

EUROFIGHTER

PROGRAMME NEWS & FEATURES
APRIL 2018

WORLD



ILA Berlin Air Show

25TH - 29TH APRIL 2018
SPECIAL EDITION



**EUROFIGHTER:
THE PERFECT
CHOICE FOR GERMANY**

 Eurofighter
Typhoon



German Air Power.
Photo: Dr. Stefan Petersen

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EDITORIAL

WELCOME

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

With recent contract wins in the Middle East, and potential opportunities for additional orders in the European arena and elsewhere, we are currently living through one of the most exciting times for the Eurofighter programme.

In the latter part of 2017 the German government formally commenced proceedings to look at a possible replacement for their existing Tornado fleet. In this edition of Eurofighter World we look at how Eurofighter Jagdflugzeug GmbH and our partners at Airbus Defence & Space are responding to this opportunity.

I'd like to thank Dirk Hoke, CEO of Airbus Defence and Space, for taking the time out of his busy schedule to talk to Eurofighter World. I'll not go into too much detail here — I'll let you read the article in full — but what I can say is that we firmly believe that together we can provide an attractive, cost-effective and forward-thinking solution that will meet all of the German government's requirements.

Germany is not the only nation in the region looking to its future fighter aircraft requirements, and elsewhere in this edition we reflect on the campaigns in Belgium and Switzerland. We talk to the people who are involved on a day-to-day basis to understand the key issues in each country.

Of course, while the campaigns represent exciting opportunities for the future, Eurofighters continue to be active today. An Italian Air Force Eurofighter Task Force is currently involved in a NATO Air Policing mission in Estonia, and there are some great pictures of the team in action inside this issue.

Elsewhere, we speak to Typhoon pilot Raffael Klaschka, Head of Marketing at Eurofighter Jagdflugzeug GmbH about the issues and facts that often go unspoken in discussions about stealth. It's a fascinating read from the perspective of someone who truly understands the arena.

As ever, I hope you enjoy the magazine.

Volker Paltzo
CEO
Eurofighter Jagdflugzeug GmbH

EUROFIGHTER IS THE 'LOGICAL' CHOICE FOR GERMANY

In November 2017 the German government issued an RFI for replacing its fleet of Tornado aircraft.

We spoke to **Dirk Hoke**, CEO of Airbus Defence and Space, and **Volker Paltzo**, CEO of Eurofighter Jagdflugzeug GmbH, about the opportunity and why they believe Eurofighter is the right choice for Germany >>

What do you honestly believe would be the best solution for Germany – and why?

Dirk: Despite what you see in the Press about the different options the German Ministry of Defence could choose, I strongly believe that the only real solution to answer the twin questions of a Tornado successor and the need to prepare the way for an FCAS – it has to be the Eurofighter.

Dirk: “Eurofighter is already today the backbone of the German Air Force.”

Eurofighter is already today the backbone of the German Air Force. Squadrons are familiar with the aircraft and therefore there is absolutely no learning curve to be expected compared to integrating any new jet into the system but instead a row of synergies. And clearly, Eurofighter can take over the current role of Tornado. From my point of view there is no better choice.

Through a mid-life upgrade, with new functions built in and further development, Eurofighter would make sure it is a close step to the Future Combat Air System. And in parallel we could develop a transition.

Of course, it's a competition – it's not a done deal – and we have to ensure we have a competitive and comprehensive offer.

Dirk Hoke,
CEO of Airbus Defence and Space



Volker: If we want to build a strong Europe we should build it with projects not just words.

But there are a whole host of good logical reasons why Eurofighter should be the choice. It is the stepping stone to a next generation system; it is mission-proven, it supports the EU and NATO and is fully cooperative so can go into international operations, plus it offers low risk capability transfer.

We have established trust, transparency and cooperation between the key stakeholders – the nations, the agencies, the industry. We have synergies and can control costs. We offer autonomy and sovereign capability for Germany and Europe and offer a solution that maintains and sustains a European base.

It is the best thing to do, it is the logical thing to do.

Dirk: A key consideration is the future cooperation announced in 2017 by German Chancellor Merkel and French President Macron and for that we need to guarantee sovereignty. A French and German partnership on the next European combat aircraft system would sustain and enhance capabilities in Europe and ensure the homogenisation of the European fleet. This final point is important – ensuring we don't have too many types of aircraft would help create a whole number of synergies.

How significant is the German decision for Eurofighter?

Dirk: I think this is a crossroads for Eurofighter. If we are successful in competing

for the Tornado replacement in Germany this would also be a strong sign for possible future exports – you can be sure that neighbours like Belgium and Switzerland are watching closely what is happening in Germany. It would mark a significant high point.

It would mean factories working to capacity and the capabilities required to build fighter aircraft in Europe would be secured. But winning contracts today isn't simply good news for the intermediate prolongation of the Eurofighter production, it will also help us in the transition to the Future Combat Air System.

Given that the Luftwaffe already operate Typhoon there must be some advantages to buying more of the same aircraft – can you give any examples?

Dirk: From an economic standpoint the advantages are obvious. It's good in terms of reduced costs for training, support, maintenance and simulators and by reducing the types and versions of aircraft you also significantly reduce operation costs.

Volker: The German customer already understands the costs and risks associated with Eurofighter. Evolving the Eurofighter's capability is a relatively low risk option and it represents a good opportunity for industry to develop the innovative skills that will be required for the next generation of aircraft systems.

Germany would have the largest fleet on the continent and be able to take advantage of

economies of scale in the support of the weapons system. It would also allow Germany to play an even stronger role in the programme in the future.

You claim that Eurofighter will deliver the option with the greatest sovereign control for Germany – why is that, and why is sovereign control so important?

Dirk: It should be in the interest of every nation to have control over your defence tools, options and the data. Buying a US solution does not give you access to the data – it comes with black boxes that you wouldn't have access to and you would not be fully in control. Where and how you use your aircraft would have to be in line with US approval.

In light of a sovereign European defence we believe it is mandatory to have full control of your combat aircraft and decide for which kinds of mission you use them. Taking Eurofighter as a Tornado replacement immediately gives you all those options both as a NATO partner and as an independent air force.

Volker: “The German Air Force already understands the costs and risks associated with Eurofighter.”

What additional capabilities or sensors will be required to meet the Tornado RFI?

Volker: With the integration of Meteor, Storm Shadow and Brimstone we are already making big steps forward. The Tornado RFI asks us to take on 10 roles from the Tornado and two additional ones in relation to the Future Combat Air System. >>

>> TORNADO RFI



Volker Paltzo, CEO of Eurofighter Jagdflugzeug GmbH

I cannot disclose the full configuration standard for confidentiality reasons, however, we will see modifications in a number of areas. These include: the sensors (like the E-Scan radar), the DASS, in the targeting and recce pods and on the HMI side (one option could be the Striker 2 helmet). We will see modifications to the basic aircraft in the aerodynamic area, fuel capacity, RCS and IR reduction, propulsion enhancements and general systems. On the weapons side we will see the integration of enhanced guided bomb units, stand-off weapons, small diameter precision bombs and other German-specific requirements. With the comms we will see enhancement of the MIDS and the Beyond Line Of Sight capability.

There are some new requirements among these, but many have already been discussed — though not yet under contract — under the P4E Enhancements.

Will there be any commonality of design between an enhanced Eurofighter and the potential future requirement of an FCAS?

Volker: It is an absolutely logical pathway for Europe to go on. Key technologies will be the main discriminator for a 6th Generation aircraft. These include high-speed data management and Artificial Intelligence, sensor fusion, electronic attack, enhanced navigation, comms, high-speed data links, cyber resilience, which will be a significant requirement and low observability. Then there's self-protection systems and laser and counter-laser technologies.

In principle it is an evolution of what we have done in designing Tornado and then Eurofighter.

We'd build up enhancements towards an FCAS and we'd maintain sensitive skills.

The European option would significantly reduce certification and qualification effort because we have qualified solutions available that we can transfer to another platform. That's a big subject that's often overlooked but we know how it works.

What are the likely upsides from a European industrial base perspective with a European vs US solution?

Dirk: A European solution would support and maintain our skills for the production of combat aircraft. Not just for the big three industrial partners but also for the smaller firms that make up the supplier base. And it would give our key suppliers more reasons to maintain their European bases.

We have around 400 small and medium companies supplying to Eurofighter. For bigger enterprises like ours we can work

through peaks and troughs but for many of the smaller suppliers in the chain it is a question of survival and a cut in production means severe problems.

The Eurofighter programme has had its challenges. What do you say to its critics?

Volker: We have a lot to shout about. Eurofighter is the most advanced combat

“Eurofighter is the most advanced combat aircraft in the world and it is the biggest fleet in Europe.”

aircraft in the world and it is the biggest fleet in Europe. We should not hide what Europe has been able to produce.

We are now evolving the weapons system like every weapons system. Into the future and keeping it relevant in a 6th Generation battle space. <<



ITALY TAKES OVER **BALTIC** POLICING ROLE IN ESTONIA



Italian Eurofighters took over NATO's Baltic Air Policing (BAP) mission in Estonia in January. Operating from the Ämari Air Base in Estonia, Task Force Air 36th Wing is tasked with ensuring the integrity of the airspace on behalf of NATO over the skies of the three Baltic Republics. >>

The task force is working hand in hand with a Royal Danish Air Force detachment leading the mission based at Šiauliai, Lithuania.

Task Force Air 36th Wing comprises four aircraft drawn from two of the Italian Air Force's Eurofighter Wings— the 36th Wing in Gioia del Colle and 4th Wing in Grosseto. The pilots and the support team, including maintainers and engineers, are drawn from all three Italian Air Force Eurofighter bases, including Trapani, base of the 37th Wing.

A spokesman for the Task Force Air 36th Wing said: "Eurofighter is the backbone of the Italian Air Defence and it is successfully showing its great robustness all around the world."

This is the second Italian Air Force Baltic Air Policing mission. In 2015 the Italian Air Force sent a task force to Šiauliai and enjoyed a successful deployment.

This latest operation underscores the Italian Air Force's deep commitment to NATO. It is the only NATO country participating in four air policing operations. In addition to the Baltic

activity it also provides air defence for Slovenia 24/7, 365 days a year.

In Albania, the Italians share duties with the Greek Air Force — with Italy on duty for 15 days then the Greeks the next 15 days — and the force also provides Icelandic air policing support.

In 2017 Italy also provided Augmented Air Policing in Bulgaria, where it operated alongside the host nation's air force.

Meanwhile, Italian Air Force Eurofighters will be part of a mixed deployment that will ferry to the China Lake Naval Air Weapons Base in California. The exercise will allow the force to test and certify equipment, with the Mojave Desert location providing ideal test-conditions.

Two Italian Air Force Eurofighters are also flying complex training missions at Albacete in Spain, where they are participating in the Tactical Leadership Program (TLP). <<



Task Force Air 36th Wing comprises four aircraft drawn from two of the Italian Air Force's Eurofighter Wings.

ALBANIA:

Shared duties with Greek Air Force on 15/15 days basis.

BULGARIA:

In 2017 - Augmented Air Policing alongside Bulgarian Air Force.

CALIFORNIA:

China Lake Naval Air Weapons exercise participation.

SLOVENIA:

Air defence 24/7, 365.

SPAIN:

Tactical Leadership Programme (TLP) involvement at Albacete.



NATO'S TROUBLE SHOOTERS

In the summer of 2017 a commercial passenger aircraft was making a regular flight to the UK from mainland Europe. Mid-flight over Germany radar signals suddenly picked up that it had veered off course and was flying around in circles. Air traffic controllers tracking the flight were concerned and tried to make contact with the cockpit to ask what was going on. Silence... >>

AIR POLICING OF EUROPE

On any given day there are around 30,000 air movements over Europe. Most of those take place over Western Europe, with Frankfurt, Charles de Gaulle in Paris and Heathrow in London the major hotspots. 30,000 flights. Every single day. When you're dealing with so much activity, things can, and occasionally do, go wrong.

The question is, what happens next? How do you find out if a plane is merely suffering a short term technical difficulty, illness in the cockpit, or it may even have a hijack situation? What happens and who calls the shots?

The answer to that final question is NATO's Allied Air Command. It has two Combined Air Operation Centres (CAOCs) which deal with air policing and they're responsible for the north and south of Europe respectively. The northern centre is in Uedem, Germany, the southern in Torrejón, Spain. All the command and control installations and radar sites dotted right across the European NATO area feed into the two CAOCs. The overview provided from all this incoming data is known as the Recognised Air Picture.

TAKING THE 'LAUNCH' DECISION

Each CAOC has a Commander who makes the tactical decision of exactly when and how to react, or if to do anything at all. The fact is NATO does not launch QRA aircraft every time there's an issue, each decision depends entirely on the tactical and geographical situation that prevails at the time.

A scramble decision will only be made if the Commander feels something is not right — an aircraft may have put out a distress signal, veered off its planned route or failed to respond through the usual channels. At that point, he makes the call for a QRA aircraft. It's then that the respective nations — who each have aircraft and pilots on the ground in

a state of 24/7 readiness — send up their air forces to actually carry out the mission.

If the issue is reported in the vicinity of the UK then the likely course would be to launch a Royal Air Force QRA team, a two-ship formation. Within minutes of the call from the CAOC they're airborne and often the crews only find out the full detail of the alert, where they are heading and why, after they've actually taken to the skies.

Exactly which air base is given the job can depend on various factors like the direction of the flight that's being tracked.

This protocol has existed since the 1960s when NATO nations together agreed to have a single standard of safety and security in the skies. (That said, there are some nations, including Denmark and Turkey, who still scramble under their own national authority discretion. However, all activities are coordinated by Allied Air Command.)

BALTIC AND ENHANCED AIR PATROLS

Of course, not every scramble is triggered because of a technical issue. NATO deals with a lot of QRA activity particularly over the Baltic states of Latvia, Lithuania and Estonia — where activity from Russian aircraft is closely watched.

NATO's Baltic Air Policing regime started in 2004 after the three Baltic States joined NATO, with a detachment in Lithuania covering all three Baltic states (the three states don't have fighter jet capabilities that could perform Air Policing, which is why Allies take turns deploying their fighters). But, following increased tensions in the region, this was beefed up with a second detachment in Ämari, Estonia. These detachments rotate on a four-month basis.

NATO's stance has been designed to reassure the Baltic states that the other NATO

nations are standing by them by reinforcing their air policing. It's a policy designed to be a deterrent to any further Russian provocation and clearly says that NATO has eyes in the sky.

17 of NATO's 29 Allies have provided detachments for the Baltic Air Policing mission so far and Eurofighter Typhoons have been heavily involved over recent years with squadrons from Italy, Spain, Germany and the UK all playing their part.

The region is particularly busy in QRA terms because the adjacent Baltic Sea is a transit area for Russian aircraft from the mainland to Kaliningrad where they have a military presence. The call to scramble isn't made simply because the aircraft is a Russian one but rather because they sometimes pose a threat to the adjacent NATO airspace or they may be flying without transponders.

Last year Eurofighter Typhoons from the UK and Italy took on lead roles policing the skies over the Black Sea region under the auspices of NATO's Southern Air Policing mission. A detachment of four Typhoon fighter jets from the UK RAF's 3 (Fighter) Squadron worked alongside the Romanian Air Force to police the skies over Romania. Meanwhile, Italian Air Force Typhoons from the 4^o Stormo (Wing) in Grosseto were based in Bulgaria at Graf Ignatievo Air Base, close to the town of Plovdiv, for a three-month deployment.

SHARING RESOURCES

Not all European NATO nations have the capability to provide a single standard of security for their own air space. In fact, some countries, like Iceland, don't even have air forces.

But NATO, as one strategic alliance, has agreed to provide one single standard of security and it is therefore committed to carrying out air policing for its members — even those without an air force.

In Iceland a NATO nation sends a fighter detachment there once every four months for a short term deployment. <<

"Within minutes of the call from the CAOC they're airborne."



NATO FAST FACTS



- ▶ NATO was founded in 1948 following the end of World War II. The countries came together to form an alliance to resist the pressure and the threat from the east, particularly after the Berlin Blockade.
- ▶ Despite what many assume, NATO wasn't founded as a military alliance. It's actually a political alliance to promote and support democracy and for consultation and cooperation in questions of defence and security.
- ▶ The principle of collective defence is enshrined in Article 5 of the NATO Treaty. Less well known is the one that precedes

it, Article 4, which is all about consultation. It means the Allies consult one another and discuss the most appropriate response.

- ▶ The NATO Headquarters is in Brussels where the North Atlantic Council is chaired by the NATO Secretary, Jens Stoltenberg.
- ▶ The Council meets regularly at varying levels for example, Defence Ministers, Foreign Ministers, Chiefs of Defence, Ambassadors. When the Heads of State and Government meet this is referred to as the NATO Summit. In addition, every member country has an ambassador to NATO.
- ▶ The NATO Air Command commander is the US General Tod D Wolters and his

deputy commander is Air Marshal Stuart Evans from the UK.

- ▶ 25 of the 29 NATO nations are represented at Air Command in Ramstein, Germany. The biggest contributor to the headquarters is the United States with 90 personnel, followed by the British and the French, and Germany is fourth with 52 posts.
- ▶ In 2017 alone, there were more than 860 situations where communications were lost between civilian aircraft and air traffic control, with NATO deciding to scramble more than 80 times for this reason.

EUROFIGHTER GEARS UP FOR SWISS CAMPAIGN

Geographically in the heart of Europe, Switzerland stands fiercely independent. In Western European terms it's an exception and exceptional. Neutral for centuries but always standing ready to defend its neutrality. That's why its air force — described by one Swiss politician as 'the roof on top of the building' — is currently looking to modernise. >>

The Bundesrat (the Swiss Governmental Ministerial Council) wants a complete replacement of the Swiss Air Force's (SwAF's) 26 F-5E/Fs and 31 F/A-18C/Ds along with a new ground-based air defence system.

This summer the government is expected to issue a Request For Proposal to meet this need — and naturally Eurofighter will be in the contest.

Alexander Vinh, Campaign Director and Head of Bid Management with Airbus, says it's a contest that will be closely followed by the general population. Indeed, it's possible that they may even have the final say.

That's exactly what happened in the previous campaign. Initially won by Sweden's Gripen, the result was ultimately overturned following a referendum.

"The Gripen case was the first ever referendum in Switzerland concerning a military topic that failed in a public vote," says Vinh. "It showed the public was not convinced about the overall process, nor was it convinced about the result. The other conclusion to draw is that the Swiss public is extremely interested in their security."

They'll certainly be following this latest campaign far more closely than most other nations do in similar circumstances which gives the competition a different edge. "Switzerland is one of the few countries in the world that's strongly interested in its military system — everyone plays their part."

Of course, the Gripen vote hasn't changed the need for it to update an ageing fleet. In 2016 a group from the SwAF came together with politicians, industry and various other experts to look at every aspect of what was required including the budget, planning and industrial topics.

With the benefit of hindsight Vinh believes the previous campaign came a little too early in Eurofighter's life cycle but feels the timing is much better now.

"There is a big difference between the evaluation of the 2008 aircraft and the one we

will present in 2019. In 2008 we were still in the learning phase and the aircraft was new to the squadrons, whereas today it has changed significantly — it's combat-proven and reliable. In capability terms there are lots of elements either on contract or where the development has already been completed but there is still a growth path — or Long Term Evolution vision — which shows the customer where we are going. In short, today we have a much more mature system but one with significant growth potential."

The last point is important because Vinh says that Switzerland is looking for something which will still be operational in the 2050s.

"The chief operational focus is on air policing, because Switzerland has some of the busiest air space in Europe. There are a couple of thousand of air movements every day, hence air policing is key. But they are also looking for a basic air to ground capability with a specific focus on close air support."

Obviously, much will depend on how the various rival aircraft perform during the flight evaluation, which Vinh describes as 'the moment of truth'. The evaluations are expected to take place in-country and with SwAF pilots at the controls.

"This element will be hugely important but I am convinced we can perform well and demonstrate how stable the Eurofighter is, how well it has evolved and how reliable it is in service."

How else will Eurofighter impress? "We have to play to our key strengths as a group of international allied partners working together. I think Switzerland sees the potential in corporation, not only with our industry but also with our partner nations. A good example is training facilities. Switzerland has limited air space to carry out training flights and night flights are limited. But through our European partner nations this is something we have to offer.

"At the same time they also enjoy their independence in deciding what they want to do. For example, Switzerland does not wish

to join NATO or the EU. This desire to protect their independence also has constitutional resonance and it's something we have to respect and act accordingly.

"Our aim, and this is the key for me, is to show how there is potential within the Eurofighter construct for Switzerland to be a partner for future development. It's a very stable and reliable state. Brexit is a perfect example to demonstrate that even within a club such as ours there is the freedom to speak and freedom to go your own way."

Last but by no means least, another key consideration will be budget. Naturally, any successful bid will have to be compliant within the framework of their budget. But what is also obvious in this context is that the Swiss are looking for a 'smart' solution, and that would include support.

"One good example of an innovative approach to support is the UK's TyTAN support solution. (TyTAN is a unique 10-year support solution — a partnership between BAE Systems and the Royal Air Force to provide support for the UK Typhoon fleet, which will generate an estimated £500m of savings)."

"Overall, taking all the different elements together, we need to present a proposal that's very competitive and credible — and I firmly believe we can." <<

Alexander Vinh, Campaign Director and Head of Bid Management with Airbus, says it's a contest that will be closely followed by the general population.





Photo: Hans Georg Schröder

RELIABLE EVIDENCE

After clocking up close to a million engine flying hours the EUROJET EJ200 engine has established a very impressive track record as the power behind the Eurofighter Typhoon. It boasts a virtuous trinity of Performance, Maintainability and Reliability. >>

The EJ200's flying record has created an authoritative bank of data, pilot testimony and engineer evidence. What all this evidence indicates above all is that the EJ200 is an extremely dependable product.

Operators like the EJ200 because of its carefree handling and reliability, it requires minimal maintenance to keep it on the wing. The average engine on-wing time is over 1,000 flying hours and the fleet leader has currently over 2,000 flying hours on the

wing (excluding scheduled maintenance). All of which shows the engine is performing far better than it was originally contracted to do, but how does it compare to other fast jet engines?

Gary Way, Technical Director at EUROJET says: "In terms of comparison with other equivalents, there is limited information available. Everybody knows the length, the diameter or the thrust, but reliability data, is not always placed in the public domain. However, the EJ200 has demonstrated better reliability in-service than its original specification and I am confident that the EJ200 is very competitive in the market."

How does the EJ200 achieve such high reliability and what's been built into the design

of the that makes it such a consistent performer?

Says Gary: "One of the keys to its reliability is the simplicity of the design. The

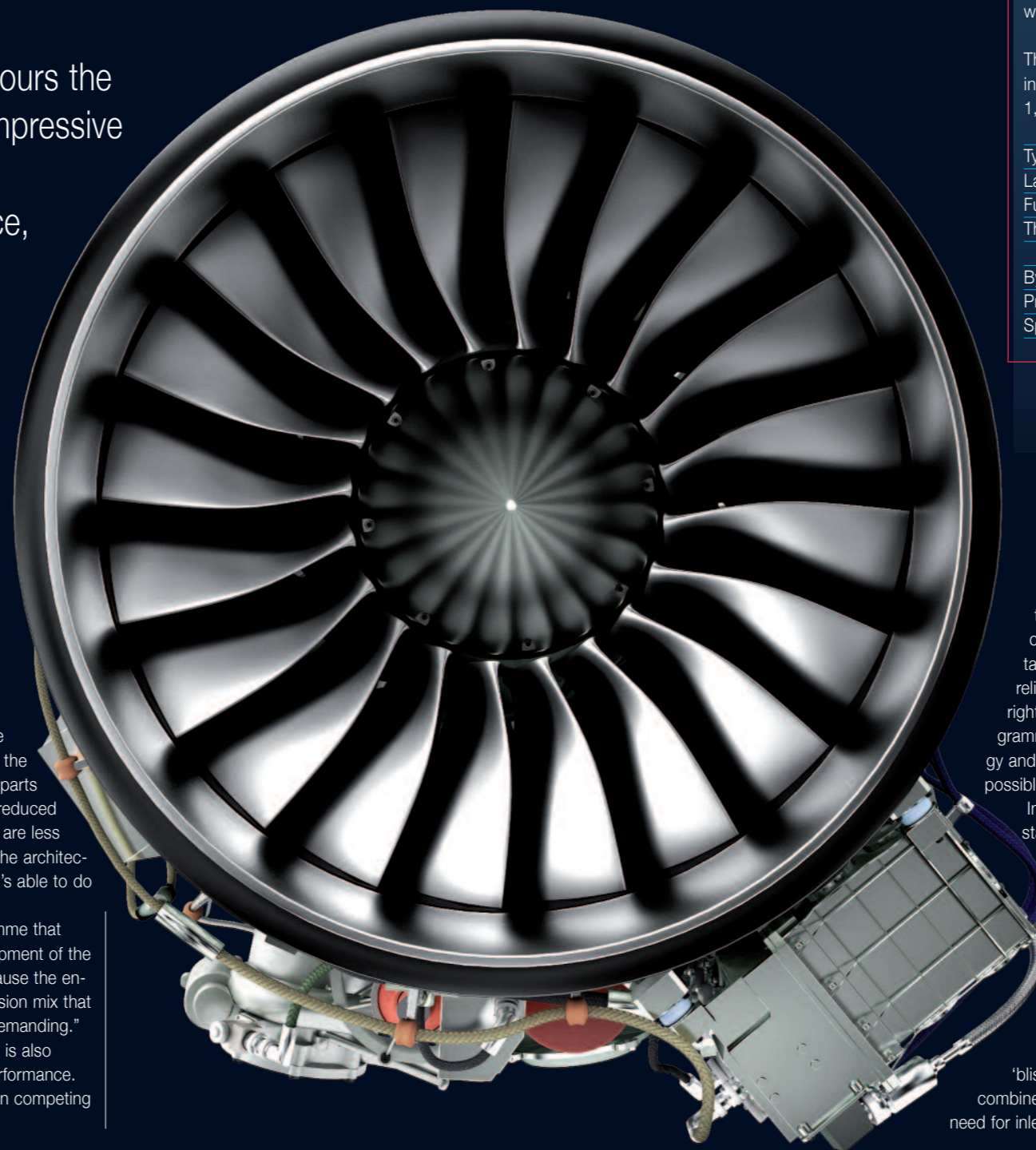
EJ200 has fewer stages than previous generations of engine and, thanks to the application of technology, the

parts count is reduced too. Also, the number of variable components, parts which move within the engine is reduced as well. All of which means there are less things to go wrong. In essence, the architecture is simpler on the EJ200 so it's able to do more with less.

"At the same time the programme that forged the design and the development of the EJ200 was incredibly robust because the engine was designed to meet a mission mix that was very deliberately extremely demanding."

As well as reliability the EJ200 is also renowned for its leading-edge performance. How do you balance the two often competing factors?

"One of the keys to its reliability is the simplicity of the design."



FAST FACTS

The consortium behind EUROJET consists: Rolls-Royce (UK), MTU Aero Engines (Germany), ITP Aero (Spain) and Avio Aero (Italy) is proof of successful partnership working.

The powerplant features high-end compressor and turbine technology and, including its reheat system, is about 4 metres long with a dry weight in the order of 1,000 kg. It boasts a thrust to weight ratio of close to 10:1.

Type	Twin Spool Turbofan with afterburner
Launch application	Eurofighter Typhoon (two EJ200 engines)
Further applications	Single or twin engine fighter aircraft
Thrust	90 kN (20,000 lbf) with reheat
	60 kN (13,500 lbf) without reheat
Bypass ratio	0.4:1
Pressure ratio	26:1
Specific fuel cons	47-49 g/kNs with reheat

"At the heart of the original requirements, equal priority was given to maintainability, performance and reliability. So it wasn't about creating a highly optimised, high-tech, high performance engine that was going to require frequent maintenance or removal from aircraft. It was balancing the maintainability, performance and the reliability. That was the premise right from the start for the programme and, thanks to the technology and the architectural design, it was possible to get that balance."

In fact, in order to reach this state of equilibrium the EJ200 designers introduced a number of ground-breaking factors.

Says Gary: "The compression system combined high-tech aerodynamics to provide the performance, but it was also designed to be tolerant to Foreign Object Damage too. The 'blisk' — the blade and the disk combined — design did away with the need for inlet guide vanes at the low-pres-

sure compressor. The high-pressure compressor has only one variable guide vane, when previously there would be more. The turbine system only needs a single stage on high pressure and low pressure and they are single crystal blades. The material selection, combined with the aerodynamic design, in the turbine, again takes the part count down and delivers high time on-wing.

"From a reliability point of view, to deliver an on-condition maintenance philosophy the engines feature a full authority digital engine control with an in-built health monitoring system. This reduces the maintenance burden because it gives intelligent focused guidance to the maintainers letting them know exactly what's going on within the engine. This improves fault diagnosis activity and also means that the engine in the aircraft is carefree handling. This in turn stacks into the reliability story allowing the pilot to focus on the mission.

"The way the engine is designed and operated provides layers of protection from the issues that might have gone wrong in the past. Pilots love the engine because it gives them all the performance that they need in a very simple and straightforward way. So, it manages to get the performance and the reliability in one go." <<

The fight against DAESH

UK RAF reported that Eurofighter Typhoon through more than 900 missions over Iraq and Syria managed 100% mission support rate proving its reliability and utility. Not one mission missed for technical reasons.

Anti FOD through design

The EJ200's bladed discs have an anti-FOD design, which reduces foreign object damage and means they are very FOD tolerant.

Crystal clear

The single crystal turbine blade is designed to operate 200°C above its melting point.

Hot stuff

At its heart, in the combustion chamber, the heat is about 2,000°C which is nearly half the temperature of the surface of the sun — and the pressure is the same as half a kilometre down in the ocean.

Highly Dependable

The Mean Time Between Removals for engines on the on the Typhoon fleets is significantly higher than specification requirement. The engine removal rate at less than 1 in

1,000 engine flying hours. In fact, the RAF is the fleet leader and the lead engine has achieved over 2,000 flying hours.

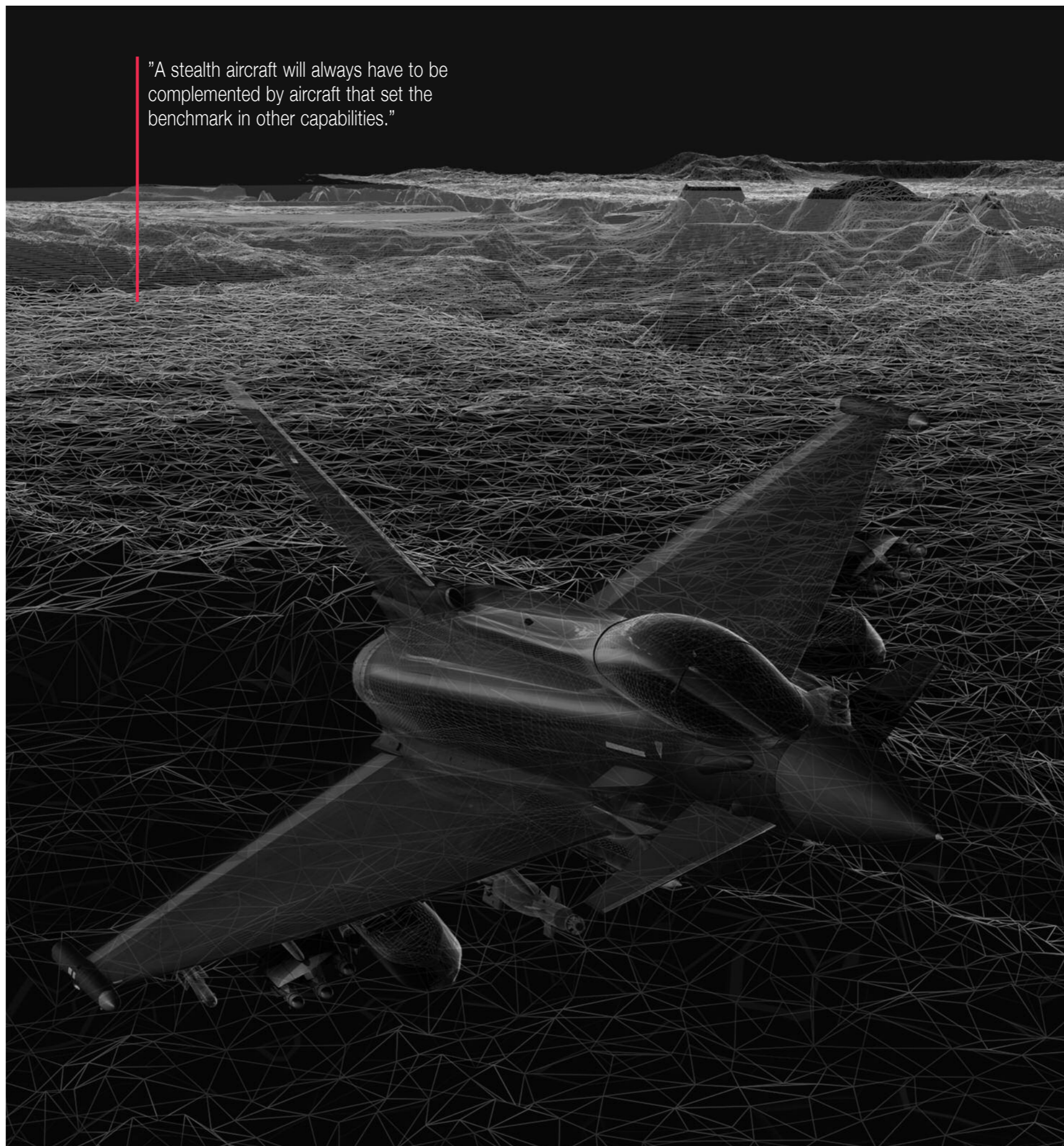
STEALTH: THE HIDDEN PICTURE

Stealth – the ability to give an aircraft the cloak of invisibility – has received lots of attention over the last decade. However, experienced Typhoon pilot **Raffael Klaschka**, Head of Marketing at Eurofighter GmbH, believes that there are a number of issues and facts that are often overlooked when the topic is discussed. >>

Gaining tactical advantage by using stealth assets has its place in a certain spectrum of air war. A number of air forces are adopting this capability – even though it's not exactly a cheap option.

However, stealth comes at another price too. It is limited in terms of other capabilities and the potential disadvantages are rarely, if ever, discussed. But there are a whole host of reasons why a non-stealth alternative might be the best option for an air force – particularly forces with limited budgets who are looking to maximise their military effectiveness in respect of the money tax payers have invested. >>

"A stealth aircraft will always have to be complemented by aircraft that set the benchmark in other capabilities."



To get a more comprehensive and fair view on the stealth topic you need to consider the following:

Different spectrums of air war: There is not "one and only one" type of scenario. History has shown that the capabilities required to achieve desired effect depend heavily on the threat encountered – in the air and on the ground. Clearly there are offensive-type scenarios where stealth is required to penetrate denied air space, gather data and distribute information in real-time.



Raffael Klaschka, Head of Marketing at Eurofighter GmbH

But there are far many more scenarios which don't require specific stealth assets to gain the same amount of information and tactical advantage. Robust capabilities like supercruise, firepower, sustainment and payload - rather than stealth - are widely required over all scenarios. Stealth is a capability that, as mentioned before, has its place, but it remains a niche capability.

And, as a niche capability a stealth aircraft will always have to be complemented by aircraft that set the benchmark in other capabilities. Only then will you be able to project air dominance. Relying purely on a stealth aircraft, with their limitations in payload and agility means relying heavily on coalition partners to project full air dominance.

Firepower: To maintain their stealth characteristics the payload on stealth assets is mostly carried internally. This means a limitation in payload. A Typhoon, for example, just doesn't have this burden as it was never designed around stealth capability. >>

>> STEALTH



A Eurofighter Typhoon with the PIRATE sensor below / front of the cockpit

With just a fleet of stealth aircraft a force would lack firepower. That's why some nations are adopting a complementary approach, combining their swing-role capable fighter force with stealth aircraft. This way they are able to operate in scenarios where stealth brings an advantage. One of those scenarios is known as a "Day 1" scenario, where you need to penetrate denied airspace and attain freedom of action by countering enemy's GBAD (ground-based air defence). But even here the main workload would be carried out by swing-role fighters like the Typhoon. A good example is the UK RAF, transferring all capabilities from the Tornado (via Project Centurion) to the Eurofighter Typhoon. On top of its standard-setting Air-to-Air capabilities the Typhoon will take over all required Air-To-Surface roles from Tornado.

Stealth is not stealth for every sensor:

The high cost of a stealth fighter is the result of a long development cycle to reach a certain level of "stealthiness". This is in a spectrum and bandwidth where most anti-aircraft radars operate. However, you can already 'see' a stealth fighter. Looking through an infrared (IR) sensor, like the PIRATE on the Typhoon for example, a stealth fighter remains fully visible due to its IR-signature.

And, given the rapid pace of technological developments, it's only a matter of time before the technology becomes available to offer sensor coverage of stealth aircraft, fully countering the effectiveness of stealth. That will be a particular concern for aircraft that were developed in the 1990s. Stealth over all spectrums is a myth.

In short, an aircraft might be stealthy today but in 10 or 20 years that might not be the case.

Information sharing and classification:

The real value of a stealth aircraft is gathering data in a time-compressed denied airspace.

However, you can only fully leverage this capability if the remaining assets in the air, on the ground, and elsewhere in the command chain are able to work at the same pace and understand the data. The additional price of introducing the stealth concept is the need

Sovereignty: Aside from the technical interoperability issues there's also a question mark over the sovereignty of the data. The fidelity of the information is only ever as good as the manufacturer allows it to be. With Eurofighter we make sure it is developed according to a



to review and most likely change quite a few processes. Only then can you transform information into quick decisions and probable kinetic effect.

All of which means that you cannot assume that by acquiring a stealth aircraft you'll immediately be able to take full advantage of it. And introducing and incorporating such a concept costs time and money. This is clearly not a showstopper, but it certainly is a major consideration that is rarely highlighted.

In essence, if you want stealth in your air force you have to adapt everything else around it and that includes a new mind-set. We're talking about the whole infrastructure behind how information is processed, classified, who classifies it and how it can be used. And who, at the end of the day, is responsible for the kinetic effect on the target because everything is highly automated.

customer's needs and give the customer the ability to participate as a partner. There are no "black boxes" in the Eurofighter.

IN CONCLUSION

Stealth has been an unquestioned industry buzzword for the past decade, conveniently ignoring the fact that it's a niche capability with a number of associated challenges. On the other hand, Eurofighter Typhoon remains the most complete, robust and effective military solution for most of the challenges in the current and future battlespace. As the bigger stealth picture becomes clearer questions like Information-handling and sovereignty will soon be a natural part of the capability discussion, areas where the Typhoon is also very well suited. <<

TEAM EUROPE OFFER FOR BELGIUM

The European consortium promoting Eurofighter in the ongoing bid to replace the Belgian air force's F-16 aircraft say theirs is a truly 'European' solution. >>

Anthony Gregory, Campaign Director for Belgium at BAE Systems, says that in addition to Eurofighter's proven military effectiveness the bid team's industrial offer to Belgium will create up to 8,000 new jobs as well as giving Belgian industry a seat at the top table of European defence and aerospace for decades to come.

"The Belgians want a highly capable multi-role platform to see them through to 2058", said **Anthony Gregory**. "One that brings the lowest total cost of ownership and in addition they want an industrialisation package which meets their essential security interests.

"The latter is of huge interest to the political decision makers in Belgium because it looks at wider context, things like job sustainability and creation, as well as the impact of the choice on the broader economy. Being a European product and consortium we've put a proposition together that really looks to the future technology needs of the nation.

"It's an offer that's all about Europe first rather than America first. We recognise that it's a straightforward competition between ourselves and F-35 — a European versus US solution — and we believe our advantage lies in being the 'European solution'.

"Eurofighter is designed, manufactured and assembled in Europe, with Belgian industry already an established part of the supply chain. We estimate across the Eurofighter consortium that we currently sustain around €600 million of revenue every year with Belgian companies and support about 10,000 jobs directly in Belgium. Our industrial propos-

als will initially help sustain this activity and, as they pay off, we estimate we can grow that value to between €1.3 and €1.5 billion per year. That's a significant increase over the life of a 30-year programme. Independent analysis also suggests it would create between 6,000 and 8,000 new and highly skilled jobs."

Gregory says one of the consortium's key industrialisation proposals includes the establishment of two, innovation centres. They're proposing one in Flanders and another in the Wallonia region. Each would have slightly different R&D agendas and focuses; one around advanced materials and the other looking at additive layer and manufacturing technologies. These activities are on the national agenda.

"We've been talking about the idea to the Belgian companies involved and asking what areas of technology they are interested in. Bridging this technical readiness level between academic research and commercially viable technologies is a big investment. The model is similar to the Advanced

Manufacturing Research Centres in the UK. Belgium can see the benefits of this approach and our analysis indicates that it would bring significant benefits to their economy as we go through the life of the programme.

"We estimate we can grow the value to the Belgium economy between €1.3 and €1.5 billion per year over the life of a 30-year programme."

"Belgium's existing aerospace base is already very capable, particularly the manufacturing of components and sub-assemblies. In fact, it's among the most competitive

and the most profitable in Europe. Hence the industrial activities we're offering are linked to where the Belgian aerospace sector sees itself in the next 20 years or so.

"We've really focused on research and development around specific sectors of advanced material science. For example, how we use graphene, how we use glass metal composites and the development of future manufacturing technologies themselves, such as additive layer manufacture. Our offer looks to the digitisation of factories, in terms of re-configurable factories, robotics, cobotics, all of these types of things. >>

>> TEAM EUROPE OFFER FOR BELGIUM

"It's a very exciting proposition because we believe that some of the technologies coming out of these innovation centres will be enabling technologies for a future programme in Europe. Belgian companies would be able to bring some niche technologies to the party and be part of European security, rather than being completely dependent on somebody else. They would have a voice and be able to play an active role."

Another key element of the industrial package being put forward by the Eurofighter consortium is around cyber security.

"We are proposing a government to government cooperation around cyber enabled by BAE Systems Applied Intelligence at Belgium (a Belgian entity set up to establish a national cyber defence capability for Belgium). This is an area which is firmly on the Prime Minister's agenda and we think that's also a discriminating part of our offer."

When the Belgians put their Request For Government Proposals out in March last year another key aspect they wanted out of the process was a strategic partnership.

Gregory says: "This element of our proposal is not just about the aircraft but it's about training, the use of airspace, the use of facilities such as Electronic Warfare Ranges, it's about working together on operations; using logistics chains and mobility chains. That's why the UK MoD and the Royal Air Force have committed to a really deep and strategic partnership with the Belgian Air Force for the life of the programme."

"Obviously there's a military effectiveness assessment and we're absolutely competitive in that sphere — indeed ours is the most forward leaning capability offer ever proposed

with the Eurofighter. But affordability, both at the initial acquisition and, most importantly, the total cost of ownership, which includes support, the weapons, the training, everything, is another key measurement. This is one of our major strengths where we believe we have a significant advantage over F-35.

"We're proposing that we work shoulder to shoulder with the RAF on Eurofighter. We will manage the fleet support jointly through the TyTAN enterprise and the future capability would be exactly the same for the two air forces — the same weapons set and weapons capability. TyTAN is the most effective combat aircraft support programme in the world, full stop. Under it we will be operating Eurofighter for the same cost, or even less, than Belgium is currently operating an F-16. We know definitively we have a very attractive and proven through-life support mechanism, which will continue generating savings as we go forwards together."

It's a practical solution too. The two Belgian air bases in Florennes and Kleine Brogel are closer to Coningsby than Coningsby is to Lossiemouth (the RAF's second operating base in northern Scotland).

<<

THE TIMETABLE

2014: A Request for Information is issued by the Belgian government signalling the start of the process.

17th March 2017: Belgian government issues Request for Government Proposals [RGP] for an F-16 replacement. The BAE Systems Campaign Director Anthony Gregory and his team deconstruct the different elements of the RGP and work out the model and the partnership with the MoD and RAF.

7th September 2017: Deadline for bids to be received. Once submitted, a formal process starts to validate the content of bids — this ensures a complete understanding of the offer. That's followed up with formal dialogue, described as clarification and qualification of bid information. 35 specialists visit RAF Coningsby, Warton and Edinburgh to look at the detail of the bid.

14th February 2018: Best and Final Offer stage — deadline for final offers have to be submitted.

July 2018: Decision expected to be announced, possibly around the NATO Summit in Brussels.



Eurofighter Typhoon will generate long term Economic Growth in Belgium by addressing the protection of all Essential Security Interests, and position Belgium for a future European combat aircraft programme.

Building on the already well established Eurofighter consortium footprint in Belgium, our ESI proposals will generate an estimated €19 Billion of additional economic value by 2043, with wider multiplier effects creating a further €6.2 Billion. With significant investment in research and development of world leading manufacturing and material technologies, and knowledge

transfer, selection of Eurofighter Typhoon will position Belgium for partnership in a next generation European combat aircraft programme. In addition, the establishment of a National Network Cyber Centre in co-operation with the UK will protect vital sectors of the Belgian economy and create highly skilled cyber specialists.

Over 25 years the Eurofighter ESI Proposals could deliver €19 billion into the Belgian economy, with an additional €6.2 billion from wider economic multipliers

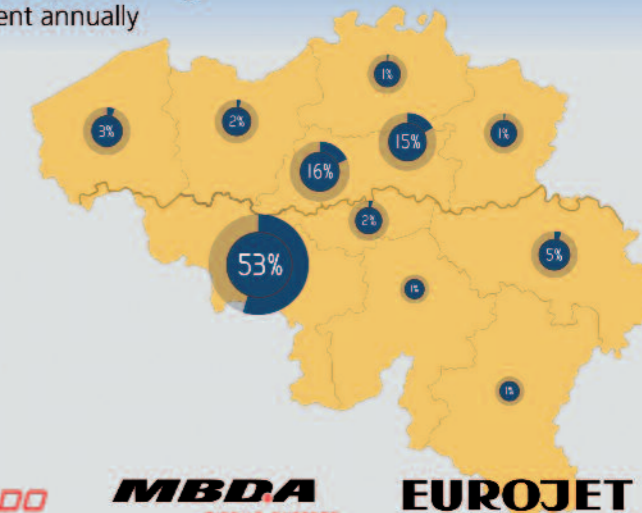


Current Eurofighter Programme Footprint in Belgium > €600 million investment annually

Eurofighter and Eurojet consortium companies spend over €600m annually in Belgium, working with some 200 companies spread across the regions.

- €378m+ Estimated annual spend in the Wallonia region by Eurofighter consortium companies
- €132m+ Estimated annual spend in the Flanders region by Eurofighter consortium companies
- €90m+ Estimated annual spend in the Brussels region by Eurofighter consortium companies

This equates to a further €7.2B of sales between now and 2030.



AIR DOMINANCE



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Typhoon**

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