EUROFIGHTER

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JULY 2018

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EUROFIGHTER IN THE FUTURE BATTLESPACE

Eurofighter Typhoon

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AIR SHOW 2018 SPECIAL EDITION

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EDITORIAL

WELCOME

Welcome to this special edition of Eurofighter World — timed to coincide with the 2018 Farnborough International Air Show.

It's certain to be another memorable show, not least because this year marks the 100th anniversary of the Royal Air Force in the UK, as well as a number of other air forces around the world.

Speaking on behalf of everyone at Eurofighter we are proud of our association with the RAF and, alongside our UK industry partner BAE Systems, we look forward to supporting its ongoing mission to provide air defence for the UK.

Thanks to our well-planned capability roadmap, Eurofighter Typhoon will remain the backbone of the RAF, and other European air forces, for decades to come, helping it maintain its status as a world leader.

Indeed, looking at the wider Eurofighter family, it's an exciting time for everyone involved. It's very clear to me that we are currently living through one of the most dynamic periods in the history of the Eurofighter programme.

We have enjoyed recent contract wins in the Middle East, and there are a host of potential opportunities for additional orders in the European arena and elsewhere, and we are competing strongly for all of them.

This magazine reflects that well, with an in-depth look at the ongoing competition for a new fighter aircraft for the Finnish Air Force, who are also celebrating their centenary in 2018.

In the article Paul Hitchcock, Managing Director Finland for BAE Systems argues strongly that Eurofighter represents Europe's solution — European aeroplanes defending European skies — but I'll let you read the article in full.

That theme continues elsewhere. In another article we find out how the RAF and our industry partners at BAE Systems are successfully working together under an innovative contract called TyTAN to drive down support costs to help add to the aircraft's capability.

We also look at the positive impact the Eurofighter programme has had on the European aerospace supply chain, creating and sustaining thousands of jobs on the Continent, allowing companies and industries to flourish.

Elsewhere, we examine the future of the platform looking in-depth at additional capabilities like the Striker II helmet and Marte ER maritime weapon, as well as how the aircraft will be developed to maintain its advantage in the future battlespace.

Volker Paltzo
CEO
Eurofighter Jagdflugzeug GmbH

EUROFIGHTER IN THE **FUTURE BATTLESPACE**

Recent seismic geopolitical shifts and new and rapid technological developments require new approaches and solutions to cope with the changing environment. Volker Paltzo, CEO of Eurofighter GmbH, explains how the Eurofighter weapons system is evolving to meet emerging challenges, and maintain its advantage in the battlespace of the future. Clemens Linden, CEO of Eurojet GmbH, also talks about how the EJ-200 engine will be developed to support this evolution.

Eurofighter is the established backbone of European air power. And, as Eurofighter evolves to meet a geopolitically and technologically changing world, it will take Europe's defence industries forward to the next generation of weapon system development.

An evolving Eurofighter is absolutely vital, both in terms of meeting the emerging threats of a future battle space and also for European defence industries to develop the technologies that will feed into future air power.

Of course, future mission scenarios and resultant platform characteristics are also shaping the requirements for future FCAS solutions. And that's why we see Eurofighter as the perfect bridge to – and a central pillar of – a European FCAS.

Eurofighter will be able to carry, demonstrate and certify a whole host of new technologies, and deliver them as a mature capability. It is therefore a logical step from an enhanced Eurofighter to a future FCAS solution.

But how exactly should the platform evolve and what are the priorities? Ongoing dialogue with our customer community points to five fundamental drivers currently shaping our thinking. Two reflect a changing political environment, the others focus on the counter-technologies being developed to combat and degrade our forces. The five are:

CHANGING ENVIRONMENT

Asymmetric threats
Dealing with threats from terror cells or insurgents who offer a different threat in terms of size and tactics – requiring the capability to deal with small, fast-moving targets operating in landscapes that demand a high precision to avoid collateral damage.

Homeland Security and Defence
In essence, the actions and strategies of current and emerging superpowers has seen European nations taking more responsibility and more ownership of their own territorial integrity over 'out of area' operations.

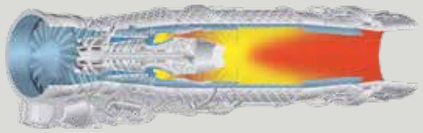
New Weapon Systems
New threats are constantly emerging and these include major development programmes from other nations. The ability to counter these threats is going to be critical to maintain air superiority.

Advanced Radar Systems and Electronic Warfare
Developments in air defence systems will drive future air warfare requirements. Advanced radar systems work in VHF/SHF Bands or have enhanced passive, bi-static capabilities, meaning you don't see the radar but they see you. It means developing new capabilities to counter them and working on tactics that allow air forces to continue to be effective, such as Enhanced Electronic warfare aids supporting Anti Access / Area Denial (A2AD) strategies, allowing safe operations to be →

Eurofighter will be able to carry, demonstrate and certify a whole host of new technologies, and deliver them as a mature capability.

→ EUROFIGHTER IN THE FUTURE BATTLESPACE

EXTRA THRUST, EXTRA EFFICIENCY — THE EJ200 OF THE FUTURE



Known for its reliability, maintainability and performance, the EJ200 is the best engine in the world for its class today. But Eurojet see Eurofighter flying well beyond the 2050s.

"To ensure the engine can still deliver for the next 30 or 40 years we have developed a number of technologies," says Clemens Linden, CEO of Eurojet GmbH. "These can be inserted into the engine to provide growth, because, as the aircraft evolves with new systems and heavier weapons loads it will require more power.

"We can provide a 15 per cent increase in thrust — in fact we could eventually provide up to 25 per cent but that's not needed at the moment. 15 per cent more thrust would allow pilots to operate with a heavily loaded aircraft in the battlespace with the same performance levels as they have today.

"The technology insertion also provides more persistence — giving aircraft longer range or longer loitering time. Additional power will also boost the electrical power uptake of the aircraft's systems. The modifications would also lead to improved life of the engine components and provide a positive knock-on effect on fuel consumption and through-life costs overall."

How would increased thrust and fuel efficiency be achieved? "It's all about physics and advanced technologies," says Clemens. "To achieve more thrust we would increase the airflow and pressure ratios of the high and low pressure compressors and run higher temperatures in the turbines by using the latest generation single crystal turbine blade materials. And with higher aerodynamic efficiencies we can achieve a lower fuel burn.

"A third area of improvement would be the engine exhaust nozzle which would be upgraded with the installation of a 2-parametric version allowing independent and optimized adjustment of the throat and exit area at all flight conditions, providing fuel burn advantages.

"The technologies for the different components are at a Technology Readiness Level of between 7 and 9. The nozzle has been at ITP in Spain on a test bed for 400 hours. These are proven technologies — we would simply need to move it into a final development programme to pull them all together. We are confident we can maintain the reliability because we will not change the architecture of the engine."

maintained while operating in this contaminated environment.

Cyber Technology
Ensuring your system is safe and cannot be hacked — or is able to fulfil its mission in spite of cyber-attack — will form part of future requirements.

KEY CHARACTERISTICS FOR AN EVOLVING EUROFIGHTER

These five areas will evolve and change over time but will continue to drive Eurofighter thinking on how the weapon system has to transform, such as introducing the game changing E-Scan radar, to complement and enhance mission capabilities for future roles that Eurofighter will be expected to take on. These roles include an enhanced air to ground role, an air to sea role, and also suppression of enemy air defences or destruction of enemy air defences roles too.
You can see this shift happening already. In the UK, Project Centurion is already transforming Eurofighter to take on roles that have previously been with Tornado. While in Germany, there's also a requirement for a German Tornado replacement. With Airbus, we have answered the RFI to transform missions from Tornado to Eurofighter that take advantage of the capability, power and multi-role design of our platform.

THE TECHNOLOGIES THAT WILL SHAPE THE FUTURE BATTLESPACE

Interoperability & Connectivity
The future battlespace will be far more contested. Assets will need to link into a network and fulfil several roles, communicating in real time with a much larger interoperable set of assets on the ground, in the air, and share data. Assets will need to be able to go active or passive in terms of sensors, comms and detectability throughout a mission. Eurofighter Typhoon is already highly interoperable with all NATO assets, and will continue to develop and enhance this capability for the future battlespace.

Survivability
Improved survivability will mean taking advantage of all sensors on the platform and enhancing the Defensive Aid Sub-System (DASS) and mission management system to ensure the lowest observable profile and lowest possible emissions in any dynamic scenario.

Effective use of the sensors
Here, the arrival of E-Scan radar – the main sensor of the platform — will be huge but so too will data fusion. That's about fusing all the data from the radar and other key sensors and enhancing the situational awareness of the pilot to ensure the weapons system can deal with all kinds of emerging threats.
In the future this will require AI levels of information management – taking sensor and data fusion to the next level.

Complementary escort jamming
In certain contaminated environments, electronic warfare is the capability of choice to enhance your mission success. The ability to jam enemy radar will allow you to get close enough to the target to be able to use weapons like Storm Shadow or Taurus.

Network enabled weapons
A clear future requirement will be to either carry network-enabled weapons or 'lead' them if they're launched by a different asset. The same idea follows with the UAV element too. Future platforms many need to 'remotely' control a UAV or swarm of UAVs.

Station time and persistence
A key consideration for future commanders will be how long they can keep their assets in theatre, and how quickly they can return. Of course, you have to have the fuel to re-engage and you have to have the weapons load to provide maximum effectiveness. Future planned developments for Eurofighter will enhance both these areas.

Improving persistence will focus on the engine, in particular measures to reduce fuel consumption, as well as introducing enhanced refuelling capability and additional fuel tank solutions.

Sheer Weapons Load
Eurofighter already scores massively in this respect because of its huge and versatile weapons load, coupled with incredible performance, which gives it the ability to transport a large weapons load. There are 13 outboard stations, which can be further increased by use of multiple weapon launchers. It's not just about numbers but flexibility too. This is key for the future when the number of mixed configurations you can support will bring significant advantages. ←

> The ability to jam enemy radar will allow you to get close enough to the target to be able to use weapons like Storm Shadow or Taurus.

CAPABILITY EVOLUTION

THE FUTURE COCKPIT

Eurofighter's current cockpit arrangement is a perfect solution for the needs of operational pilots today. However, the arrival of an E-Scan radar along with other emerging technologies means there will be a demand for an enhanced pilot interface, which is leading us to look at a complete refresh of technology in the cockpit.

That means a large area and high-resolution display that is capable of fusing data from the sensors and their subsystems to ensure the best possible support for a pilot in any given scenario. It also means optimising the HOTAS (hands on throttle and stick) operation and making use of the Striker II helmet. We are in ongoing dialogue with our customers regarding these emerging requirements.

POWER GENERATION

Eurofighter already has an incredible power option with the EJ-200 twin engines, which provide high power generation in the platform, and have plenty in reserve to meet future needs.
But clearly new sensors and capabilities also need increased processing power and to deliver that, you will need an intelligent power and cooling management system. Because generating more power means fuel consumption, maximising power use and optimising fuel efficiency become crucial for mission effectiveness.

MARTE ER ADDS CAPABILITY BOOST

Destined to form the backbone of air force fleets for decades to come, Eurofighter Typhoon has a well-planned Capability Road Map shaping the aircraft's evolution which includes the integration of Storm Shadow, a deep strike cruise missile, Meteor, a beyond visual range air-to-air missile, and Brimstone, a precision attack missile.

And now, in response to demand from potential customers, an anti-ship missile capability MARTE ER is set to join that list.

An 18 months System Definition Phase for the integration of MARTE ER on the Typhoon platform started in the second half of 2016. Recently completed, it represents a significant milestone on the route to full integration of the missile, having identified the major areas of intervention at missile and platform level in order to implement the anti-ship capability.

In addition to a formal interest from one of Eurofighter's export customers, the Italian Air Force has launched a business case evaluation for the integration of MARTE ER.

"MARTE ER is a low risk, high capability, proven missile," says Paul Mead, Head of Business Development at MBDA. "The integration activities will be part of a proven and well-established model of integration between MDBA and Eurofighter. In short, it's a low risk, "quick" capability.

"Globally there's been a significant upturn in the need for maritime dominance and MARTE ER and Eurofighter could address that requirement. If you look at the international market for Eurofighter there are a number of potential customers who have a need for anti-ship capabilities. Naturally, we're working very closely with all the Eurofighter partner companies to provide what the market requires."

MARTE ER is the 3rd generation of the missile system. Earlier versions are in use on helicopters, naval platforms and coastal batteries, and this new version has been modified to ensure that it's compatible with the wing carriage on a fighter jet like Eurofighter.

Originally looked at following interest from a Eurofighter export customer in 2011, this work was followed up in 2014 with preliminary activities carried out between MBDA and Leonardo who worked closely with the other Eurofighter Partner Companies. The contract for the System Definition Phase was then signed in May 2016.

"This established a preliminary statement of work for the integration on the Typhoon. Effectively, it defines activities required to get to a final clearance, including the system engineering activities, as well as mechanical and electrical interface definitions," says Marco Gelli, Head of new Italian anti-ship for MBDA Italia.

During this phase of work Eurofighter successfully attracted export customers who had anti-ship requirements.

"This meant that the System Definition Phase has effectively been the first 18 months for the full-scale integration to platform," says Marco.

The work to date has included structural activity and ground trials using the test aircraft IPA2, a lot of which centred on handling and carriage. Says Marco: "We were able to manage the installation of MARTE ER on IPA2 — move the missile from the trolley to the pylon — in just three minutes. This was quite an astonishing feat. Leonardo told us that it was the first time an installation of a new store took only three minutes."

With experience deriving from the integration of weapons onto Typhoon, MBDA has developed a very close relationship with the Eurofighter programme.

Says Paul: "We see ourselves as partners who are focused on delivery and capability for the customer. Our experience through the Brimstone and Meteor integrations has helped us build a very different and successful working relationship; one which we believe will help streamline the MARTE ER integration.

"We've been focusing on aligning our processes such that we end up with a missile and a platform that are able to come together technically, functionally and also in terms of satisfying the market – so understanding the market requirement is important."

←

The integration activities will be part of a proven and well-established model of integration between MDBA and Eurofighter.

THE **EUROPEAN PROJECT**

There's no doubting the impact the Eurofighter Typhoon programme has had on the aerospace industry of Europe. The supply chain sustains the jobs of around 100,000 people, with more than 400 companies directly involved. We take a look at what that involvement has meant to individual companies and nations.

SPANISH REVOLUTION

There are numerous examples of businesses that have grown and developed thanks to being part of Europe's largest military procurement programme but nowhere has the Eurofighter effect been felt more keenly than in Spain, where the economic impact has been enormous. In fact, you could argue that an entire industry has been nurtured.

"You can clearly say there is a 'Before Eurofighter' and an 'After Eurofighter' for the Spanish aerospace industry," says Ivan Gonzalez Exposito, Head of Combat Aircraft Campaigns for Airbus Defence and Space.

> The Eurofighter programme provided a great opportunity for Spanish industry and academia to grow together.

'Before' the industry was very local-oriented looking at military transport for a single customer, the Spanish MOD. On the combat side the CASA (Construcciones Aeronáuticas) work — which partially thanks to Eurofighter went on to become first EADS, then Airbus Spain — was limited to maintenance for the Spanish Air Force's American or French fighters, but this tended to be of low value and on the less sophisticated systems.

Ivan points out that the Spanish government's decision in the 1980s to become one of four founding Eurofighter core partner nations came along at an important stage in Spain's Aerospace history. Back then it was a young democracy undergoing something of a cultural, social and economic revolution and looking to present a new face to the world. In 1982 it had joined the EEC (European Economic Community) and NATO.

Spain put 13 per cent of the funding into the programme and in work share negotiations insisted Spanish industry was involved in all the important systems in the aircraft. This was a crucial and challenging period for all four countries and their industry partners. The selection process and negotiations for the original group of close on 90 suppliers was completed in 18 months.

Spanish industry became involved in every aspect of the platform, from composite manufacturing through to involvement in different systems like flight control, weapon integration, fuel, environmental control system, landing gear, communications, the RADAR and DASS (Defensive Aid Sub-System). This meant public funds helped to research and develop new technologies and know-how which has encouraged indigenous businesses to flourish and develop sovereign capabilities.

Says Ivan: "The Eurofighter programme provided a great opportunity for Spanish industry and academia to grow together. It allowed the companies to compete against and learn from other nations about how to work in different systems and how to get access to new technologies. Very quickly they were able to associate with companies from Italy, the UK and Germany, who had the previous experience with the Tornado programme.

The Economic Impact of Eurofighter Contract in Spain:

- 20,000 jobs created and sustained (all phases of development, production, support; and counting aerospace direct, supply chain related and indirect/other industrial or economic sectors).
- +40% of Gross Contract Value (contract VAT, other taxes, social security contribution) returned to public funds of Spanish Government.

"It was difficult because being involved in the work and the development packages meant the industry teams had to learn quickly in terms of technology requirements and quality standards. But what the Spanish industry lacked in knowledge it made up for in terms of ambition. People were very hungry to learn and grow internationally and there was a spirit of ingenuity and entrepreneurship. It was a great opportunity but also a great learning curve for them.

"Many of the companies which work on Eurofighter in Spain nowadays didn't exist. Take SENER – now ITP (which is now the 9th largest aero-engine business in the world), for example. Suddenly thanks to the Eurofighter programme we founded a company which was able to invest in the industrialisation processes.

"There are others, like leading avionics supplier Indra, M-Torres, which has a global reputation for jigs and tools for carbon fibre aero-structures, Tecnobit and CESA – spin-off of CASA, that all took off thanks to being part of Eurofighter.

"Today Spain has a network, and one that's not concentrated in Madrid or in a single company. There are small, medium and large suppliers and they are competing, and winning, on a world stage. Many can rightly say they are global concerns in their own right."

As well as developing and sustaining a skills base, working on the programme has conferred real credibility for these growing businesses, allowing them to win work on other projects worldwide, including the A400M, Tiger Helicopter, Boeing and Airbus Civil airliners, Space & Satellite business.

Says Ivan: "The reputation and credibility of working on the Eurofighter programme has definitely helped them get a foothold on other projects. If you are able to say that you are working on the biggest defence programme in Europe then a number of doors open up for you. It underlines your credibility and is like putting a quality stamp on your business card.

"And thanks to our involvement in big defence programmes like this, Spanish firms are not only creating jobs and acquiring technologies but developing spin-offs for other industrial sectors. That's why it's still important to keep on working with the Spanish government in the long-term evolution of the Eurofighter in the future."

Another plus has been the collaboration between industry, the Universities (Madrid, Sevilla, Barcelona, Bilbao) and with Spanish Government institutions CLAEX (Logistic Centre of Armament and Experimentation, within Spanish Air Force) and INTA (National Institute for Aerospace Technology).

As Eurofighter and its partner companies, BAE Systems, Leonardo and Airbus, pursue future opportunities in Europe — where there are potentially in excess of 300 new combat aircraft orders – the story of Spain's involvement is a powerful one at a time when other nations are weighing up the positives of becoming part of the family.

Adds Ivan: "Maybe they wouldn't have to go through the same learning curve that the Spanish industry had to because we are now talking to countries like Belgium, Finland, Poland and Switzerland, that already have a well developed aerospace industry. But through Eurofighter they would be able to participate in the development of new capabilities and get access to all the technologies.

"This is something that our competitors can't easily offer. They can also have a voice through their own governments on the future evolution of the Eurofighter. It's a unique offer that benefits the governments, the military and the industries."

COLLABORATION KEY FOR FUTURE SUCCESS

Earlier this year Eurofighter hosted a supplier conference in Munich, bringing together many of the key industry partners from across the supply chain, which comprises more than 400 suppliers in Europe.

Briefed on the current and future opportunities being pursued by Eurofighter and its partner companies The conference also heard that collaboration and innovation will be vital for future success.

Delegates also received a detailed update on Germany's requirement to replace its current fleet of Tornado aircraft, and Eurofighter's response to that which was delivered in April.

THE EUROPEAN PROJECT. CASE STUDY: INDRA

Indra is one of Spain's best respected technology companies and a key player in the defence market. A world player with a great reputation. But as **Daniel de Lorenzo** (Indra's Director of Sales & Business Development Eurofighter Programme) explains, a key catalyst for its growth has been the Eurofighter.

"Spain joined the Eurofighter programme in part as a way of boosting its aeronautical industry. The government wanted to involve Spanish industry in as many areas as possible. Indra became involved in development of many different pieces of equipment, both on the aircraft side and the ground side, including simulation and support equipment.

"The Eurofighter has been a capability, a technology and even a contact booster for Indra, because when we started in the late '80s we were a national team. Now, we play globally. Thanks to the Eurofighter, we worked together, and compete, with the best, with Europe's benchmark defence companies.

"That has come about through a combination of the Eurofighter programme and our own industrial policy. If the company hadn't taken the decision to invest then we would not be here. But of course Eurofighter has helped in terms of capabilities, in technology acquisition, and in terms of our contacts. Today we have products in all the main subsystems of the aircraft and we are part of the consortia responsible for the main sensors (RADAR and DASS).

> The impact of the Eurofighter programme in Spain has been extremely positive, in terms of employment, technology, industry and aeronautical industry growth.

"And that means we work with the key players in Europe, with Leonardo, Airbus, Hensoldt, Elettronica and BAE Systems — giving us a wide net of contacts and many partnerships.

"Through a combination of a strong industrial policy, investment from Indra and deep collaboration with the customer, we have become the third biggest supplier of on-board equipment, we are a reference company in synthetic training and simulation and we are a leading company in support and engineering service solutions.

"We've reached a position of becoming a key supplier. In fact, we are part of the Key Supplier Forum and we are the only company there that isn't linked to one of the Partner companies: Leonardo, Airbus or BAE Systems.

"The programme has been a capability booster for all Spanish industry — not just Indra. It has forced our industry to work with the key players, take some technology, develop our own technology to grow capabilities in order to face and to afford the different programmes. In this regard the participation of Indra in the different areas of the programme has enabled us to develop our own technology that we've evolved and implemented in our own products that nowadays are the reference in their sector and are fitted in multiple platforms.

"The public doesn't always get to know all the implications and benefits of having an industrial programme like this. But whenever you explain what we are doing in Eurofighter — investing in local industry to develop capabilities, to acquire technology, to create highly qualified jobs… instead of paying for a big flying black box — people grasp it. The impact of the Eurofighter programme in Spain has been extremely positive, in terms of employment, technology, industry and aeronautical industry growth. It's been huge.

"But today it's important to keep that approach going in the future. We need to keep the knowledge, that highly skilled and qualified workforce, and all the sovereignty we have developed. One way to do that is in the evolution of the Eurofighter. We can still develop new technology and capabilities because systems are evolving. And if we want to keep relevant, we have to maintain the policy, this industrial approach that's worked so well." ←

THE ULTIMATE **CUSTOMER HOTLINE**

As the collective 'brain trust' behind the Eurofighter Typhoon, the **International Weapon System Support Centre** (IWSSC) is as crucial as it is unheralded.

Few outsiders realise it even exists (there's nothing else like it in the global combat air world) and fewer still understand how it has become the living body that makes the weapons system tick.

Based in Munich, the IWSSC opened for business in March 2003, shortly before Eurofighter Typhoon entered into service. On the face of it the IWSSC offers a mundane service, providing technical In-Service Support for all Eurofighter Typhoon Weapon System products. In essence it answers a wide variety of questions from maintenance to the actual operation of the aircraft.

But to truly understand its value you have to consider how you'd feel if you were an engineer on a base facing an issue that you've never encountered before and under pressure to ensure you meet availability targets. Who do you turn to? Well, if you're part of the Eurofighter community the answer could be the IWSSC.

Representatives from the UK, German, Italian and Spanish Air Forces are all part of the IWSSC, as well as industry representatives. RAF Engineering Officer **Squadron Leader Dom Marshall** has spent the last three and a half years as the UK's senior representative for the Typhoon Project Team at the IWSSC. He's also been the man the UK Typhoon team turn to when they're puzzling over an issue.

Says Dom: "This talent pool inside the IWSSC is one of the great benefits of the whole Eurofighter programme. I've never seen it in any other multinational project that I've worked on. You've got industry and the military customer working cooperatively side-by-side.

"There's usually a barrier but not here. One of the major benefits of having the IWSSC is the osmosis of information and experience sharing, cooperation and the ability to do business face-to-face.

"It's the collective power of the industry partners that makes the Eurofighter what it is. It's been put in the hands of users who want to get as much as possible out of it."

It's a busy place too. The IWSSC's helpdesk system deals with more than 600 requests each year and these range from the simple to the complex. So what's it like on the inside of the organisation. Says Dom: "Inside the IWSSC you see how big and complex the programme is. Some days it's amazing how you can get a quick answer to an issue, of course some days it's frustrating too.

"If you're back in the MOD or on an RAF squadron, you're very focused on the job at hand, not the complexity of the programme and what's required to arrive at a solution or answer, so it can be frustrating for those guys. But the unique benefit of us being here is that we can manage things through the system by hand. You can only convey so much through a phone call or an email, but with us here, as a military customer, here you can apply real context. You can say with authority 'Industry, we are asking you to drop everything else to do this but this is why it's critical.' That can work to really good effect here.

"Equally there are benefits for industry people working within the IWSSC. They may know the aircraft, its systems and the design inside out but may have very little experience of how the air forces operate the aircraft on the frontline. We have that ability to explain the RAF procedures and processes to industry, because we've been through them."

To any outsider this culture of sharing information sounds like common sense but, of course in a world of global politics, concerns over sovereignty, and control, over black box data, such an approach is a rarity.

Says Dom: "One of the key founding aims of the IWSSC was mutual cooperation and information sharing, and on a regular basis we share information and questions between nations, look at issues and share solutions to in-service issues. This might extend to the loan of equipment and support where one nation may have an excellent facility for fixing something, or a shortfall in another.

"Defence programmes from other nations come to look at the IWSSC. It's a unique organisation because you've got representatives from military, industry, programme managers, design team, development people, flight test support, finance, safety - all these niche specialisations all coming together.

"We're not competing against each other. The weapon system is competing on the global stage and we all want to maximise the availability and utility for whatever needs we've been set. Our ability to share information and experiences really pays dividends. Prior to coming to Typhoon I worked on another programme with multiple customers but you would never expect somebody in the other customer's air forces to contact the team in UK MOD and ask how they solved a problem.

"Here you have that unique ability to fire a question into the IWSSC. We may take some time to get you an answer – if we've never seen it before – but we do have an established route to get an answer and that's priceless." ←

PROUD TO **SUPPORT THE RAF**

Over the last 100 years the **Royal Air Force** has built up a world class reputation for excellence.

RAF 100

It's a status that has been built on a foundation of consistent operational success, achieved by a group of men and women committed to producing outstanding results, however demanding or dangerous the circumstances.

Eurofighter Typhoon is, therefore, alongside our UK industry partner BAE Systems, hugely proud to support the Royal Air Force in its ongoing mission to provide decisive air power contribution in support of UK Defence.

Because, just as the RAF is regarded as world leading, so too their main 'weapon of choice' the Eurofighter Typhoon, is also recognised as the most advanced swing-role combat aircraft available on the market today. Flexible, agile and enduring, it provides simultaneously deployable Air-to-Air and Air-to-Surface capabilities ensuring the aircraft can be deployed in the full spectrum of air operations.

Thanks to a well-planned capability roadmap, Eurofighter Typhoon and the Royal Air Force will have a significant 'Combat Edge' – enhanced situational awareness combined with a suite of flexible weapons options — for decades to come.

Together the pilots of the Royal Air Force and the Eurofighter Typhoon will enjoy a real advantage in the battle space. ←

Here's to the Royal Air Force — we're proud to serve.

Typhoon RAF 100, © MoD Crown Copyright

STRIKER II – THE GAME CHANGER

YEARS ahead of anything else available Striker II is a game changing piece of technology that's destined to become a key enabler for the Eurofighter for decades to come.

The original Striker – the world's first visor-projected helmet system – went into service in Eurofighter Typhoon in 2009. It's the only helmet of its class that boasts so much operational experience. But, it's essentially built around analogue technology - that's Cathode Ray Tube displays and high voltage power supplies.

The digital upgrade Striker II does far more than simply replace old analogue elements. It's radically different.

For starters, going from analogue to digital means the BAE Systems team behind it at Rochester in the UK have been able to lay out the electronics in a much more sympathetic way in terms of pilot comfort.

On a set of scales there's not much between the original Striker and Striker II, (they're both about two kilos), but pilots who are used to the original feel Striker II is lighter simply because the centre of gravity is perfectly balanced, whereas the original was quite nose heavy because of the limitations associated with analogue technology.

The design team has taken the lessons from nine years of operational experience on Typhoon to make a number of improvements, starting with the fitting process. They carry out a contact scan of the pilot's skull, and the liner is made to the shape of the pilot's head to ensure a perfect fit. A perfect fit means a pilot can sustain 9G manoeuvring.

Another improvement is the optical tracking system. Its high speed and accurate to almost a milliradian.

Paul Harrison, Simulation Facility Manager at Rochester, says: "When the pilot puts Striker II on, everything lines up and is ready to go, making the whole operation very fast. The digital system augments the aircraft's optical tracker with an inertial tracker, giving the pilots seamless tracking.

"But the real reason inertial tracking is being introduced is because of specially-designed algorithms which predict where the pilot is moving their head. The system is able to draw symbology, so when the pilots stop moving their head everything is there instantaneously."

Previously there was a limit to the number of symbols that could be drawn, but the digital system allows any amount of symbology, plus it can be in full colour and display any sensor data, from the poorest sensor right up to a full high-def colour display.

Essentially, the helmet can take every bit of data the aircraft has – whatever the source, as soon as that data is on the aircraft it can be presented to the pilot who is eyes up, on the visor. →

When the pilot puts Striker II on, everything lines up and is ready to go, making the whole operation very fast.

→ **STRIKER II**

This cuts out the time spent looking down into the cockpit at displays.

Adds Paul: "It means pilots see their world in a very intuitive way and by colourising the display it is even more attention grabbing. The system gives pilots complete spatial awareness and reduces their workload because they don't have try to work out what's out there."

That's not all. The system allows them to stream high definition colour video from different sources to add to their battlespace picture. There's also integrated digital night vision, meaning pilots no longer need to wear night vision goggles, which add weight and limit manoeuvrability. Plus there's the option to have complete noise reduction and three-dimensional audio.

Striker II is future proofed too. As functionality is added to the aircraft, more advantages of Striker II will be unlocked.

And it works right out of the box. Striker II is completely 'plug and play' for the existing fleet, it simply takes the analogue symbol generator and upscales that to digital.

And from a pilot's perspective, all the heavy kit — the data block on the end of the cable on the uniform and the high voltage hook up for the helmet — goes away. ←

THE DEMO

When you pull on Striker II and tilt your head the first thing you notice is that it's relatively lightweight. It feels comfortable, more so than its predecessor, and better balanced.

When you pull the visor down you see the outside world but there's a green crosshair too, floating in the near distance along with a long horizon line through the middle. You can see a basic symbol set giving you all the basic information you need for flying the aircraft — speed, altitude and so on — along with various symbols; diamonds, squares (friendlies) and circles (unknown), which all represent aircraft tracks, and there's also a triangle which represents a ground track.

This world of shapes, as familiar to fighter pilots as road signs are to drivers, paint a vivid picture of their world. But the really clever stuff happens when you start moving your head to scan the horizon. For a novice like me the colour coding helps — threats are red, friendlies are blue, unknowns yellow and you instantly know where to focus your attention. Red is danger. Real clarity. It's what pilots call situational awareness. And all the time you've got your head up and you're looking out of the cockpit, not down at the controls.

At the edge of the helmet there are a number of different shapes. These indicate the direction that you have to move your head to see the friend or threat. There are chevrons too which give you an idea of how far you have to move.

Then the 3D audio kicks in adding an extra element — you hear a radio warning from your right-hand side but, as the threat moves, so too does the sound.

I look down to a ground target, and move my head so the crosshairs are over the triangle. As I do, a video picture is activated in the right-hand corner of my view. This turns out to be a live signal from a UAV and suddenly the complex picture of the battlespace gets clearer. And still I've got my eyes out of the cockpit and can see what's going on outside the aircraft.

Within minutes of using Striker II you're immersed in a different world but it quickly becomes intuitive. No wonder pilots love it!

> Pilots see their world in a very intuitive way and by colourising the display it is even more attention grabbing.

GHOST TIGER TYPHOON ROARS HOME WITH **TIGER MEET AWARD**

The **Luftwaffe EF2000 31+00** (GS077), known as 'Ghost Tiger', won the **Best Painted Tiger Aircraft** accolade at the annual Tiger Meet, held for the first time in Poland at 31st Tactical Air Base in Krzesiny.

Hotly-contested each year, The Tiger Trophies have been awarded since the Tiger Meet originally launched in 1961. It was the Ghost Tiger's distinctive design which stood out to the judges, displaying green and black striped markings across the entire top of the Typhoon, covering the wings, tail and body.

During the two weeks of exercise at the NATO Tiger Meet 2018 (NTM18), the Eurofighter community was represented by Italy, Germany and Spain.

The Italian Air Force was present with four Typhoons from the 12°Gruppo at Gioia del Colle Air Base. Five Typhoons from Tactical Air Wing 74 in Neuburg were in attendance from the German Air Force and the Spanish Air Force participated with four Typhoons from 142 Escuadrón – Albacete Air Base.

The Tiger Typhoons from these three Eurofighter nations successfully conducted complex Composite Air Operations, focusing their training in several types of missions.

These included the implementation of a No-Fly zone, the defence and the attack of HVAA (High Valuable Airborne Assets), DCA Defensive Counter Air, OCA Offensive Counter Air, Personnel Recovery and Search and Rescue missions.

22 squadrons from 13 countries took part in NTM18, including Italy, Spain, Czech Republic, Netherlands, Germany, Belgium, Hungary, Switzerland, Austria, France and Great Britain.

A total of 70 aircraft, 10 helicopters and an AWACS Early Warning took part in the large-scale aerial exercise, held annually with the objective of exchanging tactical knowledge and improving interoperability between various NATO and non-NATO air arms. ←

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TyTAN'S TRUSTED FORMULA FOR SUCCESS

In the two years since its launch **TyTAN** (Typhoon Total Availability Enterprise) has proved a real success. The availability contract between the MOD, RAF and UK Industry is on track to meet its targets of driving down the cost of support so that the UK can invest in future capability elements. But it's more than an efficiency drive — it's transformed cultures too.

Two years into a 10-year programme to deliver flying hours and reduce costs, all parties are happy that the TyTAN contract is on track to hit its KPIs. Not surprisingly air forces around the world are interested in how these targets have been achieved. Wing Commander Mark Butterworth, Officer Commanding Engineering and Logistics Wing at RAF Coningsby sums it up in one word — trust.

"What we have achieved to date on TyTAN has been quite incredible," he says as he looks out of his office window across the busy flight line at RAF Coningsby.

> What we have achieved to date on TyTAN has been quite incredible.

"We're all really inspired by the distance we have come in two short years because we have changed cultures and brought people together in a way that we have not done before. Today we are thinking in a different way, partnering in a different way.

"Since starting TyTAN the level of trust and collaboration has gone through the roof. It's the main change for me. We are working far more closely than we used to.

"The RAF has much closer links with BAE Systems across every part of the base — whether that's the support element, operations or on the squadrons. The company is now treated as one of our key communities— it participates in our command group and when we are organising events, like family days, it's part of those.

"It is truly demonstrating the 'whole force concept' we've been striving for. It shows how we can embed an industry partner within an airbase and make a real success out of it. All of this makes a big difference to what we are achieving."

Alison Ballard, BAE Systems' Head of Transformation for TyTAN agrees. "I think the improved relationship that we have developed over the first two years of the contract and the whole force attitude that we all have will really stand us in good stead for the next eight years."

What has TyTAN actually achieved in the 24 months since its inception? Well it's not only hit but exceeded its flying hours target in both years, and cost savings are on track. To achieve this there are a number of projects under the TyTAN banner that look at how the operating model can be shaped to meet the cost challenge.

One of the first big changes under TyTAN has been the extension to the maintenance programme. Previously jets were on a 500-hour cycle for a scheduled maintenance visit. That's now been extended out to 625 hours.

Says Alison: "That means less maintenance and more savings on spares and labour. Over the 10-year period of TyTAN, that removes a number of maintenance events and saves several millions."

Another example where TyTAN has had a major impact is the establishment of a joint planning cell that looks at the whole fleet with all three parties – DE&S, RAF and BAE Systems – around the table.

"We all leave our company badges at the door, look at the fleet and say, 'What is the most efficient way for this fleet to be maintained?' rather than just focusing on our own specific elements of the puzzle, and this approach has driven significant changes.

"We are now much more knowledgeable and involved in the fleet planning. It has also driven the right behaviours, getting the three parties to work together. Everybody is working towards a common goal."

Alison believes that having a simple common goal has paid dividends. She says: "Under TyTAN we are paid to deliver a certain number of flying hours per year to the end customer, One Group. It's a very simple measure that allows everybody to understand what we are trying to deliver. It's also a simple and easy message to communicate and one that has really helped align people whatever their role.

Barry Peach, BAE Systems UK Availability Technical Services Manager, is tasked with making sure TyTAN's goals are met day to day in the maintenance hangars (themselves exemplars of collaboration, with 40 percent of the workforce provided to Barry's team by the RAF).

"In the past, the more work we were doing, the more we got paid. However, once the MOD said we will only pay you if this capability produces an output, it completely changed the way we thought.

"Now, with TyTAN, we have a fixed price contract for ten years, which is great because we have longevity for our footprint here at Coningsby and it means people can make plans. But the other key thing with a fixed price contract is that the less work we do, the more we can feed back into the capability of the platform. We all recognise the benefit of delivering new capability for export and keeping the aircraft at the cutting edge.

"Effectively, we are focusing on the strategic fleet plan and how we can build efficiency into my part of the organisation."

Part of that change has been the introduction of personal licensing; another, the way the teams are structured. "We have changed the teams so that they are now aligned in cohorts, with a team leader in charge of up to three aircraft at any one time. That gives me greater flexibility on the shop floor and means I can give →

→ TYTAN'S TRUSTED FORMULA FOR SUCCESS

PILOT TRAINING UNDER TyTAN

TyTAN isn't solely about maintenance hours, training forms a growing part of the picture too. Jim Haskins and Mark Pocock are part of the 16-strong Typhoon Training Facility instructor cadre at RAF Coningsby, which is made up of BAE Systems pilot trainers as well as Royal Air Force pilot reservists.

Both Jim and Mark are pilot instructors. Until recently that was confined to simulator work but now they are also working on live aircraft.

Jim and Mark are part of a 4-strong team who teach everything on the Typhoon syllabus, right from day one of ground school through to the end of the conversion course. They are an integral part of 29 Squadron (the Operational Conversion Unit) as RAF QPIs but they're civilians working for BAE Systems.

The RAF has complete control of the syllabus and BAE Systems does not employ anyone in the roles that aren't completely sanctioned and approved by the RAF.

Says Jim: "Within Typhoon Training Facility we have thousands of jet hours experience, instructing and operational, and the RAF and BAE Systems see that as an opportunity under the Whole Force construct to retain that expertise and allow us to teach the new students coming through, whether it be in the synthetic or in the live environment."

Jim says the process of integrating the BAE Systems team into the squadron has been seamless. "We've been operating here for a long time in the synthetic world and we know most of the pilots. In fact, we trained a lot of the instructors who are on the squadron now.

"I think the whole force attitude is evident in the way we operate. There isn't a 'them and us' culture, it's just one big team. It just so happens that some of us are in blue suits and some of the guys are in green suits."

Adds Mark: "It has a benefit to our teaching too, because if we're current at flying the aircraft with all its latest updates, then it makes our ground teaching more relevant."

In addition to having instructors working in the simulator and live flying environment at RAF Coningsby, BAE Systems has recently increased its simulator capacity up at RAF Lossiemouth.

Alison Ballard, Head of Transformation for TyTAN at BAE Systems said: "We had two simulators at Lossiemouth and we have just added another two, bringing it to a total of four simulators which means we now have a four ship capability. In the past pilots would have to travel from the north of Scotland to Coningsby."

the customer the right kind of aircraft he requires to deliver his combat effect."

This kind of thinking is key for the RAF and, for Wing Commander Butterworth, it's been a fundamental change of focus. "Previous contracts used to be about aircraft maintenance, the engineering state, the airworthiness, having the right spares in the right place and so on.

"With TyTAN we are moving into areas of availability that we've never even considered before in the operating domain. It's about thinking more about maximising the use of the aircraft. BAE Systems teams look at how they can support us in doing the job better.

"Moving the concept to operating the aircraft is not a subtle difference — it's a big, big difference.

> RAF Coningsby has become a shop window to show how availability contracting can be done.

"We have talked about availability contracts for a long time and I think TyTAN was always the logical step. What we always wanted to achieve was to be able to put the contract in the bottom drawer and collectively do whatever was needed in order to deliver an output. We are now in a true availability-style contract.

"We are two years in and have made phenomenal progress but that doesn't mean we have achieved a plateau yet. I don't just need my Typhoon pilots to get airborne for an hour, we need them to get airborne and practice a particular skillset. We now need to focus our efforts on delivering available, airworthy and 'capable' aircraft.

"What's been really heartening to see is our industry adapting to the changing demand, and demonstrating exceptional flexibility and willingness to learn. They've embraced new ideas to really try and understand our business."

For Barry, partnership is key: "We couldn't have done this on our own. We have become more aware of why the customer makes certain demands, all through better understanding and closer working."

The success of TyTAN has generated keen interest from the military around the world. Says Alison: "RAF Coningsby has become a shop window to show how availability contracting can be done. Every export customer is different, and each has different requirements out of the aircraft and its support solution but TyTAN is good because it is so flexible.

"Qatar, for example, want an in-country solution with facilities built in Qatar. But initially they want to benefit from partnering with the RAF. We now have a proven model here of how we work with the RAF and air forces, and industry can come over here and learn from that model."

Looking to the future, one of the big tests all three identify is embedding the culture. "The challenge as people move roles in each organisation is how we make the new behaviour patterns stick and make the trust we've developed 'business as usual'.

"We are all really happy with what we have achieved so far but recognise that it is not complete yet — not by a long way." ←

ALL EYES ON THE PRIZE

Back in March this year Paul Hitchcock hopped in a cab from Helsinki airport to the city centre. En route the driver asked him what he was doing in Finland and Paul explained he works in the aerospace industry. The driver mentioned Finland's intention to buy new combat aircraft, immediately gave his passenger a perfect synopsis of the competition so far and provided an outline of the five runners and riders.

That little incident sums up just how closely this competition is being followed in Finland, says Paul. "Everyone is watching."

"The public are really engaged," says Paul, who as Managing Director Finland for BAE Systems, lives in the country during the week. "If you stopped anyone in the street the majority of people would have a rough idea of the contenders and some would have a preference based upon what they've read or been told."

Finland's requirement is for 64 aircraft and when the Request For Information (RFI) came out in 2016 it was one of the most comprehensive RFIs that Paul and the team had ever seen. This year the competition ramped up a notch. In April Finland issued a formal Request For Quotation (RFQ) and expect responses in January 2019. Further rounds of discussions and refinement are likely to follow before a decision is made in about 2020 and a contract placed in 2021.

"They've got an acquisition budget of somewhere between 7 and 10 billion Euros. In anybody's world, this is a huge competition," says Paul. →

→ ALL EYES ON THE PRIZE

The outline requirement is for a multi-role fighter. Something that can both protect their sovereign airspace and has a ground attack capability. It also has to provide a deterrent effect and possess impressive electronic warfare and Intelligence, Surveillance and Reconnaissance capabilities.

Eurofighter, championed in this campaign by the UK government and BAE Systems, is competing against Lockheed Martin and the F-35, Boeing with the Super Hornet, Saab with the Gripen and Dassault with the Rafale.

So how is the campaign shaping up from a Eurofighter perspective?

"There are a lot of genuine reasons that give us confidence that we have a real shot at this," says Paul.

There are a number of key aspects under consideration, including operational evaluation of the aircraft, the industrial partnership on offer, price, security of supply and the broader national defence and security considerations. And when considering all those major elements, Paul believes that the Eurofighter bid stacks up well.

"Fighter jet competitions are often defined by the capability, and there's no doubt Eurofighter really does fit the military need both for today and decades to come. Our team and the Royal Air Force have carefully looked at the operational scenarios that have been sent out and said, 'You know what? That's exactly what this aircraft does.' In terms of the Eurofighter product and the growth paths we have, we believe they fit very neatly with the type of aeroplane that Finland wants to buy.

"Then when you look at the industrial side of the equation, this is the kind of thing that's in the company's DNA. We understand the need to provide an economic return into countries. It's what we do with all our partners. We have enjoyed a good relationship with the Finnish company Patria for decades and have worked fantastically well together on Hawk, which means we fully understand their capabilities.

"In fact, BAE Systems' land business signed a contract with one of Patria's companies in Estonia, Milrem, earlier this year to support the Estonian CV-90 infantry fighting vehicles. It's a good example showing we are happy to partner with people to support our products. On the industrial side we will put our best foot forward.

"Security of supply and the ability to operate independently in times of crisis are also extremely important requirements for the Finns. We have an approach which we believe will satisfy all of Finland's key requirements in this area.

"When you look at price, Eurofighter offers exceptional value for money through-life. We can definitely learn from the benefits we are seeing on the Typhoon Total Availability eNterprise (TyTAN) programme in the UK and deliver this learning into our Finnish proposal.

"In terms of the broader security and defence aspects, we're really emphasising that ours represents 'the' European solution and, whilst Finland are not NATO members, they are part of Europe, which is very important to them in a defence and security sense.

"The British Government is front and centre in terms of leading the campaign, and as their industrial partner, we're alongside them, but we also have our German, Italian and Spanish partners alongside us too. As we say to the Finns - whilst they are speaking to the Brits they've all of our European partners alongside.

> Eurofighter is going to be the backbone of the Royal Air Force into the 2060s.

"That's an important theme for us: this is Europe's solution - European aeroplanes defending European skies."

One key requirement is that Finland wants an aircraft that's going to be in service until around 2060 and Paul believes recent announcements around the Eurofighter show that they are more than capable of meeting that demand.

"We know that Eurofighter is going to be the backbone of the Royal Air Force and Eurofighter's partner air forces for decades to come," he says.

He also points to potential new orders as evidence of the longevity in the weapons system.

"Anyone coming on board in the next few years will actually be joining a very vibrant and active Eurofighter club.

"Initiatives like the UK's Project Centurion already strengthen the aircraft's air to ground capability but when you factor in other planned product improvements and look at potential new orders across the world, you can see that we will have aircraft in service for 30, 40, 50 years. That sort of fits perfectly with the Finnish.

With the contest ramping up Eurofighter is ensuring the wider public get their chance to see first hand what's on offer.

"The Finns often describe themselves as a nation of engineers. As I said earlier they are really engaged in the process and that's why it's important to explain our proposition to that broad population. To show them: this is Eurofighter, this is what it does, this is what it will do in the future and this is why it's the right choice for you.

"That's why appearing at air shows and events like the Finnish Air Force's 100th anniversary celebrations this year is important.

"There's no doubt that since we have engaged with the public the perception of Eurofighter has changed, particularly after the air show last year. There was a full Eurofighter display, the weather was perfect and the RAF's Display Pilot, Flt Lt Ryan Lawton, who came over produced a rip-roaring display. That moved the Eurofighter narrative forward in Finland. That's why we'll do it again to bring that wow factor to a different set of people.

"It's funny, you can produce glossy brochures and detailed RFI documents, packed with data and facts, but sometimes it's only when the aircraft turns up and screams around the sky for 10 minutes higher, faster, tighter, than anything else that people look at it and truly understand the capability Eurofighter offers." ←

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