EUROFIGHTER

PROGRAMME NEWS & FEATURES
JUNE 2020

WORLD

- The Best Is Still To Come
- Southern Defenders
- Solid In Defence

EUROFIGHTER **EVOLUTION**

Eurofighter Typhoon

2020 · EUROFIGHTER **WORLD**

Cover: A pilot of the 4th Wing inside the Eurofighter cabin during the last TLP 2020-1 course held in Albacete (Spain) in February. During the training, the Typhoon pilots work towards the mission commander qualification.

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JUNE 2020

CONTENTS

PROGRAMME NEWS & FEATURES
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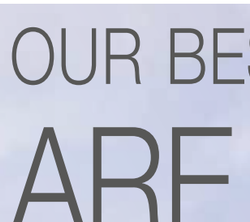
OUR BEST YEARS ARE STILL AHEAD



Eurofighter GmbH CEO, **Herman Claesen**, discusses how Europe's future air power requirements and Typhoon's future capability journey are converging.

Eurofighter is already the most successful European defence project ever. But anyone who believes that Eurofighter has reached its peak could not be more mistaken — the truth is the best years are yet to come.

Right now, we have a number of exciting opportunities. There are serious prospects, both in terms of more sales and future capability developments.

You only have to look to our core nations to understand that sales landscape.

Germany is ready to replace its entire fleet of Tranche 1 Eurofighters, in excess of 30 aircraft under its Project Quadriga programme. These will be replaced by new-build latest standard Tranche 3 aircraft that will include the E-Scan radar and updated software. In addition both Germany and Spain are expected to place a contract this year to implement the new E-scan radar in their fleet.

These plans clearly demonstrate Germany's ambitions to significantly advance the Luftwaffe capability and their trust and commitment to not only the Eurofighter programme, the aircraft and its capability, but also clearly supporting the European Defence industry.

Germany is also looking to replace its Tornado fleet. I firmly believe that Eurofighter is the country's best choice. We will be continuing to support the German nation with information to support their assessments and we look forward to entering detailed talks in due course on how this requirement can be satisfied.

However, the need for more aircraft to be manufactured doesn't stop here. We also received a 'Request for Quotation' from the Spanish government to provide an offer to commence replacement of their F-18 fleet which are fast approaching the end of their life.

Since the very beginning of Eurofighter, both Germany and Spain have shown great trust and commitment in the programme — and both will be part of our future.

EVALUATING THE EXPORT MARKET

While discussions with existing customers on augmenting their respective fleets continue, we have also successfully completed flight evaluations in Finland and Switzerland.

These trials confirmed Typhoon's strength from a capability point of view, and both of these potential customers have noted the comparatively small support footprint directly contributing to more affordable operating cost.

Of course, whenever we take part in these global competitions, we are in a highly competitive environment, but the Eurofighter offering is strong — and by that I'm not purely thinking in terms of capability but also politically and importantly, credible industrial offerings underpinning a strong economic dimension.

Recognising the four-nation collaborative nature of the Eurofighter programme; from day one, the Eurofighter programme has built its solutions on the best balance between politics, sovereignty, budgets and operational capability. Eurofighter therefore is THE role model for European defence collaboration.

People try to compare us directly with other aircraft but that would be to ignore the fact that the Eurofighter programme is so much more. It forges political, industrial and operational relationships; our operators have more ownership of the asset and our air forces are much more connected. In short, there's a whole Eurofighter eco-system that you are part of which has collaboration at its heart. These are the kind of things you simply don't get if you buy something 'off the peg'.

EVOLVING CAPABILITY

Of course, deals for new aircraft represent just one side of the equation — the other is capability. Here again we have a number of major enhancement programmes running. Eurofighter is already able to carry a very impressive array of air-to-air and air-to-ground weapons. In addition to this we will shortly be introducing our first E-scan variant into the Typhoon fleet. This will be one of the most powerful and capable air combat radars available on the market and will significantly enhance our weapon systems capability.

And in parallel, last year we announced a study of the Long-Term Evolution (LTE) of the aircraft to ensure it will continue to be part of the backbone of NATO air defences to 2060 and beyond. The LTE study is now taking shape, and we are entering into conversations with our customers about finalising a detailed programme of mission system enhancements. These will improve the aircraft's processing capability, increase its agility to introduce new capability and enhance the operator interface using latest technologies.

All of this is being developed with the next generation air combat system in mind. Not only will Eurofighter be a technology maturation platform for the future fighter, it will also have to co-operate seamlessly with a next generation air combat solution. We aim to deliver the best possible air combat capability by harnessing the innovative technologies that will protect our nations while strengthening Europe's future prosperity.

THE MATURING E-SCAN PICTURE

We have already made significant advances in the maturation of E-Scan. This will offer a step change in capability — with a class-leading wide field of regard offering significant benefits in both the air-to-air and air-to-surface domains. The large power and aperture will provide pilots with much enhanced coverage compared to other solutions.

We flew the first Kuwaiti production aircraft equipped with the entry into service standard of E-Scan and the newest P3Eb weapon system standard in December 2019 and completed a further series of test flights in March this year.

Our E-Scan development and test programme is already intense, and throughout 2020 there will be a number of technical maturity milestones to complete.

As well as forming the entry into service level for Kuwait and subsequently Qatar Air Forces, the E-Scan programme will also be the foundation for the early embodiment of the solution on Typhoon for the German and Spanish Air Forces.

COLLABORATION AT OUR HEART

Effective collaboration has been our bedrock and remains at the heart of what we are. Already the most successful European defence programme ever, Eurofighter is the benchmark for collaboration across the continent.

Our core nations all believe firmly the importance of a strong Europe in terms of defence and security and the Eurofighter Typhoon programme plays an important role in supporting this objective. All four nations have a strong commitment to NATO and see their defence and security relationships with European states, as critically important.

Yes, the Eurofighter programme delivers economic benefits to the core nations and industry, but it also forges political alliances — alliances which create mutual benefits and underpin the strength of Europe as a positive influencer globally, specifically on security.

EVERYTHING CHANGES

During combat operations and air policing operations in the Baltics, Eurofighter has proved its operational strengths, with hugely positive feedback from operators.

An evolving Eurofighter makes sense for a number of reasons, says Typhoon pilot and Weapons Instructor **Daniel Krueger**.

Everything changes. Threats mutate and multiply. Technology shifts and data is exploding. The way wars are fought, and territory defended, is altering. And so, the question is, 'Where does Eurofighter Typhoon fit into this?'

The answer is simple: Eurofighter is constantly evolving too.

More specifically, ideas around a future vision for Typhoon are taking shape and key aspects that can be delivered have started to be identified.

Agreement on an evolved Eurofighter will secure a number of things: the operational sovereignty for European nations, our core engineering minds, and defence industrial base, along with all the economic benefits that brings. With every Euro spent in Europe, the investment stays in the European economy.

In parallel, the evolution of Eurofighter will deliver the best possible technology path towards future air domain security for the region. And it represents a cost-effective technology route towards FCAS capability; while ensuring evolving 6th-generation system compatibility.

Where are we now?

Right now, Typhoon plays a key role in securing the defence of Europe, with more than 500 aircraft defending the skies over Europe, and realistic hopes for more sales, as several European nations are looking at the potential of Typhoon for the defence of their countries and Europe. Even today
Eurofighter is Europe's largest and most successful defence collaboration programme.
It supports more than 100,000 highly-skilled jobs across 400 companies in Europe.

And, during combat operations like Operation Shader over Syria and Iraq, and air policing operations in the Baltics, Eurofighter has proved its operational strengths, with hugely positive feedback from operators.
Their opinion is clear and unambiguous, as Eurofighter has climbed up the capability curve, through the addition of weapons like Paveway IV, Storm Shadow, Meteor, Brimstone II, and other elements of a 'Phased' enhancement programme, the aircraft has evolved in the right direction.

Looking to the near horizon, the capability roadmap envisages the embodiment of E-Scan radar and the next enhancement, P4E. However, to ensure Eurofighter remains flying and is still relevant into the 2060s, the evolution beyond P4E needs to be mapped out. And that's what's taking place now.

Getting to grips with future needs

From a logical standpoint we need to continue the Eurofighter evolution journey but no-one can anticipate exactly what might be needed for the 2050s and beyond. Nobody knows what the threat environment will look like then.

What we do know for certain today is that Eurofighter offers huge growth potential, in terms of connectivity and the ability to fully exploit current and future sensors. Unlocking that potential is key to ensuring that the aircraft stays as relevant in the decades ahead as it is today.

While the detail grows increasingly hazy the further out you project, some of the core characteristics required to retain relevance as threats evolve are already coming clearly into view. These include battlefield awareness, interoperability, connectivity, flexible firepower and cyber-resilience.
If that shopping list represents a future commander's base requirements, the next question is: what are the fundamental enablers that will help transform it from a wish list to a done deal?

From a pilot's perspective, you'd say that in complex air-to-air and air-to-ground scenarios, you will need 360-degree, time-sensitive battlefield awareness. You'll need connectivity for tactical operations, decision-making and data/imagery sharing. In addition, with so much reliance on data, you will need incredibly secure cyber-resilience. And, at the end of the day, you will still need to be able to call on flexible and scalable firepower.

Hence, in order to make Eurofighter fit for the future, you have to look at certain enablers — many of these are going to be required in the future on all kinds of assets, not just Eurofighter. →

It means boosting the onboard processing capacity to a high level to be able to cope with all the new technology and information that will be gathered by a range of more sophisticated sensors, both on board and elsewhere, like for example, from a forward air controller. It also means having the capability to elaborate on, present and share data. It means having an ability to carry a wide variety of weapons and, often, using them in the same mission.

The way we use those kinetic effects should be scalable. The pilot should be able to choose from the aircraft gun, up to a 2000lb bomb, and be able to release these different weapons in any way he needs.

What does this mean in terms of capabilities

INFORMATION SUPERIORITY

Let's start with the end in mind: information superiority. That's what any pilot or any commander needs in order to hold an advantage over an adversary.

What does that mean? Well, consider this, the air domain will once again become a contested one and there will be increasingly complex operations, featuring a range of connected assets, meaning scenarios become ever more dynamic. To operate effectively in this new world, you will need information at hand and be in a position to use it first. A prerequisite of this is connectivity. You need to be able to 'talk' and share your information across multiple domains of air, land, sea and space.

You have to have reach back capability, where you communicate with your decision-makers and give them the information needed to make a tactically sound decision. And fast. We are talking seconds.

Information superiority also means having better target fidelity. Quite simply, the more precise the data, the better the weapon effect. And, to get to this point requires data fusion — supplying the pilot in any split second ALL the most relevant information. Easy to say — getting to that state is quite a process.

So, there's a clear requirement for enhancing Eurofighter's computing capacity in order to fully exploit the new sensor technology.

Coupled with that we are also looking at a redesign of the cockpit — again this is in part being driven by a desire to unlock the full potential of new sensors like E-Scan radar. These are essential steps to ensuring Eurofighter's role as a force multiplier is utilised to the max.

FIREPOWER AND OPERATIONAL FLEXIBILITY

Next up is firepower and operational flexibility. To fulfil a complex task with minimal reaction time you have to be able to maximise and optimise what you have on the jet. Eurofighter already has a very impressive set of weapons but in the future we are also looking into electronic attack and other mission roles. It will offer a much wider and scalable spectrum of effect.

What's envisaged is a Eurofighter that's as flexible as possible, one that can carry more and has fewer constraints in terms of its flight envelope. Ultimately, that envisages a future where you are able to hang whatever is needed for a particular mission under each wing.

An increase in the number of missiles on the aircraft is also being looked at. Consider this: a configuration with up to 16 air-to-air missiles and also 14 air-to-surface weapons. That's fully exploiting the capability of the Eurofighter.

As a pilot I believe there will be a future requirement for an aircraft that just has its boxing gloves on. Yes, it's nice to have a sensor monster, but you need one with a powerful jab too.

This flexibility would also increase a pilot's fighting time in the battlespace available. To aid this development, ways of increasing fuel loads with new extended range tanks, and more fuel stations, are being looked at.

It would maximise Typhoon's firepower while still fully exploiting the potential of the aircraft, because what doesn't change is Eurofighter's world-beating characteristics — its extreme high thrust-to-weight ratio, its power and its agility.

In short, more weapons, and an ability to carry a greater variety of weapons, means greater operational flexibility. That's one of the reasons why pilots want to have a Typhoon flying by their side.

Then there are improvements that will extend the lifetime of the aircraft both in terms of flying hours and flying years.

EXPLOITATION OF SENSOR TECHNOLOGY

Other key areas include faster sensor management, self-protection kit and increased battlefield awareness. That means: the introduction of multi-core processing, high speed data network, further exploitation of our Defensive Aids Sub-System (DASS), new cockpit technologies like a larger display, and a new helmet display, Striker 2, which is about to be integrated. We are also looking into the provision for app-based programming of the jet.

The latter means restructuring the mission architecture in order to enable an app-based enhancement. This would potentially open the door for national specialists to programme the jet and give a nation a specific requirement.

This idea of flexibility is being addressed in the planning stage. All of the enhancements are envisaged as scalable options, that the nations might elect to do it or just go for part of this technical solution according to their national requirements.

But it's clear that new sensor technology, like E-Scan radar, will have a high demand on the data network on the aircraft and need processing power to fully exploit them. So a common baseline, including the safety critical items, would have to be agreed.

The processing power and the sensors provide information which drive towards a very increased battlefield awareness. You need a way to display this. In short, to truly exploit new sensors you need a large area display.

Generations

Eurofighter's evolution is a continuous transition. The jet will be flying and relevant until 2060 and beyond, playing a key role in the future battlespace alongside any future combat air system.

Indeed, a number of technologies ideas and solutions currently being earmarked for these 6th Gen Combat Systems can be matured on Typhoon and then evolve into a future combat air system. For example, the large area cockpit display. Putting that onto Eurofighter will allow the industry partners to gain experience about how to integrate it and take this knowledge onto a 6th-generation fighter.

Other examples include high-speed data networks and multi-core processing, both key aspects where gaining experience, via Eurofighter embodiment, will have important spin-offs for bringing those features to a future system.

A Common Core with Inbuilt Flexibility

While there is an emerging common thread of national requirements, each national air force might also have its own specific needs. That's normal and Eurofighter has proven to be flexible in the past, indeed its flexibility is one of its strengths.

It's therefore important that any enhancements that go onto the aircraft are as scalable as possible. Initially, nations will agree a common baseline and they are currently making progress on this. Part of the thinking behind the current evolution study is to identify the common development threads and examine how these can be scaled.

There's a high degree of interdependency here too. For example, the arrival of an E-Scan will give the pilot more accurate target data and hence you can better employ your weapons. But to carry all the weapon configurations you might want, you would need an aerodynamic modification kit.

FACTS AND FIGURES:

- 623 aircraft ordered – Europe's largest military collaborative programme
- More than 525,000 flying hours achieved
- 97% mission availability during Unified Protector 2011 (Libya)
- 99.4% mission availability during Baltic Air Policing 2015
- Current deployment over Baltics and Middle East
- Over 300 yearly flying hours per jet
- Eurofighter is the backbone of NATO Quick Reaction Alert over Europe
- Combat-proven during operations over Libya, Syria and Iraq
- More than 10,000 hours flown, over 800 precision-guided ammunition dropped in missions, during operation Shader by UK RAF

LEONARDO ISPA 6 TESTAIRCRAFT COMPLETES THE **E-SCAN RADAR ENTRY** INTO SERVICE FLIGHT TEST CAMPAIGN

On the 23rd of December 2019, the first Instrumented Series Production Aircraft (ISPA 6) equipped with the Kuwait Air Force configuration has successfully completed its first flight at the Flight Test Centre of the Leonardo Aircraft Division in Turin-Caselle.

To accomplish this achievement, an Italian Air Force Typhoon (IT 014) went through a radical modification process in the Caselle Plant ultimately being named the Instrumented Series Production Aircraft 6 (ISPA 6).

ISPA 6 represents the latest technological evolution of the Eurofighter Typhoon test fleet, having the most sophisticated weapon system on board. In fact, ISPA 6 is one of the three Typhoon test aircraft currently equipped with the Captor-E electronically scanned (E-Scan) radar, which is being designed and produced by the EuroRADAR consortium, led by Leonardo in Edinburgh, UK. The aircraft is currently allocated to the Eurofighter/NETMA Phase 3 Enhancements Package b (P3Eb) development programme to perform E-Scan Entry Into Service (EIS) flight tests and provide clearances for Kuwait, which has ordered 28 Typhoon aircraft.

In March the aircraft completed the "E-Scan XCR#1" flight test campaign, performing seven sorties between the 3rd and the 27th March, also in partnership with two Italian Air Force Typhoons.

This challenging programme was completed on schedule, despite the difficulties posed by the global COVID-19 pandemic: all flight test points were completed and all planned evidences were collected in order to best contribute to the path towards final clearance for the Kuwaiti customer.

Notably, the E-Scan XCR#1 campaign highly benefited from the ISPA 6's permit to fly granted by the Italian National Aviation Authority and the other Partner Nations within just a few days from the receipt of clearance documentation. This was the first time in Eurofighter history in which permission has been granted so quickly demonstrating full commitment from the wider Typhoon community on the Programme.

With the successful conclusion of the E-Scan XCR#1 flights, ISPA 6 has also completed the broader P3Eb flight test campaign. Nevertheless, the aircraft will continue flying in July and August in order to perform final E-scan software certification flights for Kuwaiti Initial EIS-standard aircraft as to support the initial deliveries of Typhoon to Kuwait.

Production of Kuwaiti Typhoons commenced at Leonardo's Turin-Caselle site in May 2019. To this day, eight aircraft started their final assembly processes. KT001, the first aircraft of the batch, is now undergoing electromagnetic compatibility (EMC) testing and the other aircraft will follow soon.

THE **FAMILY BUSINESS**

On March 27th 1994, 5-year-old Jan Kramer went 'to work' with his father Christian Kläsener, Eurofighter's Manager Flight Ops and Capabilities. It was a special day in European aviation history and one that would change young Jan's life forever. The trip was to the Airbus factory in Manching where the pair witnessed the first flight of the Eurofighter. Fast forward 25 years and today Jan is a Captain in the German Air Force, flying Eurofighter Typhoon jets.

"Flying has been in my blood almost from the day I started to walk," says Luftwaffe pilot Captain Kramer. "Naturally, with my father working for Eurofighter I was inspired to get involved in the industry in some capacity from the very beginning. I was only five when my dad took me to witness the maiden flight."

Jan's decision to become a pilot came during fifth grade when he started looking into getting into one of the squadrons. Over time the dream turned into reality.

"There's always been a unique connection with the Eurofighter programme because my dad was so intimately involved. One time when I flew in one of the aircraft from Nörvenich for the 400-hour inspection, I texted him the day before and suggested meeting up there. That was a very special moment for us. It was a once-in-a-lifetime chance to meet up and do business."

AUSTRIAN TYPHOONS PROVIDE **DAVOS PROTECTION**

Eurofighter aircraft from Austria's Bundesheer secured Austrian airspace during the World Economic Forum in Davos last week. The Eurofighter Typhoon jets were on hand to secure the annual event in Switzerland, under the auspices of the newly-created Air Force Command named Operation Dädalus.

THE BIG PICTURE

Royal Air Force Typhoon pilots from RAF Coningsby in Lincolnshire continue their operational training whether it be for Quick Reaction Alert in the UK or the Falklands or deployed international operations such as SHADER in the Middle East.

PARALLEL LINES

Finland and **Switzerland** are both running competitions for new combat aircraft. The next 12 months will be crucial as decision day looms. While both nations have very specific requirements, there are a number of similarities. Both are looking to replace ageing fleets of F-18s, both nations are working to broadly similar timeframes, both put a very strong emphasis on running a fair contest, and both Finland and Switzerland represent an opportunity for future Eurofighter sales.

TWO NATIONS, TWO CAMPAIGNS, BUT SEVERAL COMMON THEMES

Franz Posch, CEO, DS Schweiz Airbus, and **John Rossall**, HX Campaign Director, BAE Systems, understand each other's roles well. The two men respectively lead the Swiss and Finnish campaigns on behalf of the Eurofighter partners.

SOVEREIGNTY AND MISSION DATA

"Sovereignty is key to our offers in Finland and Switzerland," says John. "It's an important but complex issue but one way to help understand it is thinking about it in terms of a social media. A couple of years ago, people didn't understand that Facebook or Instagram could hold and use all their personal data unless they ticked a box. Nor did they realise that these companies could pass this data on to marketing companies or whomever. Today society is much more aware and eager to protect personal data.

"If you think about how important your personal data is, then consider it in terms of a nation's military and security data then you can see how imperative the protection and sovereign control of data is. The collaborative nature of the Eurofighter programme and the core nations ensure new partners are equipped to collect and exploit their sovereign data. The ability to do this is unique to European offers, the speed, and programmability and therefore usefulness is unique to Eurofighter.

What we are talking about is being able to assess the data you're collecting and use it to defeat threats. Eurofighter will allow you access to your data and access to your sensors so you can adapt them to the threat. Essentially, it allows you to do things you need to do to gain a military advantage. If you don't have sovereign control of your data, then you've got to seriously question your ability to sustain military credibility now and in the future.

"What we demonstrated clearly in Finland was that Eurofighter was able to identify potential threats and then the planner was able to reprogram the mission data, provide it back to the aircraft. This is how it knows how to deal with threats. The unique thing about Eurofighter, is that it can be turned around on a sortie by sortie."

John says this message around sovereignty and mission data is starting to land. "Let's face it, we're talking about titanium, carbon fibre, and two phenomenal engines. But the crucial element is all the 1s and 0s.

John Rossall (left), HX Campaign Director, BAE Systems and Franz Posch, CEO, DS Schweiz Airbus,

It's sensors, it's data and your ability to access the 1s and 0s and analyse them and use them. That's really what you're buying. All the hardware does is collects that data — if you don't control that, if you can't defend yourself against the threat and you can't direct your complex weapons to a target, then all you're left with is a very expensive bit of kit that you might not even be able to fly."

SECURITY OF SUPPLY

Both nations put a strong emphasis on security of supply and software. They both respect the fact that they have to have sovereign capability and need to be able to act independently. Hence the importance of the sovereignty issue.

ENDURING CAPABILITY

Both nations want confidence that their chosen platform will be flying and supported into the 2060s. Eurofighter is a phenomenal platform, with a fantastic structure and very powerful engines. And it's got potential for growth in those two areas. The military capability is changing its sensors, its weapons. 2060 is important but both nations want to understand the Eurofighter capability road map that will ensure its relevance throughout its years in service.

STRONG EUROPEAN FOOTPRINT

This notion is becoming more and more important. From a Finnish perspective, Finland is a very pro Europe nation. Part of being a European solution means collaboration is in our core.

It's a similar story in Switzerland. Says Franz: "We are proud to point to Eurofighter as the European solution because we offer common training, common exercises with the partner nations, while also allowing the Swiss to retain the ability to operate their fleet independently.

"Sometimes Eurofighter is misunderstood and viewed simply as a product. The truth is that it's really Europe's biggest multinational defence programme. We have four core nations behind it, we've got three of the biggest defence companies in Europe behind it. If you want to compete in F1 you don't buy simply an F1 car, you need to be part of a team." →

SWITZERLAND

WHAT IT WANTS

Switzerland needs to replace its ageing fleet of F-5s and F-18s, which are planned to be phased out between 2025 and 2030. The contest started with a Request for Proposal in 2018, which was focused on the capabilities they were looking for from a replacement.

Switzerland is a neutral state, not a member of NATO, and its major task is air policing, but in 'intense situations' they want to be able to defend their airspace.

Switzerland is asking for 36 aircraft in full condition, with everything included in their package. They also want to have a single price for four additional aircraft and the budget is 6 billion Swiss francs. Switzerland is asking for an offset commitment of 60% of the purchase price.

"The good thing is Switzerland has very clear requirements, a confirmed budget, a clear and well-defined evaluation process." Interestingly they are asking for a solution that is very similar to the solution that Germany is introducing. This Swiss Eurofighter would be almost exactly the same.

THE PROCESS SO FAR

Last year the competition moved into a key stage — the Flight Evaluation Phase. Explains Franz: "The flight trials are a huge effort and carry lasting significance. In effect, all the things we had claimed in the proposal had to be demonstrated in the flight evaluations. We mainly used UK Eurofighter jets, but supplemented those with a German Eurofighter because they had different software configurations, and used both. We needed both variants to really show exactly what's available."

HOW HAS EUROFIGHTER FARED?

"We flew all the missions and performed all the tasks they gave us. We had a two-seater aircraft and they sat in the back in order to get a direct view. They were also flying alongside us using their own F-18s to see close up what we are doing. After the flights the pilots took part in extensive debriefings. The whole effort was carried out in a hugely professional way from both sides. There are very strict rules governing the process but the result was that the customer was really satisfied."

The Swiss evaluations highlighted another Eurofighter strength: reliability. "We took an Airbus A400M loaded with spare parts to Switzerland for the trial, but we didn't need a single screw, which showed them Eurofighter's high reliability."

In addition to the live flying, the Swiss team also carried out simulator trials in Germany and the UK, looking at a number of different weapon configurations, so they could get a feel of what's possible in different scenarios.

A KEY ISSUE

Lifecycle costs are crucial, says Franz: "A support audit took place last year. Switzerland is particularly interested in the lifecycle costs of whatever they finally end up procuring and how you operate your aircraft over time. One of the reasons for this is that Switzerland will be the last nation flying F-18 as it's more or less at the end of its lifecycle. As such they're having to invest heavily in order to keep their F-18 fleet operating. They've found it's very expensive at the end of the lifecycle if you're the only user left. Hence recent pronouncements stating that Eurofighter will be flown beyond 2060 are very important for Switzerland, because they don't want to be in the same situation again."

WHAT'S NEXT?

In January this year the Swiss team received the RFP Part 2 which puts the focus on what it will actually deliver, and this proposal has to be delivered by August 19th — it's the Best and Final Offer (BAFO) stage. Says Franz: "That's it until Type Selection and this will be made in Quarter 1, 2021. However, the final details on fleet sizing, weapons and mission equipment will be taken after the Type Selection."

The final decision will be made on the minister's level of all seven ministers because it's a strategic decision. It's not only about the product. It's about a partnership, their security relationships, and this is a very important factor in the process.

CAN WE WIN?

Our strong belief is that we have a very stable solution.

FINLAND

WHAT IT WANTS

Finland too is looking for replacements for its F-18 fleet and delivery timescales are similar, with deliveries required between 2025 and 2030. Finland's primary requirement is to defend its territory. Eurofighter is fast, it can fly high and carry an array of advanced weaponry, and that's exactly what you need when you have a threat in your airspace.

It has a budget of 10 billion euros and wants full value for every cent spent.

Says John: "Finland has identified a number of scenarios which they need to defeat. The configuration of Eurofighter we will propose, will include capabilities that are not currently on the aircraft today, but they are part of the UK RAF's requirements and will be embodied prior to when deliveries are due to commence."

Both nations want confidence that their chosen platform will be flying and supported into the 2060s. Eurofighter is a phenomenal platform, with a fantastic structure and very powerful engines.

THE PROCESS SO FAR

"We submitted an RFQ response in 2019 and a revised RFQ response on 31st January 2020. We are continually developing the solution that we'll finally offer with the Finnish customer and this process will go up until the end of May this year (some programme changes may result from Covid 19). Then they will produce their Best and Final Offer documentation, which we will respond to," says John.

Finland has carried out cold weather flight evaluation trials where they operated the Eurofighter at base for the week. But there are other evaluations too, including simulator trials which will be used to verify some of the things we've offered in our proposal.

KEY ISSUES

1. Support: On the support side the UK has demonstrated through TyTAN that it can provide high availability at a low operating cost, and an availability-style contract will be proposed at the sustainment phase. But we'll do that in partnership with the Finnish military and industry.

"We will transfer as much MRO (Maintenance, Repair and Overhaul) capability as we possibly can to Finland, to be as close to the operator as possible. That means the operators can deliver the maximum military capability possible; provide the means to drive platform availability; therefore airplanes are available for flying the missions. By providing support as close the aircraft as possible we will also need to provide airworthiness and engineering support – which we can and will do."

2. Sovereignty: Eurofighter will provide Finland with sovereign control of their own mission data. That's a key USP in both these competitions.

WHAT'S NEXT?

A decision is due around April 2021.

CAN WE WIN?

Yes. Eurofighter was designed to be a phenomenal air superiority fighter. The Centurion Programme transferred air-to-surface capabilities to Eurofighter that made it a world beating multi/swing-role fighter. Investment in Eurofighter, that will introduce new complex weapons, expand the flying envelope, enhance its sensors and person-machine interfaces make Eurofighter a very strong capability for Finland. Add the military capability to the political and industrial partnership in Europe and Eurofighter wins.

SOUTHERN DEFENDERS

The Italian Air Force's Trapani Air Base is home to the 37° Stormo and the 18° Gruppo. It is one of the most important geo-strategic hubs in Europe. With its Eurofighter Typhoon fleet, the air base plays a key role in safeguarding the Mediterranean region. We were granted exclusive access to the base.

As soon as you enter the 18° Gruppo's building you're taken back in time. The pictures on the walls trace the key milestones of a unit that was established in 1917. The history of the squadron is slightly peculiar; periodically reborn when needs require and disappearing when they end.

PROMINENCE OF TRAPANI

That said, the geo-strategic importance of Trapani-Birgi Air Base in Sicily was highlighted by the 2011 Libyan crisis when the air base provided vital support for air operations. During the crisis many believed that the end of operations in Libya would leave the base facing an uncertain future. However, the experience only served to underscore the importance of Trapani Air Base and the decision was taken to re-equip the unit with Eurofighters.

Following the delivery of the first aircraft in October 2012, there was an intense programme of training, involving pilots and maintenance personnel.

Once Final Operational Capability was achieved the squadron started its operational training activities. From 2013 operating procedures and capabilities were tested through a series of exercises and deployments — both nationally and internationally.

The arrival of the Eurofighter also led to a change in the maintenance organisation. Maintenance is entrusted on a STR – Servizio Tecnico Rinforzato (Reinforced Technical Service), in line with the 18° Squadron Commander. The STR autonomously ensures all 1st and 2nd Technical Level maintenance tasks. The squadron is supported by the 936th GEA of the 36th Wing of Gioia del Colle, for some 2nd level maintenance. This reduces technical time and encourages efficient decision-making, which in turn guarantees greater efficiency and flight hours. In fact, the squadron produces about 2000 flight hours every year, with very high reliability.

THE MISSION

The mission of the 18° Gruppo, as for the other units equipped with the Eurofighter (4th Wing of Grosseto, 36th Wing of Gioia del Colle and 51st Wing of Istrana), is the defence of the Italian airspace.

Their missions take place either under NATO command or under the aegis of the national Government. Under NATO the squadron is committed to covering NATO's southern sector 24/7 for about a week a month, sharing this task with Gioia del Colle (36th Wing), in the remaining three weeks the squadron provides QRA.

In recent years the Italian Air Force has enhanced Eurofighter's air to ground capabilities, investing significant resources in terms of expertise, men, preparation in both flight and ground personnel.

"The swing-role capability of the Eurofighter is now a reality," says Maj. Gianluigi 'Cash C, Commander of the 18 Gruppo.

"The crews and aircraft have responded well in all their operations. The deployment in Kuwait, under the aegis of the Inherent Resolve/Prima Parthica operation confirmed, at an international level, the ability of our aircraft to be able to operate both in the air-to-air and air-to-ground domains or more precisely, in the role of reconnaissance. A clear example of this was the simultaneous redeployment of the Eurofighter in Kuwait and Romania, where it carried out the surveillance of Romanian airspace on behalf of NATO."

PILOTS TRAINED FOR EVERY MISSION

The majority of training missions are performed by employing 'dummy' weapons in segregated working areas, where air civilian traffic is highly restricted. "Training at the firing range remains an integral and fundamental part of a pilot's professional growth" said Maj. Gianluigi "Cash" C.

"Over the years the process of becoming an air-to-ground and, subsequently, multi-role pilot has changed. Initially it was a process of converting pilots already trained under an air to air profile, integrating their training path with air-to-ground training." →

"The swing-role capability of the Eurofighter is now a reality," says Maj. Gianluigi 'Cash C, Commander of the 18 Gruppo.

"New pilots undergo a swing-role rotation at the 20°Gruppo OCU – Operational Conversion Unit, ensuring that when they go to their operational squadron they can immediately carry out any type of Eurofighter mission," explains Maj. Gianluigi "Cash" C.

"The training process includes the use of simulators which allow pilots to acquire confidence in the management of the onboard systems. The training uses a 'building blocks' approach, so once the necessary confidence with different roles has been acquired, these are joined to form the swing-role pilot."

Of course, the pilot's next scenario is unknown: this is one of the major challenges faced by NATO. So, Eurofighter pilots have to be current in any possible mission role, giving the Italian Air Force an employable "tool" in the majority of foreseeable scenarios.

MISSION READY

The Italian Air Force Eurofighters fleet includes Tranche 2 and Tranche 3A, both upgraded to P1Eb configuration, while the Tranche 1 F-2000s have been upgraded to ITA Mod 4 configuration that allow the use of the RecceLite pod for ISR missions.

In terms of armaments the Italian Eurofighter has the AMRAAM missile, and IRIS-T IR-guided missile for air-to-air mission, with the GBU-16 Paveway Laser Guided bomb and GBU-48 Enhanced Paveway Dual Mode (GPS and Laser guided) for air-to-ground. The Phase 2 Enhancement (P2E) package will bring a range of new, long-range capabilities.

"P2E is planned to be available from the end of 2020 and will certainly have important and structural improvements that will change the concept of using the Eurofighter," explained Maj. Gianluigi "Cash" C.

P2E will increase the air-to-ground capability enabling stand-off targeting of high value assets through the integration of the Storm Shadow air-to-surface cruise missile; while in the air to air domain the addition of the Meteor Beyond Visual Range air-to-air missile will augment the Beyond Visual Range capability, providing enhanced capability against a variety of targets such as agile fast jets, Unmanned Air Vehicles and cruise missiles.

Over the last eight years, the 18° Gruppo has achieved important results, at the same time the importance of an advanced base in the region has become clear. The commitments of the 18° Gruppo continue to be many and varied: exercises, air policing and other activities.

"The required standard is maintained thanks to the efficiency, passion and dedication of the staff," says Maj. Gianluigi "Cash" C.

"Thanks to everyone's constant commitment, we are able to ensure the smooth running of daily activities and the normal training of the pilots. In addition, planning and scheduling remain the most important tools in the daily life of a fighter squadron: planning ahead of schedule allows you to better organize the training of pilots ensuring their promptness and effectiveness.

"The results we have been able to achieve so far are manifold: from the Air Policing in Iceland, to the hot sand of Kuwait, passing through Romania and the Baltic States, not to mention the countless exercises around Europe and the 2016 Red Flag exercise in the United States. The multiplicity and diversity of the commitments we have managed to support over the years, as a squadron, as a wing and as a Eurofighter line, underline the importance and maturity that this aircraft and this Gruppo has achieved."

THE BIG PICTURE

Morón Air Base is home to the 11th Fighter Wing, the operational squadron which is a multi-role air defence and attack squadron — meaning it's capable of conducting both air defence and strike missions, or both in the same mission.

As a rule of thumb, in evaluations we assume about 100 hours of preparation for every hour of flight time.

ULTIMATE FLIGHT TEST

Over recent months both Switzerland and Finland have been carrying out Flight Evaluation trials as they look to select a successor for their respective combat air fleets. Naturally, Eurofighter is in the mix in both competitions. A key common element is the flight evaluation – some might call it the ultimate flight test.

The Pilot
When it comes to a flight evaluation, BAE Systems Test Pilot **Luke Gili-Ross** knows better than most what's involved — because he flew the Eurofighter in both Switzerland and Finland. Not only that, he has first-hand experience of each of the rival aircraft too from his days in the RAF. Here Luke tells us what's involved, what the purpose is, and how much pressure a pilot is under during the test.

SWITZERLAND AND FINLAND: THE EXAM QUESTION

A lot of flight evaluations are bespoke to the customer's requirements. In the cases of Switzerland and Finland, there are some stark differences and clear similarities. Ultimately, both wanted to evaluate Eurofighter in all of the roles they'll need to use it, now, and in the medium to long term.

In both Switzerland and Finland these roles were tested over a two-week period with up to eight missions. Effectively, we carried out scenarios where we played the part of the potential successor to demonstrate Typhoon could deliver the capabilities they need.

They're both independent nations and have requirements for activities such as Quick Reaction Alert (QRA) to defend their sovereign airspace from a threat. They also evaluated the aircraft's air-to-air potential and air-to-surface strike capabilities. Both nations understand the value of owning the data they collect, giving them the ability to execute a mission however they may choose.

The Missions

We were challenged to carry out combat identification tasks whilst building situational awareness against large numbers of aircraft. They also wanted to see how our two Eurofighters communicated with each other and shared data, in order to achieve our targeting tasks within the mission.

Switzerland and Finland: Distinctly Different

The Finland exercise was planned as an Arctic environmental cold weather evaluation in mid-January. These conditions are really testing for any aircraft, let alone Eurofighter. But they wanted to see how we operated in an environment where very few aircraft work regularly.

Trying to make really nuanced decisions about the weather was difficult. The question was if it was fit enough to be able to demonstrate the aircraft could handle the adverse conditions, versus not fit for anybody to fly no matter what aircraft. We had to gain the trust of the host nation Test Pilots. They understood the operating environment, we knew all about the Eurofighter and we came together in the planning phase to understand the boundaries.

Switzerland had a different set of unique challenges — mountainous terrain, with very steep approach gradients. They asked us to look at tasks such as a really steep vertical descent into relief landing grounds, because some fast jets may struggle in those kinds of environments. However, we demonstrated that successfully.

Again, that took a lot of planning because if you commit to those descents, you need to be supremely confident the aircraft has the performance to get out of them if it's not going well. Mountain terrain is extremely unforgiving.

Flight Evaluation: The Key Activities

For security reasons we can't go into specific detail, but in large part both evaluations looked at the following:

QRA: looking at time to access to the aircraft; climb to height to intercept an aircraft; and intervening procedures — maybe heading to a relief landing ground, finally a recovery.

Warfighting: each evaluation included some higher-end warfighting, in some cases multiple Eurofighters vs. a significant numbers of adversaries. This was an important demonstration. It showed Eurofighter as a force multiplier, but also these scenarios are designed by the host nations to stretched the candidate aircraft to their limits, which is a good way to evaluate them.

Surface mission: other tests involved air-to-surface scenarios, like simulated targeting profiles, the use of the sensors, such as the Litening V targeting pod for recce and non-traditional intelligence, surveillance, and reconnaissance actions.

Training: both nations will assess how easy Eurofighter is to learn to fly, examining the basic handling qualities. Both Finland and Switzerland are F-18 operators, and each wanted to test how easy it might be to convert to Eurofighter.

Interoperability: no military exists in isolation, and while both Switzerland and Finland are independent nations, they want to interoperate with NATO partners or the nations that have active borders with them. They also need the aircraft to operate effectively with their naval and/or land forces. So part of the test looked at the interconnectivity and interoperability of the aircraft as a system.

VIEW FROM THE COCKPIT

Pressure? What Pressure

There was pressure but not as you might expect. The most important thing to me was safety —delivering the validation in a safe way.

The next stress point was to provide the data to the host countries' pilots so they could write their reports. You had just one shot. Flight tests are expensive, particularly if they significant numbers of aircraft airborne, so it was really important we delivered.

Another factor was time. For both Finland and Switzerland time was tight and some things, like weather, are outside your control. That added pressure. When the weather went bad, we had to get creative. Sometimes that meant adding to an evaluation because we were conscious that we might miss the opportunity completely. →

Ultimate Skills Test

That kind of high-end operational warfighting is really unusual for us. It definitely requires pilots who are operationally competent and aware. To get the most out of the aircraft, you really need to be practised, rehearsed and familiar with the procedures you have to perform.

It is a challenge because the aircraft is only as good as the pilot flying it and the pilots are only as good as the aircraft they're provided with. You work together.

You can't showboat either. You need to try and demonstrate the aircraft without overcompensating for any aircraft deficiencies because you have somebody watching you. There's a balance to be struck. You have to demonstrate the capabilities within the scope of what a reasonable pilot is expected to achieve.

The Rivals

I'm in a very fortunate situation. I have operating experience of the competitor aircraft in the Swiss and the Finnish competitions. We went into the evaluations knowing where we stood. They're all good aircraft. They've all got their unique strengths and weaknesses.

The job was about us targeting our strengths and being honest and talking to the host nation about the aircraft. That way we were able to keep things on a professional level. We were very honest about Eurofighter's capabilities because it's a great aircraft. If we'd had a less effective or capable aircraft, it would have been a more difficult job. But I went into it knowing the aircraft would sell itself just as long as I did my job and demonstrated it properly.

THE ASSESSORS

Both Switzerland and Finland have Class A Test pilots, graduates from one of the four main test pilot schools, either the Empire Test School in the UK or in the case of many of the Finnish pilots, the US Navy Test Pilot School. This means they think about evaluation in the same way as we do — and that's important. In fact, in many cases we knew one another professionally before starting the evaluation. That helped us understand the questions they were asking through the evaluation process. We discussed things before we started, ensuring we actually answered the correct question.

Impressing the Judges: Your priority is safety and delivering what the assessors need. The easiest way to do it is by putting yourself in the shoes of the evaluating pilot and asking yourself, what you would need to be able to write your report if you were them?

I knew that I had two weeks of high stress in terms of delivering the flying, but they had to do that another five or six times with other competitors. Essentially, I was trying to make their job as easy as possible.

There were completely different ways of working between Switzerland and Finland.

In Finland, they designated Test Pilots to fly all of the missions. That meant we could pair up one of the test pilots from Finland with one of the Test Pilots from BAE Systems for the whole week.

Working together meant we were able to develop a close relationship as the week went on and build up a rapport when making the more nuanced decisions on weather and data collection.

From the start, both host nation Test Pilots were able to operate Eurofighter themselves, which demonstrated the fact that the aircraft is intuitive and easy to learn to use. It also showed them that when I was demonstrating a capability that I wasn't working that hard, because we were able to have a conversation at the same time. Over a mission sortie, the Test Pilots were able to understand the aircraft and get to know its nuances.

In Switzerland there were half a dozen evaluating pilots. We had different pilots in the backseat for most sorties. Here, it was a different relationship where generally we concentrated on delivering the data in as professional a way as possible, but they were all still able to operate the aircraft effectively in a short space of time.

They were two very different approaches, but both had their merits. Switzerland's approach allowed them to get more pilots airborne to evaluate the platform, while in Finland the pilots were able to become more intimately aware of the capabilities of the aircraft.

100 HOURS PREP FOR EVERY HOUR FLYING!

As a rule of thumb, in evaluations we assume about 100 hours of preparation for every hour of flight time. But in reality, that was probably multiplied even more, given the amount of people and the complexity of the missions.

Planning was the key. We spent a lot of time trying to understand what good looks like. That was a really challenging set of discussions, which in the case of Finland took over a year. With Switzerland it was slightly different because Airbus was the intermediary.

The planning started with scoping which aircraft were available, whether they're single or twin seat, and how many blue force Eurofighter we could contribute to the scenarios.

We then looked at the level of information we could provide. Where it was limited by a classification release then it was largely handled on a government to government basis, which was the case in Finland, though that was slightly different in Switzerland.

Planning is all about relationship building with the customer. What was really important (to both Finland and Switzerland) was not that we say we can do something. And not even that we could demonstrate it. But for them to be able to validate through their own audit process that we had demonstrated it.

Obviously, it takes time to negotiate each of the test points. With both Switzerland and Finland we were first to demonstrate the aircraft. The aspiration for both campaigns was that the assessment was fair and consistent across all competitors. Going first puts extra pressure on us during the planning, as you have a responsibility to ensure that the plan is deliverable by all, whilst suiting the host nation requirements.

The preparation phase was as important as the evaluation itself. If we plan perfectly, we may still have an unexpected event, which could mean we don't perform and don't show the aircraft in its best light. However, if we don't plan effectively it's impossible to show the aircraft in its best light.

Team and Equipment

Don't underestimate the complexity. It took an awful lot of time to plan and deliver because both evaluations were seriously complex. Both were full scenario rehearsals. It was a huge team effort, with something like 30 to 40 people involved in the planning and delivery phase alone for each evaluation.

In both Switzerland and Finland, BAE Systems provided two Eurofighters and two test pilots, myself and Chief Test Pilot Steve Formoso (about 3,500 Eurofighter flying hours between us).

Unique among the competitors, we took one single and one twin seat jet. While the single seat Eurofighter is a mission-ready, operational-representative version, we felt it was also important to fly the host nation pilots in our aircraft so they could validate in person. We felt that it was the best way to experience the capability to the widest possible audience.

The standard of the two Eurofighter aircraft was slightly different too. This showed the customers that, although they were only a couple of months apart in development, the capability was significantly different. They were able to join the dots and see where the platform was going in terms of capability growth, an idea further underpinned by the proven delivery of Project Centurion in the UK.

HOW DID IT GO?

Really well. Especially when you consider there are so many things that can go wrong over a long evaluation and across a complicated set of missions, because there were huge amounts of variables: technical, personal, and environmental.

For both campaigns we were able to deliver all the flying that we had planned, within the timescales. We arrived on time, departed on time, used little or no spares, provided the data we'd promised, with very few losses. Both evaluations are something that we're really, really proud of. They both showed the aircraft, and the whole Eurofighter consortium, in a really positive light. The whole team that contributed to the effort can be very proud.

ICE WARRIOR: THE **ALL WEATHER** EUROFIGHTER

Eurofighter is a combat-proven, robust and flexible platform that's available 24/7, 365 days a year to deliver capability, whether it's air-to-air or air-to-surface in any of the environments across the globe.
From the extreme heat of deserts to more wintery climates.

TECHNOLOGY TRANSFER: Eurofighter operators control their own mission data — they can use it for themselves across all domains.

SHORT STORY: Powered by two EJ200 engines which pack huge amounts of thrust ensuring Eurofighter is capable of using short and damaged runways.

TAKEN TO EXTREMES: Robust and adaptable, Eurofighter Typhoon has been designed to operate effectively in austere environments across the globe. From the extreme heat of deserts to more wintery climates.

THE BIG PICTURE

Changes of command always leave room for unforgettable moments. This photo shows Maj. Antonino 'Ponch' M. (outgoing 12th Group Commander) being greeted by a passage of four Eurofighter aircraft, whose formation leader is Maj. Fabrizio 'Mono' N. (incoming 12th Group Commander). The photo was taken at the 36th Wing in Gioia del Colle, Italy, and was obtained thanks to meticulous timing on the ground between the photographer and the flight crews.

EPCS PLAY PART IN FIGHT AGAINST COVID-19

Eurofighter industry partners Airbus, BAE Systems and Leonardo have played their part in the global fight against COVID-19.

Airbus' commitment to the fight against COVID-19 was underscored by a long-distance airlift mission that brought 4 million face masks and medical supplies from China to Europe for use by health systems and caregivers in France, Germany, Spain and United Kingdom.

BAE Systems has supported the UK's national ventilator effort. The business provided integrated, tested sub-systems and components, which makes best use of our strong project management and engineering skills, while saving significant time during final assembly of the ventilators.

Meanwhile, Leonardo's Aircraft Division Working has been working together with Armed Forces and Government Agencies in Italy and around the world, in making assets available to the authorities to support the crisis.

DREAM JOB FOR DEAN

Flt Lt **Dean Rogers** of 29 Sqn has been named the RAF's 2020 Typhoon display pilot. Flt Lt Rogers will spend the winter at RAF Coningsby carrying out detailed preparation for the display. We caught up with him to discover more about the man who will be wowing the crowds next summer.

Can you briefly summarise your career in a few sentences?

When I joined the RAF I was classed 'ab initio' which means I'd never flown any front line type before. I went to RAF Wyton, flew the Tutor and then the Tucano at RAF Linton-on-ouse. Immediately after that I was streamed to fast jets and went to RAF Valley flying the Hawk T2. From there I came to Coningsby for my first Typhoon tour. After that I joined No 1 (Fighter) Sqn and did a three-year "frontline" tour. That was the best three years of my life to date. Then I became an instructor here, gained lots of qualifications and successfully landed this job.

What experiences with No 1 (Fighter) Sqn stand out?

Taking the jet to major international exercises like Red Flag at Nellis Air Base. Red Flag was the first time I really felt part of something. And in Typhoon terms we fully deserved to be there. We were surrounded by world class aeroplanes and never felt out of place because we knew we'd be able to do a good job there. The thing that really impressed me was the level of situational awareness we had thanks to all the sensors and systems. The combination of the performance of the jet, the weapons integration and the onboard sensors made me feel at home in what is a high-end war fighting scenario.

Typhoon has always performed really well on Red Flag, which I imagine is partly why the Americans keep inviting us back. As a junior pilot, brand new on my squadron, I was able to compete against the best in combat using a Typhoon … that's how good the aeroplane is.

An exercise like Red Flag is also a great demonstration of Typhoon's ability to integrate with 5th generation aircraft, and that's obviously very relevant for the RAF with what's happening with the F-35.

Over the seven years as a Typhoon pilot have you noticed it changing?

Through the various software drops the aircraft is continually incrementally improving and with it the human-machine integration (HMI) is always improving. When I arrived on Typhoon in 2012 it was good then, but it's even better now. Of course, there are always improvements that can be made and that's another good thing about Typhoon — we're able to make them incrementally because they're mainly software-based. You can see this progression with Project Centurion, which transfers capability for the RAF from Tornado to Typhoon. The HMI is now the best we've ever had, and it's needed because we have so many more weapons on the platform.

What was it about the display pilot role that attracted you?

I applied because I'd been told by all of the previous display pilots that it is the best flying they've ever done in their careers — and some have had very illustrious careers. The display pilot role represents a completely different challenge for me — especially when you're pulling 9G very close to the ground. Thankfully Typhoon's aircrew equipment, the G-suits and so on, are awesome. It means you can pull 9G instantaneously but feel confident you're going to be able to stay awake whilst you're doing it!

It's a punishing schedule, how will the aircraft cope?

I've been all over the world in the jet — QRA, Baltic Air Policing, the Falklands, Malaysia, all the major exercises —and I've operated in extreme heat and cold weather, and I've never had any issues with Typhoon. The Falklands is probably the best example of the Typhoon working in extreme cold and the jet holds 24/7 QRA there regardless of the weather. It's shown it's able to operate in some of the most inhospitable climates in the world.

THE BIG PICTURE
A Luftwaffe Eurofighter Typhoon in charge at the 71st Tactical Air Wing "Richthofen" in Wittmund Air Base, is about to leave the parking lot following the instructions of the ground specialists during the TLP 2020-1 course in Albacete, Spain. The aircraft will take part in a COMAO mission in the air-to-air role.

OUTPACING THE THREAT

The Praetorian DASS, consists of the Electronic Surveillance Measures (ESM), Electronic Counter Measures (ECM) and Missile Approach Warner (MAW), providing platform survivability and Situational Awareness. Praetorian integrates with the remaining elements of the Typhoon Defensive Aids System (DAS), namely the Defensive Aids Computer (DAC) and the Chaff and Flare Counter Measures Dispensing System (CMDS).

Leonardo's **Phil Liddiard**, consortium programme lead for EuroDASS, looks at what's in store for the Typhoon's defensive capabilities as threats rapidly evolve.

Eurofighter Typhoon is equipped with one of the most capable Electronic Warfare (EW) systems installed on any combat aircraft. At its heart is the Typhoon's Defensive Aids Sub System (DASS), known as Praetorian and provided by the EuroDASS consortium, a four-nation group of EW experts comprising Leonardo in the UK, Elettronica in Italy, Indra in Spain and Hensoldt in Germany.

Praetorian protects Typhoon from threats including Infra-Red (IR or heat-seeking) and radar-guided missiles, while integrated sensors and jamming equipment also provide situational awareness and a digital stealth capability, achieved through advanced electronic deception techniques. The system has protected crews for over 20 years, including on peace-keeping operations in Libya and Syria.

However, we at EuroDASS recognise that as adversary technology and techniques rapidly evolve, the Typhoon's traditional position of air dominance could be tested by advanced new air and surface threats.

This is why, over the last two years, EuroDASS has undertaken an assessment of the capability growth potential of the existing DASS system architecture. The conclusion drawn is that whilst there are short term enhancements that can maximise the capability growth of the existing system architecture, the continued evolution of the threat demands a corresponding evolution of the Praetorian DASS, embracing new technology to realise a new system architecture that will continue to provide exceptional survivability and keep Praetorian relevant through to the Out of Service Date (OSD) of Typhoon.

FITTING THE DEFENSIVE SUITE TO THE ROLE REQUIREMENT

Recognising both the budgetary constraints faced by nations, and their numerous priorities, EuroDASS have considered how best to maximise the Typhoon's defensive capability across future fleets. At the simplistic level, it may be the case that not every Typhoon being operated will need the most comprehensive DASS system installed, depending upon the role being fulfilled. This has led to a pragmatic approach based upon our interpretation of future role requirements; from a predominantly defensive role (for example Quick Reaction Alert, QRA) to an overtly peer-on-peer offensive role. The corresponding standard or capability of DASS has then been considered against this.

A rational approach is to assume a sub-set of the future fleet mix will maintain the current DASS system architecture, maximised for capability growth to address the more defensive spectrum of operations and role requirements. A further sub-set will require a new DASS system architecture, capable of countering and defeating the evolving threat and staying relevant with capability growth potential to the OSD of Typhoon.

OPTIMISING TODAY'S DASS

Firstly, let's consider the current DASS. The existing Praetorian system architecture and the threat landscape that this was designed against dates back to the early 1990s.

Fortunately, the design contained significant head-room for expansion, which has enabled both incremental upgrades and the introduction of new capabilities over the years. There still remain a number of further upgrades that will maximise the residual capability growth of the current Praetorian system, enhancements have already been made via software updates and new hardware is currently being developed by EuroDASS:

i. The Integration of a digital receiver into the existing Electronic Support Measures (ESM) processor.
ii. The extension of the ESM operational frequency by the introduction of the Extended Low Band (ELB) enhancement.

Both of the above enhancements will increase the Situational Awareness provided by Praetorian. Further hardware updates are also proposed which will improve interoperability and Electronic CounterMeasure (ECM) performance. →

A NEW ARCHITECTURE FOR THE FUTURE BATTLESPACE

Looking towards the future, we first must consider the future threat environment. Maintaining control of the Electro-Magnetic (EM) Spectrum is fundamental for Nations to achieve freedom of movement, access and control of the air. The threat environment is becoming increasingly complex, congested and contested. The threat continues to evolve at a pace, with increasingly complex emitters and agile software adaption, coupled with increased availability and proliferation of long range, mobile and networked surface threats. Opposition air platforms are also being equipped with advanced Digital Radio Frequency Memory (DRFM) capabilities. This all means that unless the DASS continues to outpace the evolution of the threat, nations risk losing the essential elements of control of the air.

Inevitably, in some areas of the current DASS, the physical constraints imposed by the system architecture are resulting in the capability approaching its maximum potential, meaning that a new architecture is necessary to continue to achieve the air dominance Typhoon is accustomed to.

EuroDASS has, whilst being cognisant of the future challenges imposed by the future operating environment, considered the future of Praetorian on Typhoon. Resulting from this work are the fundamentals for a future DASS architecture that will continue to provide world-class survivability for Typhoon and also contribute to the role evolution of the platform.

Praetorian Evolution represents this new system architecture, and addresses four key operational capability themes:

1. Capability Availability

Operational capability is only relevant if it is available when required. At our recent EuroDASS Future Capability Conference (October 2019) this was effectively articulated as 'Little C' and 'Big C'. 'Little C' being the underpinning availability, serviceability and maintainability that makes the 'Big C' available and deployable when needed.

Praetorian Evolution will have a maximal digital architecture, exploiting high-rel manufacturing techniques to improve equipment reliability. The digital architecture also supports enhanced health monitoring, offering improved fault diagnosis and reduced no-fault-found scenarios, both contributing to reduced repair turn-around-times.

The Evo architecture will comprise of common hardware modules, configured by software, thus reducing through life cost of ownership by reducing the requirement for spares holdings.

2. Weapon System Integration

A multi-channel digital receiver architecture will provide high quality, high fidelity parametric data. This capability will allow Typhoon to act as a forward combat ISR-node, providing forward intelligence gathering opportunities and contributing to the wider digital battlespace picture and shared situational awareness via data off-boarding.

The enhanced processing will also allow the DASS to contribute to sensor correlation and confirmation.

Clearly, interoperability across the weapon system, own-ship and multi-ship will increase in complexity as the number of on-board emitters increase and exhibit increased bandwidth and/or power. The Evo architecture will provide additional interfaces (ethernet and discrete) to interface to other subsystems to facilitate improved interoperability.

3. High Frequency Agile Change

Agility and adaptability will be a key discriminator in the future dynamic battlespace. Legacy threats are evolving, and exhibiting agile update cycles; modern threats are quickly and easily reprogrammed. In response the future DASS must support agile update and migrate from traditional mission data constructs to a more intelligent algorithmic based mission data construct. The traditional approach of parametric-based mission data fields is becoming insufficient to cover all modes of threat variants and unable to resolve threat system ambiguities. Furthermore, we must strive to reduce the complexity and burden placed upon National Air Warfare centres for the creation of mission data.

The Evo architecture will provide a segregated software architecture that supports the safe introduction of applications and algorithmic mission data. This will support threat-specific ECM applications, and ESM analytical algorithms providing threat identification, situational awareness and optimised countermeasures. The segregated architecture will also support the longer term aspiration to move certain elements of operational functionality from the operational software to algorithmic mission data, meaning functional update can be achieved in a far more agile and cost effective manner.

4. Operational Capability

In terms of the future capability requirements for the DASS, in generic terms these address themes such as extension to the operational frequency ranges; effective operation in the future congested and contested EM environment; networked multi-platform co-operative techniques; enhanced ECM in terms of field of view, power and technique complexity; geolocation and unambiguous emitter identification; low false alarm rate missile warning. These have shaped the Praetorian Evolution architecture, alongside the future growth potential to support incremental capability growth by software update through to the Typhoon's OSD.

NEW TECHNOLOGY UNDERPINNING FUTURE CAPABILITIES

The exploitation of latest technology and manufacturing techniques is fundamental to realising the capabilities and benefits of Praetorian Evolution. New technology will realise advancements in orders of magnitude in data processing, integration and bandwidth over the existing architecture.

Some examples of technology exploitation within the proposed Praetorian Evolution architecture include:

- Advances in ultra-fast sampling and digitisation will enable wide bandwidth digitisation, effectively behind the receive antenna.
- System-on-Chip (SoC) technology combines hardware (analog, digital, mixed-signal, Radio Frequency (RF) functions) and software processing into a single integrated chip. This high level of integration uses less power, and offers significant SWaP (size weight and power) benefits.
- Novel antenna design techniques will mean traditionally large physical antenna designs can be realised in smaller, more integration friendly adaptations formats.

Across the EuroDASS consortium, each partner company is already investing in maturation of these technology enablers, increasing the respective Technology Readiness Level (TRL) and realising mature building blocks for the future architecture.

The recently-contracted Long Term Evolution Study provides a timely opportunity for the Eurofighter partner companies and EuroDASS to collectively mature the work already undertaken. A number of studies are currently underway, exploring the technology enablers to support a range of future architectures which will be presented to nations. These will have an associated capability trade-off thus helping nations assess the trade space between operational capability, wider platform impact, risk maturity and cost.

In summary, while Typhoon remains one of the best-protected platforms flying today, EuroDASS recognise the future challenges and are working hard to make sure Typhoon stays a step ahead over the decades to come. In the short term, mature candidate solutions are available to maximise the capability of the existing system architecture, providing longevity to the current Praetorian for defensive roles.

Looking towards the future and the OSD of Typhoon, EuroDASS continue to undertake significant work to mature Praetorian Evolution, the future of the DASS on Typhoon. This will fully exploit technology advancement to ensure nations can count on Typhoon to achieve freedom of movement, access and control of the air. Praetorian Evolution create a 6th generation DASS, providing continued world class survivability and support the evolution of Typhoon by guaranteeing capability growth potential for traditional and non-traditional DASS functionality throughout the life of the platform.

AWARD FOR **TyTAN**

TyTAN a ground-breaking support solution for the UK's Eurofighter fleet has saved more than £500m which has provided the UK Customer with re-investment opportunities to further enhance Capability of the platform has won a major industry award.

The Typhoon Total Availability Enterprise (TyTAN) sees the Royal Air Force working together with the Ministry of Defence and BAE Systems to ensure aircraft are available at the right place and the right time whilst reducing costs which can be re-invested into new capability. The TyTAN team have been recognised by Aviation Week and will be picking up an award at the prestigious Aviation Week Network Laureates Awards, which recognises leaders across the Aviation community. In the first three years of the programme, £501m of savings were re-invested in to enhancements in radar, defensive aids, future weapons and next generation mission planning.

Michael Southern, TyTAN Delivery Director, said the joint team was hitting its targets "delivering more than 75,000 flying hours whilst also coping with demands of continuing capability enhancements to the fleet and involvement in major events such as the RAF's centenary celebrations in 2018. It is about delivering the right aircraft, the right capability, at the right time and the right cost."

"TyTAN has transformed the support of the frontline Eurofighter force whilst delivering a 40% reduction in the through-life support costs of the fleet. This has enabled the re-investment of the savings made into future-proofing Typhoon, ensuring it is ready for the challenges of today and tomorrow."

In the first three years, TyTAN has already delivered 70% of its targeted savings including the Joint Avionics Service (JAS), a collaboration on avionics support with BAE Systems' Electronic Systems business and Leonardo.

EUROFIGHTER SQUADRON **ASSIGNED TO ITALIAN AIR FORCE 51ST WING**

The Italian Air Force has officially included the 51st Wing at Istrana Air Force Base, northern Italy, among the units responsible for national air defence. This follows the assignment of Eurofighter fighters to the 132nd Flight Group. The announcement brings the number of Eurofighter bases in Italy to four.

Eurofighter aircraft have been deployed at Istrana on QRA duties since 2017, though until now deployments were carried out in rotation by aircraft and crews from the 4th Wing in Grosseto (Tuscany), the 36th Wing in Gioia del Colle (Puglia) and 37th Wing in Trapani (Sicily).

The changes at Istrana Air Force Base — with the arrival of Eurofighter fighters to the 132nd Flight Group — represent the latest part of the 51st Wing's current transformation

This will eventually be concluded when the Eurofighter replaces the AMX aircraft. However, during the current transition phase, the 132nd Flight Squadron will operate two fleets simultaneously: one with Eurofighters providing the air defence requirements, the other with AMX aircraft carrying out tactical reconnaissance flights.

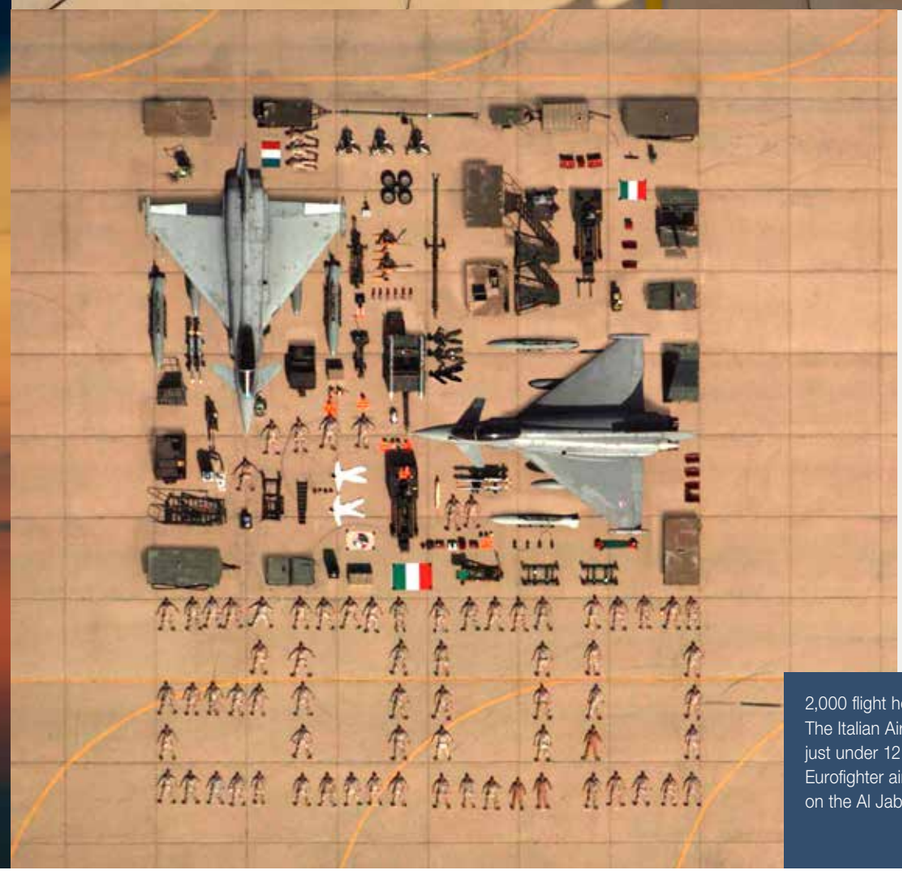
Work on the base, preparing for the permanent deployment of Eurofighters, took place last year. Key activity focused on the development of the maintenance bays for the Eurofighter line – these are specifically designed work areas that are fully equipped for technical inspections.

In 2019, following the activation of the maintenance bays of the Eurofighter line – specific work areas equipped for technical inspections – the 51st Wing reached full maintenance capacity, allowing the staff of the Gruppo Efficienza Aeromobili (GEA) at Istrana to take over the other Eurofighter Units in the aircraft maintenance cycle.

The Commander of the Combat Forces, General of Air Division Francesco Vestito, said. "The effort made by the 51st Wing, especially in this period of serious emergency for the country, is even more relevant because it testifies to the passion, motivation and sense of duty that have always characterized the daily work of the Air Force personnel."

If you ever wondered about the typical kind of equipment that's required for a Typhoon to work efficiently, then our colleagues from the German Air Force have come up with an eye-catching answer!
During the multinational fighter exercise Blue Flag 2019 in Israel they took time out to contribute to the latest viral trend called the Tetris Challenge.
The Pilot and Maintenance team participated in the challenge, which involves emergency and military forces around the world.
The pictures produced offer a rare glimpse of the equipment used by all the participating servicemen.

Picture credit: Bundeswehr/Jane Schmidt



2,000 flight hours for the Eurofighters deployed in Kuwait!
The Italian Air Force reached an important milestone in just under 12 months from the start of the mission for the Eurofighter aircraft of the Task Group "Typhoon", deployed on the Al Jaber air base.

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