EUROFIGHTER

PROGRAMME NEWS & FEATURES
JUNE 2019

WORLD

PARIS AIR SHOW
SPECIAL EDITION

MISSION DATA

Eurofighter Typhoon

2019 · EUROFIGHTER **WORLD**

Cover: CGI of Eurofighter Typhoon in a future battlespace

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EDITORIAL

WELCOME

I am delighted to have this opportunity to introduce myself as the new Chief Executive Officer (CEO) of Eurofighter Jagdflugzeug GmbH. Eurofighter Typhoon is a world class combat aircraft and I am absolutely convinced that we can look to the future with confidence.

I also firmly believe that Eurofighter is a role model for industrial and national collaboration, and that it provides the ideal balance between cost, economic benefit, national sovereignty and ultimately an effective and powerful operational capability. That theme of industrial and national collaboration comes out strongly in this issue of Eurofighter World.

As NATO celebrates its 70th anniversary this year, we hear from Colonel Luis Villar of the Spanish Air Force about the strength of the organisation and the role that Eurofighters play in helping protect member nations.

Indeed, to underline the point there are reports from Iceland and Norway respectively, where Eurofighter Typhoons from the Italian Air Force played key roles. In Iceland they defied testing conditions with 100% reliability as they helped safeguard Icelandic airspace during a NATO deployment. The force had previously proved their swing-role capability during this winter's NATO training exercise Trident Juncture in Norway.

The thing both these stories clearly illustrate is how Eurofighter has a crucial role to play — in all weathers — right across Europe.

In this edition we also speak to BAE Systems Strategy Director Michael Christie about the work of Team Tempest and how Eurofighter is expected to play a part in future technology development.

There are also fascinating insights into the importance of mission data, and an in-depth look at the Spanish Air Force with a special report from Moron Air Base.

And finally, you get to hear more from me in a special interview alongside Kurt Rossner, head of Combat Air Systems at Airbus, where we discuss sovereignty, the future and that vital topic of collaboration again.

I hope you enjoy the read.

Herman Claesen
CEO
Eurofighter Jagdflugzeug GmbH

MISSION DATA

EQUALS AIRCRAFT CAPABILITY

Experienced Typhoon pilot **Raffael Klaschka**, Head of Marketing at Eurofighter, explains how the sovereign control of mission data is vital for delivering operational effectiveness and military capability.

Raffael Klaschka

DATA IS THE KEY

For any modern combat aircraft, mission data is as essential as fuel, that's true today and will remain a fundamental fact of life in the future operating environment. Mission data dramatically increases survivability of the weapon system by "fine-tuning" every sensor to the actual situation on the battlefield. This includes electromagnetic footprints, situational awareness of geo-positions and latest troop movements. That fine-tuning gives the pilots the ability to react swiftly and increase their survivability.

Threat intelligence - the information that's used to create your mission data - is gathered from a range of assets to ensure forces have the latest, effective, and most accurate data to cope with the range of threats they'll face. And, as Eurofighter is actually flying regularly in operations, this is business as usual for the Eurofighter community.

During operations, an aircraft returning from a sortie will feed back through certain classified equipment what the aircraft's sensors picked up. This information all goes back into a modification process and then finds its way back onto the aircraft. Hence that data can be used in future missions, supporting pilots' situational awareness and increasing survivability. It means, for example, the aircraft's Defensive Aids Sub System (DASS) is fine-tuned to the right threats.

Exactly how this data is gathered is classified information. However, what we can say is that one area where Eurofighter scores highly is that new mission data can be fed into the weapons system in an extremely short time, often in hours. To put that into context, with some other aircraft the mission data set is generic and that feedback loop can take anywhere up to 12 months. →

CASE STUDY: THE UK'S AIR WARFARE CENTRE, AND ITS SUPPORT TO EXPORT TYPHOON OPERATORS

The UK Royal Air Force's Air Warfare Centre (AWC), based at RAF Waddington in Lincolnshire, is the beating heart of the UK's mission data operations. Among its roles, the AWC collects and analyses data from operations and then provides this data to various platforms, user groups and mission support centres within the UK and across the world.

For example, if an RAF Typhoon encounters an unknown radio frequency contact while on a mission, it will collect a wide range of data about that contact using its on-board sensors. Following the mission, that data will then be downloaded and analysed, which will identify the contact (perhaps it's a new or modified threat radar system) and then be used to create a new mission data set in time for the next mission – one which will allow the Typhoon to recognise the previously unknown contact and deal with it appropriately. For RAF Typhoons, because of their open systems and the UK's sovereign mission data capability, this process can take just hours. For some other aircraft, where mission data needs to be updated by its foreign supplier, it can take months.

In 2014, the UK government began working with Eurofighter partner company Leonardo to support the mission data capabilities of international Typhoon operators and other export customers. Based within RAF Waddington and supported by Leonardo's specialist Electronic Warfare Operational Support (EWOS) capability, the 'UK Partnered EWOS' team creates, develops and maintains UK-sourced Electronic Warfare data, which can be released on a government-to-government basis in support of exports. This data can then be used to form the basis of a sovereign mission data capability for a country operating the Typhoon. Support from the UK's Partnered EWOS team ranges from assistance with advice on establishing and refining EW requirements and data set development, through to helping establish a full, in-country Electronic Warfare centre with similar capabilities to the AWC, providing the operator with the sovereign ability to update and install their own mission data without needing to request data or permission from a foreign country.

As well as understanding the operational aspects of mission data, Leonardo's engineers also lead the delivery of the Typhoon's Defensive Aids Sub System (DASS), so they can ensure that the aircraft's protection stays as up-to-date with the latest mission data as it flows in from theatre.

In September 2018, Leonardo opened a new £2M extension to its Cyber and Electromagnetic Activity Academy in Lincoln – an extended training offering that allows 150 students to learn at any one time. As well as continuing to train UK MOD personnel, Leonardo also offers training to other Typhoon operators, ensuring that they have the skills to support their own sovereign mission data operations.

Indeed, while new weapons integration often grabs the headlines, it's fair to say that many of the enhancements to Eurofighter's capability over the last decade have come from the software. With the increase in experience, engineering capability and software enhancements, the overall capability of the aircraft has also been enriched through live operations — proof positive that the ability to modify mission data was given the right priority during the aircraft's development phase.

MISSION DATA EQUALS AIRCRAFT CAPABILITY

When we discuss 'data sovereignty', effectively we're talking about the control and use of data. You've got sovereign control over the mission data. That increases your ability to shape your own mission dataset in order to cope with a specific threat picture.

Mission scenarios can be highly dynamic and therefore you have to be able to adapt. Eurofighter is living proof of the success of that concept. (Rather than using an off-the-shelf data solution).

So what is mission data? There's a vast range of variables but, for example, it could include the frequencies of enemy radars, and data about other weapons systems in the airspace. Each one of these will have their own emission signature and that's something that you'd classify and track.

When all this information is fed into the aircraft it increases the pilot's situational awareness and also the weapons system's sensitivity towards potential threats.

As the aircraft is designed to allow data to be loaded on the flight line, squadrons can carry out a mission, return, adjust the data, and fly with new data on subsequent missions. For example, that might mean adjusting the sensitivity of sensors to particular threats. Doing that would improve the capability and survivability of the aircraft, so in short, you can argue that mission data equals aircraft capability. That is very important considering that in the past we have seen very slanted views on which parameters to use to classify one aircraft as 'better' than another. It is not just thrust, it is not just agility, or stealth, that needs to be taken into account but also data sovereignty.

And in the future, the reliance on mission data will grow. You will only be able to operate in a contested environment with the most up-to-date and adapted mission data. Looking at other available platforms, we see the Eurofighter maintaining this operational advantage for quite a long time.

IT'S IN THE DNA, NOT THE BLACK BOXES

This sovereignty on data, and in effect capability, has been built into the DNA of the aircraft. And in times of on-going political discussions about independence and increased debate around defence responsibility in Europe, sovereignty is a key topic to consider.

Many Air Forces have their own experiences of having to cope with the restrictions 'black boxes', give them. We hear this frequently when talking to potential new customers. And they are not positive.

Therefore independence is a key point, particularly in a world where geo-strategic relationships can change over the years. Having full control and sovereignty of your own mission data is crucial.

The question you should ask is: 'Do I want the control and sovereignty of sensitive data in my hands, or rather to be dependent on the strategic intentions of other nations?'.

Squadrons can carry out a mission, return, adjust the data, and fly with new data on subsequent missions.

EUROPE AT ITS **HEART**

We're on the roof of the training centre at Morón Air Base. There's a fierce westerly wind blowing the last of the morning rain clouds away but no-one is considering taking shelter. We have the perfect vantage to see a Spanish Air Force display pilot hone his routine. It's a once in a lifetime opportunity.

Base Commander Colonel **Carlos Perez Martinez**:
"The decision Spain took to be part of the Eurofighter programme was a turning point in our industrial history."

Photos: Walter Hodel

Take-off is the attention grabber. Noise and a physics-defying vertical climb! Then, for the next 15 minutes we're treated to an eardrum-shattering display that emphasises Eurofighter's incredible power and agility and the pilot's nerveless skill. It's a balletic sequence of rolls, dives, climbs, loops, and slow, low passes.

Back in the warmth of the training centre the pride in the Eurofighter is clear for all to see. One entire wall features a picture of the jet in flight over a crystal blue ocean, while over the balcony there's a huge Spanish flag.

At Morón you're left in no doubt what people think about the aircraft nor what Eurofighter means to the Spanish Air Force. Base Commander Colonel Carlos Perez Martinez is unequivocal: "For Spain, Eurofighter represents a huge positive in two main ways. First, from an industry point of view, we have been able to develop a robust aeronautical industry, and that in turn has provided us with technological independence.

"The decision Spain took to be part of the Eurofighter programme was a turning point in our industrial history. Eurofighter has been the catalyst for a lot of companies — companies like Indra who have a presence at Morón Air Base. Today, it's one of the biggest technology companies in Spain and there are many others who have benefited from being part of the Eurofighter programme.

> Eurofighter represents a smooth, logical transition for the Spanish Air Force from the F18 to a much more advanced aircraft

"The second effect for Spain is that Eurofighter represents a smooth, logical transition for the Spanish Air Force from the F18 to a much more advanced aircraft. For us in the Air Force the aircraft represents combat readiness. It has high availability, it's reliable, and, of course, it's very capable. Moving from the F18 to Eurofighter was such a natural path. The Eurofighter does everything its predecessor did but is more powerful, more robust, has more powerful sensors and more capability. Everything about it is superior.

"It also provides us with interoperability with several other air forces across Europe. So if we go on exercises we find the same spare parts, same support equipment and same aircraft. It's an aircraft that was built and developed 100 per cent to NATO standards which underscores its inter-operability."

Colonel Martinez says another key advantage of being part of the Eurofighter family is that Spain has direct influence over how the programme develops.

Major Rafael 'Rafon' Sanz Rebollo, **the 111 Sqn Commander**

"With Eurofighter we are the owners of the aircraft and we have control. There are no black boxes — everything in the aircraft is managed by the Spanish Air Force. It means we develop what we want, and we have full capability over the developing software, the improvements we want, and we have a real say in how the aircraft will evolve.

> With Eurofighter we are the owners of the aircraft and we have control. There are no black boxes

Morón 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.

"This is our job. It's what drives our training on a daily basis and it's what drives our participation in exercises," explains Major Rafael 'Rafon' Sanz Rebollo, the 111 Sqn Commander.

"As part of our role we have jets prepared on base 24/7 every day of the year on Quick Reaction Alert [QRA]. The aircraft are ready to take off at all times in order to safeguard our air space.

"From an operator's perspective Eurofighter is specially built for that mission, because the start-up procedures are very, very fast. We are able to get airborne much faster than the NATO requirement — we just start the engines and everything's good to go. Our role will sometimes require us to quickly intercept or identify other aircraft and Eurofighter is ideal for the job. It's capable of reaching altitudes of over 50,000 feet in less than two minutes.

"And it has a great future. This weapon system is designed for constant evolution and enhancement. The enhancements will change the capabilities of the aircraft and expand its potential." →

Major Rafael ‘Rafon’ Sanz Rebollo:
“Eurofighter provides us with the highest level of combat readiness in the world.”

Photo: Geoffrey Lee, Planefocus Ltd

QRA is just one element of the squadron’s work. The pilots and support crews need to be prepared to deploy anywhere in the world.

Says Rafon: “We became part of the NATO Response Force in 2015 which was a major milestone for the Spanish Air Force. Today, we are constantly part of NATO response forces and national response forces. We take part in NATO drills and one of the most important missions right now is to safeguard the air space in those nations that don’t have the capability to safeguard the air space themselves, because they don’t have a fighter fleet.

“A Spanish Eurofighter unit has been part of NATO’s multi-air policing mission every year and will continue to do so in the future.”

Indeed, Spain deployed a unit to the Baltics during the summer of 2018. “We decided to do a little bit more during that mission. We took six jets over and carried out a lot of training flights with other nations and we did it all using what we call the ‘bare-base concept’. In essence that means we didn’t deploy to a fixed infrastructure but instead we went over to a runway out of Šiauliai Air Base in Lithuania. We deployed with our own infrastructure, with our own material and with our own squadron on a very limited footprint. It was very challenging.”

During the deployment the ground crew built temporary shelters and had a small container city of spares and equipment to service and maintain the aircraft. They had two aircraft on QRA and carried out a lot of different training exercises. And incredibly, despite the conditions and the volume of activity, the unit still managed to achieve daily availability for all QRA activity of 97 per cent.

For Rafon, Eurofighter can be summed up in one word: Europe. “We are co-operating in so many aspects nowadays. We share the same currency, we have the same foreign affairs. We are trying to develop around capability and that’s true in terms of technology and aviation. Having the possibility to develop both software and hardware and to tailor the platform to our requirements — to our national requirements — is a must.”

He says that a good example of how interoperability is growing within Europe is the presence of exchange pilots in different air forces.

“Earlier in my career I had a chance to become an exchange pilot, but the difference then was that we had to learn to fly a different aircraft. It took too long for us to adapt to it, to the tactics and the procedures,” says Rafon.

“But today we are hosting an exchange pilot from the German Air Force and at the same time there’s a Spanish pilot in a German squadron and they’re both familiar with Eurofighter.

“That’s a huge difference when it comes to interoperability and with so many different nations flying Eurofighter it gives us the possibility to grab a flight bag, show up at a different base and fly exactly the same aircraft with the same software versions, and there is no need to convert to a different weapon system. That’s a huge advantage.

“Eurofighter provides us with the highest level of combat readiness in the world. And because we have more than 500 Eurofighters in Europe over several nations all operating the same aircraft it provides us with obvious inter-operability amongst us.”

TRAINING FORMS THE BACKBONE OF DELIVERY

The demands on the 111 Sqn are heavy and key to their pilots being able to deliver to the highest level is ensuring they have the right training. The air base at Morón boasts one of the finest training centres in Europe.

The centre consists of four devices including cockpit trainers and full mission simulators and one part ex trainer. Says Major Barranco: “These four devices give us the opportunity to carry out both basic training and some advanced training by connecting them in network. We also have the capability with our database to generate on demand any scenario from all over the world.” →

Photo: Geoffrey Lee, Planefocus Ltd

98% Mission Availability

The Eurofighter’s characteristic ease of maintenance was underlined by the Technical Group Commander, Lieutenant Colonel Jose Enrique Hernandez Medel, in charge of maintenance at Moron.

He said: “Eurofighter is far more reliable and easy to maintain than other aircraft I’ve worked with during my career. When I think of other aircraft you have to deal with a host of different issues — maybe the fuselage, or a fuel leak or a gear box problem. Complications like these can take weeks or months to deal with. Eurofighter is completely different.

“Yes, we do get issues but they tend to be ones that are easily resolved and are more to do with the sensitivity of the equipment. I think you can sum it up like this — when I think about going into work with other aircraft it was a case of ‘oh dear’, but with Eurofighter it’s ‘wow, fantastic.’

“You can see that ease of upkeep and reliability factor play out during deployments. Last year we were able to operate with mission availability of 97-98%, which from a maintenance perspective is excellent.”

Photo: Geoffrey Lee, Planefocus Ltd

Its role is clear: it provides support to the flying squadrons. The simulators there provide the squadrons with a chance to conduct and finesse any number of operational training missions to ensure they're prepared for what they're going to encounter in the real world.

One key advantage of the synthetic environment is that trainers can set up situations that would be difficult or too risky to replicate in the air.

"The centre gives the pilots the opportunity to learn the tactics and procedures and be familiar with how the sensors operate," says Major Victor Barranco. "This is why we needed a virtual training unit. It doesn't just serve this wing but the whole of the Spanish Air Force and we are also able to provide that capability to train Eurofighter pilots from other nations. We are currently providing training to the German Air Force.

German pilot from the Luftwaffe

Photos top & left: Walter Hodel

"The centre carries out training for all the Eurofighter pilots, not only from Morón Air Base but also for pilots from the 14th Wing at Albacete as well as pilots from our test flying centre in Madrid. As an example of our interoperability we are now currently giving training to some German pilots from the Luftwaffe.

"We train under the same standards, use the same aircraft, the same software and there's no need for adaptations once that refresher course is finished even if it's in a different country. For that reason we can provide synergies and we are able to train other nations to their required standards."

"It's an aircraft that was built and developed 100 per cent to NATO standards which underscores its inter-operability."

Photo: Geoffrey Lee, Planefocus Ltd

FULL CONTROL

EUROFIGHTER WORLD INTERVIEW
HERMAN CLAESEN &
KURT ROSSNER

Debates around Combat aircraft often focus on technology, capability or performance, but there are significant aspects that can get overlooked. Freedom of Action, inherent in Eurofighter, is a case in point.

Eurofighter World talks to **Herman Claesen**, CEO of Eurofighter Jagdflugzeug GmbH, and **Kurt Rossner**, Head of Combat Air Systems at Airbus and Chair of the Eurofighter Supervisory Board to explore what it means to them.

"If you don't have sovereignty, your'e entirely dependent on the rules other nations place on you"

Herman Claesen

Kurt Rossner

Herman Claesen sums up sovereignty in one word — crucial.

"Air combat capability is a key part of the defensive arsenal for many governments, but you have to be able to exercise it the way you want to — that's Freedom of Action, and that's what sovereignty is all about," says the Eurofighter CEO.

"Eurofighter is a data driven aircraft — it generates data and uses (mission) data to deliver the desired operational effect. If your air force is unable to harness this data it significantly constrains the full capability of the aircraft. With Eurofighter, you have control over the data."

Kurt Rossner says sovereignty is one of the most powerful enablers for nations. "It gives you the ability to develop a mission with your own data. Sovereignty brings other advantages too. It helps nations command a seat at the world, political and economic table.

"The fighter is one of the biggest symbol of a nation's sovereignty — it shows the international world that you're an important nation with mission capability. And with Eurofighter, it's also a symbol of economic power because for every Euro spent on Eurofighter you receive 1.2 Euros back into your economy."

JOINING FORCES

Control really matters in a world where established alliances are being strained and new threats are emerging.

"In recent years we've seen the world pivot towards 'nation first' views," says Herman. "In this environment, defence ministries and air forces are starting to rethink where they source their equipment from. It is understandable that they look for alternatives and organisations that they can reliably collaborate with. It is worth remembering that Eurofighter is a collaborative programme, it's our second nature, quite frankly, it's our first nature.

"Such high-quality collaboration doesn't just happen overnight. It's thanks to years of experience, going back through Eurofighter's predecessor Tornado. Today it's in our approach to new customers, which says: 'Let's work together to ensure you can satisfy your national sovereign requirements'." →

Kurt says Eurofighter sets the benchmark for collaborative programmes in the defence world: “Eurofighter started life as a collaboration between nations and the industry partners developed it, so it’s in our DNA. The aircraft was designed with multi-national mission capability, with an open architecture and open use in mind. In addition, the respective capabilities that each industry partner are able to bring to the table delivers a unique benefit for all users.”

With export customers looking for political relationships as well as operational capability, this Eurofighter partnership model is a significant proven strength. Governments can strengthen relationships with four nations rather than just one. The Eurofighter world is characterised by cross-border industrial partnering and high levels of co-operation between core nation forces.

Eurofighter sets the benchmark for collaborative programmes in the defence world: “It’s in our DNA”

Says Herman: “Air forces actively learn from each other, working on how they can exploit the jet to advance their doctrines, sharing information beyond the usual military exercises. It’s a phenomenal benefit. No-one should ever lose sight of the fact we are delivering truly exceptional world-beating capability, whilst delivering the other benefits of a collaboration in terms of cost, political alliances and sustainment of skills in the Eurofighter partner nations.”

As well as leading-edge capability, Eurofighter provides work for over 400 supply chain companies, sustaining over 100,000 jobs across Europe.

The programme sets technical standards too. “Carbon fibre manufacturing is a good example,” says Kurt. “Eurofighter was ‘the’ enabler for the whole aeronautical industry to develop carbon fibre capability. The civil aviation industry learned a lot from us. Now we’re looking at advances in mission capability, sensor capability, computing power, data connection and communication technology.”

And, with constant development being a cornerstone of the programme, it is destined to be the bridge into the next European air combat programme, ensuring Europe can continue to develop this kind of capability in line with sovereign requirements.

FIT FOR THE FUTURE

It is clear that any future air combat programme will be a collaborative one, with nations joining together and sharing know-how, giving developers a much broader knowledge base. But how will Eurofighter fit into this emerging picture?

Kurt describes Eurofighter as both an enabler for a future system and a risk-reducer. “It makes sense to have an incremental development approach where risk is reduced at each step towards a new model of a mission capability. It will not only be a new platform that’s developed but the data exchange, the data usage and so on. That’s not possible if you start from zero — it has to be part of an incremental approach, with Eurofighter as a test bed.”

When you look at this idea of Typhoon as a bridge to the future there are key technologies that are already being looked at. One is sensor development via an E-scan radar, another is the avionic system architecture, where the intent is to make it easier to integrate equipment, capability, weapons and sensors.

Summing up, Herman says: “Choices being made now, around collaboration, investment and capability development, will shape the future but what’s already clear is that Eurofighter will be one of the most important assets in the future operating environment.”

Eurofighter pools together some amazing technical skills from across Europe


Typhoon
MM.7339
4-51
Typhoon
MM.7346
37-37
Typhoon
MM.7313
36-35

NORTHERN GUARDIANS

Words and photos:
Giovanni Colla and Remo Guidi

The Italian Air Force defied testing conditions with 100% reliability as they helped safeguard Icelandic airspace during a recent NATO deployment, once again demonstrating the capability and efficiency of the Typhoon fleet.

In the dead of night on March 29, 2019, two Italian Air Force (ITAF) Eurofighter Typhoon took off from Keflavik Air Base in Iceland. Two Russian long-range aircraft had been picked up on radar flying into the NATO air-space surveillance area near Iceland.

It was the second live scramble in a matter of weeks for the crews taking part in Task Force Air 37th Wing, Northern Stork 2019, underscoring the value of this Icelandic Air Policing assignment.

The six week deployment saw four ITAF Eurofighter Typhoon fighters (two from 37th Wing, one from 4th Wing and the fourth from 36th Wing) involved in more than 100 flying hours.

The Icelandic Air Policing role was initially established as a NATO operation in 2008, following a request from the islandic govern-ment for NATO allies to periodically provide protection of its airspace. The responsibilities, now updated to Airborne Surveillance and Interception Capabilities, have been designed to meet Iceland's Peacetime Preparedness needs. Since 2014 the aircraft deployed to Iceland have been placed on Quick Reaction Alert (QRA) status and fly armed patrols. →

A Russian long-range aircraft had been picked up on radar flying into the NATO airspace surveillance area

"A deployment to Iceland is very challenging, especially in winter," says Col. **Daniele Porelli**, Task Force Air Commander.

"A deployment to Iceland is very challenging, especially in winter. We carry out airspace surveillance but at the same time we train with our partners and do it in the kind of extreme conditions we don't find at home," says Col. Daniele Porelli, Task Force Air Commander.

During the latest deployment the ITAF was able to draw on experiences gained during its previous missions in 2013, 2017 and 2018, where they provided intercept capabilities and took part in training activities to maintain and hone skills, proficiency and interoperability.

Working with the Icelandic Coast Guard, the ITAF detachment comprised around 130 men and women operating and maintaining the aircraft. It was made up of pilots, officers, specialists, logistics and operational personnel.

As well as QRA the fleet also carried out daily training missions over Iceland. "We trained in much the same way we train in Italy, but were able to take advantage of the presence of other assets from other NATO nations, for example there was a training sortie with a USAF B-52, which is part of the Bomber Task Force, where we provided the escort."

Throughout the deployment the aircraft lived up to its highly-prized reputation for reliability. Maj. Davide M., Task Group Typhoon Commander, says: "The airplane is very simple to maintain. On the ground its systems feed back everything that has happened during flight. It really is a cutting-edge engineering solution. It's easy to replace the electronic components, both cards and the entire hardware operating system; and can be worked on in a shelter, without any need to move the airplane in a dedicated hangar."

All these characteristics make the aircraft highly efficient.

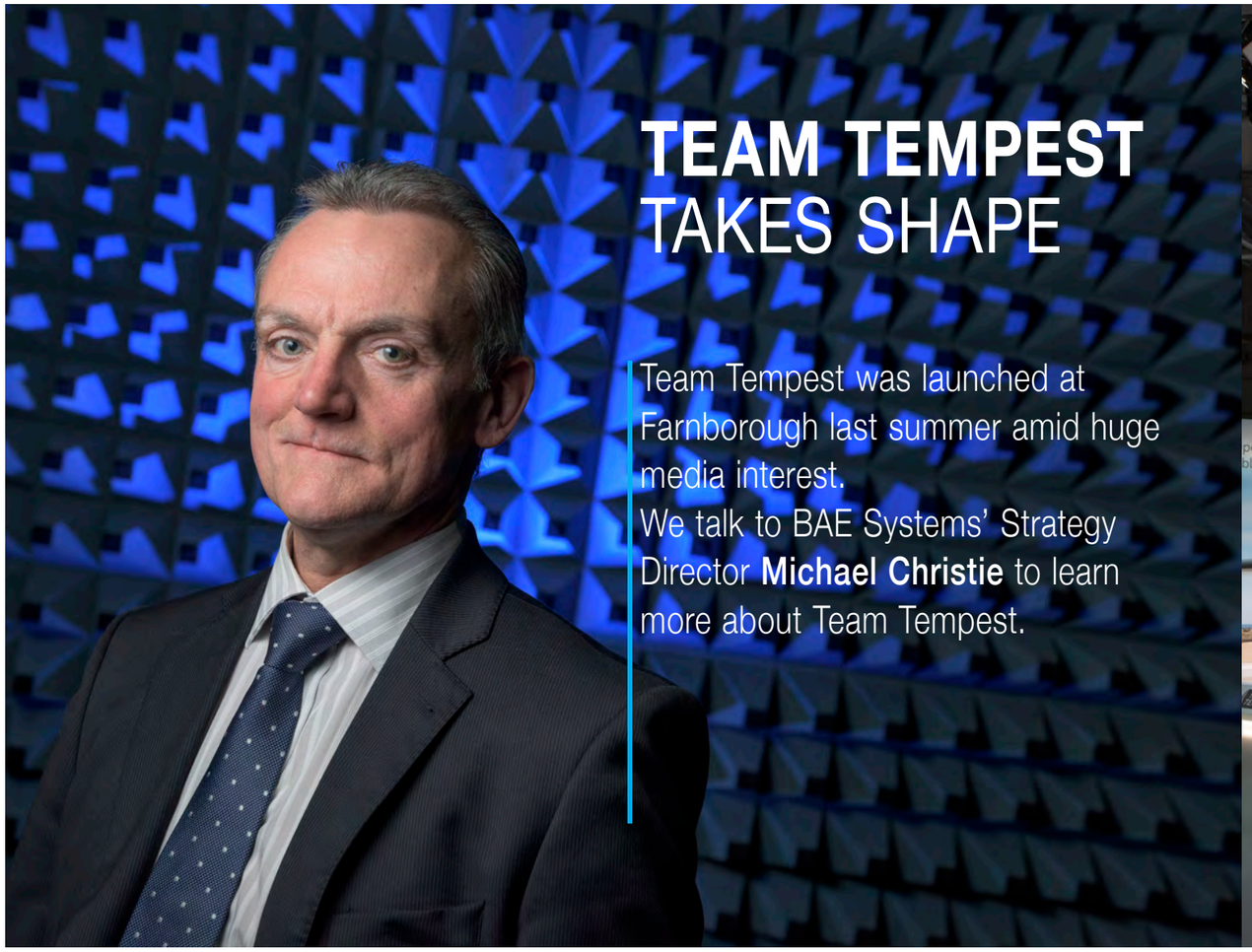
The aircraft was also able to cope with the demands of the severe Icelandic weather, and was able to land in extreme low cloud conditions and poor visibility.

Prior to the deployment there was a degree of concern over how the aircraft would cope with very low temperatures and high humidity.

In fact the crews were able to complete their missions with 100% efficiency throughout the deployment. Thanks to the maintenance team, manned by technicians from the 4th Wing of Grosseto, 36th Wing of Gioia del Colle, 37th Wing of Trapani, 51st Wing of Istrana and from the 1st RMV of Cameri, which is the Typhoon "I-level maintenance" site for the Italian Air Force.

Working in severe weather conditions is tough. Alessandro R. from the maintenance team says: "During a single day in Iceland you can face heavy wind, heavy rain, hail, snow. And with average temperatures below 0°C, especially overnight, snow removal and de-icing of the taxiways were an additional challenge for us."

The maintenance operators were brought together from different units and were able to share best practice, which will help become a new standard within the Italian Typhoon maintenance community.



TEAM TEMPEST TAKES SHAPE

Team Tempest was launched at Farnborough last summer amid huge media interest.
We talk to BAE Systems' Strategy Director **Michael Christie** to learn more about Team Tempest.

How does Tempest fit into the future combat air picture?

The best place to start is with the UK's Combat Air Strategy. Announced at Farnborough last year, it looks at the overall challenges we face and talks about how industry and government can work together, but differently. The other thing that happened that day was the launch of an overall agreement between industry and government that we called 'Team Tempest'.

Team Tempest is BAE Systems, Rolls-Royce, Leonardo, MBDA and the Ministry of Defence jointly working together, funding a programme to deliver a very wide-ranging set of technology demonstrations. They cover technology areas specific to those companies but go beyond that and include some broader concept work as well.

The model unveiled at Farnborough was there to give a vision of what the fighter component of that overall system could be. The slight danger of creating a model is that people think that the only thing we're looking at is the aeroplane, when in fact we are looking at a 'system of systems'. That said, we believe any future airborne air defence environment will include a fighter component.

What are the main challenges Team Tempest face and what timescales are you working towards?

Air defence capability will need to be replenished in the UK and other European nations somewhere between the 2030s and 2060s. We are working at getting something into service in the mid-30s. If you look back at the history and complexity of these programmes we're talking about a system that's more complex than the last generation, however, we're aiming to do it in a timescale that's faster than the last.

Obviously, there are technological challenges, but there are also behavioural and team-working challenges. In addition, our vision is that this will be an international collaborative programme from the outset.

Take all that together, a 2035 entry to service date, next generation capability, a system of systems and international partnership, it means we have got to go quickly and we've got to do things differently. Last year was an example of doing things very differently. The Combat Air Strategy was published in the UK and an eight-year agreement between five parties was launched. Things are moving at a rate of knots. The next stage is to engage with international partners and we are already entering a deepening dialogue with Sweden.

Why the emphasis on collaboration?

We firmly believe that any future programme is going to be collaborative and the best way to do that is to involve people at the earliest stage. In the early days on Eurofighter we had a national requirement, which became a European requirement. That created focus which is great, but also a challenge to balance national and wider programme requirements. However, collaboration is absolutely the right way forward.

We have an interesting challenge. We don't have a stated national requirement and that gives us some freedom and flex. Obviously, we want to get to the point where there's clarity on what we're actually going to put into service but engaging with future international partners at this early stage allows them to influence and shape what is to come.

By late 2020 we will go from the concept to the assessment phase. We will then have to have a much clearer view about what the collaborative options are. The MOD will select their options by 2025.

In technology terms, what are your priorities?

Well, we are talking about multiple assets, rather than trying to do everything on one. That makes the individual assets potentially simpler. The trend to date has been for platforms to become increasingly complex as you try to do more with them. Now, we're looking at the potential of distributed systems, wing men, but wing men of different kinds. A system that operates on a lot of different platforms, but one that will still have platform technologies.

But it will also need to be affordable. So, we will be looking at how we can manufacture it more efficiently, and how we can architect it better for upgrades.

At Farnborough, for instance, we showed a helmet as part of a software configurable cockpit — with virtually no equipment in the cockpit — it was an extreme version, but we believe it's achievable.

In short, we're looking at things that are affordable, upgradable and exportable to provide a level of features and options that are not cost prohibitive. There's a →

level of business thinking in this as well as just pure military thinking — there has to be.

So we are looking at something with open mission system architectures and flexible, software configurable cockpits, but also with sophisticated platform and sensing technologies.

Come 2035 what might we expect to see roll out of the hangar doors?

It will probably still be an iconic fighter aircraft but with lots of related systems.

How does the future battlespace come into your thinking?

It's a big part of the thinking. It's why it has to be upgradable because there's only so much you can predict about what the environment in 2035 is going to be like.
We can deal with this uncertainty by having a system of systems rather than a single platform. And if you design in upgradability, you'll be able to respond to whatever the change in threat is.

What are your thoughts on the future battlespace in terms of the different kinds of threats that are emerging?

The emergence of sensor technologies and defence counter-technologies means we're going to operate in a different way. I have an image of a multi-tiered battlespace with a commander largely sitting at the back, then a slightly riskier tier and final an even more risky tier, with different assets used at each of those tiers.

The other real challenge we've got is that there's this thing called the 'grey space' where it's not either warfare or peace but rather a grey conflict and that will mean different thinking about the assets we need. The future battlespace will be very complex and we don't want a one-size-fits-all solution.

How do you envisage being able to deal with a mass threat or swarm?

The quote I've heard from Chief of The Air Staff: "Do you need capability or mass?" and his answer is "Both, I want mass but I want high capability at the same time."

The challenge for us is not to try and put all of the capability into something and then have it in mass because that would be too expensive. You can create the mass by using smaller, arguably less sophisticated aircraft. But the way they're connected is still quite sophisticated.

How you fight somebody who's coming at you with mass, takes you into different weapons technologies. In short, you'd have to have the right defensive technologies.

You are painting a picture of a mix of unmanned and manned assets.

I believe that the next generation is going to have a mix and with manned/unmanned teaming. One of the challenges is working out what the man does and what the machine does.

Autonomy is still going to be used heavily as a decision aid. AI will go through everything it can see and say, "That's what I think you should do, what do you think?" Then the man can make the final call. Fundamentally it means you've got a man controlling, or a man plus a machine controlling a bunch of other machines.

And this can be done using existing assets. For example, Eurofighter could be given the capability to manage a bunch of UAVs. That technology is something we have already looked at and software development that looks at how you would manage a fleet of UAVs from a single Eurofighter has been carried out.

What role do you see Eurofighter playing in the future battlespace?

Many of the concepts and technologies will be developed on Eurofighter in advance. For example, with the advanced cockpit, you might not want to go to the full helmet-only option but you could go to a halfway house to mature the technology.

It would be very valuable for Eurofighter today to have more in the helmet and less in the head down display. The system architectures could be very valuable too and enable continued upgrades because Eurofighter is going to be in service for many decades.

A lot of what we're looking at is back-transferable onto Eurofighter. There's a double-positive here. Eurofighter can benefit from being part of this journey, and those future programmes can benefit from Eurofighter maturing the technology along the way.

I believe there's a sort of roll-forward/roll-back capability. We'll find opportunities to feed the work we are doing on Tempest into Eurofighter development. Not only will Typhoon remain at the forefront of technology, but it will also be the natural partner to work alongside a future fighter in the decades to follow.

What other technology areas being looked at?

A key area is autonomy, with decision aids and autonomous processing forming a massive aspect of what we'll be doing. Clearly if the asset is going to be autonomous it's vital but it's equally important for the high workload of a pilot. We've done a lot of work for many years on autonomous aircraft and that will get fed through into the next manned generation, as well as the next unmanned generation.

Another key area is what I call 'affordable stealth'. That's trying to get to a level of stealth but doing it without a massive premium. It's key to making something affordable and exportable.

Then there's the mission system architecture. We want something that enables quick upgrades so that when you make a change to the aircraft it's like loading an app on your smartphone. Trying to do that whilst retaining safety and clearance of an aircraft is a lot easier said than done, but we need flexibility and upgradability because we know things are going to change. You want to be able to change something without incurring a huge cost or time penalty.

With so many different assets operating together how important will connectivity be?

Secure connectivity or making sure that you can securely communicate between the various assets, is crucial. The next generation will be all about information, and information dominance will be key. Having multiple assets and strong situational awareness means information will be at the heart of everything.

The Team Tempest construct isn't just about an airframe. There's a sensor business and a weapons business in there. You've also got Rolls-Royce who will provide propulsion but they'll also play a role in power and thermal management across the whole system. There is a whole set of complex issues for each of the individual companies as well as that broader connectivity idea.

For me being a leader in the information generation is going to be about how you manage all that information properly. When you talk about multiple assets, both yours and the enemies, it's all about situational awareness. That's all about knowing where everything is, who's a friend, who's a foe.

That's also today's problem but it's going to be much more complex in the next generation. Then you're going to have to be able to decide what's the best course of action to take in this three-dimensional game of chess.

One thing to stress through all this is that we're thinking about how to make all this affordable. It could become a massive techfest and we could be here until 2050 trying to define the perfect solution. That's not the right way to do this.

You've got all these kind of technology threads that you're pulling together and some will be at different maturities, levels, but how do you decide where the priorities lie?

The answer gets ever more complex when you add other international partners because everybody's priorities are slightly different. What we're trying to do now is flush out, what do we need to do first?

We don't need to do everything on day one but what we do need to do is to make sure that whatever we do on day one is capable of getting to day two, day three, and so on.

It's about achieving what I call the 'minimum viable product', it can't just be a shell that does nothing. We get to the 'minimum viable product' point and then spiral it. We've been talking about spiral development for decades but the system architecture will be key to making spiral development credible, possible and affordable — that last word is the hardest.

Spiral development is complex, you end up with mid-life upgrades. If we have mid-life upgrades it means we've failed because the idea is you'll be able to constantly update.

How important do you think it is for Europe to develop its own capability and fund the development of these new technologies?

In the UK and across Europe, we feel the need to have freedom of action — it is referenced heavily in the strategy document. It's something that Europe ought to be protecting. That expands to protecting its industrial capability because freedom of action is strongly linked to industrial capability. A nation won't have full freedom of action if it doesn't have a strong industry.

There are a lot of reasons why European governments need to be looking at this. It's clear there are emerging threats and capabilities being developed in other parts of world and we have to keep an eye on this military capability.

In broad terms Europe has got to look at its defence capability and be really careful that it doesn't become completely reliant on offshore purchasing. It's partly this that's driving us to look at a much more joined up approach between industry and government.

There's a line in the strategy documents that sums it up. It's "our vision for the UK to remain at the leading edge of Combat Air system development to protect our people, project influence and promote our prosperity. To do this the Ministry of Defence and industry must build on success, rapidly change our approach and work together to achieve common goals."

NATO CELEBRATES

70 YEARS OF PEACE

On April 4, 1949 the North Atlantic Treaty was signed in Washington by 12 governments. In 2019, as NATO celebrates its 70th anniversary, we speak to Colonel **Luis Villar** of the Spanish Air Force. His division is responsible for establishing, planning and executing the NATO training and exercise programme that enables NATO's Allied Air Command to accomplish its tasks.

NATO remains as relevant today as it ever was, says Colonel **Luis Villar**

Founded 'to safeguard the freedom, common heritage and civilisation of their peoples, founded on the principles of democracy, individual liberty and the rule of law,' NATO remains as relevant today as it ever was, says Colonel Luis Villar, head of the Training and Exercises Division at NATO's Allied Air Command in Ramstein, Germany.

"For 70 years, NATO has been the strongest Alliance in history," he says. "Thanks to the Transatlantic link, the history we have together and the values we confer, we have helped prevent conflict and helped maintain the safety of more than one billion people.

"The most important thing is the commitment that each ally provides to the rest of the Alliance. It's the principle that an attack against one ally is an attack against all. That's what helps guarantee the prosperity and security of NATO members, and allows everybody to live in freedom."

Colonel Villar says given the current unpredictable and unstable global security situation the need for NATO is as great as ever, and air power has a particular potency to bring.

"There's no one single service that prevails over any other — everybody needs everybody. But the air power element has very defined and, in some cases, unique capabilities. The major contribution of air power is the speed, reach, agility, and flexibility in which it can be employed. We provide the initial foil to any attack because we are fast; we have a lot of agility and we can create a concentration of rapid force; speed also means we can operate in different areas with the same assets at any given moment. We have permanent missions, like air policing in the Baltic, and air power represents the first line of defence through NATO's Ballistic Missile Defence, Airborne Early Warning and Alliance Ground Surveillance systems.

"What we do at Allied Air Command is bring together the contribution of all NATO members into allied air power that can be employed flexibly and responsibly, delivering military effect."

Of course, within the air sector Eurofighter, as the backbone of several European NATO fleets, plays its part too.

"It's important to note that at NATO we are not equipment providers or contractors, what we do is to pull together the different weapons systems provided by Alliance members and integrate them to make a cohesive air power solution. However, in terms of Eurofighter I think it's important that we have four of the Alliance nations [the UK, Germany, Spain and Italy] providing the same weapons system. That provides its own synergies with logistic support, and ways of operating between those air forces.

"The other thing with Eurofighter (as with other Alliance assets), is that it's very interoperable. It operates very well with weapons systems provided by the other members of the Alliance.

"In my view, interoperability is the most important quality, the fact that we can work together and enjoy the synergies is key. Obviously different aircraft have different capabilities and can be better for different situations, but acting together as one force, NATO can provide the perfect solution for whatever problem we face."

Colonel Villar is also keen to stress that air power is only one element of NATO. He says: "We are a collective, a team, and like a football team, you need to have a defence, midfield and attack. You might have the best attack but if your defence is poor you won't have the right balance and no-one will be happy.

"We have a number of separate branches: land, air, maritime, space, cyber, political, and we have excellent communication between them. The Alliance is all of these working cohesively together that creates the right team to protect the allies."

Looking to the future, Colonel Villar has no doubt that NATO will continue to be a force for good. He says that the Alliance has grown stronger throughout the last 70 years.

"NATO is still hugely important because it protects the liberty and freedom of so many. People turn to us to see how we do things and how we project into other areas. I think that in the years to come NATO will get even better, grow bigger and continue to help prevent conflict."

ICE WARRIORS

"It's the real definition of a Swing Role platform"

Typhoon pilot Colonel **Daniele Porelli**, ITAF Detachment Commander, said: "Trident Juncture is a very demanding mission, but it's also a very valuable one because we have an opportunity to take part in training in a way that would be unthinkable in Italy.

By
Giovanni Colla and Remo Guidi

Italian Air Force Eurofighter Typhoons proved their swing-role capability this winter during the NATO Exercise Trident Juncture in Norway.

Exercise Trident Juncture is centered on the scenario of protecting Norway from a border invasion by providing reinforcements by air and by amphibious landing. The exercise took place mainly in central and eastern parts of Norway, and air and sea areas in Norway, Sweden and Finland. It was one of the biggest NATO exercises held in the last ten years.

Colonel Daniele Porelli,
ITAF Detachment Commander

It was led by Admiral James Foggo III, Commander of NATO Joint Force Command Naples, with Allied Air Command providing an Air Component Command Exercise Control Headquarters at Ramstein.

During the exercise Bodø Air Base hosted most of the flying Air Force assets, with seven NATO nations — France, Greece, Canada, Italy, Spain, Turkey, along with NATO partner nation Sweden — contributing aircraft.

The largest detachment based at Bodø was sent by the Italian Air Force who contributed 4 Eurofighters (4th - 36th - 37th Wing), 6 Tornados (6th Wing), a KC-767 tanker and a G-550 Airborne Early Warning aircraft (14th Wing). →

Their Eurofighter jets were able to deliver close to 100% reliability during the planned missions, despite operating in cold and wet weather. In total, Eurofighter carried out about 70 sorties during the exercise.

Trident Juncture is a huge undertaking, featuring 50,000 participants from 31 nations, including 10,000 vehicles, 250 aircraft and 65 vessels. Consequently, it's a hugely complex and challenging one for those taking part.

Typhoon pilot Colonel Daniele Porelli, ITAF Detachment Commander, said: "Trident Juncture is a very demanding mission, but it's also a very valuable one because we have an opportunity to take part in training in a way that would be unthinkable in Italy.

"The exercise comprises various types of set-ups and missions, including Composite Air Operations (COMAO) in which more than 50-60 aircraft fly. We've carried out Close Air Support missions supporting ground troops and Tactical Air Support of Maritime Operations over the sea."

Air units from each of the participating nations flew both Blue Air and Red Air missions so that each had a chance to train in both roles.

Each of the tasks were set by NATO Air Command in Ramstein. The ground and flight crews arrived in Bodø the day before each mission to make their plans. Explained Col. Porelli: "The mission commander took part in video-conferences with other bases involved in the mission before assigning us with our different roles at our daily briefings.

"Of course, some days orders were modified during the course of the actual mission. In one instance, for example, the initial task was Air to Ground but that switched to an Air to Air role, which we were able to do thanks to Eurofighter's Swing-Role capability.

"In fact, because of this ability, the Eurofighter's tasks were split between Red Air, Air to Ground and Air Defence in almost equal proportions. The aircraft allows pilots to carry out multiple tasks at the same time or seamlessly switch between different tasks in the same mission — it's the real definition of a Swing Role platform, in this respect, Eurofighter has little competition," said Col. Porelli.

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