

European Security & Defence

€9.90
D 14974 E



7/2023

International Security and Defence Journal



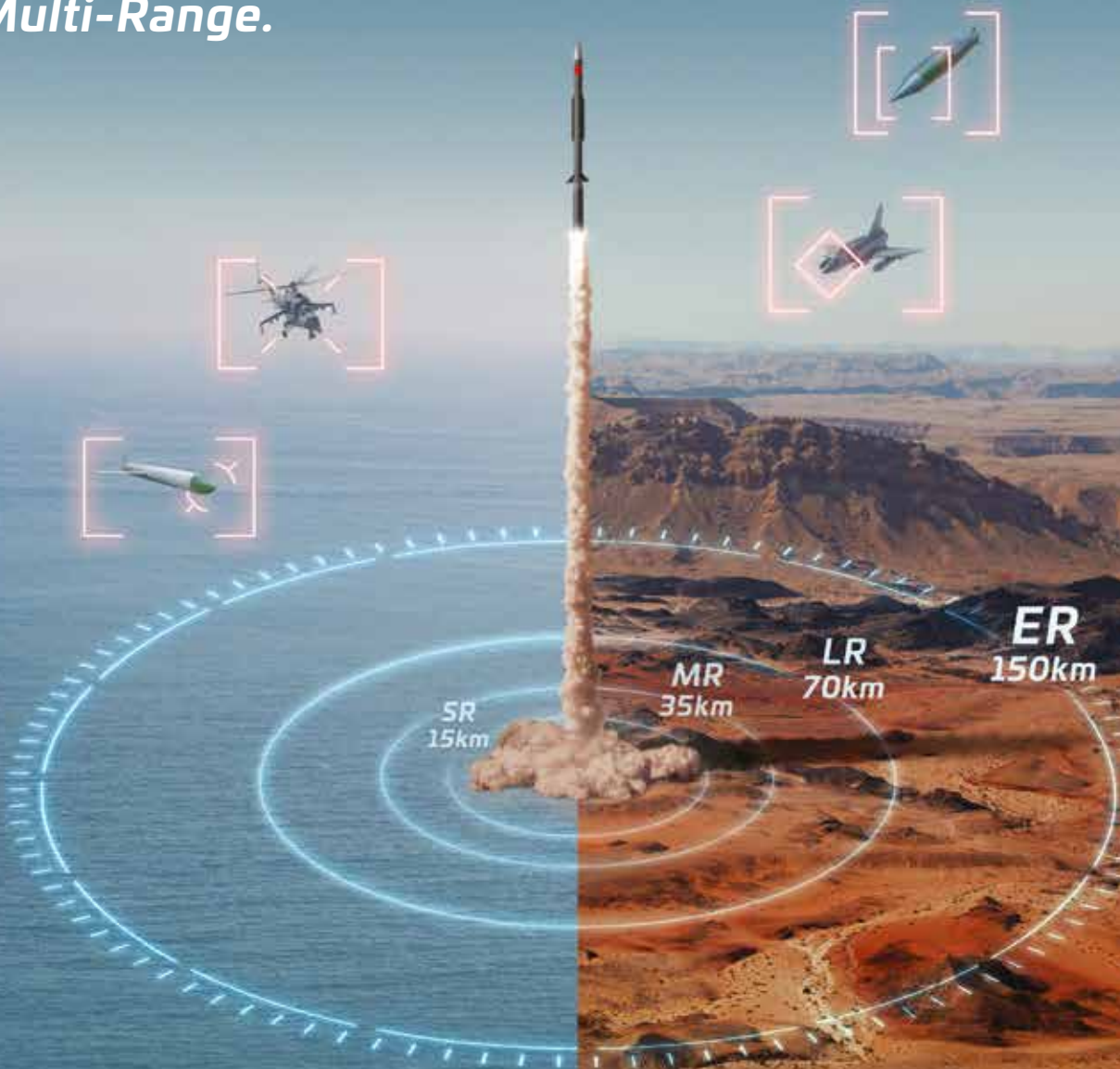
IDEF Special Edition

- Major Turkish Programme Updates
- Inside NATO's JFTC
- GBAD Programmes in Europe
- Türkiye's Newest Export Offerings
- Eurofighter Typhoon Update
- European UAV Programmes



BARAK MX

**Multi Mission. Multi-Target.
Multi-Range.**



Modern Combat-Proven Air and Missile Defense Solution

Barak MX sets the standard for Air Breathing Targets (ABT) and Tactical Ballistic Missile (TBM) defense, on land and at sea, with simple integration with new or legacy sensors, external networks through various data links. Its interceptor's superior wide aperture seeker, dual-pulse rocket motor that delivers thrust for high-energy end-game maneuvering, built-in simulation, and training are only some of the technologies that place Barak MX at the cutting edge of air defense.

www.iai.co.il • iai-mth-sms@iai.co.il



Discover More



Photo: author



Witnessing Prigozhin's Drive Down the Fury Road

While few who have followed his statements over the past year were surprised at Yevgeniy Prigozhin's hostility toward the Russian Armed Forces' leadership, few thought this enmity would go as far as mutiny and capture of the Southern Military District (SMD) headquarters in Rostov, as was the case in the early hours of 24 June. Along with the SMD HQ, Prigozhin managed to capture senior members of the Russian General Staff (referred to as the 'GenShtab' in Russian), including Deputy Defence Minister Colonel General Yunusbek Bamatgireyevich Yevkurov and Deputy Chief of Staff Lieutenant General Staff Vladimir Stepanovich Alekseyev.

The capture of the SMD HQ was followed by a Wagner contingent driving northward along the M-4 motorway, downing around seven Russian Aerospace Forces (VKS) aircraft on the way, and reportedly taking control of at least one military site in Voronezh Oblast. In the meantime, Putin's presidential plane was reported to have left Moscow for St Petersburg, indicating that the leader had fled the capital. When the column was approximately 200 km from Moscow, thought to be somewhere before the town of Tula, Prigozhin announced that the Wagner column would be turning around and the troops would return to their bases, since a deal had been reached with the help of the President of Belarus Aleksandr Lukashenko. A few hours later the Kremlin announced that the deal included legal amnesty for Prigozhin and Wagner members who participated in the mutiny, but they would be relocated to Belarus, in a move that seemed to indicate *de facto* exile.

A major question which repeatedly surfaced was why Russian aviation didn't destroy the column. While on paper, this should have been perfectly possible for a VKS operating within its own airspace, there are various factors to consider. For starters, Wagner had high-ranking GenShtab hostages at the SMD HQ, discouraging action against the column. The second is that the remaining MoD may have thought that attacking the convoy could aggravate the situation and result in unpredictable behaviour, therefore providing an additional incentive to resolve the situation peacefully. Lastly, since Prigozhin was in contact with the Russian leadership for at least part of the day to work out a deal, this may have given the MoD additional hope that everything could be resolved through negotiation.

Having said that, footage has surfaced showing at least two such strikes purporting to be on the Wagner column, but it is difficult to confirm the effectiveness of these strikes, or if the vehicles hit even belonged to Wagner. On the other hand, Wagner were reported to have downed a fixed-wing aircraft and at least six helicopters, one of which was a Ka-52 attack helicopter. These figures do not reflect particularly well on the VKS.

While Prigozhin appears to have secured himself a deal which appears to include his and the mutineer portion of Wagner's effective exile to Belarus, the fine details are not known. Given that this incident was deeply embarrassing to Putin personally, along with much of his circle, it is hard to accept the notion that the situation has been truly settled, and the working assumption is that this will result in retribution down the line, if for no other reason but to secure the regime against direct challengers.

Furthermore, Putin and his circle will have likely been taking notes on how various actors behaved toward Wagner during the incident, using their statements as a litmus test of loyalty. Reactions ranged from criticising both Wagner and the Russian leadership in the case of Igor Girkin, to the soft condemnation of Wagner and calls to halt the infighting by Sergey Surovkin, to comparisons of the incident to the "tragedy" of the 1917 revolution by the head of Russia's SVR Sergey Naryshkin, to the outright support for Wagner shown by Aleksey Milchakov, leader of the neo-Nazi Rusich paramilitary group, which is closely aligned with Wagner. Elsewhere, Ramzan Kadyrov and his Akhmat force declared their loyalty to the President and filmed themselves driving at least two columns to Rostov, ostensibly to fight Wagner. Yet despite entering Rostov by the afternoon, they opted not to engage Wagner in combat.

It may yet be a while before we see any retaliation against actors deemed disloyal, but such action is likely to come once when the Putin regime feels that it is relatively safe to do so. Presumably Prigozhin is aware of this possibility, and will take measures to secure his own safety in Belarus. Yet it is difficult to make any hard predictions, as the fallout from the incident will likely be ongoing for some time, and the situation will remain dynamic. Possibly above all else, by exposing the regime's internal and external weaknesses so starkly, the incident has opened up the conceptual space for change at the top. Yet the form this change may take remains difficult to predict. In the power game among the Kremlin elite, Prigozhin was a threat to the regime that day, but tomorrow it could be someone else.

Mark Cazalet

ARMED FORCES

- 12 **The Joint Force Training Centre – A Key Venue for NATO Training, Exercises & Development**
NATO Joint Force Training Centre,
Office of Public Affairs

ARMAMENT & TECHNOLOGY

- 16 **European Ground-Based Air Defence Programmes**
Jean Auran
- 22 **IRST Pods: Eagle Eyes for Passive Detection**
Georg Mader
- 26 **Eurofighter Approaches True Maturity as a Combat Air Platform**
Peter Felstead
- 32 **UAV Programmes: a Focus on the EU**
Giulia Tilenni
- 38 **Travelling Light – Nurol Makina Details its 4x4 Fleet Concept**
- 42 **Made-in-Türkiye: Indigenous Programmes Update**
Kubilai Han
- 47 **2023: A Big-Ticket Year for the Turkish Aerospace Industry**
Peter Felstead
- 53 **Türkiye Pursues Export Ambitions with Modern Product Range**
Kubilai Han

COLUMNS

- 1 **Word from the Editor**
- 3 **Masthead**
- 4 **ESD Spotlight**
- 11 **Firms & Faces**

Index of Advertisers

Aselsan	4 th Cover
Diehl Defence	17
Edex	55
ESG	27
Eurofighter	29
IAI	2 nd Cover
Indo Defence	51
Kallman	31
Leonardo	5
Lockheed Martin	25
MBDA	21
Nurol Makina	41
PBS Velka Bites	37
Raytheon Elcan	35
WB Group	9
Yugoimport	7



European Security & Defence

Issue 7/2023, July 2023, IDEF Special Edition
ISSN 1617-7983 · www.euro-sd.com

Published by



Mittler Report Verlag GmbH

A company of the TAMM Media Group

Office Address:

Mittler Report Verlag GmbH
Beethovenallee 21, 53173 Bonn, Germany
Phone.: +49 228 35 00 870, Fax: +49 228 35 00 871
info@mittler-report.de, www.mittler-report.de

Managing Director: Peter Tamm

Editorial Team

Publisher and Editor-at-Large: Stephen Barnard (sb)

Editor-in-Chief: Mark Cazalet (mc)

News Editor: Peter Felstead (pf)

Editorial Staff: Waldemar Geiger (wg, Infantry, Industry), Wolfgang Gelpke (wge), Gerhard Heiming (gwh, News, Land Forces), Ole Henckel (oh), Rolf Hilmes (rh, Army Technology), Lars Hoffmann (lah), Hans-Uwe Mergener (hum, Naval Forces)

Copy Editor: Christian Kanig (ck)

Regional Correspondents

Belgium/EU/NATO: Joris Verbeurgt (jv), **Brazil:** Roberto Guimarães de Carvalho (rgc), **Denmark:** J. Bo Leimand (jbl), **France:** David Saw (ds), **Georgia:** Beka Kiria (bk), **India:** J C Menon (jcm) **Israel:** Tamir Eshel (te), **Italy:** Luca Peruzzi (lp), **Japan:** Shinichi Kiyotani (sky), **The Netherlands:** Jaime Karremann (jk), **Poland:** Grzegorz Sobczak (gs), **Portugal:** António Brás Monteiro (abm), **Spain:** Esteban Villarejo (ev), **Taiwan, North & East Asia:** JD Kitsch (jdk), **Turkey:** Korhan Özkilinc (kÖ), **UK:** Christopher Foss (cf), Tim Guest (tg), **Ukraine:** Alex Horobets (ah) **USA:** Sidney Dean (sd), Chet Nagle (cn)

Layout:

AnKo MedienDesign GmbH, Germany

Production:

Saner Basim Hizmetleri San. ve Tic. Ltd. Sti.
Maltepe Mah. Litrosyolu Sk. No: 2-4
Ic Kapi No: 2BC3-4
Zeytinburnu, Istanbul
Tel: 212-6741051

Advertising, Marketing and Business Development

Achim Abele
Phone: +49 228 25900 347
a.abele@mittler-report.de

Stephen Barnard
Phone: +49 228 35 00 886, Mobile: +44 7984 033154
s.barnard@mittler-report.de

Stephen Elliott
Phone: +49 228 35 00 872, Mobile: +49 1590 173 0346
s.elliott@mittler-report.de

Exhibition Management and Advertising Administration: Renate Herrmanns

Advertising Accounting: Florian Bahr

Subscription/Reader Service:

PressUp GmbH, PO Box 70 13 11,
22013 Hamburg, Germany
Phone: +49 40 38 66 66-319, Fax: +49 40 386666-299
Email: mittler-report@pressup.de

European Security & Defence, ©2023 Mittler Report Verlag GmbH

All rights reserved. No part of this publication may be reproduced without prior written permission of the publisher in Bonn.

Cover Photo: Nurol Makina's newly-developed Ejder Yalçın – Extended Wheelbase variant. This vehicle is on display at IDEF 2023.
Credit: Nurol Makina

Annual subscription rate: €113.00 incl. postage

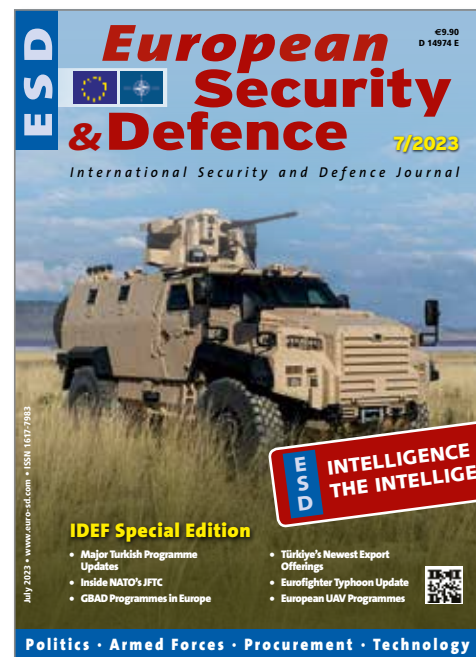
Reduced annual subscription rate for distribution in Germany:
€95.00 incl. postage

European Security & Defence

Media kit:



**MITTLER
REPORT**



Published monthly,
**EUROPEAN SECURITY & DEFENCE
(ESD)**

is the leading defence and security
trade journal in and for Europe.

Organised in four dedicated sections
of interest – Politics, Armed Forces,
Armament & Technology, and Industry
– every issue responds to the information
requirements of the European and
global defence and security community.

**We have the readers.
Print and digital.**

MITTLER REPORT VERLAG GMBH
53173 Bonn · Germany

info@mittler-report.de
www.mittler-report.de

■ PAS 2023: MBDA, Rafael, Brief on Plans to Counter Hypersonic Weapons

(pf) Major missile manufacturers MBDA and Rafael Advanced Defense Systems took the opportunity of the 2023 Paris Air Show, held at Le Bourget from 19-25 June, to brief on their plans to address the challenge of countering hypersonic weapons.

European missile house MBDA announced the launch of the Hypersonic Defence Interceptor Study, known as HYDIS2, at the show on 20 June 2023.

The HYDIS2 effort – which involves partner nations France, Italy, Germany and the Netherlands – brings together a consortium of 19 partners and 30 subcontractors in 14 European countries, with MBDA gathering round it national champions of missile defence, from aerospace and defence companies and institutions to niche specialists in both industry and academia.

The work will be conducted under a three-year concept phase study contract worth EUR 80 M from the European Defence Fund (EDF) Work Programme 2023; the company received an invitation to tender for the work in March 2023 and its response, submitted in May, is currently under evaluation.



Credit: MBDA

Under this concept phase study the design of various interceptor concepts will be developed before one is selected and its critical technologies pursued with the support of the four partner nations involved.

The HYDIS2 consortium met at the Paris Air Show on 20 June to prepare short-term actions to launch the project, but MBDA has already been working on a counter-hypersonics initiative called the Aquila project for the last five years. This builds on the company's expertise with its Aster anti-missile interceptor and its knowledge of hypersonic threat systems already fielded.

Rafael, meanwhile, has also been working on a counter-hypersonic weapon capability for several years. This work has now manifested itself in the Sky Sonic system unveiled at the Paris Air Show.

Little information is currently being released on the Sky Sonic system, but a Rafael official involved with the programme did confirm to ESD at Le Bourget on 21 June that it is a hit-to-

Credit: Rafael



kill system using a two-stage interceptor comprising a booster and a powered kill vehicle. This was also reflected in artwork displayed by Rafael at the air show.

"Either you hit it, or you've missed it," said the official. "I'm not saying there are no munitions [on the kill vehicle], but no blast in the vicinity of the target is any good." He did add, however, that even just damaging rather than immediately destroying a threat hypersonic weapon is ultimately likely to seal its fate, given the velocity and consequent heat-build-up it will be subject to as it descends through the atmosphere to its target.

Citing the key attributes of hypersonic weapons as being not just their sheer velocity but also their accuracy and unpredictability, the official noted that to intercept them you "need height; you have to hit the target before it dives, ideally at an altitude above 10 km". That said, he also noted that multiple interceptors might have to be launched to close any potential gaps in a given air defence environment. This then drives a cost challenge; the interceptors need to be cost-effective, he said, "so you don't have to think twice about shooting multiple interceptors".

The official also said that a very long-range seeker is required to successfully intercept hypersonic missiles and that this "usually would need a bigger rocket". The implication of that statement, surely, is that Rafael has successfully developed modestly sized long-range seeker that is nevertheless effective.

■ GDLS, American Rheinmetall Vehicles Downselected for Rebadged OMFV Contest

(pf) The US Army announced the award of two firm-fixed price contracts for the Optionally Manned Fighting Vehicle (OMFV) Phase III and IV detailed design and prototype build and testing phases on 26 June 2023.

The contracts were competitively awarded to General Dynamics Land Systems (GDLS), which has proposed its Griffin III infantry fighting vehicle (IFV) technology demonstrator, and American Rheinmetall Vehicles, which uses the Lynx KF41 IFV as the basis for its candidate vehicle.

The total award value for both contracts is approximately USD 1.6 Bn (EUR 1.46 Bn).

Bids led by BAE Systems, Oshkosh Defense/Hanwha, and Point Blank Enterprises have not been chosen to proceed to the next phase.

Meanwhile, with the initial digital design phase of the programme now complete, the army is redesignating the OMFV programme as the XM30 Mechanized Infantry Combat Vehicle (MICV) programme.

"The XM30 programme has been highly successful," Major General Glenn Dean, the US Army's Program Executive Officer for Ground Combat Systems, was quoted as saying in a 26 June press release. "The army's iterative concepting and digital design approach, combined with increased emphasis on competition, continues to allow the programme to quickly design a transformational capability for the army of 2030 and beyond."

Destined to replace the US Army's Bradley Fighting Vehicle fleet (a task that has seen multiple aborted programmes over the last several years), the XM30 programme is expected bring new capabilities that will transform the way US armour formations fight. Developed with a modular open-system architecture (MOSA), the XM30 will allow new, developing technologies to be added to the vehicle as they mature, ensuring the XM30 stays ahead of the threat.



Credit: American Rheinmetall Vehicles

Regarding the oncoming run-off between GDLS and American Rheinmetall Vehicles, Doug Bush, Assistant Secretary of the Army for Acquisition, Logistics and Technology, stated, "Competition remains a vital aspect of the XM30 programme. Fully funding two companies for the next phases of the programme will allow the army to place the XM30 on a rock-solid foundation from a resourcing perspective, while also maintaining a competitive environment."

During the next two phases of the programme, the army will conduct activities to mature XM30 designs and will verify prototype performance during test activities, including a limited user test. The awardees will be required to deliver up to 11 prototype vehicles, as well as two ballistic hulls and turrets, armour coupons and digital engineering data.

Following the detailed design and prototype build and testing phases, the army intends to

SIMPLY NO RIVALS



AW139^M

Based on the market-leading AW139, the AW139M was designed to meet the stringent military and civilian certification requirements of government, homeland security and military users, for a wide range of missions, day and night. It provides enhanced operational effectiveness with mission detection and protection systems and a range of role equipment for multi-role and combat missions. Thanks to its compact footprint for confined area operations, its 60-min certified gearbox dry-run capability and crashworthiness to latest standards; it can meet the most challenging conditions anywhere.

Visit us at LE BOURGET, Chalet 250 - Static Area B6



leonardo.com

 **LEONARDO**
ACCELERATING TECHNOLOGY EVOLUTION

have a limited competition to downselect to one vendor at the programme's 'Milestone C' near the end of fiscal year 2027, with first unit equipped anticipated in fiscal year 2029.

■ Accord Signed on Transfer of Leopard 2A4 MBTs to Ukraine

(pf) Officials of the Netherlands, Denmark and Germany, together with representatives from Germany's Rheinmetall, have recently signed an agreement to effect the transfer of 14 Leopard 2A4 main battle tanks (MBTs) to Ukraine, Rheinmetall announced on 27 June 2023.



Credit: Rheinmetall

The Dutch and Danish governments first announced their intention to jointly acquire Leopard 2A4 MBTs for donation to Ukraine in April 2023. The Dutch government then contracted Rheinmetall to supply 14 Leopard 2A4s, worth a figure "in the lower three-digit-million-euro range", according to Rheinmetall. The Dutch and Danish government are jointly financing the order as part of the international tank coalition to provide effective support for Ukraine.

The first MBT is scheduled for delivery in January 2024, with the last due to ship over the course of the year. The tanks are upgraded Leopard 2A4s acquired by Rheinmetall from the inventories of user nations.

"The transaction underscores Rheinmetall's role as an important supplier of materiel to the Ukrainian armed forces," the company stated in a press release. It is just the latest in a series of actions taken by the company in support of Ukraine's defensive war effort. In the meantime, Rheinmetall is the embattled country's sole source of large-volume shipments of new medium- and large-calibre ammunition, including 20 mm rounds for the Marder IFVs' automatic cannon and 105 mm and 120 mm tank ammunition for the main armament of the Ukrainian Army's Leopard 1 and Leopard 2 MBTs. A first lot of 35 mm ammunition for donated Gepard anti-aircraft tanks will soon be ready for shipment as well."

Rheinmetall has been instrumental in supplying the Ukrainian military with substantial numbers of armoured fighting vehicles, either through multilateral Ringtausch exchange programmes with partner nations or via direct deliveries at the behest of the German government. In March 2023, for example, Rheinmetall shipped 20 Marder infantry fighting vehicles (IFVs) to Ukraine, while a second lot of 20 of these IFVs is due to ship this summer. "By the end of 2023 Rheinmetall will also be supplying Ukraine with 26 brand-new military trucks and two state-of-the-art air defence systems," the company added. "The support effort also encompasses SurveilSPIRE mobile reconnaissance systems with day- and night-capable cameras and autopiloted mini-drones. The group is also furnishing Ukraine with a field hospital system consisting of containers and tents as well as a container-based mobile surgical station for initial treatment of trauma cases, both of which will be a vital source of support for the Ukrainian military in the coming months."

■ Ukrainian-Released Storm Shadows Target One of Russian Forces' Few Links to Crimea

(pf) In an attack that Russia would have widely expected, the Ukrainian military targeted the dual road and rail bridges at Chonhar that link Russian-occupied Crimea to the rest of Ukraine on the night of 21/22 June 2022.

Photographs and video posted on Telegram by the Kremlin-backed governor of occupied Kherson, Vladimir Saldo, show that the road bridge, at least, was heavily damaged, although not destroyed. Saldo played down the effects of the strikes, stating on Telegram, "We know how to repair bridges quickly; vehicle passage will be restored in the very near future."

Saldo also stated that "According to preliminary estimates British Storm Shadow missiles have been used", while The Times newspa-

per reported that a source in Ukrainian military intelligence had confirmed this. Again, it would have been expected by the Russians that infrastructure like bridges would be targeted by Ukraine's UK-supplied Storm Shadow air-launched cruise missiles, although striking targets in Crimea is likely to heighten tensions between Russia and Ukraine's Western allies. Moscow has even mentioned the potential use of nuclear weapons should its occupation of Crimea, which it illegally annexed in 2014, be threatened.

Ukraine's targeting of the bridges at Chonhar is significant; only three main roads link Crimea to Russian-occupied Kherson Oblast and, of those, the road bridge at Chonhar links the Crimean peninsula directly to the strategic hub city of Melitopol in Russian-occupied Zaporizhia Oblast in southeastern Ukraine. Beyond these routes there is only the Kerch Strait Bridge that links eastern Crimea to Russia directly: a crossing built by Moscow after it annexed the peninsula in 2014 that was targeted and heavily damaged by a large truck bomb on 8 October 2022.

If Kyiv can strangle the logistical links between Crimea and Russian-occupied southeastern Ukraine, then the position of the Russian forces on the peninsula will become increasingly difficult to retain quite regardless of any Ukrainian counter-offensive, which would run into considerable Russian defensive lines. For the recent attacks on the Chonhar crossings to be more than symbolic, however, Ukraine would need to follow up its initial strikes to cause more comprehensive damage or to harass Russian forces repairing or still using the bridges.

Certainly for both sides it is clear that Russia's continued occupation of Crimea is central to the credibility of the regime of Russian President Vladimir Putin, making the peninsula territory of great strategic importance.

■ PAS 2023: New Eurofighter CEO Sounds Upbeat Note on New Sales

(pf) The new CEO of Eurofighter struck an upbeat note on the prospects for new sales of the aircraft during a press conference at the Paris Air Show on 21 June 2023.

Giancarlo Mezzanatto, who began his new role on 1 May, told journalists that he sees opportunities to sell an additional 150 to 200 new Eurofighters over the next two years, noting that the company is "much more optimistic than we were some years ago".

The situation in Ukraine – and Russian President Vladimir Putin's February 2022 invasion of that sovereign European na-



Credit: V Saldo/Telegram

30
years

IDEF'23

16th International
Defence Industry Fair

July 25-28, 2023

İSTANBUL - TÜRKİYE

www.idef.com.tr



Credit: Eurofighter



tion – “has had a huge impact”, said Mezzanatto, who noted that this has led countries to re-examine both what they consider to be adequate armed forces capabilities as well as their previous attitudes to defence exports.

Most crucially, Mezzanatto, suggested that Germany’s refusal to sanction export licences for further Eurofighter sales to Saudi Arabia (a stance taken in light of the October 2018 murder of US-Saudi journalist Jamal Khashoggi and Riyadh’s involvement in the war in Yemen) might soften in light of the Ukraine conflict, adding that “The UK, as lead nation for Saudi Arabia [regarding Eurofighter exports], is really active”.

A future Eurofighter order for Saudi Arabia, which currently operates 72 of the type, could be substantial, involving at least 48 or possibly as many as 72 aircraft. An order for another 15 Eurofighters could come in the form of electronic warfare (EW) variants for Germany (where they are known as EK variants). Eurofighter is hoping these EK variants will be new-build Tranche 4 aircraft, although it is still likely that Germany will include them within its Project Quadriga order, which covered the acquisition of 38 Eurofighters and was signed in November 2020. In the run-up to the Paris Air Show Saab’s Araxis EW system was declared to be the preferred bid for the Eurofighter EK variants, yet there has been no contract and Saab has been reticent to detail what Araxis solution the Eurofighter would receive; the system can either be fully integrated into the aircraft or come in the form of a missionised pod. Meanwhile, Eurofighter is anticipating that Spain will soon order 25 new aircraft under its Halcon II project, which is aimed at replacing the EF-18 Hornets operated by the Spanish Air Force out of Torrejon and Zaragoza air bases.

“Spain have an operational requirement to replace their Hornets,” said Mezzanatto, although he noted that a Halcon II contract could be delayed – or even brought forward – by Spain’s national elections in July.

Interestingly, Mezzanatto also said, “I think for Eurofighter Poland is a very good opportunity,” citing the fact that the Polish Air Force has become familiar with the Eurofighter through the type’s deployment to Malbork Air Base in Poland as part of NATO’s enhanced Air Policing (eAP) mission in the Baltic region. The Italian Air Force deployed four Eurofighters to Malbork for four months from August 2022, having completed a seven-month deployment of Eurofighters to Romania on 1 July 2022 (extended from four months due to the Russian invasion of Ukraine).

Mezzanatto’s optimism regarding a Eurofighter sale to Poland is perhaps a little surprising, however, given that Poland has already opted to procure the F-35, of which it ordered 32 in 2020, and in 2022 ordered 48 KAI FA-50 light strike aircraft. Lastly, Mezzanatto also referenced Turkey, where the UK is leading a sales campaign for the Eurofighter. Turkey was kicked out of the F-35 Joint Strike Fighter programme in 2019 for buying the Russian S-400 air defence system and, although Turkish Aerospace is developing the indigenous Kaan next-generation fighter, the prototype has yet to fly.

Regarding his goals for Eurofighter as a business, Mezzanatto said he wanted to: deliver the Eurofighter’s capability roadmap to keep the aircraft operationally effective out to 2060; be ready to support and ramp up production when additional sales are secured; support the mission readiness of the customer; and continue to promote the strength of the Eurofighter procurement model.

Beyond these goals, however, Mezzanatto is also looking to streamline and harmonise the upgrading of the various national Eurofighter fleets. “One of my objectives is to align as much as possible the configurations of our customers,” he said.

This will be quite a challenge, given the disparities between the user nations in both aspirations and budgets.

■ LIMA 2023: Multiple Malaysian Aircraft Contracts Finalised

(pf) The 16th LIMA 2023 defence exhibition, held in Langkawi from 23-27 May 2023, saw the signing of 20 contracts, 21 letters of acceptance and two letters of intent worth a total of MYR 10.128 Bn (EUR 2.05 Bn), according to the Malaysian Ministry of Defence (MoD). Among the deals a number of aircraft acquisitions were finalised.

The most notable of these was a contract for 18 Korea Aircraft Industries (KAI) FA-50 light combat aircraft worth USD 920 M (EUR 858 M). This contract was officially signed at LIMA on 23 May after a Letter of Acceptance for the aircraft was agreed on 24 February 2023. The FA-50s will replace BAE Systems Hawks in the Royal Malaysian Air Force (RMAF) fleet, which currently operates 12 Hawk 208 light attack aircraft and four Hawk 108 advanced jet trainers.

The Malaysian MoD described its future FA-50s as “fighter lead-in trainer/light combat aircraft (FLIT-LCA)”, with reports suggesting that eight aircraft will be used lead-in fighter trainers with the rest operating as light fighters.

Credit: Leonardo



Raytheon announced on 15 May 2023 that it will be furnishing KAI’s FA-50s with its PhantomStrike compact active electronically scanned-array fire control radar. This system will be integrated in the RMAF aircraft, the first deliveries of which will take place in August 2026.

On 25 May, meanwhile, LIMA witnessed the Malaysian MoD signing a contract with Leonardo for two ATR 72 Maritime Patrol Aircraft (MPA) variants plus related integrated logistic support and training services. The contract, worth MYR 789.6 M (EUR 159.03 M), follows the selection of the aircraft by Malaysia in October 2022 and was described as a “Phase 1” deal by the Malaysian MoD, suggesting that a follow-on purchase could ultimately take place.

The twin-turboprop ATR 72 MPA, the latest specialised variant of the ATR 72 regional transport aircraft, is designed to conduct missions including maritime surveillance, anti-submarine warfare (ASW), anti-surface unit warfare (AsuW), search and rescue (SAR), environmental monitoring, medical evacuation and transport of personnel and materials.

According to a Leonardo press release on 25 May, the aircraft chosen by Malaysia will be equipped “with a flexible mission system, advanced sensors and a complete communications suite for

command, control, communications, intelligence, surveillance and reconnaissance (C4ISR) missions over land and sea". Although the specific mission and sensor fit of the Malaysian order was not disclosed, Leonardo stated that the Malaysian ATR 72 MPAs would be "optimised for maritime patrol, electronic intelligence (ELINT) gathering, sea surface and submerged target detection and tracking, SAR, countering illegal activities (drug trafficking, piracy and smuggling) and protecting territorial waters". The company added that there is growth potential for the aircraft to evolve into fully fledged ASW and AsuW platforms. Leonardo did confirm that the Malaysian ATR 72 MPAs would feature the modular Leonardo Airborne Tactical Observation and Surveillance (ATOS) mission system. This manages the aircraft's onboard sensors, fusing the information gathered and presenting a comprehensive and continuously updated tactical picture to the mission system operators. Also on 25 May the Malaysian MoD signed a contract with Turkish Aerospace

for three Anka medium-altitude, long-endurance (MALE) unmanned aerial systems (UASs). This contract, also described as a "Phase 1" deal, is worth more than MYR 400 M (EUR 80.56 M) and covers an unspecified number of Anka unmanned aerial vehicles (UAVs) and ground control stations as well as a training and logistics package. Its signing brings to a close an open-tender contest that lasted around five years.

Erol Oguz, UAS programme manager at Turkish Aerospace, told ESD at LIMA that the UAV type being supplied to Malaysia will be a new version of the Anka-S with modified wings. Oguz also confirmed that the Ankas will not be armed, but will carry a maritime intelligence, surveillance and reconnaissance (ISR) payload that includes a synthetic aperture radar and an electro-optical/infra-red sensor. The training of Royal Malaysian Air Force (RMAF) personnel on the Anka UAS will begin next year, while deliveries of the systems will take two years.

Although it appears clear that the RMAF will procure additional UAVs in a sec-

ond phase, Oguz told ESD that it is "not 100% clear" what these would be, but that their type would be defined during delivery of the programme's Phase 1.

Beyond the RMAF, the Malaysian MoD also announced at LIMA that a contract had been signed for the Malaysian Army to receive four Sikorsky UH-60A+ Black Hawk helicopters leased from Aerotree Defence & Services Sdn Bhd. The MoD stated that these aircraft will be used both for training as well as "operational flight duty". The Malaysian Army currently operates two Sikorsky S-61A-4 Nuri medium transport helicopters, according to the IISS's 2023 edition of The Military Balance, along with 10 AW109 light transport helicopters. The S-61 Nuri were originally operated by the RMAF, which first received the type in 1967 but retired the last 12 in 2020 after they become too expensive to continue operating. Nevertheless, a couple of S-61s have been used by the Malaysian Army to stand up its first air transport units. The value of the Black Hawk leasing deal was not specified.

We set standard with **FONET**
now watch what we do with
FONET Mk2



Designed to support command, control, communications, computers, cyber-defense, and combat systems integrations.



Complete system integration on a wide range of platforms.



Scalable and modular to support C2 framework system deployment from small units to battalion level and higher.

WB GROUP

FONET Mk2 - Tactical Vehicle Integration Platform

■ Lithuania to Provide Ukraine with Two NASAMS Units, More M113s

(pf) The Lithuanian Ministry of National Defence (MND) announced on 28 June 2023 that it will contribute a military assistance package to Ukraine that will include the purchase two National Advanced Surface-to-Air Missile Systems (NASAMS) from Norway's Kongsberg Defence & Aerospace (KDA). An acquisition contract worth around EUR



Credit: Kongsberg

9.8 M for the NASAMS units was signed between Lithuania's Defence Materiel Agency and KDA on 27 June, the MND stated. "We are purchasing upgraded NASAMS missile launchers, which will be fully ready for integration with the armed forces of Ukraine fire control units, thus supplementing and extending its NASAMS operational capability donated by Norway and [the] US," Minister of National Defence Arvydas Anušauskas was quoted as saying in a 28 June press release.

Lithuania is also arranging the transfer and hand-over of the equipment to the Ukrainian armed forces, which will take place in the coming three months, according to the MND. The Norwegian Ministry of Defence, meanwhile, is contributing to the package with a donation of NASAMS launcher maintenance equipment.

Lithuania is itself a NASAMS user, having received its first systems in October 2020. The Lithuanian military assistance package is also planned to include 10 M113 armoured personnel carriers, thus making a total of 72 such vehicles donated by Lithuania to Ukraine.

Additionally, the MND noted that Lithuania has placed an order for 12.5 million rounds of ammunition for Ukraine to be produced in 2023, 2.5 million rounds of which will be handed over to Ukraine shortly.

"Thousands of rounds of anti-tank ammunition for grenade launchers will follow soon as well. With this assistance package, Lithuania's contribution to Ukraine's defence will exceed half a billion euros," the MND stated. Lithuania has also committed to continue

supporting Ukraine in the long term by endorsing a military assistance plan worth at least EUR 200 M in the period 2024-2026. In March 2023 Lithuania raised its defence spending by EUR 97.5 M, ensuring it reaches a level of 2.52% of GDP, on top of a 2023 defence budget of EUR 1.775 Bn, which was itself about EUR 573 M more than what was approved in 2022.

As a former Soviet territory that shares a border with the Russian exclave of Kaliningrad, Lithuania has keenly felt the plight of Ukraine since the Russian invasion of February 2022.

■ Design Contract Issued For New Danish Patrol Ship

(Thomas Lauge Nielsen) The Danish Ministry of Defence's Acquisition and Logistics Organisation (DALO) has awarded a contract to the Danish Patrol Ships consortium (comprising Terma, Odense Maritime Technology and PensionDanmark) for the design of a new class of patrol vessel for the Royal Danish Navy (RDN), the ministry body announced on 23 June 2023.

The project will be conducted in co-operation with the Danish armed forces and with potential subcontractors in the

Image: OMT



Danish maritime and defence industry to ensure a sustainable, future-proof and affordable design.

The intent is that the practical work on the design will start in the summer of 2023 and be finalised by mid-2025. At that point the Danish government will then decide on the procurement and construction of the new vessels.

The design itself is intended to incorporate features such as 'green' technologies, for example, in order to reduce reliance on fossil fuels, as well as advanced decision support systems and modular mission equipment. For the latter, the Danish ship design and construction industry has significant experience from the previous Flyvefisken (Flying Fish)-class patrol ships and Absalon-class frigates. Both of these classes house most of their mission equipment in interchangeable, containerised modules, allowing rapid switching between missions.

The design contract has its origins in a decision by the Danish government in June 2021 to start the development of a new class of patrol ship for the RDN that will be capable of sovereignty patrols and environmental protection. A little over a year ago, in April 2022, DALO announced its intention to award contracts for the new patrol ships to the Danish Patrol Ships consortium, making the consortium responsible for the overall design, system integration, construction and initial maintenance of the new ships. With this latest contract the design part of the project has been initiated.

The decision to make a Danish consortium responsible for the patrol ship project has undoubtedly been influenced by the desire, following the Russian invasion of Ukraine in February 2022, to bolster the Danish defence industry and to increase the assurance of supply, especially for important defence assets. There can also be little doubt that the war in Ukraine, and the resultant new European security environment, has influenced the intended roles of the new ships, with an increased focus on potential combat operations, to safeguard Denmark's and NATO's sea lanes of communication and to defend Danish territorial waters.

The project also constitutes a novel approach to new ship design for DALO and the RDN. Traditionally, DALO and the navy themselves have retained primary responsibility for design and system integration, with just the actual construction of the ships being contracted to industry. By making a single industry partner, in this case the Danish Patrol Ships consortium, responsible for the complete project, DALO and the RDN wish to further leverage industry expertise. Should the project become a success, DALO and the Danish government expect it to become a model for the future contracting of complex capabilities.

The Danish Patrol Ships consortium is one of the largest defence contractors in Denmark, with a focus on radar systems, avionics and space technology. As previously reported by EST, Terma was also recently awarded the contract to act as system integrator for the Danish Army's new very-short-range air defence system. Odense Maritime Technology is a maritime consulting firm specialising in, among other things, ship design and integration, while PensionDanmark is a labour market pension fund with more than 800,000 members and, as such, brings to the table not only funding but also skills in project and risk management.

■ Saab CEO Johansson Appointed Vice Chairman of the Board at ASD

(pf) Saab President and CEO Micael Johansson was appointed vice chairman of the board at the Aerospace and Defence Industries Association of Europe (ASD) on 15 June 2023, the company announced in a press release.



Credit: Saab

The company noted that Johansson's appointment "comes at a time when defence and security in Europe are more important than they have been in decades, and where the European defence industry is seen as a crucial component for maintaining peace in the region".

"It is an honour to be elected to this position by my CEO peers and the national associations of ASD," Johansson was quoted as saying. "I very much look forward to helping to steer ASD in these challenging times for Europe, together with the newly elected ASD President and Chairman of the board, Airbus CEO Guillaume Faury," "Through my role as Vice Chairman of the board at ASD, I will be able to advocate for ASD's interests, drive concrete initiatives, and foster the technological advancements necessary to address emerging security challenges in Europe," Johansson added.

ASD represents the European aerospace, defence and security industries, mainly in relation to EU institutions but also on a global level in relation to other international bodies of importance to the sector. It serves as a collective voice for more than 3,000 companies, ranging from small and medium-sized enterprises to larger corporations.

ASD members together employ 879,000 people and generated a turnover of EUR 238 billion in 2021. The organisation

works closely with policymakers, institutions, and other stakeholders to foster a secure and innovative defence industry ecosystem in Europe.

■ PAS 2023: Elettronica Emerges as ELT Group

(pf) The former Elettronica Group emerged on the first day of the 2023 Paris Air Show on 19 June as the newly rebranded ELT Group. The company explained that its new identity and image came about "in light of the ambitious strategic evolution set forth by our TENET 2030 plan".

The Tenet 2030 industrial plan focuses ELT Group on "an increasingly global, multi-domain dimension, reflecting new trends in the realm of sixth-generation air platforms, chiefly the multi-national Global Combat Air Programme (GCAP), which ELT Group is involved with", the company stated.

"Following Tenet 2030, ELT Group is evolving to respond more effectively to new technological challenges and increasingly complex protection demands," the group's president and CEO, Enzo Benigni, was quoted as saying in a company press release. "This evolution has been possible thanks to the deep expertise, gained over seven decades, in the innovative use of the electromagnetic spectrum through proprietary technologies, and through continuous work in research and development.



Image: ELT Group

"Today, ELT is a group showcasing its expertise in new domains and in new geographies, without losing focus of its core business, where the company continues to invest in innovative solutions to provide armed forces with advanced proprietary systems," Benigni added.

A new area of emphasis for the group, known for its heritage and expertise across the electromagnetic spectrum, is operations in the space and cyber domains.

"Space is becoming an increasingly strategic business sector, which, at the same time, is attracting cyber criminals," the company explained. "Examining emergent threats in this sector, ELT Group is leveraging its electromagnetic spectrum

expertise by making the first payload, SCORPIO, for space-based signals intelligence collection placed in a low Earth orbit. The satellite carrying the payload was launched on 15th April on board a SpaceX Falcon 9 rocket."

Regarding the cyber domain, ELT Group stated that, via its CY4GATE investee, it has enhanced the capabilities of its Anti-Drone Interception, Acquisition and Neutralization (ADRIAN) system with a new feature called Cyber RF (Radio Frequency), which makes it capable of effectively detecting and reacting to new and more complex civilian and military operational scenarios involving new-generation malicious unmanned aerial vehicles (UAVs). Cyber RF is a complement to ADRIAN's jamming, radar and visual modules, allowing it to perform a full takeover of a hostile UAV to achieve a safe landing, avoiding impacts in the locale where the UAV is flying.

"Cyber RF ensures 100% detection of most commercial drones being used for hostile purposes," the company stated. "It also allows the real-time tracking of the drone and pilot, the possibility of aircraft identification and obtaining related telemetry (cyber detection) and finally selective drone takeover and countermeasures (cyber countermeasures)."

Also relating to the cyber domain, ELT Group entity Cy4Gate used the Paris Air Show to present its Hybrid Cyber Digital Twin platform, which can simulate an information technology/operational technology network to identify potential vulnerabilities and preventively implement countermeasures that facilitate a more effective and timely response to a hacker. Digital twin technology makes it possible to improve the cyber resilience of networks and their technologies; to make red and blue team training more effective by having them practise on simulated attack scenarios using real and current threats; and to implement a 'honey net' – a simulated network identical to the real one that is used as 'cyber bait' for an attacker in order to isolate it, study its behaviour and attack techniques, and then adjust defensive measures.

ELT Group says its new logo, featuring a sphere from which electromagnetic waves propagate, summarises three messages at the heart of the company's evolution: the dominance of the electromagnetic spectrum in every domain; the global projection of the company; and the increased ability to protect assets, people and data.

The Joint Force Training Centre – A Key Venue for NATO Training, Exercises & Development

NATO Joint Force Training Centre, Office of Public Affairs

As tensions continue to rise across the globe, it has never been more important for NATO member countries to ensure that their armed forces are properly trained and stand ready to defeat potential adversaries. This is NATO's Joint Force Training Centre (JFTC), located in Bydgoszcz, Poland, principle objective. JFTC's state-of-the-art facility plays a key role in preparing Joint NATO forces for the challenges they will face while operating in all domains. In this article, we will take a closer look at this training centre and the role it plays in keeping Joint NATO forces mission ready.

JFTC is the only NATO training facility responsible for conducting joint military exercises and training at the tactical level. The only other NATO training facility, Joint Warfare Centre in Stavanger, Norway, focuses on the strategic and operational level. JFTC provides a challenging and comprehensive tactical level training environment for NATO military and non-military personnel. Furthermore, JFTC also conducts military experimentation and testing which supports the NATO warfighters' effectiveness against today's threats and prepares them for future threats.

Background Information

The Centre's history goes back to November 2002. During the NATO Prague Summit, Heads of State and Government opened a new chapter of the Alliance's history. The Baltic States were invited to accession talks and they committed themselves to equipping NATO with new and advanced capabilities to better prepare for security threats of the 21st century. One of the initiatives was the ambitious reorganisation of the NATO Command Structure. The overarching intent was to make it leaner, more effective and deployable, in order to ensure the full range of Alliance missions could be accomplished. Therefore, it was decided to develop two different four-star level strategic commands: one responsible for current NATO operations focused on how we fight today - Allied Command Operations (ACO) in Mons, Belgium, and the other to focus on NATO's transformation, how we will fight in the future - Allied

Credit: JFTC



JFTC's Headquarters in Bydgoszcz, Poland.

Command Transformation (ACT) in Norfolk, Virginia. Since one of NATO's transformational objectives includes the continuous advancement of interoperable, network-enabled, combined joint forces, it was determined that investments, particularly in the area of integrated joint training, needed to be made. As a result, JFTC was established under the new Allied Command Transformation (ACT), along with Joint Warfare Centre (JWC) and Joint Analysis and Lesson Learned Centre (JALLC).

JFTC was officially formed on 31 March 2004 and conducted its Inauguration Ceremony on 25 June 2004. It was the first NATO Command Structure unit established in Central and Eastern Europe. The Centre paved the way for other NATO institutions

to be established in the city of Bydgoszcz, which is now commonly referred to as "the NATO Capital of Poland".

JFTC was initially established solely for the purpose of providing tactical level training to NATO forces. Over time, and as a consequence of the evolution of global security threats and NATO enlargement, JFTC's mandate expanded to include experimentation and testing and quickly became a prominent and valuable member within the NATO network.

On 9 September 2009, JFTC moved into its new facility, equipped with modern communication and information systems. This enhanced the Centre's capabilities and offered a one of a kind training facility, ready to support NATO current operations, future



Credit: JFTC

JFTC was responsible for Exercise LOYAL LEDA 2022 that provided a venue for training, evaluation and certifying NATO Rapid Deployable Corps-Türkiye as the designated NATO Warfighting Corps for 2023.

operations, emerging requirements, and tactical level certifications. JFTC's critical contribution to the NATO training community makes it an essential player in maintaining readiness and operational effectiveness of the Alliance.

Leadership & Structure

JFTC operates in a highly coordinated and structured manner to ensure that its missions are executed effectively. The Centre's Commander is two-star General Officer. The command alternates between Germany and Poland, and currently, the position is filled by Major General Norbert Wagner of the German Armed Forces. The Commander is supported by a Deputy Commander and Chief of Staff. This position rotates between Czech Republic and Hungary, and is presently occupied by Brigadier General Petr Svoboda of the Czech Armed Forces. The Centre consists of three divisions, each responsible for specific functions, supported by the Director of Management. The Director of Management (DOM) is responsible for managing the staff in all work requiring the attention of the Commander or Deputy Commander / Chief of Staff, coordinates administrative support, and information management. The Training and Exercise Division (TED) is responsible for the development, management, and execution all training and exercise evolutions. The Training and Exercise Enabling Division (TEED) is responsible for warfare development to include testing and experimentation. They also support preparation, execution, and assessment process of training and exercises. The Headquarters Support

Division (HSD) is responsible for all logistical support for all programmes, training and exercise evolutions.

JFTC's structure is composed of approximately 170 core positions, filled by soldiers and civilians, who possess the required knowledge and expertise necessary to meet a broad range of NATO training requirements. Additionally, JFTC is responsible for the NATO liaison team at the NATO-Georgia Joint Training and Evaluation Centre (JTEC) in Tbilisi, Georgia. JFTC's team is comprised of representatives from 22 NATO nations (Belgium, Bulgaria, Canada, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, the Netherlands, North Macedonia, Norway, Poland, Portugal, Slovakia, Spain, Tür-

kiye, the United Kingdom, and the United States), as well as one Partnership for Peace nation (Georgia).

Missions & Tasks

JFTC has three focused mission areas which promote NATO cohesiveness, resilience, and adaptability. The first mission area is support to Current Operations through the execution of NATO pre-deployment training. The second mission area is support to Future Operations through the execution of Major Joint Exercises (MJO+). The third mission area is support to Warfare Development through experimentation, capability integration testing, and promoting interoperability. The following paragraphs will go through each mission area in more detail.

Support to Current Operations

JFTC continuously builds on its vast experience, gained from previous NATO missions, in order to provide effective training to warfighting Headquarters and special advisors deploying in support of NATO Mission Iraq (NMI). The Centre ensures that trainees gain the necessary knowledge, flexibility, and capacity necessary to provide sound advice and assistance to their counterparts, while laying the groundwork for long-term sustainability.

The pre-deployment training for NMI is conducted three times a year. It gathers future NMI staff members, advisors and subject matter experts, to include current NMI members, who facilitate the training. The training events consist of two phases. The first phase is one week and is conducted virtually. During this phase a series of briefings, individual learning modules, and



Credit: JFTC

NATO Mission Iraq (NMI) pre-deployment training.

Credit: JFTC



EX LOYAL LEDA 2022, featured an Article 5 scenario encompassing both traditional warfare domains as well as space and cyber domains, and hybrid warfare.

live chats are conducted that enhances the participants' understanding while increasing their basic level of knowledge about the mission and the operating environment. Phase two is a one week residential phase. It is executed at JFTC and the trainees develop the necessary skills that will prepare them to effectively operate in this challenging environment. This is done through the direct interaction with experts and team building events. For a majority of the participants, NMI pre-deployment training at JFTC is the first opportunity for them to meet their future comrades. Personal interactions help to establish a solid foundation for future cooperation and enables them to smoothly transition in theatre.

To date, JFTC has trained approximately 20,000 staff members and advisors for various NATO missions, including Iraq, Afghanistan, and Kosovo. Its extensive experience in delivering high-quality training has made JFTC a trusted and valued partner to NATO allied forces. JFTC's training programmes are designed to prepare personnel for the challenges they will face in the real world and to enhance their readiness to support NATO missions.

Support to Future Operations

The Joint Force Training Centre holds a crucial position in NATO Command Structure and NATO Force Structure exercises. With its adaptable and flexible approach, the institution is ready to respond to the ever-changing training environment of the Alliance. It excels in delivering complex, high-intensity computer assisted exercises, serving as an Officer Conducting and/or Directing Exercise (OCE/ODE).

JFTC's importance in the Alliance's training programme is further highlighted by its key role in the LEDA exercise series as the Officer Directing the Exercise (ODE). The LEDA exercises bring together thousands of warfighters and non-military personnel from across NATO, with Exercise Control comprising 700-800 personnel, who control the exercise from JFTC in Bydgoszcz. The last edition of this series took place in 2022.

LOYAL LEDA 2022, was a land domain tactical-level Computer Assisted Exercise / Command Post Exercise sponsored by NATO Allied Land Command. It was based on a robust Article 5 scenario that encompassed a wide range of modern warfare challenges, to include those deriving from space and cyber domains as well as hybrid warfare.

The exercise was held at the end of 2022, after more than a year of meticulous planning, coordination, and preparation. JFTC, as the ODE, was responsible for the exercise that provided a venue for training, evaluation and certifying NATO Rapid Deployable Corps-Türkiye as the designated NATO Warfighting Corps for 2023. Moreover, LOLE22 trained Headquarters Multinational Corps South-East and Headquarters Multinational Division South-East in the planning and execution of an Article 5 Major Joint Operation against a peer adversary. The Centre was responsible for proper preparation and execution of the exercise and made sure all objectives were met. JFTC experts also contributed significantly to the experimentation activities of the exercise.

Additionally, JFTC serves as the OCE/ODE for the annual NATO Key Leader Training – Exercises STEADFAST PYRAMID AND PINNACLE (STPYPI), scheduled by the Supreme Headquarters Allied Powers Europe (SHAPE). This training programme offers an introduction to recently appointed NATO Flag and General Officers to the Alliance's planning process, doctrine, and policy. The exercises are conducted at the Joint Headquarters of the Latvian National Armed Forces in Riga, where the Host Nation provides the venue for both events. NATO has conducted the STPYPI exercise series for 27 years and JFTC has been responsible for its preparation and execution since 2018.

The purpose is to train senior commanders and staff officers in the planning, preparation, and execution of joint operations through the application of informed decision-making, operational art, and the operational planning process. The attendees gain a better understanding of the context and connections associated with a compre-

Credit: JFTC



Participants for EX STEADFAST PINNACLE 2022.

hensive approach to a collective defence situation. Additionally, they actively interact with non-NATO organisations during the planning phase and learn how to effectively integrate them into their operations. Exercise STEADFAST PYRAMID is designed for senior staff officers who will support commanders during NATO operational planning and joint operations. Exercise STEADFAST PINNACLE, on the other hand, is intended for commanders selected to assume command within the NATO Command Structure (NCS) and NATO Force Structure (NFS).

JFTC provides NATO entities properly equipped facilities necessary to conduct tactical level exercises. Two such exercises were planned for this year: Exercise GRIFFIN LIGHTNING 2023, conducted in March by Multinational Corps Northeast, and Exercise CITADEL BONUS 2023, which will be executed by Rapid Reaction Corps France at the end of the year. JFTC is thus an essential training institution for the Alliance, providing a diverse range of training exercises and programmes which enhances the operational readiness of all NATO forces.

Contribution to Warfare Development

JFTC houses the only Battle Laboratory within NATO Allied Command Transformation (ACT) and possesses both the capacity and capability to promote Warfare Development based on Higher Headquarters direction and guidance.

The Centre provides support to ACT led Warfare Development Agenda (WDA) by concentrating at the joint tactical level via three Lines of Effort (LOE): Experimentation, Wargaming and Innovation. All LOE's are interconnected within overarching strategic priorities, which includes Multi-Domain Operations (MDO) and adaptation to Deterrence and Defence of the Alliance (DDA).

JFTC hosts the Coalition Warrior Interoperability Exercise (CWIX), NATO's largest annual interoperability testing event, which gathers more than 2,000 participants from 40 nations. During this event various agencies and organisations are able to collaborate, verify and validate the interoperability between various systems. This event attracts scientists, industry representatives, and military operators, from around the globe, and provides them an environment where they can explore, experiment and examine current and emerging capabilities. Additionally, it encourages innovation by identifying and addressing interoperability gaps, providing an opportunity to explore alternative approaches, and allows emerging technologies to be



Credit: JFTC

Experimentation and testing for warfare development are an important part of JFTC's work.

tested. Overall, CWIX is vital to ensuring NATO forces maintain the military advantage in an increasingly complex and uncertain global security environment.

Finally, to maximise the benefits from such events, JFTC will then link CWIX experimentation and testing to LEDA exercise series, in order to create an open continuum framework for the Alliance in order to further experimentation and testing for the benefit of NATO warfighters at the tactical level. For example, during Exercise LOYAL LEDA 2024, JFTC intends to execute six experimentation activities that range from discovery to hypothesis testing to validation.

Support to JTEC

In 2015, JFTC took on the leading role in preparations for NATO-Georgia Exercise 2016, based on a non-Article 5 peacekeeping support operations scenario. After a successful execution of the event, the Centre used its experience in planning and delivering NATO training to mentor and support the newly established NATO-Georgia Joint Training and Evaluation Centre (JTEC). In 2019, JTEC directed the NATO-Georgia Exercise, and JFTC mentored them during the event. The outcome of that exercise confirmed JTEC's capability to plan and deliver a multinational brigade level command post exercise and computer assisted exercise that met NATO standards.

In 2022, JFTC and its advisors at JTEC successfully completed another iteration of the NATO-Georgia Exercise. For the second time, JTEC, supported by JFTC,

was the Officer Directing Exercise. JFTC mentors assisted all key positions in the Exercise Control (EXCON) structure in order to enhance interoperability as well as to share experience, skills and knowledge. The next NATO-Georgia Exercise will be held in 2025.

Summary

Over the years, cooperation between JFTC and NATO-Georgia JTEC has evolved and developed significantly - from mentorship to partnership. The Partnership Agreement between the two centres was officially signed on 11 December 2020.

At JFTC, we live by our motto, "Transformation Through Training", and over nearly 20 years, JFTC has been instrumental in ensuring NATO forces are ready to deter and defend the Alliance against any adversary. By synthesising NATO training requirements with cutting-edge technology, state-of-the-art communication and information systems architecture and a responsive support capability, JFTC plays a critical role in the NATO transformation process.

As the geopolitical situation evolves so must NATO adapt. With the programme of work increasing year by year, JFTC aggressively organises both its workforce and infrastructure. JFTC is continuously adapting to the ever-changing realities and is ensuring they remained postured to provide the right training at the right time. In conclusion, whether through training or capability building, JFTC remains on the cutting edge of enhancing NATO's ability to project stability, deter adversaries and defend the Alliance. ■

European Ground-Based Air Defence Programmes

Jean Auran

Air defence has returned to the centre of the scene since Russia's invasion of Ukraine. This article focuses on ground-based air defence (GBAD) systems, political initiatives in this area, European capabilities and cooperation, and a review of key acquisition programmes.

Since February 2022, with Russia's invasion of Ukraine, Europe has become acutely aware of its shortcomings in air defence and has launched multiple initiatives to replenish stocks after deliveries of various systems to Ukraine. In October 2022, at the NATO defence ministers meeting in Brussels, plans were unveiled to bolster Europe's air defences, as Russian missiles and drones have continued to strike Ukrainian cities. The European Sky Shield initiative (ESSI) aims to set up an anti-missile shield combining types of equipment such as the IRIS-T, the PATRIOT system, and the Arrow 3, designed to destroy ballistic missiles. Seventeen countries participated in the initiative after Denmark and Sweden joined the programme in February 2023. Austria is also considering participating in the ESSI, even if Poland, Spain, France, and Portugal have remained outside the project. For Paris, this initiative is seen as a significant breach of European sovereignty and, from an industrial point of view, an opportunity to relaunch the IRIS-T.

Credit: Saab



The latest version of RBS70 is highly mobile with the Giraffe 1X 3D multi-mission radar.

European capabilities

Europe's defence industry has a number of champions in the field of anti-aircraft missiles. First and foremost is MBDA, a joint subsidiary of Airbus (37.5%), BAE Systems (37.5%) and Leonardo (25%), resulting from the merger of Matra BAe Dynamics, Aerospatiale Matra Missiles and Alenia Marconi Systems.

After winning a large contract from France and Italy for missiles of the Aster family signed at the end of the year (approximately EUR 2 Bn), MBDA signed

for the supply of CAMM medium-range missiles to Poland. The European missile builder has already secured more orders amounting to EUR 4 Bn in four months. Thales produces high-quality radars and Command and Control (C2) capabilities for air defence systems, in addition to well-known missiles such as StarStreak and LMM. Germany has the support of Diehl, which produces the IRIS-T missile and its land-based version, in both short- and medium-range variants. Added to this, in April 2022, Diehl and Hensoldt decided to intensify their cooperation. Swedish manufacturer Saab produces the RBS70, which includes its NG version. The company also offers radar such as the Giraffe 1X multi-mission 3D. In partnership with Raytheon, Norway's Kongsberg has been developing the National Advanced Surface-to-Air Missile System (NASAMS) whose model 3 is already fully operational.

Lower layers of air defence

The return of the threat of so-called high-intensity conflicts has revived very short-range air defence (VSHORAD) programmes, a good example of which is

the Skyranger 30, produced by Germany's Rheinmetall Air Defence. Denmark announced on 16 May 2023 that they had selected this piece of equipment. The turret is equipped with a radar, infrared sensors, and a laser rangefinder. The armament is an Oerlikon KCE 30 × 173 mm automatic cannon that fires Advanced Hit Efficiency and Destruction (AHEAD) air bursting munitions, each of which releases 160 tungsten projectiles. The 1,200 rpm gun is extremely precise, allowing it to engage small aerial targets such as drones. The Thales rapid fire cannon is also a solution to counter armed drones and loitering ammunition. The system results from a Thales partnership with Nexter. Its 40 mm Case Telescoped Armament (CTA) cannon has the compactness of a 25 mm cannon and provides heavy firepower up to 4,000 m, with a reduced logistics footprint compared to a conventional cannon of the same calibre. MBDA's Mistral 3 is still in production, and the company announced in March 2023 months ago that production of the armament would increase from 20 to 30 units per month. After Serbia and Croatia, Spain is the third country to order

Author

Jean François Auran is a retired French Armed Forces officer and a Defence and Security Analyst.

the latest version. The Spanish Ministry of Defence placed a EUR 330 M order to upgrade its MISTRAL fleet to standard 3 between 2023 and 2032. During the next Military Programming Law, the French Army will also receive 24 Serval armoured vehicles equipped with a MISTRAL 3 turret. The Serval Atlas RC uses the MBDA remotely operated turret armed with two missiles and a 7.62 mm machine gun for self-defence. The turret should also be installed on the TITUS mine-resistant ambush-protected vehicle (MRAP) produced by Nexter. Norway and France have provided Ukraine with hundreds of missiles and firing units. The demand for Saab's RBS 70 NG man-portable air defence system (MANPAD) is rising, with the company receiving fresh orders from several countries. In December 2022, Saab received an order from Finland for this system with the order valued at approximately SEK 800 M, and deliveries due to take place between 2023 and 2026. This order includes the latest version of Saab's missile for the RBS 70 system, BOLIDE, which can engage armoured airborne targets and drones. The RBS 70 NG has an effective range of over 9 km and can



Credit: Jean François Aurant

Nexter exhibited a surface-to-air Serval project at Eurosatory 2022. This configuration is not definitive but demonstrates what this system could look like.

hit targets up to a height of 5 km with a maximum velocity of Mach 2.

Air defence units are combining VS-HORAD systems with ultra-mobile radars such as the Giraffe 1X. The RBS 70 New Generation (NG) is fitted with an advanced sighting system, capable of operating at night with advanced training functions and systems allowing re-visualisation of the firing sequence. This equipment weighs less than 150 kg with a topside weight of 100 kg. The system

can be operated remotely or locally. The Ground Master 60 is also an ultra-tactical air defence radar system with a detection range of 80 km (150 km optional) able to detect all types of targets from a moving carrier. The radar is deployable in less than two minutes and easily integrated into a C2 system. The Stinger surface-to-air missile remains essential in Europe with three main variants: the Stinger Basic, Stinger-Passive Optical Seeker Technique (POST), and the Reprogrammable Microproces-

DIEHL
Defence

**DEFEAT TODAY'S AND
FUTURE UAS THREATS**

HPEM SkyWolf – protects public events, critical infrastructure and military missions.

www.diehl.com/defence

Credit: Diehl Defence



The IRIS-T SLM launcher uses the traditional configuration of vertical launchers. The system has been very successful since the Russian invasion of Ukraine.

Credit: Raytheon Missiles & Defense



The GhostEye MR is an advanced medium-range air and missile defence radar, unveiled in October 2021.

Credit: UK MoD



The Sky Sabre system replaced the venerable Rapier. The system is armed with MBDA's CAMM missile, and can engage multiple targets simultaneously.

son (RMP). The United States and its allies have shipped 2,800 Stingers to Ukraine according to the Pentagon. The Stinger production line was due to close in 2020, but Raytheon Missiles & Defense has since been awarded several US Army contracts.

Medium-range GBAD

For medium-range systems, European companies produce several different missiles. In this regard, there are recent developments regarding the Aster missile. At the beginning of the year, Italy and France signed a new contract with Eurosam to produce 700 Aster missiles. This order includes Aster 15 and Aster 30 B1 missiles for both navies, the Aster 30 B1NT (New Technology) missile for the French Air Force, and Italy's three Army branches. Royal Navy ships, the Italian Horizon class frigates and future Greek FDI frigates are also equipped with the Aster B1NT. The Aster 30B1NT will have a capability against missiles with a range of 1,500 km. Thales has designed a new Ka-band seeker for the missile and the system will also receive the new multifunction radar Ground Fire 300.

In 2018, MBDA launched the technological development of the VL MICA NG. The Missile d'Interception de Combat Aérien (MICA) uses an infrared or electromagnetic seeker, depending on the threat. MICA NG offers improved capabilities to engage atypical targets such as drones and small aircraft. The missile is capable of intercepting targets beyond 40 km. Fifteen countries use naval and land versions, which is an alternative to the Aster 15 and is less expensive. Existing ground systems can combine missiles of both generations due to their compatibility. The latest version will be available in series from 2026.

CAMM and CAMM-ER form the basis for MBDA's Enhanced Modular Air Defence Solutions (EMADS) range. The Sky Sabre or Land Ceptor (operationally BMC4I Sky Sabre) is the land-based version of the British Armed Force's CAMM (Common Anti-Air Modular Missile). CAMM has similar characteristics to ASRAAM, with the main differences being the use of an active electromagnetic seeker and a two-way data link. CAMM weighs 99 kg, provides an operational range of up to 25 km, and can achieve a speed of 1,028 m/s (3,702 km/h) and engage threats such as fighter aircraft, laser-guided smart bombs, and drones. The MIC4AD is a unified, integrated command, control, communications, computers, and intelligence (C4I) developed by Rafael for a different air and missile defence system. Italy and the UK developed the CAMM extended range version.

Another popular system is the NASAMS, a surface-to-air missile designed for medium- and long-range warfare, utilising the American AIM-120 AMRAAM missile. The project started in 1994, initiated by Kongsberg and supported by Raytheon. The customer base comprises 12 countries, but 15 have acquired the command-and-control solution. NASAMS-3 is the latest upgrade and has been operational since 2019. It has the capability to fire the AIM-9X-2 Sidewinder, IRIS-T SLS and AMRAAM-ER missiles and introduces mobile air-liftable launchers. The AIM-9X variant includes an internal cooling system, eliminating the need for the launch-rail nitrogen supply required by older missile variants. A NASAMS unit has a modular design comprising a fire distribution centre (FDC), an active 3D Radar AN/MPQ-64F1 Sentinel, a passive electro-optical and infrared sensor, and several missile canister launchers. As NASAMS uses existing air-to-air missiles such as the AIM-9 Sidewinder, AMRAAM, and AMRAAM-ER, there may be thousands of older missiles in NATO's arsenal that can be used without change. The NASAMS system is also able to integrate the GhostEye MR, a medium-range S-band AESA radar based on GhostEye (formerly LTAMDS) technology developed for the PATRIOT system. In April 2023, the Ukrainian Air Force reported that NASAMS had shot down more than 100 missiles and drones since the system became operational. Diehl Defence developed the surface-launched IRIS-T SL, an upgraded version of the IRIS-T missile equipping fighter aircraft for the Bundeswehr's Tactical Air Defence System (TLVS). The first version was the short-range IRIS-T SLS fielded in 2015. The company has launched a version with a higher extension, which entered service in 2022. The IRIS-T-SLM (Surface-Launched Medium-range) consists of a Multi-Functional Air Surveillance and Target Acquisition Radar System TRS-4D/TRML-4D developed by Hensoldt, a tactical operations centre and a vertical launch vehicle with eight missiles. The radar can track 1,500 targets up to a range of 250 km. It supports IFF Mode 5, and Mode S. A first battery was handed over to Ukraine in October 2022, and another in April 2023. On the US side, the MIM-104 PATRIOT continues its career on the European continent. Over the years, the system has established itself as the backbone of NATO's air defence. Different system versions are in service in Germany, Greece, the Netherlands, Romania, Spain, and also in Sweden. In December 2022, the US provided a battery of PATRIOT to the Ukrainian Army to combat Russian strikes. At the beginning



Credit: Jean François Auran

German Patriot launcher. Germany still has eleven firing units equipped with this system.

of January 2023, Germany announced it would supply a battery to Ukraine, as did the Netherlands. The PATRIOT PAC-3 CRI is currently operational in Ukraine. This version, specialised in anti-missile defence, represents the most advanced variant of the PAC-3 version. This variant is surpassed only by PAC-3 Missile Segment Enhancement (MSE). Raytheon intends to establish a European regional PATRIOT centre for maintenance, repair, and overhaul in Switzerland with RUAG and Rheinmetall Air Defence AG.

Latest European orders and tenders

Switzerland has chosen to equip itself with the PATRIOT system after a long period of deliberation. The country will spend USD 1.2 Bn to acquire five firing units by 2030, each consisting of a command post, a multifunction radar sensor, and one or more launchers. The system ordered by Switzerland should make it possible to defend an area of 15,000 km², a little more than the Swiss plateau and its most densely populated cities. Switzerland is adding a ballistic missile defence capability to its future PATRIOT batteries by purchasing PAC-3 MSE interceptors. The first missiles should arrive in 2023. Austria is also looking for a mid-range air defence system with a range of up to 40 km, such as the IRIS-SLM or NASAMS.

Poland, which shares a border with Russia (Kaliningrad exclave) and with Belarus and Ukraine, has been trying for years to reinforce its air defence. On 28 April 2023, the Polish MoD turned to MBDA UK to procure 44 iLaunchers and around 750 CAMM missiles in a contract valued at USD 2.4 Bn. This order is part of the Pilica+ programme, which aims to provide 22 air defence batteries with a range of up to 25 km. Deliveries of launchers and CAMM missiles will take place between

Credit: UK MoD



Soldier belonging to the 16th Regiment, T deploying the Agile Multi-Beam surveillance radar of the new Sky Sabre Air defence missile system.

2025 and 2029. Poland is already a user of the CAMM missile after receiving its first battery in 2022 in response to an urgent need under the Narew programme. The Narew system is based on the iLauncher platform mounted on the Jelcz 8x8 truck. The Narew is the result of cooperation between MBDA and PGZ and its subsidiaries JELCZ (responsible for the truck platform), PIT-RADWAR and WZU.

Poland is also waiting for the PATRIOT to expand its defence system and integrate them into NATO's NATINAMDS system. The purchase includes Northrop Grumman's Integrated Air and Missile Defence Battle Command System (IBCS) and four fire units equipped with four AN/MPQ-65



NASAMS 3 High Mobility Launcher (HML) is mobile, provides quick-reaction, and is easily deployable by C-130.

radars, sixteen launchers, four engagement control stations, six engagement operation centres, twelve integrated fire control network (IFCN) Relays and 208 PAC-3 MSE missiles. Raytheon will deliver two batteries in 2023-2024, and then four batteries in 2026-2028. In December 2022, the first equipment reached Poland.

Finland has used NASAMS-2 since 2009 but launched an RFI to procure a long-range air defence system. In April 2023, the Ministry of Defence authorised the Finnish Defence Forces to procure the David's Sling system. Rafael Advanced Defense Systems (Israel) will deliver the system for EUR 316 M. The weapon system has been designed to intercept or counter long-range rockets and slow-flying cruise missiles at ranges of 40-300 km. Both Finland and Latvia ordered the RBS-70 NG. The Finnish order also includes the Giraffe 1X radar, to be delivered between 2023 and 2026.

In 2017, Lithuania ordered the NASAMS-3 to improve its air defence capabilities and received two batteries in 2020. Estonia and Latvia started joint negotiations to acquire

the IRIS-T SLM in May. Their goal is to have an operational system in 2025.

In Germany, the Luftwaffe possessed all ground-to-air defence capabilities of the Bundeswehr for ten years. The Army now wants to restore an accompanying protection capability. On 3 January 2023, German media reported on consultations between Washington and Berlin regarding the Bundeswehr's acquisition of the Arrow 3 system. The two countries are accelerating negotiations and formulating the contract for the sale of the Arrow 3.

In 2019, the Czech Republic prepared for the acquisition of Israeli MADR (Mobile Air Defence Radar) radars, eight sets of medium-range mobile 3D radars and in 2021, a contract for the purchase of Israeli SPYDER (Surface-to-air PYthon and DERby missiles) on the TATRA truck platform. A total of five MADR radars are currently in the Czech Republic's inventory. Military testing on the 3D MADR mobile radar ended in April 2023 and the contractor, ELTA Systems Ltd, has until the end of July to resolve the remaining minor defects.

The French Armed Forces are also involved in the accelerated modernisation of its air defence capabilities. There are a number of ongoing concerns, despite the new military programming law. The 16 NC1-30 and 14 NC1-40 systems, carrying the Army's MISTRAL command posts and radars, will no longer be logistically supported in 2025 and 2030, and will need replacing. The MISTRAL's mid-life renovation (RMV) concerns only 850 missiles out of an initial target of 2,050. The purchase of 24 Serval armoured vehicles with air-defence capabilities appears to be limited, taking into account the requirements of two Army divisions. The Crotales NG's VT1 missile will be withdrawn from service on the French Air Force side in 2026. The Directorate General of Armament (DGA) chose the VL MICA solution (munition and its launcher) as the interim effector to replace the Crotales missile pending the arrival of a future low-level ground-air system.



Credit: Norwegian Armed Forces

Norwegian NASAMS 3 live fire.

In the UK, the Sky Sabre has been in service since 2022, and the British Army deployed the new system to Poland as part of NATO's build-up in 2022. The UK Ministry of Defence published a "Prior Information Notice" detailing their intention to purchase a new, fully integrated air defence system. Babcock and Rafael will jointly develop a C2 solution for a GBAD programme in the UK.

Future developments

Hypersonic threats are an important subject for air defence. The ability of these vectors to move and manoeuvre at extremely high speeds and to remain in endo-atmospheric or low exo-atmospheric space complicates their detection and reduces reaction times, thereby increasing their ability to penetrate defended spaces.

The leading players in the air defence industry are taking part in a reflection on the fight against this type of threat. Specific projects are already in progress. For example, the modernisation of the systems should contribute to an initial capability with the development of the SAMP/T NG radars or an ultra-high-frequency radar (UHF). In addition, the Timely Warning and Interception with Space-based TheatER surveillance (TWISTER) project of the Permanent Structured Cooperation (PSC) is based on two pillars: the endo-atmospheric interceptor and early space warning. Regarding endo-atmospheric interceptors, the EU HYDEF (European Hypersonic Defence Interceptor) project was selected for the European Defence Fund (EDF) under the Spanish group SENER Aerospacial against MBDA's HYDIS project.

Russia's 2022 war against Ukraine has highlighted the effectiveness of air defence as a battlefield enabler, with a concentration of VSHORAD and short-range, medium and long-range systems, thus ensuring a multi-layered bubble protecting the land forces. This layout has hampered the ability of both air forces to conduct air-to-ground support, air combat, and airborne operations.

The French parliament recently issued a report regarding air defence in Europe. One of the report's conclusions was that the proposition to acquire the Arrow 3 was inconsistent in that this system does not respond to any current or developing threat in the strategic environment of Germany and Europe. Having been designed by, and for Israel in response to a specific threat, it is not in compliance with NATO doctrine and is not interoperable with the chain of command. ■



MBDA

ORCHESTRIKE THE FORCE MULTIPLIER.

Collaborative combat effectors will form an essential part of future weapons systems to defeat evermore complex threats. Building on its renowned experience in delivering cutting-edge missile systems, MBDA presents "Orchestra" a unique set of advanced innovations that will turn collaborative combat effectors into reality. From digital engineering to system integration, MBDA's excellence stands by your side in delivering a new force multiplier.



IRST Pods: Eagle Eyes for Passive Detection

Georg Mader

Passive IRST (infrared search and track) sensors – whether built-in or in podded solutions – are an essential element of modern and future combat aircraft. IRST is a form of FLIR (forward looking infrared) that tracks individual targets, generally for weapons guidance or linked recce, while FLIR alone just ‘sees’ infrared heat signatures. Passive automatic search, detection and tracking functions are key elements in silent operations or tactical scenarios saturated with enemy jamming, such as Ukraine.

This article focuses on podded multi-role IRST systems. At the outset, and to set the record straight, it was not the Russians who ‘invented’ IRST systems, since the first system was an upgrade of the USAF F-101B Voodoo, which received the sensor from the cancelled F-108 Rapier fighter (1956). The subsequent F-102 Delta Dart and F-106 Delta Dagger interceptors both had IRST systems, as did several versions of the F-4 Phantom II. It was only later that the US ‘Teen Series’ fighters (F-15, F-16, F-18s, as well as European aircraft), which abandoned IRST systems, since it was felt that the increasing sophistication of aircraft radar systems made IRST redundant. The sole exception was the still much-bemoaned F-14 Tomcat, fitted with an extremely sophisticated IRST, since it was expected to operate in extreme jamming environments.

That is the reason why many fighters and especially the older ones, from their conception did not have the space to fully install IRST devices, as with the PIRATE system on the Typhoon, the OLS-series on Russian fighters, or today on F-15K/SA, F-16/60, F-18E/F III, F-35, Gripen-E or Rafale. To provide these earlier aircraft with that capability when it was later deemed urgent, the IRST equipment was housed in an external pod mounted to the fuselage or wing weapons rails. The ‘only’ modifications to the plane was new video-wiring to the cockpit display, as with Rafael’s Litening-V targeting pod on the Austrian Tranche-1 Typhoons.

Author

Georg Mader is a defence correspondent and freelance aerospace journalist based in Vienna, Austria, and a regular contributor to ESD.

Credit: Czech Air Force



Close up of the Litening IV pod mounted on a Czech Gripen aircraft.

Abilities and limitations

IRST works by scanning the sky for an IR signature, and when it locates one or more, it locks on for weapons tracking and guidance. Modern systems are usually equipped with an autonomous inertial navigation system (INS) that automatically calculates the angle of deviation of the target from the longitudinal axis (boresight) of the carrier aircraft. Furthermore, it provides high targeting accuracy, even under high dynamic G-loads. However, IRST is not magic and cannot fully replace radar, but it can pull off some very neat tricks, including giving a passive lock for air-to-air missiles (AAMs) and not triggering the targets’ radar warning receiver (RWR). Maybe the most promising trick is spotting low-observable aircraft without using radar. Yet, while modern IR sensors are becoming sensitive, no one is going to launch a Meteor missile on IRST alone at >100 km range, or even

obtain a dynamic launch zone on IRST at 100 km. The performance of IRST depends on several factors, mainly clouds, humidity, time of day (which relates to atmospheric temperature), target altitude, relative bearing, throttle setting, and aircraft structural composition in respect to thermal conductivity. A higher humidity negatively affects their performance, independent of temperatures.

Another issue is their need for cooling. Cooling is good for the sensitivity of IR detectors and reduction of noise with the signals, but is operationally inconvenient. Sensors may for example be cooled by cryogenic liquid or by cryogenic liquified gas. As cryogenic liquid is an expendable consumable, and could run out during a mission, it definitely needs to be serviced before each flight. Non-cryogenic cooling for IR-detectors can also be done with Peltier semi-conductor coolers operating on electrical power, more convenient in design as well as operation.



Credit: Northrop Grumman

Front View Of Northrop Grumman's Openpod.

Litening Pods

With 26 user nations and 28 aircraft, the Israeli Rafael's Litening-family no doubt became the most widespread system of this type, since its first versions were introduced more than 20 years ago. The system's development programme ran from 1992 until 1999, when the successor Litening II entered service, proving its worth by competing directly with the AN/AAQ-13/14 LANTIRN targeting pod with the thousandth pod sold in October 2010. The Litening V is the latest of the family, and equipped with two small and medium-wave FLIR sensors. Previous versions, including the Litening III are nevertheless still in production. These usually have a third-generation FLIR sensor (3-5 micron), medium waveform and a resolution of 640 x 512 pixels. It can provide a wide (18.4° x 24°), medium (2.8° x 2.8°) and narrow (0.77° x 0.77°) field of view (FOV). The daytime camera (CCD sensor) provides a resolution of 659 (horizontal) x 494 (vertical) pixels with a FOV of 3.5° x 3.5° degrees, while a second is available with a smaller FOV of 0.7° x 0.7°. Its American coding is AN/AAQ-28 and since 1995 Northrop Grumman (NG) is in cooperation with Rafael, carrying out production in the US and promotion to the US Armed Forces. NG delivered more than 700 pods to the USAF, USMC and Spain, Italy, Australia, the Netherlands, Portugal, Finland and Denmark.

The air-to-air mode is well documented, including for example with videos of intercepted Russian aircraft in the Baltics, filmed at BALTOPS by a Czech Gripen. The Czechs have bought four of the previous version Litening-4i (fitted with ZEISS Optonics) pods in 2018 for CZK 325 M (EUR 13 M) - and reportedly

want more. They also operate it on the L-159 ALCA. This model features colour symbology, tracker improvement and enhanced zoom compared to prior versions. Czech Air Force Commander Maj. Gen. Petr Mikulénka explained last year to the author: "Although it is primarily a tool for launching accurate attacks on ground targets, it was used there to improve the ability to visually observe aircraft day and night, which means that thanks to optical technology, Czech pilots are now able to track suspicious aircraft at very long distances and predict their behaviour..." Elsewhere, 150 units of Litening-4 were ordered by the Indian Air Force, demonstrating Rafael's versatility with integrating them into platforms such as the Su-30MKI or MiG-29UPG.

The UK's RAF Typhoons used the Litening III pod, originally carried by the service's Panavia Tornado GR4s, which were retired in April 2019. With two crewmembers, the GR4s could dedicate their weapon systems officer to working the targeting pod, but this imposed a greater workload on the single pilot of a Typhoon. Now the Litening V has entered service early last year with the RAF's No 41 Test and Evaluation Squadron (TES) for around 18 months for 'minor tweaks' and to clear it for squadron service. TES staff at RIAT 2022 were convinced that the auto-tracking, accuracy, co-ordinate generation and advanced optics "will get better by an order of magnitude..."

As an evolution to Litening, Northrop Grumman has also developed the OpenPod based on the aforementioned AN/AAQ-28(V). Any Litening pod can be converted to an OpenPod and sensors are advertised as being capable of being swapped out without modifications to the aircraft or its mission computer. It was presented as a future solution providing targeting, communications, and LIDAR, with the integration of IRST technology developed in Europe for the Typhoon's PIRATE and the Gripen's SkyWard – the latter a SELEX (now Leonardo) design. The OpenPod was discussed for the Hellenic Air Force's F-16 upgrade.

Legion pod

IRST21 (also known as AN/ASG-34) is the next-generation IRST sensor by Lockheed Martin's Missiles and Fire Control segment in Orlando, FL. It builds on the lega-



Credit: USAF

Side view of Legion Pod during trials at Eglin AFB.

cy AN/AAS-42 IRST sensor system, which accumulated over 300,000 flight hours on F-14 and international F-15 platforms. As a compact design, it enables IRST21 to be integrated in a variety of ways. On the F/A-18E/F, IRST21 is mounted on the nose section of the centreline fuel tank, (hopefully never in need to be jettisoned). A 16 inch (406 mm) diameter structure podded sensor system with IRST21 is also being introduced as the Legion pod and will be transferable across a wide range of platforms.

Eglin's Integrated Test Team (from Eglin Air Force Base in Florida) conducted the first-ever multi-platform operational test to effectively locate a target using shared IRST sensor data on 7 April 2022. An F-15C and F-16D, both Legion/IRST21 equipped, were then able to share that sensor data over the pod's Advanced Data Link (ADL) to passively triangulate target position without the use of radar or other active ranging sources. The pod's common interface allows integration onto any aircraft with minimal to no impact on the aircraft's core software. This versatility opens the door for integration with minimal effort onto other fighter aircraft such as the USAF's newest 'conventional' fighter, the F-15EX. The Eglin team's eventual goal is to provide this capability to anyone carrying an ADL Legion pod, regardless of platform. To verify this, a first successful two-ship F-15 IRST ADL test occurred in April 2021 and the first successful two-ship F-16 IRST ADL in December 2021. So far, Lockheed Martin is due to produce more than 130 systems.

The other US giant is also involved. In late 2022, the US Navy's Naval Air Systems Command asked Boeing to procure 19 ASG-34A(V)1 IRST pods to enable Navy F/A-18E/F jets to detect, track, and attack enemy aircraft with a within visual range (WVR) limit of no more than 40 km, without making its presence known. The USD 43.5 M order includes the supply of 15 IRST pod spare parts, 34 fuel tank as-

Credit: Armée de l'air et de l'espace



Close up of the TALIOS pod gimbal head housing the sensor suite.

semblies, 34 sensor assembly structures and special tooling, non-recurring engineering, sustainment support and data. Boeing will carry out the work in St. Louis and should be finished by April 2026.

TALIOS

The Rafale F3R fighters operated by the French Air Force and Navy currently use two types of pods: Damocles, which entered service in 2010, for engaging ground targets, and the newer TArgeting Long-range Identification Optronic System (TALIOS) for various functions including IRST, since 2020. French manufacturer Thales produces both.

The French Directorate General of Armaments (DGA) announced that the TALIOS pod, which are able to capture HD video, will be integrated with the Rafale F4.2 standard and Mirage 2000D RMV. Equipped with this pod, the Rafale covers the entire spectrum of intelligence, acquisition, tracking and target designation missions, by providing images in the

near-infrared and infrared domains. It also has new, more efficient fixed or moving target tracking capabilities against ground and aerial targets, an automatic detection capability for moving targets and a new man/machine interface.

A total of 67 TALIOS pods have been ordered; as of late 2022, 36 are still to be delivered, by 2025. In February 2023, the Hellenic Air Force General Staff received Thales representatives to negotiate a deal for TALIOS pods for the Hellenic Air Force's new Rafale fleet. As the F4 variant will also be operated by the United Arab Emirates (UAE) and Indonesia, the TALIOS pod could well be used by these nations too, while at the recent LIMA trade show in Malaysia, it was heard that the Malaysian Air Force (TUDM) is also discussing this option for their Su-30MKM upgrade. Malaysian Sukhoi are currently using the Damocles targeting pod.

ASELPOD

Turkish defence electronics specialist ASELSAN has the new ASELPD multi-role optronic targeting system in its portfolio. It has been tested on TuAF (THK) F-4E/2000 and F-16s, with ASELSAN having already signed contracts.

Pakistan is one customer, having signed a USD 25 M deal for eight ASELPDs to equip their Sino-Pakistani JF-17 Thunder jets. Another recent customer appears to be Iraq, which fits into a recent release by the Turkish firm mentioning a USD 31 M contract in September 2022, as well as a recent sighting of trials on an L-159T2X testbed at the Czech AERO Vodochody facility.



Three-quarter view of the Aselsan Aselpod.

ENSURING THOSE WE
SERVE ALWAYS STAY

AHEAD — OF — READY

WHEN YOU SEE ACROSS ALL
DOMAINS, GLOBAL THREATS
BECOME EMPTY ONES.



LOCKHEED MARTIN 

Eurofighter Approaches True Maturity as a Combat Air Platform

Peter Felstead

Having now been in service for almost 20 years, the Eurofighter Typhoon is reaching full maturity as a combat air platform. While most of its users, in Europe at least, have now joined the 'F-35 club', the Typhoon will continue to operate as a potent complement to the F-35 for some years to come. Peter Felstead reports

As the dominant indigenous fighter in Europe, the Eurofighter Typhoon began entering service with the four Eurofighter countries – Germany, Italy, Spain and the United Kingdom – from 2003.

investment in the Future Combat Air System (FCAS, now the Anglo-Italian-Japanese Global Combat Air Programme (GCAP)).

Germany's Luftwaffe, which has a total of 143 Eurofighters, is ultimately slated

30 Boeing F/A-18E/F Super Hornets and 15 Boeing EA-18G Growlers to address these respective requirements. However, following a change of government in Berlin at the end of 2021, in March 2022 Germany made the decision to buy 35 Lockheed Martin F-35s as strike platforms as well as 15 Typhoons for the ECR mission, with these aircraft now known as Eurofighter EK (Elektronischer Kampf) variants.

In Italy the country's final Eurofighter was received into service in October 2020, completing a fleet of 96 aircraft. However, given that 26 of these are Tranche 1 aircraft and another 15 are ECR variants, it has been reported that Italy could yet make an additional Eurofighter purchase to cover the retirement of its 50 Panavia Tornado IDS strike aircraft and 13 Tornado ECR variants.

Spain, with 73 aircraft delivered, had up to recently operated the smallest fleet of the Eurofighter countries. However, in December 2021 Madrid approved the procurement of 20 new fighters to replace the Spanish Air Force EF-18 Hornets based on the Canary Islands under Project Halcón (Hawk). In June 2022 it was announced that Madrid had ordered 20 new Eurofighters to fulfil that requirement. Under that EUR 2.04 Bn (USD 2.15 Bn) deal Spain will acquire 16 single-seat and four twin-seat Tranche 4 Eurofighters, with deliveries to commence in 2026. Beyond the Eurofighter Consortium nations the only other European operator of the type is Austria, where fighter plans were in a state of disarray in recent years. After deciding in 2017 that its 15 Tranche 1 Typhoons, in service since 2007, were too expensive to operate, Vienna then made a U-turn on that decision in 2020 after cracks were found in tail-section bolts of the Austrian Air Force's dozen remaining Saab 105 jet trainers, which



Credit: USAF

A German Eurofighter lands at Selfridge Air National Guard Base in Michigan on 20 March 2020 on its way back from 'Red Flag' air manoeuvres at Nellis Air Force base in Nevada.

The UK's Royal Air Force (RAF) has 160 Typhoons but intends to retire its older Tranche 1 aircraft by 2025, leaving the force with 107 Typhoons: 67 Tranche 2 and 40 Tranche 3 aircraft. The RAF currently operates the Typhoon alongside the F-35 Lightning II. In terms of the future UK fighter force mix an RAF spokesperson stated on 20 January 2022, "The UK is committed to developing its Combat Air capability through continued capability growth in both the Lightning and Typhoon fleets as well as significant

to replace that fleet with the Franco-German 'other FCAS' programme's New Generation Fighter. However, in November 2020, under Project Quadriga, Berlin ordered 38 Tranche 4 Eurofighters to replace a similar number of Tranche 1 Eurofighters in the Luftwaffe inventory. Beyond this buy, meanwhile, was the Luftwaffe requirement to replace its Panavia Tornado Interdiction/Strike (IDS) and Electronic Combat/Reconnaissance (ECR) fleets. In 2019 the German Ministry of Defence announced plans to acquire

had been used as cheaper-to-operate air policing platforms. Austria thus continues as a Eurofighter operator, but is unlikely to invest in further enhancements to its fleet.

In the Middle East, meanwhile, the Eurofighter is operated by Oman, Kuwait, Qatar and Saudi Arabia, with fleets numbering 12, 28, 24 and 72 aircraft respectively.

Radars

In terms of enhancements to the Eurofighter's combat capabilities, the most significant ongoing development is the adoption of active electronically scanned array (AESA) radar technology. Unlike the mechanically scanned radars typically installed in fourth-generation aircraft, AESA radars radiate multiple beams at multiple frequencies simultaneously, making them more difficult to detect and more resistant to jamming.

The first Eurofighter users to operate with this technology are the air forces of Kuwait and Qatar. Kuwait ordered 28 AESA-equipped Eurofighters in April 2016, while Qatar followed suit in December 2017 with an order for 24 air-

Credit: Leonardo



The first ECRS Mk2 prototype alongside a Typhoon test aircraft at BAE Systems' Warton facility.

craft. The AESA radar in these aircraft is what is now known as the European Common Radar System Mark 0 (ECRS Mk 0), which was developed by Leonardo.

European users of the Eurofighter, meanwhile, are pursuing two parallel paths with regard to AESA technology. Berlin ordered ECRS Mk 1 radars for its Project Quadriga Eurofighters under a contract awarded to

The ESG logo, consisting of a stylized blue 'E' and 'S' followed by the letters 'ESG' in a bold, blue, sans-serif font, is positioned in the upper right corner. The background of the entire section is a photograph of a CH-47F Chinook helicopter in flight against a backdrop of a blue sky with white clouds and a mountain range. The helicopter is shown from a low angle, emphasizing its size and the complexity of its rotor system.

ESG – PART OF THE GERMAN CH-47F CHINOOK INDUSTRY TEAM

esg.de

Credit: Eurofighter



Eurofighters flying in formation during the NATO Tiger Meet at Poznan-Krzesiny Air Base in May 2018

Germany's Hensoldt, supported by Spanish firm Indra, in April 2021, while Madrid's Project Halcón order in June 2022 also covered Eurofighters equipped with the ECRS Mk 1.

The UK, meanwhile, is playing a longer game with regard to AESA technology and in July 2022 the UK Ministry of Defence (MoD) committed GBP 2.35 Bn (EUR 2.68 Bn) to a Typhoon upgrade that will see the adoption of the more advanced ECRS Mk 2 AESA radar developed by Leonardo UK. The MoD's current planning assumption is that the ECRS Mk 2 will be fitted to the RAF's 40 Tranche 3 Typhoons, although any further rollout of the technology is being kept under review.

On 21 April 2023 it was announced that the first ECRS Mk 2 had been delivered by Leonardo UK to BAE Systems' site in Warton, Lancashire, where it will undergo integration work and ground-based testing in preparation for first flights on a Typhoon in 2024.

The UK is paying a time penalty with the ECRS Mk 2 – it is essentially a completely new radar and its initial operational capability is forecast for 2030 – while its integration presents a considerably intrusive modification to the nose of the aircraft, but its capabilities offer a significant advantage.

While the ECRS Mk 1 is essentially an improvement to the ECRS Mk 0, both of those radars are essentially narrow-band arrays, so although they have many of the design advantages of a high-speed electronically scanned antenna, they are still designed primarily to detect other airborne targets. The ECRS Mk 2, on the

other hand, is a wide-band array that will not only detect its own emissions and find other targets in that way, but will also passively detect emissions through a far broader range of the frequency spectrum.

As Andrew Mallery-Blythe, Typhoon Operational Requirements Manager at BAE Systems, told ES&T on 5 May 2023, the ECRS Mk 2 will be able to passively track airborne targets and other surface-based emitters as well without having to emit itself. "It's a very, very high-gain sensor," he explained, "and it can also emit throughout that wide band, that wide frequency range, and it can emit and potentially attack all of those emitters: surface emitters, airborne emitters, etc, so as an electronic attack and electronic warfare tool it's hugely capable to do all of that while performing its primary role as an air-to-air sensor as well. And that's why the UK have pursued it."

With Leonardo UK leading the development of the ECRS Mk 2, it was announced in September 2021 that engineers from parent company Leonardo in Italy had joined the UK development team at its site in Edinburgh. Thus, while Italy has not formally committed to the ECRS Mk 2 for its Eurofighters, there is what may be described as 'mood music' implying that Italy may well adopt the ECRS Mk 2 for its Eurofighters.

Beyond Europe, the Royal Saudi Air Force (RSAF) has yet to decide on an AESA radar for its Eurofighter fleet. However, given that the RSAF typically aligns itself with UK capabilities, it is more likely than not that Saudi Arabia will ultimately also adopt the ECRS Mk 2.

Weapons

Beyond the Eurofighter's internal 27 mm Mauser cannon, a wide array of missiles and bombs have been integrated onto the Eurofighter, although not all user nations operate every type of weapon. Short-range air-to-air missiles (AAMs) integrated onto the Eurofighter include the ASRAAM, IRIS-T and AIM-9 Sidewinder, while beyond-visual-range AAMs include the AIM-120 AMRAAM and Meteor. In terms of air-to-surface missiles UK, Italian and Saudi Eurofighters can deploy the Storm Shadow cruise missile, German and Spanish Eurofighters the KEPD 350 cruise missile, while UK, German and Saudi aircraft can also carry the Brimstone family of missiles. Precision-guided bombs integrated onto the Eurofighter include the Paveway II series of laser-guided bombs and Paveway IV dual-mode GPS/INS and laser-guided bomb, while Germany has also integrated the GPS/INS-guided GBU-54 Joint Direct Attack Munition (JDAM) onto the aircraft.

Regarding future weapons integration, MBDA UK is going into production with the Brimstone 3 later in 2023, which, as Mike Mew, the company's director of UK sales and business development, explained in a briefing on 10 May 2023, "has been modernised top to tail; the only thing that's consistent with the original Brimstone is the external shape. [It has] new energetics, additional modes in the seeker, additional software modes for use from a wider range of launch platforms." Given that Brimstone is already integrated on the Eurofighter, just a brief requalification process will be required for the aircraft to carry the Brimstone 3.

MBDA is also working on two largely classified concepts for a Future Cruise/Anti-Ship Weapon, which will be a successor to Storm Shadow. One is subsonic and designed to be very survivable through the use of stealth, while the other is supersonic and would rely more on high speed to defeat any air defences. Both concepts will move into the development phase from 2025, with a view to being put into service at the end of the decade. Whatever weapons proceed, they are likely to be integrated onto the UK's Typhoons.

The Eurofighters in the RAF are currently at the Phase Three Enhancement A (P3EA) core avionics standard. While P4E has not yet finished its system definition phase, that package will bring integration of MBDA's Select Precision Effects At Range (SPEAR) Capability 3 stand-off attack missile plus an electronic warfare (EW) variant of that weapon, SPEAR EW,



Strength through capability, commitment and collaboration.



www.eurofighter.com

 **Eurofighter
Typhoon**

nothing comes close

in which the missile's warhead is replaced by an EW payload to suppress enemy air defence radars.

Apart from weapons specifically, another key development in the UK is the implementation of enhancements to the RAF's Rafael Litening V targeting pods, which first entered squadron service on RAF Typhoons in February 2022. The enhancements are being made under the UK's National Delta Package (NDP) 1b Increment 2.2 in what BAE's Mallery-Blythe bills as "the product of the year". This standard is currently being tested and will be released later this year.

the overall slickness of the integration has been improved for the Litening V, and that's going to make a real difference on operations."

Beyond the UK, in August 2021 the Luftwaffe declared that its Eurofighters had become operational with the Meteor, which thus joined the IRIS-T and AIM-120 AMRAAM in the German Eurofighters' air-to-air inventory.

Meanwhile, in December 2021 it was announced that MBDA's Marte ER anti-ship missile had successfully completed its final test firing the previous month. Derived from the Marte MK2/S anti-ship missile,

delivered to the Luftwaffe under Project Quadriga and to the Spanish Air Force under Project Halcón will also be equipped with the Praetorian Defensive Aids Sub-System (DASS). This system, provided by the EuroDASS consortium, will provide enhanced protection and situational awareness, as well as facilitating advanced electronic deception techniques.

Regarding the Luftwaffe's 15 Eurofighter EK variants, these are likely to receive a new EW pod being developed by Hensoldt in association with Israel's Rafael Advanced Defense Systems. Integrating Hensoldt's Kalatron Attack technology into Rafael's Sky Shield EW pod, this new system is expected to be integrated onto the Eurofighter EK variants around 2030.

Meanwhile, since 2019 the Eurofighter consortium has been working on a Long Term Evolution (LTE) study for the aircraft that aims to secure its operational relevance for some decades to come. This will cover every aspect of the platform, from its avionics to its powerplants. While any plans under the LTE study have yet to solidify, one key development is likely to be replacement of the Eurofighter's three existing multi-function displays with a new touchscreen large area display (LAD). This would especially be useful for presenting sensor fusion to the pilot in a manner found on fifth-generation combat aircraft like the F-35.

A Frequency Issue

One upcoming issue that the Eurofighter community will have to address is Multifunctional Information Distribution System (MIDS) frequency remapping in relation to the aircraft's Link 16 datalink. MIDS frequency remapping is required to operate in a country that is changing the frequencies available to Link 16 to free up frequencies available to cell phones and other systems that use the radio frequency spectrum. Given the United States is a country that will be implementing these changes by 2025, air forces wanting to participate in the US 'Red Flag' air manoeuvres from that year, for example, will need to be compliant.

Additionally, changes to the IFF transponders of military aircraft will also be required in order to fly in controlled airspace around the world from 1 January 2025.

The UK is tackling these issues under its NDP 1c, which will be implemented in time for full international compliance in 2025, meaning that the RAF will not have to operate under any exemptions and will retain full operational flexibility with its Typhoon fleet. ■

Credit: Eurofighter



Future iterations of the Eurofighter will still be in service for decades to come.

"Litening 5 is the most advanced targeted pod in the world," said Mallery-Blythe. "It's brought some amazing capability, both in the area of optics – much more powerful optics than have been seen before – and the ability to generate coordinates accurately. It's vastly, vastly superior to the Litening III and that has brought real, tangible capability improvements on operations right now. It particularly helps you employ Brimstone."

Mallery-Blythe explained that the Litening V enhancements under NDP 1.1 Increment 2.2 have added some improvements to the pod's usability. "One capability is there's a nudge feature, [which] just makes that tracking task easier for the operator," he explained. "The autofocus capabilities have [also] been significantly improved, and I would just say that

which is already in service with Italy and Qatar as a helicopter-launched weapon, the Marte ER is propelled by a turbojet in place of its predecessor's rocket engine. While it is known that a feasibility study has been conducted by MBDA in relation to integrating the Marte ER on the Eurofighter, which was reportedly due to a request to Leonardo from a foreign customer that is likely to have been Qatar, it remains unclear how much further this development has progressed. However, one military aerospace analyst told ESD that he would not be surprised if the Marte ER was already in operation on Qatari Eurofighters.

Future Systems

As well as being fitted with the ECRS Mk 1 radar, the Tranche 4 Eurofighters being

We are going **GREEN**, **BEIGE**, and **BROWN**!



So you may not always see us,
but we've always got your back!

In the land defense and security industries, Kallman Worldwide is the world's largest national pavilion organizer — working with hundreds of exhibitors at these world-class events.



Chiba, Japan



Rio de Janeiro, Brazil



Kielce, Poland



London, UK



Bangkok, Thailand



Paris, France



Expodefensa
Feria Internacional de Defensa y Seguridad
International Defense and Security Trade Fair

Bogota, Colombia

defexpo



India



Singapore



Kuala Lumpur, Malaysia



Australia



New Delhi, India



Doha, Qatar

VISIT KALLMAN.COM TO SECURE YOUR SPACE IN THE
PARTNERSHIP PAVILION AT THESE UPCOMING DEFENSE SHOWS



UAV Programmes: a Focus on the EU

Giulia Tilenni

Unmanned Aerial Vehicles (UAVs) have become a crucial asset on the battlefield in the last decades. Initially a niche product that only a few of the best funded armies in the world could afford, these systems are now broadly used by state and non-state actors, and the war in Ukraine has clearly proved their importance in conventional conflicts as well. Are EU countries ready to take up the challenge, as users and as producers?

In recent decades, UAVs have mainly helped regular armed forces carry out intelligence, surveillance and reconnaissance (ISR) missions in non-contested airspace. Unmanned systems were mostly redeployed for persistent information gathering in asymmetric conflicts opposing a regular armed force and/or a non-state actor. With the systems evolving to mount weapons, their use was then expanded to ad-hoc strike missions, mainly to clear the battlefield before the arrival of ground troops. During the 2000s, these two

The 2020 Nagorno-Karabakh conflict represents a game changer in the deployment of unmanned systems on the battlefield, marking the first large-scale use of unmanned aerial technology in a conventional state-on-state conflict. In fact, UAVs, and in particular loitering munitions (LMs), had already been used in an earlier phase of the conflict in 2016. However, in September-November 2020 Azerbaijan's UAVs first destroyed Armenia's substantial array of ground-based air defence (GBAD) systems,

the Ukrainian Aerorozvidka air reconnaissance unit, consisting of 30 special forces troops and UAV operators, detected a 65-km-long Russian mechanised column tasked with mounting an attack in the north of the country, most likely with Kyiv as its ultimate objective. After several days halted on the route, the Russian operation failed due to Aerorozvidka's nightly ambushes, mainly based on attacks by UAVs. Since then, Ukraine has considered unmanned aerial assets as a cost-effective tool

Credit: Bayraktar, via Wikimedia Commons



The Bayraktar TB2 UAV has served with success in a number of recent conflicts, most notably the 2020 Nagorno-Karabakh War.

roles made up the most frequent unmanned aerial missions in Iraq and Afghanistan. About a decade later, the same kind of missions were carried out during the war in Libya. As the use of these systems has proven to be increasingly effective, a growing number of companies and countries are now developing this kind of technology. The miniaturisation has gradually allowed non-state actors acquire small UAVs and redeploy them in strike missions, such as the Houthi's attacks against Saudi Arabia's critical infrastructure demonstrate.

followed by Yerevan's land forces materiel, including tanks, artillery, and supply trucks. For the first time, unmanned vehicles were replacing manned systems for air attack and close air support (CAS) missions in a regular conflict.

More recently, the war in Ukraine has reaffirmed the importance of UAVs on the battlefield. The first regular conflict on European soil in decades sees a significant use of regular weapon systems, such as tanks and artillery, but also the massive use of UAVs by both sides. As neither Russia nor Ukraine have been able to achieve air superiority, the two parties have been deploying tactical UAVs to reduce risks when carrying out strike missions. Moreover, intelligence provided by small UAVs has been a game changer in different battles. In March 2022,

in countering Russian attacks. In February 2023, the Ukrainian Deputy Prime Minister and Minister for Digital Transformation Mykhailo Fedorov, said that Kyiv had purchased 1,765 UAVs for USD 3.4 Bn and trained about 3,500 soldiers in their use. Last June, President Zelenskyy launched the "Army of Drones" crowdfunding campaign and called on hobbyists and commercial drone pilots to donate their machines to regular Ukrainian troops.

Kyiv's inventory comprises several models, their pre-war fleet of around 20 Turkish-made Baykar Bayraktar TB2 was supplemented by a further 50 according to Ukrainian Defence Minister Oleksii Reznikov. Added to these, Ukraine has received roughly 850 Prox Dynamics Black Hornet micro-UAVs, and weaponised commercial

Author

Giulia Tilenni is an international affairs analyst based in Paris, France.

off-the-shelf UAVs to drop explosives, not dissimilar to ISIS' techniques. As part of the significant military aid pledged to the country, the US approved the delivery of several UAV models in February 2023. These systems include the Area-I ALTIUS-600 LM (which has a swarming capability, and was tested as an electronic warfare (EW) platform). Also delivered was the AeroVironment Jump 20 UAV with vertical take-off and landing (VTOL) capability, as well as a 14-hour endurance and a range of 185 km; and the AeroVironment Switchblade 600 LM, which can carry a 14 kg payload for 40 minutes within a 40 km range.

In the meantime, Ukraine is significantly investing in the development of locally-produced UAVs. In an interview with Reuters in March 2023, Defence Minister Reznikov said that the Government was working with about 80 Ukraine-based producers, adding that Ukraine required hundreds of thousands of UAVs. Kyiv, which has set up drone assault units within its armed forces, plans to invest USD 550 M on these systems in 2023 alone, with a focus on loitering munitions. Coupled with foreign supplies of tanks, missiles and artillery assets, the development of domestic UAVs, which are substantially cheaper compared to traditional weapon systems, might help in reducing the capability gap with Russia. During the first year of war, the deployment of UAVs on the battlefield has maximised Ukrainian reconnaissance capabilities. The country is now seeking the use of assets that can travel longer and carry larger payloads.

Baykar Technologies is emerging as one of the big winners in the conflict. Now that the place of Medium-Altitude Long Endurance (MALE) strike UAVs on the modern battlefield has been well-established, Baykar is expected to further increase its global market share and is starting to sell its UAVs to EU members. Although EU defence companies possess all the know-how required to develop UAVs, their development is quite complex, and armed forces have strong capability gaps in this domain. Let's try to understand why.

Programmes within the EU: a fragmented landscape

The EU military mission in Libya in 2011 confirmed the importance of UAV-carried ISR missions, suggesting to European countries that unmanned technology would have been the best solution to fill the long-lasting capability gap in this domain, which first emerged during operations in the Balkans in the early 1990s. Since then, some EU mem-

bers have acquired US or Israeli off-the-shelf MALE UAVs, and/or launched national programmes to develop tactical systems, while trying to develop a common MALE system to gain strategic independence. In the meantime, France, Germany, Italy and Spain are all involved in programmes to develop next-generation fighters – the first three within the Future Combat Air System (FCAS) programme, the latter within the Global Combat Air Programme (GCAP) with the UK and Japan. Both efforts take a system-of-systems approach integrating different types of unmanned systems. Several major EU countries have launched several development projects simultaneously, hoping to relaunch their national defence industries. However, their ambitions have been at odds with the slow recovery from decades of underinvestment in defence, and the need to focus on the replacement of all sorts of ageing equipment and weapon systems at once.

Eurodrone –

The Quest for a European MALE UAV

France, Germany, Italy and Spain launched the medium-altitude long-endurance remotely piloted aircraft system (MALE RPAS) programme, also known as MALE 2020 (and later: Eurodrone), in August 2016, within the framework of the Organisation for Joint Armament Cooperation (OCCAR). The idea to jointly fill the already mentioned gap in ISR capabilities with ITAR-free technology, to gain independence from the US and the other non-EU producers, dates back to 2013. When the programme was launched, the four countries all had some experience

with MALE systems. Italy was among the users of the General Atomics MQ-9 Reaper and MQ-1 Predator, which had already been deployed in the Middle East and just received Congress's authorisation to mount Lockheed Martin AGM-114 Hellfire missiles. France already had the General Atomics MQ-9 Reaper in its inventory for a couple of years, and Spain had just ordered a batch of them. Germany had several years of experience with the Israel Aerospace Industries (IAI) Heron TP, in use in Afghanistan under a lease agreement.

After a definition study that lasted two years and ended with the 2018 System Requirement Review (SRR) and a System Preliminary Design Review (SPDR), two additional years were devoted to the elaboration of the offer and the negotiation of the global contract. Prime contractor Airbus Defence and Space GmbH and major sub-contractors Airbus Defence and Space S.A.U, Leonardo and Dassault Aviation, finally signed a contract on 24 February 2022, agreeing on the development of 20 systems (seven for Berlin, five for Rome, four for Paris and Madrid), each one consisting of three flight units and two ground control stations.

According to the initial schedule, the first flights of a prototype were expected in early 2023, and the delivery of the final system in 2025. However, the programme is behind schedule due to fundamental divergences in core technical features, namely propulsion and armament, and on the final costs. Germany, which wants the system to be used above its national territory, pushed for the twin-turboprops in a pusher configuration. This is a solution that increases safety during flight



The full-size mock-up of the European MALE UAV, also known as 'Eurodrone', presented for the first time at the ILA 2018 exhibition. This ambitious joint development programme demonstrates the limits of defence collaboration in Europe.

Credit: Giulia Tieni

in non-segregated airspaces, but brings the weight of the system to 11 tonnes, compared to the Reaper at 4.5 tonnes. In a document released in June 2019, the French Senate pointed out the systems' 'obesity', barely compatible with the country's need to redeploy it in operational theatres, mainly in Africa. After long discussions, Berlin finally agreed on a system with strike capabilities.

Able to carry out intelligence, surveillance, target acquisition and reconnaissance

A Plethora of Tactical Unmanned Systems

EU countries with the most advanced armed forces have all reaffirmed the importance of fielding tactical UAVs in their strategic documents. Despite the similar operational requirements, most decided to go for national solutions, resulting in the multiplication of programmes. This choice is likely driven by political-industrial considerations, namely, the possibility of helping national defence compa-

the Bundeswehr has still not received any of these UAVs.

Looking at France, the latest military programming law (Loi de Programmation Militaire, LPM) allocates EUR 5 Bn in unmanned aerial technology between 2024 and 2030. Paris stressed its willingness to maintain investment in naval UAVs, to increase the number of tactical UAVs in use with the Army, and to develop French-made loitering munitions. This batch of investments is supposed to fuel the efforts begun under



A Luna NG UAV on its launch rail.

(ISTAR) missions, each UAV will have an endurance of 30 hours, a 13.7 km service ceiling, and a 500 km/h maximum speed. With a length of 17 m and wingspan of 30 m, it will be 1.5x larger than the MQ-9 Reaper. Its maximum payload is estimated at 2,300 kg.

According to the latest information available, the production of the first prototype is now scheduled in 2024 and the beginning of flight tests in 2027, with first deliveries likely at the end of the decade.

As was the case for the A400M, the Eurodrone programme highlights the limits of pan-European defence cooperation. As participating nations have different operational needs, the definition of the systems' features took a long time, and finally ended in sub-optimal specifications. Moreover, delays in production forced the parties to purchase off-the-shelf systems again, and might further delay the Future Combat Air System (FCAS) programme, a system-of-systems supposed to integrate the Eurodrone. The possible failure of the Eurodrone, among the first programmes to receive a grant under the European Defence Fund kicked off in 2021, might discredit EU efforts towards a stronger defence base, undermining an EU interdependence deemed necessary but far from being a reality.

nies develop and produce new systems at relatively limited costs. According to results obtained so far, this vision is short-sighted, with several programmes delayed due to COVID-19, thus increasing armed forces' capability gaps, as well as R&D and acquisition costs, which had been expected to be limited for this type of asset.

In April 2022, Rheinmetall announced the development of the LUNA NG, an advanced version of the EMT Luftgestützte Unbemannte Nahaufklärungs Ausstattung (LUNA) UAV, which has been in service with the German Armed Forces since the early 2000s. The new system has an endurance of 12 hours, a range of 100 km, a service ceiling of 5,000 m, in addition to a 40 kg take-off weight and a 30 kg maximum payload. Compared to its predecessor, the LUNA NG can have a reconnaissance or combat configuration, being able to mount the Hero-R rotary-wing loitering munition recently developed by Rheinmetall in collaboration with the Israeli company UVision. If this collaboration allows for having state-of-the-art combat capabilities, it is worth noting that the contract for the development of three unmanned systems with five UAVs each was awarded in July 2017, with deliveries initially expected in 2020. However,

the 2019-2025 document, but some of the systems are not operational yet, or have been recently delivered to their end-users. The Patroller UAV was developed by Safran and intended to replace the ageing fleet of Sagem Sperwer UAV. In 2016, Paris signed a EUR 330 M contract for 14 Patrollers, later revised upwards to 25 units with the 2019-2025 LPM. Due to enter service in 2019, the system only received certification for operational use in February 2023, and deliveries are due to take place out to 2030.

Final Remarks

Since their role on the battlefield began to grow with the Wars in Afghanistan and Iraq in the 2000s, UAVs have gradually become a key aerial asset on the battlefield, both for symmetric and asymmetric conflicts. The importance of these systems has launched a global race not only for their acquisition, but also for their development. Unable to access the Western market, dominated for a long time by the General Atomics MQ-9 Reaper and MQ-1 Predator and the Israeli Aerospace Industry Heron, China and Turkey have developed a broad range of competing systems. Cheaper than Western systems and exported without strings attached, they have conquered African and Asian markets in recent years.

PRECISION OPTICS

The hidden advantage to every mission

You've seen the platforms – now discover the competitive advantage that lies within. Through dust, sand, and darkness; through weather, pressure, and vibration; at supersonic speeds and temperature extremes, Raytheon ELCAN high-precision optical systems deliver unmatched capabilities: to see faster and farther, across the spectrum. Every mission. Every time.



RTX.com/ELCAN

By focusing on building the best possible MALE UAVs, despite different operational requirements, EU countries are lagging behind in terms of production, and will likely be unable to find a place in the global UAV market. Worse still, their efforts to build a common system are preventing them from filling a capability gap identified two decades ago. As other EU defence cooperative programmes have shown in the past,

a more efficient decision. Conversely, the biggest defence spenders focused on the development of national tactical UAVs, or off-the-shelf purchases, thus deepening market fragmentation and the dependence on non-EU producers.

On the one hand, the launch of new programmes seems to be purely driven by political objectives, such as increasing the production of national companies

eral Atomics for several MQ-9A Reapers to prepare an eventual purchase. In April 2023, Romania became another EU customer for the Bayraktar TB2, ordering 18 UAVs for EUR 280 M.

'Hope Springs Eternal'

If accompanied by strong and long-lasting political will, two trends might still help the EU recover, and enter this race again. First, trying to push ahead with meaningful cooperative programmes. In 2021, Spain, Germany, Portugal, Romania and Slovenia decided to launch the Next Generation Small RPAS (NGSR) project within the Permanent Structured Cooperation (PESCO) framework. This Spanish-led project is intended to develop a multi-role, next-generation tactical UAV, with a range of approximately 200 km and an endurance of 5 to 10 hours. The system should be rapidly deployable to support military operations in the land, air and maritime domains, but also be used for law enforcement, disaster management and other civilian missions. The first prototype should be ready in 2026, and tests should be completed by 2027, with a development that runs in parallel with the Euromale. This system might be an interesting test bed for the impact of EU funding on procurement, as the European Defence Fund is supposed to support the joint procurement of the system once operational.

Second is the little-discussed case of Greek know-how. Greece is not at the heart of cooperative programmes despite its strong and long-lasting experience with locally made UAVs. The Hellenic Aerospace Industry (HAI) Pegasus, whose development started in 1979, was delivered to the Greek Air Force in the early 2000s with the upgraded version, Pegasus II, introduced in 2005. Considering Turkish assertiveness and relevant know-how in UAVs, Greece has decided to build up its capacities to boost its national production while continuing to procure abroad – mainly in Israel. In September 2022, HAI and the Aristotle, Thessaly and Democritus universities presented Archytas, a multipurpose, dual-use, VTOL UAV, with significant surveillance and reconnaissance capabilities. In January 2023, Athens announced that the consortium would also develop the Grypas combat UAV. With a more modular structure and a larger payload than its predecessor, a first prototype is expected in 2025. Greece will officially be the first customer, but other countries willing to buy European might follow. ■



Credit: Giulia Tilenni

The Hellenic Aerospace Industry's Archytas tactical UAV. An important step in the domestic development of Greek drones might have a positive impact on EU defence cooperation – if European stakeholders want to take up this opportunity.

developing an ambitious multinational programme can end in late deliveries of expensive systems that have average technical features resulting from a compromise among all the relevant operational requirements.

Unfortunately, the Eurodrone case seems to follow this logic: the countries involved are investing a lot of time and money in a technological solution that will barely be useful for its end-users. Miniaturisation has allowed for high-performing tactical UAVs with interesting payloads, able to perform strike missions in support of ground forces. This is a trend that has spread over the last decade, but one that EU countries do not seem able (or willing) to identify. Overly-focused on trying to find a compromise solution on the Eurodrone, most EU countries underestimated the urgency to boost the range and number of tactical UAVs in their respective inventories. Considering the know-how present in different European defence companies and the similar operational requirements across Europe, going for just one or a couple of EU solutions to develop tactical UAVs might have been

to maintain employment levels or create new jobs, rather than military ones. As an example, the Spanish Ministry of Finance recently authorised a EUR 500 M investment in the development of the Sistema Remotamente Tripulado de Altas Prestaciones (SIRTAP) tactical UAV, to be divided into eight annual payments between 2023 and 2031. Co-funded by Spain and Colombia, expected to purchase 27 and 18 units respectively, the system will be developed by Airbus. The vehicle will have an endurance of 20 hours, a service ceiling of 6,000 km, a 750 kg maximum take-off weight, and a 150 kg payload. These are almost the same characteristics as the Leonardo FALCO EVO, reportedly in use in several Middle Eastern countries, but not in the inventories of any European customer.

On the other hand, national preferences force countries with limited budgets or urgent operational requirements to procure non-EU, off-the-shelf products. This is the case for Poland, which ordered four Bayraktar TB2 UAVs in May 2021, thereby becoming the first EU user. Poland also concluded a lease agreement with Gen-

TURBINE ENGINES

FOR TARGET DRONES, UAVs & MISSILES



CHOOSE THE RIGHT ENGINE FOR YOUR APPLICATION



PBS TJ40-G1
425 N



PBS TJ80-120
1,200 N



PBS TJ100
1,250 N



PBS TJ150
1,500 N



PBS TJ200
2,280 N



AI-PBS-350
3,400 N

Travelling Light – Nurol Makina Details its 4×4 Fleet Concept

Turkish manufacturer Nurol Makina has been expanding its vehicle families with new variants, with the aim of promoting a light vehicle fleet concept centred around 4×4s. Emre Akin, Nurol's head of strategic planning, along with another company representative, Brig Gen (retd) Recep Özdemir, provided the ESD with additional details.

Emre Akin told ESD that Nurol Makina is promoting its updated range of 4×4 'Heavy Tactical Wheeled Armoured Vehicles' (HTWAV) for use in high-intensity conflict, rather than just low-intensity conflicts, as has been typically the case for vehicles in this class. Brig Gen Özdemir stated that "We started with Yalçın – it was particularly for asymmetric warfare, low-intensity warfare in the beginning," continuing, "we visualised that 4×4 vehicles were developed enough, and their 'golden' capabilities, which are manoeuvrability, mobility, agility, protection, survivability, and payload capacity are quite mature. And just to think of these vehicles in low-scale warfare would be unfair."

Özdemir added that "there are some small countries who cannot allocate enough resources for sophisticated and

very expensive weapon systems, like tanks, tracked vehicles, and even 8×8 vehicles." In response to this demand, Nurol Makina has developed a range of variants based on their 18-tonne Ejder Yalçın and 13-tonne NMS (known as 'Yörük' in Turkish) 4×4 platforms, which would be considered heavy wheeled platforms within their class. These two families of vehicles are being offered for the combat, combat support, and combat service support segments within a 4×4 fleet concept. For instance, in the 'combat support' segment, which Nurol Makina envisions as being used just behind the front lines, variant options include anti-tank, very short-range air defence (VS-HORAD), reconnaissance, command, and mortar variants. This is intended to provide users with organic capabilities at lower costs compared to 8×8, 6×6, or

medium-weight tracked platforms employed in the same role.

High costs for many vehicle types is indeed a problem, and is one of the reasons why armed forces today broadly operate much smaller vehicle fleets than they did during the Cold War. While modern vehicles are generally both more capable and survivable than their forbears, being restricted to operating a smaller fleet of these brings its own restrictions to the battlefield. For instance, a heavy force with fewer vehicles may not be able to cover as broad a front as a force built on greater numbers of lighter vehicles. While each individual element in the lighter formation may be less protected than a heavier alternative, their greater numbers, higher top speeds, and easier deployability can nonetheless create tactical opportunities which may be hard to achieve otherwise.

Graphic: Nurol Makina

Nurol Makina 4x4 Armored Vehicles at High Intensity Warfare Environment

Front
Line

Combat Service Support 4x4 Vehicles



Utility



Logistics



Ambulance
/ Medevac



Troop
Transporter

Mine / IED
Clearance



Combat Support 4x4 Vehicles



Anti-Tank
Missiles



120 & 81 mm
Mortar



Recce



Command
& Control

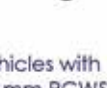


Short Range Air Defense
Radar & Missile

Combat 4x4 Vehicles



Combat Vehicles with
12.7 / 25 / 30 mm RCWS



Nurol Makina presented this slide to demonstrate the wide variety of combat roles which they envision can be credibly filled by 4×4 protected vehicles in place of heavier-armoured and more expensive alternatives.



Photo: Nurod Makina

The Ejder Yalçın mortar configuration (Havan), conducts a test firing with its on-board semi-automatically loaded Aselsan Alkar 120 mm mortar.

Availability is another concern, as concentrating sophisticated capabilities onto heavier platforms will also make them high-value targets, and very in-demand by low-level commanders during wartime. This puts higher-echelon commanders in the position of having to carefully weigh where these vehicles can be committed to. In this vein, Özdemir stated that at the "battalion plus brigade level, lots of capabilities should be organic, must be under the hand of the commander," adding: "it is not possible to ask the brigade commander: 'Sir, can you please send me four CV90s or four tanks (which are probably assigned to more critical tasks) to conduct this task which is not very challenging considering the mission, enemy and terrain,' but it is possible to ask for tactical wheeled protected vehicles to [carry out] a relatively less challenging task, so these are really very good tools for the low-level commanders, and there are lots of gaps to be filled by using those agile platforms." In this vein, the employment of 4x4s as weapons carriers allows a force to push

organic capabilities such as mobile mortars or light artillery, Counter-UAV (C-UAV) or Short-Range Air Defence (SHORAD), and direct fire support down to low echelons for a relatively low cost. Various forces have already started acquisitions of 4x4-based weapon carriers, with mobile mortars becoming a relatively popular offer in this segment, due to many 4x4 platforms being perfectly adequate for this role, as a representative noted: "You don't need Boxer for this capability." Beyond mortars, following on from the Second Nagorno-Karabakh war and the War in Ukraine, demand for organic mobile C-UAV and SHORAD capabilities in particular is increasing, especially for countries without large air forces. Fulfilling these requirements using heavier platforms is likely to be prohibitively expensive for some armed forces.

'Better' is the Enemy of 'Good Enough'

There are other reasons why it can be advantageous for smaller countries in particular, who tend to have relatively small armed forces to begin with, to operate a larger fleet of lighter, less protected vehicles, than a larger number of heavy vehicles.

Going the lightweight route provides a number of benefits for such users – protected 4x4s are cheaper to procure and operate, repair, and train on than 8x8s, 6x6s or medium-weight tracked vehicles. As Özdemir stated, "Another beauty of these [4x4] vehicles – for tanks, for tracked vehicles, you have to train your guys intensively, you have to spend lots of time for this. If you lose those guys, you have to train new guys, and it takes time. But these [4x4] vehicles are very simple, they are like commercial vehicles."

Secondly, many 4x4 protected vehicles have sufficient payload headroom to be equipped with most of the same armament and mission system options as their heavier counterparts, with the exception of large guns and automatic cannons. As an example, the Northrop Grumman M230LF, chambered in 30 mm × 113 would represent the typical upper limit of their armament. Due to the lower roof-mounted weight limits of 4x4s compared to 6x6s or 8x8s, they also will generally not be able to carry as much ammunition, meaning they would need to be resupplied more frequently, but their relative numbers and availability can compensate for this somewhat.

Smaller vehicles can suffer more than their larger cousins in some mobility sce-

narios, such as fording, obstacle climbing, and trench crossing, where the 4x4 is inherently at a disadvantage compared to tracked, 6x6, and 8x8 vehicles. Having said this, their lower weight and typically lower profile allows 4x4s to more easily navigate civilian infrastructure such as bridges and pass underneath obstacles which would hinder a larger vehicle, and makes them easier to recover when they get stuck.

However, where lighter vehicles really shine is in the strategic mobility department. Modern medium-weight wheeled and tracked vehicles are difficult to transport them in large numbers using aircraft. As an example, it takes three A400M aircraft to transport two Boxer 8x8s, and the process requires decoupling the vehicles' mission modules from their drive modules, loading both mission modules onto one aircraft, while the remaining two aircraft each take a drive module. Although the A400M can carry a payload of 37 tonnes, which Boxer comes close

Photo: Nurod Makina



Among their other qualities, protected 4x4s have lower visual and acoustic signature than their 8x8, 6x6, and medium-weight tracked counterparts, decreasing their chances of detection.



Photo: Nuro Makina

The NMS (Yörük), is Nuro Makina's the lighter wheeled platform offering in the company's protected 4x4 portfolio. However, it is capable of mounting a wide array of armament options, including ATGMs, MANPADS, and 70 mm rockets.

to at a typical combat weight of 36.5 tonnes, the loading ramp's weight tolerance is only 32 tonnes. Thus, the load needs to be decreased before the vehicle can be driven on and off the aircraft. By contrast, something like the Ejder Yalçın, although no featherweight at around 14-18 tonnes (depending on version and configuration), is sufficiently light to drive on or drive off A400M, and at this weight, two could be carried per aircraft. If the vehicle is equipped with a relatively tall roof-mounted remote weapon station, this may be a little on the tall side for A400M and would require removal prior to driving on, but this limitation would apply to most tall armoured fighting vehicles.

What is Sufficient Protection on the Modern Battlefield?

On the protection side, 4x4s may lack the same level of passive armour protection as heavier vehicles, however this may be less relevant than it once was. While heavy machine guns and automatic cannons remain very common threats, the proliferation of relatively low-cost but

effective Anti-Tank Guided Missiles (ATGMs) and loitering munitions has had two main changes on the battlefield. Firstly, combatants everywhere generally feel more comfortable using these weapons for engaging any kind of target. This was perhaps best exemplified in Syria, where various factions have used ATGMs such as TOW, Fagot, Konkurs, Kornet against everything from heavy to very light vehicles, buildings, and even personnel in the open. Secondly, this has meant that realistically, unless they are equipped with an active protection system (APS), any vehicle with armour protection below the level of a modern tank (and even some tanks) can be reliably defeated with ATGMs which are fairly common on today's battlefields.

RPGs have also grown in capability, with modern tandem-HEAT warhead varieties having comparable terminal effects to ATGMs. Although even modern RPGs typically have slightly lower overall penetration compared to modern ATGMs, this factor is largely irrelevant for most vehicles on the battlefield, whose armour can be comfortably overmatched at a fraction of their total penetrative capability. Older

RPG variants such as the PG-7V and PG-9V families of munitions meanwhile, are usually countered by statistical protection such as bar armour, which can be fitted to heavy or light vehicles alike.

On the topic of survivability, Nuro Makina provided ESD with a first-hand account of an ambush from a soldier working as the driver of an Ejder Yalçın with the Gendarmerie Commando unit based in south-eastern Turkey, close to the Iraqi border. The soldier did not wish to be identified, but described the ambush to ESD, which took place near the town his unit was based:

"In the summer of 2019, when I was working with the Gendarmerie Commando unit in [south-eastern Turkey], we set off for road controls and [searched for] IEDs in culverts, with [our] vehicle in the early morning hours. Together with my commando friends and commanders, we continued to work very carefully all day and the duration of our duty was extended. We had done all the culvert and IED searches. We waited until the evening hours [at a small temporary base]. After taking a break, we received information [from] the military convoy coming from [a town located 52 km from us] and started patrolling. I was [in the lead] with my vehicle that day. We identified a heat source through our thermal camera and stopped while we were on patrol. As soon as we stopped, two [RPGs] hit my vehicle, 10 seconds apart. We tried to exit the death zone [calmly] with my vehicle commander and personnel. We got out of the death zone using the special abilities of our vehicle."

According to Nuro Makina, both RPGs had struck the engine area of the vehicle, and the vehicle was heavily damaged in the attack, including damage to the electronics and one of the tyres, but fortunately, the RPGs' penetrating shaped charge jets did not strike at the correct angle to cause damage to the engine. Thus the driver was able to continue driving for four kilometres, bringing the crew to safety before leaving the vehicle. Akin added that due to the danger posed by hits on the engine, which would immobilise the vehicle and leave the crew unable to escape, the Ejder Yalçın has the same level of armouring around the engine bay as around the passenger compartment. This provides the engine with protection against machine gun, blast, and fragmentation threats, helping the vehicle to preserve its mobility when hit.

The vehicle is also highly mine and IED-resistant. Recalling another incident featuring the Yalçın, Akin stated that in 2015,

Southeastern Turkey, a fertiliser-based IED weighing than 600 kg (somewhere in the realm of >10 kg of TNT equivalent) exploded under the vehicle body. While this caused significant damage to the vehicle and the occupants survived. Akin stated that during tests in 2022, the vehicle's underbody was demonstrated to provide protection conforming to STANAG 4569 Level 4A/4B, translating to 10 kg of TNT equivalent under the body or under any wheel location. This level of protection is being offered as an option depending on user requirements.

Photo: Nurol Makina



Closing Thoughts

In sum, while protected 4x4 vehicles in the medium-weight category are never going to be capable of doing everything their heavier brethren can do, yet they nonetheless offer a number of compelling reasons for increasing their participation in high-intensity warfare, rather than being left to counter-insurgency operations.

Recalling Ukraine's high-speed counteroffensive around Kharkiv launched on 6 September 2022, after Russia had redeployed many of its more capable forces in the East of Ukraine to protect Kherson in the South. Ukraine's rapid response caught Russian forces off-guard. Although Ukraine's forces used all manner of equipment during the campaign, they notably made use of large numbers of light (some of which unarmoured), or medium-weight protected 4x4s to rapidly move personnel forward. Speed was absolutely key to this operation, as it gave the unprepared Russian forces little time

Although they may not have the same trench-crossing capabilities as 8x8, 6x6, and tracked counterparts, 4x4s such as the NMS nonetheless have fairly good off-road mobility. However, operational and strategic mobility are their greater strengths, due to their high on-road mobility and ease of transportability via aircraft.

to organise a defence or even sabotage their own equipment before retreating. The result was Ukrainian forces retaking over 500 settlements, and around 12,000 km² of territory, along with large stocks of captured Russian equipment in working order.

Nurol Makina's proposed force concept may not be the highest priority for users who already operate large, modern

medium-weight and heavy vehicle fleets, supported by various other systems on the ground and in the air. However, it is admittedly a rather compelling model for users with more limited budgets, as well as for countries gearing up for a mix of counter-insurgency and high-intensity conflict tasks, or users who wish to increase their share of organic capabilities at very low levels. ■

**MULTI PURPOSE
ARMORED VEHICLES**

**SUPERIOR MOBILITY
AND PROTECTION
FOR YOUR MISSIONS**

**COMBAT
PROVEN**



www.nurolmakina.com.tr



Made-in-Türkiye: Indigenous Programmes Update

Kubilai Han

The Turkish defence & aerospace sector has become one of the sectors that make the highest contribution to the Turkish economy, with an annual revenue of USD 12.2 Bn, exports amounting to USD 4.396 Bn, and R&D investments exceeding USD 2 Bn as well as with more than 2,700 companies and over 80,000 employees. Showing remarkable progress over the last two decades, Turkish Industry can now meet the majority of domestic requirements and compete in many sectors of the export market.

Through investing heavily into the development of the local defence sector capabilities and encouraging the design and development of high-tech defence equipment since early 2000s, Türkiye has been transitioning from being a licence producer to a technology owner. It is now keen to export the fruits of its labours to become internationally competitive in the global defence market.

Although Turkish Aerospace Sector still ranks below established giants, Türkiye is making progress with domestically developing increasingly sophisticated manned and unmanned fixed- and rotary-wing aircraft. In this context, the country has developed first prototypes of their indigenously developed 'Kaan' (formerly known as TF-X/MMU) fifth-generation fighter jet prototype GTU/P0 and twin-seat, single-engine supersonic Advanced Jet Trainer (AJT) Hürjet, dubbed P1. These two prototypes performed their first engine runs on 12 February and 30 January 2023 respectively, and started their slow taxi tests on 17 and 18 March respectively.

Following on from this, the Hürjet P1 conducted its maiden flight on 25 April, and as of 9 June, a total of 10 test flights have been conducted during which Hürjet accumulated a total of 6 hours and 16 minutes flight hours.

The Kaan is scheduled to perform its maiden flight by the end of 2023, but according to the author's sources, this could be postponed to February or March 2024. However, contrary to Turkish Aerospace

Credit: TUSAS



The Kaan indigenously developed fifth-generation fighter first prototype GTU/P0 is planned to perform its maiden flight by the end of 2023.

(TUSAS) President & CEO Prof. Dr. Temel Kotil, the Turkish Defence Industry Agency (SSB) believes that the first flight shall take place in late 2024 or in 2025.

Meanwhile, the first prototype of indigenously designed and developed T929 ATAK 2 attack helicopter successfully conducted its first flight test on 28 April 2023, following ground tests.

Türkiye also has a strong heritage of ship building that dates back to the Ottoman Empire, and has already built capability for naval construction in state-owned naval shipyards, starting in the 1970s. Having completed the local construction of three Atılay class (Type 209/1200), four Preveze class (Type 209/1400) and four Gür (Type 209/1400 Mod) diesel-electric submarines under the HDW license during 1981-2008, the Gölcük Naval Shipyard, is Türkiye's only state-owned shipyard with the ability to construct submarines.

Under the New Type Submarine Project (NTSP) valued at EUR 2.06 Bn, six Reis class (Type 214TN AIP) Submarines are being constructed at Gölcük Naval Shipyard. The first boat of the class, TCG Piri Reis is currently at the Sea Acceptance Tests (SAT) Phase, having launched on 6 December

2022, and expected to be commissioned in September 2023.

Türkiye's first indigenous submarine MILDEN (short for 'Milli Denizaltı', which translates to 'National Submarine') will be much larger, heavier and more capable than the current German-designed Atılay, Preveze, Gür, and Reis class Submarines constructed at the Gölcük Naval Shipyard under license from Germany's HDW. Design studies for MILDEN commenced on 14 April 2010, and have provided the Turkish Defence Industry with a domestic submarine design capability. Six boats are due to be built under the programme.

Kaan Fifth-Generation Fighter

Designed to meet the operational requirements of the Turkish Air Force (TurAF) between 2030 and 2070, the 'Kaan' is a proposed single-seat, twin-engine all-weather multi-role fighter being developed by prime contractor Turkish Aerospace (TUSAS) with technological assistance from BAE Systems. Kaan will replace the F-4E 2020 Phantom IIs and F-16C/D Fighting Falcon combat aircraft currently in the ser-

Author

Kubilai Han, is a freelance specialist on regional defence matters based in Istanbul, Turkey.



Credit: Kubilai Han

Prototypes and initial batches of Kaan are to be powered by a pair of F110-GE-129E turbofan engines.

vice with the TurAF during the first quarter of the 2030s. Türkiye is likely to procure some 150-200 Kaan (TUSAS' production goal is 400) over the long term to replace F-4E 2020s and F-16C/Ds. The unit cost per prototype aircraft is estimated at USD 120 M, while series-produced aircraft are estimated to end up costing USD 80-100 M per unit.

By 2028, 8 Kaan prototypes will be manufactured. According to TUSAS President Kotil, the first 7 aircraft will be powered by GE's F110-GE-129E Turbofan Engines and starting from the 8th prototype (in 2028) the 15,876 kgf (35,000 lb) class indigenous turbofan engine will be used. Kotil underlined that after two years of testing, the indigenous engine will start to be fitted to series production Kaans in 2030. TUSAS applied to the US Government in 2019 (for 5 engines) and 2021 (for 5 engines) to procure a total of 10 engines for Kaan prototypes. Meanwhile in June 2022, the SSB issued a Request for Proposal (RFP) for a new tender to select the prime contractor for the Kaan Engine Development Project Phase-II, which constitutes the second development phase for the indigenous engine. In addition to TRMotor Power Systems (TR-M) and TEI, which carried out Phase-I activities, and TAEC Uçak Motor Sanayi, a Kale-Rolls-Royce Joint Venture also submitted its bid for Engine Development Project Phase-II. It seems that TR-M and TEI, in cooperation with Ukraine's Ivchenko-Progress (as Technical Support Provider), will develop the indigenous engine for the Kaan.

Prototypes and the first batches of series-produced Kaans are to be powered by a pair of F110-GE-129E turbofan engines, each generating 13,381 kgf (29,500 lb) of thrust. The F110-GE-129E engines are expected to be used in GTU/P0, Block 10

aircraft (production in 2028/2029) and most of the Block 20 (production in 2030) aircraft and then switch to the indigenous engine from Block 30 onwards. According to the author's sources, TUSAS will procure further 80 F110-GE-129E engines for the Kaan Block 10 and Block 20 aircraft. In May 2023, President of SSB İsmail Demir disclosed that around 40 Kaan aircraft will be delivered with F110-GE-129E engines. In his statement on 8 December 2022, CEO of TUSAS Temel Kotil announced that starting from 2028/2029, TUSAS will begin series production of the Kaan at a rate of 24 per year (two per month). On 1 May 2023, Kotil disclosed that the deliveries of the first batch of 20 Kaan Block 10 aircraft will be started in 2028.

According to TUSAS data the Kaan has a length of 21 m, height of 6 m and a wingspan of 14 m. In terms of performance, it

has a service ceiling of 16,764 m (55,000 ft), a top speed of Mach 1.8, and can pull +9g to -3.5g. However, some of these figures are slightly contested, according to posters in the Kaan final assembly line, which give the maximum speed of the aircraft as Mach 2, a service ceiling of 16,764 m (55,000 ft), an absolute ceiling of 18,228 m (60,000 ft), a maximum payload capacity of 9,072 kg (20,000 lb), and a g-limit of +9g to -3g, with a turn rate of 9g at Mach 0.9 at 4,572 m (15,000 ft) and 4g at Mach 0.9 at 9,144 (30,000 ft).

The Critical Design Review (CDR) Phase of the Kaan GTU/P0, which is expected to perform its maiden flight by the end of 2023, is scheduled for completion in September 2023. Painted with a two-tone grey colour, the GTU/P0 prototype performed its first engine run-up test with F110-GE-129E Turbofan Engines on 12 February 2023 at the Outdoor Engine Test Field, next to the Kaan Assembly & Test Building. With this test, ground trials have been launched. Appears to be equipped with an Infra-Red Search & Track (IRST) sensor housed on top of the nose in front of the cockpit, and an integrated optronic targeting system mounted underneath the aircraft's nose, reminiscent of the F-35's Electro-Optical Targeting System (EOTS).

The Kaan GTU/P0 prototype conducted its first slow taxi test on 17 March 2023. During the taxi tests the aircraft moved under its own power, marking a successful integration of its General Electric F110 engines, and reaching a milestone. Currently, work on the Kaan is focused on development of the flight control system which the GTU/P0 prototype will use during its maiden flight. However, not every team is working on the GTU/P0 first flight – as of June 2023, pro-



Credit: TUSAS

TUSAS utilises robotic painting stations for painting the Kaan's fuselage and components. This was established with an investment of approximately USD 25 M, and uses locally-produced special paint.

duction of the second and third prototypes has been launched and the work on the Block 10 configuration, which will be the first aircraft to be delivered, continues in parallel.

Hürjet New-Generation AJT & LCA

The Hürjet is a twin-seat, single-engine supersonic new-generation Advanced Jet Trainer (AJT) and Light Combat Aircraft (LCA). It is being developed by TUSAS under an agreement signed between TUSAS, the SSB and the Turkish Air Force (TurAF) on 2 July 2018. The Hürjet Project is aimed at the development of an indigenous Advanced Jet Trainer (AJT), able to perform supersonic flight to replace the T-38M currently in service with the TurAF in the 2030s, and a Light Combat Aircraft (LCA) able to perform Close Air Support (CAS) to decrease dependence on the TurAF's F-16C/Ds for this role. Upon entering service, the Hürjet will be used to train pilots for the Kaan.

On 12 January 2022, at the Defence Industry Executive Committee Meeting, a decision was taken for Series Production for Hürjet. In the first phase, orders were placed for the first batch of 4 aircraft (with option for 12 more) for the TurAF. However on 22 June 2023, during the Paris Air Show, TUSAS President Kotil disclosed that TUSAS have secured a contract for the deliveries of 2 prototypes and 16 Hürjets. According to this contract, TUSAS will deliver 4 Hürjets to the TurAF by the end of 2025, the remaining 12 aircraft by the end of 2028. TUSAS believes that by the mid-2030s they could sell 100 Hürjets to the TurAF and 300 Hürjets to the export customers.

Following the necessary controls, the first production prototype of the Hürjet New Generation AJT & LCA, P1, has begun the ground testing phase in January 2023 ahead of a first flight, which was supposed

Credit: TUSAS



A screenshot from Hürjet P1's first flight video. On 25 April 2023 the prototype performed its 26-minute maiden flight.

to take place on 18 March 2023, the 108th anniversary of the Battle of Canakkale (Gallipoli). Powered by a General Electric F404-GE-102 turbofan engine, the Hürjet P1 performed its first engine run-up test successfully on 30 January 2023. Prior to the maiden flight, the engine start system, and control and warning systems had been tested at the ground tests. On 18 March 2023 the President of Turkish Defence Industry Agency (SSB) Ismail Demir announced the start of slow taxi tests of the Hürjet, uploading a video of the Hürjet P1 prototype taxiing. Kotil also uploaded a video showing the P1 prototype being towed out of its hangar, with the video showing the taxiing test from inside the prototype's cockpit.

In his statement to NTV on 28 March 2023, SSB President Demir disclosed that the organisation plans to produce 40 Hürjets at first, noting: "We expect a large number of orders." A month later on 25 April 2023, Hürjet P1 took-off at 07:35 to perform its maiden flight, which lasted 26 minutes. According to TUSAS, during its successful maiden flight, Hürjet P1 climbed to an altitude of 4,267 m (14,000 ft) and reached an air speed of 128.6 m/s (250 kn).

Within the scope of the project, three Hürjets and two mock-ups have been produced. These included the Static Test Aircraft (which was rolled out of the hangar by a towing vehicle on 24 December 2022) used in strength tests, the P1 prototype that performed the first flight, and the Fatigue Test Aircraft to be used in the Iron Bird Test System. In addition, an Hürjet cockpit fuselage was shipped to the ejection seat manufacturer Martin Baker for canopy tests.

According to TUSAS, each Hürjet consists of around 8,000 parts and the company aims to produce two Hürjets per month during the serial production phase. The first aircraft is expected to be delivered to the TurAF in 2025, and will be capable of undertaking training, air patrol, and aerobatic demonstration roles. Possessing a top speed of Mach 1.4 and g-limits from +8g to -3g, Hürjet will be able of operating at up to 13,716 m (45,000 ft) and carrying a payload of around 3,000 kg. With its advanced human-machine interface (HMI), digitally controlled flight system, and internal tactical and virtual training systems, Hürjet will offer a new-generation aircraft flight experience.

Within the scope of flight test campaign, the Hürjet P1 prototype performed its ninth and tenth test flights on 8 and 9 June respectively – the former with retracted landing gear and the latter with two pilots aboard. As of the tenth test, the Hürjet P1 has accumulated a total of 6 hours and 16 minutes of flight hours. However, according to the author's sources, during one test flight in the first half of June, Hürjet P1 was forced to make an emergency landing after a bird struck one of the aircraft air intakes. Reportedly, the engine fan blades suffered heavy damage from the bird strike, and it is understood that the engine had to be shipped back to the US for repair. Lending some credence to this is that since June

Credit: TUSAS



TUSAS believes that by the mid-2030s they could sell 100 Hürjets to the TurAF and 300 Hürjets to the export customers.

10, no information has been publicised by TUSAS about Hürjet's flight test campaign. During Paris Air Show 2023, on 22 June, Kotil disclosed that TUSAS signed a contract with GE Aerospace for the supply of 100 F404-GE-102 engines for the Hürjet Programme.

T929 ATAK 2 Attack Helicopter

The first prototype (P0) of the TUSAS ATAK 2 attack helicopter programme flew for the first time on April 28, 2023, from the company's plant in Kahramankazan, Ankara. The first flight lasted 10 minutes. The helicopter, formally designated as T929, was developed under a contract signed between the Defence Industry Agency (SSB) and Turkish Aerospace (TUSAS) on 22 February 2019. The T929 ATAK 2 is a testament to the industrial experience that TUSAS has gained both through its joint venture with the Italian Leonardo Company for the T129A/B Attack Helicopter Project and the testing infrastructure and experience obtained from the T625 Gökbey Turkish Light Utility Helicopter Programme. The contract for the T929 ATAK 2 Project was signed in April 2019, with production of the first prototype (P0) beginning in the summer of 2022, and the final assembly activities were completed in February 2023. Following these, ground tests began on the T929 P0 prototype, successfully passing its first power-on test on 1 March 2023, and its first engine run test on 23 April 2023, during which both engines were tested separately. After around 15 hours of engine ground tests, it commenced taxi tests on 28 April and lifted off for the first time on the same day, two days ahead of the initially-planned date for its maiden flight. Flight tests will continue throughout the



Credit: Kubilay Han

TUSAS is due to deliver three T929 ATAK 2 helicopters to the Turkish Land Forces in 2025-2026.

year with the T929 P0 prototype. In this context, work is due to focus on expanding the flight envelope, followed by weapon integration. The T929 ATAK 2 will have two separate variants for the Land and Naval Forces. The Naval version must have a 'navalised' (protected against the corrosive effects of the maritime environment's high humidity and salt) fuselage, engine, and transmission. In fact, the helicopter's tail section and rotors also need to be foldable for easy transportation and minimising required space on the ship's deck. Kotil announced that three T929 ATAK 2 helicopters will be delivered to the Turkish Land Forces in 2025, and then two helicopters will be produced every month, making Türkiye one of three countries in the world producing attack helicopters of this class. Thanks to the testing infrastructure and experience obtained from the T625 Gökbey Helicopter Project, TUSAS has been able to implement the ATAK 2 Programme in a short timeframe, with ground tests com-

pleted quickly. By way of example, the first operational test of the transmission was directly conducted on the T929 P0 prototype instead of a test bench.

After the 'Century of the Future Launching Ceremony' held on 1 May 2023 at TUSAS facilities in Kahramankazan, Ankara, Mehmet Demiroğlu, Executive VP of TUSAS Helicopters stated that TUSAS is about to complete the work on the second prototype (P1), and that this will have slightly smaller dimensions and a slightly different nose design compared to the P0. Following the P1, production of the third prototype (P2) for the Land Forces Command, will begin. According to Demiroğlu, TUSAS will deliver 3 ATAK 2 helicopters to the Turkish Land Forces in 2025-2026. Production of the Naval Forces variant is expected to start afterward, but according to Demiroğlu, as of 1 May 2023, no contract for the Naval variant has yet been signed.

In June 2021, under the agreement signed between TUSAS and Ukraine's Motor-Sich, 14 TV3-117VMA-SBM1V-01T turboshaft engines (with a power output of 1,860 kW (2,500 hp) each) were ordered for use on first batch of 7 helicopters to be manufactured under the ATAK 2 Project. The first batch of two TV3-117VMA-SBM1V-01T turboshaft engines only reached TUSAS facilities on 27 January 2023, with integration onto the P0 prototype carried out in March 2023, followed by preparations for ground tests.

According to TUSAS, the T929 ATAK 2 has a maximum service ceiling of 6,096 m (20,000 ft), a maximum cruising speed of 296 km/h, a range of 556 km, and an endurance of 2.5 hours. Although TUSAS didn't state the dimensions of ATAK 2, according to TUSAS Chief Test Pilot Arif Ates, ATAK 2 will be the world's largest attack helicopter.



Credit: TUSAS

The first prototype (P0) of the ATAK 2 flew for the first time on April 28, 2023, in a flight lasting 10 minutes, taking place at the company's plant in Kahramankazan, Ankara.

MILDEN Submarine Programme

In order to meet Turkish Naval Forces Command (TNFC)'s next-generation diesel-electric attack submarine requirement, that will operate in the 2030s and beyond, through indigenously designed and constructed submarines, the MILDEN Project was launched on 14 April 2010, with first design activities starting. The MILDEN Programme has been coordinated by the Turkish Naval Research Center Command (ARMERKOM - TNRCC) since March 2012. The project will use infrastructure established and know-how gained from Reis class (Type 214TN AIP) programme. To equip this submarine, Turkish industry is developing a suite of sonar, communications and sensor technologies as well as propulsion and armament systems that will be incorporated for the first time into the MILDEN Submarines. Thus, MILDEN promises to take Türkiye's shipbuilding industry to the next level, joining a small group of countries which can design and build their own submarines.

According to Turkish MoND 2021 Annual Report, the MILDEN Design Project Office was established on 19 April 2019, and the new office building was opened on 22 March 2021 at Gölcük Naval Shipyard. As of August 2022, 28 personnel (23 engineers, 5 technical designers) were working in the MILDEN Design Project Office, and is set to increase in later stages of the Project. As pointed out by MILDEN Design Project

Office Platform Systems Chief Engineer Captain İzzet Emre Afacan, Türkiye has gained the capability to design attack submarines for the first time with the MILDEN Project. The concept design of MILDEN, giving the volume and the shape of the submarine hull, was submitted to the TNFC on 25 October 2021 and received technical approval in January 2022. This marked the end of the conceptual design phase and beginning of the preliminary design phase in which main and auxiliary systems are elaborated in greater detail. According to the MoND 2021 Annual Report, the protocol regarding preparation of the MILDEN design was signed on 22 December 2021 between the General Directorate of Shipyards and ASFAT AŞ.

The MILDEN Programme covers the construction of 6 submarines. According to the most recent scale model, and contrary to the design revealed at the MILDEN Workshop in June 2017, the new MILDEN features a traditional cross-shaped rudder rather than the initially-planned X-shaped rudder, and does not have shrouded screw. The Reis class hulls are being built using the 'vertical construction' method at the Gölcük Naval Shipyard. They are built from ballistic steel plates supplied from Austria, since at that time of construction, Türkiye could not produce ferromagnetic HY-100 and HY-80 high yield stainless steel alloys. By contrast, the hulls of MILDEN Submarines are due to be built from locally-produced high-yield stainless ballistic steels (HY-100 and HY-130) with high corrosion



MILDEN submarines feature eight 533mm torpedo tubes for launching heavyweight torpedoes and SLCMs.

resistance. MILDEN Submarines feature eight 533 mm torpedo tubes for AKYA National Heavyweight Torpedo (HWT), Sub-ATMACA Submarine-Launched Cruise Missiles (SLCMs) for the Anti-Ship role and GEZGIN SLCMs for the Land Attack role. The submarine will be equipped with an indigenous navigation system, and the sonar suite will include a bow array, a low-frequency flank array, and a towed array. MILDEN's pressure hull test production phase will be started at Gölcük Naval Shipyard later in 2023, following infrastructure improvement and design adaptation for MILDEN. Regarding the project schedule, Afacan stated that first welding of the MILDEN prototype is scheduled for early 2025 and construction, installation and trials will be completed by the end of 2031. "MILDEN is designed as a diesel-electric submarine with a surface displacement of about 2,700 tonnes and a length of over 80 m, and is powered by an air-independent propulsion (AIP) system. Compared to our current submarines, MILDEN will stay submerged longer, have a heavier weapons load and be able to operate at greater depths" Afacan said.

Along with two diesel engines, MILDEN will be the first domestic submarine to be equipped with the indigenously developed AIP system, which is aimed to develop 300 kW of net power and approximately 360-370 kW of gross power. It will consist of six Polymer Electrolyte Membrane (PEM) Fuel Cell modules, each of which will be able to generate at least 60 kW, at least one Methanol Reformer System, and Lithium-Ion Battery (LIB) sets, which are currently under development.

The Atılay class submarines (of which three were built at HDW and three at the Gölcük Naval Shipyard) were inducted into TNF service between March 1976 and July 1990. Presently, only four remain in service, and are due to start being replaced by the MILDEN submarines starting in late 2031 or early 2032.



At the MILDEN Workshop held in June 2017, the Commander of the Turkish Naval Forces Admiral Bulent Bostanoglu (third from left), Fleet Commander Admiral Veyssel Kosele and Commander of Gölcük Naval Shipyard Rear Admiral Aydın Eken posed with MILDEN's scale model together with ARMERKOM staff.

2023: A Big-Ticket Year for the Turkish Aerospace Industry

Peter Felstead

Turkey's military aerospace industry is becoming predominantly self-reliant and increasingly adventurous as the Turkish Republic celebrates its 100th anniversary, with a number of major programmes about to build on what is already a successful story of technological progress

With 2023 being the centenary year of the founding of the Turkish Republic, a number of big-ticket national programmes are coming to fruition. While these were to an extent used to gild the presidency of Recep Tayyip Erdoğan ahead of his successful re-election, they also served another purpose: illustrating the very significant progress made in recent years by Turkey's military aerospace industry. Turkey's growing aerospace and defence (A&D) capabilities are also contributing to economic success for the country. According to the 'Trends in International Arms Transfers 2022' report published by the Stockholm International Peace Research Institute (SIPRI), Turkey's arms exports increased by 69% in the 2018 to 2022 period compared to 2013-2017.

The country's growing A&D capabilities are also making Turkey much less reliant on imported defence materiel. According to the Turkish Ministry of National Defence, local industry now supplies 80% of Turkey's military equipment and weaponry; that figure was just 20% in 2004.

Building Toward Success

The seeds of Turkey's 21st century aerospace capabilities were most obviously sown by the Peace Onyx programmes (I, II, III and IV), under which Turkey became one of just five countries to locally produce what was originally the General Dynamics F-16 fighter for its air force. The Turkish government announced plans to buy 132 F-16Cs and 24 F-16Ds under the US Foreign Military Sales (FMS) programme in September 1983 under the Peace Onyx I programme, with all but the first eight aircraft to be built in country. While Turkish Aircraft Industries Corporation (TUSAS) had been established in 1973 under the Turkish Ministry of Industry and Technology, its aim being to decrease the country's foreign dependency in the A&D sector, TUSAS Aerospace Indus-



Credit: TAI

The TF-X – also known as the Milli Muharip Uçak (National Combat Aircraft) – is Turkey's most ambitious manned aircraft programme to date.

tries Inc (TAI) was established 1984, at that point as a Turkish-US partnership, to build Turkey's F-16s. The first flight of a Turkish-built F-16, a C model, took place on 20 October 1987.

Such was Turkey's success in licence-producing the F-16 that TAI was contracted to build wings, centre fuselages and aft fuselages for US F-16s as well as producing 46 F-16C/Ds for Egypt under the Peace Vector IV programme.

TAI went on to licence-build 80 F-16C/Ds under Peace Onyx II, 40 under Peace Onyx III and 30 under Peace Onyx IV.

Moving on from its success licence-producing F-16s with what had become Lockheed Martin, Turkey became the seventh international partner in the Lockheed Martin-led F-35 Joint Strike Fighter (JSF) programme in July 2002, initially intending to order 116 F-35As with involvement in F-35 production. Despite political issues with the United States over Turkey's relations with Israel, along with Turkish concerns over F-35 costs and a US refusal to share source codes, Turkey received its first F-35 at Lockheed Martin's facilities in Fort Worth, Texas, on 30 June 2018. By then, however, President

Erdoğan's somewhat ambivalent attitude in relation to the country's allegiance with the US and NATO was running its participation in the JSF programme into trouble. In late 2017 Turkey had signed a USD2.5 Bn agreement with Russia for the delivery of S-400 air defence systems: a deal that, given the required Russian assistance in delivering the system, threatened to compromise the stealth characteristics of the F-35. With Erdoğan refusing to cancel the S-400 deal, the first Russian S-400 components were received in Turkey on 12 July 2019 and Turkey was ejected from the JSF programme five days later.

Indigenous Designs

TAI, which became wholly Turkish owned in 2005 (and is now rebranded as Turkish Aerospace), started work on its first indigenously designed aircraft in March 2006 with the initiation of the programme to produce the Hürkuş turboprop trainer/light attack aircraft: a low-wing, tandem-seat monoplane.

After the SSM approved the Hürkuş design in April 2009, manufacture of a prototype

Credit: TAI



The Hürkuş-C, a light attack/close air support variant of the Hürkuş turboprop trainer, has achieved export sales as well as being order by the Turkish Air Force.

began on 7 July 2009 and this aircraft made its maiden flight on 29 August 2013. After a few modifications, type certification of the Hürkuş was achieved in 2016 and the aircraft made its international debut at the Paris Air Show in June 2017.

Produced in three variants – the Hürkuş-A basic trainer, an advanced Hürkuş-B version with Aselsan integrated military avionics and other enhancements, and the Hürkuş-C light attack/close air support variant – the Hürkuş has secured a number of sales. The Turkish Air Force ordered 15 Hürkuş-Bs in 2016 and then subsequently ordered six Hürkuş HYEU air-ground integration variants and 24 Hürkuş-Cs. In November 2021 Niger became the first export customer for the Hürkuş with an order that may eventually number 12 Hürkuş-Cs, while in May 2022 it was announced that the Libyan Air Force under the Government of National Unity had signed a contract with Turkish Aerospace for ‘several’ Hürkuş-Cs. This was a somewhat controversial contract since Libya remained subject to UN sanctions at the time. Then, in July 2022, it was announced that Chad had ordered a number of Hürkuş-Cs (at least three).

Powered by a Pratt & Whitney Canada PT6A-68T turboprop, the Hürkuş is stated to have a maximum speed of 546 km/h, a maximum ceiling of 10,455 m (34,300 ft), a range of 1,161 km at 5,486 m (18,000 ft) and g limits of +7g to -3.5g (in clean configuration). The Hürkuş-C has three pylons on each wing plus a centreline store that can accommodate 12.7 mm and 20 mm gun pods, rockets, missiles and bombs up to a maximum payload of 1,500 kg.

Moving on to Jets

Four years after the maiden flight of the Hürkuş, in August 2017 TAI initiated the programme to build the Hürjet supersonic,

tandem-seat advanced jet trainer (AJT)/light attack aircraft. As well as being positioned as a platform that could replace older AJTs such as the Northrop T-38, Aero L-39 and BAE Systems Hawk with an aircraft that could train fifth-generation fighter pilots, the Hürjet is billed as a potent yet affordable

light attack platform: potentially an attractive proposition for air forces that cannot afford to operate a full-on jet-powered strike aircraft fleet.

The Hürjet passed its preliminary design review in July 2019 and its critical design review in February 2021. In January 2022 it was announced that the first Hürjet prototype had entered the assembly phase and that serial production of the Hürjet had been given the go-ahead by the Turkish government, while the final assembly process of the first aircraft was initiated in June 2022.

Around that time Turkish Aerospace stated that it planned to conduct the maiden flight of the Hürjet on 18 March 2023 and the first completed prototype was unveiled in Ankara in December 2022, but the devastating earthquake that struck Turkey and Syria on 6 February has inevitably delayed the programme.

However, on 18 March 2023 the SSB posted a video of the Hürjet conducting taxi trials at Turkish Aerospace’s facility 20 km northwest of Ankara. Then, on 25 April,

Credit: TAI



The Hürjet – a supersonic, tandem-seat advanced jet trainer/light attack aircraft – is close to making its maiden flight.

Credit: SSB



A video of the Hürjet conducting taxi trials at Turkish Aerospace’s facility near Ankara was released by the SSB on 18 March 2023.

the first Hürjet prototype made its maiden flight, during which it was airborne for 26 minutes, reached a speed of 250 knots (463 km/h) and attained an attitude of 4,267 m (14,000 ft).

Currently powered by a General Electric F404 turbofan, the Hürjet is designed to have a maximum speed of Mach 1.4, a service ceiling of 13,716 m (45,000 ft), a climb rate of 11,887 m/minute (39,000 ft/minute), a range of 2,222 km and a payload capacity of 2,721 kg.

The Hürjet has already secured orders from the Turkish government for four Block 0 prototypes and 12 initial Block 1 AJT-configured aircraft as replacements for the Turkish Air Force's T-38 Talon AJTs.

Moving to the Next Level

TAI's most ambition plan – the development of the TF-X fifth-generation fighter, also known as the *Milli Muharip Uçak* (National Combat Aircraft) – began in December 2010 on the instruction of Turkey's Defense Industry Executive Committee, with the country's Defence Industries Undersecretariat (SSM), now known as the Defence Industry Agency (SSB), signing an agreement with TAI for TF-X concept work in 2011. A contract for design and development of the TF-X was signed between the SSM and TAI on 5 August 2016. Around this time the UK's BAE Systems and Rolls-Royce came on board to provide assistance to the programme, with a BAE Systems spokesperson confirming to ESD on 18 April, "We continue to support Turkey's future combat aircraft capability requirements through the TF-X programme."

The initial TF-X prototypes are powered by a pair of US General Electric F110-GE-129 turbofans, but on 2 July 2022 the SSB issued an invitation to tender for the development of a domestic powerplant for the TF-X.

The TF-X made something of a debut on the world stage when a mock-up of the aircraft was displayed at the 2019 Paris Air Show, but actual production of the first TF-X prototype was initiated in November 2021.

With Turkey's ejection from the F-35 programme and the onset of the Turkish centenary year providing a true impetus for TF-X progress, Temel Kotil, CEO of Turkish Aerospace, stated in a 9 January 2023 interview with CNN Turk that he was optimistic the TF-X could make its maiden flight about two years ahead of schedule. "We were planning to make the first flight of the National Combat Aircraft in 2025," he said, "but my teammates were surprised. We took the flight forward."



Foto: SSB

Photos of the first TF-X prototype conducting taxi trials at Turkish Aerospace's facility outside Ankara were posted on the SSB website on 17 March 2023.



Credit: TAI

Turkish Aerospace is using its experience in building the T129 ATAK to develop a heavier attack helicopter.

Despite the 6 February earthquake, the SSB posted a series of photos on its website on 17 March showing the first TF-X prototype on the runway at Turkish Aerospace's facility near Ankara, where construction of the aircraft is taking place. It seems most likely that the aircraft will take to the skies by the end of the year.

As one of just a handful of fifth-generation fighters in production, the TF-X is very much the jewel in the crown of Turkey's military aerospace endeavours. The aircraft is designed to have a maximum speed of Mach 1.8, a service ceiling of 16,764 m (55,000 ft), and g limits of +9g to -3.5g. It is expected to serve with the Turkish Air Force, replacing its ageing fleet of F-16s, until the 2070s. At a public roll-out ceremony on 1 May 2023, the TF-X was officially named the 'Kaan', meaning 'Ruler', or 'King of Kings' in Turkish.

Rotary-wing Developments

Beyond Turkish Aerospace's fixed-wing developments, the company is also active in the helicopter market. This formally

began in June 2008 when TAI signed an agreement with Italian/UK helicopter manufacturer AgustaWestland to develop the T129 ATAK: a multi-role attack helicopter based on the Agusta A129 Mangusta but assembled in Turkey by TAI incorporating indigenous components and with the Turkish company retaining full marketing and intellectual property rights for the aircraft.

The first T129 took its maiden flight in Italy on 28 September 2009, although this prototype suffered a tail rotor failure on 19 March 2010 and crash landed. Nevertheless, a successful maiden flight of the first Turkish-built T129 was announced on 17 August 2011.

Despite some weight/balance issues in testing, the first serial production T129 was formally delivered by TAI to the Turkish Land Forces on 22 April 2014 and in May 2014 the Turkish Land Forces formally accepted the first nine T129As into service (subsequent deliveries would be for more developed B variants, with the A models ultimately upgraded to this standard).



More than 30 variants of the Anka UAV are currently in service with the Turkish armed forces and security services.

By July 2018 TAI had received 116 firm orders for T129s: 59 for the Turkish Land Forces (with a requirement for 'more than 90'), 27 for the Turkish Interior Ministry (18 for the Turkish Gendarmerie and nine for the police), plus 30 export orders from Pakistan, although this latter order fell into abeyance when the US government refused to issue an export licence for the T129's LHTEC T800-4A powerplants. However, the Philippine Air Force ordered six T129Bs in July 2020 and Nigeria also ordered six in October 2021.

Following on from the T129 ATAK programme, Turkish Aerospace received a contract from the SSB in February 2020 to produce a heavier version of the T129. Under a contract signed with Motor Sich in June 2021 the T929 ATAK 2 was slated to be powered by Ukrainian TV3-117 turboshafts, leaving the programme liable to be adversely affected by Russia's February 2022 invasion of Ukraine. However, in March 2023 it was announced that the first two TV3-117 powerplants had been delivered to Turkish Aerospace (their original delivery date, delayed by the war in Ukraine, was September 2022). Motor Sich is under contract to supply an initial 14 TV3-117 powerplants for the T929 programme.

Prior to the Russian invasion of Ukraine Turkish Aerospace had stated that the T929 ATAK 2 would make its maiden flight in 2023.

Meanwhile, a programme to produce a Turkish twin-engine light utility helicopter, the T625 Gökbey, was launched in 2010, with TAI receiving an initial contract from the SSM on 26 June 2013. Construction of a prototype had begun by July 2016, with the first prototype taking flight on 6 September 2018. The T625 is currently powered by two US LHTEC CTS800-4AT turboshafts while Turkey's TUSAS Engine Industries continues to develop the indigenous TEI TS1400 powerplant, with the fourth prototype making its maiden flight in May 2022. The intention for the T625 is that it will replace the Turkish Land Forces' Bell UH-1H Iroquois fleet.

UAVs

Turkish Aerospace also produces the Anka family of medium-altitude long-endurance (MALE) unmanned aerial vehicles (UAVs). The original single-engined Anka, which has a wingspan of 17.5 m and first flew on 30 December 2010, was envisioned for surveillance and reconnaissance missions, but has evolved in complexity and been built in a number of variants. In July 2012 it was announced that TAI had started to develop an armed UAV called the Anka +A that would carry Roketsan Cirit missiles, while on 30 January 2015 came the first flight of the Anka-B: an improved version of the original Anka +A, carrying a synthetic aperture radar/ground moving-target indicator (SAR/GMTI) payload in addition to the UAV's optoelectronic day and infrared sensors. The Anka-S then added satellite communications to the platform, with the SSM ordering 10 of these in October 2013. The Anka-S completed its first live fire trials, using Roketsan MAM-L lightweight 'smart micro munitions', in August 2018. TAI then developed the Anka-I as an electronic intelligence and communications intelligence platform for the Turkish National Intelligence Organisation.

A departure from the original Anka design is the Anka-2, also known as the Aksungur, which is a twin-engine, twin-boom UAV with a wingspan of 24 m. This has a heavier payload capacity of 750 kg and an endurance of 50 hours (or 12 hours with a 750 kg payload) compared to 30 hours of endurance and a 350 kg payload for the single-engined Ankas. Lastly, in December 2022 it was announced that a jet-powered Anka, to be known as the Anka-3, would be developed.

In all, more than 30 Anka-B, -I and -S UAVs are currently in service with the Turkish armed forces and security services, while Ankas have also been sold to Algeria, Chad, Indonesia, Kazakhstan (where a licensed-production deal is in place), Kyrgyzstan, Malaysia and Tunisia.

However, it is the UAV platforms of another Turkish company – Istanbul-based Baykar – that have had the greatest impact on the world stage. Founded in 1984 as a supplier of precision machining services, Baykar did not start producing UAVs until 2000. Initially producing mini fixed- and rotary-wing UAVs, in 2007 Baykar started to focus its attention on developing tactical UAVs under a programme initiated by the SSM. Baykar initially produced a handful of Bayraktar TB1 tactical UAVs under this work, the first of which flew in 2011, although these aircraft were not delivered but used instead as prototypes for what would become one of the world's most famous UAVs: the Bayraktar TB2.

Designed as an armed MALE UAV, the Bayraktar TB2 has a blended wing body with an inverted V-tail structure, a wingspan of 12 m and is powered by a propeller mounted between its tail booms. The type made its first flight in August 2014 and had conducted firing trials with Roketsan MAM-L munitions and TÜBİTAK Bozok laser-guided bombs by the end of 2015.



The Baykar Bayraktar TB2 must surely be the only UAV to have a song penned in its honour.



Credit: Baykar

As well as operating in an ISR and ground attack role, the Akinci UAV is claimed by Baykar as being able to perform air-to-air combat missions.

According to Baykar, the TB2, which is powered by a 105 hp internal combustion engine, has a maximum speed of 120 knots (222 km/h), a payload capacity of 150 kg, an endurance of 27 hours, and a maximum operational altitude of 7,620 m (25,000 ft). While its ISR payload can be switchable between an optoelectronic day and infrared sensor with laser designator or a multi-purpose active electronically scanned-array radar, its ability to carry weapons (typically Roketsan MAM-L and MAM-C laser-guided bombs) means that it can attack hostile targets directly.

While the Bayraktar TB2 is arguably not so remarkable as a tactical UAV design in and of itself, it is the type's operational history that has garnered worldwide attention. Significantly cheaper than its rival platforms (the cost of a single TB2 has been estimated at USD 5 M, which is around a sixth of the cost of a US-built GA-ASI Reaper UAV), the TB2 has been sold to countries that could not have otherwise afforded an armed UAV capability – or would not have been sold one in the first place. The integration of Turkish munitions on the TB2 also makes it something of a 'turnkey' solution, since its users do not have to go beyond Turkey for support or munitions.

The TB2 was first used in anger by the Turkish armed forces to attack Kurdistan Workers Party (PKK) and People's Protection Units (YPG) militants in Iraq and Syria. Then, in June 2019, it was reported that units of the Libyan Government of National Accord (GNA) had used TB2s to attack an airbase held by the rival Libyan National Army (LNA), although around two dozen GNA-operated TB2s were subsequently destroyed by the LNA during the fighting in Libya.

From 2020 to 2022 TB2s were more successfully used by Turkish forces to attack Syrian Army targets in a number of operations, but it was the operation of TB2s sold to Azerbaijan in the 2020 conflict in Nagorno-Karabakh that cemented the type's reputation as an effective platform, with dozens of Armenian armoured vehicles, artillery pieces and infantry units successfully targeted for the loss of a couple of TB2s. Meanwhile, by the time of Russia's invasion of Ukraine on 24 February 2022 the Ukrainian armed forces had acquired around 20 TB2s, which they had begun to use against separatist forces in eastern Ukraine, and acquired more following the Russian invasion. As the Russians failed to gain air superiority, the Ukrainian TB2s were allowed to take a

Hosted by

Ministry of Defence
of the Republic of Indonesia

INDO DEFENCE 2024 EXPO & FORUM

THE 10th INDONESIA'S OFFICIAL TRI-SERVICE DEFENCE, AEROSPACE, MARITIME, AND SECURITY EVENT

6 - 9 NOVEMBER 2024



JIEXPO KEMAYORAN | **MAIN EVENT**

HALIM PERDANA KUSUMA AIR FORCE BASE | **AIRCRAFT DISPLAY**

PONDOK DAYUNG DOCK | **NAVAL SHIP DISPLAY**

JAKARTA, INDONESIA



INCORPORATING WITH

**INDO
AEROSPACE
2024 EXPO & FORUM**

**INDOMARINE
2024 EXPO & FORUM**



Indo Defence Expo & Forum



@IndoDefence



@Indo_defence



CONTACT US
LIMITED SPACE AVAILABLE
BOOK YOUR STAND TODAY!

www.indodefence.com

ORGANISED BY

Shaping The Way!

Napindo

significant toll in the first few weeks. Such was the perception that these TB2s had slowed the Russian advance, with a consequent uplifting morale effect on the Ukrainian military and population as a whole, that the TB2 became surely the first ever UAV to have a song, 'Bayraktar', recorded in its honour.

After the first few weeks however, the Russian air defences became more effective in targeting TB2s. As of mid-April 2023, the Oryx military blog, which tracks visually verifiable equipment losses in Ukraine, listed Ukraine as having lost 17 Bayraktar TB2s.

Nevertheless, the TB2's reputation had already been further burnished. Oryx currently publishes a detailed list of around 890 targets confirmed to have been destroyed by Bayraktar TB2s that have been operated in Syria, Libya, Iraq, Nagorno-Karabakh, Ukraine, Tajikistan and Burkina Faso.

Baykar's UAV developments have now passed beyond the TB2. On 6 December 2019 the company conducted the maiden flight of the Bayraktar Akinci, a twin-engined high-altitude long-endurance (HALE) armed UAV, with the type conducting its first firing trials on 22 April 2021. According to Baykar, the Akinci, which has a wingspan of 20 m and is powered by two 750 hp turboprops, has a maximum speed of 361 km/h (195 knots), an operational ceiling of 12,192 m (40,000 ft), an endurance of 24 hours and a payload capacity of 1,500 kg. With satellite communications, the Akinci can operate beyond line of sight, with Baykar stating that it "is capable of conducting missions that are performed with fighter jets". As well as ISR and ground attack missions, the Akinci is claimed by Baykar as being able to perform air-to-air combat missions, with Bozdogan within-visual range air-to-air missiles and Gokdogan beyond-visual-range air-to-air missiles



Credit: Baykar

Baykar Chairman and Chief Technology Officer Selçuk Bayraktar and staff on the deck of TCG Anadolu, standing next to a Bayraktar TB3 with a Kızılelma UAV behind.

among the several munitions that have been integrated onto the aircraft.

The Akinci entered service with Turkey in August 2021, with at least 15 of the type now operational, while the Pakistan Air Force is already operating the first of an initial seven Akincis ordered.

UAVs at sea: a new first

On 10 April 2023 Turkey commissioned its largest warship, the landing helicopter dock (LHD) TCG *Anadolu*, during a ceremony at the Sedef Shipyard in Istanbul. On the ship's flight deck for the ceremony, along with four helicopters, were two new Baykar UAVs: the Bayraktar TB3 armed UAV and the Bayraktar Kızılelma jet-powered UAV.

Attending the ceremony, President Erdoğan hailed TCG *Anadolu* as the world's first aircraft carrier to host an air wing consisting predominantly of UAVs. The ship, which will now become the Turkish flagship, is stated to have a deck capacity for 10 helicopters

plus 11 UAVs and a hangar capacity for 19 helicopters and 30 UAVs.

A naval version of the TB2, the Bayraktar TB3 has folding wings to allow a larger number of UAVs to be hosted on TCG *Anadolu*. TB3 was specifically designed to be capable of taking off from and landing on short-runway aircraft carriers following Turkey's ejection from the JSF programme, and given that TCG *Anadolu* was to have operated the F-35B short take-off/vertical landing version of the JSF. The TB3 is due to make its first flight very soon.

Development of the Bayraktar Kızılelma, meanwhile, was initiated in 2013, with the type making its maiden flight on 14 December 2022. Powered by a Ukrainian Ivchenko-Progress AI-25TLT turbofan, the first Kızılelmas are subsonic, while subsequent versions are expected to be supersonic, and will be powered by an Ivchenko-Progress AI-322F turbofan. The UAV is expected to carry an array of weapons in two internal stations and on six hardpoints under the wings.

However, operating Kızılelma UAVs from TCG *Anadolu* will certainly present a design challenge for the Turks. The 14.7 m-long UAV has reportedly been designed to make carrier landings using arrestor gear, but TCG *Anadolu*, which is based on the design of the Spanish LHD *Juan Carlos I*, was never designed to feature such a system.

Baykar has also developed the Bayraktar Vertical Landing Unmanned Aerial Vehicle (DIHA): a tactical UAV that takes off using electric motors and then transitions to a cruise flight mode using a combustion engine. With a wingspan of 5 m, a communications range of 150 km and an endurance of 12 hours, this first flew in August 2019. The UAV is primarily intended for ISR missions and is also expected to operate from TCG *Anadolu*.

Credit: Baykar



As well as operating in an ISR and ground attack role, the Akinci UAV is claimed by Baykar as being able to perform air-to-air combat missions.

Türkiye Pursues Export Ambitions with Modern Product Range

Kubilai Han

As a result of investment from the Turkish Defence Industry Agency (SSB; formerly Presidency of Defence Industries) to develop Turkish defence industrial capabilities, during the last decade, Türkiye's Defence Industry has transitioned from a license producer to a technology owner. Presently, Turkish Industry can now develop and produce modern products and subsystems that comply with NATO standards.

On 21 June 2023 Minister of Industry and Technology Mehmet Fatih Kacir stated that "Our high technology exports approached USD 7.5 Bn last year, we aim for this figure to reach at least USD 10 Bn in 2023." The Turkish defence industry now finds itself increasingly a part of the equation. Following a decade of investment in the Turkish defence industry, the SSB is now preparing to start reaping the fruits of its labour in 2023, when the 100th anniversary of the Republic will be celebrated. For 2023, the SSB has set an export target of USD 6 Bn. The export figures for the Turkish Defence Industry in May 2023, which were announced by the Turkish Exporters Assembly (TİM) in early June, seem to validate this anticipation.

According to the export data from May 2023, the Turkish Defence and Aerospace Industry achieved exports totalling USD 554.4 M. While there was increase of around 24% compared to the previous month's exports valued at USD 418.1 M and a 68.8% increase compared May 2022 (USD 330.4 M), the total export value for the first five months of the year has reached a new high of USD 2.04 Bn, marking a 22.5% increase compared to the same period in the record-breaking year of 2022 (USD 1.67 Bn). Meanwhile, the average price of Turkish defence export products has reached USD 56.57 per kg during the first five months of 2023, compared to USD 55.9 in 2022 and USD 48.4 in 2021.

Unmanned aerial vehicles (UAVs) in particular make up have a significant share of total defence exports. In 2021, UAV export revenue exceeded USD 750 M and in 2002

Credit: TUSAS



In terms of appearance and concept, Anka-III bears a resemblance to the Dassault nEUROn concept.

it reached USD 1.02 Bn. As of June 2023, Baykar Technology has exported the Bayraktar TB2 UAV to 30 countries (including NATO members Albania, Poland, and Romania). Following the signing of a contract valued at USD 370 M in June 2023 for 18 Bayraktar TB2s, 1,800 Smart Munitions and three Ground Control Stations, Kuwait has become the latest customer. Baykar has also exported their heavier Akıncı UAV to six countries. Elsewhere, TUSAS has exported Anka to six countries, Aksungur to two countries and Lentatek has exported Karayel-SU to one country so far.

With these recent sales, Türkiye has become one of the world's leading players in the field of UAVs. International demand for Turkish UAVs soared after they took active part in TAF operations and conflicts in Syria and Libya, as well as their use in the 2020 Nagorno-Karabakh War and the ongoing War in Ukraine. Moreover, UAVs sales have also helped Türkiye to improve its political ties with Turkic states such as Kazakhstan,

Kyrgyzstan, Turkmenistan, and Azerbaijan, and even establish new ties with various other countries such as Angola, Burkina Faso, Chad, Nigeria, Poland, Tunisia, and the UAE.

UAV Development Continues

Since its debut at TUSAS facilities in Kahramankazan, Ankara on May 1, 2023, the jet powered Anka-III, as the TUSAS' flagship UAV has been receiving attention. The UAV has a length of around 9.5 m, a wingspan of around 12.5 m, a height of 2.8 m, an empty weight of 3,500 kg and maximum take-off weight (MTOW) of 6,500 kg. In terms of appearance and concept, it bears a resemblance to the Dassault nEUROn UAV, which Türkiye was interested in in the early 2000s. According to open sources the nEUROn has a total length of 9.44 m, height of 3 m, wingspan of 12.4 m, an empty weight of 4,900 kg and an MTOW of 7,000 kg.

Author

Kubilai Han, is a freelance specialist on regional defence matters based in Istanbul, Turkey.



Using a stealthy flying wing design, the Anka-III is a high-altitude, long-range and high-speed UAV, long-range reconnaissance and strike missions in hostile environments

As a low-observable, flying wing design UAV powered by AI-322 series turbofan engine, the Anka-III is a high-altitude, long-range and high-speed UAV capable of conducting long-range reconnaissance and strike missions in hostile environments. Anka-III is able to carry a total payload of 1,200 kg split between two internal weapon bays (IWBs), and five external hardpoints (two on each wing and one underbelly). Each IWB and outer wing hardpoint can carry 650 kg, while the outer wing hardpoints can carry 100 kg. The underbelly external hardpoint has a carrying capacity of 1,000 kg. The IWBs and inner underwing stations can carry Mk-82 and Mk-83 series general-purpose or guided munitions. Anka-III can carry SOM-J and Mk-84 smart or general-purpose munitions (up to 1,000 kg weight) on the underbelly weapon station. The IWBs can hold a total of 8 Tolun guided munitions (similar to the Small Diameter Bomb/SDB) or the Kuzgun guided munition family. Additionally, TUSAS' newly de-

veloped Super Simsek target drone, can be also carried on the inner underwing hardpoints.

During the series production phase, the Anka-III UAVs will be powered by the TF-6000 Turbofan Engine, which is currently under development by TEI using the company's own resources. TEI aims to start final assembly of the first TF-6000 prototype in 2023. With a dry thrust of 2,721 kgf (6,000 lb), TF-6000 will be the largest domestically-developed turbofan engine in Türkiye. TEI has designed the TF-6000 Turbofan Engine to be interchangeable with the AI-322 engine, using its own resources prior to the start of the Anka-III program. This design allows for replacement of the TF-6000 engine with the AI-322 engine on both Anka-III and Kizilelma UAVs without significant technical difficulties.

New USVs and Protection Systems

On the naval side, Turkish industry has presented various Unmanned Surface Vessels (USVs). A notable example is the RD09 Marlin, designed for anti-surface warfare.

The USV can transform from monohull to trimaran form with outrigger hulls (floats) attached to both sides of the hull. This enables increasing the payload capacity and integrating various weapons on top of the floats. The RD09 autonomous and swarming-capable USV, which has two counter-rotating propellers driven by two diesel engines. In terms of dimensions, it has a length of 14.75 m, a width of 3.85 m, a draft of 0.85 m, and weighs between 21-26 tonnes depending on the payload and configuration. RD09, is stated to be capable of conducting missions in sea state 4 and navigating in sea state 5. In terms of performance, it can stay at sea for up to 7 days, and has a cruising range of 700 NM (1296 km), with a cruising speed of 10 kn and a maximum speed of 36+ kn. Marlin has participated in the REPMUS (12-22 September 2022) and Dynamic Messenger (25-30 September 2022) exercises, both held off the coast of Portugal.

Further capabilities are in development, as shown in video imagery shared by the SSB on 28 March 2023, which showed Marlin launching a Kuzgun-KY (the KY suffix stands for 'Solid Propellant' in Turkish) surface-to-surface missile during a test. Kuzgun-KY is a low-cost, 100 kg class missile with a diameter of 180 mm, powered by a solid-propellant rocket motor which provides a top speed of Mach 1.5 and a range of 40 km. On 15 September 2022, the SSB disclosed that Marlin was the first USV in the world to be equipped with an Electronic Warfare, comprising an Aselsan ARES-2NC R-ES System and ASELSAN AR-EAS-2NC Compact R-EA System.

In order to counter the threat of missiles with optronic seeker heads, Meteksan Defence in cooperation with Altınay Defence Technologies developed the Nazar Laser Electronic Attack (L-EA) System. It was designed to meet Turkish Naval Forces (TNF) requirements under a contract awarded by the SSB on 4 April 2016. The system uses a laser in order to dazzle or blind incoming missiles with optronic seeker heads, thereby protecting the host platform. The critical design phase of the Nazar Project was successfully completed in July 2019.

As the first output of the Nazar Project, Gabya-LETS (Laser Electronic Attack System) was developed and mounted on the MK-92 STIR radar of the Gabya Class Frigate of the TCG Gokova (F-496), and entered service on 22 March 2021. It was the first such system to enter service with the TNF. Prime Contractor Meteksan Defence will also develop Land, Naval and Lite versions of the NAZAR Laser EA System and to deliver one prototype of each to the TNF for testing. However, the ultimate goal is to use numer-



A shot from the Kuzgun-KY launch from Marlin USV that took place in the Gulf of Saros in March 2023.

ous Nazar systems to protect both critical ground-based facilities and naval platforms. The production of the first land-based Nazar was completed in 2021 and following acceptance tests, the Nazar Land L-EA System was inducted into TNF service during late 2022. It is deployed at a TNF Naval Base to enhance existing air defence capabilities.

Considering the size of the system, Nazar Naval would only be suitable for large naval platforms. That is why from the design stage, it was planned to be used on TF-2000 Air Defence Warfare Destroyers. The Nazar Lite version is planned to be launched in around mid-2023 and be completed in 2024. Both Nazar Land and Nazar Naval turrets feature 11 optical windows and operate in 5 different wavelengths. The Lite version will operate in two or three different wavelengths (depending customer requirement) and will be lighter, so it can be installed on smaller surface platforms such as fast attack craft, corvettes, or frigates. Nazar has its own tracking capability thanks to an integrated LIDAR (Laser Imaging Detection and Ranging) detection and tracking system. Nazar can engage targets far beyond the effective range of close-in weapon systems (CIWSs) in TNF service,

out to approximately 10 km, making it more effective in some simultaneous salvo or swarm attack scenarios. After blinding the first threat, it can immediately move on to engaging the second.

Air-Based Radars

The Aselsan Murad is an Active Electronically Scanned Array (AESA) fire control radar. Building on Aselsan's 32-year legacy producing radars, it integrates within the F-16's current structural, power and cooling constraints without Group A aircraft modification. It was shown for the first time as a mock-up during the IDEF 2021 Exhibition. The radar consists of Transmit/Receive and Signal Processing Unit (GASIB), Converter Unit, and Antenna Sub-systems. It is planned to be used both on the manned (F-16C/D Block 30TMs, being modernized under the OZGUR Project) and unmanned (including Akinci, Kizilelma, and Ankara-III UAVs) fighter aircraft. The prototype model was debuted for at an event held at Aselsan's Ankara Golbasi campus on 10 November 2022, and integration studies for the radar on the Akinci UAV started in late-2022.

Credit: Kubilai Han



According to Aselsan, the Murad will be an ITAR-Free and COTS product.

HELD UNDER THE PATRONAGE OF HIS EXCELLENCY, PRESIDENT ABDEL FATTAH EL-SISI THE PRESIDENT OF THE ARAB REPUBLIC OF EGYPT, THE SUPREME COMMANDER OF THE EGYPTIAN ARMED FORCES



EGYPT'S LEADING TRI-SERVICE DEFENCE EXHIBITION

EGYPT INTERNATIONAL EXHIBITION CENTRE
4-7 DECEMBER 2023



@egyptdefenceexpo

/egyptdefenceexpo

@visitedex

www.egyptdefenceexpo.com

Headline Sponsor

Platinum Sponsor

Platinum Sponsor

Platinum Sponsor

Gold Sponsor

Supported by

Media Partner

Organised by



Murad will feature a total of 1,152 Gallium Nitride (GaN)-based Transmit/Receive modules, and aims to match or exceed the performance of the AN/APG-83 SABR on F-16V Block 70, and greatly exceed the AN/APG-68(V)9 Radar onboard the F-16C/Ds in the TurAF inventory in terms of target detection and tracking range performance. According to open sources, the Gallium Arsenide (GaAs)-based AN/APG-83 SABR AESA Radar has a maximum instrumented range of 296.3 km (or 370.4 km according to another source), is capable of detecting an aircraft at 120 km, obtain a track from 84 km, and is capable of tracking more than 20 targets simultaneously. The AN/APG-83 SABR has been reported to be capable of detecting a 1 m² radar cross section (RCS) target at a distance of 87 km (47 NM), while the APG-68(V)9 radar can detect a target with same RCS at 70 km (38 NM). Although there is no information about the number of T/R modules on SABR in open sources, there are 1,020 on its predecessor AN/APG-80 (F-16E/F).

Aselsan is also developing the AESA Fire Control Radar for the Kaan fifth-generation fighter, however this will use a different architecture called the 'integrated RF system' (abbreviated as BÜRFİS in Turkish). According to Aselsan's roadmap, BÜRFİS will be ready for tests in 2026.

Into Space

Elsewhere, TUBITAK Space developed Türkiye's first sub-metre high-resolution earth observation satellite to be designed and manufactured entirely by Turkish engineers (around 200 engineers took part in the Project). The Imece satellite was successfully launched into space with Space X's Falcon 9 rocket on 15 April 2023 from the

Credit: TUBITAK Space



Imece undergoes testing in an anechoic chamber.

Vandenberg Space Force Base in California, USA and placed in a sun-synchronous orbit at an altitude of 680 km. The TUSAS Space Systems Assembly Integration and Test (AIT/USET) Centre was used for satellite ground tests before IMECE was shipped to the USA.

Imece features an indigenously-developed electric propulsion system for in-orbit manoeuvring and station-keeping. In terms of capabilities, it is able to collect black-and-white images at a 99 cm resolution and full-colour images at a 3.5 m resolution. Measuring 12 m long by 3.1 m wide and weighing about 700 kg, Imece can capture an area 1,000 kilometres in length and 16.73 kilometres in width in a single shot and has a high-speed data communication system allowing it to download the captured images to the ground station at a gross data rate of 320 megabytes per second.

The satellite features a 100% local content in terms of engineering (design and manufacturing) and over 60% in hard-

ware. TUBITAK Space carried out the design, analysis, manufacturing, and testing of Imece and 35 subsystems, including the high-resolution optronic camera, the Hall-effect thrusters, sun detector, star trackers, reaction wheel, global positioning system (GPS) receiver, magnetometer, X-band and S-band communication equipment and antennas, power regulation and distribution equipment, onboard flight computer, flight software, compression and formatting unit, payload data storage, ground station antenna and ground station software. Türkiye has thus evolved into a country capable of designing and manufacturing all subsystems for high-resolution earth observation satellites and ground stations from the ground up.

The Imece satellite can be controlled from a TurAF ground station in Ahlatlibel, Ankara and by TUBITAK Space's ground station. On 27 June 2023 TUBITAK shared the first high-resolution image captured by the Imece on social media. The satellite is due to enter service with the TurAF following the completion of orbital tests.

According to TUBITAK's 2022 Annual Report, within the scope of the contract signed between TUBITAK Space and Pakistan's SUPARCO on 26 January 2022 under the IQBAL project, a High-Resolution Satellite Camera with a resolution of ≤50 cm and Image Processing Software will be developed with the participation of SUPARCO personnel. In April 2023 TUBITAK President Prof. Dr. Hasan Mandal disclosed that TUBITAK will supply high-resolution optronic satellite cameras to a friendly country and added, "We are producing 2 Imece cameras for a friendly and allied country [understood to be referring to Pakistan]. Again, we participated in the tender to produce a satellite for a friendly country. The preliminary stages are over, we are shortlisted."

Credit: Meteksan Defence



The Nazar Land L-EA System was inducted into the TNF service during late-2022.

AD: 21 August • **CD:** 22 August • **PD:** 1 September

Contents include:

- 3rd-Generation Submarine Developments
- Airborne ASW
- AJAX
- Annual Future Soldier Programmes Update
- APACHE AH-64E: CSP Status Report
- Battlefield ad hoc and Persistent Surveillance
- CBRN: Protection, Decontamination and Returning into Service
- CIWS: Challenges, Updates and Options
- Complex Weapons: UK Thinking
- Coordinating Naval Programmes in Europe
- Equipping a Mobile Command Post
- US GMD: Alliance Implications
- Ground-based Observation Systems
- MFP Update
- NATO's Future Helicopter Programme
- Next-Generation ISTAR for the UK
- Nuclear Options
- OPVs
- Post-BREXIT Defence Partnerships
- Project RENOWN SITREP
- PROTECTOR: Deep and Persistent Armed ISTAR
- SERPENS Programme Update
- SKY SABRE: Assessing the UK's GBAD baby
- SKYNET Update: The Terminator gets closer
- Sniper 1: Weapons and Ammunition
- Tactical Secure Communications
- TEMPEST Update
- The "Special Relationship": America in the UK
- Type 26 Global Combat Ship Programme Report
- Type 31 Sitrep
- VTOL / Tiltrotor Developments

FOCUS:



BONUS DISTRIBUTION

- MSPO, Kielce, Poland (5-8 September)
- DSEI, London, UK (12-15 September)

Programme Subject to Modification

ESD Online: www.euro-sd.com - International News, Reports, Analysis and Comments



A meaningful and constantly updated complement to the expert articles published in print with news from:

- politics, the armed forces, government organisations, industry, associations and scientific institutions.

Supported by a global network of correspondents.

KNOCKS HARMFUL AIR TARGETS OUT

ASELSAN AIR DEFENCE SYSTEMS



HİSAR

AIR DEFENCE MISSILE SYSTEM



GÖKDENİZ

CLOSE-IN WEAPON SYSTEM (CIWS)



KORKUT

AIR DEFENCE GUN SYSTEM



www.aselsan.com

aselsan

TECHNOLOGY SERVING PEOPLE & PLANET