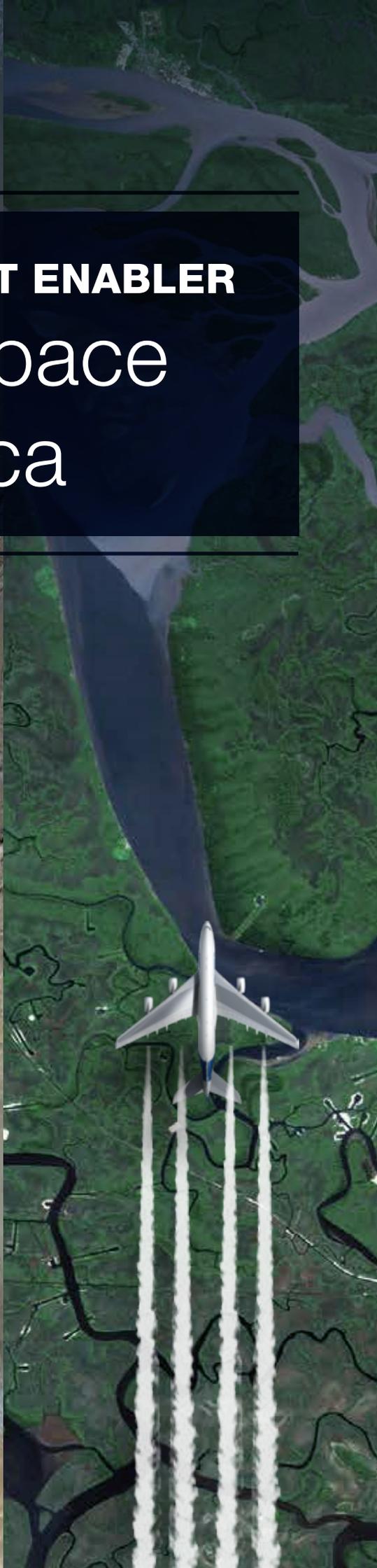


AIRBUS

THE GREAT ENABLER
Aerospace
in Africa



THE GREAT ENABLER

Aerospace in Africa



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LIST OF ACRONYMS

AFDB	African Development Bank
AMREF	African Medical and Research Foundation
DFI	Development Finance Institutions
DMC	Disaster Monitoring Constellation
ECA	Export Credit Agency
EMS	Emergency Medical Services
FDI	Foreign Direct Investment
FIPA	Foreign Investment Promotion Agency (Tunisia)
GDP	Gross Domestic Product
GIMAS	Group of Moroccan Aviation and Aerospace Industrialists
GSMA	Groupe Spéciale Mobile Association
GTPI	Growth and Transformation Plan
IATA	International Air Transport Association
IFC	International Finance Corporation
IMA	Aviation Professions Institute (Morocco)
IUU	Illegal, Unreported and Unregulated
LCC	Low Cost Carrier
MCP	Medical Care Plan
MRO	Maintenance Repair Overhaul
OAU	Organisation of African Union
OECD	Organization for Economic Cooperation and Development
OEM	Original Equipment Manufacturer
PIDA	Program for Infrastructure Development in Africa
PPP	Public Private Partnership
R&D	Research & Development
SAATM	Single African Air Transport Market
SARA	Small African Regional Aircraft
STEM	Science, Technology, Engineering and Mathematics
TAAT	Technologies for African Agricultural Transformation
TCAA	Tanzania Civil Aviation Authority
TDB	Trade and Development Bank
UAV	Unmanned Aerial Vehicle
UIMM	Union of Metallurgical Profession Industries (Morocco)
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Cultural and Scientific Organisation
UNICEF	United Nation's International Children's Emergency Fund
UNWTO	United Nations World Tourism Organization

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FOREWORD

The great enabler

Historically, the global aerospace industry has driven social and economic transformation around the world. Aerospace has since the beginning enabled many technological breakthroughs facilitating the connection of people, countries and cultures, providing access to global markets and generating trade and tourism.

Aerospace technologies have furthered our horizons, expanded access to education and information to the most remote areas on the planet, and revolutionized how people and businesses connect and create wealth thus improving the living standards of millions of people around the globe.

The aerospace industry offers solutions to many of the socio-economic challenges Africa is facing on the path to sustainable development. A paradigm shift from thinking about aerospace as an isolated industry to a key enabler of socio-economic change is necessary to realize its benefits for a prosperous future. That is what this White Paper is aiming at, by highlighting different ways in which aerospace technology can enable social and economic development in Africa.

Specifically, the paper looks at how different segments of this industry would address a core set of challenges on the continent by increasing access to basic healthcare, enhancing food security, making agriculture more competitive and sustainable, promoting education, training and innovation, empowering businesses with innovative products and solutions and breaking down barriers to movement of people and goods across Africa.

The key focus areas are: government policy, manufacturing and industrialisation, civil aviation, agriculture, healthcare and humanitarian assistance. The paper puts forward observations and evidence-based solutions from governments, the private sector, entrepreneurs and development practitioners.

The narrative of Africa's leapfrogging and rise as a global leader in mobile banking and communications can apply to many other domains. This report is looking at the full potential of aerospace technology for the continent and the many other "leapfrogs" that have and will continue to take place thanks to the aerospace industry. From drones delivering medicine faster and further, to satellite images enabling farmers to grow more with less, tracking and combatting infectious diseases and mitigating risk from natural disasters - the applications of aerial and space-based technologies are boundless.

The research included 30 in-depth interviews of stakeholders including government officials and policymakers, business leaders, entrepreneurs, intergovernmental bodies and multilateral development organizations, to understand the broad spectrum of ways the aerospace industry is currently serving and will continue to serve individuals and institutions across Africa.

We look forward to continuing the dialogue in this important topic.

Patrick de Castelbajac
Executive Vice President of Strategy & International,
AIRBUS

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EXECUTIVE SUMMARY

The inherent and extensive nature of aerospace technology offers boundless possibilities and opportunities for Africa's socio-economic transformation by creating wealth and jobs, building skills and aiding in the delivery of essential services.

This report focuses on sectors with the greatest possible impact on social and economic development through aerospace technology such as manufacturing and industrialisation, civil aviation, agriculture, health-care and humanitarian assistance.

On manufacturing and industrialization, many African countries are final consumers in the global aerospace value chain. Joining the rank of producers in this value chain is challenging for many but not impossible. The examples of Africa's current leaders in aerospace – South Africa, Tunisia and Morocco – demonstrate the complexities but also the opportunities for African countries to develop aerospace manufacturing and industrialization capacity. Key among these opportunities is Africa's potential demographic dividend, which will be achieved by investing in its youthful and increasingly techno-savvy population.

In the aviation sector, the key question remains how to connect people to markets and goods in a faster, cheaper and more efficient way in order to maximize the sector's role as an economic engine and a vehicle for greater integration in Africa.

In terms of a single industry's potential impact on the daily lives of Africans, agriculture is perhaps the most consequential pillar of the continent's sustainable development. However, despite employing more than 60 percent of Africa's population, the sector contributes only about 15 percent of the continent's GDP as underlying challenges persist. Aerospace technology such as precision farming could potentially reverse this situation by enabling farmers to produce more with less.

Access to healthcare is still a challenge for many rural populations. While building onto the existing technologies in the sector - such as air ambulances - new technology that will further change the dynamics of access to medical care and response to emergency relief in terms of quantity, distance and data collection is fast emerging.

The White Paper also stresses the need for clear policy by government to harness the power of aerospace technology, while concluding with key recommendations on human capital development, partnerships and financing.

The research process included 30 in-depth interviews with a cross-section of stakeholders including government officials and policymakers, business leaders and entrepreneurs, intergovernmental bodies and multilateral development organisations. This was supplemented with independently published research and content from industry and global development sources.



01

Government policy and aerospace

Building a robust commercial aerospace industry in Africa is no longer a question of *if* but *how*. For those countries that are already part of the global aerospace value chain as well as those in the process of becoming so, the critical success factors are human capital development and creation of a business-friendly environment in order to become competitive.

In order to pursue these approaches in aerospace, government officials and policymakers must implement clear and realistic strategies to enable countries to reap the benefits of this robust and impactful industry.



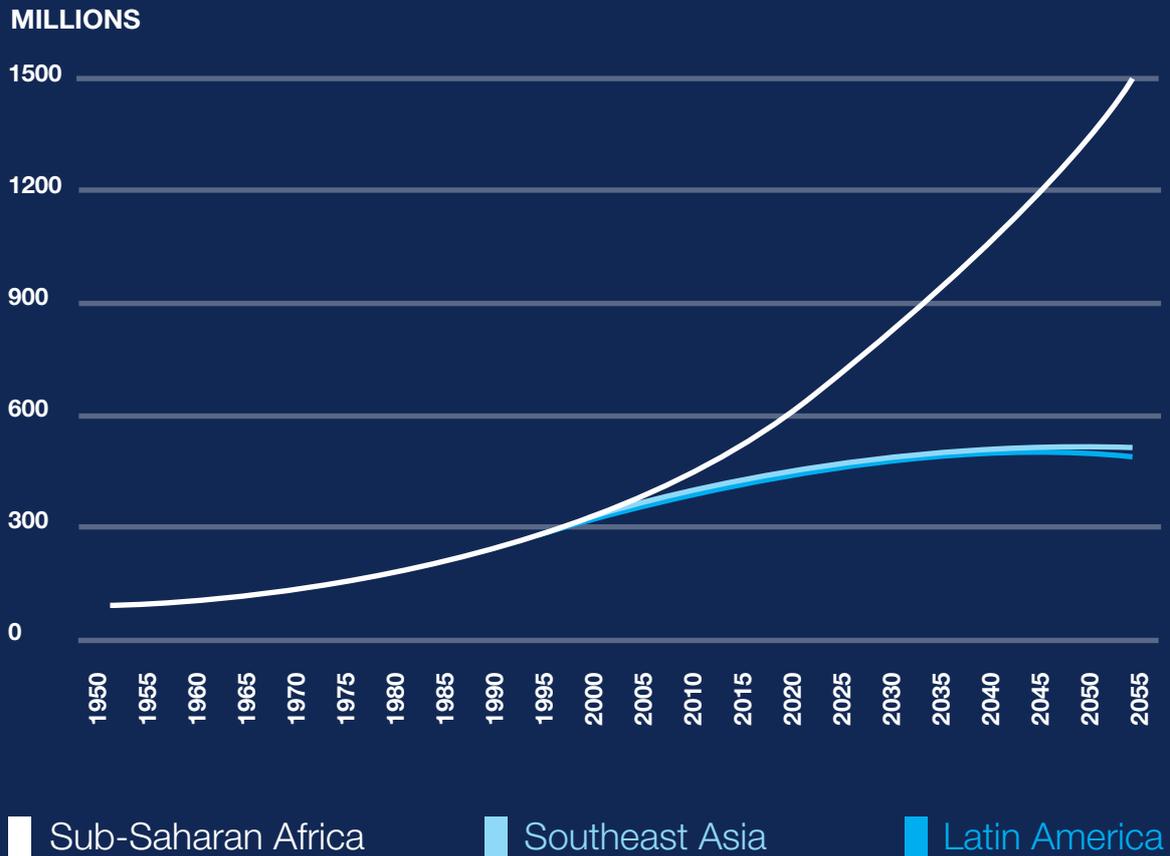


The Opportunity for Competitiveness

Africa's competitive advantage relative to many emerging and developed markets is what interviewees referred to as its potential demographic dividend – the potential for growth resulting from changes in the age structure of its population accompanied by investments in skills development and entrepreneurship.

In the last 30 years, Africa's population has almost doubled – from around 550 million in 1985 to 1.2 billion in 2015. This rapid growth is projected to continue well into this century. 46% of that growth is expected to come from young people between the ages of 15 and 24. According to the latest estimate, the populations of 26 African countries are expected to double their current size between 2017 and 2050.¹

FIGURE 1: Trend in Working-Age Population (15-64) in Africa²



¹www.un.org/sustainabledevelopment/blog/2017/06/world-population-projected-to-reach-9-8-billion-in-2050-and-11-2-billion-in-2100-says-un/

²www.weforum.org/reports/africa-competitiveness-report-2017ic-Schulz-GMF-2018.pdf

The competitive opportunities offered by Africa's population growth align closely with opportunities and changes in the aerospace industry at large. To understand these opportunities, one must first look at demand and trends in commercial aerospace globally. The commercial aircraft segment offers a good example. Air transport's center of gravity, as measured by demand for air transport services, has moved South and East over the last thirty years. In 2017, 30% of emerging country populations took a flight. By 2037, 85% of emerging country populations will fly.³ As such, the global fleet of aircraft is expected to double over the next 20 years.

FIGURE 2: Demand for Air Travel Moves South and East



“THE RISE OF DEMAND IN EMERGING ECONOMIES IS CREATING NEW OPPORTUNITIES FOR FIRST TIER PRODUCERS, BUT NEW THREATS TOO. IN OTHER WORDS, RECENT DYNAMICS IN THE GLOBAL INDUSTRY HAVE GENERATED LARGE OPPORTUNITIES AND CHALLENGES FOR THE FEW AFRICAN ECONOMIES THAT HAVE MANAGED TO ACHIEVE CAPABILITIES IN AEROSPACE MANUFACTURING. IN FACT, THE EMERGENCE OF GLOBAL OUTSOURCING HAS PROVIDED INCREASING OPPORTUNITIES FOR LOWER COST SITES IN DEVELOPING COUNTRIES AT THE LOWER TIER LEVEL. AS A RESULT, COMPANIES IN EMERGING ECONOMIES ARE NOW COMPETING WITH SUPPLIERS AT HIGHER COST LOCATIONS IN MORE MATURE ECONOMIES. THE REAL CHALLENGE IS THE ABILITY OF THESE COUNTRIES TO MAINTAIN THE RAPID SOPHISTICATION OF SKILLS AND CAPABILITIES NECESSARY TO ATTEND TO INTERNATIONAL DEMANDS.”

ABDELBASSET GHANMI,
DIRECTOR, ADVANCED TECHNOLOGY PROMOTION,
FOREIGN INVESTMENT PROMOTION AGENCY, TUNISIA

³Airbus Global Market Forecast 2017-2037. Accessed: <https://www.airbus.com/content/dam/corporate-topics/publications/media-day/Presentation-Er>

Human Capital Development is Africa's Ticket to Competitiveness

Harnessing the power of Africa's youthful population to create competitiveness does not happen passively. For a country or region to become competitive in a labour and capital-intensive industry like aerospace, there must be accelerated investments in people to create the right skills.

Therefore, government policies should focus on investing in this human capital – by imparting high-level skills that are essential for the development and growth of the aerospace industry in their respective countries. In Africa, policies, strategies and plans to boost competitiveness in commercial aerospace start with human capital development. The task for government is to support and stimulate this development. In many respects, Africa has a core prerequisite for developing a competitive advantage in aerospace, thanks to its increasingly techno-savvy and youthful population.

The continent has the youngest population in the world, with 200 million people between ages 15 and 24. This enterprising and techno-savvy generation has an appetite for innovation, technology and digitalization. The driving force of innovation in Africa stems from a need and urgency to find fast and practical solutions to the socio-economic challenges people live with each day.

If we look at the history of financial technology (Fintech), we find that Africa was among the first regions to adopt the concept in the form of mobile payment solutions. The idea was first developed by a student from Moi University in Kenya who came up with a software that could allow people to send, receive, and withdraw money from their mobile devices back in 2005.

Mobile network operator Safaricom saw an opportunity and acquired the rights and full ownership of the project, which has spread widely since. The number of Africans who have mobile money accounts now exceeds the number of those with traditional bank accounts.⁴

This basic dynamic – where ambition and ideas meet technology and resources – is what government officials and policymakers should seek to replicate and support across the continent both before and after their inception. Simply put, the shared goal between the public and private sectors is to increase the number of these interactions and create an environment that supports both the individuals who have ideas and institutions that have capital and know-how. This is what leads to growth.

“WHAT MANY AFRICAN ECOSYSTEMS LACK IN MEANS IS COMPENSATED BY AMBITION, MOTIVATION AND CREATIVITY TO APPLY THE EXISTING RESOURCES EFFICIENTLY. MOREOVER, THE TECHNOLOGY LEAPFROG IN THE COMMUNICATION SECTOR STRAIGHT TO MOBILE DEMONSTRATES AN OPPORTUNITY. AFRICA HAS THE POTENTIAL TO LEAPFROG INTO THE WORLD OF DIGITALIZATION OF THE AEROSPACE INDUSTRY.”

**Bruno Gutierrez,
Head of Airbus BizLab,
Airbus**

⁴ qz.com/1039896/m-pesa-mtn-orange-others-lead-africas-mobile-money-revolution/

SOME CHALLENGES PERSIST

In parallel to bolstering a competitive workforce, governments must also work to reduce persistent barriers to competitiveness. Challenges to competitiveness and human capital development in Africa persist in the areas of infrastructure and education, respectively. The imperative of investment in both infrastructure and education comes from the simple fact that both create and enable skilled jobs.

INFRASTRUCTURE

Interviewees were quick to point out the disparity between high hopes for technology and workforce development in Africa and many of the deficits in infrastructure and education. Interestingly, some pointed to the “leapfrog” narrative – the notion that Africans have skipped the agrarian and industrial revolutions in favour of mobile and other digital technologies that connect people and businesses – as a liability that may be misleading in the development of something like a home-grown aerospace sector. The critical view is that relying on the power of the leapfrogging phenomenon alone overshadows the need to build and further develop adequate infrastructure and quality education – necessary components of global competitiveness.

Physical infrastructure – including roads, airports, electrical grids and telecommunication networks – forms the backbone of commerce and, by extension, competitiveness. It requires a great deal of technical expertise and public funding in its own right. Experts believe African countries need to greatly accelerate their investments in infrastructure development. The latest estimate from the African Development Bank suggests that Africa’s infrastructure needs amount to \$130–170 billion a year, with a financing gap in the range of \$68–\$108 billion.⁵

EDUCATION

When it comes to education, there is no shortage of a critical mass of labour in Africa; rather, there is a shortage of a critical mass of highly skilled labour required to be competitive in the aerospace sector.

Competitiveness is linked closely with the quality of a given country’s primary, secondary and higher education systems. While Africa’s younger generation is considerably more educated than older generations, thanks in part to decades of government investment, the need to improve education systems and opportunities at each level remains. There is a fundamental skills mismatch between African graduates and jobs in a high-skilled technical sector like aerospace. Less than 25% of students who graduate from African universities have degrees in science, technology, engineering and mathematics (STEM).⁶

In addition, many interviewees cited brain drain as one of the education challenges hampering the growth of the aerospace sector on the continent. Skilled and talented minds tend to leave to the continent due to inadequate resources such as equipment and research and development capacity.

“ATTRACTING AND RETAINING TALENT IN AFRICA IS A CENTRAL CHALLENGE FOR THE DEVELOPMENT OF COMMERCIAL AEROSPACE SECTOR.”

Stephanie von Friedeburg,
Chief Operating Officer, International Finance Corporation (IFC).

⁵www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/2018AEO/African_Economic_Outlook_2018_-_EN_Chapter3.pdf

⁶africapolicyreview.com/stem-education-and-african-development/

Creating a Healthy Business Environment

The footprint of the global aerospace industry has changed significantly with globalization – moving away from primarily home-based manufacturing and integrating other countries that now play increasingly important roles in the supply and value chains. There is a consensus among original equipment manufacturers (OEMs) and other aerospace manufacturers that Africa is among the most promising markets in the world in terms of future economic and business growth, showing further interest in future investment and long-term presence in African markets. In order to take advantage of this, improving the business environment is a key ingredient and indicator of competitiveness in its own right.

Government visions and policies need not be aerospace-specific to generate activity in the sector. They need merely to address the systemic policy and investment challenges – in infrastructure, education and workforce development – faced by any sector aspiring for growth globally.

POLICY AND STRATEGY

The fact of the matter is that some governments in Africa have created highly competitive aerospace clusters by articulating industrialization policies, making deliberate investments in technical education, and creating an environment attractive to entrepreneurs and investors alike. The aerospace sector has enjoyed notable growth and stability in South Africa, Morocco and Tunisia, where national governments had clear strategic visions and policies for the development of the sector at large.

Other countries that have adopted strategies to enable the development of aerospace include Ethiopia and Cote d'Ivoire.

The positive remarkable of the first Growth and Transformation Plan (GTPI) in Ethiopia has led to achievements in real GDP growth, infrastructure development, social development and capacity-building at all levels. During the implementation period of GTPI, public participation, the common cause and spirit of development, and a sense of ownership are credited with stimulating real growth and prosperity for Africans. These achievements led to the introduction of a second Growth and Transformation Plan (GTPII), which places a high focus on creating an industrialization policy that specifically includes the aerospace sector. The country has also set an ambitious target known as Vision 2025, which aims to make Ethiopia the leading manufacturing hub in Africa, including within the aerospace industry. As part of that vision, Ethiopian Airlines, whose global expansion has driven the wider economic development policy agenda in Ethiopia, entered into an agreement with South Africa's Aerosud to establish a joint-venture – an aerospace manufacturing company that plans to manufacture and supply various aircraft parts to OEMs..

Côte d'Ivoire has also implemented an economic development policy model that has been successful in driving foreign investment to the country and created interest in its aerospace potential. The 2012 Investment Code offers incentives including tax reductions and exemptions from value added taxes (VAT) on equipment for private investors. The code also includes planned industrial zones that offer benefits to investors depending on the location of the investment. There are also incentives to promote the development of factories and transportation infrastructure key to the country's wider economic development.

At the continental level, the African Union's Agenda 2063, which is a strategic framework for the socio-economic transformation of the continent over the next 50 years, is a good place to start for national governments in search of a playbook for aerospace development.



TABLE 1: Policy Frameworks Responsive to Key Challenges on the African Continent and the Space-based Information Products that Support Them ⁷

SOCIETAL NEEDS	POLICY FRAMEWORK	INFORMATION AND PRODUCTS
FOOD SECURITY	COMPREHENSIVE AFRICA AGRICULTURE DEVELOPMENT PROGRAMME (CAADP)	RAINFALL, YIELD, PRODUCTION, CROPS DISTRIBUTION, SOIL AND LAND SUITABILITY
WATER RESOURCES	AFRICAN WATER VISION 2025	HYDROGRAPHY, AQUIFERS, WATER BODIES, QUALITY, WASTE WATER
MARINE AND COASTAL ZONES	2050 AFRICA'S INTEGRATED MARITIME STRATEGY (AIMS)	COASTAL ZONE DEGRADATION AND FISHING POTENTIAL
ENVIROMENT	NEPAD ENVIROMENT ACTION PLAN	ECOSYSTEMS, BIODIVERSITY, VEGETATION AND LAND COVER
WEATHER AND CLIMATE	CLIMATE FOR DEVELOPMENT IN AFRICA (CLIMDEV AFRICA) AND THE INTEGRATED AFRICAN STRATEGY ON METEOROLOGY	RAINFALL, TEMPERATURE, WIND, AEROSOL AND CLIMATE TRENDS AND EXTREMES
SECURITY AND DISASTER RESPONSE	AFRICA REGIONAL STRATEGY ON DISASTER RISK REDUCTION AND THE CONVENTION ON CYBER SECURITY AND PERSONAL DATA PROTECTION	RISK AND VULNERABILITY DATA
HEALTH PLANNING	AFRICA HEALTH STRATEGY	DISEASE VECTORS, ENVIRONMENTAL FACTORS, POPULATION DISTRIBUTION
GOVERNANCE AND COMMERCE	E-GOVERNMENT STRATEGY	LOCATION-BASED MOBILE SERVICES, MAPPING OF GOVERNMENT INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) INFRASTRUCTURE
INFRASTRUCTURE	PROGRAMME FOR INFRASTRUCTURE DEVELOPMENT IN AFRICA (PIDA)	SPATIAL INFORMATION ON KEY INFRASTRUCTURE, SUCH AS TRANSPORT INFRASTRUCTURE, ENERGY SOURCES AND POWER SYSTEMS, AND DISTRIBUTION NETWORKS
INFORMATION AND COMMUNICATION	REFERENCE FRAMEWORK FOR HARMONIZATION OF TELECOM / ICT POLICES AND REGULATIONS IN AFRICA	TELECOMMUNICATIONS, INTERNET, TELEVISION BROADCASTING, MOBILE COMMUNICATIONS, E-COMMERCE, E-GOVERNMENT AND E-LEARNING
INNOVATION	SCIENCE, TECHNOLOGY AND INNOVATION STRATEGY FOR AFRICA (STISA)	FOOD SECURITY, DISEASE PREVENTION, COMMUNICATIONS AND SECURITY

On January 31, 2016, the African Union adopted the African Space Strategy and subsequent Space Policy – representing the first concrete steps toward realizing an African Outer space program. The policy is considered a flagship program under the wider African Union Agenda 2063. Conceptually, the strategy's adoption and implementation is supported by adjacent frameworks – notably the Science, Technology and Innovation Strategy for Africa 2024. Moreover, it was an expression of consensus that all member nations see space technology specifically as touching each and every existing development framework for the continent's social and economic needs. While these frameworks prioritize and address specific socioeconomic challenges, they also create fertile ground for the development of a competitive African aerospace sector.

⁷au.int/sites/default/files/newsevents/workingdocuments/33178-wd-african_space_strategy_-_st20445_e_original.pdf



“IT TAKES INVESTMENT AND COLLABORATION TO CREATE AEROSPACE CLUSTERS THAT CAN COMPETE IN INTERNATIONAL MARKETS. ORGANISING AND ALIGNING ALL STAKEHOLDERS TO DEVELOP INDUSTRIALISATION POLICIES THAT ADVANCE A COLLECTIVE OUTLOOK IN WHICH AEROSPACE TAKES CENTRAL STAGE IS KEY – WITH IT COMES THE PROMISE OF SOCIO-ECONOMIC DEVELOPMENT.”

Mikail Houari,
President - Africa and Middle East,
Airbus

INVESTMENT: PARTNERSHIPS AND FINANCING

Creating policies that promote attractive business environments where industries like commercial aerospace can thrive cannot happen without investment. These policies merely set the stage for establishing partnerships with the private sector and development finance institutions (DFIs) to unlock financing where it is needed.

Today, the private sector in Africa is acting as a key driver of the continent's economic development – more so than in years past. To capture the opportunities of knowledge transfer and drive more foreign direct investment (FDI), African governments are entering into public-private partnerships (PPPs) with local and global private sector organisations.

In June of 2018, the Government of Côte d'Ivoire signed a Memorandum of Understanding (MoU) with Airbus to establish a framework of collaboration to support the development of the country's aerospace industry, which the government has identified as strategic for its socio-economic development for many of the reasons outlined in Figure 1 above. Under this agreement, Airbus will work closely with the government through sharing expertise in order to support efforts in building a viable aerospace sector. This includes a component on training and skills development.⁸

Interest from international investors ideally and predictably follows the policies and partnerships forged locally in a given sector. Overall, the United Nations Conference on Trade and Development (UNCTAD) estimated that overall FDI inflows to Africa fell to \$42 billion in 2017 – a 21% decrease from 2016.⁹ However, there is a positive correlation between FDI inflows and those African countries that have taken steps to lay the groundwork in either aerospace or advanced manufacturing capacity. New legislation on PPPs in Tunisia, a notable manufacturing hub and growing aerospace ecosystem, kept FDI inflows relatively stable at nearly \$1 billion in 2017. In Morocco, another country where government incentives and investments have been offered to aerospace and other advanced manufacturing sectors, FDI inflows across industries actually increased by 23% to \$2.7 billion in 2017. Countries with established or emerging national air carriers, such as Ethiopia, Morocco, and Egypt, were among the top five African host economies for FDI in 2017.

In conclusion, many of the policy opportunities and hurdles African governments face – in workforce development, infrastructure and education – are not new challenges and certainly not unique to building a competitive aerospace industry. The transformational visions and strategies set forth at the continental level are strong and sound frameworks. They serve a critical function in raising awareness about the challenges and opportunities Africa faces. As some trailblazing African countries begin to build viable and valuable aerospace capacity, getting these critical components right takes on new urgency for national governments as they benchmark against their peers and explore the economic possibilities in front of them.



⁸www.airbus.com/newsroom/press-releases/en/2018/06/mou-to-de-elop-aerospace-industry-in-cote-d-ivoire.html

⁹https://unctad.org/en/PublicationsLibrary/wir2018_en.pdf

02

Manufacturing and Industrialisation

Building industrial capacity has long been a key priority for African economic development due to the potential benefits in terms of creating jobs, developing SMEs, turning innovation into commercially viable products and increasing competitiveness. As such, industrialization is a key feature of the African Union's Agenda 2063.¹⁰

Building home-grown aerospace industrial capacity is critical. The scale of high-value skills, direct and indirect jobs, increase in government revenues as well as local and foreign investment is alluring. The rise of aerospace manufacturing clusters and the economic resilience that comes with them – in South Africa, Tunisia and Morocco – makes this point.

¹⁰au.int/sites/default/files/pages/3657-file-agenda2063_popular_version_en.pdf









The State of Aerospace
Industrial
Capacity in Africa



Most examinations of the global aerospace industry begin by valuing “all in-country activities pertaining to the development, production, maintenance and support of aircraft and spacecraft.”¹¹ In 2017, the global aerospace industry, including sub-tier suppliers, who account for 54% of the industry’s overall production, was valued at \$838 billion.

Three African countries - South Africa, Tunisia, and Morocco – are among the 45 largest aerospace manufacturing nations in the world, as measured by the value of components produced, largely for export. The rise of Tunisia and Morocco in the past two decades has been powered largely by their proximity to key European aerospace powers.

The key benefit of the aerospace industry, especially in Africa, is the number of highly skilled jobs it creates – both directly and indirectly. South Africa’s aerospace sector directly employs around 15,000 highly skilled engineers and is estimated to support at least 60,000 further skilled jobs in the economy. This is a multiplier effect of roughly 1:4.¹²

In Tunisia, it is estimated that aerospace manufacturing directly employs more than 9,000 people.¹³ Morocco’s aerospace manufacturing cluster, which consists of more than 110 companies, directly employs around 11,500 people.

Table 2: Industry Size of Africa’s Top Aerospace Clusters



South Africa and Morocco are ranked 33rd and 36th respectively in terms of the total size of their aerospace industry. Morocco has more than 100 aerospace facilities dedicated to aerostructures, components and wire harnesses.¹⁴ In Tunisia, there are around 70 export-oriented aerospace companies that employ about 13,000 people. The Tunisian Aerospace Industry Association (GITAS), a leading Tunisian aerospace industry trade organization, has 40 member companies.

Morocco’s push for international investment in its aerospace sector may serve as a template for emerging nations seeking to develop an aerospace industry. In fact, Morocco has seen a rapid growth of its aeronautical sector; official figures through 2016 said the industry had seen export sales grow tenfold, to \$1 billion. Revenue growth has risen 17 percent per year, on average, since 2009.

¹¹gallery.mailchimp.com/349bcb36927b83ba537910354/files/0b847ec4-76e7-4184-8627-3486b81d71f0/AeroDynamic_Teal_Global_Aerospace_Industry_16July2018.pdf

¹²www.engineeringnews.co.za/article/south-africas-defence-industry-faces-serious-challenges-but-also-sees-future-opportunities-2017-07-14-1

¹³www.engineeringnews.co.za/article/south-africas-defence-industry-faces-serious-challenges-but-also-sees-future-opportunities-2017-07-14-1#fence-industry-faces-serious-challenges-but-also-sees-future-opportunities-2017-07-14-1

¹⁴gallery.mailchimp.com/349bcb36927b83ba537910354/files/0b847ec4-76e7-4184-8627-3486b81d71f0/AeroDynamic_Teal_Global_Aerospace_Industry_16July2018.pdf

The image shows a vast, high-ceilinged industrial facility, likely an aircraft manufacturing plant. The structure is composed of a complex network of white steel beams and supports. In the foreground, a large white aircraft fuselage is being assembled, with a red crane hook visible. A blue forklift and a red cart are also present on the floor. The text "Full Service Station" is visible on a sign in the upper right corner. A white semi-transparent text box is overlaid in the center of the image, containing the title "Challenges to Building an Aerospace Ecosystem".

Challenges to Building an Aerospace Ecosystem

The prerequisites for any African country aspiring to build an aerospace ecosystem and find its place in the global supply and value chains include adequate infrastructure, human capital and access to financing.

Developing aerospace clusters requires stable and efficient infrastructure – from power-supply, access roads, free zones, ports, and other facilities. Countries like Tunisia plan further massive investments in the development and provision of free zones, industrial areas, ports, airports, highways, and energy generation, alongside the creation of the Tunisia Aeronautic Valley to host new entrants to the sector. Morocco boasts many economic free zones that provide an important platform for the country's growing aeronautics sector. These include Casablanca's Aeropole Nouaceur and Midparc free zones, in addition to zones with aerospace facilities in Tangier; Kenitra, north of Rabat; Oujda, in north-east Morocco; and Sale, near Rabat.¹⁶

Basic infrastructure such as power supply and road access still represent challenges even for larger aerospace clusters. According to the senior executive of Tunisian FIPA, many African countries still have huge infrastructure gaps, which increase the cost of doing business. These countries must develop a "high industrial readiness index" by accelerating investments in other critical infrastructure such as roads, ports and rail, aviation and ICT, which will position them as a competitive destination of choice.

Investing in human capital is also critical for building an aerospace ecosystem. Although building a strong base of highly skilled aerospace professionals is still a challenge for those aspiring to join the commercial aerospace value-chain, some countries have made significant steps towards this by taking deliberate strategies at the national level. For instance, the Morocco-based Aviation Professions Institute (IMA), which gives vocational training for professionals in the sector, aims to train 800 aviation and aerospace professionals per year. The institute is the result of a partnership between the Government of Morocco, the Group of Moroccan Aviation and Aerospace Industrialists (GIMAS) and the Union of Metallurgical Profession Industries (UIMM).

Another major challenge closely linked to the industrial infrastructure gap is access to private financing due to an unfavorable view of the perceived risks and returns compared to other emerging markets. None were advocating for a retreat of capital from Africa but simply felt that in a lot of countries the discussion of aerospace industrialization was slightly premature – often describing the relationship between adequate infrastructure and capital as a "chicken and egg" scenario. Nevertheless, international finance experts see a viable path forward in the long-term through two key solutions for attracting capital, in conjunction with infrastructure improvements: the ability to secure a sovereign guarantee on financing and the existence of a profitable future business plan.

¹⁶www.moroccoworldnews.com/2018/10/254695/moroccos-thriving-aeronautic-industry-attracts-international-interest/



Building Partnerships and Investing in Entrepreneurs to Grow Ecosystems

A one-size-fits-all approach rarely works, especially in a place as geographically, economically and culturally diverse as Africa. Nonetheless, two distinct schools of thought emerged among interviewees on how African countries aspiring to build aerospace industrial capacity can get there.

The first is focused on collaboration with Africa's existing aerospace hubs to allow the region to capture more value from the aerospace clusters that do exist, relying on collaboration between countries and companies. The second is focused on putting the basic building blocks of an aerospace technology ecosystem in place in countries that do not have a clear link to an existing hub. These two approaches do not necessarily exclude each other.

“TWO YEARS AGO WE SIGNED A MEMORANDUM OF UNDERSTANDING WITH ETHIOPIAN AIRLINES HELP THEM ESTABLISH A MODEST MANUFACTURING CAPABILITY. THE ROUTES OF THIS ARE IN OUR COLLABORATION WITH ETHIOPIAN AIRLINES AND ORIGINAL EQUIPMENT MANUFACTURERS. THROUGH THIS COLLABORATION WE CAN USE MANY YEARS OF OEM EXPERIENCE TO SUPPORT THEIR GROWTH STRATEGY. WE ARE A SUPPLIER TO MOROCCO AS PART OF THE GLOBAL SUPPLY CHAIN AND WE HAVE A GOOD UNDERSTANDING OF WHAT IS HAPPENING THERE. IN SA WE HAVE ESTABLISHED A COMMERCIAL AVIATION ASSOCIATION TO (CAMASA) TO PROMOTE AND GROW THE GLOBAL COMPETITIVENESS OF THE SA INDUSTRY.”

**Johan Steyn,
Managing Director, Aerosud**

For those more interested in building ecosystems from the ground up, the focus is on government and private sector initiatives to support skills growth and talent development. Contributors to this paper agree that education is a base for building a local aerospace industry for the future. Kenya and South Africa are examples interviewees commonly cited as African countries adept at sourcing and cultivating talent to support their industrial ambitions. Strong higher education institutions and frequent collaboration between the government and private sectors are cited as pillars of that strength.

The rise of foreign and African investment in innovation and entrepreneurial hubs across Africa serves a complementary function to primary, secondary and higher education on the continent. The popularity and proliferation of accelerators, incubators and other programs supporting entrepreneurship in Africa is likely to be a driving force behind any growth in its aerospace industry. These hubs do not need to be aerospace specific to help the industry's development. As a result, we see an increasing number of OEMs and engine manufacturers investing in incubators of their own and establishing venture funds.. Increasing the industry's engagement with hardware and software innovators is ultimately a hedge against competition from new places and in line with how customer needs are evolving. This is especially true in advanced data analytics and artificial intelligence realms. In our interviews, entrepreneurial ecosystems – that convene universities, the private sector and entrepreneurs - were commonly cited as a critical and competitive necessity not only for the purposes of workforce development but in attracting capital at scale – often alongside more formal education.

GSMA estimates that there are now 442 active tech hubs in Africa.¹⁷ In summer of 2018, Google announced plans to open its first global Artificial Intelligence research center in Accra, Ghana. The company also decided on Lagos in Nigeria when setting up its first Launchpad Accelerator outside its home market in the U.S. Facebook followed suit by launching its own hub, also in Lagos. More established African-born hubs like MEST and AfriLabs have also increased their footprint across the continent.

“WE NEED AN ENTREPRENEURIAL ECO-SYSTEM MADE UP OF INCUBATORS AND ACCELERATORS, AND YOU ARE STARTING TO SEE THESE

Stephanie von Friedeburg,
Chief Operating Officer,
International Finance Corporation (IFC)

Sweeping pan-African policy frameworks are focused heavily on a paradigm shift toward prioritizing STEM education and offering incentives for young talent to remain in Africa and contribute to aerospace industry growth. The task falls largely to national governments to encourage and support this sort of skill development. Projects such as Airbus BizLab, Flatlab and other similar incubators are a step in the right direction as long as they are complemented by supportive, business-friendly policies at the local level and continuing government investment in technical education.

“THE #AFRICA4FUTURE INITIATIVE REVEALED STRONG TALENT AND PROMISING IDEAS IN SOUTHERN AND EASTERN AFRICA. YET, THE PEOPLE AND THE HOTSPOTS ARE NOT CONNECTED WITH EACH OTHER. THE AEROSPACE TECH ECOSYSTEM HAS THE OPPORTUNITY TO IMPROVE ITS READINESS TO SUPPORT THE NEXT GENERATION OF AEROSPACE INITIATIVES BY COMBINING DIGITAL DEVELOPMENT WITH HIGH-TECH HARDWARE CAPABILITIES. FOR THAT, THERE SHOULD BE MORE BRIDGES FOR OPEN COLLABORATION AMONG THE DIFFERENT ACTORS OF THE CONTINENT BUT ALSO BETWEEN OEMS AND THESE ACTORS.”

Bruno Gutierrez,
Head of BizLab Airbus

¹⁷www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/1000-tech-hubs-are-powering-ecosystems-in-asia-pacific-and-africa/

03

Civil Aviation

An essential
economic engine





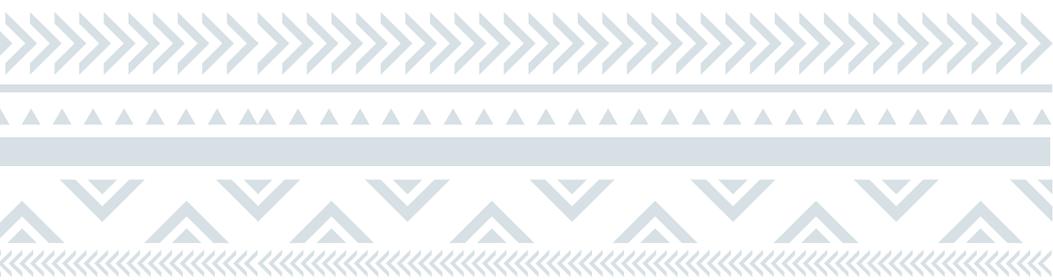


Despite the global economic growth, civil aviation in Africa has long been a victim of the same challenges – namely a lack of bilateral agreements on civil aviation, high operating costs, volatile taxation and persistent perceptions of poor safety. For years, getting from point A to point B by air was only possible through hubs outside Africa. The introduction of direct intra-African flights proved non-competitive in terms of pricing. This hampered African economic development and reduced African countries' ability to trade efficiently with the world. This section assesses the current state of air transport in Africa and how aviation can make an immense contribution to the continent's socio-economic development.

African aviation supports approximately 7 million jobs and contributes more than \$80 billion in GDP. In the past, the African market was even more fragmented. In 1999, twelve African countries agreed in principle to implement the landmark Yamoussoukro Decision, launching the first attempt at market integration and liberalization, which would add an estimated 155,000 new aviation-related jobs and \$1.3 billion in annual GDP for the continent.¹⁸ However, this effort was never quite realized in full – perhaps only by the few who moved to implement liberalization policies with their neighbours and were, in turn, rewarded for it.

According to a 2014 IATA report on the economic benefits of implementing the Yamoussoukro Decision, an agreement of a more liberal air transport market between South Africa and Kenya in the early 2000s, was credited with increasing passenger traffic by nearly 70%. Allowing the operation of a low-cost carrier (LCC) between South Africa and Zambia led to a nearly 40% reduction in fares and a sizable increase in traffic. When Morocco signed an open skies agreement with the EU in 2006, traffic increased by an estimated 160% and the number of routes between Morocco and the EU more than tripled between 2005 and 2013.¹⁹

Today, the promise of African air transport is defined largely in terms of the demographic, economic and policy hurdles faced by the underserved African air transport market. Africa is home to 16% of the world's people but accounts for less than 3% of global air service.²⁰ For Africans, the cost of a plane ticket is prohibitively expensive : 45% higher than anywhere else in the world according to industry officials we spoke with. The continent accounts for 30% of earth's total land area but remains the most challenging terms of road network density. In terms of the distance between its largest population centers, Africa has the third largest distance between them, only behind Latin America and Asia Pacific.



¹⁸ www.iata.org/whatwedo/Documents/economics/InterVISTAS_AfricaLiberalisation_FinalReport_July2014.pdf

¹⁹ www.lexology.com/library/detail.aspx?g=44fb879c-7a37-4060-8db2-399146747ec0

²⁰ issuu.com/objectif-developpement/docs/revue_psd_24_uk



Liberalization Remains the Big Prize



This year, the long-running global push to open African skies benefited from the signing of the Single African Air Transport Market (SAATM) by 23 countries, making a commitment to shift toward a continental approach in liberalizing the market, which would increase connectivity and reduce the unit costs for both airlines and passengers. IATA supported the African Union's efforts with SAATM as the only feasible solution for meaningful industry growth.

“THE FOCUS OF THE AFRICAN UNION COMMISSION IS ON THE LIBERALISATION OF THE AIR TRANSPORT INDUSTRY IN AFRICA, BEING ONE OF THE FLAGSHIP PROJECTS IDENTIFIED BY AFRICAN LEADERS IN THE AU AGENDA 2063 AS AN IMPETUS TO ENHANCE THE CONNECTIVITY AND INTEGRATION OF THE CONTINENT AND TO ENABLE THE EFFECTIVE OPERATIONALISATION OF THE AFRICAN FREE TRADE AREA — ANOTHER FLAGSHIP PROJECT OF THE CONTINENTAL AGENDA. THIS REQUIRES DEVELOPING A SEAMLESS AIR NAVIGATIONAL AND GROUND BASED INFRASTRUCTURE ARCHITECTURE AS WELL AS IMPLEMENTATION OF INTERNATIONAL STANDARDS, PARTICULARLY ENSURING COMPLIANCE WITH SAFETY AND SECURITY STANDARDS.”

**H.E. DR. AMANI ABOU ZEID,
AFRICAN UNION COMMISSIONER
FOR INFRASTRUCTURE, ENERGY,
TOURISM AND ICT**

“AVIATION HAS THE POTENTIAL TO MAKE A HUGE CONTRIBUTION TO ECONOMIC GROWTH AND DEVELOPMENT ACROSS THE CONTINENT AND TO OPEN UP AND CONNECT MARKETS, FACILITATE TRADE AND ENABLE AFRICAN FIRMS TO INTEGRATE GLOBAL SUPPLY CHAINS. ENHANCING AIR CONNECTIVITY CAN HELP RAISE PRODUCTIVITY BY ENCOURAGING INVESTMENT AND INNOVATION AND BY IMPROVING BUSINESS OPERATIONS AND EFFICIENCY. I’M VERY OPTIMISTIC ABOUT SAATM IMPLEMENTATION. COUNTRIES AGREED THIS YEAR VOLUNTARILY. NOBODY COMPELLED THEM. IN AFRICA, WE DON’T SEE MANY OF THE AFRICAN AIRLINES WORKING TOGETHER AND THIS IS THE PART OF THEIR BUSINESS. AND WE WANT TO SEE MANY OF THEM BEGIN TO WORK TOGETHER ESPECIALLY UNDER THE SINGLE AIR TRANSPORT MARKET SO THAT THEY CAN BE ABLE TO DEVELOP THEIR BUSINESS AND COULD BE MORE EFFECTIVE.”

RAPHAEL KUUCHI,
VICE PRESIDENT FOR AFRICA, IATA

FIGURE 3: IATA/InterVISTAS Estimated Impact of Liberalization in Senegal, Nigeria and Angola (2014)



Perhaps most significantly, enhanced air service can facilitate countless other sectors by supporting increased trade, attracting new businesses to the region, encouraging investment and boosting productivity. Industries and activities that would otherwise not exist in a region can be attracted by improved air transport connectivity. The induced benefits to trade, investment and productivity not directly related to aviation activities from liberalized air services were estimated at 42,000 jobs across the 12 countries studied, generating additional incremental GDP of \$343 million.²¹

²¹ www.iata.org/whatwedo/Documents/economics/InterVISTAS_AfricaLiberalisation_FinalReport_July2014.pdf

“WE HAVE A HUGE OPPORTUNITY. OUR PEOPLE, OUR ARMY OF YOUTH ARE THE OPPORTUNITY, THEY NEED TO TRAVEL AND WE DO NOT HAVE PROPER ROAD INFRASTRUCTURE, BUT DISTANCES ARE HUGE. SAATM IS THE STEP IN THE RIGHT DIRECTION. WE SHOULD LOOK AT IT NOT AS ANOTHER AGREEMENT BUT THE RIGHT STEP FOR INTEGRATION IN AFRICA”

**CAPTAIN EDWARD BOYO,
FOUNDER AND MANAGING DIRECTOR OVERLAND AIRWAYS**

However, SAATM is also viewed with scepticism and reservations by certain governments and airlines on the continent, who do not see its immediate benefits.

“IF SAATM’S IMPLEMENTATION WILL BRING MORE TOURISM TO OUR COUNTRY AND ADDING VALUE TO OUR ECONOMY, THEN IT IS A GOOD MOVE TO BE A PART OF IT. BUT IF NOT THEN IT IS NOT GOOD FROM A STRATEGIC POINT OF VIEW.”

**SOMAS APPAVOU,
CEO, AIR MAURITIUS**

Opportunity: Tourism Will Be Driven by a Vibrant and Liberalized Aviation Sector

FIGURE 4 : Historic Tourism Export Revenues in Africa

1995-1998

\$14 billion



2005-2008

\$41 billion



2011-2014

\$47 billion



Data: UNCTAD Economic Development in Africa report 2017

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Interestingly, intra-African tourism is developing despite SAATM to some considerable extent; and contributes more to overall tourism traffic than many give it credit for. This growth is attributed to the increasing size of Africa’s middle class.

²² unctad.org/en/PublicationsLibrary/aldcafrica2017_en.pdf

Information



A person with a large, dark-colored backpack is seen from behind, standing in an airport terminal. They are looking at several large digital flight information screens. The screens display flight schedules with columns for flight numbers, destinations, and times. The person's backpack has green straps and a small orange tag. The terminal floor is polished and reflects the lights from the screens.

“ACTUALLY, OVER HALF OF ARRIVALS IN DESTINATIONS IN THE REGION (27 MILLION OF THE 58 MILLION IN 2016) ARE FROM SOURCE MARKETS IN THE REGION. THE GROWTH RATE HAS BEEN CONSIDERABLE - AT 6% PER YEAR BETWEEN 2005 AND 2015. MOST OF THESE ARRIVALS ARE OVER THE SURFACE TO NEIGHBORING COUNTRIES, THOUGH WITH ARRIVALS TO AFRICAN DESTINATIONS BREAKING DOWN ROUGHLY TO HALF BOTH BY AIR AND OVER THE SURFACE. ARRIVALS TO AFRICA FROM OUTSIDE THE REGION ARE PREDOMINANTLY BY AIR, WITH EXCEPTION TO PART OF THE ARRIVALS IN MOROCCO AND TUNISIA FROM EUROPE, AND SOME FROM THE MIDDLE EAST (INCLUDING EGYPT AND LIBYA) OVER WATER OR LAND. IT IS A MISPERCEPTION TO SAY THAT THERE IS LITTLE (OR NO) INTRA-AFRICAN TOURISM. IT COULD BE MORE THOUGH WITH BETTER CONNECTIONS. THE GENERAL TENDENCY IS CLEARLY POSITIVE.”

**ELCIA GRANDCOURT,
DIRECTOR, REGIONAL DEPARTMENT
FOR AFRICA, UNWTO**

Successful implementation of SAATM will have a positive impact beyond tourism. In the 12 countries IATA’s report examined in 2014, open skies could generate an estimated \$1.3 billion of additional spending. Tourism has the potential to stimulate the growth in a wide range of economic sectors – from manufacturing to construction, to more advanced industries such as telecommunications, finance and professional services. Indirect socioeconomic benefits extend to sub-sectors such as taxi and transportation services as well as food sales, both of which provide jobs for thousands of people on the continent.

“INTRAREGIONAL AND CONTINENTAL TOURISM BUILDS STRONGER LOCAL LINKAGES, MAKING GREATER USE OF LOCALLY SUPPLIED FOOD AND BUILDING MATERIALS AND LABOR. INTRAREGIONAL AND CONTINENTAL TOURISM ARE ALSO CHARACTERIZED BY HIGHER LEVELS OF LOCAL SPENDING.”

**UNCTAD REPORT ON ECONOMIC
DEVELOPMENT IN AFRICA 2017: TOURISM**

The growth of tourism and indirectly air transport is dependent on other government policies like free travel and visa liberalization. The African Union’s goal of a completely visa-free continent by 2020 should significantly boost regional traffic. Last year the African Union launched the African Passport program, but this document is currently available only to top diplomats. Seychelles is currently the only country to offer visa-free access to all other African nationals. Rwanda implemented a visa-on-arrival system in 2013 that enables African nationals to stay in the country for up to 90 days and since then has seen the number of visitors increase by more than 100%.²³



²³ www.newtimes.co.rw/section/read/226777



Tackling the Challenge of Local Talent Retention and Training

A growing aviation sector may well be hindered by the global shortage of qualified pilots. According to an Airbus forecast, Africa will require over 21,000 new pilots and 22,000 new technicians to operate, support and maintain the continent's future aircraft fleet by 2035. Airline executives interviewed for this report cited talent retention as a key challenge and opportunity for Africa. The training and licensing process is currently very fragmented, and unlike Europe, where captains from one country can work for other European carriers, African aviation professionals are often constrained to their home countries. Airline executives agree that investing in African talent, training and education can lead to talented people leaving for better-paid jobs in the Middle East or Asia.

The solution for aviation brain drain according to Girma Wake, former CEO of Ethiopian Airlines, could be in establishing a cross-country licensing model and setting up Centers of Excellence where aviation talent of different nationalities could receive their training. As IATA's senior executive pointed out, there are a number of non-African pilots operating in Africa because they have experience and young African pilots have a hard time breaking into the system. Regional cooperation and cross-country licensing are key to keeping the best and the brightest aviation talent on the continent.

Partnership on issues like the pilot shortage, which threaten the viability of the industry at large, is essential. Some countries like Ethiopia and Nigeria are pioneering training academies to fulfil their needs but are also open to cooperation with other African countries. IATA's Airline Training Fund in Africa offered training to nearly 2,500 African aviation professionals this year alone:²⁴

FIGURE 5: Training and Job Opportunities Offered by Air Transport in Africa ²⁵

Total estimated number
of pilot jobs in 20 years:

32,000

Total estimated number
of technicians:

25,000

Ethiopian Airlines
Academy capacity:

4,000 annually

²⁴ www.iata.org/about/Pages/iatf.aspx

²⁵ Interview with Raphael Kuuchi, Vice President for Africa, IATA; Airbus Data (Accessed in 2018)



Facilitating Aircraft and Infrastructure Financing: Opportunities in Public-Private Partnerships

Access to capital was unanimously defined as another key challenge facing air transport in Africa. Financing experts such as Benoit Chervier of One2Five Advisory firmly believe that the future is in PPPs and building an ecosystem with motivated stakeholders. Building a competitive commercial airline through partnership between public and private entities can complement each other. Such partnerships are in fact, necessary.

The African Development Bank (AfDB) is currently developing its Aviation policy. Financing fleet growth and the ancillary needs of airlines is one of the key issues to address: Some of our interviewees confirm that creating economies of scale (i.e. pan-African alliances) would be a good way forward to reduce the unit cost of aircraft and obtaining trust of the financing institutions.



“AFRICAN AIRLINES FACE HIGHER FINANCING COSTS, AND THEIR LEASING COSTS ARE SIGNIFICANTLY HIGHER THAN ANYWHERE ELSE IN THE WORLD. THE DISCOUNTS THAT AIRLINES GET ON PURCHASED PLANES ARE MUCH SMALLER. SO BASICALLY, IT COSTS AFRICAN AIRLINES MUCH MORE TO OWN OR LEASE AIRCRAFT.”

Pierre Guislain, Vice President for Private Sector, Infrastructure and Industrialization, African Development Bank

The long-term benefits of implementing frameworks like SAATM will take time but there are other policy mechanisms that interviewees thought deserved attention – like the Cape Town Convention and Protocol - which enhances legal certainty and lowers the cost of acquiring and leasing modern, fuel-efficient aircraft and many other mobile assets. Putting in place the right infrastructure needed to make an economy run is paramount to attracting capital.

In the last 10 years, countries such as Ethiopia, Ghana, Ivory Coast, Kenya, Morocco, Nigeria, Rwanda, South Africa, Tanzania, Uganda, and others have entered into forms of PPPs on infrastructure projects across several industries, including the construction of roads, power generation, telecommunications, and now, aerospace manufacturing.²⁶

Development finance organizations such as the World Bank, the International Finance Corporation (IFC), and African Development Bank (AfDB) also have vast portfolios of projects, including in the air transport segment – often dealing with airport revitalization, connecting multi-modal infrastructure and, occasionally, supporting airlines.²⁷

This is particularly notable given that the mission of such institutions is to eradicate poverty and create wealth, thus corroborating and reinforcing the essential link between aviation, infrastructure and the wider socio-economic development of the continent. In 2017, the World Bank’s global portfolio for air transport development projects stood at \$1.03 billion with numerous projects across Africa and other developing markets. As of 2017, the African Development Bank has invested in 30 airport projects across Africa.

Between 2004 and 2017, around 30 African countries have developed laws or are in the process of drafting PPP laws. However there have been 17 transactions related to PPPs at a total investment of \$8 billion, excluding energy and telecommunication projects. Africa’s Program for Infrastructure Development in Africa (PIDA) envisages 400 such PPP projects, many of which will have direct or indirect links to supporting air transport infrastructure.²⁸

“DECISIONS ON FINANCING BETWEEN AIRPORTS AND AIRLINES ARE NOT A TRADE-OFF. IT’S A GLOBAL VALUE CHAIN AGAIN. YOU CANNOT HAVE A ROBUST AND DEVELOPED AIRLINE WITHOUT HAVING A ROBUST INFRASTRUCTURE. ROBUST INFRASTRUCTURE MEANS NOTHING IF YOU DON’T HAVE PROPER PLANES TO OPERATE.”

Benoit Chervalier, Chairman, One 2 Five Advisory

As a policy and practical matter, the public sector’s ability to secure financing is key to increasing the number and viability of PPPs according to finance experts interviewed.

²⁶www.un.org/africarenewal/sites/www.un.org.africarenewal/files/Africa_Renewal_EN_August_November_2017.pdf

²⁷documents.worldbank.org/curated/en/107521524554748507/pdf/125638-AR-PUBLIC-AirTransportAROFVsAPR.pdf

²⁸blogs.worldbank.org/ppps/ppp-laws-africa-confusing-or-clarifying



Maintenance Repair and Overhaul (MRO): Growing Local Capabilities and Building Regional Cooperation



Many see potential in Africa's growing maintenance, repair and overhaul (MRO) segment, which is still not fully developed - costing the continent millions of dollars in potential revenue. One of the main reasons is that Africa has a lot of carriers with small fleet sizes and no economies of scale to attract or develop a large-scale MRO industry. However, Airbus' latest Global Market Forecast predicts that passenger traffic to, from and within Africa will increase by 5.2% annually over the next 20 years. African carriers will need over 1000 aircraft and freight aircraft to meet the rising demand by 2036. The Nigerian government made a pitch to investors for single-aisle MRO services at this year's Farnborough Air Show. The repair of aircraft in Nigeria would save the country about \$1 billion annually.²⁹

Increasing local MRO capabilities cuts the cost of maintenance outside of the continent and opens a major job market for the local engineers and mechanics.

Ethiopian Airlines is making a leap in that direction through an expansion of its MRO operations from Addis Ababa to other parts of Africa. This leading aviation group is looking at establishing its MRO center in Malawi but also to cover West Africa via Lome, Accra or Lagos. Ethiopian's MRO center in Addis generated \$45 million in revenue during the 2016/17 financial year from third-party business, and it currently sustains 1,500 jobs.³⁰

²⁹ newtelegraphonline.com/2018/03/mro-africas-untapped-potential/

³⁰ www.thereporterethiopia.com/article/ethiopian-mro-branch-out-other-african-countries

The Future of Air Transport in Africa



SAATM is a huge opportunity for the 23 African governments that have signed it as well as the remaining countries expected to sign – an opportunity to grow connectivity, increase revenues, codeshare and build alliances between airlines to drive income into African economies. Those countries generate around 70% of the total air travel and are a powerful force capable of bringing long-awaited change. It's clear that governments need to shift their focus from protectionism to collaboration and from total ownership control to building partnerships with the private sector. Africa can certainly benefit from more private airlines and private concessions of airport infrastructure. Tourism has huge potential on the continent and its further growth is dependent on the full implementation of a visa-free regime for inter-African tourists and more intra-African travel options for international tourists.

The perception of poor safety remains the battle airlines and governments need to win. The reality is that Africa's safety record has been very good in the past two years, but there is very little messaging internationally to highlight and support that fact. Lingering perceptions of a poor safety record hurt all African airlines.

“AFRICAN AIR TRANSPORT MARKETS ARE TOO FRAGMENTED AND A TOP PRIORITY FOR POLICY MAKERS SHOULD BE TO ENSURE THE SINGLE AFRICAN AIR TRANSPORT MARKET BECOMES A REALITY SOONER RATHER THAN LATER. 54 MOSTLY SMALL AND LOW INCOME NATIONAL MARKETS CANNOT SUPPORT A THRIVING AIRLINE INDUSTRY. AIRLINES NEED SCALE TO GROW AND THAT REQUIRES MARKET ACCESS BEYOND NATIONAL BOUNDARIES.”

**Pierre Guislain,
Vice President for Private Sector,
Infrastructure and Industrialization,
African Development Bank**

Ethiopian Airlines Creates Opportunities

SUCCESS FACTORS

When Ethiopian Airlines was established in 1945, air transport in Africa looked very different. Ethiopian Airlines is not only a driver of the country's economic growth but also a symbol of what a fast-growing airline in Africa can be.

What made Ethiopian Airlines a champion and model for air transport in Africa was the early recognition that a sustainable, competitive operation is far more than just having a fleet and operating crew. As the airline grew, they realized the need and larger economic benefits of having their own MRO facility - training experts who would be able to serve the fleet timely and effectively and reduce operational costs. That created additional jobs and offered a long-term opportunity for STEM students to stay in their home country and build a career. In 2015, Ethiopian Airlines recorded profits of \$148 million which was more than all other African airlines combined.³¹

A CUTTING-EDGE AVIATION ACADEMY

Ethiopian's executives maintain a clear vision for creating and sustaining its own talent pool. They established a cutting-edge aviation academy back in 1964. Over 1,500 students from 49 different countries were trained there in 2015 and by 2020 that number is expected to triple. A new academy was inaugurated in 2016 from a total investment of \$100 million.

DRIVING TOURISM GROWTH

One of the major contributions of the airline was to the country's tourism sector. It flies to all key tourist destinations in the country and strongly supports the sector, which accounts for 2.7% of the country's total GDP.³² With its membership in Star Alliance, the airline secures additional passengers and cargo traffic through codeshare agreements and its transit hub in Addis Ababa.

In its Vision 2025, the airline set a goal of having the leading aviation group in Africa. The spirit of sustainability, human development and partnership are largely responsible for its success – establishing a corporate culture that seeks to avoid ineffectiveness and bureaucracy.³³

³¹ apex.aero/2016/02/19/ethiopian-airlines-rapid-growth-transform-home-country

³² www.wttc.org/-/media/files/reports/economic-impact-research/countries-2018/ethiopia2018.pdf

³³ www.ethiopianairlines.com/corporate/company/about-us/vision-mission



04

Agriculture

If Agricultural Transformation is Imperative to Africa's Future, so is Aerospace







Agriculture accounts for over 60% of all jobs on the continent but contributes only about 15 percent of its GDP.³⁴ Africa has 65% of the planet's uncultivated arable land yet the region still spends \$35 billion each year on food imports – a figure estimated to reach \$110 billion by 2025. The continent also loses up to \$42 billion annually to illegal, unregulated and unreported fishing carried out in its seas, which also threatens the maritime ecosystem.

There is a reason that modernization of agriculture is such a central feature of the African Union's Agenda 2063 and most major policy frameworks stemming from it. In terms of a single industry's potential impact on the daily lives of Africans, agriculture is perhaps the most consequential pillar of Africa's socio-economic and sustainable development. In the socio-economic context, modernizing African agriculture means: achieving food security, job creation and ultimately to contributing economic development of the continent. The vast potential of agriculture, forestry and fishing to achieve food security in Africa but also create wealth and jobs remains largely untapped according to the experts interviewed for this report.

Globally, the application of aerospace and other technologies to agriculture, sometimes referred to as precision farming, is increasing crop yields, reducing waste and changing agribusiness - ballooning into an industry unto itself estimated to be worth USD 10.23 billion by 2025.³⁵ The value of geo-intelligence services alone in Africa – across sectors - is projected to triple from \$40 million back in 2012 to \$150 million by 2020.³⁶

Space-based and aerial technologies such as remote sensing and the provision of geospatial data are a key feature of the precision farming revolution. In Africa, remote sensing satellites, unmanned aerial vehicles and mobile communications have a growing and multidimensional role to play by enabling farmers to produce more on the same land, manage inputs and costs more efficiently and monitor land and soil resources to safeguard them for future use.



³⁴ www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/Feed_Africa-Strategy-En.pdf

³⁵ www.grandviewresearch.com/press-release/global-precision-farming-market

³⁶ www.technoserve.org/files/downloads/case-study_eyes-in-the-sky-for-african-agriculture-water-resources-and-urban-planning.pdf

A new paradigm: empowering farmers to plan with data

According to agriculture industry experts interviewed for this report, the most important shift underway in African agriculture today is a movement away from subsistence farming to one of professionalization and commercialization – essentially, from agriculture to agribusiness.

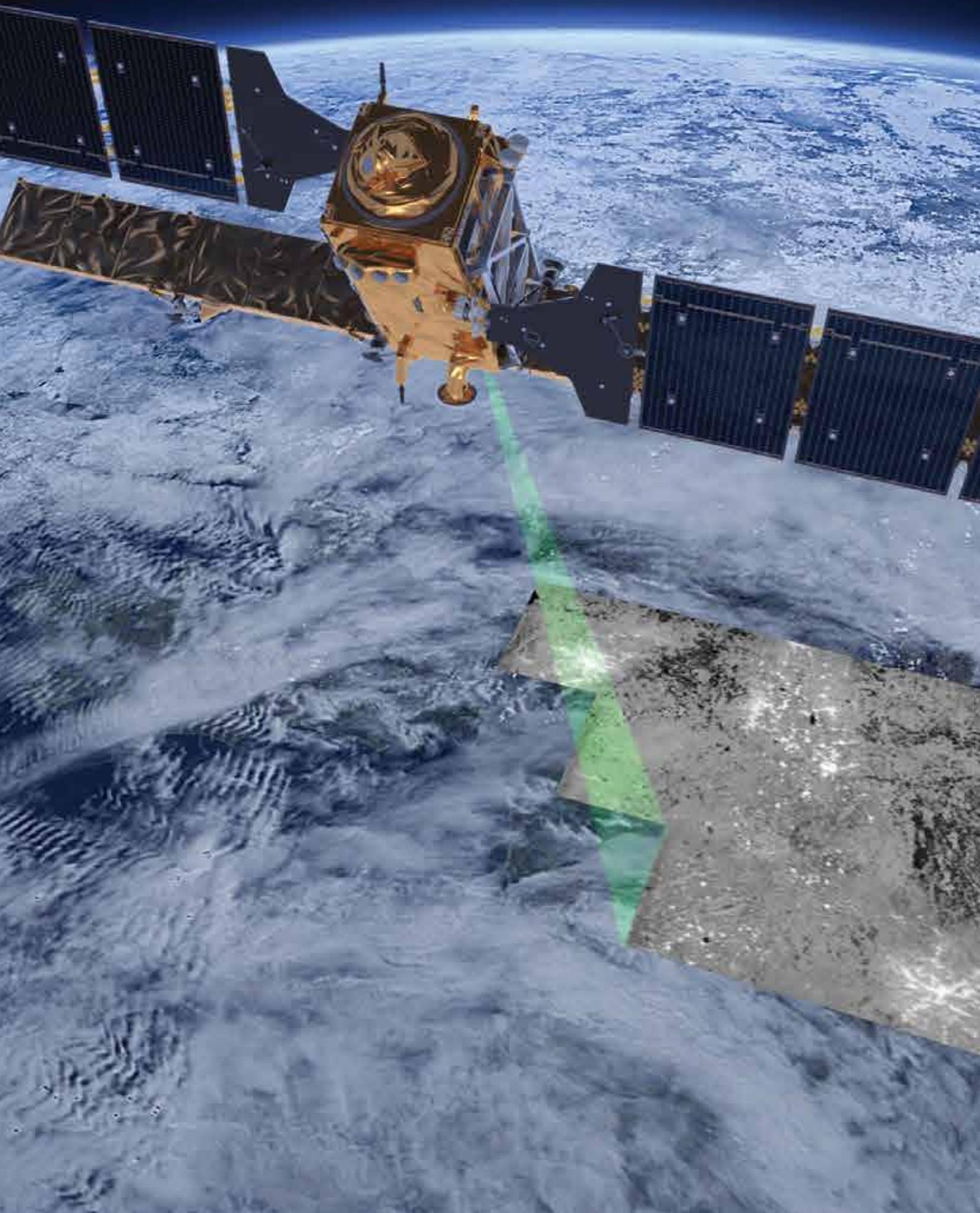


Aerial Industries

“NOW, WE ARE TALKING ABOUT A NEW PARADIGM IN AFRICAN AGRICULTURE AND THIS NEW PARADIGM IS THE USE OF SCIENCE, TECHNOLOGY, INNOVATION AND KNOWLEDGE AS WELL AS GOOD AGRICULTURAL PRACTICES TO ENSURE HIGHER PRODUCTIVITY IN TERMS OF LAND, LABOR, CAPITAL AND MANAGEMENT.”

**JONAS CHIANU,
CHIEF AGRICULTURAL ECONOMIST
(COORDINATOR, TECHNOLOGIES FOR AFRICAN AGRICULTURAL TRANSFORMATION),
AFRICAN DEVELOPMENT BANK**





Hardware and software developed by the aerospace industry – namely aerial images from remote sensing satellites, analytics software and unmanned aerial vehicles - play a crucial role in obtaining and analysing imagery to monitor and measure a vast number of biophysical parameters on the ground. Rainfall assessments can help farmers predict how much irrigation is needed in a place where water is a scarce and expensive resource. This imagery can be used to monitor crop development, determine how much farmers need to spend on pesticides by monitoring the spread of pests and crop diseases, monitoring soil conditions, and estimating agricultural output.

At the continental level, policymakers are aware of this and have launched numerous pilot projects and frameworks to address the absence of technology in agriculture. The AfDB's Technologies for African Agricultural Transformation (TAAT) initiative believes it will add 513 million tons of additional gross food production, which can reduce the need for imported food with crops and other commodities grown in Africa.

The growth of the fishing industry is also significantly inhibited by illegal, unreported and unregulated fishing (IUU). Many governments on the continent have limited technological capacity to tackle illegal, unreported and unregulated fishing leading to losses of up to \$42 billion annually across the continent.³⁷ The practice also endangers the entire marine ecosystem in addition to threatening the source of livelihood of more than 12 million people who depend on fishing across the continent. Aerospace technology through maritime surveillance can significantly improve the capacity of governments to tackle illegal IUU fishing

MARITIME SURVEILLANCE IN MOROCCO

Morocco is the 13th leading producer of fish globally and the first in Africa. Reducing fish stocks below biological sustainability is a major risk to the industry as is illegal, unreported and unregulated fishing – which can overexploit and degrade the resource irreparably.

In 2010, Morocco established a national plan to develop its fishing industry. The Plan Halieutis, as it is known, includes a component on marine vessels monitoring and surveillance by satellite imagery to tackle illegal, unreported and unregulated (IUU) fishing. From 2011 to 2013, the number of IUU fishing offenses detected through imagery rose from 284 to 641. From 2013 to 2015, due in large part to the deterrence effect of monitoring and surveillance that strengthened the enforcement mechanism, the number of offenses detected decreased from 641 to 404. The technology also helps to monitor pollution and protect the safety and security of the people and equipment involved in maritime fishing.

These protections and enhancements contributed to new interest from local and foreign investors in Morocco's fishing sector. Plan Halieutis led to a 10% annual increase of investments in value-addition activities for marine products from 2010, attaining \$40 million in 2015. The result was diversification of the marine fishing sector and development of related sectors such as refrigeration, conservation, preservation, oils and animal feeds. The fishing sector in Morocco grew by 7.7% annually, from an \$848 million industry in 2007 to a \$1.5 billion industry in 2016. The plan's implementation is estimated to have created 1,300 jobs onshore and 1,740 jobs offshore. Today, fishing and aquaculture accounts for an estimated 2.5% of Morocco's GDP.

³⁷ www.uneca.org/sites/default/files/PublicationFiles/blueeco-policy-handbook_en.pdf
https://www.researchgate.net/publication/313529780_Economic_Social_and_Environmental_Impacts_of_IUU_Fishing_in_Africa_Action_Plan_Advocacy_Paper

³⁸ www.rvo.nl/sites/default/files/2018/06/Aquaculture-Business-Opportunities-Morocco.pdf

Closing the Knowledge Gap and Reducing Barriers to Data-driven Farming

Interview data suggests that in Africa, planning without modern farm technology let alone data is still largely the norm in agriculture.

FIGURE 6: Low Mechanization Levels in Farms Across Africa



Data: Food and Agriculture Organization Corporate Statistical Database

With a growing middle class more big commercial farms are expected to come online in some African countries.³⁹ Those farms are more likely to utilize precision farming technologies to manage inputs and attract investors. But other experts we spoke to pointed out that the overwhelming majority of farms in Africa are not large commercial farms. Most of Africa's agricultural output, about 70%, comes from smallholder, and farmers who face higher cost and knowledge barriers to adopting and utilizing satellite and drone imagery. Though a number of high-level international partnerships are beginning to change this, the cost of acquiring, analysing and implementing advanced satellite data for smallholder farms remains relatively high. It is a completely different skill set from the one that has been used for generations.

The central challenge for the highly fragmented African agricultural ecosystem is therefore one of access to the satellite data and analysis that can really support farmers on the ground. So in this context, the question and challenge is less about whether space-based and aerial technologies can help the agricultural sector. The question is how exactly these tools can be put in the hands of most farmers.

At the highest levels of government, steps are being taken to increase access to satellite data for farmers – chiefly by reducing or completely eliminating costs. In June of 2018, the African Union signed a deal with the European Commission's Copernicus Programme - one of the world's largest providers of satellite imagery - to provide open access to weather, soil and climate change data. This move has been hailed as a major step forward for the 500 million smallholder farmers that produce the vast majority of the continent's food. Government and development assistance programs will serve a critical role in the collection, analysis, interpretation and application of that data to enable farmers to realize the benefits of this agreement.

Experts we spoke to pointed to the diverse applications of commercial drones as a powerful means for closing the technology and knowledge gap and putting more than data in the hands of farmers. Delivering and applying agrochemicals and fertilizers via drones can sidestep the physical infrastructure gaps that exists in many of the rural regions that stand to benefit most from agricultural modernization.⁴⁰

Additionally, the higher resolution imagery provided by drones, below cloud cover, will be critical for monitoring and delivering critical information about crop disease, which freely crosses borders and can wipe out an entire harvest. While drone imagery cannot cover nearly the physical area that satellite images can, it may still present a feasible alternative for individual farms interested in adopting the aerospace technology. Connectivity between farmers – even by basic mobile telecommunications and data – was commonly cited as a powerful force in the wider agricultural transformation effort, particularly when it comes to the persistent challenge of duality in African agriculture – when food or commodity surpluses from one country or region aren't bought or consumed in another location where there is a greater need or demand for them.

NIGERIA ACCOUNTS FOR ABOUT HALF OF ALL AFRICAN FOOD IMPORTS. NIGERIA-BASED AERIAL INDUSTRIES, WHICH IS SUPPORTED BY THE AEROSPACE INCUBATOR AIRBUS BIZLAB, IS USING DRONE-BASED TECHNOLOGY NOT ONLY TO ENHANCE FOOD PRODUCTION BUT TO MITIGATE THE HEALTH EFFECTS ASSOCIATED WITH FARMING. DESPITE BEING THE WORLD'S LARGEST PRODUCER OF CASSAVA, A STAPLE FOOD IN THE COUNTRY, NIGERIA'S AVERAGE ANNUAL YIELD OF THE CROP IS ABOUT 14 METRIC TONS PER HECTARE – AGAINST AN ESTIMATED POTENTIAL YIELD OF 40 METRIC TONS PER HECTARE, UNDERSCORING THE OPPORTUNITY FOR FAR GREATER PRODUCTIVITY.⁴¹ INTENSIVE FARMING PRACTICES HAVE WORSENED THE PROBLEM OF LAND DEGRADATION. CHRONIC UNDERDEVELOPMENT HAS STALLED AGRICULTURAL PRODUCTION AND FOOD INSECURITY IS ON THE RISE.

AERIAL INDUSTRIES CONDUCTED DEMONSTRATION FLIGHTS OF ITS UNMANNED AGRICULTURAL DRONES FROM 2016 TO 2017 IN 7 SMALL-SCALE FARMS IN NIGERIA. AMONG THE 7 WAS A CASSAVA FARMER IN THE OGUNPA AREA, IBADAN. THE PROJECT WAS ABLE TO IMPROVE CROP YIELDS BY 7%. OVEREXPOSURE TO TOXIC AGROCHEMICALS, WHICH ARE LINKED TO RESPIRATORY PROBLEMS AND SKIN CONDITIONS, IS ALSO COMMON AND THE COMPANY HOPES TO COMPLETELY ELIMINATE FARMERS' CONTACT WITH THOSE CHEMICALS AS THEIR COMPANY GROWS.

³⁹ G. Wells, Ag. COO Ag Aviation, during interview for the White Paper.

⁴⁰ White paper interviews

⁴¹ www.fao.org/nigeria/fao-in-nigeria/nigeria-at-a-glance/en/

A young man with short dark hair, wearing a red, blue, and white plaid shirt over a dark t-shirt, is smiling broadly. He is standing in a greenhouse, with rows of green plants visible in the foreground and the curved structure of the greenhouse in the background. He is holding a white tablet computer in his left hand. A semi-transparent white box is overlaid on the image, containing the text.

Growing and
Engaging a New
Generation of Farmers

The average age of a farmer in Africa is about 60 years old, while the majority of the continent is under the age of 24.⁴² Rapid urbanization in Africa is driven in part by young people moving from less educated rural areas to cities. This is rapidly depleting the African agricultural labor pool. The AfDB's flagship Africa Economic Outlook report, estimated that 22 percent Africa's working age population are starting businesses – the highest portion of entrepreneurs of any region globally. In sub-Saharan Africa, the region with arguably the most to gain from modernizing agriculture, small- and medium-sized enterprises (SMEs) with less than 20 employees and under five years of working experience are the largest providers of formal sector jobs.

The term “agripreneurs” came up more than once in reference to modernizing and drawing meaningful investment to agriculture in Africa. There are key demographic and economic realities in Africa that open the door for entrepreneurs linked to the aerospace sector to play an important if not necessary role in agricultural transformation – bridging a crucial legacy sector with the skills and opportunities of the future.

ALLOYSIUS ATTAH IS THE CEO AND CO-FOUNDER OF GHANA-BASED FARMERLINE. A SELF-TAUGHT PROGRAMMER, ATTAH AND HIS TEAM FORMED THE COMPANY TO “TRANSFORM SMALLHOLDER FARMERS INTO SUCCESSFUL ENTREPRENEURS BY INCREASING THEIR ACCESS TO INFORMATION, INPUTS, AND RESOURCES TO INCREASE PRODUCTIVITY.” FARMERLINE, WHICH IS JUST SIX YEARS OLD, EMPOWERS OVER 200,000 FARMERS THROUGH INNOVATIVE MOBILE PLATFORMS AND SERVICES.

THE THEME OF CONNECTIVITY, COMMUNICATION, AND SHARED DATA AMONG FARMERS IS THE DRIVING FORCE BEHIND THEIR GROWING BUSINESS. ONE PRODUCT, COCOALINK, PROVIDES CLOUD-BASED COMMUNICATIONS CHANNELS, SURVEY DATA, AND ANALYSIS TO MORE THAN 12,000 COCOA FARMERS IN 12 DISTRICTS ACROSS GHANA. THE FREE APP IS CREDITED WITH RAPIDLY SPREADING DATA-DRIVEN BEST PRACTICES AND HELPING FARMERS CAPTURE MORE VALUE FROM THEIR CROPS BY PRODUCING HIGH QUALITY, SUSTAINABLY-GROWN RAW COCOA.

At their core, entrepreneurs are problem solvers. While companies like Farmerline have turned their skills and attention to the many challenges and opportunities facing African agriculture, it is impossible to understate the urgency with which interviewees believe the public and private sectors must continue to encourage and support entrepreneurship in Africa more broadly. In our interviews, entrepreneurial ecosystems – that convene universities, the private sector, and entrepreneurs - were commonly cited as a critical and competitive necessity not only for the purposes of workforce development but in attracting capital. The popularity and proliferation of accelerators, incubators and other programs supporting entrepreneurship in Africa is likely to be a driving force behind any growth in its aerospace industry and, by extension, modern agriculture.

Like agriculture, the delivery of health care and aid is another area of urgent need where African entrepreneurs are beginning to apply their problem-solving skills, powered in part by aerospace technologies.

⁴² www.un.org/en/ecosoc/integration/pdf/foodandagricultureorganization.pdf#page=3

05

Healthcare & Humanitarian Assistance

Lack of Connectivity
Hinders Healthcare
Delivery







Lack of Connectivity
Hinders Healthcare
Delivery



Access is one of the challenges to healthcare services in Africa, particularly for rural communities which face hurdles accessing medical supplies, primary and preventative care. Vast rural areas combined with a limited transportation system make delivery of healthcare quite challenging. Nowhere are the challenges more acute than in the delivery of emergency medical services (EMS), where the stakes are high and receiving primary health care can be the difference between life and death.

“THE CURRENT STATUS OF EMS IN MOST COUNTRIES IN AFRICA IS VERY POOR, ALMOST NON-EXISTENT OUTSIDE THE MAJOR CITIES. THE KEY CHALLENGE IS THE COST OF THE SERVICES AND LACK OF GOVERNMENT INVESTMENT. EMS IS THEREFORE DEPENDENT ON THE PRIVATE SECTOR. HOWEVER, 70-80% OF THE AFRICAN POPULATIONS LIVE IN THE RURAL AREAS AND DO NOT HAVE THE FINANCIAL MEANS TO PAY FOR PRIVATE EMS SERVICES. THERE IS A VERY HIGH DEMAND FOR QUALITY EMERGENCY SERVICES, AND THIS MAY DRIVE OPPORTUNITIES, BUT WITH THE LACK OF FUNDING IT IS DIFFICULT TO HAVE A SUSTAINABLE MODEL THAT WILL WORK FOR THE MASSES.”

**DR. BETTINA VADERA,
CHIEF EXECUTIVE OFFICER AND MEDICAL DIRECTOR,
AMREF FLYING DOCTORS**

It could take hours or even days to reach the closest village or city. Where regional health care centers exist, the lack of connectivity by public transportation or road places an undue burden on health workers who need essential medical supplies and must spend time trying to secure them in addition to practicing medicine and caregiving.

A 2017 survey published in the Cambridge medical journal Prehospital and Disaster Medicine found no evidence of EMS systems in 33 African countries.⁴³ Government subsidies for curative healthcare in Africa are not properly targeted to rural areas and instead tend to favour urban areas.

⁴³www.cambridge.org/core/journals/prehospital-and-disaster-medicine/article/state-of-emergency-medical-services-ems-systems-in-africa/90C79371E0A0C62DE1CB1B729E8F93DB



Continuing a Tradition
of Building on What
Works



The aerospace industry stepped in to play a key role in supporting aid and health care delivery in Africa. Regional aircraft and helicopters that do not require complex landing infrastructure have been operated in Africa by organizations like Flying Doctors for many years, providing air ambulance, disaster evacuation, and medical supply delivery services.

Over time, air ambulances in Africa evolved to include sophisticated on-board medical treatment equipment and trained medical staff. They remain one of the most efficient modes of EMS transportation and delivery. In sub-Saharan Africa, air transport by means of regional aircraft is currently offered by 12 service providers in limited geographical areas in South Africa, Namibia, Botswana, Zimbabwe, Angola, Tanzania, Zambia, Kenya, and Gabon. Though their prevalence is more limited than fixed-wing aircraft, helicopter services have also been used as air ambulances by the Red Cross and Flying Doctors, primarily in East Africa.

Limited funding for regional or local centers creates gaps in many healthcare systems. With the high need for health services in these areas, governments and non-governmental organization (NGOs) are in search of new and sustainable models for healthcare delivery.



Drones Rush in to
Fill an Urgent Need

According to healthcare and aid experts interviewed for this report, aerospace technology adoption has been gaining momentum in Africa's health care community – and the impact has proved significant. Through partnerships with private UAV operators, several African countries have become early adopters of this commercial aerospace technology in health care, which has had the effect of sidestepping some of the connectivity challenges posed by the natural and infrastructure environments.

Medical groups, humanitarian aid organizations, and national governments now see UAV technology as a viable and more affordable solution and are beginning to implement programs and explore applications for improving healthcare in Africa.

“AEROSPACE TECHNOLOGIES WILL STRENGTHEN HUMANITARIAN EFFORTS THROUGH DECREASING RESPONSE TIMES CONCERNING THE DELIVERY OF URGENT AID ITEMS, BLOOD, TRANSFUSION, RELIEF ITEMS AND OTHER RESPONSES. MEDICAL EQUIPMENT CAN BE TRANSPORTED ACROSS THE COUNTRY TO AREAS HARD TO REACH OR STRANDED COMMUNITIES DURING FLOODS, AND OTHER EMERGENCIES AS WELL AS THROUGH ALLOWING FOR AN EARLY WARNING MECHANISM TO BE STRENGTHENED.”

**DR. ABBAS GULLET,
SECRETARY GENERAL,
KENYA RED CROSS**

Rwanda made global headlines in 2017 when it became home to the world's first commercial drone service after a San Francisco-based tech company, Zipline, launched blood delivery to about half of Rwanda's remote health centers. Costing around the same as the motorbike delivery alternative, a journey of a few hours now takes between 20-30 minutes. Orders are made by existing mobile communications devices and chat apps.

These results in turn encouraged the country's government to become one of the first adopters of performance-based regulations for drones, paving the path for the creation of UAV regulations in Africa and possibly contributing to the development of UAV regulations elsewhere around the globe.

Since launching operations in 2016, Zipline has delivered more than 7,000 units of blood on 4,000 flights - a third of which have been in an emergency, life-saving situations. Zipline also plans to expand its operations in Africa. The company aims to launch services in Tanzania, where the government intends to use the technology to make 2,000 deliveries of blood and other medical supplies per day – serving 10 million people through over 1,000 medical facilities.

Today the Red Cross, UNICEF, AMREF and Health Africa have also adopted UAV technology to improve healthcare and aid delivery in rural Africa. In 2017, the Government of Malawi and UNICEF opened the doors of Africa's first humanitarian drone testing corridor. It stands as one of the most significant and promising cross-sector initiatives focused solely on the experimentation and application of UAV technology for good. The corridor will convene universities, NGOs and the private sector.

A Regulatory Environment Struggling to Keep Pace with Innovation

A 2018 survey conducted by the publication TechCabal looked at UAV start-ups in Africa. It focused on the diverse civil and commercial applications of a group of African drone entrepreneurs. Nearly 15% of those applications are in the health sector, and this number is expected to register significant growth subject to developing clearer regulations on the use of commercial UAVs. With around 30% of those applications being classified as “other”, it’s safe to say we are in the early stages of seeing what UAV technology will do for Africa.

FIGURE 7: Drone Start-Up Applications By Sector In Africa ⁴⁴

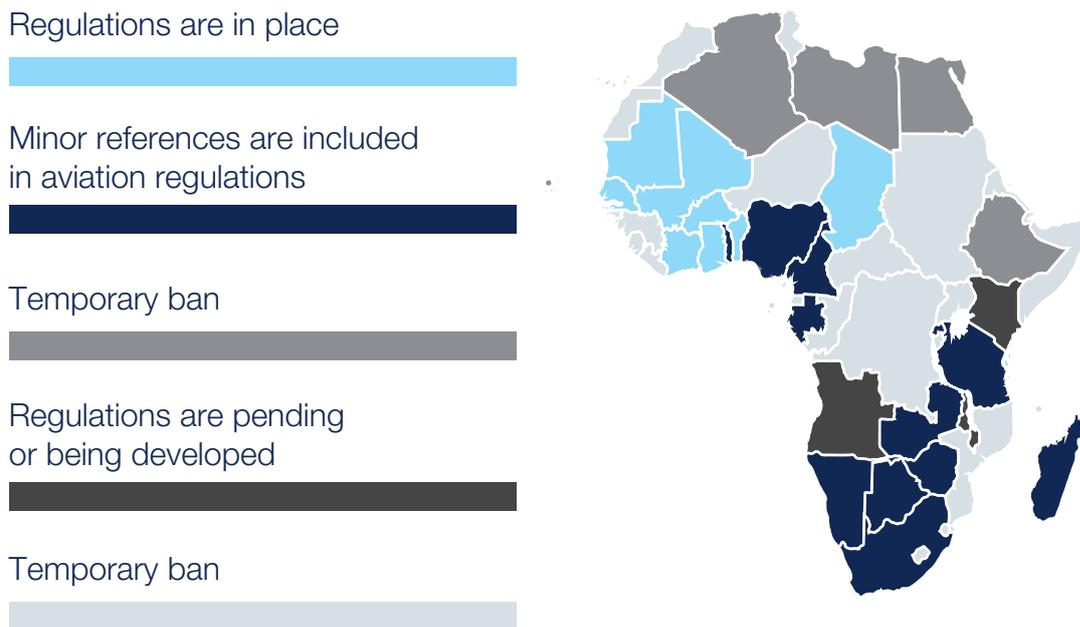


Showing the sectors of 21 drone startups we researched

Development and health care experts interviewed for this report saw the lack of clear regulations or cumbersome rules currently on the books as the main threat to unlocking the commercial and social potential of UAV technology in Africa. The number of African countries with UAV regulations in place or in process is improving, but at a slow pace. Only 28% of all countries on the continent have published dedicated drone regulations.

⁴⁴techcabal.com/2018/07/09/a-snapshot-of-the-different-sectors-drone-tech-is-transforming-in-africa/

FIGURE 8 : Status of UAV Regulations in Africa ⁴⁵



The process of acquiring a commercial drone license remains cumbersome and inconsistent across several African countries. Often, the operator must get approval from multiple authorities and penalties can be harsh. In Nigeria, the applicant must have a registered company with a minimum of \$100,000 in capital, and the application itself costs around \$4,000.

Despite commercial drones being operational for at least 5-7 years, countries like Kenya and Tanzania took time to issue regulations for drone operations due to the perceived security risks. Regulations in Kenya and Tanzania finally came out in 2017, but their implementation is still evolving in real time.

The Kenya Red Cross was one of the first aid organizations globally to engage with its government and pursue a license to become a preferred humanitarian agency for operating UAV technology. However, they have only been given a temporary license for use on a case-by-case basis – hindering their ability to plan and deliver care in the long-term.

In June 2018, new regulations for the use of UAVs in Kenya failed to secure parliamentary ratification due to safety and privacy concerns. In Tanzania, operators have to get express authority from the Tanzania Civil Aviation Authority (TCAA) to bring UAVs into the country.

⁴⁵rpas-regulations.com/wp-content/uploads/2018/06/African-Union_Drone-Report_Transforming-Africas-Agriculture_EN_180608.pdf



Nonetheless, the momentum and possibilities of UAV technology for healthcare and humanitarian assistance applications in Africa is seen as a positive sign of what will come. In 2017, for example, Ghana removed a ban on UAVs and in doing so became the second African country after Rwanda to deliver blood and essential medicines to inaccessible rural areas.

Enter UAVs – an emerging aerospace technology that offers complementary, lower-cost capabilities to regional planes and helicopters. UAVs, as an emerging aerospace technology, may be following a similar development path in the delivery of health care. UAVs have found a natural place in African development because of their utility. Drone start-ups don't need nearly the capital an upstart airline or even air ambulance service requires. While the industrial and economic impact of a commercial drone ecosystem may not employ as many people, the technology will nonetheless require a wide range of skills and professional services that may eventually constitute an ecosystem – from professional drone pilots, training centers, and opportunities to develop monitoring and analytics software that drones can deploy to create knowledge and address local needs.

In conclusion, aerospace technologies have a deep history and bright future for the delivery of healthcare services and humanitarian assistance in Africa. The path forward, in the near term, is likely to be about making both worth. One does not exclude the other and viable models are largely a function of the specific challenges and regulatory environment of a specific community or country. The air ambulance and UAV industries still remain relatively small.

COULD AUTONOMOUS AIRSHIPS REVOLUTIONIZE AID DELIVERY IN AFRICA?

THE AIR TRANSPORT SEGMENT OF THE WIDER AEROSPACE INDUSTRY NOT ONLY INCLUDES THE TRANSPORTATION OF PEOPLE, BUT OF COMMERCIAL AND AID CARGO. ONE BILLION PEOPLE LIVE IN PLACES WITHOUT ACCESS TO ROADS, RAILWAYS OR AIRSTRIPS, SAYS SOUTH AFRICAN ENTREPRENEUR SPENCER HORNE. BUT HE BELIEVES HE HAS A SOLUTION TO THIS PROBLEM: TO DELIVER ANY KIND OF CARGO TO THESE LOCATIONS WITH A NETWORK OF LIGHTER-THAN-AIR DRONES. HIS FOCUS LIES ON A VERY SPECIAL KIND OF AIRSHIP.

WHEREAS CURRENT DRONES CAN CARRY ONE OR TWO KILOGRAMS, HORNE WANTS TO BUILD AUTONOMOUS AIRSHIPS CAPABLE OF CARRYING MORE THAN 250 KILOS AND TRAVELLING UP TO 400 KILOMETERS.

HORNE HAS STARTED A NEW COMPANY CALLED CLOUDLINE TO DELIVER GOODS AND INTERNATIONAL AID TO THE MOST REMOTE PARTS OF AFRICA. AND THE IDEA COULD ALSO SPREAD TO OTHER PARTS OF THE WORLD IN WHICH STANDARD TRANSPORT INFRASTRUCTURE DOESN'T WORK, INCLUDING ISLAND NATIONS AND DISASTER AREAS.

THIS MAKES THINGS ESPECIALLY CRITICAL FOR HUMANITARIAN AID. "IT COSTS AROUND 10,000 DOLLARS TO DELIVER JUST 200 DOLLARS WORTH OF FOOD TO SOUTH SUDAN USING AIRLIFT. I THINK WE CAN DIVIDE THAT BY 10 USING THE TYPE OF AIRSHIPS WE WANT TO DEVELOP, BECAUSE WE DON'T NEED MOST OF THE INFRASTRUCTURE AND GROUND CONTROL," SAYS HORNE. "THERE WOULD ALSO BE NO POLLUTING FUELS INVOLVED." THE COMPANY HOPES TO EVENTUALLY WORK WITH THE UN WORLD FOOD PROGRAMME.



Conclusion and Recommendations

Aerospace offers solutions and applications to solve or begin to solve many of the socio-economic challenges Africa is grappling with on the path to sustainable development. A shift in thinking about the sector as an isolated industry to a great enabler of socio-economic transformation - is necessary to realize its vast benefits for a prosperous and sustainable future.

From the numerous testimonials of how aerospace technologies are being applied to power social and economic transformation - in government, manufacturing, civil aviation, agriculture and healthcare - emerged a set of common, cross-sector values that are instructive for the future. These themes form a broad framework of solutions that are capable of unlocking the potential of the aerospace sector not solely for the industry's benefit, but for that of Africans as they chart the course to 2063. We distilled these themes into three more general recommendations, which apply to public and private stakeholders across the aerospace industry.

COMPETE BY INVESTING IN PEOPLE

Education and entrepreneurship are, respectively, the most challenging and promising elements of the emerging African aerospace ecosystem. If roads, bridges and airports are the physical infrastructure that aerospace or any industry demands, education, and entrepreneurship form the intellectual infrastructure. In Africa, we observed not only a great deal of enthusiasm around building these skills but a great deal of action. New forms of training and incubation of entrepreneurs are flowing in to fill a shortfall in formal STEM education. Accelerating and growing investment in Africa's human capital is the best path to achieving its demographic dividend. It emerged as a critical necessity and prominent feature of every sector we examined. Aerospace is demanding new skills even in the most advanced markets.

COLLABORATE AND CROSS BORDERS TO FORGE PARTNERSHIPS

Partnerships – between sectors, companies, and countries – are a powerful antidote to the fragmented economic development that has characterized and challenged much of African aerospace’s growth in years past. Those firms, countries, and leaders who have found success, in almost every case, did so with support both from within and outside of the continent. The collective economic power of thinking and acting regionally – among countries, companies and people – was hard to miss in our interviews. Cooperation will be the ingredient that decides whether grand policy frameworks like Agenda 2063 or the African Union’s Space Strategy become real. Their success relies on integration. African countries, in aerospace or any sector, have more to gain by growing the overall size of the GDP pie than attempting to capture a larger slice of what’s currently there. Regionalization to break down protectionism is a powerful antidote to many of the economic and social fragmentation woes that have held back social and economic development.

In air transport, the battle to open Africa’s skies relies heavily on, if not solely, on a collective outlook for unlocking the sector’s massive social and economic impact in the long-term. The push to license pilots across borders and retain aviation talent is a powerful example of this. In agriculture, sharing information across borders is not only a way to enhance productivity but to reduce costs and mitigate jointly against natural disasters and climate change. In manufacturing, the joint ventures and public-private partnerships between countries and companies will ensure that more African nations share in the wealth and value generated by those African countries that already enjoy a place in the global aerospace supply chain.

DON’T CHASE FINANCING. MAKE IT COME TO YOU.

There is no silver bullet for making a given market, start-up or project attractive to foreign or African investors – public or private. It is a long-term, systemic endeavor requiring buy-in and participation from an increasingly diverse field of stakeholders. However, access to financing was an unavoidable and sobering barrier to scaling many of the promising, game-changing applications and initiatives we encountered in this report. Frustrations were particularly noticeable on the issue of aircraft financing. The long-term benefits of implementing frameworks like SAATM will take time, but there are other policy mechanisms that interviewees thought deserved attention – like the Cape Town Convention and Protocol. Incremental wins like this require vigilance and must happen concurrently with the wider development of the aerospace sector. Interest from investors is, in a sense, a measure of a country’s or company’s success in developing a long-term sustainable vision and value proposition.

These three big-picture recommendations work together or not at all. The ultimate burden of their implementation is a shared one – with responsibility spread evenly among industry, government, and the development community. While many of them are well-known, it is our hope that their prevalence in the discussions detailed in this report will reinforce for value and relevance in the wider mission of unlocking all that aerospace can offer.

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