a lot of grounds, recording impressive achievements across a wide variety of areas. Aside from introducing a management model that prioritizes collaborative efforts and emphasizes adequate training, re-training and motivation of the workforce, Farouk has been expending tremendous energy in infrastructure expansion and upgrade, leveraging the growing availability of innovative technologies to meet the growing demands of the global air navigation system.

Today, under Farouk, NAMA has attained self-sufficiency in terms of the periodic conduct of ground and flight checks on radio navigation aids as enshrined in Chapter 2 of ICAO Annex 10 and to the levels of accuracy specified in ICAO Doc 8071 (*Manual on Testing of Radio Navigation Aids*). To reach this milestone, Farouk acquired a wholly-owned Beechcraft 350i twin-engine turbo-prop aircraft equipped with the

state-of-the art Airfield Technology's AT940 flight calibration console, engaged a team of flight crew, aircraft maintenance engineers and flight inspection engineers, embarked on aggressive training and certification of the flight calibration team, and mapped out a vision for transforming the flight



Engr. Ahmed Umar Farouk, FNSE
Managing Director and CEO, NAMA

calibration team to a global force capable of providing ground and flight checks for ANSPs in Africa and beyond.

But this flight calibration milestone is not the only achievement NAMA has garnered under Farouk's pragmatic leadership. Notwithstanding the increasing utilities and prospects of GNSS (global navigation satellite system) based positioning, navigation, and timing (PNT) services, Farouk's pragmatic, incisive, and forward-thinking management posture is driving him to continue to invest heavily in ground-based navigation aids, rather than maintain a trajectory of phased de-commissioning of these conventional navigation aids, which could serve as robust backups in the event of GNSS unavailability and inaccuracy, which are becoming commonplace today particularly in conflict zones and the Middle East, the Baltic Sea, and eastern Mediterranean. Thus, NAMA's continuing investment in ground-based navigation aids has witnessed the installation of new state-of-the-art ILS/DME in Lagos and Minna airports as well as the Nigerian Air Force (NAF) Base in Kaduna. The installation of VOR/DME

systems has also been completed in Wachakal as well as the newly-upgraded Ibadan International Airport.

Likewise, there is also a frenzied upgrade of VHF (very high frequency) ATC radio communication systems across the entire swathe of the Kano FIR in a spirited effort to address observed ATC radio communication blind spots as well as provide improved coverage for the Agency's satellite telecommunication-enabled extended ATC radio communication network. Twelve airports have been earmarked for this ATC radio communication upgrade using the state-of-the-art Jotron radio systems, with installation already completed in two airports – Enugu and Minna.

Through Farouk's goal-savvy leadership style, the long-stalled AIS Automation Project (AAP) is fast nearing completion, with the VSAT infrastructure of the project fully in place in 26 out of a total of 27 airports. The AAP, the contract (Contract No. FMA/NAMA/4556) for which was perfected as early as 2006, is an ambitious domestic aeronautical satellite telecommunication network designed to provide upgraded voice services – integrating extended range VHF ATC radio communication or remote-controlled air-ground radio communication, air traffic services direct speech and telephony services – as well as data services, integrating monitoring and control data, AMHS data service, MET data, AIS/NOF/AIP, Mapping/Charting, and AIXM-based services.

In the realm of logistics, NAMA has purchased and distributed various operational vehicles to stations and airports to aid site inspections, as well as maintenance and repair works. From the inception of his management, Farouk has transitioned his management team well beyond the realms of operational logistics to addressing the welfare and competence of the NAMA workforce. This is because Farouk believes that safety and efficiency are a function of the level of motivation as well as the degree of competence of the workforce and he's really doing a very good job at that.

A VIEW FROM IFATSEA GLOBAL

AN INTERVIEW WITH IFATSEA PRESIDENT ING. FRANK KOFI APEAGYEI

Ing. Frank Kofi Apeagyei, President of the International Federation of Air Traffic Safety Electronics Associations (IFATSEA), believes that all that is needed to address the implications of the imminent large-scale adoption of AI technologies into aviation operations is a harmonized AI governance framework with human-in-the-loop oversight that should necessarily be led by ICAO, ANSPs, and CAAs.

As IFATSEA stages its 53rd General Assembly in picturesque Cape Town, South Africa from 9 to 14 November 2025, making another milestone ever since the inaugural General Assembly in Frankfurt, Germany in October 1972, Apeagyei maintains a vision that is rooted in safety, collaboration, leadership, and excellence.

Ing. Apeagyei recently spoke with *Air Traffic Safety Electronics International* Managing Editor, Adeyinka Olumuyiwa Osunwusi, and shared his insights regarding a wide array of issues bordering upon air traffic safety electronics practices.

At the 52nd IFATSEA General Assembly in Las Vegas, Nevada, USA, you were elected, by acclamation, the President of IFATSEA, the first African to assume the reins of office as IFATSEA President. How significant is this to you on one hand and Africa on the other hand?

Thank you for the opportunity to speak to your esteemed network. I am pleased to answer your questions. However, permit me to make a correction. In Las Vegas, my election was not just by acclamation. Rather, I went through the voting process and got elected. Our esteemed affiliates made me an overwhelming favorite and, therefore, did not contest with me. The IFATSEA constitution requires every candidate to go through an election even if he or she is the only candidate.

Assuming the reins of office as the first IFATSEA president from Africa was quite humbling, but at the same time very historic for IFATSEA and the African continent and I remain grateful for the confidence reposed in me. On a personal level, it represents the culmination of years of dedication to the course of Air Traffic Safety Electronics Personnel (ATSEP), IFATSEA and aviation safety as well as the recognition of the expertise and leadership that Africa brings to the global stage. It's a moment of pride, responsibility, and reflection, knowing that this role carries the hopes of many who have long aspired to see greater representation and advocacy of ATSEP profession at the highest levels of international aviation.

For Africa, this achievement is profoundly significant. It signals a shift toward inclusivity and acknowledgment of the continent's growing contributions to IFATSEA, aviation safety, innovation, and infrastructure. It also serves as an inspiration to countless Air Traffic Safety Electronics Personnel and aviation professionals across Africa, affirming that their voices matter and their leadership is valued. This presidency opens doors for deeper collaboration, capacity building, and the elevation of African perspectives in shaping global aviation standards.

That notwithstanding, it's not only about representation but the impact one makes. If you ask me again, I will tell you the same thing; I am committed to ensuring that this moment translates into meaningful progress for both IFATSEA and the African aviation community.

And what would be the major agendas of IFATSEA under your watch?



Ing. Frank Kofi Apeagyei, IFATSEA President

My views and commitment in respect of achieving a globally recognized standardized license for Air Traffic Safety Electronics Personnel remain the same. Under my humble leadership as president of the International Federation of Air Traffic Safety Electronics Associations (IFATSEA), the vision is bigger and requires several agendas to let it happen. As human as we are, and considering our own limitations, together with the team, we lean towards only key agendas aimed at strengthening global aviation safety and the role of Air Traffic Safety Electronics Personnel (ATSEP).

As IFATSEA president, my priorities fall under three broad areas: **ATSEP Licensing and ICAO Annex 1 Recognition; Global Collaboration and Network Expansion; and Empowerment and Inclusion.** With respect to ATSEP licensing and ICAO Annex 1 recognition, heaven knows how often we have tried under previous leadership to get this agenda off the table. It is a top priority for me. As our profession in the field of air traffic safety electronics is not yet officially recognized under ICAO Annex 1, which governs personnel licensing in international civil aviation, we need to keep the flame on this agenda burning until we achieve it. Isn't it ironic that while aircraft maintenance engineers are licensed under Annex 1, the ATSEP professionals who manage the ground-based CNS/ATM systems are excluded, despite their safety-critical role?

For the benefit of your varied readers, allow me to explain why licensing of Air Traffic Safety Electronics Personnel matters. The aviation industry is becoming complex with new and emerging technologies being deployed. In addition, the advent of Artificial Intelligence (AI) and Cyber Security threats have introduced new risks in our scope of work. Again, levels of training of ATSEP differ from region to region. There are no standardization and harmonization which represent the bedrock of safety assurance in the aviation ecosystem. Licensing, therefore, would ensure: one, uniform training and competency standards globally, reducing risks from system failures or cyber threats. It assures proof of competency, safety and standardization. Secondly, it would assure mobility and recognition. Licensed ATSEP could work across borders more easily,

supporting international operations and harmonization. Thirdly, some countries are already following ICAO guidance on ATSEP training in Doc 10057, so formal licensing would not impose any major new costs on the authorities.

From the perspective of global collaboration and network expansion, it's worth remarking that IFATSEA has a number of corporate relationships but with no formal engagements. The vision is to recognize and strengthen ties with international partners and expand our global footprint, including new affiliations everywhere there is an administration for civil aviation activities. To do this, we will ensure representation in international meetings, ICAO panels and establish some Memorandum of Understanding or cooperation as a start. It will be my vision for the collective voice of ATSEP to be loud on the international arena and for ATSEP to be recognized not in name but for their invaluable contributions.

From the standpoint of empowerment and inclusion, we recognize that IFATSEA has a pool of expertise. The vision is to bring together these seasoned professionals, former leaders, and industry experts to offer high-level guidance on policy, governance, and global trends. As a result, we have created three subcommittees - namely Council of Advisors, IFATSEA Research Subcommittee and Legal & Administration subcommittee - to allow more inclusivity and engagement that would benefit IFATSEA. These subcommittees obviously will bring to bear some vital expertise to enhance our credibility when engaging with ICAO and with global aviation stakeholders. Creating a Council of Advisors, which includes former leaders of IFATSEA, will not only assist us to preserve institutional memory but also ensure that our long-term vision will remain consistent across leadership transitions. It also provides an opportunity for mentorship and leadership development for emerging leaders within IFATSEA and member associations. Most importantly, we stand to benefit from free strategic advice.

The introduction of the Council of Advisors, the Administration and Legal Subcommittee and the Research Subcommittee within IFATSEA will serve strategic and operational purposes that are vital to our mission of advancing air traffic safety electronics. IFATSEA already celebrates diversity within the ATSEP community, including initiatives that highlight the contributions of women in aviation safety. I intend to give it my full support. These agendas reflect our collective commitment to shaping the future of air traffic safety electronics through innovation, unity, and professional excellence.

From your perspective as the President of IFATSEA, what are some of the dynamic changes you are seeing today regarding the ATSEP working environment?

The Air Traffic Safety Electronics Personnel (ATSEP) working environment is undergoing significant transformation in response to technological, regulatory, and workforce trends. With the digitalization of CNS/ATM systems, for example, ATSEP roles are shifting from hardware maintenance to software-centric systems, including



virtualized infrastructure and cloud-based air traffic management. There is also increased reliance on remote monitoring and diagnostics tools are changing how we maintain and troubleshoot systems.

Artificial Intelligence (AI) and automation integration are also transforming the ATSEP working environment. Whether we like it or not, AI is taking the centre stage now as it's slowly being introduced in our operations and maintenance. There are growing calls for ICAO to establish some guidance material on the ethical use of AI in civil aviation operations. In some administrations, AI is being used to automate routine tasks, optimize system performance, and predict failures. ATSEP roles are expanding into data analytics and machine learning interpretation, especially in high-traffic regions like Asia-Pacific. As professional ATSEP, we must remain relevant in today's technological evolution, modern trends and ways of managing maintenance and operations. Our only choice is to upskill in AI, data analytics, and cybersecurity.

We also need to embrace cybersecurity as a core responsibility. One important evolution in our operations is the threat of cyber activities. CNS/ATM systems are increasingly exposed to cyber threats and the immediate frontline defenders in aviation cybersecurity is the ATSEP. This is why IFATSEA submitted a working paper, WP/353, for consideration at the ICAO 42nd General Assembly meeting in Montreal, Canada. The paper basically asked for AI and Cyber Security to be considered in ATSEP training domains. CNS/ATM systems must be cyber resilient, which requires that ATSEP should be properly trained to manage the systems.

Another thing worth considering as changing the ATSEP environment is the growing emphasis on competency frameworks and standardized training aligned with ICAO Doc 10057. More countries are now modelling the ATSEP training on ICAO Doc 10057, which is quite encouraging. There is also a strong push for formal licensing under ICAO Annex 1. Kazakhstan's proposal to ICAO 42nd General Assembly meeting for ATSEP licensing under Annex 1 represented growing support across the globe. The outcome of this paper could redefine ATSEP career pathways and international mobility.

These changes are not just technical; they are regulatory and strategic as well. ATSEP professionals are becoming hybrid experts, blending engineering, cybersecurity, AI and digital systems management.

There are growing concerns today regarding the impact of GNSS anomalies on the safety, regularity and security of air navigation globally. What's IFATSEA's position on this unfolding new normal in air navigation?

I am aware of the increasing frequency and severity of the Global Navigation Satellite System (GNSS) anomalies, specifically with Satellite-Based Augmentation System (SBAS), and see them as a growing threat to the safety, regularity, and security of global air navigation. This is not a new normal. We will be doomed the very day we accept it as a new normal. It is a serious threat to safety and security, and its impact is not only in the aviation industry but is also in the rail and marine sectors, and if you stretch it further, in agriculture as well. IFATSEA has appeared on a few panels in Europe

and Asia Pacific to discuss this very subject. We acknowledge that GNSS jamming and spoofing incidents are becoming more common, especially near conflict zones and sensitive regions like the Mediterranean, Black Sea, Middle East, and Arctic.

During the IFATSEA 51st General Assembly held in Buenos Aires, Argentina, one of the panel discussions focused on GNSS disruptions and the solutions. These disruptions can lead to loss of navigation accuracy, false terrain alerts, and even flight diversions as witnessed in the first quarter of the year posing direct risks to air traffic safety. IFATSEA supports ICAO's Resolution 41-8C, which calls for ensuring the resilience of CNS/ATM systems against GNSS interference. We also think that there is urgent need for redundant systems, including ground-based navigation aids and robust augmentation systems, to mitigate reliance on satellite signals, which is quite vulnerable. In fact, these GNSS anomalies should be viewed as a new operational reality which requires systemic resilience, technical vigilance, and global coordination. As a federation, we would continue to encourage our ATSEP to enhance their competencies to manage such GNSS anomalies and to detect and report such occurrences in time.

And what, from your perspective, should the global aviation community be doing to mitigate the growing incidence of GNSS anomalies across the vast swathes of the global airspace?

For the many ATSEP whose duty is to monitor GNSS signals and report occurrences or anomalies, they will tell you the fatigue they have had to endure especially at the time that the jamming and spoofing were becoming quite excessive and too often. We need to recognise that these threats of interference on the GNSS signal is limited to specific locations or regions such as eastern Europe and some part of the Mediterranean.

As I have mentioned previously, IFATSEA's role is being championed through the ATSEP, a number of whom are actively engaged in mitigating the danger. It will interest you to know that the current IFATSEA treasurer, Mr. Nikola Cojic, recently co-authored a book on *"GPS Signal Interference: A threat to Civil Aviation Safety and Airspace Integrity"*. Apart from that, there are a few of IFATSEA members on different committees and panels in their regions working to find mitigations to this threat. So, by and large, we are making impact with our contributions. IFATSEA no longer sees this threat as a normal technical issue but a threat that demands our technical vigilance and cooperation, some regulatory improvements, and a global solidarity. Personally, I think the global aviation community is doing well in responding to these challenges. We see a well-coordinated multi-pronged strategy being adopted.

EUROCONTROL has issued multiple warnings about GNSS jamming and spoofing, especially in Eastern Europe and the Mediterranean. The airlines are being advised to rely more on inertial navigation and ground-based aids when flying near high-risk zones. Also, in the United States, the FAA is investing in multi-layered navigation systems, including DME/DME and VOR backups, to reduce sole reliance on GNSS. This approach is quite refreshing to note as it aligns with my advocacy that, no matter how reliable the satellite systems may be especially for use in civil aviation, it still does not warrant the de-

commissioning of the ground-based systems. Technology makes things and works easier, but we need to maintain and re-deploy the ground-based systems such as ILS, DME, and VOR as a fallback redundancy measure.

Again, as part of the mitigation measures, we need to tighten cybersecurity protocols for CNS/ATM systems. Currently, we have only four GNSS constellation receivers. It will be important to have more than just the GPS, GLONASS, Galileo and BeiDou. It is like a radar with only a rotating joint. When the rotating joint breaks, radar coverage and important data will be lost. So, nowadays, air navigation service providers have deployed multiple radars to ensure availability and continuity of service. The lesson here is that, having more constellations will reduce the dependency on any single system.

In addition, the aviation community may seek to strengthen the civil-military cooperation, share data and information to identify jamming/spoofing hotspots. Another key area that should be supported is research and technology for the development of anti-jamming and anti-spoofing mitigations. Another area to consider is how AI could be explored to provide real-time monitoring and reporting of GNSS anomalies.

Now, we need to continue the advocacy on GNSS vulnerabilities and contingency plans and procedures. Reporting GNSS occurrences is important, and we must encourage our ATSEP to be vigilant and cooperate with authorities in mitigating the threat.

There is much buzz today regarding the imminence of a large-scale incursion of AI technologies into virtually every aspect of aviation operation, particularly the ANS/ATM realms. How concerned are you about this and how should IFATSEA be responding to this?

There are those who think AI's rapid integration into ANS/ATM should be embraced as quickly as possible. Others also think that there is need to go slowly until further studies have been conducted to ensure its safe use. IFATSEA's working paper 353 presented at the ICAO 42nd General Assembly was precisely about AI integration into ATSEP training domain. Technology has evolved and so is the aviation environment. Hence, IFATSEA's call is meant to ensure that personnel are properly trained on the use of AI. There were other working papers from some ICAO Member States on the use of AI in the civil aviation.

Our industry relies heavily on the skills of the personnel to uphold the highest standard of safety. Therefore, some important engagements, workforce upskilling, and advocacy for safety, transparency, and human oversight will be key to successfully integrating AI into our environment.

Personally, I am quite concerned about the ongoing development regarding the use of AI. The reality is that AI is no longer futuristic. The earlier we get it in the ATSEP training domain, the better. I say so because, AI systems must also satisfy same performance criteria on safety, and integrity. Sometimes what may seem as AI may rather be machine learning which has its own challenges. As ATSEP, we are duty bound to ensure that once we are using AI, it should be used to serve the mission of safe, efficient, and human-centered air traffic systems. AI should not replace the human at the centre of operations but augment the human



decision making. The human – in-the-loop validation is very essential. At the moment, there is uncertainty regarding implementation of AI in ATM/CNS environment because ICAO appears not leaning towards that agenda in the present.

My other concern has to do with job security. It does appear that an over reliance on AI and automation could shift or eliminate job and roles traditionally held by ATSEP. On the part of IFATSEA, we need to continue the advocacy on AI especially its ethical use and to ensure that it rather gets integrated into ATSEP traditional roles, defining a new career path for ATSEP. IFATSEA must get involved in defining AI certification and frameworks. To conclude on this question, allow me to state that, while we anticipate ICAO's further directive on the ethical use of AI in the aviation environment, IFATSEA could start defining a harmonized training curriculum for use by ATSEP.

And what strategic and policy interventions should ICAO, ANSPs and CAAs be looking at in order to ensure a safe, secure and efficient AI-driven civil aviation ecosystem?

What we need is a harmonized AI governance framework with human -in-the - loop oversight and this should be led by ICAO, ANSPs, and CAAs. Civil Aviation Authorities should seek to invest in workforce upskilling to ensure safety, security, and efficiency in an AI-driven aviation ecosystem. ICAO should also lead the drafting of very bold policy interventions on AI. In doing so, ICAO should define standards for AI certification, ethics, explainability, and operational integration across ANS/ATM systems. ICAO must support member states in training aviation professionals to work with AI tools, especially ATSEP and regulators. It should also integrate AI into its global aviation safety and environmental performance goals. Again, the ANSPs can develop AI risk assessment protocols and evaluate them for failure modes and cybersecurity vulnerabilities before deployment. Another area to mention is collaboration. ICAO may engage with industry players and system manufacturers about the role of AI in today's aviation and how to trust the AI information.

Talking about your role as the President of the International Federation of Air Traffic Safety Electronics Associations (IFATSEA), how would you describe your key guiding principles as you continue to pilot the affairs of the Federation?

As President of IFATSEA, my guiding principles are rooted in safety, collaboration, leadership, and excellence. In an era of rapid transformation especially with technology reshaping aviation, these principles ensure that IFATSEA remains an authoritative voice and a strategic force on ATSEP competence. The 'S' in IFATSEA or ATSEP is safety, reminding us that every decision we make or take should be anchored on safety. I have an unwavering commitment towards ensuring that we are able to collaborate and partner organizations that strategically could align with our agenda. ATSEP professionals are the unsung heroes of aviation safety. My team's effort is to elevate their profile, secure their professional recognition, and protect their roles amid technological evolution. I believe in equipping ATSEP with the skills and knowledge to thrive in a digital, AI-enhanced environment. It is this basis that the Executive Board championed a working paper on AI training into ATSEP training domain. We also supported the Ghana paper at ICAO 42nd General Assembly which called for the retention of ATSEP in PANS training manual Document 9868 as well as the opportunity to define and associate ATSEP job in ICAO Annex10. IFATSEA represents

a diverse community across continents. I strive to ensure that all member associations, regardless of size or resources have equal voice and access to opportunities as well. The support of the Executive Board has been great so far and I remain thankful to my God and the Board for the support.

Are you still keen on pushing on with the struggle for the inclusion of ATSEP in ICAO Annex 1 – Personnel Licensing?

Absolutely! My commitment to seeing through this has never waned. One of the hurdles in the way of ATSEP is ATSEP licensing. The inclusion of ATSEPs in ICAO Annex 1 – Personnel Licensing remains a strategic imperative, not just for recognition, but for global aviation safety, accountability, and harmonization. ATSEPs are responsible for the integrity of CNS/ATM systems. Our work directly impacts aircraft separation, navigation, and surveillance.

Licensing ensures that only qualified personnel handle these systems. Without Annex 1 inclusion, ATSEP qualifications vary widely across states. This undermines interoperability and weakens the global safety net. Apart from that, there is no proof of assurance of competence. Licensing elevates ATSEPs from "technical support" to regulated aviation professionals, with clear responsibilities, rights, and protections. In this technological era where automation sometimes blurs lines of responsibility for the ATSEP, licensing will provide a framework for ethical and operational accountability. For me, I continue the advocacy and lobby ICAO and other national CAAs to recognize ATSEPs as licensed aviation personnel. This is why IFATSEA strongly supported Kazakhstan working paper 317 at the ICAO 42nd General Assembly. ATSEP licensing and recognition is an advocacy for fairness, safety, and the future of aviation. And truly yes, I'm still pushing with the greatest conviction and clarity that it will happen.

How would you describe IFATSEA's partnership with other sister international professional organisations and other industry stakeholders today?

IFATSEA's partnerships today are strategic and collaborative. They reflect its evolving role as a global thought leader in aviation safety electronics. These relationships are not just symbolic but are also essential to the attainment of our goals. IFATSEA works closely with ICAO, IFATCA, IFALMA, ITF, IFISA, and CANSO to align on critical issues like personnel licensing, cybersecurity, and the safe integration of AI and automation.

These partnerships amplify IFATSEA's voice in global forums, ensuring ATSEP concerns are considered in the broader aviation safety strategies. Through collaboration with EUROCONTROL, EASA, and other regional aviation bodies, IFATSEA contributes to harmonized training standards, competency frameworks, and digital transformation roadmaps including SESAR Joint Undertaking in Europe. These efforts help ensure ATSEP professionals are equipped to manage emerging technologies like remote towers, SWIM, and AI-enhanced ATM systems. IFATSEA has been on corporate partnership drive renewing our partnership with system manufacturers, software developers, and integrators. We are doing all that to strengthen the

Federation and create a platform for our ATSEP to discuss their concerns on CNS system deployment. We are not done yet as there remain a vast number of industry stakeholders and manufacturers to contact.

In short, IFATSEA's partnership is built on trust, shared purpose, and a commitment to safe, efficient, and future-ready aviation systems. They remain the backbone of our global influence and the engine of our strategic impact.

Overall, how would you describe the future of ATSEP particularly in the context of the dynamic techno-operational changes sweeping across the ANS/ATM working environments?

If we train and acquire new skillsets or improve on our proficiency in the ongoing technological evolution, certainly, we will be strategic to the future. It will be very demanding in technical expertise, cybersecurity acumen, and how fast one is able to adapt to AI evolution systems and the evolving ATM/CNS infrastructure. At the moment, there is a wind of rapid transformation blowing across many air navigation services and air traffic management sectors. This wind is driven by digitalization, automation, and service-oriented architectures and is defining the role of Air Traffic Safety Electronics Personnel (ATSEP). If you consider the push toward a *Digital European Sky* under the Single European Sky (SES) framework which introduces open, competitive service models, it does provide some affirmations that ATSEP will be central to managing these architectures, ensuring system-wide situational awareness and technical integrity across increasingly distributed and virtualized infrastructures. Artificial Intelligence is revolutionizing traditional ATSEP tasks. AI-driven tools enable predictive maintenance, automated monitoring, and data-driven diagnostics, reducing downtime and enhancing reliability. In future dispensation, ATSEP must evolve from reactive technicians to proactive system analysts. Due to the growing reliance on cloud services, datacenters, and third-party IT providers, cybersecurity has become a core competency. ATSEP are expected to distinguish between technical failures and cyber incidents, coordinate responses, and ensure continuity of the CNS/ATM even under cyber threat situations.

ATSEP will need to understand and supervise AI behaviors, ensuring safety-critical functions remain operational and under their control. All of this will mean that we must evolve skillsets and that requires effective and harmonized training. The traditional specializations in expertise existing in our current environment will have to give way to multi cross-disciplinary expertise. In the immediate future, the ATSEP will no longer be referred to as the 'behind the scenes technician/engineer'. Our role will transition to a frontline strategic function in safeguarding the future of air traffic services. Their ability to adapt, innovate, and collaborate will be pivotal in navigating the techno-operational hurdles ahead. Let me end with these words: "I remain grateful to you Prof. Adeyinka for the excellent job and the publicity your works is giving to IFATSEA". God bless you.



Advancing ATSEP Competencies: NCAT's Commitment to International Standards and Innovation

The Nigerian College of Aviation Technology (NCAT), an ICAO TPP Platinum-accredited institution and recognized as a Training Centre of Excellence (TCE), stands proudly as a leader in training Air Traffic Safety Electronics Personnel (ATSEP).

With a firm commitment to aligning our training with ICAO's global standards, NCAT ensures that ATSEP professionals are well-prepared for the challenges they face in installing, operating, and maintaining Communication, Navigation, and Surveillance (CNS) systems, as well as Automation and System Monitoring technologies.

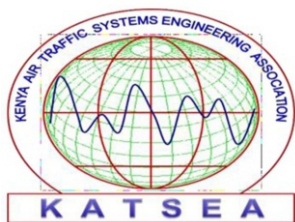
As ATSEPs form the backbone of air traffic safety, our training equips them with the competencies and knowledge necessary to support safe and efficient air traffic management (ATM). Our globally recognized methodology focuses on competency-based learning, providing practical, hands-on experience to ensure ATSEPs can perform in high-stakes environments with confidence.

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KATSEA: A VERITABLE PLATFORM TO BOOST ATSEP PERFORMANCE

Kenya Air Traffic Systems Engineering Association (KATSEA) – a proud African affiliate of the International Federation of Air Traffic Safety Electronics Associations (IFATSEA) – is steadily finding its niche in the global air traffic safety electronics community and building an enviable reputation amongst IFATSEA's African affiliates and African air traffic safety electronics personnel (ATSEP). Such is the significance of KATSEA's footprint on the global air traffic safety electronics landscape that the Association is presently working assiduously to host the 54th General Assembly of IFATSEA in Nairobi in November of 2026 along with Kenya's critical civil aviation stakeholders.

Although KATSEA is presently grappling with a handful of concerns – including the need for the adaptation of the ATSEP concept and CBTA training, change of title from ATO to ATSEP, and concerns surrounding the equitable placement of officers after training as well as the institutionalization of fair selection criteria across engineering personnel cadres – there is a strong determination on the part of the current Wilberforce Lalang-led administration to build upon the achievements of previous administration in order to ensure that the ATSEP working environments in Kenya are

aligned with international best practices in terms of competence, training and assessment, licensing/certification, infrastructural adequacy, aviation

and ICAO Doc 9868 (*Procedures for Air Navigation Services – Training*).

Today, KATSEA can lay claim to a number of achievements; a consequence of dodged determination, strategic thinking, persuasive advocacy, and symbiotic partnerships. A huge number of KATSEA members can walk proudly today as ICAO-trained and certified ATSEP instructors, inspectors, course developers, and assessors. All ATSEP training programmes at the Kenya Civil Aviation Authority-run East African School of Aviation (EASA) have also been operationalized in line with ICAO Doc 10057. The icing on the cake, of course, is the growing prospects of a licensing and certification regime covering the communication, navigation, surveillance and auxiliary systems spectrum. The Kenya Civil Aviation Authority (KCAA) has not only facilitated the operations of a Licensing and Rating Board, but has also approved an ATSEP licensing and certification policy. As it is now, appropriate ATSEP regulations have been enshrined in the KCARs (Kenya Civil Aviation Regulations) 2024, awaiting final legislative deliberation and approval in the Kenyan Parliament.



safety practices, and conformance with international guidance materials including ICAO Doc 10057 (*Manual on Air Traffic Safety Electronics Personnel Competency-based Training and Assessment*)



WILBERFORCE K.T. LALANG:

ADVANCING THE AIR TRAFFIC SAFETY ELECTRONICS PROFESSION IN KENYA



Wilberforce and the KATSEA Executive Committee are also working assiduously with KCAA on the preparation for the 54th IFATSEA General Assembly, which will be held in November 2026 in Nairobi, Kenya - the land of the *Big Five* and the great *Wild Beast Migration*, marking the '*Seven New Wonders of the World*'.

Wilberforce K.T. Lalang is the President and CEO of the Kenya Air Traffic Systems Engineering Association (KATSEA). A seasoned professional in the aviation industry with over three decades of experience, Wilberforce holds a Master's degree in Computer-Based Information Systems (CBIS) from Sunderland University in the United Kingdom, a Bachelor of Science (BSc) in Electrical and Electronic Engineering, an HND (Higher National Diploma) in Electrical and Electronic Engineering and Avionics certification. He is also an ICAO certified CNS/ANS Inspector, an ICAO Aerodrome Engineer, an ATM system security champion and a member of the ATM Infrastructure Cyber-Security Committee.

As a senior ATSEP officer, Mr. Lalang demonstrates and continues to demonstrate exceptional expertise in the installation, maintenance and system analysis of Air Traffic Management (ATM), Aeronautical Information Management (AIM), Navigational Aids and VHF radio systems in the context of the Kenyan airspace. His involvement in the air traffic safety systems realm includes the installation of 3D Tower, and approach and area control simulators for air traffic controllers (ATCOs). He has also been involved in the installation of AIM cartography laboratory system at the East African School of Aviation as well as the installation and maintenance of the EUROCAT-C currently the TOP Sky ATC and CRONOS system for AIM at the JKIA airport, Nairobi and the Mombasa International Airport.

Mr. Lalang's impressive portfolio includes extensive training both within Kenya and abroad in the aviation industry. This has projected him to his current position as a senior ATSEP and an ICAO Certified CNS/ANS Inspector. His dedication to the safety and security of aviation systems has further been underscored by his certification as an ICAO Universal Safety Oversight Audit Programme (USOAP) expert and his acquisition of an ICAO Aerodrome Engineering certificate from South Korea.

Wilberforce Lalang is also involved in the academia and has been imparting knowledge since 2012, first as a lecturer at the Jomo Kenyatta University of Agriculture and Technology (JKUAT) and then at the Technical University of Mombasa (TUM). He is currently at the Kenya Civil Aviation Authority (KCAA) Central Workshop, appointed as Air Traffic Management system security champion and a member of the ATM Infrastructure Security Committee. He is also engaged in the Cyber Security realm, handling the sensitization of staff on prevalent cyber risks and threats within the civil aviation working environment.

As the current president of KATSEA and a long-time member of the association, Wilberforce has occupied various positions in the Executive Committee since 2007. He was once the Deputy President and was among those who were championing the introduction of ATSEP certification and rating in the Kenya Civil Aviation Authority since 2008 as a member of an Executive Committee, which later transitioned to the setting up of a team to draw up a benchmark with other countries that have ATSEP certification programmes in place. Subsequent committees have improved on the initial document produced, the implementation framework of which will be rolled out to the KATSEA members in a few months.

As the President of KATSEA, Mr. Lalang is also working towards having a competent workforce which is adequately motivated and focused on the achievement of KCAA's core mandate of providing the kind of air navigation services essential for ensuring safe and efficient air traffic in Kenya. Wilberforce and the KATSEA Executive Committee are also working assiduously with KCAA on the preparation for the 54th IFATSEA General Assembly, which will be held in November 2026 in Nairobi, Kenya - the land of the *Big Five* and the great *Wild Beast Migration*, marking the '*Seven New Wonders of the World*'.

Thomas Chauque is the Executive President of the South African Air Traffic Safety Electronics Personnel Association (SAATSEPA), an affiliate of the International Federation of Air Traffic Safety Electronics Associations (IFATSEA). He earned his National Diploma in Electronic Engineering from the Central University of Technology and completed his experiential training with ATNS as a Trainee Technician between 2016 and 2017. He, thereafter, joined the South African National Space Agency in November 2017 as an Instrumentation Technician. Thomas earned a B. Tech in Telecommunication Engineering from the University of South Africa in 2022 and is currently pursuing a Post-Graduate Diploma in Future Studies (Managing New Technology) at the University of Stellenbosch. Thomas' journey with South Africa's ATNS began on October 1, 2022 as an Engineering Instructor. Hailing from Embalenhle in Mpumalanga, Thomas is a passionate sports-man, holding a Karate Referee certification and a black belt in karate.

In this interview with *Air Traffic Safety Electronics International* Managing Editor, Adeyinka Olumuyiwa Osunwusi, Thomas shared his insights regarding a wide array of issues surrounding aviation operations and the air traffic safety electronics profession in South Africa.

For starters, could you paint a clear picture of the state of the air traffic safety electronics profession in South Africa Today?

In South Africa, the ATSEP profession stands at a pivotal turning point. While challenges remain, particularly around infrastructure maintenance and the integration of emerging technologies, the industry continues to benefit from strong training programs, regional partnerships, and a growing electronics sector. With sustained investment in modern infrastructure, ongoing skills development, and strengthened international collaborations, the ATSEP community is well-positioned to shape the future of air traffic management and play a critical role in ensuring the safety, efficiency, and resilience of South Africa's aviation system.

What do you see as the main challenges confronting South African ATSEP today?

Specialisation within the ATSEP profession remains a persistent challenge, with limited pathways for professionals to focus on advanced or niche technical areas. On-the-job training is often unstructured, leaving gaps in the transfer of practical skills and standardised learning. System thinking, which is critical for managing the complexity of modern CNS/ATM environments, is still underdeveloped and in some cases perceived as a foreign concept. Documentation practices also present difficulties, with inconsistencies in quality, availability, and standardisation. Furthermore, maintenance approaches vary significantly across stations—some assign entire sites to ATSEPs, while others allocate weekly

THOMAS CHAUQUE: STRENGTHENING THE SOUTH AFRICAN AIR TRAFFIC SAFETY ELECTRONICS LANDSCAPE



tasks—resulting in uneven practices and inefficiencies in system reliability and accountability.

And how, from your perspective, should South Africa's ATNS and SAATSEPA be responding to these challenges?

A coordinated approach between ATNS and SAATSEPA is essential to strengthening the ATSEP profession and ensuring the safety, reliability, and efficiency of South Africa's air traffic management system. On the infrastructure side, ATNS must prioritise the modernisation of CNS/ATM systems, enforce strict maintenance schedules, and explore public-private partnerships to accelerate technology upgrades, while SAATSEPA provides technical input on maintenance priorities, participates in audits, and promotes a proactive culture of equipment monitoring.

Regulatory alignment is equally critical. ATNS should strengthen their collaboration with SACAA to ensure ATSEP roles are clearly defined and compliant with international standards, while SAATSEPA actively lobbies for licensing, certification, and professional recognition aligned with ICAO guidelines. Career development also plays a central role. ATNS can create structured career paths that offer advanced technical training, leadership opportunities, and cross-functional exposure, while SAATSEPA supports mentorship, professional advocacy, and recognition of ATSEP contributions. To future-proof the workforce, ATNS must implement continuous learning programs focused on emerging technologies such as remote towers and AI-based systems, complemented by simulation and hands-on training.

In turn, SAATSEPA should help shape curricula, address training gaps, and support competency development. Finally, both organisations must commit to cultural reform - ATNS by fostering transparency, accountability, and meritocracy, and SAATSEPA by championing ethical standards, fairness, and professional integrity. Together, these combined efforts create a resilient and forward-looking framework that empowers South African ATSEPs to thrive in an evolving aviation landscape.

From an African perspective, how would you describe the African aviation industry today in terms of its technological, operational, regulatory, and infrastructural dynamics?

The African aviation industry today reflects a mix of progress and persistent challenges across technological, operational, regulatory, and infrastructural dynamics. On the technological front, many African ANSPs and airports still rely on legacy CNS/ATM systems, with limited deployment of advanced tools such as remote towers, ADS-B, or AI-driven traffic management. Encouragingly, countries like South Africa, Kenya, Morocco, and Nigeria are pioneering initiatives in digital towers, automated flight data processing, and integrated radar networks, while the broader adoption of GNSS and predictive analytics signals untapped opportunities for greater efficiency, safety, and harmonization.

Operationally, steady traffic growth has outpaced capacity in several regions, with bottlenecks arising from limited infrastructure, staffing shortages, and uneven safety management practices. While some states maintain strong ICAO compliance,

others struggle with training gaps and maintenance backlogs, compounded by the uneven distribution of skilled ATSEPs across the continent. Regulatory frameworks remain fragmented, as certain countries have well-established CAAs, while others lag in enforcing ICAO standards. Regional efforts—through AFCAC, ICAO's AFI initiatives, and the Single African Air Transport Market (SAATM)—are working toward harmonised oversight, licensing, and safety standards, though many nations continue to face challenges in audit readiness, certification, and enforcement due to resource constraints.

Infrastructure presents another area of contrast: while major hubs such as Johannesburg, Nairobi, and Addis Ababa boast modern facilities, smaller regional airports often lack basic navigation aids, surveillance systems, and maintenance capacity.

And what's the position of South Africa today as far as the certification and

expertise is increasingly critical to support the integration of advanced digital and automated systems in air traffic management.

South Africa is hosting the 53rd General Assembly of IFATSEA in Cape Town later this year. How significant is this to you and SAATSEPA?

Hosting the 53rd IFATSEA General Assembly in Cape Town is a milestone moment for ATNS and SAATSEPA. It signifies international recognition of the role our organization and the ATSEP association play in the ATSEP profession and positions South Africa as a leader on the African continent in advancing air traffic safety electronics.

For SAATSEPA, it is both an honour and a responsibility: an honour because it showcases the professionalism and expertise of our ATSEPs on a global stage, and a responsibility because it gives us the platform to influence international discussions on key issues such as

improve information sharing, and cultivate a cybersecurity culture.

There are also issues surrounding threats posed by GNSS anomalies. How real are these threats as far as the South African airspace is concerned?

Indeed, there is a genuine and growing threat to South African airspace from Global Navigation Satellite System (GNSS) anomalies, such as jamming and spoofing. The increase of GNSS interference occurrences worldwide highlights the possible threats to aviation safety, even though specific incidents in South Africa are not frequently reported. Even though there haven't been any GNSS interference occurrences in South Africa that have been made public, the rise in these instances worldwide and the region's vulnerabilities make preventative actions crucial. Important actions to protect aircraft operations in South African airspace include putting in place reliable monitoring systems, strengthening regulatory frameworks, and preserving alternate navigation capabilities.

Overall, and talking about your role as the SAATSEPA Executive President, what are your visions for SAATSEPA and the South African air traffic safety electronics landscape going forward?

With every ATSEP in South Africa certified, equipped, and prepared to safely and effectively traverse the rapidly changing digital skies, we envision SAATSEPA as a beacon of excellence. We want to establish South Africa as a regional leader in air traffic safety electronics by promoting industry-wide standards, adopting developing technology, and bolstering professional development. This will guarantee that our skies are not only safe now but also ready for the future.

In my capacity as Executive President, I hope to establish our organization as a catalyst for resilience, creativity, and professional excellence in the technical aviation industry. While addressing the particular difficulties of our national and regional environment, we will promote the official recognition, licensing, and certification of our members, guaranteeing conformity with international standards.

We will create a workforce that is knowledgeable and prepared for the future by making investments in ongoing training, encouraging cooperation with industry partners, and embracing digital transformation, which includes automation, virtualization, and cyber resilience. We will simultaneously foster an environment of honesty, diversity, and mentoring that supports both seasoned professionals and the upcoming generation. Ultimately, our goal is to ensure that our technical community is not only prepared for the demands of today but also positioned as leaders in shaping the safe, efficient, and technologically advanced aviation systems of tomorrow. ■

WITH EVERY ATSEP IN SOUTH AFRICA CERTIFIED, EQUIPPED, AND PREPARED TO SAFELY AND EFFECTIVELY TRAVERSE THE RAPIDLY CHANGING DIGITAL SKIES, WE ENVISION SAATSEPA AS A BEACON OF EXCELLENCE.

licensing of South African ATSEP is concerned?

Our position is that ATSEPs should ultimately be licensed to ensure professional recognition, accountability, and alignment with international best practices. However, as a first step, we will begin by focusing on ATSU licensing under the framework of an Electronic Safety Organisation. It is important to note that individual ATSEP licensing is not currently mandated by ICAO, as ATSEP licensing has not yet been incorporated into Annex 1 as a compulsory requirement.

Where does South Africa stand today regarding the development of the competences and the honing of the skills of South African ATSEP, particularly in relation to the growing digitalization, automation, and virtualization of the CNS/ATM landscape?

Each time a new system is introduced, only a limited number of ATSEPs are sent to the manufacturer for training, after which they return to participate in installations and gain further hands-on exposure. In some cases, specialized training is arranged on an ad hoc basis for selected ATSEPs at the manufacturer's facilities, which, while valuable, does not always ensure widespread skills transfer across the workforce. With technology advancing rapidly under the Fourth Industrial Revolution (4IR), it has been proposed that future intakes at the ATNS Aviation Training Academy also include Electrical Engineering students specializing in computer systems, as their

certification, training, cybersecurity, and the future of CNS/ATM systems. This Assembly also provides an invaluable opportunity to strengthen collaboration with our African partners, build strategic networks, and share our local experiences while learning from global best practices. Ultimately, hosting this Assembly is about affirming South Africa's commitment to safety, innovation, and excellence in aviation, and ensuring that our ATSEPs are prepared for the technological and operational challenges of the future.

The theme of the 53rd IFATSEA General Assembly is centred on addressing cyber threats against CNS/ATM systems. How real are these threats?

A major worry for the global aviation sector is highlighted by the 53rd IFATSEA General Assembly's subject, which focuses on mitigating cyber threats against Communication, Navigation, and Surveillance/Air Traffic Management (CNS/ATM) systems. In addition to being genuine, these threats have materialised in a number of situations around the world, including in South Africa.

The aviation sector in South Africa is becoming increasingly concerned about cyber threats to CNS/ATM systems. Even while cybersecurity frameworks and tactics have advanced significantly, the dynamic nature of cyber threats demands constant adaptation and cooperation from all parties involved. To protect the integrity and safety of South Africa's aviation infrastructure, it is imperative to strengthen incident response capabilities,

ANGELA KABALI: Navigating the Unique Demands of the Aviation Industry



Angela Kabali is the President of the Tanzanian Air Traffic Safety Electronics Association (TATSEA), taking over the reins of office from Francis Charle. A Principal Air Navigation Engineer at the Tanzania Civil Aviation Authority (TCAA) with 14 years of experience in the aviation field, Angela stands out as a beacon of hope for women striving to make impacts in a largely patriarchal industry. Given her wealth of experience in the CNS (communication, navigation and surveillance) field and her passion for knowledge sharing, she was reassigned at the Tanzania Civil Aviation Authority and currently works as Chief Instructor for CNS, building competency in the areas of instructional techniques. She is also an ICAO certified aviation training instructor. Aside from this and given Angela's hard work and flexibility, she was recently selected as an ICAO cybersecurity panel member representing Tanzania. From the academic perspective, Angela holds a Bachelor degree in Telecommunications Engineering, a Master's degree in Engineering Management (specialising in Projects management) and Masters in Education Management and Administration.

In this interview with *Air Traffic Safety Electronics International* Managing Editor, Adeyinka Olumuyiwa Osunwusi,

Angela shared her insights regarding the Tanzanian aviation sector and the role of women in the male-dominated aviation ecosystem.

Recently, you took up the reins of office as the President of the Tanzania Air Traffic Safety Electronics Association (TATSEA). How significant is this to you, especially in the context of being a female ATSEP in a largely patriarchal aviation sector?

I feel really honoured to be the President of TATSEA. It is a challenging assignment in this growing industry. TATSEA had a woman president before. Whether it is male or female, the spirit is of the engineers which goes into the institution. In that way, I am really honoured.

And how would you describe your journey so far in a largely male-dominated industry?

A woman has to work twice harder than a man. You need to earn the trust by being competent in whatever you do. I do my job with high efficiency and no complaints. And, I have always been open to new challenges and domains which has opened many doors for me to date.

How would you describe today the status of the air traffic safety electronics profession in Tanzania?

The ATSEP profession in Tanzania is striving to seek its recognition. The profession is highly valued in the industry because of the competency shown towards safety of the airspace but people really do not appreciate the importance of the field. Engineers work tirelessly in the background to ensure safety is achieved.

And where does Tanzania stand today regarding the training, certification, and licensing of Tanzanian ATSEP?

Trainings provided to ATSEP has changed compared to how it was 10 years back. Trainings are focused on enabling ATSEP to solve up to level 3 of maintenance. On certification and licensing, we are yet to finalise the document. However, from 2020, the training of all ATSEP recruits follows ICAO Doc 10057 ATSEP training guidelines. The main challenge is the modality of licensing because our engineers work in pool and specialization is on equipment and not domain.

As the TATSEA President, what are your visions and agenda for the promotion of air traffic safety electronics practices in Tanzania?

As TATSEA president, my vision and goal are to make good use of the expertise of my team and learn from international standards, operational procedures and industry best practices in order to advise our government



Francis Charle (left-hand side) handing the reins of the office of TATSEA President over to Angela Kabali.

gender equality so growth is measured in competency.

And would you say that Tanzanian female ATSEP are getting a fair deal as far as engagement rates and career progression are concerned?

Yes, women ATSEP are getting fair opportunities. Tanzania embraces gender equality and inclusivity.

What do you see as the most significant challenges confronting female ATSEPs in Tanzania and across Africa?

Aviation has its unique demands in terms of service delivery. There are issues of shift-

female ATSEP towards honing management and leadership skills. When women climb the ladder, representation will be increasing. The same goes for professional visibility.

And how involved are you with the IFATSEA Global's Women Wing?

I am a new entrant in this domain but I am sure Tanzania will assume a greater role in the IFATSEA global women wing.

What are your thoughts regarding the future of women in the context of the air traffic safety electronics profession in Tanzania and beyond?

The future is bright in terms of the profession. Our voices are being heard and respected in the organization. We have to work hard to ensure that the number of female ATSEP increases. Efforts are being made to encourage girls to pursue STEM subjects all over the world; so this will motivate employers to consider female candidates during selection.

Overall, what do you see as the major drivers of the future of the CNS/ATM profession in Tanzania in particular and Africa in general?

The drivers of the future CNS/ATM are a combination of things. CNS/ATM safety demands require modernization of technology to match the new players like AI and cyber threats. Talking from the perspective of training, capacity building and skills development through competency-based trainings for ATSEP is the major driver, followed by regional cooperation and integration. When these two are enhanced, we will witness the profession soaring beyond the boundaries of Africa. ■

"A WOMAN HAS TO WORK TWICE HARDER THAN A MAN. YOU NEED TO EARN THE TRUST BY BEING COMPETENT IN WHATEVER YOU DO. I DO MY JOB WITH HIGH EFFICIENCY AND NO COMPLAINTS. AND, I HAVE ALWAYS BEEN OPEN TO NEW CHALLENGES AND DOMAINS WHICH HAS OPENED MANY DOORS FOR ME TO DATE." – Angela Kabali

to invest on advanced CNS/ATM technologies. My agenda is to push forward the visibility of Tanzanian ATSEPs in the industry by showcasing their achievements in various projects as well as ensure proper implementation of ATSEP licensing and certification.

Talking from the perspectives of gender equality and inclusiveness, how would you describe the place of women today as far as the Tanzanian aviation landscape is concerned?

Tanzania has made a big step. Out of 5 directors, 2 are women. Our CNS boss is also a woman. And this is seen in other aviation sectors in the country. Tanzania embraces

works and travelling to remote sites as well as working in harsh environments and with complex systems coupled with rapid advancement of aviation technology. One can go on and on. The female ATSEP has to balance family and career. The busy schedules and work demands have to be balanced. The women in engineering and those who have grown in the ladder are really excellent examples.

Is TATSEA under your watch doing anything to broaden the horizons of female ATSEP in Tanzania as well as encourage more women to embrace the CNS/ATM profession?

TATSEA is advocating capacity building for

Calendar

EVENTS

OCTOBER 2025

14-16/10/2025	IFATCA European Regional Meeting (ERM) 2025. https://erm2025.com	Bologna, Italy.
14-16/10/2025	World Safety and Operations Conference (WSOC). https://www.iata.org/en/events/all/wsoc/	Xiamen, China.
20-22/10/2025	IFATCA Asia Pacific Regional Meeting (APRM) 2025. Venue: Banyan Tree Hotel, Macau. https://aprm2025.org/preview/	Macau.
20-23/10/2025	International Telemetry Conference (ITC) 2025. Venue: Horseshoe, Las Vegas. https://telemetry.org	Las Vegas, Nevada, USA.
21-22/10/2025	World Sustainability Symposium (WSS). Venue: Kerry Hotel, Hong Kong. www.iata.org/en/events/all/world-sustainability-symposium/	Hong Kong, China.
22-23/10/2025	CILT (Chartered Institute of Logistics and Transport) Nigeria 2025 National Conference and Annual General Meeting (AGM). https://ciltinternational.org/events/cilt-nigeria-2025-national-conference-agm/	Lagos, Nigeria.
25-28/10/2025	ACI-NA and ACI World Annual General Assembly, Conference and Exhibition 2025. Hosted by Toronto Pearson Airport and Ports Toronto. https://aci.aero/events/aci-na-aci-world-annual-general-assembly-conference-and-exhibition-2025/	Toronto, Canada.

NOVEMBER 2025

03-07/11/2025	1 st Meeting of the Africa-Indian Ocean Aviation System Planning & Implementation Group (AASPG/1) www.icao.int/events/first-meeting-africa-indian-ocean-aviation-system-planning-and-implementation-group-aaspg1	Libreville, Gabon.
04-06/11/2025	78 th Annual International Aviation Safety Summit (IASS25). https://flightsafety.org/events-at-flight-safety-foundation/	Lisbon, Portugal.
04-06/11/2025	20 th Symposium on the ICAO Traveller Identification Programme (TRIP-Symposium-2025). Theme: "Identify Beyond Borders: Building the Next Generation of Seamless Travel". Venue: ICAO Headquarters, 999 Robert-Bourassa Boulevard, Montreal, Canada. www.icao.int/events/twentieth-symposium-icao-traveller-identification-programme-trip-symposium-2025	Montreal, Canada.
09-14/11/2025	53 rd IFATSEA General Assembly 2025. Hosted by: ATNS and SAATSEPA. Venue: Cape Town Marriot Hotel Crystal Towers, Century City, Cape Town. https://ifatseaga53.org	Cape Town, South Africa.
12-13/11/2025	International Conference on Managing the Impact of Weather on Air and Space Launch Operations. Venue: EUROCONTROL Headquarters, Brussels. https://academieairespace.com/meteopsconference/preliminary-programme/	Brussels, Belgium.
12-13/11/2025	EASA Annual Safety Conference 2025. Theme: "Aviate-Navigate-Communicate-Safety Today, Safety Cross-Domain, Safety Tomorrow". Venue: Copenhagen Marriott Hotel, 1560 Copenhagen. www.easa.europa.eu/en/newsroom-and-events/events/easa-annual-safety-conference-2025	Copenhagen, Denmark.
17-28/11/2025	ITU World Telecommunication Development Conference 2025 (WTDC-25). Hosted by: The Government of Azerbaijan. https://www.itu.int/itu-d/meetings/wtdc25/	Baku, Azerbaijan.
18-19/11/2025	Wings of Change Europe (WOCE). www.iata.org/en/events/all/wings-of-change-europe/	Brussels, Belgium.
25-27/11/2025	Airports Innovate 2025. https://aci.aero/events/airports-innovate-2025/	Busan, Republic of Korea.

DECEMBER 2025

09-11/12/2025	Airspace Asia Pacific 2025. https://airspaceasiapacific.com	Hong Kong, China.
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FEBRUARY 2026

03-08/02/2026	Singapore Airshow. Venue: Changi Exhibition Centre, Singapore. https://www.singaporeairshow.com/trade	Singapore.
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MARCH/APRIL 2026

29/03-01/04/2026	CANSO Global Safety Conference 2026. Host: Saudi Air Navigation Services (SANS). Venue: Jeddah Hilton, Jeddah. https://canso.org/event/canso-global-safety-conference-2026/	Jeddah, Saudi Arabia.
14-16/04/2026	ICAO Global Implementation Support Symposium 2026. Venue: Palmeraie Golf Palace (PGP), Palais des congrés Circuit de la Palmeraie, Marrakech. https://icaogiss2026.com	Marrakech, Morocco.
20-24/04/2026	65 th IFATCA (2026) Annual Conference. https://ifatca.org/events-annual-conferences/	Bucharest, Romania.

MAY/JUNE 2026

26-28/05/2026	Airspace World 2026. https://airspaceworld.com	Lisbon, Portugal.
10-11/06/2026	13 th Annual Safety Forum. Theme: Data and AI for Operational Safety: Opportunities and Responsibilities. Venue: EUROCONTROL Headquarters, Brussels. https://flightsafety.swoogo.com/safetyforum2026	Brussels, Belgium.

AUGUST 2026

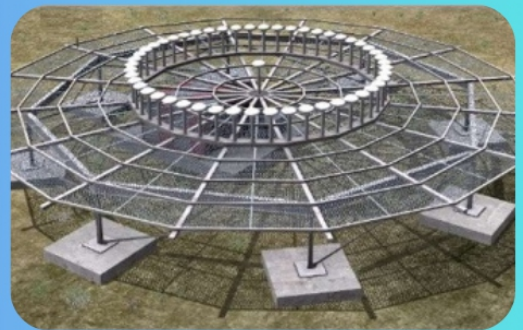
04-06/08/2026	4 th Annual Asia Pacific Summit for Aviation Safety. https://flightsafety.swoogo.com/ap-sas-2026	Osaka, Japan.
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OCTOBER 2026

13-14/10/2026	Airspace Africa and Middle East 2026. https://canso.org/event/airspace-abu-dhabi/	Abu Dhabi, U.A.E.
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National Association of Air Traffic Engineers Nigeria

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Affiliated to
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ATSEP – Navigation Aids Equipment Maintenance Course (ICAO STP)

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