Geneva Institute of International Relations

SOUTH KOREA'S FIGHTER JET PROGRAMS

September 2024

Mr. Guillaume Fournier
Cofounder & Executive Director

www.giir.ch

Contents:

I. THE KOREA AEROSPACE INDUSTRIES (KAI) T-50 GOLDEN EAGLE PROGRAM....2
1. T-50....2
a. From the KTX-2 program to the T-50....2
b. Exports....3
2. TA-50 training or light attack aircraft....5
3. FA-50 Fighting Eagle fighter/attack aircraft....5
a. Export to Poland....7
b. Export to the Philippines....8
c. Export to Malaysia....9
d. Export to Senegal....10
e. Partnership agreement with Egypt....11
II. THE KF-21 BORAMAE FIGHTER JET PROGRAM....11
1. Technical specifications....12
2. International Cooperation and exports....13
3. Timeline....14
III. CONCLUSION....20

South Korea's aerospace ambitions have significantly advanced over the past few decades through the development of its indigenous fighter jet programs. These initiatives, primarily led by **Korea Aerospace Industries** (**KAI**), have produced sophisticated aircraft that serve both training and combat roles. Central to these advancements are two cornerstone programs: the **T-50 Golden Eagle** and the **KF-21 Boramae**, which highlight **South Korea**'s ambition to achieve self-reliance in advanced military aviation technology.

The **T-50 Golden Eagle** program began in the 1990s and represents **South Korea**'s first significant step toward developing a supersonic trainer and light combat aircraft. This program marked a substantial leap in **South Korea**'s defense manufacturing capabilities. It has since evolved into a family of aircraft tailored for various operational needs and capable of a wide range of missions, including attack, reconnaissance, and electronic warfare. The **T-50** series includes the **T-50** for advanced jet training, the **T-50B** for aerobatic demonstrations, the **TA-50** for lead-in fighter training, and the **FA-50** for light combat roles. The versatility and performance of these aircraft have not only met the **Republic of Korea Air Force**'s (**ROKAF**) needs but also made them attractive options for international customers, competing favorably against more expensive fighters.

Building on the success of the **T-50** program, **South Korea** embarked on an even more ambitious project in the early 2000s: the **KF-21 Boramae**. This program, a collaboration between **KAI** and several international partners, aims to develop a 4.5-generation multi-role fighter aircraft. The **KF-21** incorporates advanced technologies, including stealth features, cutting-edge avionics, and superior maneuverability. Equipped with advanced weaponry and systems, the **KF-21** enhances its versatility for various combat scenarios, including air-to-air and air-to-ground missions. Rigorous testing and validation processes have demonstrated the aircraft's potential to meet and exceed the operational requirements of the **ROKAF**.

The **T-50** and **KF-21** programs underscore **South Korea**'s strategic use of technological innovation to become a significant player in the global aerospace industry. Both aircraft have proven effective for domestic and international customers, contributing to **South Korea**'s reputation as a reliable defense partner. Through these programs, **South Korea** continues to advance its aerospace capabilities, fostering growth and innovation within the industry.

Published by Guillaume Fournier

I. THE KOREA AEROSPACE INDUSTRIES (KAI) T-50 GOLDEN EAGLE PROGRAM

The **T-50** has been developed in several variants to meet diverse training and combat needs, namely the **T-50B**, **TA-50**, and **FA-50**. The original **T-50** variant focuses on advanced jet training. The **T-50B** is an acrobatic demonstrator flown by the **Republic of Korea Air Force** (**ROKAF**), the **53rd Air Demonstration Group**, nicknamed the Black Eagles. It demonstrates to the public the flight characteristics of the **T-50**. The **TA-50** Lead-In Fighter Trainer (LIFT) was developed for advanced **ROKAF** pilot training. It provides advanced training in battlefield, air-to-air, and air-to-ground operations. The **FA-50** is the light combat fighter version that features upgraded tactical and protection systems for multi-role capabilities.

1. T-50

a. From the KTX-2 program to the T-50

The **KTX-2** program[1&2] (which evolved into the **T-50**) was initiated in 1990 and resulted from **South Korea**'s ambition of self-sufficiency in advanced aerospace technology. It aimed at creating an Indigenous supersonic trainer and light combat aircraft. The program started as the **KTX-2** in 1992 but was suspended at the end of 1995 when the **Ministry of Finance and Economy** (**MFE**) declared it could no longer invest any further funds. At the beginning of the program, the primary contractor, **Samsung Aerospace**, teamed up with **General Dynamics** (later **Lockheed Martin**) as a partner. In 1997, the South Korean government revived the project, recognizing its strategic importance for national defense and technological advancement. It decided to cover 70% of the development costs through the **Ministry of National Defense** budget. The goal of the program was to achieve 95% proficiency in manufacturing/production technology, 80% in test/evaluation technology, and 70% in design and development technology. It involved the cooperation of **Samsung Aerospace**, **Daewoo Heavy Industries**, **Korean Air**, and **Lockheed Martin**. In October 1999, **Korea Aerospace Industries** (**KAI**) was established by merging **Samsung Aerospace**, **Hyundai Aerospace,** and **Daewoo Heavy Industries**' aircraft division.

The general concept of the **KTX-2** was developed through a joint cooperation between engineers from **Samsung Aerospace** and **Lockheed Martin Tactical Aircraft Systems** under the guidance of the **ROKAF**. By 1999, the Preliminary Design Review (PDR) for the **KTX-2** was completed, and the outer mold line had been decided upon. In February 2000, the **KTX-2** was rebranded as the **T-50/A-50 Golden Eagle**. Assembly on the **T-50** started in January 2001, and the first plane was rolled out in October 2001. Flight testing in 2002 demonstrated the aircraft's airworthiness and operational capabilities, and the **T-50**'s first supersonic flight took

[1] "*KTX-2 Indigenous Trainer*", globalsecurity.org, https://www.globalsecurity.org/military/world/rok/ktx-2.htm
[2] "*KAI T-50 Golden Eagle*", Wikipedia, https://en.wikipedia.org/wiki/KAI_T-50_Golden_Eagle

place in February 2003. The **ROKAF** demonstrated its commitment to the program by purchasing around 100 **T-50**s.

In August 2003, the **T-50** completed 20 months of static structural testing. These tests were conducted by **KAI** and the **Korea Aerospace Research Institute** (**KARI**) at the Daejeon facility in **South Korea**, with support from **Lockheed Martin** engineers. They validated the aircraft's structural design, confirming the safety and durability of the **T-50** and ensuring that it would meet or exceed all structural design parameters.[3] In December 2003, **KAI** received initial production authorization for twenty-five **T-50** for the **ROKAF**.

In July 2004, the **ROKAF** initiated high angle-of-attack flight testing on the **T-50** to thoroughly examine the aircraft's high AOA characteristics. The test verified the recovery from controlled flight departures and the efficiency of the digital electronic flight control system, which features a degree AOA limiter and aids in recovery from out-of-control situations.[4]

In June 2005, after the completion of various structural, climatic, and developmental tests, the **T-50** moved from full-scale development (FSD) to production, and the first production aircraft rolled out in August 2005. In December 2005, **KAI** delivered the first two **T-50**s to the **ROKAF,** which entered service in April 2007. A follow-on contract for forty-seven aircraft was signed in October 2006. It included twenty-five **T-50**s and twenty-two **TA-50**s.[5] By 2007, 13 aircraft had been deployed for training purposes. The remaining **T-50**s were continuously delivered through 2008. By this time, two squadrons (30 to 40 aircraft) were operational. The **ROKAF** took delivery of the 50th and final **T-50** in May 2010.[6]

With an individual cost of $25 million, the **T-50** is used to facilitate a smooth transition for pilots to advanced fighters. It can reach speeds of up to Mach 1.5.

b. Exports

Indonesia was the first export customer, buying 16 **T-50i** (i for **Indonesia**) for $400 million in 2011. Deliveries started in September 2013 when **Indonesia** received its first pair of **KAI T-50i** at the Iswahyudi Air Base in East Java[7]. Indonesian pilots and ground crew began training with the South Korean Air Force in February 2013 on the **T-50** and the **TA-50** variant, which includes a cannon and air-to-air missiles. In July 2021, **KAI** secured a $238 million deal

[3] "*KAI and Lockheed Martin's T-50 Successfully Completes Ultimate Loads Testing*", Lockheed Martin, 22 August 2003, https://investors.lockheedmartin.com/news-releases/news-release-details/kai-and-lockheed-martins-t-50-successfully-completes-ultimate/

[4] "*T-50 Trainer Begins High Angle-of-Attack Flight Testing*", Lockheed Martin, 13 July 2004, https://investors.lockheedmartin.com/news-releases/news-release-details/t-50-trainer-begins-high-angle-attack-flight-testing/

[5] J.R. Wildridge, "*T-50 Update*", Code One, 20 May 2015, https://www.codeonemagazine.com/t50_article.html?item_id=170

[6] Vasundhara, "*South Korea Takes Delivery of Final T-50 Training Jet*", Airforce Technology, 16 May 2010, https://www.airforce-technology.com/news/news85283-html/

[7] Greg Waldron, "*Indonesia receives first pair of T-50i advanced jet trainers*", Flight Global, 13 September 2013, https://www.flightglobal.com/indonesia-receives-first-pair-of-t-50i-advanced-jet-trainers/111066.article

to supply **Indonesia** with six additional **T-50i**.[8] The deal spans from December 2021 to October 2024 and will increase **Indonesia**'s **T-50i** fleet to 21 units.

In December 2013, **Iraq** signed a $1.1 billion contract with **KAI** for 24 **T-50IQ** (IQ for **Iraq**) aircraft, a variant of the **T-50**, and a 25-year support and pilot training package. The **T-50IQ**s are twin-seat aircraft used primarily as lead-in fighter trainers for **Iraq**'s 36 **Lockheed Martin F-16** Fighting Falcons. This version includes underwing hardpoints for air-to-ground, missile launch rails, and a **M61A1** 20mm Vulcan cannon. The first batch of aircraft was delivered in 2017, the second batch arrived in 2018, and the final delivery occurred in December 2019. Deliveries had been delayed due to the complex security situation in **Iraq** and a 2017 investigation against **KAI** by South Korean prosecutors allegedly accusing **KAI** of inflating the value of the **T-50IQ** sale to **Iraq**, uncovering possible corruption and fraud related to the contract.[9]

Iraq's fleet of 24 **T-50IQ** was not flown until June 2022 following the negotiation of a $360 million operational support contract with **KAI** in November 2021. The three-year deal included training programs for Iraqi pilots and engineers and logistics and maintenance support.[10]

In 2015, **Thailand** signed a deal valued at $110 million to acquire four **T-50TH** (TH for **Thailand**) to modernize its air force capabilities. In 2017, a follow-up contract worth US$260 million for eight additional **T-50TH** trainer jets was signed. [11]A 52 million contract was awarded in 2019 to install EL/M-2032 radar, MIL-STD-1760 databus, Radar Warning Receiver (RWR), and other avionics upgrades. In July 2021, the **Royal Thai Air Force** (**RTAF**) confirmed its intention to procure an additional two **T-50TH** for approximately USD 72 million. This contract also includes spare parts, related equipment, and tools.[12]

Between 2016 and 2017, **Lockheed Martin**, in collaboration with **KAI**, decided to submit the **T-50A** fighter jet for the **U.S. Air Force**'s Advanced Pilot Training (T-X Trainer) competition that aimed at replacing the aging **T-38 Talons** trainers, which have been in service since the 1960s. This upgraded version based on the **FA-50** would have had significant avionics upgrades, including an electronic warfare suite, multimode radar, and advanced data-link and air-to-air and air-to-ground weapons capabilities.

[8] Greg Waldron, "*KAI lands Indonesian deal for six more T-50is*", Flight Global, 21 July 2021, https://www.flightglobal.com/defence/kai-lands-indonesian-deal-for-six-more-t-50is/144679.article
[9] "*T-50 Golden Eagles find new roost*", Times Aerospace, https://www.timesaerospace.aero/features/defence/t-50-golden-eagles-find-new-roost
[10] "Greg Waldron, "*KAI secures $360 million deal to support Iraqi T-50IQs*", Flight Global, 10 November 2021https://www.flightglobal.com/defence/kai-secures-360-million-deal-to-support-iraqi-t-50iqs/146311.article
[11] Wasamon Audjarint, "*Thai Air Force to get South Korean T-50TH fighter training aircraft*", The Nation, 11 July 2017, https://www.nationthailand.com/in-focus/30320493
[12] "*Thailand confirms plan to buy additional T-50TH aircraft*", Janes, 20 July 2021, https://www.janes.com/osint-insights/defence-news/thailand-confirms-plan-to-buy-additional-t-50th-aircraft

2. TA-50 training or light attack aircraft

The **TA-50** is an armed variant of the **T-50** trainer, designed for lead-in fighter training and light attack roles. It features the Elta EL/M-2032 radar and can deploy precision-guided weapons, air-to-air missiles, and air-to-ground missiles. The **TA-50** can carry up to 3,850 kg of weapons, including a rotary cannon, **AIM-9** and **AIM-120** missiles, **AGM-65 Mavericks**, rockets, cluster bombs, and general-purpose bombs. It is powered by a **General Electric F404-GE-102** engine, reaching speeds of 1,852 km/h and a range of 1,850 km. Reconnaissance (**RA-50**) and electronic warfare variants (**EA-50**) are under development.

In June 2012, the **Philippines** signed a deal valued at around $360 million with **KAI** to export 12 **TA-50**. The **TA-50**s are priced at approximately $29.8 million. This deal is part of a broader $1.3 billion military modernization program to upgrade the **Philippine Air Force**'s capabilities.

In June 2020, **KAI** concluded a second mass-production deal with **DAPA** valued at approximately $575 million for the deliveryby 2024 of an undisclosed number of **TA-50**s Block 2 and integrated logistics support.[13]

In December 2023, the **Republic of Korea Air Force** received its first **TA-50** Block 2 aircraft from **KAI**. This delivery is part of a $764.7 million contract signed in 2020, covering at least 20 **TA-50** Block 2 aircraft. The Block 2 features improved avionics, a radar system, precision-guided bombs, night-vision capabilities, and self-protection systems. These enhancements address the insufficiency of the 22 Block 1 units in training combat pilots and enhance the aircraft's light attack capabilities.[14]

3. FA-50 Fighting Eagle fighter/attack aircraft

The **FA-50 Fighting Eagle**[15], which took its maiden flight in 2011, is an attack aircraft manufactured by **KAI** and is the most advanced variant of the **T-50 Golden Eagle** trainer. The **FA-50** features a tandem glass cockpit hosting two crew members. The front-seat pilot maneuvers the plane, and the rear-seat co-pilot manages control and navigation information. The **FA-50** balances firepower and maneuverability and can be used for attack, reconnaissance, and electronic warfare.

It measures 13.1 meters in length, 4.82 meters in height, and has a 9.45-meter wingspan. The **FA-50** has an empty weight of 6.5 tons and a maximum take-off weight of 10.7 tons, including 2.6 tons of internal fuel. Despite its compact size, it performs similarly to the

[13] "*KAI concludes a second mass-production deal for TA-50 with DAPA*", Defence Review Asia, 30 June 2020, https://defencereviewasia.com/kai-concludes-a-second-mass-production-deal-for-ta-50-with-dapa/
[14] Sakshi Tiwari, "*South Korea Receives 1st Cutting-Edge TA-50 Block 2 Aircraft, Signs LoA For Additional F-35 Fighters*", Eurasian Times, 04 January 2024, https://www.eurasiantimes.com/south-korea-receives-1st-cutting-edge-ta-50-block-2-aircraft/
[15] "*FA-50 Light Combat Aircraft*", Airforce Technology, 28 April 2023, https://www.airforce-technology.com/projects/fa-50-light-combat-aircraft-south-korea/?cf-view

American **F-16** fighter but at a significantly lower cost. The **FA-50 Block 20** is priced at around $45 million, making it 50% cheaper than the **F-16**. It is powered by a **General Electric F404-GE-102** turbofan engine licensed by **Samsung Hanwha Techwin**. It has a maximum speed of Mach 1.5, a ceiling of nearly 15,000 meters, and a range of 1,800 km.[16]

It can carry weapons similar to those of the **TA-50**. Its main armament is a 20 mm Gatling gun from **General Dynamics**. It also features hardpoints under the wings and fuselage to carry up to 4,500 kg of ordnance such as the **AIM-120** Advanced Medium-Range Air-to-Air Missile (AMRAAM) and **AIM-9 Sidewinder** air-to-air missiles, **AGM-65 Maverick** air-to-ground missiles, **KEPD-350K-2** land attack cruise missile, **GBU-38/B** Joint Direct Attack Munitions (JDAM), **Mk.82** or **Mk.83** bombs or the Naval Strike Missile for anti-shipping missions.[17] Additionally, it has an internal LAU-3/A 19-tube 2.75″ rocket launcher.

The **FA-50** features advanced avionics such as a Night Vision Imaging System (NVIS), a wide field of view Head-Up Display (HUD), color multifunction displays (MFDs), digital engine instrumentation, Hands-On Throttle-And-Stick (HOTAS), and OnBoard Oxygen Generation Systems (OBOGS). It also has digital fly-by-wire flight control, an active stick, an emergency power unit, brake-by-wire, and a triple redundant electrical system. The **FA-50** avionics also includes an embedded INS/GPS, an integrated mission computer, an IFF system, a radar altimeter, multimode radar, a store management system, a UHF/VHF radio, a tactical data link, a data transfer and recording system, a Radar Warning Receiver (RWR), and a Counter Measure Dispensing System (CMDS). Its advanced radar ensures detection similar to that of the South Korean **KAI KF-16** multi-role fighter (the license-produced version of the US **F-16**). The **FA-50** can also be equipped with **Lockheed Martin**'s Sniper Advanced Targeting Pod (ATP) to enhance capabilities for non-traditional intelligence, surveillance, and reconnaissance (NTISR) missions. The **FA-50**'s advanced variant features the Link 16 tactical data link, an **Elta Systems** EL/M-2032 pulse Doppler radar, and potential upgrades to active electronically scanned array (AESA) radars.

In December 2011, **KAI** signed a $600 million production contract with the **Defense Acquisition Programme Administration** (**DAPA**) for 20 **FA-50**s that would be delivered between 2013 and 2014. In May 2013, **DAPA** placed a $1bn follow-on serial production contract.

In January 2019, **KAI** began upgrading the **FA-50**s, referred to as Block 10 and Block 20. Block 10 has a software upgrade that can use the **Lockheed Martin** AN/AAQ-33 sniper targeting pod. The Block 20 has an improved capability for beyond-visual-range air-to-air missions, carrying munitions such as the **AIM-120** AMRAAM.

[16] Fabrice Wolf, "*The KAI FA-50 will be available in a single-seat version by South Korea*", Meta-Defense, 07 May 2024, https://meta-defense.fr/en/2024/05/07/kai-fa-50-single-seater-2030/
[17] "*KAI FA-50*", Military Today, https://www.militarytoday.com/aircraft/fa_50.htm

In June 2022, **KAI** and **Lockheed Martin** signed an agreement to market an improved version of the **FA-50** to the **U.S. Air Force** (**USAF**) and **Navy**. This effort includes bids for the **USAF**'s Advanced Tactical Trainer and the **U.S. Navy**'s Tactical Surrogate Aircraft programs, which plan to procure 280 and 220 aircraft by 2024-2025.[18]

In October 2023, the **ROKAF** announced that its **FA-50**s had collectively logged 100,000 accident-free flight hours and had collectively flown approximately 55 million kilometers over the past decade.[19]

In May 2023, **Raytheon Technologies** announced that it would start outfitting **the FA-50**s with the new PhantomStrike radar, which provides long-range threat detection, tracking, and targeting.[20] **KAI** also announced plans to increase its manufacturing capacity for the **FA-50** by building two additional production lines in 2024 to meet rising global demand.[21]

In March 2024, **KAI** announced that it was investing $27 million to develop a single-seat variant of its **FA-50** designated as the **F-50**. The rear seat would be replaced with an additional fuel tank that would address range limitations. In this version, the **FA-50** would carry 370 kg more fuel than the two-seat version, boosting its operational range by 31% for air-to-air missions and 28% for air-to-ground missions. Design adjustments would need to be made to prevent fuel leakage and manage the center of gravity while keeping development costs low.

The **FA-50** has attracted global interest, including from countries in Asia, Europe, and the Middle East. It has been exported to various countries, such as **Poland**, the **Philippines**, **Thailand**, **Malaysia**, **Egypt**, **Senegal**, **Colombia,** and **Indonesia**. Despite this success, spare parts shortages have impacted combat readiness in countries like the **Philippines**, **Indonesia**, **Iraq**, **Thailand**, **Colombia**, and **Poland**.[22]

a. Export to Poland

In July 2022, **Korea Aerospace Industries** (**KAI**) agreed on a $3 billion deal with Poland to export 48 **FA-50** light attack fighters. This contract was part of a larger arms package that included the delivery of 180 **K2 Black Panther** tanks by **Hyundai Rotem** and

[18] Valius Venckunas, "*KAI, Lockheed Martin team up again to sell T-50 jet trainer in the United States*", AeroTime, 13 June 2022, https://www.aerotime.aero/articles/31293-kai-lockheed-martin-to-team-up-again-on-t-50-salesto-the-us

[19] Ashish Dangwal, "*100,000 Accident-Free Flight Hours! South Korean FA-50 Fighter Jets Achieve Key Milestone*", Eurasian Times, 06 October 2023, https://www.eurasiantimes.com/100000-accident-free-flight-hours-south-korean-fa-50-fighter/

[20] "*Raytheon Technologies upgrading Korea Aerospace Industries' FA-50 aircraft with PhantomStrike™ radar*", Raytheon Technologies, 15 May 2023, https://www.rtx.com/news/news-center/2023/05/15/raytheon-technologies-upgrading-korea-aerospace-industries-fa-50-aircraft-with-p

[21] Joe Saballa, "*South Korea Plans to Double FA-50 Fighting Eagle Aircraft Production*", The Defense Post, 02 May 2023, https://www.thedefensepost.com/2023/05/02/south-korea-fighting-eagle/

[22] Boyko Nikolov, "*Malaysia pays 18 KAI FA-50 light combat aircraft with palm oil*", BulgarianMilitary.com, 24 February 2023, https://bulgarianmilitary.com/2023/02/24/malaysia-pays-18-kai-fa-50-light-combat-aircraft-with-palm-oil/

approximately 670 **K9** 155mm self-propelled howitzers by **Hanwha Defense**. Under this deal, approved by **Poland**'s Deputy Prime Minister and Minister of National Defence **Mariusz Błaszczak,** the initial batch of 12 aircraft designated **FA-50GF** (Gap Filler) was scheduled for delivery in mid-2023. These are almost identical to the **FA-50**s currently in use with the **ROKAF**, except for the **NATO** identification friend-or-foe (IFF) systems. The remaining 36 aircraft designated as **FA-50PL** will be customized to meet the specific requirements of the **Polish Air Force** and are expected to be delivered between 2025 and 2028.[23] They will include **Raytheon**'s PhantomStrike active electronically scanned array radar, which permits the use of beyond-visual-range air-to-air missiles like the **AIM-120** and long-range air-to-surface missiles.[24]

According to **KAI** CEO **Ahn Hyun-ho**, this deal represented the beginning of joint defense cooperation between **South Korea** and **Poland**. It will also include the establishment of a maintenance, repair, and overhaul (MRO) center in **Poland**.[25]

The official signing ceremony took place in September 2022 in **Poland** at the Polish Air Force's 23rd Tactical Air Base in Mińsk Mazowiecki with the presence of Polish President **Andrzej Duda** and Defense Minister **Mariusz Blaszczak**, as well as **Eom Dong-hwan**, the minister of **South Korea**'s **Defense Acquisition Program Administration** (**DAPA**), and **KAI** CEO **Kang Goo-young**.[26]

In September 2023, the first group of four **Polish Air Force** pilots started receiving instruction on the **FA-50**. This included a one-month ground school phase completed at a **KAI** facility and then a 23-week program at **ROKAF** 1st Fighter Wing at Gwangju. The training was computer-based and also included flights in the T-50 trainer.

In June 2023, **KAI** rolled out the first **FA-50** for export to **Poland**. A ceremony took place at **KAI** headquarters in Sacheon. The first two **FA-50**s were delivered in July 2023 at the Polish Air Force's Air Base in Mińsk Mazowiecki.[27] In December 2023, **Poland**'s Armament Agency announced that the country had received all 12 of its first batch of **FA-50**.

b. Export to the Philippines

A milestone in the modernization of the **Philippine Air Force** (**PAF**) was the delivery in December 2015 of two of twelve **FA-50PH**, a specialized version for the **Philippines**. In

[23] "*Poland to buy FA-50 combat aircraft from South Korea*", Janes, 27 July 2022, https://www.janes.com/defence-news/news-detail/poland-to-buy-fa-50-combat-aircraft-from-south-korea
[24] Albert L, "*Deliveries of Poland's First FA-50 Light Attack Jets Complete*", Overt Defense, 02 January 2024, https://www.overtdefense.com/2024/01/02/deliveries-of-polands-first-fa-50-light-attack-jets-complete/
[25] "*KAI signs $3 bil. deal with Poland to export 48 FA-50s*". The Korea Times, 28 July 2022, https://www.koreatimes.co.kr/www/tech/2022/07/419_333505.html
[26] "*KAI signs follow-up contract with Poland to sell 48 FA-50s*", The Korea Times, 16 September 2022, https://koreatimes.co.kr/www/nation/2022/09/205_336188.html
[27] Jr Ng, "*KAI delivers first FA-50 aircraft to Poland*", Asian Military Review, 21 July 21, 2023, https://www.asianmilitaryreview.com/2023/07/kai-delivers-first-fa-50-aircraft-to-poland/

June 2017, the 12 **FA-50PH** fighter jets acquired by the **PAF** were successfully delivered[28]. This delivery fulfills a $400 million contract signed in 2013. In January 2016, the **Philippine Department of National Defense** (**DND**) bought ammunition and countermeasures for its recently acquired **FA-50**. This $2.25 million contract included 93,600 rounds of 20mm ammunition, 17,280 RR-170 chaffs, and 8,640 MJU-7 infrared flares.[29] The **FA-50PH** is considered an interim solution until the **PAF** acquires more advanced fighters. They nonetheless enable the PAF to patrol its disputed waters of the West Philippine Sea.

The **FA-50PH** saw their first combat use during the five-month battle to reclaim Marawi City from **ISIS**-linked terrorists in 2017. It played a critical role in the government's victory by providing crucial close-air support to ground troops.

In June 2022, the **Philippine Air Force** (**PAF**) announced it was considering acquiring additional **FA-50**s. **PAF** chief Lt. Gen. Connor **Anthony Canlas Sr**. highlighted their versatility as a lead-in trainer and their air-to-ground and air-to-air missions capability.

In September 2022, the **Philippine Air Force** (**PAF**) confirmed that some of **their FA-50PH** fighter jets were undergoing scheduled maintenance and waiting for spare parts due to recent global events that slowed down the supply chain. This has resulted in only three out of twelve **FA-50PH** jets being operational.[30]

In June 2023, **KAI** offered the **PAF** to sell them 36 more **FA-50**s and upgrade their existing fleet. **KAI** proposed retrofitting the 12 **FA-50**s to enhance their capabilities and enable them to perform air-to-ground, air-to-sea, and air-to-air missions more effectively. It also argues that it is the most economical solution to strengthen the **PAF**. **KAI** also suggested that the **Philippines** buy the **KF-21** jet fighter, which is currently under development.[31]

c. Export to Malaysia

In order to replace its aging **BAE Systems Hawk** 108 and 208 aircraft, Malaysia launched the Fighter Lead In Trainer-Light Combat Aircraft (FLIT-LCA) program. **KAI** promoted its **FA-50 Golden Eagle**.

In February 2023, **KAI** announced a $920 million agreement with **Malaysia**'s **Ministry of Defense** to deliver 18 **FA-50 Block 20**. The fighter was selected over competing models

[28] Dylan Malyasov, "*South Korea completes delivery of FA-50PH fighter jets to Philippines*", Defence Blog, 04 June 2017, https://defence-blog.com/south-korea-completes-delivery-of-fa-50ph-fighter-jets-to-philippines/
[29] "*Philippine Air Force to acquire ammunition for FA-50 aircraft*", Airforce Technology, 10 January 2016, https://www.airforce-technology.com/news/newsphilippine-air-force-to-acquire-ammunition-for-fa-50-aircraft-4773771/?cf-view
[30] Stefano D'Urso, "*Philippine FA-50PH Jets Undergoing Mandatory Precautionary Maintenance*", The Aviationist, 30 September 2022, https://theaviationist.com/2022/09/30/philippine-fa-50ph-jets-undergoing-mandatory-precautionary-maintenance/
[31] Philippine News Agency, "*Korea Aerospace Exec to PAF: Consider Buying FA-50 Aircraft*", Defense-Aerospace.com, 21 June 2023, https://www.defense-aerospace.com/korea-aerospace-offers-additional-fa-50-fighters-to-philippines/

from **India**, **Pakistan**, **Russia**, and **Turkey**. This deal is part of a broader Malaysian defense acquisition strategy. The defense procurement tender which was issued in July 2021, required the phased delivery of the planes, supersonic speed, capacity for beyond-visual-range missile engagements, reloading capability, and the domestic manufacture of 30% of the aircraft components. The partial assembly of the **FA-50** locally will include the horizontal stabilizers, vertical fins, wings, and engines, with **KAI** overseeing the final delivery.

The deal may be expanded to include an additional 18 **FA-50**s if they meet the requirements of the **Royal Malaysian Air Force**'s (**RMAF**) Fighter Lead-In Trainer-Light (FLIT) program. **KAI** collaborated with local firm **Kemalak Systems Sdn Bhd** for their bid.[32] It was agreed that at least half the payment would be through the delivery of palm oil. The first **FA-50**s are expected to be delivered in 2026 as part of the FLIT program, which aims to develop the **RMAF** capabilities by 2055. The Block 20 series differs from those acquired by **South Korea** and features advanced capabilities such as increased fuel capacity, improved avionics, a central pylon for the targeting pod, advanced targeting, and compatibility with various munitions and missiles like the **AIM-120** Advanced Medium-Range Air-to-Air Missile.[33]

The signing ceremony of the contract took place during the Langkawi International Maritime and Aerospace Exhibition (LIMA 2023) in **Malaysia**. It was attended by **KAI** President & CEO **Kang Goo-young**, Korean government officials including **Jung Sang-hwa**, the Air Force Chief of Staff, **Yeo Seung-bae,** the Ambassador to **Malaysia**, **Kang Hwan-seok** the Deputy Defense Acquisition Program Administration Chief, and **Dato'Sri Muez bin Abd Aziz**, the Secretary-General of the **Malaysian Ministry of Defence**.[34]

d. Export to Senegal

In January 2024, **Senegal** decided to acquire **FA-50**s[35] to enhance its air capabilities. The exact number of aircraft and the deal's value remain undisclosed, though a report by **Lionel Ekene** in **Military Africa**[36] suggests **Senegal** may have ordered four **FA-50**s worth $147 million. General **Sarr Pape Souleymane**, head of the **Senegalese Air Force**, selected **KAI**'s **FA-50** to meet the need for light combat aircraft. The country currently operates a fleet composed mainly of helicopters and six **Daher Socata TB 30** training aircraft.

[32] "ADJ, "*Malaysia Go For Korea's FA-50 for its LCA Programme*", Dsa Exhibition, 18 March 2023, https://www.dsaexhibition.com/malaysia-go-for-koreas-fa-50-for-its-lca-programme
[33] "*KAI signs a deal with Malaysia for FA-50 aircraft*", Janes, 24 February 2023, https://www.janes.com/defence-news/news-detail/kai-signs-a-deal-with-malaysia-for-fa-50-aircraft
[34] Gastón Dubois, "*Malaysia Signed Purchase Contract for 18 Korean FA-50 Light Fighters,*" Aviacionline, 24 May 2023, https://www.aviacionline.com/2023/05/malaysia-signed-purchase-contract-for-18-korean-fa-50-light-fighters/
[35] "*Senegal to Buy South Korean KAI FA-50 Light Combat Aircraft*", Army Recognition, 30 January 2024, https://armyrecognition.com/news/aerospace-news/2024/senegal-to-buy-south-korean-kai-fa-50-light-combat-aircraft
[36] Ekene Lionel, "*Senegal to acquire FA-50 light combat aircraft from South Korea*", Military Africa, 29 January 2024, https://www.military.africa/2024/01/senegal-to-acquire-fa-50-light-combat-aircraft-from-south-korea/

e. Partnership agreement with Egypt

In December 2022, **KAI** and **Egypt**'s **Arab Organisation for Industrialisation** (**AOI**) signed a cooperation and partnership agreement to promote the sale of **FA-50**/**T-50** jets to **Egypt**, which is currently looking to replace its aging **Alpha Jet** and **K-8** jet trainers with 100 new jets. Under the agreement, the planes would be built at the **AOI** aircraft factory in Helwan.[37]

AOI chairman **Mokhtar Abdel-Latif** concluded discussions with a South Korean delegation that included their counterparts from **KAI** and **Hanwha Aerospace** and members of parliament. The talks centered on implementing the cooperation agreement, specifically regarding technology transfers, establishing local manufacturing capabilities in **Egypt**, and even determining the possibility of future exports of these jets to other African and Arab countries.[38]

II. THE KF-21 BORAMAE FIGHTER JET PROGRAM

The **Korean Fighter eXperimental** (**KF-X**) program (now the **KF-21 Boramae** ("young hawk" in Korean)) intends to produce an advanced multi-role jet fighter that will ultimately replace the aging fleet of American **F-4E Phantom II** and **F-5E/F Tiger II** fighters. It had been announced in March 2001 by South Korean President **Kim Dae-Jung** at a graduation ceremony of the **Korea Air Force Academy**[39]. The **Joint Chiefs of Staff** confirmed the plan to develop the indigenous fighter jet in 2002. However, it was not until 2014 that the green light for the project was finally given after seven assessments of the project's feasibility.

The program is composed of two stages over 13 years, between 2015 and 2028. The first stage between 2015 and 2026 focused on developing aircraft and integrated logistics systems. The second phase between 2026 and 2028 aims to develop aircraft capabilities to carry out air-to-surface missions. The program, which aims to produce more than 120 cutting-edge fighters for the **Republic of Korea Air Force** (**ROKAF**) by 2032-2033, is funded by the **Republic of Korea** and the **Republic of Indonesia**. The exact breakdown of each country's share has evolved over time (see part 2).

---

[37] defenceWeb "*Korea Aerospace Industries Signs Agreement With Egypt Over Golden Eagle Aircraft*," defenceWeb, 05 December 2022, , https://www.defenceweb.co.za/aerospace/aerospace-aerospace/korea-aerospace-industries-signs-agreement-with-egypt-over-golden-eagle-aircraft

[38] Taha Sakr, "*Egypt on cusp of Korean 'Golden Eagle' light combat aircraft deal*", Daily News Egypt, 01 May 2024, https://www.dailynewsegypt.com/2024/05/01/egypt-on-cusp-of-korean-golden-eagle-light-combat-aircraft-deal/

[39] "*South Korea to finalize assembly of local-made KF-X fighter jet in the second half of this year*", Army Recognition, 17 June 2020, https://www.armyrecognition.com/news/aerospace-news/2020/south-korea-to-finalize-assembly-of-local-made-kf-x-fighter-jet-in-the-second-half-of-this-year

The **KF-21** program is a significant investment in the nation's defense sector, with a projected allocation of $7.8bn between 2023-2033. Each **KF-21** unit will cost approximately $65 million. The **KF-21 Boramae** is being developed by **South Korea**'s **Korea Aerospace Industries** (**KAI**) and the **Defense Acquisition Program Administration** (**DAPA**). The **KF-21 Boramae** is expected to play a crucial role in **South Korea**'s defense strategy.

1. Technical specifications

The **KF-21** will be a 4.5-generation aircraft and, therefore, less stealthy than the fifth-generation **F-35 Lightning II**, **Chengdu J-20**, or the **Sukhoi Su-57**.

It is expected to have a maximum take-off weight of 25,600 kg and a cruising distance of 2,900 kilometers. It is larger than the **F-16** and comparable in size to the **F-18**, with a length of 16.9 meters, a wingspan of 11.2 meters, and a height of 4.7 meters.[40]

About 65% of the jet's components are being produced locally. This includes four major avionic components: the electronically scanned array radar, the infrared search and track pod, the electro-optical targeting pod, and the electronic warfare suite.

It will be powered by two **General Electric F414** engines, which should provide a top speed of Mach 1.8. **Hanwha Aerospace** will be in charge of manufacturing key parts, locally assembling the engines, and overseeing the installation of the engine on the aircraft. The twin-engine design was selected due to its high reliability and as it is also more suited to the geography of **South Korea**, which has many mountains and lacks alternate airports. The **KF-21** is expected to be produced in single- and tandem-seat variants. It should feature three hardpoints under each wing for weapons and/or external fuel tanks and be capable of carrying four missiles under the fuselage. According to **KAI**, the **KF-21** should be capable of carrying up to 7,700 kg of payload, such as air-to-air missiles and other armaments.

The **KF-21**'s AESA (Active Electronically Scanned Array) radar, developed locally by **Hanwha Systems**, is a crucial component of the fighter jet. This advanced radar system will have the capability to detect and track targets, providing vital information such as distance, elevation, and speed.[41] It allows simultaneous tracking of up to ten objects within a range of 50-60 nautical miles.

The **KF-21** is anticipated to carry the first domestically developed future long-range, air-launched cruise missile (ALCM) being developed by defense companies, including **KAI**, **LIG Nex1**, and **Hanwha Aerospace**, under the supervision of the **DAPA**. This ALCM is anticipated to be capable of hitting a target up to 500 kilometers away.[42]

[40] "*KF-21 Boramae*," Global Security, https://www.globalsecurity.org/military/world/rok/kf-21.htm
[41] "*AESA Radar*," Hanwha Systems, https://www.hanwhasystems.com/en/business/defense/isr/radar01-aesa.do
[42] "*Korea to develop air-launched cruise missile by 2028*", The Korea Times, 12 December 2022, https://www.koreatimes.co.kr/www/nation/2022/12/113_341560.html

2. International Cooperation and exports

In 2009, **South Korea** and **Indonesia** signed a Letter of Intent to collaborate on the development of the **KF-X** (**KF-21**)[43]. **Indonesia** officially joined the program in 2016 when it signed two key pacts with **KAI** to facilitate the joint development. It initially pledged to provide 20% of the funding and share technological know-how through its state-owned **Indonesian Aerospace** in exchange for 48 planes manufactured in **Indonesia** and some technology transfer. In 2016, **Indonesia** agreed to pay 1% of the program costs annually, with its contribution to rise above 2% from 2017 onwards. However, in 2017, **Indonesia** failed to pay most of its annual share of expenses.[44] In 2019, **Indonesia** sought to renegotiate the contract for the joint development of the **KF-21**. According to the Coordinating Minister for Political, Legal, and Security Affairs, the country did not have the money to cover its share of the jet project as it prioritized its spending on infrastructure development. **Indonesia** considered offering **CN-235** medium-range twin-engined transport aircraft instead of its contribution. **ROKAF** refused as it required larger-sized transport planes such as the **C-130**.[45]

In May 2024, **Indonesia** proposed significantly reducing its financial contribution to the joint venture. Instead of paying 20% of the agreed-upon costs, **Indonesia** offered to pay around $439 million for the program, a decrease from the $1.2 billion initially agreed sum.

Indonesia has missed payment deadlines and so far only contributed around $220 million to the project.[46] In response to the request, **South Korea**'s **DAPA** seemed ready to accommodate the proposed cuts. **South Korea** would nonetheless decrease the transfer of key technologies to **Indonesia** to align with the reduced payment. Despite **Indonesia**'s reduced financial input, **DAPA** insisted that the remaining stages of the project, mainly test flights, should not incur significant costs and delays and that the first batch of fighter jets is expected to be delivered in 2026.

Another major issue was the attempts by Indonesian engineers to steal confidential data about the **KF-21** project. Two Indonesian engineers were caught attempting to smuggle unauthorized flash drives out of **KAI**'s facilities. South Korean police raided **KAI** offices. An investigation involving **South Korea**'s **National Intelligence Service and Defense Counterintelligence Command** was launched to determine if any classified information was leaked or if the Defense Industry Technology Protection Act was violated. This suspected data leakage, overdue payments, and **Indonesia**'s will to reduce its contribution raised skepticism about the country's commitment to the **KF-21** project and its reliability as a partner.

[43] Prashanth Parameswaran, "*Indonesia, South Korea Move Closer to New Fighter Jet With Key Pacts*", The Diplomat, 08 January 2016, https://thediplomat.com/2016/01/indonesia-south-korea-move-closer-to-new-fighter-jet-with-key-pacts/
[44] Kim Hyo-jin, "*Indonesia factor may postpone KF-X project*", The Korea Times, 01 November 2017, https://www.koreatimes.co.kr/www/nation/2017/11/356_238625.html
[45] Jung Da-min, "*Cost-sharing problem emerges over fighter jet project*", The Korea Times, 29 July 2019, https://www.koreatimes.co.kr/www/nation/2019/07/205_273060.html
[46] Juster Domingo, "*South Korea Mulls Indonesia's KF-21 Budget Cut Proposal*", The Defense Post, 13 May 2024, https://www.thedefensepost.com/2024/05/13/south-korea-indonesia-boramae-budget/

In 2023, **Poland** indicated it would be interested in joining the **KF-21** development project in 2026 when the Block 1 units start being produced. It has not yet delivered a letter of intent to develop the fighter jointly with **South Korea**. Therefore, **Poland** would only be participating in the program's Block 2 variant stage. This decision would deepen the defense ties between both countries.[47]

During the **Defence Service Asia Exhibition and Conference (DSA)-2024** event in **Malaysia**, **South Korea** and the **Philippines** talked about the possible export of the **KF-21**. The **Philippine Air Force** is considering the fighter jet due to its advanced features and compatibility with its own defense needs. **KAI** offered long-term partnerships, including joint technology production and transfer.[48]

3. Timeline

In 2015, the **KF-21** project faced setbacks as the **DAPA** failed to secure core technologies from the **U.S**.[49] **Lockheed Martin** was planning to share twenty-five aviation technologies as part of a deal for **South Korea** to purchase 40 **F-35 Lightning II**.[50] The deal also included technical and design assistance to help develop the **KF-21**.[51] However, the **U.S. State Department** opposed the transfer of four vital technologies out of the twenty-five (the AESA radar, the infrared search and track system, the electro-optical targeting pod, and the radio frequency jammer technology). The **U.S.** government also demanded further discussions on specific sub-technologies. Challenges were due to the sophistication and sensitivity of the required technologies, and four of those crucial technologies were denied due to technology protection policies. Seoul and Washington planned to hold further consultations on the issue, including discussions within the joint Defense Technology Strategy and Cooperation Group. The inability of the **DAPA** to secure these vital technologies for the development of the indigenous fighter jet posed the risk of further delays.[52] **South Korea** was, therefore, required to develop these technologies domestically. These delays raised concerns over an airpower vacuum due to **South Korea**'s shortage of warplanes compared to **North Korea**.[53]

[47] Daniel Darling, "*Add the KF-21 Boramae to Poland's South Korea Shopping Wish List*". Defense & Security Monitor, 10 May 2023, https://dsm.forecastinternational.com/2023/05/10/add-the-kf-21-boramae-to-polands-south-korea-shopping-wish-list/

[48] "*South Korea Opens Talks to Export KF-21 Jets to the Philippines*", Defense Mirror, 13 May 2024, https://www.defensemirror.com/news/36773/South_Korea_Opens_Talks_to_Export_KF_21_Jets_to_the_Philippines

[49] Shin Hyon-hee, "*Who is responsible for troubled KF-X?*", The Korea Herald, 27 November 2015, https://www.koreaherald.com/view.php?ud=20151127000931&ACE_SEARCH=1

[50] Andrew Chuter, "*Lockheed Strikes S. Korean F-35 Offset Deal*", Defense News. 19 March 2015, https://www.defensenews.com/air/2015/03/19/lockheed-strikes-s-korean-f-35-offset-deal/

[51] "*Korea soon to strike deal with Indonesia to kick off KF-X*", The Korea Herald, 19 November 2015, https://www.koreaherald.com/view.php?ud=20151119000996&ACE_SEARCH=1

[52] Shin Hyon-hee, "*Failed tech transfer may delay fighter jet project*", The Korea Herald, 24 September 2015, https://www.koreaherald.com/view.php?ud=20150924001147&ACE_SEARCH=1

[53] Song Sang-ho, "*DAPA under fire over plane tech transfer date*", The Korea Herald, 24 November 2015 https://www.koreaherald.com/view.php?ud=20151124001127&ACE_SEARCH=1

In 2018, **Meggitt PLC**, a British company specializing in high-performance components and sub-systems for the aerospace, defense, and energy industry, signed various multi-million dollar contracts with **KAI** to supply advanced carbon brakes and braking control systems, fire detection and bleed air leak detection systems and to design, develop, and produce standby flight displays, engine displays, and heading sensors for the **KF-21** fighter.[54&55]

In February 2018, during the **Singapore Airshow**, **United Technologies Corporation** (**UTC**) stated that it would cooperate with **KAI** to provide several key components of the **KF-X** program. These include the environmental control system, including the air conditioning system, bleed air control system, cabin pressurization system, and liquid cooling system. It will also manufacture the air turbine starter and flow control valves.

In April 2018, **KAI** chose **Martin-Baker**'s **Mk18** ejection for the **KF-X** fighter program.

In June 2018, **DAPA** unveiled the preliminary design of the **KF-21** fighter, during which the outer mold line of the aircraft was finalized. It completed a preliminary design review and was set to enter the critical design review phase. The preliminary **KF-X** design included four **Meteor** long-range air-to-air missiles developed by **MBDA** and two IRIS-T (infra-red imaging system – tail/thrust vector controlled) short-range guided air-to-air missiles. Previous plans to equip the **KF-X** fighter with **U.S.** missile systems faced export license approval issues.[56]

In February 2019, **KAI** started production on the first **KF-21** prototype, which was scheduled to be unveiled in 2021. This production involved more than 100 local agencies, including 84 companies, 16 tertiary institutions, and 11 research institutes. An additional 35 companies were planned to be involved when production increased. The **KF-21** program planned to develop six prototypes by 2021.[57]

In September 2019, the **DAPA** announced that the critical design review of the **KF-21** fighter was finished, which paved the way for the future production and delivery of the first prototype. During the critical design review meeting, the **Defense Affairs Agency** confirmed that the jet met all initial product specifications. Around 390 technical data points were

[54] "*Multiple contracts for KF-X jet fighter*", Meggitt, 18 July 2018,, https://www.meggitt.com/news/multiple-contracts-for-kf-x-jet-fighter/

[55] "*Contract for KF-X advanced total braking system*", Meggitt, 23 April 2018, https://www.meggitt.com/news/multi-million-dollar-contract-kf-x-advanced-total-braking-system/

[56] Jeff Jeong, "*South Korea unveils first images of KF-X design with European missiles*", Defense News, 29 Jun 2018, https://www.defensenews.com/air/2018/06/29/south-korea-unveils-first-images-of-kf-x-design-with-european-missiles/

[57] Jon Grevatt, "*KAI reaches early production milestone on KFX*", Jane's Defence Industry, 18 February 2019 https://web.archive.org/web/20190825064559/https://www.janes.com/article/86534/kai-reaches-early-production-milestone-on-kfx

reviewed by government and civilian experts, including members of the Air Force, to ensure military requirements were met in the design.[58]

In September 2020, **DAPA** announced that the final assembly of the first prototype was underway. **KAI** began joining the aircraft's fuselage sections and wings at its facility in Sacheon, South Gyeongsang Province, and the expected rollout was still on track.[59]

In April 2021, **KAI** unveiled the first prototype of the **KF-21**. Following the delivery, the prototype underwent various ground tests to confirm that it was ready for a safe maiden flight that was expected in July 2022. South Korean President **Moon Jae-in** announced plans to deliver 40 **KF-21**s to the Air Force by 2028 and 80 jets by 2032. Mass production for the **KF-21** was expected to start once the six prototypes completed 2,200 sorties. [60] Among six prototypes, only the fourth and sixth ones are two-seater types.

In July 2022, the **KF-21** flew for the first time, making the **ROK** the eighth country to develop an advanced supersonic fighter. The first prototype took a 33-minute roundtrip flight from the airstrip of the Air Force 3rd Flight Training Wing in Sacheon, Gyeongsangnam-do. After take-off, the **KF-21** checked the basic aircraft performance before returning to the airstrip. During this first test, the **KF-21** did not fly at supersonic speed but around 400 kilometers per hour[61].

In August 2022, **South Korea** prioritized the development of the **KF-21** by including it in the list of priority defense offset projects for the period between 2024 and 2032. Twenty-six foreign suppliers are involved in developing the **KF-21**. This list includes major companies such as **BAE Systems**, **General Electric**, **Moog**, **Meggitt**, **Leonardo**, **Elbit Systems**, **Honeywell**, **Boeing**, **General Dynamics**, and **Collins Aerospace**.[62] This highlights the significant involvement of foreign defense companies in the **KF-21** program and the country's intent to enhance local sourcing of replacement technologies.

Defense offset projects are agreements where the selling party in defense contracts invests in the purchasing country's economy. These investments include co-production, technology transfer, infrastructure development, and non-defense tech transfers, aiming to boost defense capabilities, industrial growth, job creation, and economic stimulation.

In September 2022, during the **DX Korea 2022** defense exhibition, **KAI** unveiled plans to develop a carrier-borne version of its **KF-21** fighter aircraft, named the **KF-21N**. It would feature folding wings for carrier compatibility that would be 20% larger for stability, a catapult

[58] Greg Waldron, "*K-FX CDR sets stage for prototype production*", Flight Global, 27 September 2019 https://www.flightglobal.com/news/articles/k-fx-cdr-sets-stage-for-prototype-production-461123/

[59] "*KAI begins final assembly of first KF-X prototype*", Janes, 03 September 2020, https://www.janes.com/defence-news/news-detail/kai-begins-final-assembly-of-first-kf-x-prototype

[60] Brian Kim, "*South Korea unveils prototype of homegrown KF-X fighter jet*", Defense News, 09 April 2021, https://www.defensenews.com/industry/techwatch/2021/04/09/south-korea-unveils-prototype-of-homegrown-kf-x-fighter-jet/

[61] Bak Seong-jin, "*South Korean Fighter KF-21 Successfully Makes First Flight: In the Air for 33 Minutes*", 21 July 2022, https://english.khan.co.kr/khan_art_view.html?artid=202207210941467&code=710100

[62] "*South Korea prioritises offsets on KF-21 programme*", Janes, 17 August 2022, https://www.janes.com/defence-news/news-detail/south-korea-prioritises-offsets-on-kf-21-programme

system (CATOBAR or STOBAR systems), and the same **General Electric F414** engines as the **KF-21**. The **KF-21N** would have a maximum speed of Mach 1.6, a maximum onboard weight of 7,620kg, and a maximum take-off weight of 25,600kg. It might integrate hypersonic long-range air-to-surface missiles under development by the **Agency for Defense Development**.

According to **KAI**, the **KF-21N** now lies in a preliminary design concept phase as this model is contingent on the **Republic of Korea Navy** (**RoKN**) acquiring an aircraft carrier capable of operating such aircraft. The Defense Ministry had formalized the **CVX** project to develop a 30,000-ton light aircraft carrier that could operate up to twenty fighter aircraft, such as **F-35B**s and **KF-21N**s. Currently, there is no national consensus or parliamentary approval.[63]

In January 2023, the third prototype of the **KF-21** completed its inaugural flight. According to the **DAPA**, the plane took off from the Air Force's 3rd Flying Training Wing in Sacheon, and the flight lasted 37 minutes. It had testing systems that measured the speed and loadable weight.[64]

In February 2023, the fourth prototype of the **KF-21** completed its maiden flight. According to the **DAPA**, the 34-minute flight test was aimed at evaluating the performance, safety, and stability of the two-seat configuration, unlike the previous single-seat prototypes. Based on current specifications, the two-seat prototype will primarily be used for new pilot training missions.

In March 2023, **South Korea** conducted successful weapon tests on two **KF-21** prototypes. The tests that involved the second and third prototypes and took place over the waters off the southern coast. The second prototype dropped an inert **Meteor** air-to-air missile to verify its separation from the jet without issues. The third prototype fired 100 rounds from its 20mm gun to check if it was operating properly.[65] Both prototypes were also used to verify the structural, engine, and aerodynamic changes to ensure stability and safety.

In April 2023, the South Korean government and **DAPA** confirmed that they were planning to transfer the sixth **KF-21** prototype to **Indonesia** under the joint engineering and manufacturing development agreement between the two countries. The prototype would be transferred to **PT Dirgantara Indonesia** (**PTDI**) for testing and research. Nonetheless, this transfer is contingent on Jakarta fulfilling its financial obligations to the project.[66]

---

[63] Lim Chang-won, "*KAI displays model plane at defense exhibition as potential carrier-born aircraft*", Aju Press, 21 September 2022, https://www.ajupress.com/view/20220921171804283

[64] "*Maiden flight of S. Korean third KF-21 prototype a success*", Baha, 05 January 2023, https://www.baha.com/maiden-flight-of-s-korean-third-kf-21-prototype-a-success/news/details/59228268?ts=1716804275056

[65] Yonhap News Agency, "*KF-21 Prototypes Successfully Conduct 1st Armament Flight Tests*", Defense-Aerospace.com, 28 March 2023, https://www.defense-aerospace.com/two-kf-21-prototypes-begin-weapon-trials-with-meteor-gun/

[66] "*Indonesia to receive KF-21 prototype no 5 if payments completed*", Janes, 13 April 2023, https://www.janes.com/osint-insights/defence-news/air/indonesia-to-receive-kf-21-prototype-no-5-if-payments-completed

In May 2023, the fifth prototype of the **KF-21** successfully completed its first test flight from Sacheon Air Base. It lasted about 45 minutes and primarily tested avionics performance, including the AESA radar. With this flight, the four single-seat aircraft prototypes (number 1, 2, 3, and 5) and the tandem-seat aircraft prototype (number 4) completed their maiden flights.[67]

In May 2023, the **DIA** announced that the **KF-21** had passed a "*provisional combat suitability evaluation*". This milestone was reached after two years of trials, which included ground tests and around 200 flight tests to check flight speed, combat operational range, and take-off and landing distances[68]. The evaluation allows weapons developers to secure mass-production budgets even before the prototypes meet all combat requirements and is intended to accelerate aircraft manufacturing.[69]

In June 2023, The sixth and final prototype of the **KF-21** successfully completed its first flight. The thirty-three-minute test confirmed the aerodynamic performance of the two-seater variant. The flights tested capabilities such as supersonic flight, advanced avionics, and electronic warfare equipment. The results of these flights will allow improvements to be made in the development program of the **KF-21**.[70]

During the **International Aerospace & Defence Exhibition** (**ADEX**) that took place between October 17 and 22, 2023, in Seoul, the **KF-21** made its public debut by performing an aerial demonstration at the Seoul Air Base in Seongnam.[71] **Diehl Defence** also featured its air-to-air missile IRIS-T, which is currently being integrated into the **KF-21**.[72]

KAI also unveiled the Loyal Wingman program, which plans to develop a series of unmanned aerial vehicles (UAVs) that will be controlled from the **KF-21**.[73] This concept will be a two-tiered manned-unmanned teaming (MUM-T) system that includes one **KF-21**, four "*loyal wingman*" unmanned fighters, and "*Adaptable Aerial Platforms*" (AAPs) paired to each larger unmanned fighter. The unmanned formation will be used to conduct operations over hazardous battle areas and have specific roles like electronic warfare, optical reconnaissance, and anti-radar operations intelligence gathering, decoying, and jamming. The **KF-21** and the UAVs will all be interconnected via high-speed data links.[74]

---

[67] Gastón Dubois, "*The fifth prototype of the Korean kf 21 boramae fighter took flight for the first time*" ", Aviaci Online, 16 May 20233, https://aviacionline.com/2023/05/the-fifth-prototype-of-the-korean-kf-21-boramae-fighter-took-flight-for-the-first-time/

[68] Yonhap, "*S. Korea's KF-21 fighter gets 'provisional' combat suitability evaluation*", The Korea Herald, 16 May 2023, https://www.koreaherald.com/view.php?ud=20230516000463

[69] "*Korea's KF-21 fighter gets 'provisional' combat suitability evaluation*", The Korea Times, 16 May 2023, https://www.koreatimes.co.kr/www/nation/2023/05/113_351053.html

[70] Gastón Dubois, "*The sixth prototype of the Korean kf 21 boramae fighter took off for the first time*", Aviaci Online, 28 June 2023, https://www.aviacionline.com/2023/06/the-sixth-prototype-of-the-korean-kf-21-boramae-fighter-took-off-for-the-first-time/

[71] Kim Eun-jung, "*Homegrown fighter jet KF-21 makes public debut at Seoul defense exhibition*", Yonhap News Agency, 16 October 2023, https://en.yna.co.kr/view/AEN20231016006800315

[72] "*ADEX 2023: Diehl Defence supports KF-21 Boramae fighter programme*", Defence Industry Europe, 16 October 2023, https://defence-industry.eu/adex-2023-diehl-defence-supports-kf-21-borame-fighter-programme/

[73] Nigel Pittaway, "*KAI plans loyal wingman role for KF-21*", Australian Defence Magazine, 03 November 2023, https://www.australiandefence.com.au/defence/air/kai-plans-loyal-wingman-role-for-kf-21

[74] "*ADEX 2023: KAI updates MUM-T concept for KF-21*", Janes, 20 October 2023, https://www.janes.com/defence-news/news-detail/adex-2023-kai-updates-mum-t-concept-for-kf-21

In January 2024, the second prototype of the **KF-21** conducted high angle-of-attack tests over the ocean near **KAI**'s Sacheon facility. It achieved an angle-of-attack of around 70° during a maneuver performed at an altitude of over 11,500 meters.[75]

In March 2024, **South Korea** decided to reduce the initial production of the **KF-21**. Due to feasibility concerns, the **DAP** announced that production would be cut from 40 to 20 aircraft for the year. This would allow for additional air-to-air missile and radar capabilities tests. The additional 20 fighters are expected to be produced in 2025 after these tests are completed.

In March 2024, the fifth prototype of the **KF-21** also successfully conducted its first aerial refueling test with a **KC-330** multipurpose aerial refueling transport aircraft from the **Republic of Korea Air Force**. This test involved connecting the refueling boom of the tanker to the fighter prototype's receptacle, transferring fuel, evaluating the impact of turbulence, and ensuring that the procedures for connecting and disconnecting were taking place without incident. The Ministry of Defense stated that the **KF-21** is expected to increase its operational radius by at least 50% with a single aerial refueling. According to **DAPA**, 60 trials will take place until March 2025 to verify aerial refueling capabilities at various altitudes and speeds.[76]

The aerial refueling trials are part of a comprehensive flight-test program aimed to be concluded in the first half of 2026. Following the successful completion of these tests, the first production **KF-21**s are expected to be delivered to the military before the end of the same year.

In May 2024, the **KF-21** successfully fired an IRIS-T short-range **AIM-2000** air-to-air guided missile produced by **Diehl Defence**[77]. This follows an earlier safe separation test with an unguided missile in May 2023. This latest test marked a significant milestone in the development program[78] as it proved the compatibility of this missile with the **KF-21**. When the jets enter service, the **AIM-2000** will be part of the **KF-21**'s armaments. In the latest test, the missile, guided by the onboard AESA radar, successfully engaged a target drone.[79] Collaboration between **Diehl Defence** and **KAI** has been ongoing since 2017.

In June 2024, **KAI** signed a $1.41 billion deal with the **DAPA** to begin production of 20 **KF-21** Block 1 fighter jets. The first aircraft of this series should be delivered by the end of 2026, and the final from this series by 2027. **KAI** aims to produce 120 **KF-21**s, with 40 Block

[75] Greg Waldron, "*KF-21 conducts high angle-of-attack tests*", Flight Global, 31 January 2024, https://www.flightglobal.com/defence/kf-21-conducts-high-angle-of-attack-tests/156715.article
[76] David Cenciotti, "*South Korea's KF-21 Boramae Refuels From KC-330 During Historic First AAR Test*", The Aviationist, 19 March 2024, https://theaviationist.com/2024/03/19/south-koreas-kf-21-boramae-refuels-from-kc-330-during-first-aar-test/
[77] "*KAI KF-21 accomplished first successful firing of IRIS-T*", 17 May 2024, Diehl Defence, https://www.diehl.com/defence/en/press-and-media/news/kai-kf-21-accomplished-first-successful-firing-of-iris-t/
[78] Juster Domingo, "*South Korea KF-21 Boramae Jets Successfully Fire IRIS-T Missiles*", The Defense Post, 20 May 2024, https://www.thedefensepost.com/2024/05/20/south-korea-boramae-iris-t-missiles/
[79] John Hill, "*KF-21 Boromae fighter fires IRIS-T missile for first time*", Airforce Technology, 20 May 2024, https://www.airforce-technology.com/news/kf-21-boromae-fighter-fires-iris-t-missile-for-first-time/?cf-view

I and 80 Block II aircraft. The development of Block II is expected to run between 2026 and 2028, and it will have additional air-to-ground capabilities and expanded performances.[80]

The **Republic of Korea Air Force** plans to have the first **KF-21**s in service by the second half of 2026 and deploy over 120 **KF-21** aircraft by 2032. The estimated production cost is $5.9 billion.[81]

III. CONCLUSION

South Korea's fighter jet programs, spearheaded by **KAI**, represent significant advancements in defense and aerospace. The **T-50 Golden Eagle** series and the **KF-21 Boramae** have demonstrated versatility in training and combat roles, incorporating advanced avionics and combat systems to enhance **South Korea**'s air force capabilities. These programs highlight **South Korea**'s blend of local innovation, self-reliance, and international collaboration, making the country a significant player in the global aeronautic defense sector.

KAI's efforts extend beyond national defense, as the company actively seeks international markets. These achievements reflect **South Korea**'s commitment to maintaining a robust, technologically advanced military force ready to meet future global challenges and opportunities.

Strong government support and strategic partnerships have been crucial to this development. The **DAPA** and collaborations with global defense giants like **Lockheed Martin** have facilitated technology transfer, joint development projects, and access to international markets, significantly advancing South Korea's aeronautic defense capabilities.

The development of **South Korea**'s aeronautic defense industry is also deeply rooted in the regional security dynamics of East Asia, especially the Korean Peninsula. The rapid modernization of military forces by neighboring countries, such as **China** and **Japan**, has further driven **South Korea** to enhance its military capabilities by developing sophisticated fighter jets and other defense technologies.

[80] Gordon Arthur, "*South Korea orders first batch of KF-21 fighters*", Defense News, 27 Jun 2024, https://www.defensenews.com/global/asia-pacific/2024/06/27/south-korea-orders-first-batch-of-kf-21-fighters/
[81] Juster Domingo, "*South Korea Cuts Initial KF-21 Boramae Production by Half*", The Defense Post, 26 March 2024, https://www.thedefensepost.com/2024/03/26/south-korea-boramae-production-half/