

AVIATION TURKEY

**WILL 5G
TECHNOLOGY
INCREASE
AIRPLANE
ACCIDENTS?**

**ON TOP OF THE
WORLD
DUBAI EXPO2020
WITH EMIRATES
AIRLINES**

**TURKSAT 5B
COMMUNICATIONS
SATELLITE
LAUNCHED WITH
FALCON 9 ROCKET!**

**BOEING'S
COMMERCIAL
MARKET
OUTLOOK REPORT**



BEYOND THE HORIZON

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TURKEY

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Aviation and Travel Industry Into the Metaverse and Beyond...

Recently, as the metaverse concept dominates world agenda, the companies are positioning themselves into this new world.

What is the metaverse and what does it mean for this industry?

The metaverse is a concept of a persistent, online, 3D universe that combines multiple different virtual spaces where people can interact with digital objects and digital representations of themselves and others.

Besides supporting social media, 2022 will see consumer trends and business opportunities emerge as the metaverse takes shape. In the near and medium-term it seems that metaverse will have any impact on traveling. It covers new opportunities for the air transport industry to keep.

For travel industry, the biggest potential of such an immersive world is to help people visualise their upcoming trips. Virtual reality (VR) and augmented reality (AR) technologies could be powerful tools to create Digital-twin destinations. Business travellers are reportedly already using the Metaverse and see a destination even before travelling to it. Therefore for aviation companies there would be digital twin replicas of the aeroplanes that you can experience first hand. This same could work for hotels, and places in the same way.

Lately Boeing announced that it will take a dive into the Metaverse and plan to build its next aircraft in the metaverse. The company's factory is working with immersive 3-D engineering designs with robots and more. Boeing is working

on an ambitious new project wherein the company is trying to bring together design, production, and airline services under a single digital ecosystem. The company says it will put in place in the next two years.

On the other hand, Airbus too has pledged to invent new production systems and leverage the power of data in order to optimise its industrial system. Both these aircraft companies, the biggest in the world, are embarking in the digital revolution that the world is going towards.

KLM Royal Dutch Airlines, launched a trial of a 3D virtual space, called Glue, where remote participants using VR can collaborate using features like whiteboards, sharing videos, web pages, and presentations as they



would in the physical world.

Latvian airline airBaltic became the world's first airline to issue non-fungible tokens (NFTs) in the metaverse. The airline issued limited collector NFTs, showcasing an



individual Airbus A220-300 with its registration as well as a piece of art of Kuldīga, one of the most beloved Latvian cities. Following the first edition airBaltic has issued four more digital art pieces honouring beloved Latvian cities Cēsis, Alūksne, Liepāja,

Bauska and Sigulda. 55 NFTs of the first historic release can still be purchased, but the NFTs from following four editions are sold out.

The shared digital space is using virtual reality, and the aviation sector, or the travel sector are

not too far away from getting an action of this augmented reality.

The metaverse in its full potential is a long way away, but there are clearly some opportunities that could be utilised in the near-term for remote workers,

cabin training, aircraft maintenance, design and airport operations.

Enjoy the issue...

Ayşe Akalın
Editor in Chief

Boeing's Commercial Market OUTLOOK REPORT



by Ayşe Akalın

Forecast of Aviation Market for Next 20 Years & Activities in Turkey

Boeing has had a strong, long-standing partnership with Turkey for more than 70 years. It supports both airline operators with commercial jets and the government with defense platforms. Boeing Turkey General Manager and Country Representative Ayşem Sargin and Boeing Commercial Airplanes Turkey Marketing Director Keith Nida held a press conference to inform 'Commercial Market Outlook' report focused on current situation and forecast of aviation market for next 20 years and Boeing activities in Turkey

Aviation sector showing signs of recovery and resilience

While health and regulatory dynamics will continue to shape the near-term Boeing's analysis of market dynamics shows that commercial airplanes and services are showing signs of recovery and resilience. Availability and distribution of COVID-19 vaccines will continue to be critical factors in recovery of passenger air travel. Countries with more widespread vaccination distribution have shown rapid air travel recovery,

Multi-Speed Recovery Assumptions Largely Unchanged From CMO 2020



Domestic markets lead

LCCs recover fastest

Single-aisle resilience

Hubs support long-haul recovery

2023-2024 return to 2019 traffic

as governments ease domestic restrictions and open borders to international travel.

Keith Nida, Boeing Commercial Airplanes Turkey Marketing Director gave a briefing about Current Market Outlook report. He mentioned that demand for domestic air travel is leading the

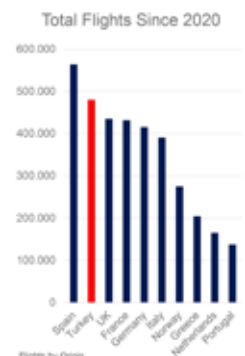
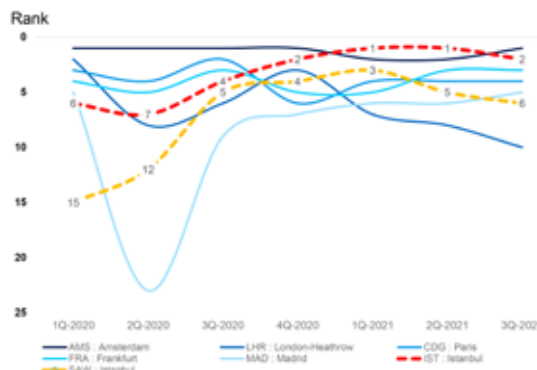
recovery, with intra-regional markets expected to follow as health and travel restrictions ease, followed by long-haul travel's return to pre-pandemic levels by 2023 to 2024.

According to the Boeing Commercial Market Outlook, more than 700 older aircraft in Europe's

fleet will retire in near term. Fleet renewal provides significant cost savings (3.1B usd/year), fuel savings (1,7B usd / year) and environmental benefits (CO2 reduction 6,5M tonnes per year).

Keith Nida stated that Turkish airports have become the busiest in Europe during pandemic.

Turkish Airports Have Become the Busiest in Europe During Pandemic



Delivering Sustainable European Growth, 90% Fleet Renewal by 2040

Historically, short-haul travel has been stimulated through improved offerings such as new direct routings and lower fares via low-cost carriers. That trend is expected to continue, particularly within emerging markets, where large shares of the population have not flown before. In the forecast, travel within regions accounts for more than half of industry total growth requirements, with intra-China travel alone accounting for 17% of new capacity produced by the industry.

8,700 new aircraft will be needed between 2021 and 2040 in Europe. This is 20 percent of global demand. European network airlines leverage single-aisle versatility serves range of market needs.

Long term, market fundamentals and resilience drive demand through 2040 for more than 43,500 new airplanes valued at \$7.2 trillion. Boeing forecasts the global commercial fleet will surpass 49,000 airplanes by 2040. China, Europe, North America and other Asia-Pacific countries each account for about 20% of new airplane deliveries, with the remaining 20% going to other emerging markets.

The Boeing CMO 2021 freighter fleet forecast incorporates near-term

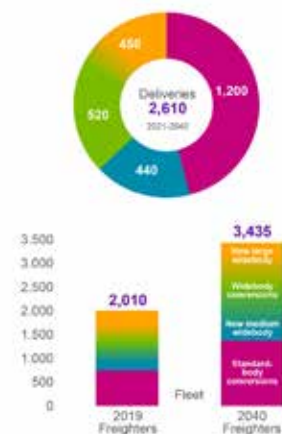


cyclical disruptions and long-term structural impacts we anticipate will impact air cargo markets. This assumes the current dynamics of constrained widebody passenger belly capacity will dissipate into the long term, and air cargo will then reflect market dynamics closer to those seen in the years prior to the COVID-19 pandemic. 20-year traffic growth (2021-2040) is forecast to be 4.6%, reflecting

low base year effects due to the pandemic-induced traffic reduction estimated at 9% in 2020. The 21-year traffic growth, using 2019 as a baseline, remains at our previous growth forecast of 4.0% (2020-2039). In 2040, the world's freighter fleet will grow from ~2,000 units in 2019 to ~3,400 units, an increase of 70% over the pre-pandemic fleet. This long-term fleet growth will be powered by GDP growth,

industrial production and replacement demand. Near-term air cargo market demand has been boosted by increased e-commerce, supply chain disruptions, severe maritime interruptions, economic recovery and the previously mentioned widebody passenger capacity loss. This boost is reflected in total air freighter unit demand that sees somewhat higher demand in the first decade of the forecast.

Freighter Fleet to Grow by 70% by 2040



Boeing presence in Turkey focuses on strong and long-standing partnership

Ayşem Sargin, Boeing Turkey General Manager and Country Representative enlightened the press about Boeing activities and strategies in Turkey focused on industrial, technological partnerships along with commercial aircraft marketing.

In 2017, Boeing and Turkey launched the National Aerospace Initiative (NAI), a strategic partnership that contributes to both the growth of Boeing in Turkey and the growth and competitiveness of Turkey's aerospace sector, in conjunction with targets set by Turkey's Vision 2023. NAI focuses on four key pillars of collaboration: Industrial Development, Technology Acceleration, Services Collaboration and Advanced Skilling.

NAI aims to support industrial capability development, broaden supply base and improve bid win rate among Boeing suppliers in Turkey. The Supplier Development Program (SDP) is a key NAI component, which includes industrial training, assessment, mentoring and development



activities. This program envisions a greater share for the Turkish aerospace industry in Boeing's global aerospace supply chain.

In the last 10 years, purchases from Turkey have reached 2 billion dollars. Boeing makes purchases of 200 million

dollars annually from suppliers in Turkey. It works with more than 20 suppliers in Turkey. 4 companies became a Boeing approved supplier last year.

TUSAŞ and Kale Aero are among Boeing's major suppliers of structural parts in commercial

aviation programs and have been taking part in all Boeing commercial aircraft programs since 1997. TCI and TSI are also Boeing's major supplier of cabin interior products, and Boeing is partnering with these two companies to reach markets outside of Turkey.

IN-COUNTRY FLEETS AND SERVICES

Commercial



294 Boeing aircraft in operation among four Turkish carriers

Turkish Airlines and SunExpress:
112 aircraft on order (737 MAX, 787, 777F)
Turkish Aerospace: Key supplier (787, 737, 737 MAX, 777, 777X, 767)
KALE Aero: Key supplier (737, 747-8, 767, 777, 777X)
Turkish Cabin Interiors: Galley producer
Turkish Seat Industries: Seat producer

Defense



11 CH-47F Chinooks
4 AEW&C Peace Eagles
49 F-4 Phantoms
7 KC-135 tankers

Services



THY Flight Training Center:
Pilot training program partnership
THY Flight Academy: Part of Boeing flight academy network
Turkish Technic:

- Regional maintenance hub through Global Fleet Care agreement
- Regional Landing Gear Exchange partnership
- Boeing maintenance training delivery partnership

NAI aims to grow Boeing's engineering and technology footprint in Turkey. In this framework, the Boeing Turkey Engineering and Technology Center opened in Istanbul in December 2018. The center develops technologies that Boeing adopts globally and partners with local universities while adding to the existing engineering capabilities in Turkey, bringing the country closer to its target to become a global player in aerospace.

NAI aims at positioning Turkey as a regional hub expanding Boeing partnerships with Turkish maintenance, repair and overhaul (MRO) providers to service the global Boeing fleet. With the signing of the Global Fleet Care Agreement in 2018, Turkish Technic was positioned as a strategic regional supplier for Boeing for airplane line maintenance and heavy maintenance as well as component services and repair.

NAI aims to deliver training programs for strategic skills critical to Turkey's fast-growing aerospace sector. Boeing's simulator investment for expanded flight training capacity in partnership with Turkish Airlines (THY) is a key initiative. Another major partnership includes

the joint master's program in aerospace structures and materials that Boeing launched with Istanbul Technical University (ITU) and Turkish Aerospace in 2019.

These investments constitute the foundation of a long-term, successful partnership between Boeing and Turkey as the company continues to expand collaboration with world-class partners in industry, services, engineering and academia in the country.

Partnering with several universities and companies in Turkey to foster aerospace innovation Boeing has invested more than \$2 million in research, technology and technical aerospace education in Turkey. Boeing currently has eight technical partnership programs in Turkey focused on aerospace technologies, including joint research and technology projects as well as engineering and technical education initiatives.

Boeing and Turkish Airlines share a long history that began in 1945 with the arrival of Turkish Airlines first DC-3/C-47 airliners. Turkish Airlines entered the jet age in the late 1960s, when the airline began operating DC-9, DC-10 and Boeing 707



Ayşem Sargin & Ayşe Akalin

airplanes. Over the years, Turkish carriers have also flown 727, 757, MD-80 and, of course, modern 737 and 777 airplanes. Boeing has also developed mutually beneficial relationships with key customers in Turkey such as Sun Express (the joint venture of Turkish Airlines and Lufthansa) and Pegasus Airlines.

Turkish Technic, a subsidiary of Turkish Airlines, is a world-class maintenance

center for the 737, with certifications from regulatory authorities throughout the region and beyond. The Global Fleet Care agreement with Turkish Technic has positioned the Turkish Airlines maintenance arm as a regional MRO provider for Boeing aircraft. Boeing has also partnered with THY Flight Academy on a pilot training program and invested in simulator training capability in the Turkish Airlines Flight Training Center in Istanbul.

WILL 5G TECHNOLOGY INCREASE AIRPLANE ACCIDENTS?

When cellular phones were first introduced, power wheelchair users did not like them because if cell phone signals interfered with wheelchair signals, it could lead to terrible consequences for them. Within a short time, a solution was found to address all such concerns. A simple shielding technology was developed to prevent signal interference.

When mobile phones started to use international GSM digital standards, this time hearing aid users protested. Hearing aids designed for the analog world were faced with a new digital reality. The solution was in the simple updates that would adapt the hearing aids to the modern technology.

In the early years of the digital phone era, people living with pacemakers were also concerned. What if their cell phone signals interfered with the pacemaker signals that keeping them alive? As a short-term solution, doctors told their patients with pacemakers not to carry their cellular phones in their pockets close to their hearts. Afterwards, a shielding technology was developed again and the problem was solved.

Similar issue has appeared and is being discussed nowadays. US telecommunication operators are preparing to launch 5G service across the country on January 5th. The aviation industry is voicing its concern over the risk of this technology that

may cause plane crashes. So, will 5G mean airplanes falling from the sky when it comes to our lives?

IS 5G THE ENEMY OF AVIATION?

5G technology is defined as a next-generation mobile data service and network communication that will provide communication service at higher speeds and less latency via smart devices. In other words, we will be able to transmit very large files very fast with 5G. The quality of our voice calls will also improve significantly. 5G, the advanced level reached in mobile communication for now, has become one of the most important milestones of today's technology. However, it has been the



by Muhammed Yilmaz

subject of many conspiracy theories up until now. For example it was claimed that 5G mobile networks could interfere with signals from weather satellites in the neighboring frequency band and it was even claimed that it was the reason behind the Covid-19 virus.

The US Federal Aviation Administration (FAA) released a special information bulletin on November 2, on the risk of potential adverse effects of 5G technology on aviation industry.



(Special Airworthiness Information Bulletin – SAIB AIR-21-18)

With this bulletin, aircraft manufacturers, altimeter manufacturers, airlines and pilots have been warned against the possible effects of 5G on aircraft electronic systems. Two major communications companies AT&T and Verizon, taking the concerns of the FAA into consideration, agreed to delay the use of a new set of radio frequencies for 5G, which was supposed to be launched on December 5, 2021, to January 5, 2022.

As the date of January 5 gets closer, the FAA released two new airworthiness directives (Airworthiness Directive

AD 2021-23-12 and AD 2021-23-13) at the beginning of December, raising the level of alarm over concerns that 5G signals could interfere with radio altimeter devices that measure aircraft's altitude above the ground. In the presence of C-Band wireless broadband signals used by 5G technology, the Agency ordered the revision of flight manuals of aircraft and helicopters to prohibit certain operations requiring radio altimeter data. Thus, a new flight safety rule has been put into effect that prohibits pilots from using auto-landing and some other flight systems at lower altitudes.

This rule, which will affect dozens of aircraft manufacturers and thousands of aircraft, is thought to cause disruptions on some flight routes with low visibility conditions, where pilots must rely on the radio altimeter to land safely. The FAA says there is a potential risk that the 5G signals could lead to faulty readings that may make flying unsafe in these conditions. The FAA directives said the wireless broadband signals could create an "unsafe condition" unless immediate action before the January 5 deployment. That's why

the FAA went beyond the ordinary process for the new rules it introduced. It directly enforced the new rules without any feedback from industry representatives.

PUBLIC SECURITY OR NATIONAL SECURITY?

The safety conditions of passengers on commercial and private aircraft are an unquestionably critical issue. But on the other hand, the United States does not want to fall behind in its technological competition with China, which has started to see the positive results of the expansion of 5G technology. For this reason, the potential problem that 5G technology will create in aviation safety has brought the concepts of public safety and national security in the United States.

Airwaves, also known as spectrum, is a common national asset subject to innovations brought by changing and transforming technologies. As technologies change, so do the assumptions in the spectrum-based environment. The necessity of redesigning products such as wheelchairs, pacemakers and hearing aids with

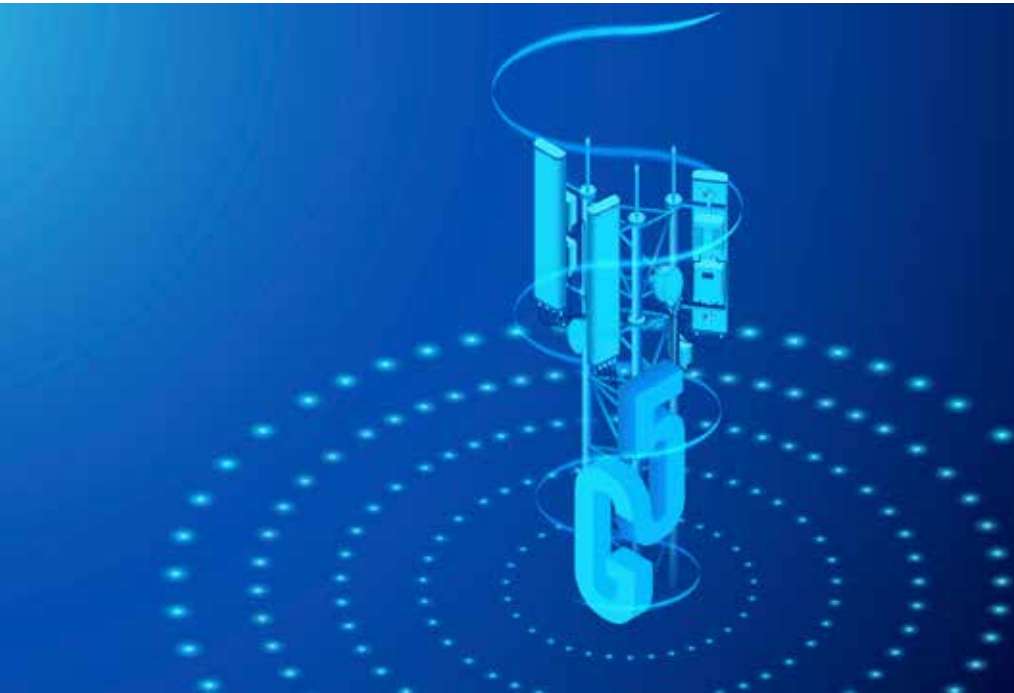
developing technology is exactly about this subject. These products were designed according to existing realities. The new spectrum users have built a new world without any intention of harming such devices. In order for these devices to survive, they had to be redesigned.

FAA officials argue that things should be changed for a scenario where the use of 5G technology and aviation rules will co-exist safely. This is why the two airworthiness directives, enacted with an immediate action, are claimed to provide a framework for gathering more information to avoid potential impacts on equipment aimed at making aviation safer.

5G & RADIO ALTIMETERS

A radio wave emitted by the radio altimeter located under the airframe of the aircraft, which has a simple receiver and transmitter, hits the ground and it is reflected back up to the receiver. Calculations over the elapsed time and the length of the emitted radio wave determine how high the aircraft is from the ground (altitude).

In the frequency allocation table, which is allocated according to international rules,



aeronautical navigation systems operate between 4.2 and 4.4 GHz. One of the main uses of frequency allocation in aviation is to transmit information over aircraft altimeters to facilitate computer assisted landings, especially below 2500 ft. The use of C-band spectrum used for 5G is authorized for between 3.7 and 3.98 GHz in the US.

For this reason, aviation industry authorities are warning that 5G networks operating in the C-band have the potential to cause harmful interference to radio altimeters. Their concern is that the radios being used with the altimeter may not appropriately filter out signals lapping over from another part of the spectrum.

In response, the FAA issued such rules for airlines and pilots to “be prepared for the possibility that interference from 5G transmitters and other technology could cause certain safety equipment to malfunction.”

Recently, the Canadian government has taken decisions to restrict the use of C-band at airports and ban the installation of 5G base stations near airports. Similar steps are also taken in Australia and France.

THERE IS NO ROOM FOR “POSSIBILITIES” IN AVIATION!

Two words are at the center of the FAA statements: The “potential” for interference and the

“possibility” for signals to interfere with each other. However, decisions about the safety of air traffic are not based on assumptions such as the “potential” or “possibility”, but on certain situations where all possibilities are eliminated.

Thus, a study was conducted by the Aerospace Vehicle Systems Institute (AVSI) simulating the worst-case 5G signal emission and its effect on aircraft avionics systems. In this study, it was concluded that there may be substantial differences in the receiver performance of radio altimeters from different manufacturers. This means that some altimeters are equipped with radio receivers with appropriate filters to

protect against spurious emissions, while others allowed signals from outside the 4.2 to 4.4 GHz allocation to intrude. Many other companies have also conducted similar studies.

Subsequently, a guard band was created between the 5G spectrum and the spectrum in which the aircraft’s avionics systems operate. Boeing’s proposal was to prohibit the use of 5G technology within the 4.1-4.2 GHz frequency range. Thus, the guard band developed to prevent interference was determined as a 220 MHz buffer between 3.98 GHz and 4.2 GHz, the highest frequency value of 5G.

The FAA emphasizes that manufacturers of radio altimeter equipment should continue testing for susceptibility to 5G interference and work on design changes that could minimize the effects of interference.

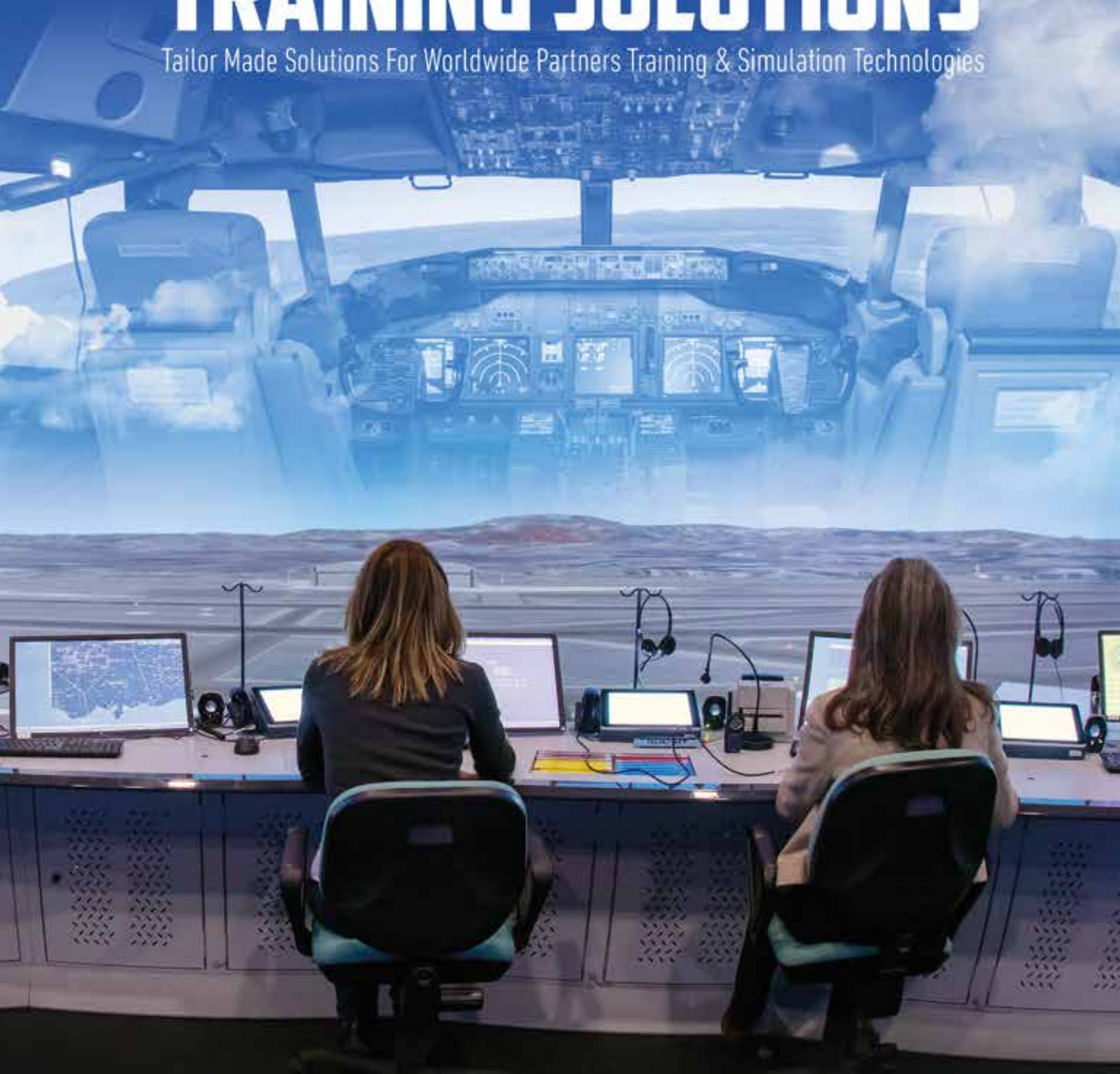
It is also strongly recommended that pilots remind passengers that all portable electronic devices equipped with 5G must be turned off or put into airplane mode during flight. This bandwidth is used seamlessly in 40 countries around the world. No other development is expected to occur in the US. For now, no proven study is available that 5G causes malfunctions as feared.



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WILL 5G PROVIDE ANY BENEFIT TO AVIATION INDUSTRY?

It is for sure that 5G technology, which has the potential to create various problems for piloted systems, will provide great opportunities for the use of Low Altitude Airspace, that is to say the Unmanned Traffic Management (UTM). As 5G is increasingly defined by civil aviation regulators on a region-by-region basis, it will offer enormous advantages for autonomous drones or electric air taxis, which are expected to become an integral part of our lives in the near future.

When the concept of the Internet of Things (IoT) and 5G fully combine, a large number of objects or devices will be in communication with each other. This is a quite significant advantage in all areas of the aviation industry.

Almost all the stakeholders of the aviation industry, especially the airlines, airports and companies providing aircraft maintenance and repair services, have already started to make collaborations in order to incorporate 5G technology into their workflow processes.

Airlines will shift to a new understanding of in-flight entertainment. Saving weight with the new in-flight entertainment system will be possible, and all kinds of benefits will be offered to the passengers more easily and cost-efficiently. Thanks to instant access to movie and music platforms thanks to 5G, airlines will be able to offer a variety of services to satisfy their customers. In-flight messaging, communication, reading newspapers/magazines, and using the internet will seamlessly be achieved with 5G. Check-in processes will also be accelerated.

Flight crews will be able to easily manage passengers' food orders, control flight-related information, track connecting flights, and much more, with the tablets they use. They will even be able to check how many beverages are left in which service trolleys.

For example in February, Lufthansa Technik and Nokia deployed a 5G private wireless network for their Hamburg facility. This project enables virtual engine parts inspection where maintenance engineers in Hamburg can service customers in different locations. It will also be possible with 5G to train engineers all over

the world through high definition videos.

In order to maximize the passenger experience at airports, projects are being developed that will use the combination of AI (Artificial Intelligence), from developing autonomous buses to security checks and all services at the terminal. With minimum human intervention, high precision and absolute security, 5G is thought to be one of the keys for a major transformation in aviation.

Thanks to the IoT, it is possible to instantly discover how many people are absent or who has not arrived yet from the passengers waiting to board. 5G technology is expected to support up to 1 million devices per square kilometer. Airport operations will also be managed in real time with 5G. Cooperation between airports, airlines, ground services and air traffic controls will be easier and more effective.

In addition, with the 5G, biometrically matching of passengers with their bags will be simplified. Lost luggage will be reduced. A seamless mobile experience will be achieved with Wi-Fi networks at airports. Rapid transmission and analysis of aircraft data will enable proactive aircraft maintenance

and faster return to service and timelier take-offs. With the convergence of 5G and satellite communications, airplanes will be able to connect to all relevant systems. All stages of the flight can be monitored simultaneously from multiple centers.

With these modernized operations, airlines and airports will not only lower their costs, but also reduce their carbon footprint to achieve a more sustainable aviation industry.

To summarize, the potential problem that 5G will create for the aviation industry stems from the absence of a worldwide spectrum planning, that is, the lack of global standardization. It is certain that the 21st century will be remembered as the wireless century. Studies for 6G are currently being conducted in many countries. The way to keep up with the communication and technological requirements of the age is to set permanent strategies with a sound policy. The expectation across the world is to realize the scenario where 5G technology and safe aviation activities can coexist in the shortest possible time. And to achieve this, everyone has to do their part 🌍

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TURKSAT 5B Communications Satellite Launched with Falcon 9 Rocket!

**The 6th generation
TURKSAT 5B
Communications
Satellite, which will
be the most powerful
Communications
Satellite of TURKSAT
in terms of both
useful load capacity
and electrical power,
was launched on
December 19, 2021,
at 06:58 Turkey time
from Cape Canaveral
Space Force Station
in Florida, USA, with
SpaceX's Falcon 9
Rocket.**

With this successful launch, the TURKSAT 5B Communications Satellite began its 164-day travel towards its orbit. TURKSAT 5B Communications Satellite will settle into orbit in June 2022 and start its activities in August 2022 after a 45-days testing. Accordingly, having started its first communications satellite adventure with TÜRKSAT 1B, launched on August 10, 1994 and served for 12 years, Turkey today becomes one of the 30 countries that own satellites and has



by İbrahim Sünnetçi

increased the number of active communications satellites in space to 5 (TURKSAT 3A, 4A, 4B, 5A and 5B), and the total number of satellites will increase to 8 (GOKTURK I/II and RASAT Earth Observation Satellites). TURKSAT 3A and TURKSAT 4A continue to serve in 42° East orbit, TURKSAT 4B in 50° East orbit and TURKSAT 5A in 31° East orbit. TURKSAT 5B will serve in the 42° East orbit as of June 2022.

Deputy Minister of Transport and Infrastructure Ömer Fatih SAYAN, Turksat Company Chairman of the Board Prof. Kemal YÜKSEK, Turksat Company CEO Hasan Hüseyin ERTOK, Turksat Board Member İbrahim KOLCU and accompanying delegation watched the



launch of the satellite at the Cape Canaveral Space Force Station. Minister of Transport and Infrastructure Adil KARAİSMAİLOĞLU and Vice President Fuat OKTAY watched live the launch of the TURKSAT 5B at the ceremony held at Turksat Company's Gölbaşı Campus.

Speaking at the ceremony, Minister of Transport and Infrastructure Adil KARAİSMAİLOĞLU pointed out that Turkey has the satellite capacity that addresses more than one third of the world in terms of coverage area and said, "TURKSAT 5B set off its 164-day journey. With TURKSAT 5B, we will reach all regions that we cannot reach by sea, air and land." Reminding that TURKSAT 5A serves more than thirty percent of the world in television broadcasting, KARAİSMAİLOĞLU said that the TURKSAT 5B Satellite, from which data communication is mainly provided, will serve in regions such as the Persian

Gulf, Red Sea, North and South Africa and Nigeria, and that its coverage area will continue to increase with TURKSAT 6A. Emphasizing that with the launch of TURKSAT 6A, the production and test processes of which are in progress, Turkey will be among the top 10 countries to exist in space by producing its own satellite in the world, KARAİSMAİLOĞLU said, "As in all sectors, we started to make our presence felt in space, our power, the great and powerful Turkey, to the whole world." Emphasizing that there are two domestic and indigenous components in TURKSAT 5B, KARAİSMAİLOĞLU said, "For the first time, the satellite with domestic and indigenous components will operate in space, but the most important thing for us is the completely domestic and indigenous satellite TURKSAT 6A. Our domestic and national contribution in technology will continue to increase. We particularly want to

use 5G with completely domestic and national infrastructure. Our next goal is the 6G. The interest of young people is very precious for us, especially to become a country that produces, develops and exports technology." Pointing out that they work with ASELSAN, TUSAŞ, TUBITAK Space and CTech in the development of TURKSAT 6A, KARAİSMAİLOĞLU emphasized the importance of workforce and said, "With our domestic and indigenous satellites, we will be among the top 10 countries in the world that has the capacity to produce satellites. The assembly, integration and tests of TURKSAT 6A are carried out at Ankara Space Systems Integration and Test Center. We plan to launch our indigenous TURKSAT 6A satellite in 2023. With TURKSAT 6A, our country's satellite coverage area will also expand thanks to the eastern coverage area including India."

TURKSAT 5A and 5B Communications Satellites

The 6th generation TURKSAT 5B Communications Satellite is the second of two new generation communications satellites ordered to Airbus Defence and Space (Airbus D&S) under the contract signed on November 9, 2017. To produce such satellites, three leading companies in the world submitted proposals, the French-British partnership Airbus Defense and Space (Airbus D&S), Mitsubishi Electric Corporation (MELCO) from Japan, the Canadian-US partnership MDA/Space System Loral (MDA/SSL). Airbus D&S was selected as the successful bidder in terms of financial and domestic contribution. Immediately after the contract award, the production of the new generation TURKSAT 5A and TURKSAT 5B Communications Satellites was initiated.

The 5th generation communication satellite TURKSAT 5A, whose design, production and testing phases were successfully completed at Airbus D&S facilities in France and the UK, was received from Airbus D&S on October 2, 2020, and delivered to Cape Canaveral Space Force Station in Florida, USA on January 8, 2021. It was launched with SpaceX's Falcon 9 rocket. The orbital tests of TURKSAT 5A, which completed its journey in space after reaching 31° East geosynchronous (Geostationary/GEO) orbit on May 4, 2021, started on May 5 and it started to serve in June 2021 after approximately 1.5 months of testing and commissioning. TURKSAT 5A Commissioning Ceremony was held on June 28, 2021, at Türksat Gölbaşı campus with the participation of President Recep Tayyip ERDĞAN and Minister of Transport and Infrastructure Adil KARAİSMAİLOĞLU. With its 1728-megahertz capacity, the TURKSAT 5A Communications Satellite, which has thirty percent more capacity compared to the previous communications satellites and is the highest capacity satellite of the Türksat Satellite Fleet in Ku-Band, still provides television broadcasting and data communication services in a wide geography



spanning 3 continents, covering Turkey, Europe, Middle East, North Africa, Midwest Africa, South Africa, Mediterranean, Aegean Sea and the Black Sea. TURKSAT 5A Communications Satellite will serve for at least 35 years (projected to be 37 years) and secure orbital and frequency rights of Turkey.

The TURKSAT 5B Satellite, whose design, production and testing phases were completed successfully, was delivered to Turkey with the participation of Deputy Minister of Transport and Infrastructure Ömer Fatih SAYAN and Türksat CEO Hasan Hüseyin ERTOK and

the satellite was shipped to the U.S. from France on November 29th.

TURKSAT 5A broadcast satellite which operates in Ku-band at the 31° East longitude slot in geostationary orbit. It has a launch mass of 3,500 kg and electrical power of 12 kW. TURKSAT 5B is a broadband satellite which operates in Ku- and Ka-bands at the 42° East longitude slot in geostationary orbit. Its HTS (High Throughput Satellite) payload will provide more than 50 Gbps of capacity via 73 beams over a wide coverage including Turkey, the Middle East and large regions of Africa. It has a

launch mass of 4,500 kg and electrical power of 15 kW.

TURKSAT 5A and TURKSAT 5B Communications Satellites have the latest version of the Electric Orbit Lifting (EOR) system of Airbus D&S' highly reliable Eurostar E3000 platform, which uses a new generation electric propulsion system for in-orbit raising and station-keeping. TURKSAT 5A and TURKSAT 5B are the 57th and 58th Eurostar E3000 satellites ordered, and the 7th and 8th in the Eurostar E3000e version, which recently completed the fastest electric orbit raising ever from transfer to geostationary orbit.

Capabilities to be acquired by TURKSAT 5B Communications Satellite

TURKSAT 5B, which has the highest payload capacity satellite in our country, is in the category of high-efficiency satellites with at least 20 times more capacity efficiency than Fixed Satellite Service (FSS) satellites. TURKSAT 5B, which will serve in a wide coverage area including the Middle East, the Persian Gulf, the Red Sea, the Mediterranean, North and East Africa, Nigeria, South Africa and close neighbor countries, as well as Turkey, will increase Turkey's capacity from 1.8 GB to 12 GB with

its Ka-Band payload, in which frequency reuse and multibeam coverage concepts are used, and will provide a data transmission capacity of more than 55 Gbps in total across the world. TURKSAT 5B, which will increase Turkey's Ka-Band capacity -the satellite data communication capacity- more than 15 times, will be effective in commercial sectors such as maritime and aviation where satellite communication is used. Within this framework, maritime services will be initiated at Ka-Band frequency in the Mediterranean and Arabian Peninsula, and in the aviation field, services will be started to be delivered with the TURKSAT 5B Satellite. 2 communication equipment produced by ASELSAN as part of the Domestic Industry Contribution Program was used in TURKSAT 5B, thus the equipment designed and produced domestically was sent to space for the first time on a commercial communication satellite. The Ku-Band Receiver and Ka-Band Low Noise Amplifier (LNA) developed by ASELSAN within the scope of the TURKSAT 5B Communication Satellite Project was sent to space with TURKSAT 5B and hence space experience was acquired. The integration of the flight models of both equipment to the TURKSAT 5B Satellite was carried out at



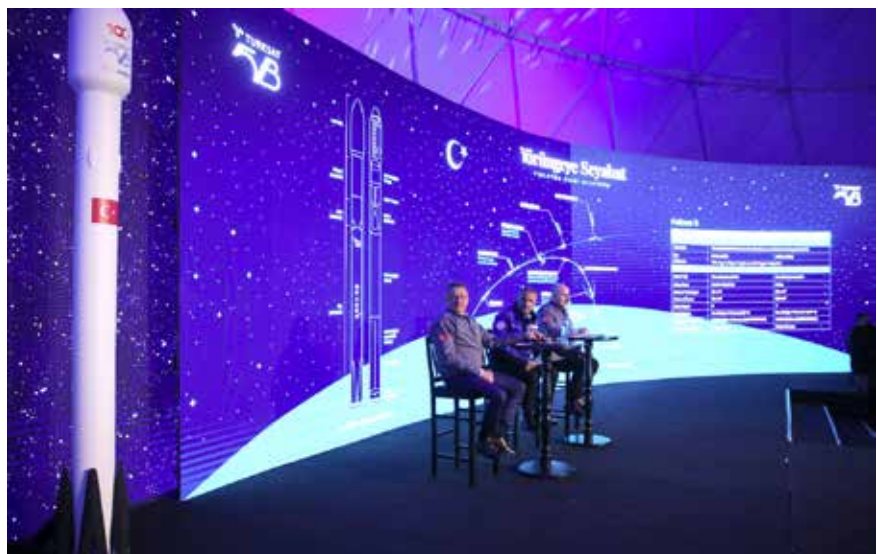
Airbus D&S facilities. With the high data capacity provided by the TURKSAT 5B Satellite, it will be possible to reach places in Turkey that cannot be accessed by terrestrial infrastructure, and an internet infrastructure will be established.

With the use of the satellite, having the new generation electric propulsion system, in its 42° East orbit, the

Ka-Band data service as well as the Ku-Band capacity will be increased, and redundancy will be achieved for the TURKSAT 3A and TURKSAT 4A satellites serving in the same orbit. It will also serve in 42° East orbit with a maneuver and service life of over 35 years.

With TURKSAT 5B taking its place in space, the coverage and speed of Turksat Company's

domestic and national satellite antenna family PycON services will also be improved. With the enhancement of the satellite coverage area, it will be possible to use the MicrON, AerON, HidrON and TerrON antenna family together with services such as internet, corporate network and IP backhauling in many countries around the world 🌐





The World's Space Enthusiasts Met in Dubai for the IAC2021

Dr. Ozan Kara
Senior Engineer DeltaV Space Technologies Inc.

The International Astronautical Congress (IAC), one of the world's leading organizations, was held in Dubai on October 25-29, 2021. Organized for the 72nd time by the International Astronautical Federation, the congress was held for the first time in the United Arab Emirates, the first Arab country hosted the IAC since its establishment in 1950. Nearly 6500 participants from 110 countries attended the event, hosted by the United Arab Emirates Mohammed Bin Rashid Space Center (MBRSC).

In the event held under the theme of "Inspire, Innovate & Discover for the Benefit of Humankind", more than 1400 speakers made academic presentations on 182 different technical subjects. Academic

presentations covered many exciting topics such as space propulsion, orbital calculations, satellite design, Moon and Mars colonization, space economy and social entrepreneurship.

In addition, there were booths of 90 different companies at IAC 2021. Panels, trainings, collaborations and forums were held with the participation of senior executives of leading organizations and companies in the space industry such as NASA, ESA, Boeing, Airbus, Lockheed Martin. The introductions of newly established companies, presentations of young professionals and students also motivated the future generations.

A large space was allocated to the Turkish Space Agency (TUA) at IAC 2021, taking place at the Dubai Trade Center. TUA was





accompanied by TUBITAK Space Technologies Research Institute, Gokmen Aerospace and Aviation Training Center (GUHEM), DeltaV Space Technologies Inc. and Saha Istanbul.

TUA held more than 34 bilateral meetings between states and organizations. In addition to the relevant space agencies of Russia, Japan, the United Kingdom and Azerbaijan, several meetings were held with

international companies that have recently attracted attention with their activities on space, such as SpaceX and Blue Origin. During the congress, a memorandum of cooperation was signed with the Japan Aerospace Exploration Agency (JAXA), and a goodwill agreement was signed with the Mexican Space Agency. Moreover, at the IAF General Assembly held during the congress, TUA's official membership of the IAF has been registered.

DeltaV Space Technologies, on the other hand, introduced its probe rocket at the booth of TUA. Developed in Turkey using hybrid rocket (solid fuel and liquid oxidizer) technology, the rocket had exceeded 100 km speed in 2021 and performed a suborbital flight. DeltaV uses paraffin as fuel in its rocket, which conducted its historical flight. It uses high performance (cryogenic phase) liquid oxygen (LOX)

as the oxidizer. The paraffin-based fuel used in the solid phase, on the other hand, combines with liquid oxygen to provide cost-effective and high-performance and high-performance propulsion. In the future, this technology will also be used in orbital flights and propulsion systems in the space environment. DeltaV engineers develop cryogenic valves, regulators, ignition systems, composite pressurization tanks, turbopumps and many more





flight systems as part of this technology. IAC 2021 has been an amazing platform for introducing these systems to the world. Hybrid rocket system is planned to be used in the Moon Program, which is planned to be carried out under the leadership of the Turkish Space Agency. Within this frame, the systems to be developed by DeltaV will provide high added value for Turkey.

Like many space enthusiasts, I attended the IAC and had the opportunity to represent Turkey for the 8th time. I was selected as a delegate to the Young Professionals workshop for the first time in 2012. Afterwards, I took part in many technical committees. I am still active in space education and outreach, space propulsion, knowledge management and workforce development committees. As per my observations, IAC 2021 was more modest than those held prior to the pandemic. Compared to previous congresses, the number of participants was small. The greatest advantage of this is that everyone was able to focus easily on the subject they were interested in. Because many events take place at the same time during the congress, for example while there is a panel of

astronauts at one hand, academic presentations and trainings take place on the other hand.

The most significant aspect of the IAC 2021 congress is that it took place for the first time in a United Arab Emirates country. Accordingly, the activities of the Mohammed Bin Rashid Space Center (MBRSC) came to the fore. MBRSC announced cooperation agreements with Thales Alenia Space, Airbus, SpaceX, UNOOSA (United Nations Office for Outer Space Affairs) and ESA (European Space Agency). Also, a live broadcast was held with the United Arab Emirates CrewONE analog mission. This analog mission is part of 8-month-long mission taking place in Russia and simulates space-like conditions.

Commercial space companies also announced important progresses at the International Astronautical Congress. Blue Origin, Boeing and Sierra Space announced that they will build a commercial space station called "Orbital Reef". Additionally, Lockheed Martin and Nanoracks announced that they will work on the space station called "Starlab". The Polish Space Agency signed a cooperation agreement

with NASA for the Artemis project. The Artemis project is NASA's "Manned Return to the Moon" project by 2025.

The most outstanding panel in the congress was the "Head of Agencies" event. In the panel attended by the space agency presidents/directors of the European countries, Canada, Japan, the US, Russia, India and China, the space roadmaps of each country were discussed.

Another remarkable panel of IAC 2021 was the "Heads of Emerging Agencies" event, attended by the space agencies of developing countries. The heads of space agencies of Azerbaijan, Brazil, South Africa, Colombia and Turkey discussed the impact of their countries' socio-economic conditions on new technologies, their level of technological maturity and new cooperation ideas. Accordingly, IAC 2021 Congress has become an effective platform for developing countries.

One of the most significant missions in the space industry in 2020 was the MARS 2020 project, which brought the Perseverance and Ingenuity vehicles to the Red Planet. The Mars 2020 Perseverance rover landed in Jezero Crater on February 18, 2021. The largest and most

capable robotic system in human history will search for evidence of past microbial life, test new technologies including a method of generating oxygen from the Martian atmosphere, and collect several dozen samples for future return to Earth. Other tasks include characterizing weather, dust and other potential environmental challenges that could affect future astronauts who will live and work on Mars. As part of the Mars 2020 mission, Ingenuity helicopter made the first ever flight over the Martian surface. Thus, Ingenuity proved the viability of powered flight even in the thin atmosphere of another planet.

During IAC 2021, an important panel was held for Mars 2020 with the participation of NASA and ESA mission managers. They presented their studies specifically for bringing the samples to be collected from the surface of Mars to Earth. NASA and the European Space Agency have committed to conclude this brave mission by the early 2030s.

When we talk about an astronautical congress, the first thing that comes to mind is the "astronauts". Certainly, astronauts and cosmonauts gathered at



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this five-day congress as well. Especially the astronauts from the United Arab Emirates attracted great attention. Astronauts met with the participants at the "Expedition 60/61 Reunion" panel. In this panel, all nine (9) crew members who were part of Expedition 60/61 to the International Space Station (ISS) were introduced for the first time. Crew members gathered at IAC 2021 in Dubai to share their experience, knowledge, scientific mission and achievements. What distinguishes this team from other space station crews are as follows:

The participation of Hazzaa Al Mansoori, the first UAE Astronaut, in the International Space Station. Hazzaa Al Mansoori's launch of for the ISS was a milestone in the UAE's space program and an important breakthrough in the development of the Manned Space Flight Program. Achieving the UAE's first mission to the ISS was a successful example of international cooperation among all space agencies.

Successful conduct of the first "All-Woman Spacewalk" by NASA astronauts Jessica Meir and Christina Koch. This achievement inspired all women around the world and proved that they can achieve their dreams and reach greater heights with hard work and dedication.

Astronaut Christina Koch broke the record for the longest single spaceflight by a woman.

The International Space Station (ISS) has 9



members for the first time since the departure of the Soyuz TMA-16M in September 2015.

The most spacewalks in the history of the ISS; 9 times!

This panel was important in many ways: International cooperation in Manned Space Flights, Capacity Building for Manned Space Flights in Developing Countries, Women's Role and Significant Contributions in Space, Bringing together and inspiring young people in STEM (Science, Technology, Education and Mathematics), Outcomes of the First UAE Manned Space Flight and UAE effect over the region.

Space studies are inspiring for humanity. It requires social responsibility among space industry actors to maximize the benefits of space for all countries. Social responsibility in space industry ensures the fair and sustainable implementation of innovations. In IAC 2021, social responsibility projects

consisting of space studies were discussed through various panels consisting of selected young professionals and students.

Covid-19 pandemic has had a dramatic impact on humanity in different aspects. But the excitement of space exploration always remains high. In summary, we will see more robotic technologies developed for Moon and Mars exploration in the upcoming years. Global health studies are supported by earth observation satellites. The number of commercial space companies is increasing. Cost-effective rocket systems will affordably bring us to space. High-performance and cost-effective systems are being developed with new fuels and oxidizers. The global economy is progressing in a more balanced way with the developing technology. In view of that, the roles of young people in science and engineering will enable us to develop cost-effective

projects in the future. This will make space exploration sustainable. Developing countries' access to space will also increase. Space education will develop with mobile applications and virtual reality applications. With virtual reality and "gamification" systems, we can make the surface of Mars accessible even for kids. By simulating the Martian atmosphere and surface, we can even prevent some accidents before we go. As can be seen from these examples, space exploration will be a struggle to turn imagination into reality for future generations. A struggle worth the risks!

IAC 2021, on the other hand, has inspired new generations in several ways and kept cooperation in the space industry alive. The international astronomical congress will take place in Paris, Baku and Milan in the following years and will unquestionably play a significant role for global cooperation 🌐



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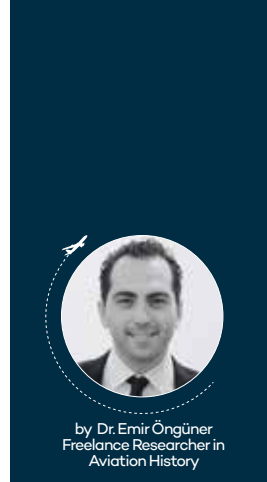
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THK-13: Challenge Faced by the Turkish Aeronautical Association, and the Reality



Known as “stealth” in engineering terminology, this aircraft feature is an essential part of the fifth-generation fighter class in the 21st century. The first models that come to mind when talking about “stealth aircraft” are undoubtedly the F-117 of the U.S. Lockheed Martin, the maiden flight of which took place in 1981, and the B-2 aircraft of the U.S. Northrop Grumman that first flew in 1989. The partial similarity of THK-13, developed by the Turkish Aeronautical Association (THK) with the B-2 caused serious information pollution in the Turkish media and led to some myths that are irrelevant to reality. In order to eliminate such conceptual confusion, it is necessary to shed light on the technical details.

As per the official studies made, no object can be made entirely invisible. The radar cross-sectional area of every conventional aircraft appears on the screen when the radar wave is sent to the aircraft and then captured by the radar after hitting the aircraft surface and returning to radar. With the “stealth” method, electromagnetic waves

hitting the aircraft surface are tried to be prevented from being manipulated and transmitted to the radar. In addition, activities are carried out in other areas such as the aircraft geometry enabling wave dispersion, the integration of the wave absorbing or dispersing materials into the body, the minimization of the acoustic projection, the reduction of the infrared signatures from the hot engine parts. To summarize, the “ghost plane” term used in the popular media is technically based on the “low visibility” concept.

Due to the low radar cross section, the concept’s (defined as flying wing in the past) fit for “stealth” design was also elaborated. Accordingly, the history of flying wing design should also be examined in terms of low visibility studies in aviation. The first known idea of flying wings dates back to the 19th century. The German zoologist and physicist Friedrich Ahlborn discovered the aerodynamic properties of the plant *Alsomitra macrocarpa*, known as the gliding seed, and dealt with the subject in detail in his book “Über die Stabilität

der Flugapparate” published in 1897. Austrian pilot-engineer Ignaz Etrich also put this idea into practice. Etrich, with his engineer partner Franz Wels, succeeded to fly the first model of the patent (no: 23465) named “Flugmaschine” on November 29, 1909, which he obtained from the Austrian Patent Office on March 3, 1905. Interestingly, the first aircraft used in the history of world warfare was this flying wing named “Etrich-Rumpler-Taube”, which was used by Italian pilot Giulio Gavotti during the Italian invasion of Libya in 1911 and dropped bombs on Turkish troops.

The related feature of *Alsomitra macrocarpa* attracted the attention of German engineer and aircraft designer Hugo Junkers, and he applied to the German Imperial Patent Office on February 1, 1910 with his own design. Junkers patent 253788 was approved on November 14, 1912. From the 1920s, tailless designs started to become popular. At the Soviet side, engineers such as Boris Cheranovski and Vladimir Chizhevski carried out activities on motor gliders. The BICH-

26 model, designed by Cheranovski in 1948, was claimed to be the world’s first supersonic flying wing aircraft. One of the most important projects of the world-famous Ukrainian aircraft designer Oleg Antonov, when he was the chief designer of the Moscow Glider Factory, was the tail-supported flying wing, named LEM-2, designed in 1937.

During World War II, three important names came to the fore in Germany working on this subject: Alexander Lippisch, the pioneer of the delta wing, which was also used in the Concorde model, and Reimar and Walter Horten, aka Horten brothers, who were considered to have laid the foundations of modern low-visibility aircraft. Lippisch’s idea of a triangular delta wing dated back to 16th-17th century. At that time, it was determined that German engineer Conrad Haas and Polish general Kazimierz Siemienowicz used rockets with delta wing stabilizer elements. The world’s first jet-propelled flying wing Ho IX / Ho 229, designed as a fighter and bomber, was the improved version of the Horten IV glider model

previously designed by the Horten brothers. Before Ho 229 was mass-produced, the German government surrendered, and the war ended.

At the American side, Jack Northrop applied for a patent for the N-1M flying wing with the name "Design for an Airplane" on November 25, 1941, and this design was patented with the no D-143.853 on February 12, 1946, almost five years later. The Americans, not showing interest in the flying wing concept during the war, changed their minds after 1945. Theodore von Kármán, Chairman of the Scientific Advisory Board of the American Air Force, and his team, who were appointed to examine the strategic industrial facilities in Germany, after its defeat in the war, had a critical meeting with Alexander Lippisch, a German engineer who surrendered to the Allied forces. Simultaneously, the Horten brothers' workshops were also seized by the American soldiers. In the aftermath, interest in flying wing design exploded. The development of the YB-35 (1946) and YB-49 (1947) models, considered to be the ancestors of the Northrop B-2 bomber, coincided with this period. Lippisch was one of the German scientists abducted by the Allied forces at the

Operation Overcast but later renamed Operation Paperclip, and in the following years he took charge at Convair and Douglas companies and lectured at the University of Iowa. Many German engineers who were brought to the USA like him, strengthened the Americans' hand against the Soviet Union in the technical field in the post-war period.

During Cold War, something unusual happened. Soviet physicist Pyotr Ufimtsev demonstrated that the radar projection was related to the surface and edges of the planes in his physical theory of diffraction published in 1962, using the edge wave method. Nonetheless this idea did not attract attention at the Soviet military side. When the Americans, following the scientific studies of their rivals, translated this work from Russian into English with the title of "Method of Edge Waves in the Physical Theory of Diffraction" in 1971 and analyzed it, they realized that the proposed solution they were looking for was put forward by Ufimtsev years ago. Ufimtsev developed a mathematical model that the degree of reflection to the radar would decrease if electromagnetic waves were scattered in other directions. Based on this idea, the Americans



Ulus newspaper, April 10, 1948, the first news about THK-13

focused on sharp-edged designs and developed the F-117 Nighthawk, starting with the Have Blue project. The B-2 bomber model, introduced after the F-117, was produced using similar methods. Ufimtsev, on the other hand, moved to the USA with the invitation from the California Institute of Technology after the collapse of the Soviet Union and continued his studies there.

As it can be seen, a plant species that attracted the attention of a German zoologist at the end of the 19th century inspired the world of technology under the name of flying wing and became a part of the aviation industry especially between 1910-1945. The low visibility in the fifth-generation combat aircraft developed in the 21st century,

including Turkey, is tried to be achieved not with the flying wing, but with the methods such as the sharp-edged geometry explained above. In other words, the equivalent of today's stealth technology is not just a flying wing.

When looking at the Turkish side, studies on the flying wing were initiated within the Turkish Aeronautical Association (THK) started in 1947, after World War II. The prototype of THK-13 first appeared on the local media on Saturday, April 10, 1948. Ankara-based Ulus newspaper shared the first image of this design with the headline "Tests of the flying wing model conducted yesterday" on the first page. In the text of the news, it was also stated that the American company Northrop produced a 9-crew flying

AVIATION HISTORY

wing model that could reach a speed of 400 kilometers per hour. This information was obtained from THK engineers during the interview. This naturally shows that Turkish engineers are aware of the equivalent designs developed previously. In short, when we look at the first newspaper article about THK-13, it is immediately understood that the "The Americans built the million-dollar Northrop B-2 stealth bomber after inspired by the Turks" and similar headlines are incorrect. We also need to state that the THK-13 was not a stealth aircraft and not developed for this purpose. The THK-13 can be defined as an experimental glider with a flying wing design.

The first flight test of the Turkish type flying wing THK-13 was made on August 20, 1948.¹ THK-13, attached to the back of an off-road vehicle, proved that it could take off by making short 10-meter bounces. However, according to the statement of pilot Kadri Kavukçu, the vertical rudder control and aileron failed to show the expected performance. The short bounce trials continued in the following days, and the glider was able to reach an altitude of 300 meters in the last attempt on August 25,



THK-13 in parking position

1948, and after a short glide, it landed again with an S movement. In the report of Pilot Kavukçu dated August 25th, it was repeatedly stated that there was a problem with the controllers.

A long flight over Ankara was planned for the

following day. The glider took off with a tow plane used by pilot Bahaeddin İdemen and while it was hovering over Çankaya skies, an unexpected event occurred near the Presidential Palace. The hook connecting the glider to the towing plane broke for an unknown

reason and the pilot Kavukçu wanted to land the THK-13 at a suitable spot. While descending around Seyranbağları, the nose of the glider was crushed and one of its wheels was broken. After the THK engineers arrived at the scene and made the necessary repair, it took off again. After the second attempt on the same day, THK-13 made a forced landing because of an off-road vehicle that suddenly came across while it was gliding at low altitude around the Armored Corps School. When the engineers went to inspect for the second time, they witnessed that both of their vertical rudders were broken, and

T . H . K . 13 - 2

<p>ANADOLU KANAT</p> <p>En yüksek hızı 400 km/h Minimum hızı 200 km/h En büyük sürat 300 km/h En küçük sürat 100 km/h En büyük sürat 400 km/h En küçük sürat 100 km/h</p> <p>ANADOLU KANAT</p> <p>En büyük sürat 400 km/h En küçük sürat 100 km/h En büyük sürat 400 km/h En küçük sürat 100 km/h</p> <p>ANADOLU KANAT</p> <p>En büyük sürat 400 km/h En küçük sürat 100 km/h En büyük sürat 400 km/h En küçük sürat 100 km/h</p> <p>ANADOLU KANAT</p> <p>En büyük sürat 400 km/h En küçük sürat 100 km/h En büyük sürat 400 km/h En küçük sürat 100 km/h</p> <p>ANADOLU KANAT</p> <p>En büyük sürat 400 km/h En küçük sürat 100 km/h En büyük sürat 400 km/h En küçük sürat 100 km/h</p>	<p>KANATEK</p> <p>Kanatağın uzunluğu 10 m Kanat genişliği 10 m Kanat yüksekliği 10 m Kanat ağırlığı 10 kg Kanat maliyeti 10 TL</p> <p>UÇKİ DÜMEN</p> <p>Dümen uzunluğu 10 m Dümen genişliği 10 m Dümen yüksekliği 10 m Dümen ağırlığı 10 kg Dümen maliyeti 10 TL</p>	<p>SARILI DÜMEN</p> <p>Dümen uzunluğu 10 m Dümen genişliği 10 m Dümen yüksekliği 10 m Dümen ağırlığı 10 kg Dümen maliyeti 10 TL</p>
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Technical features of THK-13

¹ Source for the official story of THK-13 and images in the text: Kılıç, M., Uçan Kanat, Sonçağ Yayınları, 2021, Ankara, p. 5-65.

the wings and wheels were seriously damaged. Pilot Kadri Kavukçu was injured in his head and ankles, but in stable condition, and he recovered in a short time.

Such accidents were reported impartially in most of the local newspapers in the following days, but the news in Yeni Sabah newspaper dated September 5, 1948, intended to spread the message that Turkish Aeronautical Association (THK) wasted money on unnecessary projects. It was stated that while the country needed military and passenger planes, dealing with flying wing was an extravagant expense, there were no necessary infrastructure facilities for tests, there were technical errors in the design and such errors were not fixed despite the warnings of the pilots. Thereupon, on September 16, 1948, a disclaimer was published in the newspaper Yeni Sabah with the signature of the THK President, General Seyfi Düzgören. Düzgören firmly stated that he trusted his engineers and pilots, that false news should be disregarded, and that THK would continue its activities. An interview of an anonymous THK employee was published in the Kudret newspaper dated September 9, 1948. According to the



THK-13 pilotları: Kadri Kavukçu (sol, ilk uçuş), Cemal Uygun (sağ, ikinci uçuş)

statements of chief engineer Yavuz Kansu, some information was leaked to the press by Bahaeddin İdemem, one of the THK pilots, or someone else from the association.

The damaged THK-13 was brought to the factory and overhauled for weeks, and on September 29, 1948, bounce tests were restarted. The pilot of THK-13 this time was Cemal Uygun. After the successful tests, it was decided to make another flight attempt in the evening of the same day with a tow plane used by the pilot Cemalettin Aytas. When they took off one after the other, the glider started to pull to the right and suddenly hit the runway on the nose. Pilot Uygun suffered a head injury and fortunately

survived. THK-13, on the other hand, was shattered into pieces. Following the examinations, the pilot Cemal Uygun explained the problem as follows: A clamp was forgotten in the right wing, this piece was displaced during the take-off and the glider tilted to the right due to a sudden weight shift. In short, the THK-13 crashed because of foreign object damage.

After the accident, THK Aircraft Factory Manager Selahattin Beler wrote a letter to the American Northrop Aircraft Inc. to take counsel and ask for their examination. The reply received on December 15, 1948, was quite plain and diplomatic. Writing the letter on behalf of Jack Northrop, Engineering Director Walter J. Cerny stated that

they admired the design of the THK-13, liked the mechanism in the landing gear and appreciated THK's forward-thinking ideas. As it is understood from the letter, the main questions of THK remained unanswered and they only sent a brochure. It was also added that the technical drawings and reports sent by THK were put in Northrop's institutional archive.

Although the construction of a new THK-13 started after the second accident, no official approval was received from THK Headquarters. The production of the second glider was concluded in August 1949 and this time the errors detected in the first flights were corrected. THK-13's chief engineer, Yavuz Kansu, noted that



THK-13 wreck after the accident on September 29, 1948

the second glider could not fly due to the unavailability of a tow plane. There is no other information about the project in official written sources.

THK-13 is an innovative project that was developed by the THK team after examining German and American flying wings in the years of economic difficulties in the post-war period. Since the technical training and R&D understanding had not yet been achieved in Turkey at that time, the problems faced in the testing process were reported incorrectly in the

press and described as a "waste of money, a luxury project" in a newspaper. After the death of THK President General Seyfi Düzgören on 28 December 1948, who defended the engineers and pilots against the press, no project defender remained at the senior management level.

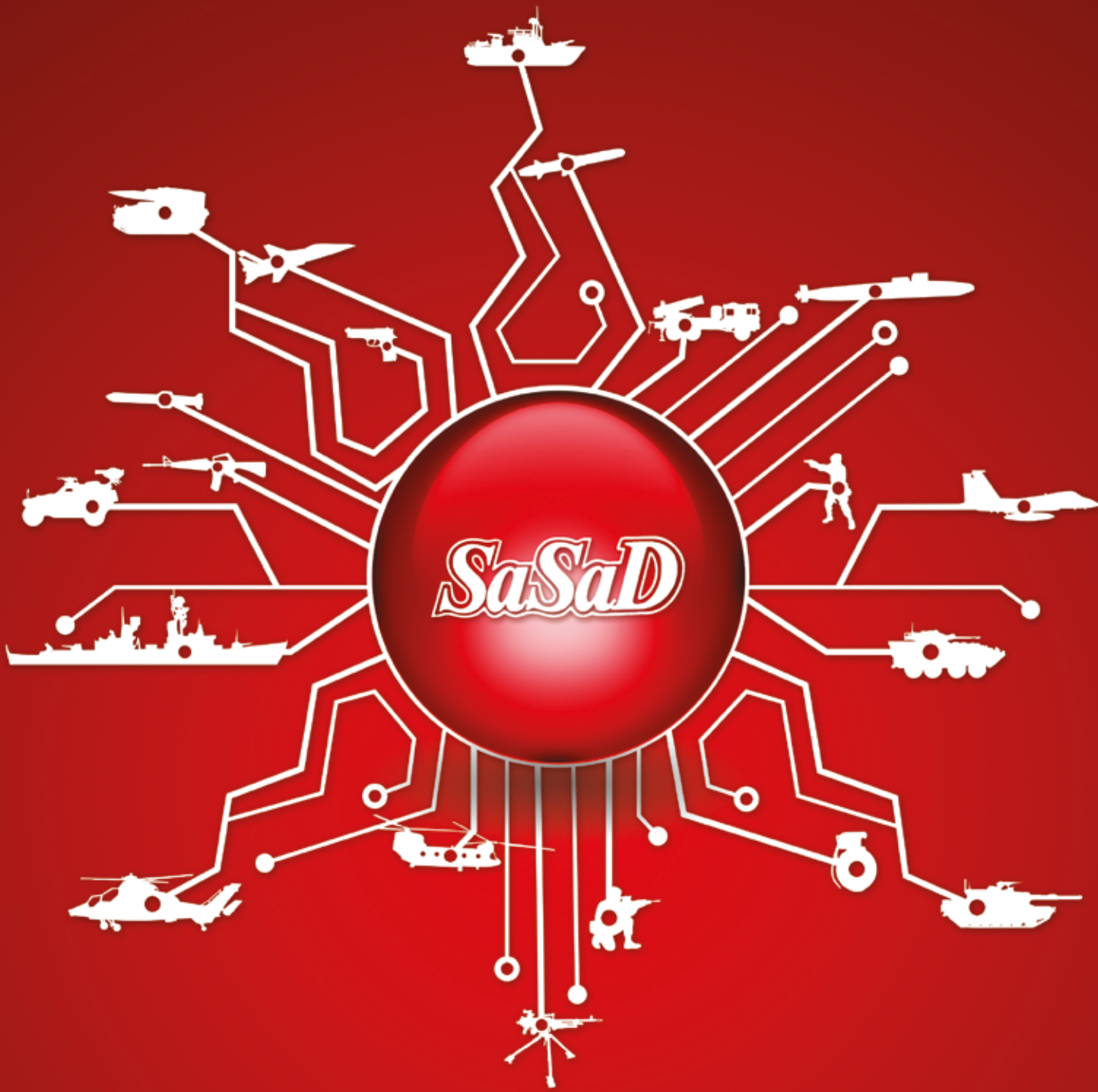
The story of THK-13 reveals how serious the testing stages in engineering are and that such processes must be accomplished with determination in order to achieve progress. Technical negligence

before the second test flight caused foreign object damage and a serious accident. The reports prepared by the pilots after the tests clearly indicate that the technical problems in the control and rudder mechanism of the glider could not be resolved² and such problems were under the responsibility of the engineering team. This process that could be accomplished after repeated tests with the healthy communication of the pilots and the technical team could not be sustained due to the

inability to conduct new tests.

The management mistake of THK when establishing the factories and the suspension of aircraft order from THK in line with the decisions taken by the government adversely affected the institution, and the factories were transferred to the state at THK's own request. Consequently, the first Turkish type flying wing THK-13 project, unfortunately, could not persist due to the turbulent period and remained an idle venture

² For reports please see: Kılıç, M., *Uçan Kanat, Sonçağ Yayınları, 2021, Ankara, p. 33-35 and 64-65*; Hasan Erkan Karaca's interview with pilot Cemal Uygun: *Uçantürk, Eylül 1994, Issue: 388, p. 42.*



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Who was the Winner of Airbus-Boeing Competition at Dubai Airshow

by Muhammed Yilmaz

Dubai Airshow, the first major global aviation organization held after the onset of the Covid-19 pandemic, opened its doors to its visitors for the tenth time. While more than 1200 companies from 148 countries participated in the fair, more than 160 aircraft were exhibited. More than 120 thousand visitors attended the organization, which took place under the impact of the pandemic. Manufacturers managed to receive a record number of orders.

Two giant manufacturers Airbus and Boeing managed to exceed the figures they achieved at the 2019 fair regarding the aircraft orders.

European Airbus closed the Dubai Airshow with an order for 404 aircraft. Its American rival Boeing, on the other hand, received an order for 101 aircraft. At the 2019 fair, Airbus received 220 orders and Boeing 97 orders. The list price of the orders given by the airlines at the fair is thought to have reached 80 billion dollars.

Regional aircraft manufacturer ATR managed to receive 7 orders for the 72-600 model, while Brazilian Embraer managed to receive 6 orders for the E175 model, 3 of which are optional.

Dubai's national airline Emirates, on the other hand, managed to attract the attention at the fair, as it did in the fair 2 years ago, by placing an order of 25 billion dollars to the manufacturers.

On the first day of the fair, Airbus managed to receive

a total of 255 orders for A321neo family aircraft from Indigo Partners companies and made a great start. 29 of these orders were placed for the A321XLR. The breakdown of 255 orders was 102 aircraft to Hungarian Wizz Air, 91 to U.S. Frontier, 39 to Mexico Volaris and 23 to Chilean JetSMART. On the second day of the fair, aircraft leasing company Air Lease Corporation placed an order for a total of 111 aircraft, including 7 A350 freighters. Thus, it became the launch customer for the

Airbus A350 freighter. The breakdown of ALC's 111 orders was 25 A220-300, 55 A321neo, 20 A321XLR and 4 A330neo. On the third day of the fair, Kuwait Jazeera Airways committed to buy 28 Airbus A321neos, while Nigerian Ibom Air placed an order of 10 A220s.

During the show, all eyes were on Boeing's 777X, which was unveiled at the Dubai Airshow and also participated in demonstration flights. Although the new aircraft was the focus of attention at the fair, the U.S. manufacturer failed to receive an order for this aircraft in Dubai. For the 777X program, which is 2.5 years behind the planned schedule, the operators, especially Emirates, the

launch customer of the aircraft, were a bit hesitant and distant. The B777X is expected to complete the certification process in 2023.

The orders Boeing was able to receive at the fair were mainly for freighters. On the first day of the fair, Icelandic leasing company Icelase placed an order for 11 passenger-to-cargo conversion 737-800s. On the second day, DHL Express placed 9 passenger-to-cargo conversion 767-300 orders. On the second day, Emirates also placed an order for 2 new Boeing 777 freighters. On the third day of the fair, Sky One purchased 3 777-300s. Air Tanzania ordered 1 Boeing 787 Dreamliner, 1

767 freighter and 2 737 MAX aircraft. On the last day of the fair, the new Indian airlines venture Akasa Air pleased Boeing with its 72 Boeing 737 MAX aircraft order.

Things Getting Hot in Freighter Market

Aircraft manufacturers are taking their positions for freighters against the increase in demand. U.S. manufacturer Boeing previously announced that it was holding serious negotiations to produce the cargo version of the 777X aircraft. Qatar Airways stepped in to become a launch customer of the 777X freighter at the Dubai Airshow, committing to place a major order.

Boeing announced during the week that three new conversion lines will be added for the 737-800 aircraft across North America and Europe. In 2022, the company will open one conversion line at Boeing's London Gatwick Maintenance, Repair & Overhaul (MRO) facility; and two conversion lines in 2023 at KF Aerospace MRO in Kelowna, British Columbia, Canada.

Boeing forecasts 1,720 freighter conversions will be needed over the next 20 years to meet the demand. The company expects nearly 20% of that demand coming from European carriers, and 30% coming from North America and Latin America.





Boeing also announced that it has received more than 200 orders and commitments from 19 customers for the 737-800 standard body freighters. The company signed a firm order with Icelease, Iceland-based aircraft lessor, for 11 freighters as the launch customer for the new conversion line in London.

It is most certainly believed that Boeing is to expand the aircraft

conversion lines in North America, Europe and Asia in the future.

Boeing's European rival, Airbus, announced that it expects 4.7% annual growth in freight demand boosted by e-commerce. The company also forecasts 2.7% annual volume growth in general cargo, representing nearly 75% of the market.

Airbus has hit the button to launch a freighter version of its long-

awaited wide-body A350 aircraft. The aircraft is scheduled to enter into service in 2025. Airbus, at the Dubai Airshow, signed an agreement with Air Lease Corporation for 7 aircraft. The company aims to announce further orders for this aircraft soon. The freighter version of the A350 will compete against Boeing's 777 freighter.

Airbus has failed to sell a single freighter since

2015. The freighter version of Airbus' most popular wide-body aircraft, the A350, is thought to ignite new competition in the Boeing-dominated cargo market. It is a matter of curiosity how the Airbus A350 can take a share in this market dominated by Boeing.

Airbus predicts that over the next 20 years there will be a need for some 2,440 freighters, of which 880 will be new-build.





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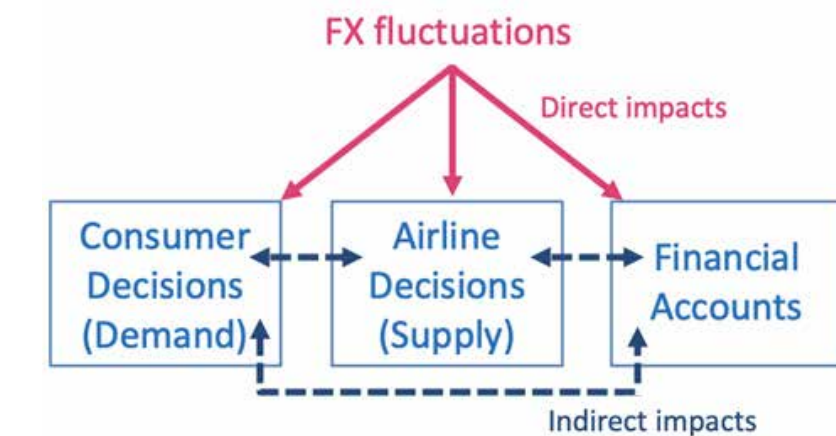


How Do Fluctuations In Exchange Rates Affect Airlines?

by Muhammed Yilmaz

In recent days, we all live and breathe the loss of value of the Turkish lira. We feel the effects of the uncontrolled depreciation of our currency against all foreign currencies at every point of our lives. Needless to say, this negative picture also affects our travel and transportation habits severely. While it has been difficult to get out of the city for about 2 years due to the pandemic, when we look at the devaluation of our domestic currency against foreign currencies, we can say that it has almost become a dream to go abroad. When calculating our budget for visas, airfare, accommodation and food, multiplying the figures by 15-20 is pretty scary.

So, how will the foreign exchange appreciation in our country affect the aviation industry, where almost all costs are indexed to the US Dollar? What awaits us and our airlines next?



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Stylized impacts of FX fluctuations on airlines

Reducing Costs or Increasing Revenue is the Sine Qua Non!

Since airline companies export services, they are directly exposed to all kinds of effects related to international trade. As liberalization in global aviation markets increases, it becomes even more challenging for airlines competing with other countries' airlines, especially on international routes.

Actions to be taken by an airline in order to compete with another country's airline are

quite clear. Companies have to reduce their costs or increase their revenues compared to their competitors. Accordingly, one of the key factors of competitive power for airlines is the exchange rate condition in their countries.

Expences of Companies are in US Dollars!

Airlines pay millions of dollars to buy or lease aircraft. They buy the fuel to fly these aircraft with dollars. They insure these aircraft by paying tens of thousands of

dollars. They pay the fees of the airports where they conduct flights and all the services they receive in dollars. They also spend dollars for the regular maintenance of their aircraft and the supply of spare parts. In brief, almost all expense items of airlines are in dollars.

How do Airlines Generate Revenue?

In return, companies only generate revenue by passengers and cargo transport. In addition to the fee for the seat that airlines sell to fly

their passengers, aside from the cargo being transported, they have some extra income, which we call beyond-the-fare income and which is also mostly derived from the passengers. The money we pay for seat selection at check-in, the extras we pay when we exceed the limit given to us for luggage, the money we pay for using various services such as food and beverage on the plane and for the internet constitute the ancillary income of the companies.

In addition, they receive commissions on items such as contracted hotels, car rental and travel insurance. Sales made with frequent flyer miles and points and revenues from some transactions made with the company's co-branded credit cards with a bank are also the revenue channels of the airlines. All kinds of advertisements that may be placed on or off the aircraft, advertisements in magazines onboard, in the private passenger lounges of the airline and

in all communication channels of the company are among the ancillary income sources of the airlines. In short, humans are the basis of the main and ancillary income sources of airlines. So the more people fly, the more revenue the companies generate. The airlines index all their income items to dollars in order to make the payments that need to be made in dollars, which I mentioned at the beginning.

How do FX Changes Affect Airlines?

Airlines are affected by changes in exchange rates in three different ways: supply, demand and financial effects.

Number of Passangers Will Change With FX Fluctions

The higher the exchange rates in a country, the harder it gets for the citizens of that country to travel by plane. A TL-based pricing is applied for domestic flight tickets. Since almost all of the expenses of airlines were in foreign currency, they already could not make a profit on domestic flights. However, due to this uncontrolled increase in foreign exchange rates,

we will see price gouging over ticket prices in the coming days.

Since the ticket prices on international flights have already been indexed to the US dollar for a long period of time, they have already risen. If you want, you can search for a ticket price for an international destination that you fly frequently for a few months later. You can't believe your eyes when you see the prices.

At this point, perhaps the only thing that strengthens the hand of the airlines is the arrival of more passengers from abroad due to the increase in foreign exchange rates and accordingly the country's getting cheaper. However, if we take into account the course of the pandemic and our country's general situation under current conditions, the validity of this plan is uncertain.

Airlines have to work on new strategies to rebalance supply and demand due to the change in passenger demand. Companies will try to look for ways to attract foreign passengers instead of domestic passengers who will become disinterested as ticket prices increase.

Therefore, the first method that comes to mind may be to make plenty of advertising and promotion abroad. But of course, the US dollar will again be needed to run such campaigns. A vicious circle...

Capital Structure of Companies is Quite Critical

Changes in exchange rates secondly affect airlines over their capital structure. The size of this effect is directly related to the currencies in which companies borrow and in which currencies they invest. Long-term, permanent and large-scale changes in exchange rates directly concern all investment decisions of companies, especially aircraft purchases, route and fleet planning.

Sharp increases in exchange rates cause excessive fall of total asset and market values of companies in the US dollar terms, and likewise lead to increase in their debts. Therefore, the financial accounts of companies that have already been hit hard by the pandemic may also shake the companies to their foundations. This may turn our airline companies into a commercial commodity

ARTICLE

that can be purchased at a low price by their global competitors. Rumors may even restart for the sales of Turkish Airlines to Qatar Airways or other global competitors, which have been claimed for a long time and denied many times.

Input Costs of Airlines Will Rise!

As a final point, changes in exchange rates can also affect the prices companies pay for inputs, weakening competitiveness. The fact that competitors pay much lower prices for the same inputs

creates a negative competitive effect for our companies. This may cause our airlines to lose their shares in markets in which they are strong.

Revenues and Expenses Are In Us Dollar Terms!

Airlines, due to the nature of the industry, have to index their revenues and expenses to the US dollar. The balance between dollar revenues and dollar expenses is of vital importance. If a company has a dollar deficit, it becomes almost impossible to cover this deficit with the local currency, in

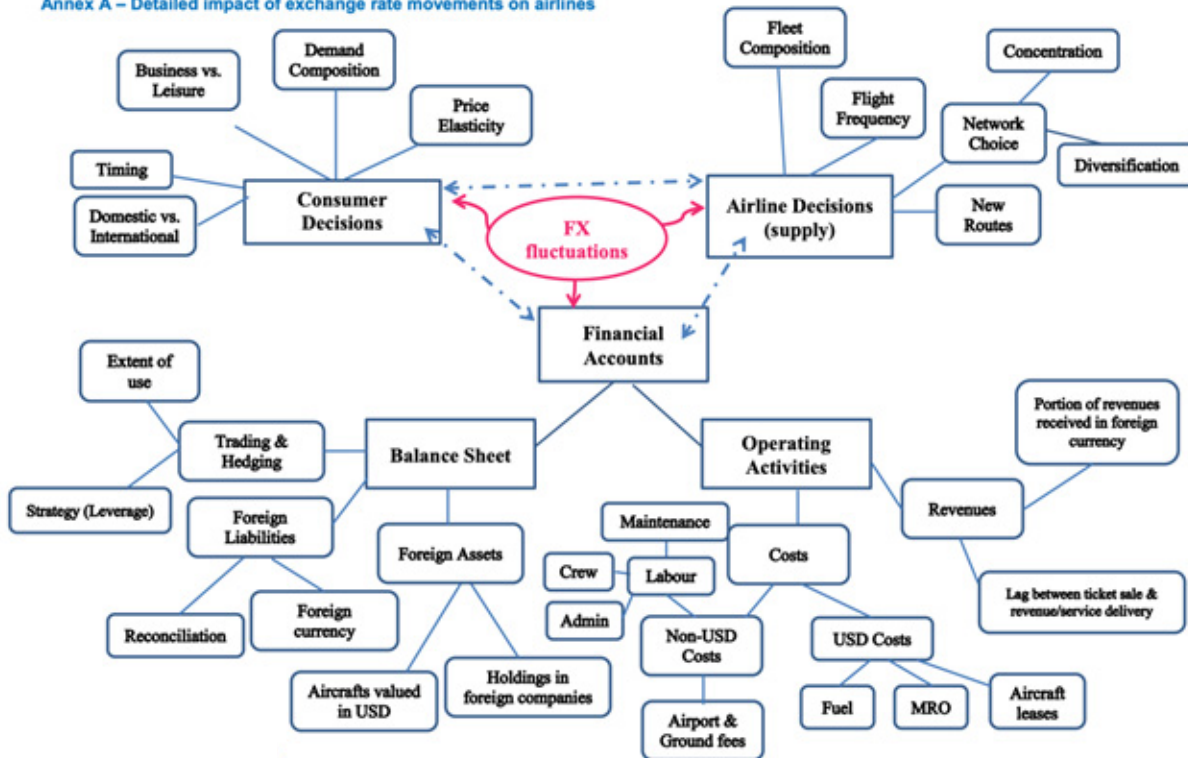
countries like ours with high exchange rates. In the long term, this may lead to credit utilization with high interest rates, downsizing, selling of the business and, worst of all, filing bankruptcy. It is quite difficult to manage such turmoil and develop a long-term strategy in markets where exchange rates are aggressively rising against the local currency.

Airway Becoming No Longer Public's Way!

To summarize, the rapid depreciation of

our currency against exchange rates, while seriously refraining us from the pleasure of air travel makes it quite difficult for our companies to survive financially. All other stakeholders of the sector, from airport operators to ground handling services, from parts suppliers to pilot candidates, are also affected by this negative situation. It is for sure that in the near future, we will remember the phrase "airway is public's way" with a bitter smile when we think of our past travels...

Annex A – Detailed impact of exchange rate movements on airlines



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Promising Results on 100% Sustainable-Fuels Emissions Study of Passenger Jet

Initial findings from a world-first study of the impact of 100% sustainable aviation fuel (SAF) on both engines of a commercial jet have provided promising early results.

The ECLIF3 study, involving Airbus, Rolls-Royce, German research centre DLR and SAF producer Neste, marks the first time 100% SAF has been measured simultaneously on both engines of a commercial passenger aircraft – an Airbus A350 aircraft powered by Rolls-Royce Trent XWB engines.

In-flight emissions tests and associated ground testing on the ECLIF3 programme began

earlier this year and have recently resumed. The interdisciplinary team, which also includes researchers from the National Research Council of Canada and The University of Manchester, plans to publish its results in academic journals towards the end of next year and 2023.

Findings from the study will support efforts currently underway at Airbus and Rolls-Royce to ensure the aviation sector is ready for the large-scale use of SAF as part of the wider initiative to decarbonise the industry. Aircraft are currently only allowed to operate on a 50% blend of SAF and conventional jet

fuel, but both companies support the drive to certify 100% SAF use.

In April, the A350 flew three flights over the Mediterranean Sea pursued by a DLR Falcon chaser plane to compare in-flight emissions of both kerosene and Neste's hydro-processed esters and fatty acids (HEFA) sustainable fuel. The team also carried out compliance tests using 100% SAF and no operational issues were experienced.

In-flight emission tests using 100% SAF and a HEFA/Jet A-1 fuel blend resumed this month, while ground-based emissions testing to quantify the benefits of SAF on local

air quality were also performed. The research team found SAF releases fewer particulates than conventional kerosene at all tested engine operating conditions, which points to the potential for reduced climate impact and improvement in air quality around airports.

In addition, SAF has lower density but higher energy content per kilogram of fuel compared to conventional kerosene, which brings some aircraft fuel-efficiency advantages due to lower fuel burn and less fuel mass to board to achieve the same mission. Detailed analysis by the team is ongoing.



ON TOP OF THE WORLD

FLIGHT & TRAVEL NOTES

Emirates, conducting reciprocal flights between Istanbul and Dubai since 1987, started flights to Istanbul airport with the Airbus A380, the world's largest passenger aircraft, as of October 1, 2021.

Emirates, which has 123 A380s in its fleet and took delivery of the last 272 A380 aircraft in Airbus' production line on December 16th, offers its passengers Economy, Business and First Class options with this iconic double-decker superjumbo jet, providing the highest level of comfort and safety. With a capacity of 519 seats, the aircraft has 14 First Class & 76 Business Class cabins and 429 spacious Economy Class seats.

Emirates Airlines, which operates 3 flights a day and 17 flights a week from

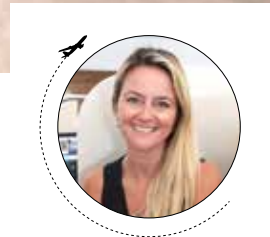
Istanbul during the winter period, added A380 aircraft to its previous B777-300ER flights as of October 1, 2021. I was one of the special guests of the press tour prepared for the first flight from Turkey with the A380 aircraft. I was quite excited for this new experience as I had never traveled with an Airbus A380 before.

Before this travel, which will take 4 hours and 15 minutes from Istanbul IGA Airport to Dubai, there are some special procedures that you must follow. First, you need to be fully vaccinated for flight. In addition, as per the COVID-19 measures, the United Arab Emirates asks you to present your negative COVID-19 PCR test, taken at most 24 hours before flight, to the officer at the passport checkpoint on your

flights from Turkey. Likewise, you are subject to a PCR test again at specially prepared counters at arrival.

The UAE, in addition to the necessary procedures related to COVID-19 measures that have become part of our lives, requires visas from passengers with Turkish passports, so don't forget to contact your airline and apply online from its website after purchasing your ticket. Emirates completes this process for you in a very short time.

For this travel, our Business Class tickets were booked and seat selections were made previously. Emirates recommends and frequently reminds their passengers to make online check-in to minimize contact during the pandemic.



by Şebnem Akalın

Emirates Business Class seats consist of 3D cabins that give the feeling to each passenger having their own room. In the 3D cabins, the passenger has his own 23-inch TV and a mini-bar filled with soft drinks. It has wide and comfortable seats that turn into a fully-flat bed when you want to sleep.

The cabin crew welcomes you on board with a glass of high-quality champagne or fresh juice and this gives you the hint that your journey will be enjoyable from the first minute.

Emirates prepares its entire food menu from halal certified products and works with the best chefs in the world to create an amazing menu.

I had the chance to monitor the entire take-off from the screen in front of me, as I did not know how I would feel at the time of take-off with the excitement of flying such a large aircraft. Emirates, which employs highly experienced pilots among its staff and contributes to the development of its pilots increasingly with frequently repeated flight trainings, is one of the most reliable airlines.

I felt relaxed from all reasons above, and while we were excited to take off with an aircraft of this size, we suddenly found ourselves in the sky even without understanding how we took off. Being up in the clouds in the world's most reliable aircraft was more than a pleasure.

There were delicious starters, main courses and desserts that can be selected from the menu just before the start of the meal service, of course, a

carefully selected wine menu from the most famous brands of the world, champagne and other alcoholic beverages, as well as soft drinks were served.

Just before I started my meal with classic Arabic appetizers, my tray table was turned into a stylish restaurant table in seconds with a white cloth spread over it. Hummus, muhammara and other appetizers prepared in a high-end restaurant quality started to increase my appetite. For the main course, I chose fish and seafood, but chicken or meat options can also be selected.

After your table is cleared, a quality chocolate served with a delicious coffee makes you feel like you



Şebnem Akalın

are in France. The last flavor of the meal service, desserts, relaxes you even more before sleep.

The service given in Emirates Business Class is not limited to food service only. The on-board lounge, exclusively designed for

Business Class and First Class passengers, with its spacious seating areas and specially designed bar, offers passengers the opportunity to have a drink and taste delicious sweet and salty snacks while socializing.

If you want to lounge and watch something to relax a little before arriving in Dubai, there is an in-flight entertainment system with over 4500 movies, series or TV channels. In addition, for a small fee, you can connect to the Wi-Fi on the plane during the journey to be online or check your e-mails in order not to fall behind at your work.

Free COVID-19 test is offered to Emirates passengers upon landing in Dubai. Then you pass to the passport control. The testing made in Turkey only allows us to board the plane, so this test is also mandatory. You can check



the results online, since quarantine conditions vary, it is useful to check before the travel.

While the average temperature is 46 degrees in the summer period from April to October in Dubai, it varies between 14 and 23 degrees in October-March period. Of course, it is quite difficult to luck into 14 degrees in such a hot geography. The temperature is rarely at these values in February. In general, we can say that Dubai is always very humid and hot. Considering that the air conditioners are used in all vehicles, hotels, shopping malls, briefly in all closed areas, you should take a sweatshirt or jacket with you in order not to get sick.

With an area of 83,600 square kilometers, United Arab Emirates is a federation of seven emirates, namely Abu Dhabi, Dubai, Sharjah,



Fujairah, UmmAl Quwain, Ajman and Ras Al Khaimah. The capital of the country is Abu Dhabi, but the country's entertainment, tourism, service, finance, trade and investment center is undoubtedly Dubai. The Emirate of Dubai, the country's second largest

emirate, is not rich in natural gas and crude oil reserves. It derives almost 90% of its revenues from finance, tourism, free zone and trade. Dubai is preferred more than other emirates with its tax-free zone, luxury hotels and restaurants, ease of establishment of

offices and businesses, international fairgrounds, advanced transportation facilities, reliable finance and other services it offers to foreign investors.

You can be sure that you will see something different in Dubai every time you travel, as the city develops and grows rapidly.

There are lots of things to do in this metropolitan city, but of course, the priority should be getting to the top of the tallest building in the world. After all, you can't shout 'I am on top of the world' anywhere else. Burj Khalifa is a 160-storey building at an altitude of 828 meters. Since it takes 1 minute to reach the 124th floor by elevator in Burj Khalifa, which offers different options to its visitors from dinner organization to teatime, even someone who is afraid of heights like me can get to the top





of the tallest building in the world with the elevator decorated with a visual show, easily and without discomfort. There you can see all of Dubai with a panoramic view, with the excitement of being at the top.

Burj Al Arab and, certainly, Palm Jumeirah are the first places that our eyes are searching for with excitement. When you come down from the highest point in the world, you can find all the brands of the world at the Dubai Mall, which is right next to it, and you can have the chance to do some shopping and taste some world flavors. The famous U.S. cheesecake brand, which you cannot go and eat since the U.S. is far away, has branches here as well. Take your time and drop by.

If you prefer to have dinner at a nice local restaurant, especially in Dubai Mall, you can watch the fountain show

here. This show, repeated every half hour, has been transformed into a visual feast by using sound and music effects in the shadow of Burj Al Arab, which rises in all its majesty on one side.

On another day in Dubai, you can visit the Dubai Jumeirah Mosque, see the Zabeel Palaca, take a water taxi ride from Dubai Creek to the Deira side, visit the traditional bazaars and do some spice

shopping. Or if you're in Dubai for a vacation, you can surf or watch the surfers at Sunset beach with the iconic Burj al Arab structure behind you. In addition to being a 7-star luxury hotel, Burj al Arab is also known for its Michelin-starred restaurants.

The night safari, which should certainly be preferred for spending more traditional time, is a completely different experience. During the

safari, you can ride on camels, do sand boarding, taste specially prepared Arabian dishes when you are tired, watch exciting shows and even end the night watching a belly dancer.

If you are looking for a wonderful meal and an interesting environment while you are in Dubai, Ossiano inside the Atlantis hotel, which is a restaurant hidden under the sea, will be the right choice. You can have a high standard meal by watching the small sharks and the variety of colorful fish swimming.

The world's most comprehensive Expo, Dubai Expo, which was postponed in 2020 due to the pandemic, opened its doors to its guests on October 1, 2021. As the guests of Emirates, we were one of the first visitors of Dubai Expo and we had a pleasant experience. It can be visited between October 1, 2021 and March 31, 2022.





In the Dubai Expo, the main themes of which are sustainability, mobility and opportunity, there are the pavilions of 192 countries, including the Turkish pavilion. These pavilions, offering the opportunity to get to know the culture of the countries, and which are prepared in accordance with the theme of business life, as well as family and vacation, appeal to all visitors.

Our first stop during the expo tour, the Emirates pavilion, allowed me to make literally time travel into the future.

Sustainable energies of the future, clean fuel options, airports and unmanned passenger

aircraft were the mind-blowing technologies for future. The most important issue for Emirates

airlines is fuel options. Environmentally friendly zero-emission hydrogen is the most popular one. We have learned that liquid hydrogen, which is called the fuel of the future, does not occur naturally in convenient reservoirs on earth although it is one of the most common elements in the world, but can be extracted from fuels such as methane and will be a tremendous power source when it is used in aircraft engines.

You can visit the pavilions of 192 countries, including Turkey, at the Expo, which is surrounded by





the technology of the future. At the time we visited the Dubai Expo, the Turkish pavilion had not been opened yet, but many European and Asian countries had opened their pavilions. During such visits, you can learn about the cultures of the countries and enjoy the feast of taste with the traditional dishes of the countries in the restaurants. You can watch traditional dances in front of most pavilions or attend concerts in the evening accompanied by the spectacular light shows. You will also be given a one complimentary Expo day



pass at your Dubai flights with Emirates between these dates, don't forget and make a note of it. But I must admit that one day is never enough.

We were unhappy to leave the Expo when it was time for our return, but we were excited to make another amazing journey with the A380. I can't help saying that the Business Class Lounge meals we ate before boarding were of French quality. I must say I felt the fact that the cooks were either French or trained in France after every single food I tasted.

I must say that the ground handling staff, the staff in the Lounge and of course the cabin crew are all very well trained, smiling and successful in what they do. You feel special and safe in each service you receive. The A380 Business Class makes you feel special from the moment you step into the cabin until you get off the plane. The freshness of the food, the

selection of drinks, the taste of the snacks...

On my return flight, I had the opportunity to have a short interview with Emirates Divisional Senior Vice President, International Affairs - Sheikh Majid Al Mualla, who was traveling with

us to attend the launch of the Emirates airlines jumbo jet, which will fly to/from Istanbul. I asked him about Emirates' future investment and growth plans, technology and eco-friendly practices, expectations from EXPO and more, for our readers.





Sheikh Majid Al Mualla: We Look Forward to Hosting Visitors in Dubai and Dubai Expo 2020

Şebnem Akalın: Mr. Sheikh Majid Al Mualla, thank you for making this interview with us in the A380's onboard lounge. It's amazing to think that we are literally soaring through the air right now, thousands of miles up on this exceptional flight from Dubai to Istanbul. Emirates launched A380 flights from Dubai – Istanbul and the opening of Dubai Expo on the same day...and as Emirates Airlines guests we had the chance to visit the Emirates booth and experienced innovative airplanes, the future of air travel and the Dubai airport.

Emirates Airlines is an official sponsor of the Dubai Expo. Can you share a bit about your aircraft and the expo as far as what's in store for your guests at the Emirates booth? What will visitors experience and see at this year's event?

Sheikh Majid Al Mualla: This is an exciting time as we are launching the A380

to Istanbul and at the same time we are opening Dubai Expo 2020. As you know this is a huge event with more than 190 participants and Emirates airlines is proud to be part of this expo and is one of the main sponsors. As part of our promotion our customers flying to Dubai receive a one-day free pass to the Dubai Expo and can safely experience the expo and the Dubai airport as we have implemented all recommended COVID measures and are making travel touchless during the flight and in the airport. At the Dubai Expo you will experience what we will be offering in the future.

Şebnem Akalın: The A380 is mostly a long-haul aircraft but Emirates airlines will fly on a short line from Dubai to Istanbul? Did your customers request this kind of service? Because it's really an incredible experience flying with the A380.

Sheikh Majid Al Mualla: Istanbul is one of the main points of our network. We have seen tremendous growth, especially after the initial COVID outbreak

when flights were back to normal operations. We recognized that lots of people from Dubai wanted to fly to Turkey and that's why we were considering it, and we have wanted to fly to Istanbul with the A380 for a while, but the airport was not ready until now. When the airport was ready we felt that it was the right time to start our flights. Our customers who travel all over the world can connect directly A380 to A380 from Istanbul. I have met with some passengers who are flying right now and had a little talk with them, and they told me that they are really very excited. We also thank the Civil Aviation Authority and the government of Turkey for making this happen.

Şebnem Akalın: With increased global awareness on the environment, individuals as well as companies are shaping the future now for a greener tomorrow. Yesterday at the Dubai Expo we saw that Emirates airlines is focusing a lot of attention on creating a greener world and working on new

technologies like aircraft fuel, environmentally friendly customer service and green airports. What can you tell us about this?

Sheikh Majid Al Mualla: The fundamental aim of Emirates airlines is net zero carbon emissions. We are also striving to use less plastics to protect the environment as well. Our aircraft are all new and this means less fuel consumption. We are one of the main global airlines trying to use all the new technologies to protect the environment.

Şebnem Akalın: Mr. Sheikh Majid Al Mualla thank you for your time. What would you like to add for our readers in closing?

Sheikh Majid Al Mualla: Turkish people are always welcome to our country. The UAE is their second home, and our services will strengthen relations between our two countries. We are excited to welcome new passengers aboard the A380 and we look forward to hosting visitors from across the globe in Dubai at Dubai Expo 2020 🌍



Airlines Financial Monitor

December 2021 - January 2022

Key points

- The latest financial results confirm that the pressure on the industry's operating profitability eased in Q3 2021. In the sample of 87 airlines, the operating loss – improved from 13.6% of revenues in Q2 to 2.6% in Q3.
- The Global airline share price index picked up in January 2022 amid investors' confidence that Omicron-related disruptions might have a smaller impact on the travel industry than previously expected. Nevertheless, the index remains 30% below pre-crisis levels.
- Jet fuel prices also rebounded from the Omicron-related dip in December and are currently at the highest level since late-2018. The elevated price is adding extra pressure on airlines' operating costs just at the time when travel demand is being hit by renewed travel restrictions.

Global airline share price index rebounds as fears over Omicron disruptions ease

Airline Share Prices

US\$ indices (Jan 2014=100)	Index Jan 11th	% change on		
		vs Dec 10th	vs Dec 2019	start of year
World airlines	94.7	7.0%	-30.0%	+5.8%
Asia Pacific airlines	76.4	16.2%	-30.5%	-0.5%
European airlines	81.4	-0.3%	-28.1%	+13.4%
North American airlines	119.6	7.8%	-28.7%	+6.4%
FTSE All World \$	190.8	0.3%	+31.9%	-0.9%



Source: Refinitiv Eikon Datastream

- The Global airline share price index started the year 2022 on a positive note, rising by 5.8% in the first half of January. The improvement was driven by investors' confidence that the new Omicron variant will lead to fewer hospitalizations than other strains and therefore might cause less disruption than previously expected.
- The global index hides some regional variation. Shares of European airlines rose the most significantly in January (13.4%), driven by renewed optimism about the industry's recovery. Meanwhile, airline stocks in Asia Pacific fell by 0.5%, reflecting concerns about the impact of a potential interest rate hike in the US.
- Taking a step back from the short-term developments, the bigger picture remains that airline stocks continue to trade about 30% below the pre-crisis level in all regions.

Industry-wide operating income improved in Q3 amid gradual air travel recovery



Source: IATA Economics using data from the Airline Analyst & Refinitiv Eikon

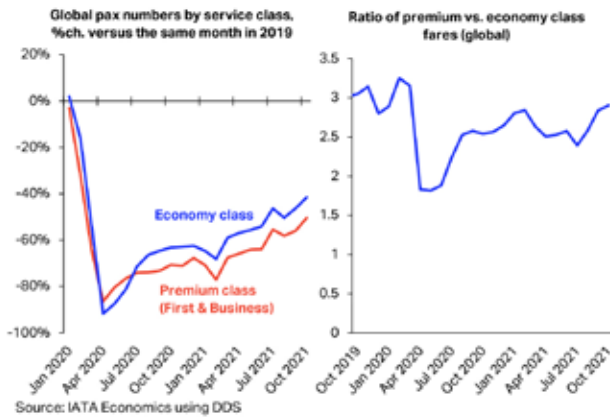
- The latest financial results confirm that pressure on airlines' operating profitability eased in Q3 thanks to a gradual improvement in passenger traffic and a booming air cargo business. The industry-wide operating loss was 2.6% of revenues over the July-September period, compared with a 13.6% loss in Q2.
- The EBIT margin improved the most in Europe which airlines benefitted from recovering air travel demand on intra-European routes. The European metric rose from -30% to 3% between Q2 and Q3. The improvement was smaller in North America where the Delta variant's spread delayed the air travel recovery. Asia Pacific airlines showed the weakest operating result in aggregate (-20% of revenues), notably due to still very restricted international travel to, from, and within the region.
- Looking ahead, some of the North American airlines improved their revenue forecast for Q4, stating that travel demand remained robust during the holiday season despite Omicron disruptions. That said, costs pressures are expected to rise as well.

Airline Financial Results

Number of airlines in sample	Regions	Q2 2021		Q3 2021	
		EBIT margin ¹	Net post-tax profit ²	EBIT margin ¹	Net post-tax profit ²
33	North America	-7%	1,073	1%	2,941
26	Asia-Pacific	-15%	-1,866	-20%	-3,170
14	Europe	-30%	-4,634	3%	31
8	Latin America	-18%	-700	-8%	-1,938
4	Others	-20%	-118	4%	-31
87	Sample total	-13.6%	-6,245	-2.6%	-2,167

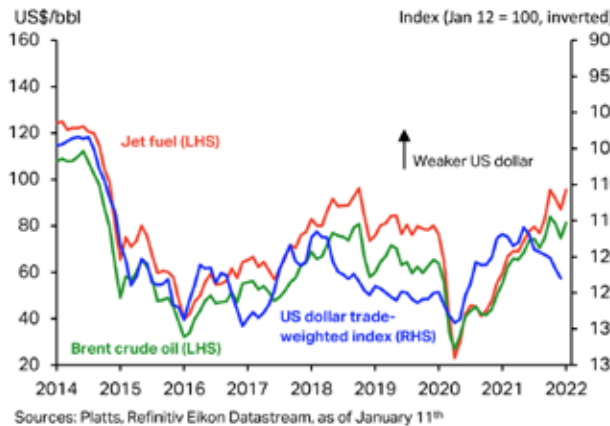
¹% of revenues ²US\$ million
Source: The Airline Analyst, IATA

Economy class continues to recover faster than premium class at the global level



- Taking a closer look at different sources of passenger revenues, premium class passenger traffic continues to lag the recovery in the economy counterpart.
- Following the peak of the crisis in April 2020, premium was briefly recovering faster than economy. This can be partly explained by premium tickets becoming relatively less expensive than economy tickets (see the blue line in the right-hand chart). However, the price advantage has largely disappeared since July 2020 and the economy class recovery started to outperform. The performance gap between the two has been broadly unchanged since then, at 8-10 percentage points.

Jet fuel prices are on the rise again, putting upward pressure on airline costs



- Jet fuel and Brent crude oil prices bounced back in January, with the former currently at the highest level since late-2018. As with airline stocks, the price recovery has been driven by rising optimism about the short-lived impact of the Omicron variant on global economic activity, including fuel demand.
- The elevated jet fuel price adds pressure on airlines' operating costs just at the time when the revenue side is being hit by Omicron-related flight cancellations. This might delay airlines' financial recovery from the crisis.
- In 2021 as a whole, jet fuel and Brent crude oil prices surged by 68% and 63% respectively compared with 2020, as demand increased with easing lockdowns while OPEC+ supply remained tight.

The industry burned cash in Q3 2021, but significantly less than in 2020

Airline Cash Flow¹

Number of airlines in sample	Regions	Q2 2021			Q3 2021		
		Net cash flow ²	Capex	Free cash flow	Net cash flow ²	Capex	Free cash flow
16	North America	40%	11%	29%	-8%	6%	-14%
23	Asia-Pacific	5%	11%	-7%	2%	11%	-9%
10	Europe	21%	14%	7%	9%	7%	2%
5	Latin America	-12%	7%	-19%	-2%	13%	-16%
4	Africa & Middle East	40%	13%	26%	7%	1%	6%
58	Sample total	26%	11%	15%	-1%	8%	-9%

¹% of revenues

²From operating activities

Sources: The Airline Analyst, IATA

- In the sample of 58 airlines, the industry-wide net cashflow from operating activities was at -1% of revenues in Q3. This represents a significant improvement versus Q3 2020 (around -50%). However, it is a weaker outcome compared with Q2, partly due to a negative impact of the Delta variant on ticket sales in some markets.
- International bookings for future travel have been falling amid new travel restrictions. This will negatively impact some airlines' cashflow over the northern hemisphere winter.

IATA Economics



Emirates and GE Aviation commit to test flight program using 100% Sustainable Aviation Fuel to reduce CO2 emissions

Emirates and GE Aviation have signed a Memorandum of Understanding (MoU) to develop a program for a test flight of an Emirates Boeing 777-300ER, powered by GE90 engines, using 100% Sustainable Aviation Fuel (SAF) by the end of 2022.

Currently, SAF approved for use is a blend of petroleum-based Jet A or Jet A-1 fuel and a SAF component with a maximum blend limit of 50%. One of GE's fuel experts chairs an international task force to develop standardized industry specifications supporting adoption of 100% SAF, which does not require blending with conventional jet fuel.

As a milestone collaboration for both Emirates and GE Aviation, the 100% SAF test flight is expected to demonstrate how wide-body commercial aircraft using jet fuel made from alternative sources can lower lifecycle CO2 emissions compared to petroleum-based fuels with no operational issues.

The demonstration flight also supports both companies' broader efforts to reduce CO2 emissions as the industry looks to scale up its use of SAF.

Emirates will work closely with regulators to secure approvals for experimental type certification, and will also coordinate with airframe, Auxiliary Power Unit (APU) and Original Equipment Manufacturers (OEMs) on pre-flight and post-flight requirements, in addition to closely working with SAF suppliers on procurement and delivery logistics.

GX Aviation Solution is Available to Passengers

Inmarsat has announced that its award-winning GX Aviation solution is now available to passengers on more than 550 aircraft at APEX Expo.

Coinciding with the fifth anniversary of GX Aviation, the service has become Inmarsat's most successful passenger inflight broadband service, selected by more than 35 airlines available on over 550 aircraft, with approximately 1,000 additional aircraft in the order book.

Powered by the world's first and only globally available broadband network, GX Aviation has transformed the airline passenger experience, offering reliable, consistent and high-speed inflight connectivity that is on par with mobile Wi-Fi on the ground. Since its inception, millions of passengers have enjoyed access to GX Aviation, with major airline customers including Lufthansa, Qatar Airways, AirAsia, Eurowings, Singapore Airlines, Air New Zealand, Philippine Airlines and Virgin Atlantic.

This latest milestone for GX Aviation comes at a critical time for the aviation industry, with the pandemic having accelerated passenger demand for digital inflight experiences. Inmarsat's 2021 Passenger Confidence Tracker, the largest and most comprehensive global survey of its kind since the pandemic began, found that digital solutions that keep passengers connected and minimise their contact with cabin crew and fellow passengers can go a long way in boosting confidence. In addition, out of the 10,000 respondents, 41% believed inflight Wi-Fi had further increased in importance after the pandemic.



Entry of AW169 into the African Market

Contract has been signed between Leonardo and Bestfly of Angola for four helicopters. The Leonardo AW169 light intermediate twin engine helicopter further reinforces its global market presence and its success in the energy industry sector with the sale of four aircraft to Bestfly of Angola. This contract marks the entry of the AW169 into the African market with the first purchase from major local operator.

The introduction of the 4.6/4.8 tonne AW169 is a significant boost to Bestfly's air operations in Angola. It will be conducting passenger and equipment transport in the energy industry by leveraging latest technology and navigation/mission avionics, latest certification and safety standards, outstanding performance, the largest cabin in its category and a modern maintenance approach.

"This contract is a great milestone for BestFly in its sustainable growth strategy. We would like to thank Leonardo for its great support in putting this deal together. We are confident the AW169 will be a great addition to our fleet, enhancing the capabilities of our off-shore and on-shore operations. We would like also to thank our customers for their continued support and trust, allowing us to continue to grow stronger in the future" said Bestfly.

Orders and options for nearly 290 AW169 helicopters have been signed by over 90 customers in more than 30 countries around the world to date for a wide range of applications, including air ambulance, law enforcement, executive/corporate and offshore transport, electronic newsgathering, training, military and utility roles. In the energy industry sector, by supporting oil and gas or wind farm, the AW169 has already proven successful in Europe and the Middle East. More than 130 units have been delivered worldwide and have logged more than 90,000 flight hours.

Orders and options for nearly 290 AW169 helicopters have been signed by over 90 customers in more than 30 countries around the world to date for a wide range of applications, exceeding 90,000 flight hours.



Turkish Cargo Transports Ukrainian Sich-2-30 Earth Observation Satellite to Miami for its Launch

Turkish Cargo raised the bar to the space for sensitive and complex cargo transportation. The air cargo brand transported Sich-2-30, the Earth observation satellite developed by Ukraine, to Miami for its launch with a connection flight at Istanbul.

The satellite, which was developed as part of the National Targeted Scientific and Technical Space Program of Ukraine, will blast off at the launch area at the Kennedy Space Center (USA) in January 2022. After its orbit, the Earth observation satellite will capture the digital and infrared images of the Earth's surface and collect generic data by probing the ionosphere parameters.

Sich-2-30 Earth Observation Satellite, for facilitating loading and unloading operations, was dismantled into multiple components, and the components of the satellite were placed carefully on 2 separate pallets together with the supplies in order to avoid any damage during the transportation. The transportation of the spacecraft, loaded on the Turkish Cargo aircraft by related experts, was conducted successfully.

Turkish Cargo uses special equipment for the product shipments requiring maximum attention and sensitivity, and it constantly monitors every movement of valuable cargo stored in sensitive cargo storehouses via cameras located in and around the storage facilities.

Rolls-Royce Signs TotalCare® Agreement with MNG Airlines for Trent 700 engines that power its freighter aircraft



Rolls-Royce has signed a TotalCare® agreement with MNG Airlines for the Trent 700 engines that power its Airbus A330-300 P2F freighter aircraft. Istanbul-based MNG already operates one A330-200F, which is also powered by the Trent 700 and has TotalCare service support.

This agreement will give Istanbul-based MNG Airlines a secured cost of operating and maintaining their Trent 700 engines through a dollar-per-flying-hour payment mechanism. MNG Airlines will support fleet efficiency, creating better economics for its customers. An enhanced aircraft availability will be delivered thanks to Rolls-Royce's in-depth engine knowledge that draws on its advanced engine health monitoring and on more than 60 million flying hours the Trent 700 has accumulated in service.

Rolls-Royce's TotalCare service not only provides support to passenger

airlines customers but also to air cargo carriers. In addition to such support, TotalCare offers more than just an engine maintenance plan; it is a service concept based upon predictability and reliability.

The Trent 700, with more than 60% market share for combined passenger and freighter aircraft, also delivers the highest thrust on the A330 freighter – which translates into extra payload compared to other engine choices. As well as emitting less

CO2 and being the most economical engine to operate on the A330, the Trent 700 is also the most reliable option, with 99.9% dispatch reliability.

John Kelly, Rolls-Royce, Senior Vice President Customers, said: "We look forward to continuing to support MNG Airlines with our TotalCare services. The Trent 700 has proven itself as the market choice for the A330 and our services will help MNG Airlines maximize all of its benefits."

Ali Sedat Özkazanç, Managing Director, MNG Airlines said: "With a growing fleet, we are continuing to keep our customers delighted and confirm our leading position in our country and industry. We need to maintain our A330 freighter fleet at the highest operational reliability level and keep our maintenance cost at minimum. Our TotalCare agreement allows us to do just that, drawing on many years of Rolls-Royce expertise with this engine. We would like to thank Rolls-Royce for this TotalCare opportunity"





TAV and Fraport Selected as the Successful Bidder in Antalya Airport Tender

TAV Airports and Fraport JV placed the best bid of 7.25 billion euros plus VAT in a tender for the expansion of Antalya Airport's capacity and its operating rights for 25 years. Vnukovo-INTEKAR Yapı JV was the other bidder in the tender conducted at the General Directorate of State Airports Authority (DHMI).

TAV Airports and Fraport JV will pay twenty-five percent of the bidding price up front to the DHMI. The tender covers the 25-year period from January 2027, the expiry date of the existing agreement, to December 2051.

TAV Airports President & Group CEO Sani Şener said, "As TAV, we invest in airports and conduct airport operations. Together with our partner Fraport, we have been performing successful services in harmony for three and a half years in Antalya, the largest tourism center of the Mediterranean. During this period, Antalya reached

all-time high passenger traffic. Even though we have spent the last two years under the effect of the pandemic, we believe Antalya will achieve a much better place with its natural richness and cultural heritage as well as its developed tourism infrastructure. With this agreement, we will initiate the necessary investment activities at the earliest possible time in order to achieve the required capacity increase in the airport. Today, we once again reiterate our commitment to invest in Turkey and our confidence in the future of Turkish aviation. We would like to thank all our stakeholders, especially DHMI, General Directorate of Civil Aviation and Turkish Airlines, who have made Turkey one of the world's leading countries in aviation in the last 20 years, under the guidance of the Ministry of Transport. Together with our partner Fraport, we will exert efforts to realize the potential of Antalya

by using the knowhow and experience we have accumulated."

Fraport AG CEO Dr. Stefan Schulte said, "We delivered a convincing bid backed by our many years of successfully operating and developing Antalya Airport as one of the world's premier tourism hubs. Together with our partner TAV, we look forward to continuing this dedication to customer service, innovation and operational excellence in the decades to come."

TAV and Fraport JV will invest approximately 600 million euros in the first phase and approximately 765 million euros in total, in order to increase the capacity of the airport to 80 million passengers a year.

As part of the agreement, Terminal 2 will be enlarged to cover 190 thousand sqm from the current 82 thousand, to serve as the new main international terminal. In parallel, the domestic terminal will be expanded to 78 thousand

sqm from 37 thousand. In 2040, the international terminal with an area of 70 thousand sqm will be opened.

An additional 1 million sqm of apron area will be built and the number of parking positions will increase to 181 from 106, while the number of passenger bridges at the terminals will increase from 20 to 38. The new carpark will have a heliport on its roof, which will be able to accommodate eight helicopters. New general aviation and cargo terminals will be built together with access roads to divert the traffic from the main passenger access. The investment will be completed within three years, without interrupting the ongoing operations.

Antalya Airport, first put into service in 1960, served 35.7 million passengers in 2019 with its domestic and international terminals with a total area of 178 thousand sqm and two parallel runways.

Connect Europe to Kayseri with Corendon Airlines

Connecting the world and Europe to Turkey with its wide flight network, Corendon Airlines; It will enrich its flight plan by adding new airports from Austria, Germany, the Netherlands and Switzerland to its direct flights from Europe to Kayseri.

These direct flights, which will especially please Turkish citizens living in Europe, will also be an important alternative for foreign tourists who prefer Erciyes for a ski holiday or who come to Cappadocia, which is on the UNESCO World Heritage List.

Corendon Airlines, which currently offers direct flights to Kayseri from 7 cities of Germany and the Netherlands with the aircraft it bases in Kayseri, will start direct flights from Austria and Switzerland to this favorite city of Central Anatolia as of the summer season of 2022.

Corendon Airlines, which will choose the flight personnel it will employ for the wide flight program it will offer, will be among the people living in Kayseri who will best represent the region's culture and service quality.



Singapore Airlines Selects its New Freighter

Singapore Airlines (SIA) is adding the world's newest freighter, the A350F, to its fleet, which will fully meet ICAO's enhanced CO2 emissions standards coming into effect in 2027.

Singapore Airlines has signed a Letter of Intent (LoI) for seven Airbus A350F Freighters. With this LoI, A350Fs will begin replacing the airline's existing B747-400F fleet in 2025 Q4.

Christian Scherer, Airbus Chief Commercial Officer and Head of Airbus International said, "We are honored by Singapore Airlines' confidence in the A350F as it renews its freighter fleet. The A350F is the world's all-new large freighter and will be unmatched in its market segment in terms of operational efficiency, lower fuel consumption and CO2 savings. It is gratifying that Singapore Airlines recognizes the value of the A350F as we build on the strong partnership we already enjoy."

Earlier this year Airbus received Board of Directors approval for a freighter derivative of the A350 designed to meet the imminent wave of large freighter replacements and the evolving environmental requirements, shaping the future of airfreight. The A350F will be powered by latest technology, fuel-efficient Rolls-Royce Trent-XWB97 engines.

As part of the world's most modern long-range family, the A350F will have a high level of commonality with the A350 passenger versions. With a 109-ton payload capacity, the A350F will serve all cargo markets. The aircraft features a large main deck cargo door, with its fuselage length and capacity optimized around the industry's standard pallets and containers.

Over 70% of the airframe will be made of advanced materials, resulting in a 30-ton lighter take-off weight and generating at least 20% lower fuel consumption and emissions over its current closest competitor. The A350F will fully meet ICAO's enhanced CO2 emissions standards coming into effect in 2027.



DEFENCE TURKEY

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Uçuşta Güvenlik Yerde Başlar!

Let-X ile sivil havacılık, iş sağlığı ve güvenliği eğitimlerinde gerçekçi deneyim ve dijital dönüşümü yaşıyor.

