

EUROFIGHTER

PROGRAMME NEWS & FEATURES
NOVEMBER 2019

WORLD



INTERNATIONAL
FIGHTER 

INTERNATIONAL FIGHTER CONFERENCE 2019
12-14 November, 2019, Berlin, Germany

Exclusive: Full story on
Electronic Warfare SPEAR-EW

Revealed: Eurofighter's
Digital Stealth Capability



CENTURION
AND BEYOND:
**HOW THE BEST
GETS BETTER**

 Eurofighter
Typhoon



Cover: Eurofighter Typhoon IPA6 with Centurion Fit at BAE Systems, Warton

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Am Söldnermoos 17, 85399 Hallbergmoos
Tel: +49 (0) 811-80 1587
communications@eurofighter.com

Editorial Team
Tony Garner
Adam Morrison

Contributors
Airbus Defence and Space
BAE Systems
LEONARDO
Viva PR

Photography
Eurofighter Jagdflugzeug GmbH
Eurofighter Partner Companies

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EDITORIAL

WELCOME

Welcome to this special edition of Eurofighter World, timed to coincide with this year's International Fighter Conference.

There are a couple of very clear themes in this issue. The first looks at how Eurofighter Typhoon is equipped to take the fight to adversaries in the information and digital warfare age, thanks to advances in electronic warfare, digital stealth and mission data. There's also a feature on SPEAR-EW — a new electronic warfare version of the SPEAR weapon system.

The second strand concerns the delivery and operation of what has been dubbed Project Centurion, which transfers capability for the RAF from Tornado to Eurofighter. This programme introduced three major new weapons onto the Eurofighter Typhoon — Meteor, Brimstone and Storm Shadow. It was delivered to the UK Royal Air Force ahead of schedule and has since been used in operations. We speak to pilots, test pilots and the people in the Eurofighter industrial consortium who helped make it happen, to find out how it was done and, importantly, how the aircraft is performing.

For me, these two themes illustrate two things. First, they underscore Eurofighter's ability to meet national sovereignty needs, and secondly, they demonstrate how our industrial collaboration model works — by

bringing together some of the brightest minds on the continent to meet the challenges of working on one of the world's most high-tech products.

Eurofighter is constantly building on rich experience and our vision is to use our collective knowledge to evolve. In this edition we also look at the future of Eurofighter beyond Centurion. Earlier this year we announced that we had signed contracts worth €53.7 million to support a study into the long-term development of the Eurofighter Typhoon. We look at what this means in detail in terms of Electronic Warfare capability.

The Eurofighter programme continues to deliver a highly capable Air Combat solution, now and in the future for decades to come.

Enjoy the read.



Herman Claesen
Herman Claesen
CEO

Eurofighter Jagdflugzeug GmbH

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WINNING IN THE DIGITAL BATTLESPACE

The future battlespace environment will be highly contested and congested. **Mark Hewer**, Leonardo's Vice President Integrated Mission Solutions and experienced Typhoon pilot **Raffael Klaschka**, Head of Strategic Marketing at Eurofighter GmbH argue that Eurofighter's Electronic Warfare and mission data capability will ensure it plays a vital role countering the increasingly sophisticated threats.



'There's a real need to move away from one-dimensional generation labelling and talk about future capabilities'



Raffael Klaschka,
Head of Strategic Marketing
at Eurofighter GmbH

GROWING HOSTILITY

The threats we face are constantly evolving and become increasingly deadly. And, as we look into the future, they will achieve an even greater level of connectivity. We face challenges like adversary SAM sites being connected, providing a protective shield that means it's almost impossible to get to a high value target. Threats are also evolving in numbers terms or combat mass.

In short, it will be much harder to operate in this 'contested' environment. We need to stay ahead and to do so we need to be innovative and bring in new capability areas like digital stealth, to ensure we provide the capability our air forces need.

Today, our adversaries have the latest-generation fighters, unmanned air vehicles and complex ground-to-air threats. But by far the most significant change is that they are now networking.

Traditionally, we were able to fly against threats who didn't necessarily co-ordinate their actions effectively. Today we may see ground and air threats but won't necessarily know who is guiding the missile. Why? Well, because they are networked, they can effectively hand-off control of the missile.

In this new world, countering a particular threat will no longer be the most important thing. It's about countering the potential behaviour and the networking of the joint threats and bringing intelligent counter-measures against networked multiple threats. These highly proliferated, long-range surface-to-air missile systems have the ability to link with other systems. The question now isn't 'How do I counter that threat?', but 'How do I counter its network?'

TACKLING FUTURE THREATS

When you're up against a networked adversary you've got to consider how the network is behaving. You've got to have intelligence about the threat's behaviour and →

tactics. You've also got to have an Electronic Warfare (EW) system which is able to carry out threat linking and coordinate complex countermeasures.

It comes down to understanding the threat picture. That's about gathering information and analysing behaviour, before turning that data into intelligence and ultimately into mission data and effective countermeasures. That's the critical loop, gathering data, analysing it, understanding it, and then programming it into your highly adaptable, EW system so you can react effectively.

Here it's important to understand that, unlike other aircraft, Eurofighter is not black boxed. This is a critical factor in tackling these future threats and it's one that often gets overlooked. But the point is, you only get the effective use of your kit if you're able to fine tune it exactly to your specifications and requirements.

Of course, in this new digital environment you need to be able to adapt within hours. A threat's tactics and the way it's interacting with others needs to be seen and understood quickly. That means looking out

for different sets of behaviours, recording them, returning to ground and analysing them. With Eurofighter you can do all this and then update the mission data, giving forces sovereign capability.

It's hard to overstate how critical it is to get back in the air within hours with an up-to-date mission data set that's reflective of that new behaviour and those new tactics.

THE MOST ADVANCED OPERATIONAL EW CAPABILITY AVAILABLE

Eurofighter's operational capability is the most advanced because it combines incredibly effective tools, processes, data and technology together to actually create a very powerful up-to-date relevant mission data set. The key word is 'operational' because this isn't about technology and hardware alone, it's about the powerful combination of knowledge, process, people, data and technology.

But, importantly, it also benefits from having 1000s of combat hours from different operators and this knowledge is invaluable. This is what is being used to further en-

hance its EW capability. The speed at which the aircraft can be fine-tuned and adapted so that the mission data set is always the one that's required is unrivalled.

There are three elements that back up the claim that Eurofighter is the most advanced operational EW capability. First Eurofighter Typhoon doesn't stand still — there's continuous spiral development; second there's a powerful relationship between industry and end-users as part of that spiral and a continuous feedback loop. Here, we're benefitting from all the customers and their respective experiences. And finally, Typhoon's ability through the work that has been done by the different industry partners to truly join up the data, process, people and technology together.

WINNING THE ELECTRO-MAGNETIC BATTLE

We are now in an Information and Digital Warfare Age and to maintain a capability edge you need a platform that can manage information and data and stay up-to-date. EW is a key part of that. But it's not the only part. With the LTE programme there's a lot

of other things happening with Eurofighter, but EW plays a key part in staying relevant in that information digital warfare age.

In years gone by the range of a threat was simply not great enough to stop a fighter jet getting close enough to launch its missiles and achieve its mission. However, it has reached a point where our forces can no longer rely upon the range of their missiles alone. They have to get closer, but getting closer means getting within a potential missile engagement zone. To do that you have to win the electro-magnetic battle first and this is only won with effective EW systems.

In this new world EW is becoming more of an offensive capability. Without trying to jam, suppress or proactively confuse threats, you're not likely to get anywhere close to achieving your mission.

In fact, EW is starting to be seen as an extension of Eurofighter's offensive capabilities. This is evident in the SPEAR-EW programme, which integrates the SPEAR system with cutting edge miniaturised EW payload technology. This gives a Suppression of Enemy Air Defence (SEAD)

capability in addition to its current jamming capability. Eurofighter's EW capabilities are continuously enhanced to stay ahead of the threat, which is where BriteCloud comes in. BriteCloud gives another layer of protection and jamming capability.

In the future if you're not able to cope with the demands of this digital arena, then you are out. That's why EW capability will be so critical in terms of keeping you relevant in the future battlespace.

FUTURE BATTLESPACE THINKING

The critical thing about the future battlespace is that it's no longer about single threat engagements, it's a joint battlespace with joint threat environment engagements. Here, the ability to coordinate the data, understand it, share it and make sure the picture is accurate so that you can update the requisite mission data on each relevant platform speedily is probably the greatest challenge.

Systems are being developed that exploit greater parts of the EM spectrum. Other advances will include programming the system's ability to learn by employing

machine learning techniques and artificial intelligence to understand data. Then there are techniques to ensure data is shared quickly across systems and platforms.

One key area being looked at is trying to make sure mission data is turned around even quicker than it is. We already have examples of it being done in hours. However, as the threat data and recording capability of aircraft grows, the information is measured in terabytes so we need to reduce the burden on people to update mission data.

This is leading to work on new ways to improve the analysis of data. This includes improving the ability for mission data to identify and self-learn if a threat has changed its behaviour and recognise that it needs to update itself.

Automating data analysis and mission data programming, using machine learning, is a really important challenge. This forms part of the Long Term Evolution of Eurofighter. It's also about allowing an asset like Eurofighter to share its situational awareness picture with other aircraft. Sharing intelligence — like threat identification and location — will build multi-platform mission data.

Of course, speed is of the essence. Adversaries are going to be far less bothered about verifying new techniques and gaining iterative confidence. Instead, they will try things out to disrupt our thinking, disrupt our tactics, and disrupt our countermeasures.

Therefore, we can't go through a very slow process of trying to build confidence, we need the ability to stay up to date. That's where the close working relationship between industry and end-user nations comes in. We're looking at rapid capability insertion because we recognise we have to continue to develop faster processes to ensure we stay ahead of the game.



'The generation idea fails to take account of today's complex world of air war'

STEALTH MASTER



The Eurofighter Typhoon has one of the world's most advanced **Electronic Warfare (EW)** systems.

Here we talk to Mark Hewer, Leonardo's Vice President Integrated Mission Solutions, about how the Eurofighter Typhoon's EW system allows the aircraft to operate stealthily, evading threats and preventing engagement.

HOW DOES DIGITAL STEALTH WORK?

There are two main elements to being able to act stealthily: being aware of your environment and being hard to observe. The Eurofighter EW suite covers both. Firstly, the system provides full awareness of surrounding threats so the pilot knows where they are and what modes they're using. This picture is enhanced further by pulling in data from other operators in the theatre, networking via the Eurofighter EW system.

With an up-to-the-moment, accurate and comprehensive picture of the environment, a Eurofighter pilot can make sure they don't even come within range of potentially-dangerous radar.

However, staying away from threats isn't always possible, so the second core element of stealth is to make yourself hard to see. Here, the Eurofighter EW suite employs a range of electronic countermeasures that allows the aircraft to digitally hide its signature, becoming invisible to radar, or to digitally create a complex and confusing picture (noise) for a threat operator, denying them a clean targeting opportunity and preventing them from launching a missile in the first place.

DIGITAL MEANS ADAPTABLE

Importantly, the Eurofighter's advanced, reprogrammable EW suite allows the aircraft to react to a constantly-changing threat environment in ways that physical stealth cannot.

Consider today's threats. The latest surface-to-air missile systems are having their hardware regularly upgraded, are being networked, and can change their behaviour almost instantaneously via software-reprogramming. In short, they are constantly evolving, creating a dynamic and challenging threat environment. This means that the advantage of aircraft which use

traditional physical stealth technology, which is designed to make the aircraft hard-to-observe by threat radar systems, is eroding. Counter-stealth techniques are on the rise and have been successfully employed as far back as 1993.

This vulnerability against high-end threats with counter-stealth techniques is difficult to address because the basic elements of physical stealth (an aircraft's skin & surface treatments, internal structure, and configuration) cannot easily be changed. However, in contrast, the Eurofighter's EW systems, which are readily re-programmable, can evolve digitally to maintain the aircraft's combat advantage even as threats change around it.

The secret to this advantage is 'mission data', a term which sounds relatively benign but is critical to an aircraft's EW performance and often life-saving. Mission data is the threat intelligence that allows the Eurofighter's sensors to recognise a threat and use the appropriate electronic countermeasure or evasion technique to keep the Eurofighter safely out of harm's way. For some aircraft, mission data is controlled by foreign nations or platform manufacturers, meaning that updates can be months, even years apart.

With Eurofighter, which has an open, reprogrammable system which can be updated by the operator, a new threat which is reported as 'unknown' during today's mission can be programmed into the system in hours, meaning that the threat will be identified and dealt with during the very next mission.

Leonardo provide full training to sovereign nations in the programming of Eurofighter and development of tactics and countermeasures (optional) so they are able to capitalise on the equipment's capability rapidly and effectively.

I'M THE LUCKY ONE – I GET TO SEE THE SUN

As Chief Test Pilot for Airbus Defence and Space based in Manching, **Geri Krähenbühl** has one of the most fascinating jobs in the Eurofighter Consortium.

He's a man of vast experience, who has countless flying hours under his belt and is often the focal point at air shows and media events. But he insists his job is all about the team.



"The role of the test pilot has changed completely over the years, we've gone from a single man in the cockpit to a team of about 20 specialists," says Geri. "We are like a big machine with a lot of different cogs. I'm the lucky one because I get to see the sun more often."

"Everyone sees the data that is fed back from the aircraft in real time. The flight test engineer (FTE) is the direct link with me but

each member of the team has the right to call a stop to the flight at any time if they see something they are not happy with.

"It's much better than it used to be now there's real harmony and everybody has the same rights."

"The job title 'test pilot' is cool but what happens behind the scenes, nowadays, is completely different from the old Humphrey Bogart movies. To be honest, I wouldn't have liked to have flown in the Chuck Yeager era in the 50s and 60s because back then pilots were exposed to a lot more risks."

One thing hasn't changed, only the elite are selected as test pilots but one glance at Geri's CV underscores his credentials. To date he has flown 65 different aircraft, including over 1,000 flying hours in Eurofighter.

Born in Bern, Switzerland, in 1963, he's quite unusual for a pilot because he didn't have much interest in aeroplanes until the age of 15. Then a magazine article sparked what quickly turned into an obsession. Despite relatively small numbers of professional pilots in Switzerland, Geri was selected and earned his wings in 1985. An incredibly varied career — taking in a host of roles and aircraft — has followed.

He's well-respected not least by the media because he knows his stuff, he's honest and direct. He also possesses a rare ability to take the complex and make it accessible to different audiences, which is a key skill in his role. That's why he is often asked to be a spokesman on all things Eurofighter. He's also expected to be able to speak with clarity and honesty to the project teams back in industry.

He says: "One of the fascinating aspects of the job is that we are involved in the design and development phase. We are advisers to the designer and can give valuable inputs based on our experience."

"During the validation phase we are looking to see if the final product meets the design specifications. We also assess

whether it can do what it was designed for and finally, we are the Quality Assurance team too. In that sense we are the team's conscience and the customers' advocate.

"Occasionally that might mean we are a pain in the neck for the project management teams but we have our own professional pride and credibility to think about and they wouldn't have it any other way. When we're developing a new piece of software or integrating a weapon, we carry out a series of test flights and go step by step, building up from low performance flights to high performance."

Earlier this year, Eurofighter, EUROJET and NETMA, the NATO Eurofighter and Tornado Management Agency, signed contracts together worth €53.7 million to support the long-term development of the Eurofighter. The flight test teams from the different industry partners will play a crucial role in helping these developments progress. For Geri, it points to an exciting future for the aircraft. His team will be involved particularly for the HMI work in the cockpit and new weapon integration.

"We also have a role to play in the initial discussions because we have to be sure that what's planned is really flyable, whether it would it work in a war scenario, could it deploy weapons, or can it actuate the countermeasures? These are the things we can consider because of our air force background. We know how the platform is actually used in operations and how things function."

"We are at the early stage of LTE which means talking to the customer to find out what they'll need in the future. This is very important; we can't simply impose our ideas we have to listen to the customer's perspective on their future needs. Right now, there are a lot of simulations being carried out. But the potential is there because with the airframe, the engines, the delta wing we have the perfect platform. These are all the attributes for a perfect combat aircraft."



'BRITE' THINKING DELIVERS SPEAR EW

MBDA is working in partnership with Leonardo to develop a new electronic warfare version of the SPEAR weapon system – SPEAR EW – which brings enhanced Suppression of Enemy Air Defence (SEAD) capability to Eurofighter.

Chris Stevens, MBDA's Head of Air Domain Sales for the UK, reveals how this revolutionary new capability could be a game-changer for Eurofighter.

WHAT IS SPEAR EW?

SPEAR EW uses the SPEAR missile as its baseline but, instead of a warhead and seeker, the payload is an Electronic Warfare (EW) device which is a state-of-the-art electronic jammer designed to confuse adversaries and keep pilots safe.

At the heart of SPEAR EW is a miniaturised EW payload from Leonardo, based on the innovative BriteCloud technology. It uses less capacity than a conventional warhead and this extra volume means there's additional fuel capacity. Hence, what looks and

behaves exactly like a normal SPEAR has three times the range.

Using the existing SPEAR architecture as the starting point has a number of other advantages. SPEAR EW's power, weight, and centre of gravity remain exactly the same so integration is relatively straight-forward because activities that normally bring a level of complexity like flight test and separation clearance are already carried out.

WHAT DOES SPEAR EW PROVIDE?

It marks a fundamental change in the ability of friendly air forces to conduct their missions despite the presence of enemy air defences.

SPEAR EW acts as a stand-in jammer which greatly increases the survivability

of the Eurofighter by suppressing enemy air defences. It can be used for multiple different types of EW. At one end of the spectrum it could simply jam a radar, effectively blinding it, and at the other it could mimic 100s of different objects, therefore creating a mask.

This flexibility gives a pilot a range of options. Blinding a threat radar is an overt action but they can call on more subtle effects. For example, SPEAR EW can be used to create a decoy by making you appear bigger or appear as though there are 50 targets so that it's impossible for an adversary to determine which is the real target. Alternatively, you might want to encourage the threat target to start shooting which would enable your forces to find it. Another option could be to get the adversary to train

their fire at an imaginary target and therefore allow you through their defences.

SPEAR EW isn't simply restricted to land targets. It could be used for maritime strike to blind or confuse a ship.

WHAT DOES IT MEAN FOR EUROFIGHTER?

Electronic Warfare has many guises and Eurofighter already boasts strong capability, while future enhancements promise even greater offensive capability. However, dedicated EW attacks require huge amounts of power. There's also a limitation of how far a platform like Eurofighter can project these kinds of effects.

That's where SPEAR EW comes into its own. It means EW effects can be projected either over a long distance or for a long time, whilst allowing the pilot to retain the ability to use the aircraft's own sensors for effects.

Eurofighter already has the ability to carry a mixed payload depending on the mission, so for example, you could carry three SPEAR EWs and nine regular SPEAR missiles.

IS THERE ANYTHING ELSE LIKE IT?

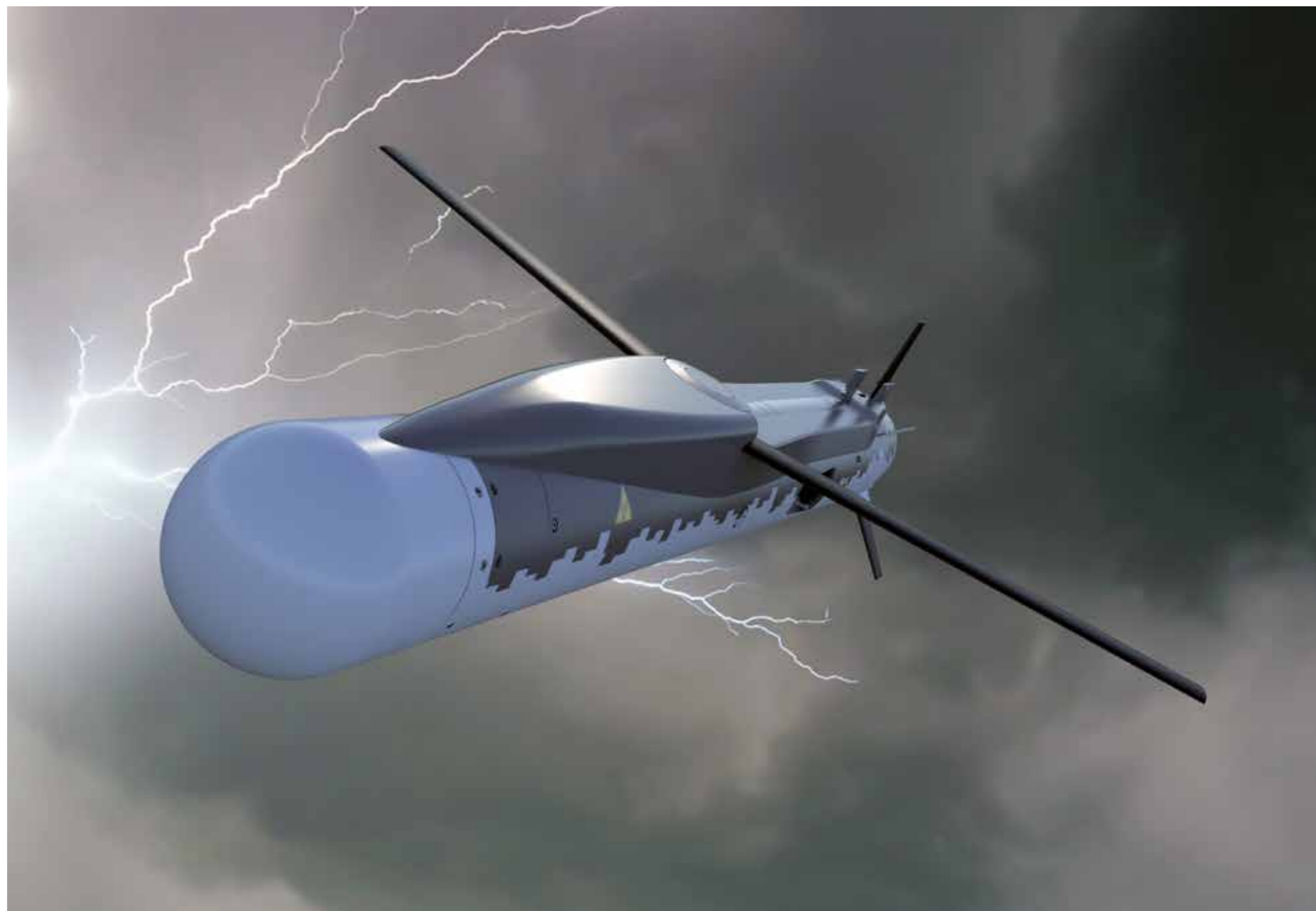
In a word, no. Compressed to a size that no-one else can match, Leonardo's BriteCloud leads the way in terms of miniaturised technology. BriteCloud combined with SPEAR provides an EW capability that's unrivalled.

WHAT IS THE CURRENT STATUS?

MBDA and Leonardo have been awarded a contract to carry out a Technical Demonstration Programme (TDP) by Defence Equipment & Support (DE&S). This one-year contract continues the development work already carried out by MBDA and Leonardo. This will enable that work to mature. One of the aims is to keep development of SPEAR EW as closely aligned with the main SPEAR programme as possible to ensure any integration work is as seamless as possible.

HOW DOES SPEAR EW FIT INTO THE SPEAR FAMILY?

MBDA's vision for SPEAR is to create a swarm of network-enabled miniature cruise missile weapons able to saturate and neutralise the most sophisticated air defences. Adding SPEAR-EW alongside complementary variants of the SPEAR family will add significant capability and force multiplication without the need to repeat the platform integration. There is a roadmap of variants, spirals and technology insertions in the pipeline to further enhance the family.



SPEAR-EW

Being developed by MBDA in partnership with Leonardo to deliver a cutting-edge electronic warfare (EW) weapon.

The core of **SPEAR-EW's** payload is Leonardo's advanced, miniaturised **Digital Radio Frequency Memory (DRFM)** technology, which offers the most advanced and future-proof electronic jamming and deception available on the market today.

False target decoying and obscurity jamming capability to increase the survivability of aircraft and suppress enemy air defences, acting as a significant force multiplier.

Turbojet propulsion provides long range and high subsonic speed.

Long endurance enables launching at enhanced standoff ranges and extended loitering time on mission.

Network enabled, providing operational flexibility.

Part of **SPEAR** weapon system family enabling a single integration pathway and launcher solution.



LONG TERM EVOLUTION PROGRAMME LAUNCHED

Eurofighter Jagdflugzeug GmbH, EUROJET Turbo GmbH and NETMA, the NATO Eurofighter & Tornado Management Agency, have signed contracts together worth €53.7 million to support the long-term development of the Eurofighter Typhoon combat aircraft.

The study contracts, which look at the Long Term Evolution (LTE) of the aircraft and the EJ200 engine, will span a total of 19 months for the aircraft and 9 months for the engine elements.

These contracts represent a significant step in shaping the future of Eurofighter and will ensure it continues to be one of the most important assets in the future operating environment

Herman Claesen, CEO of Eurofighter, says: "These contracts represent a significant step in shaping the future of Eurofighter and will ensure it continues to be one of the most important assets in the future operating environment."

The LTE study contracts will underpin the future of Eurofighter by identifying a suite of technology enhancements for the Weapons System infrastructure and the engine that will

ensure the aircraft remains operationally effective and can continue to spearhead the Partner Nations' air forces for the decades to come.

NETMA General Manager, General Salvestrini, said: "We are delighted to begin a new chapter in the development of the Eurofighter Typhoon. The LTE study contracts will set out a clear road map for the future of the platform that will make it relevant and resilient for decades to come."

The high technology areas being explored include:

Mission System Architecture: The Eurofighter Typhoon already has one of the world's most advanced Electronic Warfare systems. The LTE study will reinforce this by supporting the generation, transmission and utilisation of ever-increasing amounts of digital data both onboard (via advanced multi-spectral sensors) and offboard (via

high performance tactical datalinks), whilst remaining resilient to new and emerging threats, including cyber. This will maintain Eurofighter's ability to operate in the highly contested and congested future operating environment.

The Praetorian Defensive Aids Sub System (DASS): Looking at potential future DASS requirements out to 2050, enabling Typhoon to cope faster, easier and more affordably with new requirements to counter threats as they arise in the future.

The Human-Machine Interface: Refreshed cockpit displays and controls which will enable more demanding missions in the future, whilst ensuring full interoperability with cooperating assets in the air and over land and sea.

Operational Flexibility: Applying new adaptive power and cooling techniques and facilitating the agile integration of advanced weapons, thereby enabling more flexible store configurations to be flown.

Engine Performance: In terms of the EJ200 engine, the focus is on four key areas: thrust growth; range and persistence with increased parts life; survivability as well as control system enhancements.

Clemens Linden, CEO of EUROJET, said: "Together with further life extension measures and the development of a future maintenance strategy based on in-service experience, the LTE contracts are the first step towards ensuring that Eurofighter's combat strength can be maintained and fully exploited throughout the first half of the 21st century."

ENGINE PERFORMANCE

In terms of the EJ200 engine, the focus is on four key areas: thrust growth; range and persistence with increased parts life; survivability as well as control system enhancements.

THE HUMAN MACHINE INTERFACE

Refreshed cockpit displays and controls which will enable more demanding missions in the future, whilst ensuring full interoperability with cooperating assets in the air and over land and sea.

ELECTRONIC WARFARE

Mission System development will maintain Eurofighter's leading-edge capability by ensuring it has the Electronic Warfare capability that will be required in the highly contested and congested future operating environment.

MISSION SYSTEM ARCHITECTURE

This will support the generation, transmission and utilisation of ever increasing amounts of digital data, both on-board (via advanced multi-spectral sensors) and off-board (via high performance tactical datalinks), whilst remaining resilient to anticipated cyber threats.

OPERATIONAL FLEXIBILITY

Applying new adaptive power and cooling techniques and facilitating the agile integration of advanced weapons, thereby enabling more flexible store configurations to be flown.





SHADER CENTURIONS

The Royal Air Force is now flying Eurofighter operations over Iraq and Syria in full Project 'Centurion' standard.

Jamie Hunter reports from RAF Akrotiri on a textbook transition to assume the full range of missions.

Working six days straight in the heat of a Cyprus spring takes its toll on people and equipment alike. Fortunately, the two rows of protective shelters — known as RESs (Rapid Erect Shelters) — provide some respite from the glare of the Mediterranean sun's rays for the teams that keep the resident fighters poised and ready for action.

At RAF Akrotiri, on a small peninsula of British Sovereign territory on the southern tip of Cyprus, the Royal Air Force operates a pivotal element of its Operation Shader, the UK spearhead for missions to eliminate so-called Islamic State (IS, also known as Daesh) since August 2014.

Eurofighter Typhoons have operated here constantly since December 2015, with the RAF's front-line squadrons rotating to man the detachment for a four-month period. They initially operated alongside Tornado GR4s on this particular →



mission for just over three years, then the arrival in May of six F-35Bs from No 617 Squadron took the RAF's combat air interoperability to a new level.

WHOLE FORCE

RAF Typhoons initially flew missions here carrying four Paveway IV bombs, plus AIM-120 Advanced Medium-Range Air-to-Air Missiles (AMRAAMs) for self-protection, working in concert with the proven Tornado GR4s. However, as retirement loomed for the combat veteran Tornados, attention turned to the Typhoons assuming the full range of combat air roles for the diverse Shader requirement.

Enter Project Centurion, which essentially provided a suite of capabilities for the Typhoon under an ambitious programme run concurrently by the RAF and industry as a 'Whole Force' concept that included the partnership of BAE Systems and weapons manufacturer MBDA.

Centurion was broken down into two main elements: Phase 2 Enhancement (known as P2E), which added the Meteor

beyond-visual-range air-to-air missile and the Storm Shadow standoff cruise missile. It was then followed by P3E, which added the Brimstone 2 ground-attack missile.

The counter-IS mission has evolved significantly over the past five years, as the RAF continues to work closely with coalition partners. Gp Capt Jonny Moreton is the current 903 EAW commander at Akrotiri. He said: "From a mission perspective, we are now flying mainly overwatch in support of coalition forces in Syria and Iraq. We're still flying [six Typhoons] at the same rate, but it's not as kinetic now."

Typhoons have flown a range of roles in both air-to-air and air-to-ground to help ensure 24/7 air coverage of the theatre.

For the front-line squadrons, Operation Shader is a four-month rotation, involving up to nine Typhoon pilots, plus operations staff and around 70 engineers at any given time. The Typhoons essentially act as non-traditional intelligence, surveillance and reconnaissance (NTISR) platforms that can 'swing' into a kinetic role if required.

INTO COMBAT

Wg Cdr Jim Lee is Officer Commanding No II(Army Cooperation) Squadron and led the debut 'Centurion' Shader deployment. "The 'Centurion' rollout began for the frontline RAF squadrons at the start of 2018 with Meteor followed by Storm Shadow as part of P2E," he explained. "My squadron took on the Brimstone portion," which followed under P3E.

The squadron participated in Exercise Saif Sareea in Oman as part of their workup for the deployment but they were still flying P2E-standard jets and Paveway IV. "We returned home in November [2018] and focused on Brimstone and the P3E," said Lee. "We received a really good package in terms of the aircraft and procedures, which was good because we didn't have long to train with it." Lee was quick to praise the combination of industry and No 41 Test and Evaluation Squadron (TES), which worked in concert to deliver the capability as well as tactics to the front line.

"Brimstone is a laser-guided weapon, so you have to see the surface in order to

employ it," Lee continued. The challenging part of certain target sets – especially if they're moving – is using the Litening pod. You can practise the mechanics of the mission set in the simulator as that's more about the fingers and thumbs, making sure you can track the target with the pod. With Brimstone you support the weapon all the way to impact."

Clearly, porting Brimstone to the single-seat Typhoon needed a seamless human-machine interface to avoid overloading the pilot. In its previous integration on Tornado, the pilot would fly the aircraft while the weapon systems officer (WSO) executed the attack. "Our training was critical," said Wg Cdr Lee. "My biggest concern was making sure pilots could use Brimstone safely, repeatedly and that we wouldn't make any mistakes. Our delivery profiles are designed to maximise employment of the autopilot and the auto-throttle and we make use of that a lot more now because when the weapon is in the air you're staring at the pod imagery."

Wg Cdr Lee's detachment assumed responsibility for the Shader mission on February 1, but rather than bring its own aircraft, the unit inherited the in-theatre assets from No XI (Fighter) Squadron, upgraded at Akrotiri with the new [P3E] software standard. The day No II(AC) Squadron took over the detachment they were flying in the new Brimstone fit.

FIRST BRIMSTONE MISSIONS

The initial combat use of Brimstone from Typhoon came in February, when the RAF was called upon to attack a small boat that was being used by IS fighters to cross the Euphrates River. Wg Cdr Lee says: "The first Brimstone attack was by a junior pairs leader and he'd never fired a Brimstone before. It wasn't our QWI [Qualified Weapons Instructor], he flew the profile perfectly, which was a ringing endorsement of the training and the overall package that we received from No 41 TES and industry. We trust the system and it works."

On March 12, the Syrian Democratic Forces came into contact with IS forces

in dispersed positions, and two Typhoons conducted a series of three attacks. In addition, a large number of vehicles had been abandoned in the area of the fighting, and one large truck was identified as having been booby-trapped with an improvised explosive device (IED). The Typhoons engaged the truck-bomb and destroyed it with a single Brimstone 2. Flt Lt Philip, a junior pilot, conducted that Brimstone firing. "I completed my combat ready workup in around six months and went straight into the Brimstone upgrade." Referring to the specific engagement, he added: "A JTAC talked us onto the area. My flight leader only had Paveways, so it was down to me to prosecute the attack."

It was a ringing endorsement of both the effectiveness of the cockpit avionics and the integration of this new weapon that both initial firings – by relatively junior pilots – were conducted accurately and professionally. It came as a clear illustration of the end-to-end success of Project 'Centurion'.





THE NEXT STEPS BEYOND CENTURION

Luke Gili-Ross has lived and breathed Project Centurion over the last three years. When the project started he was serving on 41 Squadron, the Royal Air Force's Typhoon Test and Evaluation unit, but immediately following retirement Luke joined BAE Systems as the Typhoon Project Pilot. Following the successful delivery of the project, Luke talks us through the next steps on the journey.

RAPID UPDATES

From the standard that was delivered in January 2019, there are already a significant number of refinements on top of what the squadrons are currently operating in theatre. These incremental updates effect Paveway IV, Meteor, AMRAAM and Brimstone. It's a rapid change programme that's being delivered at an unprecedented rate.

Other updates are continually being made to the Human Machine Interface (HMI). For pilots the really big step change was when they moved from P1E standard to a P2E aircraft; but the change from P2E to the P3E feels smaller because we have already implemented significant changes to the HMI. These changes are being further developed and refined, in order to allow us to springboard to the next stage.

LITENING V:

A new standard of targeting pod — Litening V — is being integrated onto the aircraft which follows on from the current Litening III. It's being introduced to counter the increased threats that necessitate operating

at a greater standoff range to the target area and which require the best possible sensors.

Litening V is also useful for night operations when its technological superiority can be best leveraged. The better the sensors, the better the image quality and the easier it is for the pilot to operate effectively in the darkness.

The other evolutionary benefit of the new pod is processing power. As well as providing enhanced tracking of multiple moving ground targets, it can also be used for tracking multiple air tracks. This aspect is becoming more and more relevant as we move into a more congested, contested and low observable battlespace.

EXISTING WEAPON UPDATES:

Several weapons that have been on the aircraft for some time, like ASRAAM, are being updated to counter the proliferation of threats and the advancement of counter-measures available. This will make a real difference to the air forces.

SENSOR IMPROVEMENTS:

Over the next three to five years there will be big changes to all sensors. This will include E Scan, and PIRATE — the Passive Infrared and Tracking Equipment. The latter is a forward-looking infrared (FLIR) and infrared search and track (IRST) device, which allows pilots to work day or night. It's able to track multiple targets passively,

which is a key requirement for the future environment.

COCKPIT INFORMATION:

As sensors improve then so too does the information coming into the cockpit. The operational task for pilots, especially at night in an ambiguous environment, is a real challenge, and it's important that we make the aircraft as easy to operate as possible. We are constantly looking at how we can alleviate some of the pressures faced by pilots. For example, we can offload some of the tasks and improve the tracking performance through Litening V because the pilot would no longer have to manually manipulate the pod.

STRIKER II HELMET:

One of the key enablers to leveraging the new sensor and weapons capabilities is the Striker II helmet. RAF pilots are currently working with BAE Systems on its development. It fuses the head down colour imagery of the Human Machine Interface (HMI) and night camera capability, allowing the pilot to look out of the cockpit rather than down at screens — thus building their situational awareness.

CAPABILITY AND TRAINING:

There has been significant improvement over the last two years in the HMI. At the same time new design standards, allowing the aircraft operation to be more intuitive, have been introduced. Standardising everything in the cockpit should allow pilots to sit in the cockpit and operate it with relative ease and, as new capabilities are introduced, they will quickly appear familiar to the pilots.

ROBUSTNESS AND AVAILABILITY:

Forces need an aircraft that's always available and always works, day in, day out. They don't just want that level of availability in operations, they want it in front line training every day. Earlier this year the Eurofighter consortium supported the German Government and Airbus during the evaluation phase of Switzerland's ongoing assessment for a new combat aircraft. We took two of the latest standard aircraft to Switzerland and they were flown two or three times, day and night, for two weeks. We used no spares and the aircraft were available on time for every single sortie. Maintaining this level of availability, while continuing on the development journey, is crucial.



ANALYSIS: THE POWER OF PARTNERSHIP



Andy Flynn, BAE Systems

For me, Project Centurion illustrates the power of the different Eurofighter industry partners who work in unison to deliver against a unified purpose. All the skills and technologies from across Europe came together to help us deliver against an extremely tough milestone. The whole team had an 'every day counts' mindset.

During the programme we were test flying Brimstones, Meteors and Storm Shadows simultaneously. No one nation would be able to do that by itself and certainly not in the challenging timescales we were working to.

A perfect example of just how good this Eurofighter consortium collaboration is, occurred when the programme hit an issue. We were flying Storm Shadow with the Italian team when suddenly the range was closed.

We quickly rescheduled everything, and the Italian test aircraft came over to the Stornoway range in Scotland, supported by a team from the UK. The team arrived in the



UK on the Friday and on Saturday they were up on the range and delivering against a key milestone.

There was also a similar approach with the Spanish team with Meteor. They came over to the UK and delivered a number of test flights and firings on their jet. Airbus Germany were really important, too, on flight control systems. They delivered months ahead of time.

We all understood the contracts, but we delivered against the timelines, and did a workshare swap to make sure we hit deadlines.

When you take a step back, Centurion has done a few things. It's shown that we can do things differently, work within timelines and build collaborations to deliver against a need. But what it's also done is prove the model of Eurofighter collaboration. This could not have happened without Eurofighter.

We've just done something which feels very special. Yes, it was about hitting timelines for a UK need, but it was delivered internationally. And, it should be remembered that the capability is going to go to other nations as well.

"What project Centurion has done is prove the model of collaboration across the Eurofighter enterprise. This could not have happened with any other programme."

EURODASS LAUNCHES NEW CONCEPT FOR A FUTURE DASS

A new concept for a future Eurofighter Typhoon defensive aids sub-system (DASS) has been launched.

EuroDASS, which comprises Leonardo, Elettronica, Indra and Hensoldt, says Praetorian Evolution, will ensure that Eurofighter keeps pace with rapidly-developing air and surface threats, such as networked, layered and Integrated Air Defence Systems (IADS).

Providing new capabilities that go beyond protection, such as combat ISR, Praetorian Evolution, will keep the Eurofighter Typhoon at the heart of the future fleet mix, alongside current and future platforms.

The launch took place at the EuroDASS Future Capability user conference, which was attended by senior military and industry figures from the UK, Italy, Germany and Spain.

The existing DASS equips the Eurofighter with protection from threats including Infra-Red (IR or heat-seeking) and radar-guided missiles. Integrated sensors and jamming equipment also provide situational awareness and a digital stealth capability, achieved through advanced electronic deception techniques.

The system has protected on peace-keeping operations in Libya and Syria. However, Eurofighter's traditional position of air dominance could face threats in the future from the rapidly evolving nature of air and surface threats such as Integrated Air Defence Systems (IADS).

The proposed roadmap for the DASS ensures the Eurofighter retains its world-class level of protection for decades to come. It will also look beyond the traditional protective role of DASS.

In the future battlespace, the role of Eurofighter will evolve and its DASS will need to do more to keep the fighter at the heart of the future fleet mix. It will propose a number of advanced new capabilities, including multi-platform Electronic Warfare and combat ISR functions such as high-precision targeting and advanced combat ID.

As the DASS for Eurofighter Typhoon evolves to meet these future requirements, the EuroDASS partners recognise that value-for-money must be at the heart of this

fundamental upgrade. Praetorian Evolution's all-digital architecture will ensure ease of future upgrades, while life cycle costs will be optimised. This will also be an opportunity to take advantage of the latest hardware advances to increase the reliability and reduced integrated logistics support requirements.

The launch follows the announcement earlier this year of the Eurofighter Typhoon Long Term Evolution (LTE) study. The Praetorian Evolution roadmap will feed into this by delivering options for long-term technical solutions and enablers which will sustain the growth path of the platform in the future.



UK and Germany Sign Twinning Agreement

RAF Coningsby and Taktisches Luftwaffengeschwader 73, based at Laage, Germany have signed a formal 'Twinning' agreement.

The agreement, which was signed at a special ceremony at RAF Coningsby, allows the two forces to create regular opportunities to meet, train and exercise together, both at Laage and Coningsby.

Station Commander at Coningsby, Group Captain Mark Flewin said: "I'm delighted that we have now joined with our German colleagues in this mutually beneficial arrangement. The Twinning agreement formalises the relationship we have had with our NATO ally for many years, but it will also create enhanced opportunities to strengthen cooperation and interoperability"

Lieutenant Colonel Joachim Kaschke, the Commander of the Tactical Air Wing at Laage said: "This is a great day for all of us. With this agreement we have taken our cooperation to the next level. We have already achieved a lot and are excited to continue this shining example of British and German Airmen working together."



